Modifying the Project EIA Framework for a Large-Scale Dam Removal Project

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Introduction

The rapidly growing need for the removal or renewal of large dams in North America requires new and innovated approaches to environmental impact assessment (EIA). This is particularly the case for large-scale dam removals that may have environmental impacts on a geographic scale that far exceed what is typical for project EIA. Further complicating the use of standard assessment methods is that the environmental impacts are often significant by design and intent and not mitigable using standard approaches. Large rivers often form political boundaries where cross-boundary impacts may occur or may have diadromous fish stocks that migrate across management boundaries. Finally, hydroelectric dams may be vital components to climate change management programs as they may regulate greenhouse gas emissions and control flooding. For these reasons it is important to have an EIA framework that is capable of incorporating elements of strategic environmental assessment (SEA), for the consideration of regional and cross-boundary policy initiatives and regulation, and will benefit from the inclusion of adaptive management in the project description and at each stage of assessment.

This paper describes the use of such a framework as applied to the EIA[2] of the Petitcodiac River dam and causeway located in the tri-community area (Moncton, Riverview, Dieppe) in New Brunswick, Canada. Although the framework differed from that of project EIA, the paper emphasizes the attempt to incorporate SEA within the cumulative effects assessment (CEA).

Impetus for the EIA

Where it empties into the Bay of Fundy, the Petitcodiac River estuary is unique in the world for its 11 m average tides and natural suspended sediment loading regularly exceeding 30,000 mg/L. Historically, important as the primary breeding and rearing grounds for the now endangered Inner Bay of Fundy strain of Atlantic Salmon, its freshwater habitats were effectively cut off from the marine environment by the installation of a dam and causeway between the Town of Riverview and City of Moncton in 1968. As early as 1961, scientists with Fisheries and Oceans Canada (DFO) warned of the potential adverse impacts that such a

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[2] The EIA was undertaken by AMEC Foster Wheeler, Stantec Consulting Ltd., Gemtec and the New Brunswick Department of Supply and Services (AMEC 2005).

development would have on several diadromous fish species (Elson 1961), in particular the highly valued Atlantic Salmon. The 40 years that followed the commissioning would prove these warnings correct as extreme sediment transport and deposition in the upstream direction from tidal forces blocked all attempts at providing fish passage at the structure.

The Petitcodiac Riverkeeper was launched in 1999 with the restoration of fish passage at the causeway established as one of three initial priorities and they were steadfast in their determination to move government towards remediating environmental problems in the Petitcodiac River. They documented a history of such problems resulting from installation of the dam and causeway as studied by various government and academic institutions, gathered the support of most local communities, and proceeded to notify DFO of their intent to begin legal action to enforce the *Fisheries Act.* These actions ultimately led DFO to appoint a Special Advisor (Eugene Niles) to review and report on the fish passage non-compliance issues.

The Niles Report (2001) included historical review and consultation results with discussion and recommendations. It identified five potential options for addressing the fish passage issue and recommended a specific option (i.e., replace the dam and causeway with a bridge) proceed to EIA. The Niles Report did determine that fish passage at the dam did not work for most species but also added several other ecosystem and social issues with the dam and causeway identified during the public consultation process. Although the Niles Report relied solely on historical information and consultation, lacking establishment of a current baseline and a rigid assessment framework, it ultimately failed as a stand-alone option selection process for such a contentious and environmentally impacting project. It was evident that more consideration of the options was required and DFO and the Province of New Brunswick called for an EIA (screening and comprehensive, respectively), and the two were carried out in a harmonized manner.

The EIA guidelines (NBDELG 2002) carried forward four of the Niles Report options: 1) replace the fishway; 2) gates open during peak migration; 3) gates open permanently; and 4) replace the causeway with a bridge. The fifth option of the Niles Report—the status quo[3]—was included for comparative purposes. The guidelines also established clear project objectives as: "The modifications…are intended to achieve a long-term solution to fish passage and other ecosystem issues related to the causeway, including tidal exchange, sediment transport and other physical processes, and biophysical functions...". Hence, it was now the responsibility of the proponent to not just address fish passage concerns but also to remediate a diverse scope of issues, while selecting from four distinct project options, transparently with extensive public input. It was clear that a new EIA framework was required.

[3] DFO removed the status quo from the list of options because it was already determined to be in violation of Section 20 of the *Fisheries Act*.

Modified EIA Framework Methods and Scoping

For the purpose of selecting between distinct options, the weaknesses of project EIA are well known. While project EIA can excel in the identification of mitigation for typical development projects, the framework can be inadequate for evaluating the complexity of large-scale projects with multiple distinct options where the intent of the project is to produce (or remediate) significant impacts. Where this is the case, a modified EIA framework that emphasizes an adaptive management approach and includes elements of SEA may be better suited.

Despite the decision making process sharing many of the methodological and procedural elements of the equivalent model (Partidário 2000[4]) of SEA, including consideration of sustainable development within the watershed region, the project EIA framework was selected as the basis for the impact assessment because: a) it was mandated by the project guidelines (NBDELG 2002); and b) the project was not proactively linked to policy development or evaluation. However, owing to the immensity in magnitude and geographic extent of the impacts and their connection to sustainable development, and the potential for the project to manage some climate change issues in the region, some elements of SEA were incorporated into the CEA where proposed changes in policies and regulation were considered along with regionally existing or planned management of climate change and marine fisheries.

To tighten the scope of the assessment from the vague requirements of the EIA Guidelines, the proponent proposed design criteria early in the EIA process that improved the transparency of the EIA process by establishing clear objectives for addressing the other ecosystem issues requirements of the EIA Guidelines. The design criteria were fundamental to options evaluation in making a clear case for the elimination of the two options that did not widen the channel and improve tidal exchange.

From the beginning, public consultation was central to the project options evaluation. The EIA proponent established the first ever project-specific EIA website in New Brunswick which at its peak was receiving tens of thousands of hits per day. Several workshops were held with relevant stakeholders to educate them in key aspects of the assessment such as hydrodynamic and sediment transport modelling. Open houses of various types were held regularly throughout the potentially affected communities, including further abroad in commercial fishing villages and ports.

[4] Reference taken from Partidário (2000) in which the author attributes the definition of the *equivalent* (environmental appraisal) model, where policy and plan evaluation are undertaken to identify and take account of environmental effects, to Sadler and Verheem (1996).

The establishment of baseline and future conditions was a large-scale multi-year undertaking and was scoped broadly to include impacts of all options though ultimately limited geographically to the jurisdiction of Canada. The primary objective was improving the acceptability of the outcome of the EIA through robust studies that followed the guidance of both regulators and input from the public workshops.

The project description included an interim gate opening 'trial' period in which the follow-up program could be initiated and results considered prior to finalizing project detailed design. Incorporating this time-stepped approach in the project design allowed for true adaptive management. For example, a sediment budget program greatly improved confidence in the EIA predictions and allowed for a significant reduction in project costs related to sediment relocation and management.

The CEA was atypical because the magnitude and extent of project impacts were so great that contributions from other typical projects were mostly negligible. The CEA attempted initially to follow the common guidance document in Canada (Hegmann et al, 1999) but in so doing found the approach limited by its definition of "actions" which was based on the concepts of "physical works" and "physical activities" as contained within the Canadian Environmental Assessment Act (CEAA 1992) in place at that time. This focus on the physical interactions with other projects and activities failed to consider other policies, plans, programs and management objectives within the vast area of impact. Thus, in addition to considering the typical and required other physical projects and land use actions, the CEA framework was adapted to include changes in policy and regulation in a manner more consistent with SEA. In this way, the CEA was able to apply a VEC-centered lens taking into account a broader array of human activities and avoiding many of the common shortcomings of CEA in EIA (Duinker and Greig, 2005).

The Follow-up Program (FUP) allowed for adaptive management at each of three stages: 1) establishing baseline; 2) monitoring during a trial period; and 3) monitoring following the construction of the bridge. The trial period was planned as a two-year duration; however, changes in federal and provincial governments with differing funding priorities resulted in an extended gate-opening period. The extended trial period and FUP proved essential to mitigating unexpected impacts and informing design. For example, the follow-up program during the trial period identified fecal coliform issues that were not accurately predicted which led to increased rigor and new technologies (DNA-marker species identification) to be implemented in the follow-up program.

Unintended Benefit of the Framework

During the EIA process, the fourth option was split into three distinct options thereby increasing the total number of options under evaluation from four to seven. Multi-option evaluation led to EIA approval of four options, which provided subsequent design flexibility for adaptive management. During the detailed design

process, and the FUP, it was determined that some aspects of the design required modification from the original plans. Being able to adjust the design between the limits of the four approved options without need for further assessment or consultation greatly improved the efficiency of the design process and ultimately reduced the cost and the environmental remediation success of the project.

Conclusions and Recommendations

The modified EIA framework was successful at providing an options selection process that satisfied the project objectives in a manner that was transparent and the public remained engaged throughout. The entire process, from EIA through implementation, has spanned three very different governments and new criticisms and challenges imposed by each. The inclusion of SEA elements and adaptive management were invaluable aspects of the framework and should be considered for inclusion in future dam removal EIAs.

The inclusion of multiple options within the EIA promoted flexibility at the design and implementation stages that improved efficiency and reduced overall costs. Alternatively, where decisions are required on rivers with multiple dams, the application of SEA should be explored as a management tool at the regional level followed by site-specific single-option project EIAs.

REFERENCES

AMEC. 2005. Environmental Impact Assessment Report for Modifications to the Petitcodiac River Causeway. New Brunswick Department of Supply and Services, Document YB299A.

Duinker, P. and Grieg, L. 2005. The Impotence of Cumulative Effects Assessment in Canada: Ailments and Ideas for Redeployment. Environmental Management, 27(2), 153161.

Elson, P.F. 1961. Proposed Moncton Causeway-aboideau in Relation to Anadromous Fish of the Petitcodiac System. Unpublished report, Fisheries Research Board of Canada. January 31 1961. 9 p.

Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L., Ross, W., Spaling, H., Stalker, D. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group, Canadian Environmental Assessment Agency, Hull,Quebec.

Niles, Eugene. 2001. Review of the Petitcodiac River Causeway and Fish Passage Issues: Final Report. Prepared for Fisheries and Oceans Canada by E.J. Niles & Associates, New Brunswick.

New Brunswick Department of Environment and Local Government (NBDELG). 2002. Guidelines for an Environmental Impact Assessment: Modifications to the

Petitcodiac River Causeway. Issued by the Minister of the Department of the Environment and Local Government for the Province of New Brunswick and Fisheries and Oceans Canada. July 26, 2002.

Partidário, Maria R. 2000. Elements of an SEA Framwork—Improving the Added-Value of SEA. Environmental Impact Assessment Review. 20 (2000) Pages 647-663.

Sadler, B., and Verheem, R. 1996. Strategic Environmental Assessment—Status, Challenges and Future Directions. The Hague: Ministry of Housing, Spatial Planning and the Environment of the Netherlands, 1996.