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Your file *Votre référence*

August 30, 2022

Our file *Notre référence*

18-HMAR-00523

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Subject: Attachment (2) - DFO comments and Request for Information in relation to IR IAAC-14

Dear Mr. MacLean:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) has completed a technical review of the consolidated Round 1 IRs for the Boat Harbour Remediation Project (dated July 28, 2022) received on August 8, 2022. This attachment is a compilation of our comments and specific questions/request for information in response to IR IAAC-14.

Context and Rationale

The proponent was requested to:

Provide more detailed information on the baseline conditions in the estuary and the Northumberland Strait shorelines immediately outside of the mouth of Boat Harbour. They were requested to use this information and the results of the WSP 2020 Coastal Hydraulic Modeling Report (Appendix Z) to update the effects assessment of surface water, marine environment, and fish and fish habitat. This was to include a discussion of the impacts from both water column increases in TSS and deposition of sediment on:

• marine water quality;
• marine plants, including all benthic and detached algae, marine flowering plants, brown algae, red algae, green algae, and phytoplankton;

• marine fauna, including benthic organisms, fish, marine mammals and sea turtles and their associated habitat;
• federally and provincially listed marine species at risk; and
• fisheries resources, such as aquaculture and seafood facilities.

For the WSP 2020 Coastal Hydraulic Modelling Report, the proponent was requested to expand the model to include nearby marine habitat, provide the revised model results, and update any relevant information such as the effects assessment based on those results.

The proponent was also required to provide sediment deposition thickness data for the marine environment in the Pictou Road area, and update any relevant information such as the effects assessment, mitigation measures, and follow-up monitoring.

<u>Comments and Information Requests in response to IAAC-14</u>

- The proponent often refers to "the nominal 25 milligrams/Litre (mg/L) guideline" or a "TSS compliance threshold of 25 mg/L". The proponent should be advised and fully understand that CCME guideline values are as follows:
  - Clear Flow – Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g. 24 hour period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
  - High Flow – Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.

- Given, that the project is anticipated to impact TSS levels within the marine environment for a period of longer than 24 hours (i.e. the project will increase TSS for > 120 days), the proponent should be advised that the CCME Water Quality Guideline for the protection of aquatic life for long term exposures is a maximum average increase of 5 mg/L from background during clear flow periods. The proponent should apply this guideline to their model results and update the effects assessment throughout the EIS as required to include a discussion of the impacts from both water column increases in TSS and deposition of sediment on:

  - marine water quality;
  - marine plants, including all benthic and detached algae, marine flowering plants, brown algae, red algae, green algae, and phytoplankton;
  - marine fauna, including benthic organisms, fish, marine mammals and sea turtles and their associated habitat;
  - federally and provincially listed marine species at risk; and
  - fisheries resources, such as aquaculture and seafood facilities.

- In the response to IAAC-14, the proponent provides an abundance of marine water quality data from previous HHERA reports and studies, however the proponent does not link this data to the potential impacts on marine plants and/or fauna, species at risk, or fisheries resources. The proponent should use this data to assess if the project will impact the above listed biota and resources.

- The proponent discusses the habitat within the estuary as a marsh/saltmarsh, but does not describe the benthic habitat within the estuary itself which will be impacted by dredging and increases in TSS. The proponent should be advised that this information will be required to be collected for the estuary as well as the area outside of the mouth of Boat Harbour during the *Fisheries Act* application stage. Furthermore, as noted in previous IR comments, the proponent should be advised that they are required to use the precautionary approach in the absence of data. In this case the proponent should assume that these areas contain sensitive benthic habitat (i.e. eelgrass) when conducting their assessment of the Marine Environment as well as Fish and Fish Habitat.

- In Section 2.14.5, the proponent states that:

  > "The Northumberland Strait is characterized as having high naturally occurring suspended matter, resulting from a high production of phytoplankton and periodic resuspension of sediments".

  The proponent does not give a reference for this statement. The proponent is requested to provide a reference to support their statement.

- In Section 2.14.5, the proponent provides a description of naturally occurring high sediment within various areas of the Northumberland Straight and provides two photos which are 20 km and 90 km away from the estuary to visually depict this fact. This information is somewhat beneficial, however the proponent was requested to provide detailed information on the baseline conditions in the estuary and the Northumberland Strait shorelines immediately outside of the mouth of Boat Harbour. Providing images many kilometers away from the Project Area does not aid in the effects assessment for this Project. Furthermore, explaining the natural regime, under which high winds and currents from storm events cause increased TSS levels in the marine environment, does not negate the fact that anthropogenic sources of sediment can be harmful to marine biota. The reasoning behind CCME's clear flow and high flow guidelines is precisely due to these naturally occurring processes.

- In Section 2.14.5, proponent states:

  > "Stronger tidal currents (i.e., zones of high energy) prevent the deposition of muddy sediments. Thus, mud deposits only occur in the wider areas of

> the Northumberland Strait, such as near the Site, while sand and gravel sediments settle in the narrow sections."

The proponent is requested to clarify if the definition of "Site" in this statement refers to marine environment adjacent to Boat Harbour. The statement is contradictory to the findings of the 2017 LIDAR report, which indicates that the majority of the benthic substrate near the site is composed of sand.

- Most of the information provided in Section 2.14.5 has been collected throughout the entire Northumberland Straight and is not indicative of the conditions within the estuary or in the marine environment near and adjacent to the mouth of Boat Harbour. The proponent did not provide more detailed information on the baseline conditions in the estuary and the Northumberland Strait shorelines immediately outside of the mouth of Boat Harbour as requested in the IR. As a result, an effects assessment on Fish and Fish Habitat and the Marine Environment cannot be not carried out with any confidence.

- Throughout Section 2.14.5, the proponent lists various TSS measurements from various locations, which are often not clear, throughout the Northumberland Straight in an attempt to show that high TSS level can be found within the marine environment. The proponent should be advised that a comprehensive multi-season, multi-year baseline study would need to be carried out to conclusively depict baseline TSS levels within the vicinity of the Project.

- In Section 2.14.5, the proponent states:

> "Seagrass beds have the capacity to improve water quality and clarity, including turbidity, through trapping of suspended particles, nutrient uptake and retaining organic matter, during periods of time when suspended particle concentrations are higher, to aid in their long-term survival (Moore, 2004). Growing together in beds of shallow water can also trap suspended particles, and aid in stabilizing sediments (Plaisted et al., 2020)."

These statements have been taken out of context in an attempt to indicate to the reader that any impacts from elevated TSS can be mitigated by eelgrass in the Project Area. However, this is a false statement. The proponent is advised to refer to information pertaining eelgrass and increased sedimentation attached to this document. The proponent is also requested to use this information to update their affects assessment, once their sediment dispersion models have been re-run or new data is collected (see comments below).

- In Section 2.14.6.1, the proponent states that:

> "Results of Scenario D show that the TSS concentrations reached equilibrium values below the threshold limit of 25 mg/L (exclusive of background) in the marine environment after approximately 140 days following dam removal."

This statement is incorrect and should be revised. Given that fact that this project will affect TSS levels within the Northumberland straight for a long period, a threshold limit of 5 mg/L for clear flows should also be applied as outlined in the CCME Water Quality Guidelines (WQGs) for the Protection of Aquatic Life.

- Furthermore, Section 2.14.6.1 of the IR response states:

> "As indicated above, background TSS concentrations in the Northumberland Strait are highly variable and dependent on tidal currents and wind turbulence with historical TSS concentrations recorded ranging from <10 mg/L to 66 mg/L. Using historical maximum background concentrations of TSS, the threshold limit would then increase to approximately 91 mg/L and decrease the duration to reach seasonal TSS concentrations to approximately 20 days."

A wide range of TSS values have been measured from various locations within the Northumberland Strait and near the Project Area. TSS measurements taken in June of 2020, indicate that typical flood tide TSS levels fall within in the range of 1 to 5 mg/L, with ebb tides ranging between 3 to 6 mg/L (refer to Section 5.3.5 of Appendix Z – Hydrological Modeling). Overall, the TSS levels near the Project Area are relatively low during non-storm events, and drastically lower than a historical maximum of 91 mg/L. The proponent has not provided a reference for the 91 mg/L measurement and is asked to provide the reference and location and date of this sample. Furthermore, the theory of using a historical maximum TSS measure for comparison against modeling result and the CCME WQGs is erroneous. Historical maximums for TSS would generally occur during large storm events, with TSS levels subsiding quickly after the storm has passed. These levels are not appropriate for comparing against the affects of long-term anthropogenic increases of TSS in the marine environment. The CCME WQGs allow for an increase in TSS against background levels in both clear and high flows **at the time of sampling** and not against historical maximums. The proponent is advised to adjust their affects assessment and conclusions of the EIS based on this information.

- Within the IR response, the proponent frequently states:

> "With specific reference to the potential additional mitigation measures such as bed scour protection, a reduction in TSS concentrations approaching historical background conditions is predicted to occur within 20 days".

This statement is not true based on the information given above and historical baseline levels will not be reached within 20 days. The proponent is advised to remove these statements from the IR response and revise their conclusions throughout.

- Section 2.14.7.2 of the IR response states:

> "In addition to TSS concentrations, the modelling also shows that a significant portion of the sediments eroded from BH and the Estuary will be deposited immediately in the embayment area of the Northumberland Strait (Gauge 3 area). Although there are very localized areas with higher deposition predicted, and similarly small areas of where erosion of bottom sediments is predicted, most of the modelled area of the embayment is predicted to have a net deposition of between 4 and 10 centimetres (cm). Based on this nominal increase in sediment deposition, which are similar to natural suspension and re-deposition fluxes in the Northumberland Strait (Kranck, 1971), the effects to marine habitat and biota from both TSS concentrations and sediment loading in the embayment area and other areas of the Northumberland Strait are considered insignificant."

The proponent does not offer any evidence to support the conclusion that these TSS concentrations will cause insignificant effect to eelgrass or other biota. The proponent is advised to refer to information pertaining eelgrass and increased sedimentation attached to this document and to revise their conclusions for this IR response as well as throughout their EIS.

- Section 2.14.7.5 of the IR response states:

> "While elevated TSS concentrations are predicted to occur immediately after dam removal, the area potentially affected is small and these elevated TSS concentration are below those that cause acute effects on aquatic biota."

The proponent has not offered reasoning or references to support this conclusion. The proponent is requested to provide this information.

- Section 2.14.8 of the IR response states:

> "The monitoring program will be specifically completed prior to dam removal activities to document water quality and marine habitat conditions in the Northumberland Strait pre-dam removal. It is noted that the Dam removal is planned near the end of the BHRP in year 7 of the Project. This additional baseline conditions evaluation will focus on sediment transport (TSS and bed morphology/deposition evaluations) during the late fall or early winter periods when the dam removal is being proposed. In addition,

> underwater benthic habitat surveys (or similar evaluation techniques) will be used to document habitat conditions with a special emphasis placed on mapping and delineating seagrass beds in the area (including biomass and biodiversity). This information will be used to validate the effects assessment predictions post-dam removal."

The proponent should be advised that this baseline information will be required during the *Fisheries Act* authorization application stage. The Harmful Alteration, Disruption, or Destruction (HADD) of fish and fish habitat cannot be authorized after impacts have occurred.

- Figure 2, within Section 2.14.9 of the IR response, depicts bed level development post tidal restoration for scenario D. Given that there are many ranges in the legend for erosion and sedimentation, the map itself is very difficult to accurately read. The proponent is requested to clarify this map by adding lines with erosion and sedimentation numeration in-between each classification on the map.

- Figures shown within Appendix B (Supplemental Coastal Modelling Memo) indicate that TSS concentrations will range from 20-36 mg/L, above short-term CCME guidance for clear flows, 120 days after tidal connectivity has been restored for the entire model domain. Given the fact that exceedances of CCME guidelines may be observed for greater than 120 days (in fact Figure 1.8 indicates exceedances of the 25 mg/L guideline after 230 days) and that CCME guidance for long-term exposures is 5 mg/L for clear flows, the proponent is advised to expand the model domain to further explore the extent of potential impacts from TSS to a 5 mg/L level.

- The IR responses state:

> "With the above measures in mind, the residual environmental effects characteristics were reviewed for the surface water, marine and fish and fish habitat Valued Components (VCs) with respect to the removal of the dam activity. It was determined that the frequency be modified from "Once" to "Regular" to better match the tidal influence that will occur. It should be noted though that the duration and reversibility remain "short-term" and "reversible", respectively for those effects characteristics."

Due to the fact, that benthic impacts from sediment deposition, will take from one to five years to return to baseline conditions, the duration of the effects are recommended to be changed from "short-term" to "medium-term". Furthermore, the reversibility is recommended be changed from "reversible" to "partially-reversible" due to the fact that as a return to baseline cannot be guaranteed if eelgrass habitats are adversely impacted. The proponent has not yet been able to show that this will not happen and the precautionary approach should be used.

Specific Comments and Requests Related to the Delft 3D Modelling Exercise

- WSP used the Delft 3D modelling system v4.04.01 to look at water levels, salinity and sediment transport (TSS concentration) in an around boat harbour after removal of the damn and causeway in Boat Harbour and widening of the inlet and approaches to Boat Harbour from the Northumberland Strait. The implementation of the appropriate model and also the Cross-sectional Area Tidal Prism work of O'Brien (cf. pg 724, 5.2 model set-up EIA) lends confidence in the ability to obtain results similar to what is expected to occur, however, based on the parameterization of the model (cf. Table 4.3 page 787) there are concerns about the results, specifically TSS transport and concentrations and how realistic these numbers may be. The existing conditions were able to be modelled with in good RMSE based on collected data but the ability to predict cohesive sediment transport is not easy and there are little site specific measures of important variables.

- There is a lack of confidence around the use of shear stress for erosion of silt at 0.1 Pa and 0.01 Pa for clay. There is also a lack of confidence in the use of the settling velocities used of 3.6 E-6 m/s for clay and 6.0 E-4 m/s for silt as well as the erosion rate of 1.0 E-4 kg/m^{2}s. There is agreeance that these are values that are found in the literature and may represent the clay and silt at this site but there is concern that in absence of site specific measures of these values they may be orders of magnitude off. For example clay and fine silts most often flocculate in the marine environment as stress weans and as a results form larger aggregates with settling velocities on order of a mm/s (see Hill et al. 2013, Milligan and Law 2007, etc). Also, tau critical for erosion generally increases with depth in the seabed and differences in erosion rates are possible. Adding clay to bottom sediment can greatly increase the tau critical for erosion and if these sediments are mobilized and transported and deposited on mass it may change the bottom dynamics (sands can winnow silts and clays but if a large amount of cohesive material is deposited, with a large clay fraction sand can become buried, cf. Law et al.2008).

- The proponent is requested to re-run the model, using settling velocities of 1mm/s for clay and silt and tau critical of 0.01 to 0.6 Pa in steps (e.g. 0.1 Pa) or using erosion rates both higher and lower as the one chosen (i.e. in the literature ERates can be 1E-1 to 1E-7 kg/m2s, may try 1E-2 and 1E-6 for example). This would give more confidence in the modelling and give book ends of what may be expected in a real world scenario. The proponent is also requested to clarify if there was a budget calculated of how much sediment in boat harbour could be transported (i.e. after dredging and using cores could an amount be determined, and then how does that number compare to the amount predicted to be transported from the model results)? In the absence of further modeling, the proponent is requested to conduct field measurements at the site for these parameters.

Eelgrass Guidance

- The main growing season begins in April with maximum shoot density in mid-summer. Shoot density is reduced in the fall and winter. Overwintering survival is supported by nutrients stored in the rhizomes.

- Similar to all plants, eelgrass must capture and fix enough carbon through photosynthesis (P) to offset carbon demands from respiration (R). P:R ratios must be ≥ 1 for carbon balance.

- Re-suspended sediments from dredging, runoff, and storms can increase water turbidity and reduce light availability. In low light conditions, eelgrass will change their biomass, morphology, and physiology to maintain carbon balance. Increases in leaf length and chlorophyll (short term response) allow more light absorption while decreases (long term response) reduce carbon demand. Plants will also reduce number of leaves, secondary metabolites, and biomass to lower carbon demand. Use of carbohydrates stored in the rhizomes also help plants achieve carbon balance. Physiological responses occur within minutes to hours of stress, morphological responses within days to weeks, and biomass reductions within weeks to months.

- Settlement of re-suspended particles or movement of eroded sediments can bury eelgrass plants. Burial thresholds are positively related to sheath length, rhizome diameter, and rhizome growth rate, indicating that faster growing plants with strong carbohydrate stores can tolerate higher burial depths.

- Recovery rates of disturbed beds vary depending on the scale of damage and the resilience characteristics of the beds. In temperate eelgrass beds, recovery can take 2-4 years when small patches (2-4m^2) of eelgrass (both above and belowground vegetation) are removed from beds that rely primarily on asexual growth. Recovery is faster (~1y) in beds that depend mainly on sexual reproduction, when conditions allow seed germination. Large-scale destruction (3-30 hectares) can take 6-10 years to recover in optimal conditions, but 20 years or more in sub-optimal conditions. Recovery may not be possible when eelgrass loss changes site conditions. For example, removal of plants can destabilize sediments, causing sediment resuspension and elevated water turbidity, reducing light levels below those required by eelgrass.

- Burial tolerance of eelgrass scales with plant size (Mills & Fonseca 2003; Cabaco et al. 2008). Mills and Fonseca showed that sediment covering 25% of the plant height results in ~75% mortality for eelgrass (4cm of 16cm tall plant), while sediment depths of 50 and 75% of plant height resulted in 100% mortality.

- In Atlantic Canada, eelgrass plants can more easily tolerate low to moderate light reductions in the spring/summer compared to fall, because ambient light is higher in the growing season. However, extreme shading in the summer during warm water events will cause shoot mortality and premature use of carbohydrate reserves. Extreme shading in the fall may also cause premature use of stored carbohydrates, while shading in the winter may not have strong impacts if carbohydrate reserves are strong. Eelgrass beds physically damaged in the spring will have more time to recover than those damaged in the fall.

- Light reduction can be chronic or episodic, where light stress is punctuated by recovery periods. Studies have shown that continuous shading has stronger impacts than episodic shading, mainly when light stress pulses are short and light reduction is extreme.

- Observations of 50% mortality gave been seen within nine weeks of low to moderate shading, with mortality occurring at a faster speed under higher shade levels or warm water temperatures.

- The following references are a good starting point, but the proponent is encouraged to conduct a further review of the literature to support their conclusions:

Wong, M. C., Griffiths, G., & Vercaemer, B. (2020). Seasonal Response and Recovery of Eelgrass (Zostera marina) to Short-Term Reductions in Light Availability. Estuaries and Coasts, 43(1), 120–134. https://doi.org/10.1007/s12237-019-00664-5

Wong, M. C., Vercaemer, B. M., & Griffiths, G. (2020). Response and Recovery of Eelgrass (Zostera marina) to Chronic and Episodic Light Disturbance. Estuaries and Coasts. https://doi.org/10.1007/s12237-020-00803-3