Science Expert Opinion on
Whites Point Quarry & Marine Terminal Environmental Impact Statement.

July 5, 2006

Context

The Whites Point Quarry and Marine Terminal Project is currently being assessed by a Joint Review Panel with DFO and Transport Canada as the Responsible Authorities under the *Canadian Environmental Assessment Act (CEAA)*.

The Whites Point Quarry and Marine Terminal Project is proposed for Whites Cove on Digby Neck, Nova Scotia. The operations, which include a basalt quarry, ship loading facilities and a marine terminal for the production and export of crushed rock, are expected to operate year-round with approximately 40,000 tonnes of aggregate produced for ship loading each week, totalling two million tonnes per year. The lifespan of the project is projected to be 50 years.

Issue

DFO Maritimes Science Branch has been asked by DFO Maritimes Oceans and Habitat Branch, Major Projects and Environmental Assessment Division, to review and provide comment on the draft Whites Point Quarry and Marine Terminal Environmental Impact Statement and related documentation. A scientific review was undertaken and comments are provided on:

- the technical accuracy and completeness of the documentation,
- the conclusions of the assessment, and
- the proposed mitigation and monitoring.

Response

Comments on Technical Accuracy and Completeness

Volume 3 – Maps

Map 21 – Marine Mammal and Seabird Observations

Other species of whale that are not listed on the map have been seen in this area. In particular, humpbacks, fin backs and sei whales have been seen. Additional data are available. For example, Brier Island Whale and Seabird Cruises cover some of the area depicted; the International Fund for Animal Welfare (IFAW) 2006 right whale survey also covered some of this area. There are likely several other data sources for marine birds as well (e.g., Brier Island Whale and Seabird Cruises, Canadian Wildlife Service).

Map 23 – Leatherback Turtles

Information on the timing of the records would be useful.

Map 24 – Northern Atlantic Right Whale Critical Habitats/ Conservation Areas

This map simply identifies and locates the five right whale conservation areas (two in Canadian waters and three in US waters). The areas have been correctly located identified, and labelled.

Map 25 – Right Whale Density

This map appears to be accurate.

Map 26 – Atlantic Salmon Rivers of the Inner Bay of Fundy

Context for this map has not been provided, i.e., what is the map meant to represent? A more descriptive caption or title would be helpful. For example, the rivers depicted here appear to be rivers for which an electrofishing survey or reported recreational catch were available to indicate the past presence of Atlantic salmon. This does not necessarily capture all rivers that may support inner Bay of Fundy populations of Atlantic salmon.

Atlantic salmon migration routes, as depicted on this map, are not informative. The map caption should clarify what these "migration routes" are meant to represent.

The symbology for an oceanographic gyre and Atlantic salmon migration routes appears to be the same on this map.

Map 31 – Blast Monitoring and Observation Area

Blast locations not clearly indicated on this map. Have blast locations been described elsewhere in this report?

<u>Volume 6 – Environmental Impact Statement</u>

Section 9.1.7.1.7 – Waves

Based on Appendix 46, the statement that monthly mean wave statistics for December and January imply mean wave heights of 1.1m is correct.

Section 9.2.0 – Biological Environment and Impact Analysis - Introduction

The summary of invasive species in section 9.2.0 does not mention concerns about the potential for the introduction of disease organisms. Among those mentioned in the reference document (Tab 13) is the pathogen responsible for lobster disease in New Jersey:

> "*The greatest immediate concern for the Whites Point ecosystem and fishing community would be the potential introduction of the "pathogen" responsible for the mass lobster mortalities observed in the Long Island Sound area in 1999. Evaluating this risk is, however, very difficult given the current status of the research on this issue*" (Carver and Mallet, 2003).

The potential for this transport could be addressed by experts in aquatic animal disease. This potential for introduction of pathogens and other invasives (such as the Asian crab) by this project may be no different (or may be lower) than that from existing shipping but this does not appear to be addressed.

Section 9.2.3 – Marine Intertidal Zone

This section provides a reasonable description of the marine intertidal zone and the proponent has collected data directly from the site. Since there is no infilling planned, it is agreed that habitat disturbance from construction of conveyor system supports is likely to be short lived and limited in extent. A concern is the reliability of the containment system for aggregates being transported to the ship. From the description provided, it is difficult to judge whether the containment system would be fully secure.

The question of particulate matter or silt from the ongoing transport of quarry materials is not mentioned in this section. Certainly any steady flow of silt into this zone will lead to loss of algal cover. It is unclear whether this has been dealt with elsewhere in the report.

One statement on lobsters is a bit broad "Lobsters also rely on..." (page 52, last paragraph) infers that rockweed is a habitat for lobsters. Intertidal seaweeds are not typically considered lobster habitat; however, subtidal kelps are considered to be lobster habitat.

Section 9.2.4.0.3 – Plankton community

This description of the plankton community is quite adequate. In paragraph 2, it seems unnecessary to call zooplankton both “small” and “microscopic”; either one alone would suffice.

Section 9.2.5 Fish – Endangered

The Recovery Strategy for inner Bay of Fundy salmon is currently being redrafted, which may include identification of critical habitat.

See comments on Tab 25.

From previous meeting minutes, DFO remains of the opinion that historic fishing, scientific sampling and theoretic modeling indicates that there could be migrating inner Bay of Fundy Atlantic salmon in the Whites Point, Digby Neck area from May until October.

Section 9.2.6 Fish – Threatened and Special Concern

No information is provided on Atlantic whitefish. St. Mary's Bay/Digby Neck are within the historic extent of occurrence of Atlantic Whitefish and could be again should repatriation of the species to the Tusket Watershed proceed.

A habitat compensation ratio of 3x is being proposed. What will be the timing of this compensation, i.e., will it be constructed *prior* to habitat loss that may result from this project?

While spawning habitat requirements of Atlantic cod are not fully understood, there may be other habitat requirements that could have been described here. For example:

> "*The habitat most likely to be critical and potentially limiting for Atlantic cod may well be the vertical, 'three-dimensional' structures provided by plants, rocks, physical relief, and corals. In addition to providing protection from predators, such physical heterogeneity would almost certainly provide habitat for small fish and invertebrates, organisms upon which juvenile cod could feed.*" (COSEWIC, 2003)

Section 9.2.8 – Marine Reptiles

In general, this section was difficult to read, poorly referenced and contained several inaccuracies. For example, in the first paragraph on page 109, *Lepidochelys kempi* should be referred to as Kemp's Ridley instead of Ridleys. In addition, the COSEWIC assessment for loggerheads was deferred – it was not assessed at the May 2006 meeting. The second paragraph simply contains a few unreferenced points on morphology, distribution and diet. There is no further mention of loggerheads. There have been very few sightings of leatherbacks in the Bay of Fundy. It is not clear what the relevance of the third paragraph is. In the forth paragraph, it is unclear why the Convention on the Conservation of Migratory Species of Wild Animals is mentioned if Canada is not a signatory. It should be noted that CITES does not list species (i.e., does not itself determine whether a species is endangered or not); the IUCN and COSEWIC list species. The first paragraph on page 110 provides no discussion of the extent of the survey coverage in either time or space. The second paragraph states that "leatherback turtles are fast and deep swimmers," but provides no reference. It would be interesting to know where this information was taken from, since it does not reflect common understanding. Again, there is no discussion of loggerhead turtles.

Section 9.2.9 – Blasting, Fish Habitat

Most assertions in this section are based on the acoustic model study by D. Hannay, JASCO Research and D. Thomson, LGL Ltd. titled "Peak Pressure and Ground Vibration Study of White's Cove Quarry Blasting Plan". Comments on this study have been provided previously by DFO Science (DFO, 2005).

Several issues were earlier identified in regard to this study, the most important pertaining to apparent quantitative inaccuracies in assessing how P (compressional) to S (shear) wave conversions at the water sediment interface would enhance the amplitude of P waves transmitted into the water. The conclusion was that the Hannay & Thomson study probably overestimated the compressional wave amplitudes transmitted into the water column. This would tend to strengthen the statement that the model presented represents a "worst case situation" (last paragraph on page 112).

Sub-section 9.2.9.2 (Analysis) states, "this is within the 100.5 m (330 ft.) at the point of producing 13 mm/s in the guideline/threshold criteria." This statement, as presented, is confusing. Direct reference to the Thomson & Hannay study clarifies the statement: The DFO Guidelines for Explosives in Canadian Waters (Wright and Hopky, 1998) predicts a 45 kg charge should produce a ground velocity of 13 mm/s at 100.5 m range. It is

encouraging that the CONWEP model as applied by Thomson & Hannay and the DFO Guidelines model yield reasonably similar distances (118 m vs. 100.5 m respectively) for the 13 mm/s ground velocity criteria.

Sub-section 9.2.9.3 (Mitigation) states, "the explosive ANFO will be used whenever possible." Does this imply that the quarry operator reserves the right to use more powerful explosives for some blasts? The Hannay & Thomson study considered only ANFO explosives. It is also asserted that "ANFO" has a lower yield per equivalent weight than TNT, which was presumably used to derive the DFO Guidelines. Without the benefit of data on comparative yields, TNT does have a significantly higher detonation velocity (about 22,800 fps) than ANFO (variable with charge geometry but typically 13,000 – 15,000 fps).

Sub-section 9.2.9.4 (Monitoring) states, "monitoring for peak pressure and ground vibration will be conducted at locations in one meter of water depth in the tidal zone and at approximately 170m (560 ft.) and 500 m (1640 ft.) from the detonation site." Are both ground vibration and pressure to be measured at these sites? Will the ground vibration be measured underwater or at an equivalent distance on land? If the blast is conducted within 3 hours of low tide there will only be a 0 – 1.5m water depth at 170m range so measuring at 1m depth (if the water is indeed this deep) may be reasonable. At 500m range, the water depth could be in the vicinity of 10m. At 500m range, blast pressure measurements should be made near-bottom rather than at 1m depth where the direct wave and surface reflection will be expected to nearly cancel. Near-bottom, the pressure levels will maximize. These monitoring considerations should be clarified.

In regard to the models employed, it should be kept in mind that the geometries assumed constitute only an idealized 2-dimensional approximation to a 3-dimensional reality. This is particularly true in modeling the propagation of the pressure wave across the bottom interface at very low grazing angles and where surface reflection multi-path is also very important. Clearly, the real bottom interface (and often the surface interface) is rough and of variable slope on sufficiently small spatial scales. A factor of 2 uncertainty in the resulting pressure field is probably not unreasonable. Since the model parameters were selected fairly conservatively, and in light of the fact that the Hannay & Thomson model would appear to overestimate the theoretical pressure, there seems to be minimal cause for concern in terms of direct harm to fish. Predicted peak ground velocities could be expected to have smaller associated uncertainties than water column pressures since the geometry essential to their calculation is simpler. Nevertheless, because of inherent uncertainties in any physical model, monitoring is recommended. It should be kept in mind that the 100 kPa criteria pertains to lethal or obvious sun-lethal injury to fish and not to more subtle behavioural effects, which if they do exist, are likely to be transitory considering the extremely low repetition rate characteristic of quarry blasting.

Section 9.2.10 – Blasting, American Lobster

This section uses material from the reference document (Tab 24) to conclude that effect will be "long term, insignificant negative effect of local scale". See comments on reference documents.

Section 9.2.11 – Blasting, Marine Mammals

See Science Expert Opinion on Assessment of Possible Effects of Construction Blasting at Whites Point Quarry and Marine Terminal on Marine Mammals in the Bay of Fundy (DFO, 2005).

Should clarify from what location the 500m setback radius is measured from, i.e., does this mean 500m from shore or from the blast location on land. Sound propagation properties are different for land and water. Guidelines developed for marine conditions may not apply in this case.

To my knowledge, DFO has not formally "accepted" 180 and 190dB as acceptable thresholds for sound exposure of toothed whales and pinnipeds.

Model results are for a single blast only.

Monitoring station locations as indicated in Map 31 do not appear to be consistent with the locations (170m and 500m) described in the text. Without clearly identifying the blast location on this map, it is difficult to verify distances. Talking about a 500m setback radius may be confusing to readers. This setback radius appears to be different from the 500m marine mammal observation area indicated in Map 31.

Noise monitoring at far-field (i.e., greater than 500m) locations has not been proposed as was recommended in the Expert Opinion. No monitoring of the seal colony appears to have been proposed.

Section 9.2.13 – Ship Interactions, North Atlantic Right Whale

Sightings of North Atlantic right whale are in the area of proposed operation are relatively low compared to other areas of the Bay of Fundy. DFO and the Right Whale Consortium hold sightings data additional to the SPUE data analyzed in the EIS. These data suggest that right whales are seen occasionally in the area.

Section 9.2.14 – Ballast Water

The issue is the potential transport of non-indigenous species in the ballast water of transport vessels involved in the proposed Whites Point Quarry project.

The Carver and Mallet document (Tab 13) concludes that a lack of specific port data makes a detailed assessment impossible. Their general conclusion is that ballast water exchange en route from Raritan Bay would be the most important mitigating step. They note that this should be taken in the context of the hundreds (~300-500) of vessels that annually perform mid-ocean exchange (MOE) in the Scotian Shelf, Gulf of Maine region. In other words, if MOE is performed by the transport vessels, this project is really just part of what already routinely occurs.

Bilcon states that they will employ a reputable bulk carrier which is required to follow BW exchange guidelines (p.135). They agree to conduct monitoring at the receiving terminal, and submit a written report to Environment Canada upon completion of the investigations (p.136). However, they provide no details of what "upon completion of the investigations" means. They should more specific about this. They conclude that no

mitigation is required and the impact is neutral. While current practices for ballast water management leave much to be desired, I find no reason to disagree with their position regarding ballast water control.

Section 9.2.15 – Noise and Vibration, Marine

In Sub-section 9.2.15.2, it is stated that for a one day sonobuoy deployment within the North Atlantic right whale Conservation Area, sound levels were elevated at both 500 and 100 Hz, the measurement period coinciding with verified high levels of shipping in the area. Upon examination of the literature, the measured noise levels reported in Sub-section 9.2.15.1 at 100 Hz appear to be as much as 10 dB higher than normally expected in corresponding heavy shipping areas in the deep ocean and 20 – 25 dB higher than those anticipated in the same deep ocean areas both measured at sea state zero. However, the sonobuoy levels are somewhat comparable to older historical acoustic levels measured in shallow waters off New York harbour (Urick 1975), so I do not have a problem with the reported measurements themselves. However, one could legitimately ask if one day of recording provides a representative sample.

The overall point being made in this Section is not very clear. It is reasonable to assume that a couple of bulk carrier transits per week through or close to the Conservation Area would not add greatly to *average* incremental exposures *in the Conservation Area itself*. However it should be emphasized that for any individual vessel passage the locally observed noise level and any specific animal exposure will be very dependent on the distance to the vessel and also, at increasing ranges, on the water depth and other physical variables. As an example, for a freighter travelling at 10 knots Urick (1975) quotes a 100 Hz spectral noise level of 152 dB re 1 $\mu Pa^2/Hz$ at 1 yd, which is about equivalent (within 1 dB) to a reference viewing distance of 1m. Crudely assuming single vessel noise to fall-off at a 20 log R rate up to a distance comparable to the water depth, say 200m in the Grand Manan Basin, and at a 10 log R rate for distances beyond 200m, vessel acoustic levels comparable to the above reported 93 to 81 dB ambient would be approached at ranges of 4 to 60 km. What this implies is that at observation ranges up to at least a few kilometers the noise levels from a large ship will almost certainly be above the measured (elevated) ambient background. The last sentence in Sub-section 9.2.15.2 stating “background noise levels are therefore expected to be less than noise levels recorded in the North Atlantic right whale Conservation Area study previously mentioned” is tricky to interpret. This is no doubt true providing acoustic levels are highly averaged over time and space. Levels from one or two close bulk carrier passages will no doubt average to something close to the otherwise ambient levels provided the averaging period is long enough (such as a week) – this constitutes a legitimate environmental consideration - but by no means the only consideration.

If this project were to go ahead, it would be advisable to make baseline measurements of bulk carrier noise around the terminal and nearby areas of potential environmental sensitivity. It should be noted that it not entirely certain that modern bulk carrier generated noise levels would closely approximate those of a “freighter at 10 knots” (our example) nor if the general ambient noise levels close to Whites Point would be similar to those measured in the Conservation Area during a period of high shipping density.

Section 9.3.18 to 9.3.20 – Contaminants

There is no proposal within this EIS for environmental effects monitoring of the commercially valuable species such as lobster, crab, and scallop that are sensitive to the toxic metal exposures, especially in the Bay of Fundy areas. The monitoring of water quality of outflow from the sediment retention ponds is insufficient to detect the possible problem of contamination associated with quarrying operation. In the study of the selection of bioindicators for monitoring marine environmental quality of the Bay of Fundy, Chou et.al. (2003) reported that lobsters from Digby had elevated digestive gland copper (70 µg/g) in comparison to lobsters from Pubnico (10 µg/g). Chou et al. also reported the ineffectiveness of mussels and sediments as reliable indicators of contaminants. Mussels and sediments failed to reveal the problem of high toxic metals in the Bay of Fundy areas. The EIS quotes the Gulfwatch results and states that heavy metal concentrations in blue mussels are near natural levels (Table MC-1, page 128). The report should include recent bioindicator studies by Chou et al with regard to the contaminant levels in lobsters and crabs from the Bay of Fundy areas. The selection of bioindicators is key to revealing the toxic metal exposure in marine organisms.

Volume 7 – Cumulative Impacts Assessment

Section 10.0.3.3 and 10.0.3.4 – Marine Mammals, Blasting and Ship Interactions

Cumulative impacts due to blasting and vessel traffic are difficult to evaluate. For ship interactions, see comments on Section 9.2.13. The methods proposed for mitigation of possible deleterious effects due to blasting appear appropriate, if undertaken with rigour. Given that blasting will occur (at intervals) well into the future (ca 20 years) the possibility exists for long term displacement of fauna from the area, due to avoidance behaviour triggered by the noise from blasting.

Reference Documents

Tab 8 – Interpretation of a sublittoral benthic survey along the shoreline of Whites Point, Digby Neck, Nova Scotia.

The grab samples and video described in this report are restricted to just two days (June 28 and 29, 2002) between 9.5 and 41.5m depth. Only two video transects were taken, 525m and 30m long. Only 12 grabs were attempted, yielding only five actual samples. Samples were frozen and not analysed until February 21, 2004. Sieve size for sample analysis is not stated. According to the maps provided, the short video transect had only one grab sample associated with it. The long video transect had none. Apparently, the camera was drawn through the water too quickly or it was not in focus most of the time.

The above information indicates a deeply flawed sampling design and field execution:

- Shallow areas (<9.5m) were ignored, even though that zone can be highly productive and diverse.
- By only sampling on two days in June, seasonal variability was not captured.
- Taking only two video transects and five grab samples is not a field survey, it is simply an equipment test.

- Nets and traps were not used, so useful information on mobile organisms like crabs and fish was not obtained.
- Typical analysis of benthic grab samples involves checking for organisms >0.5mm in size, the perpetrators of this farce obviously did not even attempt to look for organisms on that scale as they tossed out sample G8 as "biological insignificant" in the field!
- Even large organisms seen in the field samples apparently disappeared by the time the samples were examined in the lab over one and a half years later (samples G2, G5, and G9 or three out of the five samples actually saved). My guess is the samples were improperly stored in a regular home freezer rather than a proper laboratory freezer (-80ºC).
- Video that is moving too fast or having the camera out of focus most of the time shows an appalling lack of professionalism. Both errors can be corrected in real time in the field by any competent camera crew.

Considering the problems noted above, the conclusions section of this report (part 4.0) cannot be taken as definitive. The statement on subtidal substrate (coarse sands, gravels and mollusc shell fragments) is likely accurate given the field evidence. However, the statement that "there appears to be little or no infauna" cannot be supported. The field sampling and lab analysis were far too poor in quantity and quality to make any claims regarding infauna.

Tab 10 – Results of a survey of the intertidal marine habitats and communities at a proposed quarry site located in the vicinity of Whites Cove, Digby Neck, Nova Scotia.

The brief survey and transects described in this report are restricted to just two days (June 13 and 14, 2002). Only three transects were made, one in Whites Cove and two outside. All from high tide to low tide mark. Tidal range on the days of sampling is not specified. The description of general shoreline morphology appears to be accurate given the photos provided. By only sampling on two days in June, seasonal variability was not captured. Observations along only three transects is a rather limited survey. The photographs indicate a typical Nova Scotian semi exposed rocky shoreline in healthy condition. Table 1 is a very short listing of marine shoreline plants and animals that could be found almost anywhere in Nova Scotia. It is obvious that the field survey was very cursory and rare / small / cryptic organisms were not sought out. Organisms unique or unusual in the area may have been missed. The brook survey (section 4.4) also appears to have been very cursory. Without detailed observations over large sections of the stream, biological sampling and water chemistry data, it may be premature to conclude that Middle Brook is "not suitable as fish habitat". The observations made on North Brook appear to be more detailed, and the suggestion that "It is unlikely that this stream serves as a significant habitat for salmonids" may be valid. However, that suggestion cannot be confirmed without better sampling over a number of seasons.

Overall, the report is quite limited. It provides some indication of the nature of the biological community in the area, but is certainly not definitive. For example, the *Laminaria* beds noted in the sublittoral may be important habitat to a number of crab or fish species which are not found in abundance in other areas of the coast. The *Laminaria* beds were not sampled at all, let alone seasonally.

Tab 11 – Results of a survey of the plankton communities located offshore of a proposed quarry site at Whites Cove, Digby Neck, Nova Scotia.

This report represents a reasonable and competent piece of work. The spatial and temporal coverage of the survey performed was not detailed, but adequate. The species encountered were as expected from previous studies and appear to be typical of the area. It provides a baseline with which future changes can be examined. There were, however, one or two technical errors:

On page 5 – Section 4.1.3 "*Mesodimium ruben*" is mis-spelled and incorrectly characterised. The correct spelling is "*Mesodinium rubrum*", although the name has been changed to "*Myrionecta rubra*" (Jankowski, 1976). It is an obligately phototrophic ciliate that contains endosymbiotic cryptophyte chloroplasts.

On page 5 – Section 4.2 "*Phaeocystis pouchetii*" is not a foramnifera. It is a species of phytoplankton, a member of the Haptophyta. It is found either as solitary flagellated cells (about 3 microns across) or in a colonial form, with individual cells embedded in a gelatinous matrix.

On page 8 – 4th paragraph "*Mesodinium rubren*" is mis-spelled and wrongly classified as a dinoflagellate (see above).

On page 13 – "Pseudo/Paracalanus" at station S3, the value is written 112,2. I assume it should be 112.2.

On page 14 – "Microstella" should be "Microsetella"

Tab 12 – Results of a Suspended Solids Survey at the Whites Point Quarry.

There are some critical points that should be addressed before acceptance of this report as a reference for the EIS. At this point, the report does not conclusively refute the statement of the DFO inspector that sediment was entering the bay from the Quarry site making it difficult for the proponent to use it as a reference for no impact. Deficiencies in the report need to be addressed.

The salinity values for the tide pools appear to be wrong. With the exception of stations 2 and 4 which are above the "ordinary high water mark" indicated on the map provided, all others should have been inundated by seawater within 6 hours of sampling. For the tide pools to be fresh, there must be an outside source of freshwater filling them. There are three possible sources: rainfall, groundwater or fresh water runoff from the quarry or other source on land none of which appear likely in this environment.

It is not clear if there is a relationship between the Total Suspended Solids (TSS) in the tide pools and the amount of sediment on the bottom. One would assume that if the material on the bottom is fine-grained, then it settled from the overlying water. No data on the ambient sediment concentrations in the water overlying the pools at high water has been provided. This is a critical parameter for evaluating how much sediment is likely to be deposited in the pools naturally. The material in the tide pool would be expected to start settling as soon as the pool is exposed by the falling tide. The time between exposure and sampling is another critical factor for the interpretation of the data

that should be provided. Assuming a standard floc settling velocity of ~1 mm s^{-1}, the deepest pool could be expected to clear within several minutes.

From the photos provided, tide pools 1 and 5 closest to the outfall appear to have elevated sediment concentrations. In the images, they appear to be a cloudy brown which would seem to be unusual for this area. They also appear to be significantly different from the other images provided. Tide pool 5 appears to have sediment on the bottom whereas in tide pool 1 it appears to be suspended. If there is build up of sediment on the bottom, then it could be reasonably assumed that it settled in the tidal pool between inundations. The depth of the newly deposited sediment in the pool could give some indication of the amount of material available in the overlying water. Again, it is critical that the time between sampling and initial exposure of the pool be provided.

Based on the images alone, it is difficult to see how pool 6 can have such a high level of TSS. It appears to be clearer than pool 5.

It should be noted that the receiving environment is very energetic, and that any sediment that enters from the quarry will likely be dispersed. It should also be noted that TSS values can appear to be high when observed optically which might be the case in trying to interpret the photos. This can be due to the presence of very fine grained sediment at low concentration. Depending on the type of treatment being carried out in the quarry's settling basin (no information provided), it is possible that a "stranded" population of very small but optically very significant particles are remaining in suspension. This was the case at the Dartmouth Crossing project when extremely high rainfall mobilized large amounts of sediment. It appeared that much of this sediment was reaching the lakes downstream but analysis revealed that TSS values were surprisingly low despite a significant plume (Wrye, 2006). It is unlikely that a significant build up of sediment will occur along the shoreline near the outfall from the settling basin; however, at this time, the report should not be used as the sole basis for such a statement.

Tab 13 - A preliminary assessment of the risks of introducing non-indigenous phytoplankton, zooplankton species or pathogens/parasites from South Amboy, New Jersey (Raritan Bay) into Whites Point, Digby Neck, Nova Scotia.

This appears to be a thorough review of the available material. The recommendations are very reasonable, again based on the available material. However, it should be explicit in any set of regulations vis-à-vis ballast water exchanging etc., that regulations will change as there are changes in conditions/threats in the future.

Tab 19 – Erosion, Suspended Sediment and Sediment Transport.

This is a very well written description of the general sediment regime for the Bay of Fundy. However, as a document to support the EIS for the Whites Point Quarry and Marine Terminal it has much less merit. While it is interesting to know that sediment concentrations are high in the upper Bay of Fundy and that there are mega ripples and dunes, the information provided does not have direct relevance to the transport of sediment derived from quarry operations. What is happening in the Petitcodiac is irrelevant for sediment transport off of the quarry site. The question that needed to be answered is what would the fate of the 2.5 m^3 of sediment released from the quarry be. It is correct to state that in comparison to the total sediment in the Bay this amount of

irrelevant, but if this material was deposited in the wrong place, for example in an area of macrophytes sensitive to TSS, then the impact could be significant.

There is a need for data on the background levels of suspended sediment off of the quarry site and some estimate of the dispersion based on tidal current velocities, wave climate and tidal range for the area of interest. While it is highly unlikely that sediment will accumulate in the area, the report fails to make a case for that assumption. Similar to the Brylinski report (Tab 12), the overall conclusion that sediment from the quarry will be dispersed is likely correct but the report provided does not support it.

Tab 24 – Whites Cove Quarry Blasting Potential Impacts on American Lobster.

This report is confined to noise related to blasting and does not address runoff or the potential introduction of pathogens.

The frequency of blasting will be low compared to seismic testing. In addition, if predictions of sound intensity are accurate, it seems the intensity will be lower than seismic exploration. There are still uncertainties regarding effects on crustaceans, however. It would be of interest to know how far the blasting sound will carry at a given level of intensity, and what the background noise levels are during storms. This information would better circumscribe what is local and what level of sound is unusual.

Page 3 states, "in a 1998 DFO assessment, less than 10% of lobster landings…were from the waters around Digby Neck." Given the size of the LFA 34 fishery (~ 17000 mt in 2004-05), 10% is still a large quantity of lobster landings (say 1700 mt) with a value on the order of $26 million.

Uncertainties regarding effects of acoustic stimuli and waterborne vibrations on crustaceans in general and lobsters in particular remain, e.g., "in terms of physical and/or behavioural impact of sound energy on decapod crustaceans, research of this nature is also limited" (page 4).

The conclusion that, "…the quarry would likely have negligible physical effects on the lobsters in the White Cove area," is not fully convincing. On page 4, uncertainties are provided regarding the sensitivities of lobster to intense sounds. On pages 4-5, some evidence is presented for effects of seismic noise on snow crab egg viability. No documentation of the likely size of the area affected is provided.

No mitigation measures are recommended within the EIS to address aforementioned uncertainties. One potential mitigation measure would be to work with local lobster fishermen to limit blasting when lobsters are nearshore and when there is fishing activity in the area. In LFA 34, fishing occurs from late Nov through until May 31 but is diminished in the nearshore areas in winter and early spring.

Tab 25 – Migration of inner Bay of Fundy Atlantic salmon in relation to the proposed quarry in the Digby Neck Region of Nova Scotia.

This report is poorly written and appears to have a lot of inaccuracies. It's not clear that the statistics in Table 4 are correct, and many of the arguments are based on extrapolation from material that may be inappropriate. In addition, the conclusion that

salmon do not migrate close to shore is questionable -- the weir data apparently show that good numbers do in fact migrate close to shore (otherwise they wouldn't be caught).

Appendices

Appendix 40 – Review of the tidal information presented in the Whites Point Quarry and Marine Terminal.

The tidal information presented in 'Ocean Tides and Currents' seems appropriate for the purpose. The proponent's analysis indicates that the large tidal heights and the tidal currents are not a problem for their operation. For example, they have designed the marine terminal so that the water flows through the structure and this reduces the impact of the currents on the structure and the structure on the currents.

There are lots of references to tidal currents in relation to the sediment, which are not reviewed here. However, there is an interesting inconsistency on pages 51 and 52. On page 51, the tidal currents are said to dominant sea bed processes at all depths. However on page 52, the tidal currents are not having any impact on the movement of sediment; 'No sediment bedforms were visible on the sidescan sonar and photographic data indicating little current movement close to the bottom.' Does this mean that all of the fine sediment has already been removed by the currents?

The document mentions sea level rise and considers the potential effect of future sea level rise on operations and the potential environmental impact of the quarry. This seems very sensible. The following is not a criticism; rather, additional information is provided for interest on the latest scientific understanding of sea level rise in the Bay of Fundy.

The proponent quotes a sea level rise expectation of 30 cm/century. This number is based on historical records. Best estimates for Saint John are that the 30 cm per century is made up of 20 cm per century of regional subsidence and 10 cm per century of the ocean rising (Petrie and Loucks, unpublished). However the expectation is that the ocean rising component will increase to about 50 cm per century for the next century (IPCC 2001; the range is 10 to 90 cm per century). In addition the amplitude of the M2 tide is increasing by about 10 cm per century at Saint John (Godin 1992). Thus one can expect that mean sea level at Saint John, and along Digby Neck, will increase by about 40 cm over the next 50 years ((30+50)/2) and that the high water level will increase by about 45 cm over the next 50 years ((30+50+10)/2). The increase in each case could be as much as 60 or 70 cm.

Appendix 46 – Wave Statistics.

The material presented consists of standard wave statistics and is appropriate for this study.

Comments on the Conclusions of the EIS

Intertidal Fish Habitat
The statement on subtidal substrate (coarse sands, gravels and mollusc shell fragments) is likely accurate given the field evidence. However, the statement that; "there appears to be little or no infauna," cannot be supported. The field sampling and lab analysis were far too poor in quantity and quality to make any claims regarding infauna.

Since there is no infilling planned, it is agreed that disturbance of intertidal fish habitat from construction of conveyor system supports is likely to be short lived and limited in extent.

Suspended Sediments
The overall conclusion that sediment from the quarry will be dispersed is likely correct but the report provided does not support it. Supporting documentation does not conclusively refute the statement of the DFO inspector that sediment was entering the bay from the Quarry site, which makes it difficult to use this as the basis for a conclusion of no impact.

Contaminants
The monitoring of water quality of outflow from the sediment retention ponds is insufficient to detect the possible problem of contamination associated with quarrying operation.

Marine Mammals
The conclusions provided in the EIS regarding collision risk with right whales are generally correct. The increased ship traffic due to the proposed activity, and the proposed route for these vessels, will result in an increase in the probability of vessel-whale interaction along the proposed route, but the increase will not be substantial. The likelihood of collision will still be low in the area under investigation relative to other regions in the Bay of Fundy (such as in the vicinity of the Conservation Zone).

It is reasonable to assume that a couple of bulk carrier transits per week through or close to the Right Whale Conservation Area would not add greatly to *average* incremental exposures *in the Conservation Area itself*. However it should be emphasized that for any individual vessel passage the locally observed noise level and any specific animal exposure will be very dependent on the distance to the vessel and also, at increasing ranges, on the water depth and other physical variables.

If applied correctly and with rigour, the proposed mitigation should minimize the risk of direct noise effects to marine mammals.

Sea Turtles
It is agreed that this proposed activity is likely to have no effect on sea turtles; however, it is a stretch to come to this conclusion based on the text provided.

Atlantic Salmon
DFO Maritimes Science remains of the opinion that historic fishing, scientific sampling and theoretic modeling indicates that there could be migrating inner Bay of Fundy Atlantic salmon in the Whites Point, Digby Neck area from May until October.

Effects of Noise on Fish
Based on physical modelling, there seems to be minimal cause for concern in terms of lethal effects on fish. It should be kept in mind that the 100 kPa criteria pertains to lethal or obvious sun-lethal injury to fish and not to more subtle behavioural effects, which if they do exist, are likely to be transitory considering the extremely low repetition rate characteristic of quarry blasting.

Effects of Noise on Lobster
Sound from blasting appears to be substantially less than that from seismic exploration, but enough uncertainty remains that there should be some mitigation of potential negative effects to lobster.

Invasives
The potential for introduction of pathogens and other invasives (such as the Asian crab) by this project may be no different (or may be lower) than that from existing shipping. While current practices for ballast water management leave much to be desired, there is no obvious reason to disagree with the position regarding ballast water control.

Comments on Mitigation and Monitoring

Marine Mammals
Bilcon makes the following commitments:

- North Atlantic right whale sightings in the Whites Cove area will be communicated to the ships captain before the ship exits the inbound shipping lane.
- Blasting will not be carried out if seals are present within 170 metres of the point of detonation or if whales, porpoises or dolphins are within 500 metres of detonations. If endangered marine mammal species such as right whales, blue whales or fin whales are sighted in the near-shore area of Whites Point the safety radius will be increased to 2500 metres.

These commitments will require monitoring of the area before and during blasting and also before and during ship transit. Details of how they plan to undertake this monitoring are not clear. Trained marine mammal observers should be utilized.

Suspended Sediments
It appears that there will be no post-construction monitoring of suspended sediments. No operational triggers are identified should suspended sediments increase. It may be advisable to undertake post-construction monitoring for some period of time to ensure that there is no elevation of suspended sediments either from the conveyor and transfer to the ship, or from runoff from the quarry itself.

Noise
At 500m range, blast pressure measurements should be made near-bottom rather than at 1m depth where the direct wave and surface reflection will be expected to nearly cancel. Near-bottom, the pressure levels will maximize. These monitoring considerations should be clarified.

If this project were to go ahead, it would be advisable to make baseline measurements of bulk carrier noise around the terminal and nearby areas of potential environmental sensitivity.

Contaminants
It is suggested that lobster, scallop, and crab be assessed for contaminants in addition to other environmental samples within the environmental effects monitoring program.

Fish Habitat
A habitat compensation ratio of 3x is being proposed. What will be the timing of this compensation, i.e., will it be constructed *prior* to habitat loss that may result from this project?

Potential mitigation for potential effects of blasting on lobster and lobster fishing would be to adjust timing so that blasting is not conducted when lobsters are nearshore and when fishing activity is nearshore.

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