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Mr. R. Petrie
District Manager – Yarmouth
Department of Environment and Labour
13 First Street
Yarmouth, Nova Scotia B5A 2S9

RE: Whites Point Quarry Blasting Plan

Following is additional information concerning items in paragraph 10 h) and 10 i) of your Approval to Construct and Operate – Quarry. Approval No. 2002 – 026397, PID # 30161160.

Regarding item 10 h), our previous submittals confirmed that all blasting would be conducted in accordance with the Department of Fisheries and Oceans “Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters” – 1998. These Guidelines set forth guideline criteria that no explosive is to be detonated in or near fish habitat that is likely to produce an instantaneous pressure change greater than 100 kPa (14.5 psi) in the swim bladder of a fish. Also, no explosive is to be detonated that is likely to produce a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation. Tables 1 & 2 contained in the aforementioned Technical Report provide setback distances from the centre of detonation of a confined explosive to fish and spawning habitat. These setback distances are essentially based on the weight of explosive charge and type of substrate.

In this regard, site specific investigations were carried out to determine possible effects on fish and fish habitat from blasting during quarry operations. These investigations concentrated on the marine environment since no suitable fresh water fish habitat exists on or near the quarry site. Shock wave propagation from the proposed blast sites to the marine water column were modeled. This investigation was conducted by JASCO Research Limited and LGL Limited (Hannay, David E. M.Sc. and Thomson, Denis M.Sc. “Peak Pressure and Ground Vibration Study for Whites Cove Quarry Blasting Plan” August 2003). Site specific topography, bedrock composition, and bathymetry were used to illustrate a “worst case” situation for quarry blasting in relation to the marine water column. Also, specifications outlined in Global Quarry Products Blasting Plan dated November 18, 2002 were used e.g. weight and type of explosive, shot pattern and spacing, shot hole depth and diameter, and delay sequence. The blast effects model CONWEP (Hyde 1992) was then run to predict the shape of the shock wave pressure at various distances from the detonation site.

Results from the CONWEP model indicate that the proposed 73 meter setback from the detonation of a confined explosive to fish habitat (the ordinary high water line) are not expected to exceed pressures of 50 kPa. Blasting within 3 hours of low tide, as proposed, would further reduce pressures to less than approximately 25 kPa in the water. This is significantly below the 100 kPa guideline criteria. Further, a conservative water depth of one meter at the ordinary high water line was assumed rather than a zero depth. Also, the CONWEP model predicts peak velocity of 13 mm/s corresponding with the ordinary high tide line. As proposed in the Blasting Plan, blasting will be conducted within three hours of low tide or at low tide if conditions permit. The setback from the detonation site to the water column within three hours of low tide would be 118 meters. This exceeds the 100.5 meters required in the guideline criteria. Again, a conservative approach has been taken to reduce risk to potential spawning areas. In summary, proposed setback distances exceed guideline criteria for 100 kPa peak pressure and 13 mm/s ground vibration for fish, fish habitat and spawning areas.

Further, mitigation measures include that the timing of blasting activities is proposed to be within 3 hours of low tide, when atmospheric conditions permit, at low tide. This will result in the maximum setback distance from the marine water column and exceed the guideline criteria set forth in the "Guidelines for the Use of Explosives in or Near Canadian Fisheries waters". Also, the explosive ANFO will be used whenever possible. ANFO has a lower yield per equivalent weight than TNT and will possibly further reduce pressure and vibration in fish habitat. The frequency of blasting is proposed to be once per week initially and once every two weeks during full quarry operation with a duration of generally less than one second per blast. Thus, the frequency and duration of blasting will be transitory and should have minimal effects on fish behavior, fish health or movements.

Monitoring of blasting activities would include video documentation of each blast event and land monitoring for concussion and ground vibration for each blast event. The latter would be done in accordance with the Nova Scotia Department of Environment and Labour regulatory requirements. Also, monitoring of each blast will be conducted at three stations located within nearshore marine waters. Monitoring for peak pressure and ground vibration will be conducted at locations in one meter tidal zone depth and at approximately 170 meters and 500 meters from the detonation site.

Regarding item 10 i), our research recognizes that noise from the detonation of explosives or other man made sources, in addition to natural sources, may cause adverse effects on marine mammals. Some studies indicate excessive noise may induce changes in behavior and effects on hearing which in turn may interfere with breeding activities, locating food, detecting predators, communication, migratory paths and abnormal behavior. General guideline criteria as published in Fisheries and Oceans Canada – Newfoundland Region "Factsheet – Blasting – Fish and Fish Habitat Protection" 1999 indicates blasting activities are not to be carried out in the marine environment within 500 meters of marine mammals. Again, the CONWEP model was used to predict the shape of the shock wave pressure at the 500 meter setback radius to assess possible harassment to marine mammals. An additional more conservative, setback radius will be used if

endangered marine mammals such as the Right Whale have been sighted in the immediate nearshore area. This setback or safety radius for endangered marine mammals would be based on the formula $r=260(\text{cube root of } w)(7.28)$ where r =radius, w =weight of explosive (TNT equivalent in pounds) (ref. Florida Fish and Wildlife Conservation Commission "Endangered Species Conservation Conditions for Blasting Activities" 2001.

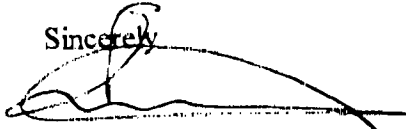
CONWEP model results indicate peak pressure at 500 meters will be approximately 5 kPa in the basalt which corresponds with a peak level in the water of approximately 2 kPa or equivalently 186 dB re $1\mu\text{Pa}$ peak. Root – mean – square (RMS) levels are typically 5 – 10 dB less than peak level as a result of signal spreading in time due to multi path propagation. The Department of Fisheries and Oceans has recently accepted safety standoff thresholds of 180 dB RMS for toothed whales and 190 dB for Pinnipeds in the vicinity of air gun systems used for seismic explorations. These thresholds represent received levels at which marine mammals could sustain temporary threshold shift (TTS). Temporary threshold shift is a temporary and recoverable increase in hearing threshold, similar to what a human would experience at a loud rock concert. The distance at which TTS could occur is commonly used as a distance for a safety radius around a noise source. The pulse raise time for air gun signals and the blast pressure wave at this range will be similar for these two types of noise source. Consequently, the same 180 dB RMS threshold would be appropriate here.

The proposed 500 meter distance from the point of detonation for a safety radius therefore appears appropriate for Cetaceans. The safety range for Pinnipeds presumably could be approximately one third this range or approximately 170 meters if inverse distance ($1/r$) acoustic spreading transmission loss is assumed. It should be noted that during seismic operations, air guns are shot every 20 seconds for hours on end. In the case of the proposed blasting, the entire event will be over in less than 0.5 seconds. The National Marine Fisheries Service, responsible for implementation of the Marine Mammal Protection Act has ruled that a single, short, noise pulse, such as that caused by an under water explosion does not constitute disturbance (U.S. Federal Register 61 (#234, 4 Dec. 1996, page 64, 337). As outlined in the subsequent paragraph, a conservative approach is proposed to protect marine mammals and in accordance with published guideline criteria. In summary, the proposed 170 meter safety radius for Pinnipeds, a 500 meter safety radius for Cetaceans, and an increased safety radius of 2500 meters if endangered marine mammals are sighted in the immediate area, meet or exceed accepted guideline criteria for the protection of marine mammals during proposed blasting activities at the Whites Point Quarry.

As mitigation measures, blasting will be executed using the minimum weight of explosives and greatest safety radius in relation to the marine environment as conditions warrant. Blasting will not be conducted if Pinnipeds are present within 170 meters of the point of detonation or if Cetaceans are within 500 meters of detonations. If endangered marine mammal species such as Right Whales or Blue Whales are sighted in the nearshore area off Whites Point, the safety radius will be increased to 2500 meters.

Monitoring of each blast will be conducted as outlined previously.

Sincerely

A handwritten signature in black ink, appearing to read 'Paul G. Buxton', written over a horizontal line.

Paul G. Buxton, P. Eng.
Project Manager