5.0 ACOUSTIC ENVIRONMENT

5.1 SCOPE OF THE REVIEW

This section reviews the potential interactions for each Option with the acoustic environment. Activities that will interact with the acoustic environment as part of this review include noise and ground vibration from heavy equipment, on-road trucks and passenger vehicles, and pile driving and blasting arising from activities associated with the construction and operation of the Preferred Option to be selected.

Estimated noise levels for this review are based on typical noise-generating equipment that will be used for each of the Options, as available from literature sources. The review considers potential changes in sound quality at nearby residences and common activities around the nearby community.

5.1.1 Why Acoustic Environment is a Valued Component

The acoustic environment includes:

- sound quality; and
- ground vibration.

Sound quality can be defined as a listener's perceived reaction to sound and how acceptable a sound is (*i.e.*, the nature and level of sound). For example, sound quality in an urban area is typically characterized by traffic, other human activities, and natural sources such as wind. Intrusive noises such as chainsaws, construction equipment or loud music could be perceived as reducing sound quality. Noise, as perceived by humans as a result of changes to sound quality, is defined as unwanted sound. Ground vibration is caused mainly by shock waves moving through the earth as a result of some natural or man-made activity. Vibration can cause annoyance to people, if perceptible, and can also cause structural vibration and damage if the vibration is strong enough.

The acoustic environment is a Valued Component (VC) because, if not properly managed, potential unwanted sound (noise) or ground vibration from the Preferred Option may cause annoyance, sleep disturbance, loss of property enjoyment, and structural damage to nearby residences and communities.

5.1.2 Regulations and Policies Relevant to Acoustic Environment

Noise Limits

There are currently no noise guideline levels, regulations or standards in New Brunswick for limiting acceptable sound levels from industrial facilities. Where necessary, the New Brunswick Department of Environment and Local Government (NBDELG) sets limits on a case-by-case basis; these are documented in an Approval to Operate, issued under the New Brunswick *Clean Air Act* to industrial facilities. Approvals require that sound emissions from a facility do not affect enjoyment of the normal use of any property, or cause substantial interference with normal conduct of business.

Absolute limits are sometimes included in NBDELG's approvals and typically range from 50 to 55 dBA (day) to 40 to 50 dBA (night). Some approvals specify a limit in reference to background levels; for example that noise levels at the nearest sensitive receptor should not exceed a specified number of decibels (dB) above background levels (Glynn, M., pers. comm., 2015). In some approvals, this threshold above background levels ranges from 3 dBA to 10 dBA.

Health Canada recommends mitigation for sound pressure levels of 75 dBA or higher over baseline (or more than 6.5% change in Percent Highly Annoyed (PHA) for construction phases lasting more than one year).

Blasting, including Ground Vibration

Blasting in New Brunswick is regulated through the *Blasting Code Approval Regulation* under the *Municipalities Act*. The limit for instantaneous blasting noise is 128 dB (linear), and 12.5 mm/s for ground vibration. These limits afford protection from damage to structures (such as cracking of drywall) with a reasonable margin of safety and are applicable at the nearest residence or building from the blast site. Where warranted and to avoid nuisance claims, pre- and post-blast surveys are typically carried out to assess for damage based on proximity to residences. In an urban setting, surveys within 400 m of the blasting source are typical (Dowding 2000).

Did you know?

Health Canada suggests evaluating noise issues by calculating a "**percent highly annoyed**". It is a measurement that accounts for higher potential annoyance from noise at night by considering both daytime and nighttime noise levels. A mathematical equation was created based on community interviews and surveys. It is used to estimate how noise might bother a population of people, expressed as 'percentage highly annoyed'.

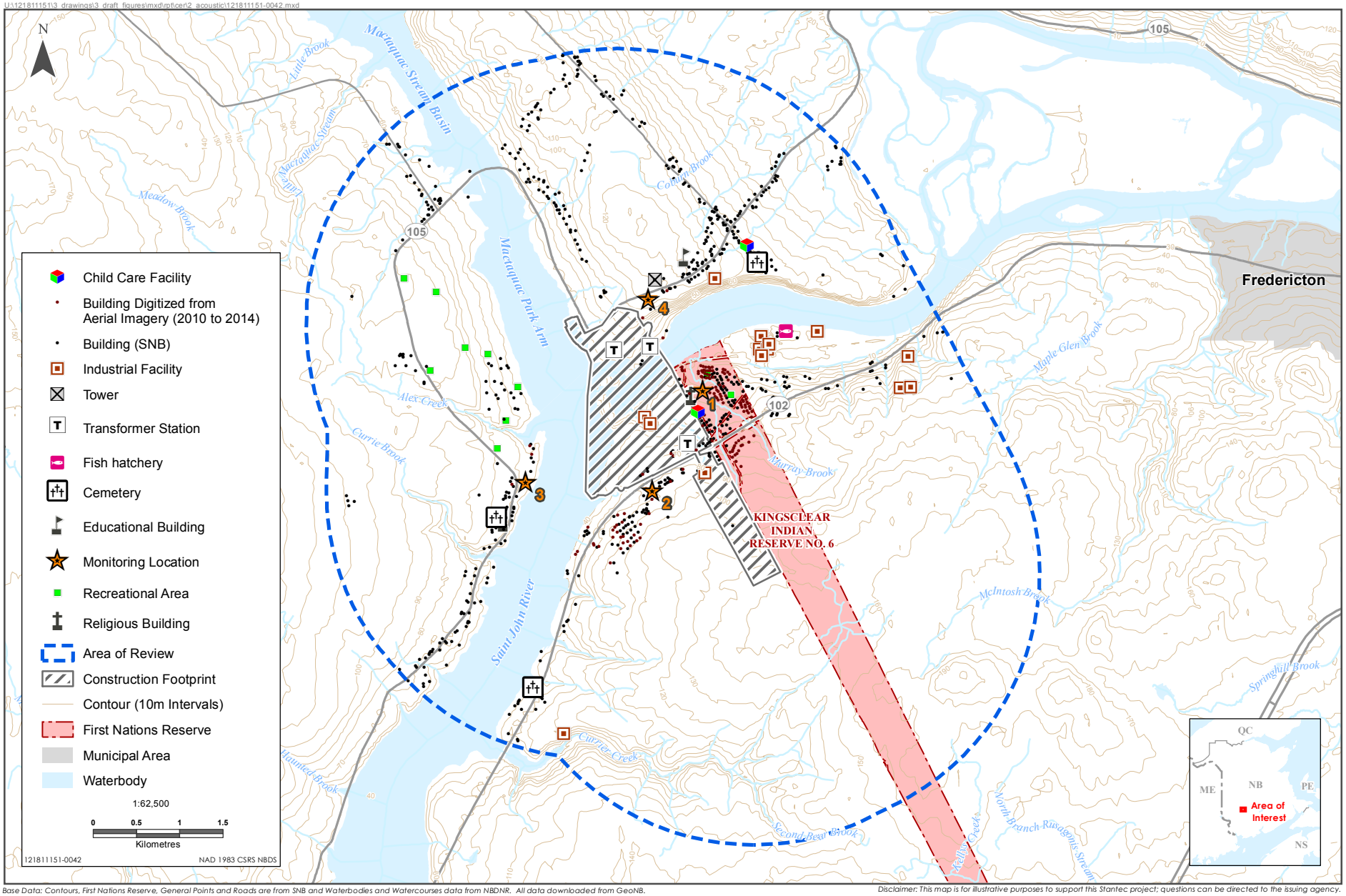
In New Brunswick, there are currently no limits or guidelines for ground vibration from traffic or mobile equipment. A general guideline for annoyance is where the receptor distinctly feels ground vibration, which according to Jones and Stokes (2004) is approximately 6 mm/s. Jones and Stokes (2004) have established 0.15 mm/s as a threshold of perceptibility for steady-state ground vibration. This guidance is part of the "Transportation- and Construction-Induced Vibration Guidance Manual", prepared by Jones and Stokes (2004) for the California Department of Transportation.

5.1.3 Area of Review

The area of review for the acoustic environment (see Figure 5.1) is defined as the area of physical ground disturbance for the three Options during construction, demolition and decommissioning, and is supplemented by a 3 km perimeter beyond the area of disturbance. Although blasting noise may be heard as far out as 10 km, a 3 km perimeter covers the area of greatest concern for noise disturbance.

5.1.4 Key Issue

The key issue of concern for this VC is a potential change in sound quality (which for convenience in this review will include ground vibration), which is described in Table 5.1. If not properly managed, noise and ground vibration could cause annoyance to nearby residents, loss of enjoyment of property, sleep disturbance, or property damage (ground vibration).



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Area of Review for the Acoustic Environment

Figure 5.1

Table 5.1 Description of Key Issue for Acoustic Environment

Key Issue	Description
Potential change in sound quality (including ground vibration)	• Increased traffic noise. • Increased noise from blasting and pile driving. • Increased noise from mobile construction equipment (such as excavators). • Increased noise from other site activities such as rock crushing, concrete production. • Perceivable ground vibration. • Ground vibration causing structural damage.

5.2 EXISTING CONDITIONS

5.2.1 Sources of Information

Sound quality is evaluated in this review with respect to the nearest sensitive receptors. Noise sensitive receptors include such private and public facilities as hospitals, schools, child care centres, seniors' residences, recreational areas, and areas where First Nations cultural or religious ceremonies take place.

Sources of information used to characterize existing ambient sound quality conditions include:

- noise control guidelines for operations and facilities published by the Alberta Energy Resources Conservation Board [ERCB] (2007); and
- a field survey conducted in the area of review.

Sources of sound in the area of review are considered normal (no major sources beyond traffic and routine human activity); therefore published background noise estimation methods based on values accepted by Alberta provincial regulators (ERCB) are considered appropriate and have been adopted for use in the area of review.

To supplement the Alberta ERCB information, a confirmatory field survey was conducted on April 29, 2015 in the area surrounding the potential main area of disturbance near the Saint John River at Mactaquac. The survey's objective was to confirm ambient sound levels and identify any major deviations from the estimated background sources of sound based on the Alberta ERCB data. Short-term measurements of sound pressure levels were taken at various locations near the Station (see Figure 5.1 and Table 5.2).

The sites were chosen due to proximity to the construction site and are considered representative of the areas that could experience the greatest changes in sound quality from the Options.

5.2.2 Description of Existing Conditions

The Station is located in a relatively rural, agricultural area. The existing acoustic environment within the area is affected by:

- natural sounds (*e.g.*, wind, birds, leaves rustling);
- traffic along surrounding highways and secondary roads;
- noise from recreational activities, such as boating, camping, ATVs; noise is expected to increase in the summer due to increased recreational use from what was recorded during the April 2015 field survey; and
- other human-related activities, such as lawn mowers, chainsaws and power tools and children playing.

Estimated Baseline Sound Pressure Levels

Based on research conducted by the Environment Council of Alberta, the average rural ambient sound level is about 35 dBA at night, with daytime levels typically about 10 dBA higher. A sound level of 45 dBA could therefore be expected at a rural location during the daytime (ERCB 2007).

Baseline sound pressure levels also exist for less rural areas which is based on the number of dwellings in an area and proximity to heavily travelled roads. The Alberta ERCB defines a heavily travelled road as more than 10 vehicles per hour during the nighttime. Traffic counts for Routes 105 and 102 near the Station were carried out by exp. Services Inc. in summer 2014 and fall well within this definition.

Four noise monitoring sites were selected near the Station to gain an understanding of potential sound pressure levels near the Station. Table 5.2 lists the estimated and measured sound pressure levels for the four monitoring sites, as well as sound sources that were observed by the field team during the field visit.

Table 5.2 Estimated and Measured Baseline Sound Pressure Levels – Mactaquac Area

Site	Description of Site	Approximate Distance from Construction Footprint	Observed Sounds during Field Study	Measured Sound Pressure Level – Daytime (1-h L_{eq}, dBA)	Estimated Sound Pressure Level – Daytime (1-h L_{eq}, dBA)[1]	Estimated Sound Pressure Level – Nighttime (1-h L_{eq}, dBA)[1]
1	Kingsclear First Nation - residential and other use, including a school and a church	200 m to the east	Occasional vehicles, birds, occasional dog barking	50	45–50	35–40
2	Residential area off Route 102	150 m to the south	Vehicles on Route 102 and secondary roads	59 (measured approximately 30 m from Route 102)	48–58 (depending on proximity to Route 102)	38–48
3	Residential area on Route 105	700 m to the southwest	Vehicles on Route 105, birds	57 (measured approximately 30 m from Route 105)	48–58 (depending on proximity to Route 105)	38–48

Table 5.2 Estimated and Measured Baseline Sound Pressure Levels – Mactaquac Area

Site	Description of Site	Approximate Distance from Construction Footprint	Observed Sounds during Field Study	Measured Sound Pressure Level – Daytime (1-h L_{eq}, dBA)	Estimated Sound Pressure Level – Daytime (1-h L_{eq}, dBA)[1]	Estimated Sound Pressure Level – Nighttime (1-h L_{eq}, dBA)[1]
4	Residential on Route 105	200 m to the north	Vehicle passes on Route 105, birds	59 (measured approximately 20 m from Route 105)	48–58 (depending on proximity to Route 105)	38–48

Note:
[1] Based on ERCB (2007)
dBA = Decibels on an "A" weighted scale.

Following ERCB methodology and the field survey completed in the area, baseline sound pressure levels near the Station are expected to range from 45 to 58 dBA during the day and 35 to 48 dBA during the night. Residences that are closer to Routes 102 and 105 are expected to experience levels at the higher end of the range.

There are no substantive existing sources of ground vibration near the Station; the existing level of ground vibration in the area of review is therefore assumed to be negligible.

5.3 SUMMARY OF STANDARD MITIGATION FOR ACOUSTIC ENVIRONMENT

Standard and acoustic-specific mitigation and best management practices that will be implemented are based on normal operating procedures and regulatory requirements (see Section 2.6).

Large construction projects typically include detailed plans to control noise and vibration to acceptable levels. Noise management options will be included in environmental protection planning documentation. Management of noise and ground vibration for the Options includes the following mitigation.

- Idling of vehicles will be limited. Vehicles and equipment will be turned off when not in use, unless required for effective or safe operation.
- Vehicles and equipment will be maintained regularly (including mufflers), following manufacturer's maintenance schedules.
- Traffic patterns will be optimized so that project-related traffic follows efficient routes to and from the site and to reduce use of noise-producing equipment (*e.g.*, back-up beepers).
- Blasting will be conducted according to provincial legislation, and will be subject to terms and conditions of applicable permits.

- Mechanical excavation measures will be used in lieu of blasting where practical.

- To the extent feasible blasting will be limited to daytime or evening hours, and be conducted at regular planned intervals, with the public notified prior to a blast.
- Blasting contractors will review the design and associated mitigation measures to control noise and off-site ground vibration, and to monitor the blasting program.
- Pre-blast surveys will be completed to evaluate the potential for ground vibration and identify potentially affected structures.
- Noise mitigation will be monitored and additional mitigation will be identified if needed to reduce noise to acceptable levels.
- Nearby residents will be given a construction schedule for key noise-generating activities, and provided with contact information in case of complaints.

5.4 POTENTIAL INTERACTIONS BETWEEN ACOUSTIC ENVIRONMENT AND THE OPTIONS

Table 5.3 provides an overview of how the Options might interact with the acoustic environment.

Table 5.3 Potential Interactions between the Acoustic Environment and the Options

Phase	Option 1	Option 2	Option 3
	Potential Change in Sound Quality (including Ground Vibration)		
Construction (New facilities, Option 1 and Option 2)	✓	✓	
Demolition (Existing structures, Option 1 and Option 2)	✓	✓	
Operation (Option 1 and Option 2)	NI	NI	
Decommissioning (Option 3)			✓

Notes:
✓ = Potential interactions.
NI = No interaction.
Shaded cells are not applicable to the particular option and phase.

Generally, operation of Options 1 or 2 is not expected to result in sound emissions or ground vibration beyond existing ambient conditions. This is because operation of the new facilities would be very similar manner to current operation of the dam, though on the south bank of the river instead of the north bank where they are currently. Since the change is anticipated to be nominal, the interactions of the operation of Options 1 or 2 with a change in sound quality (including ground vibration) are not considered further in this review.

5.4.1 Potential Change in Sound Quality (Including Ground Vibration)

Because Options 1 and 2 include many of the same activities and are of similar duration (Option 1 duration is approximately 11 years; Option 2 duration is approximately 10 years), potential for changes in sound quality are expected to be similar for both. They are thus evaluated together, below.

5.4.1.1 Option 1 or Option 2

Construction and Demolition Activities

During construction of new structures (*e.g.*, site preparation, excavation, facility and access road construction) and demolition of existing structures, heavy equipment and activities such as blasting (which is required to remove bedrock for the main spillway, powerhouse and diversion sluiceway) may produce noticeable noise and ground vibration at nearby properties. Transport of materials, equipment, personnel (in cars and buses) and products to and from the work site will also generate noise and possibly to a lesser extent vibration.

Changes in sound pressure levels and ground vibration arising from Option 1 or 2 will occur intermittently over 10-11 years in the vicinity of the Station, and thus constitutes a long-term source of noise and ground vibration. These activities will not, however, be uniform during this period. For Option 1, the construction of the powerhouse and main spillway is anticipated to take approximately 6 years, and the construction of the auxiliary sluiceway and demolition of the existing structures is anticipated to take an additional 5 years. For Option 2, the construction of the main spillway is anticipated to take 5 years, and the construction of the auxiliary sluiceway and demolition of existing structures will take an additional 5 years. Construction activity would be intermittent throughout this period, with some greater levels of activity during some periods (generating noise and ground vibration) and lesser activity during other periods. To the extent feasible activities would be limited at night, for safety reasons and to reduce disruption to the everyday life of nearby residents. As a number of noise-generating activities will be required within 500 m of permanent residential properties, and other sensitive receptors (*e.g.*, schools), detailed planning of noise mitigation will need to be developed for either Option 1 or 2, with a view to limiting disruption to residents. Some noise barriers adjacent to nearby receptors are included in the preliminary site plan for Options 1 and 2 (Figure 2.9).

Typical sound pressure levels of some commonly used construction equipment compared with various common household sounds are provided in Table 5.4.

Table 5.4 Typical Sound Pressure Levels of Construction Equipment and Household Activities

Equipment Powered by Internal Combustion Engines	Sound Pressure Level (dBA at 15 m)
Roller/Excavator/Bulldozer[1]	85
Front Loader/ Backhoe/Diesel Truck[1]	80
Grader[1]	95
Common Household Activities[2]	
Gasoline-powered lawn mower	100-106
Busy traffic, vacuum cleaner, alarm clock	70
Typical conversation, dishwasher, dryer	60
Quiet room	40
Whisper	30

Notes:
dBA = Decibels on an "A" weighted scale.
Source:
1 FHWA (2006)
2 ASHA (2015)

Construction Noise Scenario

Because the specific equipment that is required during construction and demolition has not yet been defined at this early planning stage, a typical scenario was developed and modelled to provide an order-of-magnitude estimate of potential noise during daytime for construction and demolition activities associated with Options 1 and 2. The scenario includes regular material trucking and heavy equipment as these are expected to be some of the noisier activities and more prolonged and frequent than other noisy activities like blasting. This scenario also assumes that heavy vehicular use will occur during daytime hours only, although during detailed engineering planning it may be determined that some activities may be required overnight during peak construction periods. Because of this mitigation, nighttime noise levels are not expected to change noticeably from current levels. The modeling was carried out using a model called CadnaA (Computer Aided Noise Abatement), which is an industry standard software program for calculation, presentation, assessment and prediction of environmental noise.

For the purpose of this review, the modelling scenario assumed that one diesel-powered piece of heavy equipment (equivalent to an excavator or bulldozer) operates at every 200 m interval over a defined area, for a total of 19 pieces of motorized equipment operating simultaneously on the construction site. The equipment is assumed to be distributed evenly over the general footprint of the excavation area, as shown in Figure 5.2. The modelling scenario also assumes 30 heavy trucks per hour operate on a haul road, located in the model at 25 m from the nearest receptor. This is likely a high estimate scenario, as all the heavy equipment is assumed to be operating simultaneously. The model also uses conservative assumptions for wind and meteorological conditions, which favour noise propagation towards the noise sensitive receptor.

Table 5.5 provides a breakdown of estimated daytime sound pressure levels at various distances from activities noted above.

Table 5.5 Estimated Daytime Sound Pressure Levels from Busy Construction and Demolition

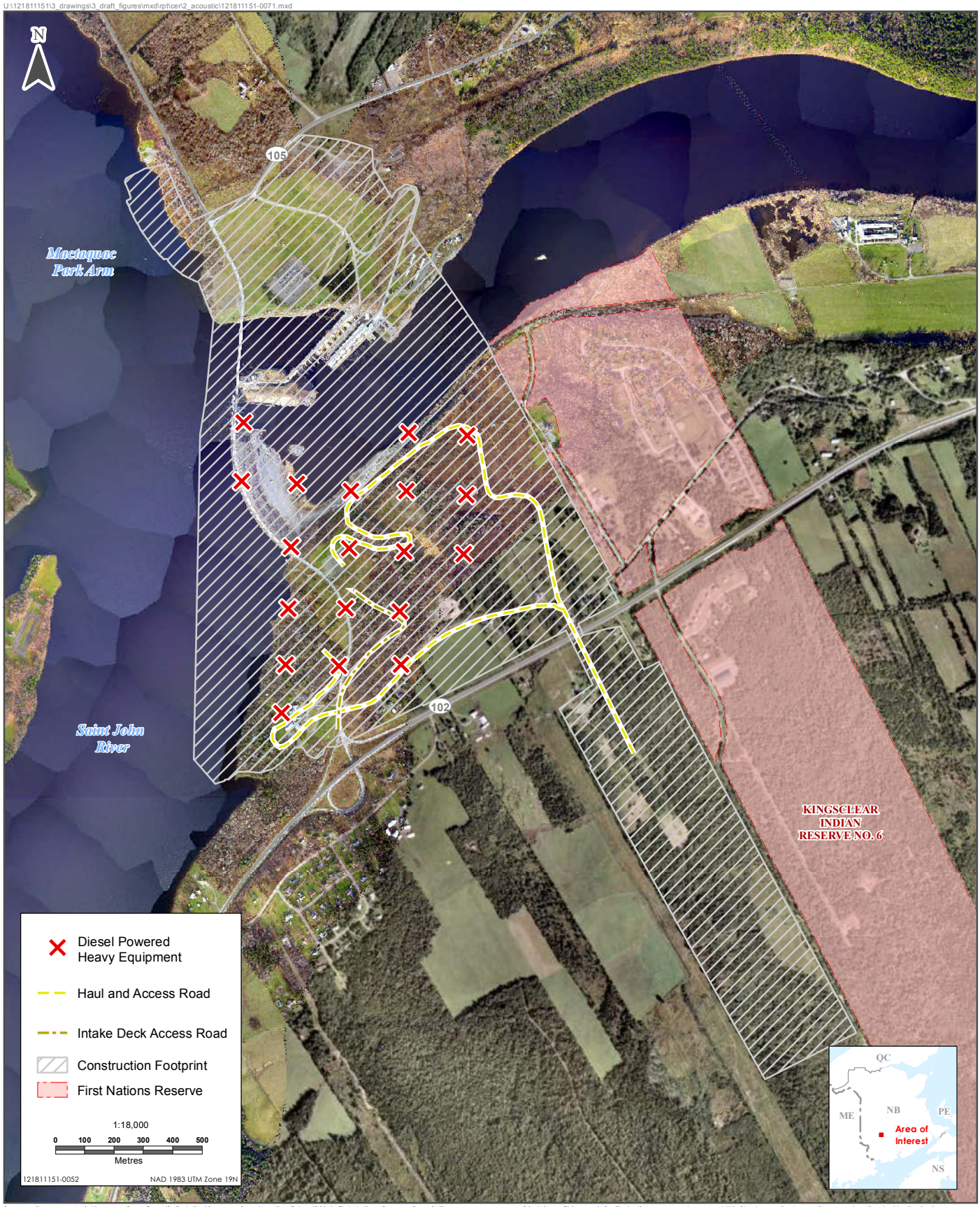
Distance from Construction Activity (m)[1]	Distance from Haul Road (m)	Predicted Daytime Sound Pressure Level (dBA)*
150	25	65
300	175	58
500	375	51
1,000	875	45

Notes:

* Sound pressure level estimates are for outdoor noise level and do not include the 15 to 25 dBA decrease in sound pressure levels (depending on insulation and construction quality) that is typically achieved by the walls of a well-built building (windows closed) (Hoover and Keith Inc. 2005).

[1] Distance from construction activity is based on distance from the nearest piece of heavy equipment modelled. Equipment is shown as red Xs in Figure 5.2.

dBA = Decibels on an "A" weighted scale.



Sources: Basemap Aerial imagery from GeoNB. Detailed imagery from Leading Edge (2014). First Nations Reserve from SNB.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

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Noise Model Layout

Figure 5.2

The nearest human-occupied receptor is expected to be about 150 m from the primary construction activities and could be closer to the haul road and other ancillary activities such as laydown areas. As evidenced by the modelling results in Table 5.5, the daytime sound pressure level expected at the nearest residential receptor to the construction activities is 65 dBA, with sound pressure levels decreasing with increased distance from the noise-producing sources. At approximately 1,000 m from the noise-producing activities, sound pressure levels would be at or near background levels, at approximately 45 dBA.

Potential Interactions during Construction and Demolition

As noted in Table 5.2, existing baseline sound pressure levels during daytime at nearby residences are expected to be between 45 and 58 dBA. Based on the preliminary estimates, without mitigation, residences within 300 m may perceive a doubling in ambient noise during peak construction activities. A 10 dBA increase from baseline levels is generally perceived as a doubling in noise by the human ear, therefore an increase from 48 dBA to 58 dBA would result in double the noise. The largest perceived change in noise will occur at residences close to the construction activities (within 300 m) that are not near higher traffic roadways (Route 102 and Route 105) as background levels would be lower at those locations. For comparison, a 3 dBA increase is the approximate threshold of perception for humans of a change in sound or noise levels. Noise from peak construction may be noticeable 1,000 m from the site, and farther out for impact noises such as blasting or pile driving.

Because the specific details of which construction equipment will be used and their daily operating schedules for each Option are not yet available, this review does not compare preliminary values to noise guidelines (such as those in Section 5.1.2). A comparison will be completed for the Preferred Option during any EIA of the Preferred Option, once it has been selected. However, based on possible noise levels and the duration of activities planned, detailed noise management planning will be needed to minimize disruption to nearby residences and other noise sensitive receptors from construction and demolition activities associated with Option 1 or Option 2.

Details of nighttime activities have not yet been defined at this early stage of planning; however, as nighttime noise is a concern for annoyance and sleep disturbance, mitigation plans for any potential nighttime construction activities that may occur will be considered, including a reduction of activity and mitigation to reduce nighttime noise to acceptable levels. Most construction-related activity would occur during the daytime for safety reasons and to minimize disruption, though some lesser level of construction activity could be conducted at night for some periods. Regardless, residences and other users within 1,000 m of the Project site will be consulted regarding planned activities.

Noise from trucking activities to and from the Project site may reduce sound quality at residences along the route; therefore, route selection will consider best practices to reduce potential interactions with adjacent residents and communities, to the extent feasible.

Blasting noise is brief (typically about 2 to 5 seconds at a time due to the delays between charges), and may occur up to twice daily during peak blasting periods. Blasting will be needed for the excavation of the approach and discharge channels associated with Option 1 or Option 2, and may possibly be used for demolition activities for the now-obsolete existing concrete structures. Blasting would not be a continuous activity, but would occur frequently (*e.g.*, on average, approximately once every second day) during the daytime for approximately 2-3 years (cumulative time) as the approach and discharge

channel is excavated. Because the excavation will be completed in stages, there will be intermittent periods lasting months to years in duration with no blasting. Noise from blasting (*i.e.,* air concussion) will likely be noticeable several kilometres from the blast site. Blasting will necessarily need to meet the *Blasting Code Approval Regulation* peak overpressure limit (instantaneous blasting noise) of 128 dB (linear) (see Section 5.1.2). Blast times will be communicated to nearby residents to reduce the startle effect and potential for annoyance. Pre- blast surveys will be comprehensive and include an evaluation of potential for ground vibration at nearby structures. Post blast surveys will be in place to assess, and avoid, any structural damage. Blasting will be completed to the extent possible during daytime hours, although some blasting may be required during evening hours.

Ground vibration from heavy equipment may be noticeable within 90 to 300 m of the activities. Given that the nearest human-occupied receptor is expected to be about 150 m from the primary construction activities, occupants may notice some limited and infrequent ground vibration, during or immediately following a blast. Residents will be notified prior to a blast.

Impulse noise (*e.g.*, metal-on-metal clanging from truck tailgates) may occur intermittently, and has potential to cause annoyance. As such, noise mitigation will consider ways to reduce impulse noise.

Nearby residents will be notified when key noise-generating activities are to occur. The environmental management plan will outline how noise complaints, if any, will be managed. Any complaints will be reviewed case-by-case, to resolve the complaint and investigate additional mitigation options.

5.4.1.2 Option 3

Noise-generating activities during Option 3 (decommissioning) are expected to be less than Option 1 or 2, given the more limited Project-related activities and lesser duration with this Option compared to Options 1 or 2; however, some mitigation may still be required during peak activities. Because Option 3 will last approximately 7 years, it is considered long-term in duration (Health Canada 2010a).

Prior to decommissioning of the existing Station, an alternative transportation link may be required to replace the road that currently travels over the dam. Because of this change in traffic patterns, there may be a noticeable decrease in traffic-related noise near the dam and an associated increase near the location of the alternate (new) crossing. Whether or not nearby residents notice noise at any new crossing will depend on its location.

5.5 SUMMARY OF INTERACTIONS BETWEEN ACOUSTIC ENVIRONMENT AND THE OPTIONS

As described in Section 5.4, several interactions between acoustic environment and the Options are anticipated. These interactions are summarized in Table 5.6.

Table 5.6 Summary of Interactions between Acoustic Environment and the Options[1]

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does it occur?	Has additional mitigation been recommended?
Potential Change in Sound Quality (Including Ground Vibration)						
Option 1	Negative	Medium	Area	Long	Multiple	Yes
Option 2	Negative	Medium	Area	Long	Multiple	Yes
Option 3	Negative	Medium	Area	Long	Multiple	Yes

KEY

Is the interaction negative or positive?
- Positive.
- Negative.

What is the amount of change?
- Low – a change that remains near existing conditions, or occurs within the natural variability for the acoustic environment.
- Medium – a change that occurs outside the natural variability for the acoustic environment but does not change the overall status of the acoustic environment.
- High – a change that occurs outside the natural range of change for the acoustic environment that will change the status of the acoustic environment locally or regionally.

What is the geographic extent?
- Site – the interaction is limited to the immediate area where Project-related activities occur.
- Area – the interaction is limited to the general area surrounding the Station.
- Region – the interaction occurs throughout the area of review and may extend to other regions.
- Province – the interaction affects the entire province.

How long does it last?
- Short – the interaction occurs for less than 3 months.
- Medium – the interaction occurs for 3 months – 1 year.
- Long – greater than one year.
- Permanent – there is no foreseeable end-date for the interaction.

How often does it occur?
- Single – the interaction occurs once.
- Multiple – the interaction occurs several times, either sporadically or at regular intervals.
- Continuous – the interaction occurs continuously.

Has additional mitigation been recommended?
- Yes.
- No.

Note:

[1] Some of the ratings for the environmental interactions in the table above have been updated from those provided in the Draft CER Report dated September 2015 (Stantec 2015b), to more accurately reflect the nature and extent of the anticipated interactions with the Options and to reflect feedback received during the public comment period.

5.5.1 Summary of Additional Potential Mitigation and Information Requirements

As described in Section 5.4, this review has identified the requirement for some additional potential mitigation and requirements for further study in some areas. These potential requirements are summarized in Table 5.7.

Additional mitigation identified in Table 5.7 below may be required, beyond the planned standard mitigation discussed in Section 2.6, to bring noise levels associated with each Option below Health Canada guidelines. For construction noise with durations of more than one year (*i.e.* long-term), and where noise levels are in the range of 45 to 75 dB, Health Canada (2010a) advises that health impact endpoints be evaluated according to the change in the percentage of the population (*e.g.*, at a specific receptor location) that become highly annoyed (PHA). Health Canada (2010a) proposes additional mitigation if the predicted change in PHA at a specific receptor is greater than 6.5%

between project and baseline noise environments, or when the baseline-plus-project-related noise is in excess of 75 dBA.

Additional mitigation options to be investigated as needed as a means of reducing Project-related noise levels in a manner consistent with the Health Canada guidelines are summarized in Table 5.7.

Table 5.7 Summary of Additional Potential Mitigation and Information Requirements

Option	Additional Potential Mitigation	Additional Information Requirements
Option 1, 2 or 3	• Limit construction activity at night. • Limit blasting during non-daytime hours. • Use vibratory-type pile driver (if required, instead of impact-type pile driver, where practical). • Select impact-type pile drivers (if required) that meet a minimum acoustic specification. • Use a sound-reducing barrier around loud equipment or along the perimeter of the construction area, between the construction area and noise sensitive receptors. Material stockpiles and equipment storage can be strategically located to act as a sound barrier, as is currently planned between the laydown area and Kingsclear First Nation. • Use newer mobile equipment with upgraded mufflers. • Replace standard backup alarms with lower noise alternatives deemed to provide "equivalent safety" such as flag people, strobe lights, broadband backup alarms (identified as less likely to cause annoyance than tonal beepers), or configuring the site so that backing up can be greatly reduced. • Schedule limitations (time of day adjustments, limitations on number of concurrent equipment). • Use acoustic enclosures for noisy stationary equipment (*e.g.*, diesel generators, crusher).	• Detailed baseline noise monitoring to establish existing conditions for use in evaluating Health Canada's guideline. • Detailed Construction Plan and Sequencing of Activities. • Details of activities, equipment types, volumes of equipment during each phase of the work, schedules of operation for daytime and nighttime. • Predictive noise modelling of the Preferred Option, and implement additional mitigation as required.

5.5.1 Discussion

Because of the relatively long duration of construction (beyond one year is considered long-term construction by Health Canada in relation to noise), noise management is an important consideration to limit disturbance and interactions with nearby residents and land users. Application of the Health Canada guideline (as described in Section 5.1.2) is recommended in planning noise mitigation for the Preferred Option. Detailed noise mitigation may be required for any of the Options during construction, demolition and decommissioning (as applicable) to achieve noise levels below the Health Canada guideline.

Noise from blasting will be noticeable several kilometres from the blast site and may influence sound quality. Although blasting will be infrequent (expected to be up to twice daily during peak blasting periods), it will occur over several years.

Given the extent of noise expected, effective communication with nearby residents regarding the blasting schedule and overall activity schedule will be critical to reduce annoyance and stress of nearby residents and land users.

The potential for ground vibration will need to be evaluated in detail as part of the pre-blast surveys. Pre-blast surveys will be comprehensive surveys of potentially affected structures prior to blasting to discern any pre-existing conditions, and periodic follow-ups including seismic monitoring of ground vibration and air blast overpressures while blasting is taking place.

Noise management, including planned mitigation, communication and complaint resolution processes will be required for any of the Options.

5.5.2 Assumptions and Limitations

Information available for review of noise is preliminary and subject to change as planning proceeds. The estimates of sound pressure levels near the site are preliminary, for planning purposes and do not cover all activities contemplated for each of the Options.

Because details of construction equipment and daily operating schedules are not yet confirmed, this review does not compare preliminary values to the established noise guidelines. A comparison will be completed for the Preferred Option during any EIA for the Preferred Option, once it has been selected.

The EIA of the Preferred Option will include more detailed measurements of existing sound quality in the area surrounding the construction site. Noise from the Preferred Option and potential environmental effects to nearest receptors and sensitive receptors will also be reviewed. Planning will include detailed consideration of noise mitigation for the most prolonged and noisy activities.

Assumptions are an inherent part of acoustic modelling. As with any model, there is some uncertainty in the results as models are simplified representations of complex physical phenomena. Some of this uncertainty is addressed through the use of conservative assumptions that overstate the risk.