9.2 Noise

9.2.1 Introduction

This Section of the Environmental Assessment Certificate (EAC) Application/Environmental Impact Statement (EIS) (hereafter referred to as the EA) has been prepared by Golder Associates Ltd. (Golder). It addresses the effects of the Proposed BURNCO Aggregate Project (hereafter referred to as the 'Proposed Project') identified in the construction, operation, reclamation and closure phases on VCs related to the acoustic environment. Consideration has been given to mitigation measures proposed to mitigate any identified effects to acceptable levels and any residual effects have been characterized. Additionally consideration has also been given to cumulative effects of other reasonable foreseeable future projects in combination with the residual effects of the Proposed Project.

This Section should be read in conjunction with the following technical baseline report provided in Volume 4, Part G – Section 22.0: Appendices:

- Appendix 9.2-A - Noise Baseline Study
- Appendix 9.2-B - Permissible Sound Level Calculation
- Appendix 9.2-C - Sound Power Levels of Project Construction Equipment
- Appendix 9.2-D - Sound Power Levels of Project Operation Equipment
- Appendix 9.2-E - Sound Measurement Program for BURNCO Springbank Aggregate Pit in Alberta
- Appendix 9.2-F - Source Measurement Program for Pine Ridges Inland Clamshell Operation in Manitoba
- Appendix 9.2-G - Source Measurements for Treat Creek Aggregate Pit with Marine Barge Loading Facility in British Columbia

9.2.2 Regulatory and Policy Setting

This section provides a summary of the regulatory and policy setting of the Proposed Project as it relates to the acoustic environment.

9.2.2.1 Commission Guideline

In British Columbia (BC), there is no requirement or standard method for completing noise assessments for gravel load-out projects. In the absence of formal guidance, the environmental noise from the Proposed Project will be assessed in accordance with noise regulations specified by the British Columbia Oil and Gas Commission (the Commission) in the document *British Columbia Noise Control Best Practices Guideline* (BC OGC 2009) – hereafter referred to as the Commission Guideline. The Commission Guideline is only strictly applicable to oil and gas projects, but it can also be considered to represent best practice for assessment of environmental noise from all industrial projects. The focus of the noise assessment is on determining changes to the existing Ambient Sound Level (ASL) resulting from the Proposed Project, and comparing the results with noise regulations from the Commission Guideline.

The Commission Guideline defines the daytime period as 7 a.m. to 10 p.m. (15 hours) and the nighttime period as 10 p.m. to 7 a.m. (9 hours). According to information provided by BURNCO, Proposed Project construction and operation will be confined to daylight hours only – i.e., within the daytime period defined by the Commission Guideline. As such, the noise assessment based on the Commission Guideline will focus on the daytime period.

The Commission Guideline does not set specific noise limits for construction activity. However, the Commission Guideline recommends some reasonable mitigating measures to reduce construction noise from new facilities or modifications to existing facilities. The recommended mitigation measures for construction of the Proposed Project are summarized in Section 9.2.5.3.

The Commission Guideline requires that A-weighted energy equivalent cumulative noise levels (L_{eq}) associated with operation of the Proposed Project not exceed a Permissible Sound Level (PSL) at any noise sensitive receptors (i.e., dwellings) within the Commission Guideline Criteria Boundary, which is defined as a 1.5 kilometre (km) buffer from the Proposed Project fenceline. In addition, in the absence of noise sensitive receptors there is a requirement for the Proposed Project to comply with the PSL at the Commission Guideline Criteria Boundary. The cumulative noise level consists of the logarithmic addition of the ASL specified in the Commission Guideline and the predicted Proposed Project operation noise level and any other existing or proposed Commission-regulated facilities in the area. The cumulative noise levels calculated using the ASL specified in the Commission Guideline will hereafter be referred to as the Commission cumulative noise levels. The Commission cumulative noise levels at relevant receptor locations will be compared to the Commission Guideline daytime PSL to characterize potential noise effects associated with the Proposed Project. Determination of specific ASL and PSL values is discussed in detail in Section 9.2.3.3.

Additional guidance for conducting the noise assessment was obtained from the Alberta Energy Regulator (AER) document *Directive 038: Noise Control* (EUB 2007); hereafter referred to as Directive 038. In many ways Directive 038 is very similar to the Commission Guideline, but Directive 038 provides more details on appropriate methods for assessing potential Low Frequency Noise (LFN) effects than are available in the Commission Guideline.

9.2.2.2 Health Canada Guidance

Further guidance on assessing potential noise effects associated with the Proposed Project was taken from Health Canada. Although Health Canada does not have any formal noise guidelines or enforceable noise thresholds or standards, they do provide some guidance for the assessment of environmental noise in the document *Useful Information for Environmental Assessments* (Health Canada 2010); hereafter referred to as the HC Guidance. The HC Guidance suggests three specific criteria for assessing noise effects:

- High annoyance;
- Sleep disturbance; and
- Speech intelligibility.

The cumulative noise levels from construction and operation of the Proposed Project are needed to assess the noise effect based on the HC Guidance. According to the HC Guidance, cumulative noise levels should be calculated at relevant receptor locations through the logarithmic addition of measured or estimated baseline noise levels and predicted noise contribution from the Proposed Project construction/operation. The cumulative noise levels calculated using the measured or estimated baseline noise levels will hereafter be referred to as the HC cumulative noise levels. The difference between the HC cumulative noise levels and the Commission cumulative noise levels (described above in Section 9.2.2.1) comes down to the method used for characterizing the existing environment – in the HC cumulative noise level the contribution of the existing environment is characterized using actual field measurements, while in the Commission cumulative noise level the contribution of the existing environment is characterized using a mandated ASL.

One of noise criteria recommended by the HC Guidance and used in this assessment is “change in High Annoyance (%HA)”. Percent HA is calculated based on the day-night energy equivalent noise level ($L_{eq,dn}$) using the formula presented below:

$$\%HA = \frac{100}{1+e^{\left(10.4-0.132\times L_{eq,dn}\right)}},$$

where $L_{eq,dn}$ is defined in the formula presented below based on the 15 hour daytime equivalent energy noise level ($L_{eq,day}$) and 9 hour nighttime equivalent energy noise level ($L_{eq,night}$):

$$L_{eq,dn} = 10log_{10}\left(\frac{15\times10^{L_{eq,day}/10}+9\times10^{\left(L_{eq,night}+10\right)/10}}{24}\right).$$

$L_{eq,day}$ and $L_{eq,night}$ here are the HC cumulative daytime and nighttime noise levels calculated through the logarithmic addition of measured or estimated baseline noise levels and predicted noise contribution from the Proposed Project construction/operation for the periods of daytime and nighttime respectively.

If the %HA increases by 6.5% or more as a result of the Proposed Project, then the HC Guidance recommends mitigation be considered. In other words, a change in %HA greater than 6.5% is indicative of a potential adverse noise effect.

HC defined quiet rural areas to be where dwelling units are more than 500 m from heavily travelled roads and/or rail lines, not subject to frequent aircraft flyovers and have a $L_{eq,dn}$ of less than or equal to 45 dBA. In quiet rural

areas, HC Guidance recommends adding 10 dBA to the predicted project noise level and baseline levels when calculating %HA. This leads to a greater change in %HA than would occur with unadjusted noise levels, as the exponential relationship between %HA and noise levels produces increasingly larger changes in %HA for equal increases in project noise compared to baseline level as the noise levels increase.

Sleep disturbance is not relevant to Proposed Project construction, operation, or remediation/closure, since each of these activities will take place during the daytime period.

The HC Guidance indicates that outdoor cumulative noise levels should be maintained below 55 dBA to ensure good outdoor speech intelligibility. In other words, a cumulative noise level greater than 55 dBA is indicative of a potential adverse noise effect.

For construction noise at receptors with durations of more than one year (i.e., long term) and where noise levels are in the range of 45-75 dBA, HC advises to assess noise endpoints on the change in %HA similar to what is described above for operational noise. On grounds of conservatism, all construction phases have been assessed using the same endpoints as used for the operational noise assessment, although for construction activities that last for less than one year, this assessment would not be required.

9.2.2.3 Sunshine Coast Regional District Bylaw No. 597

The Sunshine Coast Regional District Noise Control Bylaw (Sunshine Coast Regional District 2008) is a nuisance based noise bylaw which governs the Sunshine Coast Regional District, including the West Howe Sound area. It specifies that no person or property owner should be responsible for noise or sound which disturbs the quiet, peace, rest, enjoyment, comfort or convenience of any person in the neighbourhood or vicinity. It also specifies construction and machine noise must be limited to the hours of 7 a.m. to 9 p.m., or 7 a.m. to 6 p.m. on holidays.

As construction and operation activities for the Project will occur during daytime hours only, the construction and machine noise bylaw will be satisfied. As this bylaw is nuisance based, no quantitative assessment will be completed; however, the magnitude resulting from the Commission Guideline and HC Guidance effects assessments of Project operations will be used to inform a conclusion on whether the bylaw conditions will be met by the Project.

9.2.3 Assessment Methodology

This section provides a description of the assessment methodology used in preparing the EA. related to the acoustic environment.

Please refer to Volume 2, Part B - Section 4.0: Assessment Methods of this EA For a full description of the assessment methodology and scope including: selecting value components, establishing boundaries, describing existing conditions, identifying Project-VC interactions, identifying mitigation measures, evaluating residual effects and assessing cumulative effects.

9.2.3.1 Value Component (VC) Selection and Rationale

This section describes the VCs and measureable indicators identified for this assessment related to the acoustic environment. The VCs identified reflect issues and guidelines, potential Aboriginal concerns, issues identified by BC EAO and CEA Agency, First Nations, other stakeholders, professional judgment and key sensitive resources, species or social and heritage values. All identified candidate noise VCs were carried forward in the effects assessment (e.g. no noise VCs were excluded from the assessment). Additional details regarding the methods used to select VCs is provided in Part B, Volume 2 – Section 4.2.4.

In accordance with the Commission Guideline and the HC Guidance, noise levels were identified as the appropriate VC for assessing potential effects of the Proposed Project on the acoustic environment. Potential noise effects of the Proposed Project were assessed at receptor locations consisting of seasonal, semi-permanent and permanent residences in the area surrounding the Proposed Project. In particular, the dwellings within the McNab Strata Community east of the Proposed Project, and the recreation camps, seasonally occupied dwellings at Ekins Point, and yacht club across the Thornbrough Channel from the Proposed Project were considered relevant receptors. To the north and west of the Proposed Project, where there are no sites of human habitation, potential noise effects were assessed at unoccupied locations 1.5 km from the Proposed Project – i.e., at locations on the Commission Guideline Criteria Boundary.

Potential noise effects considered in the assessment were:

- Changes in daytime, nighttime, and day-night cumulative noise levels ($L_{eq,day}$, $L_{eq,night}$, and $L_{eq,dn}$, respectively) expressed in A-weighted decibels (dBA);
- Changes in the difference between noise levels expressed in C-weighted decibels (dBC) and dBA – this difference is considered to be a good indicator of potential LFN effects;
- Changes in %HA resulting from noise level changes; and
- Changes in speech intelligibility resulting from noise level changes.

Table 9.2-1 provides a summary of identified VCs, rationale for their inclusion in the assessment, and measurable Indicators that will be considered.

Table 9.2-1: Value Components and Measurable Indicators: Noise

Value Component	Rationale	Measurable Indicators
Noise Levels	Regulatory requirement based on Commission Guideline and HC Guidance.	Daytime noise levels, $L_{eq,day}$
		Nighttime noise levels, $L_{eq,night}$
		Day-night noise levels, $L_{eq,dn}$
		Difference between dBC and dBA noise levels
		Percentage of people that are highly annoyed, %HA

9.2.3.2 Assessment Boundaries

9.2.3.2.1 Spatial Boundaries

The spatial boundaries for the EA have been selected to take into account the physical extent of the Proposed Project, Physical extent of Proposed Project-related effects and the physical extent of any key environmental systems. The specific study areas for the acoustic environment are provided in Table 9.2-2.

For a full description of the spatial boundaries of the Proposed Project please refer to Volume 2, Part B – Section 4.0 of this EA.

Table 9.2-2: Spatial Boundaries: Noise

Study Area	Description
Local Study Area (LSA)	1.5 km in all directions from the Project fenceline based on the Commission Guideline – i.e., the LSA is selected to coincide with the Commission Guideline Criteria Boundary.
Regional Study Area (RSA)	5.0 km in all directions from the Project fenceline to include the entire area over which direct or cumulative effects from the Project could be potentially observed.

The LSA for the assessment of potential Proposed Project noise effects extends out 1.5 km in all directions from the Project fenceline. The LSA was selected based on the Commission Guideline, which requires that environmental noise effects be assessed at receptors within 1.5 km of the Proposed Project fenceline or at 1.5 km from the Proposed Project fenceline in the absence of receptors. In other words, the boundary of the LSA was selected so as to coincide with the previously defined Commission Guideline Criteria Boundary (see Section 9.2.2.1).

The RSA for the assessment of potential Proposed Project noise effects extends out 5.0 km in all directions from the Project fenceline. Because noise attenuates with distance, this definition of the noise RSA is anticipated to include the entire area over which direct or cumulative effects from the Proposed Project could be potentially observed. In fact, the expected zone of influence of Proposed Project-related noise will likely be confined to the LSA.

The noise LSA and RSA can currently be described as a recreational area used for hunting, fishing, camping, boating, and other outdoor activities.

The Commission Guideline considers noise sensitive receptors to be any permanent residences or seasonally occupied dwellings within 1.5 km of the Proposed Project fenceline (i.e., within the LSA). The HC Guidance expands this definition of noise sensitive receptor to also include any daycares, schools, hospitals, places of worship, nursing homes, and First Nations and Inuit communities that could potentially be affected by noise from the Proposed Project. According to the above definition, the dwellings in the McNab Strata Community are the only relevant noise sensitive receptors for the Proposed Project. A total of 14 receptors were chosen to represent dwellings in the McNab Strata Community for the noise assessment. Since the seasonally occupied dwellings, summer camps, and yacht clubs on the south side of the Thornbrough Channel are farther than 1.5 km from the Proposed Project fenceline, the Commission Guideline does not consider them relevant noise sensitive receptors. However, in the interest of characterizing existing noise levels across the entire RSA, a representative receptor on the south side of the Thornbrough Channel was also included in the noise assessment. Furthermore, receptors corresponding to unoccupied locations 1.5 km north and 500 m west of the Proposed Project were also included.

Table 9.2-3 provides a description and Universal Transverse Mercator (UTM) coordinates for each receptor included in the noise assessment. Receptors NR1, NR2, NR3 and NR4 correspond to locations used for baseline noise monitoring (see Volume 4, Part G - Section 22.0: Appendix 9.2-A). Receptor NR3 represents an unoccupied location on the Commission Guideline Criteria Boundary north of the Proposed Project and NR4 a receptor south of the Proposed Project on the south side of the Thornbrough Channel. Receptors R1 through R14 represent dwellings within the Community east of the Proposed Project. Receptor R15 represents an unoccupied location on the Commission Guideline Criteria Boundary west of the Proposed Project.

Table 9.2-3: Noise Assessment Receptors

Assessment Receptors	Description	UTM (NAD83, Zone 10)	
		Easting (m)	Northing (m)
NR1	Unoccupied location within the LSA immediately west of McNab Creek just inside the eastern edge of the Proposed Project fenceline; not considered a noise sensitive receptor by either the Commission Guideline or the HC Guidance, but used as baseline noise monitoring receptor for the purposes of characterizing the existing acoustic environment in the eastern part of the LSA.	472286	5490348
NR2	Unoccupied location within the LSA approximately 500 m west of the Proposed Project fenceline; not considered a noise sensitive receptor by either the Commission Guideline or the HC Guidance, but used as a baseline noise monitoring receptor for the purposes of characterizing the existing acoustic environment in the western part of the LSA	471028	5490525
NR3	Unoccupied location within the LSA approximately 1.5 km north of the Proposed Project fenceline; not considered a noise sensitive receptor by either the Commission Guideline or the HC Guidance, but used as a baseline noise monitoring receptor for the purposes of characterizing the existing acoustic environment in the northern part of the LSA; will also be used in the assessment of potential noise effects.	472029	5492630
NR4	Children's summer camp outside the LSA but within the RSA on Gambier Island; representative of several camps, yacht clubs, and seasonally occupied dwellings at Ekins Point on Gambier Island immediately south of the Proposed Project; located too far from the Proposed Project fenceline to be considered a noise sensitive receptor by the Commission Guideline, but used as a baseline noise monitoring receptor for the purposes of characterizing the existing acoustic environment in the southern part of the RSA; will also be used in the assessment of potential noise effects.	471629	5486330

Assessment Receptors	Description	UTM (NAD83, Zone 10)	
		Easting (m)	Northing (m)
R1	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472492	5490163
R2	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472473	5490134
R3	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472502	5490113
R4	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472514	5490093
R5	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472526	5490064
R6	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472512	5490043
R7	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472517	5490024
R8	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472553	5490032
R9	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472530	5489996
R10	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472561	5490005
R11	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance	472545	5489970
R12	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance	472580	5489941
R13	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472604	5489898
R14	Occupied dwelling within the LSA in the McNab Strata Community east of the Proposed Project; considered a noise sensitive receptor by both the Commission Guideline and the HC Guidance.	472604	5489883
R15	Unoccupied location within the LSA approximately 1.5 km west of the Proposed Project fenceline; not considered a noise sensitive receptor by either the Commission Guideline or the HC Guidance, but included in the assessment for the purposes of characterizing potential noise effects in the western part of the LSA.	469764	5490065

Figure 9.2-1 shows the location of the Proposed Project, LSA and RSA, and noise assessment receptors. The Project boundary and Project fenceline are also presented in Figure 9.2-1. The Project boundary describes the footprint of the Project, which will encompass the major Proposed Project infrastructure, while the Project fenceline describes the limit of public access that will be denoted by either a fence or signage.

9.2.3.2.2 Temporal Boundaries

Based on the Proposed Project schedule, the temporal boundaries for the effects assessment for the acoustic environment are as follows:

- Project construction – up to 2 years;
- Project operations – 16 years; and
- Project reclamation and closure – on-going throughout Project operations, and 1 year beyond operations.

For a full description of the temporal boundaries of the Proposed Project please refer to Volume 2, Part B – Section 4.0 of this EA.

9.2.3.2.3 Administrative Boundaries

There are no administrative boundaries proposed for the Noise assessment.

9.2.3.2.4 Technical Boundaries

There are no technical boundaries proposed for the Noise assessment.

9.2.3.3 Assessment Methods

Two sets of methods were used for the Proposed Project noise assessment, based on the Commission Guideline and the HC Guidance. The details on these two methods are presented in the following sections.

9.2.3.3.1 Existing Conditions

Methods used to describe existing noise conditions are provided below under Sections 9.2.3.3.3.1.1, 9.2.3.3.3.3.1, and 9.2.3.3.3.4.1.

9.2.3.3.2 Identifying Project Interactions

A preliminary evaluation of identified interactions between the various physical works and activities and the selected VCs across all spatial and temporal phases of the Proposed was undertaken to characterize interactions as:

a) Positive, none or negligible, requiring no further consideration; or
b) Potential effect requiring further consideration and possibly additional mitigation.

This evaluation is presented in Section 9.2.5. Rationale is provided for all determinations that there is no or negligible interaction and that no further consideration is required. For those Project-VC interactions that may result in a potential effects requiring further consideration, the nature of the effects (both adverse and positive) arising from those interactions is described. Potential effects include direct, indirect and induced effects.

9.2.3.3.3 Evaluating Residual Effects

Potential Project-related residual effects were characterized as the basis for determining the significance of potential residual adverse effects for each VC. The characterization of effects was undertaken following application of appropriate mitigation measures.

Potential residual effects were characterized using the following standard residual effects criteria:

- **Context** – the current and future sensitivity and resilience of the VC to change caused by the Proposed Project;
- **Magnitude** – the expected size or severity of the residual effect;
- **Extent** – the spatial scale over which the residual physical, biological and/or social effect is expected to occur;
- **Duration** – the length of time the residual effect persists;
- **Reversibility** - indicating whether the effect is *fully reversible*, *partially reversible*, or *irreversible*; and
- **Frequency** – how often the residual effect occurs.

The criteria defined in Table 9.2-6 have been used to characterise and determine the significance of potential effects of the acoustic environment VCs.

Where possible, definitions have taken into account the technical guidance that has been produced. The following documents are considered to be relevant to the acoustic environment:

- Commission Guideline; and
- HC Guidance.

Please refer to Volume 2, Part B – Section 4.0: Assessment Methods of this EA for a description of the criteria used to characterise potential effects for all disciplines.

The likelihood of potential residual effects occurring was also characterized for each VC using appropriate quantitative or qualitative terms. The likelihood of a potential residual effect can be characterized as:

- Low - likelihood of occurrence (0 to 40%) – Residual effect is possible but unlikely;
- Medium - likelihood of occurrence (41 to 80%) - Residual effect may occur, but is not certain to occur; and
- High - Likelihood of occurrence (81% to 100%) - Residual effect is likely to occur or is certain to occur.

9.2.3.3.3.1 Assessment Cases

The two cases assessed in this report are the Baseline Case and the Application Case. The Baseline Case describes the existing acoustic environment, and includes contribution from natural noise sources, as well as noise sources associated with existing and approved facilities and activities within the Proposed Project RSA.

The Application Case describes the cumulative acoustic environment including the predicted contribution of noise sources associated with the Proposed Project. In other words, the cumulative noise levels for the Application Case are the logarithmic sum of the contributions from the Baseline Case and from the Proposed Project.

9.2.3.3.3.1.1 Baseline Case

The contribution of the Port Mellon Project, which is located more than 7.5 km southwest of the Proposed Project, was estimated to be very minor and was found not to influence the Baseline Case noise levels for the Proposed Project LSA or RSA.

In the absence of relevant existing or approved industrial facilities, the Commission Guideline mandates the use of specific ASL values to represent Baseline Case noise levels. The Commission Guideline discusses the use of an Ambient Monitoring Adjustment (Section 2.3.4 of the Guideline), when the ASL's are not thought to be representative of the actual sound environment. The only two cases where it may be necessary to consider an ambient monitoring adjustment are:

- Areas considered to be pristine; and
- Areas with non-energy industrial activity that would influence the background noise levels.

The Commission Guideline defines a pristine area as:

> "*A pure, natural area that might have a dwelling but no industrial presence, including energy, agricultural, forestry, manufacturing, recreational, or other industries that already impact the noise environment*."

McNab Creek is not considered to be a pristine area, and although there is non-energy industrial activity in the area, it does not cause the baseline noise levels to exceed the Commission Guideline ASL's, and therefore the ambient monitoring correction is not used. As such, for the noise assessment based on the Commission Guideline, Baseline Case noise levels at relevant receptors were established based on the ASL values specified in the Commission Guideline.

The HC Guidance indicates that Baseline Case noise levels should be established through field measurements. As such, for the noise assessment based on the HC Guidance, the Baseline Case noise levels at relevant receptors were established based on field measurements conducted in the summer of 2012 and fall of 2013 at five representative receptors within the LSA and RSA. A detailed description of the baseline noise monitoring program is provided in Volume 4, Part G – Section 22.0: Appendix 9.2-A.

9.2.3.3.3.1.2 Application Case

The Application Case consists of the Baseline Case added to noise levels predicted for Proposed Project construction and Proposed Project operation. The major facilities and major noise sources associated with Proposed Project construction and operation are described in the following sections.

For the noise assessment based on the Commission Guideline, the ASL values mandated by the Commission Guideline are used to represent the Baseline Case noise levels at the assessment receptors and within the Proposed Project LSA and RSA. Correspondingly, for each receptor the Commission cumulative noise level is calculated through the logarithmic addition of the ASL and the predicted Proposed Project construction/operation noise level.

For the noise assessment based on the HC Guidance, measured noise levels are used to represent the Baseline Case noise levels at the assessment receptors. Correspondingly, for each receptor the HC cumulative noise level is calculated through the logarithmic addition of the measured baseline noise level and the predicted Proposed Project construction/operation noise level.

9.2.3.3.3.1.2.1 Construction

Proposed Project construction will require a total of four months of effort. The construction phase can be broken down into these overlapping stages:

- Dock and existing barge ramp upgrade;
- Road, warehouse and facilities upgrade and construction including substation and transmission lines;
- Processing plant area clearing and site clearing at the same time;
- Preload processing plant area construction of processing plant facilities;
- Barge load jetty and new dock facilities, including pile driving;
- Initial dry excavation of pit using excavators;
- Installation of floating clamshell dredge and conveyor; and
- Construction of McNab Creek Flood Control Dyke.

Effects on noise levels at receptor locations during Proposed Project construction will vary based on type of construction activity, and their proximity to noise receptors. The primary noise sources associated with construction are various pieces of large off-road equipment such as dozers, excavators, graders, land cranes, and haul trucks,

as well as large marine equipment such as marine cranes, and tug boats. The amount of noise generated by construction activities will depend primarily on the number and type of noise sources active and their proximity to noise receptors. Potential noise effects associated with Proposed Project construction have been predicted using computer noise models that account for the major noise sources associated with the different construction phases. Estimated noise emissions for each major piece of construction equipment, which serve as inputs to the computer models, are discussed in detail in Section 9.2.5.

9.2.3.3.3.1.2.2 Operation

Operation of the Proposed Project can be divided in five overlapping areas which are:

- Clamshell dredge operation, which consists of one clamshell dredge, one jaw crusher, and one grizzly screen on a floating deck, as well as a conveyor system for moving material onto shore;
- Crush plant area, which consists of one crusher, two dry screens, and an associated conveyor system;
- Wash plant area, which consists of one washer screen, and its associated conveyor system;
- Storage and sorting area, which consists of at least eight stockpiles of different aggregate product types, and an associated conveyor system; and
- Marine barge loading operation, which consists of one vibratory hopper, one tug boat, one or two barges, and an associated conveyor system.

The combination of the crush plant, wash plant, and storage and sorting area will hereafter be referred to as the processing plant.

The Proposed Project has an expected economic lifespan of 16 years. The operation will start after the construction of the initial pit area and installation of operation equipment for the clamshell dredge operation, processing plant, and barge loud-out operation. As discussed in Section 9.2.3.3.3.1.2.1, this initial construction will last approximately 4 months. The subsequent construction associated with expansion of the pit area will be overlapping in time with the operation phase. As such, the noise contribution from the construction associated with expansion of the pit area will be included in the calculation of cumulative noise levels for the noise assessment of Proposed Project operation. During the Proposed Project operation, the clamshell dredge and its associated conveyor system will be relocated almost continuously based on the aggregate deposit and extraction plan, gradually enlarging the pit pond. The other operation facilities, which are located on land, have fixed locations within the Proposed Project Area.

The aggregate operation at the Proposed Project comprises the following general process and facility components:

- Aggregate material is extracted by the floating clamshell dredge;
- Aggregate material extracted from the aggregate pit is screened by one primary grizzly screen which is installed on the floating deck;
- One jaw crusher will be used for material larger than 6 inches (6”) in size;

- A conveyor system is used to move screened aggregate to stockpiles on the shore of the aggregate pit and then on to the crush plant;
- In the crush plant, material will be crushed and screened, then transported via a conveyor system to stockpiles of different aggregate product types;
- Crusher gravel greater than 20 millimetres (mm) in size will be transported via a conveyor system to the wash plant;
- In the wash plant, material will be washed and screened by a washer screen unit and transported via a conveyor system to stockpiles of different product types; and
- Barges will be loaded by a conveyor system transporting aggregate material fed by dump trucks and front end loaders.

Based on the plot plans and equipment lists provided by BURNCO, the major noise sources were identified as follows.

The major noise sources located in the clamshell operation area include:

- One floating clamshell dredge on a floating deck. Activity of the clamshell dredge includes digging gravel underwater and releasing material onto the screens. The main noise sources include the clamshell dredge electric motor, water falling from the dredge bucket, and the release of the gravel onto the screen;
- One electric-powered primary screen on the floating deck;
- One electric-powered primary crusher on the floating deck;
- One electric-powered conveyor system reaching from the floating deck to the shore of the pit; and
- Falling sand and gravel from conveyors to screen and crusher.

Major noise sources located within the crush plant area include:

- One electric-powered crusher in a canvas shed;
- Two electric-powered screens in canvas sheds;
- One conveyor system for aggregate transport connecting crushers, screens, and wash plant; and
- Aggregate material falling from crushers and screens onto conveyors.

Major noise sources located within the wash plant include:

- One outdoor electric-powered washer screen unit;
- One electric-powered washer pump;

- One conveyor system for aggregate transport connecting washer, screen, and sorting and storage area; and
- Aggregate material falling from washer screen onto conveyors.

Major noise sources associated with the sorting and storage area include:

- Backhoe and excavator for moving aggregate material between different sorting and storage stockpiles;
- Front end loaders for loading aggregate material into dump trucks; and
- Dump trucks for transporting aggregate material from the sorting and storage area to the barge loading area.

Major noise sources associated with the barge loading area include:

- Dump trucks loading aggregate material into a hopper that feeds the conveyor system;
- A conveyor system to move aggregate, including noise sources associated with electric motors and aggregate dropping into barges;
- Falling sand from the end of conveyor system onto the barges; and
- Tug boat for manoeuvring barges filled with aggregate material.

Based on the plot plans provided by BURNCO, the other structures which are part of the facility which are not noise sources but are important structures for noise prediction modeling include:

- Eight 10 – 15 m high stockpiles consisting of 150 mm crushed gravel, 25 mm crushed rock, 20 mm crushed gravel, 10 mm crushed gravel, 5 mm concrete sand, 10 mm washed rock, 20 mm washed rock and 14 mm washed rock respectively;
- McNab Creek Flood Protection Dyke - approximately 830 m long and 5 m high on the north side of the aggregate pit;
- Pit Lake Containment Berm - approximately 800 m long and 9 m high on the south side of the aggregate pit;
- Processing Area Dirt Berm - approximately 230 m long and 9 m high on the east side of the processing plant; and
- One sand and gravel pit approximately 28.2 hectares (ha) in area.

Stockpiles will not be applied as noise screening in the computer models of Proposed Project operation since they will fluctuate in size during the operation period. The two berms and the dyke will be applied as noise screening in the computer models of the Proposed Project operation because they will be maintained at roughly the same height throughout the whole operation period.

Computer noise prediction models were built to include the major noise sources and other structures (e.g., berms, dykes and the pit), and were used to predict the noise contribution from the Proposed Project.

9.2.3.3.3.2 Noise Prediction Methodology

9.2.3.3.3.2.1 Noise Model

The Type 7810 Predictor® (Predictor®) software, developed by Softnoise GMBH and distributed by Brüel and Kjaer, was identified as the appropriate software to develop a predictive noise model for the Proposed Project. Predictor® is capable of assessing the potential noise effects associated with the Proposed Project as well as the effectiveness of potential noise controls. In accordance with the Commission Guideline, the HC Guidance, and Directive 038, the noise propagation algorithms used by the model are consistent with international standards, in particular *ISO 9613-2: 1996 Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation* (ISO 1996). The model was used to predict $L_{eq,day}$ in dBA and dBC for individual receptors and the entire LSA and RSA. Proposed Project construction and operation will be confined to the daytime period, so $L_{eq,night}$ values were not calculated for the Proposed Project.

The model has the ability to simulate a series of point, line and area emission sources. Each source type can be characterized by entering octave-band noise emissions. Other parameters, such as building dimensions and equipment enclosure noise attenuation ratings, are also used to define the nature of noise emissions. The Predictor® model also accounts for noise attenuation related to meteorological conditions (such as temperature and humidity), ground cover and physical barriers, either natural (terrain-based) or man-made.

9.2.3.3.3.2.2 Model Uncertainty

According to ISO 9613-2, the overall accuracy of the standard is ± 3 dB for distances between the source and receptor of up to 1 km. The accuracy for distances over 1 km is not stated. Accuracy will also depend on the accuracy of the supplied noise data (i.e., equipment noise emissions), which is often ± 2 dB for measured sources. Taking this into account, the expected accuracy of the predictions is ± 5 dB.

To account for this level of uncertainty, conservative assumptions about propagation conditions have been made where appropriate. In particular, each noise receptor is modelled as downwind from each noise source 100% of time. Since downwind conditions are known to enhance noise propagation, this downwind assumption is a conservative treatment of potential noise effects – i.e., will tend to overestimate noise levels associated with the Proposed Project.

9.2.3.3.3.2.3 Model Input Parameters

Table 9.2-4 lists the configuration of the calculation parameters used to complete noise modelling for the Proposed Project.

Table 9.2-4: Noise Model Input Parameters

Parameter	Model Setting	Descriptions/Notes
Standards	▪ ISO 9613 only	All sources and attenuators are treated as required by the cited standard
Ground Absorption	▪ 0.0 - berm, dyke/stockpile areas and water; ▪ 0.1 - regions of rock and sand cover; ▪ 0.2 - compacted ground within the Proposed Project fenceline; and ▪ 0.8 – rest of LSA and RSA	These values represent the acoustic properties of the ground in accordance with ISO 9613-2. A value of 0.0 represents hard ground and a value of 1.0 represents porous ground.
Temperature/Humidity	▪ 10°C/ 70% Relative Humidity	Average summer conditions for area
Wind conditions	▪ 1 to 5 m/s	Default ISO 9613-2 – moderate inversion condition, each receptor downwind from each source 100% of the time
Terrain	▪ Height lines at 5 m resolution	Ground elevation contours (i.e., height lines) were used to characterize the topography in the LSA and RSA
Reflection Factors	▪ 0.8 – building walls ▪ 0.2 –berms and dyke	These values represent the fraction of noise energy reflected during interaction with building walls and berms/dyke, respectively.

9.2.3.3.3.3 Noise Assessment Based on Commission Guideline

The approach taken in the noise assessment based on the Commission Guideline was as follows:

- Identify the ASL and PSL values for the assessment receptors, LSA, and RSA (ASL values represent Baseline Case noise levels for the noise assessment based on the Commission Guideline);
- Evaluate potential noise emissions resulting from the Proposed Project operation;
- Calculate noise levels associated with Proposed Project operation at relevant receptors and across the LSA and RSA;
- For relevant receptors, calculate Application Case Commission cumulative noise as the logarithmic sum of the ASL and predicted noise levels for Proposed Project operation;
- Compare the Application Case Commission cumulative noise levels to the relevant ASL and PSL values to characterize the magnitude of potential noise effects at relevant receptor locations;
- Assess potential for LFN issues at relevant receptors using criteria specified in Directive 038; and
- Combine magnitude classification with classification of direction, geographic extent, duration, frequency, and reversibility to obtain overall significance rating for potential noise effects at each receptor.

The Commission Guideline is explicitly not applicable to construction noise, and so the noise assessment based on the Commission Guideline will not consider potential noise effects associated with Proposed Project construction. Potential noise effects associated with construction will be dealt with in the noise assessment based on HC Guidance, since the HC Guidance provides appropriate criteria for construction noise.

9.2.3.3.3.3.1 Baseline methods

For the noise assessment based on the Commission Guideline, the Baseline Case was assessed through the identification of appropriate ASL values using methods specified by the Commission Guideline. As discussed in Section 9.2.3.3.3.1.1, because there are no existing or approved industrial facilities influencing the existing acoustic environment in the LSA or RSA, the ASL values mandated by the Commission Guideline can be considered representative of Baseline Case noise levels for the purposes of the noise assessment based on the Commission Guideline.

9.2.3.3.3.3.1.1 Ambient Sound Level (ASL)

The ASL represents the average noise environment in a given area without the contribution of any industrial facilities. The ASL is expressed as L_{eq} in dBA, and is calculated starting from a Basic Sound Level (BSL) derived from population density and proximity to transportation infrastructure. The BSL is adjusted for:

- The time of day, to account for the fact that nighttime noise is more disruptive than daytime noise;
- The nature of the activity; and
- Responses to temporary activities (Proposed Project operation cannot be considered a temporary activity and so this BSL adjustment is not applicable).

According to the Commission Guideline, the appropriate ASL is then calculated as 5 dB less than the BSL.

9.2.3.3.3.3.2 Effects Analysis Methods

The Commission Guideline requires that Application Case cumulative noise levels be controlled to a PSL at relevant receptors – this includes occupied dwellings within 1.5 km of the Proposed Project fenceline or unoccupied locations 1.5 km from the Proposed Project fenceline, in the absence of any such dwellings. As discussed in Section 9.2.3.2.1, the only receptor locations considered relevant by the Commission Guideline are the dwellings within the McNab Strata Community. However, additional receptors will be considered in the noise assessment in the interest of fully characterizing potential noise effects within the LSA and RSA.

LFN is known to be potentially annoying even when the overall broadband noise level is otherwise acceptable. However, the Commission Guideline does not provide any methods or criteria for characterizing potential LFN effects. As such, LFN guidance will be taken from Directive 038, which provides detailed instructions for identifying potential LFN effects.

9.2.3.3.3.3.2.1 Permissible Sound Level (PSL)

The PSL is expressed as L_{eq} in dBA and is calculated using an adjusted BSL, as described in Section 9.2.3.3.3.3. PSL values were established for each noise receptor and for the LSA and RSA based on instructions provided in the Commission Guideline.

The applicable daytime PSL values for each noise receptor, along with PSL values applicable to the LSA and RSA, are summarized in Table 9.2-5. Since Proposed Project operation will be conducted during the daytime, nighttime PSL values are not applicable to this noise assessment. NR1 and NR2 were locations used for baseline noise monitoring and are not considered assessment receptors. Therefore, there is no applicable PSL for these two receptors. The PSL values for receptors within the McNab Strata Community are higher than the PSL values for receptors elsewhere because of the increased dwelling unit density within the McNab Strata Community. Within the McNab Strata Community there are more than 9 dwellings per quarter section (i.e., within a 451 m radius) and so the Commission Guideline mandates a 3 dB increase in the PSL at these receptors. A detailed breakdown of the PSL determination for each receptor is provided in Volume 4, Part G - Section 22.0.

Table 9.2-5: Permissible Sound Level Summary

Assessment Receptors	Permissible Sound Level, L_{eq} [dBA]
	Daytime (7:00 a.m. to 10:00 p.m.)
NR1	N/A[(a)]
NR2	N/A[(a)]
NR3	50
NR4	50
R1	53
R2	53
R3	53
R4	53
R5	53
R6	53
R7	53
R8	53
R9	53
R10	53
R11	53
R12	53
R13	53
R14	53
R15	50
LSA/RSA	50

(a) These locations were used for baseline monitoring but are not receptors for the purposes of noise assessment. As such, there is no applicable PSL

9.2.3.3.3.3.2.2 Low Frequency Noise Analysis (LFN)

Although LFN is not discussed by the Commission Guideline, LFN annoyance may be an issue even when the broadband noise level is otherwise acceptable. LFN can be annoying in its own right and can induce vibration (i.e., shaking and rattling) in buildings. Directive 038 considers a potential for an LFN condition to exist if:

- The difference between dBC and dBA noise levels is greater than 20 dB; and
- A distinct tone exists at a frequency below 250 Hz.

According to Directive 038, a distinct tone exists if:

- The linear noise level of one band is 10 dB or more above at least one of the adjacent bands within two 1/3 octave-band widths; and
- There is a drop off of at least 5 dB in level within two bandwidths on the opposite side.

A-weighting (and dBA) refers to a specific set of spectral weights that can be applied to measured data to approximate the response of the human auditory system; A-weighting tends to emphasize the middle frequency spectral bands. C-weighting (and dBC) refers to a specific set of spectral weights that tends to emphasize the low frequency spectral bands.

If an LFN issue is present, a 5 dBA penalty is applied to the L_{eq} and the resulting noise level must still comply with the PSL.

The first LFN condition (i.e., dBC – dBA) can be assessed with model predictions but the second LFN condition (i.e., distinct tone) can only be evaluated using noise data at 1/3 octave-band spectral resolution, which can only be obtained via field measurements. As such, a definitive assessment of Application Case LFN effects can only be conducted once Proposed Project operations commence. At present it will only be possible to identify potential Application Case LFN issues.

9.2.3.3.3.4 Noise Assessment Based on Health Canada Guidance

The approach taken in the noise assessment based on the HC Guidance was as follows:

- Identify Baseline Case noise levels for the assessment receptors using the results of the baseline noise monitoring survey conducted in summer 2012 and fall 2013;
- Evaluate potential noise emissions resulting from the Proposed Project construction and operation;
- Calculate noise levels associated with Proposed Project construction and operation at relevant receptors and across the LSA and RSA;
- For relevant receptors, calculate Application Case HC cumulative noise levels as the sum of the Baseline Case noise levels and predicted noise levels for Proposed Project operation and construction;

- Compare the Application Case HC cumulative noise levels to %HA and speech intelligibility criteria to characterize the magnitude of potential noise effects at relevant receptor locations; and
- Combine magnitude classification with classification of direction, geographic extent, duration, frequency, and reversibility to obtain overall significance rating for potential noise effects at each receptor.

9.2.3.3.3.4.1 Baseline Methods

According to the HC Guidance, Baseline Case noise levels at receptors should be characterized using field measurements. Baseline Case noise measurements were collected at four representative locations across the LSA and RSA during the summer of 2012. Logging activities began in the area, and therefore further noise measurements were collected within the McNab Strata Community in fall of 2013 to obtain baseline noise levels which accounted for the logging activities. The results of the baseline monitoring survey are summarized in Section 9.2.4, and the baseline monitoring survey is described in detail in Volume 4, Part G - Section 22.0. The baseline measurements represent noise levels typical of the existing acoustic environment in the LSA and RSA.

9.2.3.3.3.4.2 Effects Analysis Methods

The HC Guideline recommends that potential Application Case noise effects be assessed at relevant receptors – this includes any occupied dwellings, daycares, schools, hospitals, places of worship, nursing homes, and First Nations and Inuit communities. As discussed in Section 9.2.3.2.1, the dwellings within the McNab Strata Community east of the Proposed Project, and the recreation camps and yacht club across the Thornbrough Channel from the Proposed Project were considered relevant receptors. However, additional noise receptors were considered in the noise assessment in the interest of fully characterizing potential noise effects in the LSA and RSA.

The HC Guideline recommends that potential Application Case noise effects be assessed using separate %HA and speech intelligibility criteria. Both of these criteria are applied at each receptor as part of the noise assessment based on HC Guidance.

9.2.3.3.3.4.2.1 High Annoyance (%HA) Criterion

The broadband noise from Proposed Project construction and operation will be assessed using the %HA criterion described in the HC Guidance. The %HA criterion uses an equation based on empirical studies of human reaction to noise to estimate the percentage of residents that would be highly annoyed (%HA) by Baseline Case noise levels, the %HA by Application Case noise levels, and identifies a change in %HA greater than 6.5% as being indicative of a potential adverse noise effect.

9.2.3.3.3.4.2.2 Speech Intelligibility

The HC Guidance indicates that outdoor noise levels above 55 dBA will interfere with speech intelligibility. As such, in the noise assessment based on HC Guidance an Application Case cumulative noise level greater than 55 dBA is considered to be indicative of a potential adverse noise effect.

9.2.3.3.4 Evaluating Significance of Residual Effects

The significance of potential residual adverse effects has been determined based on the residual effects criteria, a review of background information and available field study results, consultation with government agencies and other experts, and professional judgement. The determinations of the significance of potential residual effects on VCs are provided in Section 9.2.5.

9.2.3.3.5 Level of Confidence

The level of confidence for each predicted effect is discussed to characterize the level of uncertainty associated with both the significance and likelihood determinations. Level of confidence is typically based on expert judgement and is characterized as:

- Low: Limited evidence is available, models and calculations are highly uncertain, and/or evidence about potential effects is contradictory.
- Moderate: Sufficient evidence is available and generally supports the prediction.
- High: Sufficient evidence is available and most or all available evidence supports the prediction.

The level of confidence for the assessment of the acoustic environment will be based on the accuracy of the computer noise model predictions and conservative propagation assumptions implemented on the noise modelling.

Table 9.2-6: Criteria for Characterizing Potential Residual Effects: Noise VC – Noise Levels

VC	Context	Magnitude		Extent	Duration	Reversibility	Frequency
		Commission Guideline	HC Guidance				
Noise Levels	**Disturbed:** Effect takes place within an area with human activity. Area has been substantially previously disturbed by human development or human development is still present; **Somewhat Disturbed:** Effect takes place within an area that is somewhat affected by human development; or **Undisturbed:** Effect takes place within an area that is relatively unaffected or not adversely affected by human development.	**Negligible:** Commission cumulative noise levels have ≤3 dB change from ASL; **Low:** Commission cumulative noise levels are ≤PSL; **Moderate:** Commission cumulative noise levels exceed the PSL by ≤5 dB; or **High:** Commission cumulative noise levels exceed the PSL by >5 dB.	**Negligible:** Change in %HA ≤ 6.5% AND HC cumulative noise levels ≤ 55 dBA for speech intelligibility; **Low:** Change in %HA ≤ 6.5% AND HC cumulative noise levels exceed 55 dBA speech intelligibility threshold by ≤3 dB; **Moderate:** Change in %HA ≤ 10% AND HC cumulative noise levels exceed 55 dBA speech intelligibility threshold by ≤5 dB; or **High:** Change in %HA > 10% OR HC cumulative noise levels exceed 55 dBA speech intelligibility threshold by >5 dB.	**Local: E**ffect restricted to LSA; **Regional:** Effect extends beyond the LSA into the RSA; or **Beyond Regional: E**ffect extends beyond the RSA.	**Short-term**: <1 year; **Medium-term**: 1 year to life of Proposed Project; or **Long-term**: >life of Proposed Project.	**Fully reversible:** Effect reversible with reclamation and/or over time; **Partially Reversible:** Effect can be reversed partially; or **Irreversible:** Effect irreversible and cannot be reversed with reclamation and/or over time.	**Low:** Occurs rarely or during a specific period; **Medium:** Occurs intermittently; or **High:** Occurs continuously.

Table 9.2-7: Combined Criteria for Overall Effect Significance: Noise

Residual Effects Criteria			Significance of Effect
Magnitude[(a)]	Geographic Extent	Duration	
Negligible	Local Regional Beyond Regional	Short Term Medium Term Long Term	Negligible
Low	Local	Short Term	Negligible
		Medium Term	Negligible
		Long Term	Low
	Regional Beyond Regional	Short Term	Negligible
		Medium Term	Low
		Long Term	Low
Moderate	Local	Short Term	Low
		Medium Term	Moderate
		Long Term	Moderate
	Regional Beyond Regional	Short Term	Low
		Medium Term	Moderate
		Long Term	Moderate
High	Local	Short Term	Low
		Medium Term	Moderate
		Long Term	High
	Regional Beyond Regional	Short Term	High
		Medium Term	High
		Long Term	High

[(a)] Magnitude will be determined based on the worst-case of the Commission Guideline and HC Guidance noise assessment – e.g., if Commission Guideline Magnitude is Low and HC Guidance Magnitude is Moderate, the overall Magnitude will be taken Moderate.

9.2.4 Baseline Conditions

9.2.4.1 Introduction

As described in Section 9.2.3.3.3.1.1, the Commission Guideline and the HC Guidance require two very different approaches for characterizing Baseline Case noise levels. The Commission Guideline requires that Baseline Case noise level be defined so as to coincide with a mandated ASL value that is calculated using information about population density and proximity to transportation infrastructure. The HC Guidance requires that Baseline Case noise levels be established using field measurements.

9.2.4.2 Traditional Ecological and Community Knowledge Incorporation

TEK/CK information was gathered from a Project-specific study undertaken by *Sḵwx̱wú7mesh* (Squamish Nation) and from publicly-available sources. The TEK/CK information available at the time of writing was used to inform existing conditions and this effects assessment.

TEK/CK informed BURNCO's understanding of fisheries and freshwater habitat. The main sources of this information include:

- Occupation and Use Study (OUS) undertaken by *Sḵwx̱wú7mesh* (Traditions 2015 a,b)
- An expert report produced on behalf of Tsleil-Waututh Nation for another project (Morin 2015)
- Regulatory documents for other projects in close proximity to the Proposed Project Area (e.g., Eagle Mountain – WGP 2015 a,b; PMV 2015; WLNG 2015).

For a full summary of Aboriginal Group use and occupancy of Howe Sound refer to Part C of this Application.

Aboriginal Groups consulted on the Proposed Project noted concerns regarding the potential effects of noise from the Proposed Projects on their experience while using Howe Sound. *Sḵwx̱wú7mesh* considers acoustic disturbance, particularly industrial noises that are starkly different from natural sound sources, as one component of sensory disturbance that can affect their sense of place related to cultural practices.

As noted in Section 9.2.3.2.1, receptor locations were chosen in areas where there are seasonal, semi-permanent and permanent residences surrounding the Proposed Project, as well as a location across the Thornbrough Channel from the Proposed Project and at unoccupied locations 1.5 km from the Proposed Project. These locations were considered adequate to provide information on potential effects of noise in areas of use by Aboriginal Groups.

9.2.4.3 Results

9.2.4.3.1 Commission Guideline Baseline Case Noise Levels

According to the Commission Guideline, a daytime ASL of 45 dBA is representative of receptors located more than 500 m from transportation infrastructure and in areas with population density less than 9 dwellings per quarter

section. For the purposes of the noise assessment based on the Commission Guideline, this ASL value is used as the Baseline Case noise level at all receptors excluding those within the McNab Strata Community.

According to the Commission Guideline, a daytime ASL of 48 dBA is representative of receptors located more than 500 m from transportation infrastructure and in areas with population density greater than or equal to 9 dwellings per quarter section. For the purposes of the noise assessment based on the Commission Guideline, this ASL value is used as the Baseline Case noise level at the receptors within the McNab Strata Community.

Table 9.2-8 summarizes Baseline Case noise levels used in the assessment based on the Commission Guideline. Proposed Project operation will be confined to the daytime period, so Baseline Case noise levels for the night-time period are not presented.

Table 9.2-8: Commission Guideline Baseline Case Noise Level Summary

Assessment Receptors	Baseline Case Noise Level (Daytime) [dBA]
NR1	45
NR2	45
NR3	45
NR4	45
R1	48
R2	48
R3	48
R4	48
R5	48
R6	48
R7	48
R8	48
R9	48
R10	48
R11	48
R12	48
R13	48
R14	48
R15	45
Noise LSA/RSA	45

9.2.4.3.2 Baseline Noise Survey

9.2.4.3.2.1 Baseline Noise Monitoring Method

According to the HC Guidance, Baseline Case noise levels should be established via field measurements. As such, during the summer of 2012 a baseline monitoring program was conducted at four receptors, NR1 – NR4, within the Proposed Project LSA and RSA. One survey of two to three days duration was completed at each of the four noise monitoring locations. The monitoring measurements were conducted at NR2 and NR3 between July 18 and July 21, 2012, and at NR1 and NR4 between August 14 and August 17, 2012. Logging activities began in the LSA in 2013, which were not accounted for in the first round of noise monitoring. Another noise monitoring location, NR5 located within the McNab Strata Community, was surveyed on October 15 and 16, 2013 and between October 26 and 28, 2013 to account for logging noise in the baseline noise levels. Corrections based on

the NR5 measurements were applied to receptors NR1-NR4 to account for logging operations, which are to be ongoing throughout much of the Proposed Project lifespan. Surveys of this type and duration provide information on daily variability in noise levels as well as an expected typical or average daily condition.

Model 2250 Brüel and Kjær Type I integrating sound level meters were used to collect noise measurements and audio recordings. This type of meter logs noise levels and records audio data over intervals selected by the user. Data parameters logged for the survey periods included:

- Energy equivalent noise level over a one-minute time period ($L_{eq,1min}$) in dBA;
- 1/3 octave band values over a one-minute time period in dB; and
- Audio data continuously in *.wav format files.

A Brüel and Kjær Type 4231 calibrator was used for calibrating the meters before and after each monitoring period to ensure the sound meter's variance was within 0.5 dB. The calibrator has an estimated uncertainty for sound pressure level of ±0.12 dB at a 99% confidence level. The calibration data were logged by the meter and calibration results were also described in field notes.

Neither the Commission Guideline nor the HC Guidance specify weather conditions appropriate for baseline noise monitoring, but Directive 038 indicates that baseline noise monitoring should only be conducted under favourable summertime conditions. In particular, Directive 038 requires monitoring be conducted in the absence of snow, water, or ice ground cover, and in the absence of steady precipitation. Directive 038 also specifies that baseline noise monitoring should only be conducted when wind speeds are less than 15 km per hour (km/h).

During the baseline monitoring survey, weather data were collected using Kestrel 4500 pocket weather meters from Nielsen Kellerman, set-up near the noise monitoring sites. The weather meters recorded wind speed and direction, temperature, and relative humidity data every five minutes. Data from the weather meters were used as required by Directive 038 for the interpretation of the logged noise data. Direct observations and field notes made by the study team included precipitation, cloud cover, wind direction, and observed audible noise sources; these field notes were also used to interpret the logged noise data.

Data were downloaded to a computer for analysis with the Brüel and Kjaer 7820 Evaluator® software program. The data were reviewed to identify noise sources from the audio recordings and, in accordance with Directive 038, to filter out invalid data – noise from the sources that were considered not representative of normal conditions at the monitoring locations.

Hourly equivalent energy noise levels ($L_{eq,1hr}$) values were calculated for each hour of the survey period from the valid one-minute data, and these $L_{eq,1hr}$ values were then used to establish daytime, nighttime and day-night baseline levels ($L_{eq,day}$, $L_{eq,night}$ and $L_{eq,dn}$, respectively) as per the HC Guidance.

A detailed description of the baseline noise survey is provided in Volume 4, Part G - Section 22.0.

9.2.4.3.2.2 Measured Baseline Noise Levels

The baseline noise survey methods used were consistent with Directive 038 requirements. The average energy equivalent daytime and nighttime background noise levels measured at the baseline noise receptors are shown in Table 9.2-9. The logging baseline noise levels at NR1-NR4 were calculated based on the measurements at NR5. As logging operations will be ongoing throughout the lifespan of the Proposed Project, the logging case baseline noise levels will be used for the noise assessment. Additional information on the baseline noise survey is provided in the Volume 4, Part G - Section 22.0.

Table 9.2-9: Baseline Noise Survey Results

Monitoring Location	Baseline Noise Levels – No Logging (dBA)		Baseline Noise Levels – Logging (dBA)	
	Day-time, $L_{eq, day}$	Night-time, $L_{eq, night}$	Day-time, $L_{eq, day}$	Night-time, $L_{eq, night}$
	7:00 AM to 10:00 PM	10:00 PM to 7:00 AM	7:00 AM to 10:00 PM	10:00 PM to 7:00 AM
NR1 – BURNCO East	36	36	42	37
NR2 – BURNCO West	43	37	46	38
NR3 – BURNCO North	42	41	42	41
NR4 – BURNCO South	44	33	44	33
NR5 – McNab Strata Community	40	36	43	37

The five monitoring locations used for the baseline noise survey were selected to be representative of baseline noise levels throughout the noise LSA and RSA. NR1 represents noise levels in the LSA and RSA east of the Proposed Project fenceline near McNab Creek; NR2 represents noise levels in the heavily forested portions of the LSA and RSA west of the Proposed Project fenceline; NR3 represents noise levels in the heavily forested portions of the LSA and RSA north of the Proposed Project fenceline; NR4 represents noise levels in the LSA and RSA south of the Proposed Boundary, in particular, on the north shore of Gambier Island directly opposite the Proposed Project; and NR5 represents noise levels within the McNab Community.

The baseline noise levels at NR1 were mainly influenced by noise from a segment of McNab Creek in which water was moving relatively slowly. The baseline noise levels at NR3 were mainly influenced by noise from a segment of McNab Creek in which water was moving relatively quickly. The baseline noise levels at NR2 were mainly influenced by natural noise from birds and other wildlife. The baseline noise levels at NR4 were mainly influenced by recreational activities associated with summer camps and yacht clubs. The baseline noise levels at NR5 were mainly influenced by fast flowing water in McNab Creek, wave activity in Howe Sound, human activities including power generation in the community and on the beach, wind in trees and other vegetation, and birds, insects, and other wildlife.

9.2.4.3.2.3 Baseline Low Frequency Noise Analysis

The 1/3 octave-band noise levels logged during the baseline noise monitoring survey were used to calculate dBC noise levels and to identify distinct tones below 250 Hz so as to identify Baseline Case LFN issues using the criteria described in Section 9.2.3.3.3.3. Table 9.2-10 presents Baseline Case LFN analysis at the four receptors used for baseline noise monitoring.

Table 9.2-10: Low Frequency Noise Analysis at Baseline Monitoring Locations

Monitoring Location	Period	dBC – dBA	Number of Tones below 250 Hz	LFN Issue
NR1	Daytime (7 am – 10 pm)	10.7	0	no
	Nighttime (10 pm – 7 am)	3.4	0	no
NR2	Daytime (7 am – 10 pm)	1.9	0	no
	Nighttime (10 pm – 7 am)	2.2	0	no
NR3	Daytime (7 am – 10 pm)	0.8	0	no
	Nighttime (10 pm – 7 am)	3.8	1	no
NR4	Daytime (7 am – 10 pm)	11.1	0	no
	Nighttime (10 pm – 7 am)	14.1	0	no
NR5	Daytime (7 am – 10 pm)	10.3	0	no
	Nighttime (10 pm – 7 am)	6.8	0	no

Table 9.2-10 indicates that there was no LFN issue during the daytime or nighttime periods at any of the five receptors used for noise monitoring. Since these receptors were selected to characterize the baseline noise levels across the LSA and RSA, it can be concluded that there are no LFN issues associated with the existing acoustic environment.

9.2.4.3.2.4 Health Canada Guidance Baseline Case Noise Levels

In accordance with the HC Guidance, baseline noise levels measured at the five receptor locations distributed across the LSA and RSA were used to establish Baseline Case noise levels at the assessment receptors. Table 9.2-11 summarizes Baseline Case noise levels used in the assessment based on the HC Guidance. Baseline Case noise levels measured at NR5 in the McNab Strata Community are assigned as Baseline Case levels for R1-R15. Even though the Proposed Project construction and operation will be confined to the daytime period, the HC Guidance requires consideration of $L_{eq,day}$, $L_{eq,night}$, and $L_{eq,dn}$ and so Baseline Case values are presented for both the daytime and night-time period.

Table 9.2-11: HC Guidance Baseline Case Noise Level Summary

Assessment Receptors	Baseline Case Noise Level (Daytime) $L_{eq,\ day}$ [dBA]	Baseline Case Noise Level (Nighttime) $L_{eq,\ night}$ [dBA]	Baseline Case Noise Level (Day-Night) $L_{eq,\ dn}$ [dBA]
NR1	42	37	44.7
NR2	46	38	46.9
NR3	42	41	47.7
NR4	44	33	43.9
R1	43	37	45.0
R2	43	37	45.0
R3	43	37	45.0
R4	43	37	45.0
R5	43	37	45.0
R6	43	37	45.0

Assessment Receptors	Baseline Case Noise Level (Daytime) $L_{eq, day}$ [dBA]	Baseline Case Noise Level (Nighttime) $L_{eq, night}$ [dBA]	Baseline Case Noise Level (Day-Night) $L_{eq, dn}$ [dBA]
R7	43	37	45.0
R8	43	37	45.0
R9	43	37	45.0
R10	43	37	45.0
R11	43	37	45.0
R12	43	37	45.0
R13	43	37	45.0
R14	43	37	45.0
R15	43	37	45.0

9.2.5 Effects Assessment

9.2.5.1 Project-VC Interactions

A preliminary evaluation of identified interactions between the various physical works and activities and the selected VCs across all spatial and temporal phases of the Proposed Project is presented in Table 9.2-12. Potential Project-VC interactions are characterized as:

a) Positive, none or negligible, requiring no further consideration; or

b) Potential effect requiring further consideration and possibly additional mitigation.

Rationale is provided for all determinations that there is no or negligible interaction and that no further consideration is required.

For those Proposed Project-VC interactions that may result in a potential direct, indirect and induced effects requiring further consideration, the nature of the effects (both adverse and positive) arising from those interactions is described in Sections 9.2.5.2 and 9.2.5.2.2 below.

Table 9.2-12: Project-VC Interaction Table: Noise VC – Noise Levels

Project Activities	Description	Noise Levels	
		Potential Interaction (See Notes)	Potential Effect / Rationale for Exclusion
Construction			
1. Crew and equipment transport	▪ Daily water taxi ▪ Tug and barge transport of machinery/materials (est. 8 loads) ▪ Barge household and industrial solid waste barged off-site	●	▪ Increase in noise levels
2. Site preparation, including construction of the berms and dyke	▪ Logging, clearing and grubbing ▪ Grading ▪ Construction of the berms and dyke ▪ Compaction and laying of gravel base ▪ Limited improvements to existing on-site road infrastructure	●	▪ Increase in noise levels
3. Processing area installation, including conveyors and materials handling system)	▪ Installation and use of portable concrete batch plant for construction ▪ Installation of concrete foundations ▪ Installation of screens, crushers, wash plant, conveyor system and automated materials-handling system (i.e., reclaim tunnels) ▪ Installation of groundwater well as a source of make-up water for the wash plant	●	▪ Increase in noise levels
4. Substation construction and connection	▪ Construct electrical substation adjacent to existing BC Hydro transmission line ▪ Construct outdoor switchyard, electric building, and 100 m transmission line	●	▪ Increase in noise levels
5. Marine loading facility installation	▪ Remove existing mooring dolphins ▪ Steel pile installation ▪ Installation of conveyor, barge movement winch and mooring dolphins	●	▪ Increase in noise levels

Project Activities	Description	Noise Levels	
		Potential Interaction (See Notes)	Potential Effect / Rationale for Exclusion
6. Pit development	▪ Dry excavation to remove overburden/topsoil ▪ Installation of clamshell and floating conveyor	●	▪ Increase in noise levels
7. Other ancillary land-based construction works	▪ Temporary construction infrastructure set up (trailers, temporary power, etc.) ▪ Upgrades to the existing heavy equipment maintenance shop and warehouse ▪ Upgrades to the existing fuelling facility for the storage of diesel and gasoline for on-site equipment ▪ Construct site office, communications building, workers lunch/dry room, caretaker's cabin, first aid facility and helipad ▪ Install contained washroom facilities ▪ Construct pump room for well/stream intake water distribution and fire-fighting	●	▪ Increase in noise levels
8. Other ancillary marine construction works	▪ Removal of existing small craft dock; install temporary dock for worker access ▪ Construct new floating small craft dock, the with tie-up area for a float plane, serviced with 30 amp (A) 125 volt (V) shore power ▪ Barge household and industrial solid waste off-site	●	▪ Increase in noise levels
Operations			
9. Crew transport	▪ Daily water taxi	●	▪ Increase in noise levels

Project Activities	Description	Noise Levels	
		Potential Interaction (See Notes)	Potential Effect / Rationale for Exclusion
10. Aggregate extraction	▪ Use of electric powered floating clamshell dredge ▪ Primary screening and conveyance of extracted material to processing area ▪ Install channel plug in WC 2	●	▪ Increase in noise levels
11. Processing (screening, crushing, washing)	▪ Screening to separate aggregate sizes ▪ Oversized gravels crushed ▪ Operation of wash plant fed using recycled water from two large storage tanks, supplemented with make-up water by a groundwater well. ▪ Drying and storage of fines and silt	●	▪ Increase in noise levels
12. Progressive reclamation	▪ Ongoing earth works (including site clearing, surface material removal) ▪ Fines and silt mixed with organic overburden material and used for infilling, re-vegetation and landscaping	●	▪ Increase in noise levels
13. Stockpile storage	▪ Processed sand and gravel conveyed to stockpile area ▪ Storage of processed materials in stockpiles	●	▪ Increase in noise levels
14. Marine loading	▪ Transfer of stored material using marine conveyor system ▪ Barge loading ▪ Site and navigational lighting	●	▪ Increase in noise levels
15. Shipping	▪ Barge traffic (delivery/collection) in Howe Sound, Ramillies Channel, Thornbrough Channel, and Queen Charlotte Channel ▪ Tug and barge transport of fuel and consumables ▪ Navigational lighting	●	▪ Increase in noise levels
16. Refueling and maintenance	▪ Refueling and maintenance of on-site equipment	●	▪ Increase in noise levels

Project Activities	Description	Noise Levels	
		Potential Interaction (See Notes)	Potential Effect / Rationale for Exclusion
Reclamation and Closure			
17. Crew and equipment transport	▪ Daily water taxi ▪ Tug and barge transport of machinery/materials ▪ Barge household and industrial solid waste barged off-site	●	▪ Increase in noise levels
18. Removal of land-based infrastructure	▪ Remove surface facilities, including clamshell dredge, conveyor system, screens, crushers, wash plant, automated materials-handling system, heavy equipment maintenance shop and warehouse, fuelling facility, site office, communications building, workers lunch/dry room, caretaker's cabin, first aid facility, helipad and contained washroom facilities	●	▪ Increase in noise levels
19. Removal of marine infrastructure	▪ Remove marine facilities, in marine load out facility, jetty, conveyors and piles	●	▪ Increase in noise levels
20. Site reclamation	▪ Final completion of the pit lake, landscaping and re-vegetation to develop a functional ecosystem in the freshwater pit ▪ Landscaping and re-vegetation of processing area, berms and dyke	●	▪ Increase in noise levels

Notes:
O = Potential effect of Proposed Project activity on VC is positive, none or negligible; no further consideration warranted.
● = Potential effect of Proposed Project activity on VC that may require mitigation/benefit enhancement; warrants further consideration

9.2.5.2 Project-related Effects

9.2.5.2.1 Construction

The initial construction of the Proposed Project is expected to last up to four months. Subsequent construction activities associated with the Proposed Project (i.e., construction that will take place simultaneously with Proposed Project operation), will be considered as part of Proposed Project operation. All Proposed Project construction activities will take place during daylight hours from 7 a.m. to 9 p.m. (14 hours) – i.e., Proposed Project construction activities will be confined to the daytime period, as defined in the Commission Guideline and HC Guidance.

Noise due to construction is temporary; the variability of noise emission levels and locations over different construction phases will result in a wide range of noise levels at receptors. The activities associated with Proposed Project construction are described in Section 9.2.3.3.3.1.2.1. Because the activities will occur in different locations with different major noise emitting equipment, all the activities during different periods were modeled.

Proposed Project construction activity phases and associated major noise sources/equipment are listed as below in Table 9.2-13.

Table 9.2-13: Project Construction Activities and Major Noise Sources/Equipment

Project Construction Activity Phase No.	Project Construction Activity Phases	Major Noise Source/Equipment
1	Dock and existing barge ramp upgrade	300 hp diesel crane
		1700 hp tug boat
2	Road, warehouse and facilities upgrade and construction, including substation and transmission	John Deere 850k XLT Dozer
		John Deere 460E haul truck
		Caterpillar 140M grader
		Caterpillar 980K loader
		503 hp Liebherr land crane
3	Processing plant area clearing and site clearing at the same time	John Deere 470 G LC excavator
		John Deere 460E haul truck
		John Deere 850K XLT dozer
4	Preload processing plant area, construction of processing plant facilities	503 hp Liebherr land crane
		Caterpillar 980k Loader
		John Deere 460E haul truck
5	Barge load jetty and new dock facilities. Pile driving etc.	300 hp diesel crane
		1700 hp tug boat
		Vibratory hammers (APE 200), or impact (Drop Hammer 10,000lb).
6	Initial dry excavation of pit using excavators	John Deere 470 G LC excavator
		John Deere 460E haul truck
		John Deere 850K XLT dozer
		Caterpillar CS64 packer
		Caterpillar 140m grader

Project Construction Activity Phase No.	Project Construction Activity Phases	Major Noise Source/Equipment
7	Installation of floating clamshell dredge and conveyor	300 hp diesel crane
8	Construction of McNab Creek Flood Protection Dyke, the Pit Lake Containment Berm and the Processing Area Dirt Berm	John Deere 470 G LC excavator
		John Deere 460E haul truck
		John Deere 850K XLT dozer

9.2.5.2.1.1 Project Construction Noise Emissions

Table 9.2-13 presents a summary of the major noise emitting equipment expected to be used during construction of the Proposed Project. For each piece of equipment, Table 9.2-14 presents total noise emissions in the form of broadband Sound Power Level (PWL), as well as an estimate of the acoustical usage factor – i.e., the percentage of the total work time (14 hours during the daytime) that the equipment is expected to effectively be operating. Octave-band spectral PWL values for relevant sources are presented in Volume 4, Part G - Section 22.0. The tug boats, haul trucks and loaders, when arriving and leaving the site, are treated as moving point sources. Other off-road equipment, such as cranes, dozers, pile drivers, excavators, packers, and graders were modeled as point sources. Noise emissions for the Proposed Project construction sources were established using the following:

- Empirical formulae (Crocker 2007; Bies and Hansen 2003);
- A database published by the United Kingdom Department for Environment Food and Rural Affairs (DEFRA) (DEFRA 2007);
- A database published by the United States Department of Transportation (DOT) (DOT 2006); and
- Field measurements of similar equipment.

Table 9.2-14: Proposed Project Construction Equipment and Noise Emissions

Equipment	Source Type	ISO Penalty [dB][(a)]	Acoustical Usage Factor (%)	Operating Hours (hr)	Point Source PWL [dBA]
1700 hp tug boat	Point Source	0	50	7.0	111.0
300 hp diesel crane	Point Source	0	16	2.2	115.6
503 hp Liebherr land crane	Point Source	0	16	2.2	116.9
Caterpillar 140M grader	Point Source	0	40	5.6	112.0
Caterpillar 980K loader	Point Source	0	40	5.6	113.6
Caterpillar CS64 packer	Point Source	5 – regular impulsive	20	2.8	117.0
John Deere 460E haul truck	Point Source	0	40	5.6	116.1

Equipment	Source Type	ISO Penalty [dB][(a)]	Acoustical Usage Factor (%)	Operating Hours (hr)	Point Source PWL [dBA]
John Deere 470 G LC excavator	Point Source	0	40	5.6	116.9
John Deere 850k XLT dozer	Point Source	0	40	5.6	112.9
Vibratory hammers (APE 200), or impact (Drop Hammer 10,000lb).	Point Source	12 – highly-impulsive	20	2.8	128.9

(a) The international standard ISO 9613-1: Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures (ISO 2003) indicates that penalties should be applied to noise sources identified as "regular impulsive" or "highly-impulsive"

Once the noise emissions of the various relevant noise sources were established, the sources were applied to the computer model of Proposed Project construction to determine the contribution of these sources to noise levels at the assessment receptors.

9.2.5.2.1.2 Noise Assessment Based on Commission Guideline

The Commission Guideline is explicitly not applicable to construction noise, and so the noise assessment based on the Commission Guideline will not consider potential noise effects associated with Proposed Project construction. Potential noise effects associated with construction will be dealt with in the noise assessment based on HC Guidance, since the HC Guidance provides appropriate criteria for construction noise.

9.2.5.2.1.3 Noise Assessment Based on Health Canada Guidance

9.2.5.2.1.3.1 Noise Level Predictions for Proposed Project Construction

As discussed in Section 9.2.2.2, for the noise assessment based on the HC Guidance measured baseline data are used to represent the Baseline Case noise levels at the assessment receptors. The Application Case HC cumulative noise levels are then calculated through the logarithmic addition of the Baseline Case noise levels and the predicted noise contribution from the Proposed Project.

For each noise receptor, Table 9.2-15 through Table 9.2-22 present the Baseline Case noise levels, Proposed Project contribution, and Application Case HC cumulative noise levels for each phase of construction described in Table 9.2-13.

Table 9.2-15: Construction Phase 1 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}
NR1	42	37	44.6	36.4	0	43.1	37.0	45.0
NR2	46	38	46.9	37.8	0	46.6	38.0	47.2
NR3	42	41	47.6	27.5	0	42.2	41.0	47.6
NR4	44	33	43.7	31.0	0	44.2	33.0	43.8
R1	43	37	45.0	38.2	0	44.2	37.0	45.5

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
R2	43	37	45.0	37.7	0	44.1	37.0	45.4
R3	43	37	45.0	39.3	0	44.5	37.0	45.6
R4	43	37	45.0	39.6	0	44.6	37.0	45.7
R5	43	37	45.0	39.8	0	44.7	37.0	45.7
R6	43	37	45.0	39.7	0	44.7	37.0	45.7
R7	43	37	45.0	40.3	0	44.9	37.0	45.8
R8	43	37	45.0	40.3	0	44.9	37.0	45.8
R9	43	37	45.0	40.4	0	44.9	37.0	45.8
R10	43	37	45.0	40.2	0	44.8	37.0	45.8
R11	43	37	45.0	40.2	0	44.8	37.0	45.8
R12	43	37	45.0	40.0	0	44.8	37.0	45.7
R13	43	37	45.0	40.4	0	44.9	37.0	45.8
R14	43	37	45.0	40.5	0	44.9	37.0	45.8
R15	43	37	45.0	24.8	0	43.1	37.0	45.0

(a) Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-16: Construction Phase 2 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
NR1	42	37	44.6	38.7	0	43.7	37.0	45.2
NR2	46	38	46.9	41.1	0	47.2	38.0	47.5
NR3	42	41	47.6	25.4	0	42.1	41.0	47.6
NR4	44	33	43.7	28.3	0	44.1	33.0	43.7
R1	43	37	45.0	37.3	0	44.0	37.0	45.4
R2	43	37	45.0	37.6	0	44.1	37.0	45.4
R3	43	37	45.0	37.9	0	44.2	37.0	45.5
R4	43	37	45.0	38.5	0	44.3	37.0	45.5
R5	43	37	45.0	39.3	0	44.5	37.0	45.6
R6	43	37	45.0	40.0	0	44.8	37.0	45.7
R7	43	37	45.0	40.1	0	44.8	37.0	45.8
R8	43	37	45.0	39.7	0	44.7	37.0	45.7
R9	43	37	45.0	40.8	0	45.0	37.0	45.9
R10	43	37	45.0	40.2	0	44.8	37.0	45.8
R11	43	37	45.0	40.6	0	45.0	37.0	45.8
R12	43	37	45.0	40.4	0	44.9	37.0	45.8
R13	43	37	45.0	40.5	0	44.9	37.0	45.8
R14	43	37	45.0	40.7	0	45.0	37.0	45.9
R15	43	37	45.0	28.3	0	43.1	37.0	45.0

(a) Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-17: Construction Phase 3 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}
NR1	42	37	44.6	39.6	0	44.0	37.0	45.4
NR2	46	38	46.9	41.8	0	47.4	38.0	47.6
NR3	42	41	47.6	24.8	0	42.1	41.0	47.6
NR4	44	33	43.7	26.1	0	44.1	33.0	43.7
R1	43	37	45.0	37.9	0	44.2	37.0	45.5
R2	43	37	45.0	38.2	0	44.2	37.0	45.5
R3	43	37	45.0	38.0	0	44.2	37.0	45.5
R4	43	37	45.0	38.2	0	44.2	37.0	45.5
R5	43	37	45.0	39.1	0	44.5	37.0	45.6
R6	43	37	45.0	40.0	0	44.8	37.0	45.7
R7	43	37	45.0	40.1	0	44.8	37.0	45.8
R8	43	37	45.0	39.3	0	44.5	37.0	45.6
R9	43	37	45.0	40.7	0	45.0	37.0	45.9
R10	43	37	45.0	39.9	0	44.7	37.0	45.7
R11	43	37	45.0	40.5	0	44.9	37.0	45.8
R12	43	37	45.0	40.2	0	44.8	37.0	45.8
R13	43	37	45.0	40.2	0	44.8	37.0	45.8
R14	43	37	45.0	40.4	0	44.9	37.0	45.8
R15	43	37	45.0	26.7	0	43.1	37.0	45.0

[(a)] Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-18: Construction Phase 4 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}
NR1	42	37	44.6	38.0	0	43.5	37.0	45.1
NR2	46	38	46.9	40.3	0	47.0	38.0	47.4
NR3	42	41	47.6	23.4	0	42.1	41.0	47.6
NR4	44	33	43.7	25.4	0	44.1	33.0	43.7
R1	43	37	45.0	36.3	0	43.8	37.0	45.3
R2	43	37	45.0	36.6	0	43.9	37.0	45.3
R3	43	37	45.0	36.4	0	43.9	37.0	45.3
R4	43	37	45.0	36.6	0	43.9	37.0	45.3
R5	43	37	45.0	37.6	0	44.1	37.0	45.4
R6	43	37	45.0	38.5	0	44.3	37.0	45.5
R7	43	37	45.0	38.6	0	44.3	37.0	45.5
R8	43	37	45.0	37.9	0	44.2	37.0	45.5
R9	43	37	45.0	39.3	0	44.5	37.0	45.6
R10	43	37	45.0	38.4	0	44.3	37.0	45.5
R11	43	37	45.0	39.1	0	44.5	37.0	45.6
R12	43	37	45.0	38.8	0	44.4	37.0	45.6
R13	43	37	45.0	38.8	0	44.4	37.0	45.6
R14	43	37	45.0	39.0	0	44.5	37.0	45.6
R15	43	37	45.0	25.6	0	43.1	37.0	45.0

[(a)] Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-19: Construction Phase 5 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}
NR1	42	37	44.6	47.2	0	48.3	37.0	47.9
NR2	46	38	46.9	45.3	0	48.7	38.0	48.4
NR3	42	41	47.6	34.5	0	42.7	41.0	47.7
NR4	44	33	43.7	40.4	0	45.6	33.0	44.8
R1	43	37	45.0	50.5	0	51.2	37.0	50.1
R2	43	37	45.0	49.8	0	50.6	37.0	49.6
R3	43	37	45.0	52.0	0	52.5	37.0	51.2
R4	43	37	45.0	52.4	0	52.9	37.0	51.5
R5	43	37	45.0	52.6	0	53.1	37.0	51.6
R6	43	37	45.0	52.5	0	53.0	37.0	51.5
R7	43	37	45.0	53.3	0	53.7	37.0	52.2
R8	43	37	45.0	53.2	0	53.6	37.0	52.1
R9	43	37	45.0	53.5	0	53.9	37.0	52.3

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[a] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
R10	43	37	45.0	53.1	0	53.5	37.0	52.0
R11	43	37	45.0	53.2	0	53.6	37.0	52.1
R12	43	37	45.0	52.9	0	53.3	37.0	51.9
R13	43	37	45.0	53.3	0	53.7	37.0	52.2
R14	43	37	45.0	53.5	0	53.9	37.0	52.3
R15	43	37	45.0	35.4	0	43.7	37.0	45.2

[a] Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-20: Construction Phase 6 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[a] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
NR1	42	37	44.6	40.2	0	44.2	37.0	45.5
NR2	46	38	46.9	42.6	0	47.6	38.0	47.8
NR3	42	41	47.6	30.1	0	42.3	41.0	47.6
NR4	44	33	43.7	26.3	0	44.1	33.0	43.7
R1	43	37	45.0	39.5	0	44.6	37.0	45.7
R2	43	37	45.0	39.4	0	44.6	37.0	45.6
R3	43	37	45.0	39.3	0	44.5	37.0	45.6
R4	43	37	45.0	39.1	0	44.5	37.0	45.6
R5	43	37	45.0	38.8	0	44.4	37.0	45.6
R6	43	37	45.0	38.9	0	44.4	37.0	45.6
R7	43	37	45.0	38.6	0	44.3	37.0	45.5
R8	43	37	45.0	38.4	0	44.3	37.0	45.5
R9	43	37	45.0	39.0	0	44.5	37.0	45.6
R10	43	37	45.0	38.3	0	44.3	37.0	45.5
R11	43	37	45.0	39.6	0	44.6	37.0	45.7
R12	43	37	45.0	39.1	0	44.5	37.0	45.6
R13	43	37	45.0	39.0	0	44.5	37.0	45.6
R14	43	37	45.0	39.4	0	44.6	37.0	45.6
R15	43	37	45.0	28.6	0	43.2	37.0	45.0

[a] Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-21: Construction Phase 7 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
NR1	42	37	44.6	31.1	0	42.3	37.0	44.7
NR2	46	38	46.9	30.5	0	46.1	38.0	46.9
NR3	42	41	47.6	20.4	0	42.0	41.0	47.6
NR4	44	33	43.7	17.0	0	44.0	33.0	43.7
R1	43	37	45.0	29.4	0	43.2	37.0	45.0
R2	43	37	45.0	29.5	0	43.2	37.0	45.0
R3	43	37	45.0	29.2	0	43.2	37.0	45.0
R4	43	37	45.0	29.0	0	43.2	37.0	45.0
R5	43	37	45.0	28.8	0	43.2	37.0	45.0
R6	43	37	45.0	28.8	0	43.2	37.0	45.0
R7	43	37	45.0	28.7	0	43.2	37.0	45.0
R8	43	37	45.0	28.4	0	43.1	37.0	45.0
R9	43	37	45.0	29.0	0	43.2	37.0	45.0
R10	43	37	45.0	28.2	0	43.1	37.0	45.0
R11	43	37	45.0	29.9	0	43.2	37.0	45.0
R12	43	37	45.0	29.4	0	43.2	37.0	45.0
R13	43	37	45.0	29.5	0	43.2	37.0	45.0
R14	43	37	45.0	30.1	0	43.2	37.0	45.0
R15	43	37	45.0	20.1	0	43.0	37.0	45.0

[(a)] Logarithmic sum of baseline and Proposed Project construction noise levels.

Table 9.2-22: Construction Phase 8 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	L_{dn}
NR1	42	37	44.6	52.1	0	52.5	37.0	51.1
NR2	46	38	46.9	39.9	0	47.0	38.0	47.4
NR3	42	41	47.6	24.9	0	42.1	41.0	47.6
NR4	44	33	43.7	24.3	0	44.0	33.0	43.7
R1	43	37	45.0	45.0	0	47.1	37.0	47.1
R2	43	37	45.0	45.2	0	47.2	37.0	47.2
R3	43	37	45.0	44.4	0	46.8	37.0	46.9
R4	43	37	45.0	44.1	0	46.6	37.0	46.8
R5	43	37	45.0	43.6	0	46.3	37.0	46.6
R6	43	37	45.0	43.7	0	46.4	37.0	46.6
R7	43	37	45.0	43.5	0	46.3	37.0	46.6
R8	43	37	45.0	42.9	0	46.0	37.0	46.4
R9	43	37	45.0	43.4	0	46.2	37.0	46.5
R10	43	37	45.0	42.7	0	45.9	37.0	46.3

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}
R11	43	37	45.0	43.3	0	46.2	37.0	46.5
R12	43	37	45.0	42.5	0	45.8	37.0	46.3
R13	43	37	45.0	42.1	0	45.6	37.0	46.2
R14	43	37	45.0	42.4	0	45.7	37.0	46.2
R15	43	37	45.0	26.9	0	43.1	37.0	45.0

(a) Logarithmic sum of baseline and Proposed Project construction noise levels.

9.2.5.2.1.3.2 High Annoyance Analysis

Table 9.2-23 through Table 9.2-30 apply the high annoyance criterion from the HC Guidance to the Application Case HC cumulative noise levels for each phase of Proposed Project construction. To create these tables:

- As specified in the HC Guidance and described in Section 9.2.2.2, 10 dBA was added to the Baseline Case and Application Case noise levels at all receptors considered to be in quiet rural areas. All receptors except for NR2 and NR3 have Baseline Case $L_{eq,dn}$ values less than or equal to 45 dBA and are thus considered to be quiet rural areas;
- The %HA was calculated for the Baseline Case noise levels at each receptor location using the equation presented in Section 9.2.2.2;
- The %HA was calculated for the Application Case HC cumulative noise levels at each receptor location using the equation presented in Section 9.2.2.2; and
- The difference between Application Case and Baseline Case %HA was calculated via subtraction.

As discussed in Section 9.2.2.2, the HC Guidance indicates that there is the potential for an adverse noise effect if the change in %HA between the Baseline Case and Application Case is greater than 6.5%. In other words, when the change in %HA is less than 6.5% the magnitude of the effect is classified as Negligible (see Table 9.2-6).

Table 9.2-23: High Annoyance Criterion Applied to Construction Phase 1

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.1	0.2	N/A[(a)]
NR2	1.5	1.5	0.1	N/A[(a)]
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.6	0.1	Negligible
R1	4.1	4.4	0.3	Negligible
R2	4.1	4.4	0.3	Negligible
R3	4.1	4.5	0.4	Negligible
R4	4.1	4.5	0.4	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R5	4.1	4.5	0.4	Negligible
R6	4.1	4.5	0.4	Negligible
R7	4.1	4.6	0.5	Negligible
R8	4.1	4.6	0.5	Negligible
R9	4.1	4.6	0.5	Negligible
R10	4.1	4.6	0.5	Negligible
R11	4.1	4.6	0.5	Negligible
R12	4.1	4.6	0.4	Negligible
R13	4.1	4.6	0.5	Negligible
R14	4.1	4.6	0.5	Negligible
R15	4.1	4.1	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-24: High Annoyance Criterion Applied to Construction Phase 2

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.3	0.3	N/A(a)
NR2	1.5	1.6	0.1	N/A(a)
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	4.4	0.2	Negligible
R2	4.1	4.4	0.3	Negligible
R3	4.1	4.4	0.3	Negligible
R4	4.1	4.4	0.3	Negligible
R5	4.1	4.5	0.4	Negligible
R6	4.1	4.6	0.4	Negligible
R7	4.1	4.6	0.4	Negligible
R8	4.1	4.5	0.4	Negligible
R9	4.1	4.6	0.5	Negligible
R10	4.1	4.6	0.5	Negligible
R11	4.1	4.6	0.5	Negligible
R12	4.1	4.6	0.5	Negligible
R13	4.1	4.6	0.5	Negligible
R14	4.1	4.6	0.5	Negligible
R15	4.1	4.2	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-25: High Annoyance Criterion Applied to Construction Phase 3

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.3	0.4	N/A[(a)]
NR2	1.5	1.6	0.2	N/A[(a)]
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	4.4	0.3	Negligible
R2	4.1	4.4	0.3	Negligible
R3	4.1	4.4	0.3	Negligible
R4	4.1	4.4	0.3	Negligible
R5	4.1	4.5	0.4	Negligible
R6	4.1	4.6	0.4	Negligible
R7	4.1	4.6	0.4	Negligible
R8	4.1	4.5	0.4	Negligible
R9	4.1	4.6	0.5	Negligible
R10	4.1	4.5	0.4	Negligible
R11	4.1	4.6	0.5	Negligible
R12	4.1	4.6	0.5	Negligible
R13	4.1	4.6	0.5	Negligible
R14	4.1	4.6	0.5	Negligible
R15	4.1	4.1	0.0	Negligible

[(a)] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-26: High Annoyance Criterion Applied to Construction Phase 4

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.2	0.3	N/A[(a)]
NR2	1.5	1.6	0.1	N/A[(a)]
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	4.3	0.2	Negligible
R2	4.1	4.3	0.2	Negligible
R3	4.1	4.3	0.2	Negligible
R4	4.1	4.3	0.2	Negligible
R5	4.1	4.4	0.3	Negligible
R6	4.1	4.4	0.3	Negligible
R7	4.1	4.4	0.3	Negligible
R8	4.1	4.4	0.3	Negligible
R9	4.1	4.5	0.4	Negligible
R10	4.1	4.4	0.3	Negligible
R11	4.1	4.5	0.4	Negligible
R12	4.1	4.5	0.3	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R13	4.1	4.5	0.3	Negligible
R14	4.1	4.5	0.3	Negligible
R15	4.1	4.1	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-27: High Annoyance Criterion Applied to Construction Phase 5

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	6.0	2.0	N/A(a)
NR2	1.5	1.8	0.3	N/A(a)
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	4.0	0.5	Negligible
R1	4.1	7.8	3.7	Negligible
R2	4.1	7.3	3.2	Negligible
R3	4.1	8.9	4.8	Negligible
R4	4.1	9.2	5.1	Negligible
R5	4.1	9.4	5.3	Negligible
R6	4.1	9.3	5.2	Negligible
R7	4.1	10.0	5.9	Negligible
R8	4.1	9.9	5.8	Negligible
R9	4.1	10.2	6.1	Negligible
R10	4.1	9.8	5.7	Negligible
R11	4.1	9.9	5.8	Negligible
R12	4.1	9.7	5.5	Negligible
R13	4.1	10.0	5.9	Negligible
R14	4.1	10.2	6.1	Negligible
R15	4.1	4.3	0.2	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-28: High Annoyance Criterion Applied to Construction Phase 6

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.4	0.5	N/A(a)
NR2	1.5	1.6	0.2	N/A(a)
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	4.5	0.4	Negligible
R2	4.1	4.5	0.4	Negligible
R3	4.1	4.5	0.4	Negligible
R4	4.1	4.5	0.4	Negligible
R5	4.1	4.5	0.3	Negligible
R6	4.1	4.5	0.3	Negligible
R7	4.1	4.4	0.3	Negligible
R8	4.1	4.4	0.3	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R9	4.1	4.5	0.3	Negligible
R10	4.1	4.4	0.3	Negligible
R11	4.1	4.5	0.4	Negligible
R12	4.1	4.5	0.4	Negligible
R13	4.1	4.5	0.3	Negligible
R14	4.1	4.5	0.4	Negligible
R15	4.1	4.2	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-29: High Annoyance Criterion Applied to Construction Phase 7

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	4.0	0.1	N/A(a)
NR2	1.5	1.5	0.0	N/A(a)
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	4.2	0.0	Negligible
R2	4.1	4.2	0.0	Negligible
R3	4.1	4.2	0.0	Negligible
R4	4.1	4.2	0.0	Negligible
R5	4.1	4.2	0.0	Negligible
R6	4.1	4.2	0.0	Negligible
R7	4.1	4.2	0.0	Negligible
R8	4.1	4.2	0.0	Negligible
R9	4.1	4.2	0.0	Negligible
R10	4.1	4.2	0.0	Negligible
R11	4.1	4.2	0.0	Negligible
R12	4.1	4.2	0.0	Negligible
R13	4.1	4.2	0.0	Negligible
R14	4.1	4.2	0.0	Negligible
R15	4.1	4.1	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-30: High Annoyance Criterion Applied to Construction Phase 8

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	8.9	4.9	N/A(a)
NR2	1.5	1.6	0.1	N/A(a)
NR3	1.6	1.6	0.0	Negligible
NR4	3.5	3.5	0.0	Negligible
R1	4.1	5.4	1.3	Negligible
R2	4.1	5.4	1.3	Negligible
R3	4.1	5.2	1.1	Negligible
R4	4.1	5.2	1.0	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R5	4.1	5.1	0.9	Negligible
R6	4.1	5.1	1.0	Negligible
R7	4.1	5.0	0.9	Negligible
R8	4.1	4.9	0.8	Negligible
R9	4.1	5.0	0.9	Negligible
R10	4.1	4.9	0.8	Negligible
R11	4.1	5.0	0.9	Negligible
R12	4.1	4.9	0.7	Negligible
R13	4.1	4.8	0.7	Negligible
R14	4.1	4.9	0.7	Negligible
R15	4.1	4.1	0.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.2.1.3.3 Speech Intelligibility

In order to maintain 95% sentence intelligibility for the outdoor environment, the HC Guidance indicates that noise levels should be kept below 55 dBA. As part of the noise assessment based on the HC Guidance potential effects to speech intelligibility were evaluated for each phase of Proposed Project construction. For each receptor, Table 9.2-31 through Table 9.2-38 applies the speech intelligibility criterion from the HC Guidance to the Application Case HC cumulative noise levels for each phase of Proposed Project construction. As described in Table 9.2-6, when the cumulative level is less than the 55 dBA threshold the magnitude of the effect is classified as Negligible.

Table 9.2-31: Speech Intelligibility Criterion Applied to Construction Phase 1

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq,\ day}$	Magnitude Classification
NR1	43.1	N/A(a)
NR2	46.6	N/A(a)
NR3	42.2	Negligible
NR4	44.2	Negligible
R1	44.2	Negligible
R2	44.5	Negligible
R3	44.6	Negligible
R4	44.7	Negligible
R5	44.7	Negligible
R6	44.9	Negligible
R7	44.9	Negligible
R8	44.9	Negligible
R9	44.8	Negligible
R10	44.8	Negligible
R11	44.8	Negligible
R12	44.9	Negligible
R13	44.9	Negligible

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
R14	43.1	Negligible
R15	44.1	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-32: Speech Intelligibility Criterion Applied to Construction Phase 2

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	43.7	N/A(a)
NR2	47.2	N/A(a)
NR3	42.1	Negligible
NR4	44.1	Negligible
R1	44.0	Negligible
R2	44.1	Negligible
R3	44.2	Negligible
R4	44.3	Negligible
R5	44.5	Negligible
R6	44.8	Negligible
R7	44.8	Negligible
R8	44.7	Negligible
R9	45.0	Negligible
R10	44.8	Negligible
R11	45.0	Negligible
R12	44.9	Negligible
R13	44.9	Negligible
R14	45.0	Negligible
R15	43.1	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-33: Speech Intelligibility Criterion Applied to Construction Phase 3

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	44.0	N/A(a)
NR2	47.4	N/A(a)
NR3	42.1	Negligible
NR4	44.1	Negligible
R1	44.2	Negligible
R2	44.2	Negligible
R3	44.2	Negligible
R4	44.2	Negligible
R5	44.5	Negligible

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
R6	44.8	Negligible
R7	44.8	Negligible
R8	44.5	Negligible
R9	45.0	Negligible
R10	44.7	Negligible
R11	44.9	Negligible
R12	44.8	Negligible
R13	44.8	Negligible
R14	44.9	Negligible
R15	43.1	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-34: Speech Intelligibility Criterion Applied to Construction Phase 4

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	43.5	N/A(a)
NR2	47.0	N/A(a)
NR3	42.1	Negligible
NR4	44.1	Negligible
R1	43.8	Negligible
R2	43.9	Negligible
R3	43.9	Negligible
R4	43.9	Negligible
R5	44.1	Negligible
R6	44.3	Negligible
R7	44.3	Negligible
R8	44.2	Negligible
R9	44.5	Negligible
R10	44.3	Negligible
R11	44.5	Negligible
R12	44.4	Negligible
R13	44.4	Negligible
R14	44.5	Negligible
R15	43.1	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-35: Speech Intelligibility Criterion Applied to Construction Phase 5

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	48.3	N/A[(a)]
NR2	48.7	N/A[(a)]
NR3	42.7	Negligible
NR4	45.6	Negligible
R1	51.2	Negligible
R2	50.6	Negligible
R3	52.5	Negligible
R4	52.9	Negligible
R5	53.1	Negligible
R6	53.0	Negligible
R7	53.7	Negligible
R8	53.6	Negligible
R9	53.9	Negligible
R10	53.5	Negligible
R11	53.6	Negligible
R12	53.3	Negligible
R13	53.7	Negligible
R14	53.9	Negligible
R15	43.7	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-36: Speech Intelligibility Criterion Applied to Construction Phase 6

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	44.2	N/A[(a)]
NR2	47.6	N/A[(a)]
NR3	42.3	Negligible
NR4	44.1	Negligible
R1	44.6	Negligible
R2	44.6	Negligible
R3	44.5	Negligible
R4	44.5	Negligible
R5	44.4	Negligible
R6	44.4	Negligible
R7	44.3	Negligible
R8	44.3	Negligible
R9	44.5	Negligible
R10	44.3	Negligible
R11	44.6	Negligible
R12	44.5	Negligible
R13	44.5	Negligible
R14	44.6	Negligible
R15	43.2	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-37: Speech Intelligibility Criterion Applied to Construction Phase 7

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	42.3	N/A[(a)]
NR2	46.1	N/A[(a)]
NR3	42.0	Negligible
NR4	44.0	Negligible
R1	43.2	Negligible
R2	43.2	Negligible
R3	43.2	Negligible
R4	43.2	Negligible
R5	43.2	Negligible
R6	43.2	Negligible
R7	43.2	Negligible
R8	43.1	Negligible
R9	43.2	Negligible
R10	43.1	Negligible
R11	43.2	Negligible
R12	43.2	Negligible
R13	43.2	Negligible
R14	43.2	Negligible
R15	43.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-38: Speech Intelligibility Criterion Applied to Construction Phase 8

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	52.5	N/A[(a)]
NR2	47.0	N/A[(a)]
NR3	42.1	Negligible
NR4	44.0	Negligible
R1	47.1	Negligible
R2	47.2	Negligible
R3	46.8	Negligible
R4	46.6	Negligible
R5	46.3	Negligible
R6	46.4	Negligible
R7	46.3	Negligible
R8	46.0	Negligible
R9	46.2	Negligible
R10	45.9	Negligible
R11	46.2	Negligible
R12	45.8	Negligible
R13	45.6	Negligible
R14	45.7	Negligible
R15	43.1	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.2.2 Operation

The operation of the Proposed Project is expected to last 16 years. Proposed Project operation will take place 10 to 12 hours per day, five days per week during seasonal daylight hours – i.e., Proposed Project operation will be confined to the daytime period as defined by the Commission Guideline and the HC Guidance. It is expected that one barge will be loaded each day of operation and that barge loading will require approximately two to three hours. The major noise sources associated to the Proposed Project operation are presented in Section 9.2.3.3.3.1.2.2.

9.2.5.2.2.1 Project Operation Noise Emissions

Noise emissions for the Proposed Project operation were established using the following:

- Equipment lists supplied by BURNCO;
- Plot plans provided by BURNCO;
- Noise source measurements for similar equipment conducted at facilities throughout Western Canada; and
- Empirical formulae (Crocker 2007; Bies and Hansen 2003).

Table 9.2-39 presents a summary of the major noise emitting equipment and activities associated with operation of the Proposed Project. For each piece of equipment and each activity, Table 9.2-39 presents total noise emissions in the form of broadband PWL. Octave-band spectral PWL values for relevant sources are presented in Volume 4, Part G - Section 22.0. Stationary equipment, such as crushers and screens, are treated as point sources, moving equipment, such as loaders and dump trucks, are modeled as area sources to cover the activity areas, and conveyor systems are treated as line sources.

To determine PWL values for the noise sources that will be operational on the site during the Proposed Project operation, three source measurement field programs were conducted to measure similar equipment at other locations. In particular, similar scale crush/wash plant equipment was measured at a BURNCO facility in Calgary, Alberta, similar scale clamshell dredge equipment was measured at the Pine Ridges Inland facility in Manitoba, and a marine barge loading operation was measured at the Jack Cewe Treat Creek facility in British Columbia. Technical memoranda describing these three field programs and summarizing the results are attached to this assessment in Volume 4, Part G - Section 22.0.

Table 9.2-39 lists the PWL values for the noise sources for the Proposed Project used in the noise assessment. Octave-band spectral PWL values for relevant sources are presented in Volume 4, Part G - Section 22.0.

Table 9.2-39: Proposed Project Operation Noise Emissions

Source	Description	PWL [dBA]
Clamshell Dredge	One clamshell dredge on floating deck	108.3
Grizzly Screen	One primary grizzly screen on floating deck	109.9
Falling Gravel from Grizzly Screen	One point source of falling gravel for each screen	120.0
Screen Motor for Grizzly Screen	Two motors for the grizzly screen on floating deck	93.4
Jaw Crusher	Primary crusher on floating deck	112.0

Source	Description	PWL [dBA]
Falling Gravel from the Crusher	One point source of falling gravel for each crusher	108.2
Crusher Motor for Jaw Crusher	One motor for crusher on floating deck	91.2
Dry Screen 1 and associated motor	Two dry screens and associated motors in crush plant	121.7
Falling Gravel from Dry Screen 1	One point source of falling gravels for each screen	114.4
Dry Screen 2 and associated motor	Two dry screens and associated motors in crush plant	121.7
Falling Gravel from Dry Screen 2	One point source of falling gravel for each screen	114.4
Crusher in Crush Plant	One crusher in crush plant	119.0
Falling Gravel from Crusher in Crush Plant	One point source of falling gravels for each Crusher	108.2
Crusher Motor for Crusher in Crush Plant	Two motors for the crusher in crush plant	114.4
Washer Unit in Wash Plant	One screen washer unit in wash plant	109.3
Washer Pump with Motor	One washer pump and its motor in wash plant	98.5
Conveyor System in Clamshell Dredge Operation	One conveyor system in clamshell dredge operation	77.4[(a)]
Conveyor System in Crush Plant	One conveyor system in crush plant	90.8[(a)]
Conveyor System in Wash Plant	One conveyor systems in wash plant	78.0[(a)]
Conveyor System in Barge Loading Area	One conveyor system barge loading area	82.1[(a)]
Conveyor Motors in Clamshell Dredge Operation	Each conveyor belt has one conveyor motor on one end	91.1
Conveyor Motors in Crush Plant	Each conveyor belt has one conveyor motor on one end	100.9
Conveyor Motors in Wash Plant	Each conveyor belt has one conveyor motor on one end	95.0
Conveyor Motors in Barge Loading Area	Each conveyor belt has one conveyor motor on one end	96.2
Falling Sand	Falling sand from conveyor to barges	108.2
Front End Loader Filling Wash Plant Hopper	Front end loader loading gravels to hopper in wash plant	106.7
Loading Equipment	Backhoe, loader and dump truck besides the stockpiles	112.1
Transportation Equipment	Backhoe, loader and dump truck on the transportation	112.1

[(a)] PWL is presented in dBA/m for line sources

Fabric enclosures are expected to house the dry screens and crusher in the processing plant. The enclosure walls consist of two layers of vinyl with a layer of polypropylene foam between them. The transmission loss (TL) of the enclosures was estimated using a widely accepted formula, based on the material density provided by the manufacturer. Table 9.2-40 presents the effective noise attenuation of the enclosures, estimated based on field observations at a similar facility and the calculated TL.

Table 9.2-40: Effective Noise Attenuation of Enclosures

Octave Band Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000
Attenuation [dB]	0.0	0.0	1.6	3.0	4.3	4.8	5.0	5.0	5.0

Once the noise emissions of the various relevant noise sources were established, the sources were applied to the computer model of the Proposed Project operation to determine the contribution of these sources to noise levels at the assessment receptors.

The Proposed Project operation noise contribution was predicted for three scenarios:

- Year 1;

- Year 10; and
- Year 12.

Year 1 is the initial year of gravel extraction, and Year 10 and Year 12 are the years when the clamshell dredge is expected to be closest to the receptors within the McNab Strata Community.

9.2.5.2.2.2 Noise Assessment Based on Commission Guideline

9.2.5.2.2.2.1 Noise Level Predictions for Proposed Project Operation

As discussed in Section 9.2.2.1, for the noise assessment based on the Commission Guideline mandated ASL values are used to represent Baseline Case noise levels at the assessment receptors. The Application Case Commission cumulative noise levels are then calculated through the logarithmic addition of the Baseline Case noise levels and the predicted noise contribution from the Proposed Project.

For each noise receptor, Table 9.2-41 through Table 9.2-43 present Baseline Case noise levels, Proposed Project contribution, and Application Case Commission cumulative noise levels for each of the three operation scenarios described in Section 9.2.5.2.2.1. These tables also present the increase in cumulative noise levels as a result of the Proposed Project (i.e., the difference between Application Case and Baseline Case noise levels) and a comparison of the Application Case noise levels to the relevant PSL values. As described in Table 9.2-6, when the change in noise level is less than or equal to 3 dB the magnitude effect is classified as Negligible and when the change in noise level is greater than 3 dB and the Application Case noise level is less than the PSL the magnitude effect is classified as Low. Because Proposed Project operations will be confined to the daytime period, nighttime results are not presented.

Figure 9.2-2, Figure 9.2-3, and Figure 9.2-4 present contours representing the Proposed Project contribution to noise levels across the LSA and RSA for Scenarios 1 (Year 1), 2 (Year 10), and 3 (Year 12), respectively.

Table 9.2-41: Operation Scenario 1 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA] $L_{eq, day}$	Proposed Project Contribution [dBA] $L_{eq, day}$	Application Case Commission Cumulative Noise Level [dBA] $L_{eq, day}$	Increase in Cumulative Noise Level [dB] $L_{eq, day}$	PSL [dBA] $L_{eq, day}$	Magnitude Classification
NR1	45	47.4	49.4	4.4	N/A[(a)]	N/A[(a)]
NR2	45	54.7	55.1	10.1	N/A[(a)]	N/A[(a)]
NR3	45	37.9	45.8	0.8	50.0	Negligible
NR4	45	31.3	45.2	0.2	50.0	Negligible
R1	48	45.9	50.1	2.1	53.0	Negligible
R2	48	45.8	50.0	2.0	53.0	Negligible
R3	48	45.8	50.0	2.0	53.0	Negligible
R4	48	45.8	50.0	2.0	53.0	Negligible
R5	48	45.7	50.0	2.0	53.0	Negligible
R6	48	45.7	50.0	2.0	53.0	Negligible
R7	48	45.8	50.0	2.0	53.0	Negligible

Assessment Receptors	Baseline Case Noise Level [dBA] $L_{eq, day}$	Proposed Project Contribution [dBA] $L_{eq, day}$	Application Case Commission Cumulative Noise Level [dBA] $L_{eq, day}$	Increase in Cumulative Noise Level [dB] $L_{eq, day}$	PSL [dBA] $L_{eq, day}$	Magnitude Classification
R8	48	46.0	50.1	2.1	53.0	Negligible
R9	48	45.7	50.0	2.0	53.0	Negligible
R10	48	45.9	50.1	2.1	53.0	Negligible
R11	48	45.5	49.9	1.9	53.0	Negligible
R12	48	45.3	49.9	1.9	53.0	Negligible
R13	48	45.3	49.9	1.9	53.0	Negligible
R14	48	45.1	49.8	1.8	53.0	Negligible
R15	45	38.6	45.9	0.9	50.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-42: Operation Scenario 2 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA] $L_{eq, day}$	Proposed Project Contribution [dBA] $L_{eq, day}$	Application Case Commission Cumulative Noise Level [dBA] $L_{eq, day}$	Increase in Cumulative Noise Level [dB] $L_{eq, day}$	PSL [dBA] $L_{eq, day}$	Magnitude Classification
NR1	45	48.7	50.2	5.2	N/A(a)	N/A(a)
NR2	45	54.7	55.1	10.1	N/A(a)	N/A(a)
NR3	45	37.2	45.7	0.7	50.0	Negligible
NR4	45	31.4	45.2	0.2	50.0	Negligible
R1	48	47.3	50.7	2.7	53.0	Negligible
R2	48	47.1	50.6	2.6	53.0	Negligible
R3	48	47.1	50.6	2.6	53.0	Negligible
R4	48	47.0	50.5	2.5	53.0	Negligible
R5	48	46.8	50.5	2.5	53.0	Negligible
R6	48	46.8	50.5	2.5	53.0	Negligible
R7	48	46.8	50.5	2.5	53.0	Negligible
R8	48	46.9	50.5	2.5	53.0	Negligible
R9	48	46.6	50.4	2.4	53.0	Negligible
R10	48	46.6	50.4	2.4	53.0	Negligible
R11	48	46.4	50.3	2.3	53.0	Negligible
R12	48	46.1	50.2	2.2	53.0	Negligible
R13	48	45.9	50.1	2.1	53.0	Negligible
R14	48	45.9	50.1	2.1	53.0	Negligible
R15	45	38.7	45.9	0.9	50.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-43: Operation Scenario 3 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA] $L_{eq, day}$	Proposed Project Contribution [dBA] $L_{eq, day}$	Application Case Commission Cumulative Noise Level [dBA] $L_{eq, day}$	Increase in Cumulative Noise Level [dB] $L_{eq, day}$	PSL [dBA] $L_{eq, day}$	Magnitude Classification
NR1	45	49.5	50.8	5.8	N/A[(a)]	N/A[(a)]
NR2	45	54.6	55.1	10.1	N/A[(a)]	N/A[(a)]
NR3	45	37.4	45.7	0.7	50.0	Negligible
NR4	45	31.5	45.2	0.2	50.0	Negligible
R1	48	47.3	50.7	2.7	53.0	Negligible
R2	48	47.2	50.6	2.6	53.0	Negligible
R3	48	47.0	50.5	2.5	53.0	Negligible
R4	48	46.9	50.5	2.5	53.0	Negligible
R5	48	46.7	50.4	2.4	53.0	Negligible
R6	48	46.7	50.4	2.4	53.0	Negligible
R7	48	46.7	50.4	2.4	53.0	Negligible
R8	48	46.7	50.4	2.4	53.0	Negligible
R9	48	46.5	50.3	2.3	53.0	Negligible
R10	48	46.5	50.3	2.3	53.0	Negligible
R11	48	46.3	50.2	2.2	53.0	Negligible
R12	48	45.9	50.1	2.1	53.0	Negligible
R13	48	45.7	50.0	2.0	53.0	Negligible
R14	48	45.7	50.0	2.0	53.0	Negligible
R15	45	38.6	45.9	0.9	50.0	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.2.2.2.2 Low Frequency Noise Analysis

Based on Directive 038, potential LFN issues associated with the Proposed Project operation have been assessed. The potential for LFN effects at the identified receptor locations have been assessed by calculating the difference between the contribution of the Proposed Project expressed in dBC and the contribution of the Proposed Project expressed in dBA.

For each receptor, Table 9.2-44 to Table 9.2-46 present the difference between the dBA and dBC noise levels associated with Proposed Project during all three operating scenarios. As discussed in Section 9.2.3.3.3.2.2, there is a potential for LFN issues if the dBC – dBA difference is larger than 20 dB.

Table 9.2-44: Low Frequency Noise Analysis for Operation Scenario 1

Assessment Receptors	Proposed Project Contribution [dBA]	Proposed Project Contribution [dBC]	Difference (dBC – dBA) [dB]	LFN Threshold[(a)]	Comments
NR1	47.4	60.2	12.8	20	N/A[(b)]
NR2	54.7	65.9	11.2	20	N/A[(b)]
NR3	37.9	58.2	20.3	20	Potential LFN Issue
NR4	31.3	49.8	18.5	20	No LFN issue
R1	45.9	59.9	14.0	20	No LFN issue
R2	45.8	60.0	14.2	20	No LFN issue
R3	45.8	59.9	14.1	20	No LFN issue
R4	45.8	59.8	14.0	20	No LFN issue
R5	45.7	59.8	14.1	20	No LFN issue
R6	45.7	59.9	14.2	20	No LFN issue
R7	45.8	59.9	14.1	20	No LFN issue
R8	46.0	59.7	13.7	20	No LFN issue
R9	45.7	59.9	14.2	20	No LFN issue
R10	45.9	59.7	13.8	20	No LFN issue
R11	45.5	59.8	14.3	20	No LFN issue
R12	45.3	59.5	14.2	20	No LFN issue
R13	45.3	59.4	14.1	20	No LFN issue
R14	45.1	59.4	14.3	20	No LFN issue
R15	38.6	53.2	14.6	20	No LFN issue

(a) LFN threshold taken directly from Directive 038.
(b) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-45: Low Frequency Noise Analysis for Operation Scenario 2

Assessment Receptors	Proposed Project Contribution [dBA]	Proposed Project Contribution [dBC]	Difference (dBC – dBA) [dB]	LFN Threshold[(a)]	Comments
NR1	48.7	64.6	15.9	20	N/A[(b)]
NR2	54.7	67.5	12.8	20	N/A[(b)]
NR3	37.2	53.3	16.1	20	No LFN issue
NR4	31.4	49.2	17.8	20	No LFN issue
R1	47.3	61.6	14.3	20	No LFN issue

Assessment Receptors	Proposed Project Contribution [dBA]	Proposed Project Contribution [dBC]	Difference (dBC – dBA) [dB]	LFN Threshold[a]	Comments
R2	47.1	61.6	14.5	20	No LFN issue
R3	47.1	61.4	14.3	20	No LFN issue
R4	47.0	61.3	14.3	20	No LFN issue
R5	46.8	61.2	14.4	20	No LFN issue
R6	46.8	61.2	14.4	20	No LFN issue
R7	46.8	61.1	14.3	20	No LFN issue
R8	46.9	61.0	14.1	20	No LFN issue
R9	46.6	61.1	14.5	20	No LFN issue
R10	46.6	60.9	14.3	20	No LFN issue
R11	46.4	60.9	14.5	20	No LFN issue
R12	46.1	60.6	14.5	20	No LFN issue
R13	45.9	60.5	14.6	20	No LFN issue
R14	45.9	60.4	14.5	20	No LFN issue
R15	38.7	56.2	17.5	20	No LFN issue

[a] LFN threshold taken directly from Directive 038.

[b] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-46: Low Frequency Noise Analysis for Operation Scenario 3

Assessment Receptors	Proposed Project Contribution [dBA]	Proposed Project Contribution [dBC]	Difference (dBC – dBA) [dB]	LFN Threshold[a]	Comments
NR1	49.5	65.9	16.4	20	N/A[b]
NR2	54.6	66.6	12.0	20	N/A[b]
NR3	37.4	54.1	16.7	20	No LFN issue
NR4	31.5	49.4	17.9	20	No LFN issue
R1	47.3	62.2	14.9	20	No LFN issue
R2	47.2	62.2	15.0	20	No LFN issue
R3	47.0	62.0	15.0	20	No LFN issue
R4	46.9	61.9	15.0	20	No LFN issue
R5	46.7	61.7	15.0	20	No LFN issue
R6	46.7	61.6	14.9	20	No LFN issue
R7	46.7	61.4	14.7	20	No LFN issue
R8	46.7	61.3	14.6	20	No LFN issue
R9	46.5	61.3	14.8	20	No LFN issue
R10	46.5	61.2	14.7	20	No LFN issue
R11	46.3	61.1	14.8	20	No LFN issue
R12	45.9	60.8	14.9	20	No LFN issue
R13	45.7	60.6	14.9	20	No LFN issue
R14	45.7	60.5	14.8	20	No LFN issue
R15	38.6	55.5	16.9	20	No LFN issue

[a] LFN threshold taken directly from Directive 038.

[b] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-44 indicates a potential LFN issue at NR3. As described in Section 9.2.3.3.3.3.2.2, it is not possible to determine if a tonal component exists at a frequency below 250 Hz. However, in the event that there is, a 5 dBA penalty would be applied to the predicted Proposed Project contribution. This would lead to a Proposed Project contribution of 42.9 dBA, and a cumulative noise level of 47.1 dBA, which would give a 2.1 dBA increase over the ASL and the negligible magnitude rating would still be valid. Therefore, no LFN issue exists at this receptor, such as to change the effects assessment rating.

9.2.5.2.2.3 Noise Assessment Based on Health Canada Guidance

9.2.5.2.2.3.1 Noise Level Predictions for Proposed Project Operation

As discussed in Section 9.2.2.2, for the noise assessment based on the HC Guidance measured baseline data are used to represent the Baseline Case noise levels at the assessment receptors. The Application Case HC cumulative noise levels are then calculated through the logarithmic addition of the Baseline Case noise levels and the predicted noise contribution from the Proposed Project.

For each noise receptor, Table 9.2-47 through Table 9.2-49 present the Baseline Case noise levels, Proposed Project contribution, and Application Case HC cumulative noise levels for each operation scenario.

Table 9.2-47: Operation Scenario 1 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq,\ day}$	$L_{eq,\ night}$	L_{dn}	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ day}$	$L_{eq,\ night}$	$L_{eq,\ dn}$
NR1	42	37	44.6	47.4	0	48.5	37.0	48.0
NR2	46	38	46.9	54.7	0	55.2	38.0	53.7
NR3	42	41	47.6	37.9	0	43.4	41.0	47.9
NR4	44	33	43.7	31.3	0	44.2	33.0	43.8
R1	43	37	45.0	45.9	0	47.7	37.0	47.4
R2	43	37	45.0	45.8	0	47.6	37.0	47.4
R3	43	37	45.0	45.8	0	47.6	37.0	47.4
R4	43	37	45.0	45.8	0	47.6	37.0	47.4
R5	43	37	45.0	45.7	0	47.6	37.0	47.4
R6	43	37	45.0	45.7	0	47.6	37.0	47.4
R7	43	37	45.0	45.8	0	47.6	37.0	47.4
R8	43	37	45.0	46.0	0	47.8	37.0	47.5
R9	43	37	45.0	45.7	0	47.6	37.0	47.4
R10	43	37	45.0	45.9	0	47.7	37.0	47.4
R11	43	37	45.0	45.5	0	47.4	37.0	47.3
R12	43	37	45.0	45.3	0	47.3	37.0	47.2
R13	43	37	45.0	45.3	0	47.3	37.0	47.2
R14	43	37	45.0	45.1	0	47.2	37.0	47.1
R15	43	37	45.0	38.6	0	44.3	37.0	45.5

(a) Logarithmic sum of Baseline Case noise level and Proposed Project contribution.

Table 9.2-48: Operation Scenario 2 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, dn}$
NR1	42	37	44.6	48.7	0	49.5	37.0	48.8
NR2	46	38	46.9	54.7	0	55.2	38.0	53.7
NR3	42	41	47.6	37.2	0	43.2	41.0	47.8
NR4	44	33	43.7	31.4	0	44.2	33.0	43.8
R1	43	37	45.0	47.3	0	48.7	37.0	48.1
R2	43	37	45.0	47.1	0	48.5	37.0	48.0
R3	43	37	45.0	47.1	0	48.5	37.0	48.0
R4	43	37	45.0	47.0	0	48.5	37.0	48.0
R5	43	37	45.0	46.8	0	48.3	37.0	47.9
R6	43	37	45.0	46.8	0	48.3	37.0	47.9
R7	43	37	45.0	46.8	0	48.3	37.0	47.9
R8	43	37	45.0	46.9	0	48.4	37.0	47.9
R9	43	37	45.0	46.6	0	48.2	37.0	47.8
R10	43	37	45.0	46.6	0	48.2	37.0	47.8
R11	43	37	45.0	46.4	0	48.0	37.0	47.7
R12	43	37	45.0	46.1	0	47.8	37.0	47.5
R13	43	37	45.0	45.9	0	47.7	37.0	47.4
R14	43	37	45.0	45.9	0	47.7	37.0	47.4
R15	43	37	45.0	38.7	0	44.4	37.0	45.6

(a) Logarithmic sum of Baseline Case noise level and Proposed Project contribution.

Table 9.2-49: Operation Scenario 3 Noise Levels

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, dn}$
NR1	42	37	44.6	49.5	0	50.2	37.0	49.3
NR2	46	38	46.9	54.6	0	55.2	38.0	53.6
NR3	42	41	47.6	37.4	0	43.3	41.0	47.8
NR4	44	33	43.7	31.5	0	44.2	33.0	43.8
R1	43	37	45.0	47.3	0	48.7	37.0	48.1
R2	43	37	45.0	47.2	0	48.6	37.0	48.1
R3	43	37	45.0	47.0	0	48.5	37.0	48.0
R4	43	37	45.0	46.9	0	48.4	37.0	47.9
R5	43	37	45.0	46.7	0	48.2	37.0	47.8
R6	43	37	45.0	46.7	0	48.2	37.0	47.8
R7	43	37	45.0	46.7	0	48.2	37.0	47.8
R8	43	37	45.0	46.7	0	48.2	37.0	47.8
R9	43	37	45.0	46.5	0	48.1	37.0	47.7
R10	43	37	45.0	46.5	0	48.1	37.0	47.7
R11	43	37	45.0	46.3	0	48.0	37.0	47.6
R12	43	37	45.0	45.9	0	47.7	37.0	47.4

Assessment Receptors	Baseline Case Noise Level [dBA]			Proposed Project Contribution [dBA]		Application Case HC Cumulative Noise Level[(a)] [dBA]		
	$L_{eq, day}$	$L_{eq, night}$	L_{dn}	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, day}$	$L_{eq, night}$	$L_{eq, dn}$
R13	43	37	45.0	45.7	0	47.6	37.0	47.4
R14	43	37	45.0	45.7	0	47.6	37.0	47.4
R15	43	37	45.0	38.6	0	44.3	37.0	45.5

(a) Logarithmic sum of Baseline Case noise level and Proposed Project contribution.

9.2.5.2.2.3.2 High Annoyance Analysis

Table 9.2-50 through Table 9.2-52 apply the high annoyance criterion from the HC Guidance to the Application Case HC cumulative noise levels for each Proposed Project operation scenario. To create these tables:

- As specified in the HC Guidance and described in Section 9.2.2.2, 10 dBA was added to the Baseline Case and Application Case noise levels at all receptors considered to be in quiet rural areas. All receptors except for NR2 and NR3 have Baseline Case $L_{eq,dn}$ values less than or equal 45 dBA and are thus considered to be quiet rural areas;
- The %HA was calculated for the Baseline Case noise levels at each receptor location using the equation presented in Section 9.2.2.2;
- The %HA was calculated for the Application Case HC cumulative noise levels at each receptor location using the equation presented in Section 9.2.2.2; and
- The difference between Application Case and Baseline Case %HA was calculated via subtraction.

As discussed in Section 9.2.2.2, the HC Guidance indicates that there is the potential for an adverse noise effect if the change in %HA between the Baseline Case and Application Case is greater than 6.5%. In other words, when the change in %HA is less than 6.5% the magnitude of the effect is classified as Negligible (see Table 9.2-6).

Table 9.2-50: High Annoyance Criterion Applied to Operation Scenario 1

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	6.0	2.1	N/A[(a)]
NR2	1.5	3.5	2.0	N/A[(a)]
NR3	1.6	1.7	0.1	Negligible
NR4	3.5	3.6	0.1	Negligible
R1	4.1	5.6	1.5	Negligible
R2	4.1	5.6	1.5	Negligible
R3	4.1	5.6	1.5	Negligible
R4	4.1	5.6	1.5	Negligible
R5	4.1	5.6	1.5	Negligible
R6	4.1	5.6	1.5	Negligible
R7	4.1	5.6	1.5	Negligible
R8	4.1	5.7	1.6	Negligible
R9	4.1	5.6	1.5	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R10	4.1	5.6	1.5	Negligible
R11	4.1	5.5	1.4	Negligible
R12	4.1	5.5	1.3	Negligible
R13	4.1	5.5	1.3	Negligible
R14	4.1	5.4	1.3	Negligible
R15	4.1	4.4	0.3	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-51: High Annoyance Criterion Applied to Operation Scenario 2

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	6.6	2.7	N/A(a)
NR2	1.5	3.5	2.0	N/A(a)
NR3	1.6	1.6	0.1	Negligible
NR4	3.5	3.6	0.1	Negligible
R1	4.1	6.1	2.0	Negligible
R2	4.1	6.1	1.9	Negligible
R3	4.1	6.1	1.9	Negligible
R4	4.1	6.0	1.9	Negligible
R5	4.1	5.9	1.8	Negligible
R6	4.1	5.9	1.8	Negligible
R7	4.1	5.9	1.8	Negligible
R8	4.1	6.0	1.9	Negligible
R9	4.1	5.9	1.7	Negligible
R10	4.1	5.9	1.7	Negligible
R11	4.1	5.8	1.7	Negligible
R12	4.1	5.7	1.6	Negligible
R13	4.1	5.6	1.5	Negligible
R14	4.1	5.6	1.5	Negligible
R15	4.1	4.4	0.3	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-52: High Annoyance Criterion Applied to Operation Scenario 3

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
NR1	3.9	7.1	3.1	N/A(a)
NR2	1.5	3.5	2.0	N/A(a)
NR3	1.6	1.7	0.1	Negligible
NR4	3.5	3.6	0.1	Negligible
R1	4.1	6.1	2.0	Negligible
R2	4.1	6.1	2.0	Negligible
R3	4.1	6.0	1.9	Negligible
R4	4.1	6.0	1.9	Negligible

Assessment Receptors	Baseline Case %HA	Application Case %HA	Change in %HA	Magnitude Classification
R5	4.1	5.9	1.8	Negligible
R6	4.1	5.9	1.8	Negligible
R7	4.1	5.9	1.8	Negligible
R8	4.1	5.9	1.8	Negligible
R9	4.1	5.8	1.7	Negligible
R10	4.1	5.8	1.7	Negligible
R11	4.1	5.8	1.6	Negligible
R12	4.1	5.6	1.5	Negligible
R13	4.1	5.6	1.5	Negligible
R14	4.1	5.6	1.5	Negligible
R15	4.1	4.4	0.3	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.2.2.3.3 Speech Intelligibility

In order to maintain 95% sentence intelligibility for the outdoor environment, the HC Guidance indicates that noise levels should be kept below 55 dBA. As part of the noise assessment based on the HC Guidance potential effects to speech intelligibility were evaluated for each Proposed Project operation scenario. For each receptor, Table 9.2-53 to Table 9.2-55 apply the speech intelligibility criterion from the HC Guidance to the Application Case HC cumulative noise levels. As described in Table 9.2-6, when the cumulative level is less than the 55 dBA threshold the magnitude of the effect is classified as Negligible.

Table 9.2-53: Speech Intelligibility Criterion Applied to Operation Scenario 1

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq,\ day}$	Magnitude Classification
NR1	48.5	N/A(a)
NR2	55.2	N/A(a)
NR3	43.4	Negligible
NR4	44.2	Negligible
R1	47.7	Negligible
R2	47.6	Negligible
R3	47.6	Negligible
R4	47.6	Negligible
R5	47.6	Negligible
R6	47.6	Negligible
R7	47.6	Negligible
R8	47.8	Negligible
R9	47.6	Negligible
R10	47.7	Negligible
R11	47.4	Negligible
R12	47.3	Negligible
R13	47.3	Negligible

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
R14	47.2	Negligible
R15	44.3	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-54: Speech Intelligibility Criterion Applied to Operation Scenario 2

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	49.5	N/A(a)
NR2	55.2	N/A(a)
NR3	43.2	Negligible
NR4	44.2	Negligible
R1	48.7	Negligible
R2	48.5	Negligible
R3	48.5	Negligible
R4	48.5	Negligible
R5	48.3	Negligible
R6	48.3	Negligible
R7	48.3	Negligible
R8	48.4	Negligible
R9	48.2	Negligible
R10	48.2	Negligible
R11	48.0	Negligible
R12	47.8	Negligible
R13	47.7	Negligible
R14	47.7	Negligible
R15	44.4	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-55: Speech Intelligibility Criterion Applied to Operation Scenario 3

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
NR1	50.2	N/A(a)
NR2	55.2	N/A(a)
NR3	43.3	Negligible
NR4	44.2	Negligible
R1	48.7	Negligible
R2	48.6	Negligible
R3	48.5	Negligible
R4	48.4	Negligible
R5	48.2	Negligible

Assessment Receptors	Application Case HC Cumulative Noise Level [dBA] $L_{eq, day}$	Magnitude Classification
R6	48.2	Negligible
R7	48.2	Negligible
R8	48.2	Negligible
R9	48.1	Negligible
R10	48.1	Negligible
R11	48.0	Negligible
R12	47.7	Negligible
R13	47.6	Negligible
R14	47.6	Negligible
R15	44.3	Negligible

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.3 Mitigation

This section provides a description of the proposed mitigation measures specifically related to Proposed Project effects on VCs for the acoustic environment. The following mitigation is presented to mitigate potential Proposed Project-related effects to noise. The suite of measures proposed to mitigate potential noise effects will be provided in the Noise Management Plan (see Volume 3, Part E - Section 16.0) and are summarized in Table 9.2-56. These mitigation measures were implemented in the noise model during the effects assessment to obtain the results presented above.

The mitigation strategy outlined below forms the basis for the commitments that the Proposed Project is making with respect to noise. A detailed list of all commitments of the Proposed Project are provided in Volume 3, Part F – Section 18.

9.2.5.3.1 Construction

Construction noise emissions will occur over the duration of the Proposed Project construction, which is expected to last for four months. Effects on noise levels during Proposed Project construction will vary based on type of construction activity, and are expected to be greatest during road, warehouse and facilities upgrade and construction, pile driving, and initial dry excavation of pit. The primary noise sources associated with construction are various pieces of large off-road equipment such as graders, loaders, packers, dozers, and excavators, as well as large marine equipment such as marine cranes, tug boats, and pile drivers. The extent of potential noise effects associated with construction activity will depend primarily on the number and type of noise sources active and their proximity to noise sensitive receptors.

The Commission Guideline is not applicable to construction noise. However, the Commission Guideline does recommend that licensees implement reasonable mitigating measures for construction noise. The specific construction noise mitigation measures recommended in the Commission Guideline that will be implemented at the Proposed Project are:

- Conduct construction between 7 a.m. and 10 p.m. to reduce the potential effect of construction noise on nearby dwellings;
- Advise nearby residents of particularly noisy activities and schedule these events to reduce disruption to them;
- Establish heavy equipment muster points at least 500 m from any receptor;
- Fit equipment with standard mufflers or silencers and keep these mufflers/silencers in good working order; and
- Take advantage of acoustical screening from existing on-site barriers to shield dwellings from construction equipment noise.

9.2.5.3.2 Operations

Noise sources associated with the Proposed Project operation include screens, crushers, washers, and falling gravel. To mitigate the potential noise effects associated with Proposed Project operation, BURNCO will construct two berms and one dyke which will serve as noise screens. Specifically, BURNCO will construct:

- The McNab Creek Flood Protection Dyke - approximately 830 m long and 5 m high on the north side of the aggregate pit;
- Pit Lake Containment Berm - approximately 800 m long and 9 m high on the south side of the aggregate pit; and
- Processing Plant Dirt Berm - approximately 230 m and 9 m high on the east side of the processing plant.

The dry screens and crusher in the processing plant will be housed in fabric enclosures. Furthermore, Proposed Project operations will be confined to daylight hours. As such, there will be no noise associated with Proposed Project operations during the nighttime period.

9.2.5.3.3 Reclamation and Closure

Reclamation and closure is expected to require noise generating equipment and levels of effort similar to (or less than) construction. Therefore, potential effects associated with reclamation and closure noise are expected to be comparable (or less than) those associated with construction noise. The Commission Guideline does not define noise requirements for reclamation or closure activities but as these activities are similar to construction, the recommended mitigation measures listed for Proposed Project construction in Section 9.2.5.3.1 are applicable, and will be implemented by BURNCO.

Table 9.2-56: Identified Mitigation Measures: Noise

Potential Effect	Mitigation	Anticipated effectiveness
Construction		
Increase in noise levels	Limit construction activity to daytime hours.	Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.
	Schedule significant noise-causing activities to reduce disruption to nearby residents.	Moderately effective – BURNCO will consult with nearby residents and attempt to schedule particularly noisy activities so as to minimize disruption, but some disruption may be unavoidable.
	Position heavy equipment muster points at least 500 m from any receptor.	Moderately effective – ensuring a minimum distance of 500 m between heavy equipment muster points and receptors effectively increases noise propagation distance and reduces noise levels reaching the receptors.
	Fit equipment with standard mufflers or silencers and keep in good working order.	Highly effective – mufflers/silencers reduce noise emissions from internal combustion engines dramatically.
	Use acoustical screening from existing on-site barriers.	Moderately effective – on-site berms, dyke/barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke/barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).
Operations		
Increase in noise levels	Construct a McNab Creek Flood Protection Dyke, approximately 830 m long and 5 m high on the north side of the aggregate pit.	Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).
	Construct a Pit Lake Containment Berm, approximately 800 m long and 9 m high on the south side of the aggregate pit.	Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).
	Construct a Processing Area Dirt Berm, approximately 230 m and 9 m high on the east side of the processing plant.	Moderately effective – on-site berms/barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).
	Dry screens and crusher in the processing plant will be housed in fabric enclosures.	Marginally effective – the current design uses a low density foam and vinyl composition; increased fabric density would increase effectiveness.
	Limit operation activity to daytime hours.	Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.

Potential Effect	Mitigation	Anticipated effectiveness
Reclamation and Closure		
Increase in noise levels	Limit reclamation and closure activity to daytime hours.	Highly effective – limiting activities to daytime period will completely eliminate Proposed Project-related noise during the nighttime.
	Schedule significant noise-causing activities to reduce disruption to nearby residents.	Moderately effective – BURNCO will consult with nearby residents and attempt to schedule particularly noisy activities so as to minimize disruption, but some disruption may be unavoidable.
	Position heavy equipment muster points at least 500 m from any receptor.	Moderately effective – ensuring a minimum distance of 500 m between heavy equipment muster points and receptors effectively increases noise propagation distance and reduces noise levels reaching the receptors.
	Fit equipment with standard mufflers or silencers and keep in good working order.	Highly effective – mufflers/silencers reduce noise emissions from internal combustion engines dramatically.
	Use acoustical screening from existing on-site barriers.	Moderately effective – on-site berms, dyke /barriers will screen noise emissions from Proposed Project equipment and thereby reduce noise levels reaching nearby receptors; berms, dyke /barriers will screen direct propagation paths but noise will still arrive at receptors via indirect propagation paths (i.e., over and around barriers).

9.2.5.4 Residual Effects Assessment

Potential Proposed Project-related residual effects have been characterized using the criteria for each VC identified in Table 9.2-6 and Table 9.2-7. The characterization of potential residual effects (i.e., following application of appropriate mitigation measures) is described below and presented in Table 9.2-57 through Table 9.2-67.

The context for the noise level VC is always Disturbed because the LSA and RSA have been substantially previously disturbed by human development or human development is still present because there are dwellings and logging activity noise present in the LSA and RSA. The h for the noise level VC is always low because noise emissions will cease the moment Proposed Project equipment stops operating. The frequency for the noise level VC is always high because noise will be emitted continuously during the Proposed Project construction and operation periods when Proposed Project operations and equipment are running.

In the case of potential effects to the acoustic environment the likelihood is high. In other words, the Proposed Project is certain to increase noise levels. In the case of the acoustic environment, magnitude, extent, and duration are the most relevant criteria for characterizing potential residual effects.

9.2.5.4.1 Construction

Noise due to construction is temporary; the activities are variable and move between the processing plant, the pit location and barge loading dock. The variability of noise emission levels and locations over different construction phases will result in different noise levels at receptors.

The Commission Guideline is not applicable to construction noise. However, the Commission Guideline does recommend that licensees implement the reasonable mitigating measures for construction noise, which are listed in Section 9.2.5.3.1. BURNCO will implement these mitigation measures.

Using the criteria specified in Table 9.2-6 and Table 9.2-7, Table 9.2-57 through Table 9.2-64 present the characterization of residual effects for the assessment receptors during each phase of Proposed Project construction. The noise VC, the context, reversibility, and frequency criteria are effectively fixed as disturbed, fully reversible, and high, respectively. As such, values for these criteria are not included in the characterization of potential Proposed Project-related residual effects.

Table 9.2-57: Characterization of Potential Project-Related Residual Effects for Construction Phase 1

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

[(a)] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-58: Characterization of Potential Project-Related Residual Effects for Construction Phase 2

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within of the noise assessment.

Table 9.2-59: Characterization of Potential Project-Related Residual Effects for Construction Phase 3

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A(a)	N/A(a)	N/A(a)
NR2	N/A(a)	N/A(a)	N/A(a)
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-60: Characterization of Potential Project-Related Residual Effects for Construction Phase 4

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

[(a)] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-61: Characterization of Potential Project-Related Residual Effects for Construction Phase 5

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Low	Local	Short-term
R2	Low	Local	Short-term
R3	Low	Local	Short-term
R4	Low	Local	Short-term
R5	Low	Local	Short-term
R6	Low	Local	Short-term
R7	Low	Local	Short-term
R8	Low	Local	Short-term
R9	Low	Local	Short-term
R10	Low	Local	Short-term
R11	Low	Local	Short-term
R12	Low	Local	Short-term
R13	Low	Local	Short-term

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
R14	Low	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-62: Characterization of Potential Project-Related Residual Effects for Construction Phase 6

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A(a)	N/A(a)	N/A(a)
NR2	N/A(a)	N/A(a)	N/A(a)
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-63: Characterization of Potential Project-Related Residual Effects for Construction Phase 7

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A(a)	N/A(a)	N/A(a)
NR2	N/A(a)	N/A(a)	N/A(a)
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-64: Characterization of Potential Project-Related Residual Effects for Construction Phase 8

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A(a)	N/A(a)	N/A(a)
NR2	N/A(a)	N/A(a)	N/A(a)
NR3	Negligible	Local	Short-term
NR4	Negligible	Regional	Short-term
R1	Negligible	Local	Short-term
R2	Negligible	Local	Short-term
R3	Negligible	Local	Short-term
R4	Negligible	Local	Short-term
R5	Negligible	Local	Short-term
R6	Negligible	Local	Short-term
R7	Negligible	Local	Short-term
R8	Negligible	Local	Short-term
R9	Negligible	Local	Short-term
R10	Negligible	Local	Short-term
R11	Negligible	Local	Short-term
R12	Negligible	Local	Short-term
R13	Negligible	Local	Short-term
R14	Negligible	Local	Short-term
R15	Negligible	Local	Short-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.4.2 Operations

The assessment of noise effects associated with the Proposed Project considered the noise emissions associated with the Proposed Project at full operation.

Using the criteria specified in Table 9.2-6 and Table 9.2-7, Table 9.2-65 through Table 9.2-67 present the characterization of residual effects for the assessment receptors for all three Proposed Project operation scenarios. For the noise VC the context, reversibility, and frequency criteria are effectively fixed as disturbed, fully

reversible, and high, respectively. As such, values for these criteria are not included in the characterization of potential Proposed Project-related residual effects.

Table 9.2-65: Characterization of Potential Project-Related Residual Effects for Operation Scenario 1

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Long-term
NR4	Negligible	Regional	Long-term
R1	Negligible	Local	Long-term
R2	Negligible	Local	Long-term
R3	Negligible	Local	Long-term
R4	Negligible	Local	Long-term
R5	Negligible	Local	Long-term
R6	Negligible	Local	Long-term
R7	Negligible	Local	Long-term
R8	Negligible	Local	Long-term
R9	Negligible	Local	Long-term
R10	Negligible	Local	Long-term
R11	Negligible	Local	Long-term
R12	Negligible	Local	Long-term
R13	Negligible	Local	Long-term
R14	Negligible	Local	Long-term
R15	Negligible	Local	Long-term

[(a)] These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-66: Characterization of Potential Project-Related Residual Effects for Operation Scenario 2

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR2	N/A[(a)]	N/A[(a)]	N/A[(a)]
NR3	Negligible	Local	Long-term
NR4	Negligible	Regional	Long-term
R1	Negligible	Local	Long-term
R2	Negligible	Local	Long-term
R3	Negligible	Local	Long-term
R4	Negligible	Local	Long-term
R5	Negligible	Local	Long-term
R6	Negligible	Local	Long-term
R7	Negligible	Local	Long-term
R8	Negligible	Local	Long-term
R9	Negligible	Local	Long-term
R10	Negligible	Local	Long-term
R11	Negligible	Local	Long-term

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
R12	Negligible	Local	Long-term
R13	Negligible	Local	Long-term
R14	Negligible	Local	Long-term
R15	Negligible	Local	Long-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

Table 9.2-67: Characterization of Potential Project-Related Residual Effects for Operation Scenario 3

Assessment Receptors	Residual Effect Characteristics		
	Magnitude	Extent	Duration
NR1	N/A(a)	N/A(a)	N/A(a)
NR2	N/A(a)	N/A(a)	N/A(a)
NR3	Negligible	Local	Long-term
NR4	Negligible	Regional	Long-term
R1	Negligible	Local	Long-term
R2	Negligible	Local	Long-term
R3	Negligible	Local	Long-term
R4	Negligible	Local	Long-term
R5	Negligible	Local	Long-term
R6	Negligible	Local	Long-term
R7	Negligible	Local	Long-term
R8	Negligible	Local	Long-term
R9	Negligible	Local	Long-term
R10	Negligible	Local	Long-term
R11	Negligible	Local	Long-term
R12	Negligible	Local	Long-term
R13	Negligible	Local	Long-term
R14	Negligible	Local	Long-term
R15	Negligible	Local	Long-term

(a) These receptors were used for baseline monitoring but correspond to unoccupied locations too close to the Proposed Project to be considered valid receptors within the noise assessment.

9.2.5.4.3 Reclamation and Closure

Reclamation and closure is expected to require noise generating equipment and levels of effort similar to, or less than, construction. Therefore, potential effects associated with reclamation and closure noise are expected to be comparable, or less than, those associated with construction noise – i.e., the residual effects characterization presented in Section 9.2.5.4.1 for construction is also representative of the residual effects characterization for reclamation and closure.

9.2.5.5 Significance of Residual Effects

The significance of potential residual adverse effects has been determined based on the residual effects criteria a review of background information and available field study results, consultation with government agencies and other experts, and professional judgement.

The determination of significance of residual adverse effects is rated as negligible-not-significant, not significant, or significant, which are generally defined as follows:

- **Negligible-Not Significant:** The basis for determining that effects are negligible will be provided in the Application for each VC. Negligible effects will not be carried forward to the cumulative effects assessment
- **Not significant:** Effects determined to be not significant are residual effects greater than negligible that do not meet the definition of significant. Residual effects that are not significant will be carried forward to the cumulative effects assessment.
- **Significant:** The basis for determining that a residual effect is significant will be provided in the Application for each VC. Significant residual effects will be carried forward to the cumulative effects assessment.

Because the context, reversibility, and frequency (See Section 9.2.3.3.3) criteria are effectively fixed for the noise level VC, the overall significance is determined by the magnitude, extent, and duration criteria.

The definition of the overall effect significance based on magnitude, extent, and duration for the noise level VC is presented in Table 9.2-7.A summary of significance determinations is presented in Table 9.2-68. Detailed rationale for significance determinations is provided below.

9.2.5.5.1 Construction

The context, reversibility, and frequency criteria are effectively fixed as disturbed, fully reversible, and high, respectively. The results presented in Table 56 through Table 63 indicate that for all receptors the magnitude criterion is predicted to be negligible for all phases of construction. The results presented in Table 56 through Table 63 indicate that the extent criterion is predicted to be local for all receptors except NR4, where the extent is regional. The results presented in Table 56 through Table 63 indicate that the duration criterion is predicted to be short-term for all phases of construction. Based on the decision matrix presented in Table 7, this configuration of classification criterion leads to the conclusion that the overall residual effect of Proposed Project construction to the acoustic environment is negligible at all receptors. The likelihood is high because the Proposed Project is certain to increase noise levels.

With the negligible characterization of the residual effects at all receptors leads to the conclusion that there is negligible – not significant effects of the Proposed Project construction on the acoustic environment.

9.2.5.5.2 Operations

The context, reversibility, and frequency criteria are effectively fixed as disturbed, low, and high, respectively. The results presented in Table 64, Table 65, and Table 66 indicate that for all receptors the magnitude criterion is

predicted to be negligible for all operation scenarios. The results presented in Table 64, Table 65, and Table 66 indicate that the extent criterion is predicted to be local for all receptors except NR4, where the extent is regional. The results presented in Table 64, Table 65, and Table 66 indicate that the duration criterion is predicted to be long-term for all operation scenarios. Based on the decision matrix presented in Table 7, this configuration of classification criterion leads to the conclusion that the overall residual effect of Proposed Project operation to the acoustic environment is negligible at all receptors. The likelihood is high because the Proposed Project is certain to increase noise levels.

With the negligible characterization of the residual effects at all receptors leads to the conclusion that there is negligible – not significant effects of the Proposed Project operation on the acoustic environment.

9.2.5.5.3 Reclamation and Closure

Reclamation and closure is expected to require noise generating equipment and levels of effort similar to, or less than, construction. Therefore, like construction, there is predicted to have negligible – not significant effects of the Proposed Project reclamation and closure on the acoustic environment.

Table 9.2-68: Significance of Potential Residual Effects: Noise VC – Noise Levels

VC	Residual Effect	Significance	Rationale
Construction			
Noise Levels	Negligible	Negligible, Not Significant	Magnitude of residual effect is negligible or Low at all receptors. As per the decision matrix presented in Table 7, a magnitude classification of negligible or low for a short-term duration leads to an overall effect characterization of negligible and no significance regardless of other criteria.
Operations			
Noise Levels	Negligible	Negligible, Not Significant	Magnitude of residual effect is negligible at all receptors. As per the decision matrix presented in Table 7, a magnitude classification of negligible leads to an overall effect characterization of negligible and no significance regardless of other criteria.
Reclamation and Closure			
Noise Levels	Negligible	Negligible, Not Significant	Magnitude of residual effect is negligible or low at all receptors. As per the decision matrix presented in Table 7, a magnitude classification of negligible or low for a short-term duration leads to an overall effect characterization of negligible and no significance regardless of other criteria.

9.2.5.6 Level of Confidence

The level of confidence of predicted residual effects is provided in Table 9.2-69. The prediction confidence of the assessment on each VC is based on scientific information and statistical analysis, professional judgement and effectiveness of mitigation (rated as high confidence, moderate confidence, and low confidence).

This noise assessment is based on experienced professional judgement. Uncertainty in the noise assessment is primarily related to uncertainties in the source noise emissions data that serve as inputs to the computer models, and to inherent uncertainties in the propagation algorithms implemented in the computer models.

Every reasonable attempt was made to reduce uncertainties associated with source noise emissions. In particular, three separate noise source measurement field programs were conducted at three different aggregate facilities across Western Canada, so as to obtain accurate noise emissions for equipment similar to that which will be used in the Proposed Project.

Uncertainties associated with the propagation algorithms are an inherent and fixed feature of the international standard on which they are based (ISO 1996), which cannot be reduced. To account for the inherent uncertainty in the propagation algorithms, conservative assumptions about propagation conditions were made where appropriate. In particular, each noise receptor was modelled as downwind from each noise source 100% of time. Since downwind conditions are known to enhance noise propagation, this downwind assumption is a conservative treatment of potential noise effects – i.e., will tend to overestimate noise levels associated with the Proposed Project.

Table 9.2-69: Level of Confidence in Potential Residual Effect Predictions: Noise

Residual Effect	Level of Confidence (LOC) in Residual Effect Prediction	LOC Rationale
Construction		
Negligible	High	Based on +/- 5 dB accuracy of computer noise model predictions and conservative propagation assumptions implemented in the modelling
Operations		
Negligible	High	Based on +/- 5 dB accuracy of computer noise model predictions and conservative propagation assumptions implemented in the modelling
Reclamation and Closure		
Negligible	High	Based on +/- 5 dB accuracy of computer noise model predictions and conservative propagation assumptions implemented in the modelling

9.2.5.7 Cumulative Effects Assessment

All potential Project-related residual adverse effects were determined to be negligible and requiring no further consideration. No residual effects were carried forward to a cumulative effects assessment.

9.2.6 Conclusions

Noise from the Proposed Project construction and operation has been assessed in accordance with the Commission Guideline and HC Guidance. In particular, Proposed Project construction and operation noise levels have been predicted using computer noise models for eight construction phases and three operation scenarios. The cumulative noise levels, which consist of the logarithmic sum of Baseline Case noise levels and the contribution from the Proposed Project, have been calculated and compared to relevant assessment criteria – i.e., the Commission Guideline PSL, the Directive 038 LFN threshold, and the HC Guidance %HA and speech intelligibility metrics.

The important conclusions of the noise assessment are:

- The residual effect of the Proposed Project construction to the acoustic environment, as characterized via the noise levels VC, is found to be Negligible and there is no significance to the effect;
- The residual effect of the Proposed Project operation to the acoustic environment, as characterized via the noise levels VC, is found to be Negligible and there is no significance to the effect; and
- The residual effect of the Proposed Project reclamation and closure to the acoustic environment, as characterized via the noise levels VC, is found to be negligible and there is no significance to the effect.

The Sunshine Coast Regional District noise bylaw has also been considered in this assessment. As the magnitude of the Commission Guideline and HC Guidance assessments of the Proposed Project operations were negligible, the nuisance-based bylaw should be satisfied.

Mitigation measures associated with noise levels and the acoustic environment relate to each of the three key phases (construction, operation, reclamation and closure) of the Proposed Project. To ensure that potential noise effects are reduced to the greatest extent possible, BURNCO commits to the following:

- Proposed Project construction, operation, and reclamation and closure activities will only occur during the daytime period, as defined by the Commission Guideline and the HC Canada Guidance (i.e., 7 a.m. to 10 p.m.);
- During Proposed Project construction and decommissioning/remediation, BURNCO will implement the Commission Guideline noise mitigation recommendations listed in Section 9.2.5.3.1; and
- During Proposed Project operation BURNCO will construct two berms and one dyke which will serve as noise screens; Specifically, BURNCO will construct:
  - The McNab Creek Flood Protection Dyke - approximately 830 m long and 5 m high on the north side of the aggregate pit;
  - Pit Lake Containment Berm - approximately 800 m long and 9 m high on the south side of the aggregate pit; and
  - Processing Plant Dirt Berm - approximately 230 m and 9 m high on the east side of the processing plant.
- During Proposed Project operation BURNCO will construct fabric enclosures to house the dry screens and crusher in the processing plant.

LEGEND

- Noise Assessment Receptor
- Project Area
- Project Fenceline
- Noise Local Study Area
- Noise Regional Study Area
- Watercourse
- Road (Existing)

1,000 0 1,000

SCALE 1:50,000 METRES

REFERENCE

Roads and watercourses from the Province of British Columbia. DEM From GeoBase. Base Imagery from WMS.
Projection: UTM Zone 10 Datum: NAD 83

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

NOISE STUDY AREAS AND NOISE RECEPTOR LOCATIONS

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	ZU	2 Apr. 2013	SCALE AS SHOWN	REV. 1
GIS	DL	09 Mar. 2016	FIGURE 9.2-1	
CHECK	SD	09 Mar. 2016		
REVIEW	AF	09 Mar. 2016		

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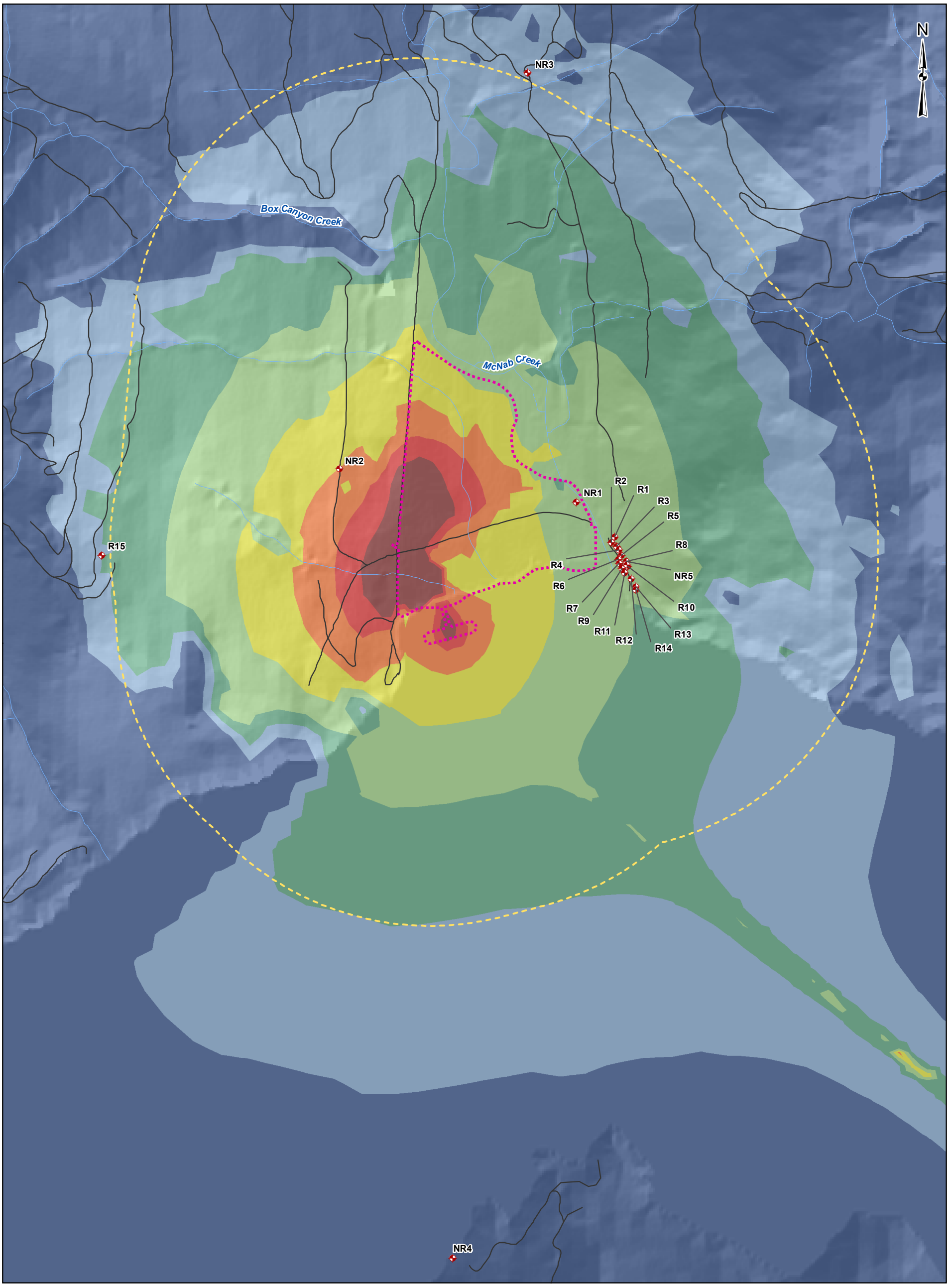

LEGEND

Noise Contours (dBA)

- > 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

- Noise Assessment Receptor
- Project Fenceline
- Noise Local Study Area
- Watercourse
- Road (Existing)

REFERENCE

Roads and watercourses from the Province of British Columbia. DEM From GeoBase.
Projection: UTM Zone 10 Datum: NAD 83

500 0 500

SCALE 1:20,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

OPERATION SCENARIO 1 (YEAR 1): PREDICTED DAYTIME NOISE LEVEL CONTOURS (PROJECT ONLY)

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	ZU	2 Apr. 2013	SCALE AS SHOWN	REV. 1
GIS	DL	09 Mar. 2016		
CHECK	SD	09 Mar. 2016		
REVIEW	AF	09 Mar. 2016		

FIGURE 9.2-2

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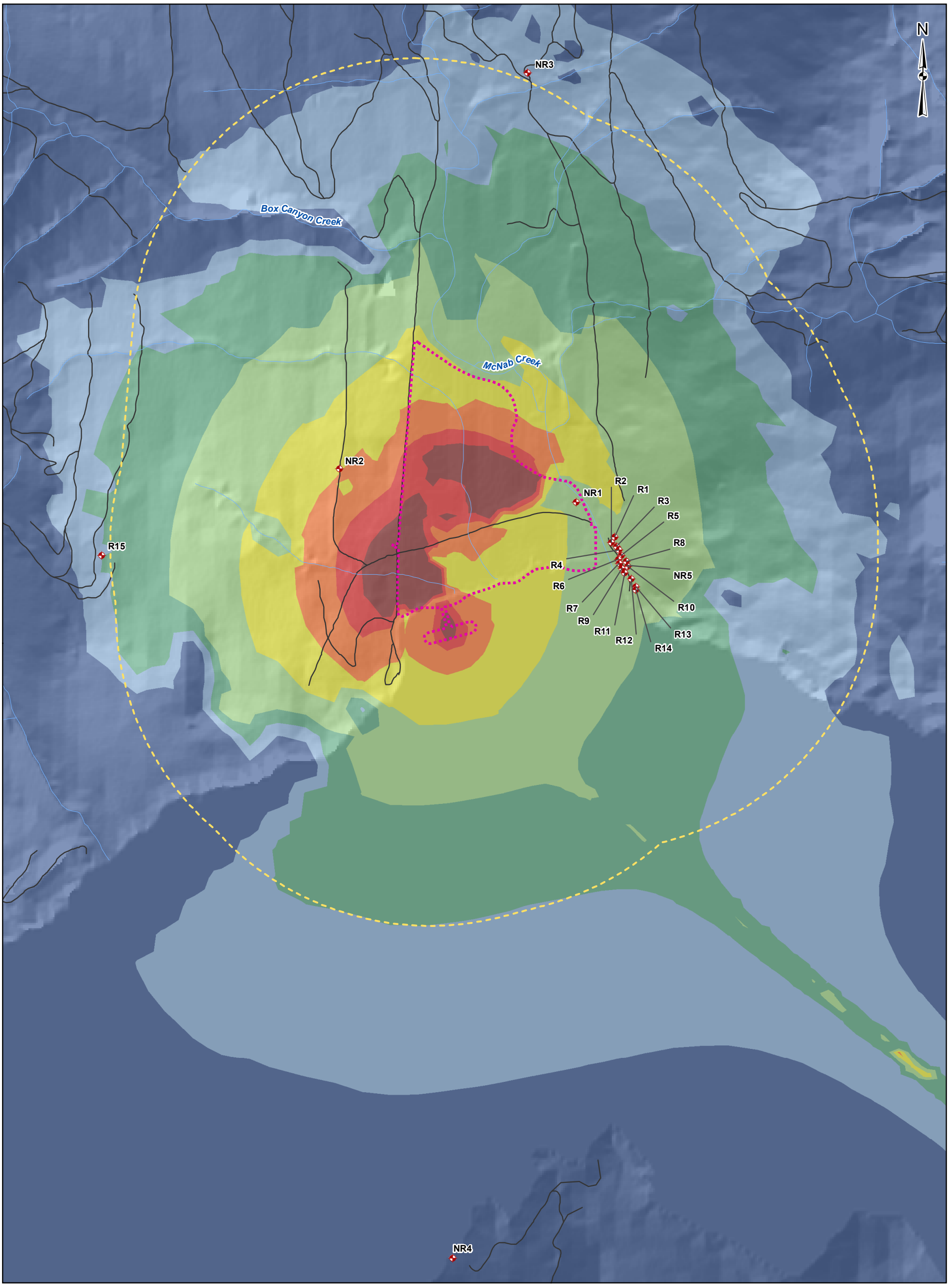

LEGEND

Noise Contours (dBA)

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

- Noise Assessment Receptor
- Project Fenceline
- Noise Local Study Area
- Watercourse
- Road (Existing)

REFERENCE

Roads and watercourses from the Province of British Columbia. DEM From GeoBase.
Projection: UTM Zone 10 Datum: NAD 83

500 0 500
SCALE 1:20,000 METRES

PROJECT

BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE

OPERATION SCENARIO 2 (YEAR 10): PREDICTED DAYTIME NOISE LEVEL CONTOURS (PROJECT ONLY)

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	ZU	2 Apr. 2013	SCALE AS SHOWN	REV. 1
GIS	DL	09 Mar. 2016		
CHECK	SD	09 Mar. 2016		
REVIEW	AF	09 Mar. 2016		

FIGURE 9.2-3

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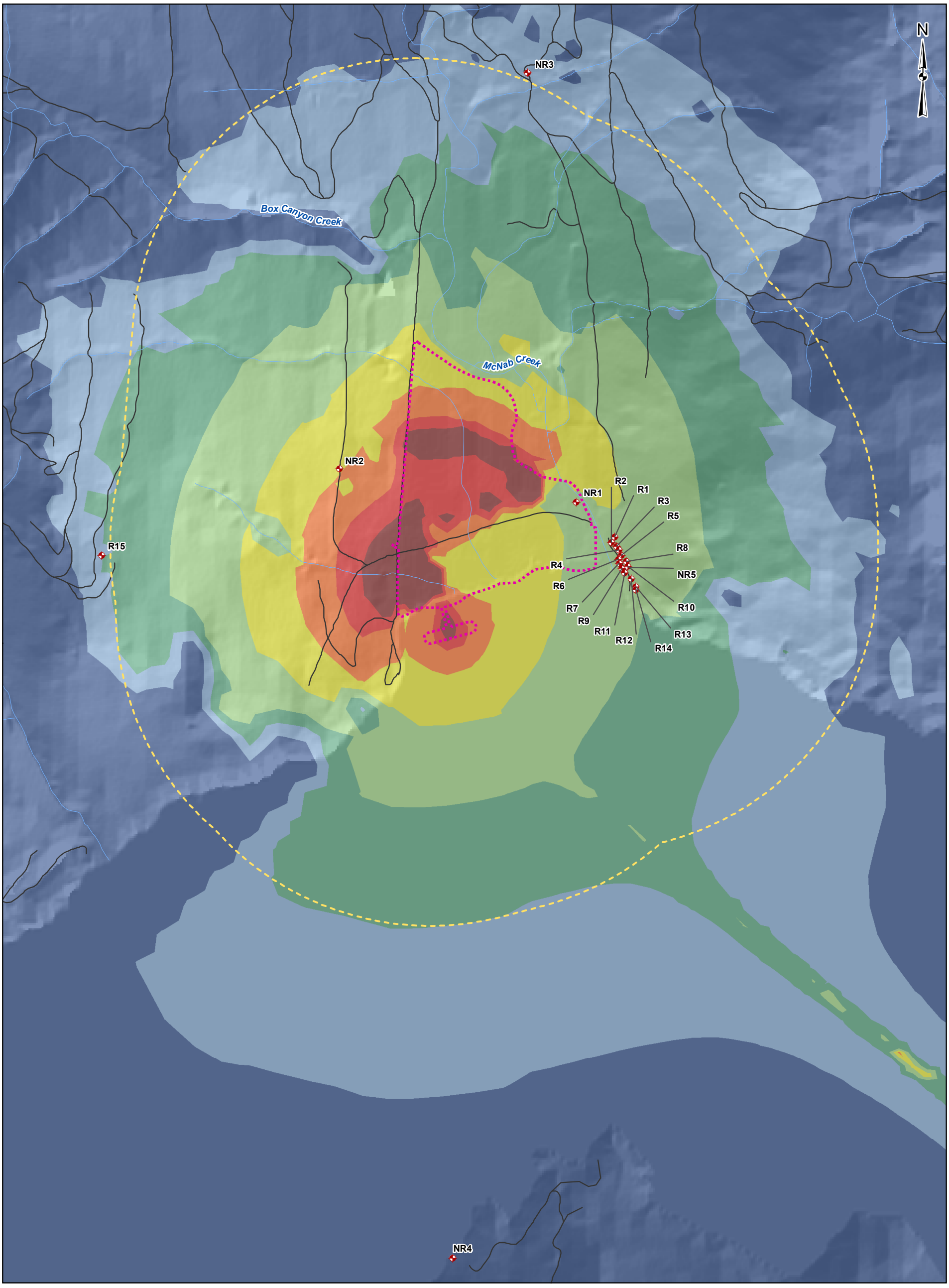

LEGEND

Noise Contours (dBA)

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

- Noise Assessment Receptor
- Project Fenceline
- Noise Local Study Area
- Watercourse
- Road (Existing)

REFERENCE

Roads and watercourses from the Province of British Columbia. DEM From GeoBase.
Projection: UTM Zone 10 Datum: NAD 83

500 0 500
SCALE 1:20,000 METRES

PROJECT
BURNCO ROCK PRODUCTS LTD.
BURNCO AGGREGATE PROJECT, HOWE SOUND, B.C.

TITLE
OPERATION SCENARIO 3 (YEAR 12): PREDICTED DAYTIME NOISE LEVEL CONTOURS (PROJECT ONLY)

Golder Associates

PROJECT NO. 11-1422-0046			PHASE No.	
DESIGN	ZU	2 Apr. 2013	SCALE AS SHOWN	REV. 1
GIS	DL	09 Mar. 2016		
CHECK	SD	09 Mar. 2016		
REVIEW	AF	09 Mar. 2016		

FIGURE 9.2-4

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