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B.9 – NOISE

B.9.1 INTRODUCTION

Noise was selected by Casino Mining Corporation (CMC) as a Valued Component (VC) because airborne sound and ground vibration propagation has the potential to affect sensitive receptors. The Proposal presented baseline information for ambient noise for the Casino Project (the Project) area and predicted changes to ambient noise from Project activities (Section A.9 Noise).

Potential changes to ambient noise from Project activities were evaluated using a three-phased approach:

1. **Determination of baseline conditions:** a limited baseline ambient noise monitoring survey was completed to confirm that baseline sound levels are naturally low and that designation as a remote site according to British Columbia Oil and Gas Commission's (OGC) published standards (OGC, 2009) is appropriate.
2. **Modelling:** noise modelling was completed using sound propagation software CadnaA for selected Project activities to predict noise effects. Predicted sound levels include noise attenuation achieved with proposed mitigation measures.
3. **Guideline comparison:** predicted noise levels were compared with OGC published noise guidelines to identify the potential for adverse residual effects and noise sources requiring additional noise mitigation measures.

Based on the predicted changes in ambient noise after the implementation of mitigation measures proposed by CMC, the Proposal concluded that noise levels are predicted to remain below existing guidelines and the potential adverse residual effects of the Casino Project as a result of increased noise are Not Significant.

On January 27, 2015, the Executive Committee requested that CMC provide supplementary information to the Casino Project (YESAB Project No. 2014-0002) to enable the Executive Committee to commence Screening. The Executive Committee considered comments from various First Nations, Decision Bodies and regulators on the adequacy of the Project Proposal in the preparation of the Adequacy Review Report (ARR). CMC provided a Supplementary Information Report (SIR-A) on March 16, 2015. Subsequently, the Executive Committee issued a second Adequacy Review Report (ARR No.2) on May 15, 2015 following a second review. CMC is providing this Supplementary Information Report (SIR-B) to comply with the Executive Committee's Adequacy Review Report ARR No.2; CMC anticipates that the information in the two SIRs and in the Proposal, when considered together, is adequate to commence Screening.

The Executive Committee has six requests related to information presented in Section 9 Noise of the Project Proposal submitted on January 3, 2014 and Section A.9 Noise of the SIR-A. These requests are outlined in Table B.9.1-1, and responses are provided below.

Table B.9.1-1 ARR No.2 Requests for Supplementary Information Related to Noise

Request #	Request for Supplementary Information	Response
R2-211	Clarification of differences between the reference noise levels presented in the original proposal and the Supplementary Information Report.	Section B.9.2.1.1
R2-212	An assessment of effects, and any proposed monitoring and mitigations, due to non-modeled noise, in relation to wildlife, due to: air traffic; blasting; and cycloning.	Section B.9.2.1.2
R2-213	Rationale for a 45 dBA background sound level.	Section B.9.2.1.3

Request #	Request for Supplementary Information	Response
R2-214	Rationale for the use of A-weightings for assessing effects to wildlife and human annoyance (in relation to low frequency sounds), including how the use of A-weightings influence an effects assessment.	Section B.9.2.1.4
R2-215	Discussion on the temporal distribution of noise effects in communities, including Carmacks and Carcross, on a seasonal and diurnal basis	Section B.9.2.1.5
R2-216	Any anticipated effects, proposed mitigations, and monitoring to noise effects in communities including Carmacks and Carcross.	Section B.9.2.1.6

B.9.2 NOISE

B.9.2.1.1 R2-211

R2-211. Clarification of differences between the reference noise levels presented in the original proposal and the Supplementary Information Report.

The reference noise levels presented in Table 9.4-1 of the Proposal were the total sound pressure levels (dBA), and the reference noise levels presented in Table A.9.2-1 of SIR-A were the octave band spectrums (frequency – Hz). The values in the column “A” of Table A.9.2-1 are equal to those presented in Table 9.4-1. Total sound pressure levels are derived from octave band spectrums using the following equation:

$$L_A(dBA) = 10 \times \log_{10} \sum_1^n 10^{(L_p+A)/10}$$

Where L_p = octave spectrum frequency (Hz)

A = A-scale correction factor, as follows:

Frequency	A-weighting correction
31.5	-39.4
63	-26.2
125	-16.1
250	-8.6
500	-3.2
1000	0
2000	1.2
4000	1
8000	-1.1

The complete combined data is provided in Table B.9.2-1.

Table B.9.2-1 Noise Sources During Construction and Operations (Total Sound Pressure Levels and Octave Band Spectrum)

Noise Source	Source	Octave Spectrum - Frequency (Hz)									Total Sound Pressure Level (dBA)
		31.5	63	125	250	500	1000	2000	4000	8000	
Crushers	DEFRA 2006	0	91	91	88	87	85	83	78	69	90.1
Conveyor		0	71	69	68	71	75	67	63	57	90.1
Screening		0	84	82	79	79	74	74	71	64	81.1
Excavator		0	95	95	89	89	86	82	76	74	91
Loader		0	88	88	87	85	86	83	77	70	89.9
Dozer		0	89	90	81	73	74	70	68	64	80.1
Grader		0	88	87	83	79	84	78	74	65	86.5
Crane		0	78	69	67	64	62	57	49	40	66.6
Mid-Size Loader		0	83	89	92	80	71	69	64	58	85
Lighting Tower		0	78	71	66	62	59	55	56	49	65.5
Gas Turbine	Qui Hansen 2012	109.9	112.9	113.9	113.9	113.9	111.9	109.9	106.9	101.9	117.5
Steam Generator		62.5	74.7	79.8	81.3	85.7	86.9	86.1	85.9	83.8	117.9
Incinerator Fan		56.7	55.7	55.7	54.7	7	63.1	46.7	38.7	30.7	63.4
Water Pump		38.2	52.4	63.5	73	78.4	84.6	82.8	78.6	70.5	88.2
SAG mill	VDI 2571	0	118	117	118	114	111	108	110	95	117.5
Ball Mill		0	113	113	115	119	111	106	98	93	117.9
Transformer		89	95	97	92	92	86	81	76	69	92.4
Workshop		0	0	85	85	90	85	80	75	0	93.2

B.9.2.1.2 R2-212

R2-212. An assessment of effects, and any proposed monitoring and mitigations, due to non-modeled noise, in relation to wildlife, due to: air traffic; blasting; and cycloning.

As discussed in the response to R315, a potential interaction with sheep may be the increase in aircraft flying into the Mine Site. Sheep respond to aircraft noise by being vigilant, resulting in less time spent foraging and resting (Laberge Environmental Services, 2002). To mitigate this potential effect, CMC will adopt the guidelines outlined in Flying in Sheep Country: How to Minimize Disturbance from Aircraft (Laberge Environmental Services, 2002).

Additionally, as discussed in the response to R321, noise modelling and potential wildlife displacement was considered in the effects assessment (Section 12 of the Proposal). Noise associated with project activity was considered a disturbance activity that could affect wildlife behaviour and distribution near Project facilities. All project disturbances and potential effects on wildlife were quantified within the various zones of influence used to quantify effects on wildlife. To quantify potential behavioural changes, habitat multipliers, or “downgrading” was applied to habitat within the zone of influence (Proposal Section 12.3.3 Caribou Effects Assessment). Habitats were considered “nil” (i.e., completely avoided) within the project footprint, with varying reduced habitat uses presumed correlated with distance from Project facilities. The justification for the size and response within a zone of influence, partly determined by noise, is provided in Proposal Section 12.3.3.2 (Potential Project Interactions with the Klaza Caribou Herd). All known relevant literature on caribou response to noise was considered in that section. Mitigation measures to reduce noise levels and, consequently, reduce sensory disturbance on wildlife are listed in Proposal Section 9, Table 9.4-4, and are as follows:

- Ensure regular equipment maintenance, including lubrication and replacement of parts.
- Keep noisy equipment inside of buildings and sheds whenever possible.
- Equipment will be operated with covers, shields, and hoods if provided by their manufacturer.
- Site workers will be trained in proper machine use and maintenance.
- Adhere to a blasting plan developed by an explosives contractor that implements controlled blasting procedures.
- Optimisation of blasting operations by licensed staff which maximise localised rock breakage within the ore body of interest, while minimising non-productive noise, vibration and flyrock effects.
- Impose speed limits for all vehicles.
- Institute a policy for all equipment and vehicles to reduce and limit idling.
- Wherever practicable, noisy equipment will be located near ground level to minimize noise propagation.

Additionally, as summarized in the response to R359, the effects assessment on birds was conducted considering, among other disturbance features, noise within a zone of influence. It was acknowledged that there will be some reduced habitat quality within the zone of influence. This reduced habitat quality was considered ‘not adversely significant’ within the bird regional assessment area.

For further details on the assessment of effects from air traffic on Dall Sheep, see the response to R2-177 in Section B.12.

B.9.2.1.3 R2-213

R2-213. Rationale for a 45 dBA background sound level.

As described in the response to R412, baseline ambient noise for the entire noise modelling study area was conservatively estimated as pristine, which is characterized as quiet and dominated by nature. To ensure that the characterization of the noise baseline as pristine was appropriate, baseline values at the nearest potentially sensitive receptor (Carmacks) were desired. The study conducted August 25 – 26, 2011, 30 m from the Freegold Road near Carmacks, resulted in average noise levels of 40.3 dBA during the daytime (7 am – 10 pm) and 33.9 dBA during the nighttime (10 pm – 7 am).

To predict potential changes in sound levels, a night-time average rural ambient sound level of 35 dBA Leq and a day-time adjustment of 10 dBA above the night-time level (i.e., 45 dBA) were used in the model. These sound levels were considered to be applicable as a year-round baseline noise level.

Even though the use of a baseline noise level of 45 dBA is higher than the actual measured average noise levels of 40.3 dBA near Carmacks, the 45 dBA background sound level value is more conservative than assuming a lower value, because it sets the baseline value at which the model starts at a higher value, resulting in an overall higher predicted noise value.

The values of 45 dBA Leq at nighttime and 55 dBA at daytime were used as Permissible Sound Levels (PSL) as per the British Columbia Oil and Gas Commission's (OGC) standards (OGC, 2009) as the Yukon does not currently have any published noise guidelines or regulations and there is no developed noise guideline for the mining industry. In comparison, Health Canada (2010) advises that "noise mitigation measures be considered.... if the Project L_{dn} exceeds 75 dBA".

Even with the more conservative higher baseline value of 45 bBA, during the construction phase, the modelling results show that the predicted equivalent sound levels during daytime and nighttime show only minor exceedances of the OGC guidelines within the mine site (Figures 9.4-1 and 9.4-2). During the operations phase, the modelling results show that the predicted equivalent sound levels during daytime and nighttime show noise levels above the calculated PSL of the OGC guidelines within the mine site and a small portion of the surrounding area (Figures 9.4-2 and 9.4-4). However, the nearest receptor is the accommodation camp, which modeling indicates is below the PSL.

For noise effects within the mine site, CMC will comply with Yukon Occupational Health and Safety Regulations, which include providing hearing protection, and if hearing protection is not able to be used, exposure will be kept to below the values in Table B.9.2-2 (YWCHSB, 2006).

Table B.9.2-2 Permissible Exposure Values (YWCHSB, 2006)

Steady State Noise		Impact Noise	
Noise Level (dBA)	Maximum Daily Exposure Time Without Hearing Protection (Hours)	Peak Sound Pressure Level (dB)	Maximum Number of Impacts per 24-Hour Period
85	8	118	14400
88	4	121	7200
91	2	124	3600
94	1	127	1800
97	½	130	900
100	¼	133	450
Over 103	0	136	225
		139	112
		140	90
		Over 140	0

B.9.2.1.4 R2-214

R2-214.Rationale for the use of A-weightings for assessing effects to wildlife and human annoyance (in relation to low frequency sounds), including how the use of A-weightings influence an effects assessment.

Noise is measured in a non-linear scale known as decibels (dB), which are then filtered to account for noise frequencies that are audible to humans (A-weighted), resulting in a value in dBA. Typical sound levels in A-weighted decibels are summarized in Table B.9.2-3.

Table B.9.2-3 Typical Sound Levels (A-weighted decibels)

Sound Range (dBA)		Source*
	0	Human hearing threshold
Faint	20	Rustling of leaves
	38	Whisper
	40	Humming refrigerator
Moderate	40	Quiet room
	50	Average rainfall
	60	Dishwasher, people talking
Loud	70	Vacuum cleaner
	80	Busy street, alarm clock
	88	Motorcycle
Very Loud	90	Lawnmower, food blender
	100	Chainsaw, snowmobile
	110	Symphony orchestra
Painful	120	Oxygen torch
	130	Shotgun
	140	Jet plane take-off
	150	Rock concert (peak)

*From Yale Medical Group, 2015.

While workers at the mine site are covered under the Yukon Occupational Health and Safety Regulations, as described above in the response to R2-213, Health Canada (2011) also recommends the assessment of sleep disturbance at on-site mine camps. Health Canada advises that sounds are dampened by 27 dBA if windows are closed, and 15 dBA if windows are opened. As the maximum noise level at the accommodation camp is 45 – 50 dBA (Figures 9.4-1 through 9.4-4), the indoor-dampened sound is at maximum 35 dBA with the windows open, but will more likely be around 13 dBA. The World Health Organization suggests that the indoor threshold for sleep disturbance be no more than 30 dBA for continuous noise (WHO, 1999). Therefore, no impact to the on-site mine camp is predicted.

While there are no federal or provincial/territorial regulations that specifically stipulate noise levels for mine development projects in terms of wildlife impacts, effects on wildlife are associated with the type of noise and the

wildlife species. Environment Canada suggests that to prevent effects to wildlife, sound pressure level from mining activities should not exceed 55 dBA during the day, and 45 dBA at night (Environment Canada, 2009). These are consistent with the values used as Permissible Sound Levels (PSL) as per the British Columbia Oil and Gas Commission's (OGC) in the effects assessment presented in the Project Proposal. While minor exceedances of the PSL are predicted around the mine site, residual adverse effects are Not Significant.

B.9.2.1.5 R2-215

R2-215. Discussion on the temporal distribution of noise effects in communities, including Carmacks and Carcross, on a seasonal and diurnal basis

Noise effects in Carmacks and Carcross will be due to increased traffic in those communities. During construction, traffic requirements may vary seasonally in small amounts, however, the impact of traffic corresponds to the year of construction. As outlined in Table 4.3-5, total traffic ranges from 4 vehicles per day (3 "heavy" and 1 "light") in year -4 to a peak of 28 vehicles per day (14 of each "heavy" and "light") in year -2. Diurnally, traffic is likely to be heavier during the day (i.e., 6 am – 6 pm).

During operations, the mine site will be operating 24 hours per day, 365 days per year. Therefore, seasonal effects are not as significant as during the construction period. As described in Table 4.4-5, daily and seasonal variations may occur, with copper concentrate outbound loads reaching up to 24 loads per day in some years, compared to the average value of 17 loads per day. Similarly to during construction, traffic is likely to be heavier during the day (i.e., 6 am – 6 pm).

Carmacks

As described in the response to R414, at the time of completing the noise model, predictions were not completed for Carmacks because mine operations are not proposed within the area and Project-generated traffic would not pass through Carmacks during operations, as Project-related traffic would utilize the Carmacks by-pass.

Based on the existing model and predictions, noise levels in Carmacks during construction are anticipated to be consistent with the maximum daytime and nighttime noise levels predicted for the Freegold Road Extension during construction (see Figures 9.4-1 and 9.4-2 in the Proposal). These predicted noise levels are below the maximum daytime and nighttime thresholds identified in the OGC guidelines (i.e., 55 dBA during the day, and 45 dBA at night).

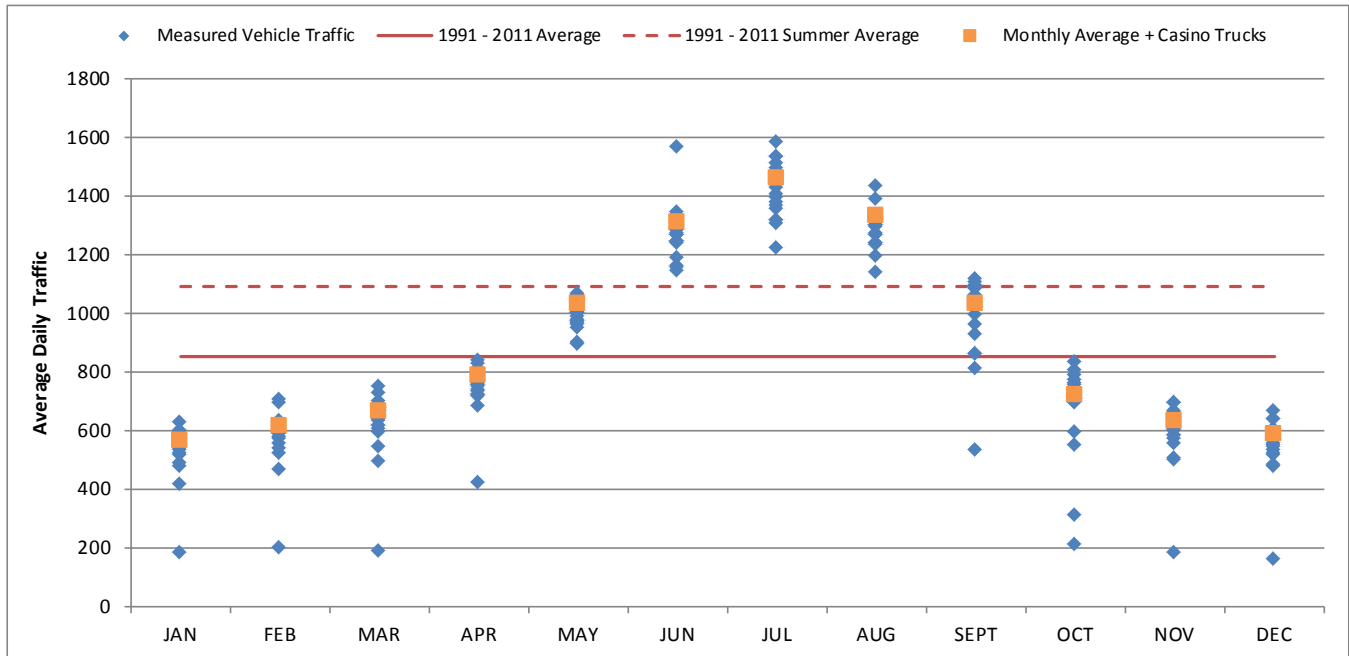
There will be a short time at the beginning of construction, when the Carmacks bypass is being constructed, that traffic will route through the Village of Carmacks. As detailed in Table 4.3-5, annual average daily traffic is estimated to be 3 "heavy" vehicles and 1 "light" vehicle, for a total of 4 extra vehicles per day during this time. The effect of this traffic on the Village of Carmacks is expected to be negligible, and vehicles will comply with all standards and guidelines established in the Traffic Management and Road Use Plans and with local speed limits.

Carcross

As described in the responses to R2-12 and R2-13, traffic through Carcross will be limited to copper and molybdenum concentrate vehicles travelling to Skagway for export, which at the maximum value, is 24 trucks per day and 4 trucks per day for copper and molybdenum concentrate, respectively. The range of monthly traffic through Carcross from 1991 to 2011, as measured by Yukon Highways and Public Works (Yukon HPW) traffic counter on the south side of Carcross on the Klondike Highway #2 is shown in Figure B.9.2-1. The average annual daily traffic through that location is 821 and the average summer daily traffic is 1092 (Yukon HPW, 2011). With the addition of 48 trucks through Carcross (i.e., 28 trucks to Skagway and 28 trucks returning from Skagway) from the Casino Project, the anticipated average daily vehicle traffic through Carcross (yellow square in Figure

B.9.2-1) is well within the range of historic traffic. Therefore, the traffic through Carcross will be only marginally greater than residents are used to seeing in an average month, and in most months are below the average summer traffic values.

Figure B.9.2-1 Anticipated Traffic through Carcross with Casino Trucks (Highway Data from 1991 – 2011)



*Data from Yukon Highways and Public Works, 2011

B.9.2.1.6 R2-216

R2-216. Any anticipated effects, proposed mitigations, and monitoring to noise effects in communities including Carmacks and Carcross.

As described above, no changes to background noise is predicted for either the community of Carmacks or Carcross. Noise levels in Carmacks during early construction prior to completion of the Carmacks Bypass are anticipated to be consistent with the maximum daytime and nighttime noise levels predicted for the Freegold Road Extension during construction which are below the maximum daytime (55 dBA) and nighttime (45 dBA) thresholds identified in the OGC guidelines. Traffic through Carmacks will be consistent with historic average daily traffic values (see R2-215), and hence noise effects are not greater than those that currently exist.

There are no anticipated residual adverse effects from noise on either the community of Carmacks or Carcross. CMC will work with the Yukon Government to determine if monitoring of noise in these communities is required and/or beneficial.