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A.9 – NOISE

A.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 an assessment of potential effects on ambient noise from Project activities (Section A.9 Noise).

Potential noise impacts 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 Project effects and with the implementation of the mitigation measures proposed by CMC, the Proposal concluded that noise levels are predicted to remain below existing guidelines and the potential 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 received from various First Nations, Decision Bodies and regulators on the adequacy of the Project Proposal in the preparation of the Adequacy Review Report (ARR). Casino Mining Corporation is providing this Supplementary Information Report (SIR) to comply with the Executive Committee's Adequacy Review Report; CMC anticipates that the information in the SIR and 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. These requests are outlined in Table A.9.1-1, and responses are provided below.

Table A.9.1-1 Requests for Supplementary Information Related to Noise

Request #	Request for Supplementary Information	Response
R411	Details regarding how the noise model accounted for seasonal variability.	Section A.9.2.1.1
R412	Details how the collected baseline data informed modeling or if other sources were used.	Section A.9.2.1.2
R413	Rationale on model selection including model limitations.	Section A.9.2.1.3
R414	Rationale on why noise levels in Carmacks and the FGR were not modeled.	Section A.9.2.1.4

Request #	Request for Supplementary Information	Response
R415	Identification of reference equipment used to calculate sound pressure levels.	Section A.9.2.1.5
R416	Confirmation that the noise modeling accounts for air traffic, shovels, cycloning, blasting, the concrete batch plant, and HLF crushing operations and revised predictions if these are not included in the original proposal.	Section A.9.2.1.6

Notes:

1. Request # refers to the assigned identification number in the YESAB Adequacy Review Report January 27, 2015 prepared by the Executive Committee of the Yukon Environmental and Socio-economic Assessment Board.
2. Response refers to the location of CMC's response to the YESAB request for supplementary information.

A.9.2 NOISE

A.9.2.1.1 R411

R411. Details regarding how the noise model accounted for seasonal variability.

Casino Mining Corporation understands that meteorological conditions, including temperature and relative humidity, and ground conditions, such as the presence of snow and type of vegetation, can affect the magnitude and extent of noise propagation by affecting atmospheric absorption and ground attenuation. To account for potential increased effects due to seasonal variability, CMC chose to model a potential worst case scenario that reflects maximum noise propagation and minimal ground attenuation.

Seasonal variability was considered in the development of the noise model by taking into consideration potential worst case scenarios due to changes in ground conditions and meteorological conditions. The noise model assumed maximum reflective ground conditions of ice, which has minimal ground attenuation and would result in the highest predicted noise. Due to the fact that the Project is surrounded by medium to high density forest, wind effects at ground level are not anticipated to change dramatically between seasons, therefore a constant wind condition is considered an appropriate assumption.

Under the potentially worst case scenario used for the noise model, noise levels are predicted to remain below existing guidelines and the potential residual effects of the Casino Project as a result of increased noise are Not Significant. Likewise, CMC anticipates that noise predictions for both summer and winter conditions will not exceed established guideline limits.

Furthermore, CMC believes that accounting for seasonal variability in noise models is more applicable when sound receptors (i.e. humans and wildlife) are located near the primary noise sources. In the case of the Casino Project, CMC has established that there are no sound receptors located near the primary noise sources around the mine site.

For these reasons, the noise model and predictions have already accounted for the potential effects of seasonal variability on the magnitude and extent of noise propagation. There is good confidence that noise predictions will not exceed established guidelines throughout the year and a good understanding that the potential adverse effects of noise are Not Significant.

A.9.2.1.2 R412

R412. Details how the collected baseline data informed modeling or if other sources were used.

The baseline ambient noise monitoring survey results were used to confirm that baseline sound levels can be appropriately designated as pristine according to OGC published standards (OGC 2009) for input into the noise model. The approach of assuming a pristine baseline noise level is an acceptable common practice and is viewed as a conservative approach that overestimates potential effects rather than underestimating potential effects.

Sound levels were measured and recorded near the village of Carmacks to establish baseline conditions at the location of a potentially sensitive receptor. Noise in the area is predominantly natural (such as noise caused by cascading water), with infrequent anthropogenic noise inputs from mining and forestry activities, agriculture activities, recreational use, and local and industrial traffic. There are no known residential or industrial developments within the noise study area around the Project; therefore using the baseline established at the location of the noise monitoring survey near the village of Carmacks to determine conformance with pristine conditions is a conservative approach.

A Larson Davis 831 Sound Level Meter was used to determine ambient sound levels over a 22-hour period from August 25, 2011 to August 26, 2011 near the village of Carmacks. The results of the limited baseline ambient noise monitoring survey were comparable to typical pristine conditions described by the OGC published standards; thus, baseline sound levels used in the noise modelling were assumed to be pristine. Following this logic, baseline ambient noise for the entire noise modelling study area was conservatively estimated as pristine which is characterized as quiet and dominated by nature with night-time average rural ambient sound levels of 35 dBA Leq and a day-time adjustment of 10 dBA above the night-time level. These sound levels are also considered to be applicable as a year-round baseline noise level.

A.9.2.1.3 R413

R413. Rationale on model selection including model limitations.

Consideration was made to ensure that the model selected and the calculation method applied for the Project was the most appropriate and adhered to internationally recognized standards. A number of commercially available noise model software packages are available, including:

- Cadna/A by Datakustik GMBH;
- SoundPLAN by SoundPLAN International LLC;
- Predictor by Bruel and Kjaer;
- WindPro by EMD International A/S; and
- WindFarmer by GL Garrad Hassan.

Noise modelling for the Project was carried out according to ISO 9613-2 Attenuation of Sound During Propagation Outdoors, using the DataKustik's CadnaA outdoor sound propagation software (ISO 1996b). The CadnaA model is a practitioner and regulator recognized tool that uses integrated industrial and road noise propagation standards to predict noise levels. Representative sound levels are obtained from DEFRA 2006, Qui Hansen 2012, and VDI 2571, which are considered to be reputable sources and standards. The model allowed for presentation of A-weighted decibels to allow comparison with the OGC's published standards (OGC 2009).

The CadnaA model has a published accuracy of ±3dBA between 100 m to 1000 m, which is considered good accuracy for an environmental noise model. Accuracy levels beyond 1000 m are not published. While it is generally understood by practitioners that the accuracy diminishes at distances beyond 1000 m from the sound source, there are a number of comparative studies that indicate it is still a good assessment tool, when the model parameters are set to conservative values (MFLNRO 2012). As well, the CadnaA model is a conservative noise

model because it attempts to account for uncertainties in meteorological conditions which contribute to worst-case noise propagation such as downwind propagation with a mild temperature inversion.

As with all predictions of future conditions, the model predictions have a level of uncertainty related to best available information and understanding of potential sources of noise. Some of the limitations associated with the model arise if the following factors inputted into the model differ from actual activities or circumstances:

- Operation hours;
- Vehicle size;
- Load size;
- Locations of potential sources of noise;
- Sounds level data;
- Ground cover such as grasses, shrubs and trees (sound is absorbed by the ground and ground cover that it passes over or through);
- Meteorological conditions, depending on temperature and relative humidity (sound is absorbed to varying degrees as it passes through the atmosphere);
- Sound propagation can be affected by wind and temperature gradients; and
- Sound can be attenuated by physical barriers such as buildings, hills or mountains.

The model depends on the accuracy of the sound level data used in the model. Standard sound emission data from the International Standards Organization's 9613-2:1996 (ISO 1996a, ISO 1996b) and German Guideline for Noise Protection on Streets (RLS-90) for mine site and traffic predictions were used. Conservative estimates were applied when specific data was not available.

Due to the conservative assumptions that were incorporated into the noise model, the confidence level of the predicted noise effects is high.

A.9.2.1.4 R414

R414. Rationale on why noise levels in Carmacks and the FGR were not modeled.

Two Local Study Areas (LSAs) were established for the assessment of noise: a 30 km^2 area surrounding the mine site and a 20 km^2 area surrounding Carmacks (Section 9 of the Proposal). The Regional Study Area (RSA) for noise included a 4 km buffer (2 km on each side) along the Freegold Road Extension. The spatial areas that were chosen for the noise model were expected to encompass the areas where attenuation resulting from noise from the Project has the potential to exceed thresholds.

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.

The Yukon Government (YG) is responsible for the Carmacks by-pass and Freegold Road Upgrade portion of the access road. Casino Mining Corporation intends to work with YG to understand the timing of the construction of the Carmacks by-pass and if it will be available for use during the construction phase of the Project.

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 Proposal). These predicted noise levels are below the maximum daytime and nighttime thresholds identified in the OGC's guidelines that were adopted for the Project.

A.9.2.1.5 R415

R415. Identification of reference equipment used to calculate sound pressure levels.

The CadnaA model uses representative industrial and road noise propagation standards for equipment, components and activities from DEFRA 2006, Qui Hansen 2012, and VDI 2571, which are considered to be reputable sources. The construction and operation phase reference equipment were selected by considering material movement schedules, stocking, mine layouts, equipment list, and power plant capacities outlined in the Feasibility Study (M3 2013) and typical mine related activities and selecting the maximum noise sources for the main activities. Supplemental activities were also identified from the Feasibility Study (M3 2013) to arrive at the final list of noise sources for input into the noise model. The Octave Band Spectrum for the major noise sources are listed in Table A.9.2-1.

Table A.9.2-1 Octave Band Spectrums for the Major Sources

Noise Source	Octave Spectrum - Frequency (Hz)										
	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
Work Shop	-	-	85	85	90	85	80	75	-	90.1	93.2
Watering Pump (100 hp)	38.2	52.4	63.5	73	78.4	84.6	82.8	78.6	70.5	88.2	90.1
Crusher	-	91	91	88	87	85	83	78	69	90.1	96.3
Conveyor	-	71	69	68	71	75	67	63	57	77	96.3
Screening	-	84	82	79	79	74	74	71	64	81.1	88
Excavator	-	95	95	89	89	86	82	76	74	91	99.3
Loader	-	88	88	87	85	86	83	77	70	89.9	94.4
Dozer	-	89	90	81	73	74	70	68	64	80.1	93
Grader	-	88	87	83	79	84	78	74	65	86.5	92.4
Crane	-	78	69	67	64	62	57	49	40	66.6	79.1
Loader Mid Size	-	83	89	92	80	71	69	64	58	85	94.3
Lighting Tower	-	78	71	66	62	59	55	56	49	65.5	79.2
Transformer	89	95	97	92	92	86	81	76	69	92.4	101
Incinerator Fan (stack)	56.7	55.7	55.7	54.7	7	63.1	46.7	38.7	30.7	63.4	65.6
Power Generator 6.7MW	62.4	78.8	89.7	97.2	102.6	103.8	103	99.8	92.7	108.6	109
SAG Mill	-	118	117	118	114	111	108	110	95	117.5	123.6
Ball Mill	-	113	113	115	119	111	106	98	93	117.9	122.3
Gas turbine	109.9	112.9	113.9	113.9	113.9	111.9	109.9	106.9	101.9	117.1	121.3
Steam Generator	62.5	74.7	79.8	81.3	85.7	86.9	86.1	85.9	83.8	93.4	105.9

A.9.2.1.6 R416

R416. Confirmation that the noise modeling accounts for air traffic, shovels, cycloning, blasting, the concrete batch plant, and HLF crushing operations and revised predictions if these are not included in the original proposal.

The sources of noise selected for the noise model takes into consideration noise sources that are steady and continuous, typically associated with the continuous use of stationary equipment and noise sources that are mobile. Non continuous noises, such as blasting and air traffic, cause short term noise pulses that may be of annoyance to noise receptors within close proximity; however for the Casino Project, sensitive noise receptors are not within close proximity to the maximum noise sources.

The noise model completed for the Proposal accounts for shovels and crushers, including the crushers that will be used during the operations of the Heap Leach Facility (HLF) as outlined in Table A.9.2-1.

The Casino airstrip is not located within the noise LSA, and Project-related aircrafts (consisting of airplanes and helicopters) will only land a few times a week at the Casino airstrip. An exclusive CadnaA model with a larger domain to include the airstrip would be required to account for landing aircrafts. This type of modelling would be more meaningful and warranted if sensitive noise receptors were identified within close proximity to the airstrip. For example, if ungulates are located within close proximity to the noise source, available threshold values for wildlife that would result in flight responses could be used to characterize the potential effects of predicted noise level on the noise receptor of interests. Even if noise modelling to account for aircrafts is completed, CMC anticipates that predicted noise levels will be below guidelines given the anticipated low frequency, small size of aircrafts and distance from noise receptors.

Blasting is expected to occur during the construction phase for removal of overburden and pit development and less frequently in other Project areas such as the Freegold Road Extension. Regular blasting is anticipated for pit development during the operations phase. In order to carry out an assessment to determine the change in percent highly annoyed due the specific contribution from blasting, assumptions need to be made to estimate the number of blasts per day, the number of days per year that blasting occurs and the C-weighted sound exposure levels for the blasts. Even if an assessment was completed to determine the specific contribution of blasting to noise, CMC does not anticipate a change in the percent highly annoyed above guidelines after the implementation of mitigation measures.

Cycloning is only proposed for the operations phase of the Casino Project and the operations of the concrete plant is only proposed for the construction phase. Casino Mining Corporation anticipates that noise predictions for the construction and operations phases will be below guidelines with the addition of these noise sources.

For these reasons, CMC believes that the potential adverse effects from Project-generated noise are not adversely significant and revising the noise model is not warranted.