



BACK RIVER PROJECT

NOISE ABATEMENT PLAN

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ACRONYMS AND ABBREVIATIONS

B2Gold Nunavut	B2Gold Back River Corp.
dBa	Sound levels measured with an A-weighted filter, which is within a response frequency range for humans and animals, between 1 kHz to 4 kHz (1,000 to 4,000 vibrations per second).
dBc	Unit used to measure C-weighted sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans.
DEIS	Draft Environmental Impact Statement
FEIS	Final Environmental Impact Statement
Leq	Average sound level over the duration of the measurement
Lex	Equivalent sound exposure level (Leq) of noise average over 8 hours
NIRB	Nunavut Impact Review Board
NU	Nunavut
QA/QC	Quality Assurance and Quality Control
OHSC	Occupational Health and Safety Committee
SOP	Standard Operating Procedures
VEC	Valued Ecosystem Component

1. INTRODUCTION

The Back River Project (hereafter “the Project”) has been designed to minimize, mitigate, and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the final Environmental Impact Statement (EIS) guidelines issued by the Nunavut Impact Review Board (NIRB), this document presents the Noise Abatement Plan that B2Gold Back River Corp. (hereafter “B2Gold Nunavut”) will follow concurrent with the development of the Project. Unless otherwise indicated, measures described in the Plan apply to all Project components, including the Back River Project Energy Centre, for the life of the Project.

The Noise Abatement Plan is a “living document.” It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other Project-related changes.

2. SCOPE AND OBJECTIVES

The intent of this plan is to outline the requirements for occupational noise monitoring, control and worker protection. The Plan targets the noise valued ecosystem component (VEC) that was included in the Final Environmental Impact Statement (FEIS). Project activities will create noise; however, the Project has been designed to minimize or eliminate potential adverse effects on workers as described in this Plan.

This Plan includes the following:

- ◆ Applicable legislation and guidelines for occupational noise.
- ◆ Operational controls focused on worker protection.
- ◆ An occupational noise monitoring program.

Mitigation and adaptive management measures focused on minimizing the potential effects of noise on select wildlife species are provided in the Wildlife Mitigation and Monitoring Plan (Chapter 20).

3. PLANNING AND IMPLEMENTATION

Planning for the Noise Abatement Plan started with the development of the DEIS and continued through the FEIS, both of which identified existing (baseline) conditions, assessed potential impacts of the Project, developed conceptual mitigation strategies and developed specific mitigation measures to execute these strategies. Conceptual strategies and plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Noise management will be tracked, reviewed, and updated through ongoing maintenance of the plan. Significance criteria have been developed that assist in identifying priority aspects, establish management criteria and activity-specific mitigation measures.

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific Standard Operating Procedures (SOPs) work instructions (WI), on-the-job instruction, tailgate/toolbox

meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

4. APPLICABLE LEGISLATION AND GUIDELINES

The noise monitoring component of the Occupational Health and Safety Program will comply with the Consolidation of Mine Health and Safety Regulations under the territorial *Mine Health and Safety Act* (1994; Sections 9.19 through 9.26 and Schedule 5), the relevant portions of which can be found in Appendix A. Schedule 5 states:

No person may be exposed without hearing protection to:

- (a) steady state noise¹ over 109 dBA;*
- (b) a maximum equivalent noise level exceeding 85 dBA for an eight-hour shift, or exceeding the equivalent exposure level set out in [Table 4-1]; and*
- (c) impact noise² at a peak pressure level exceeding 140 dBC, or exceeding the maximum levels set out in [Table 4-2].*

Where the maximum noise level permitted in paragraph (1)(a), (b) or (c) is exceeded at a work site, a person shall be provided with and shall use the hearing protection recommended in the standard CAN/CSA Z94.2-94, Hearing Protectors.

Two main health effects of working with noise are hearing loss and stress. Workplace noise can be caused by traffic, pneumatic tools, power tools, machinery and ventilation systems, for example. Regulations followed by the employer are meant to protect workers from excessive noise levels.

Table 4-1 Exposure Limits Equivalent to 85 dBA/Eight-hour Shift

Length of Exposure	Average Noise Level
16 hours	82 dBA
12 hours	83 dBA
10 hours	84 dBA
8 hours	85 dBA
4 hours	88 dBA
2 hours	91 dBA
1 hour	94 dBA
½ hour	97 dBA

¹ “Steady state noise” means noise in which variations of peak pressure levels occur in one second or less.

² “Impact noise” means noise in which variations of peak pressure levels occur at intervals greater than one second apart.

Length of Exposure	Average Noise Level
¼ hour	100 dBA

Table 4-2 Impact Noise Exposure Limits

Peak Pressure Level (decibels)	Maximum Permitted (impulses per eight-hour day)
120	10,000
130	1,000
140	100
Greater than 140	0

Noise exposure limits depend on duration of exposure, noise level, and whether the noise is steady state (i.e., constant) or impulse. An employer must ensure that a worker is not working with a noise level above the exposure limits set in these regulations.

B2Gold Nunavut and its contractors will comply with the Mine Health and Safety Regulation requirements for the management and mitigation of workplace noise exposure.

5. ROLES AND RESPONSIBILITIES

The General Manager is ultimately responsible for the success of the plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Health and Safety Manager along with their direct reports are responsible for the implementation of safety aspects of this plan including:

- ◆ Overall management of plan;
- ◆ Monitoring;
- ◆ Operational aspects;
- ◆ Internal reporting;
- ◆ External reporting; and
- ◆ Ensuring compliance and adaptive management.

Section 9.19 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states, "the manager shall take all reasonable measures to ensure the noise levels at work sites in a mine do not exceed the exposure levels shown in Schedule 5 (Noise Exposure)."

6. ENVIRONMENTAL PROTECTION MEASURES

6.1 MITIGATION MEASURES

The following section outlines operational controls that will be implemented during the construction, operation, and care and maintenance and closure phases of the Project. These operational controls were developed in order to minimize workplace noise.

6.1.1 CONSTRUCTION PHASE

Noise control during the construction phase of the Project will be focused on materials handling and transportation sources. Based on experience from other mine projects, a risk-based approach will be implemented to determine if the following noise controls are applicable:

- ◆ Equipment fitted with appropriate mufflers and silencers.
- ◆ Enclosures, berms, acoustic screening and shrouding where stationary sources may require control.
- ◆ Ensuring equipment is well maintained.

6.1.2 OPERATION PHASE

Noise control during operations will focus on the quarry and crushing areas (materials handling), power generation, processing, mine ventilation and blasting activities. Based on experience from other mines, a risk-based approach will be implemented to determine if the following noise controls are applicable:

- ◆ Equipment fitted with appropriate mufflers and silencers.
- ◆ Enclosures, berms, acoustic screening and shrouding where stationary sources require control.
- ◆ Ensuring equipment is well maintained.
- ◆ Housing stationary sources in buildings, where feasible.
- ◆ Mitigating impact of impulse events, such as blasting if applicable.
- ◆ Mitigating impact of aircraft scheduling of take-off if applicable.
- ◆ General noise abatement measures that can be implemented on site to minimize static noise due to generators, vehicles, and other sources.

6.1.3 ENERGY CENTRE PROJECT

Noise control during the construction phase of the Energy Centre Project will be risk assessed once the project moves into the pre-construction phase where risk assessments will identify potential occupational noise impacts for the project and provide guidance for the baseline conditions.

6.1.4 CARE AND MAINTENANCE AND CLOSURE PHASES

Noise control during closure will be focused on the Tailings Storage Facility (TSF) and Tailings Facilities (TFs), closure activities, plant and mine areas. Most of the noise sources during closure will be from transportation vehicles. Based on experience from other mines, a risk-based approach will be implemented to determine if the following noise controls are applicable:

- ◆ Equipment fitted with appropriate mufflers and silencers.
- ◆ Enclosures, berms, acoustic screening and shrouding where stationary sources require control.
- ◆ House stationary sources in buildings.
- ◆ Ensuring equipment is well maintained.

Any sources requiring mitigation, identified during monitoring, will be addressed using the above mitigation or engineered controls as appropriate. Noise controls that are used will be documented in the noise monitoring report.

Initial controls will be documented prior to Project start-up and the list maintained as additional control needs are identified through the monitoring plan.

6.2 OCCUPATIONAL NOISE MANAGEMENT

In accordance with B2Gold Nunavut's Industrial Hygiene Program and the B2Gold Nunavut Hearing Conservation Program (PRO-016-010) steps are outlined to mitigate negative effects caused by noise. These procedures include the following:

- ◆ Where the noise is constant and measurements show noise levels in excess of 85 dBA Lex, the area shall be clearly marked by signs indicating that hearing protection is required.
- ◆ Attempting to lower the noise level, reduce the length of exposure, and separate the worker from the sources of noise where they exceed the allowable limits.
- ◆ Provide suitable hearing protection, to be used in accordance with recommendations outlined in the Canadian Standards Association Standard Z.94.2-02, Hearing Protectors (2014), where other mitigation and management options are not available or reasonable.
- ◆ In any area where the noise level may exceed 85 dBA Lex, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Safety Superintendent.

In addition, B2Gold Nunavut will adopt an average constant upper noise limit of 85 dBA Lex for determining where noise protection must be made mandatory and the point at which noise mitigation measures should be focused as a priority.

B2Gold Nunavut and its contractors will comply with all applicable regulations, including the implementation of a hearing conservation program that will include the following (where required):

- ◆ Awareness and training of employees, contractors and visitors;
- ◆ Noise surveys of worksites and equipment;
- ◆ Engineering and administrative controls;

- ◆ Hearing protection for employees;
- ◆ Audiometric testing; and
- ◆ Consultation with employees.

B2Gold Nunavut and its contractors will also follow the Mine Health and Safety Regulation requirements specific for:

- ◆ Noise exposure limits (including steady state (i.e., constant) and impulse noise);
- ◆ Measurement of noise levels;
- ◆ Hearing protection; and
- ◆ Audiometric testing.

7. MONITORING PROGRAM

The purpose of the monitoring program is to assess the magnitude of noise impacts from Project and mining activities. Section 9.20 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states, “the manager shall ensure that a noise level survey is conducted at all work sites” and “the results of every noise level survey shall be given to the Committee and made available to an inspector”.

The main activities expected to cause noise impacts included the mine site camp operations (including vehicles, generators, and incinerators), aircraft activities, mining, crushing, drilling and transportation activities.

The noise monitoring will be carried out by a qualified professional using a noise level meter. The following noise levels will be monitored at all locations where workers may be present:

- ◆ dBA during applicable shift length of 8, 10 or 12-hour period; and
- ◆ dBC during impact events.

A-weighting is the most commonly used parameter when a single-number overall sound level is needed. Results are expected to indicate human perception or the effects of sound on humans. A-weighting accounts for the reduced sensitivity of humans to low-frequency sounds, especially at lower sound levels. C-weighting is used to evaluate sounds containing strong low-frequency components. It was originally devised to approximate human perception of high-level sounds.

Table 7-1 shows the monitoring schedule for occupational noise monitoring. Monitoring is required when equipment is first commissioned and then on an annual basis, or if an employee requests monitoring to be undertaken. Monitoring is not considered necessary during care and maintenance or closure phases as there is not expected to be any significant noise sources.

B2Gold Nunavut will also have a noise monitoring component in the Occupational Health and Safety Program. The noise monitoring component of the Occupational Health and Safety Program will comply with the Consolidation of Mine Health and Safety Regulations under the territorial *Mine Health and Safety Act* (Sections 9.19 through 9.26 and Schedule 5), the relevant portions of which can be found in Appendix A.

8. MITIGATION AND ADAPTIVE MANAGEMENT

The Noise Abatement Plan describes actions that are intended to reduce occupational noise effects on workers. The plan is intended to ensure occupational noise levels meet existing legislation, while taking into account operational requirements.

Measures described in the Noise Abatement Plan apply to all project components for the life of the Project, unless otherwise indicated. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program (Section 7). The Management Plan is a “living document.” It will be regularly updated based on management reviews, incident investigations, regulatory changes, or other project-related changes

The monitoring program (Section 7) is intended to monitor the effectiveness of mitigation actions (Section 6). The results of mitigation activities will be reported in an annual report. In addition, the results of facility-specific monitoring programs will be reported in the annual report, along with suggestions for further mitigation activities.

Table 7-1 Occupational Noise Monitoring Schedule

Phase Component	Baseline and Pre-construction	Construction	Operation	Temporary Closure	Care and Maintenance	Post-Closure
All areas where workers will be present.	Noise monitoring is not considered necessary.	Commissioning of any new equipment. Annual checks. If requested by employee.	Commissioning of any new equipment. Annual checks. If requested by employee.	Noise monitoring is not considered necessary, however the plan will be re-evaluated as required.		

This circle of mitigation activities, monitoring and evaluation and new mitigation activities will adaptively manage occupational noise issues identified and arising as a result of the Project.

9. CHECKING AND CORRECTIVE ACTION

Checking and corrective action evaluates the predicted effects of the project and mine on workers and evaluates the compliance of the project, mine and its sub-contractors. Evaluation of predicted effects will be conducted through facility-specific monitoring (Section 7). The monitoring, quality control, and reporting procedures detailed in this plan will be used to:

- ◆ Assess the effectiveness of mitigation and management measures;
- ◆ Identify project effects requiring further mitigation efforts;
- ◆ Comply with requests from regulators and stakeholders; and
- ◆ Adapt to changes in the regulations or the project.

10. RECORD KEEPING

Record keeping will be conducted by B2Gold Nunavut and its subcontractors. Data will be entered into suitable electronic databases and checked for quality control. Data will be entered in a format and program that allows statistical validation and year over year analysis. Data must be stored in a single file format for each type of survey or monitoring activity. Quality Assurance and Quality Control (QA/QC) data will be appended to the annual noise abatement report and the compilation of annual data will be transferred for storage with the Government of Nunavut, Department of Environment.

All formal documents and reports will follow version-control procedures with revision tracking and version numbers. Version control information will be required for all documents and data that are issued, and approval will be given and tracked before issue. Designated personnel will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

Section 9.20 of the Consolidation of Mine Health and Safety Regulations (Appendix A), states that the results of every noise level survey shall be given to the OHSC and made available to an inspector. Section 9.20 also states that “in any area where the noise level may exceed 85 dBA Lex, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Committee”.

11. ENVIRONMENTAL REPORTING

The Noise Abatement Plan will be reported on each year during construction and operation. The report will include monitoring data from the monitoring programs. Reporting on mitigation and management activities, including performance will be reported in an appendix to the report.

The report may be delivered to relevant regulatory agencies and stakeholders, the Government of Nunavut, and any monitoring partners involved in collaborative effects assessment.

It is not considered necessary to produce an annual report during care and maintenance, closure, periods of temporary closure and post closure. A noise assessment will be carried out at the start of each of these stages and if no significant noise sources are identified, no further reports will be produced. If significant sources are identified reporting will be continued on an annual basis.

12. PLAN EFFECTIVENESS

The Plan is intended to ensure that mitigation and management measures are effective at mitigating adverse noise effects on workers, and relevant laws and regulations are met. As part of environmental reporting, B2Gold Nunavut will distribute copies of the annual report to stakeholders, as requested. B2Gold Nunavut will also conduct an annual (or as necessary) evaluation of the efficacy of mitigation and management activities and of monitoring activities using relevant methods. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised plan. This plan may be updated as frequently as every year, or not at all, if the mine plan, and methods for mitigation and monitoring be found to be robust. The new plan will be implemented following review by stakeholders and an opportunity for response by B2Gold Nunavut.

13. QUALITY ASSURANCE AND QUALITY CONTROL

QA/QC measures will be undertaken at three key stages in monitoring activities: 1) during data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan Effectiveness.

The process of data gathering in the field will be quality controlled through the use of qualified personnel and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Standard Operating Procedures (SOP) will be established for all environmental data collection. All personnel will have necessary training and accreditation. QA/QC of data entry will be conducted via a process of standard data entry templates and checking data through either double-entry data or feedback entry, where entered data is checked back to the field cards. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre-and post-analysis checks. Finally, the efficacy of the methods will be evaluated through repeated scrutiny of the data with statistical analysis and thorough review by stakeholders. SOPs will be reassessed and updated when necessary, as part of the re-iterative QA/QC process.

The reiterative QA/QC procedures will continuously improve the effectiveness of the Management Plan to detect Project-related noise effects. These QA/QC processes are important in the overall adaptive management of project effects, and will support the goals of the project to minimize, mitigate and/or manage potential adverse effects on workers.

14. REFERENCES

1994. *Mine Health and Safety Act*. SNWT (Nu) 1994, c 25.

Canadian Standards Association. 2014. *Standard Z.94.2-02, Hearing Protection Devices - Performance, Selection, Care, and Use*.

APPENDIX A ***MINE HEALTH AND SAFETY ACT – CONSOLIDATION OF MINE HEALTH AND SAFETY REGULATIONS***

(4) Abrasive blasting and similar operations conducted outside a building shall be conducted in a place and in a manner that prevents injury to persons.

Protective Equipment

9.16. (1) Where an abrasive blasting operation is being conducted, the manager shall supply and employees shall wear air-supplied hoods or respirators suitable for the work, together with gloves, leggings and clothing designed to protect the employees from dust and projected abrasive or other material.

(2) Air supplied to the hood or respirator shall meet the requirements of the standard CAN3-Z180.1-M85, *Compressed Breathing Air and Systems*, and the volume of air supplied shall be sufficient for respiration and to prevent the entry of contaminants into the hood or respirator and shall not be less than 105 l per minute of air to tight fitting face-pieces and 170 l per minute of air to loose-fitting helmets, hoods and suits.

Nozzles and Valves

9.17. (1) Blast cleaning nozzles shall be equipped with an operating valve that must be held open manually and the normal operation of this valve shall not be defeated.

(2) A support shall be provided on which the nozzle referred to in subsection (1) can be secured when not in use.

(3) In addition to the operating valve required by subsection (1), another operating control shall be readily accessible to the operator to enable the flow of abrasive material to be stopped immediately.

Workers to be Removed

9.18. (1) Where an abrasive blasting or a similar operation releases harmful substances into the atmosphere, persons who are not required to assist in the operation shall be removed from contaminated areas.

(2) Where removal of persons as required by subsection (1) is not practical, the exposed persons shall be advised of the hazard and supplied with suitable personal protective equipment and the exposed persons shall wear the equipment.

NOISE

Exposure Levels

9.19. The manager shall take all reasonable measures to ensure the noise levels at work sites in a mine do not exceed the exposure levels shown in Schedule 5 (Noise Exposure).

Measurements of Noise Levels

9.20. (1) The manager shall ensure that a noise level survey is conducted at all work sites.

(2) The results of every noise level survey shall be given to the Committee and made available to an inspector.

(3) Where the noise is constant and measurements show noise levels in excess of 85 dBA, the area shall be clearly marked by signs indicating that hearing protection is required.

(4) In any area where the noise level may exceed 85 dBA, the manager shall ensure that effective procedures are provided to protect employees from any harmful effects of the noise and copies of the procedures are sent to the chief inspector and given to the Committee.

(5) Where personal noise dosimeters are used they shall have the following measurement specifications:

- (a) a noise measurement exchange rate of 3 dB;
- (b) a threshold level of 75 dBA or lower; and
- (c) if measurement is expressed as a percentage, a reading of 100% for an average exposure of noise equivalent to 85 dBA for eight hours (Lex).

R-016-2003,s.92.

9.21. Repealed, R-016-2003,s.93.

Hearing Protection

9.22. (1) Subject to subsection (2), the selection of the type of hearing protection devices provided by the owner is a matter to be jointly decided by the manager and the Committee or, where there is no Committee in place, other representatives of the employees.

(2) Hearing protective devices shall be used in accordance with the recommendations of Table A1 (Selection of Hearing Protectors) in the standard CAN/CSA Z.94.2-94, *Hearing Protectors*.

9.23. Where an inspector has reason to believe that the type of hearing protective device provided by the manager is unsuitable for use by the employee, the inspector may require the manager to provide an alternative type.

9.24. Every manager shall ensure that any mould of the auditory canal taken for manufacture of a hearing protective device shall be moulded for the employee by a qualified person and the initial fitting of the employee shall be done by a qualified person.

9.25. The manager shall develop and implement a hearing conservation program that shall include:

- (a) education of the employees;
- (b) noise surveys of work sites and equipment;
- (c) engineering and administrative controls;
- (d) hearing protection for employees;
- (e) audiometric testing; and
- (f) consultation with employees.

Audiometric Testing

9.26. (1) Every employee who works in an environment where the noise level is 80 dBA or greater shall, at the expense of the owner, be given an audiometric test for hearing acuity by a person who is certified, by a body acceptable to the chief inspector, to conduct such tests

- (a) on commencing employment;
- (b) annually on the anniversary of commencing employment; and
- (c) at any other time when required by the manager or the chief inspector.

(2) The manager shall keep on file a record of the audiometric tests and the record shall be available for examination by an inspector.

(3) The manager shall give the results of an audiometric test of an employee to the employee within three days of receiving the results. R-016-2003,s.94.

NON-INHALATION EXPOSURE

Injury to Eyes

9.27. (1) Where there is potential for injury by eye contact, a manager shall

- (a) provide exposed workers with such personal protective equipment as may be appropriate to their actual or potential exposure, including safety glasses, goggles or face shields or other eye protective equipment that complies with CSA Standard CAN/CSA Z94.3-M88, *Industrial Eye and Face Protectors*; and
- (b) provide, at or near the exposure site, the appropriate hygiene facilities including portable eye wash stations or eye wash fountains and maintained in a hygienic and working condition.

SCHEDULE 5

(Section 9.19)

NOISE EXPOSURE

1. (1) In this Schedule,
 - (a) "steady state noise" means noise in which variations of peak pressure levels occur in one second or less; and
 - (b) "impact noise" means noise in which variations of peak pressure levels occur at intervals greater than one second apart.

(2) For purposes of Table 2, an unweighted peak measurement may be used if an instrument is not available to measure a C-weighted peak.
2. (1) No person may be exposed without hearing protection to
 - (a) steady state noise over 109 dBA;
 - (b) a maximum equivalent noise level exceeding 85 dBA for an eight-hour shift, or exceeding the equivalent exposure level set out in Table 1; and
 - (c) impact noise at a peak pressure level exceeding 140 dBC, or exceeding the maximum levels set out in Table 2.

(2) Where the maximum noise level permitted in paragraph (1)(a), (b) or (c) is exceeded at a work site, a person shall be provided with and shall use the hearing protection recommended in Table A1 of the standard CAN/CSA Z94.2-94, *Hearing Protectors*.

Table 1

Exposure Limits Equivalent to 85 dBA/Eight-Hour Shift

Length of Exposure	Average Noise Level
16 hours	82 dBA
12 hours	83 dBA
10 hours	84 dBA
8 hours	85 dBA
4 hours	88 dBA
2 hours	91 dBA
1 hour	94 dBA
½ hour	97 dBA
¼ hour	100 dBA

Table 2

Impact Noise Exposure Limits

Peak Pressure Level (decibels)	Maximum Permitted (impulses per eight-hour day)
120	10,000
130	1,000
140	100
greater than 140	0