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TECHNICAL MEMORANDUM

DATE:	2025-10-08	RWDI Reference No.: 2508423
TO:	Sam Lynch Blackwater Gold Inc.	EMAIL: slynch@artemisgoldinc.com
FROM:	Laura Dailyde, P.Eng., PMP Senior Project Manager / Associate, RWDI	EMAIL: laura.dailyde@rwdi.com
	Matthew Johnston, P.Eng. Senior Noise Engineer, RWDI	EMAIL: matthew.johnston@rwdi.com
	Lorenzo Carboni, B.A.Sc. Noise & Vibration Scientist, RWDI	EMAIL: lorenzo.carboni@rwdi.com
RE:	Blast Monitoring – Start of Blasting Blackwater Gold Inc. Blackwater Mine, British Columbia	

RWDI was retained to conduct air overpressure (or concussion noise) and ground borne vibration measurements of the blasting at the Blackwater Gold Project. The project is located 110 kilometres southwest of Vanderhoof, in the traditional territories of the Lhoosk'uz Dene Nation and Ulkatcho First Nation, in central British Columbia.

The *Noise and Vibration Effect Monitoring and Mitigation Plan* (NVMP) dated December, 2021 requires that blast compliance monitoring occur a total of two times during the life of the Project, both during early spring/summer (March through June). These will be conducted at the start of mine blasting and during operations at peak mining output. This memorandum provides the results of the first required round of blast monitoring at the start of mine blasting.

APPLICABLE CRITERIA

The applicable criteria outlined in the NVMP and summarized again here. They are taken from Environment Canada's Environmental Code of Practice for Metal Mines (ECPMM).

Blasts should be designed such that the following criteria are not exceeded at or beyond the boundaries of the mine property:

- Ground vibration of 12.5 mm/s peak particle velocity (PPV) measured below grade or less than 1 metre above grade; and
- Concussion noise of a maximum of 128 dB.

The NVMP requires that two individual blasts be captured.

MONITORING LOCATION

The air overpressure sensor, geophone and data logger were collocated along the south mine pit boundary. Measured levels at the pit boundary are conservatively propagated to assess levels at the project boundary where the criteria applies. It is an industry standard approach to collect data at a location that may be more practical and use industry standard methodology to extrapolate that data for comparison to criteria as long as it is overseen by a qualified professional. The monitoring location, blast locations, and project boundary are identified in Figure 1.

Data collection was conducted using Sigicom D10 data logger. Overpressure levels were measured using Sigicom S10 blast overpressure sensor (SN 7786), according to the OSM/USBM Air blast standard. Vibration levels were measured with a Sigicom V12 triaxial geophone, according to ISEE Seismograph standard. The monitoring equipment set up is shown in Photo 1.

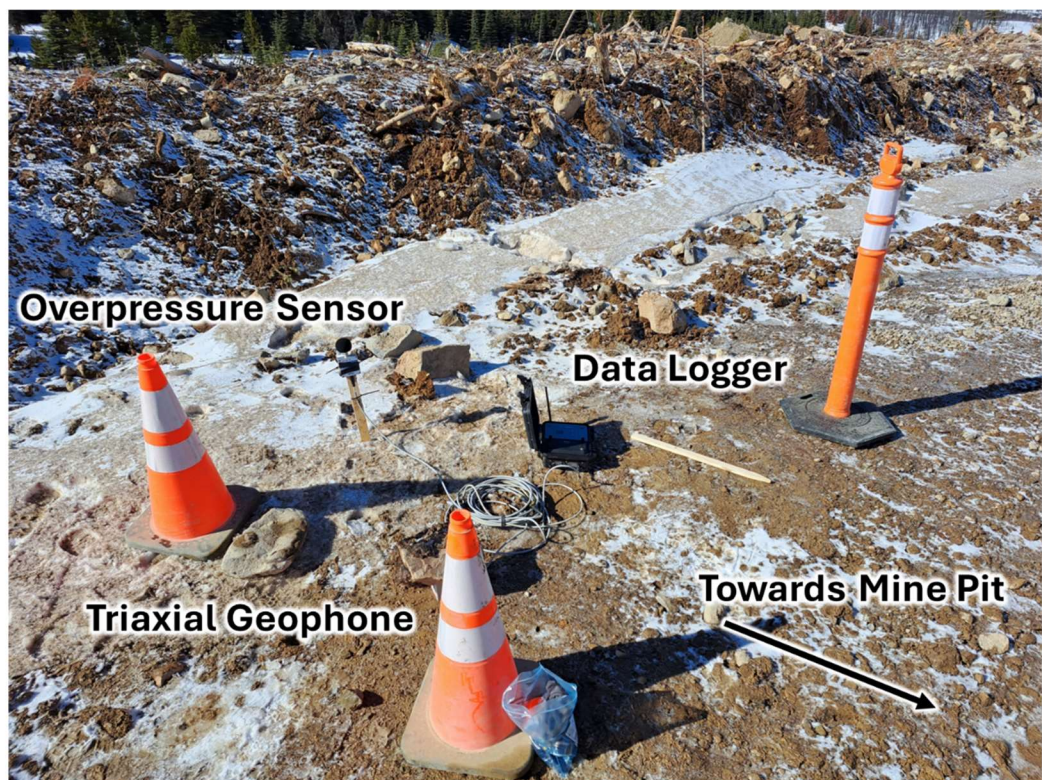


Photo 1. Monitoring Equipment



RESULTS

Results of the captured blasts at the pit boundary and estimated levels at the mine boundary are summarized in Table 1.

Ground-vibration and air overpressure extrapolation was completed using propagation calculations provided in the Blaster’s Handbook 18th edition (ISEE, 2011). The propagation calculations between the measurement and assessment locations are provided in Attachment A, the calculation result for the most conservative propagations are shown. The measured setback distances used in the propagation calculation are measured from the furthest part of the blast area. Measuring this way provides a conservative estimate for the propagated levels.

Due to softening ground conditions in support for the microphone fell over, blasts collected between May 4 and May 11, 2025 were considered invalid and therefore discarded. Three acceptable blasts from when the equipment was positioned as intended are presented here.

Table 1. Blast Monitoring Summary

Date and Time	At Measurement Location (Mine Pit Boundary)		At Assessment Location (Mine Project Boundary)		Compliance at Assessment Location?
	Maximum Overpressure Level (dB)	Peak Particle Velocity (mm/s) ¹	Maximum Overpressure Level (dB)	Peak Particle Velocity (mm/s) ¹	
2025-04-29 14:37	121	5.1	117	2.6	Yes
2025-05-01 14:14	133	13.0	128	5.5	Yes
2025-05-14 14:15	125	13.3	121	6.5	Yes

Notes:

1. Vector sum of vertical, horizontal and longitudinal components.

The sensor data for each event is presented in Figure 2.1, 2.2 and 2.3.

CONCLUSION

The results indicate that the ground vibration and concussive noise at the project boundary meet the criteria with the current blasting protocol. No adaptive management action is required.



STATEMENT OF LIMITATIONS

This document entitled *Blast Monitoring – Start of Blasting* was prepared by RWDI AIR Inc. (“RWDI”) for Blackwater Gold Inc. (“Client”). The results presented in this document have been conducted for the Client and are specific to the project described herein (“Project”). The results represent site conditions at the time the measurements were taken. Since equipment noise and vibration levels may change over time, it is recommended that RWDI be retained by the Client to verify applicability prior to relying on this data for another purpose.

The data contained in this document have also been presented for the specific purpose(s) set out herein. Should the Client or any other third party utilize the document and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this document carefully review the stated assumptions contained herein to understand the different factors which may impact the conclusions and recommendations provided.



Monitoring and Blast Locations

Map Projection: NAD 1983 UTM Zone 10N
Artemis Gold - Blackwater Mine, British Columbia



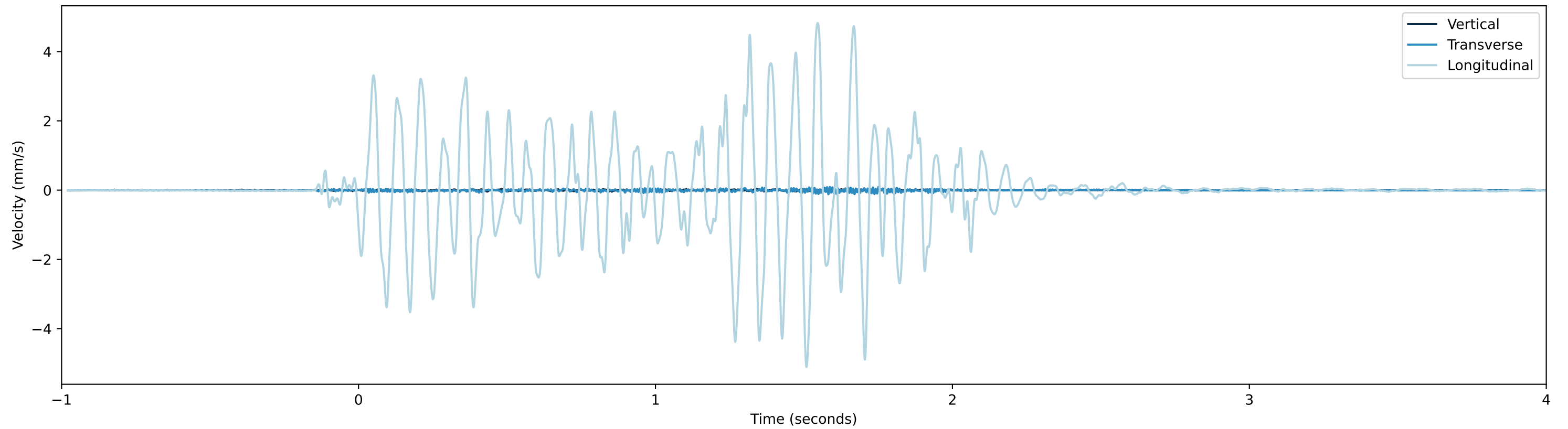
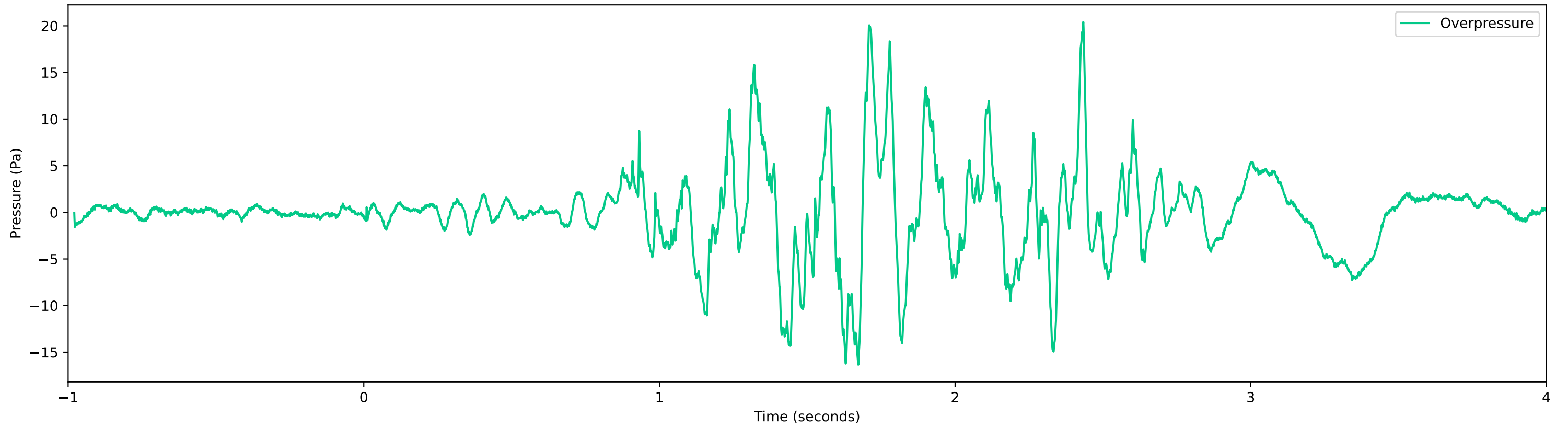
Drawn by: LRC | Figure: 1

Approx. Scale: 1:10,000

Date Revised: Sep 19, 2025



Project #: 2508423



Blast Overpressure and Vibration
Blast Around 2025-04-29 14:37 (Pacific)

Artemis Gold - Blackwater Mine, British Columbia

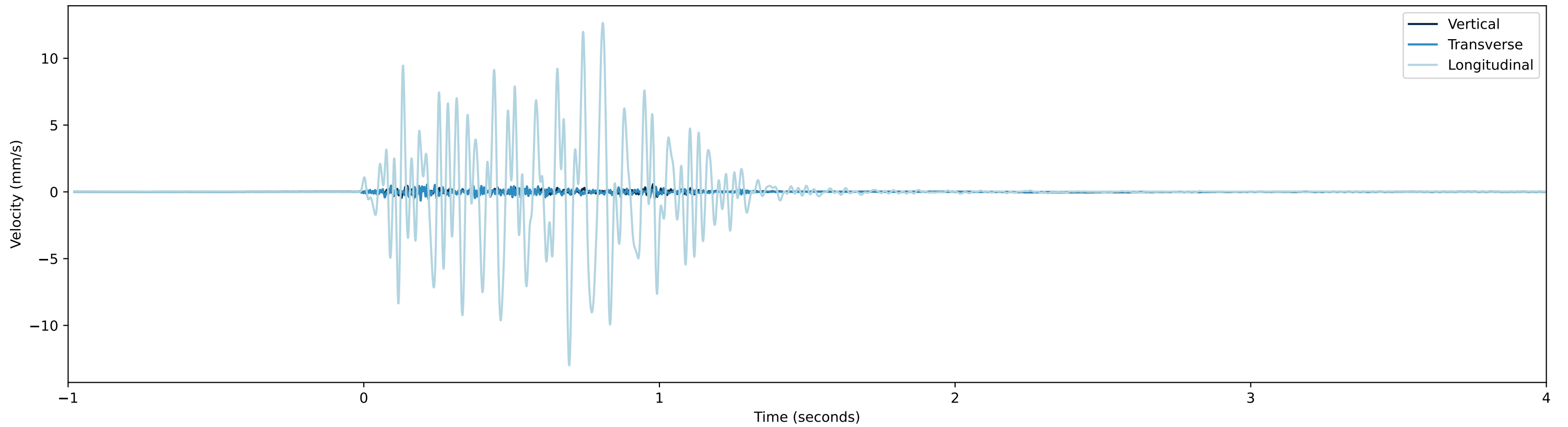
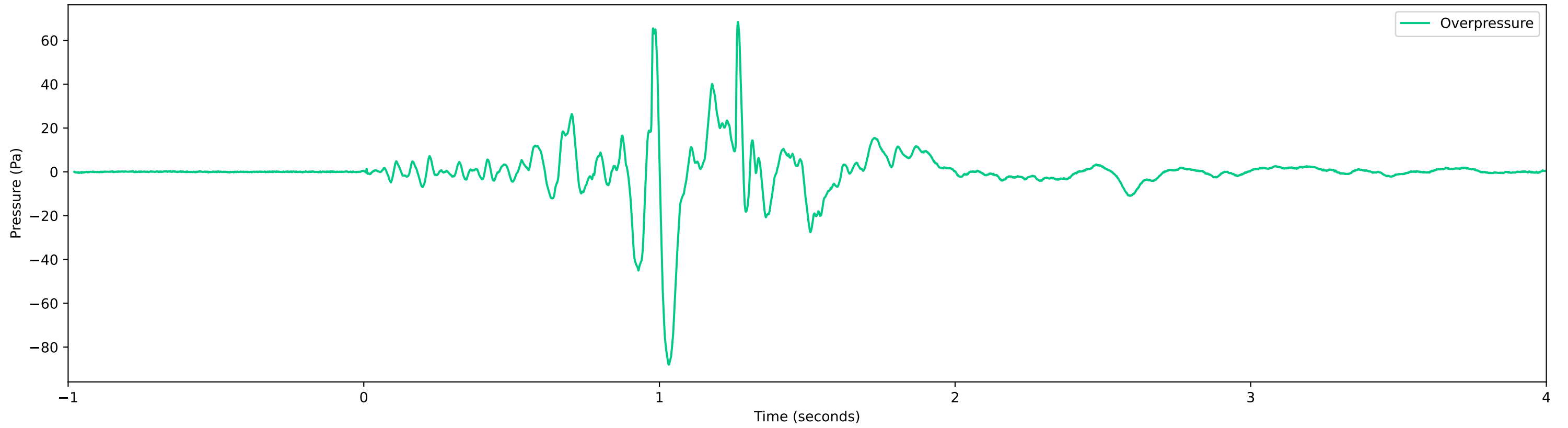
Figure No. 2.1

Drawn By: LRC

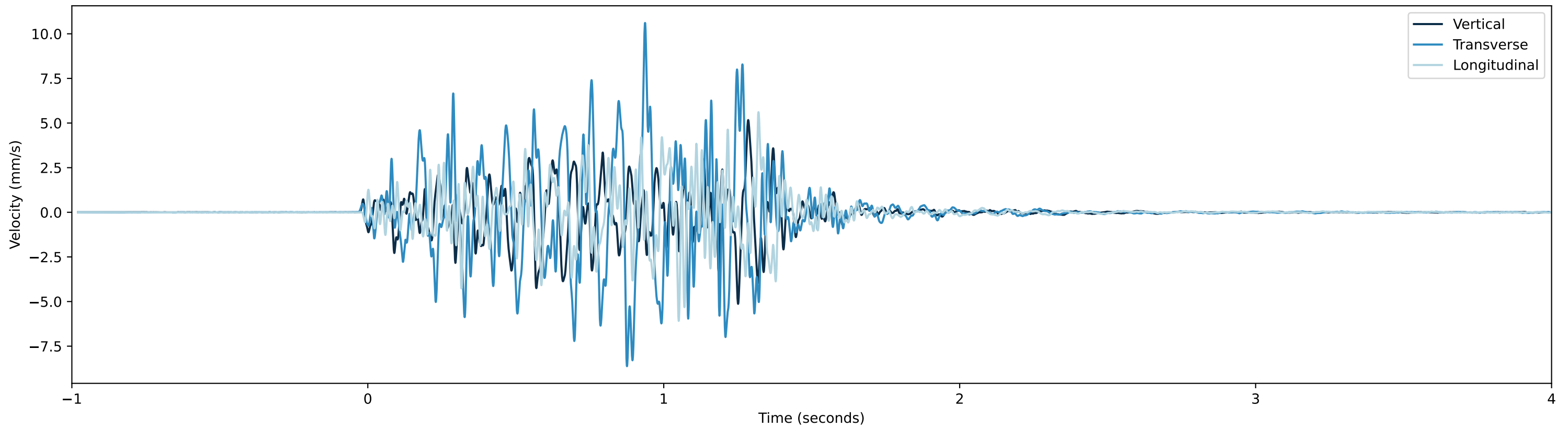
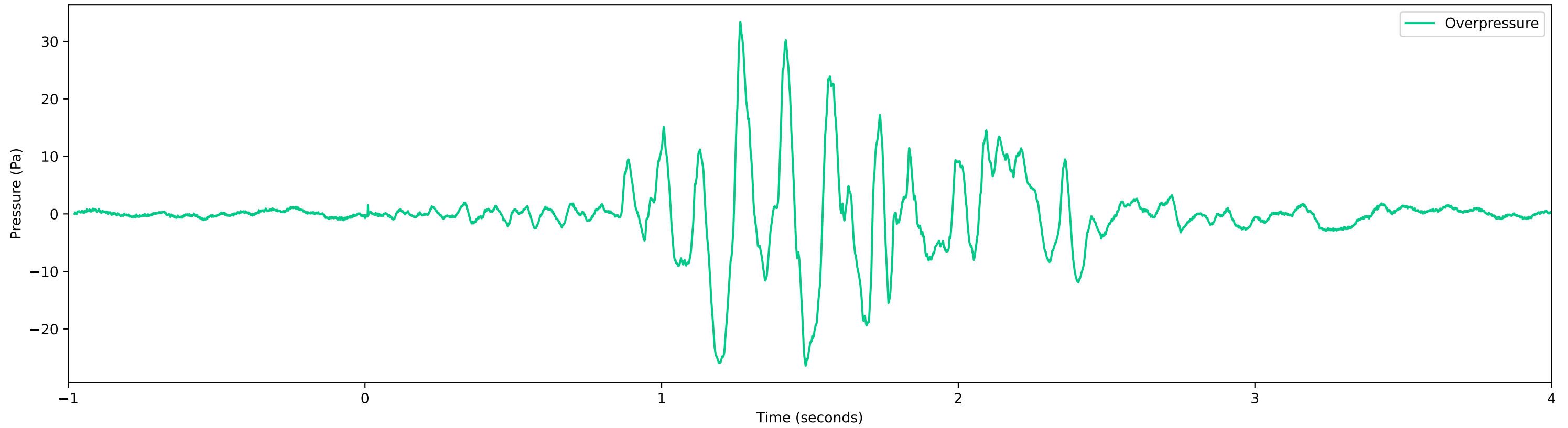
Date Revised: 2025-08-12

Project #: 2508423





Blast Overpressure and Vibration Blast Around 2025-05-01 14:14 (Pacific) Artemis Gold - Blackwater Mine, British Columbia	Figure No. 2.2	Drawn By: LRC	
	Date Revised: 2025-08-12		



Blast Overpressure and Vibration Blast Around 2025-05-14 14:15 (Pacific) Artemis Gold - Blackwater Mine, British Columbia	Figure No. 2.3	Drawn By: LRC	
	Date Revised: 2025-08-12		

ATTACHMENT A



General Acoustic Calculation Worksheet



Octave-Bands

Project Name: Blackwater
 Job #: 2508423

User: Lorenzo Carboni
 Date: 9/18/2025
 QA: Matthew Johnston

Item Heading	Description	Reference	Sched. Value	KEY VALUES			OCTAVE-BAND SPECTRA							
							31.5	63	125	250	500	1000	2000	4000
Blast Propagation of a Measurement														
Measurement: 2025-04-29 14:37														
Vibration														
	Measurement Parameters			Value										
	Peak Particle Velocity at Measurement Location	V1		5.1 mm/s										
	Source to Measurement Location Distance	R1		433 m										
	Source to Assessment Location Distance	R2		803 m										
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation													
	Blasters Handbook Table 26.3													
	Blasting	Source		Metric (mm/s)										
	Construction (Best Fit)	USBM RI 8507		A	B	V2								
				53	1.09	2.6 mm/s								
Overpressure														
	Measurement Parameters			Value										
	Air Overpressure at Measurement Location	Ps1		121.0 dB										
	Air Overpressure at Measurement Location	P1		0.224 mb										
	Source to Measurement Location Distance	R1		433 m										
	Source to Assessment Location Distance	R2		803 m										
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation													
	Blasters Handbook Table 26.7													
	Blasting	Source		A	B	P2	Ps2							
	Metal Mine (Best Fit)	USBM RI 8485		14.3	0.71	0.145 mb	117 dB							

General Acoustic Calculation Worksheet



Octave-Bands

Project Name: Blackwater
Job #: 2508423

User: Lorenzo Carboni
Date: 9/18/2025
QA: Matthew Johnston

Item Heading	Description	Reference	Sched. Value	KEY VALUES			OCTAVE-BAND SPECTRA							
							31.5	63	125	250	500	1000	2000	4000
Blast Propagation of a Measurement														
Measurement: 2025-05-01 14:14														
Vibration														
	Measurement Parameters			Value										
	Peak Particle Velocity at Measurement Location	V1		13.0 mm/s										
	Source to Measurement Location Distance	R1		312 m										
	Source to Assessment Location Distance	R2		682 m										
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation													
	Blasters Handbook Table 26.3													
	Blasting	Source		Metric (mm/s)										
	Construction (Best Fit)	USBM RI 8507		A	B	V2								
				53	1.09	5.5 mm/s								
Overpressure														
	Measurement Parameters			Value										
	Air Overpressure at Measurement Location	Ps1		133.0 dB										
	Air Overpressure at Measurement Location	P1		0.893 mb										
	Source to Measurement Location Distance	R1		312 m										
	Source to Assessment Location Distance	R2		682 m										
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation													
	Blasters Handbook Table 26.7													
	Blasting	Source		Metric (millibar)										
	Metal Mine (Best Fit)	USBM RI 8485		A	B	P2	Ps2							
				14.3	0.71	0.513 mb	128 dB							

General Acoustic Calculation Worksheet



Octave-Bands

Project Name: Blackwater
Job #: 2508423

User: Lorenzo Carboni
Date: 9/18/2025
QA: Matthew Johnston

Item Heading	Description	Reference	Sched. Value	KEY VALUES			OCTAVE-BAND SPECTRA										
							31.5	63	125	250	500	1000	2000	4000	8000		
Blast Propagation of a Measurement																	
Measurement: 2025-05-14 14:15																	
Vibration																	
	Measurement Parameters			Value													
	Peak Particle Velocity at Measurement Location	V1		13.3 mm/s													
	Source to Measurement Location Distance	R1		402 m													
	Source to Assessment Location Distance	R2		772 m													
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation																
	Blasters Handbook Table 26.3																
	Blasting	Source		Metric (mm/s)													
	Construction (Best Fit)	USBM RI 8507		A	B	V2											
				53	1.09	6.5 mm/s											
Overpressure																	
	Measurement Parameters			Value													
	Air Overpressure at Measurement Location	Ps1		125.0 dB													
	Air Overpressure at Measurement Location	P1		0.356 mb													
	Source to Measurement Location Distance	R1		402 m													
	Source to Assessment Location Distance	R2		772 m													
	Note that A is displayed for informational purposes only, B is the coefficient that defines the propagation																
	Blasters Handbook Table 26.7																
	Blasting	Source		Metric (millibar)													
	Metal Mine (Best Fit)	USBM RI 8485		A	B	P2	Ps2										
				14.3	0.71	0.224 mb	121 dB										