

Appendix 40

Meadowbank and Whale Tail 2018 Blast Monitoring Report

ANNUAL REPORT MEMORANDUM

Agnico Eagle Mines Ltd Meadowbank Division
Environment Department

SUBJECT: 2018 Meadowbank and Whale Tail Blast Monitoring Report for the Protection of Nearby Fish Habitat

1. Introduction and Objectives

In accordance with NIRB Project Certificate No.004 Condition 85 and Project Certificate No. 008 Condition 22, Agnico Meadowbank Division developed a blasting program which complies with *The Guidelines for the Use of Explosives In or Near Canadian Fisheries Water* (Wright and Hopky, 1998) as modified by the DFO for use in the North and adhere to guidance provided in *Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies* (Cott and Hanna, 2005). As a result, Agnico conducts monitoring to evaluate blast related peak particle velocity and overpressure to protect nearby fish bearing waters.

The detonation of explosives in or near water produces compressive shock waves that can cause significant impacts to the swim bladders of fish, rupture other internal organs and/or damage or kill fish eggs and larvae. In addition, the effects of the shock waves can be intensified in the presence of ice. Consequently, the Guidelines for the Use of Explosives In or Near Canadian Fisheries Water guidelines have been developed by DFO to protect fish and fish habitat from works or undertakings that involve explosives in or near fisheries waters. Guidance provided in *Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies* (Cott and Hanna, 2005) was also followed. It includes the following requirements:

1. No explosive is to be detonated in or near fish habitat that produces an instantaneous pressure change (IPC) greater than 100 kPa in the swim bladder of a fish; representatives from DFO requested that Agnico use a value of 50 kPa instead of 100 kPa; and
2. No explosive is to be detonated that produces a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation (for lakes near the Meadowbank mine, it takes place between August 15 and June 30).

Peak particle velocity (PPV) and overpressure monitoring data was recorded throughout 2018 during blasting activities at Meadowbank (North Portage Pit, South Portage Pit, Vault Pit, Phaser Pit and BB Phaser Pit) and Whale Tail (Quarry 1, Quarry 2 and Whale Tail Pit). The locations of the blast monitoring stations in 2018 for Meadowbank, Vault and Whale Tail Pit are found in Table 1 and Figure 1, 2 and 3 below.

Table 1: 2018 blast monitoring stations

Station	Easting	Northing
Portage Pit North	639,457	7,214,597
Portage Pit South	639,349	7,213,663
Vault Pit station #2	641,906	7,220,973
Whale Tail Station 1	607,104	7,255,860
Whale Tail Station 2	607,132	7,254,698
Mammoth Station 1	606,055	7,255,204

No more blast monitoring was conducted at Goose Pit since 2015 as mining has ceased in this pit in April 2015. The blast monitoring station (Goose Pit (14W 7212116N 638881E)) was originally situated on the Bay Goose Dike near the Third Portage Lake East Basin.

Vault Pit station #1 (14W 7219726N 640741E), located between the Vault Attenuation Pond (dewatered Vault Lake) and the Vault Pit, was also not monitored in 2018 as the nearest potential fish habitat is in Wally Lake and the Vault Pit station #2 is used to monitor the potential impact.

These monitoring stations are also illustrated in Figure 1 for Goose Pit and Figure 2 for Vault Pit.

Figure 1 - Portage and Goose Pit Blast Monitoring Stations

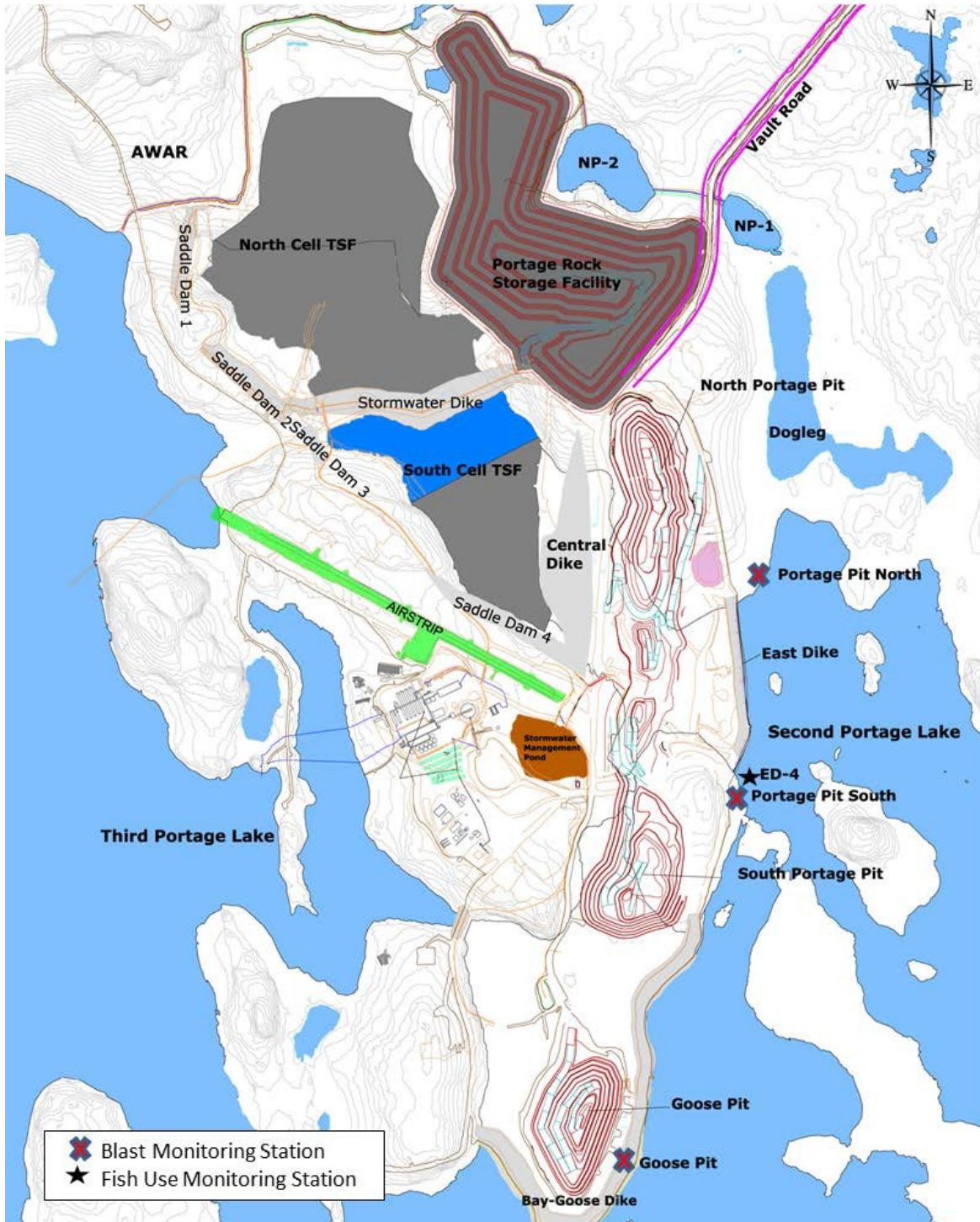


Figure 2 - Vault Pit Blast Monitoring Stations

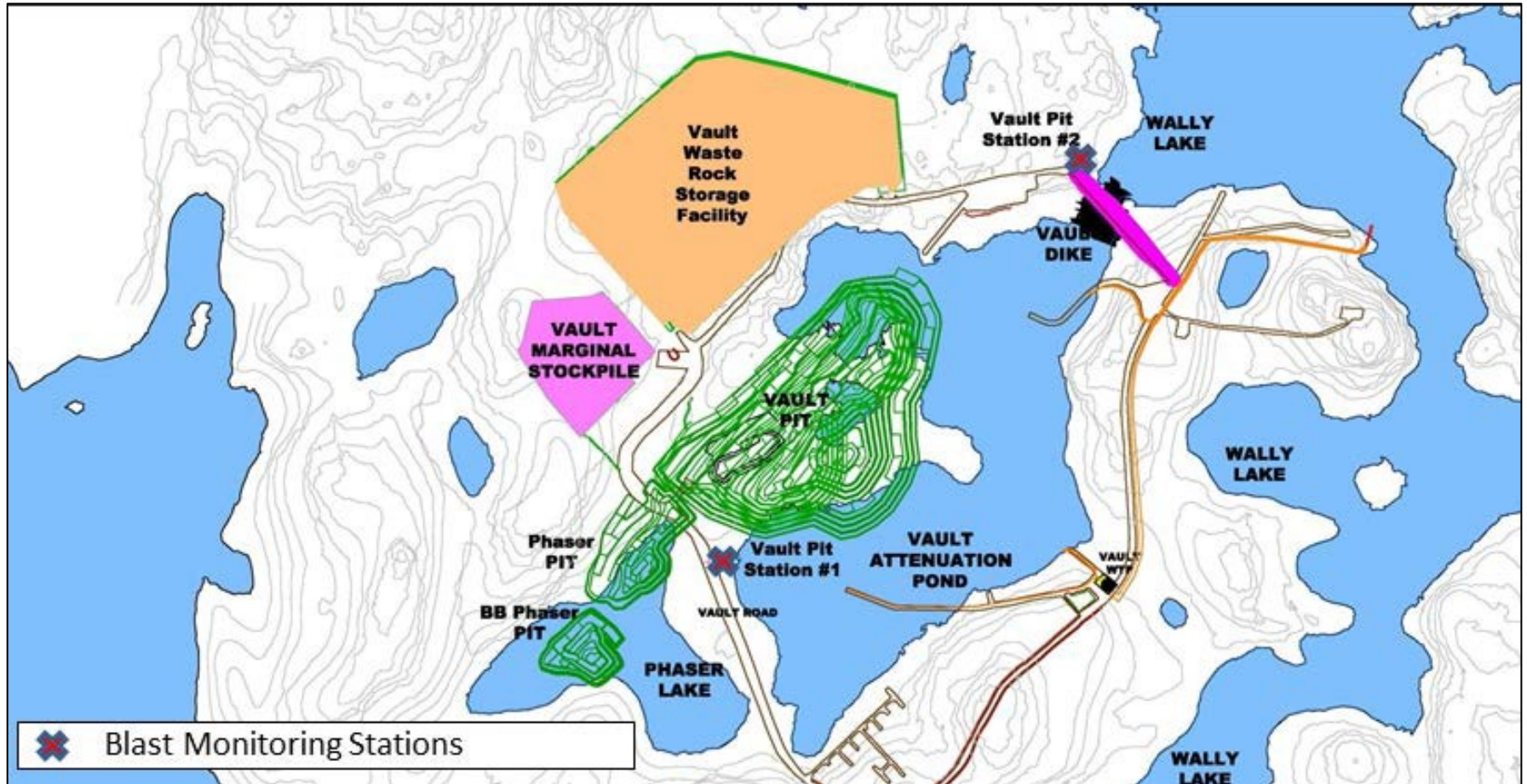
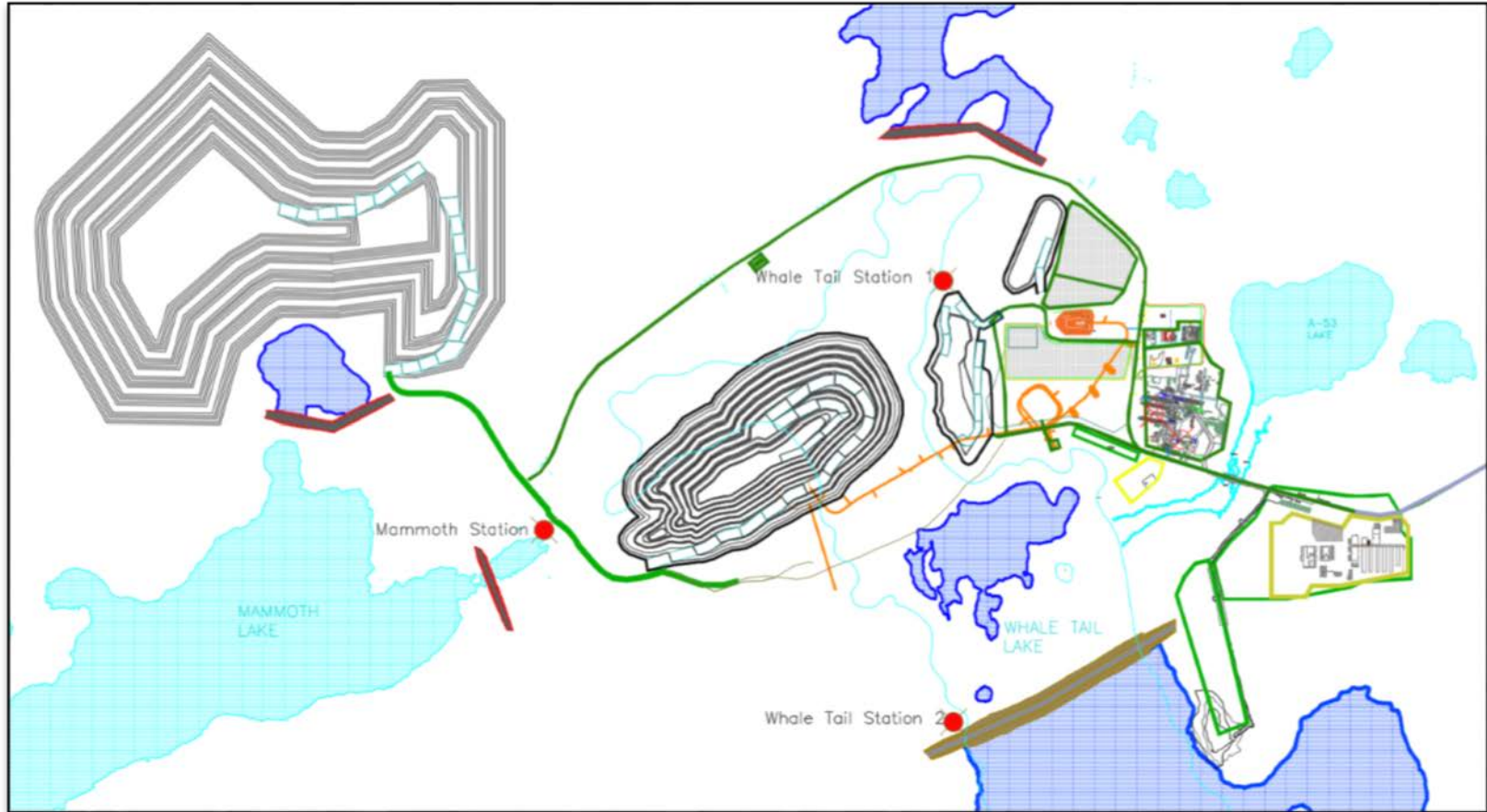


Figure 3 – Whale Tail Blast Monitoring Stations



2. Methods

2.1- Blast Monitoring

Blasts were monitored using an Instantel Minimate Blaster which is fully compliant with the international Society of Explosives and Engineers performance specifications for blasting seismographs (Instantel, 2005). The Minimate Blaster has three main parts: a monitor, a standard transducer (geophone) and a microphone. The monitor contains the battery and electronic components of the instrument. It also checks the two sensors to ensure they are functioning. The transducer measures ground vibration with a mechanism called a geophone.

This instrument measures transverse, vertical and longitudinal ground vibrations. Transverse ground vibrations agitate particles in a side to side motion. Vertical ground vibrations agitate particles in an up and down motion. Longitudinal ground vibrations agitate particles in a back and forth motion progressing outward from the event site (Instantel, 2005). The Minimate Blaster calculates the PPV for each geophone and calculates the vector sum of the three axes. The final result is the Peak Vector Sum (PVS) and is the resultant particle velocity magnitude of the event:

$$PVS = \sqrt{(T^2 + V^2 + L^2)}$$

Where:

T = particle velocity along the transverse plane

V = particle velocity along the vertical plane

L = particle velocity along the longitudinal plane

The transducer is installed as per the model specifications. All monitoring follows Agnico Blast Monitoring Program (2019).

2.2- Data Analysis

The blast monitoring data was screened to ensure blast PPV and IPC monitoring results corresponded to a single blast event. As previously discussed, in 2018 the blast engineers thoroughly documented blast patterns, sequencing, and detonation results to track the material accurately, optimize blasts and review procedures. As a result, blast monitoring data is collected as a composite of blast patterns and may include multiple blast patterns that could have occurred during the same monitoring event (i.e. a single PPV and IPC value for 3 blast patterns). The data was screened to remove all redundant data points (such as replicate readings).

3. Results, Discussion and Conclusions

PPV and IPC blast monitoring results are presented in Table 3.

In 2018, 214 blasts were monitored at Meadowbank. There were no PPV exceedance and IPC measurements were all below the DFO limit of 50 kpa.

For Whale Tail, 45 blasts were monitored and there were, two (2) PPV concentrations exceeded the DFO limit of 13 mm/s.

The two exceedances were recorded in 2018 and occurred during period of egg incubation (egg incubation period is from August 15 to June 30). These two events were located at Whale Tail:

- The first exceedance was recorded at Whale Tail Station #1 for the 5144PSA52_SEQ1 with 16.8 mm/s on March 22nd. For this blast, nine (9) preshear holes were detonated on the same delay, which isn't significantly higher than what was previously done at Whale Tail and Meadowbank for 14m holes. To mitigate the probability of another exceedance for preshear holes, mitigation technique number four from the Blast Monitoring Plan was used. This technique is to reduce the explosives quantity per delay. Since this event, no exceedances were observed for preshear holes.
- The second exceedance was recorded at Whale Tail Station #1 at 26.1 mm/s for pattern 5144A55 blasted on April 30th. This blast was for Attenuation Pond 5 where previous blasts were not yielding enough movement, in order to remediate this, delay between rows were shortened from 176ms to 66ms. Shortening the delay between rows increased our PPV over the limit, Therefore, in order to reduce the PPV and reduce the probability of exceeding the 13mm/s maximum, delay between rows were brought back to 176ms.

Summary of exceedance since 2013 is presented in Table 2.

No IPC measurements were all below the DFO limit of 50 kpa.

The blast monitoring results are reviewed after each blast and the blast mitigation plan was implemented immediately if the vibrations or the overpressure exceeded the guidelines. This plan includes a retroactive analysis to determine what caused the higher than expected results.

Table 2: Meadowbank and Whale Tail PPV exceedance 2013-2018

Year	PPV exceedance Meadowbank	PPV exceedance Whale Tail
2013	16	No activities
2014	8	No activities
2015	2	No activities
2016	0	No activities
2017	0	No activities
2018	0	2
Total	26	2

Additionally, two exceedances were recorded on the quarry located on KM10 of the Whale Tail

Haul Road (1000QY100-1-3). However, after investigation, the instrument was not properly installed and was placed next to the blast and not next to the closest fish bearing waterbody for both of the events. Going forward, it will be imperative to develop a proper blast monitoring plan for every blasting activity outside of the areas covered in the current blast monitoring plan (for Portage, Vault and Whale Tail Pit).

In 2018, the average PPV was 0.43 mm/s with a maximum of 7.43mm/s for Portage and Vault Pit. This decrease in both maximum and average values can be explained by the fact that more blasting occurred in Vault Pit where almost no vibrations are detected by the Instatel blast monitor compared to Portage. Furthermore, both Portage and Vault Pits are deeper and increasing the effective distance between the blast and the Instatel monitoring device.

In 2018, for Whale Tail Pit, the average PPV was 4.18mm/s with a maximum of 26.1mm/s. As previously mentioned, measures have been put in place to minimize the probability of having a PPV exceedance.

Table 3: Maximum and average PPV per year

Location	Parameters	2013	2014	2015	2016	2017	2018
Meadowbank (Portage and Vault, Phaser and BB Pit)	Max PPV (mm/s)	32.7	23.8	16.5	9.54	11.9	7.43
	Average PPV (mm/s)	5.39	3.93	2.38	1.18	0.78	0.43
Whale Tail Pit	Max PPV (mm/s)	No Activities	No Activities	No Activities	No Activities	No Activities	26.1
	Average PPV (mm/s)	No Activities	No Activities	No Activities	No Activities	No Activities	4.18

As discussed in the 2011 monitoring report, Wright (1982)¹, determined that peak particle velocity greater than 13 mm/s is potentially damaging to incubating eggs, however Faulkner et al. (2006)², found no effects on lake trout eggs due to blasts at Diavik Mine, NWT with maximum PPVs of 28.5 mm/s. Faulkner et al. (2006) measured mean PPV at three exposure stations from September to July, 2003-2004 and found a mean range of 5.8 - 6.4 mm/s and reported 80 exceedances of 13 mm/s PPV at these stations with a maximum PPV being double the DFO guideline. They found there were no differences in mortality of lake trout eggs in incubators between exposure sites and reference sites that resulted from blasting at Diavik in 2003-2004. As a result, Agnico suggests that additional studies may not be necessary to confirm low PPV at spawning and incubation sites, since results of this study suggest impacts are likely not occurring even if no

¹ Wright, D.G. 1982. A Discussion Paper on the Effects of Explosives on Fish and Marine Mammals in the Waters of the Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences 1052.

² Faulkner, Sean G., Tonn, William, Welz, Marek, Welz, and Schmitt, Douglas. 2006. Effects of Explosives on Incubating Lake Trout Eggs in the Canadian Arctic. North American Journal of Fisheries Management. 26:833-842.

attenuation of PPV is occurring between blast monitoring sites and spawning habitat.

In 2017, monitoring of habitat compensation features (i.e. dike faces) was conducted by Agnico in Second Portage Lake. Angling (17h) and underwater camera (28h) techniques were used along the East Dike and the Second Portage Lake reference station to establish fish presence. In total, 12 fish were caught at the station (ED-4) nearest to peak particle velocity exceedances recorded in 2016 (i.e. South Portage Pit blast monitoring station) (See 2016 Blast Monitoring Report in Appendix G6 of the 2016 Annual Report). The location of station ED-4 is illustrated on Figure 1. In comparison, 11 fish were caught at the Second Portage Lake reference station. Five (5) and zero (0) fish were captured by underwater camera video at ED-4 and Second Portage Lake Reference Area, respectively. This indicates that fish use of habitat near recorded exceedances in 2015 is not reduced compared to reference stations. Although the fish use monitoring does not coincide with the blast exceedances, it confirms no avoidance of the habitat closest to Agnico's main operations. In 2017, Agnico started partial construction of the new habitat compensation feature of dike faces in Second Portage Lake. This was not continued in 2018. A comparison of blast and habitat compensation result will permit to confirm the previous affirmation and fish use pattern once construction has been finalized.

Table 4 - 2018 PPV and IPC blast monitoring results

Area	Date of Blast	Station	Blast Pattern	Peak Particulate Velocity	Peak Sound Pressure	(sec)
				(mm/s)	(kpa)	
DFO Limit				13	50	
MARGINAL STP	23/08/2018	Portage Pit South	5150SP100-1	0	0	0
	10/9/2018	Portage Pit South	5150SP100-2	0	0	0
	4/10/2018	Portage Pit South	5146SP100-1	0	0	0
	26/10/2018	Portage Pit South	5146SP102-1	0	0	0
	25/11/2018	Portage Pit South	5146SP104-1	0	0	0
	16/12/2018	Portage Pit South	5150SP112-1	0	0	0
	19/12/2018	Portage Pit South	5150SP112-2	0	0	0
PORTAGE PIT	6/1/2018	Portage Pit South	5067RA673-1	0	0	0
	11/1/2018	Portage Pit South	5067671-1	2.92	0.0123	4.591
	14/01/2018	Portage Pit South	5074680-1	1.22	0.00925	1.923
	22/01/2018	Portage Pit South	5004354-1	2.42	0.00425	2.111
	26/01/2018	Portage Pit South	5081621-1	0	0	0
	27/01/2018	Portage Pit South	5067675-1	0	0	0
	18/02/2018	Portage Pit South	5067677-1	0	0	0
	27/02/2018	Portage Pit South	4997353-1	0	0	0
	2/3/2018	Portage Pit South	5067679-1	0	0	0
	9/3/2018	Portage Pit South	5067681-1	0	0	0
	23/03/2018	Portage Pit South	5046PS670-2	0	0	0
	25/03/2018	Portage Pit South	5046PS674-2	0	0	0
	28/03/2018	Portage Pit South	5046PS678-2	0	0	0
	31/03/2018	Portage Pit South	5060674-1	0	0	0

4/4/2018	Portage Pit South	5060672-1	0	0	0
7/4/2018	Portage Pit South	5067PP679-1	0	0	0
9/4/2018	Portage Pit South	5046PS682-1	0	0	0
14/04/2018	Portage Pit South	5046PS682-2	2.51	0.00075	0.064
23/04/2018	Portage Pit South	5046PS671-1	0	0	0
28/04/2018	Portage Pit South	5053671-1	0	0	0
5/5/2018	Portage Pit South	5053675-1	0	0	0
6/5/2018	Portage Pit South	5053RA673-1	0	0	0
13/05/2018	Portage Pit South	5053679-1	0	0	0
15/05/2018	Portage Pit South	5053677-1	1.69	0.005	3.478
30/05/2018	Portage Pit South	5046678-1	0	0	0
4/6/2018	Portage Pit South	5046RA672-1	1.49	0.0035	0.1
11/6/2018	Portage Pit South	5046676-1	1.3	0.0125	2.868
20/06/2018	Portage Pit South	5046670-1	0	0	0
23/06/2018	Portage Pit South	5046680-1	0	0	0
24/06/2018	Portage Pit South	5046676-2	0	0	0
29/06/2018	Portage Pit South	5025PS671-1	0	0	0
2/7/2018	Portage Pit South	5025PS671-2	1.26	0.012	2.029
5/7/2018	Portage Pit South	5046674-1	2.08	0.0353	2.619
7/7/2018	Portage Pit South	5039673-1	4.97	0.016	3.5
10/7/2018	Portage Pit South	5025PS679-2	4.73	0.0365	1.87
14/07/2018	Portage Pit South	5039679-1	3.98	0.0113	1.658
17/07/2018	Portage Pit South	5039681-1	0	0	0
23/07/2018	Portage Pit South	5039671-1	0.861	0.00275	3.601

25/07/2018	Portage Pit South	5025PS679-3	5.01	0.0163	6.155
30/07/2018	Portage Pit South	5039683-1	2.53	0.0135	0.596
7/8/2018	Portage Pit South	5032674-1	0	0	0
8/8/2018	Portage Pit South	5039671-2	3.84	0.0075	1.143
8/8/2018	Portage Pit South	5025PS675-1	0	0	0
11/8/2018	Portage Pit South	5025PS675-2	0	0	0
13/08/2018	Portage Pit South	5025PS675-3	0	0	0
18/08/2018	Portage Pit South	5039677-1	0	0	0
1/9/2018	Portage Pit South	EMULSION PLAN-1	0	0	0
4/9/2018	Portage Pit South	5025651-1	0	0	0
7/9/2018	Portage Pit South	5032682-1	0	0	0
9/9/2018	Portage Pit South	5025653-1	0	0	0
13/09/2018	Portage Pit South	5032684-1	0	0	0
19/09/2018	Portage Pit South	5032680-1	1.66	0.0025	1.152
22/09/2018	Portage Pit South	5032676-1	2.75	0.00925	1.935
3/10/2018	Portage Pit South	BOULDER000-2	0	0	0
6/10/2018	Portage Pit South	5025657-1	2.17	0.00823	4.86
11/10/2018	Portage Pit South	5032SL680-1	0	0	0
18/10/2018	Portage Pit South	5025655-1	5.68	0.0755	4.085
21/10/2018	Portage Pit South	5025659-1	3.75	0.0443	2.914
24/10/2018	Portage Pit South	5004PS602-2	4.19	0.0295	2.168
28/10/2018	Portage Pit South	5018650-1	2.85	0.008	3.679
31/10/2018	Portage Pit South	5004PS606-2	3.61	0.00925	3.119
2/11/2018	Portage Pit South	5004PS608-1	0	0	0

	3/11/2018	Portage Pit South	5004PS608-2	0	0	0
	3/11/2018	Portage Pit South	5018654-1	2.16	0.00575	2.407
	4/11/2018	Portage Pit South	5025681-1	1.49	0.00725	0.067
	6/11/2018	Portage Pit South	5018656-1	1.87	0.0125	1.667
	16/11/2018	Portage Pit South	5018658-1	1.14	0.0185	1.781
	19/11/2018	Portage Pit South	5004PS604-3	0	0	0
	24/11/2018	Portage Pit South	5018660-1	0	0	0
	27/11/2018	Portage Pit South	5018662-1	0	0	0
	28/11/2018	Portage Pit South	5004PS668-2	0	0	0
	30/11/2018	Portage Pit South	5018664-1	0	0	0
	3/12/2018	Portage Pit South	5004PS668-4	0	0	0
	9/12/2018	Portage Pit South	5018668-1	0	0	0
	10/12/2018	Portage Pit South	5004PS651-1	0	0	0
	16/12/2018	Portage Pit South	5011651-1	7.43	0.0305	3.905
	18/12/2018	Portage Pit South	5004PS670-1	0	0	0
	22/12/2018	Portage Pit South	5018670-1	5.52	0.0335	1.844
	25/12/2018	Portage Pit South	5011653-1	0	0	0
VAULT PIT	1/1/2018	Vault Pit Station #2	5011825-1	0	0	0
	2/1/2018	Vault Pit Station #2	5116918-1	0	0	0
	5/1/2018	Vault Pit Station #2	5011823-1	0	0	0
	8/1/2018	Vault Pit Station #2	5004800-1	0	0	0
	16/01/2018	Vault Pit Station #2	5004802-1	0	0	0
	17/01/2018	Vault Pit Station #2	5116910-1	0	0	0
	19/01/2018	Vault Pit Station #2	5004808-1	0	0	0

20/01/2018	Vault Pit Station #2	5116908-1	0	0	0
23/01/2018	Vault Pit Station #2	5004804-1	0	0	0
24/01/2018	Vault Pit Station #2	5004806-1	0	0	0
25/01/2018	Vault Pit Station #2	5116912-1	0	0	0
29/01/2018	Vault Pit Station #2	5004RA810-1	0	0	0
3/2/2018	Vault Pit Station #2	5004812-1	0	0	0
4/2/2018	Vault Pit Station #2	5109SU901-1	0	0	0
5/2/2018	Vault Pit Station #2	5004RA810-2	0	0	0
8/2/2018	Vault Pit Station #2	5004816-1	0	0	0
9/2/2018	Vault Pit Station #2	5109903-1	0	0	0
11/2/2018	Vault Pit Station #2	5130B02-1	0	0	0
14/02/2018	Vault Pit Station #2	5130B06-1	0	0	0
17/02/2018	Vault Pit Station #2	5109905-1	0	0	0
21/02/2018	Vault Pit Station #2	5109911-1	0	0	0
22/02/2018	Vault Pit Station #2	5004818-1	0	0	0
25/02/2018	Vault Pit Station #2	5109913-1	0	0	0
28/02/2018	Vault Pit Station #2	5130B08-1	0	0	0
1/3/2018	Vault Pit Station #2	4983PS801-1	0	0	0
2/3/2018	Vault Pit Station #2	4983PS817-1	0	0	0
3/3/2018	Vault Pit Station #2	4983PS801-2	0	0	0
4/3/2018	Vault Pit Station #2	5109917-1	0	0	0
5/3/2018	Vault Pit Station #2	5109RA907-1	0	0	0
6/3/2018	Vault Pit Station #2	4997801-1	0	0	0
8/3/2018	Vault Pit Station #2	4997805-1	0	0	0

10/3/2018	Vault Pit Station #2	4997803-1	0	0	0
11/3/2018	Vault Pit Station #2	5109915-1	0	0	0
16/03/2018	Vault Pit Station #2	4997807-1	0	0	0
18/03/2018	Vault Pit Station #2	4997RA809-1	0	0	0
19/03/2018	Vault Pit Station #2	5088PS902-1	0	0	0
21/03/2018	Vault Pit Station #2	4997811-1	0	0	0
25/03/2018	Vault Pit Station #2	4997815-1	0	0	0
6/4/2018	Vault Pit Station #2	5109921-1	0	0	0
11/4/2018	Vault Pit Station #2	5109919-1	0	0	0
13/04/2018	Vault Pit Station #2	4990800-1	0	0	0
14/04/2018	Vault Pit Station #2	5109PSB01-1	0	0	0
16/04/2018	Vault Pit Station #2	4990802-1	0	0	0
18/04/2018	Vault Pit Station #2	5109PSB01-2	0	0	0
20/04/2018	Vault Pit Station #2	5123B01-1	0	0	0
21/04/2018	Vault Pit Station #2	4990RA804-1	0	0	0
22/04/2018	Vault Pit Station #2	5102SU906-1	0	0	0
27/04/2018	Vault Pit Station #2	4990806-1	0	0	0
1/5/2018	Vault Pit Station #2	5088PS906-1	0	0	0
2/5/2018	Vault Pit Station #2	4990808-1	0	0	0
5/5/2018	Vault Pit Station #2	5102906-1	0	0	0
8/5/2018	Vault Pit Station #2	5123B05-1	0	0	0
9/5/2018	Vault Pit Station #2	5088PS910-2	0	0	0
11/5/2018	Vault Pit Station #2	5088PS908-1	0	0	0
14/05/2018	Vault Pit Station #2	5102908-1	0	0	0

16/05/2018	Vault Pit Station #2	4983RA801-1	0	0	0
17/05/2018	Vault Pit Station #2	5102912-1	0	0	0
19/05/2018	Vault Pit Station #2	5123B03-1	0	0	0
20/05/2018	Vault Pit Station #2	4983SU813-1	0	0	0
22/05/2018	Vault Pit Station #2	4983805-1	0	0	0
24/05/2018	Vault Pit Station #2	4983803-1	0	0	0
25/05/2018	Vault Pit Station #2	5130B12-1	0	0	0
26/05/2018	Vault Pit Station #2	4983RA801-2	0	0	0
28/05/2018	Vault Pit Station #2	5123B07-1	0	0	0
31/05/2018	Vault Pit Station #2	5116SUB10-1	0	0	0
1/6/2018	Vault Pit Station #2	5095RA901-1	0	0	0
5/6/2018	Vault Pit Station #2	4983807-1	0	0	0
8/6/2018	Vault Pit Station #2	5095903-1	0	0	0
14/06/2018	Vault Pit Station #2	4983809-1	0	0	0
NA	Vault Pit Station #2	5095905-1	0	0	0
19/06/2018	Vault Pit Station #2	4983811-1	0	0	0
20/06/2018	Vault Pit Station #2	4976SU802-1	0	0	0
30/06/2018	Vault Pit Station #2	5095915-1	0	0	0
3/7/2018	Vault Pit Station #2	5095907-1	0	0	0
6/7/2018	Vault Pit Station #2	4962PS802-1	0	0	0
8/7/2018	Vault Pit Station #2	4976802-1	0	0	0
9/7/2018	Vault Pit Station #2	4976SU810-1	0	0	0
11/7/2018	Vault Pit Station #2	4976802-2	0	0	0
14/07/2018	Vault Pit Station #2	4955PS806-1	0	0	0

15/07/2018	Vault Pit Station #2	4955PS806-2	0	0	0
17/07/2018	Vault Pit Station #2	4969PS808-1	0	0	0
18/07/2018	Vault Pit Station #2	4955PS806-4	0	0	0
21/07/2018	Vault Pit Station #2	4976808-1	0	0	0
25/07/2018	Vault Pit Station #2	5088SU906-1	0	0	0
26/07/2018	Vault Pit Station #2	4976RA804-1	0	0	0
27/07/2018	Vault Pit Station #2	5095RA917-1	0	0	0
28/07/2018	Vault Pit Station #2	5088902-1	0	0	0
31/07/2018	Vault Pit Station #2	5088900-1	0	0	0
1/8/2018	Vault Pit Station #2	5123B09-1	0	0	0
2/8/2018	Vault Pit Station #2	5088914-1	0	0	0
10/8/2018	Vault Pit Station #2	5088912-1	0	0	0
13/08/2018	Vault Pit Station #2	5088904-1	0	0	0
15/08/2018	Vault Pit Station #2	5130B16-1	0	0	0
20/08/2018	Vault Pit Station #2	4955PS806-5	0	0	0
21/08/2018	Vault Pit Station #2	4976800-1	0	0	0
23/08/2018	Vault Pit Station #2	4955PS806-6	0	0	0
25/08/2018	Vault Pit Station #2	5123B11-1	0	0	0
27/08/2018	Vault Pit Station #2	5123RAB15-1	0	0	0
28/08/2018	Vault Pit Station #2	4969SU801-1	0	0	0
30/08/2018	Vault Pit Station #2	4976806-1	1.28	0.00075	0.038
2/9/2018	Vault Pit Station #2	5123B13-1	0	0	0
5/9/2018	Vault Pit Station #2	5074PS904-2	0	0	0
12/9/2018	Vault Pit Station #2	5081903-1	0	0	0

16/09/2018	Vault Pit Station #2	5081FM901-1	0	0	0
21/09/2018	Vault Pit Station #2	5116B16-1	0	0	0
24/09/2018	Vault Pit Station #2	5116B04-1	0	0	0
26/09/2018	Vault Pit Station #2	4969803-1	1.97	0.003	2.315
29/09/2018	Vault Pit Station #2	5116RAB14-1	0	0	0
30/09/2018	Vault Pit Station #2	5081905-1	0	0	0
1/10/2018	Vault Pit Station #2	4969807-1	0.478	0.00425	3.738
2/10/2018	Vault Pit Station #2	4969RA811-1	0	0	0
8/10/2018	Vault Pit Station #2	5116B06-1	0	0	0
12/10/2018	Vault Pit Station #2	4969809-1	0	0	0
16/10/2018	Vault Pit Station #2	5074902-1	0	0	0
17/10/2018	Vault Pit Station #2	5116B08-1	0	0	0
5/11/2018	Vault Pit Station #2	4962800-1	0	0	0
9/11/2018	Vault Pit Station #2	5109SUB01-1	0	0	0
9/11/2018	Vault Pit Station #2	4962806-1	0	0	0
12/11/2018	Vault Pit Station #2	4962802-1	0	0	0
14/11/2018	Vault Pit Station #2	5116B12-1	0	0	0
19/11/2018	Vault Pit Station #2	4962RA804-1	0	0	0
5/12/2018	Vault Pit Station #2	5109B03-1	0	0	0
14/12/2018	Vault Pit Station #2	5109B03-2	0	0	0
15/12/2018	Vault Pit Station #2	5109B05-1	0	0	0
23/12/2018	Vault Pit Station #2	5109B07-1	0	0	0
27/12/2018	Vault Pit Station #2	5109B03-3	0	0	0
29/12/2018	Vault Pit Station #2	4955803-1	0	0	0

	30/12/2018	Vault Pit Station #2	5109B09-1	0	0	0
AMARUQ	3/1/2018	Whale Tail Station #1	5144A12-1	2.65	0.0005	2.123
	8/1/2018	Mammoth Station #1	5137A01-1	0	0	0
	18/01/2018	Mammoth Station #1	5156A50-1	0	0	0
	21/01/2018	Whale Tail Station #1	5154A52-1	0	0	0
	29/01/2018	Whale Tail Station #1	5137A03-1	0	0	0
	2/2/2018	Whale Tail Station #1	5137A05-1	0	0	0
	6/2/2018	Mammoth Station #1	5137A07-1	0	0	0
	20/06/2018	Mammoth Station #1	5130PSA55-1	12.7	0.0915	2.532
AMARUQ FIRE WATER STATION	21/06/2018	Whale Tail Station #1	5158A01-1	1.35	0.00175	3.698
AMARUQ PIT	14/06/2018	Whale Tail Station #1	5137PSA51-2	8.06	0.11	3.285
	23/06/2018	Whale Tail Station #1	5130SUA12-1	9.89	0.0983	0.618
	18/11/2018	Whale Tail Station #1	5144A42-1	0	0	0
	27/11/2018	Mammoth Station #1	5144A44-1	0	0	0
	30/11/2018	Mammoth Station #1	5144RAA52-1	8.36	0.115	1.447
	6/12/2018	Mammoth Station #1	5144A46-1	3.01	0.012	3.086
	9/12/2018	Mammoth Station #1	5144A48-1	0	0	0
	27/12/2018	Mammoth Station #1	5144A54-1	2.21	0.00375	1.372
AMARUQ QUARRY	9/3/2018	Mammoth Station #1	5151A17-1	8.45	0.0245	3.197
	16/03/2018	Mammoth Station #1	5151A21-1	3.3	0.0493	1.401
	16/03/2018	Whale Tail Station #1	5151RAA19-1	0	0	0
	22/03/2018	Whale Tail Station #1	5151A23-1	16.8	0.0998	0.811
	6/4/2018	Whale Tail Station #1	5151A27-1	9.61	0.0668	1.528
	23/04/2018	Mammoth Station #1	5144A53-1	5.92	0.0148	0.989

	25/04/2018	Whale Tail Station #1	5151A27-2	2.14	0.0208	2.139
	30/04/2018	Whale Tail Station #1	5144A55-1	26.1	0.0273	1.059
	7/6/2018	Whale Tail Station #1	5137PSA51-1	8.35	0.103	0.777
	14/06/2018	Mammoth Station #1	5144A20-1	8.06	0.11	3.285
	20/06/2018	Whale Tail Station #1	5144A22-1	12.7	0.0915	2.532
	25/06/2018	Whale Tail Station #1	5144RAA26-1	1.94	0.0125	1.246
	26/06/2018	Whale Tail Station #1	5130PSA55-2	10.8	0.0478	1.2
	4/7/2018	Whale Tail Station #1	5144A24-1	3.48	0.0105	1.375
	30/07/2018	Mammoth Station #1	5137A23-1	0	0	0
	6/8/2018	Whale Tail Station #1	5137A25-1	0	0	0
	24/08/2018	Mammoth Station #1	5137A27-1	0	0	0
WHALE TAIL PIT	14/11/2018	Mammoth Station #1	5137SUA41-1	0	0	0
	22/11/2018	Mammoth Station #1	5151MSW41-1	2.47	0.0005	-0.249
	27/11/2018	Mammoth Station #1	5130PSA48-1	0	0	0
	1/12/2018	Mammoth Station #1	5151MSW41-2	3.4	0.0145	1.414
	5/12/2018	Mammoth Station #1	5151MSW41-3	10.8	0.0418	1.175
	16/12/2018	Mammoth Station #1	5151MSW43-1	0	0	0
	18/12/2018	Mammoth Station #1	5144SUW01-1	0	0	0
	21/12/2018	Mammoth Station #1	5151MSW43-2	0	0	0
	23/12/2018	Mammoth Station #1	5151MSW43-3	0	0	0
	27/12/2018	Mammoth Station #1	5151MSW45-1	2.21	0.00375	1.372
	29/12/2018	Mammoth Station #1	5151MSW45-2	3.74	0.0155	2.615
AMQ- MAIN- ROAD	16/05/2018	Quarry KM10	1000QY100-1	20.1	0.00175	1.162
	1/6/2018	Quarry KM10	1000QY100-2	0	0	0

6/6/2018	Quarry KM10	1000QY100-3	40.4	0.141	0.967
9/6/2018	Quarry KM10	1000QY100-4	0	0	0
19/06/2018	Quarry KM17	1780QY100-10	0	0	0
25/06/2018	Quarry KM17	1780QY100-14	0	0	0
5/7/2018	Quarry KM26	2600QY200-1	0	0	0
8/7/2018	Quarry KM26	2600QY200-2	0	0	0
10/7/2018	Quarry KM26	2600QY200-3	0	0	0
14/07/2018	Quarry KM26	2600QY200-4	0	0	0
17/07/2018	Quarry KM30	3000QY100-1	0	0	0
20/07/2018	Quarry KM30	3000QY100-3	0	0	0
26/07/2018	Quarry KM30	3000QY104-1	0	0	0
30/07/2018	Quarry KM30	3000QY106-1	0	0	0
3/8/2018	Quarry KM30	3000QY108-1	0	0	0
9/8/2018	Quarry KM30	3000QY102-1	0	0	0
16/08/2018	Quarry KM30	3000QY110-1	0	0	0
24/08/2018	Quarry KM30	3000QY114-1	0	0	0
1/9/2018	Quarry KM35	3500QY104-1	0	0	0
9/9/2018	Quarry KM35	3500QY106-1	0	0	0
17/09/2018	Quarry KM35	3500QY108-1	0	0	0
28/09/2018	Quarry KM35	3500QY112-1	5.88	0.0203	5.088
27/10/2018	Quarry KM50	5000QY100-1	0	0	0