

Appendix 45

Meadowbank and Whale Tail 2019 Blast Monitoring Report

ANNUAL REPORT MEMORANDUM

Agnico Eagle Mines Ltd Meadowbank Division
Environment Department

SUBJECT: 2019 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 2019 during blasting activities at Meadowbank (North Portage Pit, South Portage Pit, Vault Pit and BB Phaser Pit) and Whale Tail (Whale Tail Pit). The locations of the blast monitoring stations in 2019 for Meadowbank, Vault and Whale Tail Pit are found in Table 1 and Figure 1, 2, 4 and 5 below.

Table 1: 2019 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
Mammoth Station	606,055	7,255,204
Mammoth Station 2	605,946	7,255,169
Mammoth Dike Temporary Station	605,835	7,255,012

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 2019 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.

Whale Tail Station 1 was dismissed since the fishout of Whale Tail North lake was complete in 2018.

Whale Tail Station 2 (14W 7254698N 607132E) was not used in 2019 as other blast monitoring instruments were installed directly on the Whale Tail Dike for geotechnical purposes. It was decided to stop monitoring blasts on the Whale Tail Dike for geotechnical purposes as the recording was very low or non-existent.

A new station named Mammoth Station 2 was implemented in Late-June 2019. This station is better positioned to monitor than its predecessor. Until June 25th, 2019 blasts were monitored from the Mammoth Station. From June 26th, 2019 blasts are monitored from Mammoth Station 2.

The previous monitoring stations are also illustrated in Figure 3 for Whale Tail Project.

Updated monitoring stations are illustrated in Figure 4.

Figure 1 - Portage and Goose Pit Blast Monitoring Stations

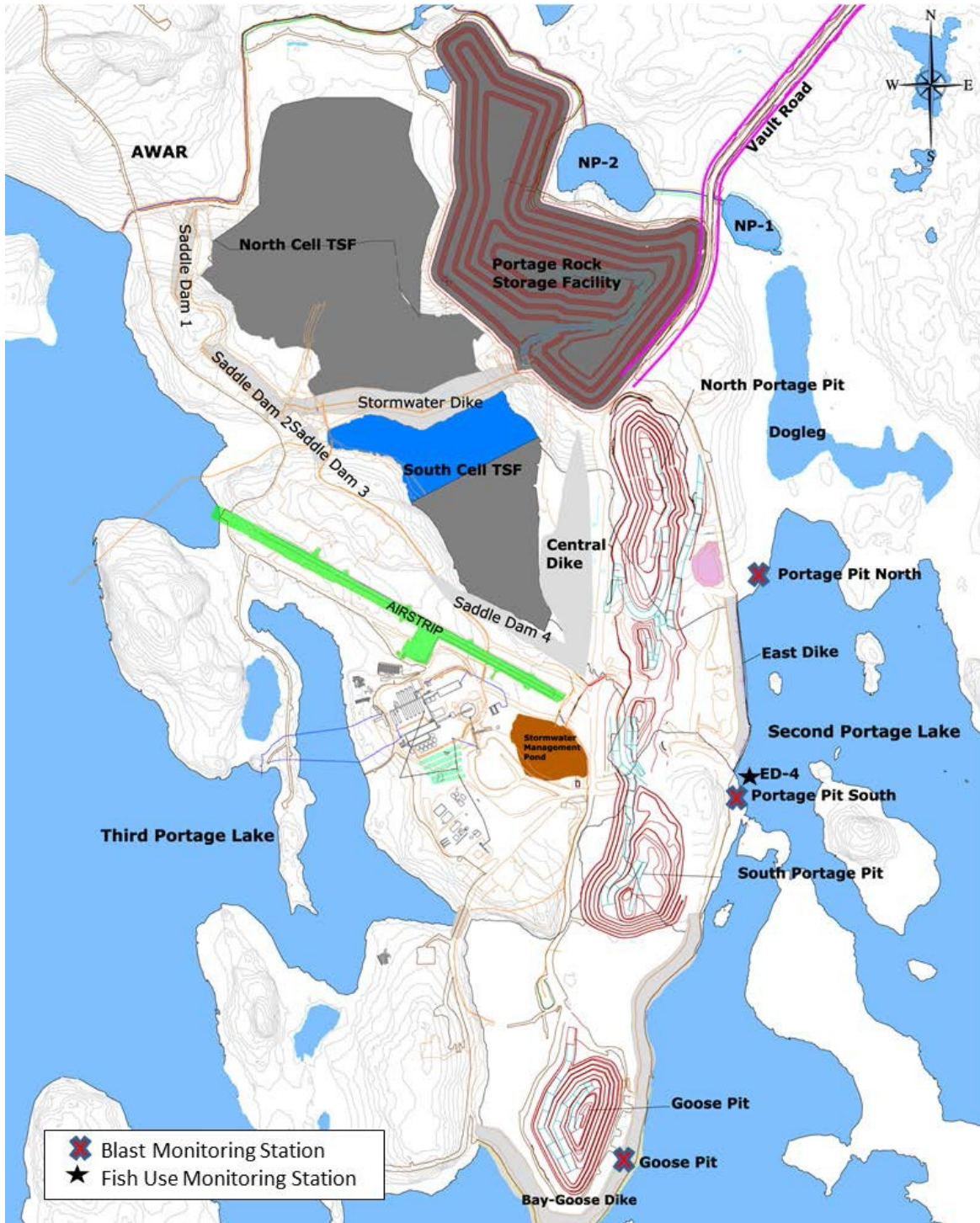


Figure 2 - Vault Pit Blast Monitoring Stations

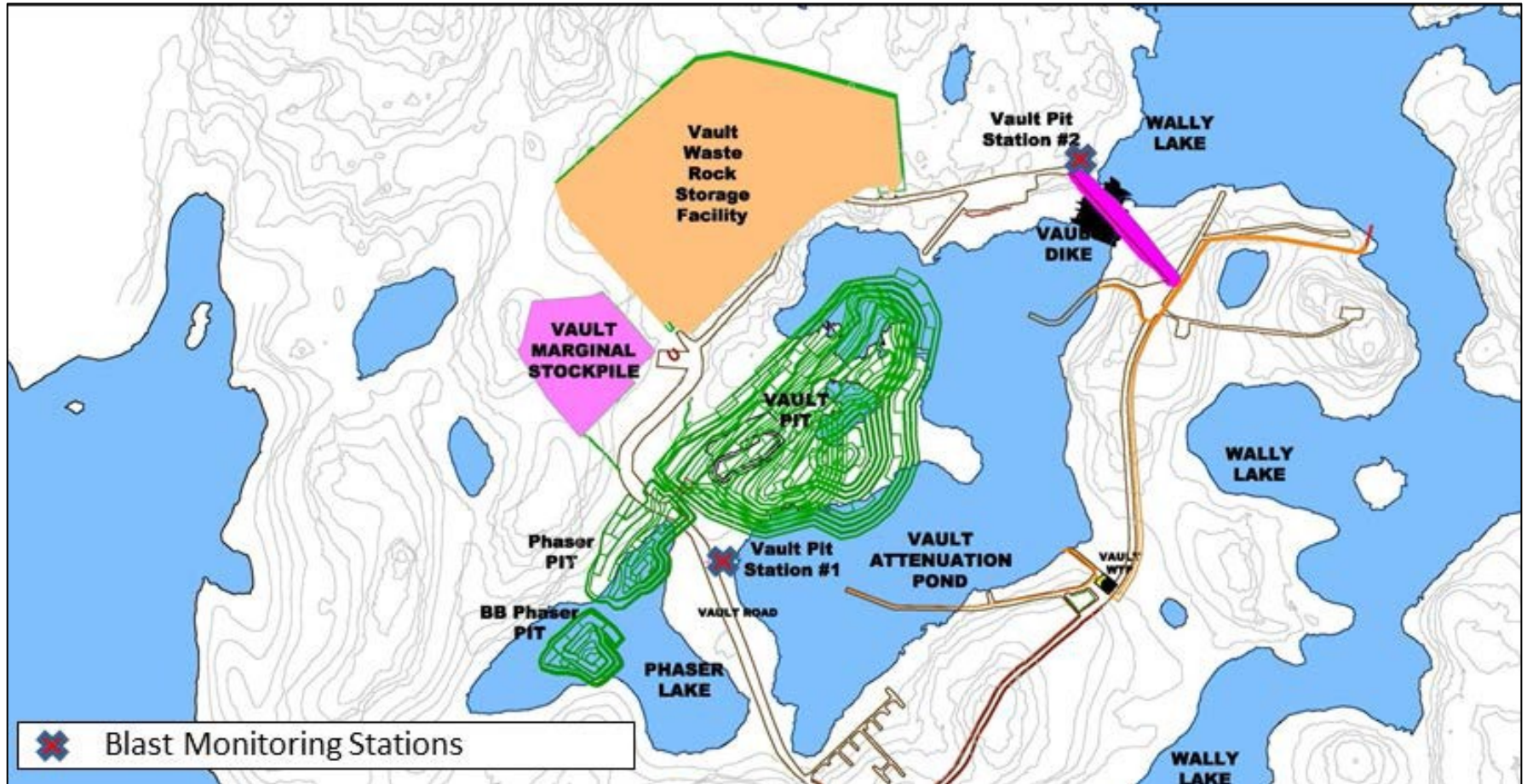


Figure 3 – Previous Whale Tail Blast Monitoring Stations

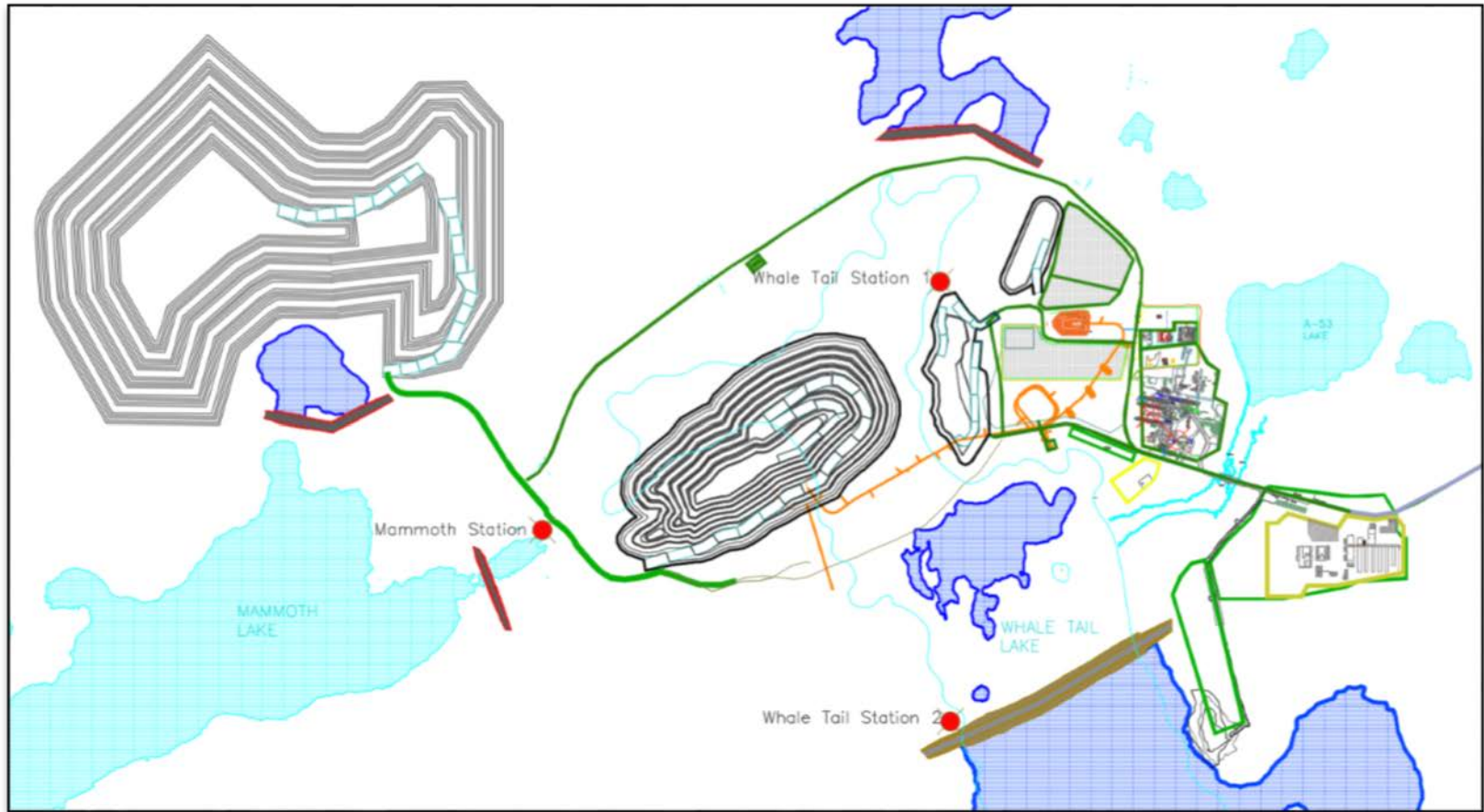


Figure 4 – 2019 Whale Tail Blast Monitoring

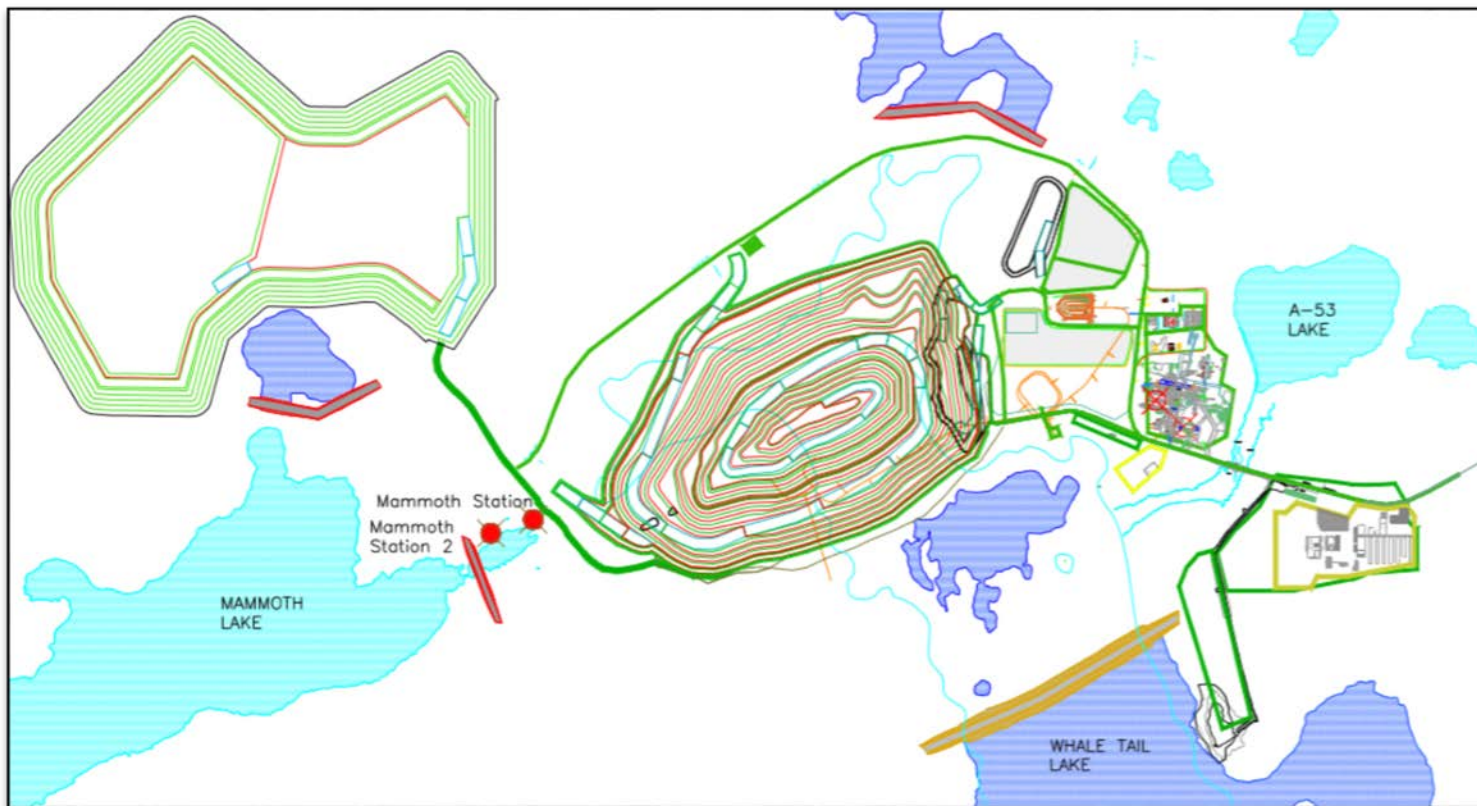


Figure 5 – Temporary blast monitoring station during Mammoth Dike Construction



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 (2020).

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 2019 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).

2.3- Results, Discussion and Conclusions

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

In 2019, 49 blasts were monitored at Meadowbank, including Baker Lake road. There were no PPV exceedance and IPC measurements were all below the DFO limit of 50 kPa.

For Whale Tail Pit project, 174 blasts were monitored. Eight (8) PPV concentrations exceeded the DFO limit of 13 mm/s.

The eight exceedances were recorded in 2019 and occurred during period of egg incubation (egg incubation period is from August 15 to June 30). These eight events were located at Whale Tail:

- The first exceedance was recorded at Mammoth Station for the 5137PSW01 with 14.4 mm/s on May 17th, 2019. For this blast, five (5) preshear holes were detonated on the same delay. 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.
- The second exceedance was recorded Mammoth Station for the 5144MSW32 with 13.5 mm/s on May 22nd, 2019. This blast was close to the blast monitoring station but a bit far from the lake shore. To mitigate the probability of another exceedance, another blast monitoring station was implemented nearer to the lake and further from the pit. This move was done on June 26th, 2019. Since this move, no exceedances were observed.
- The third exceedance was recorded at Mammoth Station for the 5130PSW04 SEQ1 with 20.9 mm/s on June 8th, 2019. For this blast, six (6) preshear holes were detonated on the same delay. 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.
- The fourth exceedance was recorded at Mammoth Station for the 5130PSW06 SEQ1 with 17.4 mm/s on June 15th, 2019. For this blast, five (5) preshear holes were detonated on the same delay. 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.
- The fifth exceedance was recorded at Mammoth Station for the 5130PSW06 SEQ1 with 14 mm/s on June 22nd, 2019. There was a working pump very near the blast monitoring station during the blast. The vibration of this pump most likely amplified the vibration recorded during the blast.
- The sixth to eighth events where exceedance were observed are located at Mammoth Dike temporary station during the blasting of the dike's foundation. They were observed Feb 20th, 23rd and 26th on the respective patterns 5149DDA01-1, 5149DDA03-1 and 5149DDA05-1

Summary of exceedance since 2013 is presented in Table 2.

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All IPC measurements were below the DFO limit of 50 kpa for both Meadowbank and Whale Tail Site.

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.

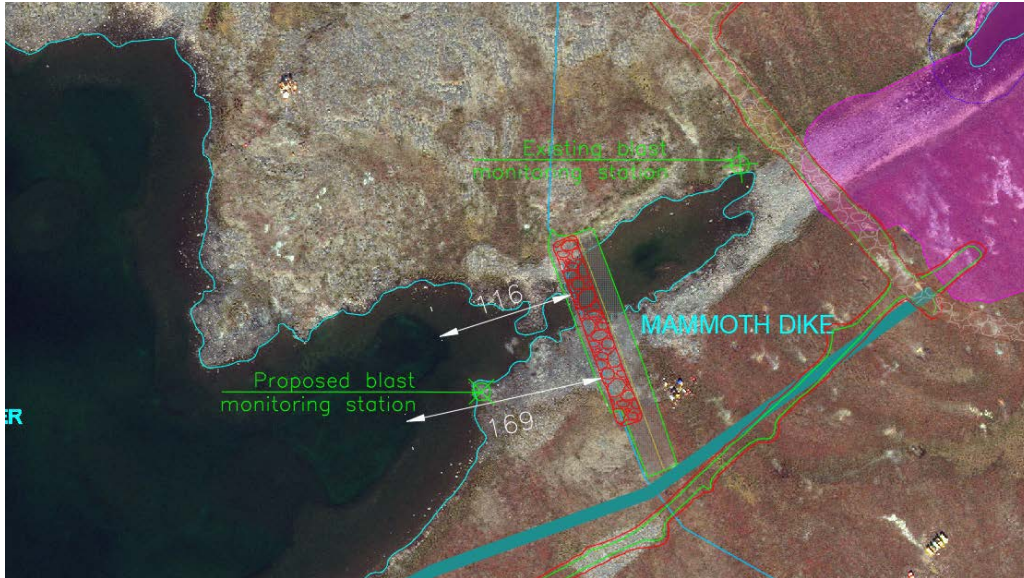
Table 2: Meadowbank and Whale Tail PPV exceedance 2013-2019

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
2019	0	8
Total	26	10

During the construction of Mammoth Dike, three (3) exceedances were recorded at a temporary blast monitoring station by Mammoth Lake (5149DDA01-1, 5149DDA03-1, 5149DDA05-1). Agnico first employed a cautionary approach by initiating the first blast as a first sequence of 2 in order to break down the pattern in smaller pieces up-front as suggested in potential mitigations measures outlined in section 5 of the DFO memo (February 2019). This aims to get the baseline and be conservative since theoretical calculations are empirical rather than site specific.

- First Blast 5149DDA01-1 recorded vibrations of 15.7mm/s. After analysis, it was revealed that the sinking cut – slightly deeper holes required for creating the free face on the first blast of the sequence – were responsible for the passing the limit threshold. The remaining blast was cut in 2 sequences for a total of 3. As additional mitigation measures – added to the fact the remaining sequence wouldn't have any sinking cuts – Agnico decided to optimize the blast timing in a way to allow for more time for the material to move during the blast which would reduce the chances of observing high vibration values.
- The second blast 5149DDA03-1 recorded vibrations of 14.7mm/s. Improvements were observed, however, the extent of them was probably neutralized to some extent by the fact that the 2nd and 3rd sequences are slightly closer to the monitoring station. Nevertheless, Agnico instructed the blasters to increase the collar – unloaded portion of a hole – in an attempt to reduce the powder factor of the blast, consistent with mitigations measures outlined in the memo. This is additional to the already taken measures above.
- The third blast 5149DDA05-1 recorded vibrations of 15.9mm/s. The lithology in the sector of this third blast was found to be predominantly in sound bedrock compared to sequence 1 that was mainly in till, therefore shock waves propagating more efficiently across the ground which may have contributed to higher vibration values.

It is worthwhile to mention that the temporary monitoring station was 116m at a perpendicular angle from the dike while the sensible fish habitat is measured to be at 169m. A 2nd blast monitor was installed at Mammoth monitoring station #1 for the first and second blasts and the recorded value on the second blast was measured at 11.6mm/s, under the vibration threshold. This station is located at 168m away from the dike, similar to the fish habitat. For the first blast – 5149DDA01-1, the second monitor at Mammoth station #1 failed to record.



In 2019, the average PPV was 0.55 mm/s with a maximum of 4.47 mm/s for Portage and Vault Pit. These low PPVs can be explained by the fact that Portage and Vault Pits are deeper and increasing the effective distance between the blast and the InstanTel monitoring device.

In 2019, for Whale Tail Pit, the average PPV was 1.94 mm/s with a maximum of 20.9 mm/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	2019
Meadowbank (Portage and Vault, Phaser and BB Pit)	Max PPV (mm/s)	32.7	23.8	16.5	9.54	11.9	7.43	4.47
	Average PPV (mm/s)	5.39	3.93	2.38	1.18	0.78	0.43	0.55
Whale Tail Project	Max PPV (mm/s)	N/A ¹	N/A	N/A	N/A	N/A	26.1	20.9
	Average PPV (mm/s)	N/A	N/A	N/A	N/A	N/A	4.18	2.16

¹ N/A: No Activity

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

Table 4 - 2019 PPV and IPC blast monitoring results

Area	Date of Blast	Station	Blast Pattern	Peak Particulate Velocity (mm/s)	Water Instantaneous Pressure Change (kPa)	Peak Sound Pressure (Pa)	Event duration (sec)
DFO Limit				13	50	N/A	N/A
AMQ-QUARRY-2	18-01-2019	Mammoth Station	5137A43-1	0	0.00	0	0
	08-02-2019	Mammoth Station	5137A45-1	0	0.00	0	0
	10-03-2019	Mammoth Station	5137A47-1	0	0.00	0	0
BAKER LAKE ROAD	03-06-2019	Quarry KM53	5300QY150-1	0	0.00	0	0
BBPHASER PIT	18-04-2019	Vault Pit station #2	5095FMB01-1	0	0.00	0	0
MARGINAL STP	01-01-2019	Portage Pit North	5150SP116-1	0	0.00	0	0
	21-04-2019	Portage Pit North	5150SP108-1	0	0.00	0	0
	21-05-2019	Portage Pit North	5150FMSP108-1	0	0.00	0	0
MAMMOTH DIKE CONSTRUCTION	20-02-2019	Mammoth Dike temporary station	5149DDA01-1	15.7	18.38	276	1.8
	23-02-2019	Mammoth Dike	5149DDA03-1	14.7	17.20	127	2.095

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.

		temporary station					
	26-02-2019	Mammoth Dike temporary station	5149DDA05-1	15.9	18.61	235	1.920
PORTAGE PIT	04-01-2019	Portage Pit South	5011655-1	1.68	1.97	4.25	2.178
	11-01-2019	Portage Pit South	5011657-1	0	0.00	0	0
	19-01-2019	Portage Pit South	5011659-1	1.08	1.26	9.75	1.962
	15-02-2019	Portage Pit South	5004650-1	4.47	5.23	10	2.14
	26-02-2019	Portage Pit South	5004652-1	0	0.00	0	0
	03-03-2019	Portage Pit South	5011661-1	0	0.00	0	0
	06-03-2019	Portage Pit South	5004654-1	0	0.00	0	0
	08-03-2019	Portage Pit South	5011FM601-1	0	0.00	0	0
	16-03-2019	Portage Pit South	5004662-1	2.5	2.93	4.25	1.777
	30-03-2019	Portage Pit South	5004656-1	0	0.00	0	0
	01-04-2019	Portage Pit South	5011FM603-1	0	0.00	0	0
	12-04-2019	Portage Pit South	5004658-1	0	0.00	0	0
	13-04-2019	Portage Pit South	5004FM602-1	0	0.00	0	0
	04-05-2019	Portage Pit South	4997651-1	0	0.00	0	0
	08-05-2019	Portage Pit South	4997657-1	0	0.00	0	0
	10-05-2019	Portage Pit South	4983PS650-1	0	0.00	0	0
	14-05-2019	Portage Pit South	4983PS650-2	2.57	3.01	47.5	2.184
	18-05-2019	Portage Pit South	4997659-1	2.39	2.80	23.3	3.858
	27-05-2019	Portage Pit South	4997663-1	1.44	1.69	11.5	1.092
	05-06-2019	Portage Pit South	4997661-1	2.63	3.08	4.25	2.2
06-06-2019	Portage Pit South	4990SU600-1	2.79	3.27	20.3	1.735	
08-06-2019	Portage Pit South	4997RA653-1	3.53	4.13	29.8	1.161	

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	13-07-2019	Portage Pit South	4990602-1	0	0.00	0	0
	16-07-2019	Portage Pit South	4976PS606-1	0	0.00	0	0
	22-07-2019	Portage Pit South	4990606-1	0	0.00	0	0
	26-07-2019	Portage Pit South	4990606-2	0	0.00	0	0
	01-09-2019	Portage Pit South	4983607-1	0	0.00	0	0
	06-09-2019	Portage Pit South	4983605-1	0	0.00	0	0
	08-09-2019	Portage Pit South	4983607-2	0	0.00	0	0
	13-09-2019	Portage Pit South	4983603-1	0	0.00	0	0
	21-10-2019	Portage Pit South	4979652-1	0	0.00	0	0
VAULT PIT	15-01-2019	Vault Pit station #2	5095PSB02-1	0	0.00	0	0
	18-01-2019	Vault Pit station #2	5095PSB02-2	0	0.00	0	0
	18-01-2019	Vault Pit station #2	5095PSB02-3	0	0.00	0	0
	21-01-2019	Vault Pit station #2	5095PSB08-1	0	0.00	0	0
	23-01-2019	Vault Pit station #2	5102B02-1	0	0.00	0	0
	24-01-2019	Vault Pit station #2	5109RAB11-1	0	0.00	0	0
	02-02-2019	Vault Pit station #2	5102B04-1	0	0.00	0	0
	06-02-2019	Vault Pit station #2	5102B06-1	0	0.00	0	0
	09-03-2019	Vault Pit station #2	5102RAB08-1	0	0.00	0	0
	19-03-2019	Vault Pit station #2	4962808-1	0	0.00	0	0
	01-05-2019	Vault Pit station #2	5095B01-1	0	0.00	0	0
	12-05-2019	Vault Pit station #2	5095B03-1	0	0.00	0	0
	29-05-2019	Vault Pit station #2	5088B04-1	0	0.00	0	0
	31-05-2019	Vault Pit station #2	5088B04-2	0	0.00	0	0
WHALE TAIL PIT	01-01-2019	Mammoth Station	5144MSW02-1	0	0.00	0	0

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07-01-2019	Mammoth Station	5151MSW49-1	9.54	11.17	70	2.756
11-01-2019	Mammoth Station	5151MSW51-1	0	0.00	0	0
14-01-2019	Mammoth Station	5144MSW04-1	0	0.00	0	0
17-01-2019	Mammoth Station	5144MSW10-1	0	0.00	0	0
24-01-2019	Mammoth Station	5144MSW08-1	0	0.00	0	0
31-01-2019	Mammoth Station	5151MSW47-1	0	0.00	0	0
03-02-2019	Mammoth Station	5151MSW53-1	0	0.00	0	0
11-02-2019	Mammoth Station	5144MSW12-1	0	0.00	0	0
11-02-2019	Mammoth Station	5130PSA52-1	1.28	1.50	14.5	0.138
14-02-2019	Mammoth Station	5137A49-1	0	0.00	0	0
20-02-2019	Mammoth Station	5149DDA01-1	0	0.00	0	0
23-02-2019	Mammoth Station	5144MSW18-1	12.5	14.63	32	6.178
26-02-2019	Mammoth Station	5149DDA05-1	11.6	13.58	231	2.212
27-02-2019	Mammoth Station	5151PPW47-1	0	0.00	0	0
01-03-2019	Mammoth Station	5144MSW20-1	5.25	6.14	26.8	3.971
09-03-2019	Mammoth Station	5137MSW07-1	0	0.00	0	0
10-03-2019	Mammoth Station	5137RAA51-1	0	0.00	0	0
13-03-2019	Mammoth Station	5137MSW01-1	0	0.00	0	0
16-03-2019	Mammoth Station	5137MSW03-1	0	0.00	0	0
29-03-2019	Mammoth Station	5137MSW05-1	0	0.00	0	0
02-04-2019	Mammoth Station	5144MSW22-1	0	0.00	0	0
05-04-2019	Mammoth Station	5137MSW11-1	0	0.00	0	0
06-04-2019	Mammoth Station	5144MSW24-1	4.92	5.76	0.5	2.583
08-04-2019	Mammoth Station	5151MSW65-1	5.95	6.96	62.3	5.826

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10-04-2019	Mammoth Station	5151MSW63-1	0	0.00	0	0
16-04-2019	Mammoth Station	5137MSW09-1	0	0.00	0	0
18-04-2019	Mammoth Station	5137PPW01-1	0	0.00	0	0
28-04-2019	Mammoth Station	5151MSW61-1	0	0.00	0	0
29-04-2019	Mammoth Station	5137MSW15-1	3.69	4.32	1.25	0.037
30-04-2019	Mammoth Station	5130MSW02-1	3.94	4.61	1	0.016
06-05-2019	Mammoth Station	5151MSW71-1	0	0.00	0	0
11-05-2019	Mammoth Station	5130MSW14-1	0	0.00	0	0
15-05-2019	Mammoth Station	5144MSW26-1	0	0.00	0	0
17-05-2019	Mammoth Station	5137PSW01-1	14.4	16.85	6.5	2.9
18-05-2019	Mammoth Station	5130MSW04-1	0	0.00	0	0
22-05-2019	Mammoth Station	5144MSW32-1	13.5	15.80	330	6.369
26-05-2019	Mammoth Station	5151MSW77-1	3.99	4.67	65	1.072
29-05-2019	Mammoth Station	5144MSW16-1	0	0.00	0	0
29-05-2019	Mammoth Station	5151MSW69-1	0	0.00	0	0
31-05-2019	Mammoth Station	5109PSW01-1	0	0.00	0	0
31-05-2019	Mammoth Station	5144RAW38-1	0	0.00	0	0
01-06-2019	Mammoth Station	5144MSW36-1	0	0.00	0	0
02-06-2019	Mammoth Station	5144MSW28-1	0	0.00	0	0
02-06-2019	Mammoth Station	5123SUW01-1	0	0.00	0	0
04-06-2019	Mammoth Station	5130MSW24-1	0	0.00	0	0
08-06-2019	Mammoth Station	5130MSW06-1	0	0.00	0	0
08-06-2019	Mammoth Station	5130PSW04-1	20.9	24.46	97.5	0.166
10-06-2019	Mammoth Station	5130PSW04-2	0	0.00	0	0

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12-06-2019	Mammoth Station	5144MSW50-1	0	0.00	0	0
14-06-2019	Mammoth Station	5151MSW83-1	8	9.36	32.5	1.251
15-06-2019	Mammoth Station	5130PSW06-1	17.4	20.36	17	0.972
17-06-2019	Mammoth Station	5130PSW06-2	12.6	14.75	42	0.937
19-06-2019	Mammoth Station	5151MSW85-1	4.95	5.79	21.3	1.135
21-06-2019	Mammoth Station	5137MSW17-1	10.7	12.52	61.5	5.25
22-06-2019	Mammoth Station	5130PSW06-4	14	16.39	150	3.125
25-06-2019	Mammoth Station	5137MSW19-1	0	0.00	0	0
26-06-2019	Mammoth Station 2	5137MSW21-1	0	0.00	0	0
29-06-2019	Mammoth Station 2	5137MSW23-1	0	0.00	0	0
01-07-2019	Mammoth Station 2	5151MSW87-1	3.77	4.41	14.8	4.666
02-07-2019	Mammoth Station 2	5130MSW26-1	4.9	5.73	9.25	4.5
05-07-2019	Mammoth Station 2	5151MSW89-1	4.14	4.85	23.5	3.653
05-07-2019	Mammoth Station 2	5130MSW12-1	4.48	5.24	9	3.625
08-07-2019	Mammoth Station 2	5130PSW04-3	12.5	14.63	70	6.375
09-07-2019	Mammoth Station 2	5151MSW99-1	6.45	7.55	20.3	3.875
14-07-2019	Mammoth Station 2	5151MSW91-1	2.22	2.60	21.5	0.821
14-07-2019	Mammoth Station 2	5130PSW04-4	9.77	11.43	96.3	0.192
16-07-2019	Mammoth Station 2	5137MSW27-1	5.91	6.92	7.5	3.979
20-07-2019	Mammoth Station 2	5144MSW56-1	0	0.00	0	0
21-07-2019	Mammoth Station 2	5151MSW91-2	0	0.00	0	0
27-07-2019	Mammoth Station 2	5151MSW93-1	0	0.00	0	0
28-07-2019	Mammoth Station 2	5130MSW12-2	0	0.00	0	0
04-08-2019	Mammoth Station 2	5151MSW95-1	2.56	3.00	0.5	0.213

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05-08-2019	Mammoth Station 2	5130MSW16-1	0	0.00	0	0
05-08-2019	Mammoth Station 2	5151MSW55-1	4.56	5.34	1.2	0.35
14-08-2019	Mammoth Station 2	5130MSW08-1	5.25	6.14	13	9.875
16-08-2019	Mammoth Station 2	5130PSW14-1	8.57	10.03	2	10
18-08-2019	Mammoth Station 2	5130PSW12-1	10.6	12.41	107	3.25
19-08-2019	Mammoth Station 2	5130PSW12-2	7.51	8.79	23.5	3.25
21-08-2019	Mammoth Station 2	5151MSW97-1	4.6	5.38	19.5	3.99
21-08-2019	Mammoth Station 2	5158MSW02-1	4.6	5.38	19.5	1.902
22-08-2019	Mammoth Station 2	5137SUW35-1	1.57	1.84	3	0
25-08-2019	Mammoth Station 2	5144MSW48-1	0	0.00	0	0
25-08-2019	Mammoth Station 2	5130PSW14-2	0	0.00	0	0
28-08-2019	Mammoth Station 2	5151MSW99-2	0	0.00	0	0
30-08-2019	Mammoth Station 2	5144MSW62-1	0	0.00	0	0
03-09-2019	Mammoth Station 2	5137MSW31-1	0	0.00	0	0
04-09-2019	Mammoth Station 2	5144MSW52-1	0	0.00	0	0
05-09-2019	Mammoth Station 2	5144MSW48-2	0	0.00	0	0
08-09-2019	Mammoth Station 2	5137MSW33-2	2.58	3.02	3	0.5
08-09-2019	Mammoth Station 2	5137MSW33-1	0	0.00	0	0
09-09-2019	Mammoth Station 2	5144MSW60-2	0	0.00	0	0
11-09-2019	Mammoth Station 2	5137MSW29-1	0	0.00	0	0
12-09-2019	Mammoth Station 2	5144RAW80-1	0	0.00	0	0
13-09-2019	Mammoth Station 2	5123MSW03-1	0	0.00	0	0
14-09-2019	Mammoth Station 2	5137MSW49-1	0	0.00	0	0
16-09-2019	Mammoth Station 2	5137RAW03-1	0	0.00	0	0

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16-09-2019	Mammoth Station 2	5144MSW72-1	0	0.00	0	0
16-09-2019	Mammoth Station 2	5130PSW18-1	0	0.00	0	0
19-09-2019	Mammoth Station 2	5123MSW05-1	0	0.00	0	0
22-09-2019	Mammoth Station 2	5144MSW74-1	0	0.00	0	0
24-09-2019	Mammoth Station 2	5151PPW87-1	0	0.00	0	0
26-09-2019	Mammoth Station 2	5130PSW20-1	0	0.00	0	0
27-09-2019	Mammoth Station 2	5130MSW18-1	0	0.00	0	0
01-10-2019	Mammoth Station 2	5151MSW75-1	0	0.00	0	0
01-10-2019	Mammoth Station 2	5144MSW76-1	0	0.00	0	0
02-10-2019	Mammoth Station 2	5137MSW41-1	0	0.00	0	0
04-10-2019	Mammoth Station 2	5130PSW22-1	0	0.00	0	0
06-10-2019	Mammoth Station 2	5130MSW18-2	0	0.00	0	0
07-10-2019	Mammoth Station 2	5116SUW02-1	0	0.00	0	0
12-10-2019	Mammoth Station 2	5137MSW43-1	0	0.00	0	0
14-10-2019	Mammoth Station 2	5144MSW82-1	0	0.00	0	0
16-10-2019	Mammoth Station 2	5130MSW20-1	0	0.00	0	0
16-10-2019	Mammoth Station 2	5137MSW61-1	0	0.00	0	0
16-10-2019	Mammoth Station 2	5144MSW78-1	0.49	0.57	0	0
17-10-2019	Mammoth Station 2	5137MSW53-1	0	0.00	0	0
18-10-2019	Mammoth Station 2	5137MSW47-1	0	0.00	0	0
18-10-2019	Mammoth Station 2	5137MSW51-1	0	0.00	0	0
19-10-2019	Mammoth Station 2	5123MSW07-1	0	0.00	0	0
20-10-2019	Mammoth Station 2	5130MSW22-1	0	0.00	0	0
22-10-2019	Mammoth Station 2	5144MSW92-1	0	0.00	0	0

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23-10-2019	Mammoth Station 2	5137MSW37-1	4.43	5.18	3.44	0.546
26-10-2019	Mammoth Station 2	5144MSW90-1	0	0.00	0	0
27-10-2019	Mammoth Station 2	5144MSW66-1	1.82	2.13	1.56	1.837
30-10-2019	Mammoth Station 2	5144MSW94-1	3.78	4.42	31.7	7.75
01-11-2019	Mammoth Station 2	5130MSW40-1	7.89	9.23	29	6
03-11-2019	Mammoth Station 2	5130MSW38-1	0	0.00	0	0
04-11-2019	Mammoth Station 2	5144MSW88-1	0	0.00	0	0
04-11-2019	Mammoth Station 2	5130MSW36-1	0	0.00	0	0
05-11-2019	Mammoth Station 2	5130PSW22-2	0	0.00	0	0
10-11-2019	Mammoth Station 2	5130MSW28-1	0	0.00	0	0
11-11-2019	Mammoth Station 2	5130PSW30-1	0	0.00	0	0
13-11-2019	Mammoth Station 2	5123MSW11-1	0	0.00	0	0
13-11-2019	Mammoth Station 2	5130MSW44-1	0	0.00	0	0
19-11-2019	Mammoth Station 2	5123MSW13-1	0	0.00	0	0
22-11-2019	Mammoth Station 2	5130MSW32-1	2.74	3.21	14.8	1.237
23-11-2019	Mammoth Station 2	5137MSW71-1	2.11	2.47	13.3	2.277
25-11-2019	Mammoth Station 2	5130MSW50-1	0	0.00	0	0
26-11-2019	Mammoth Station 2	5137MSW63-1	0	0.00	0	0
27-11-2019	Mammoth Station 2	5130MSW52-1	1.84	2.15	23.8	6
28-11-2019	Mammoth Station 2	5137FMW57-1	0	0.00	0	0
29-11-2019	Mammoth Station 2	5137MSW63-2	1.2	1.40	14	2.485
30-11-2019	Mammoth Station 2	5130PSW50-2	0	0.00	0	0
01-12-2019	Mammoth Station 2	5109PSW05-1	7.07	8.27	0	0
02-12-2019	Mammoth Station 2	5137MSW67-1	1.71	2.00	0	0

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03-12-2019	Mammoth Station 2	5137MSW69-1	0	0.00	0	0
04-12-2019	Mammoth Station 2	5137MSW57-1	0	0.00	0	0
06-12-2019	Mammoth Station 2	5123MSW37-1	0	0.00	0	0
06-12-2019	Mammoth Station 2	5130SUW74-1	0	0.00	0	0
07-12-2019	Mammoth Station 2	5109PSW05-4	0	0.00	0	0
08-12-2019	Mammoth Station 2	5123MSW27-1	0	0.00	0	0
09-12-2019	Mammoth Station 2	5109PSW05-5	0	0.00	0	0
09-12-2019	Mammoth Station 2	5109PSW05-6	0	0.00	0	0
10-12-2019	Mammoth Station 2	5123MSW15-1	0	0.00	0	0
10-12-2019	Mammoth Station 2	5109PSW05-7	0	0.00	0	0
14-12-2019	Mammoth Station 2	5137MSW55-1	0	0.00	0	0
16-12-2019	Mammoth Station 2	5109PSW07-1	0	0.00	0	0
17-12-2019	Mammoth Station 2	5144MSW96-1	0	0.00	0	0
17-12-2019	Mammoth Station 2	5123MSW17-1	0	0.00	0	0
18-12-2019	Mammoth Station 2	5137MSW59-1	0	0.00	0	0
19-12-2019	Mammoth Station 2	5109PSW09-1	0	0.00	0	0
21-12-2019	Mammoth Station 2	5123MSW29-1	0	0.00	0	0
23-12-2019	Mammoth Station 2	5130MSW86-1	4.64	5.43	25.6	2.54
25-12-2019	Mammoth Station 2	5123MSW23-1	0	0.00	0	0
27-12-2019	Mammoth Station 2	5137MSW59-2	0	0.00	0	0
28-12-2019	Mammoth Station 2	5137MSW77-1	0	0.00	0	0
29-12-2019	Mammoth Station 2	5109PSW39-1	0	0.00	0	0
29-12-2019	Mammoth Station 2	5130MSW84-1	0	0.00	0	0

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