

**To:** Connor Devereaux  
Environmental Superintendent, Baffinland Iron Mines Corporation

**Date:** March 26, 2020

**From:** Andrew Rees, Ph.D.  
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**Re:** 2019 SNP Hydrometric Monitoring Program

## 1 Introduction

A monitoring requirement of the Mary River Project's (the Project) Type 'A' Water Licence - 2AM-MRY1325 – Amendment No. 1 (Type 'A' Water Licence), issued to Baffinland Iron Mines Corporation (Baffinland) by the Nunavut Water Board (NWB), is to measure and document the surface water flow volumes at or near locations established under the Project's Surveillance Network Program (SNP), prescribed by the Type 'A' Water Licence. To ensure compliance with the monitoring requirement, a hydrometric monitoring network consisting of nine (9) monitoring stations at or near existing SNP monitoring stations was established in 2014. Table 1.1 summarizes the locations monitored during 2019, including their IDs, station types, and the data collected. Changes made to the hydrometric monitoring network during 2019 are summarized in Table 1.2.

**Table 1.1 SNP Hydrometric Stations**

Station ID	Hydrometric Station Type	Data Collected in 2019
MQ-C-B MQ-C-D MS-C-A/B	Hydrometric station installed using natural channel control.	Discharge and water level were measured during sampling events to validate stage-discharge relationships. Pressure transducers were used to measure water levels at 15-minute intervals.
MP-Q1-02 MP-C-B MP-C-B01 MS-MRY-13A MQ-C-A MS-C-E	Hydrometric station installed using a flow measurement structure and thin plate weir.	Water levels were measured during sampling events. Pressure transducers were used to measure water levels at 15-minute intervals.

**Table 1.2 Summary of 2019 Changes to SNP Hydrometric Stations**

Station ID	Changes to Stations in 2019
MP-Q1-01	Station not monitored in 2019 due to the re-routing of flow near the Q1 Quarry at Milne Port.
MP-Q1-02	Station moved to a new location to monitor flow below the Q1 Quarry at Milne Port.
MP-C-B	Station moved to a new location to accommodate changes to site drainage at Milne Port. A 90-degree v-notch weir was installed in August 2019 at the new location.
MP-C-B01	A new station was installed in August 2019 using a 90-degree v-notch weir to monitor drainage at Milne Port.

## 2 Methods and Data Collection

An initial site visit was conducted in June 2019 to install the pressure transducers, measure flow, and perform maintenance where required. Follow up site visits were subsequently conducted in June, July, August, and September to measure flow, water level, and download data from the pressure transducers. All pressure transducers were removed by September 21 prior to freeze-up.



Water level data were recorded at each station at 15-minute intervals. Daily discharge at each station was calculated by averaging the 15-minute data on a daily basis.

### 3 Results and Discussion

The daily discharge data recorded at the SNP Hydrometric Stations during 2019 are shown in Tables 3.1 and 3.2. The daily discharge data for the SNP Hydrometric Stations at the Milne Port are shown on Figure 3.1 and at the Mine Site on Figures 3.2 and 3.3.

Based on recommendations made in 2018, new all-aluminum weirs were installed at MP-C-B, MP-Q1-02, and MQ-C-A, and MS-C-E in August 2019. In addition, a weir was installed at MP-C-B01. The 2019 data record at the MS-C-A/B station is not shown in Figure 3.2 after August 16 due to an erroneous trend identified in the data involving a steady increase in the recorded water level beyond what is possible at the station. The erroneous trend is suspected to be a result of a pressure transducer malfunction and will be further evaluated in the 2020 monitoring program to confirm.

### 4 General Conclusion and Recommendations

Upgrading of the weirs installed in 2014 continued in 2019 with the replacement of four (4) weirs, and the installation of one (1) new weir. The new weir plates and boxes were constructed entirely of aluminum and will last longer than the previous versions constructed using aluminum and wood.

The MS-C-A/B, MQ-C-B, and MQ-C-D stations were not modified in 2019, and continue to produce reliable data and will not require any upgrades or modifications in 2020. The sensor used at MS-C-A/B malfunctioned after August 16 and will be returned to the manufacturer for maintenance and calibration.

To ensure compliance with the Type 'A' Water Licence, Baffinland will continue to monitor surface water flow volumes at Project sites in 2020 using the established SNP Hydrometric Monitoring Program.

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#### Attachments:

- Table 3.1 SNP Station Daily Average Discharge – June and July
- Table 3.2 SNP Station Daily Average Discharge – August and September
- Figure 3.1 Milne Port SNP Stations – Daily Discharge
- Figure 3.2 Mine Site SNP Stations MQ-C-B, MQ-C-D, and MS-C-A/B – Daily Discharge
- Figure 3.3 Mine Site SNP Stations MQ-C-A and MS-MRY-13A – Daily Discharge

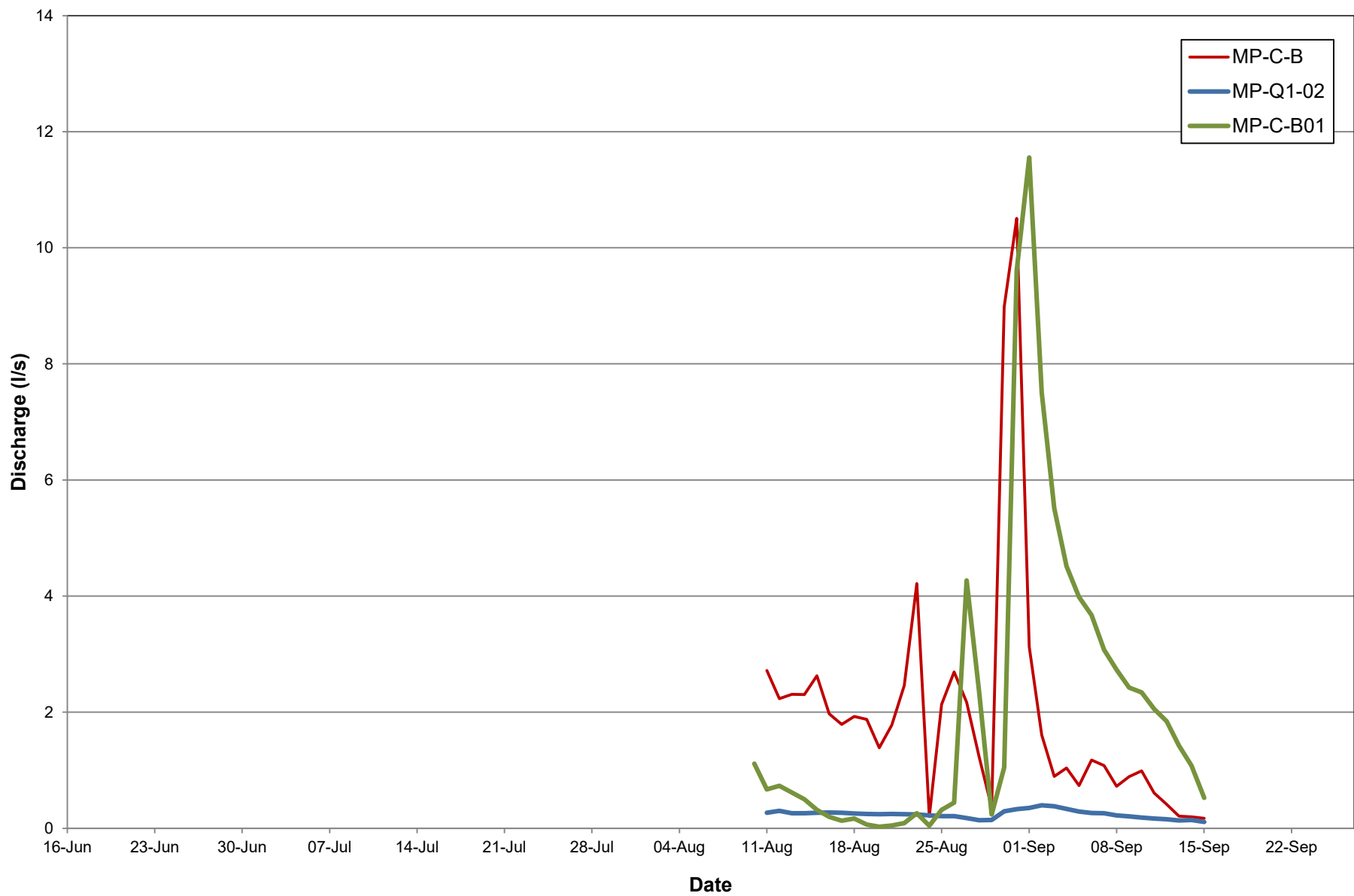
## **Attachments**

**Table 3.1 - SNP Station Daily Average Discharge - June and July**

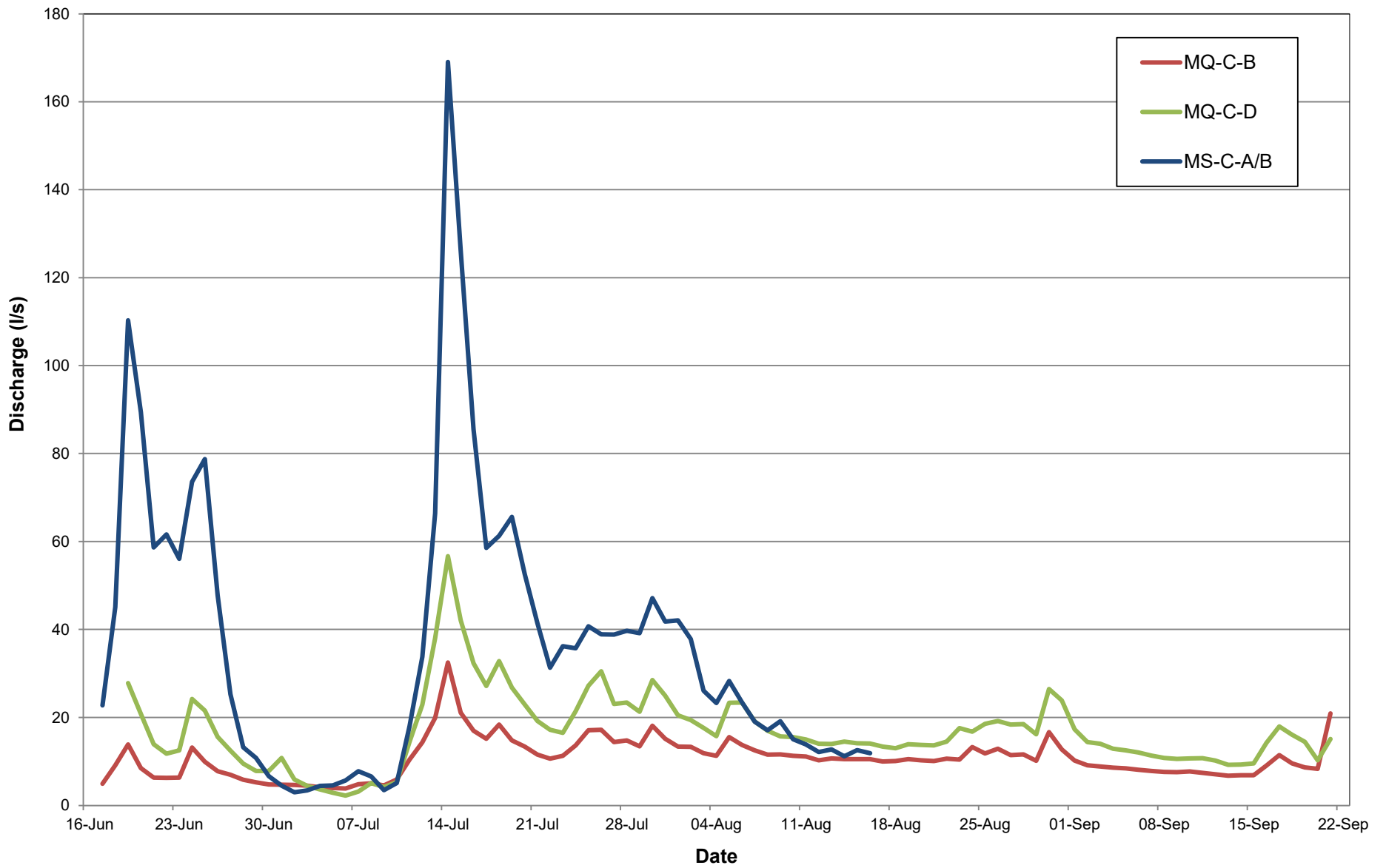
Date	Daily Average Discharge (l/s)								
	MP-C-B	MP-C-B01	MP-Q1-02	MQ-C-A	MQ-C-B	MQ-C-D	MS-MRY-13A	MS-C-A/B	MS-C-E
16-Jun-19							0.018		
17-Jun-19					4.9		0.015	23	
18-Jun-19					9.1		0.28	45	
19-Jun-19				0.69	14	28	0.13	110	
20-Jun-19				0.16	8.5	21	0.055	89	
21-Jun-19				0.013	6.3	14	0.038	59	
22-Jun-19				0.028	6.2	12	0.064	62	
23-Jun-19				0.057	6.3	13	0.069	56	
24-Jun-19				2.8	13	24	0.25	74	
25-Jun-19				0.29	9.9	22	0.073	79	
26-Jun-19				0.038	7.8	16	0.051	48	
27-Jun-19				0.008	6.9	12	0.049	25	
28-Jun-19				0	5.8	9.5	0.038	13	
29-Jun-19				0	5.3	7.8	0.036	11	
30-Jun-19				0	4.8	7.8	0.027	6.6	
01-Jul-19				0	4.7	11	0.029	4.5	
02-Jul-19				0	4.6	5.9	0.021	3.0	
03-Jul-19				0	4.5	4.4	0.013	3.4	
04-Jul-19				0	4.1	3.6	0.0085	4.4	
05-Jul-19				0	3.9	2.9	0.0013	4.5	
06-Jul-19				0	3.9	2.2	0	5.7	
07-Jul-19				0	4.8	3.1	0.0035	7.8	
08-Jul-19				0	5.0	5.1	0.0006	6.6	
09-Jul-19				0	4.5	4.1	0	3.5	
10-Jul-19				0.1	5.9	5.3	0.020	5.1	
11-Jul-19				1.0	10	14	0.025	18	
12-Jul-19				2.1	14	23	0.072	34	
13-Jul-19				3.3	20	38	0.12	66	
14-Jul-19				5.6	33	57	0.21	170	
15-Jul-19				2.5	21	42	0.064	130	
16-Jul-19				1.5	17	32	0.042	85	
17-Jul-19				1.3	15	27	0.040	59	
18-Jul-19				2.5	18	33	0.029	61	
19-Jul-19				1.0	15	27	0.0056	66	
20-Jul-19				0.73	13	23	0	53	
21-Jul-19				0.38	12	19	0	41	
22-Jul-19				0.23	11	17	0	31	
23-Jul-19				0.45	11	16	0	36	
24-Jul-19				0.86	14	21	0	36	
25-Jul-19				2.7	17	27	0.0020	41	
26-Jul-19				2.2	17	31	0	39	
27-Jul-19				0.94	14	23	0	39	
28-Jul-19				1.1	15	23	0	40	
29-Jul-19				0.75	13	21	0	39	
30-Jul-19				2.7	18	28	0.00053	47	
31-Jul-19				1.2	15	25	0	42	

**Table 3.2 - SNP Station Daily Average Discharge - August and September**

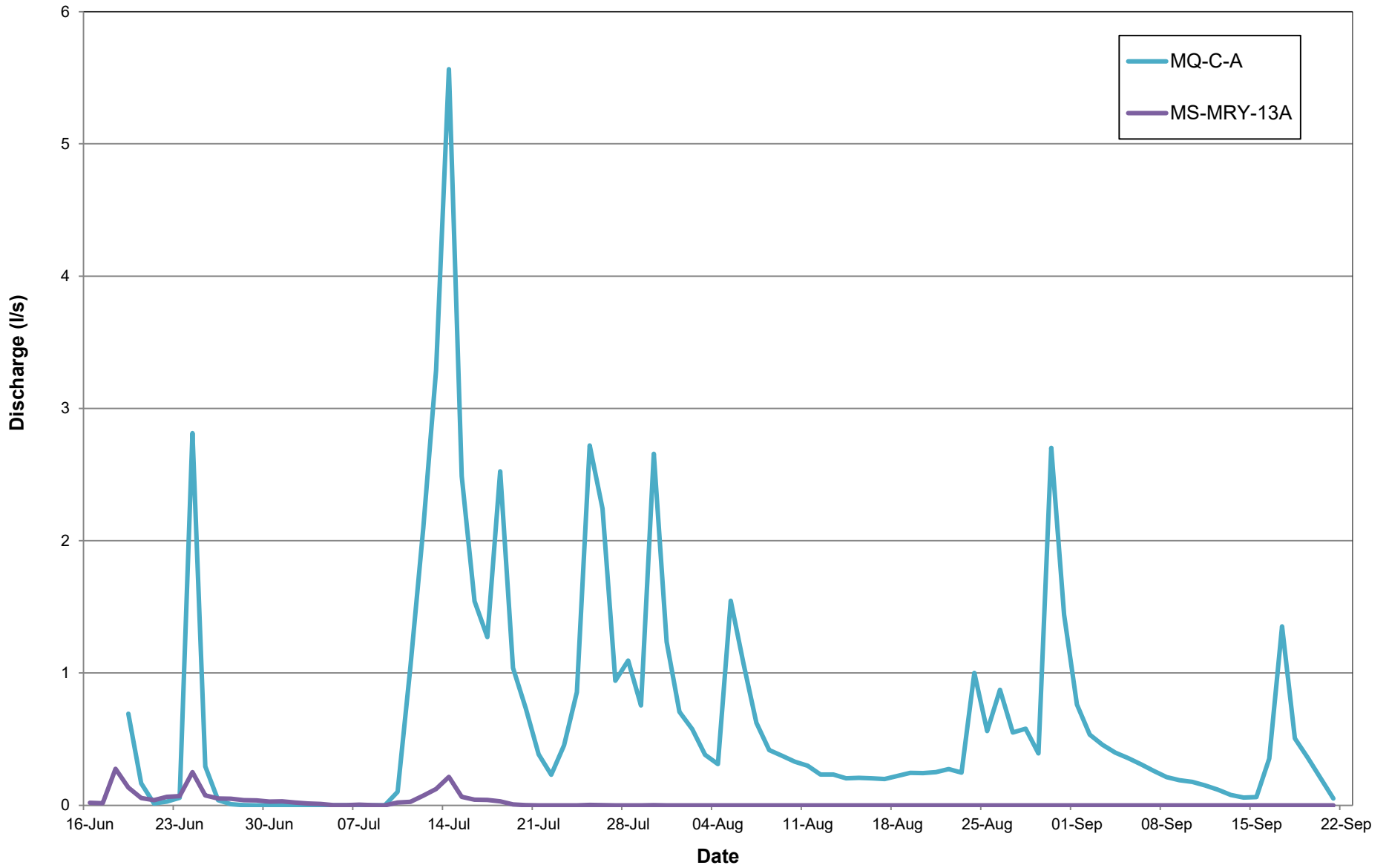
Date	Daily Average Discharge (l/s)								
	MP-C-B	MP-C-B01	MP-Q1-02	MQ-C-A	MQ-C-B	MQ-C-D	MS-MRY-13A	MS-C-A/B	MS-C-E
1-Aug-19				0.71	13	20	0	42	
2-Aug-19				0.57	13	19	0	38	
3-Aug-19				0.38	12	18	0	26	
4-Aug-19				0.31	11	16	0	23	
5-Aug-19				1.5	16	23	0	28	
6-Aug-19				1.1	14	23	0	23	
7-Aug-19				0.62	12	19	0	19	
8-Aug-19				0.42	12	17	0	17	
9-Aug-19				0.37	12	16	0	19	
10-Aug-19		1.1		0.33	11	16	0	15	
11-Aug-19	2.7	0.67	0.27	0.30	11	15	0	14	
12-Aug-19	2.2	0.73	0.30	0.23	10	14	0	12	1.4
13-Aug-19	2.3	0.62	0.26	0.23	11	14	0	13	1.7
14-Aug-19	2.3	0.50	0.26	0.20	11	14	0	11	1.6
15-Aug-19	2.6	0.32	0.27	0.21	11	14	0	13	1.6
16-Aug-19	2.0	0.20	0.27	0.20	10	14	0	12	1.7
17-Aug-19	1.8	0.13	0.27	0.20	10	13	0		1.5
18-Aug-19	1.9	0.17	0.26	0.22	10	13	0		1.5
19-Aug-19	1.9	0.066	0.25	0.24	10	14	0		1.6
20-Aug-19	1.4	0.032	0.24	0.24	10	14	0		1.5
21-Aug-19	1.8	0.051	0.25	0.25	10	14	0		1.4
22-Aug-19	2.5	0.09	0.24	0.27	11	15	0		1.5
23-Aug-19	4.2	0.26	0.24	0.25	10	18	0		1.5
24-Aug-19	0.2	0.043	0.22	1.0	13	17	0		2.7
25-Aug-19	2.1	0.32	0.21	0.56	12	19	0		2.0
26-Aug-19	2.7	0.44	0.21	0.87	13	19	0		2.5
27-Aug-19	2.2	4.3	0.18	0.55	11	18	0		2.0
28-Aug-19	1.2	2.3	0.14	0.58	12	18	0		2.1
29-Aug-19	0.36	0.24	0.15	0.39	10	16	0		1.6
30-Aug-19	9.0	1.0	0.29	2.7	17	26	0		4.6
31-Aug-19	11	9.6	0.33	1.4	13	24	0		3.6
1-Sep-19	3.1	12	0.35	0.76	10	17	0		2.4
2-Sep-19	1.6	7.5	0.40	0.53	9.1	14	0		1.9
3-Sep-19	0.89	5.5	0.38	0.46	8.9	14	0		1.8
4-Sep-19	1.0	4.5	0.33	0.40	8.6	13	0		1.7
5-Sep-19	0.74	4.0	0.29	0.35	8.4	13	0		1.7
6-Sep-19	1.2	3.7	0.26	0.31	8.1	12	0		1.5
7-Sep-19	1.1	3.1	0.26	0.26	7.8	11	0		1.5
8-Sep-19	0.72	2.7	0.22	0.21	7.6	11	0		1.4
9-Sep-19	0.89	2.4	0.21	0.19	7.5	11	0		1.3
10-Sep-19	0.99	2.3	0.19	0.18	7.7	11	0		1.3
11-Sep-19	0.61	2.1	0.17	0.15	7.4	11	0		1.2
12-Sep-19	0.41	1.8	0.15	0.12	7.1	10	0		1.1
13-Sep-19	0.21	1.4	0.13	0.077	6.7	9.2	0		1.0
14-Sep-19	0.20	1.1	0.14	0.059	6.8	9.3	0		1.0
15-Sep-19	0.18	0.53	0.11	0.062	6.8	9.6	0		1.0
16-Sep-19				0.35	9.0	14	0		1.6
17-Sep-19				1.4	11.0	18	0		3.0
18-Sep-19				0.50	9.6	16	0		2.6
19-Sep-19				0.36	8.6	14	0		2.0
20-Sep-19				0.20	8.3	10	0		1.4
21-Sep-19				0.051	21	15	0		1.3



**Figure 3.1 Milne Port SNP Stations - Daily Discharge**



**Figure 3.2 Mine Site SNP Stations MQ-C-B, MQ-C-D, and MS-C-A/B - Daily Discharge**



**Figure 3.3 Mine Site SNP Stations MQ-C-A and MS-MRY-13A- Daily Discharge**