

# Phase 2 Milne Rail Corridor Aquatic Habitat Assessment

## Location

Crossing ID: CV-89-1

Dates Surveyed: 4 July & 2 September, 2018

UTM Coordinates: 17 W 545492 7921173

## Photographs



A

B

C

**Figure 6.** Summer (top) and fall (bottom) views of CV-89-1 at the rail crossing; (A) looking upstream; (B) looking downstream; and (C) looking across.

# Phase 2 Milne Rail Corridor Aquatic Habitat Assessment

## Location

Crossing ID: CV-93-4

Dates Surveyed: 10 July & 27 August, 2018

UTM Coordinates: 17 W 548770 7918691

## Photographs



A

B

C

**Figure 6.** Summer (top) and fall (bottom) views of CV-93-4 at the rail crossing; (A) looking upstream; (B) looking downstream; and (C) looking across.

# Phase 2 Milne Rail Corridor Aquatic Habitat Assessment

## Location

Crossing ID: CV-96-1

Dates Surveyed: 10 July & 30 August, 2018

UTM Coordinates: 17 W 550924 7917265

## Photographs



A

B

C

**Figure 6.** Summer (top) and fall (bottom) views of CV-96-1 at the rail crossing; (A) looking upstream; (B) looking downstream; and (C) looking across.

## APPENDIX B

### **Fish Swim Velocity Thresholds**

(Table B-1)

TABLE B-1

BAFFINLAND IRON MINES CORPORATION  
MARY RIVER PROJECT - PHASE 2 PROPOSAL

FISH PASSAGE RISK ASSESSMENT OF WATER CROSSINGS AND STREAM DIVERSIONS - PROPOSED NORTH RAILWAY  
CULVERT PASSAGE FISH SWIMMING VELOCITY THESHOLDS

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| Velocity Thresolds (m/s) |                       |                        |                    |                       |                       |                    |                       |                        |                    |                       |                       |
|--------------------------|-----------------------|------------------------|--------------------|-----------------------|-----------------------|--------------------|-----------------------|------------------------|--------------------|-----------------------|-----------------------|
| 88 mm Arctic Char        |                       |                        |                    |                       |                       | 256 mm Arctic Char |                       |                        |                    |                       |                       |
| Culvert Length (m)       | 5% Passage (95% High) | 25% Passage (75% High) | 50% Passage (Mean) | 75% Passage (75% Low) | 95% Passage (95% Low) | Culvert Length (m) | 5% Passage (95% High) | 25% Passage (75% High) | 50% Passage (Mean) | 75% Passage (75% Low) | 95% Passage (95% Low) |
| 100                      | 0.64                  | 0.45                   | 0.27               | 0.16                  | 0.11                  | 100                | 1.56                  | 1.09                   | 0.65               | 0.39                  | 0.27                  |
| 95                       | 0.65                  | 0.45                   | 0.27               | 0.16                  | 0.11                  | 95                 | 1.59                  | 1.11                   | 0.66               | 0.39                  | 0.27                  |
| 90                       | 0.88                  | 0.61                   | 0.37               | 0.22                  | 0.16                  | 90                 | 2.15                  | 1.50                   | 0.89               | 0.53                  | 0.37                  |
| 85                       | 0.90                  | 0.63                   | 0.37               | 0.22                  | 0.16                  | 85                 | 2.20                  | 1.53                   | 0.91               | 0.54                  | 0.38                  |
| 80                       | 0.92                  | 0.64                   | 0.38               | 0.23                  | 0.16                  | 80                 | 2.24                  | 1.56                   | 0.93               | 0.55                  | 0.39                  |
| 75                       | 0.94                  | 0.65                   | 0.39               | 0.23                  | 0.17                  | 75                 | 2.29                  | 1.59                   | 0.95               | 0.57                  | 0.39                  |
| 70                       | 0.96                  | 0.67                   | 0.40               | 0.24                  | 0.17                  | 70                 | 2.34                  | 1.63                   | 0.97               | 0.58                  | 0.40                  |
| 65                       | 0.99                  | 0.69                   | 0.41               | 0.24                  | 0.17                  | 65                 | 2.40                  | 1.67                   | 1.00               | 0.59                  | 0.41                  |
| 60                       | 1.01                  | 0.70                   | 0.42               | 0.25                  | 0.17                  | 60                 | 2.47                  | 1.71                   | 1.02               | 0.61                  | 0.42                  |
| 55                       | 1.04                  | 0.72                   | 0.43               | 0.26                  | 0.18                  | 55                 | 2.54                  | 1.77                   | 1.05               | 0.63                  | 0.44                  |
| 50                       | 1.08                  | 0.75                   | 0.45               | 0.27                  | 0.19                  | 50                 | 2.62                  | 1.82                   | 1.09               | 0.65                  | 0.45                  |
| 45                       | 1.11                  | 0.77                   | 0.46               | 0.28                  | 0.19                  | 45                 | 2.71                  | 1.89                   | 1.13               | 0.67                  | 0.47                  |
| 40                       | 1.16                  | 0.81                   | 0.48               | 0.29                  | 0.20                  | 40                 | 2.82                  | 1.96                   | 1.17               | 0.70                  | 0.49                  |
| 35                       | 1.21                  | 0.84                   | 0.50               | 0.30                  | 0.21                  | 35                 | 2.95                  | 2.05                   | 1.22               | 0.73                  | 0.51                  |
| 30                       | 1.28                  | 0.89                   | 0.53               | 0.32                  | 0.22                  | 30                 | 3.11                  | 2.16                   | 1.29               | 0.77                  | 0.53                  |
| 25                       | 1.36                  | 0.94                   | 0.56               | 0.34                  | 0.23                  | 25                 | 3.30                  | 2.30                   | 1.37               | 0.82                  | 0.57                  |
| 20                       | 1.46                  | 1.02                   | 0.61               | 0.36                  | 0.25                  | 20                 | 3.56                  | 2.47                   | 1.48               | 0.88                  | 0.61                  |
| 15                       | 1.61                  | 1.12                   | 0.67               | 0.40                  | 0.28                  | 15                 | 3.92                  | 2.72                   | 1.63               | 0.97                  | 0.67                  |
| 10                       | 1.84                  | 1.28                   | 0.76               | 0.46                  | 0.32                  | 10                 | 4.49                  | 3.12                   | 1.86               | 1.11                  | 0.77                  |
| 5                        | 2.32                  | 1.61                   | 0.96               | 0.57                  | 0.40                  | 5                  | 5.66                  | 3.93                   | 2.35               | 1.40                  | 0.97                  |

\\KPL\VA-Prj\$\1\02\00181\53\A\Correspondence\VA19-00838 - Northern Railway Stream Crossings\Tables\[Culvert Crossings Monthly Flow\_20190615.xlsm]ReadMe\_First

- NOTES:**
1. DATA PROVIDED BY NSC (PERS. COMM., 2 JUNE 2019), CALCULATED FROM EQUATIONS PROVIDED BY KATOPODIS AND GERVAIS (2016)

|     |         |                               |       |      |
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## APPENDIX C

### **Fish Passage Risk Assessment**

(Table C-1)

TABLE C-1

BAFFINLAND IRON MINES CORPORATION  
MARY RIVER PROJECT - PHASE 2 PROPOSAL

FISH PASSAGE RISK ASSESSMENT OF WATER CROSSINGS AND STREAM DIVERSIONS - PROPOSED NORTH RAILWAY  
FISH PASSAGE RISK ASSESSMENT

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| Crossing Name | Culvert? | Catchment Areas (km²) | No. Barrels | Culvert Diameter (mm) | Culvert Length (m) | Slope (%) | Mean Monthly Flow (L/s) |        | Fish Bearing? | Embedded Culvert Cross-Section Average Velocity (m/s) |        | Embedded Culvert Cross-Section Max. Depth (m) |        | July Velocity Thresholds (75% Passage) |              | August VelocityThresholds (75% Passage) |              | Risk Assessment |                   |                |             |              |                  |          | Study Area | Notes                                         |                                     |
|---------------|----------|-----------------------|-------------|-----------------------|--------------------|-----------|-------------------------|--------|---------------|-------------------------------------------------------|--------|-----------------------------------------------|--------|----------------------------------------|--------------|-----------------------------------------|--------------|-----------------|-------------------|----------------|-------------|--------------|------------------|----------|------------|-----------------------------------------------|-------------------------------------|
|               | Y/N      |                       |             |                       |                    |           | July                    | August |               | July                                                  | August | July                                          | August | 88 mm Char                             | 256 mm Char  | 88 mm Char                              | 256 mm Char  | Embedded Score  | Outlet drop Score | Velocity Score | Depth Score | Length Score | Cumulative Score | Result   |            |                                               |                                     |
| CV-13-4       | Y        | 10.87                 | 5           | 1800                  | 24                 | 1         | 615.3                   | 219.6  | Y             | 0.41                                                  | 0.29   | 0.18                                          | 0.11   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-15-2       | Y        | 1.06                  | 1           | 900                   | 30                 | 1         | 60.0                    | 21.4   | Y             | 0.41                                                  | 0.27   | 0.18                                          | 0.10   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 1            | 4                | HIGH     | Rail       | Pond Infilling + Stream Crossing              |                                     |
| CV-15-3       | N        | 0.33                  | 1           | 900                   | 36                 | 1         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | Rail       | Pond Infilling + Culvert                      |                                     |
| CV-15-5       | N        | 134.57                | N/A         | -                     | -                  | -         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Bridge                              |
| CV-18-1       | N        | 1.09                  | 1           | 1500                  | 30                 | 1         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Pond Infilling + Culvert            |
| CV-27-2       | Y        | 3.05                  | 3           | 1500                  | 12                 | 1         | 172.5                   | 61.6   | Y             | 0.33                                                  | 0.23   | 0.13                                          | 0.08   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-28-6       | Y        | 2.68                  | 2           | 1500                  | 24                 | 5         | 151.5                   | 54.1   | Y             | 0.61                                                  | 0.43   | 0.10                                          | 0.06   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 0            | 4                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-29-2       | Y        | 2.70                  | 3           | 1500                  | 36                 | 3         | 152.6                   | 54.5   | Y             | 0.45                                                  | 0.32   | 0.09                                          | 0.06   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 2              | 1           | 1            | 4                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-30-5       | Y        | 0.98                  | 3           | 900                   | 18                 | 1         | 55.2                    | 19.7   | Y             | 0.25                                                  | 0.18   | 0.09                                          | 0.05   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-31-1       | Y        | 1.86                  | 2           | 1500                  | 24                 | 3         | 105.1                   | 37.5   | Y             | 0.46                                                  | 0.32   | 0.09                                          | 0.06   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-31-2       | Y        | 1.86                  | 2           | 1800                  | 24                 | 1         | 105.1                   | 37.5   | Y             | 0.30                                                  | 0.21   | 0.12                                          | 0.07   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-33-6       | Y        | 1.77                  | 2           | 900                   | 18                 | 1         | 100.3                   | 35.8   | Y             | 0.36                                                  | 0.25   | 0.15                                          | 0.09   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-35-2       | N        | 34.75                 | 4           | -                     | 36                 | 1         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Plate Arch Culvert                  |
| CV-47-1       | N        | 7.44                  | 2           | -                     | 24                 | 1         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Plate Arch Culvert                  |
| CV-47-2       | Y        | 7.44                  | 4           | 1800                  | 24                 | 2         | 421.0                   | 150.2  | Y             | 0.49                                                  | 0.34   | 0.14                                          | 0.08   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-47-3       | N        | 7.44                  | 2           | -                     | 24                 | 4         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Plate Arch Culvert                  |
| CV-48-4       | N        | 21.54                 | 4           | -                     | 54                 | 3         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Plate Arch Culvert                  |
| CV-49-2       | Y        | 0.70                  | 1           | 1200                  | 12                 | 5         | 39.6                    | 14.1   | P             | 0.51                                                  | 0.34   | 0.08                                          | 0.04   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-49-3       | Y        | 0.06                  | 1           | 1200                  | 24                 | 5         | 3.3                     | 1.2    | P             | 0.19                                                  | 0.13   | 0.02                                          | 0.01   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 0            | 1                | LOW      | Rail       | Culvert                                       |                                     |
| CV-50-5       | Y        | 3.89                  | 4           | 1800                  | 30                 | 5         | 220.2                   | 78.6   | Y             | 0.53                                                  | 0.38   | 0.08                                          | 0.05   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 1            | 5                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-50-6       | Y        | 3.89                  | 3           | 1800                  | 30                 | 5         | 220.2                   | 78.6   | Y             | 0.58                                                  | 0.41   | 0.09                                          | 0.06   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 1            | 5                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-55-3       | Y        | 0.92                  | 3           | 1500                  | 24                 | 1         | 51.9                    | 18.5   | Y             | 0.22                                                  | 0.15   | 0.07                                          | 0.04   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 0            | 1                | LOW      | Rail       | Culvert                                       |                                     |
| CV-56-1       | Y        | 2.73                  | 2           | 1500                  | 24                 | 1         | 154.6                   | 55.2   | Y             | 0.37                                                  | 0.25   | 0.15                                          | 0.09   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-57-1       | Y        | 1.61                  | 2           | 1500                  | 18                 | 2         | 91.3                    | 32.6   | Y             | 0.38                                                  | 0.26   | 0.10                                          | 0.06   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-57-2       | Y        | 0.73                  | 1           | 1200                  | 18                 | 2         | 41.5                    | 14.8   | Y             | 0.39                                                  | 0.26   | 0.10                                          | 0.06   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-58-1       | Y        | 0.09                  | 1           | 900                   | 12                 | 1         | 5.3                     | 1.9    | P             | 0.16                                                  | 0.11   | 0.04                                          | 0.02   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 0            | 1                | LOW      | Rail       | Culvert                                       |                                     |
| CV-58-2       | Y        | 0.12                  | 1           | 900                   | 12                 | 3         | 6.5                     | 2.3    | P             | 0.24                                                  | 0.16   | 0.04                                          | 0.02   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 0            | 1                | LOW      | Rail       | Culvert                                       |                                     |
| CV-58-3       | Y        | 0.01                  | 1           | 900                   | 18                 | 3         | 0.4                     | 0.1    | P             | 0.08                                                  | 0.05   | 0.01                                          | 0.00   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 0            | 1                | LOW      | Rail       | Culvert                                       |                                     |
| CV-58-4       | Y        | 0.19                  | 1           | 900                   | 18                 | 3         | 10.9                    | 3.9    | P             | 0.29                                                  | 0.20   | 0.05                                          | 0.03   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-58-4a      | Y        | 0.06                  | 1           | 900                   | 30                 | 1         | 3.7                     | 1.3    | P             | 0.14                                                  | 0.09   | 0.04                                          | 0.02   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 1            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-58-5       | Y        | 1.87                  | 2           | 1500                  | 36                 | 3         | 106.0                   | 37.8   | Y             | 0.46                                                  | 0.32   | 0.10                                          | 0.06   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 2              | 1           | 1            | 4                | HIGH     | Rail       | Culvert + Stream Infilling + Stream Diversion |                                     |
| CV-58-6       | Y        | 0.41                  | 1           | 1200                  | 95                 | 5         | 22.9                    | 8.2    | P             | 0.41                                                  | 0.27   | 0.06                                          | 0.03   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 2            | 6                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-59-4       | Y        | 3.31                  | 3           | 1500                  | 30                 | 5         | 187.5                   | 66.9   | P             | 0.58                                                  | 0.40   | 0.09                                          | 0.05   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 1            | 5                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-60-3       | Y        | 0.28                  | 1           | 900                   | 82                 | 5         | 15.8                    | 5.6    | P             | 0.40                                                  | 0.26   | 0.05                                          | 0.03   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 2            | 6                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-60-4       | Y        | 0.25                  | 1           | 900                   | 30                 | 5         | 13.9                    | 5.0    | P             | 0.38                                                  | 0.25   | 0.05                                          | 0.03   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 1            | 4                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-61-2       | Y        | 0.45                  | 2           | 900                   | 18                 | 5         | 25.4                    | 9.1    | P             | 0.37                                                  | 0.26   | 0.05                                          | 0.03   | Exceeded                               | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 2              | 1           | 0            | 3                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-62-1a      | N        | -                     | N/A         | -                     | -                  | -         | -                       | -      | P             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Stream Infilling + Stream Diversion |
| CV-62-1       | N        | 116.98                | 4           | -                     | 96                 | 3         | -                       | -      | Y             | -                                                     | -      | -                                             | -      | -                                      | -            | -                                       | -            | -               | -                 | -              | -           | -            | -                | -        | -          | Rail                                          | Plate Arch Culvert                  |
| CV-62-2       | Y        | 0.16                  | 1           | 900                   | 18                 | 4         | 9.2                     | 3.3    | P             | 0.30                                                  | 0.20   | 0.04                                          | 0.02   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-62-2a      | Y        | 0.16                  | 1           | 900                   | 24                 | 5         | 9.2                     | 3.3    | P             | 0.32                                                  | 0.21   | 0.04                                          | 0.02   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 1              | 1           | 0            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-63-4a      | Y        | 0.03                  | 1           | 900                   | 36                 | 5         | 1.7                     | 0.6    | P             | 0.17                                                  | 0.11   | 0.01                                          | 0.01   | Not Exceeded                           | Not Exceeded | Not Exceeded                            | Not Exceeded | 0               | 0                 | 0              | 1           | 1            | 2                | MODERATE | Rail       | Culvert                                       |                                     |
| CV-66-1       | Y        | 0.35                  | 1           | 900                   | 62                 | 5         | 19.8                    | 7.1    | P             | 0.43                                                  | 0.29   | 0.06                                          | 0.03   | Exceeded                               | Not Exceeded | Exceeded                                | Not Exceeded | 0               | 0                 | 3              | 1           | 2            | 6                | HIGH     | Rail       | Culvert                                       |                                     |
| CV-66-2       | Y        | 0.60                  | 1</         |                       |                    |           |                         |        |               |                                                       |        |                                               |        |                                        |              |                                         |              |                 |                   |                |             |              |                  |          |            |                                               |                                     |

TABLE C-1

BAFFINLAND IRON MINES CORPORATION  
MARY RIVER PROJECT - PHASE 2 PROPOSAL

FISH PASSAGE RISK ASSESSMENT OF WATER CROSSINGS AND STREAM DIVERSIONS - PROPOSED NORTH RAILWAY  
FISH PASSAGE RISK ASSESSMENT

|                          |   |        |     |      |    |   |       |       |   |      |      |      |      |              |              |              |              |   |   |   |   |   |   |          |             |                                                        |                          |                          |
|--------------------------|---|--------|-----|------|----|---|-------|-------|---|------|------|------|------|--------------|--------------|--------------|--------------|---|---|---|---|---|---|----------|-------------|--------------------------------------------------------|--------------------------|--------------------------|
| Print Jun/18/19 13:00:02 |   |        |     |      |    |   |       |       |   |      |      |      |      |              |              |              |              |   |   |   |   |   |   |          |             |                                                        |                          |                          |
| CV-79-0                  | Y | 0.39   | 1   | 1200 | 18 | 2 | 21.9  | 7.8   | P | 0.31 | 0.20 | 0.07 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-80-1                  | Y | 3.26   | 2   | 1800 | 30 | 1 | 184.7 | 65.9  | Y | 0.37 | 0.26 | 0.16 | 0.09 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 1 | 4 | HIGH     | Rail        | Culvert                                                |                          |                          |
| CV-80-2                  | Y | 0.00   | 1   | 1200 | 24 | 5 | 0.1   | 0.1   | P | 0.06 | 0.04 | 0.00 | 0.00 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Rail        | Culvert                                                |                          |                          |
| CV-80-2a                 | Y | 0.03   | 1   | 1200 | 24 | 5 | 1.5   | 0.5   | P | 0.14 | 0.09 | 0.01 | 0.01 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Rail        | Culvert                                                |                          |                          |
| CV-80-2b                 | Y | 0.16   | 1   | 1200 | 24 | 5 | 9.2   | 3.3   | P | 0.29 | 0.19 | 0.03 | 0.02 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-81-4                  | Y | 0.15   | 1   | 900  | 18 | 5 | 8.4   | 3.0   | P | 0.31 | 0.21 | 0.04 | 0.02 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-83-1                  | Y | 1.23   | 1   | 1200 | 18 | 1 | 69.8  | 24.9  | Y | 0.39 | 0.26 | 0.17 | 0.09 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-83-2                  | Y | 3.24   | 2   | 1800 | 18 | 2 | 183.1 | 65.3  | Y | 0.46 | 0.32 | 0.13 | 0.08 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-84-1                  | N | 11.47  | 2   | -    | 24 | 1 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | Rail        | Plate Arch Culvert                                     |                          |                          |
| CV-84-3                  | Y | 0.24   | 1   | 900  | 18 | 1 | 13.5  | 4.8   | P | 0.23 | 0.15 | 0.08 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Rail        | Culvert                                                |                          |                          |
| CV-85-2                  | Y | 0.34   | 1   | 1200 | 18 | 2 | 19.5  | 7.0   | P | 0.29 | 0.19 | 0.07 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-85-4                  | N | 122.00 | N/A | -    | -  | - | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | Rail                                                   | Bridge                   |                          |
| CV-86-2                  | N | 24.79  | 6   | -    | 24 | 1 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | Rail                                                   | Plate Arch Culvert       |                          |
| CV-87-4                  | Y | 0.49   | 1   | 900  | 18 | 3 | 27.7  | 9.9   | Y | 0.42 | 0.28 | 0.08 | 0.05 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-88-2                  | Y | 0.15   | 1   | 900  | 24 | 1 | 8.8   | 3.1   | P | 0.19 | 0.13 | 0.06 | 0.03 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Rail        | Culvert                                                |                          |                          |
| CV-88-3                  | Y | 0.16   | 1   | 900  | 24 | 4 | 8.8   | 3.1   | P | 0.29 | 0.20 | 0.04 | 0.02 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-89-1                  | Y | 3.88   | 4   | 1500 | 30 | 1 | 219.6 | 78.4  | Y | 0.32 | 0.23 | 0.13 | 0.08 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 1 | 4 | HIGH     | Rail        | Culvert                                                |                          |                          |
| CV-92-5                  | Y | 0.65   | 1   | 1500 | 24 | 4 | 36.8  | 13.1  | Y | 0.43 | 0.28 | 0.07 | 0.04 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-93-4a                 | Y | 5.39   | 3   | 1800 | 36 | 5 | 305.0 | 108.8 | Y | 0.65 | 0.46 | 0.11 | 0.07 | Exceeded     | Not Exceeded | Exceeded     | Not Exceeded | 0 | 0 | 3 | 1 | 1 | 5 | HIGH     | Rail        | Culvert                                                |                          |                          |
| CV-93-4                  | Y | 0.48   | 1   | 1200 | 36 | 5 | 26.9  | 9.6   | Y | 0.44 | 0.29 | 0.06 | 0.03 | Exceeded     | Not Exceeded | Exceeded     | Not Exceeded | 0 | 0 | 2 | 1 | 1 | 4 | HIGH     | Rail        | Culvert                                                |                          |                          |
| CV-96-1                  | Y | 16.43  | 4   | 1800 | 36 | 1 | 929.8 | 331.8 | Y | 0.50 | 0.36 | 0.25 | 0.15 | Exceeded     | Not Exceeded | Exceeded     | Not Exceeded | 0 | 0 | 3 | 1 | 1 | 5 | HIGH     | Rail        | Culvert                                                |                          |                          |
| CV-99-3                  | Y | 6.93   | 4   | 1800 | 24 | 1 | 392.2 | 140.0 | Y | 0.38 | 0.27 | 0.16 | 0.10 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Rail        | Culvert                                                |                          |                          |
| CV-102-1                 | N | -      | N/A | -    | -  | - | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | Rail                                                   | Bridge                   |                          |
| Culv-2018-B              | Y | 0.50   | 4   | 1200 | 40 | 0 | 28.2  | 10.1  | Y | 0.14 | 0.10 | 0.06 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 1 | 2 | MODERATE | Port        | Culvert                                                |                          |                          |
| CV-060-1                 | Y | 0.92   | 3   | 1500 | 24 | 1 | 51.9  | 18.5  | Y | 0.22 | 0.15 | 0.07 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Road        | Culvert                                                |                          |                          |
| CV-060-2                 | Y | 0.92   | 2   | 1500 | 24 | 3 | 51.9  | 18.5  | Y | 0.36 | 0.25 | 0.07 | 0.04 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Road        | Culvert                                                |                          |                          |
| CV-059-1                 | Y | 0.21   | 2   | 1500 | 24 | 5 | 12.1  | 4.3   | Y | 0.25 | 0.17 | 0.03 | 0.01 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Road        | Culvert                                                |                          |                          |
| CV-214-1                 | Y | 0.24   | 1   | 900  | 18 | 1 | 13.5  | 4.8   | Y | 0.23 | 0.15 | 0.08 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Road        | Culvert                                                |                          |                          |
| CV-215-1                 | Y | 0.34   | 1   | 1200 | 18 | 2 | 19.5  | 7.0   | P | 0.29 | 0.19 | 0.07 | 0.04 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Road        | Culvert                                                |                          |                          |
| BG-13-1                  | Y | 16.43  | 4   | 1800 | 36 | 1 | 929.8 | 331.8 | Y | 0.50 | 0.36 | 0.25 | 0.15 | Exceeded     | Not Exceeded | Exceeded     | Not Exceeded | 0 | 0 | 3 | 1 | 1 | 5 | HIGH     | Road        | Culvert                                                |                          |                          |
| CV-102-2                 | Y | 1.69   | 3   | 1200 | 24 | 1 | 95.6  | 34.1  | Y | 0.28 | 0.20 | 0.11 | 0.06 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Mine (Rail) | Culvert                                                |                          |                          |
| CV-103-1                 | Y | 8.21   | 4   | 1800 | 87 | 4 | 464.9 | 165.9 | Y | 0.63 | 0.45 | 0.12 | 0.07 | Exceeded     | Exceeded     | Exceeded     | Not Exceeded | 0 | 0 | 4 | 1 | 2 | 7 | HIGH     | Mine (Rail) | Culvert                                                |                          |                          |
| CV-104-2                 | Y | 0.36   | 1   | 900  | 24 | 5 | 20.2  | 7.2   | P | 0.44 | 0.29 | 0.06 | 0.03 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Mine (Rail) | Culvert                                                |                          |                          |
| CV-104-3                 | Y | 0.20   | 1   | 900  | 45 | 5 | 11.2  | 4.0   | P | 0.35 | 0.23 | 0.04 | 0.02 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 1 | 4 | HIGH     | Mine (Rail) | Culvert                                                |                          |                          |
| CV-104-5                 | N | 8.10   | 1   | -    | 48 | 5 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | Mine (Rail)                                            | Plate Arch Culvert       |                          |
| CV-105-1                 | Y | 0.06   | 1   | 900  | 18 | 3 | 3.4   | 1.2   | P | 0.19 | 0.12 | 0.02 | 0.01 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Mine (Rail) | Culvert                                                |                          |                          |
| CV-105-2                 | Y | 2.36   | 1   | 900  | 18 | 1 | 133.5 | 47.6  | Y | 0.57 | 0.37 | 0.28 | 0.16 | Exceeded     | Not Exceeded | Exceeded     | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Mine (Rail) | Culvert + Stream and Pond Infilling + Stream Diversion |                          |                          |
| CV-105-3                 | Y | -      | 1   | 900  | 18 | 5 | -     | -     | Y | -    | -    | -    | -    | Exceeded     | Exceeded     | Exceeded     | Exceeded     | 0 | 0 | 4 | 1 | 0 | 5 | HIGH     | Mine (Rail) | Pond Encroachment + Stream Crossing                    |                          |                          |
| CV-105-4                 | Y | 0.10   | 1   | 900  | 30 | 2 | 5.6   | 2.0   | Y | 0.20 | 0.13 | 0.04 | 0.02 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 1 | 2 | MODERATE | Mine (Rail) | Stream Crossing + Stream Infilling + Stream diversion  |                          |                          |
| CV-106-1                 | N | -      | 1   | 1200 | 30 | 1 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | Mine (Rail)                                            | Pond Infilling + Culvert |                          |
| CV-106-1a                | N | -      | N/A | -    | -  | - | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine (Rail)              | Stream Infilling         |
| CV-106-2                 | N | -      | 2   | 1500 | 24 | 1 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine (Rail)              | Pond Infilling + Culvert |
| CV-106-3                 | N | -      | N/A | -    | -  | - | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine (Rail)              | Pond Encroachment        |
| CV-107-1                 | N | -      | 1   | 600  | 24 | 5 | -     | -     | P | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine (Rail)              | Pond Infilling + Culvert |
| M-Culv-11                | Y | 0.01   | 1   | 600  | 15 | 3 | 0.5   | 0.2   | P | 0.10 | 0.07 | 0.01 | 0.01 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Mine        | Culvert                                                |                          |                          |
| ulv-3A (CV-10            | N | -      | 1   | -    | 30 | 4 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine                     | Plate Arch Culvert       |
| Culv-3B (CV-11           | N | -      | 1   | -    | 28 | 2 | -     | -     | Y | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine                     | Plate Arch Culvert       |
| M-Culv-4                 | Y | 1.88   | 3   | 1500 | 30 | 1 | 106.4 | 38.0  | Y | 0.24 | 0.17 | 0.11 | 0.07 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Mine        | Culvert                                                |                          |                          |
| M-Culv-16                | N | -      | 1   | 600  | 17 | 0 | -     | -     | P | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine                     | Pond Infilling + Culvert |
| M-Culv-18                | Y | 0.03   | 1   | 600  | 14 | 0 | 2.0   | 0.7   | P | 0.10 | 0.06 | 0.04 | 0.02 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 0 | 1 | 0 | 1 | LOW      | Mine        | Culvert                                                |                          |                          |
| M-Culv-14                | Y | 0.89   | 1   | 900  | 13 | 1 | 50.6  | 18.1  | P | 0.40 | 0.27 | 0.16 | 0.09 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 0 | 3 | MODERATE | Mine        | Culvert                                                |                          |                          |
| M-Culv-17                | Y | 0.05   | 1   | 600  | 26 | 5 | 3.0   | 1.1   | P | 0.24 | 0.16 | 0.03 | 0.01 | Not Exceeded | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 1 | 1 | 0 | 2 | MODERATE | Mine        | Culvert                                                |                          |                          |
| M-Culv-2a                | Y | 0.69   | 2   | 900  | 66 | 2 | 39.2  | 14.0  | P | 0.30 | 0.21 | 0.08 | 0.05 | Exceeded     | Not Exceeded | Not Exceeded | Not Exceeded | 0 | 0 | 2 | 1 | 2 | 5 | HIGH     | Mine        | Culvert                                                |                          |                          |
| WD-2 Receiver            | N | -      | N/A | -    | -  | - | -     | -     | P | -    | -    | -    | -    | -            | -            | -            | -            | - | - | - | - | - | - | -        | -           | -                                                      | Mine                     |                          |

\\KPL\VA-Prj\$1102\00181153\VA\Correspondence\VA19-00838 - Northern Railway Stream Crossings\Tables\

NOTES:

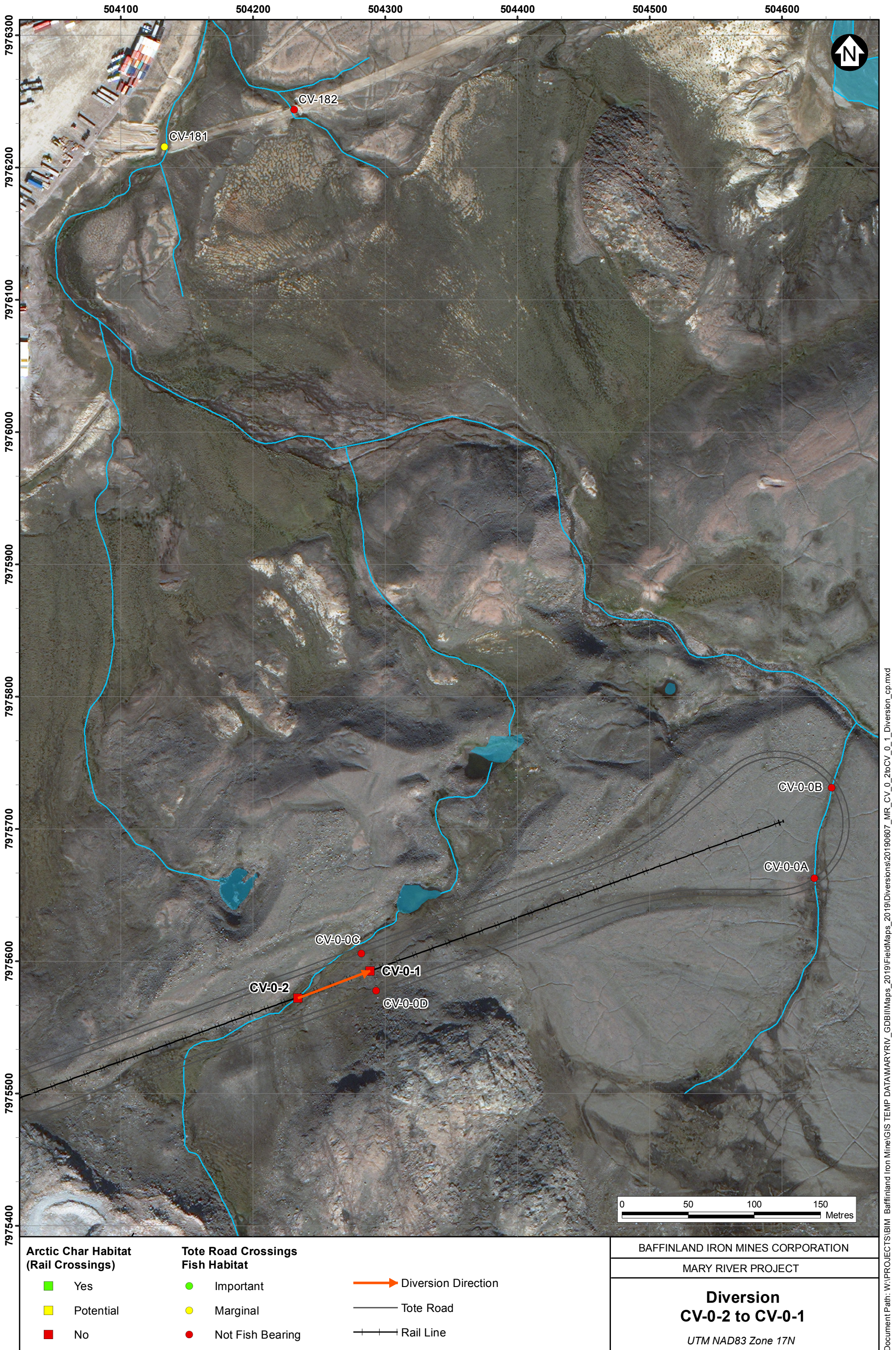
1. JULY AND AUGUST VELOCITY RESULTS ARE CALCULATED FROM MEAN MONTHLY FLOWS DURING THOSE MONTHS IN EMBEDDED CULVERTS. ALL VELOCITIES ARE CROSS SECTION AVERAGE VALUES.
2. JULY AND AUGUST DEPTH RESULTS ARE CALCULATED FROM THE MEAN MONTHLY FLOWS DURING THOSE MONTHS. ALL DEPTHS ARE CROSS SECTION MAXIMUM VALUES.
3. PLATE ARCH CULVERTS AND BRIDGES ARE NOT ASSESSED IN THIS TABLE
4. "Y" = YES, "P" = POTENTIALLY
5. EMBEDDED CULVERT SCORES: > 20% OF DIAMETER AND CONTINUOUS = 1, < 20% OF DIAMETER AND/OR DISCONTINUOUS = 0.
6. OUTLET DROP CULVERT BARRIER SCORES: NO DROP = 0, DROP = 1.
7. VELOCITY SCORES: VELOCITY THRESHOLD NOT EXCEEDED = 0, VELOCITY THRESHOLD EXCEEDED = 1.
8. FISH SCORES: P = 0, Y = 1.
9. LENGTH BARRIER SCORE: < 30 m = 0, > 30 m = 1.

|     |         |                               |        |      |
|-----|---------|-------------------------------|--------|------|
| 0   | 24MAY19 | ISSUED WITH LETTER VA18-02368 | MJB    | TJP  |
| REV | DATE    | DESCRIPTION                   | PREP'D | RVWD |

## **APPENDIX D**

### **Flow Diversions**

(Pages D-1 to D-10)



Document Path: W:\PROJECTS\BIM Baffinland Iron Mine\GIS TEMP DATA\MARYRIV\_GDB\BIMMaps\_2019\FieldMaps\_2019\Divisions\20190607\_MR\_CV\_0\_2toCV\_0\_1\_Diversion\_cp.mxd