



## 2015 HYDROLOGY BASELINE - WHALE TAIL PIT PROJECT

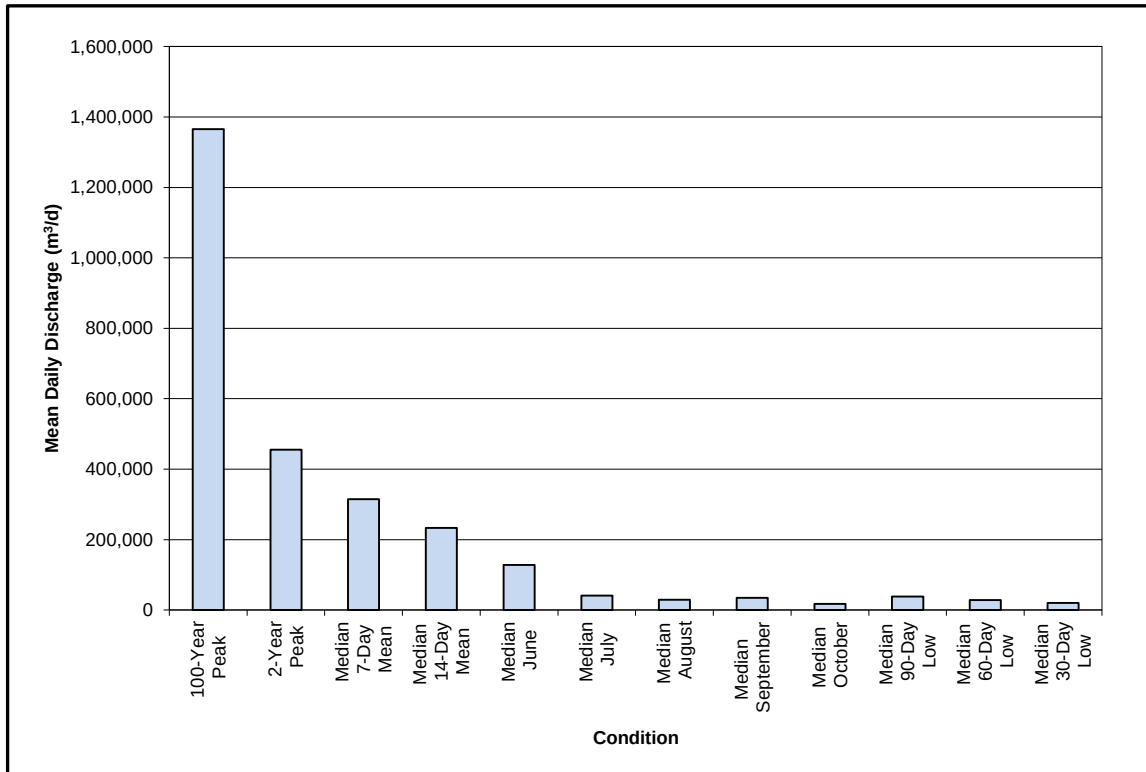


Figure 3-34: Derived Flow Regimes at Lake A5

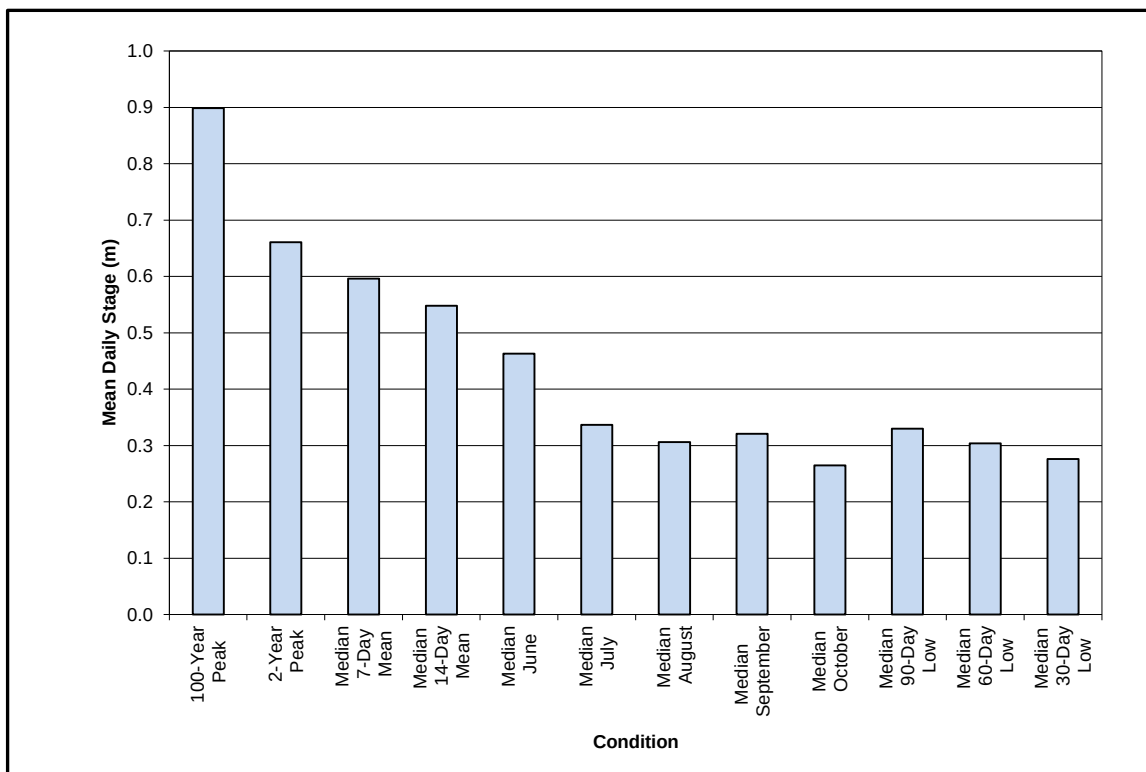


Figure 3-35: Derived Stage Regimes at Lake A5



## 2015 HYDROLOGY BASELINE - WHALE TAIL PIT PROJECT

### 3.4.2 Lake A15

Results for Lake A15 are presented in Table 3-25 (monthly mean discharges), Table 3-26 (peak and low flow discharges), Table 3-27 (monthly mean stages), and Table 3-28 (peak and low flow stages). Results are summarized in Figure 3-36 (flow regimes) and Figure 3-37 (stage regimes).

**Table 3-25: Monthly Mean Discharges at the Lake A15 Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |         |         |        |           |         |
|-----------|-----------------------|--------------------------------------------|---------|---------|--------|-----------|---------|
|           |                       | May                                        | June    | July    | August | September | October |
| Wet       | 100                   | 29,700                                     | 201,000 | 127,000 | 65,700 | 85,100    | 44,800  |
|           | 50                    | 23,200                                     | 188,000 | 109,000 | 59,500 | 76,700    | 40,600  |
|           | 20                    | 15,300                                     | 169,000 | 86,400  | 50,800 | 64,700    | 34,700  |
|           | 10                    | 9,940                                      | 152,000 | 69,700  | 43,400 | 54,800    | 29,600  |
|           | 5                     | 5,120                                      | 132,000 | 53,800  | 35,200 | 43,900    | 23,900  |
| Median    | 2                     | 0                                          | 95,400  | 34,500  | 21,800 | 26,400    | 14,300  |
| Dry       | 5                     | 0                                          | 62,800  | 25,900  | 11,900 | 14,000    | 7,030   |
|           | 10                    | 0                                          | 48,400  | 24,100  | 8,390  | 9,630     | 4,290   |
|           | 20                    | 0                                          | 38,400  | 23,300  | 6,240  | 7,070     | 2,580   |
|           | 50                    | 0                                          | 29,200  | 23,000  | 4,570  | 5,130     | 1,220   |
|           | 100                   | 0                                          | 24,300  | 22,800  | 3,830  | 4,290     | 583     |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-26: Peak and Low Flow Discharges at the Lake A15 Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 9.37                             | 593,000                               | 414,000                                | 51,800                                | 54,600                                | 68,300                                |
|           | 50                    | 8.51                             | 541,000                               | 380,000                                | 45,300                                | 50,500                                | 63,200                                |
|           | 20                    | 7.29                             | 467,000                               | 332,000                                | 37,000                                | 44,400                                | 55,800                                |
|           | 10                    | 6.26                             | 405,000                               | 291,000                                | 30,800                                | 39,200                                | 49,500                                |
|           | 5                     | 5.11                             | 334,000                               | 245,000                                | 24,700                                | 33,000                                | 42,400                                |
| Median    | 2                     | 3.22                             | 218,000                               | 168,000                                | 16,000                                | 22,200                                | 30,300                                |
| Dry       | 5                     | 1.82                             | 131,000                               | 110,000                                | 9,840                                 | 13,300                                | 20,900                                |
|           | 10                    | 1.32                             | 98,700                                | 88,000                                 | 7,320                                 | 9,530                                 | 17,300                                |
|           | 20                    | 1.01                             | 78,900                                | 74,500                                 | 5,500                                 | 7,040                                 | 15,100                                |
|           | 50                    | 0.77                             | 63,300                                | 63,700                                 | 3,690                                 | 4,890                                 | 13,200                                |
|           | 100                   | 0.66                             | 56,200                                | 58,700                                 | 2,590                                 | 3,810                                 | 12,400                                |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



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**Table 3-27: Monthly Mean Stages at the Lake A15 Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.485                  | 0.731 | 0.663 | 0.575  | 0.608     | 0.530   |
|           | 50                    | 0.460                  | 0.721 | 0.641 | 0.563  | 0.595     | 0.519   |
|           | 20                    | 0.421                  | 0.704 | 0.610 | 0.544  | 0.573     | 0.502   |
|           | 10                    | 0.384                  | 0.689 | 0.583 | 0.526  | 0.553     | 0.485   |
|           | 5                     | 0.333                  | 0.668 | 0.551 | 0.503  | 0.528     | 0.463   |
| Median    | 2                     | -                      | 0.623 | 0.501 | 0.454  | 0.473     | 0.415   |
| Dry       | 5                     | -                      | 0.570 | 0.471 | 0.399  | 0.413     | 0.356   |
|           | 10                    | -                      | 0.539 | 0.464 | 0.370  | 0.381     | 0.320   |
|           | 20                    | -                      | 0.513 | 0.461 | 0.347  | 0.357     | 0.287   |
|           | 50                    | -                      | 0.483 | 0.459 | 0.325  | 0.333     | 0.245   |
|           | 100                   | -                      | 0.465 | 0.458 | 0.313  | 0.320     | 0.209   |

m= metres.

**Table 3-28: Peak and Low Flow Stages at the Lake A15 Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 0.986                | 0.922                     | 0.854                      | 0.547                     | 0.553                       | 0.580                     |
|           | 50                    | 0.966                | 0.904                     | 0.838                      | 0.531                     | 0.544                       | 0.570                     |
|           | 20                    | 0.934                | 0.876                     | 0.814                      | 0.509                     | 0.529                       | 0.555                     |
|           | 10                    | 0.904                | 0.850                     | 0.792                      | 0.489                     | 0.515                       | 0.541                     |
|           | 5                     | 0.866                | 0.815                     | 0.763                      | 0.466                     | 0.496                       | 0.524                     |
| Median    | 2                     | 0.784                | 0.744                     | 0.704                      | 0.425                     | 0.456                       | 0.487                     |
| Dry       | 5                     | 0.694                | 0.667                     | 0.642                      | 0.383                     | 0.408                       | 0.450                     |
|           | 10                    | 0.647                | 0.628                     | 0.612                      | 0.359                     | 0.380                       | 0.432                     |
|           | 20                    | 0.611                | 0.598                     | 0.591                      | 0.338                     | 0.356                       | 0.420                     |
|           | 50                    | 0.576                | 0.571                     | 0.571                      | 0.310                     | 0.329                       | 0.408                     |
|           | 100                   | 0.557                | 0.556                     | 0.561                      | 0.287                     | 0.312                       | 0.402                     |

m= metres.



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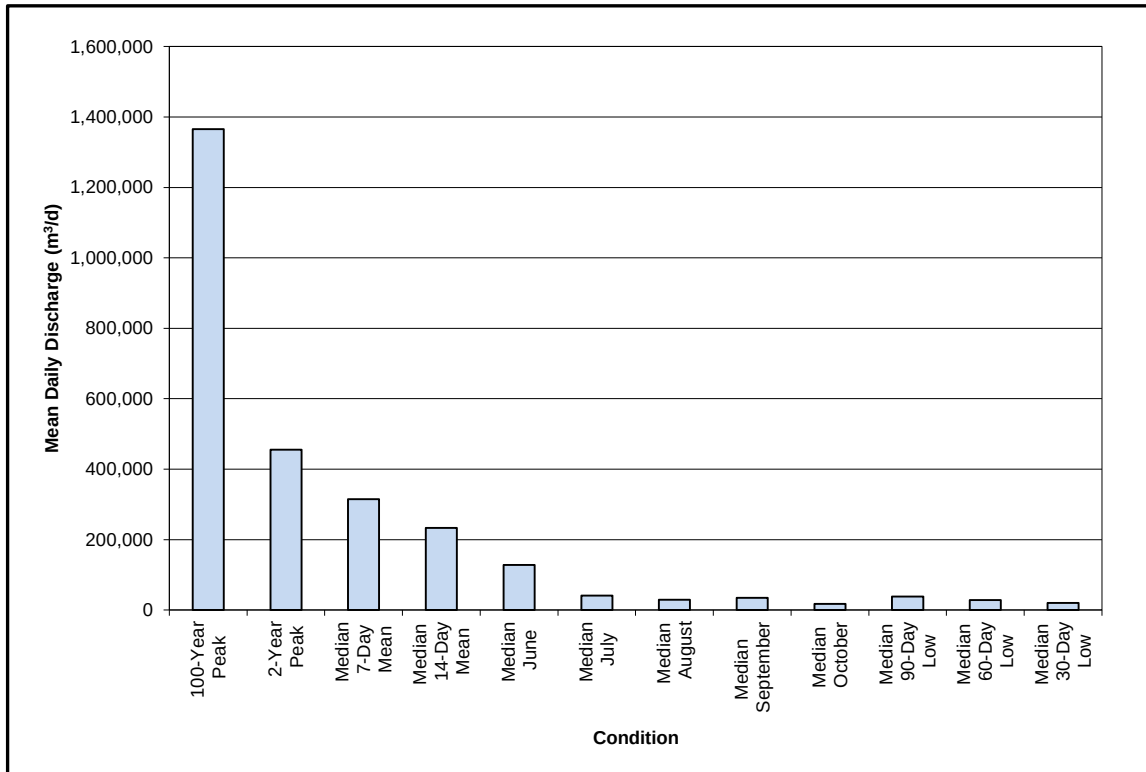


Figure 3-36: Derived Flow Regimes at Lake A15

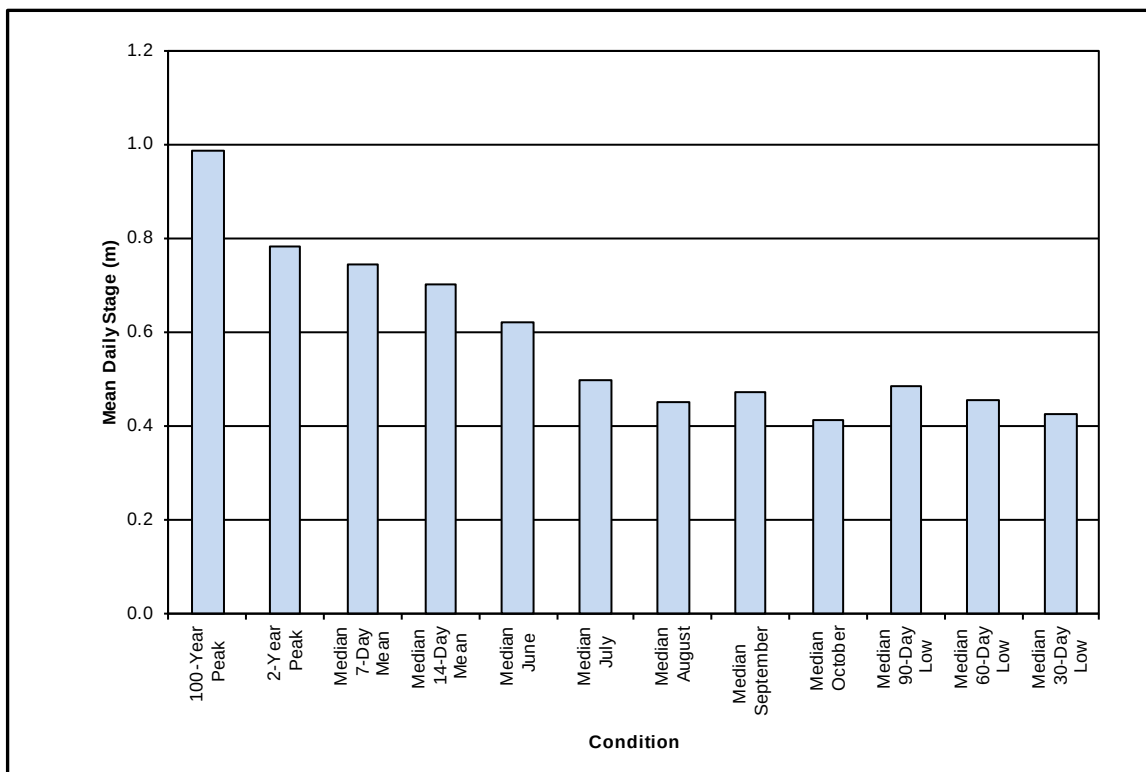


Figure 3-37: Derived Stage Regimes at Lake A15



### 3.4.3 Lake A17 (Whale Tail Lake)

Results for Lake A17 (Whale Tail Lake) are presented in Table 3-29 (monthly mean discharges), Table 3-30 (peak and low flow discharges), Table 3-31 (monthly mean stages), and Table 3-32 (peak and low flow stages). Results are summarized in Figure 3-38 (flow regimes) and Figure 3-39 (stage regimes).

**Table 3-29: Monthly Mean Discharges at the Lake A17 (Whale Tail Lake) Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |         |        |        |           |         |
|-----------|-----------------------|--------------------------------------------|---------|--------|--------|-----------|---------|
|           |                       | May                                        | June    | July   | August | September | October |
| Wet       | 100                   | 14,400                                     | 122,000 | 75,200 | 39,500 | 56,700    | 30,200  |
|           | 50                    | 11,100                                     | 114,000 | 63,700 | 35,600 | 49,500    | 26,900  |
|           | 20                    | 7,070                                      | 102,000 | 50,200 | 29,900 | 40,100    | 22,300  |
|           | 10                    | 4,420                                      | 92,300  | 41,100 | 25,200 | 33,100    | 18,500  |
|           | 5                     | 2,140                                      | 80,200  | 32,600 | 19,900 | 25,900    | 14,300  |
| Median    | 2                     | 0                                          | 57,800  | 21,600 | 11,400 | 15,400    | 8,090   |
| Dry       | 5                     | 0                                          | 37,700  | 14,600 | 5,280  | 7,810     | 4,100   |
|           | 10                    | 0                                          | 28,700  | 11,900 | 3,090  | 4,660     | 2,780   |
|           | 20                    | 0                                          | 22,400  | 9,980  | 1,780  | 2,360     | 2,030   |
|           | 50                    | 0                                          | 16,600  | 8,140  | 784    | 59        | 1,450   |
|           | 100                   | 0                                          | 13,400  | 7,050  | 343    | 0         | 1,200   |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-30: Peak and Low Flow Discharges at the Lake A17 (Whale Tail Lake) Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 6.17                             | 355,000                               | 250,000                                | 31,100                                | 32,100                                | 40,800                                |
|           | 50                    | 5.58                             | 324,000                               | 230,000                                | 26,500                                | 29,500                                | 37,700                                |
|           | 20                    | 4.74                             | 281,000                               | 202,000                                | 20,900                                | 25,700                                | 33,200                                |
|           | 10                    | 4.04                             | 245,000                               | 177,000                                | 16,900                                | 22,500                                | 29,300                                |
|           | 5                     | 3.26                             | 203,000                               | 150,000                                | 13,000                                | 18,600                                | 24,900                                |
| Median    | 2                     | 2.01                             | 134,000                               | 104,000                                | 7,790                                 | 11,900                                | 17,400                                |
| Dry       | 5                     | 1.10                             | 81,700                                | 68,600                                 | 4,280                                 | 6,320                                 | 11,500                                |
|           | 10                    | 0.78                             | 62,000                                | 55,200                                 | 2,880                                 | 4,020                                 | 9,210                                 |
|           | 20                    | 0.59                             | 49,700                                | 46,900                                 | 1,890                                 | 2,480                                 | 7,750                                 |
|           | 50                    | 0.44                             | 39,900                                | 40,200                                 | 906                                   | 1,150                                 | 6,550                                 |
|           | 100                   | 0.38                             | 35,400                                | 37,100                                 | 320                                   | 489                                   | 5,980                                 |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



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**Table 3-31: Monthly Mean Stages at the Lake A17 (Whale Tail Lake) Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.458                  | 0.847 | 0.737 | 0.612  | 0.679     | 0.566   |
|           | 50                    | 0.424                  | 0.831 | 0.702 | 0.594  | 0.653     | 0.548   |
|           | 20                    | 0.373                  | 0.804 | 0.656 | 0.565  | 0.615     | 0.519   |
|           | 10                    | 0.326                  | 0.782 | 0.619 | 0.538  | 0.582     | 0.492   |
|           | 5                     | 0.264                  | 0.751 | 0.579 | 0.502  | 0.542     | 0.457   |
| Median    | 2                     | -                      | 0.683 | 0.514 | 0.428  | 0.466     | 0.387   |
| Dry       | 5                     | -                      | 0.604 | 0.459 | 0.343  | 0.384     | 0.319   |
|           | 10                    | -                      | 0.558 | 0.433 | 0.294  | 0.331     | 0.285   |
|           | 20                    | -                      | 0.520 | 0.412 | 0.250  | 0.272     | 0.260   |
|           | 50                    | -                      | 0.477 | 0.388 | 0.198  | 0.094     | 0.236   |
|           | 100                   | -                      | 0.448 | 0.372 | 0.156  | -         | 0.224   |

m= metres.

**Table 3-32: Peak and Low Flow Stages at the Lake A17 (Whale Tail Lake) Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 1.296                | 1.152                     | 1.042                      | 0.571                     | 0.576                       | 0.618                     |
|           | 50                    | 1.259                | 1.122                     | 1.017                      | 0.545                     | 0.563                       | 0.604                     |
|           | 20                    | 1.201                | 1.077                     | 0.979                      | 0.509                     | 0.541                       | 0.582                     |
|           | 10                    | 1.147                | 1.035                     | 0.943                      | 0.479                     | 0.520                       | 0.561                     |
|           | 5                     | 1.078                | 0.981                     | 0.899                      | 0.444                     | 0.493                       | 0.536                     |
| Median    | 2                     | 0.938                | 0.870                     | 0.809                      | 0.383                     | 0.433                       | 0.483                     |
| Dry       | 5                     | 0.788                | 0.755                     | 0.717                      | 0.323                     | 0.361                       | 0.429                     |
|           | 10                    | 0.714                | 0.697                     | 0.674                      | 0.288                     | 0.317                       | 0.402                     |
|           | 20                    | 0.659                | 0.654                     | 0.643                      | 0.255                     | 0.276                       | 0.383                     |
|           | 50                    | 0.606                | 0.614                     | 0.615                      | 0.206                     | 0.221                       | 0.365                     |
|           | 100                   | 0.579                | 0.593                     | 0.601                      | 0.153                     | 0.173                       | 0.355                     |

m= metres.



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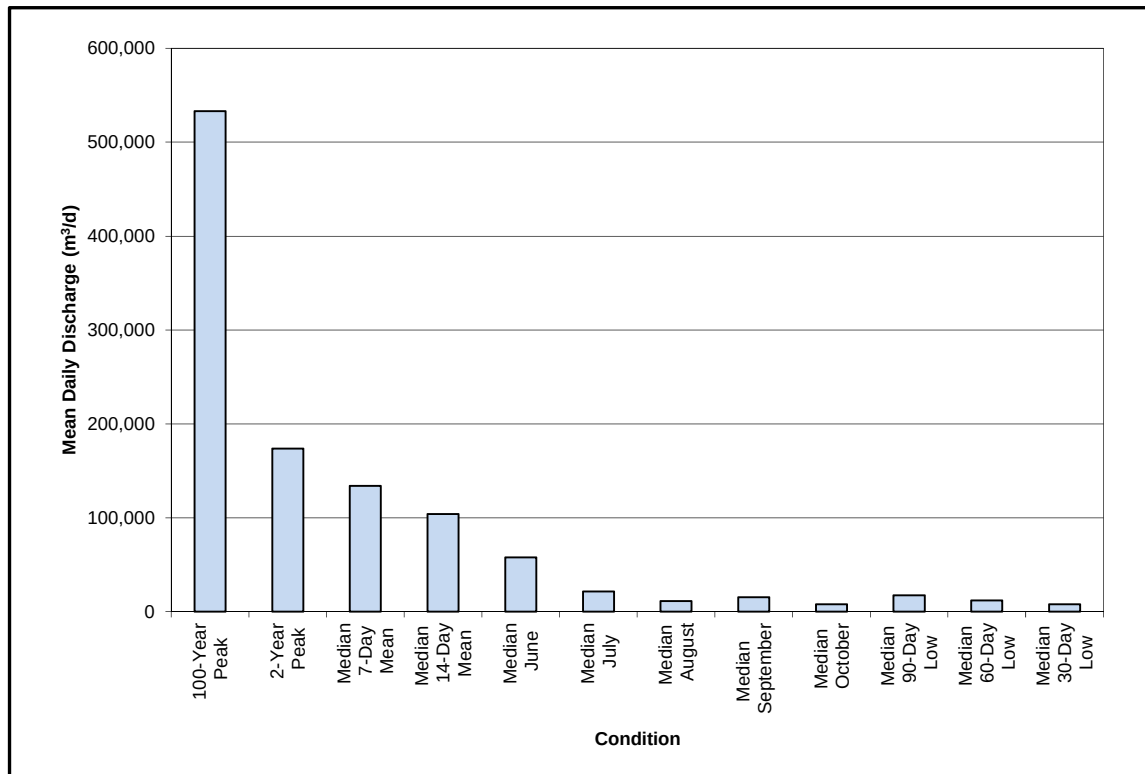


Figure 3-38: Derived Flow Regimes at Lake A17 (Whale Tail Lake)

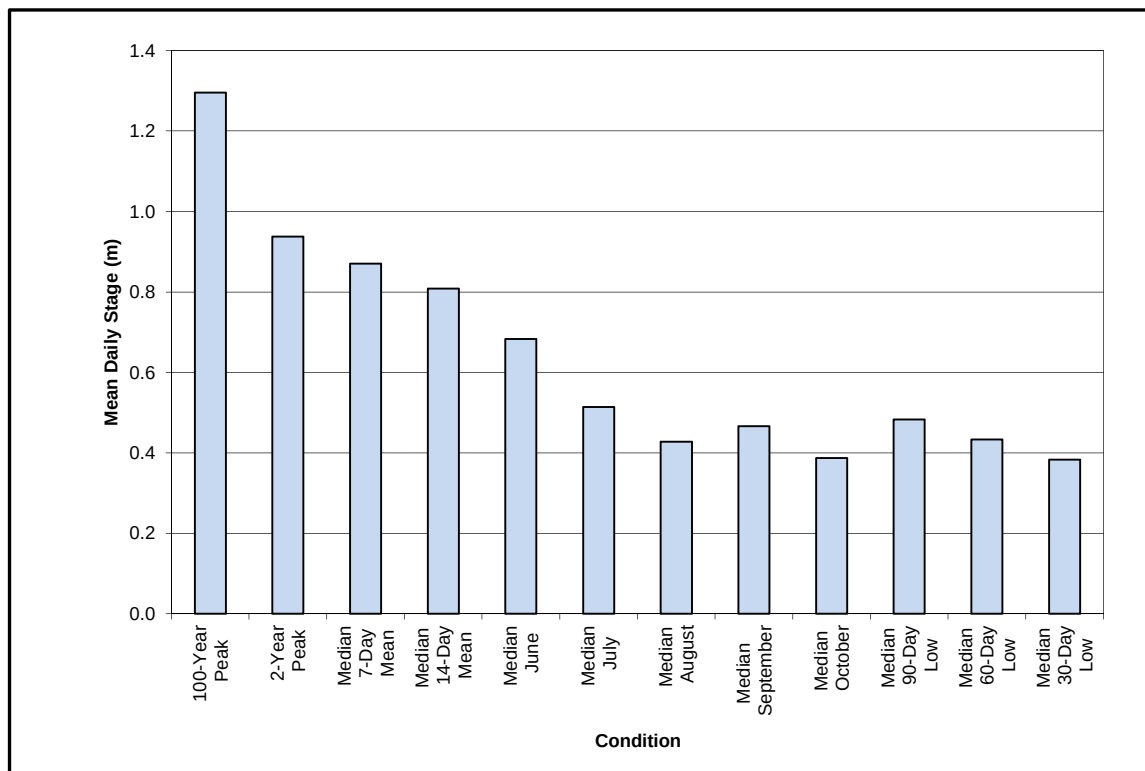


Figure 3-39: Derived Stage Regimes at Lake A17 (Whale Tail Lake)



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### 3.4.4 Lake A18

Results for Lake A18 are presented in Table 3-33 (monthly mean discharges), Table 3-34 (peak and low flow discharges), Table 3-35 (monthly mean stages), and Table 3-36 (peak and low flow stages). Results are summarized in Figure 3-40 (flow regimes) and Figure 3-41 (stage regimes).

**Table 3-33: Monthly Mean Discharges at the Lake A18 Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |        |        |        |           |         |
|-----------|-----------------------|--------------------------------------------|--------|--------|--------|-----------|---------|
|           |                       | May                                        | June   | July   | August | September | October |
| Wet       | 100                   | 12,200                                     | 57,000 | 32,600 | 23,000 | 24,900    | 13,700  |
|           | 50                    | 9,870                                      | 53,500 | 28,300 | 20,200 | 22,700    | 11,600  |
|           | 20                    | 6,910                                      | 48,200 | 22,700 | 16,600 | 19,500    | 9,080   |
|           | 10                    | 4,760                                      | 43,500 | 18,700 | 13,700 | 16,700    | 7,300   |
|           | 5                     | 2,700                                      | 38,100 | 14,600 | 10,700 | 13,600    | 5,580   |
| Median    | 2                     | 190                                        | 28,400 | 8,930  | 6,220  | 8,310     | 3,230   |
| Dry       | 5                     | 0                                          | 20,100 | 5,150  | 2,870  | 4,160     | 0       |
|           | 10                    | 0                                          | 16,700 | 3,720  | 1,440  | 2,540     | 0       |
|           | 20                    | 0                                          | 14,300 | 2,750  | 388    | 1,510     | 0       |
|           | 50                    | 0                                          | 12,100 | 1,840  | 0      | 662       | 0       |
|           | 100                   | 0                                          | 11,100 | 1,330  | 0      | 261       | 0       |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-34: Peak and Low Flow Discharges at the Lake A18 Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 3.38                             | 146,000                               | 112,000                                | 12,000                                | 16,700                                | 18,400                                |
|           | 50                    | 2.92                             | 135,000                               | 103,000                                | 10,500                                | 15,200                                | 17,200                                |
|           | 20                    | 2.36                             | 119,000                               | 91,400                                 | 8,570                                 | 13,000                                | 15,300                                |
|           | 10                    | 1.97                             | 106,000                               | 81,200                                 | 7,090                                 | 11,200                                | 13,700                                |
|           | 5                     | 1.61                             | 90,300                                | 69,700                                 | 5,560                                 | 9,160                                 | 11,800                                |
| Median    | 2                     | 1.11                             | 64,400                                | 50,700                                 | 3,300                                 | 5,840                                 | 8,490                                 |
| Dry       | 5                     | 0.81                             | 44,600                                | 36,300                                 | 1,650                                 | 3,130                                 | 5,680                                 |
|           | 10                    | 0.70                             | 37,100                                | 30,900                                 | 953                                   | 1,920                                 | 4,500                                 |
|           | 20                    | 0.63                             | 32,300                                | 27,600                                 | 446                                   | 997                                   | 3,710                                 |
|           | 50                    | 0.57                             | 28,500                                | 25,000                                 | 0                                     | 42                                    | 3,020                                 |
|           | 100                   | 0.54                             | 26,700                                | 23,800                                 | 0                                     | 0                                     | 2,670                                 |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.





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**Table 3-35: Monthly Mean Stages at the Lake A18 Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.405                  | 0.549 | 0.492 | 0.459  | 0.466     | 0.415   |
|           | 50                    | 0.389                  | 0.543 | 0.478 | 0.448  | 0.458     | 0.401   |
|           | 20                    | 0.362                  | 0.531 | 0.458 | 0.431  | 0.444     | 0.382   |
|           | 10                    | 0.336                  | 0.521 | 0.441 | 0.415  | 0.431     | 0.366   |
|           | 5                     | 0.301                  | 0.507 | 0.420 | 0.395  | 0.414     | 0.347   |
| Median    | 2                     | 0.178                  | 0.479 | 0.381 | 0.355  | 0.376     | 0.312   |
| Dry       | 5                     | -                      | 0.447 | 0.342 | 0.304  | 0.328     | -       |
|           | 10                    | -                      | 0.431 | 0.320 | 0.266  | 0.297     | -       |
|           | 20                    | -                      | 0.418 | 0.302 | 0.205  | 0.268     | -       |
|           | 50                    | -                      | 0.405 | 0.279 | -      | 0.228     | -       |
|           | 100                   | -                      | 0.398 | 0.262 | -      | 0.190     | -       |

m= metres.

**Table 3-36: Peak and Low Flow Stages at the Lake A18 Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 0.759                | 0.662                     | 0.628                      | 0.404                     | 0.431                       | 0.439                     |
|           | 50                    | 0.737                | 0.651                     | 0.617                      | 0.393                     | 0.423                       | 0.434                     |
|           | 20                    | 0.707                | 0.635                     | 0.603                      | 0.378                     | 0.410                       | 0.424                     |
|           | 10                    | 0.682                | 0.621                     | 0.589                      | 0.364                     | 0.398                       | 0.415                     |
|           | 5                     | 0.655                | 0.602                     | 0.572                      | 0.347                     | 0.383                       | 0.403                     |
| Median    | 2                     | 0.609                | 0.563                     | 0.537                      | 0.313                     | 0.350                       | 0.377                     |
| Dry       | 5                     | 0.572                | 0.523                     | 0.503                      | 0.273                     | 0.310                       | 0.348                     |
|           | 10                    | 0.555                | 0.505                     | 0.487                      | 0.245                     | 0.281                       | 0.333                     |
|           | 20                    | 0.544                | 0.491                     | 0.476                      | 0.211                     | 0.247                       | 0.320                     |
|           | 50                    | 0.533                | 0.479                     | 0.467                      | -                         | 0.132                       | 0.308                     |
|           | 100                   | 0.527                | 0.473                     | 0.462                      | -                         | -                           | 0.300                     |

m= metres.



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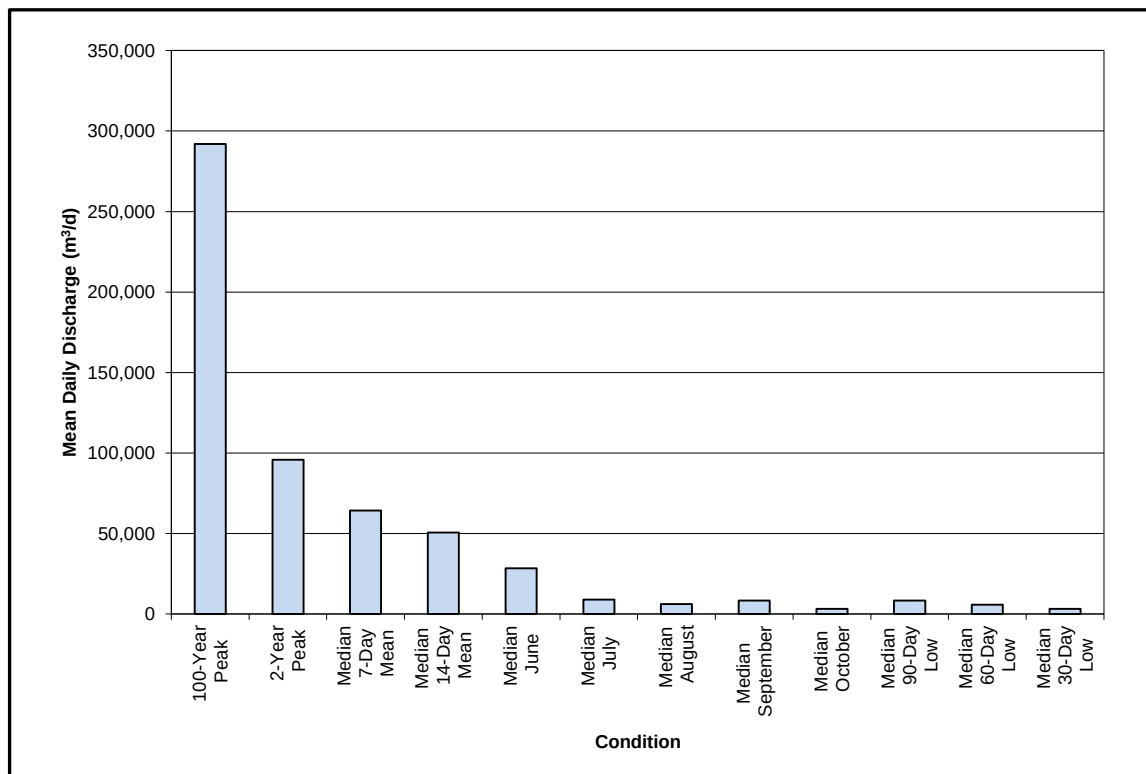


Figure 3-40: Derived Flow Regimes at Lake A18

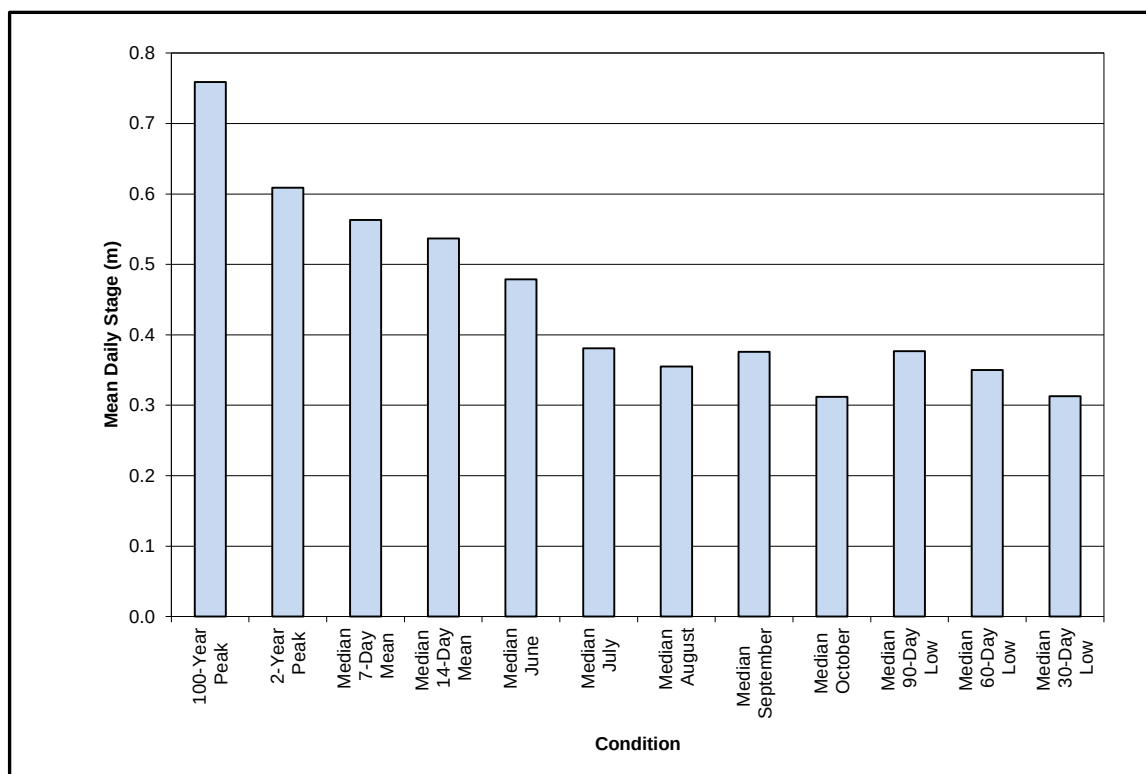


Figure 3-41: Derived Stage Regimes at Lake A18



### 3.4.5 Lake A69

Results for Lake A69 are presented in Table 3-37 (monthly mean discharges), Table 3-38 (peak and low flow discharges), Table 3-39 (monthly mean stages), and Table 3-40 (peak and low flow stages). Results are summarized in Figure 3-42 (flow regimes) and Figure 3-43 (stage regimes).

**Table 3-37: Monthly Mean Discharges at the Lake A69 Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |         |         |         |           |         |
|-----------|-----------------------|--------------------------------------------|---------|---------|---------|-----------|---------|
|           |                       | May                                        | June    | July    | August  | September | October |
| Wet       | 100                   | 65,000                                     | 285,000 | 182,000 | 109,000 | 129,000   | 69,300  |
|           | 50                    | 53,300                                     | 269,000 | 159,000 | 99,700  | 118,000   | 59,400  |
|           | 20                    | 38,000                                     | 245,000 | 127,000 | 86,600  | 102,000   | 46,900  |
|           | 10                    | 26,600                                     | 224,000 | 103,000 | 75,200  | 87,700    | 38,000  |
|           | 5                     | 15,600                                     | 199,000 | 78,900  | 61,900  | 71,900    | 29,300  |
| Median    | 2                     | 1,570                                      | 151,000 | 46,600  | 38,300  | 44,900    | 17,200  |
| Dry       | 5                     | 0                                          | 107,000 | 29,800  | 18,500  | 23,800    | 8,940   |
|           | 10                    | 0                                          | 86,700  | 25,500  | 10,200  | 15,500    | 5,620   |
|           | 20                    | 0                                          | 72,200  | 23,500  | 4,580   | 10,200    | 3,240   |
|           | 50                    | 0                                          | 58,600  | 22,300  | 0       | 5,910     | 883     |
|           | 100                   | 0                                          | 51,200  | 21,900  | 0       | 3,840     | 0       |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-38: Peak and Low Flow Discharges at the Lake A69 Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 14.5                             | 710,000                               | 571,000                                | 65,100                                | 86,000                                | 99,100                                |
|           | 50                    | 13.3                             | 659,000                               | 529,000                                | 57,900                                | 79,600                                | 92,500                                |
|           | 20                    | 11.6                             | 584,000                               | 468,000                                | 48,200                                | 70,100                                | 82,800                                |
|           | 10                    | 10.1                             | 521,000                               | 417,000                                | 40,700                                | 61,800                                | 74,400                                |
|           | 5                     | 8.58                             | 448,000                               | 359,000                                | 32,700                                | 52,000                                | 64,600                                |
| Median    | 2                     | 6.15                             | 327,000                               | 264,000                                | 20,500                                | 34,400                                | 47,300                                |
| Dry       | 5                     | 4.51                             | 233,000                               | 192,000                                | 11,300                                | 19,300                                | 32,700                                |
|           | 10                    | 3.95                             | 196,000                               | 165,000                                | 7,400                                 | 12,900                                | 26,600                                |
|           | 20                    | 3.64                             | 174,000                               | 149,000                                | 4,500                                 | 8,540                                 | 22,600                                |
|           | 50                    | 3.41                             | 155,000                               | 136,000                                | 1,550                                 | 4,650                                 | 19,000                                |
|           | 100                   | 3.31                             | 146,463                               | 129,974                                | 0                                     | 2,655                                 | 17,263                                |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



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**Table 3-39: Monthly Mean Stages at the Lake A69 Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.383                  | 0.580 | 0.511 | 0.443  | 0.464     | 0.390   |
|           | 50                    | 0.362                  | 0.570 | 0.492 | 0.432  | 0.453     | 0.374   |
|           | 20                    | 0.330                  | 0.556 | 0.462 | 0.415  | 0.435     | 0.350   |
|           | 10                    | 0.298                  | 0.542 | 0.436 | 0.399  | 0.417     | 0.330   |
|           | 5                     | 0.257                  | 0.524 | 0.404 | 0.378  | 0.394     | 0.306   |
| Median    | 2                     | 0.135                  | 0.485 | 0.349 | 0.330  | 0.345     | 0.264   |
| Dry       | 5                     | -                      | 0.441 | 0.308 | 0.269  | 0.289     | 0.220   |
|           | 10                    | -                      | 0.415 | 0.295 | 0.228  | 0.256     | 0.193   |
|           | 20                    | -                      | 0.395 | 0.288 | 0.182  | 0.228     | 0.165   |
|           | 50                    | -                      | 0.372 | 0.284 | -      | 0.196     | 0.115   |
|           | 100                   | -                      | 0.358 | 0.282 | -      | 0.173     | -       |

m= metres.

**Table 3-40: Peak and Low Flow Stages at the Lake A69 Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 0.877                | 0.748                     | 0.704                      | 0.383                     | 0.414                       | 0.431                     |
|           | 50                    | 0.857                | 0.733                     | 0.689                      | 0.371                     | 0.405                       | 0.423                     |
|           | 20                    | 0.824                | 0.709                     | 0.666                      | 0.352                     | 0.391                       | 0.410                     |
|           | 10                    | 0.793                | 0.686                     | 0.645                      | 0.336                     | 0.378                       | 0.398                     |
|           | 5                     | 0.758                | 0.658                     | 0.618                      | 0.316                     | 0.360                       | 0.382                     |
| Median    | 2                     | 0.690                | 0.602                     | 0.567                      | 0.277                     | 0.321                       | 0.350                     |
| Dry       | 5                     | 0.633                | 0.548                     | 0.519                      | 0.235                     | 0.273                       | 0.316                     |
|           | 10                    | 0.610                | 0.522                     | 0.497                      | 0.208                     | 0.244                       | 0.298                     |
|           | 20                    | 0.596                | 0.505                     | 0.483                      | 0.181                     | 0.217                       | 0.285                     |
|           | 50                    | 0.585                | 0.489                     | 0.471                      | 0.135                     | 0.183                       | 0.271                     |
|           | 100                   | 0.580                | 0.481                     | 0.465                      | -                         | 0.156                       | 0.264                     |

m = metres.



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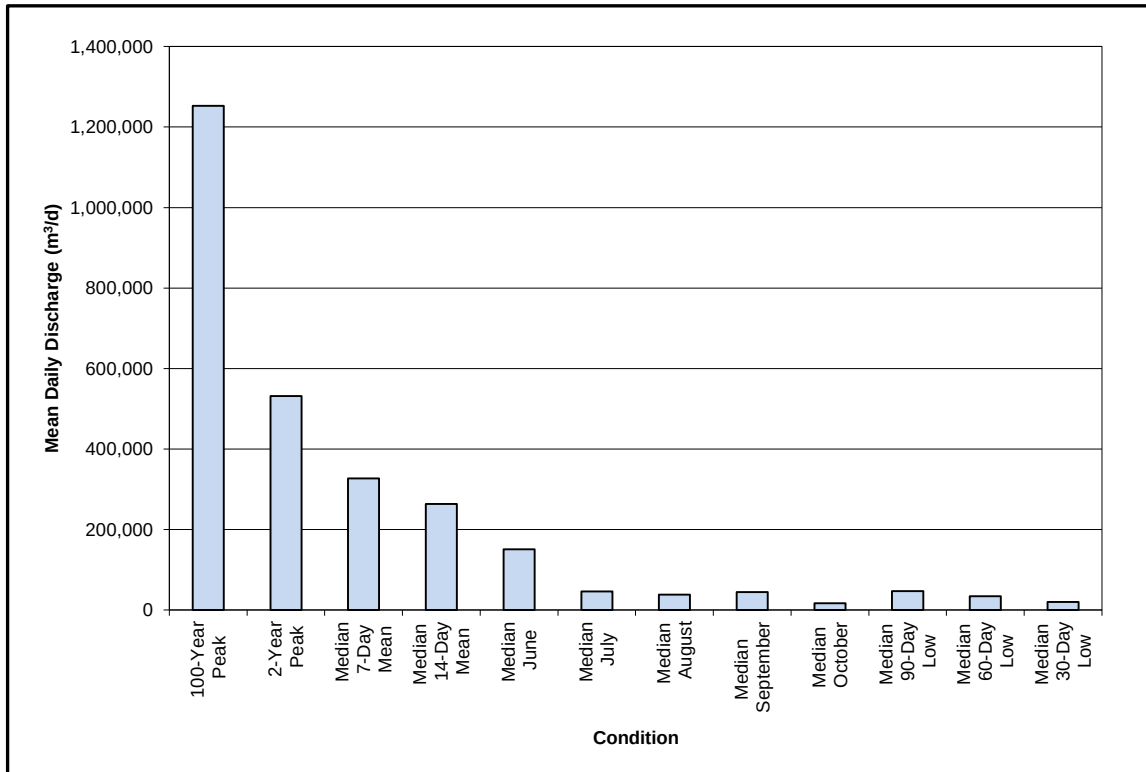


Figure 3-42: Derived Flow Regimes at Lake A69

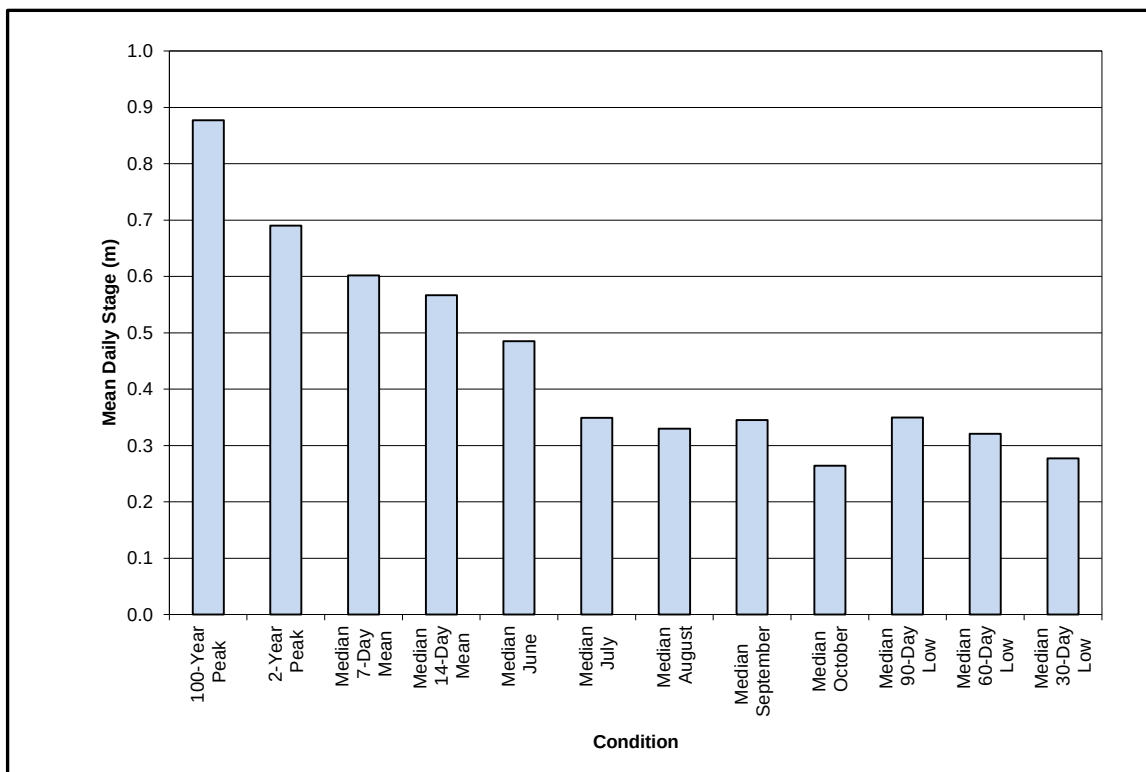


Figure 3-43: Derived Stage Regimes at Lake A69



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### 3.4.6 Lake C8

Results for Lake C8 are presented in Table 3-41 (monthly mean discharges), Table 3-42 (peak and low flow discharges), Table 3-43 (monthly mean stages), and Table 3-44 (peak and low flow stages). Results are summarized in Figure 3-44 (flow regimes) and Figure 3-45 (stage regimes).

**Table 3-41: Monthly Mean Discharges at the Lake C8 Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |        |        |        |           |         |
|-----------|-----------------------|--------------------------------------------|--------|--------|--------|-----------|---------|
|           |                       | May                                        | June   | July   | August | September | October |
| Wet       | 100                   | 22,500                                     | 56,400 | 22,200 | 20,600 | 24,100    | 13,500  |
|           | 50                    | 18,200                                     | 53,300 | 19,700 | 19,000 | 22,200    | 11,900  |
|           | 20                    | 12,600                                     | 48,600 | 16,400 | 16,600 | 19,400    | 9,690   |
|           | 10                    | 8,610                                      | 44,300 | 13,800 | 14,400 | 17,000    | 8,040   |
|           | 5                     | 4,810                                      | 39,100 | 11,200 | 11,900 | 14,200    | 6,350   |
| Median    | 2                     | 241                                        | 29,100 | 7,180  | 7,420  | 9,240     | 3,870   |
| Dry       | 5                     | 0                                          | 19,400 | 4,240  | 3,560  | 5,150     | 2,070   |
|           | 10                    | 0                                          | 14,800 | 3,030  | 1,910  | 3,460     | 1,320   |
|           | 20                    | 0                                          | 11,300 | 2,170  | 784    | 2,340     | 770     |
|           | 50                    | 0                                          | 7,920  | 1,320  | 0      | 1,370     | 218     |
|           | 100                   | 0                                          | 6,000  | 831    | 0      | 890       | 0       |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-42: Peak and Low Flow Discharges at the Lake C8 Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 5.33                             | 202,000                               | 120,000                                | 11,600                                | 16,100                                | 17,600                                |
|           | 50                    | 4.80                             | 190,000                               | 113,000                                | 10,600                                | 14,900                                | 16,300                                |
|           | 20                    | 4.09                             | 170,000                               | 101,000                                | 9,130                                 | 13,100                                | 14,500                                |
|           | 10                    | 3.53                             | 154,000                               | 91,300                                 | 7,870                                 | 11,600                                | 13,000                                |
|           | 5                     | 2.94                             | 134,000                               | 79,700                                 | 6,420                                 | 9,740                                 | 11,300                                |
| Median    | 2                     | 2.09                             | 99,500                                | 59,300                                 | 3,950                                 | 6,410                                 | 8,290                                 |
| Dry       | 5                     | 1.60                             | 69,700                                | 42,200                                 | 1,980                                 | 3,520                                 | 5,690                                 |
|           | 10                    | 1.45                             | 57,100                                | 35,000                                 | 1,210                                 | 2,280                                 | 4,460                                 |
|           | 20                    | 1.38                             | 48,500                                | 30,200                                 | 711                                   | 1,420                                 | 3,500                                 |
|           | 50                    | 1.33                             | 40,900                                | 26,100                                 | 296                                   | 648                                   | 2,490                                 |
|           | 100                   | 1.31                             | 37,000                                | 24,000                                 | 98                                    | 249                                   | 1,850                                 |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



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**Table 3-43: Monthly Mean Stages at the Lake C8 Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.457                  | 0.548 | 0.456 | 0.449  | 0.463     | 0.413   |
|           | 50                    | 0.438                  | 0.542 | 0.445 | 0.442  | 0.456     | 0.403   |
|           | 20                    | 0.408                  | 0.532 | 0.430 | 0.431  | 0.444     | 0.387   |
|           | 10                    | 0.378                  | 0.523 | 0.415 | 0.419  | 0.433     | 0.373   |
|           | 5                     | 0.337                  | 0.510 | 0.398 | 0.403  | 0.417     | 0.356   |
| Median    | 2                     | 0.187                  | 0.481 | 0.365 | 0.367  | 0.384     | 0.323   |
| Dry       | 5                     | -                      | 0.444 | 0.329 | 0.318  | 0.342     | 0.285   |
|           | 10                    | -                      | 0.421 | 0.308 | 0.281  | 0.316     | 0.261   |
|           | 20                    | -                      | 0.399 | 0.288 | 0.236  | 0.292     | 0.235   |
|           | 50                    | -                      | 0.372 | 0.261 | -      | 0.263     | 0.183   |
|           | 100                   | -                      | 0.352 | 0.238 | -      | 0.242     | -       |

m= metres.

**Table 3-44: Peak and Low Flow Stages at the Lake C8 Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 0.830                | 0.705                     | 0.636                      | 0.401                     | 0.428                       | 0.436                     |
|           | 50                    | 0.813                | 0.697                     | 0.629                      | 0.394                     | 0.421                       | 0.429                     |
|           | 20                    | 0.788                | 0.682                     | 0.615                      | 0.383                     | 0.411                       | 0.419                     |
|           | 10                    | 0.765                | 0.669                     | 0.603                      | 0.372                     | 0.401                       | 0.410                     |
|           | 5                     | 0.738                | 0.650                     | 0.587                      | 0.357                     | 0.388                       | 0.399                     |
| Median    | 2                     | 0.690                | 0.613                     | 0.554                      | 0.324                     | 0.357                       | 0.375                     |
| Dry       | 5                     | 0.654                | 0.572                     | 0.518                      | 0.283                     | 0.317                       | 0.349                     |
|           | 10                    | 0.642                | 0.550                     | 0.499                      | 0.257                     | 0.291                       | 0.332                     |
|           | 20                    | 0.636                | 0.532                     | 0.485                      | 0.231                     | 0.265                       | 0.317                     |
|           | 50                    | 0.631                | 0.515                     | 0.471                      | 0.194                     | 0.227                       | 0.296                     |
|           | 100                   | 0.629                | 0.504                     | 0.463                      | 0.156                     | 0.188                       | 0.279                     |

m= metres.



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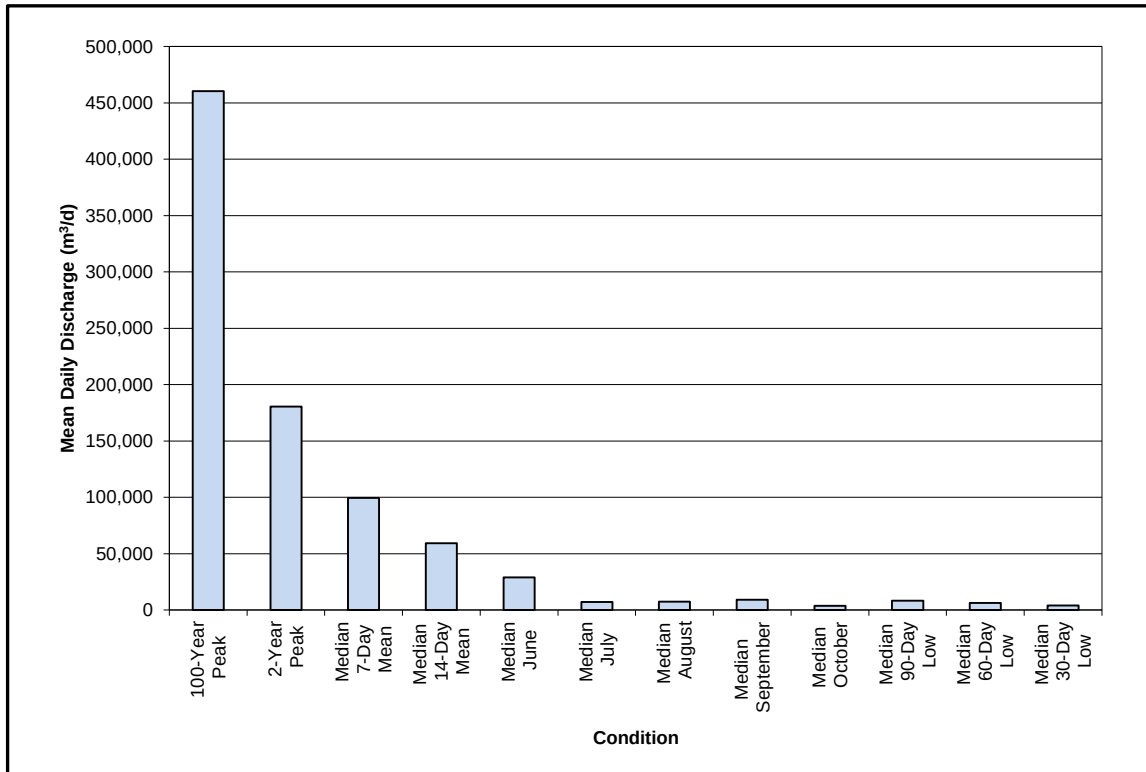


Figure 3-44: Derived Flow Regimes at Lake C8

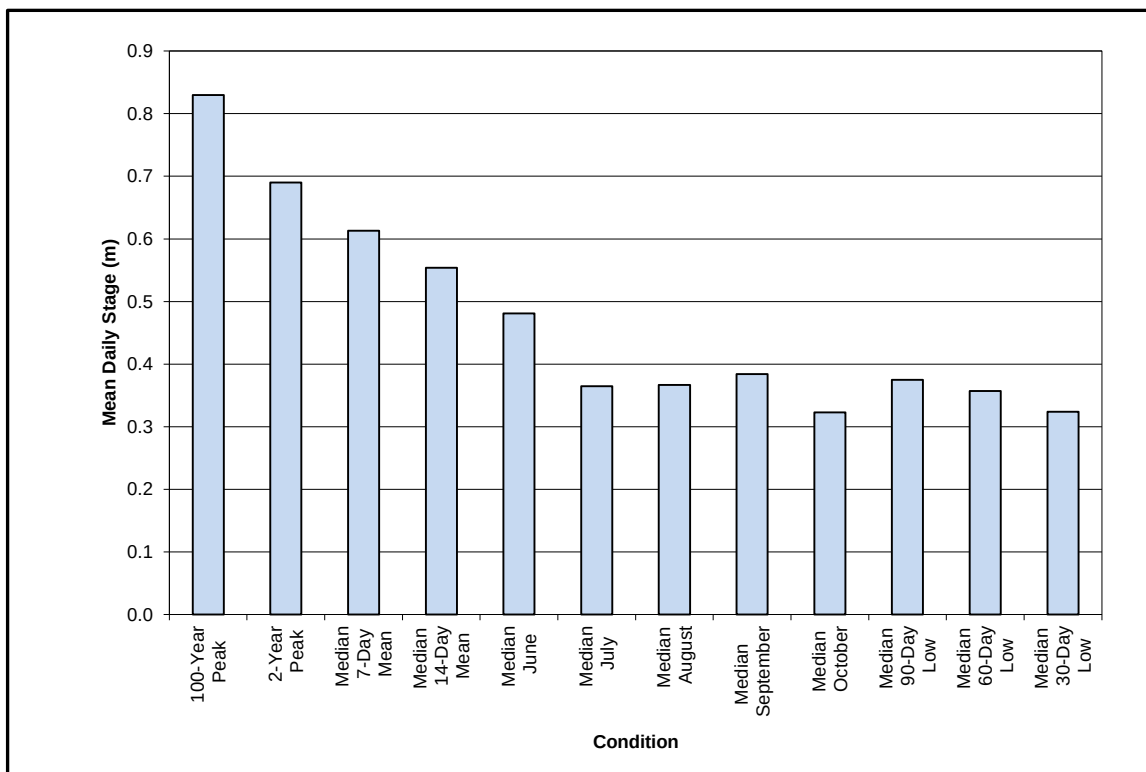


Figure 3-45: Derived Stage Regimes at Lake C8





### 3.4.7 Lake C38 (Nemo Lake)

Results for Lake C38 (Nemo Lake) are presented in Table 3-45 (monthly mean discharges), Table 3-46 (peak and low flow discharges), Table 3-47 (monthly mean stages), and Table 3-48 (peak and low flow stages). Results are summarized in Figure 3-46 (flow regimes) and Figure 3-47 (stage regimes).

**Table 3-45: Monthly Mean Discharges at the Lake C38 (Nemo Lake) Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |       |       |        |           |         |
|-----------|-----------------------|--------------------------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                                        | June  | July  | August | September | October |
| Wet       | 100                   | 396                                        | 4,380 | 5,330 | 4,100  | 3,800     | 2,520   |
|           | 50                    | 305                                        | 4,140 | 4,960 | 3,820  | 3,560     | 2,340   |
|           | 20                    | 199                                        | 3,780 | 4,430 | 3,410  | 3,190     | 2,080   |
|           | 10                    | 131                                        | 3,450 | 3,990 | 3,060  | 2,880     | 1,850   |
|           | 5                     | 72                                         | 3,050 | 3,490 | 2,650  | 2,510     | 1,580   |
| Median    | 2                     | 3                                          | 2,270 | 2,650 | 1,920  | 1,840     | 1,070   |
| Dry       | 5                     | 0                                          | 1,470 | 1,910 | 1,250  | 1,210     | 621     |
|           | 10                    | 0                                          | 1,050 | 1,570 | 929    | 898       | 421     |
|           | 20                    | 0                                          | 692   | 1,300 | 672    | 645       | 280     |
|           | 50                    | 0                                          | 288   | 1,020 | 393    | 368       | 151     |
|           | 100                   | 0                                          | 17    | 847   | 215    | 188       | 82      |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-46: Peak and Low Flow Discharges at the Lake C38 (Nemo Lake) Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 0.075                            | 6,380                                 | 6,200                                  | 3,560                                 | 3,870                                 | 4,310                                 |
|           | 50                    | 0.072                            | 6,050                                 | 5,880                                  | 3,340                                 | 3,610                                 | 4,030                                 |
|           | 20                    | 0.066                            | 5,570                                 | 5,400                                  | 3,000                                 | 3,240                                 | 3,610                                 |
|           | 10                    | 0.061                            | 5,150                                 | 4,990                                  | 2,700                                 | 2,920                                 | 3,260                                 |
|           | 5                     | 0.055                            | 4,650                                 | 4,500                                  | 2,350                                 | 2,550                                 | 2,860                                 |
| Median    | 2                     | 0.044                            | 3,730                                 | 3,610                                  | 1,700                                 | 1,870                                 | 2,150                                 |
| Dry       | 5                     | 0.034                            | 2,850                                 | 2,760                                  | 1,070                                 | 1,240                                 | 1,510                                 |
|           | 10                    | 0.029                            | 2,410                                 | 2,330                                  | 743                                   | 921                                   | 1,200                                 |
|           | 20                    | 0.025                            | 2,060                                 | 1,990                                  | 481                                   | 670                                   | 953                                   |
|           | 50                    | 0.020                            | 1,670                                 | 1,620                                  | 190                                   | 396                                   | 690                                   |
|           | 100                   | 0.017                            | 1,410                                 | 1,370                                  | 0                                     | 219                                   | 523                                   |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



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**Table 3-47: Monthly Mean Stages at the Lake C38 (Nemo Lake) Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.041                  | 0.447 | 0.543 | 0.418  | 0.388     | 0.258   |
|           | 50                    | 0.032                  | 0.422 | 0.506 | 0.390  | 0.364     | 0.239   |
|           | 20                    | 0.021                  | 0.386 | 0.452 | 0.348  | 0.326     | 0.213   |
|           | 10                    | 0.014                  | 0.352 | 0.407 | 0.313  | 0.294     | 0.190   |
|           | 5                     | 0.007                  | 0.312 | 0.356 | 0.271  | 0.257     | 0.162   |
| Median    | 2                     | 0.000                  | 0.232 | 0.271 | 0.197  | 0.189     | 0.110   |
| Dry       | 5                     | -                      | 0.151 | 0.196 | 0.128  | 0.124     | 0.064   |
|           | 10                    | -                      | 0.108 | 0.161 | 0.096  | 0.092     | 0.043   |
|           | 20                    | -                      | 0.071 | 0.133 | 0.069  | 0.066     | 0.029   |
|           | 50                    | -                      | 0.030 | 0.105 | 0.041  | 0.038     | 0.016   |
|           | 100                   | -                      | 0.002 | 0.087 | 0.022  | 0.020     | 0.009   |

m= metres.

**Table 3-48: Peak and Low Flow Stages at the Lake C38 (Nemo Lake) Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 0.660                | 0.649                     | 0.631                      | 0.364                     | 0.395                       | 0.440                     |
|           | 50                    | 0.633                | 0.616                     | 0.599                      | 0.341                     | 0.369                       | 0.411                     |
|           | 20                    | 0.581                | 0.567                     | 0.550                      | 0.307                     | 0.331                       | 0.369                     |
|           | 10                    | 0.537                | 0.525                     | 0.509                      | 0.276                     | 0.298                       | 0.333                     |
|           | 5                     | 0.485                | 0.474                     | 0.459                      | 0.241                     | 0.261                       | 0.292                     |
| Median    | 2                     | 0.388                | 0.381                     | 0.369                      | 0.174                     | 0.192                       | 0.220                     |
| Dry       | 5                     | 0.300                | 0.291                     | 0.282                      | 0.110                     | 0.127                       | 0.155                     |
|           | 10                    | 0.256                | 0.247                     | 0.238                      | 0.077                     | 0.095                       | 0.123                     |
|           | 20                    | 0.221                | 0.211                     | 0.204                      | 0.050                     | 0.069                       | 0.098                     |
|           | 50                    | 0.177                | 0.171                     | 0.166                      | 0.020                     | 0.041                       | 0.071                     |
|           | 100                   | 0.151                | 0.145                     | 0.141                      | -                         | 0.023                       | 0.054                     |

m= metres.



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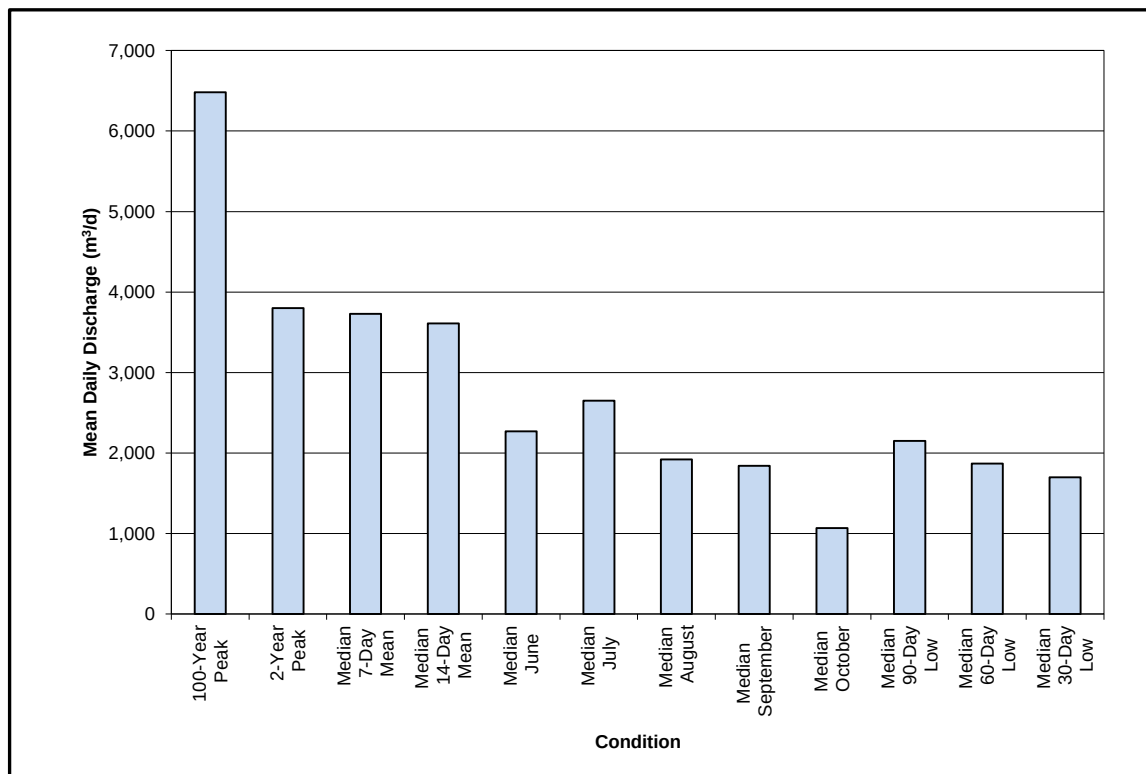


Figure 3-46: Derived Flow Regimes at Lake C38 (Nemo Lake)

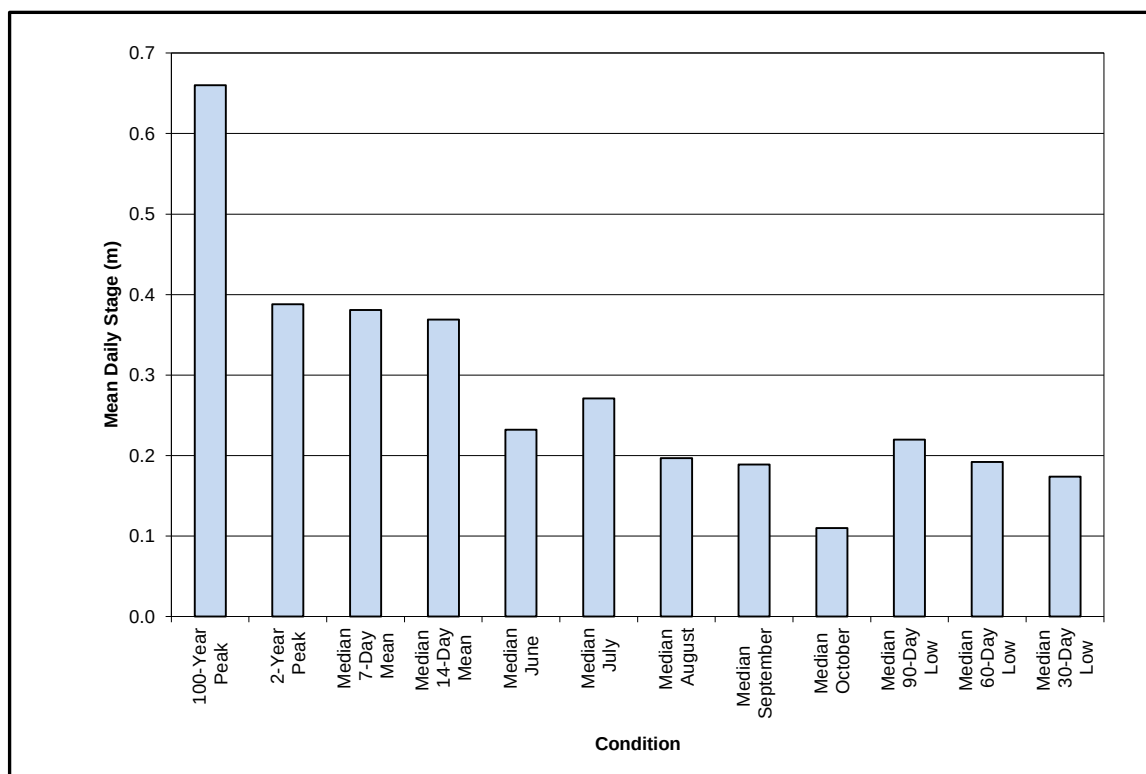


Figure 3-47: Derived Stage Regimes at Lake C38 (Nemo Lake)



### 3.4.8 Lake DS1

Results for Lake DS1 are presented in Table 3-49 (monthly mean discharges), Table 3-50 (peak and low flow discharges), Table 3-51 (monthly mean stages), and Table 3-52 (peak and low flow stages). Results are summarized in Figure 3-48 (flow regimes) and Figure 3-49 (stage regimes).

**Table 3-49: Monthly Mean Discharges at the Lake DS1 Outlet**

| Condition | Return Period (years) | Monthly Mean Discharge (m <sup>3</sup> /d) |           |           |           |           |           |
|-----------|-----------------------|--------------------------------------------|-----------|-----------|-----------|-----------|-----------|
|           |                       | May                                        | June      | July      | August    | September | October   |
| Wet       | 100                   | 329,000                                    | 3,510,000 | 5,120,000 | 1,890,000 | 2,280,000 | 1,980,000 |
|           | 50                    | 224,000                                    | 3,230,000 | 4,390,000 | 1,720,000 | 2,100,000 | 1,810,000 |
|           | 20                    | 130,000                                    | 2,810,000 | 3,500,000 | 1,480,000 | 1,830,000 | 1,560,000 |
|           | 10                    | 82,800                                     | 2,450,000 | 2,860,000 | 1,270,000 | 1,600,000 | 1,360,000 |
|           | 5                     | 48,500                                     | 2,040,000 | 2,250,000 | 1,020,000 | 1,330,000 | 1,140,000 |
| Median    | 2                     | 15,800                                     | 1,320,000 | 1,390,000 | 604,000   | 874,000   | 780,000   |
| Dry       | 5                     | 1,090                                      | 716,000   | 816,000   | 266,000   | 485,000   | 491,000   |
|           | 10                    | 0                                          | 436,000   | 584,000   | 130,000   | 306,000   | 363,000   |
|           | 20                    | 0                                          | 221,000   | 419,000   | 42,300    | 169,000   | 266,000   |
|           | 50                    | 0                                          | 0         | 256,000   | 0         | 24,400    | 165,000   |
|           | 100                   | 0                                          | 0         | 158,000   | 0         | 0         | 103,000   |

m<sup>3</sup>/d= cubic metres per day.

**Table 3-50: Peak and Low Flow Discharges at the Lake DS1 Outlet**

| Condition | Return Period (years) | Peak Daily Q (m <sup>3</sup> /s) | 7-Day Mean Peak Q (m <sup>3</sup> /d) | 14-Day Mean Peak Q (m <sup>3</sup> /d) | 30-Day Low Flow Q (m <sup>3</sup> /d) | 60-Day Low Flow Q (m <sup>3</sup> /d) | 90-Day Low Flow Q (m <sup>3</sup> /d) |
|-----------|-----------------------|----------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Wet       | 100                   | 80.8                             | 6,870,000                             | 6,540,000                              | 1,640,000                             | 1,720,000                             | 2,340,000                             |
|           | 50                    | 73.6                             | 6,260,000                             | 5,960,000                              | 1,410,000                             | 1,570,000                             | 2,150,000                             |
|           | 20                    | 63.8                             | 5,420,000                             | 5,160,000                              | 1,120,000                             | 1,350,000                             | 1,880,000                             |
|           | 10                    | 56.0                             | 4,750,000                             | 4,530,000                              | 906,000                               | 1,160,000                             | 1,660,000                             |
|           | 5                     | 47.6                             | 4,050,000                             | 3,850,000                              | 693,000                               | 956,000                               | 1,420,000                             |
| Median    | 2                     | 34.7                             | 2,950,000                             | 2,810,000                              | 388,000                               | 623,000                               | 1,010,000                             |
| Dry       | 5                     | 24.8                             | 2,100,000                             | 2,010,000                              | 174,000                               | 353,000                               | 686,000                               |
|           | 10                    | 20.5                             | 1,740,000                             | 1,660,000                              | 86,100                                | 233,000                               | 540,000                               |
|           | 20                    | 17.3                             | 1,470,000                             | 1,410,000                              | 22,800                                | 142,000                               | 431,000                               |
|           | 50                    | 14.0                             | 1,190,000                             | 1,140,000                              | 0                                     | 48,100                                | 317,000                               |
|           | 100                   | 12.0                             | 1,020,000                             | 984,000                                | 0                                     | 0                                     | 246,000                               |

Q= discharge; m<sup>3</sup>/s= cubic metres per second; m<sup>3</sup>/d= cubic metres per day.



## 2015 HYDROLOGY BASELINE - WHALE TAIL PIT PROJECT

**Table 3-51: Monthly Mean Stages at the Lake DS1 Outlet**

| Condition | Return Period (years) | Monthly Mean Stage (m) |       |       |        |           |         |
|-----------|-----------------------|------------------------|-------|-------|--------|-----------|---------|
|           |                       | May                    | June  | July  | August | September | October |
| Wet       | 100                   | 0.193                  | 1.122 | 1.485 | 0.708  | 0.814     | 0.733   |
|           | 50                    | 0.145                  | 1.054 | 1.324 | 0.660  | 0.766     | 0.686   |
|           | 20                    | 0.097                  | 0.951 | 1.119 | 0.590  | 0.691     | 0.614   |
|           | 10                    | 0.069                  | 0.859 | 0.963 | 0.527  | 0.626     | 0.554   |
|           | 5                     | 0.047                  | 0.749 | 0.806 | 0.448  | 0.545     | 0.486   |
| Median    | 2                     | 0.020                  | 0.542 | 0.563 | 0.303  | 0.399     | 0.367   |
| Dry       | 5                     | 0.003                  | 0.344 | 0.379 | 0.165  | 0.258     | 0.260   |
|           | 10                    | -                      | 0.238 | 0.296 | 0.097  | 0.183     | 0.208   |
|           | 20                    | -                      | 0.144 | 0.231 | 0.042  | 0.118     | 0.165   |
|           | 50                    | -                      | -     | 0.160 | -      | 0.028     | 0.116   |
|           | 100                   | -                      | -     | 0.112 | -      | -         | 0.081   |

m= metres.

**Table 3-52: Peak and Low Flow Stages at the Lake DS1 Outlet**

| Condition | Return Period (years) | Peak Daily Stage (m) | 7-Day Mean Peak Stage (m) | 14-Day Mean Peak Stage (m) | 30-Day Low Flow Stage (m) | 60-Day Low Flow Q Stage (m) | 90-Day Low Flow Stage (m) |
|-----------|-----------------------|----------------------|---------------------------|----------------------------|---------------------------|-----------------------------|---------------------------|
| Wet       | 100                   | 1.869                | 1.847                     | 1.781                      | 0.637                     | 0.660                       | 0.830                     |
|           | 50                    | 1.744                | 1.724                     | 1.662                      | 0.569                     | 0.617                       | 0.779                     |
|           | 20                    | 1.568                | 1.549                     | 1.493                      | 0.480                     | 0.551                       | 0.705                     |
|           | 10                    | 1.424                | 1.404                     | 1.356                      | 0.410                     | 0.493                       | 0.643                     |
|           | 5                     | 1.262                | 1.247                     | 1.201                      | 0.336                     | 0.427                       | 0.572                     |
| Median    | 2                     | 0.998                | 0.986                     | 0.951                      | 0.218                     | 0.310                       | 0.444                     |
| Dry       | 5                     | 0.777                | 0.766                     | 0.741                      | 0.120                     | 0.203                       | 0.333                     |
|           | 10                    | 0.675                | 0.666                     | 0.643                      | 0.071                     | 0.149                       | 0.279                     |
|           | 20                    | 0.595                | 0.587                     | 0.569                      | 0.027                     | 0.103                       | 0.236                     |
|           | 50                    | 0.508                | 0.502                     | 0.486                      | -                         | 0.046                       | 0.188                     |
|           | 100                   | 0.453                | 0.448                     | 0.436                      | -                         | -                           | 0.156                     |

m= metres.



## 2015 HYDROLOGY BASELINE - WHALE TAIL PIT PROJECT

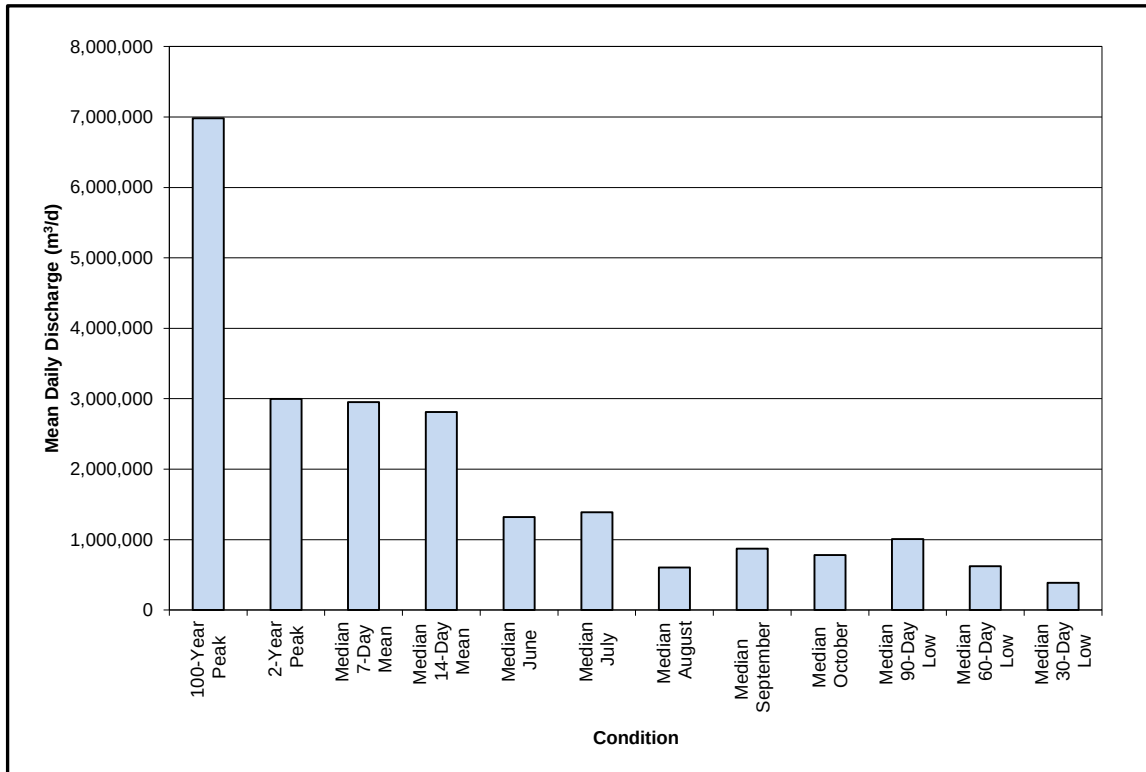


Figure 3-48: Derived Flow Regimes at Lake DS1

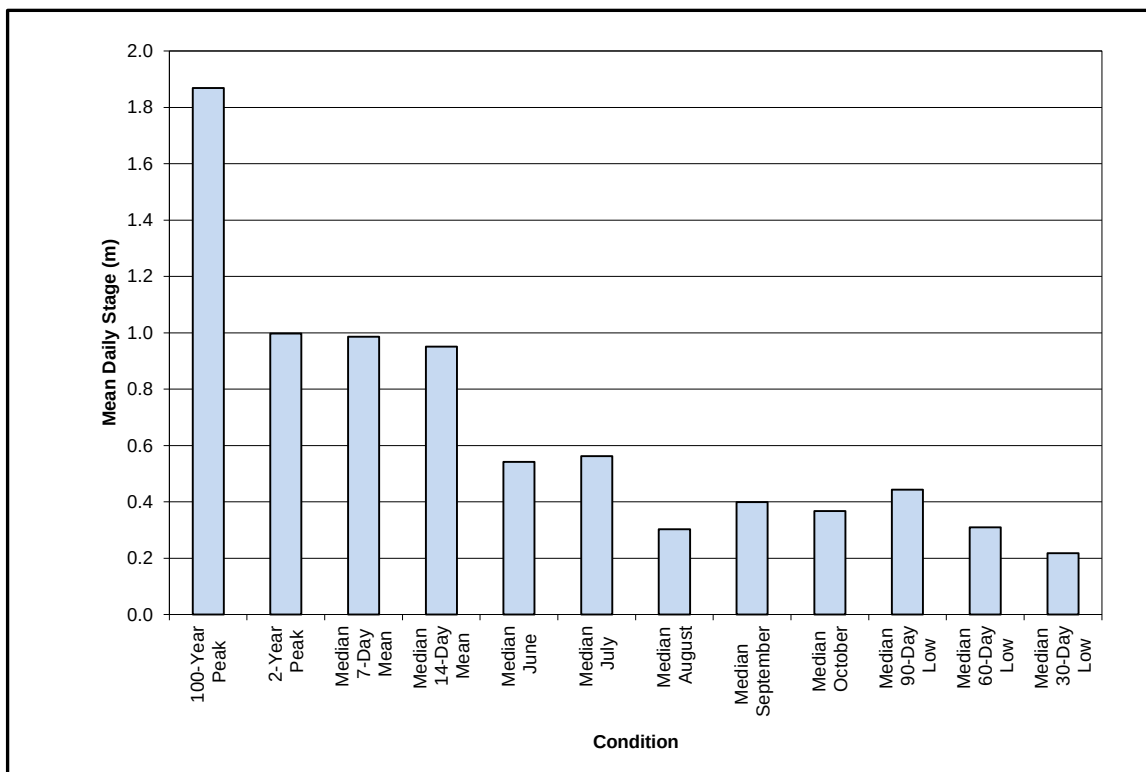


Figure 3-49: Derived Stage Regimes at Lake DS1



### 4.0 CONCLUSION

This study provides a review of existing hydrology conditions in watersheds potentially affected by the Project, based on available Project information. The Study included characterization of local watersheds and drainage patterns, flow regimes, and lake shoreline and outlet channel geomorphology, based on a review of available desktop data and four field visits in 2015 spanning from early June (during frozen conditions), to July, August and finishing in September, and is intended to provide a basis for future impact assessments of the Project.

Three distinct watersheds within the Hydrology BSA were defined as the A watershed (i.e., where Whale Tail and Mammoth Lake are located), the B watershed (i.e., located just north of the A watershed, and west of Nemo Lake), and the C watershed (i.e., where Nemo Lake is located); these three watersheds each drain into Lake DS1. Drainage patterns were initially defined based on a desktop exercise and refined and/or validated on the ground. In general, ground-truthed drainage patterns were in agreement with those derived from the desktop exercise, with the exception of Lake A12 and Lake A76, which were found to discharge through two lake outlets. Lake A12 was found to discharge northward to Lake A77, and eastward to Lake A11. Lake A76 was found to discharge westward to Lake A75, and eastward to Lake A41. The proportion of flow through each outlet of Lake A12 and Lake A76 was only assessed during low flow conditions, and may vary during high flow conditions. Derived water yields for lakes with similar periods of record (i.e., with 97 and 98 days of record) varied between 52 mm (i.e., Lake C38 [Nemo Lake]) and 267 mm (Lake A18). The lower water yields at Lake A17 and Lake C38 may be attributed to proportions of ineffective areas in the watersheds, and the potential for shallow subsurface flow to convey water outside of the assumed drainage boundaries.

The majority of the shorelines surveyed exhibit a consistent terrain type related to shorelines that have developed in morainal material. These morainal shorelines were observed at all lakes visited during the field survey. Limited areas of bedrock and shallowly sloped sandy shorelines were also observed. As a general characteristic for the surveyed shorelines, the predominant materials are boulder gardens mixed with cobble with very limited soils or organic materials on top. The outlet channels exhibit the same characteristics for streambed materials, which results in interstitial flow through large boulders or below the surface likely close to the bedrock, making flow difficult to observe and measure.



## Report Signature Page

GOLDER ASSOCIATES LTD.

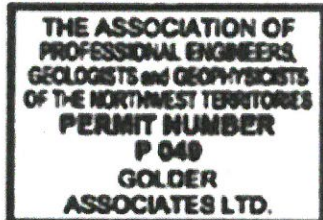
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# APPENDIX A

## Hydrometric Stations



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## APPENDIX A HYDROMETRIC STATIONS

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### FIGURES

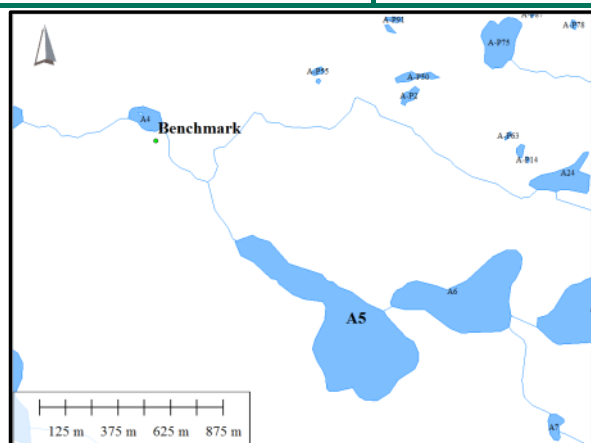
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## APPENDIX A HYDROMETRIC STATIONS

### A1.0 LAKE A5 & OUTLET (STREAM A5-A4)

| Parameter                        | Value                                                                                                                         | Note                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 57.6                                                                                                                          | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 65                                                                                                                            | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.4                                                                                                                           | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 59.0                                                                                                                          | Measured in the field on 6 August 2015     |
| Max. Wetted Depth (m)            | 0.26                                                                                                                          | Measured in the field on 6 August 2015     |
| Channel Length (km)              | 0.70                                                                                                                          | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.026                                                                                                                         | Average slope, measured in the field       |
| Bed Material                     | Boulders, cobbles                                                                                                             |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                                                   |                                            |
| Bank Vegetation                  | Grass                                                                                                                         |                                            |
| Benchmark Coordinates            | 599782 m E,<br>7260885 m N,<br>129.77 masl                                                                                    | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | 598325 m E,<br>7256756 m N                                                                                                    |                                            |
| Comment                          | Poorly defined boulder channel. Sub-surface flow present. Cross-sectional data are available in discharge calculation sheets. |                                            |



Lake A5: Benchmark location.



6 August 2015. View looking east at Lake A5 and staff gauge.



6 August 2015. View from watercourse at Lake A5 (southeast).



6 August 2015. Downstream view of the watercourse (northwest).



## APPENDIX A HYDROMETRIC STATIONS

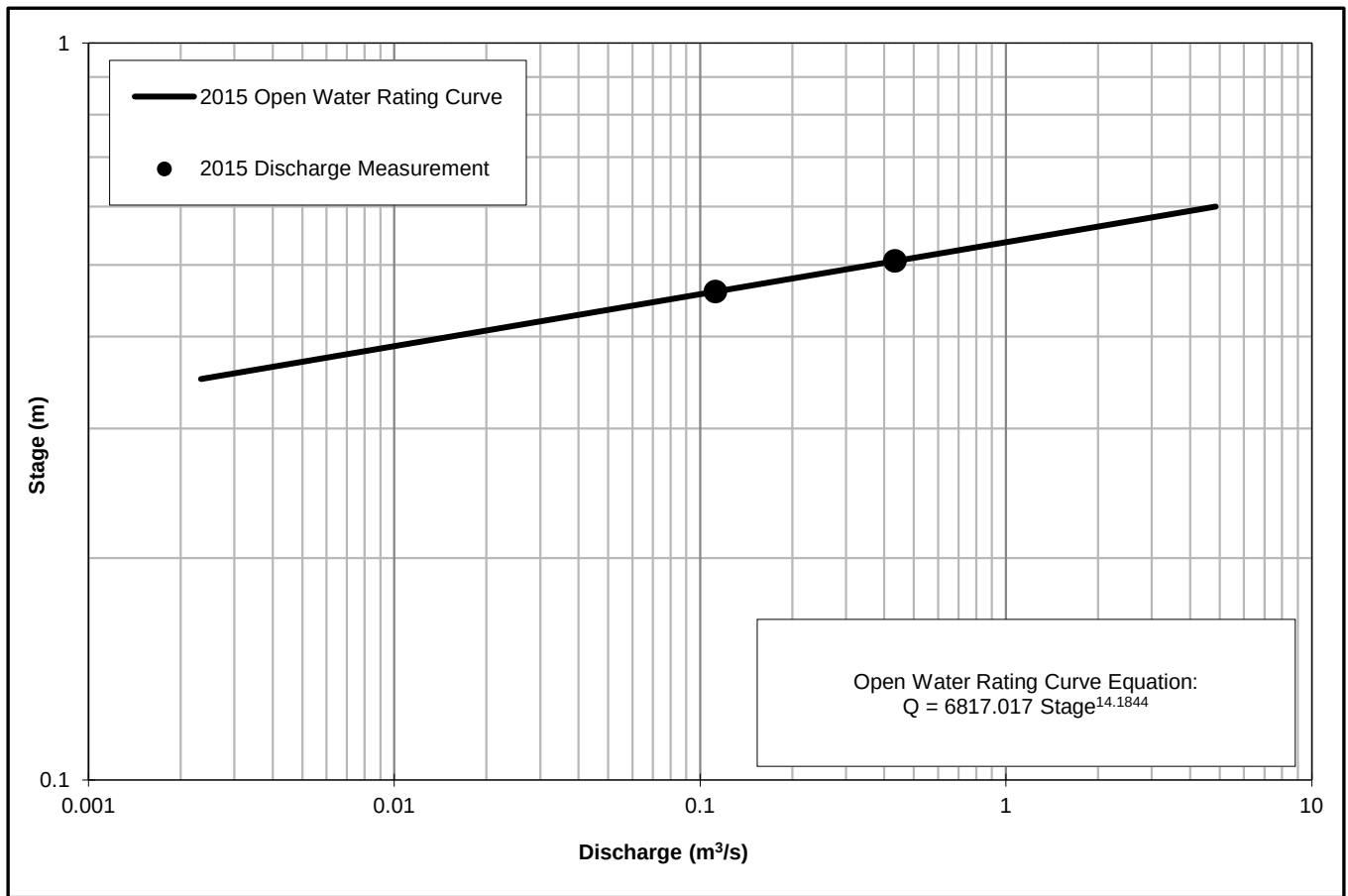


Figure 1: 2015 Stage-Discharge Rating Curve (Lake A5)



## APPENDIX A HYDROMETRIC STATIONS

Lake A5 - 2015

MEAN DAILY DISCHARGE (m<sup>3</sup>/s)

| DATE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG    | SEP    | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|-----|-----|--------|--------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -   | -   | -      | 0.06   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -   | -   | -      | 0.06   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -   | -   | -      | 0.07   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -   | -   | -      | 0.07   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -   | -   | -      | 0.06   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -   | -   | 0.39 P | 0.06   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -   | -   | 0.38   | 0.06   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -   | -   | 0.35   | 0.05   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -   | -   | 0.34   | 0.04   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -   | -   | 0.28   | 0.04   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -   | -   | 0.28   | 0.04   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | -   | -   | 0.19   | 0.05   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | -   | -   | 0.25   | 0.05   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | -   | -   | 0.24   | 0.09   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | -   | -   | 0.22   | 0.12   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | -   | -   | 0.19   | 0.12 P | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | -   | -   | 0.18   | -      | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | -   | -   | 0.18   | -      | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | -   | -   | 0.17   | -      | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | -   | -   | 0.17   | -      | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | -   | -   | 0.15   | -      | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | -   | -   | 0.13   | -      | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | -   | -   | 0.13   | -      | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | -   | -   | 0.13   | -      | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | -   | -   | 0.12   | -      | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | -   | -   | 0.10   | -      | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | -   | -   | 0.10   | -      | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | -   | -   | 0.09   | -      | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | -   | -   | 0.08   | -      | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | -   | -   | 0.08   | -      | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -   | -   | 0.07   | -      | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | -   | -   | 0.072  | 0.036  | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | -   | -   | 0.191  | 0.064  | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | -   | -   | 0.393  | 0.119  | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE

|                                 |         |         |        |
|---------------------------------|---------|---------|--------|
| Water Yield (m <sup>3</sup> ) = | 518,371 | 429,907 | 88,464 |
| Water Yield (mm) =              | 9.0     | 83%     | 17%    |



## APPENDIX A HYDROMETRIC STATIONS

Lake A5 - 2015

MEAN DAILY WATER SURFACE ELEVATION (masl) BASED ON BENCHMARK ELEVATION 129.77 masl

| DATE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG       | SEP       | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|-----|-----|-----------|-----------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -   | -   | -         | 132.238   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -   | -   | -         | 132.241   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -   | -   | -         | 132.243   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -   | -   | -         | 132.244   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -   | -   | -         | 132.242   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -   | -   | 132.302 P | 132.240   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -   | -   | 132.301   | 132.238   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -   | -   | 132.298   | 132.232   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -   | -   | 132.297   | 132.230   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -   | -   | 132.291   | 132.229   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -   | -   | 132.290   | 132.224   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | -   | -   | 132.277   | 132.232   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | -   | -   | 132.286   | 132.231   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | -   | -   | 132.285   | 132.254   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | -   | -   | 132.282   | 132.261   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | -   | -   | 132.277   | 132.262 P | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | -   | -   | 132.275   | -         | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | -   | -   | 132.275   | -         | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | -   | -   | 132.274   | -         | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | -   | -   | 132.273   | -         | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | -   | -   | 132.269   | -         | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | -   | -   | 132.264   | -         | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | -   | -   | 132.265   | -         | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | -   | -   | 132.265   | -         | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | -   | -   | 132.261   | -         | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | -   | -   | 132.257   | -         | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | -   | -   | 132.256   | -         | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | -   | -   | 132.252   | -         | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | -   | -   | 132.251   | -         | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | -   | -   | 132.249   | -         | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -   | -   | 132.245   | -         | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | -   | -   | 132.245   | 132.224   | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | -   | -   | 132.274   | 132.240   | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | -   | -   | 132.302   | 132.262   | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE





## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |                |            |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|----------------|------------|
| Project Name, Number:                        |                             | Amaruq - trip 2 |                    | Date                   |                                  | 06-Aug-15      |            |
| Waterbody:                                   |                             | A5              |                    | Start Time             |                                  | 9:45           |            |
| Crossing ID:                                 |                             | A5-A4           |                    | End Time               |                                  | 10:05          |            |
| Left Downstream Bank (LDB) UTM Location      |                             |                 | Survey             |                        | Datalogger SN:                   |                |            |
| East                                         | 600184                      | BM read         |                    |                        | Transducer SN:                   |                |            |
| North                                        | 7260409                     | WL read         |                    |                        | Meter Type/SN: Marsh McBirney    |                |            |
| Elevation, Zone                              |                             | 14W             | WL Elev            |                        |                                  | Crew: JRL & JN |            |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |
| 1                                            | 0.00                        | 0.10            |                    | 0.00                   |                                  |                | 0.180      |
| 2                                            | 1.50                        | 0.14            |                    | 0.06                   |                                  | 0.011          | 0.084      |
| 3                                            | 2.70                        | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 4                                            | 3.70                        | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.032      |
| 5                                            | 4.50                        | 0.08            |                    | 0.12                   |                                  | 0.011          | 0.090      |
| 6                                            | 6.00                        | 0.04            |                    | 0.15                   |                                  | 0.009          | 0.098      |
| 7                                            | 7.50                        | 0.09            |                    | 0.23                   |                                  | 0.031          | 0.143      |
| 8                                            | 9.00                        | 0.10            |                    | 0.10                   |                                  | 0.014          | 0.060      |
| 9                                            | 10.20                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 10                                           | 11.10                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.099      |
| 11                                           | 12.00                       | 0.22            |                    | 0.03                   |                                  | 0.006          | 0.110      |
| 12                                           | 13.00                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 13                                           | 13.50                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.015      |
| 14                                           | 13.70                       | 0.15            |                    | 0.10                   |                                  | 0.011          | 0.202      |
| 15                                           | 15.00                       | 0.16            |                    | 0.26                   |                                  | 0.042          | 0.056      |
| 16                                           | 15.70                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 17                                           | 17.00                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.020      |
| 18                                           | 17.20                       | 0.20            |                    | 0.10                   |                                  | 0.015          | 0.169      |
| 19                                           | 18.50                       | 0.06            |                    | 0.11                   |                                  | 0.008          | 0.030      |
| 20                                           | 19.50                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 21                                           | 19.80                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.040      |
| 22                                           | 20.20                       | 0.20            |                    | 0.20                   |                                  | 0.034          | 0.286      |
| 23                                           | 21.50                       | 0.24            |                    | 0.17                   |                                  | 0.055          | 0.168      |
| 24                                           | 22.90                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 25                                           | 23.40                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.132      |
| 26                                           | 24.50                       | 0.24            |                    | 0.03                   |                                  | 0.009          | 0.255      |
| 27                                           | 26.00                       | 0.10            |                    | 0.21                   |                                  | 0.032          | 0.263      |
| 28                                           | 27.50                       | 0.25            |                    | 0.15                   |                                  | 0.056          | 0.330      |
| 29                                           | 29.00                       | 0.19            |                    | 0.11                   |                                  | 0.031          | 0.203      |
| 30                                           | 30.50                       | 0.08            |                    | 0.09                   |                                  | 0.011          | 0.060      |
| 31                                           | 32.00                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 32                                           | 32.30                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.012      |
| 33                                           | 32.50                       | 0.12            |                    | 0.05                   |                                  | 0.002          | 0.018      |
| 34                                           | 32.80                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| 35                                           | 33.10                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.040      |
| 36                                           | 33.50                       | 0.20            |                    | 0.03                   |                                  | 0.006          | 0.345      |
| 37                                           | 35.00                       | 0.26            |                    | 0.00                   |                                  | 0.000          | 0.140      |
| 38                                           | 35.70                       | 0.14            |                    | 0.04                   |                                  | 0.007          | 0.198      |
| 39                                           | 37.50                       | 0.08            |                    | 0.06                   |                                  | 0.033          | 0.484      |
| 40                                           | 49.60                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |
| NOTES:                                       |                             |                 |                    | RESULTS:               |                                  | Q (m3/s)       | 0.434      |
|                                              |                             |                 |                    |                        |                                  | A(m2)          | 4.36       |
|                                              |                             |                 |                    |                        |                                  | B(m)           | 49.6       |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |              |                         |                        |                                  |                |            |           |
|----------------------------------------------|-----------------------------|--------------|-------------------------|------------------------|----------------------------------|----------------|------------|-----------|
| Project Name, Number:                        |                             |              | 1524321 - Amaruq Trip 3 |                        |                                  | Date           |            | 16-Sep-15 |
| Waterbody:                                   |                             |              | A5                      |                        |                                  | Start Time     |            | 12:45     |
| Crossing ID:                                 |                             |              | A5-A4                   |                        |                                  | End Time       |            | 13:05     |
| LDB UTM Location                             |                             |              | Survey                  |                        |                                  | Datalogger SN: |            |           |
| East                                         | 600182                      | BM read      |                         |                        |                                  | Transducer SN: |            |           |
| North                                        | 7260409                     | WL read      |                         |                        |                                  | Meter Type/SN: |            |           |
| Elevation, Zone                              | 14W                         | WL Elev      |                         |                        |                                  | Crew:          |            | JRL, DC   |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m) | Velocity                |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |           |
|                                              |                             |              | 0.2 DEPTH<br>(m/s)      | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |           |
| 1                                            | 0.00                        | 0.00         |                         | 0                      |                                  |                | 0.030      |           |
| 2                                            | 0.50                        | 0.12         |                         | 0.02                   |                                  | 0.001          | 0.030      |           |
| 3                                            | 1.00                        | 0.00         |                         | 0                      |                                  | 0.000          | 0.000      |           |
| 4                                            | 1.00                        | 0.15         |                         | 0.01                   |                                  | 0.001          | 0.105      |           |
| 5                                            | 1.70                        | 0.15         |                         | 0.01                   |                                  | 0.001          | 0.001      |           |
| 6                                            | 1.71                        | 0.00         |                         | 0                      |                                  | 0.000          | 0.000      |           |
| 7                                            | 1.71                        | 0.10         |                         | 0.06                   |                                  | 0.001          | 0.025      |           |
| 8                                            | 1.96                        | 0.10         |                         | 0.06                   |                                  | 0.001          | 0.001      |           |
| 9                                            | 1.97                        | 0.00         |                         | 0                      |                                  | 0.000          | 0.000      |           |
| 10                                           | 1.97                        | 0.08         |                         | 0.02                   |                                  | 0.000          | 0.024      |           |
| 11                                           | 2.27                        | 0.08         |                         | 0.02                   |                                  | 0.000          | 0.000      |           |
| 12                                           | 2.28                        | 0.00         |                         | 0                      |                                  | 0.000          | 0.000      |           |
| 13                                           | 2.28                        | 0.13         |                         | 0.16                   |                                  | 0.006          | 0.078      |           |
| 14                                           | 2.88                        | 0.13         |                         | 0.16                   |                                  | 0.006          | 0.001      |           |
| 15                                           | 2.89                        | 0.00         |                         | 0                      |                                  | 0.000          | 0.000      |           |
| 16                                           | 2.89                        | 0.06         |                         | 0.15                   |                                  | 0.002          | 0.021      |           |
| 17                                           | 3.24                        | 0.06         |                         | 0.15                   |                                  | 0.002          | 0.000      |           |
| 18                                           | 3.25                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 19                                           | 3.25                        | 0.10         |                         | 0.01                   |                                  | 0.000          | 0.040      |           |
| 20                                           | 3.65                        | 0.10         |                         | 0.01                   |                                  | 0.000          | 0.000      |           |
| 21                                           | 3.65                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 22                                           | 3.65                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.018      |           |
| 23                                           | 3.85                        | 0.18         |                         | 0.15                   |                                  | 0.011          | 0.060      |           |
| 24                                           | 4.45                        | 0.02         |                         | 0.01                   |                                  | 0.000          | 0.060      |           |
| 25                                           | 5.45                        | 0.10         |                         | 0.06                   |                                  | 0.007          | 0.119      |           |
| 26                                           | 6.85                        | 0.07         |                         | 0.03                   |                                  | 0.003          | 0.063      |           |
| 27                                           | 8.65                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 28                                           | 8.65                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.064      |           |
| 29                                           | 9.45                        | 0.16         |                         | 0.03                   |                                  | 0.004          | 0.153      |           |
| 30                                           | 10.35                       | 0.18         |                         | 0.05                   |                                  | 0.009          | 0.216      |           |
| 31                                           | 11.55                       | 0.18         |                         | 0.03                   |                                  | 0.006          | 0.176      |           |
| 32                                           | 12.45                       | 0.21         |                         | 0.07                   |                                  | 0.014          | 0.105      |           |
| 33                                           | 13.45                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 34                                           | 13.45                       | 0.20         |                         | 0.08                   |                                  | 0.006          | 0.150      |           |
| 35                                           | 14.20                       | 0.20         |                         | 0.08                   |                                  | 0.006          | 0.001      |           |
| 36                                           | 14.21                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 37                                           | 14.21                       | 0.10         |                         | 0.15                   |                                  | 0.003          | 0.040      |           |
| 38                                           | 14.61                       | 0.10         |                         | 0.15                   |                                  | 0.003          | 0.000      |           |
| 39                                           | 14.62                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 40                                           | 14.62                       | 0.08         |                         | 0.11                   |                                  | 0.002          | 0.032      |           |
| 41                                           | 15.02                       | 0.08         |                         | 0.11                   |                                  | 0.002          | 0.000      |           |
| 42                                           | 15.03                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 43                                           | 15.03                       | 0.07         |                         | 0.08                   |                                  | 0.000          | 0.014      |           |
| 44                                           | 15.23                       | 0.07         |                         | 0.08                   |                                  | 0.001          | 0.000      |           |
| 45                                           | 15.24                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 46                                           | 15.24                       | 0.12         |                         | 0.02                   |                                  | 0.001          | 0.108      |           |
| 47                                           | 16.14                       | 0.12         |                         | 0.02                   |                                  | 0.001          | 0.001      |           |
| 48                                           | 16.15                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 49                                           | 16.15                       | 0.12         |                         | 0.03                   |                                  | 0.001          | 0.048      |           |
| 50                                           | 16.55                       | 0.12         |                         | 0.03                   |                                  | 0.001          | 0.000      |           |
| 51                                           | 16.55                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.040      |           |
| 52                                           | 17.35                       | 0.10         |                         | 0.02                   |                                  | 0.002          | 0.110      |           |
| 53                                           | 18.45                       | 0.10         |                         | 0.06                   |                                  | 0.006          | 0.040      |           |
| 54                                           | 19.25                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.035      |           |
| 55                                           | 19.95                       | 0.10         |                         | 0.01                   |                                  | 0.001          | 0.030      |           |
| 56                                           | 20.55                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 57                                           | 20.55                       | 0.08         |                         | 0.02                   |                                  | 0.000          | 0.040      |           |
| 58                                           | 21.05                       | 0.08         |                         | 0.02                   |                                  | 0.000          | 0.000      |           |
| 59                                           | 21.06                       | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |
| 60                                           | 21.06                       | 0.06         |                         | 0.07                   |                                  | 0.001          | 0.030      |           |
| 61                                           | 21.56                       | 0.06         |                         | 0.07                   |                                  | 0.001          | 0.000      |           |



## APPENDIX A HYDROMETRIC STATIONS

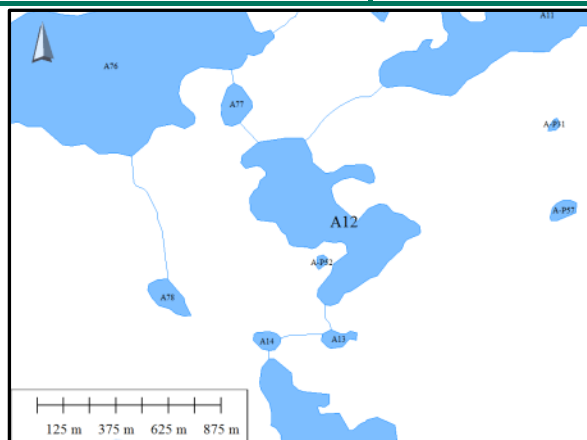
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                                                                                                                                                                                                                                                                                                            |                         |           |               |                                  |                 |              |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------|---------------|----------------------------------|-----------------|--------------|
| <b>Project Name, Number:</b>                 |                                                                                                                                                                                                                                                                                                            | 1524321 - Amaruq Trip 3 |           |               | <b>Date</b>                      |                 | 16-Sep-15    |
| <b>Waterbody:</b>                            |                                                                                                                                                                                                                                                                                                            | A5                      |           |               | <b>Start Time</b>                |                 | 12:45        |
| <b>Crossing ID:</b>                          |                                                                                                                                                                                                                                                                                                            | A5-A4                   |           |               | <b>End Time</b>                  |                 | 13:05        |
| <b>LDB UTM Location</b>                      |                                                                                                                                                                                                                                                                                                            | <b>Survey</b>           |           |               | <b>Datalogger SN:</b>            |                 |              |
| East                                         | 600182                                                                                                                                                                                                                                                                                                     | BM read                 |           |               | <b>Transducer SN:</b>            |                 |              |
| North                                        | 7260409                                                                                                                                                                                                                                                                                                    | WL read                 |           |               | <b>Meter Type/SN:</b>            |                 |              |
| Elevation, Zone                              | 14W                                                                                                                                                                                                                                                                                                        | WL Elev                 |           |               | <b>Crew:</b>                     |                 | JRL, DC      |
| STATION                                      | DISTANCE                                                                                                                                                                                                                                                                                                   | DEPTH<br>(m)            | Velocity  |               | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)    | Ai<br>(m2)   |
| Start                                        | FROM LDB                                                                                                                                                                                                                                                                                                   |                         | 0.2 DEPTH | 0.6/0.8 DEPTH |                                  |                 |              |
| LDB                                          | (m)                                                                                                                                                                                                                                                                                                        |                         | (m/s)     | (m/s)         |                                  |                 |              |
| 62                                           | 21.57                                                                                                                                                                                                                                                                                                      | 0.00                    | 0.00      |               |                                  | 0.000           | 0.000        |
| NOTES:                                       | Discharge measurement was separated into sections that contained flow. In some cases, sections were estimated as an average depth and velocity. Therefore, the distance from LDB, A and B values are not applicable to this measurement.<br><br>RDB un-measurable low flow area accounting for ~5% of flow |                         |           |               | <b>RESULTS:</b>                  | <b>Q (m3/s)</b> | <b>0.112</b> |
|                                              |                                                                                                                                                                                                                                                                                                            |                         |           |               |                                  | <b>A(m2)</b>    | <b>2.11</b>  |
|                                              |                                                                                                                                                                                                                                                                                                            |                         |           |               |                                  | <b>B(m)</b>     | <b>21.6</b>  |



## APPENDIX A HYDROMETRIC STATIONS

### A2.0 LAKE A12 & NORTHWEST OUTLET (STREAM A12-A11)

| Parameter                        | Value                                                                                                                                          | Note                                                            |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 42.4                                                                                                                                           | Based on DEM (PhotoSat 2015)                                    |
| Bankfull Width (m)               | 44                                                                                                                                             | Measured in the field, based on vegetation                      |
| Max. Bankfull Depth (m)          | 0.9                                                                                                                                            | Measured in the field, based on vegetation and high water marks |
| Wetted Width (m)                 | 42.0                                                                                                                                           | Measured in the field August 6, 2015                            |
| Max. Wetted Depth (m)            | 0.31                                                                                                                                           | Measured in the field August 6, 2015                            |
| Channel Length (km)              | 0.50                                                                                                                                           | Measured from CanVec data                                       |
| Outlet Channel Slope (m/m)       | 0.004                                                                                                                                          | Average slope, based on DEM (PhotoSat 2015)                     |
| Bed Material                     | Boulders, cobbles                                                                                                                              |                                                                 |
| Bank Material                    | Boulders, cobbles, organics                                                                                                                    |                                                                 |
| Bank Vegetation                  | Grass                                                                                                                                          |                                                                 |
| Benchmark Coordinates            | N/A                                                                                                                                            | NAD83 Zone 14                                                   |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                                                            |                                                                 |
| Comment                          | Poorly defined boulder channel. Sub surface flows present. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                                                 |



Lake A12.

6 August 2015. Looking north from Lake A12 to Lake A77 and Lake A11.



6 August 2015. Upstream view from the watercourse towards Lake A12 (southwest).



19 September 2015. Downstream view of the watercourse (northeast).



## APPENDIX A HYDROMETRIC STATIONS

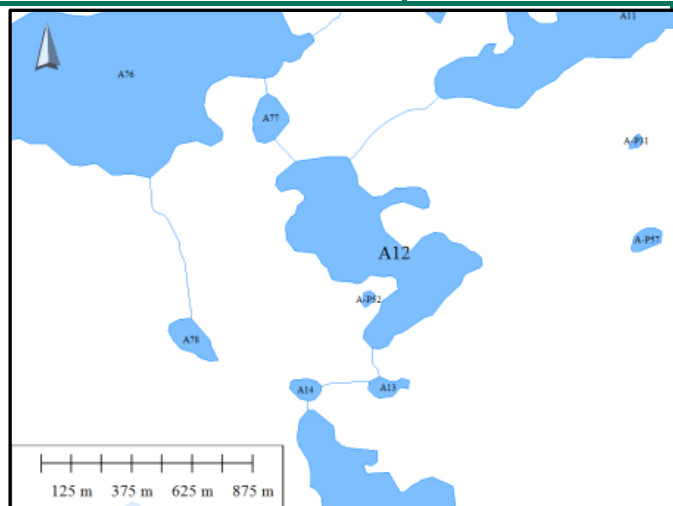
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |            |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|------------|
| Project Name, Number:                        |                             | Amaruq - Trip 2 |                    | Date                   |                                  | 06-Aug-15    |            |
| Waterbody:                                   |                             | A12             |                    | Start Time             |                                  | 12:05        |            |
| Crossing ID:                                 |                             | A12-A11         |                    | End Time               |                                  | 12:40        |            |
| LDB UTM Location                             |                             |                 | Survey             |                        | Datalogger SN:                   |              |            |
| East                                         | 603052                      | BM read         |                    |                        | Transducer SN:                   |              |            |
| North                                        | 7256600                     | WL read         |                    |                        | Meter Type/SN: Marsh McBirney    |              |            |
| Elevation, Zone                              | 156, 14W                    | WL Elev         |                    |                        | Crew:                            | JRL & JN     |            |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |
| 1                                            | 0.00                        | 0.00            |                    | 0.00                   |                                  |              | 0.114      |
| 2                                            | 1.20                        | 0.19            |                    | 0.00                   |                                  | 0.000        | 0.148      |
| 3                                            | 2.00                        | 0.18            |                    | 0.02                   |                                  | 0.004        | 0.353      |
| 4                                            | 3.50                        | 0.29            |                    | 0.02                   |                                  | 0.008        | 0.358      |
| 5                                            | 4.80                        | 0.26            |                    | 0.00                   |                                  | 0.000        | 0.442      |
| 6                                            | 6.50                        | 0.26            |                    | 0.00                   |                                  | 0.000        | 0.195      |
| 7                                            | 8.00                        | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.044      |
| 8                                            | 8.40                        | 0.22            |                    | 0.06                   |                                  | 0.013        | 0.176      |
| 9                                            | 10.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.038      |
| 10                                           | 11.90                       | 0.04            |                    | 0.23                   |                                  | 0.009        | 0.002      |
| 11                                           | 12.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.027      |
| 12                                           | 12.60                       | 0.09            |                    | 0.02                   |                                  | 0.001        | 0.018      |
| 13                                           | 13.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.117      |
| 14                                           | 14.30                       | 0.18            |                    | 0.00                   |                                  | 0.000        | 0.180      |
| 15                                           | 15.50                       | 0.12            |                    | 0.16                   |                                  | 0.016        | 0.030      |
| 16                                           | 16.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.600      |
| 17                                           | 22.00                       | 0.20            |                    | 0.09                   |                                  | 0.059        | 0.050      |
| 18                                           | 22.50                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.078      |
| 19                                           | 23.00                       | 0.31            |                    | 0.00                   |                                  | 0.000        | 1.785      |
| 20                                           | 31.50                       | 0.11            |                    | 0.02                   |                                  | 0.011        | 0.083      |
| 21                                           | 33.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.162      |
| 22                                           | 35.70                       | 0.12            |                    | 0.36                   |                                  | 0.194        | 0.378      |
| 23                                           | 42.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.000      |
| NOTES:                                       |                             |                 |                    | RESULTS:               |                                  | Q (m3/s)     | 0.316      |
|                                              |                             |                 |                    |                        |                                  | A(m2)        | 5.38       |
|                                              |                             |                 |                    |                        |                                  | B(m)         | 42.0       |



## APPENDIX A HYDROMETRIC STATIONS

### A3.0 LAKE A12 & NORTHEAST OUTLET (STREAM A12-A77)

| Parameter                        | Value                                                                                                                           | Note                                        |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 42.4                                                                                                                            | Based on DEM (PhotoSat 2015)                |
| Bankfull Width (m)               | 45                                                                                                                              | Measured in the field, based on vegetation  |
| Max. Bankfull Depth (m)          | 0.45                                                                                                                            | Measured in the field, based on vegetation  |
| Wetted Width (m)                 | 16.8                                                                                                                            | Measured in the field on 6 August 2015      |
| Max. Wetted Depth (m)            | 0.39                                                                                                                            | Measured in the field on 6 August 2015      |
| Channel Length (km)              | 0.12                                                                                                                            | Measured from CanVec data                   |
| Outlet Channel Slope (m/m)       | 0.020                                                                                                                           | Average slope, based on DEM (PhotoSat 2015) |
| Bed Material                     | Boulders, cobbles                                                                                                               |                                             |
| Bank Material                    | Boulders, cobbles, organics                                                                                                     |                                             |
| Bank Vegetation                  | Grass, bushes                                                                                                                   |                                             |
| Benchmark Coordinates            | N/A                                                                                                                             | NAD83 Zone 14                               |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                                             |                                             |
| Comment                          | Poorly defined braid-like boulder channels. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                             |



Lake A12.

6 August 2015. Upstream view from Lake A76 to Lake A12 (south).



6 August 2015. Upstream view at Lake A12 to A77 outlet (south).



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |                |            |                |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|----------------|------------|----------------|--|
| Project Name, Number:                        |                             | Amaruq - Trip 2 |                    |                        |                                  | Date           |            | 06-Aug-15      |  |
| Waterbody:                                   |                             | A12             |                    |                        |                                  | Start Time     |            | 11:20          |  |
| Crossing ID:                                 |                             | A12-A77         |                    |                        |                                  | End Time       |            | 11:45          |  |
| LDB UTM Location                             |                             | Survey          |                    |                        |                                  | Datalogger SN: |            |                |  |
| East                                         | 602772                      | BM_read         |                    |                        |                                  | Transducer SN: |            |                |  |
| North                                        | 7256632                     | WL_read         |                    |                        |                                  | Meter Type/SN: |            | Marsh McBirney |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        |                                  | Crew:          | JRL, JN    |                |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |                |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |                |  |
| 1                                            | 1.60                        | 0.00            |                    | 0.00                   |                                  |                | 0.011      |                |  |
| 2                                            | 1.90                        | 0.07            |                    | 0.13                   |                                  | 0.003          | 0.074      |                |  |
| 3                                            | 2.30                        | 0.30            |                    | 0.18                   |                                  | 0.030          | 0.203      |                |  |
| 4                                            | 3.00                        | 0.28            |                    | 0.27                   |                                  | 0.064          | 0.235      |                |  |
| 5                                            | 4.00                        | 0.19            |                    | 0.02                   |                                  | 0.003          | 0.099      |                |  |
| 6                                            | 4.60                        | 0.14            |                    | 0.10                   |                                  | 0.007          | 0.052      |                |  |
| 7                                            | 5.00                        | 0.12            |                    | 0.02                   |                                  | 0.003          | 0.120      |                |  |
| 8                                            | 7.00                        | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |                |  |
| 9                                            | 7.01                        | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |                |  |
| 10                                           | 10.00                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.002      |                |  |
| 11                                           | 10.01                       | 0.36            |                    | 0.11                   |                                  | 0.010          | 0.176      |                |  |
| 12                                           | 10.50                       | 0.36            |                    | 0.11                   |                                  | 0.010          | 0.002      |                |  |
| 13                                           | 10.51                       | 0.12            |                    | 0.11                   |                                  | 0.003          | 0.047      |                |  |
| 14                                           | 10.90                       | 0.12            |                    | 0.04                   |                                  | 0.001          | 0.001      |                |  |
| 15                                           | 10.91                       | 0.00            |                    | 0.00                   |                                  | 0.000          | 0.000      |                |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)       | 0.133      |                |  |
|                                              |                             |                 |                    |                        |                                  | A(m2)          | 1.02       |                |  |
|                                              |                             |                 |                    |                        |                                  | B(m)           | 9.3        |                |  |

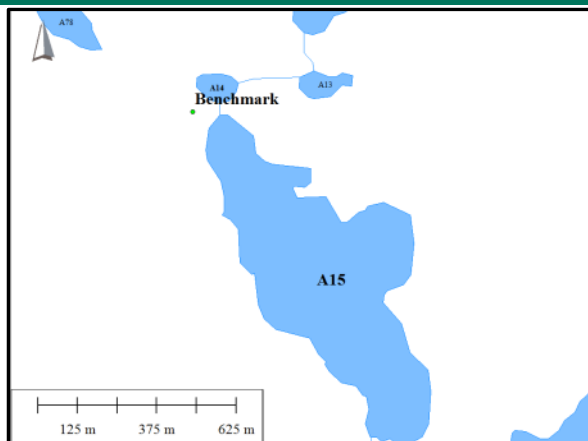




## APPENDIX A HYDROMETRIC STATIONS

### A4.0 LAKE A15 & OUTLET (STREAM A15-A14)

| Parameter                        | Value                                                                                                                                                                                                                                                                         | Note                                        |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 40.8                                                                                                                                                                                                                                                                          | Based on DEM (PhotoSat 2015)                |
| Bankfull Width (m)               | 100                                                                                                                                                                                                                                                                           | Measured in the field, based on vegetation  |
| Max. Bankfull Depth (m)          | 0.95                                                                                                                                                                                                                                                                          | Measured in the field, based on vegetation  |
| Wetted Width (m)                 | 87.7                                                                                                                                                                                                                                                                          | Measured in the field on 15 June 2015       |
| Max. Wetted Depth (m)            | 0.55                                                                                                                                                                                                                                                                          | Measured in the field on 15 June 2015       |
| Channel Length (km)              | 0.35                                                                                                                                                                                                                                                                          | Measured from CanVec data                   |
| Outlet Channel Slope (m/m)       | 0.002                                                                                                                                                                                                                                                                         | Average slope, based on DEM (PhotoSat 2015) |
| Bed Material                     | Boulders, cobbles                                                                                                                                                                                                                                                             |                                             |
| Bank Material                    | Boulders, cobbles, organics                                                                                                                                                                                                                                                   |                                             |
| Bank Vegetation                  | Grass                                                                                                                                                                                                                                                                         |                                             |
| Benchmark Coordinates            | 603366 m E<br>7254484 m N,<br>153.67 masl                                                                                                                                                                                                                                     | NAD83 Zone 14                               |
| Logger/ Staff Gauge Coordinates  | 603151 m E<br>7255313 m N                                                                                                                                                                                                                                                     |                                             |
| Comment                          | Poorly defined boulder channel. During spring freshet, Lake A14 and Lake A15 have similar water elevations and may form one lake. Discharges were measured between Lake A14 and Lake A13. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                             |



Lake A14: Benchmark location.



13 June 2015. View looking west of Lake A15 and staff gauge.



18 September 2015. View looking west of Lake 15 and staff gauge.



4 August 2015. Upstream view of the watercourse (west).





## APPENDIX A HYDROMETRIC STATIONS



13 June 2015. Downstream view of the watercourse (east).

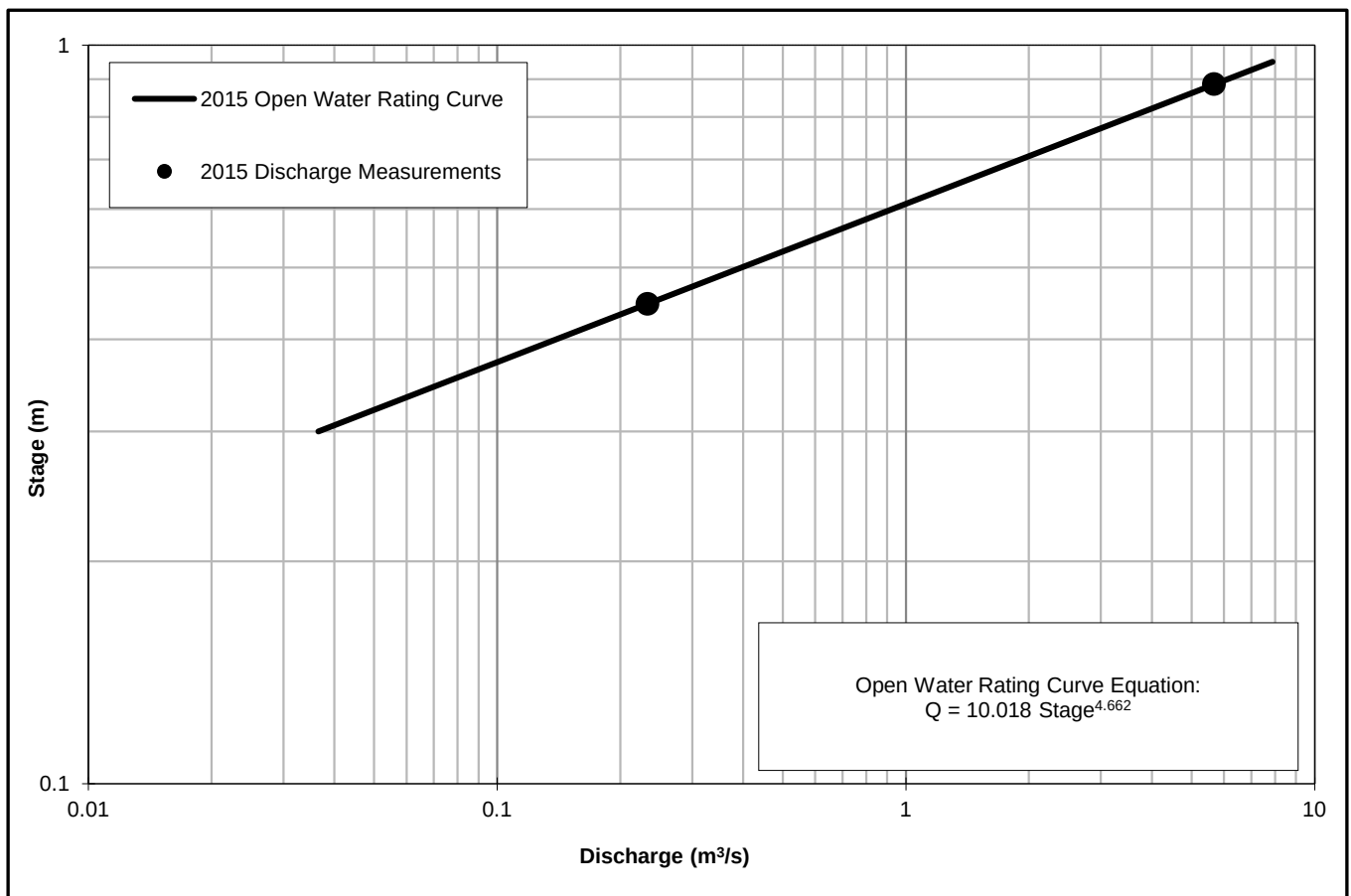


Figure 2: 2015 Stage-Discharge Rating Curve (Lake A15)



## APPENDIX A HYDROMETRIC STATIONS

Lake A15 - 2015

MEAN DAILY DISCHARGE (m<sup>3</sup>/s)

| DATE | JAN | FEB | MAR | APR | MAY | JUN    | JUL   | AUG   | SEP    | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|--------|-------|-------|--------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -      | 1.68  | 0.29  | 0.00   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -      | 1.55  | 0.26  | 0.00   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -      | 1.48  | 0.24  | 0.00   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -      | 1.36  | 0.22  | 0.00   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -      | 1.29  | 0.20  | 0.00   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -      | 1.16  | 0.18  | 0.00   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -      | 1.10  | 0.16  | 0.00   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -      | 1.06  | 0.14  | 0.00   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -      | 1.04  | 0.13  | 0.00   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -      | 1.09  | 0.11  | 0.00   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -      | 1.02  | 0.10  | 0.00   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | -      | 0.96  | 0.08  | 0.00   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 5.01 P | 0.94  | 0.07  | 0.00   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 3.52   | 0.90  | 0.06  | 0.00   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 5.68   | 0.84  | 0.06  | 0.01   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 6.30   | 0.78  | 0.05  | 0.01   | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 5.38   | 0.73  | 0.04  | 0.01   | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 4.54   | 0.70  | 0.03  | 0.01 P | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 3.93   | 0.64  | 0.03  | -      | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 3.53   | 0.60  | 0.02  | -      | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 3.26   | 0.57  | 0.02  | -      | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 3.11   | 0.53  | 0.02  | -      | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 2.92   | 0.50  | 0.01  | -      | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 2.72   | 0.46  | 0.01  | -      | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 2.50   | 0.43  | 0.01  | -      | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 2.43   | 0.39  | 0.01  | -      | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 2.33   | 0.36  | 0.01  | -      | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 2.14   | 0.34  | 0.01  | -      | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 1.97   | 0.31  | 0.01  | -      | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 1.83   | 0.30  | 0.00  | -      | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -      | 0.31  | 0.00  | -      | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 1.825  | 0.303 | 0.004 | 0.001  | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 3.506  | 0.821 | 0.083 | 0.003  | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 6.296  | 1.685 | 0.286 | 0.010  | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE

|                                 |           |           |           |         |       |
|---------------------------------|-----------|-----------|-----------|---------|-------|
| Water Yield (m <sup>3</sup> ) = | 7,878,483 | 5,452,441 | 2,197,845 | 222,881 | 5,316 |
| Water Yield (mm) =              | 193.1     | 69%       | 28%       | 3%      | 0.05% |



## APPENDIX A HYDROMETRIC STATIONS

Lake A15 - 2015

MEAN DAILY WATER SURFACE ELEVATION (masl) BASED ON BENCHMARK ELEVATION 155.17 masl

| DATE | JAN | FEB | MAR | APR | MAY | JUN       | JUL     | AUG     | SEP       | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|-----------|---------|---------|-----------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -         | 151.882 | 151.666 | 151.379   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -         | 151.870 | 151.657 | 151.380   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -         | 151.863 | 151.647 | 151.377   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -         | 151.851 | 151.642 | 151.372   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -         | 151.844 | 151.634 | 151.367   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -         | 151.830 | 151.624 | 151.361   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -         | 151.823 | 151.613 | 151.355   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -         | 151.818 | 151.600 | 151.347   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -         | 151.816 | 151.593 | 151.341   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -         | 151.821 | 151.583 | 151.335   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -         | 151.812 | 151.572 | 151.328   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | -         | 151.805 | 151.550 | 151.340   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 152.061 P | 151.802 | 151.547 | 151.368   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 151.999   | 151.797 | 151.539 | 151.386   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 152.084   | 151.787 | 151.528 | 151.398   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 152.105   | 151.778 | 151.514 | 151.409   | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 152.075   | 151.771 | 151.502 | 151.423   | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 152.044   | 151.764 | 151.492 | 151.428 P | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 152.018   | 151.755 | 151.482 | -         | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 151.999   | 151.747 | 151.472 | -         | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 151.986   | 151.740 | 151.462 | -         | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 151.978   | 151.732 | 151.451 | -         | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 151.968   | 151.725 | 151.442 | -         | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 151.956   | 151.717 | 151.434 | -         | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 151.943   | 151.708 | 151.425 | -         | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 151.938   | 151.697 | 151.419 | -         | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 151.931   | 151.690 | 151.413 | -         | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 151.918   | 151.683 | 151.405 | -         | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 151.905   | 151.676 | 151.400 | -         | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 151.894   | 151.672 | 151.395 | -         | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -         | 151.675 | 151.385 | -         | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 151.894   | 151.672 | 151.385 | 151.328   | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 151.983   | 151.773 | 151.519 | 151.372   | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 152.105   | 151.882 | 151.666 | 151.428   | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |              |                    |                        |                                  |                |            |           |  |
|----------------------------------------------|-----------------------------|--------------|--------------------|------------------------|----------------------------------|----------------|------------|-----------|--|
| Project Name, Number:                        |                             |              | 1524321 - Amaruq   |                        |                                  | Date           |            | 15-Jun-15 |  |
| Waterbody:                                   |                             |              | A15                |                        |                                  | Start Time     |            | 14:10     |  |
| Crossing ID:                                 |                             |              | A14-A13            |                        |                                  | End Time       |            | 1520      |  |
| LDB UTM Location                             |                             |              | Survey             |                        |                                  | Datalogger SN: |            |           |  |
| East                                         | 603046                      |              | BM read            |                        |                                  | Transducer SN: |            |           |  |
| North                                        | 7255689                     |              | WL read            |                        |                                  | Meter Type/SN: |            | Swoffer   |  |
| Elevation, Zone                              | 14W                         |              | WL Elev            |                        |                                  | Crew:          |            | CJ, JRL   |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m) | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |           |  |
|                                              |                             |              | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |           |  |
| 1                                            | 0.00                        | 0.00         |                    | 0.00                   |                                  |                | 0.036      |           |  |
| 2                                            | 0.60                        | 0.12         |                    | 0.27                   |                                  | 0.028          | 0.198      |           |  |
| 3                                            | 1.70                        | 0.24         |                    | 0.10                   |                                  | 0.032          | 0.341      |           |  |
| 4                                            | 3.25                        | 0.20         |                    | 0.03                   |                                  | 0.009          | 0.320      |           |  |
| 5                                            | 4.85                        | 0.20         |                    | 0.01                   |                                  | 0.003          | 0.566      |           |  |
| 6                                            | 8.75                        | 0.09         |                    | 0.04                   |                                  | 0.011          | 0.341      |           |  |
| 7                                            | 10.95                       | 0.22         |                    | 0.00                   |                                  | 0.000          | 0.851      |           |  |
| 8                                            | 15.55                       | 0.15         |                    | 0.25                   |                                  | 0.111          | 0.156      |           |  |
| 9                                            | 16.85                       | 0.09         |                    | 0.16                   |                                  | 0.023          | 0.314      |           |  |
| 10                                           | 18.75                       | 0.24         |                    | 0.09                   |                                  | 0.029          | 0.136      |           |  |
| 11                                           | 19.55                       | 0.10         |                    | 0.17                   |                                  | 0.015          | 0.145      |           |  |
| 12                                           | 20.55                       | 0.19         |                    | 0.07                   |                                  | 0.015          | 0.202      |           |  |
| 13                                           | 21.85                       | 0.12         |                    | 0.12                   |                                  | 0.017          | 0.175      |           |  |
| 14                                           | 22.85                       | 0.23         |                    | 0.23                   |                                  | 0.071          | 0.408      |           |  |
| 15                                           | 24.55                       | 0.25         |                    | 0.13                   |                                  | 0.057          | 0.621      |           |  |
| 16                                           | 26.35                       | 0.44         |                    | 0.08                   |                                  | 0.062          | 0.544      |           |  |
| 17                                           | 28.05                       | 0.20         |                    | 0.09                   |                                  | 0.026          | 0.264      |           |  |
| 18                                           | 29.25                       | 0.24         |                    | 0.08                   |                                  | 0.030          | 0.527      |           |  |
| 19                                           | 31.20                       | 0.30         |                    | 0.34                   |                                  | 0.186          | 0.476      |           |  |
| 20                                           | 32.90                       | 0.26         |                    | 0.36                   |                                  | 0.220          | 0.990      |           |  |
| 21                                           | 35.90                       | 0.40         |                    | 0.06                   |                                  | 0.058          | 0.657      |           |  |
| 22                                           | 37.70                       | 0.33         |                    | 0.20                   |                                  | 0.139          | 0.696      |           |  |
| 23                                           | 40.10                       | 0.25         |                    | 0.46                   |                                  | 0.270          | 0.518      |           |  |
| 24                                           | 42.40                       | 0.20         |                    | 0.36                   |                                  | 0.119          | 0.215      |           |  |
| 25                                           | 43.40                       | 0.23         |                    | 0.30                   |                                  | 0.090          | 0.248      |           |  |
| 26                                           | 45.00                       | 0.08         |                    | 0.45                   |                                  | 0.049          | 0.280      |           |  |
| 27                                           | 46.10                       | 0.43         |                    | 0.23                   |                                  | 0.168          | 1.024      |           |  |
| 28                                           | 48.40                       | 0.46         |                    | 0.21                   |                                  | 0.164          | 0.440      |           |  |
| 29                                           | 49.50                       | 0.34         |                    | 0.37                   |                                  | 0.157          | 0.553      |           |  |
| 30                                           | 50.90                       | 0.45         |                    | 0.37                   |                                  | 0.241          | 0.563      |           |  |
| 31                                           | 52.40                       | 0.30         |                    | 0.25                   |                                  | 0.101          | 0.510      |           |  |
| 32                                           | 53.60                       | 0.55         |                    | 0.56                   |                                  | 0.755          | 1.628      |           |  |
| 33                                           | 57.30                       | 0.33         |                    | 0.33                   |                                  | 0.283          | 0.510      |           |  |
| 34                                           | 58.80                       | 0.35         |                    | 0.65                   |                                  | 0.432          | 0.713      |           |  |
| 35                                           | 61.10                       | 0.27         |                    | 0.68                   |                                  | 0.376          | 0.576      |           |  |
| 36                                           | 62.90                       | 0.37         |                    | 0.30                   |                                  | 0.266          | 1.155      |           |  |
| 37                                           | 65.90                       | 0.40         |                    | 0.35                   |                                  | 0.350          | 0.720      |           |  |
| 38                                           | 67.90                       | 0.32         |                    | 0.26                   |                                  | 0.146          | 0.353      |           |  |
| 39                                           | 69.40                       | 0.15         |                    | 0.06                   |                                  | 0.012          | 0.186      |           |  |
| 40                                           | 70.60                       | 0.16         |                    | 0.32                   |                                  | 0.056          | 0.130      |           |  |
| 41                                           | 71.60                       | 0.10         |                    | 0.49                   |                                  | 0.129          | 0.213      |           |  |
| 42                                           | 75.85                       | 0.00         |                    | 0.00                   | end main channel                 | 0.000          | 0.000      |           |  |
| 43                                           | 76.00                       | 0.00         |                    | 0.00                   | start side channel               | 0.000          | 0.028      |           |  |
| 44                                           | 76.80                       | 0.07         |                    | 0.25                   |                                  | 0.025          | 0.221      |           |  |
| 45                                           | 78.90                       | 0.14         |                    | 0.48                   |                                  | 0.155          | 0.275      |           |  |
| 46                                           | 81.40                       | 0.08         |                    | 0.46                   |                                  | 0.155          | 0.325      |           |  |
| 47                                           | 87.30                       | 0.03         |                    | 0.42                   |                                  | 0.040          | 0.006      |           |  |
| 48                                           | 87.70                       | 0.00         |                    | 0.00                   |                                  | 0.000          | 0.000      |           |  |
| NOTES:                                       |                             |              |                    |                        |                                  | RESULTS:       | Q (m3/s)   | 5.680     |  |
|                                              |                             |              |                    |                        |                                  |                | A(m2)      | 20.35     |  |
|                                              |                             |              |                    |                        |                                  |                | B(m)       | 87.7      |  |



## APPENDIX A HYDROMETRIC STATIONS

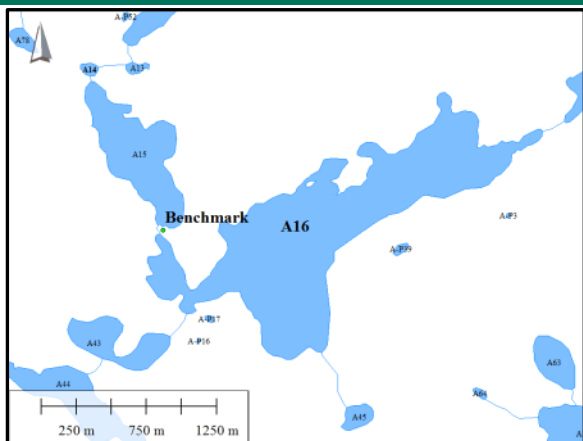
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                                              |                    |                        |                                  |              |                |       |  |
|----------------------------------------------|-----------------------------|----------------------------------------------|--------------------|------------------------|----------------------------------|--------------|----------------|-------|--|
| Project Name, Number:                        |                             | Amaruq - trip 2                              |                    |                        | Date                             |              | 04-Aug-15      |       |  |
| Waterbody:                                   |                             | A15                                          |                    |                        | Start Time                       |              | 11:45          |       |  |
| Crossing ID:                                 |                             | A14-A13                                      |                    |                        | End Time                         |              | 12:10          |       |  |
| LDB UTM Location                             |                             | Survey                                       |                    |                        | Datalogger SN:                   |              |                |       |  |
| East                                         | 6030112                     | BM read                                      |                    |                        | Transducer SN:                   |              |                |       |  |
| North                                        | 7255650                     | WL read                                      |                    |                        | Meter Type/SN:                   |              | Marsh McBirney |       |  |
| Elevation, Zone                              | 14W                         | WL Elev                                      |                    |                        | Crew:                            |              | JRL, JN        |       |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)                                 | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)     |       |  |
|                                              |                             |                                              | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                |       |  |
| 1                                            | 0.00                        | 0.00                                         |                    | 0.00                   |                                  |              | 0.885          |       |  |
| 2                                            | 35.40                       | 0.05                                         |                    | 0.00                   |                                  | 0.000        | 0.015          |       |  |
| 3                                            | 35.50                       | 0.25                                         |                    | 0.06                   |                                  | 0.002        | 0.013          |       |  |
| 4                                            | 35.60                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 5                                            | 36.10                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 6                                            | 36.10                       | 0.20                                         |                    | 0.00                   |                                  | 0.000        | 0.020          |       |  |
| 7                                            | 36.20                       | 0.20                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 8                                            | 36.20                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 9                                            | 36.80                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.020          |       |  |
| 10                                           | 37.00                       | 0.20                                         |                    | 0.06                   |                                  | 0.002        | 0.020          |       |  |
| 11                                           | 37.20                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 12                                           | 37.90                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.009          |       |  |
| 13                                           | 38.00                       | 0.17                                         |                    | 0.04                   |                                  | 0.004        | 0.185          |       |  |
| 14                                           | 39.00                       | 0.20                                         |                    | 0.04                   |                                  | 0.008        | 0.210          |       |  |
| 15                                           | 40.00                       | 0.22                                         |                    | 0.07                   |                                  | 0.015        | 0.170          |       |  |
| 16                                           | 41.00                       | 0.12                                         |                    | 0.04                   |                                  | 0.003        | 0.012          |       |  |
| 17                                           | 41.20                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 18                                           | 41.70                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.024          |       |  |
| 19                                           | 42.00                       | 0.16                                         |                    | 0.01                   |                                  | 0.001        | 0.140          |       |  |
| 20                                           | 43.00                       | 0.12                                         |                    | 0.10                   |                                  | 0.009        | 0.030          |       |  |
| 21                                           | 43.50                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 22                                           | 44.40                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.105          |       |  |
| 23                                           | 45.00                       | 0.35                                         |                    | 0.05                   |                                  | 0.007        | 0.035          |       |  |
| 24                                           | 45.20                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 25                                           | 46.80                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.021          |       |  |
| 26                                           | 47.00                       | 0.21                                         |                    | 0.06                   |                                  | 0.003        | 0.021          |       |  |
| 27                                           | 47.20                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 28                                           | 47.50                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.053          |       |  |
| 29                                           | 48.00                       | 0.21                                         |                    | 0.10                   |                                  | 0.016        | 0.305          |       |  |
| 30                                           | 49.00                       | 0.40                                         |                    | 0.05                   |                                  | 0.020        | 0.345          |       |  |
| 31                                           | 50.00                       | 0.29                                         |                    | 0.05                   |                                  | 0.015        | 0.375          |       |  |
| 32                                           | 51.00                       | 0.46                                         |                    | 0.11                   |                                  | 0.051        | 0.380          |       |  |
| 33                                           | 52.00                       | 0.30                                         |                    | 0.14                   |                                  | 0.032        | 0.075          |       |  |
| 34                                           | 52.50                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 35                                           | 53.60                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.076          |       |  |
| 36                                           | 54.00                       | 0.38                                         |                    | 0.10                   |                                  | 0.011        | 0.043          |       |  |
| 37                                           | 54.20                       | 0.05                                         |                    | 0.14                   |                                  | 0.004        | 0.144          |       |  |
| 38                                           | 55.00                       | 0.31                                         |                    | 0.03                   |                                  | 0.008        | 0.300          |       |  |
| 39                                           | 56.00                       | 0.29                                         |                    | 0.05                   |                                  | 0.015        | 0.180          |       |  |
| 40                                           | 57.00                       | 0.07                                         |                    | 0.11                   |                                  | 0.005        | 0.010          |       |  |
| 41                                           | 57.30                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 42                                           | 58.00                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.003          |       |  |
| 43                                           | 58.10                       | 0.06                                         |                    | 0.06                   |                                  | 0.000        | 0.072          |       |  |
| 44                                           | 58.90                       | 0.12                                         |                    | 0.09                   |                                  | 0.005        | 0.006          |       |  |
| 45                                           | 59.00                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| 46                                           | 59.01                       | 0.05                                         |                    | 0.00                   |                                  | 0.000        | 0.650          |       |  |
| 47                                           | 85.01                       | 0.00                                         |                    | 0.00                   |                                  | 0.000        | 0.000          |       |  |
| NOTES:                                       |                             | First and last row approximated. Depth <5cm. |                    |                        | RESULTS:                         |              | Q (m3/s)       | 0.233 |  |
|                                              |                             |                                              |                    |                        |                                  |              | A(m2)          | 4.95  |  |
|                                              |                             |                                              |                    |                        |                                  |              | B(m)           | 85.0  |  |



## APPENDIX A HYDROMETRIC STATIONS

### A5.0 LAKE A16 (MAMMOTH LAKE) & OUTLET (STREAM A16-A15)

| Parameter                        | Value                                                                                                                                        | Note                                       |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 38.7                                                                                                                                         | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 45                                                                                                                                           | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.95                                                                                                                                         | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 39.3                                                                                                                                         | Measured in the field on 13 June 2015      |
| Max. Wetted Depth (m)            | 0.48                                                                                                                                         | Measured in the field on 13 June 2015      |
| Channel Length (km)              | 0.07                                                                                                                                         | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.009                                                                                                                                        | Average slope, measured in the field       |
| Bed Material                     | Boulders, cobbles                                                                                                                            |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                                                                  |                                            |
| Bank Vegetation                  | Grass                                                                                                                                        |                                            |
| Benchmark Coordinates            | 602765 m E,<br>7255549 m N,<br>155.17 masl                                                                                                   | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                                                          |                                            |
| Comment                          | Poorly defined boulder channel. Subsurface flow present. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                            |



18 September 2015. View looking southeast towards Lake A16 and outlet.



13 June 2015. Upstream view of the watercourse (south).



18 September 2015. Downstream view from watercourse towards Lake A15 (northeast).



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |              |                    |                        |                                  |                |            |  |  |
|----------------------------------------------|-----------------------------|--------------|--------------------|------------------------|----------------------------------|----------------|------------|--|--|
| Project Name, Number:                        |                             | 154321       |                    |                        | Date                             |                | 13-Jun-15  |  |  |
| Waterbody:                                   |                             | A16          |                    |                        | Start Time                       |                | 1245       |  |  |
| Crossing ID:                                 |                             | A16-A15      |                    |                        | End Time                         |                | 1305       |  |  |
| LDB UTM Location                             |                             |              |                    | Survey                 |                                  | Datalogger SN: |            |  |  |
| East                                         | 6023386                     | BM read      |                    |                        | Transducer SN:                   |                |            |  |  |
| North                                        | 7254474                     | WL read      |                    |                        | Meter Type/SN:                   |                | Swoffer    |  |  |
| Elevation, Zone                              | 14W                         | WL Elev      |                    |                        | Crew:                            | CJ, JRL        |            |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m) | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |  |  |
|                                              |                             |              | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |  |  |
| 1                                            | 0.00                        | 0.00         |                    | 0.00                   |                                  |                | 0.052      |  |  |
| 2                                            | 0.80                        | 0.13         |                    | 0.05                   |                                  | 0.006          | 0.225      |  |  |
| 3                                            | 1.80                        | 0.32         |                    | 0.20                   |                                  | 0.256          | 1.645      |  |  |
| 4                                            | 8.80                        | 0.15         |                    | 0.11                   |                                  | 0.067          | 0.220      |  |  |
| 5                                            | 9.90                        | 0.25         |                    | 0.22                   |                                  | 0.099          | 0.638      |  |  |
| 6                                            | 12.40                       | 0.26         |                    | 0.40                   |                                  | 0.182          | 0.210      |  |  |
| 7                                            | 13.40                       | 0.16         |                    | 0.15                   |                                  | 0.029          | 0.196      |  |  |
| 8                                            | 14.80                       | 0.12         |                    | 0.42                   |                                  | 0.055          | 0.124      |  |  |
| 9                                            | 15.60                       | 0.19         |                    | 0.55                   |                                  | 0.157          | 0.297      |  |  |
| 10                                           | 17.80                       | 0.08         |                    | 0.40                   |                                  | 0.054          | 0.222      |  |  |
| 11                                           | 19.00                       | 0.29         |                    | 0.00                   |                                  | 0.000          | 0.308      |  |  |
| 12                                           | 20.40                       | 0.15         |                    | 0.35                   |                                  | 0.118          | 0.496      |  |  |
| 13                                           | 23.50                       | 0.17         |                    | 0.40                   |                                  | 0.221          | 0.561      |  |  |
| 14                                           | 26.90                       | 0.16         |                    | 0.36                   |                                  | 0.282          | 1.408      |  |  |
| 15                                           | 33.30                       | 0.28         |                    | 0.40                   |                                  | 0.423          | 0.236      |  |  |
| 16                                           | 34.45                       | 0.13         |                    | 0.42                   |                                  | 0.055          | 0.157      |  |  |
| 17                                           | 35.30                       | 0.24         |                    | 0.30                   |                                  | 0.031          | 0.000      |  |  |
| 18                                           | 35.30                       | 0.09         |                    | 0.11                   |                                  | 0.007          | 0.188      |  |  |
| 19                                           | 36.80                       | 0.16         |                    | 0.05                   |                                  | 0.028          | 0.440      |  |  |
| 20                                           | 42.30                       | 0.00         |                    | 0.00                   |                                  | 0.000          | 0.000      |  |  |
| NOTES:                                       |                             |              |                    |                        | RESULTS:                         | Q (m3/s)       | 2.070      |  |  |
|                                              |                             |              |                    |                        |                                  | A(m2)          | 7.62       |  |  |
|                                              |                             |              |                    |                        |                                  | B(m)           | 42.3       |  |  |

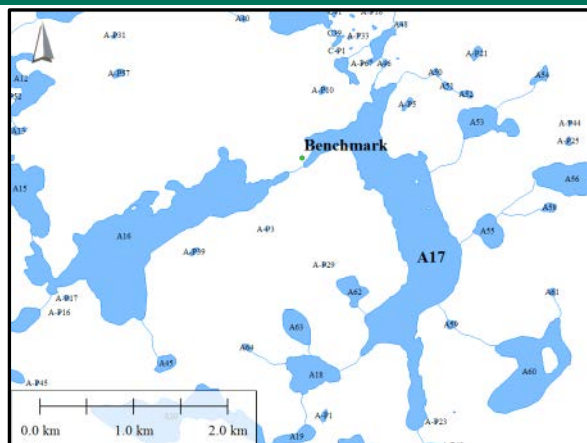




## APPENDIX A HYDROMETRIC STATIONS

### A6.0 LAKE A17 (WHALE TAIL LAKE) & OUTLET (STREAM A17-A16)

| Parameter                        | Value                                                                                                               | Note                                       |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 28.1                                                                                                                | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 75                                                                                                                  | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.80                                                                                                                | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 75.3                                                                                                                | Measured in the field on 14 June 2015      |
| Max. Wetted Depth (m)            | 0.80                                                                                                                | Measured in the field on 14 June 2015      |
| Channel Length (km)              | 0.50                                                                                                                | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.002                                                                                                               | Average slope, measured with DEM           |
| Bed Material                     | Boulders, cobbles                                                                                                   |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                                         |                                            |
| Bank Vegetation                  | Grass                                                                                                               |                                            |
| Benchmark Coordinates            | 606209 m E,<br>7255347 m N,<br>156.35 masl                                                                          | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | 606646 m E,<br>7255513 m N                                                                                          |                                            |
| Comment                          | Poorly defined boulder channel. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                            |



Lake H17: Benchmark location.



14 June 2015. View looking north at Lake A17.



7 August 2015. Upstream view of the watercourse (northwest).



14 June 2015. Downstream view of the watercourse (southwest).





## APPENDIX A HYDROMETRIC STATIONS

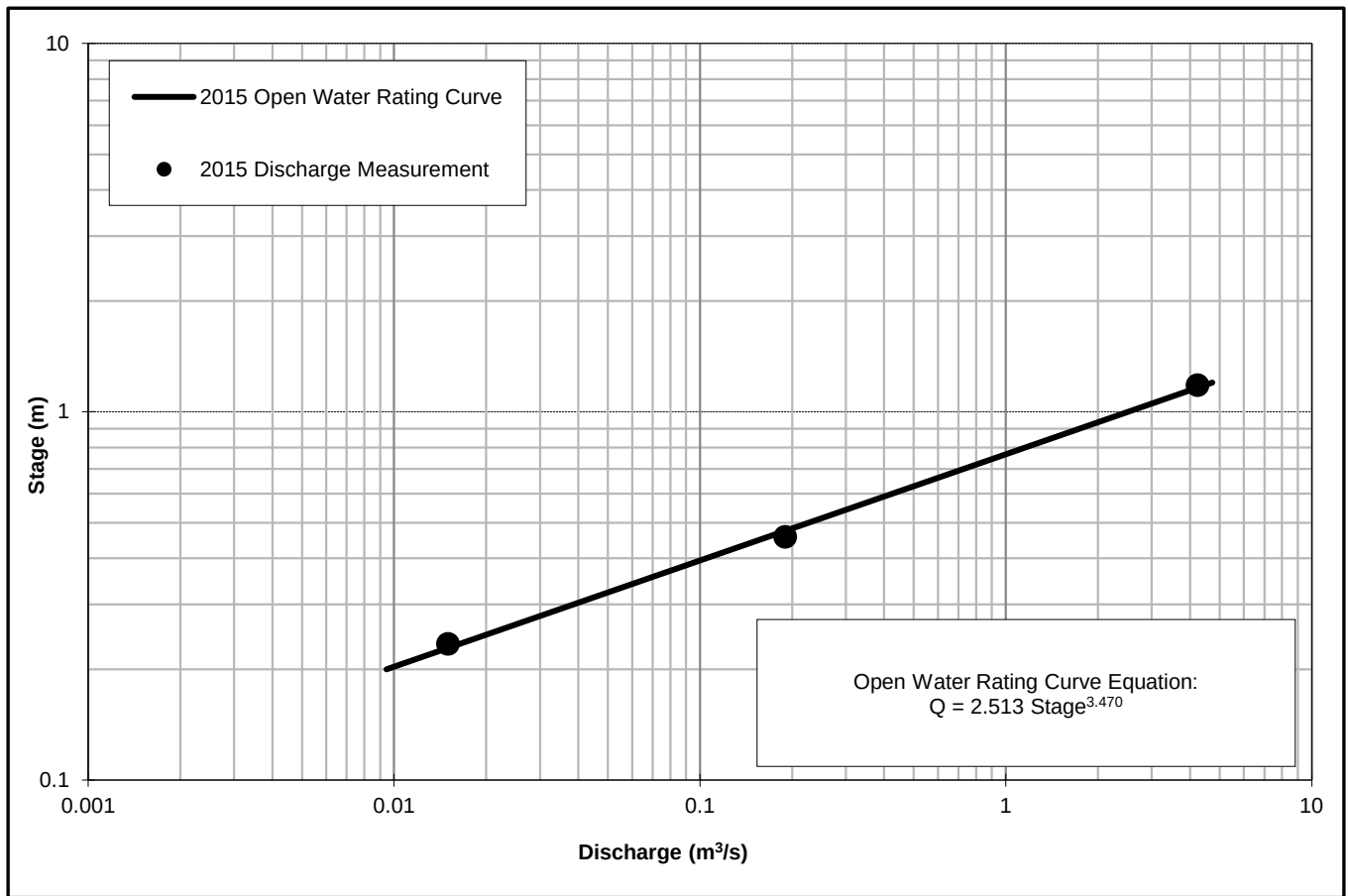


Figure 3: 2015 Stage-Discharge Rating Curve (Lake A17)



## APPENDIX A HYDROMETRIC STATIONS

Lake A17 - 2015

MEAN DAILY DISCHARGE (m<sup>3</sup>/s)

| DATE | JAN | FEB | MAR | APR | MAY | JUN    | JUL   | AUG   | SEP    | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|--------|-------|-------|--------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -      | 0.72  | 0.23  | 0.04   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -      | 0.69  | 0.21  | 0.04   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -      | 0.66  | 0.20  | 0.04   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -      | 0.62  | 0.19  | 0.04   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -      | 0.61  | 0.18  | 0.03   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -      | 0.59  | 0.17  | 0.03   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -      | 0.58  | 0.16  | 0.03   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -      | 0.56  | 0.16  | 0.03   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -      | 0.55  | 0.15  | 0.03   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -      | 0.56  | 0.14  | 0.02   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -      | 0.54  | 0.13  | 0.02   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | 1.26 P | 0.53  | 0.11  | 0.03   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 2.04   | 0.52  | 0.11  | 0.04   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 3.47   | 0.49  | 0.11  | 0.04   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 3.56   | 0.46  | 0.10  | 0.05   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 2.82   | 0.44  | 0.09  | 0.05 P | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 2.26   | 0.43  | 0.08  | -      | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 1.98   | 0.41  | 0.08  | -      | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 1.88   | 0.39  | 0.08  | -      | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 1.67   | 0.38  | 0.08  | -      | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 1.62   | 0.36  | 0.07  | -      | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 1.45   | 0.35  | 0.07  | -      | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 1.26   | 0.34  | 0.06  | -      | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 1.12   | 0.32  | 0.06  | -      | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 1.02   | 0.30  | 0.06  | -      | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 0.98   | 0.28  | 0.05  | -      | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 0.91   | 0.27  | 0.05  | -      | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 0.86   | 0.26  | 0.05  | -      | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 0.81   | 0.25  | 0.05  | -      | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 0.77   | 0.25  | 0.04  | -      | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -      | 0.24  | 0.04  | -      | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 0.768  | 0.241 | 0.042 | 0.023  | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 1.671  | 0.450 | 0.108 | 0.035  | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 3.563  | 0.723 | 0.226 | 0.049  | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE

|                                      |           |           |           |         |        |
|--------------------------------------|-----------|-----------|-----------|---------|--------|
| <b>Water Yield (m<sup>3</sup>) =</b> | 4,285,347 | 2,742,373 | 1,205,254 | 289,947 | 47,773 |
| <b>Water Yield (mm) =</b>            | 152.3     | 64%       | 28%       | 7%      | 1%     |



## APPENDIX A HYDROMETRIC STATIONS

Lake A17 - 2015

MEAN DAILY WATER SURFACE ELEVATION (masl) BASED ON BENCHMARK ELEVATION 156.35 masl

| DATE | JAN | FEB | MAR | APR | MAY | JUN       | JUL     | AUG     | SEP       | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|-----------|---------|---------|-----------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -         | 152.898 | 152.699 | 152.502   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -         | 152.888 | 152.688 | 152.500   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -         | 152.880 | 152.681 | 152.498   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -         | 152.869 | 152.676 | 152.493   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -         | 152.863 | 152.670 | 152.489   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -         | 152.860 | 152.663 | 152.483   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -         | 152.854 | 152.656 | 152.479   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -         | 152.848 | 152.650 | 152.472   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -         | 152.846 | 152.640 | 152.467   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -         | 152.848 | 152.634 | 152.463   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | -         | 152.843 | 152.626 | 152.457   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | 153.018 P | 152.840 | 152.611 | 152.479   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 153.138   | 152.834 | 152.608 | 152.498   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 153.296   | 152.825 | 152.602 | 152.508   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 153.305   | 152.815 | 152.595 | 152.517   | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 153.233   | 152.806 | 152.585 | 152.522 P | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 153.169   | 152.801 | 152.577 | -         | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 153.133   | 152.793 | 152.572 | -         | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 153.119   | 152.784 | 152.568 | -         | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 153.089   | 152.778 | 152.566 | -         | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 153.081   | 152.771 | 152.557 | -         | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 153.054   | 152.767 | 152.549 | -         | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 153.020   | 152.761 | 152.544 | -         | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 152.992   | 152.752 | 152.538 | -         | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 152.970   | 152.739 | 152.533 | -         | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 152.962   | 152.731 | 152.527 | -         | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 152.947   | 152.726 | 152.522 | -         | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 152.933   | 152.722 | 152.518 | -         | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 152.922   | 152.716 | 152.517 | -         | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 152.911   | 152.712 | 152.513 | -         | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -         | 152.709 | 152.508 | -         | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 152.922   | 152.709 | 152.508 | 152.457   | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 153.060   | 152.803 | 152.593 | 152.489   | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 153.305   | 152.898 | 152.699 | 152.522   | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |            |  |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|------------|--|--|
| Project Name, Number:                        |                             | Amaruq - 154321 |                    |                        | Date                             |              | 14-Jun-15  |  |  |
| Waterbody:                                   |                             | A17             |                    |                        | Start Time                       |              | 1538       |  |  |
| Crossing ID:                                 |                             | A17-A16         |                    |                        | End Time                         |              | 1613       |  |  |
| LDB UTM Location                             |                             |                 |                    | Datalogger SN:         |                                  |              |            |  |  |
| East                                         | 606273                      | BM read         |                    |                        | Transducer SN:                   |              |            |  |  |
| North                                        | 7255251                     | WL read         |                    |                        | Meter Type/SN:                   |              | Swoffer    |  |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | Crew:                            | CJ, JRL      |            |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |  |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |  |  |
| 1                                            | 2.50                        | 0.00            |                    | 0.00                   |                                  |              | 0.018      |  |  |
| 2                                            | 3.00                        | 0.07            |                    | 0.01                   |                                  | 0.000        | 0.063      |  |  |
| 3                                            | 3.60                        | 0.14            |                    | 0.01                   |                                  | 0.001        | 0.171      |  |  |
| 4                                            | 4.50                        | 0.24            |                    | 0.10                   |                                  | 0.023        | 0.300      |  |  |
| 5                                            | 5.50                        | 0.36            |                    | 0.14                   |                                  | 0.050        | 0.370      |  |  |
| 6                                            | 6.50                        | 0.38            |                    | 0.11                   |                                  | 0.063        | 0.830      |  |  |
| 7                                            | 8.50                        | 0.45            |                    | 0.22                   |                                  | 0.149        | 0.325      |  |  |
| 8                                            | 9.50                        | 0.20            |                    | 0.24                   |                                  | 0.048        | 0.335      |  |  |
| 9                                            | 10.50                       | 0.47            |                    | 0.18                   |                                  | 0.085        | 0.485      |  |  |
| 10                                           | 11.50                       | 0.50            |                    | 0.27                   |                                  | 0.135        | 0.485      |  |  |
| 11                                           | 12.50                       | 0.47            |                    | 0.26                   |                                  | 0.122        | 0.475      |  |  |
| 12                                           | 13.50                       | 0.48            |                    | 0.22                   |                                  | 0.106        | 0.485      |  |  |
| 13                                           | 14.50                       | 0.49            |                    | 0.30                   |                                  | 0.147        | 0.465      |  |  |
| 14                                           | 15.50                       | 0.44            |                    | 0.38                   |                                  | 0.167        | 0.450      |  |  |
| 15                                           | 16.50                       | 0.46            |                    | 0.28                   |                                  | 0.129        | 0.530      |  |  |
| 16                                           | 17.50                       | 0.60            |                    | 0.34                   |                                  | 0.204        | 0.620      |  |  |
| 17                                           | 18.50                       | 0.64            |                    | 0.26                   |                                  | 0.166        | 0.685      |  |  |
| 18                                           | 19.50                       | 0.73            |                    | 0.31                   |                                  | 0.226        | 0.720      |  |  |
| 19                                           | 20.50                       | 0.71            |                    | 0.35                   |                                  | 0.249        | 0.685      |  |  |
| 20                                           | 21.50                       | 0.66            |                    | 0.36                   |                                  | 0.238        | 0.705      |  |  |
| 21                                           | 22.50                       | 0.75            |                    | 0.31                   |                                  | 0.233        | 0.745      |  |  |
| 22                                           | 23.50                       | 0.74            |                    | 0.31                   |                                  | 0.229        | 0.720      |  |  |
| 23                                           | 24.50                       | 0.70            |                    | 0.31                   |                                  | 0.217        | 0.715      |  |  |
| 24                                           | 25.50                       | 0.73            |                    | 0.41                   |                                  | 0.299        | 0.715      |  |  |
| 25                                           | 26.50                       | 0.70            |                    | 0.33                   |                                  | 0.231        | 0.665      |  |  |
| 26                                           | 27.50                       | 0.63            |                    | 0.45                   |                                  | 0.284        | 0.615      |  |  |
| 27                                           | 28.50                       | 0.60            |                    | 0.38                   |                                  | 0.228        | 0.585      |  |  |
| 28                                           | 29.50                       | 0.57            |                    | 0.36                   |                                  | 0.205        | 0.555      |  |  |
| 29                                           | 30.50                       | 0.54            |                    | 0.00                   |                                  | 0.000        | 0.135      |  |  |
| 30                                           | 31.00                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)     | 4.233      |  |  |
|                                              |                             |                 |                    |                        | A(m2)                            | 14.65        |            |  |  |
|                                              |                             |                 |                    |                        | B(m)                             | 28.5         |            |  |  |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                       |                    |                        |                                  |              |                |       |  |
|----------------------------------------------|-----------------------------|-----------------------|--------------------|------------------------|----------------------------------|--------------|----------------|-------|--|
| Project Name, Number:                        |                             | Amaruq - Trip 2       |                    |                        | Date                             |              | 07-Aug-15      |       |  |
| Waterbody:                                   |                             | A17 (Whale Tail Lake) |                    |                        | Start Time                       |              | 8:35           |       |  |
| Crossing ID:                                 |                             | A17-A15               |                    |                        | End Time                         |              | 8:55           |       |  |
| LDB UTM Location                             |                             | Survey                |                    |                        | Datalogger SN:                   |              |                |       |  |
| East                                         | 606301                      | BM read               |                    |                        | Transducer SN:                   |              |                |       |  |
| North                                        | 7255289                     | WL read               |                    |                        | Meter Type/SN:                   |              | Marsh McBirney |       |  |
| Elevation, Zone                              | 14W                         | WL Elev               |                    |                        | Crew:                            |              | JRL, JN        |       |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)          | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)     |       |  |
|                                              |                             |                       | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                |       |  |
| 1                                            | 0.00                        | 0.05                  |                    | 0.00                   |                                  |              |                | 0.240 |  |
| 2                                            | 3.00                        | 0.11                  |                    | 0.01                   |                                  | 0.003        |                | 0.364 |  |
| 3                                            | 5.80                        | 0.15                  |                    | 0.01                   |                                  | 0.005        |                | 0.624 |  |
| 4                                            | 9.00                        | 0.24                  |                    | 0.01                   |                                  | 0.007        |                | 0.870 |  |
| 5                                            | 12.00                       | 0.34                  |                    | 0.00                   |                                  | 0.000        |                | 0.810 |  |
| 6                                            | 15.00                       | 0.20                  |                    | 0.00                   |                                  | 0.000        |                | 0.528 |  |
| 7                                            | 17.40                       | 0.24                  |                    | 0.01                   |                                  | 0.007        |                | 0.576 |  |
| 8                                            | 21.00                       | 0.08                  |                    | 0.00                   |                                  | 0.000        |                | 0.120 |  |
| 9                                            | 24.00                       | 0.00                  |                    | 0.00                   |                                  | 0.000        |                | 0.065 |  |
| 10                                           | 25.30                       | 0.10                  |                    | 0.00                   |                                  | 0.000        |                | 0.323 |  |
| 11                                           | 27.00                       | 0.28                  |                    | 0.01                   |                                  | 0.007        |                | 0.555 |  |
| 12                                           | 30.00                       | 0.09                  |                    | 0.00                   |                                  | 0.000        |                | 0.451 |  |
| 13                                           | 32.65                       | 0.25                  |                    | 0.00                   |                                  | 0.000        |                | 0.504 |  |
| 14                                           | 34.75                       | 0.23                  |                    | 0.00                   |                                  | 0.000        |                | 0.570 |  |
| 15                                           | 36.75                       | 0.34                  |                    | 0.01                   |                                  | 0.009        |                | 1.500 |  |
| 16                                           | 39.75                       | 0.66                  |                    | 0.02                   |                                  | 0.040        |                | 1.845 |  |
| 17                                           | 42.75                       | 0.57                  |                    | 0.01                   |                                  | 0.017        |                | 1.470 |  |
| 18                                           | 45.75                       | 0.41                  |                    | 0.05                   |                                  | 0.062        |                | 1.440 |  |
| 19                                           | 48.75                       | 0.55                  |                    | 0.01                   |                                  | 0.017        |                | 1.335 |  |
| 20                                           | 51.75                       | 0.34                  |                    | 0.00                   |                                  | 0.000        |                | 0.810 |  |
| 21                                           | 54.75                       | 0.20                  |                    | 0.03                   |                                  | 0.018        |                | 0.450 |  |
| 22                                           | 57.75                       | 0.10                  |                    | 0.00                   |                                  | 0.000        |                | 0.450 |  |
| 23                                           | 62.25                       | 0.10                  |                    | 0.00                   |                                  | 0.000        |                | 3.113 |  |
| NOTES:                                       |                             |                       |                    |                        | RESULTS:                         | Q (m3/s)     | 0.190          |       |  |
|                                              |                             |                       |                    |                        |                                  | A(m2)        | 19.01          |       |  |
|                                              |                             |                       |                    |                        |                                  | B(m)         | 62.3           |       |  |



## APPENDIX A HYDROMETRIC STATIONS

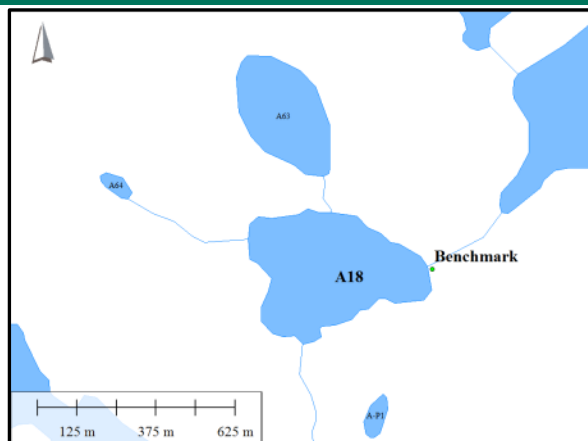
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                                                                                                                                                                                                                                                                                                 |                         |                    |                        |                                  |              |            |  |  |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|------------------------|----------------------------------|--------------|------------|--|--|
| Project Name, Number:                        |                                                                                                                                                                                                                                                                                                 | 1524321 - Amaruq Trip 3 |                    |                        | Date                             |              | 16-Sep-15  |  |  |
| Waterbody:                                   |                                                                                                                                                                                                                                                                                                 | A17                     |                    |                        | Start Time                       |              | 17:00      |  |  |
| Crossing ID:                                 |                                                                                                                                                                                                                                                                                                 | A17-A16                 |                    |                        | End Time                         |              | 17:25      |  |  |
| LDB UTM Location                             |                                                                                                                                                                                                                                                                                                 | Survey                  |                    |                        | Datalogger SN:                   |              |            |  |  |
| East                                         | 606189                                                                                                                                                                                                                                                                                          | BM read                 |                    |                        | Transducer SN:                   |              |            |  |  |
| North                                        | 7255256                                                                                                                                                                                                                                                                                         | WL read                 |                    |                        | Meter Type/SN:                   |              |            |  |  |
| Elevation, Zone                              | 14W                                                                                                                                                                                                                                                                                             | WL Elev                 |                    |                        | Crew:                            |              | JRL, DC    |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m)                                                                                                                                                                                                                                                                     | DEPTH<br>(m)            | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |  |  |
|                                              |                                                                                                                                                                                                                                                                                                 |                         | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |  |  |
| 1                                            | 0.00                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  |              | 0.012      |  |  |
| 2                                            | 0.30                                                                                                                                                                                                                                                                                            | 0.08                    |                    | 0.04                   |                                  | 0.001        | 0.013      |  |  |
| 3                                            | 0.50                                                                                                                                                                                                                                                                                            | 0.05                    |                    | 0.05                   |                                  | 0.001        | 0.005      |  |  |
| 4                                            | 0.70                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.002      |  |  |
| 5                                            | 0.90                                                                                                                                                                                                                                                                                            | 0.02                    |                    | 0.02                   |                                  | 0.000        | 0.001      |  |  |
| 6                                            | 1.00                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| 7                                            | 1.00                                                                                                                                                                                                                                                                                            | 0.05                    |                    | 0.10                   |                                  | 0.001        | 0.020      |  |  |
| 8                                            | 1.40                                                                                                                                                                                                                                                                                            | 0.05                    |                    | 0.10                   |                                  | 0.001        | 0.000      |  |  |
| 9                                            | 1.41                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| 10                                           | 1.41                                                                                                                                                                                                                                                                                            | 0.06                    |                    | 0.09                   |                                  | 0.001        | 0.030      |  |  |
| 11                                           | 1.91                                                                                                                                                                                                                                                                                            | 0.06                    |                    | 0.09                   |                                  | 0.001        | 0.000      |  |  |
| 12                                           | 1.92                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| 13                                           | 1.92                                                                                                                                                                                                                                                                                            | 0.06                    |                    | 0.04                   |                                  | 0.000        | 0.018      |  |  |
| 14                                           | 2.22                                                                                                                                                                                                                                                                                            | 0.06                    |                    | 0.04                   |                                  | 0.000        | 0.000      |  |  |
| 15                                           | 2.23                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| 16                                           | 2.23                                                                                                                                                                                                                                                                                            | 0.10                    |                    | 0.09                   |                                  | 0.001        | 0.030      |  |  |
| 17                                           | 2.53                                                                                                                                                                                                                                                                                            | 0.10                    |                    | 0.09                   |                                  | 0.001        | 0.000      |  |  |
| 18                                           | 2.54                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| 19                                           | 2.54                                                                                                                                                                                                                                                                                            | 0.10                    |                    | 0.06                   |                                  | 0.001        | 0.040      |  |  |
| 20                                           | 2.94                                                                                                                                                                                                                                                                                            | 0.10                    |                    | 0.06                   |                                  | 0.001        | 0.001      |  |  |
| 21                                           | 2.95                                                                                                                                                                                                                                                                                            | 0.00                    |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| NOTES:                                       | Discharge measurement was separated into sections that contained flow. In some cases, sections were estimated as an average depth and velocity. Therefore, the distance from LDB, A and B values are not applicable to this measurement.<br><br>20-40% of flow not measurable between boulders. |                         |                    |                        | RESULTS:                         | Q (m3/s)     | 0.012      |  |  |
|                                              |                                                                                                                                                                                                                                                                                                 |                         |                    |                        |                                  | A(m2)        | 0.17       |  |  |
|                                              |                                                                                                                                                                                                                                                                                                 |                         |                    |                        |                                  | B(m)         | 3.0        |  |  |



## APPENDIX A HYDROMETRIC STATIONS

### A7.0 LAKE A18 & OUTLET (STREAM A18-A17)

| Parameter                        | Value                                                                                                               | Note                                       |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 8.9                                                                                                                 | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 45                                                                                                                  | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.6                                                                                                                 | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 50                                                                                                                  | Measured in the field on 14 June 2015      |
| Max. Wetted Depth (m)            | 0.56                                                                                                                | Measured in the field on 14 June 2015      |
| Channel Length (km)              | 0.35                                                                                                                | Measured from Canvec data                  |
| Outlet Channel Slope (m/m)       | 0.004                                                                                                               | Average slope, measured in the field       |
| Bed Material                     | Boulders, cobbles                                                                                                   |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                                         |                                            |
| Bank Vegetation                  | Grass, bushes                                                                                                       |                                            |
| Benchmark Coordinates            | 606615 m E,<br>7253064 m N,<br>154.60 masl                                                                          | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | 606599 m E,<br>7253067 m N                                                                                          |                                            |
| Comment                          | Poorly defined boulder channel. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                            |



Lake A18: Benchmark location.



17 September 2015. View looking east at Lake A18.



7 August 2015. Upstream view of the watercourse and Lake (southwest).



16 September 2015. Downstream view of the watercourse (north).



## APPENDIX A HYDROMETRIC STATIONS

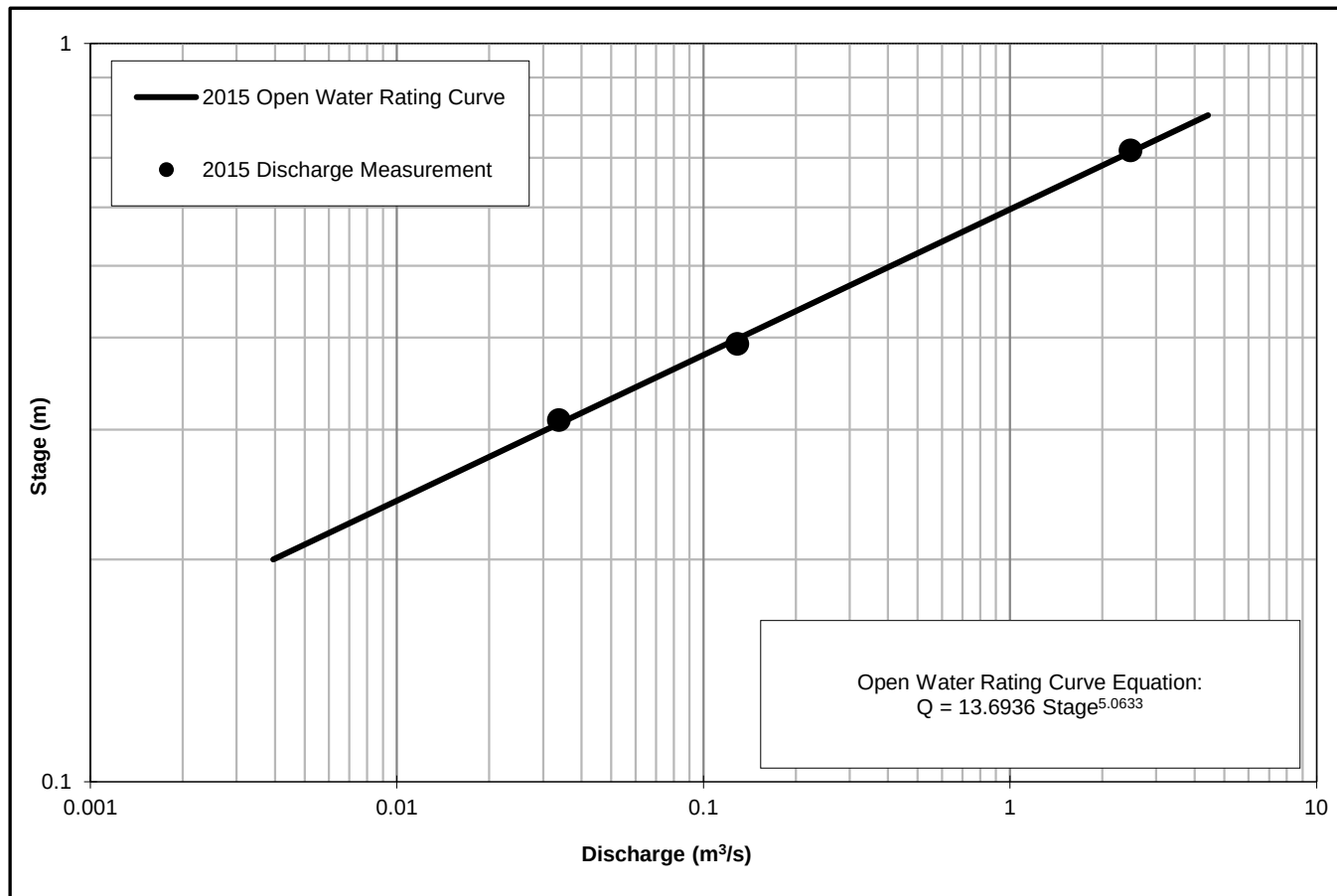


Figure 4: 2015 Stage-Discharge Rating Curve (Lake A18)





## APPENDIX A HYDROMETRIC STATIONS

Lake A18 - 2015

MEAN DAILY DISCHARGE (m<sup>3</sup>/s)

| DATE | JAN | FEB | MAR | APR | MAY | JUN    | JUL   | AUG   | SEP    | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|--------|-------|-------|--------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -      | 0.36  | 0.11  | 0.01   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -      | 0.34  | 0.10  | 0.01   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -      | 0.33  | 0.10  | 0.01   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -      | 0.30  | 0.10  | 0.01   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -      | 0.29  | 0.10  | 0.01   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -      | 0.29  | 0.10  | 0.01   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -      | 0.28  | 0.09  | 0.01   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -      | 0.27  | 0.08  | 0.01   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -      | 0.27  | 0.07  | 0.01   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -      | 0.29  | 0.07  | 0.01   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | 1.45 P | 0.29  | 0.06  | 0.01   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | 0.92   | 0.28  | 0.06  | 0.01   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 2.18   | 0.28  | 0.05  | 0.02   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 2.25   | 0.27  | 0.05  | 0.03   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 1.62   | 0.27  | 0.05  | 0.03 P | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 1.24   | 0.26  | 0.04  | -      | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 1.01   | 0.25  | 0.04  | -      | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 0.85   | 0.24  | 0.04  | -      | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 0.74   | 0.23  | 0.04  | -      | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 0.68   | 0.22  | 0.03  | -      | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 0.67   | 0.22  | 0.03  | -      | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 0.63   | 0.21  | 0.03  | -      | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 0.57   | 0.19  | 0.03  | -      | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 0.56   | 0.17  | 0.02  | -      | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 0.54   | 0.17  | 0.02  | -      | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 0.53   | 0.17  | 0.02  | -      | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 0.49   | 0.16  | 0.02  | -      | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 0.46   | 0.16  | 0.02  | -      | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 0.43   | 0.14  | 0.02  | -      | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 0.40   | 0.14  | 0.02  | -      | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -      | 0.13  | 0.01  | -      | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 0.398  | 0.130 | 0.014 | 0.008  | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 0.911  | 0.240 | 0.052 | 0.015  | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 2.249  | 0.362 | 0.115 | 0.029  | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE

|                                 |           |           |         |         |        |
|---------------------------------|-----------|-----------|---------|---------|--------|
| Water Yield (m <sup>3</sup> ) = | 2,376,562 | 1,574,018 | 643,735 | 139,983 | 18,826 |
| Water Yield (mm) =              | 267.2     | 66%       | 27%     | 6%      | 1%     |



## APPENDIX A HYDROMETRIC STATIONS

Lake A18 - 2015

MEAN DAILY WATER SURFACE ELEVATION (masl) BASED ON BENCHMARK ELEVATION 154.60 masl

| DATE | JAN | FEB | MAR | APR | MAY | JUN       | JUL     | AUG     | SEP       | OCT | NOV | DEC |
|------|-----|-----|-----|-----|-----|-----------|---------|---------|-----------|-----|-----|-----|
| 1    | -   | -   | -   | -   | -   | -         | 153.988 | 153.889 | 153.757   | -   | -   | -   |
| 2    | -   | -   | -   | -   | -   | -         | 153.981 | 153.882 | 153.758   | -   | -   | -   |
| 3    | -   | -   | -   | -   | -   | -         | 153.978 | 153.880 | 153.757   | -   | -   | -   |
| 4    | -   | -   | -   | -   | -   | -         | 153.970 | 153.880 | 153.753   | -   | -   | -   |
| 5    | -   | -   | -   | -   | -   | -         | 153.967 | 153.880 | 153.751   | -   | -   | -   |
| 6    | -   | -   | -   | -   | -   | -         | 153.967 | 153.876 | 153.747   | -   | -   | -   |
| 7    | -   | -   | -   | -   | -   | -         | 153.963 | 153.869 | 153.742   | -   | -   | -   |
| 8    | -   | -   | -   | -   | -   | -         | 153.959 | 153.861 | 153.738   | -   | -   | -   |
| 9    | -   | -   | -   | -   | -   | -         | 153.961 | 153.854 | 153.734   | -   | -   | -   |
| 10   | -   | -   | -   | -   | -   | -         | 153.968 | 153.852 | 153.731   | -   | -   | -   |
| 11   | -   | -   | -   | -   | -   | 154.142 P | 153.966 | 153.844 | 153.727   | -   | -   | -   |
| 12   | -   | -   | -   | -   | -   | 154.086   | 153.965 | 153.837 | 153.751   | -   | -   | -   |
| 13   | -   | -   | -   | -   | -   | 154.183   | 153.964 | 153.834 | 153.787   | -   | -   | -   |
| 14   | -   | -   | -   | -   | -   | 154.199   | 153.962 | 153.829 | 153.793   | -   | -   | -   |
| 15   | -   | -   | -   | -   | -   | 154.155   | 153.959 | 153.825 | 153.797 P | -   | -   | -   |
| 16   | -   | -   | -   | -   | -   | 154.122   | 153.957 | 153.819 | -         | -   | -   | -   |
| 17   | -   | -   | -   | -   | -   | 154.098   | 153.954 | 153.815 | -         | -   | -   | -   |
| 18   | -   | -   | -   | -   | -   | 154.078   | 153.949 | 153.812 | -         | -   | -   | -   |
| 19   | -   | -   | -   | -   | -   | 154.062   | 153.945 | 153.808 | -         | -   | -   | -   |
| 20   | -   | -   | -   | -   | -   | 154.053   | 153.944 | 153.803 | -         | -   | -   | -   |
| 21   | -   | -   | -   | -   | -   | 154.051   | 153.941 | 153.798 | -         | -   | -   | -   |
| 22   | -   | -   | -   | -   | -   | 154.045   | 153.937 | 153.794 | -         | -   | -   | -   |
| 23   | -   | -   | -   | -   | -   | 154.034   | 153.930 | 153.791 | -         | -   | -   | -   |
| 24   | -   | -   | -   | -   | -   | 154.031   | 153.920 | 153.786 | -         | -   | -   | -   |
| 25   | -   | -   | -   | -   | -   | 154.029   | 153.919 | 153.782 | -         | -   | -   | -   |
| 26   | -   | -   | -   | -   | -   | 154.027   | 153.919 | 153.778 | -         | -   | -   | -   |
| 27   | -   | -   | -   | -   | -   | 154.018   | 153.916 | 153.775 | -         | -   | -   | -   |
| 28   | -   | -   | -   | -   | -   | 154.011   | 153.913 | 153.772 | -         | -   | -   | -   |
| 29   | -   | -   | -   | -   | -   | 154.005   | 153.907 | 153.768 | -         | -   | -   | -   |
| 30   | -   | -   | -   | -   | -   | 153.997   | 153.904 | 153.765 | -         | -   | -   | -   |
| 31   | -   | -   | -   | -   | -   | -         | 153.898 | 153.755 | -         | -   | -   | -   |
| MIN  | -   | -   | -   | -   | -   | 153.997   | 153.898 | 153.755 | 153.727   | -   | -   | -   |
| MEAN | -   | -   | -   | -   | -   | 154.067   | 153.947 | 153.823 | 153.755   | -   | -   | -   |
| MAX  | -   | -   | -   | -   | -   | 154.199   | 153.988 | 153.889 | 153.797   | -   | -   | -   |

NOTES: P - PARTIAL DAILY AVERAGE



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |            |  |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|------------|--|--|
| Project Name, Number:                        |                             | Amaruq - 154321 |                    |                        | Date                             |              | 14-Jun-15  |  |  |
| Waterbody:                                   |                             | A18             |                    |                        | Start Time                       |              | 1148       |  |  |
| Crossing ID:                                 |                             | A18-A17         |                    |                        | End Time                         |              | 1213       |  |  |
| LDB UTM Location                             |                             | Survey          |                    |                        | Datalogger SN:                   |              |            |  |  |
| East                                         | 606650                      | BM read         |                    |                        | Transducer SN:                   |              |            |  |  |
| North                                        | 7253107                     | WL read         |                    |                        | Meter Type/SN:                   |              | Swoffer    |  |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | Crew:                            |              | CJ, JRL    |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |  |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |  |  |
| 1                                            | 3.00                        | 0.00            |                    | 0.00                   |                                  |              | 0.072      |  |  |
| 2                                            | 3.60                        | 0.24            |                    | 0.20                   |                                  | 0.055        | 0.519      |  |  |
| 3                                            | 5.30                        | 0.37            |                    | 0.12                   |                                  | 0.062        | 0.309      |  |  |
| 4                                            | 6.40                        | 0.19            |                    | 0.10                   |                                  | 0.034        | 0.442      |  |  |
| 5                                            | 8.85                        | 0.17            |                    | 0.08                   |                                  | 0.027        | 0.256      |  |  |
| 6                                            | 10.40                       | 0.16            |                    | 0.23                   |                                  | 0.056        | 0.263      |  |  |
| 7                                            | 11.90                       | 0.19            |                    | 0.34                   |                                  | 0.126        | 0.648      |  |  |
| 8                                            | 14.30                       | 0.35            |                    | 0.65                   |                                  | 0.489        | 0.599      |  |  |
| 9                                            | 16.20                       | 0.28            |                    | 0.44                   |                                  | 0.253        | 0.649      |  |  |
| 10                                           | 18.40                       | 0.31            |                    | 0.50                   |                                  | 0.357        | 0.768      |  |  |
| 11                                           | 20.80                       | 0.33            |                    | 0.16                   |                                  | 0.092        | 0.302      |  |  |
| 12                                           | 21.90                       | 0.22            |                    | 0.41                   |                                  | 0.153        | 0.621      |  |  |
| 13                                           | 24.20                       | 0.32            |                    | 0.30                   |                                  | 0.163        | 0.308      |  |  |
| 14                                           | 25.30                       | 0.24            |                    | 0.10                   |                                  | 0.037        | 0.340      |  |  |
| 15                                           | 27.30                       | 0.10            |                    | 0.37                   |                                  | 0.085        | 0.533      |  |  |
| 16                                           | 29.90                       | 0.31            |                    | 0.21                   |                                  | 0.153        | 0.536      |  |  |
| 17                                           | 32.00                       | 0.20            |                    | 0.16                   |                                  | 0.077        | 0.581      |  |  |
| 18                                           | 34.70                       | 0.23            |                    | 0.19                   |                                  | 0.098        | 0.450      |  |  |
| 19                                           | 36.50                       | 0.27            |                    | 0.14                   |                                  | 0.089        | 0.725      |  |  |
| 20                                           | 39.40                       | 0.23            |                    | 0.10                   |                                  | 0.054        | 0.387      |  |  |
| 21                                           | 41.20                       | 0.20            |                    | 0.04                   |                                  | 0.011        | 0.185      |  |  |
| 22                                           | 42.20                       | 0.17            |                    | 0.01                   |                                  | 0.003        | 0.196      |  |  |
| 23                                           | 44.50                       | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.000      |  |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)     | 2.475      |  |  |
|                                              |                             |                 |                    |                        | A(m2)                            | 9.69         |            |  |  |
|                                              |                             |                 |                    |                        | B(m)                             | 41.5         |            |  |  |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |                |  |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|----------------|--|--|
| Project Name, Number:                        |                             | Amaruq - trip 2 |                    |                        | Date                             |              | 04-Aug-15      |  |  |
| Waterbody:                                   |                             | A18             |                    |                        | Start Time                       |              | 13:20          |  |  |
| Crossing ID:                                 |                             | A18-A17         |                    |                        | End Time                         |              | 13:45          |  |  |
| LDB UTM Location                             |                             | Survey          |                    |                        | Datalogger SN:                   |              |                |  |  |
| East                                         | 606637                      | BM read         |                    |                        | Transducer SN:                   |              |                |  |  |
| North                                        | 7253084                     | WL read         |                    |                        | Meter Type/SN:                   |              | Marsh McBirney |  |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | Crew:                            |              | JRL, JN        |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)     |  |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                |  |  |
| 1                                            | 0.00                        | 0.00            |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 2                                            | 3.00                        | 0.00            |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 3                                            | 4.20                        | 0.03            |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 4                                            | 5.30                        | 0.03            |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 5                                            | 7.10                        | 0.19            |                    | 0.08                   |                                  |              | 0.015          |  |  |
| 6                                            | 7.30                        | 0               |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 7                                            | 8.40                        | 0.1             |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 8                                            | 10.90                       | 0               |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 9                                            | 11.00                       | 0.12            |                    | 0.12                   |                                  |              | 0.013          |  |  |
| 10                                           | 12.70                       | 0.18            |                    | 0.02                   |                                  |              | 0.005          |  |  |
| 11                                           | 13.50                       | 0.1             |                    | 0.04                   |                                  |              | 0.007          |  |  |
| 12                                           | 16.30                       | 0.14            |                    | 0.08                   |                                  |              | 0.020          |  |  |
| 13                                           | 17.00                       | 0.12            |                    | 0.21                   |                                  |              | 0.014          |  |  |
| 14                                           | 17.40                       | 0.11            |                    | 0.07                   |                                  |              | 0.007          |  |  |
| 15                                           | 18.90                       | 0.1             |                    | 0.07                   |                                  |              | 0.009          |  |  |
| 16                                           | 20.00                       | 0.14            |                    | 0.03                   |                                  |              | 0.006          |  |  |
| 17                                           | 21.70                       | 0.12            |                    | 0.11                   |                                  |              | 0.030          |  |  |
| 18                                           | 24.50                       | 0.08            |                    | 0.03                   |                                  |              | 0.004          |  |  |
| 19                                           | 25.00                       | 0               |                    | 0.00                   |                                  |              | 0.000          |  |  |
| 20                                           | 37.00                       | 0.00            |                    | 0.00                   |                                  |              | 0.000          |  |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)     | 0.129          |  |  |
|                                              |                             |                 |                    |                        |                                  | A(m2)        | 2.10           |  |  |
|                                              |                             |                 |                    |                        |                                  | B(m)         | 37.0           |  |  |



## APPENDIX A HYDROMETRIC STATIONS

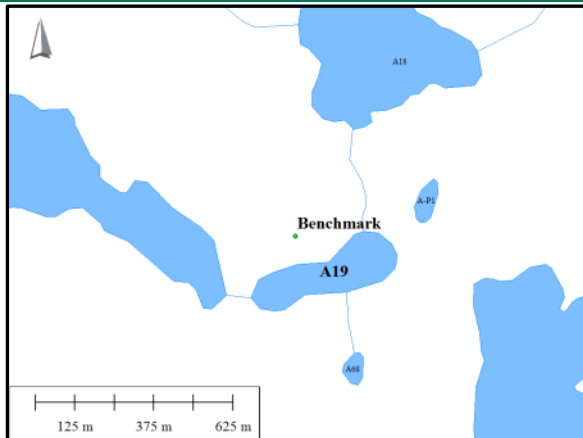
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET                                                                                                                                                                                                       |                             |                         |                    |                        |                                  |              |            |       |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------|--------------------|------------------------|----------------------------------|--------------|------------|-------|--|
| Project Name, Number:                                                                                                                                                                                                                              |                             | 1524321 - Amaruq Trip 3 |                    |                        | Date                             |              | 16-Sep-15  |       |  |
| Waterbody:                                                                                                                                                                                                                                         |                             | A18                     |                    |                        | Start Time                       |              | 16:10      |       |  |
| Crossing ID:                                                                                                                                                                                                                                       |                             | A18-A17                 |                    |                        | End Time                         |              | 16:20      |       |  |
| LDB UTM Location                                                                                                                                                                                                                                   |                             | Survey                  |                    |                        | Datalogger SN:                   |              |            |       |  |
| East                                                                                                                                                                                                                                               | 606635                      | BM read                 |                    |                        | Transducer SN:                   |              |            |       |  |
| North                                                                                                                                                                                                                                              | 7253081                     | WL read                 |                    |                        | Meter Type/SN:                   |              |            |       |  |
| Elevation, Zone                                                                                                                                                                                                                                    | 14W                         | WL Elev                 |                    |                        | Crew:                            |              | JRL, DC    |       |  |
| STATION<br>Start<br>LDB                                                                                                                                                                                                                            | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)            | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |       |  |
|                                                                                                                                                                                                                                                    |                             |                         | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |       |  |
| 1                                                                                                                                                                                                                                                  | 0.00                        | 0.03                    |                    | 0.01                   |                                  |              |            | 0.009 |  |
| 2                                                                                                                                                                                                                                                  | 0.30                        | 0.03                    |                    | 0.01                   |                                  | 0.000        |            | 0.000 |  |
| 3                                                                                                                                                                                                                                                  | 0.31                        | 0.00                    |                    | 0.00                   |                                  | 0.000        |            | 0.000 |  |
| 4                                                                                                                                                                                                                                                  | 0.31                        | 0.01                    |                    | 0.02                   |                                  | 0.000        |            | 0.005 |  |
| 5                                                                                                                                                                                                                                                  | 0.81                        | 0.01                    |                    | 0.02                   |                                  | 0.000        |            | 0.000 |  |
| 6                                                                                                                                                                                                                                                  | 0.82                        | 0.00                    |                    | 0.00                   |                                  | 0.000        |            | 0.000 |  |
| 7                                                                                                                                                                                                                                                  | 0.82                        | 0.10                    |                    | 0.02                   |                                  | 0.001        |            | 0.085 |  |
| 8                                                                                                                                                                                                                                                  | 1.67                        | 0.10                    |                    | 0.02                   |                                  | 0.001        |            | 0.001 |  |
| 9                                                                                                                                                                                                                                                  | 1.68                        | 0.00                    |                    | 0.00                   |                                  | 0.000        |            | 0.000 |  |
| 10                                                                                                                                                                                                                                                 | 1.68                        | 0.12                    |                    | 0.02                   |                                  | 0.001        |            | 0.096 |  |
| 11                                                                                                                                                                                                                                                 | 2.48                        | 0.12                    |                    | 0.02                   |                                  | 0.001        |            | 0.001 |  |
| 12                                                                                                                                                                                                                                                 | 2.49                        | 0.00                    |                    | 0.00                   |                                  | 0.000        |            | 0.000 |  |
| NOTES:<br>Discharge measurement was separated into sections that contained flow. In some cases, sections were estimated as an average depth and velocity. Therefore, the distance from LDB, A and B values are not applicable to this measurement. |                             | RESULTS:                |                    | Q (m3/s)               |                                  | 0.004        |            |       |  |
|                                                                                                                                                                                                                                                    |                             |                         |                    | A(m2)                  |                                  | 0.20         |            |       |  |
|                                                                                                                                                                                                                                                    |                             |                         |                    | B(m)                   |                                  | 2.5          |            |       |  |



## APPENDIX A HYDROMETRIC STATIONS

### A8.0 LAKE A19 & OUTLET (STREAM A19-A18)

| Parameter                        | Value                                             | Note                                        |
|----------------------------------|---------------------------------------------------|---------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 7.4                                               | Based on DEM (PhotoSat 2015)                |
| Bankfull Width (m)               | N/A                                               |                                             |
| Max. Bankfull Depth (m)          | N/A                                               |                                             |
| Wetted Width (m)                 | 0                                                 | Observed no flow in field 8 August 2015     |
| Max. Wetted Depth (m)            | 0                                                 | Observed no flow in field 8 August 2015     |
| Channel Length (km)              | 0.35                                              | Measured from CanVec data                   |
| Outlet Channel Slope (m/m)       | 0.004                                             | Not measured in the field or covered by DEM |
| Bed Material                     | Boulders, cobbles                                 |                                             |
| Bank Material                    | Boulders, cobbles, organics                       |                                             |
| Bank Vegetation                  | Grass                                             |                                             |
| Benchmark Coordinates            | 606023 m E,<br>7252491 m N,<br>157.51 masl        | NAD83 Zone 14                               |
| Logger/ Staff Gauge Coordinates  | N/A                                               |                                             |
| Comment                          | Boulder channel. No observed flow in August 2015. |                                             |



Lake A19: Benchmark location.

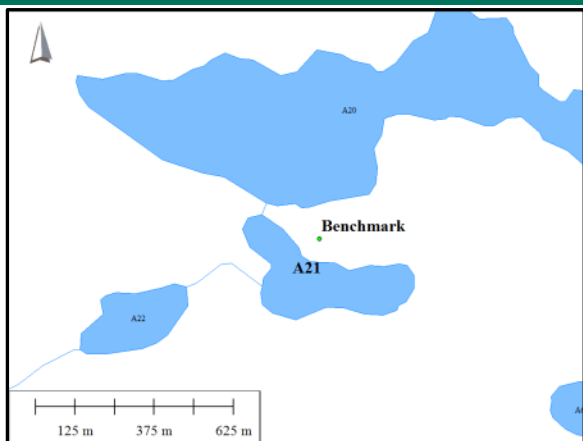
8 August 2015. Looking northwest at Lake A18.



## APPENDIX A HYDROMETRIC STATIONS

### A9.0 LAKE A21 & OUTLET (STREAM A21-A20)

| Parameter                        | Value                                                                                               | Note                                       |
|----------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 5.1                                                                                                 | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 20                                                                                                  | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.45                                                                                                | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 17.3                                                                                                | Measured in the field 3 August 2015        |
| Max. Wetted Depth (m)            | 0.32                                                                                                | Measured in the field 3 August 2015        |
| Channel Length (km)              | 0.05                                                                                                | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.001                                                                                               | Average slope, measured in the field       |
| Bed Material                     | Boulders, cobbles                                                                                   |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                         |                                            |
| Bank Vegetation                  | Grass                                                                                               |                                            |
| Benchmark Coordinates            | 604715 m E,<br>7252196 m N,<br>155.95 masl                                                          | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                 |                                            |
| Comment                          | Poorly defined boulder channel. Cross-sectional data are available in discharge calculation sheets. |                                            |



Lake A21: Benchmark location.



8 August 2015. Downstream view of the watercourse (north).



8 August 2015. View looking east of the watercourse.



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                      |              |            |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|--------------------------------------|--------------|------------|
| <b>Project Name, Number:</b>                 |                             | Amaruq - trip 2 |                    | <b>Date</b>            |                                      | 06-Aug-15    |            |
| <b>Waterbody:</b>                            |                             | A21             |                    | <b>Start Time</b>      |                                      | 14:00        |            |
| <b>Crossing ID:</b>                          |                             | A21-A20         |                    | <b>End Time</b>        |                                      | 14:25        |            |
| <b>LDB UTM Location</b>                      |                             |                 | <b>Survey</b>      |                        | <b>Datalogger SN:</b>                |              |            |
| East                                         | 604557                      | BM_read         |                    |                        | <b>Transducer SN:</b>                |              |            |
| North                                        | 7252299                     | WL_read         |                    |                        | <b>Meter Type/SN:</b> Marsh McBirney |              |            |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | <b>Crew:</b>                         | JRL, JN      |            |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°)     | Qi<br>(m3/s) | Ai<br>(m2) |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                      |              |            |
| 1                                            | 0.00                        | 0.00            |                    | 0.00                   |                                      |              | 0.048      |
| 2                                            | 0.40                        | 0.24            |                    | 0.00                   |                                      | 0.000        | 0.042      |
| 3                                            | 0.70                        | 0.04            |                    | 0.00                   |                                      | 0.000        | 0.041      |
| 4                                            | 1.60                        | 0.05            |                    | 0.01                   |                                      | 0.001        | 0.096      |
| 5                                            | 2.80                        | 0.11            |                    | 0.02                   |                                      | 0.002        | 0.017      |
| 6                                            | 3.10                        | 0.00            |                    | 0.00                   |                                      | 0.000        | 0.000      |
| 7                                            | 9.30                        | 0.00            |                    | 0.00                   |                                      | 0.000        | 0.015      |
| 8                                            | 9.60                        | 0.10            |                    | 0.00                   |                                      | 0.000        | 0.120      |
| 9                                            | 10.80                       | 0.10            |                    | 0.00                   |                                      | 0.000        | 0.100      |
| 10                                           | 12.80                       | 0.00            |                    | 0.00                   |                                      | 0.000        | 0.000      |
| 11                                           | 13.50                       | 0.00            |                    | 0.00                   |                                      | 0.000        | 0.076      |
| 12                                           | 14.30                       | 0.19            |                    | 0.02                   |                                      | 0.003        | 0.255      |
| 13                                           | 15.30                       | 0.32            |                    | 0.02                   |                                      | 0.010        | 0.580      |
| 14                                           | 17.30                       | 0.26            |                    | 0.00                   |                                      | 0.000        | 0.001      |
| 15                                           | 17.29                       | 0.00            |                    | 0.00                   |                                      | 0.000        | 0.000      |
| NOTES:                                       |                             |                 |                    | RESULTS:               |                                      | Q (m3/s)     | 0.015      |
|                                              |                             |                 |                    |                        |                                      | A(m2)        | 1.39       |
|                                              |                             |                 |                    |                        |                                      | B(m)         | 17.3       |

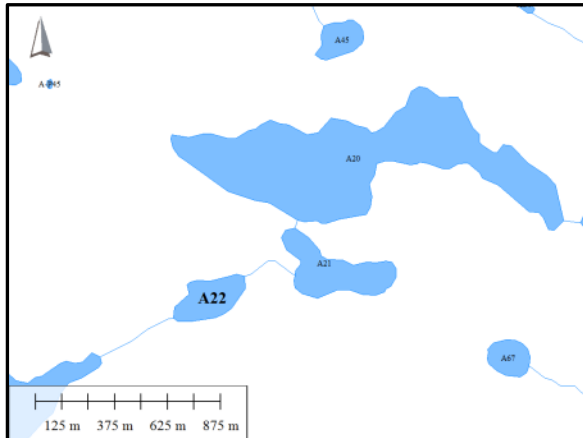




## APPENDIX A HYDROMETRIC STATIONS

### A10.0 LAKE A22 & OUTLET (STREAM A22-A21)

| Parameter                        | Value                                                            | Note                                        |
|----------------------------------|------------------------------------------------------------------|---------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 4.0                                                              | Based on DEM (PhotoSat 2015)                |
| Bankfull Width (m)               | N/A                                                              | Measured in the field, based on vegetation  |
| Max. Bankfull Depth (m)          | N/A                                                              | Measured in the field, based on vegetation  |
| Wetted Width (m)                 | 0                                                                | Observed in the field 3 August 2015         |
| Max. Wetted Depth (m)            | 0                                                                | Observed in the field 3 August 2015         |
| Channel Length (km)              | 0.3                                                              | Measured from CanVec data                   |
| Outlet Channel Slope (m/m)       | 0.001                                                            | Not measured in the field or covered by DEM |
| Bed Material                     | Boulders, cobbles                                                |                                             |
| Bank Material                    | Boulders, cobbles, organics                                      |                                             |
| Bank Vegetation                  | Grass                                                            |                                             |
| Benchmark Coordinates            | N/A                                                              | NAD83 Zone 14                               |
| Logger/ Staff Gauge Coordinates  | N/A                                                              |                                             |
| Comment                          | Poorly defined boulder channel. No observed flow in August 2015. |                                             |



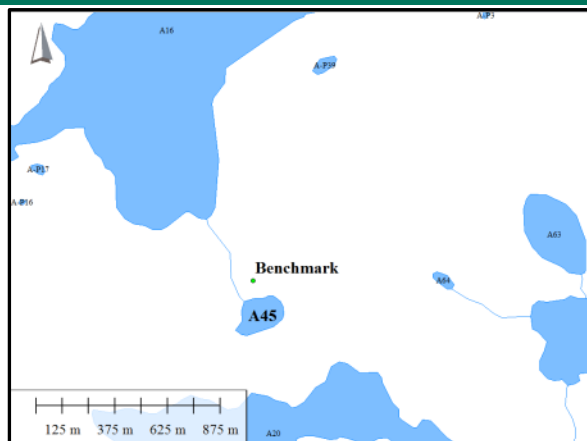
Lake A22.



## APPENDIX A HYDROMETRIC STATIONS

### A11.0 LAKE A45 & OUTLET (STREAM A45-A16)

| Parameter                        | Value                                                                                                                                                         | Note                                            |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 0.2                                                                                                                                                           | Based on DEM (PhotoSat 2015)                    |
| Bankfull Width (m)               | 35                                                                                                                                                            | Measured in the field, based on vegetation      |
| Max. Bankfull Depth (m)          | N/A                                                                                                                                                           | Not measureable; deep boulder garden            |
| Wetted Width (m)                 | 0                                                                                                                                                             | Observed no surface flow in field 8 August 2015 |
| Max. Wetted Depth (m)            | 0                                                                                                                                                             | Observed no surface flow in field 8 August 2015 |
| Channel Length (km)              | 0.45                                                                                                                                                          | Measured from CanVec data                       |
| Outlet Channel Slope (m/m)       | 0.009                                                                                                                                                         | Average slope, measured in the field            |
| Bed Material                     | Boulders, cobbles                                                                                                                                             |                                                 |
| Bank Material                    | Boulders, cobbles, organics                                                                                                                                   |                                                 |
| Bank Vegetation                  | Grass                                                                                                                                                         |                                                 |
| Benchmark Coordinates            | 604716 m E,<br>7253325 m N,<br>159.66 masl                                                                                                                    | NAD83 Zone 14                                   |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                                                                           |                                                 |
| Comment                          | Deep boulder garden channel with predominantly subsurface flows especially later in the open water season. Cross-sectional data are available in Section 3.3. |                                                 |



Lake A45: Benchmark location.

19 September 2015. View looking north towards Lake A45 (right) and outlet.



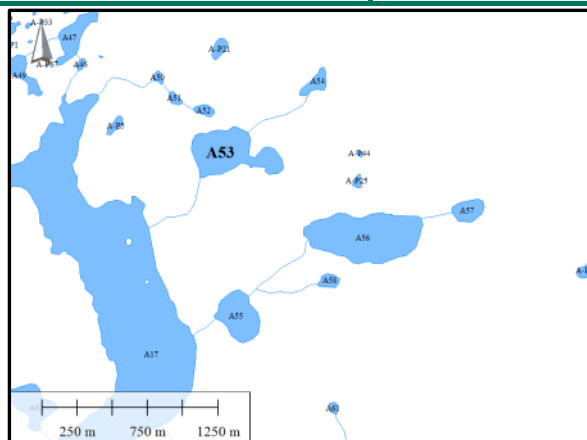
8 August 2015. Upstream view of outlet to Lake A45 (southeast).



## APPENDIX A HYDROMETRIC STATIONS

### A12.0 LAKE A53 & OUTLET (STREAM A53-A17)

| Parameter                        | Value                                                                                                                       | Note                                                   |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 1.3                                                                                                                         | Based on DEM (PhotoSat 2015)                           |
| Bankfull Width (m)               | N/A                                                                                                                         | Poorly defined channel, no visible bankfull dimensions |
| Max. Bankfull Depth (m)          | N/A                                                                                                                         | Poorly defined channel, no visible bankfull dimensions |
| Wetted Width (m)                 | 3.5                                                                                                                         | Measured in the field on 6 August 2015                 |
| Max. Wetted Depth (m)            | 0.16                                                                                                                        | Measured in the field on 6 August 2015                 |
| Channel Length (km)              | 0.60                                                                                                                        | Measured from CanVec data                              |
| Outlet Channel Slope (m/m)       | 0.017                                                                                                                       | Average slope, measured in the field                   |
| Bed Material                     | Cobbles, sand, silt, organics                                                                                               |                                                        |
| Bank Material                    | Grass, sand, silt, organics                                                                                                 |                                                        |
| Bank Vegetation                  | Grass                                                                                                                       |                                                        |
| Benchmark Coordinates            | N/A                                                                                                                         | NAD83 Zone 14                                          |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                                         |                                                        |
| Comment                          | Well defined channel, with a high width to depth ratio. Cross-sectional data are available in discharge calculation sheets. |                                                        |



Lake A53.

7 August 2015. Upstream view of the watercourse (north).



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                  |                    |                        |                                  |              |                 |       |  |
|----------------------------------------------|-----------------------------|------------------|--------------------|------------------------|----------------------------------|--------------|-----------------|-------|--|
| Project Name, Number:                        |                             | 1524321 - Amaruq |                    |                        | Date                             |              | 12-Jul-15       |       |  |
| Waterbody:                                   |                             | A53              |                    |                        | Start Time                       |              | 11:30           |       |  |
| Crossing ID:                                 |                             | A53-A17          |                    |                        | End Time                         |              |                 |       |  |
| LDB UTM Location                             |                             | Survey           |                    |                        | Datalogger SN:                   |              |                 |       |  |
| East                                         | 607754                      | BM read          |                    |                        | Transducer SN:                   |              |                 |       |  |
| North                                        | 725526                      | WL read          |                    |                        | Meter Type/SN:                   |              | Swoffer         |       |  |
| Elevation, Zone                              | 14W                         | WL Elev          |                    |                        | Crew:                            |              | AEM: RV, RD, JM |       |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)     | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)      |       |  |
|                                              |                             |                  | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                 |       |  |
| 1                                            | 0.00                        | 0.00             |                    | 0.00                   |                                  |              |                 | 0.008 |  |
| 2                                            | 0.20                        | 0.08             |                    | 0.35                   |                                  | 0.005        |                 | 0.018 |  |
| 3                                            | 0.40                        | 0.10             |                    | 0.33                   |                                  | 0.007        |                 | 0.021 |  |
| 4                                            | 0.60                        | 0.11             |                    | 0.33                   |                                  | 0.007        |                 | 0.031 |  |
| 5                                            | 0.80                        | 0.20             |                    | 0.70                   |                                  | 0.028        |                 | 0.037 |  |
| 6                                            | 1.00                        | 0.17             |                    | 0.01                   |                                  | 0.000        |                 | 0.016 |  |
| 7                                            | 1.10                        | 0.15             |                    | 0.00                   |                                  | 0.000        |                 | 0.015 |  |
| 8                                            | 1.20                        | 0.14             |                    | 0.02                   |                                  | 0.000        |                 | 0.028 |  |
| 9                                            | 1.40                        | 0.14             |                    | 0.00                   |                                  | 0.000        |                 | 0.025 |  |
| 10                                           | 1.75                        | 0.00             |                    | 0.00                   |                                  | 0.000        |                 | 0.000 |  |
| NOTES:                                       |                             |                  |                    |                        | RESULTS:                         | Q (m3/s)     | 0.048           |       |  |
|                                              |                             |                  |                    |                        |                                  | A(m2)        | 0.20            |       |  |
|                                              |                             |                  |                    |                        |                                  | B(m)         | 1.8             |       |  |



## APPENDIX A HYDROMETRIC STATIONS

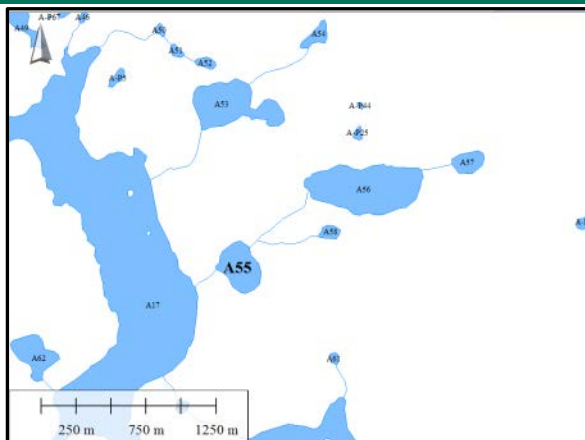
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |                |       |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|----------------|-------|--|
| Project Name, Number:                        |                             | Amaruq - Trip 2 |                    |                        | Date                             |              | 07-Aug-15      |       |  |
| Waterbody:                                   |                             | A53             |                    |                        | Start Time                       |              | 9:00           |       |  |
| Crossing ID:                                 |                             | A53-A17         |                    |                        | End Time                         |              | 9:20           |       |  |
| LDB UTM Location                             |                             | Survey          |                    |                        | Datalogger SN:                   |              |                |       |  |
| East                                         | 607914                      | BM read         |                    |                        | Transducer SN:                   |              |                |       |  |
| North                                        | 7255484                     | WL read         |                    |                        | Meter Type/SN:                   |              | Marsh McBirney |       |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | Crew:                            |              | JRL, JN        |       |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)     |       |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                |       |  |
| 1                                            | 0.00                        | 0.08            |                    | 0.00                   |                                  |              |                | 0.090 |  |
| 2                                            | 1.00                        | 0.10            |                    | 0.00                   |                                  | 0.000        |                | 0.132 |  |
| 3                                            | 2.10                        | 0.14            |                    | 0.01                   |                                  | 0.001        |                | 0.030 |  |
| 4                                            | 2.30                        | 0.16            |                    | 0.04                   |                                  | 0.001        |                | 0.032 |  |
| 5                                            | 2.50                        | 0.16            |                    | 0.04                   |                                  | 0.002        |                | 0.042 |  |
| 6                                            | 2.80                        | 0.12            |                    | 0.03                   |                                  | 0.001        |                | 0.022 |  |
| 7                                            | 3.00                        | 0.10            |                    | 0.02                   |                                  | 0.001        |                | 0.027 |  |
| 8                                            | 3.30                        | 0.08            |                    | 0.00                   |                                  | 0.000        |                | 0.008 |  |
| 9                                            | 3.50                        | 0.00            |                    | 0.00                   |                                  | 0.000        |                | 0.000 |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)     | 0.005          |       |  |
|                                              |                             |                 |                    |                        |                                  | A(m2)        | 0.38           |       |  |
|                                              |                             |                 |                    |                        |                                  | B(m)         | 3.5            |       |  |



## APPENDIX A HYDROMETRIC STATIONS

### A13.0 LAKE A55 & OUTLET (STREAM A55-A17)

| Parameter                        | Value                                                                                     | Note                                 |
|----------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 4.2                                                                                       | Based on DEM (PhotoSat 2015)         |
| Bankfull Width (m)               | 15                                                                                        | No visible bankfull dimensions       |
| Max. Bankfull Depth (m)          | 0.3                                                                                       | No visible bankfull dimensions       |
| Wetted Width (m)                 | 8.9                                                                                       | Measured in the field 7 August 2015  |
| Max. Wetted Depth (m)            | 0.14                                                                                      | Measured in the field 7 August 2015  |
| Channel Length (km)              | 0.23                                                                                      | Measured from CanVec data            |
| Outlet Channel Slope (m/m)       | 0.011                                                                                     | Average slope, measured in the field |
| Bed Material                     | Boulders, cobbles                                                                         |                                      |
| Bank Material                    | Boulders, cobbles, organics                                                               |                                      |
| Bank Vegetation                  | Grass                                                                                     |                                      |
| Benchmark Coordinates            | N/A                                                                                       | NAD83 Zone 14                        |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                       |                                      |
| Comment                          | Well defined channel. Cross-sectional data are available in discharge calculation sheets. |                                      |



Lake A55.

17 September 2015. Aerial view looking north towards Lake A55 (right) and Lake A17 (Whale Tail Lake) (left)



17 September 2015. Upstream view of the watercourse and Lake A55 (northeast).



17 September 2015. Downstream view of the watercourse (southwest).



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                  |                    |                        |                                  |              |            |
|----------------------------------------------|-----------------------------|------------------|--------------------|------------------------|----------------------------------|--------------|------------|
| <b>Project Name, Number:</b>                 |                             | 1524321 - Amaruq |                    | <b>Date</b>            |                                  | 12-Jul-15    |            |
| <b>Waterbody:</b>                            |                             | A55              |                    | <b>Start Time</b>      |                                  | 11:00        |            |
| <b>Crossing ID:</b>                          |                             | A55-A17          |                    | <b>End Time</b>        |                                  | 11:10        |            |
| <b>LDB UTM Location</b>                      |                             |                  | <b>Survey</b>      |                        | <b>Datalogger SN:</b>            |              |            |
| East                                         | 607990                      | BM_read          |                    |                        | <b>Transducer SN:</b>            |              |            |
| North                                        | 7254505                     | WL_read          |                    |                        | <b>Meter Type/SN:</b> Swoffer    |              |            |
| Elevation, Zone                              | 14W                         | WL Elev          |                    |                        | <b>Crew:</b>                     | AEM: RV, LG  |            |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)     | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |
|                                              |                             |                  | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |
| 1                                            | 0.00                        | 0.00             |                    | 0.00                   |                                  |              | 0.030      |
| 2                                            | 0.50                        | 0.12             |                    | 0.01                   |                                  | 0.000        | 0.063      |
| 3                                            | 1.00                        | 0.13             |                    | 0.00                   |                                  | 0.000        | 0.063      |
| 4                                            | 1.50                        | 0.12             |                    | 0.00                   |                                  | 0.000        | 0.065      |
| 5                                            | 2.00                        | 0.14             |                    | 0.19                   |                                  | 0.013        | 0.070      |
| 6                                            | 2.50                        | 0.14             |                    | 0.19                   |                                  | 0.013        | 0.068      |
| 7                                            | 3.00                        | 0.13             |                    | 0.20                   |                                  | 0.013        | 0.068      |
| 8                                            | 3.50                        | 0.14             |                    | 0.27                   |                                  | 0.019        | 0.070      |
| 9                                            | 4.00                        | 0.14             |                    | 0.24                   |                                  | 0.017        | 0.066      |
| 10                                           | 4.50                        | 0.13             |                    | 0.36                   |                                  | 0.023        | 0.051      |
| 11                                           | 5.00                        | 0.08             |                    | 0.28                   |                                  | 0.011        | 0.020      |
| 12                                           | 5.50                        | 0.00             |                    | 0.00                   |                                  | 0.000        | 0.000      |
| NOTES:                                       |                             |                  |                    | RESULTS:               | Q (m3/s)                         | 0.110        |            |
|                                              |                             |                  |                    |                        | A(m2)                            | 0.63         |            |
|                                              |                             |                  |                    |                        | B(m)                             | 5.5          |            |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                 |                    |                        |                                  |              |                |  |  |
|----------------------------------------------|-----------------------------|-----------------|--------------------|------------------------|----------------------------------|--------------|----------------|--|--|
| Project Name, Number:                        |                             | Amaruq - Trip 2 |                    |                        | Date                             |              | 07-Aug-15      |  |  |
| Waterbody:                                   |                             | A55             |                    |                        | Start Time                       |              | 15:30          |  |  |
| Crossing ID:                                 |                             | A55-A17         |                    |                        | End Time                         |              | 15:50          |  |  |
| LDB UTM Location                             |                             | Survey          |                    |                        | Datalogger SN:                   |              |                |  |  |
| East                                         | 608009                      | BM read         |                    |                        | Transducer SN:                   |              |                |  |  |
| North                                        | 7254529                     | WL read         |                    |                        | Meter Type/SN:                   |              | Marsh McBirney |  |  |
| Elevation, Zone                              | 14W                         | WL Elev         |                    |                        | Crew:                            |              | JRL, JN        |  |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)    | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2)     |  |  |
|                                              |                             |                 | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |                |  |  |
| 1                                            | 0.60                        | 0.00            |                    | 0.00                   |                                  |              | 0.017          |  |  |
| 2                                            | 0.90                        | 0.11            |                    | 0.00                   |                                  | 0.000        | 0.038          |  |  |
| 3                                            | 1.20                        | 0.14            |                    | 0.05                   |                                  | 0.003        | 0.081          |  |  |
| 4                                            | 1.80                        | 0.13            |                    | 0.06                   |                                  | 0.004        | 0.020          |  |  |
| 5                                            | 2.10                        | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.012          |  |  |
| 6                                            | 2.30                        | 0.12            |                    | 0.06                   |                                  | 0.005        | 0.143          |  |  |
| 7                                            | 3.60                        | 0.10            |                    | 0.02                   |                                  | 0.002        | 0.099          |  |  |
| 8                                            | 4.50                        | 0.12            |                    | 0.05                   |                                  | 0.004        | 0.060          |  |  |
| 9                                            | 5.00                        | 0.12            |                    | 0.00                   |                                  | 0.000        | 0.070          |  |  |
| 10                                           | 5.70                        | 0.08            |                    | 0.01                   |                                  | 0.002        | 0.152          |  |  |
| 11                                           | 9.50                        | 0.00            |                    | 0.00                   |                                  | 0.000        | 0.000          |  |  |
| NOTES:                                       |                             |                 |                    |                        | RESULTS:                         | Q (m3/s)     | 0.020          |  |  |
|                                              |                             |                 |                    |                        |                                  | A(m2)        | 0.69           |  |  |
|                                              |                             |                 |                    |                        |                                  | B(m)         | 8.9            |  |  |





## APPENDIX A HYDROMETRIC STATIONS

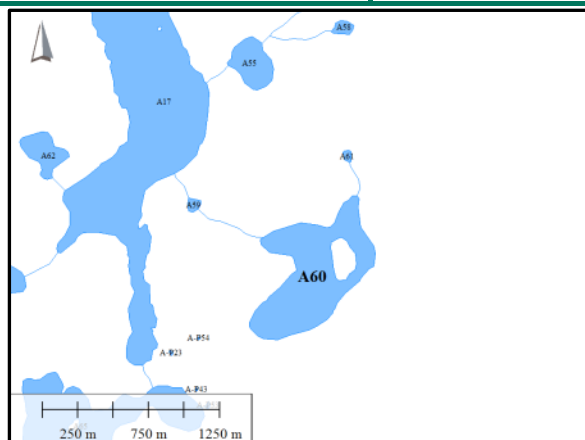
| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |              |                         |                        |                                  |                |            |           |         |
|----------------------------------------------|-----------------------------|--------------|-------------------------|------------------------|----------------------------------|----------------|------------|-----------|---------|
| Project Name, Number:                        |                             |              | 1524321 - Amaruq Trip 3 |                        |                                  | Date           |            | 17-Sep-15 |         |
| Waterbody:                                   |                             |              | A55                     |                        |                                  | Start Time     |            | 15:00     |         |
| Crossing ID:                                 |                             |              | A55-A17                 |                        |                                  | End Time       |            | 15:10     |         |
| LDB UTM Location                             |                             |              | Survey                  |                        |                                  | Datalogger SN: |            |           |         |
| East                                         | 607986                      | BM read      |                         |                        |                                  | Transducer SN: |            |           |         |
| North                                        | 7254508                     | WL read      |                         |                        |                                  | Meter Type/SN: |            |           |         |
| Elevation, Zone                              |                             | 14W          | WL Elev                 |                        |                                  |                | Crew:      |           | JRL, DC |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m) | Velocity                |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |           |         |
|                                              |                             |              | 0.2 DEPTH<br>(m/s)      | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |           |         |
| 1                                            | 0.00                        | 0.00         |                         | 0.00                   |                                  |                |            | 0.008     |         |
| 2                                            | 0.20                        | 0.08         |                         | 0.20                   |                                  | 0.003          | 0.020      |           |         |
| 3                                            | 0.40                        | 0.12         |                         | 0.08                   |                                  | 0.002          | 0.020      |           |         |
| 4                                            | 0.60                        | 0.08         |                         | 0.29                   |                                  | 0.005          | 0.014      |           |         |
| 5                                            | 0.80                        | 0.06         |                         | 0.27                   |                                  | 0.003          | 0.012      |           |         |
| 6                                            | 1.00                        | 0.06         |                         | 0.18                   |                                  | 0.002          | 0.016      |           |         |
| 7                                            | 1.20                        | 0.10         |                         | 0.25                   |                                  | 0.005          | 0.022      |           |         |
| 8                                            | 1.40                        | 0.12         |                         | 0.16                   |                                  | 0.005          | 0.021      |           |         |
| 9                                            | 1.75                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |         |
| 10                                           | 2.10                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.008      |           |         |
| 11                                           | 2.30                        | 0.08         |                         | 0.35                   |                                  | 0.007          | 0.018      |           |         |
| 12                                           | 2.60                        | 0.04         |                         | 0.21                   |                                  | 0.003          | 0.020      |           |         |
| 13                                           | 3.00                        | 0.06         |                         | 0.24                   |                                  | 0.006          | 0.015      |           |         |
| 14                                           | 3.50                        | 0.00         |                         | 0.00                   |                                  | 0.000          | 0.000      |           |         |
| NOTES:                                       |                             |              |                         |                        |                                  | RESULTS:       | Q (m3/s)   | 0.042     |         |
|                                              |                             |              |                         |                        |                                  |                | A(m2)      | 0.19      |         |
|                                              |                             |              |                         |                        |                                  |                | B(m)       | 3.5       |         |



## APPENDIX A HYDROMETRIC STATIONS

### A14.0 LAKE A60 & OUTLET (STREAM A60-A59)

| Parameter                        | Value                                                                                               | Note                                       |
|----------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 2.1                                                                                                 | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 30                                                                                                  | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 0.45                                                                                                | Measured in the field                      |
| Wetted Width (m)                 | 20.4                                                                                                | Measured in the field on 8 August 2015     |
| Max. Wetted Depth (m)            | 0.23                                                                                                | Measured in the field on 8 August 2015     |
| Channel Length (km)              | 0.50                                                                                                | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.040                                                                                               | Average slope, measured in the field       |
| Bed Material                     | Boulders, cobbles                                                                                   |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                         |                                            |
| Bank Vegetation                  | Grass                                                                                               |                                            |
| Benchmark Coordinates            | N/A                                                                                                 | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                 |                                            |
| Comment                          | Poorly defined boulder channel. Cross-sectional data are available in discharge calculation sheets. |                                            |



Lake A60.

8 August 2015. Upstream view of the watercourse and Lake A60 (east).



17 September 2015. Downstream view of the watercourse (west).



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                   |                  |                 |                     |                            |                 |           |  |  |
|----------------------------------------------|-------------------|------------------|-----------------|---------------------|----------------------------|-----------------|-----------|--|--|
| Project Name, Number:                        |                   | 1524321 - Amaruq |                 |                     | Date                       |                 | 12-Jul-15 |  |  |
| Waterbody:                                   |                   | A60              |                 |                     | Start Time                 |                 | -         |  |  |
| Crossing ID:                                 |                   | A60-A59          |                 |                     | End Time                   |                 | -         |  |  |
| LDB UTM Location                             |                   |                  |                 | Survey              |                            | Datalogger SN:  |           |  |  |
| East                                         | 608264            | BM read          |                 |                     | Transducer SN:             |                 |           |  |  |
| North                                        | 72537278          | WL read          |                 |                     | Meter Type/SN: Swoffer     |                 |           |  |  |
| Elevation, Zone                              | 14W               | WL Elev          |                 |                     | Crew:                      | AEM: RV, LG, RD |           |  |  |
| STATION                                      | DISTANCE FROM LDB | DEPTH            | Velocity        |                     | Optional ANGLE OF FLOW (°) | Qi (m3/s)       | Ai (m2)   |  |  |
| Start LDB                                    | (m)               | (m)              | 0.2 DEPTH (m/s) | 0.6/0.8 DEPTH (m/s) |                            |                 |           |  |  |
| 1                                            | 0.00              | 0.000            |                 | 0.00                |                            |                 | 0.016     |  |  |
| 2                                            | 0.20              | 0.155            |                 | 0.15                |                            | 0.005           | 0.031     |  |  |
| 3                                            | 0.40              | 0.150            |                 | 0.12                |                            | 0.004           | 0.030     |  |  |
| 4                                            | 0.60              | 0.150            |                 | 0.23                |                            | 0.007           | 0.030     |  |  |
| 5                                            | 0.80              | 0.150            |                 | 0.19                |                            | 0.006           | 0.030     |  |  |
| 6                                            | 1.00              | 0.150            |                 | 0.31                |                            | 0.007           | 0.016     |  |  |
| 7                                            | 1.10              | 0.160            |                 | 0.25                |                            | 0.004           | 0.016     |  |  |
| 8                                            | 1.20              | 0.160            |                 | 0.27                |                            | 0.006           | 0.032     |  |  |
| 9                                            | 1.40              | 0.160            |                 | 0.29                |                            | 0.009           | 0.034     |  |  |
| 10                                           | 1.60              | 0.175            |                 | 0.29                |                            | 0.010           | 0.033     |  |  |
| 11                                           | 1.80              | 0.150            |                 | 0.30                |                            | 0.009           | 0.024     |  |  |
| 12                                           | 2.00              | 0.090            |                 | 0.21                |                            | 0.004           | 0.018     |  |  |
| 13                                           | 2.20              | 0.090            |                 | 0.07                |                            | 0.001           | 0.020     |  |  |
| 14                                           | 2.40              | 0.110            |                 | 0.00                |                            | 0.000           | 0.025     |  |  |
| 15                                           | 2.60              | 0.135            |                 | 0.13                |                            | 0.004           | 0.025     |  |  |
| 16                                           | 2.80              | 0.115            |                 | 0.06                |                            | 0.001           | 0.020     |  |  |
| 17                                           | 3.00              | 0.080            |                 | 0.04                |                            | 0.000           | 0.004     |  |  |
| 18                                           | 3.10              | 0.000            |                 | 0.00                |                            | 0.000           | 0.000     |  |  |
| NOTES:                                       |                   |                  |                 |                     | RESULTS:                   | Q (m3/s)        | 0.077     |  |  |
|                                              |                   |                  |                 |                     |                            | A(m2)           | 0.40      |  |  |
|                                              |                   |                  |                 |                     |                            | B(m)            | 3.1       |  |  |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |              |                    |                        |                                  |                |            |                |  |
|----------------------------------------------|-----------------------------|--------------|--------------------|------------------------|----------------------------------|----------------|------------|----------------|--|
| Project Name, Number:                        |                             |              | Amaruq - Trip 2    |                        |                                  | Date           |            | 09-Aug-15      |  |
| Waterbody:                                   |                             |              | A60                |                        |                                  | Start Time     |            | 8:20           |  |
| Crossing ID:                                 |                             |              | A60-A59            |                        |                                  | End Time       |            | 8:40           |  |
| LDB UTM Location                             |                             |              | Survey             |                        |                                  | Datalogger SN: |            |                |  |
| East                                         | 608143                      | BM read      |                    |                        |                                  | Transducer SN: |            |                |  |
| North                                        | 7253354                     | WL read      |                    |                        |                                  | Meter Type/SN: |            | Marsh McBirney |  |
| Elevation, Zone                              | 14W                         | WL Elev      |                    |                        |                                  | Crew:          |            | JRL, JN        |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m) | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s)   | Ai<br>(m2) |                |  |
|                                              |                             |              | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |                |            |                |  |
| 1                                            | 1.40                        | 0.00         |                    | 0.00                   |                                  |                |            | 0.014          |  |
| 2                                            | 1.60                        | 0.14         |                    | 0.04                   |                                  | 0.001          | 0.022      |                |  |
| 3                                            | 1.80                        | 0.08         |                    | 0.04                   |                                  | 0.001          | 0.018      |                |  |
| 4                                            | 2.00                        | 0.10         |                    | 0.00                   |                                  | 0.000          | 0.015      |                |  |
| 5                                            | 2.20                        | 0.05         |                    | 0.06                   |                                  | 0.001          | 0.009      |                |  |
| 6                                            | 2.40                        | 0.04         |                    | 0.05                   |                                  | 0.000          | 0.004      |                |  |
| 7                                            | 2.60                        | 0.00         |                    | 0.00                   |                                  | 0.000          | 0.000      |                |  |
| 8                                            | 2.95                        | 0.00         |                    | 0.00                   |                                  | 0.000          | 0.017      |                |  |
| 9                                            | 3.10                        | 0.23         |                    | 0.01                   |                                  | 0.000          | 0.040      |                |  |
| 10                                           | 3.30                        | 0.17         |                    | 0.02                   |                                  | 0.001          | 0.026      |                |  |
| 11                                           | 3.50                        | 0.09         |                    | 0.03                   |                                  | 0.001          | 0.023      |                |  |
| 12                                           | 3.70                        | 0.14         |                    | 0.00                   |                                  | 0.000          | 0.007      |                |  |
| 13                                           | 3.80                        | 0.00         |                    | 0.00                   |                                  | 0.000          | 0.000      |                |  |
| NOTES:                                       |                             |              |                    |                        |                                  | RESULTS:       | Q (m3/s)   | 0.004          |  |
|                                              |                             |              |                    |                        |                                  | A(m2)          | 0.20       |                |  |
|                                              |                             |              |                    |                        |                                  | B(m)           | 2.4        |                |  |



## APPENDIX A HYDROMETRIC STATIONS

| OPEN WATER DISCHARGE CALCULATION SPREADSHEET |                             |                         |                    |                        |                                  |              |            |       |  |
|----------------------------------------------|-----------------------------|-------------------------|--------------------|------------------------|----------------------------------|--------------|------------|-------|--|
| Project Name, Number:                        |                             | 1524321 - Amaruq Trip 3 |                    |                        | Date                             |              | 17-Sep-15  |       |  |
| Waterbody:                                   |                             | A60                     |                    |                        | Start Time                       |              | 9:20       |       |  |
| Crossing ID:                                 |                             | A60-A59                 |                    |                        | End Time                         |              | 9:25       |       |  |
| BM UTM Location                              |                             | Survey                  |                    |                        | Datalogger SN:                   |              |            |       |  |
| East                                         | 608143                      | BM read                 |                    |                        | Transducer SN:                   |              |            |       |  |
| North                                        | 7253354                     | WL read                 |                    |                        | Meter Type/SN:                   |              |            |       |  |
| Elevation, Zone                              | 14W                         | WL Elev                 |                    |                        | Crew:                            |              | JRL, DC    |       |  |
| STATION<br>Start<br>LDB                      | DISTANCE<br>FROM LDB<br>(m) | DEPTH<br>(m)            | Velocity           |                        | Optional<br>ANGLE OF FLOW<br>(°) | Qi<br>(m3/s) | Ai<br>(m2) |       |  |
|                                              |                             |                         | 0.2 DEPTH<br>(m/s) | 0.6/0.8 DEPTH<br>(m/s) |                                  |              |            |       |  |
| 1                                            | 0.00                        | 0.00                    |                    | 0.00                   |                                  |              |            | 0.006 |  |
| 2                                            | 0.20                        | 0.06                    |                    | 0.02                   |                                  | 0.000        |            | 0.014 |  |
| 3                                            | 0.40                        | 0.08                    |                    | 0.02                   |                                  | 0.000        |            | 0.014 |  |
| 4                                            | 0.60                        | 0.06                    |                    | 0.02                   |                                  | 0.000        |            | 0.022 |  |
| 5                                            | 0.80                        | 0.16                    |                    | 0.03                   |                                  | 0.001        |            | 0.026 |  |
| 6                                            | 1.00                        | 0.10                    |                    | 0.01                   |                                  | 0.000        |            | 0.023 |  |
| 7                                            | 1.20                        | 0.13                    |                    | 0.01                   |                                  | 0.000        |            | 0.031 |  |
| 8                                            | 1.40                        | 0.18                    |                    | 0.00                   |                                  | 0.000        |            | 0.022 |  |
| 9                                            | 1.60                        | 0.04                    |                    | 0.02                   |                                  | 0.000        |            | 0.004 |  |
| 10                                           | 1.80                        | 0.00                    |                    | 0.00                   |                                  | 0.000        |            | 0.000 |  |
| NOTES:                                       |                             |                         |                    |                        | RESULTS:                         | Q (m3/s)     | 0.002      |       |  |
|                                              |                             |                         |                    |                        |                                  | A(m2)        | 0.16       |       |  |
|                                              |                             |                         |                    |                        |                                  | B(m)         | 1.8        |       |  |



## APPENDIX A HYDROMETRIC STATIONS

### A15.0 LAKE A62 & OUTLET (STREAM A62-A17)

| Parameter                        | Value                                       | Note                                        |
|----------------------------------|---------------------------------------------|---------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 0.7                                         | Measured with DEM                           |
| Bankfull Width (m)               | N/A                                         | No defined channel                          |
| Max. Bankfull Depth (m)          | N/A                                         | No defined channel                          |
| Wetted Width (m)                 | 0                                           | Observed no flow in the field 7 August 2015 |
| Max. Wetted Depth (m)            | 0                                           | Observed no flow in the field 7 August 2015 |
| Channel Length (km)              | 0.13                                        | Measured from CanVec data                   |
| Outlet Channel Slope (m/m)       | 0.020                                       | Average slope, measured in the field        |
| Bed Material                     | Boulders, cobbles, grass                    |                                             |
| Bank Material                    | Boulders, cobbles, organics                 |                                             |
| Bank Vegetation                  | Grass                                       |                                             |
| Benchmark Coordinates            | 606719 m E,<br>7253561 m N,<br>165.43 masl  | NAD83 Zone 14                               |
| Logger/ Staff Gauge Coordinates  | N/A                                         |                                             |
| Comment                          | No defined channel. No flow in August 2015. |                                             |



Lake A62: Benchmark location.

7 August 2015. View looking upstream towards Lake A62 (northwest).



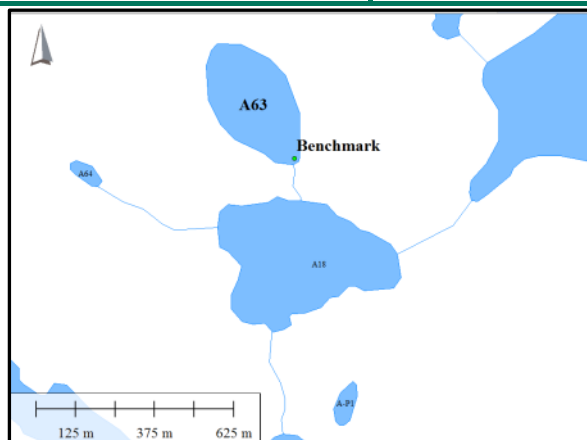
7 August 2015. View looking southeast towards Lake A17 (Whale Tail Lake) from the watercourse.



## APPENDIX A HYDROMETRIC STATIONS

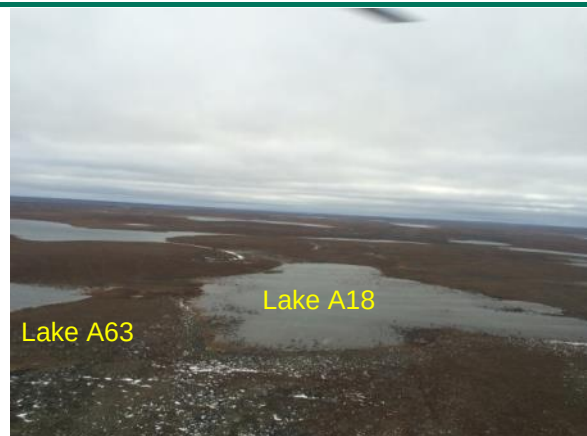
### A16.0 LAKE A63 & OUTLET (STREAM A63-A18)

| Parameter                        | Value                                                                    | Note                                                |
|----------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 0.5                                                                      | Based on DEM (PhotoSat 2015)                        |
| Bankfull Width (m)               | N/A                                                                      | Not measured                                        |
| Max. Bankfull Depth (m)          | N/A                                                                      | Not measured                                        |
| Wetted Width (m)                 | 0                                                                        | Observed no surface flow in the field 7 August 2015 |
| Max. Wetted Depth (m)            | 0                                                                        | Observed no surface flow in the field 7 August 2015 |
| Channel Length (km)              | 0.14                                                                     | Measured from CanVec data                           |
| Outlet Channel Slope (m/m)       | 0.005                                                                    | Average slope, measured in the field                |
| Bed Material                     | Boulders, cobbles                                                        |                                                     |
| Bank Material                    | Boulders, cobbles, organics                                              |                                                     |
| Bank Vegetation                  | Grass                                                                    |                                                     |
| Benchmark Coordinates            | 606276 m E,<br>7253375 m N,<br>155.24 masl                               | NAD83 Zone 14                                       |
| Logger/ Staff Gauge Coordinates  | N/A                                                                      |                                                     |
| Comment                          | Poorly defined boulder channel. No observed surface flow in August 2015. |                                                     |



Lake A63.

7 August 2015. Looking west towards Lake A63 (right) and Lake A18 (left). The channel had no surface flow at the time of this photo.



17 September 2015. View looking east at Lake A18 and A19

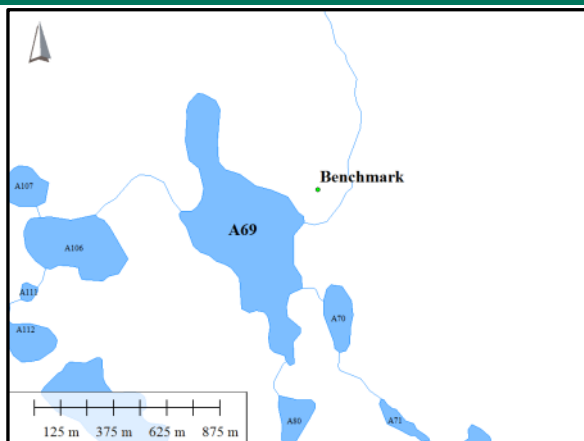




## APPENDIX A HYDROMETRIC STATIONS

### A17.0 LAKE A69 & OUTLET (STREAM A69-DS1)

| Parameter                        | Value                                                                                                             | Note                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Drainage Area (km <sup>2</sup> ) | 41.4                                                                                                              | Based on DEM (PhotoSat 2015)               |
| Bankfull Width (m)               | 30 to 60                                                                                                          | Measured in the field, based on vegetation |
| Max. Bankfull Depth (m)          | 1.0                                                                                                               | Measured in the field, based on vegetation |
| Wetted Width (m)                 | 47.5                                                                                                              | Measured in the field on 11 June 2015      |
| Max. Wetted Depth (m)            | 0.98                                                                                                              | Measured in the field on 11 June 2015      |
| Channel Length (km)              | 1.35                                                                                                              | Measured from CanVec data                  |
| Outlet Channel Slope (m/m)       | 0.0085                                                                                                            | Average slope, measured with DEM           |
| Bed Material                     | Boulders, cobbles                                                                                                 |                                            |
| Bank Material                    | Boulders, cobbles, organics                                                                                       |                                            |
| Bank Vegetation                  | Grass                                                                                                             |                                            |
| Benchmark Coordinates            | 598399 m E,<br>7256880 m N,<br>115.62 masl                                                                        | NAD83 Zone 14                              |
| Logger/ Staff Gauge Coordinates  | N/A                                                                                                               |                                            |
| Comment                          | Well defined boulder channel. Cross-sectional data are available in discharge calculation sheets and Section 3.3. |                                            |



Lake A69: Benchmark location.



11 June 2015. View looking west at Lake A69.



11 June 2015. West view of Lake A69.



11 June 2015. Upstream view of the watercourse (west).





## APPENDIX A HYDROMETRIC STATIONS



5 August 2015. Looking south towards right downstream bank.

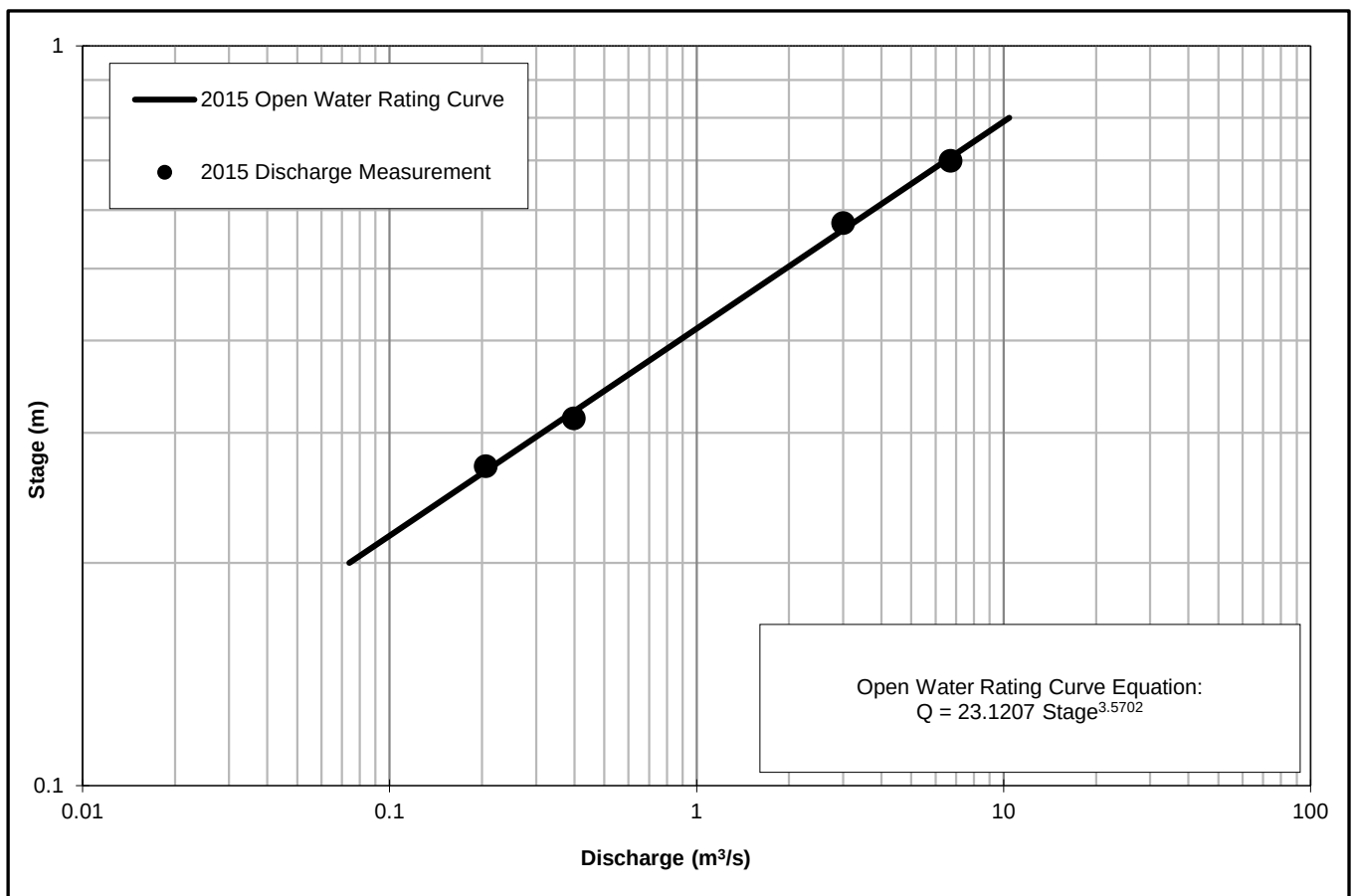


Figure 5: 2015 Stage-Discharge Rating Curve (Lake A69)