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JUMBLES RESERVOIR. DEMONSTRATION RUN.  
WINTER PMF THROUGH 24 No SIPHONS

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| TIME<br>(hours) | INFLOW<br>RATE<br>(m3/s) | WATER<br>LEVEL<br>(m) | OUTFLOW<br>RATE<br>(m3/s) | STORAGE<br>VOLUME<br>(m3) |
|-----------------|--------------------------|-----------------------|---------------------------|---------------------------|
| 1.00            | 2.30                     | 0.038                 | 1.91                      | 0.978E+04                 |
| 1.25            | 3.10                     | 0.041                 | 2.04                      | 0.104E+05                 |
| 1.50            | 4.30                     | 0.046                 | 2.31                      | 0.118E+05                 |
| 1.75            | 6.30                     | 0.056                 | 2.86                      | 0.143E+05                 |
| 2.00            | 8.70                     | 0.070                 | 3.79                      | 0.180E+05                 |
| 2.25            | 12.20                    | 0.091                 | 5.12                      | 0.234E+05                 |
| 2.50            | 15.70                    | 0.112                 | 10.80                     | 0.288E+05                 |
| 2.75            | 19.50                    | 0.126                 | 16.51                     | 0.323E+05                 |
| 3.00            | 23.30                    | 0.136                 | 20.62                     | 0.349E+05                 |
| 3.25            | 27.10                    | 0.146                 | 24.47                     | 0.373E+05                 |
| 3.50            | 31.50                    | 0.154                 | 29.12                     | 0.395E+05                 |
| 3.75            | 36.00                    | 0.162                 | 34.03                     | 0.415E+05                 |
| 4.00            | 40.60                    | 0.169                 | 38.56                     | 0.433E+05                 |
| 4.25            | 45.90                    | 0.177                 | 43.53                     | 0.453E+05                 |
| 4.50            | 51.40                    | 0.185                 | 48.96                     | 0.475E+05                 |
| 4.75            | 57.70                    | 0.195                 | 54.89                     | 0.498E+05                 |
| 5.00            | 64.90                    | 0.205                 | 61.65                     | 0.526E+05                 |
| 5.25            | 72.90                    | 0.217                 | 69.26                     | 0.556E+05                 |
| 5.50            | 82.40                    | 0.231                 | 78.07                     | 0.592E+05                 |
| 5.75            | 93.60                    | 0.248                 | 88.50                     | 0.635E+05                 |
| 6.00            | 108.00                   | 0.269                 | 100.94                    | 0.690E+05                 |
| 6.25            | 125.70                   | 0.297                 | 116.96                    | 0.761E+05                 |
| 6.50            | 152.10                   | 0.335                 | 139.05                    | 0.859E+05                 |
| 6.75            | 188.30                   | 0.395                 | 167.62                    | 0.101E+06                 |
| 7.00            | 225.40                   | 0.503                 | 184.32                    | 0.129E+06                 |
| 7.25            | 258.40                   | 0.697                 | 189.04                    | 0.179E+06                 |
| 7.50            | 281.30                   | 0.970                 | 195.65                    | 0.248E+06                 |
| 7.75            | 298.40                   | 1.265                 | 205.37                    | 0.329E+06                 |
| 8.00            | 298.70                   | 1.544                 | 222.08                    | 0.405E+06                 |
| 8.25            | 293.00                   | 1.760                 | 238.18                    | 0.464E+06                 |
| 8.50            | 283.50                   | 1.908                 | 248.36                    | 0.505E+06                 |
| 8.75            | 270.60                   | 1.996                 | 251.98                    | 0.529E+06                 |
| 9.00            | 255.90                   | 2.029                 | 253.33                    | 0.538E+0                  |
| 9.25            | 240.50                   | 2.014                 | 252.72                    | 0.534E+06                 |
| 9.50            | 225.00                   | 1.953                 | 250.24                    | 0.517E+06                 |
| 9.75            | 209.90                   | 1.852                 | 246.10                    | 0.490E+06                 |
| 10.00           | 197.30                   | 1.730                 | 235.60                    | 0.456E+06                 |
| 10.25           | 189.40                   | 1.606                 | 226.44                    | 0.422E+06                 |
| 10.50           | 183.30                   | 1.488                 | 218.30                    | 0.390E+06                 |
| 10.75           | 178.20                   | 1.375                 | 211.76                    | 0.359E+06                 |
| 11.00           | 174.20                   | 1.269                 | 205.57                    | 0.330E+06                 |
| 11.25           | 170.70                   | 1.168                 | 200.59                    | 0.302E+06                 |
| 11.50           | 167.80                   | 1.069                 | 198.07                    | 0.275E+06                 |
| 11.75           | 165.10                   | 0.967                 | 195.59                    | 0.248E+06                 |
| 12.00           | 162.60                   | 0.860                 | 192.99                    | 0.220E+06                 |
| 12.25           | 160.10                   | 0.754                 | 190.40                    | 0.193E+06                 |
| 12.50           | 157.20                   | 0.647                 | 187.80                    | 0.166E+06                 |

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| TIME    | INFLOW | WATER | OUTFLOW | STORAGE |
|---------|--------|-------|---------|---------|
| (hours) | RATE   | LEVEL | RATE    | VOLUME  |
|         | (m3/s  | (m)   | (m3/s)  | (m3)    |

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|       |        |       |        |           |
|-------|--------|-------|--------|-----------|
| 12.75 | 154.10 | 0.538 | 185.17 | 0.138E+06 |
| 13.00 | 150.60 | 0.435 | 178.35 | 0.111E+06 |
| 13.25 | 146.00 | 0.369 | 156.18 | 0.946E+05 |
| 13.50 | 142.20 | 0.347 | 145.58 | 0.888E+05 |
| 13.75 | 138.10 | 0.337 | 140.11 | 0.863E+05 |
| 14.00 | 134.20 | 0.330 | 136.12 | 0.846E+05 |

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PEAK INFLOW RATE= 298.70m3/s  
PEAK OUTFLOW RATE= 253.33m3/s  
LAG TIME= 1.00hours  
PERCENTAGE ATTENUATION= 15.19%

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Mvumase reservoir Case Study  
Analysis by Binnie & Partners,  
Johannesburg using program by  
Green modified by Furstenburg.

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MUUMASE SCHEME. 200. ONE HOUR RUN.  
20 000 CUMecs THROUGH 17X14.5m GATES.  
FLOOD ROUTING BY STORAGE INDICATION  
METHOD.

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RESERVOIR ELEVATION-STORAGE DATA.

| ELEVATION | STORAGE  |
|-----------|----------|
| 193       | 0        |
| 193.1     | 10000000 |
| 193.2     | 20000000 |
| 193.3     | 30000000 |
| 193.4     | 40000000 |
| 193.5     | 50000000 |
| 193.6     | 60000000 |
| 193.7     | 70000000 |
| 193.8     | 80000000 |
| 193.9     | 90000000 |
| 194       | .1E+09   |
| 194.5     | .15E+09  |
| 195       | .2E+09   |
| 196       | .3E+09   |
| 197       | .4E+09   |
| 198       | .5E+09   |
| 199       | .6E+09   |
| 200       | .7E+09   |
| 201       | .8E+09   |
| 202       | .9E+09   |

RESERVOIR OUTLET DATA.

GATED SPILLWAY.

CREST LEVEL OF SPILLWAY= 176.5  
NORMAL RETENTION LEVEL= 193  
DISCHARGE COEFFICIENT FOR FREE DISCHARGE OVER WEIR= 2.00  
TOTAL LENGTH OF SPILLWAY= 182  
NUMBER OF GATE GROUPS= 3

GATE PERFORMANCE DATA:

|              |         |         |      |
|--------------|---------|---------|------|
| GATE GROUP 1 | 193.115 | .21E-02 | 0.87 |
| GATE GROUP 2 | 193.415 | .21E-02 | 0.87 |
| GATE GROUP 3 | 193.715 | .21E-02 | 0.90 |

| TIME | INFLOW<br>RATE | OUTFLOW<br>GATED | OUTFLOW<br>SPILLWAY | DATE<br>TOTAL | WATER<br>LEVEL | STORAGE      |
|------|----------------|------------------|---------------------|---------------|----------------|--------------|
| 1    | 2337.7         | 0                | 0                   | 0             | 193            | 0            |
| 2    | 9555.5         | 0                | 0                   | 0             | 193            | 14990050     |
| 3    | 9555.2         | 0                | 0                   | 0             | 193            | 39990000     |
| 4    | 11111          | 0                | 0                   | 0             | 193            | 74991050     |
| 5    | 11360.1        | 426.7            | 0                   | 426.7         | 193            | 113300550    |
| 6    | 11666.5        | 1166.7           | 0                   | 1166.7        | 193            | 156700740    |
| 7    | 11944.2        | 1555.2           | 0                   | 1555.2        | 193            | 199500994    |
| 8    | 12222          | 1944.5           | 0                   | 1944.5        | 193            | 239900720    |
| 9    | 12499.7        | 2337.7           | 0                   | 2337.7        | 193            | 275610004    |
| 10   | 12777.5        | 2727.2           | 0                   | 2727.2        | 193            | 306600670    |
| 11   | 13055.2        | 3116.7           | 0                   | 3116.7        | 193            | 333000731    |
| 12   | 13333          | 3506.1           | 0                   | 3506.1        | 193            | 355000000    |
| 13   | 13610.0        | 3895.6           | 0                   | 3895.6        | 193            | 372700074    |
| 14   | 13888.6        | 4285.1           | 0                   | 4285.1        | 193            | 386000000    |
| 15   | 14166.5        | 4674.6           | 0                   | 4674.6        | 193            | 395000000    |
| 16   | 14444.3        | 5064.1           | 0                   | 5064.1        | 193            | 400000000    |
| 17   | 14722.1        | 5453.6           | 0                   | 5453.6        | 193            | 402000000    |
| 18   | 15000          | 5843.1           | 0                   | 5843.1        | 193            | 403000000    |
| 19   | 15277.8        | 6232.6           | 0                   | 6232.6        | 193            | 403000000    |
| 20   | 15555.5        | 6622.1           | 0                   | 6622.1        | 193            | 402000000    |
| 21   | 15833.2        | 7011.6           | 0                   | 7011.6        | 193            | 400000000    |
| 22   | 16111.0        | 7401.1           | 0                   | 7401.1        | 193            | 397000000    |
| 23   | 16388.6        | 7790.6           | 0                   | 7790.6        | 193            | 393000000    |
| 24   | 16666.5        | 8180.1           | 0                   | 8180.1        | 193            | 388000000    |
| 25   | 16944.2        | 8569.6           | 0                   | 8569.6        | 193            | 382000000    |
| 26   | 17222          | 8959.1           | 0                   | 8959.1        | 193            | 375000000    |
| 27   | 17500          | 9348.6           | 0                   | 9348.6        | 193            | 367000000    |
| 28   | 17777.8        | 9738.1           | 0                   | 9738.1        | 193            | 358000000    |
| 29   | 18055.5        | 10127.6          | 0                   | 10127.6       | 193            | 348000000    |
| 30   | 18333.2        | 10517.1          | 0                   | 10517.1       | 193            | 337000000    |
| 31   | 18610.0        | 10906.6          | 0                   | 10906.6       | 193            | 325000000    |
| 32   | 18888.6        | 11296.1          | 0                   | 11296.1       | 193            | 312000000    |
| 33   | 19166.5        | 11685.6          | 0                   | 11685.6       | 193            | 298000000    |
| 34   | 19444.3        | 12075.1          | 0                   | 12075.1       | 193            | 283000000    |
| 35   | 19722.1        | 12464.6          | 0                   | 12464.6       | 193            | 268000000    |
| 36   | 20000          | 12854.1          | 0                   | 12854.1       | 193            | 252000000    |
| 37   | 20277.8        | 13243.6          | 0                   | 13243.6       | 193            | 235000000    |
| 38   | 20555.5        | 13633.1          | 0                   | 13633.1       | 193            | 218000000    |
| 39   | 20833.2        | 14022.6          | 0                   | 14022.6       | 193            | 200000000    |
| 40   | 21111.0        | 14412.1          | 0                   | 14412.1       | 193            | 182000000    |
| 41   | 21388.6        | 14801.6          | 0                   | 14801.6       | 193            | 164000000    |
| 42   | 21666.5        | 15191.1          | 0                   | 15191.1       | 193            | 146000000    |
| 43   | 21944.2        | 15580.6          | 0                   | 15580.6       | 193            | 128000000    |
| 44   | 22222          | 15970.1          | 0                   | 15970.1       | 193            | 110000000    |
| 45   | 22499.7        | 16359.6          | 0                   | 16359.6       | 193            | 92000000     |
| 46   | 22777.5        | 16749.1          | 0                   | 16749.1       | 193            | 74000000     |
| 47   | 23055.2        | 17138.6          | 0                   | 17138.6       | 193            | 56000000     |
| 48   | 23333          | 17528.1          | 0                   | 17528.1       | 193            | 38000000     |
| 49   | 23610.0        | 17917.6          | 0                   | 17917.6       | 193            | 20000000     |
| 50   | 23888.6        | 18307.1          | 0                   | 18307.1       | 193            | 2000000      |
| 51   | 24166.5        | 18696.6          | 0                   | 18696.6       | 193            | 0            |
| 52   | 24444.3        | 19086.1          | 0                   | 19086.1       | 193            | 0            |
| 53   | 24722.1        | 19475.6          | 0                   | 19475.6       | 193            | 0            |
| 54   | 25000          | 19865.1          | 0                   | 19865.1       | 193            | 0            |
| 55   | 15277.8        | 12997.2          | 0                   | 12997.2       | 194.250        | 12500163E+09 |

|     |         |         |   |         |         |              |
|-----|---------|---------|---|---------|---------|--------------|
| 56  | 15555.6 | 13102.7 | 0 | 13102.7 | 194.335 | 13352193E+09 |
| 57  | 15833.5 | 13215.6 | 0 | 13215.6 | 194.426 | 14264928E+09 |
| 58  | 16111.3 | 13336.3 | 0 | 13336.3 | 194.523 | 15235639E+09 |
| 59  | 16389.1 | 13465.2 | 0 | 13465.2 | 194.626 | 16261447E+09 |
| 60  | 16667   | 13600.0 | 0 | 13600.0 | 194.733 | 17339663E+09 |
| 61  | 16944.7 | 13742.6 | 0 | 13742.6 | 194.846 | 18467951E+09 |
| 62  | 17222.5 | 13890.5 | 0 | 13890.5 | 194.964 | 19644081E+09 |
| 63  | 17500.2 | 14046.5 | 0 | 14046.5 | 195.086 | 2086555E+09  |
| 64  | 17778   | 14209.1 | 0 | 14209.1 | 195.212 | 22129565E+09 |
| 65  | 18055.7 | 14376.0 | 0 | 14376.0 | 195.343 | 23434167E+09 |
| 66  | 18333.5 | 14549.5 | 0 | 14549.5 | 195.477 | 24777473E+09 |
| 67  | 18611.2 | 14727   | 0 | 14727   | 195.615 | 26157732E+09 |
| 68  | 18889   | 14909   | 0 | 14909   | 195.757 | 2757327E+09  |
| 69  | 19166.7 | 15095.4 | 0 | 15095.4 | 195.902 | 29022494E+09 |
| 70  | 19444.5 | 15287.7 | 0 | 15287.7 | 196.05  | 30503547E+09 |
| 71  | 19722.2 | 15487.6 | 0 | 15487.6 | 196.201 | 32013999E+09 |
| 72  | 20000   | 15691   | 0 | 15691   | 196.355 | 33551941E+09 |
| 73  | 19861   | 15895.3 | 0 | 15895.3 | 196.514 | 35042546E+09 |
| 74  | 19722.1 | 16099.9 | 0 | 16099.9 | 196.641 | 36413943E+09 |
| 75  | 19583.2 | 16276.6 | 0 | 16276.6 | 196.767 | 37674853E+09 |
| 76  | 19444.3 | 16389   | 0 | 16389   | 196.892 | 38827193E+09 |
| 77  | 19305.4 | 16527.9 | 0 | 16527.9 | 197.027 | 39877832E+09 |
| 78  | 19166.5 | 16656.9 | 0 | 16656.9 | 197.162 | 40829739E+09 |
| 79  | 19027.5 | 16773.4 | 0 | 16773.4 | 197.298 | 41686204E+09 |
| 80  | 18888.6 | 16877.0 | 0 | 16877.0 | 197.435 | 42453393E+09 |
| 81  | 18749.7 | 16970.5 | 0 | 16970.5 | 197.573 | 43136655E+09 |
| 82  | 18610.8 | 17052.2 | 0 | 17052.2 | 197.712 | 43736693E+09 |
| 83  | 18471.9 | 17127.3 | 0 | 17127.3 | 197.852 | 44258176E+09 |
| 84  | 18333   | 17194.4 | 0 | 17194.4 | 197.994 | 44703647E+09 |
| 85  | 18194.1 | 17256   | 0 | 17256   | 198.138 | 45083945E+09 |
| 86  | 18055.3 | 17270.4 | 0 | 17270.4 | 198.284 | 45401144E+09 |
| 87  | 17916.5 | 17312.2 | 0 | 17312.2 | 198.434 | 45649736E+09 |
| 88  | 17777.6 | 17337.0 | 0 | 17337.0 | 198.586 | 45833679E+09 |
| 89  | 17638.8 | 17355.8 | 0 | 17355.8 | 198.742 | 45967939E+09 |
| 90  | 17500   | 17368.7 | 0 | 17368.7 | 198.904 | 46049203E+09 |
| 91  | 17361.1 | 17369.0 | 0 | 17369.0 | 199.073 | 46085791E+09 |
| 92  | 17222.3 | 17366.1 | 0 | 17366.1 | 199.248 | 46086764E+09 |
| 93  | 17083.5 | 17358   | 0 | 17358   | 199.432 | 46064125E+09 |
| 94  | 16944.6 | 17338.7 | 0 | 17338.7 | 199.624 | 46044422E+09 |
| 95  | 16805.8 | 17316.5 | 0 | 17316.5 | 199.826 | 46031455E+09 |
| 96  | 16667   | 17290.0 | 0 | 17290.0 | 199.947 | 46047353E+09 |
| 97  | 16528   | 17255.0 | 0 | 17255.0 | 199.983 | 46204640E+09 |
| 98  | 16389.1 | 17217.7 | 0 | 17217.7 | 199.999 | 46493450E+09 |
| 99  | 16250.2 | 17174.0 | 0 | 17174.0 | 199.999 | 46638924E+09 |
| 100 | 16111.3 | 17127.3 | 0 | 17127.3 | 199.999 | 46809503E+09 |
| 101 | 15972.4 | 17075.5 | 0 | 17075.5 | 199.999 | 46986157E+09 |
| 102 | 15833.5 | 17019.5 | 0 | 17019.5 | 199.999 | 46496115E+09 |
| 103 | 15694.5 | 16959.5 | 0 | 16959.5 | 199.999 | 46054947E+09 |
| 104 | 15555.6 | 16895.7 | 0 | 16895.7 | 199.999 | 45586923E+09 |
| 105 | 15416.7 | 16828.4 | 0 | 16828.4 | 199.999 | 45096694E+09 |
| 106 | 15277.8 | 16757.7 | 0 | 16757.7 | 199.999 | 44576293E+09 |
| 107 | 15138.9 | 16683.6 | 0 | 16683.6 | 199.999 | 44025771E+09 |
| 108 | 15000   | 16606.5 | 0 | 16606.5 | 199.999 | 43453526E+09 |
| 109 | 14861   | 16526.9 | 0 | 16526.9 | 199.999 | 42869473E+09 |
| 110 | 14722.1 | 16446.2 | 0 | 16446.2 | 199.999 | 42259282E+09 |
| 111 | 14583.2 | 16362.0 | 0 | 16362.0 | 199.999 | 41629628E+09 |
| 112 | 14444.3 | 16276.7 | 0 | 16276.7 | 199.999 | 40978468E+09 |
| 113 | 14305.4 | 16188.2 | 0 | 16188.2 | 199.999 | 4030971E+09  |
| 114 | 14166.5 | 16097.4 | 0 | 16097.4 | 199.999 | 3962322E+09  |
| 115 | 14027.5 | 16004.3 | 0 | 16004.3 | 199.999 | 38919821E+09 |
| 116 | 13888.6 | 15909.1 | 0 | 15909.1 | 199.999 | 38208301E+09 |
| 117 | 13749.7 | 15811.9 | 0 | 15811.9 | 199.999 | 3749541E+09  |
| 118 | 13610.8 | 15712.7 | 0 | 15712.7 | 199.999 | 36715863E+09 |
| 119 | 13471.9 | 15611.7 | 0 | 15611.7 | 199.999 | 35952342E+09 |
| 120 | 13333   | 15508.9 | 0 | 15508.9 | 199.999 | 35212549E+09 |
| 121 | 13194.1 | 15404.5 | 0 | 15404.5 | 199.999 | 34385962E+09 |

|     |         |         |   |         |         |               |
|-----|---------|---------|---|---------|---------|---------------|
| 122 | 13055.3 | 15298.4 | 0 | 15298.4 | 196.358 | .30584343E+09 |
| 123 | 12918.5 | 15191.6 | 0 | 15191.6 | 195.977 | .29771051E+09 |
| 124 | 12777.6 | 15085.6 | 0 | 15085.6 | 195.894 | .28946089E+09 |
| 125 | 12638.8 | 14978   | 0 | 14978   | 195.81  | .28109602E+09 |
| 126 | 12500   | 14869   | 0 | 14869   | 195.726 | .27262111E+09 |
| 127 | 12361.1 | 14758.7 | 0 | 14758.7 | 195.64  | .26404115E+09 |
| 128 | 12222.3 | 14647.1 | 0 | 14647.1 | 195.553 | .25536087E+09 |
| 129 | 12083.5 | 14534.2 | 0 | 14534.2 | 195.465 | .24658482E+09 |
| 130 | 11944.6 | 14420.2 | 0 | 14420.2 | 195.377 | .23771734E+09 |
| 131 | 11805.8 | 14305.1 | 0 | 14305.1 | 195.287 | .22876256E+09 |
| 132 | 11667   | 14188.9 | 0 | 14188.9 | 195.197 | .21972447E+09 |
| 133 | 11528   | 14071.6 | 0 | 14071.6 | 195.106 | .21060658E+09 |
| 134 | 11389.1 | 13953.4 | 0 | 13953.4 | 195.014 | .20141248E+09 |
| 135 | 11250.2 | 13836.4 | 0 | 13836.4 | 194.921 | .19214157E+09 |
| 136 | 11111.7 | 13718.9 | 0 | 13718.9 | 194.827 | .18279266E+09 |
| 137 | 10972.4 | 13600.4 | 0 | 13600.4 | 194.733 | .17336848E+09 |
| 138 | 10833.5 | 13481   | 0 | 13481   | 194.638 | .16387235E+09 |
| 139 | 10694.5 | 13360.8 | 0 | 13360.8 | 194.547 | .15436747E+09 |
| 140 | 10555.6 | 13240.7 | 0 | 13240.7 | 194.446 | .14487505E+09 |
| 141 | 10416.7 | 13120.7 | 0 | 13120.7 | 194.349 | .13497474E+09 |
| 142 | 10277.8 | 12999.8 | 0 | 12999.8 | 194.252 | .12520804E+09 |
| 143 | 10138.9 | 12878.1 | 0 | 12878.1 | 194.153 | .11537782E+09 |
| 144 | 10000   | 12755.7 | 0 | 12755.7 | 194.054 | .10548687E+09 |
| 145 | 9861    | 12633.1 | 0 | 12633.1 | 193.955 | .95536897     |
| 146 | 9722.1  | 12510.5 | 0 | 12510.5 | 193.855 | .85528877     |
| 147 | 9583.2  | 11203.2 | 0 | 11203.2 | 193.755 | .75592978     |
| 148 | 9444.3  | 9577.6  | 0 | 9577.6  | 193.744 | .74437065     |
| 149 | 9305.4  | 9382.5  | 0 | 9382.5  | 193.74  | .74353277     |
| 150 | 9166.5  | 9241.4  | 0 | 9241.4  | 193.737 | .73784458     |
| 151 | 9027.5  | 9102.5  | 0 | 9102.5  | 193.735 | .73514607     |
| 152 | 8888.6  | 8963.5  | 0 | 8963.5  | 193.732 | .73244906     |
| 153 | 8749.7  | 8824.6  | 0 | 8824.6  | 193.729 | .72975210     |
| 154 | 8610.8  | 8685.7  | 0 | 8685.7  | 193.727 | .72705515     |
| 155 | 8471.9  | 8546.8  | 0 | 8546.8  | 193.724 | .72435820     |
| 156 | 8333    | 8407.9  | 0 | 8407.9  | 193.721 | .72166125     |
| 157 | 8194.1  | 8269    | 0 | 8269    | 193.718 | .71896387     |
| 158 | 8055.3  | 8130.2  | 0 | 8130.2  | 193.716 | .71626970     |
| 159 | 7916.5  | 7991.3  | 0 | 7991.3  | 193.713 | .71357437     |
| 160 | 7777.6  | 7852.5  | 0 | 7852.5  | 193.71  | .71087903     |
| 161 | 7638.8  | 7713.7  | 0 | 7713.7  | 193.708 | .70818378     |
| 162 | 7500    | 7574.8  | 0 | 7574.8  | 193.705 | .70548856     |
| 163 | 7361.1  | 7436    | 0 | 7436    | 193.702 | .70279330     |
| 164 | 7222.3  | 7297.2  | 0 | 7297.2  | 193.7   | .70009769     |
| 165 | 7083.5  | 7208.6  | 0 | 7208.6  | 193.695 | .69505785     |
| 166 | 6944.6  | 7201.6  | 0 | 7201.6  | 193.685 | .68530067     |
| 167 | 6805.8  | 7271.2  | 0 | 7271.2  | 193.67  | .67085844     |
| 168 | 6667    | 7257.5  | 0 | 7257.5  | 193.651 | .65165077     |
| 169 | 6528    | 7240.7  | 0 | 7240.7  | 193.628 | .62839277     |
| 170 | 6389.1  | 7220.7  | 0 | 7220.7  | 193.6   | .60059658     |
| 171 | 6250.2  | 7197.8  | 0 | 7197.8  | 193.588 | .58857164     |
| 172 | 6111.3  | 7171.9  | 0 | 7171.9  | 193.532 | .53242441     |
| 173 | 5972.4  | 6977.1  | 0 | 6977.1  | 193.495 | .49524794     |
| 174 | 5833.5  | 6130.9  | 0 | 6130.9  | 193.471 | .47180736     |
| 175 | 5694.5  | 5841.9  | 0 | 5841.9  | 193.463 | .46380116     |
| 176 | 5555.6  | 5671.1  | 0 | 5671.1  | 193.459 | .45907038     |
| 177 | 5416.7  | 5525.4  | 0 | 5525.4  | 193.455 | .45503495     |
| 178 | 5277.8  | 5385.1  | 0 | 5385.1  | 193.451 | .45114712     |
| 179 | 5138.9  | 5245.6  | 0 | 5245.6  | 193.447 | .44729062     |
| 180 | 5000    | 5106.9  | 0 | 5106.9  | 193.443 | .44344077     |
| 181 | 4861    | 4967.9  | 0 | 4967.9  | 193.439 | .43959233     |
| 182 | 4722.1  | 4829    | 0 | 4829    | 193.435 | .43574419     |
| 183 | 4583.2  | 4690.1  | 0 | 4690.1  | 193.431 | .43189611     |
| 184 | 4444.3  | 4551.2  | 0 | 4551.2  | 193.428 | .42804805     |
| 185 | 4305.4  | 4412.3  | 0 | 4412.3  | 193.424 | .42419999     |
| 186 | 4166.5  | 4273.3  | 0 | 4273.3  | 193.42  | .42035193     |
| 187 | 4027.5  | 4134.4  | 0 | 4134.4  | 193.416 | .41650397     |

|     |        |        |   |        |         |          |
|-----|--------|--------|---|--------|---------|----------|
| 188 | 3888.6 | 3895.5 | 0 | 3895.5 | 193.412 | 41265581 |
| 189 | 3749.7 | 3856.6 | 0 | 3856.6 | 193.408 | 40880775 |
| 190 | 3610.8 | 3717.7 | 0 | 3717.7 | 193.404 | 40495969 |
| 191 | 3471.9 | 3578.8 | 0 | 3578.8 | 193.401 | 40111163 |
| 192 | 3333   | 3537   | 0 | 3537   | 193.395 | 39551413 |
| 193 | 3194.1 | 3533.6 | 0 | 3533.6 | 193.385 | 38573083 |
| 194 | 3055.3 | 3528.4 | 0 | 3528.4 | 193.371 | 37110578 |
| 195 | 2916.5 | 3521.4 | 0 | 3521.4 | 193.351 | 35170057 |
| 196 | 2777.6 | 3512.9 | 0 | 3512.9 | 193.337 | 32757603 |
| 197 | 2638.8 | 3502.6 | 0 | 3502.6 | 193.298 | 29879215 |
| 198 | 2500   | 3496.8 | 0 | 3496.8 | 193.265 | 26540751 |
| 199 | 2361.1 | 3477.4 | 0 | 3477.4 | 193.227 | 22747984 |
| 200 | 2222.3 | 3146.8 | 0 | 3146.8 | 193.19  | 19074701 |
| 201 | 2083.5 | 2382.8 | 0 | 2382.8 | 193.168 | 16871745 |
| 202 | 1944.6 | 2099.4 | 0 | 2099.4 | 193.16  | 16054277 |
| 203 | 1805.8 | 1927.1 | 0 | 1927.1 | 193.135 | 15557399 |
| 204 | 1667   | 1788.9 | 0 | 1788.9 | 193.131 | 15134731 |
| 205 | 1528   | 1639.8 | 0 | 1639.8 | 193.147 | 14729876 |
| 206 | 1389.1 | 1500.9 | 0 | 1500.9 | 193.143 | 14327389 |
| 207 | 1250.2 | 1361.9 | 0 | 1361.9 | 193.139 | 13926435 |
| 208 | 1111.3 | 1222.6 | 0 | 1222.6 | 193.135 | 13525768 |
| 209 | 972.4  | 1083.6 | 0 | 1083.6 | 193.131 | 13125148 |
| 210 | 833.5  | 944.7  | 0 | 944.7  | 193.127 | 12724539 |
| 211 | 694.5  | 805.8  | 0 | 805.8  | 193.123 | 12323933 |
| 212 | 555.6  | 666.9  | 0 | 666.9  | 193.119 | 11923327 |
| 213 | 416.7  | 528    | 0 | 528    | 193.115 | 11522722 |
| 214 | 277.8  | 389.1  | 0 | 389.1  | 193.111 | 11122116 |
| 215 | 138.9  | 250.1  | 0 | 250.1  | 193.107 | 10721511 |
| 216 | 0      | 111.2  | 0 | 111.2  | 193.103 | 10320905 |

PEAK INFLOW RATE= 20000cusecs  
 PEAK OUTFLOW RATE= 17368.8cusecs  
 ATTENUATION= 13.1%  
 LAG TIME= 1140minutes

Mvumase reservoir Case Study  
Analysis using RESIMO

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MVUMASE SCHEME. RESIMO DEMONSTRATION RUN.  
20 000 CUMECs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| ELEVATION | STORAGE |
|-----------|---------|
| -----     | -----   |
| 193       | 0       |
| 193.1     | 1E+07   |
| 193.2     | 2E+07   |
| 193.3     | 3E+07   |
| 193.4     | 4E+07   |
| 193.5     | 5E+07   |
| 193.6     | 6E+07   |
| 193.7     | 7E+07   |
| 193.8     | 8E+07   |
| 193.9     | 9E+07   |
| 194       | 1E+08   |
| 194.5     | 1.5E+08 |
| 195       | 2E+08   |
| 196       | 3E+08   |
| 197       | 4E+08   |
| 198       | 5E+08   |
| 199       | 6E+08   |
| 200       | 7E+08   |
| 201       | 8E+08   |
| 202       | 9E+08   |

AUTOMATICALLY CONTROLLED OVERFLOW WIER

| NO | INVERT | COEFFICIENT | WIDTH | HEIGHT | START EL | END EL  |
|----|--------|-------------|-------|--------|----------|---------|
| 1  | 178.5  | 2.08        | 34    | 17     | 193.115  | 193.415 |
| 2  | 178.5  | 2.08        | 34    | 17     | 193.415  | 193.715 |
| 3  | 178.5  | 2.08        | 34    | 17     | 193.715  | 194.015 |

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MVUMASE SCHEME. RESIMO DEMONSTRATION RUN.  
20 000 CUMECs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| TIME    | INFLOW | WATER | OUTFLOW | STORAGE | GATED  |
|---------|--------|-------|---------|---------|--------|
| (hours) | RATE   | LEVEL | RATE    | VOLUME  | FLOW   |
|         | (m3/s) | (m)   | (m3/s)  | (m3)    | (m3/s) |

\*\*\*\*\*

|       |          |         |          |           |          |
|-------|----------|---------|----------|-----------|----------|
| 0.00  | 0.00     | 193.000 | 0.00     | 0.000E+00 | 0        |
| 1.00  | 277.79   | 193.005 | 0.00     | 0.499E+06 | 0        |
| 2.00  | 555.58   | 193.020 | 0.00     | 0.200E+07 | 0        |
| 3.00  | 833.38   | 193.045 | 0.00     | 0.450E+07 | 0        |
| 4.00  | 1111.17  | 193.080 | 0.00     | 0.800E+07 | 0        |
| 5.00  | 1388.96  | 193.122 | 165.39   | 0.122E+08 | 165.3853 |
| 6.00  | 1666.75  | 193.157 | 929.72   | 0.157E+08 | 929.7204 |
| 7.00  | 1944.54  | 193.181 | 1387.09  | 0.181E+08 | 1387.09  |
| 8.00  | 2222.33  | 193.199 | 1729.86  | 0.200E+08 | 1729.86  |
| 9.00  | 2500.13  | 193.217 | 2022.55  | 0.217E+08 | 2022.553 |
| 10.00 | 2777.92  | 193.234 | 2291.67  | 0.234E+08 | 2291.669 |
| 11.00 | 3055.71  | 193.252 | 2546.45  | 0.252E+08 | 2546.45  |
| 12.00 | 3333.50  | 193.271 | 2789.04  | 0.271E+08 | 2789.042 |
| 13.00 | 3611.29  | 193.291 | 3079.47  | 0.291E+08 | 3079.472 |
| 14.00 | 3889.08  | 193.299 | 3949.67  | 0.299E+08 | 3949.665 |
| 15.00 | 4166.88  | 193.301 | 4026.77  | 0.301E+08 | 4026.773 |
| 16.00 | 4444.67  | 193.311 | 4030.84  | 0.310E+08 | 4030.84  |
| 17.00 | 4722.46  | 193.330 | 4038.90  | 0.330E+08 | 4038.902 |
| 18.00 | 5000.25  | 193.360 | 4050.91  | 0.360E+08 | 4050.914 |
| 19.00 | 5278.04  | 193.399 | 4066.82  | 0.398E+08 | 4066.823 |
| 20.00 | 5555.83  | 193.438 | 4602.52  | 0.437E+08 | 4602.523 |
| 21.00 | 5833.63  | 193.466 | 5209.17  | 0.466E+08 | 5209.168 |
| 22.00 | 6111.42  | 193.486 | 5610.58  | 0.486E+08 | 5610.579 |
| 23.00 | 6389.21  | 193.503 | 5930.02  | 0.503E+08 | 5930.019 |
| 24.00 | 6667.00  | 193.520 | 6214.55  | 0.520E+08 | 6214.55  |
| 25.00 | 6944.75  | 193.536 | 6479.48  | 0.536E+08 | 6479.475 |
| 26.00 | 7222.50  | 193.554 | 6733.97  | 0.553E+08 | 6733.968 |
| 27.00 | 7500.25  | 193.572 | 6979.35  | 0.572E+08 | 6979.345 |
| 28.00 | 7778.00  | 193.591 | 7213.95  | 0.591E+08 | 7213.948 |
| 29.00 | 8055.75  | 193.605 | 7848.86  | 0.605E+08 | 7848.863 |
| 30.00 | 8333.50  | 193.610 | 8293.44  | 0.610E+08 | 8293.436 |
| 31.00 | 8611.25  | 193.616 | 8312.11  | 0.616E+08 | 8312.106 |
| 32.00 | 8889.00  | 193.631 | 8324.92  | 0.631E+08 | 8324.918 |
| 33.00 | 9166.75  | 193.636 | 8345.50  | 0.656E+08 | 8345.503 |
| 34.00 | 9444.50  | 193.690 | 8373.65  | 0.690E+08 | 8373.651 |
| 35.00 | 9722.25  | 193.728 | 8708.30  | 0.728E+08 | 8708.299 |
| 36.00 | 10000.00 | 193.757 | 9377.64  | 0.757E+08 | 9377.639 |
| 37.00 | 10277.75 | 193.777 | 9796.61  | 0.777E+08 | 9796.609 |
| 38.00 | 10555.50 | 193.793 | 10123.15 | 0.793E+08 | 10123.15 |
| 39.00 | 10833.25 | 193.809 | 10411.94 | 0.809E+08 | 10411.94 |
| 40.00 | 11111.00 | 193.824 | 10681.53 | 0.824E+08 | 10681.53 |
| 41.00 | 11388.75 | 193.840 | 10942.94 | 0.840E+08 | 10942.94 |
| 42.00 | 11666.50 | 193.856 | 11195.42 | 0.856E+08 | 11195.42 |
| 43.00 | 11944.25 | 193.874 | 11441.74 | 0.874E+08 | 11441.74 |
| 44.00 | 12222.00 | 193.893 | 11679.83 | 0.893E+08 | 11679.83 |
| 45.00 | 12499.75 | 193.905 | 12354.89 | 0.905E+08 | 12354.89 |
| 46.00 | 12777.50 | 193.908 | 12728.61 | 0.909E+08 | 12728.61 |

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MYUMASE SCHEME. RESIMO DEMONSTRATION RUN.  
20 000 CUMECs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| TIME    | INFLOW | WATER | OUTFLOW | STORAGE | GATED  |
|---------|--------|-------|---------|---------|--------|
| (hours) | RATE   | LEVEL | RATE    | VOLUME  | FLOW   |
|         | (m3/s) | (m)   | (m3/s)  | (m3)    | (m3/s) |

\*\*\*\*\*

|       |          |         |          |           |          |
|-------|----------|---------|----------|-----------|----------|
| 47.00 | 13055.25 | 193.913 | 12838.28 | 0.913E+08 | 12838.28 |
| 48.00 | 13333.00 | 193.926 | 12853.94 | 0.926E+08 | 12853.94 |
| 49.00 | 13610.79 | 193.948 | 12861.14 | 0.948E+08 | 12861.14 |
| 50.00 | 13888.58 | 193.978 | 12919.41 | 0.978E+08 | 12919.41 |
| 51.00 | 14166.38 | 194.017 | 12968.29 | 0.102E+09 | 12968.29 |
| 52.00 | 14444.17 | 194.064 | 13027.35 | 0.106E+09 | 13027.35 |
| 53.00 | 14721.96 | 194.119 | 13096.16 | 0.112E+09 | 13096.16 |
| 54.00 | 14999.75 | 194.181 | 13174.37 | 0.118E+09 | 13174.37 |
| 55.00 | 15277.54 | 194.250 | 13261.59 | 0.125E+09 | 13261.59 |
| 56.00 | 15555.33 | 194.326 | 13357.50 | 0.133E+09 | 13357.5  |
| 57.00 | 15833.13 | 194.408 | 13461.77 | 0.141E+09 | 13461.77 |
| 58.00 | 16110.92 | 194.497 | 13574.06 | 0.150E+09 | 13574.06 |
| 59.00 | 16388.71 | 194.591 | 13694.09 | 0.159E+09 | 13694.09 |
| 60.00 | 16666.50 | 194.691 | 13821.58 | 0.169E+09 | 13821.58 |
| 61.00 | 16944.29 | 194.796 | 13956.25 | 0.180E+09 | 13956.25 |
| 62.00 | 17222.08 | 194.906 | 14097.82 | 0.191E+09 | 14097.82 |
| 63.00 | 17499.88 | 195.020 | 14246.06 | 0.202E+09 | 14246.06 |
| 64.00 | 17777.67 | 195.140 | 14400.73 | 0.214E+09 | 14400.73 |
| 65.00 | 18055.46 | 195.263 | 14561.58 | 0.226E+09 | 14561.58 |
| 66.00 | 18333.25 | 195.391 | 14728.38 | 0.239E+09 | 14728.38 |
| 67.00 | 18611.04 | 195.523 | 14900.93 | 0.252E+09 | 14900.93 |
| 68.00 | 18888.83 | 195.658 | 15079.01 | 0.266E+09 | 15079.01 |
| 69.00 | 19166.63 | 195.797 | 15262.44 | 0.280E+09 | 15262.44 |
| 70.00 | 19444.42 | 195.939 | 15450.95 | 0.294E+09 | 15450.95 |
| 71.00 | 19722.21 | 196.085 | 15644.43 | 0.308E+09 | 15644.43 |
| 72.00 | 20000.00 | 196.233 | 15842.67 | 0.323E+09 | 15842.67 |
| 73.00 | 19861.13 | 196.377 | 16035.63 | 0.338E+09 | 16035.63 |
| 74.00 | 19722.25 | 196.509 | 16213.58 | 0.351E+09 | 16213.58 |
| 75.00 | 19583.38 | 196.629 | 16377.09 | 0.363E+09 | 16377.09 |
| 76.00 | 19444.50 | 196.740 | 16526.68 | 0.374E+09 | 16526.68 |
| 77.00 | 19305.63 | 196.840 | 16662.90 | 0.384E+09 | 16662.9  |
| 78.00 | 19166.75 | 196.930 | 16786.27 | 0.393E+09 | 16786.27 |
| 79.00 | 19027.88 | 197.011 | 16897.33 | 0.401E+09 | 16897.33 |
| 80.00 | 18889.00 | 197.084 | 16996.58 | 0.408E+09 | 16996.58 |
| 81.00 | 18750.13 | 197.148 | 17084.51 | 0.415E+09 | 17084.51 |
| 82.00 | 18611.25 | 197.204 | 17161.64 | 0.420E+09 | 17161.64 |
| 83.00 | 18472.38 | 197.252 | 17228.40 | 0.425E+09 | 17228.4  |
| 84.00 | 18333.50 | 197.294 | 17285.29 | 0.429E+09 | 17285.29 |
| 85.00 | 18194.63 | 197.328 | 17332.74 | 0.433E+09 | 17332.74 |
| 86.00 | 18055.75 | 197.356 | 17371.19 | 0.436E+09 | 17371.19 |
| 87.00 | 17916.88 | 197.377 | 17401.05 | 0.438E+09 | 17401.05 |
| 88.00 | 17778.00 | 197.393 | 17422.74 | 0.439E+09 | 17422.74 |
| 89.00 | 17639.13 | 197.403 | 17436.63 | 0.440E+09 | 17436.63 |
| 90.00 | 17500.25 | 197.408 | 17443.10 | 0.441E+09 | 17443.1  |
| 91.00 | 17361.38 | 197.407 | 17442.50 | 0.441E+09 | 17442.5  |
| 92.00 | 17222.50 | 197.402 | 17435.18 | 0.440E+09 | 17435.18 |

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MVUMASE SCHEME. RESIMO DEMONSTRATION RUN.

20 000 CUMECs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| TIME<br>(hours) | INFLOW<br>RATE<br>(m <sup>3</sup> /s) | WATER<br>LEVEL<br>(m) | OUTFLOW<br>RATE<br>(m <sup>3</sup> /s) | STORAGE<br>VOLUME<br>(m <sup>3</sup> ) | GATED<br>FLOW<br>(m <sup>3</sup> /s) |
|-----------------|---------------------------------------|-----------------------|----------------------------------------|----------------------------------------|--------------------------------------|
| 93.00           | 17083.63                              | 197.392               | 17421.48                               | 0.439E+09                              | 17421.48                             |
| 94.00           | 16944.75                              | 197.378               | 17401.69                               | 0.438E+09                              | 17401.69                             |
| 95.00           | 16805.88                              | 197.359               | 17376.12                               | 0.436E+09                              | 17376.12                             |
| 96.00           | 16667.00                              | 197.337               | 17345.07                               | 0.434E+09                              | 17345.07                             |
| 97.00           | 16528.08                              | 197.311               | 17308.81                               | 0.431E+09                              | 17308.81                             |
| 98.00           | 16389.17                              | 197.281               | 17267.60                               | 0.428E+09                              | 17267.6                              |
| 99.00           | 16250.25                              | 197.247               | 17221.71                               | 0.425E+09                              | 17221.71                             |
| 100.00          | 16111.33                              | 197.211               | 17171.36                               | 0.421E+09                              | 17171.36                             |
| 101.00          | 15972.42                              | 197.171               | 17116.77                               | 0.417E+09                              | 17116.77                             |
| 102.00          | 15833.50                              | 197.129               | 17058.17                               | 0.413E+09                              | 17058.17                             |
| 103.00          | 15694.58                              | 197.083               | 16995.74                               | 0.408E+09                              | 16995.74                             |
| 104.00          | 15555.67                              | 197.035               | 16929.73                               | 0.403E+09                              | 16929.73                             |
| 105.00          | 15416.75                              | 196.984               | 16860.27                               | 0.398E+09                              | 16860.27                             |
| 106.00          | 15277.83                              | 196.931               | 16787.59                               | 0.393E+09                              | 16787.59                             |
| 107.00          | 15138.92                              | 196.876               | 16711.85                               | 0.388E+09                              | 16711.85                             |
| 108.00          | 15000.00                              | 196.818               | 16633.18                               | 0.382E+09                              | 16633.18                             |
| 109.00          | 14861.08                              | 196.758               | 16551.77                               | 0.376E+09                              | 16551.77                             |
| 110.00          | 14722.17                              | 196.696               | 16467.71                               | 0.370E+09                              | 16467.71                             |
| 111.00          | 14583.25                              | 196.632               | 16381.20                               | 0.363E+09                              | 16381.2                              |
| 112.00          | 14444.33                              | 196.567               | 16292.35                               | 0.357E+09                              | 16292.35                             |
| 113.00          | 14305.42                              | 196.499               | 16201.29                               | 0.350E+09                              | 16201.29                             |
| 114.00          | 14166.50                              | 196.430               | 16108.11                               | 0.343E+09                              | 16108.11                             |
| 115.00          | 14027.58                              | 196.360               | 16012.96                               | 0.336E+09                              | 16012.96                             |
| 116.00          | 13888.67                              | 196.287               | 15915.93                               | 0.329E+09                              | 15915.93                             |
| 117.00          | 13749.75                              | 196.214               | 15817.11                               | 0.321E+09                              | 15817.11                             |
| 118.00          | 13610.83                              | 196.139               | 15716.62                               | 0.314E+09                              | 15716.62                             |
| 119.00          | 13471.92                              | 196.062               | 15614.50                               | 0.306E+09                              | 15614.5                              |
| 120.00          | 13333.00                              | 195.984               | 15510.90                               | 0.298E+09                              | 15510.9                              |
| 121.00          | 13194.13                              | 195.905               | 15405.88                               | 0.291E+09                              | 15405.88                             |
| 122.00          | 13055.25                              | 195.825               | 15299.50                               | 0.283E+09                              | 15299.5                              |
| 123.00          | 12916.38                              | 195.744               | 15191.85                               | 0.274E+09                              | 15191.85                             |
| 124.00          | 12777.50                              | 195.661               | 15083.02                               | 0.266E+09                              | 15083.02                             |
| 125.00          | 12638.62                              | 195.578               | 14973.05                               | 0.258E+09                              | 14973.05                             |
| 126.00          | 12499.75                              | 195.493               | 14862.02                               | 0.249E+09                              | 14862.02                             |
| 127.00          | 12360.88                              | 195.408               | 14749.96                               | 0.241E+09                              | 14749.96                             |
| 128.00          | 12222.00                              | 195.321               | 14636.95                               | 0.232E+09                              | 14636.95                             |
| 129.00          | 12083.13                              | 195.234               | 14523.04                               | 0.223E+09                              | 14523.04                             |
| 130.00          | 11944.25                              | 195.146               | 14408.28                               | 0.215E+09                              | 14408.28                             |
| 131.00          | 11805.38                              | 195.057               | 14292.71                               | 0.206E+09                              | 14292.71                             |
| 132.00          | 11666.50                              | 194.967               | 14176.40                               | 0.197E+09                              | 14176.4                              |
| 133.00          | 11527.63                              | 194.876               | 14059.36                               | 0.188E+09                              | 14059.36                             |
| 134.00          | 11388.75                              | 194.784               | 13941.66                               | 0.178E+09                              | 13941.66                             |
| 135.00          | 11249.88                              | 194.692               | 13823.34                               | 0.169E+09                              | 13823.34                             |
| 136.00          | 11111.00                              | 194.599               | 13704.42                               | 0.160E+09                              | 13704.42                             |
| 137.00          | 10972.13                              | 194.505               | 13584.93                               | 0.151E+09                              | 13584.93                             |
| 138.00          | 10833.25                              | 194.411               | 13464.90                               | 0.141E+09                              | 13464.9                              |

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MVU BASE SCHEME. RESIMO DEMONSTRATION RUN.

20 000 CUMecs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| TIME<br>(hours) | INFLOW<br>RATE<br>(m3/s) | WATER<br>LEVEL<br>(m) | OUTFLOW<br>RATE<br>(m3/s) | STORAGE<br>VOLUME<br>(m3) | GATED<br>FLOW<br>(m3/s) |
|-----------------|--------------------------|-----------------------|---------------------------|---------------------------|-------------------------|
|-----------------|--------------------------|-----------------------|---------------------------|---------------------------|-------------------------|

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|        |          |         |          |           |          |
|--------|----------|---------|----------|-----------|----------|
| 139.00 | 10694.38 | 194.316 | 13344.39 | 0.132E+09 | 13344.39 |
| 140.00 | 10555.50 | 194.220 | 13223.43 | 0.122E+09 | 13223.43 |
| 141.00 | 10416.63 | 194.124 | 13102.03 | 0.112E+09 | 13102.03 |
| 142.00 | 10277.75 | 194.027 | 12980.23 | 0.103E+09 | 12980.23 |
| 143.00 | 10138.88 | 193.929 | 12858.04 | 0.929E+08 | 12858.04 |
| 144.00 | 10000.00 | 193.858 | 11222.20 | 0.858E+08 | 11222.2  |
| 145.00 | 9861.13  | 193.822 | 10646.09 | 0.822E+08 | 10646.09 |
| 146.00 | 9722.25  | 193.799 | 10226.69 | 0.799E+08 | 10226.69 |
| 147.00 | 9583.38  | 193.783 | 9928.55  | 0.784E+08 | 9928.549 |
| 148.00 | 9444.50  | 193.773 | 9705.95  | 0.773E+08 | 9705.946 |
| 149.00 | 9305.62  | 193.764 | 9524.29  | 0.764E+08 | 9524.286 |
| 150.00 | 9166.75  | 193.757 | 9363.66  | 0.756E+08 | 9363.66  |
| 151.00 | 9027.88  | 193.750 | 9213.56  | 0.750E+08 | 9213.556 |
| 152.00 | 8889.00  | 193.743 | 9066.60  | 0.743E+08 | 9066.596 |
| 153.00 | 8750.13  | 193.737 | 8922.69  | 0.737E+08 | 8922.691 |
| 154.00 | 8611.25  | 193.731 | 8779.74  | 0.731E+08 | 8779.741 |
| 155.00 | 8472.38  | 193.725 | 8634.65  | 0.725E+08 | 8634.653 |
| 156.00 | 8333.50  | 193.719 | 8499.50  | 0.719E+08 | 8499.495 |
| 157.00 | 8194.63  | 193.712 | 8416.18  | 0.712E+08 | 8416.179 |
| 158.00 | 8055.75  | 193.702 | 8383.39  | 0.702E+08 | 8383.393 |
| 159.00 | 7916.88  | 193.688 | 8371.75  | 0.688E+08 | 8371.745 |
| 160.00 | 7778.00  | 193.669 | 8356.37  | 0.669E+08 | 8356.371 |
| 161.00 | 7639.13  | 193.646 | 8337.39  | 0.646E+08 | 8337.39  |
| 162.00 | 7500.25  | 193.619 | 8314.91  | 0.619E+08 | 8314.911 |
| 163.00 | 7361.38  | 193.602 | 7509.70  | 0.602E+08 | 7509.704 |
| 164.00 | 7222.50  | 193.598 | 7286.83  | 0.598E+08 | 7286.833 |
| 165.00 | 7083.63  | 193.594 | 7242.80  | 0.594E+08 | 7242.802 |
| 166.00 | 6944.75  | 193.587 | 7165.72  | 0.587E+08 | 7165.719 |
| 167.00 | 6805.88  | 193.578 | 7063.39  | 0.578E+08 | 7063.386 |
| 168.00 | 6667.00  | 193.569 | 6942.26  | 0.569E+08 | 6942.258 |
| 169.00 | 6528.08  | 193.559 | 6808.37  | 0.559E+08 | 6808.367 |
| 170.00 | 6389.17  | 193.549 | 6666.15  | 0.549E+08 | 6666.154 |
| 171.00 | 6250.25  | 193.539 | 6519.68  | 0.539E+08 | 6519.678 |
| 172.00 | 6111.33  | 193.529 | 6371.00  | 0.529E+08 | 6370.999 |
| 173.00 | 5972.42  | 193.520 | 6221.53  | 0.520E+08 | 6221.525 |
| 174.00 | 5833.50  | 193.512 | 6072.26  | 0.511E+08 | 6072.263 |
| 175.00 | 5694.58  | 193.503 | 5923.78  | 0.503E+08 | 5923.78  |
| 176.00 | 5555.67  | 193.495 | 5776.29  | 0.495E+08 | 5776.292 |
| 177.00 | 5416.75  | 193.487 | 5629.93  | 0.487E+08 | 5629.925 |
| 178.00 | 5277.83  | 193.480 | 5484.71  | 0.480E+08 | 5484.71  |
| 179.00 | 5138.92  | 193.472 | 5338.80  | 0.472E+08 | 5338.801 |
| 180.00 | 5000.00  | 193.465 | 5194.41  | 0.465E+08 | 5194.405 |
| 181.00 | 4861.08  | 193.458 | 5051.01  | 0.458E+08 | 5051.009 |
| 182.00 | 4722.17  | 193.451 | 4908.02  | 0.451E+08 | 4908.016 |
| 183.00 | 4583.25  | 193.445 | 4764.72  | 0.445E+08 | 4764.717 |
| 184.00 | 4444.33  | 193.438 | 4622.49  | 0.438E+08 | 4622.493 |

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MVUMASE SCHEME. RESIMO DEMONSTRATION RUN.  
20 000 CUMECs THROUGH SIX No. 17m WIDE x 14.5m HIGH AUTOMATIC GATES.

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| TIME    | INFLOW              | WATER | OUTFLOW             | STORAGE           | GATED               |
|---------|---------------------|-------|---------------------|-------------------|---------------------|
| (hours) | RATE                | LEVEL | RATE                | VOLUME            | FLOW                |
|         | (m <sup>3</sup> /s) | (m)   | (m <sup>3</sup> /s) | (m <sup>3</sup> ) | (m <sup>3</sup> /s) |

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|        |         |         |         |           |          |
|--------|---------|---------|---------|-----------|----------|
| 185.00 | 4305.42 | 193.432 | 4479.60 | 0.432E+08 | 4479.602 |
| 186.00 | 4166.50 | 193.426 | 4335.21 | 0.426E+08 | 4335.206 |
| 187.00 | 4027.58 | 193.420 | 4191.76 | 0.420E+08 | 4191.764 |
| 188.00 | 3888.67 | 193.413 | 4108.96 | 0.413E+08 | 4108.955 |
| 189.00 | 3749.75 | 193.403 | 4068.77 | 0.403E+08 | 4068.766 |
| 190.00 | 3610.83 | 193.389 | 4063.08 | 0.389E+08 | 4063.081 |
| 191.00 | 3471.92 | 193.371 | 4055.45 | 0.371E+08 | 4055.451 |
| 192.00 | 3333.00 | 193.347 | 4045.91 | 0.347E+08 | 4045.911 |
| 193.00 | 3194.12 | 193.319 | 4034.49 | 0.319E+08 | 4034.489 |
| 194.00 | 3055.25 | 193.295 | 3557.69 | 0.295E+08 | 3557.686 |
| 195.00 | 2916.38 | 193.286 | 2952.81 | 0.286E+08 | 2952.813 |
| 196.00 | 2777.50 | 193.282 | 2917.96 | 0.282E+08 | 2917.958 |
| 197.00 | 2638.63 | 193.276 | 2846.38 | 0.276E+08 | 2846.377 |
| 198.00 | 2499.75 | 193.268 | 2748.43 | 0.268E+08 | 2748.432 |
| 199.00 | 2360.87 | 193.259 | 2630.56 | 0.259E+08 | 2630.558 |
| 200.00 | 2222.00 | 193.249 | 2498.66 | 0.249E+08 | 2498.656 |
| 201.00 | 2083.13 | 193.239 | 2357.99 | 0.239E+08 | 2357.99  |
| 202.00 | 1944.25 | 193.229 | 2212.26 | 0.229E+08 | 2212.261 |
| 203.00 | 1805.38 | 193.220 | 2064.14 | 0.220E+08 | 2064.135 |
| 204.00 | 1666.50 | 193.210 | 1914.99 | 0.210E+08 | 1914.989 |
| 205.00 | 1527.62 | 193.202 | 1766.03 | 0.202E+08 | 1766.027 |
| 206.00 | 1388.75 | 193.193 | 1617.84 | 0.193E+08 | 1617.837 |
| 207.00 | 1249.88 | 193.185 | 1470.64 | 0.185E+08 | 1470.64  |
| 208.00 | 1111.00 | 193.177 | 1324.27 | 0.177E+08 | 1324.268 |
| 209.00 | 972.13  | 193.170 | 1179.02 | 0.170E+08 | 1179.022 |
| 210.00 | 833.25  | 193.162 | 1033.12 | 0.162E+08 | 1033.116 |
| 211.00 | 694.37  | 193.155 | 889.24  | 0.155E+08 | 889.2401 |
| 212.00 | 555.50  | 193.148 | 746.43  | 0.148E+08 | 746.4345 |
| 213.00 | 416.63  | 193.142 | 602.86  | 0.142E+08 | 602.8641 |
| 214.00 | 277.75  | 193.135 | 459.15  | 0.135E+08 | 459.1509 |
| 215.00 | 138.88  | 193.129 | 315.99  | 0.129E+08 | 315.9878 |
| 216.00 | 0.00    | 193.122 | 170.70  | 0.122E+08 | 170.7007 |

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PEAK INFLOW RATE= 20000.00m<sup>3</sup>/s  
PEAK OUTFLOW RATE= 17443.10m<sup>3</sup>/s  
LAG TIME= 18.00hours  
PERCENTAGE ATTENUATION= 12.78%

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Vaaldam Case Study Analysis by  
Department of Water Affairs  
using in house program

| TIME        | %FSC  | GAUGE PL. |           | CAPACITY | DELTA   | CAPACITY | NET | GATES | SPILL | MEAN GROSS INFLOW |       |
|-------------|-------|-----------|-----------|----------|---------|----------|-----|-------|-------|-------------------|-------|
|             |       | READING   |           |          |         |          |     |       |       | 1-HR              | 6-HR  |
| hr          | %     | m         |           | 10^6 m3  | 10^6 m3 | m3/s     | no. | m3/s  | m3/s  | m3/s              | m3/s  |
| 14 / 2 / 75 |       |           |           |          |         |          |     |       |       |                   |       |
| 8           | 98.17 | 21.199    | 2150.4700 |          | 2.3293  | 647      | 4   | 260   | 0     | 907               |       |
| 9           | 98.27 | 21.207    | 2152.8000 |          | .5818   | 162      | 4   | 261   | 0     | 422               | ***** |
| 10          | 98.30 | 21.209    | 2153.3800 |          | .5830   | 162      | 4   | 261   | 0     | 423               | ***** |
| 11          | 98.33 | 21.211    | 2153.9600 |          | 1.4551  | 404      | 4   | 261   | 0     | 666               | 550   |
| 12          | 98.39 | 21.216    | 2155.4200 |          | .2903   | 81       | 5   | 327   | 0     | 408               | 502   |
| 13          | 98.41 | 21.217    | 2155.7100 |          | .2937   | 82       | 6   | 393   | 0     | 475               | 600   |
| 14          | 98.42 | 21.218    | 2156.0000 |          | .5818   | 162      | 7   | 459   | 0     | 621               | 667   |
| 15          | 98.45 | 21.220    | 2156.5900 |          | 1.7432  | 484      | 8   | 526   | 0     | 1010              | 652   |
| 16          | 98.53 | 21.226    | 2158.3300 |          | .5852   | 163      | 10  | 659   | 0     | 821               | 667   |
| 17          | 98.55 | 21.228    | 2158.9100 |          | -.2903  | -81      | 10  | 659   | 0     | 578               | 671   |
| 18          | 98.54 | 21.227    | 2158.6200 |          | -.5830  | -162     | 10  | 658   | 0     | 496               | 582   |
| 19          | 98.51 | 21.225    | 2158.0400 |          | -.5784  | -161     | 10  | 658   | 0     | 497               | 315   |
| 20          | 98.49 | 21.223    | 2157.4600 |          | -2.0425 | -567     | 10  | 656   | 0     | 089               | 221   |
| 21          | 98.39 | 21.216    | 2155.4200 |          | -4.9492 | ****     | 12  | 782   | 0     | -593              | 167   |
| 22          | 98.17 | 21.199    | 2150.4700 |          |         |          |     |       |       |                   | 167   |

| TIME        | %FSC  | GAUGE PL. |           | CAPACITY | DELTA   | CAPACITY | NET | GATES | SPILL | MEAN GROSS INFLOW |      |
|-------------|-------|-----------|-----------|----------|---------|----------|-----|-------|-------|-------------------|------|
|             |       | READING   |           |          |         |          |     |       |       | 1-HR              | 6-HR |
| hr          | %     | m         |           | 10^6 m3  | 10^6 m3 | m3/s     | no. | m3/s  | m3/s  | m3/s              | m3/s |
| 22          | 98.17 | 21.199    | 2150.4700 |          | -2.3259 | -646     | 14  | 905   | 0     | 259               | 167  |
| 23          | 98.06 | 21.191    | 2148.1400 |          | -2.3262 | -646     | 14  | 901   | 0     | 255               | 166  |
| 24          | 97.95 | 21.183    | 2145.8200 |          | -1.4504 | -403     | 14  | 898   | 0     | 495               | 287  |
| 15 / 2 / 75 |       |           |           |          |         |          |     |       |       |                   |      |
| 1           | 97.89 | 21.178    | 2144.3700 |          | -1.4517 | -403     | 14  | 895   | 0     | 492               | 427  |
| 2           | 97.82 | 21.173    | 2142.9200 |          | -.2925  | -81      | 14  | 894   | 0     | 812               | 491  |
| 3           | 97.81 | 21.172    | 2142.6200 |          | -2.3181 | -644     | 14  | 891   | 0     | 247               | 462  |
| 4           | 97.70 | 21.164    | 2140.3100 |          |         |          |     |       |       |                   | 486  |
| 5           | 97.66 | 21.161    | 2139.4300 |          | -.8755  | -243     | 14  | 888   | 0     | 645               | 511  |
| 6           | 97.53 | 21.151    | 2136.5300 |          | -2.8975 | -805     | 14  | 885   | 0     | 080               | 468  |

|    |       |        |           |         |      |    |      |   |     |     |
|----|-------|--------|-----------|---------|------|----|------|---|-----|-----|
| 7  | 97.49 | 21.148 | 2135.6700 | -.8677  | -241 | 14 | 882  | 0 | 641 | 560 |
| 8  | 97.45 | 21.145 | 2134.8000 | -.8674  | -241 | 14 | 880  | 0 | 639 | 538 |
| 9  | 97.40 | 21.141 | 2133.6400 | -1.1580 | -322 | 14 | 878  | 0 | 557 | 632 |
| 10 | 97.38 | 21.140 | 2133.3500 | -.2915  | -81  | 14 | 877  | 0 | 796 | 598 |
| 11 | 97.31 | 21.134 | 2131.6100 | -1.7373 | -483 | 16 | 1000 | 0 | 518 | 583 |
| 12 | 97.23 | 21.128 | 2129.8800 | -1.7307 | -481 | 18 | 1121 | 0 | 641 | 689 |

| TIME<br>hr  | %FSC<br>% | GAUGEPL.     |                     | DELTA<br>CAPACITY<br>10^6 m3 | NET<br>INFLOW<br>m3/s | GATES<br>no. m3/s | SPILL<br>m3/s | MEAN<br>GROSS INFLOW |              |
|-------------|-----------|--------------|---------------------|------------------------------|-----------------------|-------------------|---------------|----------------------|--------------|
|             |           | READING<br>m | CAPACITY<br>10^6 m3 |                              |                       |                   |               | 1-HR<br>m3/s         | 6-HR<br>m3/s |
| 12          | 97.23     | 21.128       | 2129.8800           |                              |                       |                   |               |                      | 689          |
|             |           |              |                     | -2.8940                      | -804                  | 20                | 1240          | 0                    | 436          |
| 13          | 97.09     | 21.118       | 2126.9900           |                              |                       |                   |               |                      | 687          |
|             |           |              |                     | -2.8906                      | -803                  | 22                | 1356          | 0                    | 553          |
| 14          | 96.96     | 21.108       | 2124.1000           |                              |                       |                   |               |                      | 785          |
|             |           |              |                     | -.5796                       | -161                  | 22                | 1351          | 0                    | 1190         |
| 15          | 96.94     | 21.106       | 2123.5200           |                              |                       |                   |               |                      | 835          |
|             |           |              |                     | -2.0173                      | -560                  | 22                | 1347          | 0                    | 787          |
| 16          | 96.84     | 21.099       | 2121.5000           |                              |                       |                   |               |                      | 878          |
|             |           |              |                     | -.8677                       | -241                  | 22                | 1344          | 0                    | 1102         |
| 17          | 96.80     | 21.096       | 2120.6300           |                              |                       |                   |               |                      | 900          |
|             |           |              |                     | -1.4392                      | -400                  | 22                | 1340          | 0                    | 941          |
| 18          | 96.74     | 21.091       | 2119.1900           |                              |                       |                   |               |                      | 896          |
|             |           |              |                     | -2.3135                      | -643                  | 22                | 1335          | 0                    | 692          |
| 19          | 96.63     | 21.083       | 2116.8800           |                              |                       |                   |               |                      | 945          |
|             |           |              |                     | -2.3008                      | -                     | 22                | 1329          | 0                    | 690          |
| 20          | 96.53     | 21.075       | 2114.5800           |                              |                       |                   |               |                      | 982          |
|             |           |              |                     | -.5774                       | -160                  | 22                | 1325          | 0                    | 1164         |
| 21          | 96.50     | 21.073       | 2114.0000           |                              |                       |                   |               |                      | 1046         |
|             |           |              |                     | -.8618                       | -239                  | 22                | 1323          | 0                    | 1083         |
| 22          | 96.46     | 21.070       | 2113.1400           |                              |                       |                   |               |                      | 1150         |
|             |           |              |                     | .0000                        | 00                    | 22                | 1322          | 0                    | 1322         |
| 23          | 96.46     | 21.070       | 2113.1400           |                              |                       |                   |               |                      | 1162         |
|             |           |              |                     | .0000                        | 00                    | 22                | 1322          | 0                    | 1322         |
| 24          | 96.46     | 21.070       | 2113.1400           |                              |                       |                   |               |                      | 1187         |
| 16 / 2 / 75 |           |              |                     | .0000                        | 00                    | 22                | 1322          | 0                    | 1322         |
| 1           | 96.46     | 21.070       | 2113.1400           |                              |                       |                   |               |                      | 1212         |
|             |           |              |                     | -2.0139                      | -559                  | 22                | 1319          | 0                    | 759          |
| 2           | 96.37     | 21.063       | 2111.1200           |                              |                       |                   |               |                      | 1185         |

| TIME<br>hr | %FSC<br>% | GAUGEPL.     |                     | DELTA<br>CAPACITY<br>10^6 m3 | NET<br>INFLOW<br>m3/s | GATES<br>no. m3/s | SPILL<br>m3/s | MEAN<br>GROSS INFLOW |              |
|------------|-----------|--------------|---------------------|------------------------------|-----------------------|-------------------|---------------|----------------------|--------------|
|            |           | READING<br>m | CAPACITY<br>10^6 m3 |                              |                       |                   |               | 1-HR<br>m3/s         | 6-HR<br>m3/s |
| 2          | 96.37     | 21.063       | 2111.1200           |                              |                       |                   |               |                      | 1185         |
|            |           |              |                     | .0000                        | 00                    | 22                | 1316          | 0                    | 1316         |
| 3          | 96.37     | 21.063       | 2111.1200           |                              |                       |                   |               |                      | 1183         |

|   |       |        |           |        |      |    |      |   |      |      |
|---|-------|--------|-----------|--------|------|----|------|---|------|------|
| 4 | 96.36 | 21.062 | 2110.8300 | -.2927 | -81  | 22 | 1316 | 0 | 1234 | 1129 |
| 5 | 96.33 | 21.060 | 2110.2600 | -.5762 | -160 | 22 | 1314 | 0 | 1154 | 1234 |

|    |       |        |           |         |      |    |      |   |      |      |
|----|-------|--------|-----------|---------|------|----|------|---|------|------|
| 6  | 96.33 | 21.060 | 2110.2600 | .0000   | 00   | 22 | 1314 | 0 | 1314 | 1233 |
| 7  | 96.28 | 21.056 | 2109.1100 | -1.1475 | -319 | 22 | 1312 | 0 | 993  | 1246 |
| 8  | 96.29 | 21.057 | 2109.4000 | .2915   | 81   | 22 | 1311 | 0 | 1392 | 1272 |
| 9  | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1272 |
| 10 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1325 |
| 11 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1311 |
| 12 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1311 |
| 13 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1311 |
| 14 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1331 |
| 15 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1371 |
| 16 | 96.29 | 21.057 | 2109.4000 | .0000   | 00   | 22 | 1311 | 0 | 1311 | 1431 |

| TIME<br>hr  | %FSC<br>% | GAUGE PL.    |                     | DELTA<br>CAPACITY<br>10^6 m3 | NET<br>INFLOW<br>m3/s | GATES<br>no. m3/s | SPILL<br>m3/s | MEAN<br>GROSS INFLOW |              |
|-------------|-----------|--------------|---------------------|------------------------------|-----------------------|-------------------|---------------|----------------------|--------------|
|             |           | READING<br>m | CAPACITY<br>10^6 m3 |                              |                       |                   |               | 1-HR<br>m3/s         | 6-HR<br>m3/s |
| 16          | 96.29     | 21.057       | 2109.4000           | .0000                        | 00                    | 24                | 1431          | 0                    | 1431         |
| 17          | 96.29     | 21.057       | 2109.4000           | .0000                        | 00                    | 26                | 1550          | 0                    | 1550         |
| 18          | 96.29     | 21.057       | 2109.4000           | .0000                        | 00                    | 28                | 1669          | 0                    | 1669         |
| 19          | 96.29     | 21.057       | 2109.4000           | -.2915                       | -81                   | 28                | 1668          | 0                    | 1588         |
| 20          | 96.28     | 21.056       | 2109.1100           | *****                        | ****                  | 28                | 1688          | 0                    | 4808         |
| 21          | 96.79     | 21.095       | 2120.3400           | 1.7339                       | 482                   | 28                | 1710          | 0                    | 2192         |
| 22          | 96.87     | 21.101       | 2122.0700           | 1.4414                       | 400                   | 28                | 1716          | 0                    | 2116         |
| 23          | 96.94     | 21.106       | 2123.5200           | .5796                        | 161                   | 28                | 1720          | 0                    | 1881         |
| 24          | 96.96     | 21.108       | 2124.1000           | 3.1787                       | 883                   | 28                | 1726          | 0                    | 2609         |
| 17 / 2 / 75 | 97.11     | 21.119       | 2127.2700           | .2856                        | 79                    | 28                | 1732          | 0                    | 1812         |
| 1           | 97.12     | 21.120       | 2127.5600           | 4.9185                       | ****                  | 28                | 1742          | 0                    | 3108         |
| 3           | 97.35     | 21.137       | 2132.4800           | 3.7642                       | ****                  | 28                | 1757          | 0                    | 2803         |
| 4           | 97.52     | 21.150       | 2136.2400           | 5.8030                       | ****                  | 28                | 1774          | 0                    | 3386         |
| 5           | 97.78     | 21.170       | 2142.0500           | 5.5161                       | ****                  | 28                | 1794          | 0                    | 3327         |

6 98.03 21.189 2147.5600

2942

| TIME | %FSC   | GAUGE PL. |                    | DELTA              | NET  | GATES    | SPILL | MEAN GROSS INFLOW |      |
|------|--------|-----------|--------------------|--------------------|------|----------|-------|-------------------|------|
|      |        | READING   | CAPACITY           |                    |      |          |       | 1-HR              | 6-HR |
| hr   | %      | m         | 10 <sup>6</sup> m3 | 10 <sup>6</sup> m3 | m3/s | no. m3/s | m3/s  | m3/s              | m3/s |
| 6    | 98.03  | 21.189    | 2147.5600          |                    |      |          |       |                   | 2942 |
|      |        |           |                    | 3.4954             | 971  | 28 1811  | 0     | 2782              |      |
| 7    | 98.19  | 21.201    | 2151.0600          |                    |      |          |       |                   | 2931 |
|      |        |           |                    | 3.2004             | 889  | 28 1823  | 0     | 2712              |      |
| 8    | 98.34  | 21.212    | 2154.2600          |                    |      |          |       |                   | 2906 |
|      |        |           |                    | 2.9111             | 809  | 28 1834  | 0     | 2643              |      |
| 9    | 98.47  | 21.222    | 2157.1700          |                    |      |          |       |                   | 2731 |
|      |        |           |                    | 3.2048             | 890  | 28 1845  | 0     | 2735              |      |
| 10   | 98.62  | 21.233    | 2160.3700          |                    |      |          |       |                   | 2798 |
|      |        |           |                    | 4.9583             | **** | 28 1860  | 0     | 3237              |      |
| 11   | 98.84  | 21.250    | 2165.3300          |                    |      |          |       |                   | 2861 |
|      |        |           |                    | 1.4687             | 408  | 28 1872  | 0     | 2280              |      |
| 12   | 98.91  | 21.255    | 2166.8000          |                    |      |          |       |                   | 2879 |
|      |        |           |                    | 4.6726             | **** | 28 1883  | 0     | 3181              |      |
| 13   | 99.13  | 21.271    | 2171.4700          |                    |      |          |       |                   | 3048 |
|      |        |           |                    | 3.8027             | **** | 30 2034  | 0     | 3091              |      |
| 14   | 99.30  | 21.284    | 2175.2800          |                    |      |          |       |                   | 3069 |
|      |        |           |                    | 2.0503             | 570  | 32 2182  | 0     | 2752              |      |
| 15   | 99.39  | 21.291    | 2177.3300          |                    |      |          |       |                   | 3334 |
|      |        |           |                    | 5.5742             | **** | 32 2199  | 0     | 3747              |      |
| 16   | 99.65  | 21.310    | 2182.9000          |                    |      |          |       |                   | 3262 |
|      |        |           |                    | 4.1125             | **** | 32 2219  | 0     | 3362              |      |
| 17   | 99.83  | 21.324    | 2187.0100          |                    |      |          |       |                   | 3358 |
|      |        |           |                    | 5.8757             | **** | 32 2241  | 0     | 3873              |      |
| 18   | 100.10 | 21.344    | 2192.8900          |                    |      |          |       |                   | 3335 |
|      |        |           |                    | 1.7671             | 491  | 32 2257  | 1     | 2749              |      |
| 19   | 100.18 | 21.350    | 2194.6600          |                    |      |          |       |                   | 3257 |
|      |        |           |                    | 5.0095             | **** | 32 2272  | 1     | 3665              |      |
| 20   | 100.41 | 21.367    | 2199.6700          |                    |      |          |       |                   | 3289 |

| TIME | %FSC        | GAUGE PL. |                    | DELTA              | NET  | GATES    | SPILL | MEAN GROSS INFLOW |      |
|------|-------------|-----------|--------------------|--------------------|------|----------|-------|-------------------|------|
|      |             | READING   | CAPACITY           |                    |      |          |       | 1-HR              | 6-HR |
| hr   | %           | m         | 10 <sup>6</sup> m3 | 10 <sup>6</sup> m3 | m3/s | no. m3/s | m3/s  | m3/s              | m3/s |
| 20   | 100.41      | 21.367    | 2199.6700          |                    |      |          |       |                   | 3289 |
|      |             |           |                    | 1.1785             | 327  | 32 2285  | 3     | 2615              |      |
| 21   | 100.47      | 21.371    | 2200.8400          |                    |      |          |       |                   | 3197 |
|      |             |           |                    | 3.5349             | 982  | 32 2296  | 4     | 3281              |      |
| 22   | 100.63      | 21.383    | 2204.3800          |                    |      |          |       |                   | 3323 |
|      |             |           |                    | 4.4290             | **** | 32 2313  | 5     | 3549              |      |
| 23   | 100.83      | 21.398    | 2208.8100          |                    |      |          |       |                   | 3329 |
|      |             |           |                    | 3.5476             | 985  | 32 2330  | 8     | 3323              |      |
| 24   | 100.99      | 21.410    | 2212.3600          |                    |      |          |       |                   | 3499 |
|      | 18 / 2 / 75 |           |                    | 4.1409             | **** | 32 2347  | 10    | 3507              |      |
| 1    | 101.18      | 21.424    | 2216.5000          |                    |      |          |       |                   | 3577 |
|      |             |           |                    | 4.7407             | **** | 32 2367  | 13    | 3696              |      |
| 2    | 101.40      | 21.440    | 2221.2400          |                    |      |          |       |                   | 3545 |
|      |             |           |                    | 4.4473             | **** | 32 2387  | 16    | 3639              |      |
| 3    | 101.60      | 21.455    | 2225.6800          |                    |      |          |       |                   | 3609 |
|      |             |           |                    | 4.7498             | **** | 32 2408  | 19    | 3746              |      |
| 4    | 101.82      | 21.471    | 2230.4300          |                    |      |          |       |                   | 3577 |
|      |             |           |                    | 3.2676             | 908  | 32 2426  | 22    | 3356              |      |
|      |             |           |                    |                    |      |          |       |                   |      |
| 5    | 101.97      | 21.482    | 2233.7000          |                    |      |          |       |                   | 3698 |
|      |             |           |                    | 4.4678             | **** | 32 2443  | 25    | 3710              |      |
| 6    | 102.17      | 21.497    | 2238.1700          |                    |      |          |       |                   | 3709 |
|      |             |           |                    | 2.9783             | 827  | 32 2460  | 28    | 3316              |      |

|    |        |        |           |        |      |    |      |    |      |      |
|----|--------|--------|-----------|--------|------|----|------|----|------|------|
| 7  | 102.31 | 21.507 | 2241.1500 | 6.8596 | **** | 32 | 2482 | 33 | 4421 | 3606 |
| 8  | 102.62 | 21.530 | 2248.0100 | 4.1785 | **** | 32 | 2508 | 38 | 3706 | 3554 |
| 9  | 102.81 | 21.544 | 2252.1900 | 1.4949 | 415  | 34 | 2678 | 38 | 3131 | 3469 |
| 10 | 102.88 | 21.549 | 2253.6800 |        |      |    |      |    |      | 3451 |

| TIME | %FSC   | GAUGEPL. |           | DELTA   | NET  | GATES    | SPILL | MEAN |      |
|------|--------|----------|-----------|---------|------|----------|-------|------|------|
|      |        | READING  | CAPACITY  |         |      |          |       | 1-HR | 6-HR |
| hr   | %      | m        | 10^6 m3   | 10^6 m3 | m3/s | no. m3/s | m3/s  | m3/s | m3/s |
| 10   | 102.88 | 21.549   | 2253.6800 |         |      |          |       |      | 3451 |
|      |        |          |           | .5977   | 166  | 36       | 2841  | 36   | 3043 |
| 11   | 102.91 | 21.551   | 2254.2800 |         |      |          |       |      | 3291 |
|      |        |          |           | .5933   | 165  | 38       | 3002  | 33   | 3200 |
| 12   | 102.93 | 21.553   | 2254.8700 |         |      |          |       |      | 3322 |
|      |        |          |           | .6011   | 167  | 38       | 3005  | 33   | 3206 |
| 13   | 102.96 | 21.555   | 2255.4700 |         |      |          |       |      | 3340 |
|      |        |          |           | 1.4937  | 415  | 38       | 3011  | 34   | 3460 |
| 14   | 103.03 | 21.560   | 2256.9700 |         |      |          |       |      | 3457 |
|      |        |          |           | 2.9978  | 833  | 38       | 3024  | 36   | 3892 |
| 15   | 103.16 | 21.570   | 2259.9600 |         |      |          |       |      | 3565 |
|      |        |          |           | .5977   | 166  | 38       | 3033  | 37   | 3237 |
| 16   | 103.19 | 21.572   | 2260.5600 |         |      |          |       |      | 3590 |
|      |        |          |           | 2.3967  | 666  | 38       | 3042  | 39   | 3746 |
| 17   | 103.30 | 21.580   | 2262.9600 |         |      |          |       |      | 3559 |
|      |        |          |           | 2.6995  | 750  | 38       | 3056  | 41   | 3846 |
| 18   | 103.42 | 21.589   | 2265.6600 |         |      |          |       |      | 3444 |
|      |        |          |           | .8948   | 249  | 38       | 3066  | 42   | 3356 |
| 19   | 103.47 | 21.592   | 2266.5500 |         |      |          |       |      | 3424 |
|      |        |          |           | .5967   | 166  | 38       | 3070  | 43   | 3278 |
| 20   | 103.49 | 21.594   | 2267.1500 |         |      |          |       |      | 3347 |
|      |        |          |           | .3040   | 84   | 38       | 3072  | 43   | 3200 |
| 21   | 103.51 | 21.595   | 2267.4500 |         |      |          |       |      | 3254 |
|      |        |          |           | .0000   | 00   | 38       | 3073  | 43   | 3116 |
| 22   | 103.51 | 21.595   | 2267.4500 |         |      |          |       |      | 3230 |
|      |        |          |           | .6011   | 167  | 38       | 3075  | 43   | 3285 |
| 23   | 103.53 | 21.597   | 2268.0500 |         |      |          |       |      | 3218 |
|      |        |          |           | .5977   | 166  | 38       | 3078  | 44   | 3288 |
| 24   | 103.56 | 21.599   | 2268.6500 |         |      |          |       |      | 3234 |

| TIME | %FSC   | GAUGEPL. |           | DELTA   | NET  | GATES    | SPILL | MEAN |      |
|------|--------|----------|-----------|---------|------|----------|-------|------|------|
|      |        | READING  | CAPACITY  |         |      |          |       | 1-HR | 6-HR |
| hr   | %      | m        | 10^6 m3   | 10^6 m3 | m3/s | no. m3/s | m3/s  | m3/s | m3/s |
| 24   | 103.56 | 21.599   | 2268.6500 |         |      |          |       |      | 3234 |
| 19   | /      | 2        | /         | 75      |      |          |       |      |      |
| 1    | 103.58 | 21.600   | 2268.9600 |         |      |          |       |      | 3223 |
|      |        |          |           | .3052   | 85   | 38       | 3081  | 44   | 3210 |
| 2    | 103.59 | 21.601   | 2269.2500 |         |      |          |       |      | 3225 |
|      |        |          |           | .2949   | 82   | 38       | 3082  | 45   | 3209 |
| 3    | 103.62 | 21.603   | 2269.8500 |         |      |          |       |      | 3213 |
|      |        |          |           | .6011   | 167  | 38       | 3085  | 45   | 3297 |
|      |        |          |           | -.2983  | -83  | 38       | 3086  | 45   | 3048 |
| 4    | 103.60 | 21.602   | 2269.5500 |         |      |          |       |      | 3187 |
|      |        |          |           | .6013   | 167  | 38       | 3087  | 45   | 3299 |
| 5    | 103.63 | 21.604   | 2270.1600 |         |      |          |       |      | 3174 |
|      |        |          |           | .2949   | 82   | 38       | 3089  | 46   | 3217 |

|    |        |        |           |         |      |    |      |    |      |  |      |
|----|--------|--------|-----------|---------|------|----|------|----|------|--|------|
| 6  | 103.64 | 21.605 | 2270.4500 |         |      |    |      |    |      |  | 3147 |
| 7  | 103.63 | 21.604 | 2270.1600 | -.2949  | -82  | 38 | 3089 | 46 | 3053 |  | 3162 |
| 8  | 103.63 | 21.604 | 2270.1600 | .0000   | 00   | 38 | 3088 | 45 | 3134 |  | 3078 |
| 9  | 103.63 | 21.604 | 2270.1600 | .0000   | 00   | 38 | 3088 | 45 | 3134 |  | 3048 |
| 10 | 103.63 | 21.604 | 2270.1600 | .0000   | 00   | 38 | 3088 | 45 | 3134 |  | 3032 |
| 11 | 103.58 | 21.600 | 2268.9600 | -1.1990 | -333 | 38 | 3085 | 45 | 2797 |  | 3002 |
| 12 | 103.56 | 21.599 | 2268.6500 | -.3052  | -85  | 38 | 3081 | 44 | 3040 |  | 2957 |
| 13 | 103.53 | 21.597 | 2268.0500 | -.5977  | -166 | 38 | 3078 | 44 | 2956 |  | 2897 |
| 14 | 103.51 | 21.595 | 2267.4500 | -.6011  | -167 | 38 | 3075 | 43 | 2951 |  | 2864 |

| TIME | %FSC        | GAUGE PL. |           | DELTA    | NET    | GATES    | SPILL | MEAN  |        |
|------|-------------|-----------|-----------|----------|--------|----------|-------|-------|--------|
|      |             | READING   | CAPACITY  | CAPACITY | INFLOW |          |       | GROSS | INFLOW |
| hr   | %           | m         | 10^6 m3   | 10^6 m3  | m3/s   | no. m3/s | m3/s  | 1-HR  | 6-HR   |
|      |             |           |           |          |        |          |       | m3/s  | m3/s   |
| 14   | 103.51      | 21.595    | 2267.4500 |          |        |          |       |       | 2864   |
|      |             |           |           | -.9006   | -250   | 38       | 3071  | 43    | 2863   |
| 15   | 103.47      | 21.592    | 2266.5500 |          |        |          |       |       | 2816   |
|      |             |           |           | -1.1978  | -333   | 38       | 3065  | 42    | 2774   |
| 16   | 103.41      | 21.588    | 2265.3500 |          |        |          |       |       | 2823   |
|      |             |           |           | -1.8010  | -500   | 38       | 3057  | 41    | 2597   |
| 17   | 103.33      | 21.582    | 2263.5500 |          |        |          |       |       | 2775   |
|      |             |           |           | -1.1956  | -332   | 38       | 3048  | 40    | 2756   |
| 18   | 103.27      | 21.578    | 2262.3600 |          |        |          |       |       | 2712   |
|      |             |           |           | -.3040   | -84    | 38       | 3044  | 39    | 2999   |
| 19   | 103.26      | 21.577    | 2262.0500 |          |        |          |       |       | 2717   |
|      |             |           |           | -1.4927  | -415   | 38       | 3039  | 38    | 2663   |
| 20   | 103.19      | 21.572    | 2260.5600 |          |        |          |       |       | 2724   |
|      |             |           |           | -2.0937  | -582   | 38       | 3029  | 37    | 2485   |
| 21   | 103.10      | 21.565    | 2258.4700 |          |        |          |       |       | 2702   |
|      |             |           |           | -.9028   | -251   | 38       | 3021  | 36    | 2806   |
| 22   | 103.06      | 21.562    | 2257.5700 |          |        |          |       |       | 2722   |
|      |             |           |           | -1.4893  | -414   | 38       | 3015  | 35    | 2636   |
| 23   | 102.99      | 21.557    | 2256.0800 |          |        |          |       |       | 2771   |
|      |             |           |           | -1.4949  | -415   | 38       | 3006  | 34    | 2625   |
| 24   | 102.92      | 21.552    | 2254.5800 |          |        |          |       |       | 2834   |
|      | 20 / 2 / 75 |           |           | .2905    | 81     | 38       | 3003  | 33    | 3117   |
| 1    | 102.93      | 21.553    | 2254.8700 |          |        |          |       |       | 3012   |
|      |             |           |           | -.2905   | -81    | 38       | 3003  | 33    | 2956   |
| 2    | 102.92      | 21.552    | 2254.5800 |          |        |          |       |       | 3179   |
|      |             |           |           | -.5989   | -166   | 38       | 3001  | 33    | 2867   |
| 3    | 102.89      | 21.550    | 2253.9800 |          |        |          |       |       | 3336   |
|      |             |           |           | 2.9841   | 829    | 38       | 3007  | 34    | 3870   |
| 4    | 103.03      | 21.560    | 2256.9700 |          |        |          |       |       | 3413   |

| TIME | %FSC   | GAUGE PL. |           | DELTA    | NET    | GATES    | SPILL | MEAN  |        |
|------|--------|-----------|-----------|----------|--------|----------|-------|-------|--------|
|      |        | READING   | CAPACITY  | CAPACITY | INFLOW |          |       | GROSS | INFLOW |
| hr   | %      | m         | 10^6 m3   | 10^6 m3  | m3/s   | no. m3/s | m3/s  | 1-HR  | 6-HR   |
|      |        |           |           |          |        |          |       | m3/s  | m3/s   |
| 4    | 103.03 | 21.560    | 2256.9700 |          |        |          |       |       | 3413   |
|      |        |           |           | 2.0962   | 582    | 38       | 3021  | 36    | 3639   |

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|    |        |        |           |         |      |    |      |    |      |      |
|----|--------|--------|-----------|---------|------|----|------|----|------|------|
| 5  | 103.12 | 21.567 | 2259.0600 |         |      |    |      |    |      | 3561 |
|    |        |        |           | 1.7964  | 499  | 38 | 3032 | 37 | 3568 |      |
| 6  | 103.21 | 21.573 | 2260.8600 |         |      |    |      |    |      | 3601 |
|    |        |        |           | 1.7979  | 499  | 38 | 3042 | 39 | 3580 |      |
| 7  | 103.29 | 21.579 | 2262.6600 |         |      |    |      |    |      | 3487 |
|    |        |        |           | 2.6982  | 750  | 38 | 3054 | 40 | 3844 |      |
| 8  | 103.41 | 21.588 | 2265.3500 |         |      |    |      |    |      | 3412 |
|    |        |        |           | .0000   | 00   | 38 | 3062 | 42 | 3103 |      |
| 9  | 103.41 | 21.588 | 2265.3500 |         |      |    |      |    |      | 3335 |
|    |        |        |           | .3030   | 84   | 38 | 3062 | 42 | 3188 |      |
| 10 | 103.42 | 21.589 | 2265.6600 |         |      |    |      |    |      | 3299 |
|    |        |        |           | .2947   | 82   | 38 | 3064 | 42 | 3188 |      |
| 11 | 103.44 | 21.590 | 2265.9500 |         |      |    |      |    |      | 3177 |
|    |        |        |           | .0000   | 00   | 38 | 3065 | 42 | 3107 |      |
| 12 | 103.44 | 21.590 | 2265.9500 |         |      |    |      |    |      | 3190 |
|    |        |        |           | .9053   | 251  | 38 | 3067 | 42 | 3361 |      |
| 13 | 103.48 | 21.593 | 2266.8600 |         |      |    |      |    |      | 3061 |
|    |        |        |           | .0000   | 00   | 38 | 3070 | 43 | 3113 |      |
| 14 | 103.48 | 21.593 | 2266.8600 |         |      |    |      |    |      | 2997 |
|    |        |        |           | -.3052  | -85  | 40 | 3231 | 39 | 3185 |      |
| 15 | 103.47 | 21.592 | 2266.5300 |         |      |    |      |    |      | 2929 |
|    |        |        |           | -3.5942 | -998 | 42 | 3380 | 34 | 2415 |      |
| 16 | 103.30 | 21.580 | 2262.9600 |         |      |    |      |    |      | 2885 |
|    |        |        |           | -2.6951 | -749 | 44 | 3521 | 28 | 2800 |      |
| 17 | 103.18 | 21.571 | 2260.2600 |         |      |    |      |    |      | 2867 |
|    |        |        |           | -2.9954 | -832 | 44 | 3503 | 26 | 2697 |      |
| 18 | 103.04 | 21.561 | 2257.2700 |         |      |    |      |    |      | 2750 |

| TIME | hr          | GAGE   | PL.       | %FSC | READING | CAPACITY | DELTA   | NET  | GATES    | SPILL | MEAN |      |
|------|-------------|--------|-----------|------|---------|----------|---------|------|----------|-------|------|------|
|      |             |        |           |      |         |          |         |      |          |       | 1-HR | 6-HR |
|      |             |        |           |      |         | 10^6 m3  | 10^6 m3 | m3/s | no. m3/s | m3/s  | m3/s | m3/s |
| 18   | 103.04      | 21.561 | 2257.2700 |      |         |          |         |      |          |       |      | 2750 |
|      |             |        |           |      |         |          | -1.4949 | -415 | 44       | 3489  | 25   | 3098 |
| 19   | 102.97      | 21.556 | 2255.7700 |      |         |          |         |      |          |       |      | 2913 |
|      |             |        |           |      |         |          | -1.7910 | -498 | 44       | 3478  | 24   | 3005 |
| 20   | 102.89      | 21.550 | 2253.9800 |      |         |          |         |      |          |       |      | 2842 |
|      |             |        |           |      |         |          | -3.5896 | -997 | 44       | 3461  | 23   | 2487 |
| 21   | 102.73      | 21.538 | 2250.3900 |      |         |          |         |      |          |       |      | 2925 |
|      |             |        |           |      |         |          | -.2961  | -82  | 44       | 3449  | 22   | 3388 |
| 22   | 102.71      | 21.537 | 2250.1000 |      |         |          |         |      |          |       |      | 2799 |
|      |             |        |           |      |         |          | -3.8789 | **** | 44       | 3436  | 21   | 2379 |
| 23   | 102.54      | 21.524 | 2246.2200 |      |         |          |         |      |          |       |      | 2756 |
|      |             |        |           |      |         |          | -.8972  | -249 | 44       | 3421  | 19   | 3191 |
| 24   | 102.50      | 21.521 | 2245.3200 |      |         |          |         |      |          |       |      | 2781 |
|      | 21 / 2 / 75 |        |           |      |         |          | -3.8777 | **** | 44       | 3406  | 18   | 2347 |
| 1    | 102.32      | 21.508 | 2241.4400 |      |         |          |         |      |          |       |      | 2626 |
|      |             |        |           |      |         |          | -2.3796 | -661 | 44       | 3386  | 17   | 2742 |
| 2    | 102.21      | 21.500 | 2239.0600 |      |         |          |         |      |          |       |      | 2677 |
|      |             |        |           |      |         |          | -2.6812 | -745 | 44       | 3371  | 15   | 2641 |
| 3    | 102.09      | 21.491 | 2236.3800 |      |         |          |         |      |          |       |      | 2549 |
|      |             |        |           |      |         |          | -3.2722 | -909 | 44       | 3352  | 14   | 2457 |
| 4    | 101.94      | 21.480 | 2233.1100 |      |         |          |         |      |          |       |      | 2558 |
|      |             |        |           |      |         |          | -2.3772 | -660 | 44       | 3335  | 13   | 2687 |
| 5    | 101.83      | 21.472 | 2230.7300 |      |         |          |         |      |          |       |      | 2540 |
|      |             |        |           |      |         |          |         |      |          |       |      |      |
|      |             |        |           |      |         |          | -3.2686 | -908 | 44       | 3317  | 11   | 2421 |
| 6    | 101.68      | 21.461 | 2227.4600 |      |         |          |         |      |          |       |      | 2549 |
|      |             |        |           |      |         |          | -3.2632 | -906 | 44       | 3297  | 10   | 2401 |
| 7    | 101.53      | 21.450 | 2224.2000 |      |         |          |         |      |          |       |      | 2601 |

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