# TABLE B1: Theoretical Calculation of East Quarry Leachate Concentration

| Parameter | Waste Stream | Mass from Bulk Analysis (avg) (mg/kg) | Mass of Waste Stream in West Quarry (kg) | Total mass of parameter (mg) | % of mass of parameter (%) | Concentration in West Quarry Landfill Leachate During Recirculation (min) | (average) | (max) | Recalculated Range in East Quarry leachate concentration (min) | (average) | (max) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ammonia** | | | | | | | | | | | |
| | AMW | 38 | 1532881 | 58249478 | 3 | 23 | – | 213 | 3 | – | 31 |
| | BOF | 135 | 815766 | 110128410 | 7 | | | | | | |
| | CONS | 69 | 1071819 | 73955511 | 4 | | 162 | | | 23 | |
| | Al Proc. | 8270 | 173659 | 1436159930 | 86 | | | | | | |
| | | | | 1678493329 | | | | | | | |
| **Chloride** | | | | | | | | | | | |
| | AMW | 185 | 1532881 | 283582985 | 0 | 2210 | – | 10400 | 34 | – | 161 |
| | BOF | 188 | 815766 | 153364008 | 0 | | | | | | |
| | CONS | 740 | 1071819 | 793146060 | 1 | | 7508 | | | 116 | |
| | Al Proc. | 450000 | 173659 | 78146550000 | 98.5 | | | | | | |
| | | | | 79376643053 | | | | | | | |
| **TKN** | | | | | | | | | | | |
| | AMW | 540 | 1532881 | 827755740 | 22 | 102 | – | 221 | 51 | – | 110 |
| | BOF | 405 | 815766 | 330385230 | 9 | | | | | | |
| | CONS | 650 | 1071819 | 696682350 | 19 | | 174 | | | 87 | |
| | Al Proc. | 10800 | 173659 | 1875517200 | 50 | | | | | | |
| | | | | 3730340520 | | | | | | | |
| **Sodium** | | | | | | | | | | | |
| | AMW | 2510 | 1532881 | 3847531310 | 8 | 1320 | – | 6050 | 161 | – | 739 |
| | BOF | 1338 | 815766 | 1091494908 | 2 | | | | | | |
| | CONS | 892 | 1071819 | 956062548 | 2 | | 5154 | | | 629 | |
| | Al Proc. | 244000 | 173659 | 42372796000 | 88 | | | | | | |
| | | | | 48267884766 | | | | | | | |
| **Fluoride** | | | | | | | | | | | |
| | AMW | 14 | 1532881 | 21460334 | 33 | 1.2 | – | 2.7 | 0.6 | – | 1.5 |
| | BOF | 9 | 815766 | 7341894 | 11 | | | | | | |
| | CONS | 5.5 | 1071819 | 5895004.5 | 9 | | 1.85 | | | 1.0 | |
| | Al Proc. | 170 | 173659 | 29522030 | 46 | | | | | | |
| | | | | 64219262.5 | | | | | | | |
| **Aluminum** | | | | | | | | | | | |
| | AMW | 31266 | 1532881 | 47927057346 | 65 | 0 | – | 0.5 | 0.0 | – | 0.4 |
| | BOF | 1547 | 815766 | 1261990002 | 2 | | | | | | |
| | CONS | 9398 | 1071819 | 10072954962 | 14 | | 0.11 | | | 0.1 | |
| | Al Proc. | 83100 | 173659 | 14431062900 | 20 | | | | | | |
| | | | | 73693065210 | | | | | | | |
| **Copper** | | | | | | | | | | | |
| | AMW | 723 | 1532881 | 1108272963 | 63 | 0 | – | 0.01 | 0 | – | 0.01 |
| | BOF | 117 | 815766 | 95444622 | 5 | | | | | | |
| | CONS | 101 | 1071819 | 108253719 | 6 | | 0.0006 | | | 0.0004 | |
| | Al Proc. | 2620 | 173659 | 454986580 | 26 | | | | | | |
| | | | | 1766957884 | | | | | | | |
| **Chromium** | | | | | | | | | | | |
| | AMW | 78.00 | 1532881 | 119564718 | 50 | 0 | – | 0 | 0 | – | 0 |
| | BOF | 57 | 815766 | 46498662 | 19 | | | | | | |
| | CONS | 44 | 1071819 | 47160036 | 20 | | 0 | | | 0 | |
| | Al Proc. | 160 | 173659 | 27785440 | 12 | | | | | | |
| | | | | 241008856 | | | | | | | |
| **Titanium** | | | | | | | | | | | |
| | AMW | 590 | 1532881 | 904399790 | 70 | 0 | – | 0.013 | 0.00 | – | 0.012 |
| | BOF | 28 | 815766 | 22841448 | 2 | | | | | | |
| | CONS | 202 | 1071819 | 216507438 | 17 | | 0.002 | | | 0.002 | |
| | Al Proc. | 801 | 173659 | 139100859 | 11 | | | | | | |
| | | | | 1282849535 | | | | | | | |

AMW – approved mixed waste
BOF – basic oxygen furnace oxides
CONS – contaminated soils
Al. proc. – aluminum processing waste

Output from PHREEQE modelling of predicted East Quarry
Landfill Leachate

```
ELEMENTS
SPECIES
LOOK MIN
Taro - predicted leachate
0030011000 1 1          .00000
SOLUTION 1
33-II - Recirculation leachate minum aluminum processing waste effects
34 10 2     11.3     -1.00      10.0      1.00
   4  0.000D+00   5  0.000D+00   6  0.000D+00   7  0.000D+00   8  1.250D+00
   9  8.300D+00  10  3.897D+03  11  1.550D+03  12  0.000D+00  13  8.000D+03
  14  0.000D+00  15  0.000D+00  16  1.500D+00  17  0.000D+00  18  0.000D+00
  19  5.300D+02  20  0.000D+00  21  0.000D+00  22  0.000D+00  23  8.683D+02
  24  3.960D+03  25  0.000D+00  26  0.000D+00  27  0.000D+00  28  0.000D+00
  29  1.200D+02  30  6.101D+01  31  5.220D+00  32  0.000D+00  33  0.000D+00
  34  0.000D+00  35  0.000D+00  36  0.000D+00  37  0.000D+00
REACTION
  23  -1.000   4.000
STEPS
  .900E-02
SOLUTION NUMBER 1          33-II
```

TOTAL MOLALITIES OF ELEMENTS

| ELEMENT | MOLALITY | LOG MOLALITY |
|---|---|---|
| BA | 9.277802D-06 | -5.0326 |
| BR | 1.058868D-04 | -3.9752 |
| TOT ALK | 6.619775D-02 | -1.1792 |
| CA | 3.942177D-02 | -1.4043 |
| CL | 2.300219D-01 | -.6382 |
| F | 8.048341D-05 | -4.0943 |
| K | 1.381685D-02 | -1.8596 |
| N | 1.427499D-02 | -1.8454 |
| NA | 1.755869D-01 | -.7555 |
| S | 1.273396D-03 | -2.8950 |
| SI | 6.470528D-04 | -3.1891 |
| SR | 6.072945D-05 | -4.2166 |

----DESCRIPTION OF SOLUTION----

```
                PH =  11.3000
                PE =  -1.0000
      ACTIVITY H2O =    .9917
    IONIC STRENGTH =    .2782
       TEMPERATURE =  10.0000
ELECTRICAL BALANCE =  -1.6415D-02
              THOR =  -9.9046D+00
  TOTAL ALKALINITY =   6.6198D-02
        ITERATIONS =   9
      TOTAL CARBON =   3.2655D-02
```

## DISTRIBUTION OF SPECIES

| I | SPECIES | Z | MOLALITY | LOG MOLALITY | ACTIVITY | LOG ACTIVITY | GAMMA | LOG GAMMA |
|---|---|---|---|---|---|---|---|---|
| 1 | H+ | 1.0 | 6.77043D-12 | -11.1694 | 5.01187D-12 | -11.3000 | 7.40259D-01 | -.1306 |
| 2 | E- | -1.0 | 1.00000D+01 | 1.0000 | 1.00000D+01 | 1.0000 | 1.00000D+00 | .0000 |
| 3 | H2O | .0 | 9.91749D-01 | -.0036 | 9.91749D-01 | -.0036 | 1.00000D+00 | .0000 |
| 8 | BA 2+ | 2.0 | 9.26934D-06 | -5.0330 | 2.78346D-06 | -5.5554 | 3.00286D-01 | -.5225 |
| 9 | BR- | -1.0 | 1.05887D-04 | -3.9752 | 7.83837D-05 | -4.1058 | 7.40259D-01 | -.1306 |
| 10 | CO3 2- | -2.0 | 9.11420D-03 | -2.0403 | 2.73687D-03 | -2.5627 | 3.00286D-01 | -.5225 |
| 11 | CA 2+ | 2.0 | 2.00041D-02 | -1.6989 | 6.74991D-03 | -2.1707 | 3.37427D-01 | -.4718 |
| 13 | CL- | -1.0 | 2.30022D-01 | -.6382 | 1.55753D-01 | -.8076 | 6.77123D-01 | -.1693 |
| 16 | F- | -1.0 | 7.62140D-05 | -4.1180 | 5.64181D-05 | -4.2486 | 7.40259D-01 | -.1306 |
| 19 | K+ | 1.0 | 1.38036D-02 | -1.8600 | 9.34672D-03 | -2.0293 | 6.77123D-01 | -.1693 |
| 23 | NO3 - | -1.0 | 6.34656D-24 | -23.1975 | 4.69810D-24 | -23.3281 | 7.40259D-01 | -.1306 |
| 24 | NA+ | 1.0 | 1.71531D-01 | -.7657 | 1.25715D-01 | -.9006 | 7.32902D-01 | -.1350 |
| 29 | SO4 2- | -2.0 | 8.49319D-04 | -3.0709 | 1.97092D-04 | -3.7053 | 2.32059D-01 | -.6344 |
| 30 | H4SIO4 | .0 | 3.61338D-05 | -4.4421 | 3.85242D-05 | -4.4143 | 1.06615D+00 | .0278 |
| 31 | SR 2+ | 2.0 | 6.06410D-05 | -4.2172 | 1.82097D-05 | -4.7397 | 3.00286D-01 | -.5225 |
| 55 | NH4 + | 1.0 | 1.42388D-02 | -1.8465 | 1.05404D-02 | -1.9771 | 7.40259D-01 | -.1306 |
| 56 | NO2 - | -1.0 | 2.98736D-14 | -13.5247 | 2.21142D-14 | -13.6553 | 7.40259D-01 | -.1306 |
| 58 | SO3 2- | -2.0 | 4.82320D-28 | -27.3167 | 1.44834D-28 | -27.8391 | 3.00286D-01 | -.5225 |
| 65 | OH- | -1.0 | 8.14416D-04 | -3.0892 | 6.02879D-04 | -3.2198 | 7.40259D-01 | -.1306 |
| 66 | H3SIO4 - | -1.0 | 5.34115D-04 | -3.2724 | 3.95384D-04 | -3.4030 | 7.40259D-01 | -.1306 |
| 67 | H2SIO4-- | -2.0 | 7.68038D-05 | -4.1146 | 2.30631D-05 | -4.6371 | 3.00286D-01 | -.5225 |
| 75 | NH4SO4 - | -1.0 | 3.61523D-05 | -4.4419 | 2.67621D-05 | -4.5725 | 7.40259D-01 | -.1306 |
| 84 | CAOH + | 1.0 | 1.24148D-04 | -3.9061 | 9.19014D-05 | -4.0367 | 7.40259D-01 | -.1306 |
| 85 | CAHCO3 + | 1.0 | 2.52100D-05 | -4.5984 | 1.86619D-05 | -4.7290 | 7.40259D-01 | -.1306 |
| 86 | CACO3 AQ | .0 | 1.90423D-02 | -1.7203 | 2.03020D-02 | -1.6925 | 1.06615D+00 | .0278 |
| 87 | CASO4 AQ | .0 | 2.22879D-04 | -3.6519 | 2.37623D-04 | -3.6241 | 1.06615D+00 | .0278 |
| 91 | CAF + | 1.0 | 3.19051D-06 | -5.4961 | 2.36181D-06 | -5.6268 | 7.40259D-01 | -.1306 |
| 92 | NACO3 - | -1.0 | 3.88378D-03 | -2.4107 | 2.87500D-03 | -2.5414 | 7.40259D-01 | -.1306 |
| 93 | NAHCO3 A | .0 | 1.94457D-05 | -4.7112 | 2.07320D-05 | -4.6834 | 1.06615D+00 | .0278 |
| 94 | NASO4 - | -1.0 | 1.51770D-04 | -3.8188 | 1.12349D-04 | -3.9494 | 7.40259D-01 | -.1306 |
| 96 | NAF AQ | .0 | 1.07892D-06 | -5.9670 | 1.15029D-06 | -5.9392 | 1.06615D+00 | .0278 |
| 97 | KSO4 - | -1.0 | 1.32763D-05 | -4.8769 | 9.82791D-06 | -5.0075 | 7.40259D-01 | -.1306 |
| 134 | SROH + | 1.0 | 8.84088D-08 | -7.0535 | 6.54454D-08 | -7.1841 | 7.40259D-01 | -.1306 |
| 135 | BAOH + | 1.0 | 8.46215D-09 | -8.0725 | 6.26419D-09 | -8.2031 | 7.40259D-01 | -.1306 |
| 272 | HCO3 - | -1.0 | 5.70487D-04 | -3.2438 | 4.22308D-04 | -3.3744 | 7.40259D-01 | -.1306 |
| 273 | H2CO3 AQ | .0 | 5.75806D-09 | -8.2397 | 6.13898D-09 | -8.2119 | 1.06615D+00 | .0278 |
| 274 | HSO4 - | -1.0 | 8.63444D-14 | -13.0638 | 6.39172D-14 | -13.1944 | 7.40259D-01 | -.1306 |
| 275 | HF AQ | .0 | 2.87244D-13 | -12.5417 | 3.06246D-13 | -12.5139 | 1.06615D+00 | .0278 |
| 276 | HF2 - | -1.0 | 8.04974D-17 | -16.0942 | 5.95889D-17 | -16.2248 | 7.40259D-01 | -.1306 |
| 277 | H2F2 AQ | .0 | 4.39559D-25 | -24.3570 | 4.68638D-25 | -24.3292 | 1.06615D+00 | .0278 |

---- LOOK MIN IAP ----

| PHASE | LOG IAP | LOG KT | LOG IAP/KT |
|---|---|---|---|
| ANHYDRIT | -5.8760 | -4.4936 | -1.3824 |
| ARAGONIT | -4.7334 | -8.2107 | 3.4773 |
| BAF2 | -14.0526 | -5.7988 | -8.2537 |
| BARITE | -9.2607 | -10.2238 | .9631 |
| CALCITE | -4.7334 | -8.4064 | 3.6730 |
| CELESTIT | -8.4450 | -6.4518 | -1.9933 |
| CHALCEDO | -4.4071 | -3.6990 | -.7081 |
| CRISTOBA | -4.4071 | -3.8036 | -.6035 |
| FLUORITE | -10.6679 | -11.1429 | .4750 |
| GYPSUM | -5.8832 | -4.8601 | -1.0231 |
| HALITE | -1.7082 | 1.5443 | -3.2525 |
| MAGADIIT | -20.4681 | -14.3000 | -6.1681 |
| MIRABILI | -5.5425 | -1.8474 | -3.6952 |
| NATRON | -4.4000 | -1.9212 | -2.4788 |
| QUARTZ | -4.4071 | -4.2515 | -.1556 |
| SIO2(A,G | -4.4071 | -2.8523 | -1.5548 |
| SIO2(A,P | -4.4071 | -2.8523 | -1.5548 |
| SRF2 | -13.2369 | -8.5885 | -4.6483 |
| STRONTIA | -7.3024 | -9.2232 | 1.9208 |
| THENARDI | -5.5066 | -.1579 | -5.3487 |
| THERMONA | -4.3676 | .2387 | -4.6063 |
| WITHERIT | -8.1182 | -8.6040 | .4858 |
| SULFUR | -88.0909 | -37.9421 | -50.1488 |
| LIME | 20.4257 | 34.5962 | -14.1705 |
| PORTLAND | 20.4221 | 23.8617 | -3.4396 |
| WOLLASTO | 16.0186 | 13.7572 | 2.2615 |
| P-WOLLST | 16.0186 | 14.6681 | 1.3505 |
| CA-OLIVI | 36.4443 | 39.7736 | -3.3292 |
| LARNITE | 36.4443 | 41.3626 | -4.9182 |
| CA3SIO5 | 56.8700 | 77.9987 | -21.1287 |
| NA2SO3 | -26.1030 | 5.0649 | -31.1679 |
| K2SO3 | -28.3604 | 8.2946 | -36.6551 |
| CASO3.2H | -26.4796 | -3.5984 | -22.8812 |
| CASO3.5H | -26.4742 | -3.1245 | -23.3498 |
| BASO3 | -29.8571 | -5.5408 | -24.3163 |
| CH4(GAS) | -107.5520 | -43.4486 | -64.1034 |
| CO2(GAS) | -25.1591 | -18.1806 | -6.9786 |
| O2(GAS) | 41.1928 | 88.4252 | -47.2324 |

STEP NUMBER 1
--------------

9.000D-03 MOLES OF REACTION HAVE BEEN ADDED.

REACTION IS:

-1.00 MOLES OF N        VALENCE = 4.000

TOTAL MOLALITIES OF ELEMENTS

| ELEMENT | MOLALITY | LOG MOLALITY |
|---|---|---|
| BA | 9.277802D-06 | -5.0326 |
| BR | 1.058868D-04 | -3.9752 |
| TOT ALK | 3.265549D-02 | -1.4860 |
| CA | 3.942177D-02 | -1.4043 |
| CL | 2.300219D-01 | -.6382 |
| F | 8.048341D-05 | -4.0943 |
| K | 1.381685D-02 | -1.8596 |
| N | 5.274993D-03 | -2.2778 |
| NA | 1.755869D-01 | -.7555 |
| S | 1.273396D-03 | -2.8950 |
| SI | 6.470528D-04 | -3.1891 |
| SR | 6.072945D-05 | -4.2166 |

---- LOOK MIN IAP ----

| PHASE | LOG IAP | LOG KT | LOG IAP/KT |
|---|---|---|---|
| ANHYDRIT | -5.8130 | -4.4936 | -1.3194 |
| ARAGONIT | -4.8268 | -8.2107 | 3.3839 |
| BAF2 | -14.0579 | -5.7988 | -8.2591 |
| BARITE | -9.2654 | -10.2238 | .9584 |
| CALCITE | -4.8268 | -8.4064 | 3.5796 |
| CELESTIT | -8.4495 | -6.4518 | -1.9977 |
| CHALCEDO | -3.4008 | -3.6990 | .2982 |
| CRISTOBA | -3.4008 | -3.8036 | .4028 |
| FLUORITE | -10.6055 | -11.1429 | .5373 |
| GYPSUM | -5.8202 | -4.8601 | -.9601 |
| HALITE | -1.7056 | 1.5443 | -3.2499 |
| MAGADIIT | -14.7110 | -14.3000 | -.4110 |
| MIRABILI | -5.5424 | -1.8474 | -3.6951 |
| NATRON | -4.5562 | -1.9212 | -2.6350 |
| QUARTZ | -3.4008 | -4.2515 | .8507 |
| SIO2(A,G | -3.4008 | -2.8523 | -.5485 |
| SIO2(A,P | -3.4008 | -2.8523 | -.5485 |
| SRF2 | -13.2420 | -8.5885 | -4.6535 |
| STRONTIA | -7.4632 | -9.2232 | 1.7600 |
| THENARDI | -5.5068 | -.1579 | -5.3490 |
| THERMONA | -4.5241 | .2387 | -4.7629 |
| WITHERIT | -8.2792 | -8.6040 | .3248 |
| SULFUR | -77.7806 | -37.9421 | -39.8385 |
| LIME | 17.9150 | 34.5962 | -16.6812 |
| PORTLAND | 17.9114 | 23.8617 | -5.9502 |
| WOLLASTO | 14.5142 | 13.7572 | .7570 |
| P-WOLLST | 14.5142 | 14.6681 | -.1539 |
| CA-OLIVI | 32.4292 | 39.7736 | -7.3444 |
| LARNITE | 32.4292 | 41.3626 | -8.9334 |
| CA3SIO5 | 50.3442 | 77.9987 | -27.6545 |
| NA2SO3 | -23.5244 | 5.0649 | -28.5893 |
| K2SO3 | -25.7865 | 8.2946 | -34.0812 |
| CASO3.2H | -23.8377 | -3.5984 | -20.2393 |
| CASO3.5H | -23.8323 | -3.1245 | -20.7079 |
| BASO3 | -27.2830 | -5.5408 | -21.7421 |
| CH4(GAS) | -94.8190 | -43.4486 | -51.3704 |
| CO2(GAS) | -22.7418 | -18.1806 | -4.5612 |
| O2(GAS) | 36.0351 | 88.4252 | -52.3901 |

## TOTAL MOLALITIES OF ELEMENTS

| ELEMENT | MOLALITY | LOG MOLALITY |
|---|---|---|
| BA | 9.277802D-06 | -5.0326 |
| BR | 1.058868D-04 | -3.9752 |
| C | 3.265549D-02 | -1.4860 |
| CA | 3.942177D-02 | -1.4043 |
| CL | 2.300219D-01 | -.6382 |
| F | 8.048341D-05 | -4.0943 |
| K | 1.381685D-02 | -1.8596 |
| N | 5.274993D-03 | -2.2778 |
| NA | 1.755869D-01 | -.7555 |
| S | 1.273396D-03 | -2.8950 |
| SI | 6.470528D-04 | -3.1891 |
| SR | 6.072945D-05 | -4.2166 |

## ----DESCRIPTION OF SOLUTION----

| | |
|---|---|
| PH = | 10.0105 |
| PE = | -1.0000 |
| ACTIVITY H2O = | .9918 |
| IONIC STRENGTH = | .2777 |
| TEMPERATURE = | 10.0000 |
| ELECTRICAL BALANCE = | -1.6415D-02 |
| THOR = | -9.8776D+00 |
| TOTAL ALKALINITY = | 5.7315D-02 |
| ITERATIONS = | 18 |

## DISTRIBUTION OF SPECIES

| I | SPECIES | Z | MOLALITY | LOG MOLALITY | ACTIVITY | LOG ACTIVITY | GAMMA | LOG GAMMA |
|---|---|---|---|---|---|---|---|---|
| 1 | H+ | 1.0 | 1.31839D-10 | -9.8800 | 9.76016D-11 | -10.0105 | 7.40306D-01 | -.1306 |
| 2 | E- | -1.0 | 1.00000D+01 | 1.0000 | 1.00000D+01 | 1.0000 | 1.00000D+00 | .0000 |
| 3 | H2O | .0 | 9.91843D-01 | -.0036 | 9.91843D-01 | -.0036 | 1.00000D+00 | .0000 |
| 8 | BA 2+ | 2.0 | 9.27737D-06 | -5.0326 | 2.78657D-06 | -5.5549 | 3.00362D-01 | -.5224 |
| 9 | BR- | -1.0 | 1.05887D-04 | -3.9752 | 7.83886D-05 | -4.1057 | 7.40306D-01 | -.1306 |
| 10 | CO3 2- | -2.0 | 6.28218D-03 | -2.2019 | 1.88693D-03 | -2.7242 | 3.00362D-01 | -.5224 |
| 11 | CA 2+ | 2.0 | 2.33954D-02 | -1.6309 | 7.89698D-03 | -2.1025 | 3.37544D-01 | -.4717 |
| 13 | CL- | -1.0 | 2.30022D-01 | -.6382 | 1.55788D-01 | -.8075 | 6.77277D-01 | -.1692 |
| 16 | F- | -1.0 | 7.56981D-05 | -4.1209 | 5.60398D-05 | -4.2515 | 7.40306D-01 | -.1306 |
| 19 | K+ | 1.0 | 1.38037D-02 | -1.8600 | 9.34894D-03 | -2.0292 | 6.77277D-01 | -.1692 |
| 23 | NO3 - | -1.0 | 2.99056D-37 | -36.5242 | 2.21393D-37 | -36.6548 | 7.40306D-01 | -.1306 |
| 24 | NA+ | 1.0 | 1.72480D-01 | -.7633 | 1.26425D-01 | -.8982 | 7.32982D-01 | -.1349 |
| 29 | SO4 2- | -2.0 | 8.38564D-04 | -3.0765 | 1.94759D-04 | -3.7105 | 2.32253D-01 | -.6340 |
| 30 | H4SIO4 | .0 | 3.66705D-04 | -3.4357 | 3.90917D-04 | -3.4079 | 1.06603D+00 | .0278 |
| 31 | SR 2+ | 2.0 | 6.07249D-05 | -4.2166 | 1.82395D-05 | -4.7390 | 3.00362D-01 | -.5224 |
| 55 | NH4 + | 1.0 | 5.26179D-03 | -2.2789 | 3.89534D-03 | -2.4095 | 7.40306D-01 | -.1306 |
| 56 | NO2 - | -1.0 | 5.33795D-25 | -24.2726 | 3.95172D-25 | -24.4032 | 7.40306D-01 | -.1306 |
| 58 | SO3 2- | -2.0 | 1.80687D-25 | -24.7431 | 5.42716D-26 | -25.2654 | 3.00362D-01 | -.5224 |
| 65 | OH- | -1.0 | 4.18218D-05 | -4.3786 | 3.09610D-05 | -4.5092 | 7.40306D-01 | -.1306 |
| 66 | H3SIO4 - | -1.0 | 2.78293D-04 | -3.5555 | 2.06022D-04 | -3.6861 | 7.40306D-01 | -.1306 |
| 67 | H2SIO4-- | -2.0 | 2.05452D-06 | -5.6873 | 6.17101D-07 | -6.2096 | 3.00362D-01 | -.5224 |
| 75 | NH4SO4 - | -1.0 | 1.32015D-05 | -4.8794 | 9.77319D-06 | -5.0100 | 7.40306D-01 | -.1306 |
| 84 | CAOH + | 1.0 | 7.45861D-06 | -5.1273 | 5.52166D-06 | -5.2579 | 7.40306D-01 | -.1306 |
| 85 | CAHCO3 + | 1.0 | 3.95974D-04 | -3.4023 | 2.93142D-04 | -3.5329 | 7.40306D-01 | -.1306 |
| 86 | CACO3 AQ | .0 | 1.53616D-02 | -1.8136 | 1.63758D-02 | -1.7858 | 1.06603D+00 | .0278 |
| 87 | CASO4 AQ | .0 | 2.57699D-04 | -3.5889 | 2.74714D-04 | -3.5611 | 1.06603D+00 | .0278 |
| 91 | CAF + | 1.0 | 3.70744D-06 | -5.4309 | 2.74464D-06 | -5.5615 | 7.40306D-01 | -.1306 |
| 92 | NACO3 - | -1.0 | 2.69260D-03 | -2.5698 | 1.99335D-03 | -2.7004 | 7.40306D-01 | -.1306 |
| 93 | NAHCO3 A | .0 | 2.62589D-04 | -3.5807 | 2.79927D-04 | -3.5530 | 1.06603D+00 | .0278 |
| 94 | NASO4 - | -1.0 | 1.50810D-04 | -3.8216 | 1.11646D-04 | -3.9522 | 7.40306D-01 | -.1306 |
| 96 | NAF AQ | .0 | 1.07785D-06 | -5.9674 | 1.14902D-06 | -5.9397 | 1.06603D+00 | .0278 |
| 97 | KSO4 - | -1.0 | 1.31215D-05 | -4.8820 | 9.71390D-06 | -5.0126 | 7.40306D-01 | -.1306 |
| 134 | SROH + | 1.0 | 4.54739D-09 | -8.3422 | 3.36646D-09 | -8.4728 | 7.40306D-01 | -.1306 |
| 135 | BAOH + | 1.0 | 4.35034D-10 | -9.3615 | 3.22059D-10 | -9.4921 | 7.40306D-01 | -.1306 |
| 272 | HCO3 - | -1.0 | 7.65909D-03 | -2.1158 | 5.67007D-03 | -2.2464 | 7.40306D-01 | -.1306 |
| 273 | H2CO3 AQ | .0 | 1.50572D-06 | -5.8223 | 1.60513D-06 | -5.7945 | 1.06603D+00 | .0278 |
| 274 | HSO4 - | -1.0 | 1.66147D-12 | -11.7795 | 1.23000D-12 | -11.9101 | 7.40306D-01 | -.1306 |
| 275 | HF AQ | .0 | 5.55696D-12 | -11.2552 | 5.92387D-12 | -11.2274 | 1.06603D+00 | .0278 |
| 276 | HF2 - | -1.0 | 1.54656D-15 | -14.8106 | 1.14493D-15 | -14.9412 | 7.40306D-01 | -.1306 |
| 277 | H2F2 AQ | .0 | 1.64490D-22 | -21.7839 | 1.75350D-22 | -21.7561 | 1.06603D+00 | .0278 |
| 353 | HSO3- | -1.0 | 1.05905D-28 | -27.9751 | 7.84023D-29 | -28.1057 | 7.40306D-01 | -.1306 |

```
0030011000 1 2          .00000
REACTION
  13  -1.000  -1.000  24  -1.000   1.000
STEPS
  .130
STEP NUMBER  1
--------------
```

1.300D-01 MOLES OF REACTION HAVE BEEN ADDED.

REACTION IS:

-1.00 MOLES OF CL    VALENCE =  -1.000
-1.00 MOLES OF NA    VALENCE =   1.000

TOTAL MOLALITIES OF ELEMENTS

| ELEMENT | MOLALITY | LOG MOLALITY |
|---|---|---|
| BA | 9.277802D-06 | -5.0326 |
| BR | 1.058868D-04 | -3.9752 |
| C | 3.265549D-02 | -1.4860 |
| CA | 3.942177D-02 | -1.4043 |
| CL | 1.000219D-01 | -.9999 |
| F | 8.048341D-05 | -4.0943 |
| K | 1.381685D-02 | -1.8596 |
| N | 5.274993D-03 | -2.2778 |
| NA | 4.558691D-02 | -1.3412 |
| S | 1.273396D-03 | -2.8950 |
| SI | 6.470528D-04 | -3.1891 |
| SR | 6.072945D-05 | -4.2166 |

---- LOOK MIN IAP ----

| PHASE | LOG IAP | LOG KT | LOG IAP/KT |
|---|---|---|---|
| ANHYDRIT | -5.6811 | -4.4936 | -1.1875 |
| ARAGONIT | -4.7791 | -8.2107 | 3.4316 |
| BAF2 | -13.9593 | -5.7988 | -8.1604 |
| BARITE | -9.0866 | -10.2238 | 1.1373 |
| CALCITE | -4.7791 | -8.4064 | 3.6274 |
| CELESTIT | -8.2707 | -6.4518 | -1.8189 |
| CHALCEDO | -3.4098 | -3.6990 | .2892 |
| CRISTOBA | -3.4098 | -3.8036 | .3938 |
| FLUORITE | -10.5538 | -11.1429 | .5891 |
| GYPSUM | -5.6843 | -4.8601 | -.8242 |
| HALITE | -2.6002 | 1.5443 | -4.1445 |
| MAGADIIT | -15.3219 | -14.3000 | -1.0219 |
| MIRABILI | -6.5393 | -1.8474 | -4.6919 |
| NATRON | -5.6373 | -1.9212 | -3.7161 |
| QUARTZ | -3.4098 | -4.2515 | .8417 |
| SIO2(A,G | -3.4098 | -2.8523 | -.5575 |
| SIO2(A,P | -3.4098 | -2.8523 | -.5575 |
| SRF2 | -13.1433 | -8.5885 | -4.5548 |
| STRONTIA | -7.3686 | -9.2232 | 1.8546 |
| THENARDI | -6.5230 | -.1579 | -6.3651 |
| THERMONA | -5.6226 | .2387 | -5.8614 |
| WITHERIT | -8.1846 | -8.6040 | .4194 |
| SULFUR | -77.7461 | -37.9421 | -39.8040 |

------LOOK MIN IAP Cont'd-----

| PHASE | LOG IAP | LOG KT | LOG IAP/KT |
|---|---|---|---|
| LIME | 17.9500 | 34.5962 | -16.6462 |
| PORTLAND | 17.9484 | 23.8617 | -5.9132 |
| WOLLASTO | 14.5402 | 13.7572 | .7831 |
| P-WOLLST | 14.5402 | 14.6681 | -.1279 |
| CA-OLIVI | 32.4903 | 39.7736 | -7.2833 |
| LARNITE | 32.4903 | 41.3626 | -8.8723 |
| CA3SIO5 | 50.4403 | 77.9987 | -27.5584 |
| NA2SO3 | -24.5613 | 5.0649 | -29.6263 |
| K2SO3 | -25.6219 | 8.2946 | -33.9165 |
| CASO3.2H | -23.7226 | -3.5984 | -20.1242 |
| CASO3.5H | -23.7202 | -3.1245 | -20.5957 |
| BASO3 | -27.1249 | -5.5408 | -21.5841 |
| CH4(GAS) | -94.8856 | -43.4486 | -51.4371 |
| CO2(GAS) | -22.7291 | -18.1806 | -4.5485 |
| O2(GAS) | 36.0766 | 88.4252 | -52.3486 |

TOTAL MOLALITIES OF ELEMENTS
----------------------------

| ELEMENT | MOLALITY | LOG MOLALITY |
|---|---|---|
| BA | 9.277802D-06 | -5.0326 |
| BR | 1.058868D-04 | -3.9752 |
| C | 3.265549D-02 | -1.4860 |
| CA | 3.942177D-02 | -1.4043 |
| CL | 1.000219D-01 | -.9999 |
| F | 8.048341D-05 | -4.0943 |
| K | 1.381685D-02 | -1.8596 |
| N | 5.274993D-03 | -2.2778 |
| NA | 4.558691D-02 | -1.3412 |
| S | 1.273396D-03 | -2.8950 |
| SI | 6.470528D-04 | -3.1891 |
| SR | 6.072945D-05 | -4.2166 |

----DESCRIPTION OF SOLUTION----

PH = 10.0200
PE = -1.0000
ACTIVITY H2O = .9963
IONIC STRENGTH = .1422
TEMPERATURE = 10.0000
ELECTRICAL BALANCE = -1.6415D-02
THOR = -9.8776D+00
TOTAL ALKALINITY = 5.7314D-02
ITERATIONS = 18

## DISTRIBUTION OF SPECIES

| I | SPECIES | Z | MOLALITY | LOG MOLALITY | ACTIVITY | LOG ACTIVITY | GAMMA | LOG GAMMA |
|---|---|---|---|---|---|---|---|---|
| 1 | H+ | 1.0 | 1.24547D-10 | -9.9047 | 9.55057D-11 | -10.0200 | 7.66826D-01 | -.1153 |
| 2 | E- | -1.0 | 1.00000D+01 | 1.0000 | 1.00000D+01 | 1.0000 | 1.00000D+00 | .0000 |
| 3 | H2O | .0 | 9.96267D-01 | -.0016 | 9.96267D-01 | -.0016 | 1.00000D+00 | .0000 |
| 8 | BA 2+ | 2.0 | 9.27731D-06 | -5.0326 | 3.20781D-06 | -5.4938 | 3.45769D-01 | -.4612 |
| 9 | BR- | -1.0 | 1.05887D-04 | -3.9752 | 8.11967D-05 | -4.0905 | 7.66826D-01 | -.1153 |
| 10 | CO3 2- | -2.0 | 5.89414D-03 | -2.2296 | 2.03801D-03 | -2.6908 | 3.45769D-01 | -.4612 |
| 11 | CA 2+ | 2.0 | 2.09436D-02 | -1.6789 | 8.16060D-03 | -2.0883 | 3.89646D-01 | -.4093 |
| 13 | CL- | -1.0 | 1.00022D-01 | -.9999 | 7.32591D-02 | -1.1351 | 7.32430D-01 | -.1352 |
| 16 | F- | -1.0 | 7.63067D-05 | -4.1174 | 5.85139D-05 | -4.2327 | 7.66826D-01 | -.1153 |
| 19 | K+ | 1.0 | 1.37989D-02 | -1.8602 | 1.01067D-02 | -1.9954 | 7.32430D-01 | -.1352 |
| 23 | NO3 - | -1.0 | 3.76260D-37 | -36.4245 | 2.88526D-37 | -36.5398 | 7.66826D-01 | -.1153 |
| 24 | NA+ | 1.0 | 4.46962D-02 | -1.3497 | 3.42683D-02 | -1.4651 | 7.66694D-01 | -.1154 |
| 29 | SO4 2- | -2.0 | 8.26121D-04 | -3.0830 | 2.55388D-04 | -3.5928 | 3.09141D-01 | -.5098 |
| 30 | H4SIO4 | .0 | 3.73877D-04 | -3.4273 | 3.86317D-04 | -3.4131 | 1.03327D+00 | .0142 |
| 31 | SR 2+ | 2.0 | 6.07243D-05 | -4.2166 | 2.09966D-05 | -4.6779 | 3.45769D-01 | -.4612 |
| 55 | NH4 + | 1.0 | 5.25770D-03 | -2.2792 | 4.03174D-03 | -2.3945 | 7.66826D-01 | -.1153 |
| 56 | NO2 - | -1.0 | 6.40210D-25 | -24.1937 | 4.90930D-25 | -24.3090 | 7.66826D-01 | -.1153 |
| 58 | SO3 2- | -2.0 | 1.96201D-25 | -24.7073 | 6.78402D-26 | -25.1685 | 3.45769D-01 | -.4612 |
| 65 | OH- | -1.0 | 4.14456D-05 | -4.3825 | 3.17815D-05 | -4.4978 | 7.66826D-01 | -.1153 |
| 66 | H3SIO4 - | -1.0 | 2.71334D-04 | -3.5665 | 2.08066D-04 | -3.6818 | 7.66826D-01 | -.1153 |
| 67 | H2SIO4-- | -2.0 | 1.84198D-06 | -5.7347 | 6.36899D-07 | -6.1959 | 3.45769D-01 | -.4612 |
| 75 | NH4SO4 - | -1.0 | 1.72977D-05 | -4.7620 | 1.32643D-05 | -4.8773 | 7.66826D-01 | -.1153 |
| 84 | CAOH + | 1.0 | 7.63826D-06 | -5.1170 | 5.85721D-06 | -5.2323 | 7.66826D-01 | -.1153 |
| 85 | CAHCO3 + | 1.0 | 4.17509D-04 | -3.3793 | 3.20156D-04 | -3.4946 | 7.66826D-01 | -.1153 |
| 86 | CACO3 AQ | .0 | 1.76889D-02 | -1.7523 | 1.82774D-02 | -1.7381 | 1.03327D+00 | .0142 |
| 87 | CASO4 AQ | .0 | 3.60271D-04 | -3.4434 | 3.72258D-04 | -3.4292 | 1.03327D+00 | .0142 |
| 91 | CAF + | 1.0 | 3.86200D-06 | -5.4132 | 2.96148D-06 | -5.5285 | 7.66826D-01 | -.1153 |
| 92 | NACO3 - | -1.0 | 7.61025D-04 | -3.1186 | 5.83573D-04 | -3.2339 | 7.66826D-01 | -.1153 |
| 93 | NAHCO3 A | .0 | 7.76093D-05 | -4.1101 | 8.01916D-05 | -4.0959 | 1.03327D+00 | .0142 |
| 94 | NASO4 - | -1.0 | 5.17498D-05 | -4.2861 | 3.96830D-05 | -4.4014 | 7.66826D-01 | -.1153 |
| 96 | NAF AQ | .0 | 3.14729D-07 | -6.5021 | 3.25201D-07 | -6.4878 | 1.03327D+00 | .0142 |
| 97 | KSO4 - | -1.0 | 1.79576D-05 | -4.7458 | 1.37703D-05 | -4.8611 | 7.66826D-01 | -.1153 |
| 134 | SROH + | 1.0 | 5.18769D-09 | -8.2850 | 3.97805D-09 | -8.4003 | 7.66826D-01 | -.1153 |
| 135 | BAOH + | 1.0 | 4.96291D-10 | -9.3043 | 3.80569D-10 | -9.4196 | 7.66826D-01 | -.1153 |
| 272 | HCO3 - | -1.0 | 7.81475D-03 | -2.1071 | 5.99255D-03 | -2.2224 | 7.66826D-01 | -.1153 |
| 273 | H2CO3 AQ | .0 | 1.60654D-06 | -5.7941 | 1.66000D-06 | -5.7799 | 1.03327D+00 | .0142 |
| 274 | HSO4 - | -1.0 | 2.05817D-12 | -11.6865 | 1.57826D-12 | -11.8018 | 7.66826D-01 | -.1153 |
| 275 | HF AQ | .0 | 5.85767D-12 | -11.2323 | 6.05258D-12 | -11.2181 | 1.03327D+00 | .0142 |
| 276 | HF2 - | -1.0 | 1.59287D-15 | -14.7978 | 1.22145D-15 | -14.9131 | 7.66826D-01 | -.1153 |
| 277 | H2F2 AQ | .0 | 1.77158D-22 | -21.7516 | 1.83053D-22 | -21.7374 | 1.03327D+00 | .0142 |
| 353 | HSO3- | -1.0 | 1.25060D-28 | -27.9029 | 9.58993D-29 | -28.0182 | 7.66826D-01 | -.1153 |

# Appendix C

## Assessment of Metal Solubilities

# APPENDIX C

## METAL SOLUBILITY

A modelling exercise was conducted to evaluate the maximum concentrations of various metals that might potentially occur in the leachate. These metals included zinc, aluminum, lead, iron and nickel.

Discussion of the modelling process

The modelling was based upon the geochemical model PHREEQE developed by the United States Geological Survey (Parkhurst et al., 1985). As input, the model requires an estimate of the pH, pe (redox potential), major ion concentrations and trace element concentrations. These input were taken from the predicted landfill leachate concentrations (Table 3, Column E) for the proposed East Quarry Landfill. The overall composition of the leachate is not critical, except that:

a) it must be a complex fluid to facilitate full speciation;
b) the pH of the leachate has been predicted to remain highly alkaline (greater than 10). pHs between 7 and 12 were considered for this exercise. This is critical for the selection appropriate solid phases used to model maximum concentrations (as discussed further below); and
c) the redox potential of the leachate is estimated to be reducing (pe = −1). The redox potential is important because the solubility for some metals varies greatly with valence.

The predicted leachate included estimated concentrations for barium, bromide, bicarbonate, calcium, chloride, fluoride, potassium, nitrogen, sodium, sulphate, silica and strontium. Species interaction between metal phases is assumed to be negligible.

To estimate soluble limits for the metals, phases were selected for modelling from the available PHREEQE thermodynamic database (about 400 solid phases). Preference was given to reduced oxides, hydroxides, carbonates and pure metals because these phases are most likely to present within the waste and are stable under reducing, alkaline conditions. The following phases were selected for equilibration:

aluminum:.......... amorphous $Al(OH)_3$
zinc:.......... $Zn(OH)_2$
iron:.......... ferrihydrite
nickel:.......... $Ni(OH)_2$
lead:.......... $Pb(OH)_2$

Solubilities were determined by individually dissolving these phases until equilibration with the predicted leachate quality at unit pHs between 7 and 12 inclusive. The initial solution was charge balanced using calcium and chloride. Equilibration was conducted under closed conditions at a pe of –1 and a temperature of 10°C. Resulting concentrations were then converted into units of mg/L and plotted.

## General Conclusions

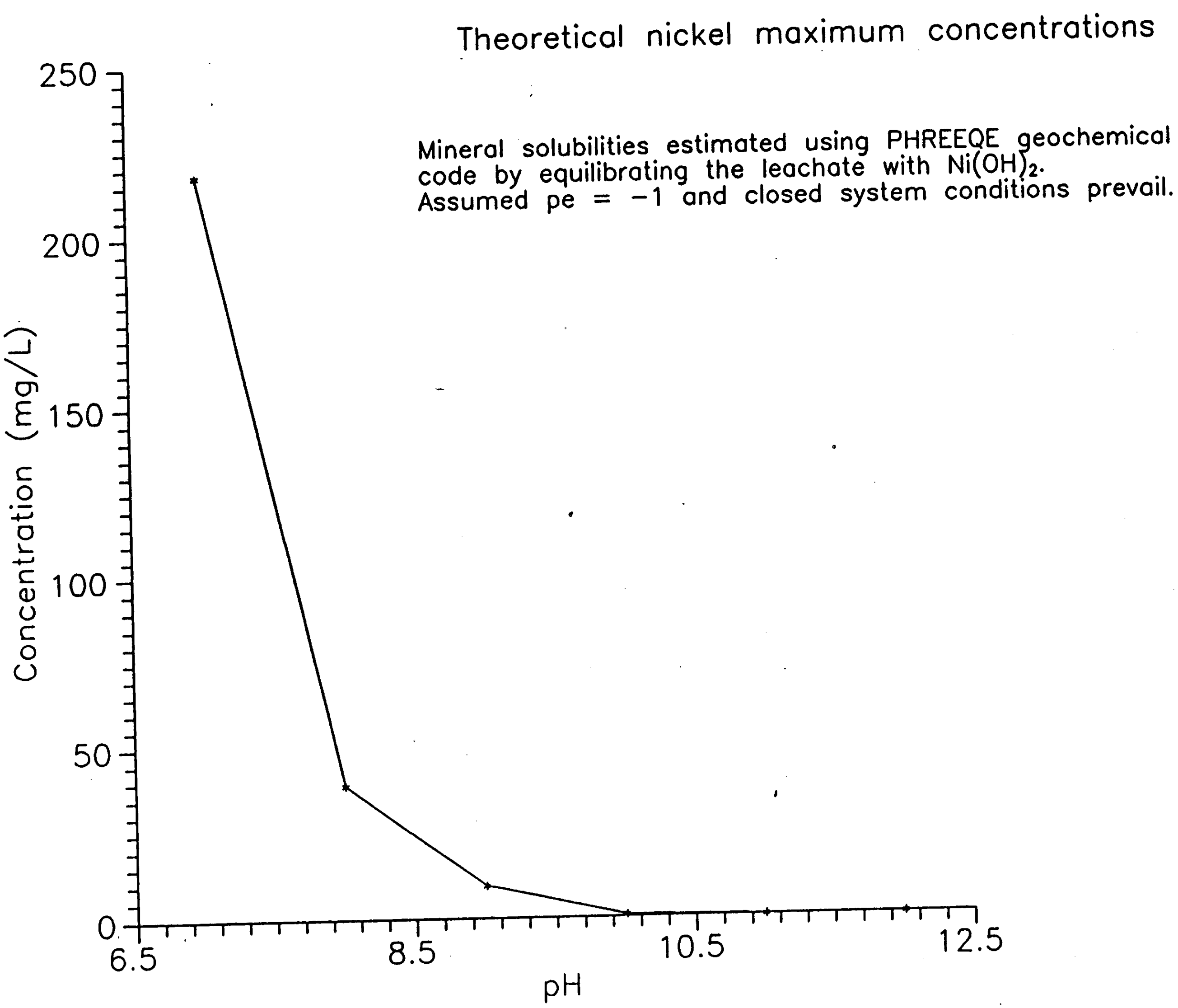
Metal concentrations are expected to be low in the leachate because of the physical limits imposed by thermodynamic conditions.

Under the alkaline conditions predicted for the leachate, these metals exhibit low solubility that decreases with increasing pH (except for aluminum). The accompanying figures demonstrate these relationships.

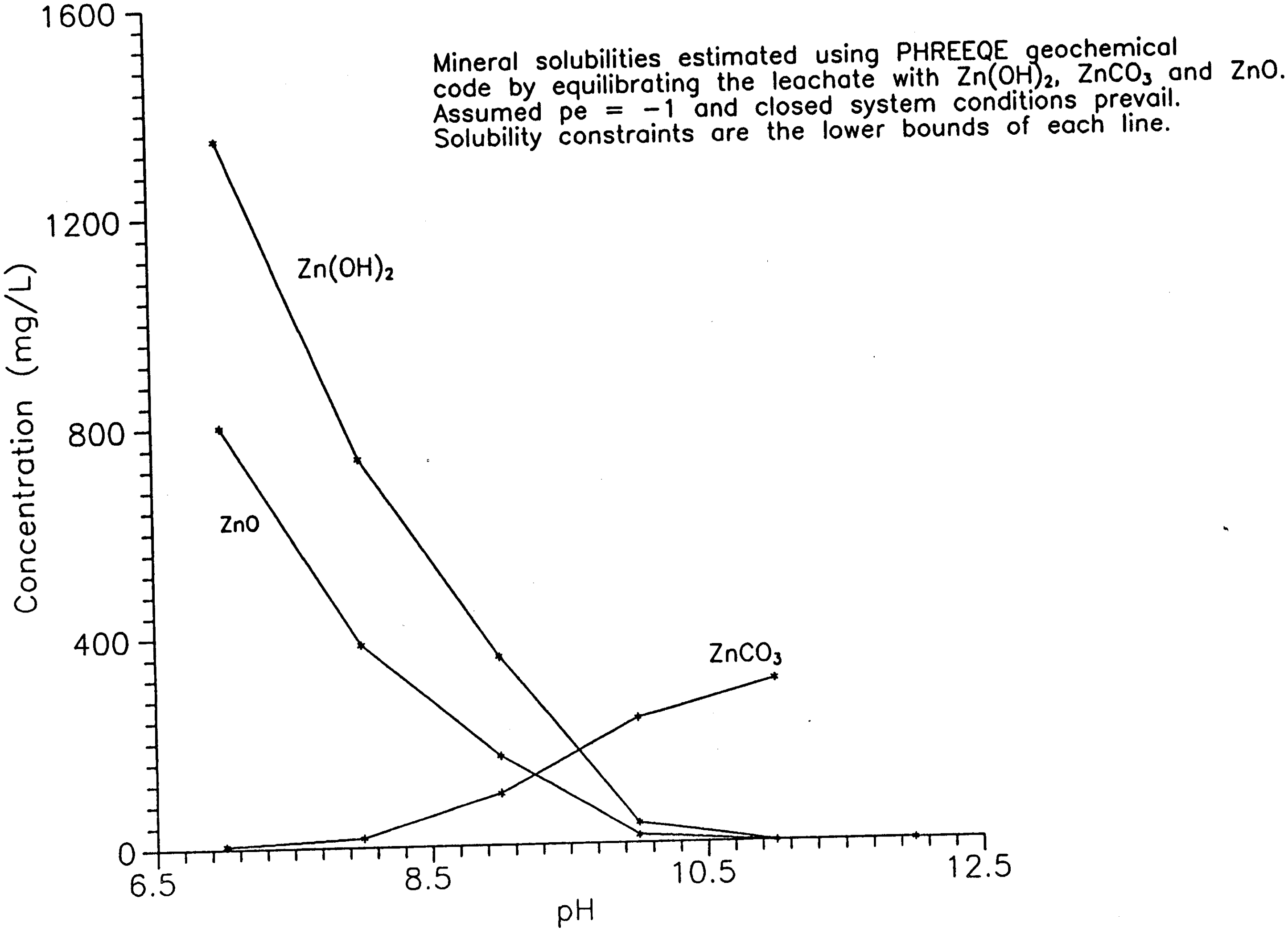
## Sensitivity Analyses

Further examinations of ZnO, Zn metal, $ZnSO_4$ and $ZnCO_3$ were completed to evaluate the effects of oxides, carbonates, sulphates and pure metal. The metal and sulphate phases were found to have much higher solubilities than the oxides and hydroxides (although the kinetics of these dissolution reactions would prevent equilibrium from being reached). ZnO constrains the maximum concentrations under slightly alkaline conditions and $ZnCO_3$ limits the concentrations under neutral and slightly acidic conditions. Similar behavior is expected for nickel, aluminum and iron.

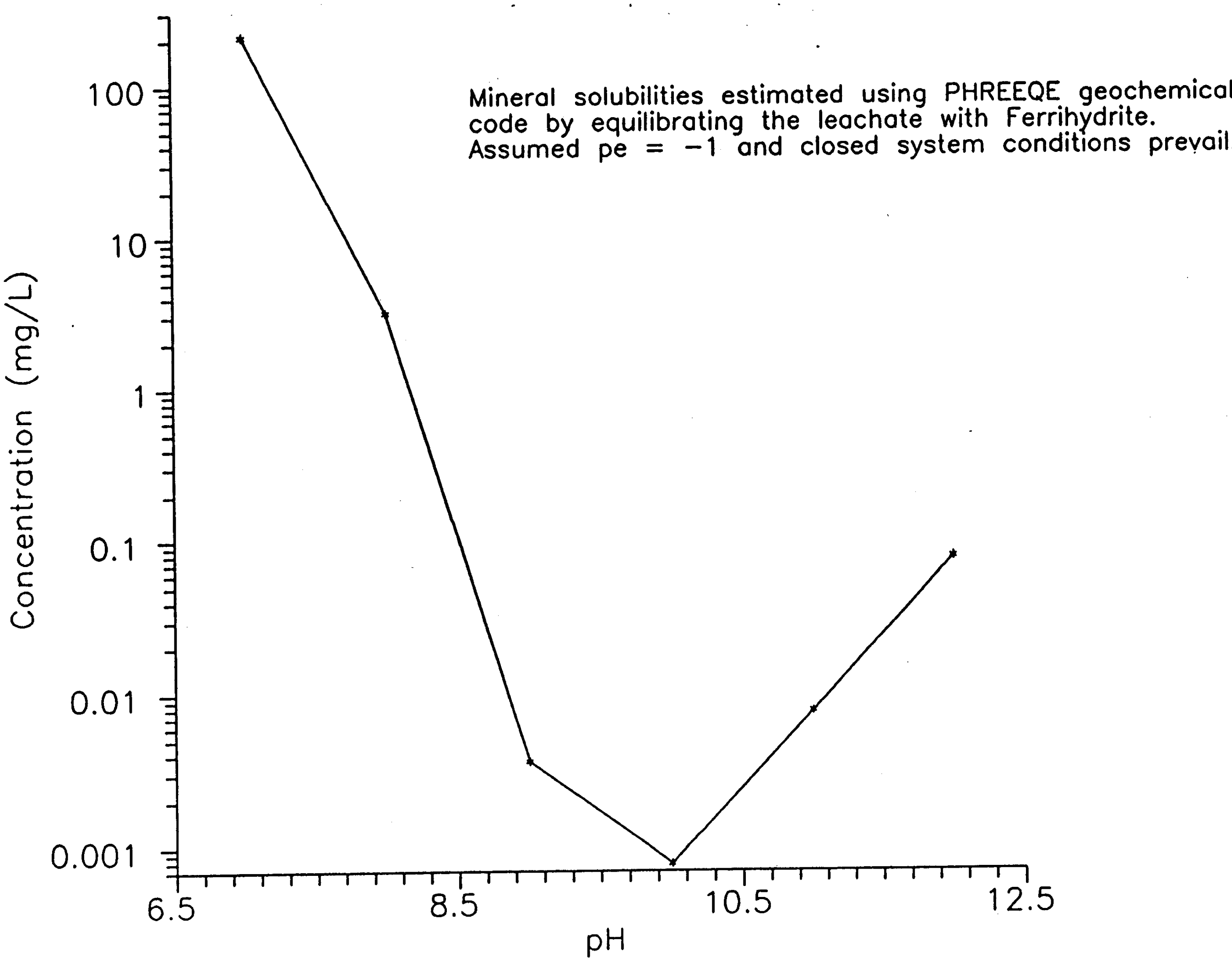
The redox sensitivity was not established. It is expected that this exercise is valid for reducing conditions but is not valid for oxidizing conditions.

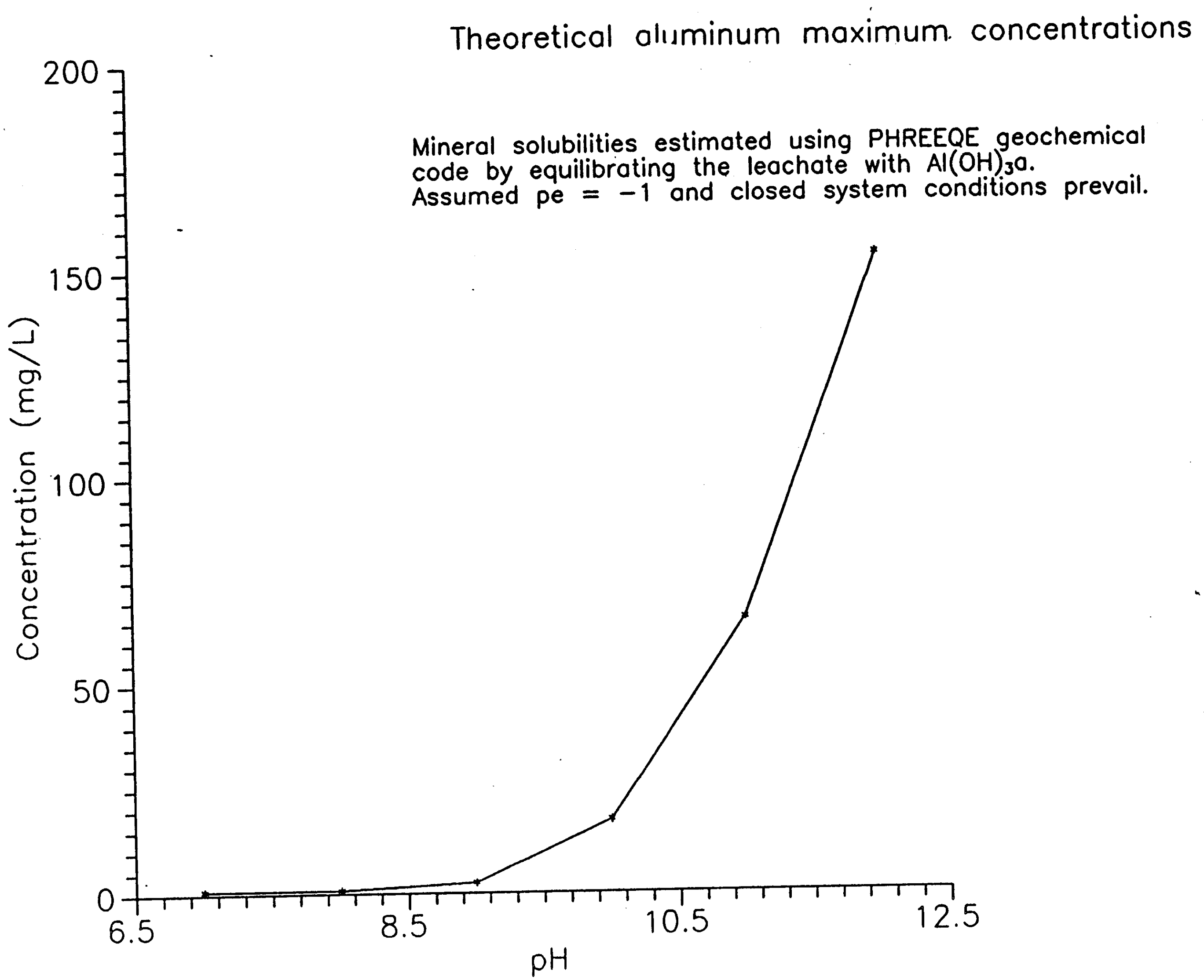

Theoretical nickel maximum concentrations
Mineral solubilities estimated using PHREEQE geochemical code by equilibrating the leachate with Ni(OH)2.
Assumed pe = −1 and closed system conditions prevail.
Concentration (mg/L)
250
200
150
100
50
0
6.5
8.5
10.5
12.5
pH

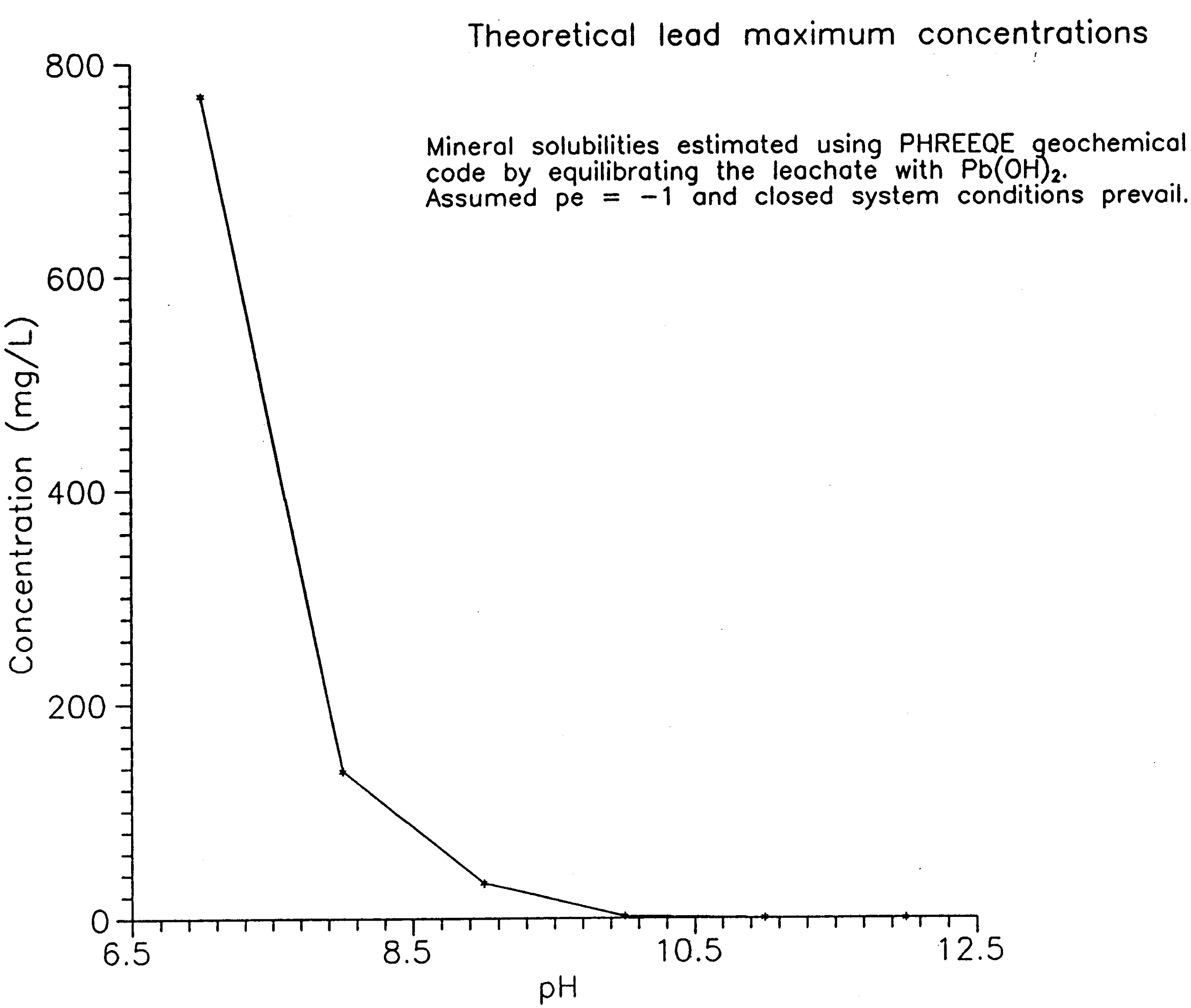
Theoretical zinc maximum concentrations



Theoretical iron maximum concentrations




Theoretical aluminum maximum concentrations
Mineral solubilities estimated using PHREEQE geochemical
code by equilibrating the leachate with Al(OH)3a.
Assumed pe = −1 and closed system conditions prevail.
Concentration (mg/L)
200
150
100
50
0
6.5
8.5
10.5
12.5
pH


Theoretical lead maximum concentrations
Mineral solubilities estimated using PHREEQE geochemical code by equilibrating the leachate with $Pb(OH)_2$.
Assumed pe = −1 and closed system conditions prevail.
Concentration (mg/L)
800
600
400
200
0
6.5
8.5
10.5
12.5
pH

# Appendix D

## Critical Contaminant Assessment

Table D1: Inorganic Parameters
Table D2: Organic Parameters

# TABLE D1: Assessment of Critical Contaminants

## West Quarry Leachate

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | West Quarry Leachate (range in all monitors) Range | Average |
|---|---|---|---|---|---|---|
| | | | | | Total # samples 78 | |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 7.4 – 12.83 | 10.86 |
| Conductivity | μmhos/cm | | | 814 – 12750 | 814 – 134000 | 13171 |
| TDS | mg/L | 500 | a | 598 – 14256 | 598 – 118000 | 10445 |
| COD | mg/L | | | 800 – 5000 | 10 – 5000 | 649 |
| TOC | mg/L | | | 154 – 1310 | 4.6 – 1310 | 185 |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 49 – 8440 | 1582 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 70 – 4552 | 1329 |
| Calcium | mg/L | | | 343 – 1820 | 20.6 – 1820 | 523.5 |
| Magnesium | mg/L | | | 0 – 26.4 | 0 – 26.4 | 4.6 |
| Sodium | mg/L | 200 | a | 161 – 739 | 139 – 47600 | 2594 |
| Potassium | mg/L | | | 1550 – 2360 | 15.1 – 2360 | 373 |
| Chloride | mg/L | 250 | a | 34 – 161 | 0 – 87000 | 4547 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0 – 4.2 | 2 |
| Bromide | mg/L | | | 0 – 78 | 0 – 78 | 7 |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 0 – 3180 | 619 |
| Ammonia | mg/L | | | 3 – 31 | 3.76 – 2330 | 154 |
| TKN | mg/L | | | 51 – 110 | 5.4 – 2330 | 167 |
| Nitrate | mg/L | 10 | h | 0 | 0 – 68.7 | 0.90 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 0.290 | 0.007 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 2.00 | 0.23 |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 3.41 | 0.17 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0.03 – 2.07 | 0.432 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0.0014 | 0.0001 |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0 – 1.24 | 0.29 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.0008 | 0.00002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 – 0.04 | 0.002 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 – 0.16 | 0.01 |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.15 | 0.01 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 – 0.04 | 0.001 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 0.63 | 0.07 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 0.44 | 0.03 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 – 1.1 | 0.11 |
| Nickel | mg/L | | | 0 – 0.78 | 0 – 0.78 | 0.14 |
| Silica | mg/L | | | 7.17 – 37.3 | 1.9 – 37.3 | 6.94 |
| Silver | mg/L | | | 0 | 0 – 0.006 | 0.0002 |
| Strontium | mg/L | | | 2.41 – 10.9 | 0.47 – 10.9 | 2.91 |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.017 | 0.003 |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.07 | 0.01 |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.5 | 0.02 |
| Thorium | mg/L | | | | 0 – 0.14 | 0.02 |
| Zircon | mg/L | | | | 0 – 0.04 | 0.01 |
| Phenols | μg/L | | | 180 – 47500 | 180 – 47500 | 7000 |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

TABLE D1: Assessment of Critical Contaminants

**Eramosa Dolostone**

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Eramosa Dolostone: Range (Total # Samples 93) | Background Range in Eramosa Dolostone: Average | Reasonable Use (Based on average) |
|---|---|---|---|---|---|---|---|
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 7.11 – 8.6 | 7.49 | Eramosa |
| Conductivity | µmhos/cm | | | 814 – 12750 | 617 – 5750 | 2226 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 443 – 12560 | 2136 | 2136 |
| COD | mg/L | | | 800 – 5000 | 0 – 552 | 29.72 | |
| TOC | mg/L | | | 154 – 1310 | 0.6 – 35.3 | 6.01 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 177 – 547 | 375 | 438 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 358.9 – 4746 | 1301 | 1301 |
| Calcium | mg/L | | | 343 – 1820 | 96.3 – 533 | 237 | |
| Magnesium | mg/L | | | 0 – 26.4 | 27.4 – 896 | 172 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 0 – 260 | 90 | 145 |
| Potassium | mg/L | | | 1550 – 2360 | 0 – 37.3 | 3.47 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 7.8 – 496 | 151 | 200 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0 – 1.3 | 0.70 | 0.90 |
| Bromide | mg/L | | | 0 – 78 | 0 – 1.9 | 0.05 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 98.2 – 4940 | 904 | 904 |
| Ammonia | mg/L | | | 3 – 31 | 0 – 0.77 | 0.13 | |
| TKN | mg/L | | | 51 – 110 | 0.02 – 2.6 | 0.45 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 19.2 | 0.96 | 3.22 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 0.21 | 0.01 | 0.25 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 1.3 | 0.06 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.67 | 0.05 | 0.07 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0 – 0.099 | 0.04 | 0.28 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0.003 | 0.0001 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0 – 1.1 | 0.14 | 1.35 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.055 | 0.0011 | 0.002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 – 0.05 | 0.003 | 0.015 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 – 0.08 | 0.001 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.17 | 0.004 | 0.502 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 – 0.02 | 0.0005 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 3.28 | 0.24 | 0.269 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 1.81 | 0.14 | 0.141 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 | 0 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 – 0.08 | 0.003 | |
| Silica | mg/L | | | 7.17 – 37.3 | 1.16 – 8.64 | 5.23 | |
| Silver | mg/L | | | 0 | 0 – 0.008 | 0.0004 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 0.266 – 6.48 | 2.24 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.011 | 0.0008 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.025 | 0.0018 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 1.09 | 0.21 | 2.60 |
| Thorium | mg/L | | | | 0 – 0.07 | 0.01 | |
| Zircon | mg/L | | | | 0 – 0.05 | 0.0040 | |
| Phenols | µg/L | | | 180 – 47500 | 0 – 2.0 | 0.09 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

TABLE D1: Assessment of Critical Contaminants

Vinemount Flow Zone

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Vinemount Flow Zone: Range | Average | Reasonable Use |
|---|---|---|---|---|---|---|---|
| | | | | | Total # Samples 107 | | Based on average |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 6.92 – 8.73 | 7.52 | VFZ |
| Conductivity | μmhos/cm | | | 814 – 12750 | 330 – 4640 | 2513 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 219 – 5410 | 2389 | 2389 |
| COD | mg/L | | | 800 – 5000 | 0 – 600 | 46 | |
| TOC | mg/L | | | 154 – 1310 | 1.2 – 26 | 7.39 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 52 – 503 | 269 | 384 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 576.8 – 2428 | 1384 | 1384 |
| Calcium | mg/L | | | 343 – 1820 | 178 – 711 | 400 | |
| Magnesium | mg/L | | | 0 – 26.4 | 19.2 – 270 | 93 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 8.3 – 512 | 119 | 160 |
| Potassium | mg/L | | | 1550 – 2360 | 0 – 47.7 | 14 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 13.5 – 890 | 179 | 215 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0 – 1.3 | 0.79 | 0.97 |
| Bromide | mg/L | | | 0 – 78 | 0 – 9.2 | 0.82 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 51.7 – 2700 | 1112 | 1112 |
| Ammonia | mg/L | | | 3 – 31 | 0 – 4.7 | 1.01 | |
| TKN | mg/L | | | 51 – 110 | 0.08 – 33 | 1.64 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 6.1 | 0.39 | 2.79 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 0.15 | 0.01 | 0.25 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 1.8 | 0.23 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.7 | 0.03 | 0.07 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0 – 0.091 | 0.025 | 0.27 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0.003 | 0.0001 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0.07 – 7.2 | 0.95 | 1.96 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.017 | 0.0005 | 0.002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 – 0.04 | 0.005 | 0.016 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 – 0.14 | 0.002 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.3 | 0.005 | 0.502 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 – 0.02 | 0.0004 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 2.07 | 0.15 | 0.225 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 5.33 | 0.53 | 0.534 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 – 0.3 | 0.005 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 – 0.31 | 0.02 | |
| Silica | mg/L | | | 7.17 – 37.3 | 0.86 – 10.3 | 3.88 | |
| Silver | mg/L | | | 0 | 0 – 0.0002 | 0 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 1.04 – 11.2 | 4.80 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.02 | 0.002 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.138 | 0.005 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.72 | 0.08 | 2.54 |
| Thorium | mg/L | | | | 0 – 0.12 | 0.02 | |
| Zircon | mg/L | | | | 0 – 0.04 | 0.003 | |
| Phenols | μg/L | | | 180 – 47500 | 0 – 250 | 2.56 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

TABLE D1: Assessment of Critical Contaminants

Upper Flow Zone

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Upper Flow Zone: Range | Average | Reasonable Use |
|---|---|---|---|---|---|---|---|
| | | | | | Total # Samples 23 | | Based on average |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 7.16 – 8.3 | 7.52 | UFZ |
| Conductivity | μmhos/cm | | | 814 – 12750 | 1259 – 9390 | 4114 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 863 – 7331 | 3266 | 3266 |
| COD | mg/L | | | 800 – 5000 | 0 – 330 | 61 | |
| TOC | mg/L | | | 154 – 1310 | 0.7 – 13 | 4.52 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 113 – 466 | 286 | 393 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 435.1 – 2151 | 1332 | 1332 |
| Calcium | mg/L | | | 343 – 1820 | 127 – 633 | 383 | |
| Magnesium | mg/L | | | 0 – 26.4 | 28.3 – 144 | 91 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 61.5 – 1490 | 473 | 473 |
| Potassium | mg/L | | | 1550 – 2360 | 0 – 51.5 | 25 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 86.3 – 2500 | 689 | 689 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0.2 – 8.5 | 1.01 | 1.13 |
| Bromide | mg/L | | | 0 – 78 | 0 – 6.4 | 1.56 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 148 – 2220 | 1261 | 1261 |
| Ammonia | mg/L | | | 3 – 31 | 0 – 28 | 6.00 | |
| TKN | mg/L | | | 51 – 110 | 0.19 – 36.4 | 6.80 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 3.7 | 0.33 | 2.74 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 3.32 | 0.18 | 0.39 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 0.1 | 0.01 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.57 | 0.06 | 0.08 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0 – 0.05 | 0.02 | 0.27 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0 | 0.00 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0.278 – 12 | 2.77 | 3.33 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.007 | 0.001 | 0.002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 | 0 | 0.013 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 | 0 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.1 | 0.004 | 0.502 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 | 0 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 0.87 | 0.14 | 0.221 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 0.25 | 0.08 | 0.083 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 | 0 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 | 0 | |
| Silica | mg/L | | | 7.17 – 37.3 | 2.69 – 5.86 | 4.10 | |
| Silver | mg/L | | | 0 | 0 – 0.005 | 0.0002 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 0.97 – 9.37 | 4.96 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.01 | 0.003 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.012 | 0.001 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.2 | 0.03 | 2.52 |
| Thorium | mg/L | | | | | | |
| Zircon | mg/L | | | | | | |
| Phenols | μg/L | | | 180 – 47500 | 0 – 4.5 | 0.30 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

# TABLE D1: Assessment of Critical Contaminants

**Mid FLow Zone**

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Mid FLow Zone: Range | Background Range in Mid FLow Zone: Average | Reasonable Use |
|---|---|---|---|---|---|---|---|
| | | | | | Total # Samples 57 | | Based on average MFZ |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 6.91 – 8.13 | 7.42 | |
| Conductivity | µmhos/cm | | | 814 – 12750 | 1172 – 84000 | 13688 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 884 – 84224 | 12896 | 12896 |
| COD | mg/L | | | 800 – 5000 | 0 – 1700 | 163 | |
| TOC | mg/L | | | 154 – 1310 | 0 – 263 | 17.08 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 123 – 370 | 214 | 357 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 673 – 29270 | 4854 | 4854 |
| Calcium | mg/L | | | 343 – 1820 | 145 – 8090 | 1364 | |
| Magnesium | mg/L | | | 0 – 26.4 | 46.1 – 2190 | 350 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 14.3 – 12600 | 1782 | 1782 |
| Potassium | mg/L | | | 1550 – 2360 | 0 – 226 | 45 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 42.7 – 50400 | 5798 | 5798 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0.2 – 1 | 0.54 | 0.78 |
| Bromide | mg/L | | | 0 – 78 | 0 – 575 | 62 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 302 – 2130 | 1309 | 1309 |
| Ammonia | mg/L | | | 3 – 31 | 0 – 25 | 5.27 | |
| TKN | mg/L | | | 51 – 110 | 0.21 – 31 | 5.92 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 1.5 | 0.05 | 2.54 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 0.061 | 0.007 | 0.26 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 1 | 0.06 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.39 | 0.06 | 0.08 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0 – 0.083 | 0.033 | 0.28 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0.001 | 0.00001 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0.1 – 30.1 | 2.43 | 3.07 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.008 | 0.001 | 0.002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 | 0 | 0.013 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 | 0 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.29 | 0.01 | 0.504 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 | 0 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 0.92 | 0.10 | 0.199 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 0.8 | 0.16 | 0.160 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 | 0 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 | 0 | |
| Silica | mg/L | | | 7.17 – 37.3 | 2.23 – 6.58 | 3.94 | |
| Silver | mg/L | | | 0 | 0 – 0.007 | 0.0001 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 1.39 – 160 | 22.7 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.1 | 0.01 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.016 | 0.001 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.2 | 0.01 | 2.51 |
| Thorium | mg/L | | | | | | |
| Zircon | mg/L | | | | | | |
| Phenols | µg/L | | | 180 – 47500 | 0 – 8 | 0.26 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

# TABLE D1: Assessment of Critical Contaminants

## Lower Flow Zone

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Lower Flow Zone: Range | Background Range in Lower Flow Zone: Average | Reasonable Use |
|---|---|---|---|---|---|---|---|
| | | | | | Total # Samples 48 | | Based on average |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 6.75 – 8.22 | 7.38 | LFZ |
| Conductivity | μmhos/cm | | | 814 – 12750 | 1680 – 96200 | 24635 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 1188 – 1E+05 | 24634 | 24634 |
| COD | mg/L | | | 800 – 5000 | 6 – 1460 | 254 | |
| TOC | mg/L | | | 154 – 1310 | 0 – 532 | 57 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 72.9 – 305 | 200 | 350 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 705.7 – 48390 | 9157 | 9157 |
| Calcium | mg/L | | | 343 – 1820 | 181 – 13200 | 2472 | |
| Magnesium | mg/L | | | 0 – 26.4 | 61.3 – 3710 | 718 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 48.3 – 19100 | 3618 | 3618 |
| Potassium | mg/L | | | 1550 – 2360 | 0 – 460 | 74 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 159 – 60100 | 12278 | 12278 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0 – 1 | 0.28 | 0.58 |
| Bromide | mg/L | | | 0 – 78 | 0 – 771 | 132 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 134 – 1960 | 917 | 917 |
| Ammonia | mg/L | | | 3 – 31 | 0.1 – 34 | 7.26 | |
| TKN | mg/L | | | 51 – 110 | 0.17 – 34 | 7.23 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 1 | 0.11 | 2.58 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0 – 3.41 | 0.12 | 0.34 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 1 | 0.17 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.31 | 0.03 | 0.07 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0 – 0.28 | 0.09 | 0.32 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 – 0.001 | 0.00004 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 0 – 86.4 | 9.59 | 9.59 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.467 | 0.020 | 0.020 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 – 0.05 | 0.002 | 0.014 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 – 0.1 | 0.002 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.26 | 0.016 | 0.508 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 – 0.03 | 0.001 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 2.5 | 0.16 | 0.229 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0 – 2.5 | 0.39 | 0.389 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 – 0.3 | 0.01 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 – 0.08 | 0.003 | |
| Silica | mg/L | | | 7.17 – 37.3 | 1.68 – 14.1 | 4.31 | |
| Silver | mg/L | | | 0 | 0 – 0.5 | 0.02 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 2.95 – 262 | 51.78 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.15 | 0.03 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.025 | 0.002 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.2 | 0.04 | 2.52 |
| Thorium | mg/L | | | | 0 | 0 | |
| Zircon | mg/L | | | | 0 – 0.03 | 0.01 | |
| Phenols | μg/L | | | 180 – 47500 | 0 – 14.5 | 0.41 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

# TABLE D1: Assessment of Critical Contaminants

**Rochester Shale**

| Compound | units | ODWO | | Predicted East Quarry Landfill Leachate | Background Range in Rochester Shale: Range | Background Range in Rochester Shale: Average | Reasonable Use |
|---|---|---|---|---|---|---|---|
| | | | | | Total # Samples 6 | | Based on average Rochester |
| pH | pH units | 6.5–8.5 | o | 7.4 – 12.83 | 7.04 – 8.3 | 7.60 | |
| Conductivity | µmhos/cm | | | 814 – 12750 | 15800 – 57100 | 41750 | |
| TDS | mg/L | 500 | a | 598 – 14256 | 11926 – 58440 | 40107 | 40107 |
| COD | mg/L | | | 800 – 5000 | 0 – 750 | 441 | |
| TOC | mg/L | | | 154 – 1310 | 0 – 96 | 44 | |
| Alkalinity | mg $CaCO_3$/L | 30–500 | o | 232 – 4550 | 103 – 208 | 150 | 325 |
| Hardness | mg $CaCO_3$/L | 80–100 | o | 109 – 2552 | 3634 – 17830 | 12135 | 12135 |
| Calcium | mg/L | | | 343 – 1820 | 1030 – 5020 | 3378 | |
| Magnesium | mg/L | | | 0 – 26.4 | 251 – 1280 | 892 | |
| Sodium | mg/L | 200 | a | 161 – 739 | 2120 – 9240 | 6565 | 6565 |
| Potassium | mg/L | | | 1550 – 2360 | 63 – 319 | 201 | |
| Chloride | mg/L | 250 | a | 34 – 161 | 5370 – 30400 | 20695 | 20695 |
| Fluoride | mg/L | 1.5 | h | 0 – 3.9 | 0.1 – 0.6 | 0.3 | 0.60 |
| Bromide | mg/L | | | 0 – 78 | 52.6 – 302 | 225 | |
| Sulphate | mg/L | 500 | a | 715 – 3180 | 1160 – 1480 | 1277 | 1277 |
| Ammonia | mg/L | | | 3 – 31 | 5.7 – 23 | 17 | |
| TKN | mg/L | | | 51 – 110 | 6.5 – 25 | 19 | |
| Nitrate | mg/L | 10 | h | 0 | 0 – 0.4 | 0.07 | 2.55 |
| Nitrite | mg/L | 1 | h | 0.01 – 0.029 | 0.004 – 0.14 | 0.065 | 0.30 |
| Phosphate | mg/L | | | 0 – 1.7 | 0 – 1 | 0.25 | |
| Aluminum | mg/L | 0.1 | o | 0 – 0.58 | 0 – 0.3 | 0.07 | 0.09 |
| Barium | mg/L | 1 | h | 0.05 – 2.07 | 0.098 – 0.204 | 0.158 | 0.37 |
| Beryllium | mg/L | | | 0 – 0.001 | 0 | 0 | |
| Boron | mg/L | 5 | h | 0 – 0.627 | 2.07 – 104 | 55.41 | 55.41 |
| Cadmium | mg/L | 0.005 | h | 0 – 0.001 | 0 – 0.006 | 0.001 | 0.002 |
| Chromium | mg/L | 0.05 | h | 0 – 0.02 | 0 | 0 | 0.013 |
| Cobalt | mg/L | | | 0 – 0.15 | 0 | 0 | |
| Copper | mg/L | 1 | a | 0 – 0.15 | 0 – 0.1 | 0.02 | 0.508 |
| Lead | mg/L | 0.01 | h | 0 – 0.04 | 0 | 0 | 0.003 |
| Iron | mg/L | 0.3 | a | 0 – 0.63 | 0 – 0.06 | 0.01 | 0.155 |
| Manganese | mg/L | 0.05 | a | 0 – 0.44 | 0.1 – 0.7 | 0.41 | 0.410 |
| Molybdenum | mg/L | | | 0 – 1.1 | 0 | 0 | |
| Nickel | mg/L | | | 0 – 0.78 | 0 | 0 | |
| Silica | mg/L | | | 7.17 – 37.3 | 2.77 – 5.3 | 3.7 | |
| Silver | mg/L | | | 0 | 0 | 0 | |
| Strontium | mg/L | | | 2.41 – 10.9 | 14.3 – 98.6 | 66.1 | |
| Titanium | mg/L | | | 0 – 0.011 | 0 – 0.06 | 0.03 | |
| Vanadium | mg/L | | | 0 – 0.07 | 0 – 0.008 | 0.003 | |
| Zinc | mg/L | 5 | a | 0 – 0.9 | 0 – 0.2 | 0.035 | 2.52 |
| Thorium | mg/L | | | | | | |
| Zircon | mg/L | | | | | | |
| Phenols | µg/L | | | 180 – 47500 | 0 – 3 | 0.98 | |

h – health related objective
a – aesthetic objective associated with taste, smell and colour
o – operational objective to ensure efficient treatment of water

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO | | | 6-I | | | 28-II | | | 30-I | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | max | min | avg | max | min | avg |
| **MISA Group 20 – Acid Extractables** | | | | | | | | | | | | |
| 2,3,4,5-TETRACHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,4,6-TETRACHLOROPHENOL | 100 | H | 25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,5,6-TETRACHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,4-TRICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,5-TRICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4,5-TRICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4,6-TRICHLOROPHENOL | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DIMETHYLPHENOL | | | | ND | ND | ND | 6 | ND | 0.8571 | 646 | 42.4 | 258.64 |
| 2,4-DINITROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DICHLOROPHENOL | 900 | H | 225 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,6-DICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4,6-DINITRO-O-CRESOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-CHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-CHLORO-3-METHYLPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-NITROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| M-CRESOL & P-CRESOL | | | | ND | ND | ND | 21.2 | ND | 3.5333 | 1310 | 16.6 | 426.09 |
| O-CRESOL | | | | ND | ND | ND | 2.9 | ND | 0.4833 | 67.8 | 4.3 | 25.843 |
| PENTACHLOROPHENOL | 60 | A | 30 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PHENOL | | | | ND | ND | ND | 176 | ND | 43.714 | 2330 | 184 | 1080.6 |
| NITROPHENOL | | | | | | | ND | ND | | 20 | ND | 10 |
| 2-METHYL-4-6-DINITROPHENOL | | | | | | | ND | ND | | 21 | ND | 10.5 |
| **Misa Group 19 – Base/Neutral Extractables** | | | | | | | | | | | | |
| ACENAPHTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 5-NITROACENAPHTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ACENAPHTHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ANTHRACENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZ(A)ANTHRACENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(A)PYRENE | 0.01 | H | 0.0025 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(B)FLUORANTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(G,H,I)PERYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(K)FLUORANTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIPHENYL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CAMPHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1-CHLORONAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-CHLORONAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHRYSENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIBENZ(A,H)ANTHRACENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FLUORANTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FLUORENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| INDENO(1,2,3-CD)PYRENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| INDOLE | | | | ND | ND | ND | ND | ND | ND | 54.3 | ND | 20.057 |
| 1-METHYL NAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-METHYLNAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| NAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | 122 | ND | 19.225 |
| PERYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PHENANTHRENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PYRENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZYL BUTYL PHTHALATE | | | | ND | ND | ND | ND | ND | ND | 0.6 | ND | 0.075 |
| BIS(2-ETHYLHEXYL)PHTHALATE | | | | 6 | ND | 1 | 10.4 | ND | 1.4857 | 36.4 | ND | 4.55 |
| DI-N-BUTYL PHTHALATE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DI-N-OCTYL PHTHALATE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-BROMOPHENYL PHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-CHLOROPHENYL PHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROISOPROPYL)ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROETHYL)ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIPHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DINITROTOLUENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,6-DINITROTOLUENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROETHOXY)METHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIPHENYLAMINE & N-NITROSODIPHA | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| N-NITROSODI-N-PROPYLAMINE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO | | | 6–I | | | 28–II | | | 30–I | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | max | min | avg | max | min | avg |
| **MISA Group 22 – Organochlorine Compounds** | | | | | | | | | | | | |
| ALDRIN | | | | ND | ND | ND | 0.003 | ND | 0.0004 | 0.001 | ND | 0.0002 |
| DIELDRIN | | | | ND | ND | ND | 0.0006 | ND | 9E–05 | ND | ND | ND |
| ALDRIN + DIELDRIN | 0.7 | H | 0.175 | 0 | | | 0.0036 | | | 0.001 | | |
| ALPHA–BHC | | | | ND | ND | ND | 0.0008 | ND | 0.0001 | 0.0015 | ND | 0.0004 |
| BETA–BHC | | | | ND | ND | ND | ND | ND | ND | 0.0043 | ND | 0.0012 |
| DELTA–BHC | | | | ND | ND | ND | ND | ND | ND | 0.005 | ND | 0.0006 |
| GAMMA–BHC | | | | ND | ND | ND | ND | ND | ND | 0.0008 | ND | 0.0001 |
| CHLORDANE | 7 | H | 1.75 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DDD | | | | ND | ND | ND | ND | ND | ND | 0.001 | ND | 0.0001 |
| DDE | | | | 0.001 | ND | 0.0002 | ND | ND | ND | ND | ND | ND |
| DDT | 30 | H | 7.5 | ND | ND | ND | ND | ND | ND | 0.001 | ND | 0.0001 |
| 2,4–DDT | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN I | | | | ND | ND | ND | ND | ND | ND | 0.001 | ND | 0.0001 |
| ENDOSULFAN II | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN SULPHATE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDRIN | | | | ND | ND | ND | 0.003 | ND | 0.0004 | 0.003 | ND | 0.0004 |
| ENDRIN ALDEHYDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HEPTACHLOR | | | | 0.0023 | ND | 0.0006 | 0.002 | ND | 0.0004 | 0.003 | ND | 0.0005 |
| HEPTACHLOR EPOXIDE | | | | 0.001 | ND | 0.0002 | 0.001 | ND | 0.0001 | 0.006 | ND | 0.001 |
| HEPTACHLOR + HEPTACHLOR EPOXIDE | 3 | inter H | 0.75 | 0.0033 | | | 0.003 | | | 0.009 | | |
| METHOXYCHLOR | 900 | H | 225 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MIREX | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOXAPHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PCB's | 3 | H | 0.75 | ND | ND | ND | ND | ND | ND | 0.3242 | ND | 0.0405 |
| **MISA Group 17** | | | | | | | | | | | | |
| BENZENE | 5 | H | 1.25 | ND | ND | ND | 0.1 | ND | 0.0143 | 3.5 | 0.5 | 1.6125 |
| ETHYLBENZENE | 2.4 | A | 1.2 | 0.2 | ND | 0.033 | 0.3 | ND | 0.0714 | 0.8 | ND | 0.2 |
| STYRENE | | | | ND | ND | ND | ND | ND | ND | 0 | ND | 0 |
| TOLUENE | 24 | A | 12 | ND | ND | ND | 151 | ND | 21.571 | 2 | ND | 0.475 |
| O–XYLENE | 300 | A | 150 | ND | ND | ND | 0.3 | ND | 0.0714 | 2.3 | ND | 0.375 |
| M–XYLENE + P–XYLENE | 300 | A | 150 | ND | ND | ND | 0.4 | ND | 0.1 | 2.4 | ND | 0.4 |
| **MISA Group 18** | | | | | | | | | | | | |
| ACROLEIN | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ACRYLONITRILE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| **MISA Group 16 – Halogenated VOC's** | | | | | | | | | | | | |
| 1,1,2,2–TETRACHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2–TRICHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1–DICHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | 0.4 | ND | 0.1375 |
| 1,1–DICHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2–DICHLOROBENZENE | 200 | H | 50 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2–DICHLOROETHANE | 5 | inter H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2–DICHLOROPROPANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3–DICHLOROBENZENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4–DICHLOROBENZENE | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BROMOFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BROMOMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CARBON TETRACHLORIDE | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROBENZENE | | | | ND | ND | ND | ND | ND | ND | 0.7 | ND | 0.0875 |
| CHLOROFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CIS–1,3–DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIBROMOCHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ETHYLENE DIBROMIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| METHYLENE CHLORIDE | | | | 330 | ND | 66 | 12.7 | ND | 2.1167 | 81.5 | ND | 11.643 |
| TETRACHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRANS–1,2–DICHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRANS–1,3–DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRICHLOROETHYLENE | 50 | H | 12.5 | ND | ND | ND | ND | ND | ND | 0.3 | ND | 0.0375 |
| TRICHLOROFLUOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| VINYL CHLORIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,1–TRICHLOROETHANE | | | | | | | ND | ND | ND | 0.4 | ND | 0.2 |
| DICHLOROMETHANE | 50 | H | 12.5 | | | | ND | ND | ND | ND | ND | ND |
| CIS–1,2–DICHLOROETHENE | | | | | | | ND | ND | ND | ND | ND | ND |
| BROMODICHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROETHANE | | | | | | | ND | ND | ND | ND | ND | ND |
| 1,2–DIBROMOETHANE | | | | | | | ND | ND | ND | ND | ND | ND |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

# Table D2: Assessment of Critical Organic Contaminants

all concentrations in µg/L

| Compound | ODWO | | | 30-II | | | 31-II | | | 32-II | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | max | min | avg | max | min | avg |
| **MISA Group 20 – Acid Extractables** | | | | | | | | | | | | |
| 2,3,4,5-TETRACHLOROPHENOL | | | | 5.3 | ND | 1.0143 | 2.9 | ND | 0.4143 | ND | ND | ND |
| 2,3,4,6-TETRACHLOROPHENOL | 100 | H | 25 | 3.7 | ND | 1.0429 | ND | ND | ND | ND | ND | ND |
| 2,3,5,6-TETRACHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,4-TRICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,5-TRICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4,5-TRICHLOROPHENOL | | | | 7.1 | 0 | 1.2143 | ND | ND | ND | ND | ND | ND |
| 2,4,6-TRICHLOROPHENOL | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DIMETHYLPHENOL | | | | 584 | 79.5 | 253.19 | 231 | 2.3 | 125.21 | 4680 | 51.5 | 1360 |
| 2,4-DINITROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DICHLOROPHENOL | 900 | H | 225 | 8.9 | ND | 1.1125 | ND | ND | ND | ND | ND | ND |
| 2,6-DICHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4,6-DINITRO-O-CRESOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-CHLOROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-CHLORO-3-METHYLPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-NITROPHENOL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| M-CRESOL & P-CRESOL | | | | 1040 | 104 | 313.43 | 1310 | ND | 235.21 | 8540 | 667 | 4715.3 |
| O-CRESOL | | | | 56.2 | 18.2 | 41.614 | 66.1 | ND | 27.129 | 245 | 39.5 | 166.93 |
| PENTACHLOROPHENOL | 60 | A | 30 | ND | ND | ND | 3 | ND | 0.375 | ND | ND | ND |
| PHENOL | | | | 1590 | ND | 761.75 | 1800 | ND | 262.04 | 13500 | 662 | 5830.3 |
| NITROPHENOL | | | | ND | ND | ND | 20 | ND | 10 | ND | ND | ND |
| 2-METHYL-4-6-DINITROPHENOL | | | | ND | ND | ND | 21 | ND | 10.5 | ND | ND | ND |
| **Misa Group 19 – Base/Neutral Extractables** | | | | | | | | | | | | |
| ACENAPHTHENE | | | | 1.1 | ND | 0.1375 | ND | ND | ND | 4.8 | ND | 1.15 |
| 5-NITROACENAPHTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ACENAPHTHYLENE | | | | 1.8 | ND | 0.225 | ND | ND | ND | 4 | ND | 0.925 |
| ANTHRACENE | | | | 0 | ND | 0 | ND | ND | ND | 2.1 | ND | 0.4375 |
| BENZ(A)ANTHRACENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(A)PYRENE | 0.01 | H | 0.0025 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(B)FLUORANTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(G,H,I)PERYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BENZO(K)FLUORANTHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIPHENYL | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CAMPHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1-CHLORONAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-CHLORONAPHTHALENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHRYSENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIBENZ(A,H)ANTHRACENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| FLUORANTHENE | | | | 1.2 | ND | 0.225 | ND | ND | ND | 4.1 | ND | 0.6 |
| FLUORENE | | | | 2.9 | ND | 0.65 | ND | ND | ND | 2.3 | ND | 0.5875 |
| INDENO(1,2,3-CD)PYRENE | | | | 0 | ND | 0 | ND | ND | ND | ND | ND | ND |
| INDOLE | | | | 38.3 | ND | 19.2 | 42.3 | ND | 6.0429 | 162 | 20.5 | 58.914 |
| 1-METHYL NAPHTHALENE | | | | 3.9 | ND | 1.0714 | ND | ND | ND | 0 | ND | 0 |
| 2-METHYLNAPHTHALENE | | | | 17.5 | ND | 4.5286 | ND | ND | ND | 2.5 | ND | 0.6143 |
| NAPHTHALENE | | | | 306 | 0.5 | 91.875 | 18.6 | ND | 2.4875 | 120 | 49.9 | 81.588 |
| PERYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PHENANTHRENE | | | | 5.3 | ND | 1.6125 | 0.2 | ND | 0.025 | 9.2 | ND | 1.675 |
| PYRENE | | | | 0.9 | ND | 0.1875 | ND | ND | ND | 3.8 | ND | 0.5375 |
| BENZYL BUTYL PHTHALATE | | | | 0.6 | ND | 0.075 | ND | ND | ND | ND | ND | ND |
| BIS(2-ETHYLHEXYL)PHTHALATE | | | | 26.2 | ND | 3.4875 | 10.7 | ND | 1.3375 | 2.2 | ND | 0.275 |
| DI-N-BUTYL PHTHALATE | | | | ND | ND | ND | 25.5 | ND | 3.1875 | ND | ND | ND |
| DI-N-OCTYL PHTHALATE | | | | ND | ND | ND | 6.6 | ND | 1.65 | ND | ND | ND |
| 4-BROMOPHENYL PHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-CHLOROPHENYL PHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROISOPROPYL)ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROETHYL)ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIPHENYL ETHER | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DINITROTOLUENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,6-DINITROTOLUENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BIS(2-CHLOROETHOXY)METHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIPHENYLAMINE & N-NITROSODIPHA | | | | 10.3 | ND | 1.4714 | ND | ND | ND | 17.9 | ND | 4.9714 |
| N-NITROSODI-N-PROPYLAMINE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 µg/L

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO Limit | ODWO Type | ODWO RUP | 30-II max | 30-II min | 30-II avg | 31-II max | 31-II min | 31-II avg | 32-II max | 32-II min | 32-II avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MISA Group 22 - Organochlorine Compounds** | | | | | | | | | | | | |
| ALDRIN | | | | ND | ND | ND | 0.002 | ND | 0.0004 | 0.004 | ND | 0.0006 |
| DIELDRIN | | | | 0.019 | ND | 0.0052 | 0.0018 | ND | 0.0003 | ND | ND | ND |
| ALDRIN + DIELDRIN | 0.7 | H | 0.175 | 0.019 | | | 0.0038 | | | 0.004 | | |
| ALPHA-BHC | | | | 0.0026 | ND | 0.0004 | ND | ND | ND | 0.012 | ND | 0.004 |
| BETA-BHC | | | | 0.034 | 0.0046 | 0.0228 | 0.0022 | ND | 0.0006 | ND | ND | ND |
| DELTA-BHC | | | | 0.0025 | ND | 0.0003 | 0.0021 | ND | 0.0003 | ND | ND | ND |
| GAMMA-BHC | | | | 0.002 | ND | 0.0003 | 0.002 | ND | 0.0005 | 0.004 | ND | 0.0005 |
| CHLORDANE | 7 | H | 1.75 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DDD | | | | 0.0035 | ND | 0.0007 | ND | ND | ND | 0.01 | ND | 0.0013 |
| DDE | | | | 0.0021 | ND | 0.0005 | ND | ND | ND | 0.007 | ND | 0.0009 |
| DDT | 30 | H | 7.5 | 0.003 | ND | 0.0004 | ND | ND | ND | ND | ND | ND |
| 2,4-DDT | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN I | | | | 0.0027 | ND | 0.0003 | ND | ND | ND | 0.004 | ND | 0.0005 |
| ENDOSULFAN II | | | | ND | ND | ND | 0.006 | ND | 0.0008 | 0.052 | ND | 0.0065 |
| ENDOSULFAN SULPHATE | | | | ND | ND | ND | ND | ND | ND | 0.076 | ND | 0.0095 |
| ENDRIN | | | | 0.003 | ND | 0.0005 | 0.002 | ND | 0.0003 | 0.0047 | ND | 0.0006 |
| ENDRIN ALDEHYDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HEPTACHLOR | | | | 0.0026 | ND | 0.0006 | 0.004 | ND | 0.0011 | 0.0159 | ND | 0.0039 |
| HEPTACHLOR EPOXIDE | | | | 0.02 | ND | 0.0026 | 0.001 | ND | 0.0002 | 0.0365 | ND | 0.0072 |
| HEPTACHLOR + HEPTACHLOR EPOXIDE | 3 | inter H | 0.75 | 0.0226 | | | 0.005 | | | 0.0524 | | |
| METHOXYCHLOR | 900 | H | 225 | ND | ND | ND | ND | ND | ND | 0.024 | ND | 0.003 |
| MIREX | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOXAPHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PCB's | 3 | H | 0.75 | ND | ND | ND | 0.3178 | ND | 0.0397 | ND | ND | ND |
| **MISA Group 17** | | | | | | | | | | | | |
| BENZENE | 5 | H | 1.25 | 13 | 3.1 | 6.8875 | 1 | ND | 0.5625 | 2.2 | ND | 1.525 |
| ETHYLBENZENE | 2.4 | A | 1.2 | 1.1 | ND | 0.5625 | 0.3 | ND | 0.0625 | 6.2 | ND | 2.5375 |
| STYRENE | | | | ND | ND | ND | 0 | ND | 0 | 1.1 | ND | 0.3875 |
| TOLUENE | 24 | A | 12 | 6.2 | 2.7 | 4.4375 | 0.9 | ND | 0.425 | 10.6 | ND | 3.25 |
| O-XYLENE | 300 | A | 150 | 4.6 | 1.3 | 2.475 | 0.8 | ND | 0.225 | 1.8 | ND | 1.15 |
| M-XYLENE + P-XYLENE | 300 | A | 150 | 4.8 | 1.7 | 3 | 0.8 | ND | 0.225 | 2.5 | ND | 1.4 |
| **MISA Group 18** | | | | | | | | | | | | |
| ACROLEIN | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ACRYLONITRILE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| **MISA Group 16 - Halogenated VOC's** | | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-TRICHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1-DICHLOROETHANE | | | | 1.5 | ND | 1.125 | 0.5 | ND | 0.15 | 0.5 | ND | 0.2875 |
| 1,1-DICHLOROETHYLENE | | | | ND | ND | ND | 0 | ND | 0 | ND | ND | ND |
| 1,2-DICHLOROBENZENE | 200 | H | 50 | 0.4 | ND | 0.075 | ND | ND | ND | 0.2 | ND | 0.075 |
| 1,2-DICHLOROETHANE | 5 | inter H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DICHLOROPROPANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-DICHLOROBENZENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-DICHLOROBENZENE | 5 | H | 1.25 | 0.3 | ND | 0.0625 | 0.1 | ND | 0.0125 | 49.6 | ND | 12.275 |
| BROMOFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BROMOMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CARBON TETRACHLORIDE | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROBENZENE | | | | 1.1 | ND | 0.3125 | ND | ND | ND | ND | ND | ND |
| CHLOROFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CIS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIBROMOCHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ETHYLENE DIBROMIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| METHYLENE CHLORIDE | | | | 42.5 | ND | 6.0714 | 61.2 | ND | 8.7429 | 380 | ND | 54.286 |
| TETRACHLOROETHYLENE | | | | 0.6 | ND | 0.075 | ND | ND | ND | ND | ND | ND |
| TRANS-1,2-DICHLOROETHYLENE | | | | 0.2 | ND | 0.025 | 0.1 | ND | 0.0125 | ND | ND | ND |
| TRANS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRICHLOROETHYLENE | 50 | H | 12.5 | 1.7 | ND | 0.7375 | 1.4 | ND | 0.375 | 0.4 | ND | 0.175 |
| TRICHLOROFLUOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| VINYL CHLORIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,1-TRICHLOROETHANE | | | | 0.4 | ND | 0.4 | ND | ND | ND | ND | ND | ND |
| DICHLOROMETHANE | 50 | H | 12.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CIS-1,2-DICHLOROETHENE | | | | 0.6 | ND | 0.6 | 0.2 | ND | 0.2 | 0.2 | ND | 0.2 |
| BROMODICHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DIBROMOETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ODWO Ontario Drinking Water Objective
(H - Health, A - Aesthetic, inter H - interim health)
RUP - Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

# Table D2: Assessment of Critical Organic Contaminants

all concentrations in µg/L

| Compound | ODWO | | | 33-II | | | | 36-I | | | | 44-I | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | | max | min | avg | | max | min | avg | |
| **MISA Group 20 – Acid Extractables** | | | | | | | | | | | | | | | |
| 2,3,4,5-TETRACHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | | | | |
| 2,3,4,6-TETRACHLOROPHENOL | 100 | H | 25 | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,3,5,6-TETRACHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,3,4-TRICHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,3,5-TRICHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,4,5-TRICHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | | | | |
| 2,4,6-TRICHLOROPHENOL | 5 | H | 1.25 | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,4-DIMETHYLPHENOL | | | | 147 | ND | 28.05 | | 1.8 | ND | 0.225 | | ND | ND | ND | |
| 2,4-DINITROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,4-DICHLOROPHENOL | 900 | H | 225 | 1.5 | ND | 0.1875 | | ND | ND | ND | | ND | ND | ND | |
| 2,6-DICHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 4,6-DINITRO-O-CRESOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2-CHLOROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 4-CHLORO-3-METHYLPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 4-NITROPHENOL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| M-CRESOL & P-CRESOL | | | | 1280 | ND | 193.07 | | 0.5 | ND | 0 | | ND | ND | ND | |
| O-CRESOL | | | | 61.9 | ND | 10.814 | | 6.8 | ND | 0.97 | | ND | ND | ND | |
| PENTACHLOROPHENOL | 60 | A | 30 | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| PHENOL | | | | 1780 | ND | 557.16 | | 25.5 | ND | 8.5 | | ND | ND | ND | |
| NITROPHENOL | | | | 20 | ND | 10 | | 40.3 | ND | 13.43 | | | | | |
| 2-METHYL-4-6-DINITROPHENOL | | | | 21 | ND | 10.5 | | ND | ND | ND | | | | | |
| **Misa Group 19 – Base/Neutral Extractables** | | | | | | | | | | | | | | | |
| ACENAPHTHENE | | | | 0.5 | ND | 0.0625 | | ND | ND | ND | | ND | ND | ND | |
| 5-NITROACENAPHTHENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| ACENAPHTHYLENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| ANTHRACENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BENZ(A)ANTHRACENE | | | | 0.8 | ND | 0.1 | | ND | ND | ND | | ND | ND | ND | |
| BENZO(A)PYRENE | 0.01 | H | 0.0025 | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BENZO(B)FLUORANTHENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BENZO(G,H,I)PERYLENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BENZO(K)FLUORANTHENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BIPHENYL | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| CAMPHENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 1-CHLORONAPHTHALENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2-CHLORONAPHTHALENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| CHRYSENE | | | | 0.9 | ND | 0.1125 | | ND | ND | ND | | ND | ND | ND | |
| DIBENZ(A,H)ANTHRACENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| FLUORANTHENE | | | | 0.8 | ND | 0.1 | | ND | ND | ND | | ND | ND | ND | |
| FLUORENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| INDENO(1,2,3-CD)PYRENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| INDOLE | | | | 21.4 | ND | 3.4 | | ND | ND | ND | | ND | ND | ND | |
| 1-METHYL NAPHTHALENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2-METHYLNAPHTHALENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| NAPHTHALENE | | | | 16.3 | 0 | 4.1 | | ND | ND | ND | | ND | ND | ND | |
| PERYLENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| PHENANTHRENE | | | | 0.8 | 0 | 0.175 | | ND | ND | ND | | ND | ND | ND | |
| PYRENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BENZYL BUTYL PHTHALATE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BIS(2-ETHYLHEXYL)PHTHALATE | | | | 2.4 | 0 | 0.5625 | | 4.6 | ND | 0.9875 | | ND | ND | ND | |
| DI-N-BUTYL PHTHALATE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| DI-N-OCTYL PHTHALATE | | | | ND | ND | ND | | 2 | ND | 0.5 | | ND | ND | ND | |
| 4-BROMOPHENYL PHENYL ETHER | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 4-CHLOROPHENYL PHENYL ETHER | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BIS(2-CHLOROISOPROPYL)ETHER | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BIS(2-CHLOROETHYL)ETHER | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| DIPHENYL ETHER | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,4-DINITROTOLUENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| 2,6-DINITROTOLUENE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| BIS(2-CHLOROETHOXY)METHANE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| DIPHENYLAMINE & N-NITROSODIPHA | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |
| N-NITROSODI-N-PROPYLAMINE | | | | ND | ND | ND | | ND | ND | ND | | ND | ND | ND | |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 µg/L

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO | | | 33-II | | | 38-I | | | 44-I | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | max | min | avg | max | min | avg |
| **MISA Group 22 – Organochlorine Compounds** | | | | | | | | | | | | |
| ALDRIN | | | | 0.002 | ND | 0.0007 | ND | ND | ND | ND | ND | ND |
| DIELDRIN | | | | 0.0415 | ND | 0.0145 | 0.0005 | ND | 6E-05 | ND | ND | ND |
| ALDRIN + DIELDRIN | 0.7 | H | 0.175 | 0.0435 | | | 0.0005 | | | 0 | | |
| ALPHA-BHC | | | | 0.015 | ND | 0.0049 | ND | ND | ND | ND | ND | ND |
| BETA-BHC | | | | 0.027 | ND | 0.0131 | ND | ND | ND | ND | ND | ND |
| DELTA-BHC | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| GAMMA-BHC | | | | 0.0005 | ND | 0.0001 | 0.0025 | ND | 0 | ND | ND | ND |
| CHLORDANE | 7 | H | 1.75 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DDD | | | | 0.004 | ND | 0.0009 | ND | ND | ND | ND | ND | ND |
| DDE | | | | 0.0026 | ND | 0.0006 | ND | ND | ND | ND | ND | ND |
| DDT | 30 | H | 7.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-DDT | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN I | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN II | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDOSULFAN SULPHATE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ENDRIN | | | | 0.0047 | ND | 0.0012 | ND | ND | ND | ND | ND | ND |
| ENDRIN ALDEHYDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| HEPTACHLOR | | | | 0.003 | ND | 0.0008 | 0.087 | ND | 0.011 | ND | ND | ND |
| HEPTACHLOR EPOXIDE | | | | 0.0008 | ND | 0.0001 | ND | ND | ND | ND | ND | ND |
| HEPTACHLOR + HEPTACHLOR EPOXIDE | 3 | inter H | 0.75 | 0.0038 | | | 0.087 | | | 0 | | |
| METHOXYCHLOR | 900 | H | 225 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MIREX | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TOXAPHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| PCB's | 3 | H | 0.75 | ND | ND | ND | 4.09 | ND | 0.5113 | ND | ND | ND |
| **MISA Group 17** | | | | | | | | | | | | |
| BENZENE | 5 | H | 1.25 | 1.8 | ND | 0.8375 | ND | ND | ND | ND | ND | ND |
| ETHYLBENZENE | 2.4 | A | 1.2 | 0.1 | ND | 0.0125 | ND | ND | ND | ND | ND | ND |
| STYRENE | | | | 0 | ND | 0 | ND | ND | ND | ND | ND | ND |
| TOLUENE | 24 | A | 12 | 1.8 | ND | 0.625 | 0.2 | ND | 0.025 | 0.2 | ND | 0.1 |
| O-XYLENE | 300 | A | 150 | 0.9 | ND | 0.1625 | ND | ND | ND | ND | ND | ND |
| M-XYLENE + P-XYLENE | 300 | A | 150 | 1.1 | ND | 0.2375 | 0.2 | ND | 0.025 | 0.1 | ND | 0.05 |
| **MISA Group 18** | | | | | | | | | | | | |
| ACROLEIN | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ACRYLONITRILE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| **MISA Group 16 – Halogenated VOC's** | | | | | | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-TRICHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1-DICHLOROETHANE | | | | 0.1 | ND | 0.0125 | ND | ND | ND | ND | ND | ND |
| 1,1-DICHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DICHLOROBENZENE | 200 | H | 50 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DICHLOROETHANE | 5 | inter H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DICHLOROPROPANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-DICHLOROBENZENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-DICHLOROBENZENE | 5 | H | 1.25 | 0.1 | ND | 0.0125 | ND | ND | ND | ND | ND | ND |
| BROMOFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BROMOMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CARBON TETRACHLORIDE | 5 | H | 1.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROBENZENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROFORM | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CIS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DIBROMOCHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| ETHYLENE DIBROMIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| METHYLENE CHLORIDE | | | | 68.5 | ND | 9.7857 | 292 | ND | 41.714 | ND | ND | ND |
| TETRACHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRANS-1,2-DICHLOROETHYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRANS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| TRICHLOROETHYLENE | 50 | H | 12.5 | 0.3 | ND | 0.1 | ND | ND | ND | ND | ND | ND |
| TRICHLOROFLUOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| VINYL CHLORIDE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,1-TRICHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| DICHLOROMETHANE | 50 | H | 12.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CIS-1,2-DICHLOROETHENE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| BROMODICHLOROMETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| CHLOROETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-DIBROMOETHANE | | | | ND | ND | ND | ND | ND | ND | ND | ND | ND |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO Limit | ODWO Type | ODWO RUP | 57-II, 58-I max | 57-II, 58-I min | 57-II, 58-I avg | |
|---|---|---|---|---|---|---|---|
| **MISA Group 20 – Acid Extractables** | | | | | | | |
| 2,3,4,5-TETRACHLOROPHENOL | | | | | | | |
| 2,3,4,6-TETRACHLOROPHENOL | 100 | H | 25 | ND | ND | ND | |
| 2,3,5,6-TETRACHLOROPHENOL | | | | ND | ND | ND | |
| 2,3,4-TRICHLOROPHENOL | | | | ND | ND | ND | |
| 2,3,5-TRICHLOROPHENOL | | | | ND | ND | ND | |
| 2,4,5-TRICHLOROPHENOL | | | | | | | |
| 2,4,6-TRICHLOROPHENOL | 5 | H | 1.25 | ND | ND | ND | |
| 2,4-DIMETHYLPHENOL | | | | ND | ND | ND | |
| 2,4-DINITROPHENOL | | | | ND | ND | ND | |
| 2,4-DICHLOROPHENOL | 900 | H | 225 | ND | ND | ND | |
| 2,6-DICHLOROPHENOL | | | | ND | ND | ND | |
| 4,6-DINITRO-O-CRESOL | | | | ND | ND | ND | |
| 2-CHLOROPHENOL | | | | ND | ND | ND | |
| 4-CHLORO-3-METHYLPHENOL | | | | ND | ND | ND | |
| 4-NITROPHENOL | | | | ND | ND | ND | |
| M-CRESOL & P-CRESOL | | | | 1690 | 5 | 847.5 | |
| O-CRESOL | | | | 528 | ND | 264 | |
| PENTACHLOROPHENOL | 60 | A | 30 | ND | ND | ND | |
| PHENOL | | | | 5970 | 292 | 3131 | |
| NITROPHENOL | | | | | | | |
| 2-METHYL-4-6-DINITROPHENOL | | | | | | | |
| **Misa Group 19 – Base/Neutral Extractables** | | | | | | | |
| ACENAPHTHENE | | | | 33 | ND | 16.5 | |
| 5-NITROACENAPHTHENE | | | | ND | ND | ND | |
| ACENAPHTHYLENE | | | | ND | ND | ND | |
| ANTHRACENE | | | | 17.5 | ND | 8.75 | |
| BENZ(A)ANTHRACENE | | | | ND | ND | ND | |
| BENZO(A)PYRENE | 0.01 | H | 0.0025 | ND | ND | ND | |
| BENZO(B)FLUORANTHENE | | | | ND | ND | ND | |
| BENZO(G,H,I)PERYLENE | | | | ND | ND | ND | |
| BENZO(K)FLUORANTHENE | | | | ND | ND | ND | |
| BIPHENYL | | | | ND | ND | ND | |
| CAMPHENE | | | | ND | ND | ND | |
| 1-CHLORONAPHTHALENE | | | | ND | ND | ND | |
| 2-CHLORONAPHTHALENE | | | | ND | ND | ND | |
| CHRYSENE | | | | ND | ND | ND | |
| DIBENZ(A,H)ANTHRACENE | | | | ND | ND | ND | |
| FLUORANTHENE | | | | 22.1 | ND | 11.05 | |
| FLUORENE | | | | 25.4 | ND | 12.7 | |
| INDENO(1,2,3-CD)PYRENE | | | | ND | ND | ND | |
| INDOLE | | | | ND | ND | ND | |
| 1-METHYL NAPHTHALENE | | | | 17.4 | ND | 8.7 | |
| 2-METHYLNAPHTHALENE | | | | 23.1 | ND | 11.55 | |
| NAPHTHALENE | | | | 382 | ND | 191 | |
| PERYLENE | | | | ND | ND | ND | |
| PHENANTHRENE | | | | 43.3 | ND | 21.65 | |
| PYRENE | | | | 17.7 | ND | 8.85 | |
| BENZYL BUTYL PHTHALATE | | | | ND | ND | ND | |
| BIS(2-ETHYLHEXYL)PHTHALATE | | | | ND | ND | ND | |
| DI-N-BUTYL PHTHALATE | | | | ND | ND | ND | |
| DI-N-OCTYL PHTHALATE | | | | ND | ND | ND | |
| 4-BROMOPHENYL PHENYL ETHER | | | | ND | ND | ND | |
| 4-CHLOROPHENYL PHENYL ETHER | | | | ND | ND | ND | |
| BIS(2-CHLOROISOPROPYL)ETHER | | | | ND | ND | ND | |
| BIS(2-CHLOROETHYL)ETHER | | | | ND | ND | ND | |
| DIPHENYL ETHER | | | | ND | ND | ND | |
| 2,4-DINITROTOLUENE | | | | ND | ND | ND | |
| 2,6-DINITROTOLUENE | | | | ND | ND | ND | |
| BIS(2-CHLOROETHOXY)METHANE | | | | ND | ND | ND | |
| DIPHENYLAMINE & N-NITROSODIPHA | | | | ND | ND | ND | |
| N-NITROSODI-N-PROPYLAMINE | | | | ND | ND | ND | |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

## Table D2: Assessment of Critical Organic Contaminants

all concentrations in μg/L

| Compound | ODWO | | | 57-II, 58-I | | | |
|---|---|---|---|---|---|---|---|
| | Limit | Type | RUP | max | min | avg | |
| **MISA Group 22 – Organochlorine Compounds** | | | | | | | |
| ALDRIN | | | | 0.003 | ND | 0.0015 | |
| DIELDRIN | | | | ND | ND | ND | |
| ALDRIN + DIELDRIN | 0.7 | H | 0.175 | 0.003 | | | |
| ALPHA-BHC | | | | ND | ND | ND | |
| BETA-BHC | | | | ND | ND | ND | |
| DELTA-BHC | | | | ND | ND | ND | |
| GAMMA-BHC | | | | 0.002 | ND | 0.001 | |
| CHLORDANE | 7 | H | 1.75 | ND | ND | ND | |
| DDD | | | | ND | ND | ND | |
| DDE | | | | ND | ND | ND | |
| DDT | 30 | H | 7.5 | ND | ND | ND | |
| 2,4-DDT | | | | ND | ND | ND | |
| ENDOSULFAN I | | | | ND | ND | ND | |
| ENDOSULFAN II | | | | ND | ND | ND | |
| ENDOSULFAN SULPHATE | | | | ND | ND | ND | |
| ENDRIN | | | | ND | ND | ND | |
| ENDRIN ALDEHYDE | | | | ND | ND | ND | |
| HEPTACHLOR | | | | 0.006 | 0.002 | 0.004 | |
| HEPTACHLOR EPOXIDE | | | | ND | ND | ND | |
| HEPTACHLOR + HEPTACHLOR EPOXIDE | 3 | inter H | 0.75 | 0.006 | | | |
| METHOXYCHLOR | 900 | H | 225 | ND | ND | ND | |
| MIREX | | | | ND | ND | ND | |
| TOXAPHENE | | | | ND | ND | ND | |
| PCB's | 3 | H | 0.75 | ND | ND | ND | |
| **MISA Group 17** | | | | | | | |
| BENZENE | 5 | H | 1.25 | 21.2 | 0.3 | 10.75 | |
| ETHYLBENZENE | 2.4 | A | 1.2 | 5.5 | ND | 2.75 | |
| STYRENE | | | | ND | ND | ND | |
| TOLUENE | 24 | A | 12 | 22.5 | 0.2 | 11.35 | |
| O-XYLENE | 300 | A | 150 | 17.1 | 0.3 | 8.7 | |
| M-XYLENE + P-XYLENE | 300 | A | 150 | 22.8 | 0.5 | 11.65 | |
| **MISA Group 18** | | | | | | | |
| ACROLEIN | | | | | | | |
| ACRYLONITRILE | | | | | | | |
| **MISA Group 16 – Halogenated VOC's** | | | | | | | |
| 1,1,2,2-TETRACHLOROETHANE | | | | ND | ND | ND | |
| 1,1,2-TRICHLOROETHANE | | | | ND | ND | ND | |
| 1,1-DICHLOROETHANE | | | | ND | ND | ND | |
| 1,1-DICHLOROETHYLENE | | | | ND | ND | ND | |
| 1,2-DICHLOROBENZENE | 200 | H | 50 | ND | ND | ND | |
| 1,2-DICHLOROETHANE | 5 | inter H | 1.25 | ND | ND | ND | |
| 1,2-DICHLOROPROPANE | | | | ND | ND | ND | |
| 1,3-DICHLOROBENZENE | | | | ND | ND | ND | |
| 1,4-DICHLOROBENZENE | 5 | H | 1.25 | ND | ND | ND | |
| BROMOFORM | | | | ND | ND | ND | |
| BROMOMETHANE | | | | ND | ND | ND | |
| CARBON TETRACHLORIDE | 5 | H | 1.25 | ND | ND | ND | |
| CHLOROBENZENE | | | | ND | ND | ND | |
| CHLOROFORM | | | | ND | ND | ND | |
| CHLOROMETHANE | | | | ND | ND | ND | |
| CIS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | |
| DIBROMOCHLOROMETHANE | | | | ND | ND | ND | |
| ETHYLENE DIBROMIDE | | | | ND | ND | ND | |
| METHYLENE CHLORIDE | | | | ND | ND | ND | |
| TETRACHLOROETHYLENE | | | | ND | ND | ND | |
| TRANS-1,2-DICHLOROETHYLENE | | | | ND | ND | ND | |
| TRANS-1,3-DICHLOROPROPYLENE | | | | ND | ND | ND | |
| TRICHLOROETHYLENE | 50 | H | 12.5 | ND | ND | ND | |
| TRICHLOROFLUOROMETHANE | | | | ND | ND | ND | |
| VINYL CHLORIDE | | | | ND | ND | ND | |
| 1,1,1-TRICHLOROETHANE | | | | | | | |
| DICHLOROMETHANE | 50 | H | 12.5 | | | | |
| CIS-1,2-DICHLOROETHENE | | | | | | | |
| BROMODICHLOROMETHANE | | | | ND | ND | ND | |
| CHLOROETHANE | | | | | | | |
| 1,2-DIBROMOETHANE | | | | | | | |

ODWO Ontario Drinking Water Objective
(H – Health, A – Aesthetic, inter H – interim health)
RUP – Reasonable Use Policy Guideline
Calculated assuming background concentration equal to 0 μg/L

# Appendix E

**Water Budget**
**Estimate of Leachate Production**

# WATER BUDGET WRITE–UP FOR HAMILTON AIRPORT

Long–term meteorological data for the Hamilton A meteorological station have been reviewed to prepare a water budget for this site.

It is estimated that the mean annual precipitation at Hamilton A is 890 mm per year, based on 31 years of meteorological data from 1959 to 1990. There is some variation, from year to year, in the total annual precipitation. It has been estimated that the total annual precipitation varies from 793 mm to 988 mm during 13 out of 20 years. This range is equivalent to a variation of one standard deviation of annual precipitation about the mean value.

The distribution of the precipitation varies from month to month, as shown on Figure D1 for a normal year.

A Water Balance has been prepared using the method described in Thornthwaite and Mather (1957). The mean annual evapotranspiration is estimated to be 552 mm, based on an assumed soil moisture storage of 100 mm (Figure D2). The mean annual water surplus is calculated to be 338 mm. The annual surplus is likely to range from 268 mm to 414 mm during 13 out of 20 years.

The distribution of the surplus water on a monthly basis through a normal year is shown on Figure D1. It shows that a significant surplus of 412 mm occurs during the autumn, winter and spring months and a deficit of 74 mm occurs during the summer.

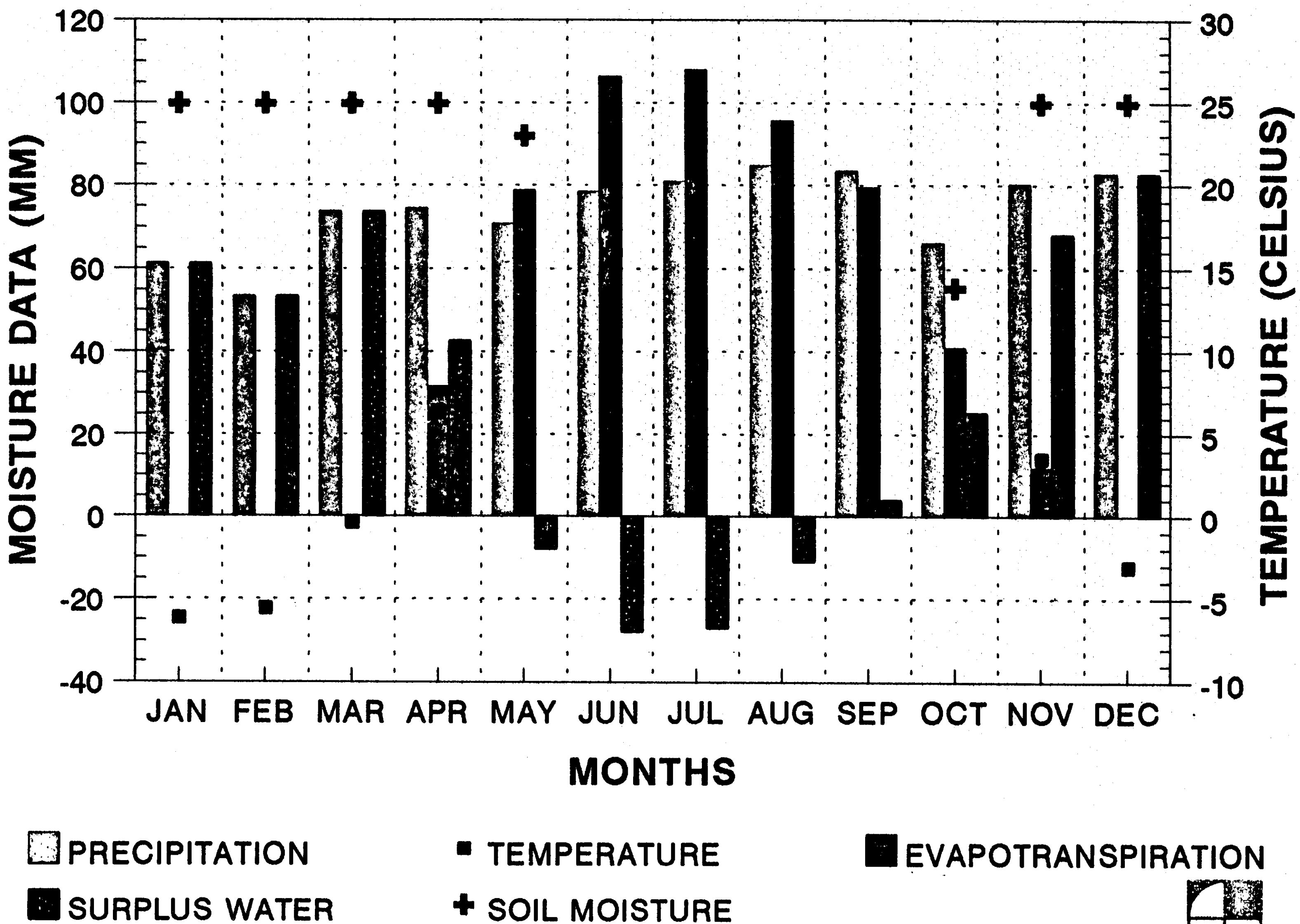
The water surplus includes both the surface runoff and infiltration components of a water balance. Site specific conditions like soils and topography need to be evaluated in order to partition the surplus.

*Reference:*

Thornthwaite C. W., and J. R. Mather:
1957 Instructions And Tables For Computing Potential Evapotranspiration And The Water Balance; Drexel Institute of Technology, Laboratory Of Climatology, Publications In Climatology, Volume X, Number 3, 1957, 311 pp.

FIGURE D.1

# WATER BALANCE SUMMARY HAMILTON AIRPORT, 1959 - 1990



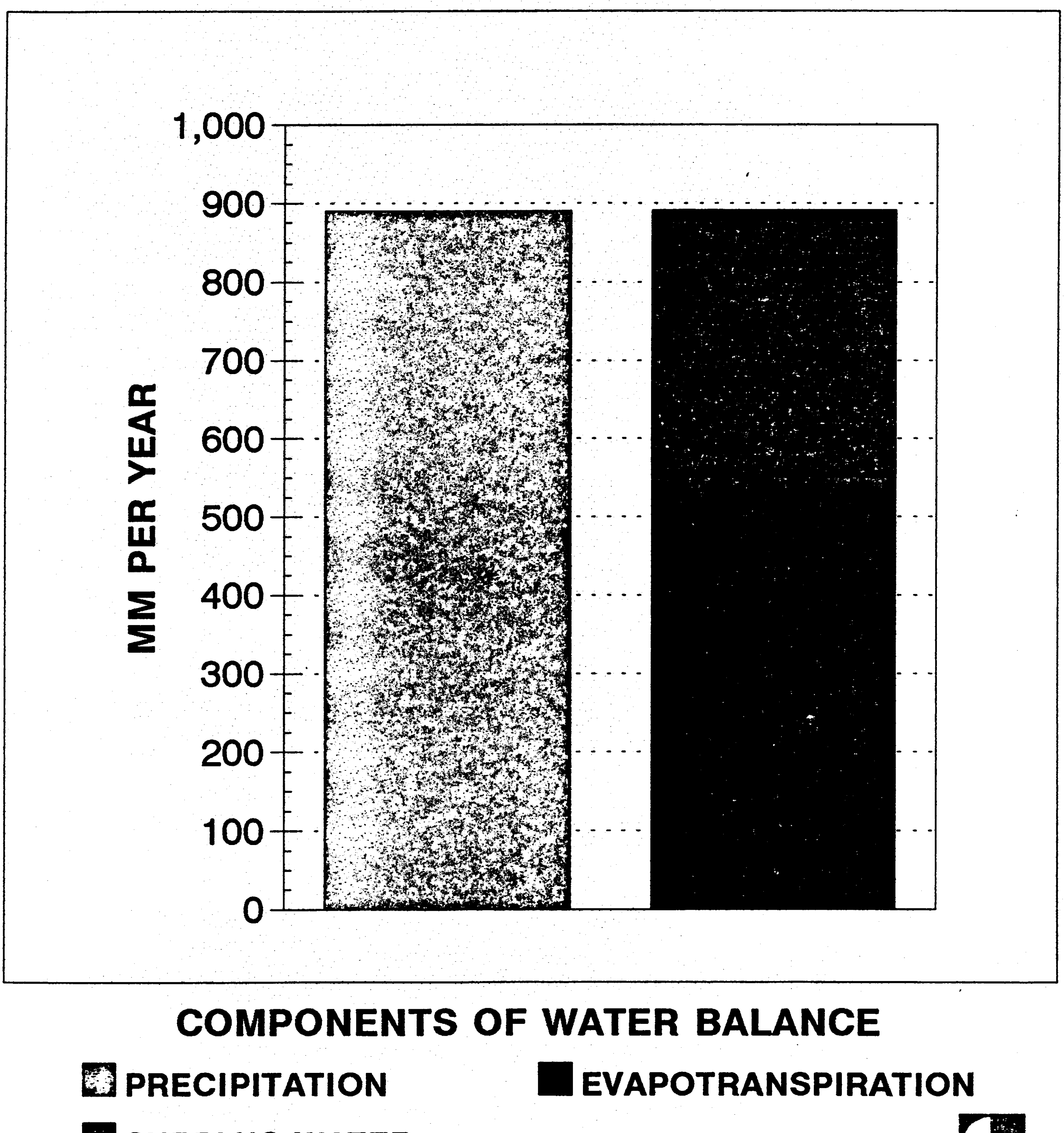

CALCULATED USING THORNTHWAITE METHOD, ASSUMED SOIL MOISTURE CAPACITY: 100 MM

GLL 94-405, \94\405\WATBUD1.CH3, JJPM, 94.03.24

GARTNER LEE

FIGURE D.2

# WATER BALANCE SUMMARY FOR HAMILTON AIRPORT, 1959 - 1990




GLL 94-405, \94\405\WATBUD2.CH3, JJPM, 94.03.24

GARTNER LEE

# ESTIMATE OF LEACHATE PRODUCTION

**Step 1:**

Leachate will be produced at this site from the infiltration of rain or melt water into the wastes.

***Assumptions***

Water available for infiltration is calculated from the water budget presented in Appendix C. The average annual water surplus is 338 mm, or 0.338 m/a. This is based on the subtraction of actual evapotranspiration from the total precipitation.

**Step 2:** <u>**Open Cell**</u>

During active landfilling of a cell, it is assumed that the entire available surplus will infiltrate.

Therefore, the average rate of leachate production, per hectare, in an open cell can be calculated.

$$0.338 \ \frac{m}{a} \times 10{,}000 \ \frac{m^2}{ha}$$

$$= 3{,}380 \ \frac{m^3}{a\ ha} \quad \text{or} \quad 0.107 \ L/s/ha$$

**Step 3:** <u>**Closed Cell**</u>

Once a cell is closed it will be capped with 0.85 m of compacted clay, plus 0.15 m of vegetated topsoil. In a weathered condition it is assumed that the cap will turn about 33% of the water surplus aside. (Experience shows that this figure can vary locally from 0 to 40 %) Hence 67% of the surplus will infiltrate, and therefore leachate production may be calculated as:

$$0.67 \times 3{,}380 = 2{,}250 \ m^3/a/ha$$
$$\textit{or} \ 0.071 \ L/s/ha$$

**Step 4:** <u>**Estimated Average Leachate Production After Closure**</u>

Based on a 59.06 ha landfill footprint, the average annual leachate production after closure (covered) is:

$$2{,}250 \ m^3/a/ha \times 54.2 \ ha$$
$$= 121{,}950 \ m^3/a$$
$$\textit{or} \ 4.21 \ L/s$$

**Step 5:** **Effect of Annual Fluctuations**

The water budget states that, in 13 out of 20 years the annual surplus is likely to range from 0.268 m to 0.414 m. By factoring this range to the average annual surplus of 0.338 m, a range in leachate production is calculated.

$$Q_{MIN} = \frac{.268}{.338} \times 4.21 \text{ L/s} = 3.3 \text{ L/s}$$

$$Q_{MAX} = \frac{.414}{.338} \times 4.21 \text{ L/s} = 5.2 \text{ L/s}$$

Therefore, it can be expected that leachate production will range between 3.0 and 4.7 L/s after landfill closure.

# Appendix F

## Contaminating Lifespan Calculations

# Table F1: Calculated Contaminating Lifespan in The Proposed East Quarry Landfill

Method 1: Leachate concentration decays over time (Rowe, 1991)

**Predicted mass of parameters in the waste**

| ELEMENTS | | Sodium | | Fluoride | |
|---|---|---|---|---|---|
| Data from bulk analysis March 1994 | kg | mg/kg | mass of compound (mg) | mg/kg | mass of compound (mg) |
| Dofasco Waste | | | | | |
| Approved Mixed Waste | 4,200,000,000 | 2510 | 1.05E+13 | 14 | 5.88E+10 |
| Oxides | 2,200,000,000 | 1338 | 2.94E+12 | 9 | 1.98E+10 |
| other | 200,000,000 | | | | |
| Industrial sands/dust/ashes | 400,000,000 | | | | |
| Contaminated Soils | 2,900,000,000 | 892 | 2.59E+12 | 5.5 | 1.60E+10 |
| Misc Industrial Wastes | 100,000,000 | | | | |
| Total | 10,000,000,000 | | | | |
| Total mass of element in Landfill (mg) (% of total waste mass) | | mg | 1.61E+13 0.16% | mg | 9.46E+10 0.0009% |

(uses average bulk analysis concentration in each waste type)

**Range in Critical Contaminant Concentrations**

| | Sodium (mg/L) | Fluoride (mg/L) |
|---|---|---|
| (1) Highest predicted East Quarry Landfill leachate concentration | 739 | 3.9 |
| (2) Average predicted East Quarry Landfill leachate concentration | 629 | 2.4 |
| (3) Highest observed concentration in the West Quarry leachate (mg/L) in areas with limited aluminum processing waste | 552 | 3.9 |

**Calculated Contaminating Lifespan**

| | Sodium | Fluoride |
|---|---|---|
| Parameter concentration considered acceptable for discharge (mg/L) | 145 ODWO – a (based on RUP calculation) | 0.9 ODWO – h (based on RUP calculation) |
| Time required to decrease the leachate concentration to levels considered acceptable for discharge to the environment using the highest predicted East Quarry Landfill leachate concentration | 267 | 268 |
| Time required to decrease the leachate concentration to levels considered acceptable for discharge to the environment using the average predicted East Quarry Landfill leachate concentration | 262 | 291 |
| Time required to decrease the leachate concentration to levels considered acceptable for discharge to the environment using the maximum leachate concentration in the West Quarry Landfill (mg/L) in areas with limited aluminum processing waste | 293 | 268 |

$t = -M \ln(C_L/C_O) / q A C_O$

t = time at which the leachate concentrations have decreased enough to allow discharge to the environment

$C_O$ = Maximum Leachate Concentration

$C_L$ = Leachate concentration required for discharge

q = Infiltration rate (0.225 m/a)

A = Landfill area (59.06 ha)

M = Mass of contaminant

RUP – Reasonable Use Policy: for health parameters, RUP = background + .25 (ODWO – background); for aethetic parameters, RUP = background + .5 (ODWO – background)

| | |
|---|---|
| Estimated leachate production rate in East Quarry Landfill with Final Cover | 0.225 m/a |
| Based on long term average surplus rainfall of 0.338 mm/a, and 66% infiltration through the cover | |

# Table F2: Calculated Contaminating Lifespan of the Proposed East Quarry Landfill

**Calculation using mass balance model**

**Predicted Mass of Critical Contamiants using Bulk Analysis Information**

| | ELEMENTS | Sodium | | Fluoride | |
|---|---|---|---|---|---|
| Data from Bulk analysis March 1994 (uses average concentrations) | | mg/kg | mass of compound (mg) | mg/kg | mass of compound (mg) |
| Dofasco Waste | kg | | | | |
| Approved Mixed Waste | 4,200,000,000 | 2510 | 1.05E+13 | 14 | 5.88E+10 |
| Oxides | 2,200,000,000 | 1338 | 2.94E+12 | 9 | 1.98E+10 |
| other | 200,000,000 | | | | |
| Industrial sands/dust/ashes | 400,000,000 | | | | |
| Contaminated Soils | 2,900,000,000 | 892 | 2.59E+12 | 5.5 | 1.60E+10 |
| Misc Industrial Wastes | 100,000,000 | | | | |
| Total | 10,000,000,000 | | | | |
| Total mass of element in Landfill (mg) | | mg | 1.61E+13 | mg | 9.46E+10 |
| (% of total waste mass) | | | 0.16% | | 0.00% |

**Predicted Leachate Concentrations**

| | Sodium (mg/L) | Fluoride |
|---|---|---|
| (1) Highest predicted concentration in the East Quarry Landfill leachate | 739 | 3.9 |
| (2) Average predicted concentration in the East Quarry Landfill leachate | 629 | 2.4 |
| (3) Highest Observed Concentration in the West Quarry Leachate (mg/L) in areas with limited aluminum processing waste | 552 | 3.9 |

**Predicted Contaminating Lifespan for Critical Contaminants**

Calculated from the Closure of the Proposed East Quarry Landfill

| | Sodium | Fluoride |
|---|---|---|
| The total volume of water needed to leach out compound, using the highest predicted East Quarry Landfill leachate concentration | (L) 2.17E+10 | (L) 2.42E+10 |
| Calculated time required to leach out the element with leachate generation rate of 3.87 L/s | years 164 | years 182 |
| The total volume of water needed to leach out compound, using the average predicted East Quarry Landfill leachate concentration | (L) 2.56E+10 | 3.94E+10 |
| Calculated time required to leach out the element with leachate generation rate of 3.87 L/s | years 192 | years 297 |
| The total volume of water needed to leach out compound, using the highest observed concentration in the West Quarry Leachate (mg/L) in areas with limited aluminum processing waste | (L) 2.91E+10 | (L) 2.42E+10 |
| Calculated time required to leach out the element with leachate generation rate of 3.87 L/s | years 219 | years 182 |

| | |
|---|---|
| Estimated leachate production rate in East Quarry Landfill with final cover (L/s)<br>Based on long term average surplus rainfall of 0.338 mm/a, and a total area of 59.06 Ha<br>Assumes 66% infiltration through the final cover | 4.21 L/s |

AECOM

# 2012 Construction Inspection Report – Newalta Stoney Creek Landfill Site Stage 1 Stormwater Management System


Newalta Corporation

# 2012 Construction Inspection Report – Newalta Stoney Creek Landfill Site Stage 1 Stormwater Management System

**Prepared by:**

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www.aecom.com

**Project Number:**

60265424

**Date:**

July, 2013

# Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“Consultant”) for the benefit of the client (“Client”) in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Agreement”).

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- must be read as a whole and sections thereof should not be read out of such context;
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*AECOM: 2012-01-06*

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July 31, 2013

Mr. Lorenzo Alfano
Newalta Corporation
65 Green Mountain Road
Stoney Creek, ON L8J 1X5

Dear Mr. Alfano:

**Project No:** **60265424**

**Regarding:** **2012 Construction Inspection Report – Newalta Stoney Creek Landfill Site Stage 1 Stormwater Management System**

We are pleased to provide you with our report documenting the quality assurance work undertaken in 2012 for the Stage 1 Stormwater Management System. We understand that this report will be used to satisfy Condition 14.1 and 14.3 of Environmental Compliance Approval No. A181008 issued by the Ministry of the Environment (MOE) for the site. We note that a letter dated May 2, 2013 was submitted to the MOE immediately upon completion of the Stormwater Management System.

Please do not hesitate to contact us with any questions or comments.

Sincerely,
**AECOM Canada Ltd.**

Larry Fedec, P.Eng., M.BA.
Manager, Waste Services, Environment
*Larry.Fedec@aecom.com*

LMF:mm
Encl.

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## Appendices

# 1. Introduction

## 1.1 Background

Newalta Corporation operates the Newalta Stoney Creek Landfill (formerly the Taro Landfill) in Stoney Creek, Ontario. The site has been operating since December 1996 under Environmental Compliance Approval (ECA) No. A181008 issued by the Ministry of the Environment (MOE). Key conditions relating to the construction of the site's Stage 1 Stormwater Management System are the following:

- **Condition 14.1:**
  *"Specifications and a detailed quality assurance/quality control program for construction of the Major works, and provisions for quality assurance procedures, with respect to the liner, to be undertaken by an independent third-party consulting firm, reporting to the Ministry."*
- **Condition 14.3:**
  *"The Company shall construct Major works in accordance with the approved final detailed design and shall implement the quality assurance procedures as approved by the Director."*


**Braking and Hauling Rock from Forebay and Detention Pond Footprint**

In 2012 Newalta undertook the construction of the Stage 1 Stormwater Management System which is shown in Figure 1. The main components of the Stage 1 Stormwater Management System include a perimeter drainage ditch along the west and south sides of the site which direct the stormwater into the forebay pond located at the northwest corner of the site. From the forebay pond the stormwater will flow through a 900 mm HDPE drainage pipe into the detention pond. Discharge from the detention pond is manually controlled by the outlet structure located at the northwest corner of the pond. The outlet structure consists of a 1,500 mm diameter concrete maintenance hole, fitted with a series 20-10c sluice gate. When the sluice gate is open, the stormwater will flow through a 750 mm drainage pipe to a 1,500 mm diameter concrete ditch inlet maintenance hole, and then into a culvert which runs under First Road West. This culvert discharges the stormwater into the road side ditch. Newalta retained AECOM to carry out the associated construction quality assurance work. The completion and documentation of this work satisfies Conditions 14.1 and 14.3.

Construction generally took place between July 2012 and April 2013, with the following being completed:

a) a perimeter drainage ditch was constructed around the south and west perimeter of the landfill site. A typical cross section through the perimeter ditch is shown on Figure 2.

b) a forebay pond was constructed on the north side of the west site entrance road along First Road West

c) A support berm was constructed from the forebay pond to the detention pond to support a 900 mm HDPE drainage pipe. This pipe allows the stormwater from the forebay pond to flow into the detention pond. A cross section through the support berm is shown on Figure 3.

d) the detention pond was constructed on the north side of the site along Green Mountain Road, east of the forebay pond

e) an overflow weir was constructed on the west side of the detention pond in order to direct excess stormwater to flow into the site's existing pond. A cross section of the overflow weir can be seen on Figure 4.

f) An outlet structure consisting of a 1,500 mm diameter concrete maintenance hole, fitted with a series 20-10c sluice gate, was constructed within the detention pond to allow manual control of the stormwater discharge from the site to the road side ditch. A cross section through the outlet structures are shown on Figure 5.

The major components mentioned above are presented on Figure 6.

There were three (3) design changes from the original Stage 1 Stormwater Management System design. These design changes are listed below:

a) The footprint of the detention pond has been reduced in area, from the original design, in order to keep a setback of 30 m from the existing septic bed. This reduction in footprint area has resulted in an overall reduction in storage capacity of approximately 35%.

b) The one (1) 1,050 mm HDPE culvert originally designed to run under the site entrance road from First Road West was changed to three (3) 675 mm concrete culverts. As bedrock is at the surface in this area, this modification was made to reduce the amount of bedrock removal and fill required to provide cover for the 1,050 mm pipe. A cross section through the culverts is shown on Figure 7.

c) Location of the 1,500 mm diameter concrete ditch inlet maintenance hole, and alignment of the 750 mm HDPE pipe from the detention pond were modified to match the existing location of the culvert running under First Road West.

A letter pertaining to completion of the Stage 1 Stormwater Management System was submitted to the MOE on May 2, 2013. Submission of this report constitutes the remainder of the required quality assurance documentation. A copy of the letter to the MOE is provided in Appendix A.

## 1.2 Scope of Report

This report is being submitted to the MOE in compliance with Condition 14.1 and 14.3 of the ECA No. A181008 for the Newalta Stoney Creek Landfill. It documents construction activities undertaken in 2012 and early 2013, and the associated construction quality assurance program. Photographs showing typical construction activities are shown in Appendix B. Daily documented construction activities can be seen in Appendix C.

The remainder of this report is organized as follows:

a) Section 2 presents a brief overview of the construction activities;
b) Section 3 summarizes the results of:
   - conformance testing of the materials used;
   - inspections to confirm that construction methods were achieved;
   - evaluation of the performance of the compacted clay liner;
   - conclusions
c) Sections 4 provides a list of references.

Results of the various field and laboratory testing carried out during the Stage 1 Stormwater Management System work are presented in Appendices D through G of this report.

# 2. Construction Activities

## 2.1 Overview

Dufferin Construction Company (Dufferin) was contracted to complete the construction of the stormwater pond and related structures. Terrafix Environmental Technology Inc. (Terrafix), was responsible for the supply of the geotextile and geoweb used during construction.

Construction commenced on June 26, 2012 and concluded on April 30, 2013. Work was typically carried out Monday to Friday, between the hours of 7:00 a.m. to 5:00 p.m. (except during or immediately after periods of inclement weather). Construction, testing and inspection work was extended into weekends periodically to take advantage of good weather conditions, with the approval of the District MOE office.

## 2.2 Key Contractors

The key contractor involved in the construction of the Stage 1 Stormwater Management System, as well as their various roles and responsibilities are outlined in Table 1.

**Table 1. Roles and Responsibilities of Key Contractor**

| Company | Role | Responsibilities |
|---|---|---|
| **Dufferin Construction Company** | General Contractor | • Construction of all components |

## 2.3 Materials

The main suppliers and manufacturers of materials involved in the construction of the Stage 1 Stormwater Management System are outlined in Table 2.

**Table 2. Suppliers and Manufacturers of Key Construction Materials**

| Material(s) | Supplier | Manufacturer(s) |
|---|---|---|
| **Soil** | Newalta Corporation | - |
| **Granular** | Newalta Corporation | Vinemount Quarries |
| **Type 400-R Geotextile** | Terrafix Geosynthetics Inc. | Propex Inc. |
| **Terrafix Terraweb 200 mm** | Terrafix Geosynthetics Inc. | Texel Inc. |
| **HDPE BOSS 2000 Pipe** | Sandale Utility Products | Oxford Plastics Inc. |
| **HDPE DR35** | Sandale Utility Products | Oxford Plastics Inc. |

## 2.4 Construction Equipment

Major equipment employed during construction consisted of the following:

a) **Tracked Excavators (Caterpillar 330C, 345CL, 365C, 550LC, John Deere 230LC, 350D, 450D)**

- excavation and loading of soils and granular pipe bedding
- bedrock excavation within detention pond (when equipped with a hydraulic hoe-ram)
- compaction of pipe bedding (equipped with hoe-pack)
- excavation of perimeter drainage ditch and pipe trenches
- transport and support of large, heavy construction materials (e.g., geotextile rolls, concrete maintenance structures and piping.
- Loading stone into gabion baskets and placing rip-rap.

b) **Caterpillar D6N, John Deere 750J Bulldozers**

- Spreading and shaping soils for clay liner and engineered fill
- Spreading topsoil for the ponds
- fine grading of ponds and ditches

c) **Volvo A35, A30D, John Deere 350D Rock Trucks**

- haulage of clay soils and granular materials
- haulage of excavation spoil

d) **Water Tank Trucks with Spray Hoses**

- addition of water to clay soils or granular materials prior to compaction
- application of water to haul roads for dust control

e) **Bomag BW213PDH-3, Caterpillar CP563D Pad Foot Compactors**

- compaction of engineered fill and clay liner for ponds and support berm

f) **Terex “Zoom-Boom” Telescopic Fork-Lift**

- movement of geotextile rolls

Other minor equipment used included diesel pumps, hand-guided augers and plate tampers/jumping jacks and skid steer.

**Construction of Gabion Walls within Detention Pond**

# 3. Construction Inspection and Testing

## 3.1 Overview

The benchmark for the quality assurance program was the approved Design Drawings and Specifications. Minor modifications to the design and quality assurance protocols were occasionally made in the field in order to accommodate specific site conditions. All such changes are documented in this report.

AECOM staff was on site to carry out quality assurance inspection and field testing during construction of the Stage 1 Stormwater Management System. AECOM carried out inspection and testing for the clay liner and engineered fill used in the forebay and detention ponds support berm, as well as the perimeter drainage ditch, maintenance hole structures and drainage pipe installation. AECOM and Dufferin jointly carried out surveying to check proper alignment and grade control in addition to the Global Positioning Satellite (GPS) grading hardware utilized on select Dufferin earth moving equipment.

In addition to the testing and inspection discussed herein, AECOM also carried out routine contract administration duties, and recorded the contractor's activities in daily field inspection records.

## 3.2 Construction Materials Testing

### *3.2.1 Liner Soils*

Soil used for the forebay and detention pond's clay liner construction was obtained from on-site stockpiles and quarry overburden strippings. Soil used in the construction was routinely tested for basic geotechnical properties including standard proctor density and optimum moisture content, Atterberg limits, and grain size analysis. Soil testing results are provided in Appendix D to F.

### *3.2.2 Engineered Fill*

Engineered fill was used for construction of the forebay and detention pond base and sidewalls. The engineered fill was obtained from material excavated out of the perimeter drainage ditch and on site stockpiles. Engineered fill used in construction was routinely tested for standard proctor density and optimum moisture content. Test results for the engineered fill are provided in Appendix D and G.

### 3.2.3 Granular 'A'

Granular 'A' was used for the foundation pad of the manhole structure within the detention pond, for pipe bedding, and for various other minor applications. Granular 'A' used in the construction of the Stage 1 Stormwater Management System was imported from Vinemount Quarries.

### *3.2.4 Rip-Rap*

Rip-Rap was placed at each bend within the perimeter drainage ditch, at the inlets of the forebay and detention ponds and around the perimeter of the overflow weir to prevent erosion due to the stormwater flow. Rip-rap was also used to construct the gabion walls inside the forebay and detention pond. The rip rap used in the Stage 1 Stormwater Management System was obtained from a previously produced onsite stockpile.

### *3.2.5 Clear Stone*

50 mm clear stone was used as infill for the geoweb at the overflow wire of the detention pond. Clear stone used in construction of the Stage 1 Stormwater Management System was obtained from on-site stockpiles of product imported from Vinemount Quarries.

### *3.2.6 Geotextiles*

Type 400-R geotextile was placed beneath the rip-rap at the inlet of the forebay and detention pond to protect the clay liner. Geoweb cellular system was used to construct the overflow weir located on the east edge of the detention pond.


**Deployment of Geoweb**

#### 3.2.7 HDPE Pipes

Approximately 85 m of 900 mm diameter BOSS 2000 HDPE piping was installed to convey stormwater from the forebay to the detention pond. The 900 mm HDPE piping was placed within a trench excavated in the support berm, and buried following completion.

Approximately 95 m of 750 mm diameter HDPE piping was installed from the outlet structure within the detention pond to the ditch inlet manhole located at the east side of First Road West. .

#### 3.2.8 Concrete Structures

A 1,500 mm diameter concrete maintenance hole outlet structure was installed within the detention pond. The maintenance hole is fitted with a series 20-10c sluice gate to allow manual control of stormwater being discharged off-site.

A second 1,500 mm concrete ditch inlet maintenance hole was installed to replace the existing catch basin structure located at the corner of First Road West and Green Mountain Road. The east inlet pipe is a 750 mm diameter HDPE drainage pipe which comes from the outlet structure in the detention pond. The west outlet pipe is a 760 mm diameter CSP culvert which runs underneath First Road West and discharges into the road side ditch.

### 3.3 Construction Methods Inspection and Testing

#### 3.3.1 General

The benchmark for the construction methods inspection and testing program was the approved Stage 1 Stormwater Management System detailed Design Drawings and Specifications.

Prior to construction of the Stage 1 Stormwater Management System, the following site preparations were necessary:

- “brush” area within the footprint of the detention pond was removed prior to the start of construction.
- clearing of stored materials from the work area
- the topsoil was stripped from the footprint area of the forebay pond and detention pond
- any bedrock outcrops within the construction area were broken and removed
- heightening and relocation of the overhead power line within the work area.

#### 3.3.2 Engineered Fill

Engineered fill was used to construct the base and sidewalls of the forebay and detention pond. Soil conditioning prior to compaction was carried out in the forebay / detention pond construction area and included rock and debris removal, breaking up of soil clods, and moisture adjustment. Water was added as required using a tank truck equipped with a spray canon.

Inspection and testing during the engineered fill placement generally consisted of:

a) visual inspection of on-site soil stockpiles of the materials for construction and conditioning operations;
b) visual inspection of the finished subgrade prior to engineered fill placement;
c) visual inspection of methods used during compaction of each lift;
d) in situ density and moisture content measurements using a nuclear density gauge, readings were periodically verified/ corrected by oven moisture content analysis on soil samples collected from in situ test locations; and
e) Visual inspection of effects of the compaction and hauling equipment on the lifts.

The inspection was undertaken by AECOM staff, and the results of the dry density and moisture content testing are presented in Appendix G. In this appendix each test carried out is numbered sequentially and the test location is identified. In many cases, a given area of the ponds is represented by several tests where the first shows inadequate compaction and subsequent tests confirm that the required density was achieved following additional compaction.

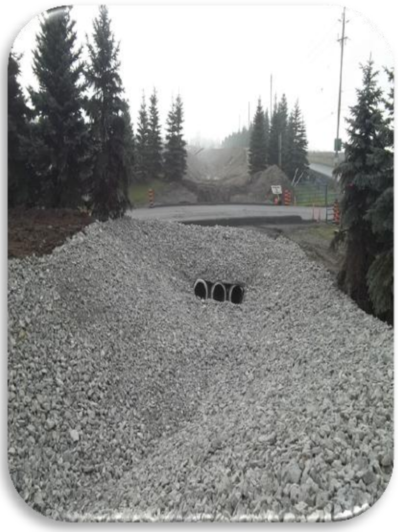
The compaction and moisture content specifications for the engineered fill soil requires that each lift be compacted to at least 95% of SPD with moisture content within 2% of optimum water content. Test results are summarized as follows:

a) densities and moisture contents within the desired range were routinely achieved; and
b) in isolated cases density or moisture content measurements outside of the desired range were accepted, based on the observed appearance and handling characteristics of the soil. This was done in cases where the measurement was made in an area where the soil was re-moulded, where it was known that an adequate number of compactor passes were made (based on the number of passes required to reach the required density in adjacent areas) and where the moisture condition was visually similar to surrounding areas. Such judgements were made on a case-by-case basis by the AECOM soils inspector.

### *3.3.3 Clay Liner*

Inspection and testing during clay liner construction consisted of the following:

a) visual inspection of on-site soil stockpiles of the materials for construction and conditioning operations;



**Perimeter Ditch with Culverts under the East Site Entrance Road**

b) visual inspection of the finished subgrade prior to clay liner construction;
c) visual inspection of methods used during compaction of each lift;
d) in situ density and moisture content measurements using a nuclear density gauge, readings were periodically verified/ corrected by oven moisture content analysis on soil samples collected from in situ test locations;
e) laboratory determinations of basic geotechnical properties and in situ moisture contents;
f) laboratory and in situ hydraulic conductivity testing;
g) visual inspection of action of the compaction and hauling equipment on the lifts,
h) visual inspection of the finished surface of the clay liners;

The results of the *in situ* density and moisture content testing are presented in Appendix F. In this appendix each test carried out is numbered sequentially and the location identified (lift number, co-ordinates). In many cases, a given area of liner is represented by several tests, where the first test shows inadequate compaction and subsequent tests confirm that the required density was achieved following additional compaction. Probe holes created by the nuclear testing gauge were routinely filled with dry granular bentonite.

*In situ* moisture contents for the completed liner were determined by oven drying samples in the on-site laboratory and by nuclear gauge testing. Moisture contents obtained from oven drying averaged approximately 2% higher than the moisture contents obtained from nuclear gauge testing. This can likely be attributed to factors such as the position of the probe or the presence of foreign material below the surface (e.g., rocks) that can affect the accurate measurement of the *in situ* moisture content. In cases where the moisture contents obtained from the two methods differed by more than 2%, a moisture correction factor was applied to the nuclear gauge in order to correlate the field readings with those obtained from oven drying in the on-site laboratory. *In situ* moisture content results are provided in Appendix E.

**HDPE Drainage Pipe Connecting the forebay pond to the detention pond**

The compaction and moisture content specification for the clay liner requires that each lift of the liner be compacted to at least 98% of SPD with a moisture content within 1% to 3% wet of optimum moisture content. At the discretion of the Engineer, the Specifications allow the reduction of the required compaction density from 98% to 95% of SPD with a corresponding increase of the moisture content from 1% to 3% wet of the optimum moisture. The results of the *in situ* testing can generally be summarized as follows:

a) densities and moisture contents within the desired range were routinely achieved; and
b) in isolated cases density or moisture content measurements outside of the desired range were accepted based on the observed appearance and handling characteristics of the soil. This was done in cases where the measurement was made in an area where the soil was well re-moulded, where it was known that adequate compactor passes were made (based on the number of passes required to reach the required density in adjacent areas) and where the moisture condition was visually similar to surrounding areas where *in situ* measurements were within the range. Such judgments were made on a case-by-case basis by the AECOM soils inspector.

##### *3.3.3.1 Construction Method*

The first (i.e., lowest) lift of each clay liner was typically constructed with a lift thickness of approximately 250 mm. This thickness ensured that the underlying materials were not disturbed by the kneading action of the sheepsfoot compactor. The remaining lifts for each liner were typically constructed with an average compacted lift thickness of 200 mm. The clay liner in each the forebay and detention pond was constructed in three (3) lifts. The top lift of the clay liner was also typically overbuilt by about 50 mm and then cut down to the required grade and smooth rolled. This reduced productivity losses in the event of rainfall since only the ‘overbuilt’ surficial soils would typically be affected and could be rapidly removed.

Soil conditioning prior to compaction was carried out at the forebay / detention pond construction area and included rock removal, breaking up of soil clods, and moisture adjustment. Water was added as required using a tank truck equipped with a spray canon. Excessively wet soils were spread, broken up and allowed to air dry.

The removal of debris/rock from stockpiled soils was carried out routinely by Dufferin during the clay placement.

#### *3.3.4 Geotextile and Geoweb Installation*

Visual inspections were carried out during all aspects of geotextile and geoweb installation to ensure that:

a) the material was not damaged during handling or placement;

b) material was covered with overlying rip-rap or 50 mm clean stone in a timely manner (e.g., within about four weeks) to prevent ultraviolet light damage to the fabric;
c) when the geotextile was overlapped, a minimum 600 mm overlap was used.

The geotextile and geoweb products were generally placed by hand. Torn or punctured material was either patched with sufficient overlap to prevent separation or replaced. Geoweb was secured in place using manufacturer supplied pins, or 8 inch spikes. Geoweb was filled with 50 mm clear stone once a sufficient area was completed. In order to prevent wind damage to the geotextile, sand bags were placed along the edges immediately following deployment, until the overlying materials could be placed.

#### *3.3.5 Piping Installation*

Various pipe sizes of concrete, HDPE, and PVC were used during construction of the Stage 1 Stormwater Management System. Visual inspections were carried out during all aspects of piping installation to ensure that:

a) materials were not damaged during handling or placement;
b) granular bedding was placed and compacted according to specifications prior to installing piping
c) elevations were verified to ensure proper inverts, flow and pipe alignment were achieved
d) required gaskets, couplings and other components were installed according to manufactures specifications

#### *3.3.6 Concrete Maintenance Holes*

Two precast concrete maintenance holes were installed as part of the Stage 1 Stormwater Management System. Inspections were carried out during all aspects of installation to ensure that:

a) materials were not damaged during handling or installation;
b) granular bedding was placed to appropriate thickness and compacted prior to setting the manhole base;
c) elevations were verified to ensure proper inverts, flow and pipe alignment were achieved;
d) required gaskets and other components were installed according to manufactures specifications.

#### *3.3.7 Perimeter Drainage Ditch*

Approximately 1,300 m of perimeter ditch was excavated to collect stormwater runoff from the site and direct the flow to the forebay and detention pond. Inspections were carried out during all aspects of ditch construction to ensure that:

a) proper alignment and grades were being achieved;
b) existing trees, cleanout structures, etc., were avoided where possible;
c) elevations were verified to ensure proper inverts;
d) geotextile and rip rap was placed as specified.

## 3.4 Conclusions

The following conclusions are drawn from the results of the quality assurance work undertaken during the 2012 Stage 1 Stormwater Management System:

a) quality assurance work was carried out by AECOM during Stage 1 Stormwater Management System construction. The quality assurance protocols were in general conformance with those described in the approved specifications. Based on this work, it is concluded that the Stage 1 Stormwater Management System has been constructed in general conformance with the approved final detailed design;

b) some modifications were made to the design of temporary works and quality assurance protocols to accommodate field conditions and material characteristics. We consider that these do not deviate from the intent of the design, and are not expected to have any effect on control system performance; and

# 4. References

Boutwell, G.P. and C.N. Tsai, 1992:
The Two-Stage Field Permeability Test for Clay Liners. Geotechnical News, Vol. 10, No. 2, pp. 32-34, June 1992.

Gartner Lee Limited, 1995:
Taro East Quarry Environmental Assessment, Design and Operations Report. January 1995. Gartner Lee 94-413.

# Figures

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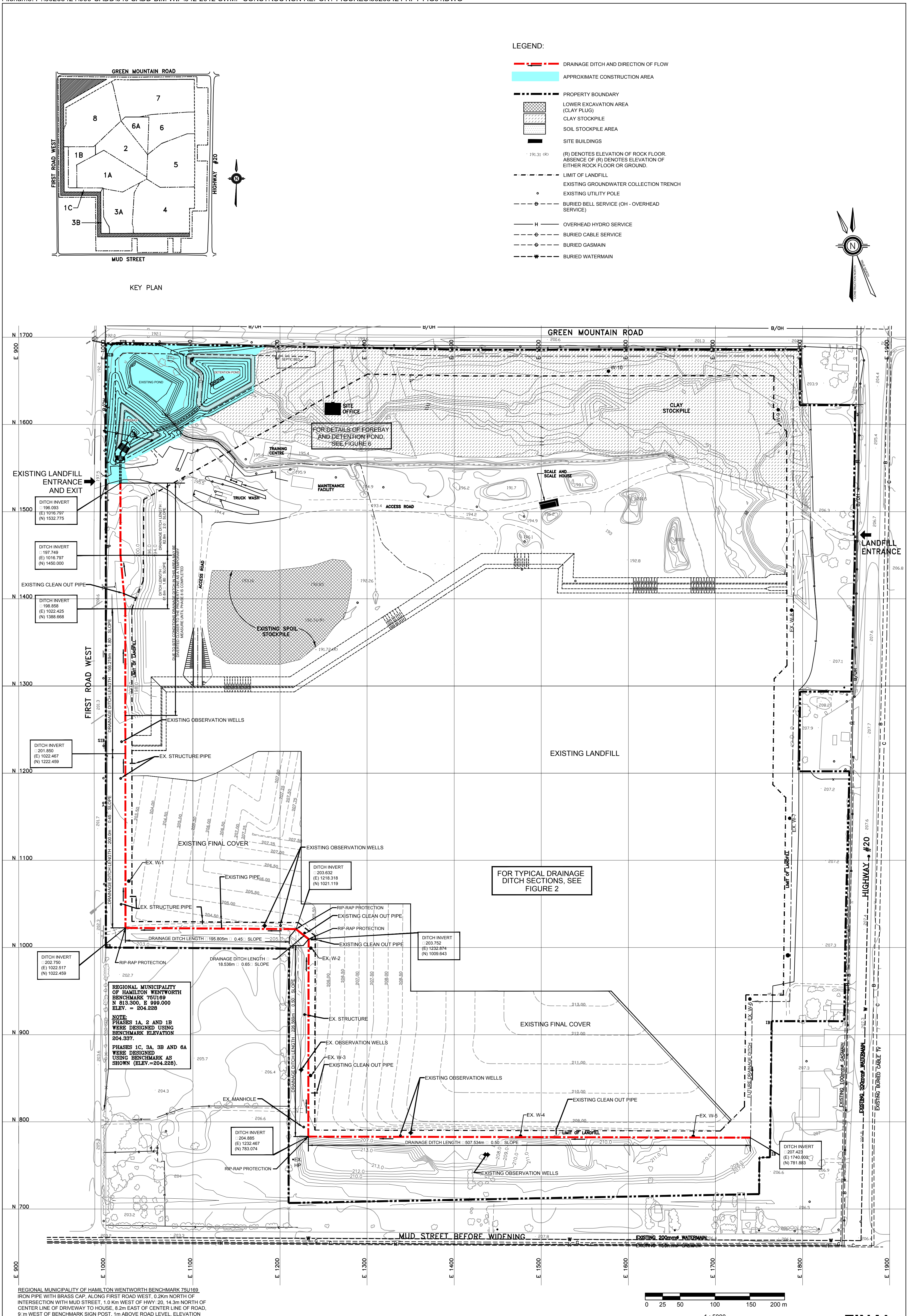
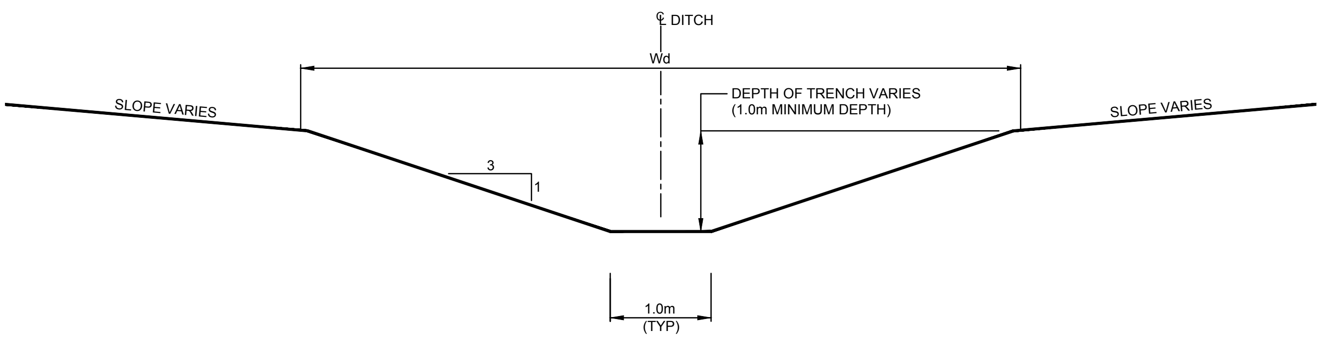



**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Project No.: 60265424 Date: July 2013

**STAGE 1 STORMWATER MANAGEMENT SYSTEM PLAN**

AECOM

**Figure: 01**




TYPICAL DITCH CROSS SECTION

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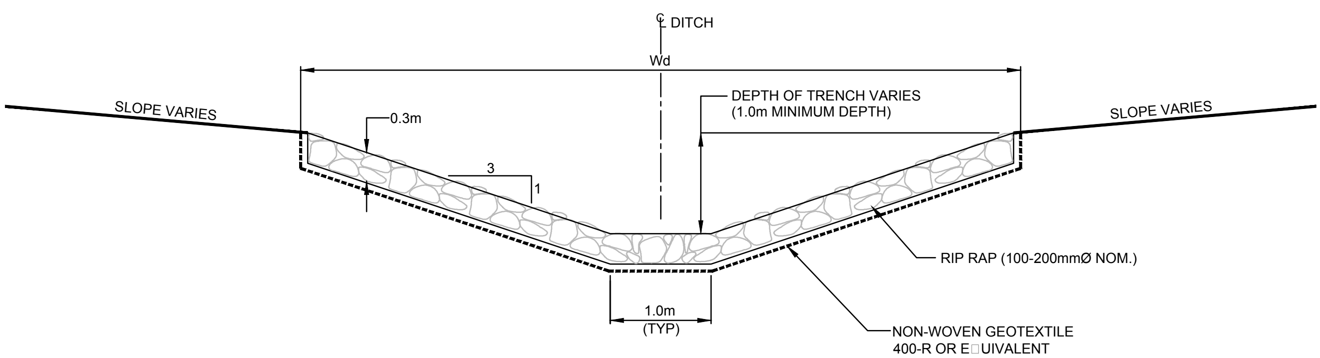


TYPICAL DITCH CROSS SECTION
WITH RIP-RAP TREATMENT

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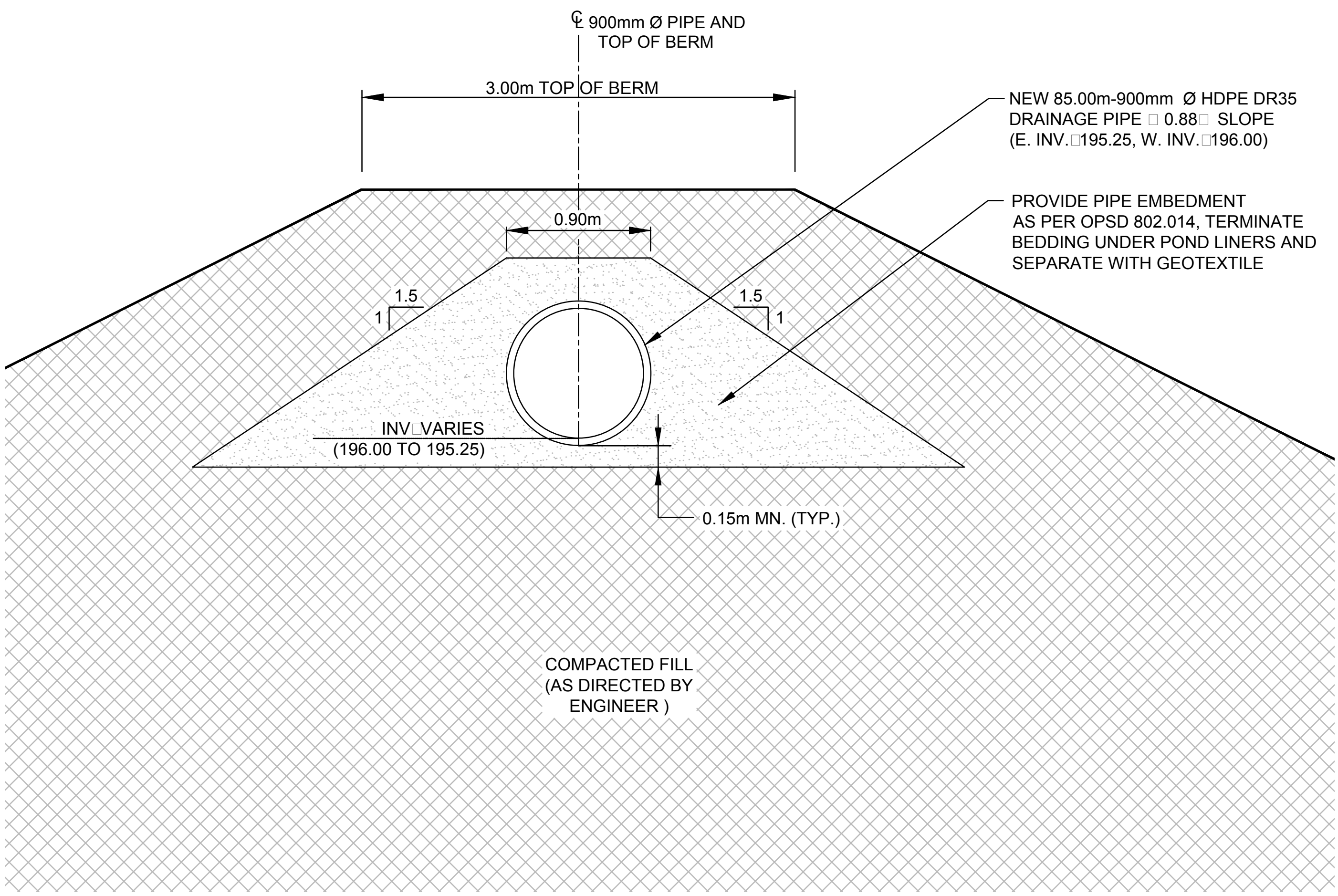
**FINAL**

**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Pr□e□□N□.: 60265424 Da□e: J□l□2013

**TYPICAL CROSS SECTION OF**
**PERIMETER DRAIANGE DITCH**

AECOM

**Figure: 02**

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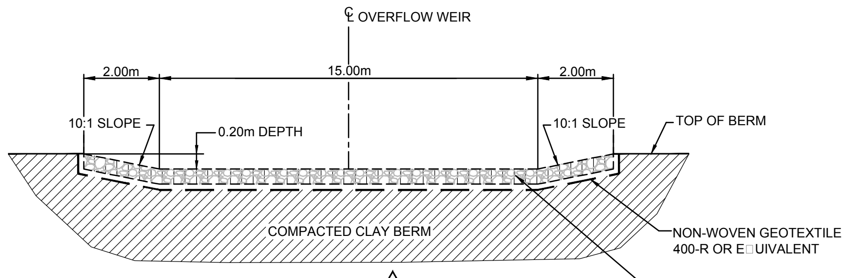
**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Pr□e□□N□.: 60265424 Da□e: J□l□2013

**CROSS SECTION OF SUPPORT BERM CONNECTING THE FOREBAY TO THE DETENTION POND**

AECOM

**Figure: 03**

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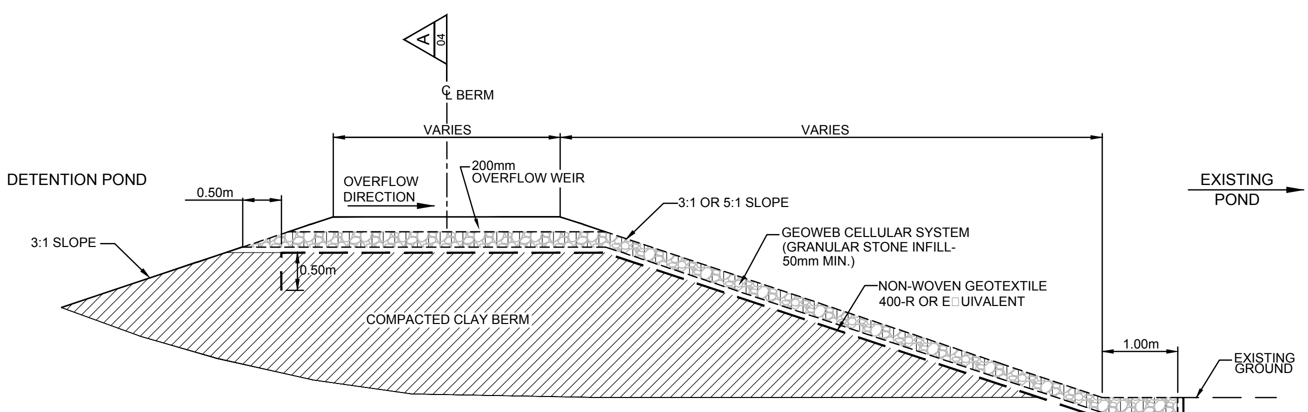


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OVERFLOW WEIR
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**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Project No.: 60265424 Date: July 2013

**CROSS SECTION OF**
**THE OVERFLOW WEIR**

AECOM

**Figure: 04**

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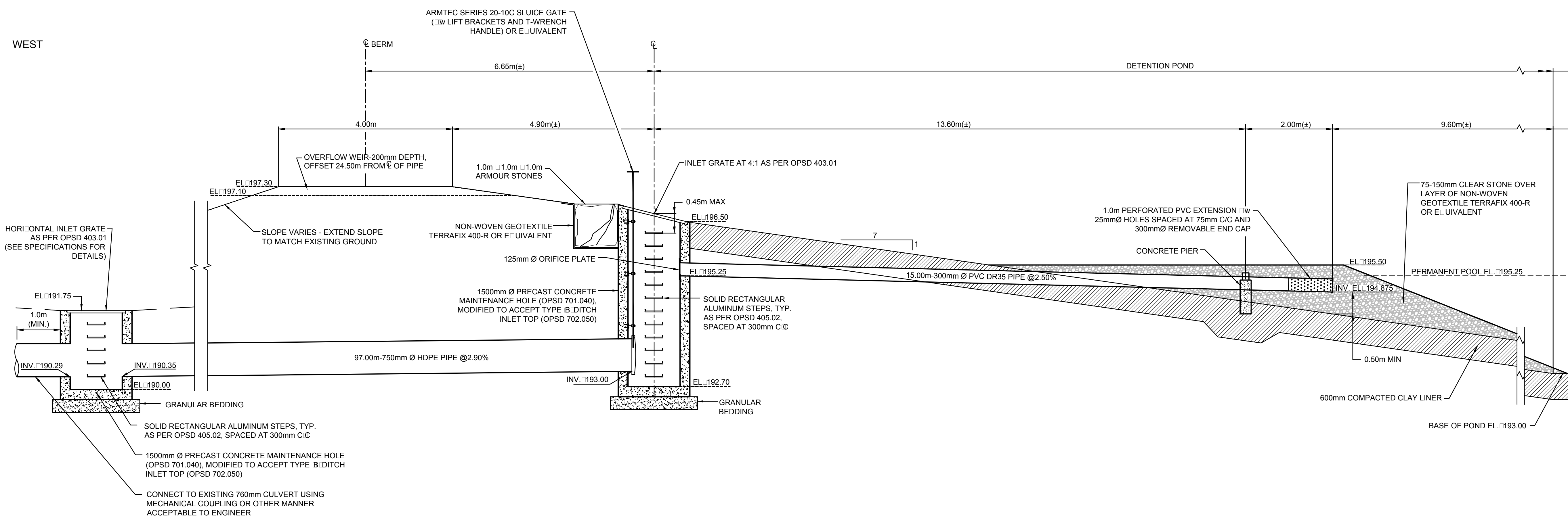
# CROSS SECTION THROUGH OUTLET STRUCTURE




AECOM

Figure: 05

**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Pr□e□□N□: 60265424 Da□e: J□□2013

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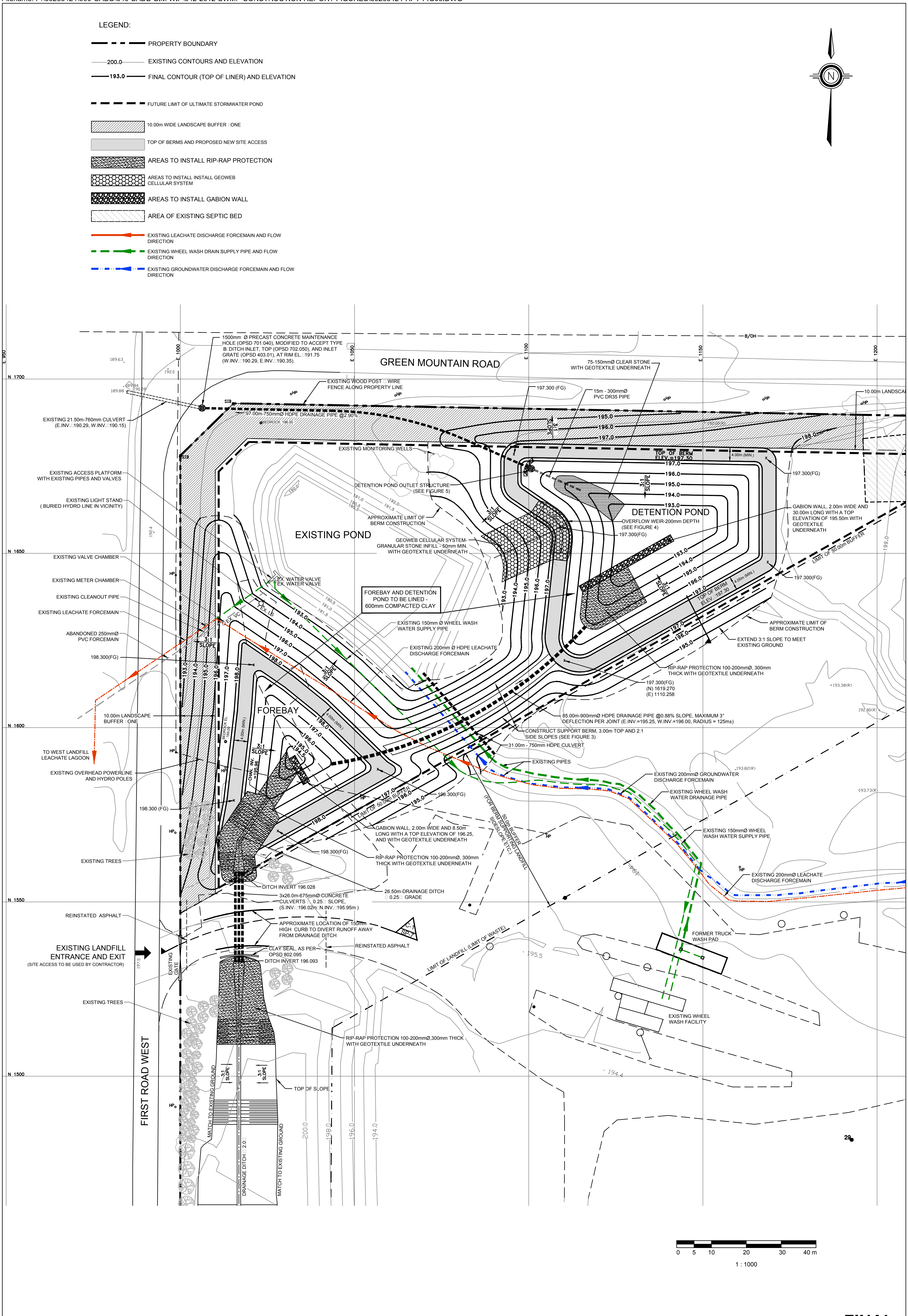


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**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Project No.: 60265424 Date: July 2013

**STORMWATER POND PLAN**

AECOM

**Figure: 06**

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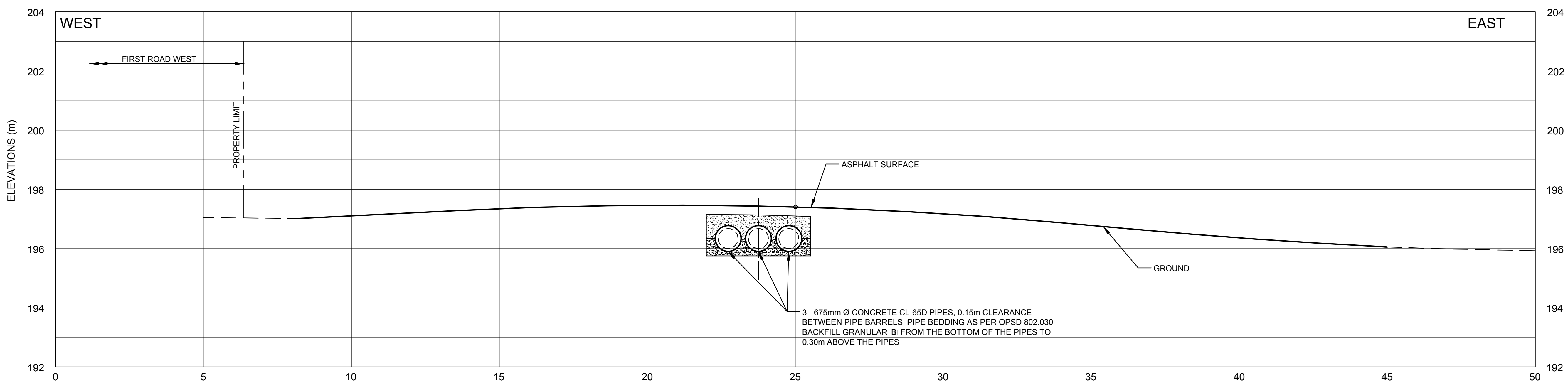


## CROSS SECTION

SCALE 1:150

**CROSS SECTION THROUGH THE CULVERT UNDER THE WEST SITE ENTRANCE**

**2012 Construction Inspection Report-**
**Newalta Stoney Creek Landfill Site**
**Stage 1 Stormwater Management System**
Pr□e□□N□: 60265424 Da□e: J□□2013

AECOM

**Figure: 07**

# Appendix A

## Letters to Ministry of the Environment

AECOM
300 – 300 Town Centre Boulevard 905 477 8400 tel
Markham, ON, Canada L3R 5Z6 905 477 1456 fax
www.aecom.com

May 2, 2013

Mr. Bill Bardswick
Director, Hamilton Regional Office
Ministry of the Environment
119 King Street West
12th Floor
Hamilton, Ontario
L8P 4Y7

Dear Mr. Bardswick:

**Project No: 60265424**

**Regarding: Completion of Stage I Stormwater Management Facility, Newalta Landfill, Stoney Creek, Ontario (Industrial Sewage Works Environmental Compliance Approval No. 5400-7DSSHU)**

Herein we provide our opinion that the construction of the stormwater management ponds and perimeter drainage ditches for the Stage I Stormwater Management Facility (SMF) at the Newalta Stoney Creek Landfill has been principally completed. The following is relevant:

a) Construction of the forebay, detention pond, overflow weir, and drainage structures have all been completed in the northwest corner of the site.

b) Perimeter drainage ditch construction has been completed over approximately 1,450 metres along the south and west sides of the landfill.

c) Quality assurance inspection has been carried out by AECOM Canada Limited, including overall contract administration, general construction oversight, and soil compaction testing. Based on this inspection work, we are of the opinion that the SMF has been constructed in general accordance with the approved design and specifications.

d) We understand that Newalta will commence operation of the SMF following implementation of the approved monitoring program and the submission of a *Stormwater Contingency and Remedial Action Plan*. Upon completion of these tasks, the SMF will be operated in a normally open position and uncontaminated stormwater will be discharged from the site to the roadside ditch outletting to Davis Creek.

We will provide detailed documentation of the construction and quality assurance work upon its full completion. Should you have any questions, please do not hesitate to contact the undersigned, or Mr. Lorenzo Alfano of Newalta at (905) 548-5876.

Sincerely,
**AECOM Canada Ltd.**

Brian Dermody, P. Eng.
Environmental Engineer
*brian.dermody@aecom.com*
D: 905-477-8400 x384

BMD
cc: Mr. Lorenzo Alfano, Newalta Corporation
Mr. Geoffrey Knapper, MOE District Manager

# Appendix B

## Construction Photographs


**Photograph 1. Breaking and Removing Bedrock within Forebay and Detention Pond Footprint**


**Photograph 2. Compacting Clay Liner within Forebay Pond**

**Photograph 3. Construction of Gabion Wall within Detention Pond** ↑

**Photograph 4. Installation of Geoweb for the Overflow Weir** ↑

**Photograph 5. Construction of the HDPE Drainage Pipe from the Forebay to the Detention Pond** ↑


**Photograph 6. Installation of Maintenance Hole at the Corner of Green Mountain Rd and First Rd** ↑


**Photograph 7. Installation of Maintenance Hole with Detention Pond ↑**

**Photograph 8. Construction of Perimeter Drain Ditch ↑**

**Photograph 9. Culverts under the West Site Entrance ↑**

**Photograph 10. Detention Pond ↑**

**Photograph 11. Forebay Pond** ↑

# Appendix C

## Daily Activity Logs

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# Field Inspection Record

**Job Number:** 60265424 **Date:** June 27, 2012

**Client:** Newalta Corporation

**Job Name:** Stormwater Management System / 7A Cell

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast/25°C/ cool breeze/afternoon rain

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Stripped topsoil from the North limit of landfill within detention pond footprint.<br>• Constructed ramp to the north limit of the landfill for brush removal and clay excavation.<br>• Began excavating clay from the north limit of the landfill.<br>• Stock piled excavated clay on the east side of the detention pond footprint.<br>• Started layout for perimeter drainage ditch south of the west entrance.<br>• AECOM took clay sample from north limit of landfill (within detention pond footprint) – sample sent to Terraprobe. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** June 28, 2012

**Client:** Newalta Corporation

**Job Name:** Stormwater Management System / 7A Cell

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, warm (30°C), slight breeze

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Excavating clay from the north limit of the landfill.<br>• Stock piling excavated clay on the east side of detention pond footprint.<br>• Started layout for forebay pond construction.<br>• Removed top soil from the forebay pond footprint and stockpiled it outside of the footprint.<br>• Excavated the forebay pond to correct base grade elevation. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** June 29, 2012

**Client:** Newalta Corporation

**Job Name:** Stormwater Management System/ 7A Cell

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, Warm (30°C), slight breeze

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Started excavation of perimeter drainage ditch south of the west entrance.<br>• Engineered fill excavated from the drainage ditch is hauled to the forebay footprint for construction of the pond berm. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 3, 2012

**Client:** Newalta Corporation

**Job Name:** Stormwater Management System/ 7A Cell

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny / partial overcast, (28°C), slight breeze

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavation of the perimeter drainage ditch along First Rd.<br>• Continued hauling engineered fill excavated from the drainage ditch to the forebay footprint for construction of the pond berm. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 4, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill / Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 32°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued excavation of the perimeter drainage ditch along First Rd.<br>• Construction of the forebay pond berm.<br>• Site meeting AECOM, Dufferin, Newalta (2:30-3:30). |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 5, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill / Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 35°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Reviewed contractor GPS setup<br>• Excavating perimeter ditch south of First Rd entrance<br>• Hauling, placing & compacting eng. fill to form forebay<br>• Starting to clear brush from detention pond area |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 6, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 36°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Excavating perimeter ditch south of First Rd entrance<br>• Hauling, placing & compacting eng. fill to form forebay<br>• Clearing brush from detention pond area |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 9, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 29°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavating perimeter ditch south of First Rd entrance<br>• Hauling, placing & compacting eng. fill to form forebay |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 11, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 29°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Hauling, placing & compacting eng. fill to form forebay & preparing for clay placement<br>• Placing & compacting clay liner of forebay<br>• Excavating perimeter ditch south of First Rd entrance |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 12, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 30°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing & compacting clay liner of forebay, 2nd lift completed |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 13, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast, Sunny breaks, 31°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Placing & compacting clay liner of forebay, completed by end of day |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 16, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 30°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Excavating channel for forebay |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** July 18, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 28°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Stripping & stockpiling topsoil from detention pond area |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** August 1, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny to partly cloudy,(30°C),

## progress:

| | |
|---|---|
| **Detention/Forebay Pond** | • Construction Site Meeting #3 in pm |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** August 8, 2012

**Client:** Newalta Corporation

**Job Name:** Stormwater Management System/ 7A Cell

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast,(28°C), slight breeze

## progress:

| | |
|---|---|
| **Detention/Forebay Pond** | • Started excavating engineered fill from detention pond footprint.<br>• Excavated engineered fill was hauled to the east buffer zone to be used for backfill. |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | August 9, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | M. Coscarella/J. Munro/M. Stocker | **Personnel:** | See attached sheet |
| **Weather:** | Overcast, light rain in am, 25°C | | |

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Concrete culvert sections for perimeter drainage ditch delivered to site in AM.<br>• Continued excavating engineered fill from the detention pond footprint. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** August 10, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast, light rain in am, 22°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Clearing perimeter ditch @ First Rd entrance for culvert installation<br>• Breaking rock @ detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** August 13, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 27°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Completed concrete culvert installation @ First Rd entrance<br>• Braking rock within the detention pond footprint and hauling to East buffer zone for backfill. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** September 13, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 28°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Hauling & placing/compacting clay PCL @ east end 7A<br>• 750 mm & 900 mm HDPE pipe delivered for Stormwater Management System. |

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# Field Inspection Record

**Job Number:** 60265424

**Date:** September 19, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker

**Personnel:** See attached sheet

**Weather:** Sunny, 15°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Construction Site Meeting #4 in pm |

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# Field Inspection Record

**Job Number:** 60265424
**Date:** September 25, 2012
**Client:** Newalta Corporation
**Job Name:** East Landfill Phase 7A
**Contractor:** Dufferin Construction
**Inspected By:** M. Coscarella/J. Munro/M. Stocker
**Personnel:** See attached sheet
**Weather:** Sunny, 20°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Excavating detention pond area<br>• 8” perforated HDPE pipe delivered<br>• Constructing berm between ponds |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** September 28, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast, 16°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing & compacting eng. fill for detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 1, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 20°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Placing & compacting eng. fill for detention pond & forebay |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 2, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast, 18°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Placing & compacting eng. fill for detention pond & forebay |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 11, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 13°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavating ditch south of forebay along First road<br>• Started placing and compacting clay in detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 12, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 8°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavating ditch south of forebay along First road<br>• Continued placing and compacting clay in detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 15, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** PC /High of 10°C

## progress:

| | |
|---|---|
| **7A cell** | • Continued placing and compacting clay in detention pond |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | October 16, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | M. Coscarella/J. Munro/M. Stocker | **Personnel:** | See attached sheet |
| **Weather:** | Sunny, 12°C | | |

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Continued placing clay liner in detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 17, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Overcast, rain, 10°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing & compacting clay in detention pond-completed by end of day |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 18, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** M. Coscarella/J. Munro/M. Stocker **Personnel:** See attached sheet

**Weather:** Sunny, 18°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Clearing connection 6C/7A<br>• Grading Leachate collection blanket |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 22, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro / M. Coscarella **Personnel:** See attached sheet

**Weather:** Sunny, 18°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavating perimeter ditch south of forebay<br>• Maintenance holes for the forebay and detention pond are delivered |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 24, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, rain, 12°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Importing and stockpiling granular 'A' for LCS<br>• Other work limited due to weather<br>• Construction Site Meeting #5 in pm |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** October 26, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, cloudy ,17°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing & compacting clay in forebay channel |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 1, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, rain, 7°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Removed old Catch Basin at First Road West and Green Mountain and replaced with new maintenance hole<br>• Connected outlet of new maintenance hole to existing culvert<br>• Started excavating trench and installing 750 mm HDPE pipe from catch basin, working east towards detention pond maintenance hole |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 2, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, showers, 7°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continue to excavate trench and install 750 mm HDPE pipe.<br>• Gabion baskets delivered to site. |

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# Field Inspection Record

**Job Number:** 60265424  **Date:** November 5, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro  **Personnel:** See attached sheet

**Weather:** Overcast, 5°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continue to excavate trench and install 750 mm HDPE pipe.<br>• Installing detention pond Maintenance hole.<br>• Fine grading and proof rolling forebay.<br>• Orifice plate installed inside the maintenance hole within the detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 6, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, 6°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Placing geotextile and rip rap at forebay channel.<br>• Fine grading and proof rolling remainder of forebay.<br>• Assembling gabion baskets. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 7, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, cloudy periods, 14°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Working on detention pond overflow weir.<br>• Placing and compacting clay base for over flow weir and in area for 300 mm PVC pipe.<br>• Assembling gabion baskets. |

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# Field Inspection Record

**Job Number:** 60265424
**Date:** November 8, 2012
**Client:** Newalta Corporation
**Job Name:** East Landfill Phase 7A
**Contractor:** Dufferin Construction
**Inspected By:** J. Munro
**Personnel:** See attached sheet
**Weather:** Sunny, 7°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Assembling and installing gabion baskets in forebay.<br>• Fine grading detention pond. |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | November 9, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | J. Munro | **Personnel:** | See attached sheet |
| **Weather:** | Overcast, 12°C | | |

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Completed gabion baskets within forebay.<br>• Completed rip rap placement in forebay.<br>• Assembling and installing gabion baskets in detention pond. |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | November 12, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | J. Munro | **Personnel:** | See attached sheet |
| **Weather:** | Sunny, rain in pm, windy 17°C | | |

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Assembling and installing gabion baskets in detention pond.<br>• Fine grading and compacting over flow weir.<br>• Installing geoweb at over flow weir. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 13, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, cloudy periods, 4°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Installing geoweb at overflow weir.<br>• Assembling and installing gabion baskets in detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 14, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, cloudy periods, 6°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Installing and filling geoweb at overflow weir.<br>• Assembling and installing gabion baskets in detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 15, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro / M. Coscarella **Personnel:** See attached sheet

**Weather:** Overcast, 8°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Installing and filling geoweb at overflow weir.<br>• Assembling and installing gabion baskets in detention pond.<br>• Placing and grading topsoil on outside banks of forebay.<br>• Installing 300 mm PVC pipe in detention pond Maintenance hole |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 16, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, 10°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Installing and filling geoweb at overflow weir.<br>• Assembling and installing gabion baskets in detention pond.<br>• Placing and grading topsoil on outside banks of forebay and detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 19, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, foggy, 9°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing and grading topsoil on outside banks of forebay and detention pond in am.<br>• Formed and poured concrete support pier for 300 mm PVC pipe at detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 20, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, foggy, 10°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Placing and compacting clay around 300 mm PVC pipe at detention pond. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 21, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, foggy, 9°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Completed constructing support berm between forebay and detention pond. |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | November 22, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | J. Munro | **Personnel:** | See attached sheet |
| **Weather:** | Sunny, 12°C | | |

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placed armour stone around MH in detention pond |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 26, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, cloudy periods, 3°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Excavating trench in support berm for 900 mm HDPE pipe between ponds<br>• Installing 900 mm pipe in late pm |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** November 30, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, windy, 5°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • 900 mm HDPE pipe complete from forebay to detention pond<br>• Compacting outside slopes of forebay and detention pond<br>• Continue perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** December 6, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, 2°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Surveyed forebay & detention pond area. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** December 11, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, flurries, 0°C

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Sluice gate delivered for maintenance hole within detention pond. |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | December 12, 2012 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | J. Munro | **Personnel:** | See attached sheet |
| **Weather:** | Sunny, 3°C | | |

## progress:

| | |
|---|---|
| **Detention/ Forebay Pond** | • Installing orifice plate and sluice gate in detention pond Maintenance hole. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** December 13, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, 4°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Installing sluice gate in detention pond maintenance hole<br>• Continued with perimeter ditch excavation in pm. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** December 14, 2012

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, windy, 6°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424

**Date:** April 17,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro

**Personnel:** See attached sheet

**Weather:** Sunny, windy, 6°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 18,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, windy, 6°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing and grading topsoil on outside banks of forebay and detention pond in am.<br>• Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 19,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Partial Cloudy, windy, 12°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing and grading topsoil on outside banks of forebay and detention pond in am. |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 22,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, 7°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Placing and grading topsoil on outside banks of forebay and detention pond in am.<br>• Continued with perimeter ditch excavation |

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# Field Inspection Record

| | | | |
|---|---|---|---|
| **Job Number:** | 60265424 | **Date:** | April 23,2013 |
| **Client:** | Newalta Corporation | | |
| **Job Name:** | East Landfill Phase 7A | | |
| **Contractor:** | Dufferin Construction | | |
| **Inspected By:** | J. Munro | **Personnel:** | See attached sheet |
| **Weather:** | Sunny, windy, 6°C | | |

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 24,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, 8°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 25,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, windy, 11°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 26,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, windy, 14°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 29,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Overcast, 12°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Continued with perimeter ditch excavation |

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# Field Inspection Record

**Job Number:** 60265424 **Date:** April 30,2013

**Client:** Newalta Corporation

**Job Name:** East Landfill Phase 7A

**Contractor:** Dufferin Construction

**Inspected By:** J. Munro **Personnel:** See attached sheet

**Weather:** Sunny, windy, 15°C

## progress:

| | |
|---|---|
| **Detention / Forebay Pond** | • Completed stormwater management system.<br>• Approved for discharge of stormwater to road side ditch. |