

## **Appendix 1**

Table 1. Soil Analytical Results, EX-1 Remediation Program October 2013

| PHYSICAL TESTING (SOIL)             |  |  |  | C<br>R<br>L |  | C<br>C<br>M<br>R<br>L |  | Initial Confirmatory Samples   |  |  |  |  |  |  |  |  |  | Second Confirmatory Samples   |  |  |  |  |  |  |  |  |  | Final<br>Confirmatory<br>Sample |
|-------------------------------------|--|--|--|-------------|--|-----------------------|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|--|--|---------------------------------|
| Sample Depth                        |  |  |  |             |  |                       |  | Confirmatory samples collected from the EX-1 excavation. The excavation was continued due to contamination in Sample 304-7. The soil from 304-7 was excavated. |  |  |  |  |  |  |  |  |  | Confirmatory samples collected after the continued excavation. Due to contamination in sample 321-8, the excavation was continued further. The soil from 321-8 was excavated. |  |  |  |  |  |  |  |  |  |                                 |
| Date                                |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Matrix                              |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| UNITS                               |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Physical Properties                 |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Moisture %                          |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Ext. Pet. Hydrocarbon               |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| PETROLEUM HYDROCARBONS              |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| F1 (C8-C10) - BTEX                  |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| F2 (C10-C16 Hydrocarbons)           |  |  |  | 210         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 500                             |
| F3 (C16-C34 Hydrocarbons)           |  |  |  | 150         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 300                             |
| F4 (C34-C50 Hydrocarbons)           |  |  |  | 300         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 300                             |
| TOTAL PETROLEUM HYDROCARBONS        |  |  |  | 2800        |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 40                              |
| Calculated Parameters               |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| LEPH (C10-C19 less PAH)             |  |  |  | -           |  | 1000                  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 283                             |
| HEPH (C19-C32 less PAH)             |  |  |  | -           |  | 1000                  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 293                             |
| Hydrocarbons                        |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| EPH (C10-C19)                       |  |  |  | -           |  | 1000                  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 293                             |
| EPH (C19-C32)                       |  |  |  | -           |  | 1000                  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 293                             |
| Volatiles                           |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Methyl-tert-butyl ether (MTBE)      |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benzene                             |  |  |  | 0.011       |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Toluene                             |  |  |  | 0.37        |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Ethylbenzene                        |  |  |  | 0.082       |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| m & p-Xylene                        |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| o-Xylene                            |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Styrene                             |  |  |  | 5           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Xylenes (Total)                     |  |  |  | 11          |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| (ΣC8-C10)                           |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Polycyclic Aromatics                |  |  |  |             |  |                       |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |                                 |
| Naphthalene                         |  |  |  | 0.013       |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| 2-Methylnaphthalene                 |  |  |  | 320         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Acenaphthylene                      |  |  |  | 0.28        |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Acenaphthene                        |  |  |  | 0.26        |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Fluorene                            |  |  |  | 0.046       |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Phenanthrene                        |  |  |  | 5           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Anthracene                          |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Fluoranthene                        |  |  |  | 15.4        |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Pyrene                              |  |  |  | 7.7         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benz(a)anthracene                   |  |  |  | 1           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Chrysene                            |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benz(b)fluoranthene                 |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benz(k)fluoranthene                 |  |  |  | 1           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benz(a)pyrene                       |  |  |  | 0.6         |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Indeno(1,2,3-cd)pyrene              |  |  |  | 1           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Dibenz(a,h)anthracene               |  |  |  | 1           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Benz(g,h,i)perylene                 |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Low Molecular Weight PAH's          |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| High Molecular Weight PAH's         |  |  |  | -           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Total PAH                           |  |  |  | 1           |  | mg/kg                 |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Index of Additive Cancer Risk(IACR) |  |  |  | 0.8         |  | -                     |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |
| Biop/TPE                            |  |  |  | -           |  | -                     |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  | 0.010                           |

Notes

RDL = Reportable Detection Limit

EDL = Estimated Detection Limit

(1) RDL raised due to sample dilution.

(2) RDL raised due to sample dilution.

- Red cells indicates parameter exceeds CCME RL, CCME RL, CCME RL - Canadian Council Ministers of the Environment Soil Quality Guideline for Residential Land Use, Soil Guideline protective of aquatic life and drinking water.

- Cyan cells indicates parameter exceeds BC CSR RL, CSR RL - Contaminated Sites Regulation Residential Land Use Standard. Standard also protective of freshwater aquatic life and drinking water.

- The Index of Additive Cancer Risk (IACR) assesses potential threats to potable groundwater water quality from leaching of carcinogenic PAH mixtures from soil. The IACR is calculated by dividing the soil concentration (numerator) of each carcinogenic PAH by its soil quality guideline for protection of potable water component value (denominator) to calculate a hazard index for each PAH, and then summing the hazard indices for the entire PAH mixture. For the above results the IACR is not detected.

Table 2. Soil Analytical Results, December 2013



| Field Label                         | CCME RL | CSR RL | UNITS | BH13-1-9     | BH13-1-10   | BH13-2-9    | BH13-2-10   | DUP-BH13-2-10 | BH13-3-9    | BH13-3-10   |
|-------------------------------------|---------|--------|-------|--------------|-------------|-------------|-------------|---------------|-------------|-------------|
| Sample Depth                        |         |        |       | 6.86m-7.62m  | 7.62m-8.38m | 6.86m-7.62m | 7.62m-8.38m | 7.62m-8.38m   | 6.86m-7.62m | 7.62m-8.38m |
| Date                                |         |        |       | 2013-12-05   | 2013-12-05  | 2013-12-07  | 2013-12-07  | 2013-12-07    | 2013-12-07  | 2013-12-07  |
| Matrix                              |         |        |       | Soil         | Soil        | Soil        | Soil        | Soil          | Soil        | Soil        |
| Physical Properties                 |         |        |       |              |             |             |             |               |             |             |
| Moisture (%)                        | -       | -      | %     | 16           | 14          | 14          | 14          | 16            | 19          | 14          |
| PETROLEUM HYDROCARBONS              |         |        |       |              |             |             |             |               |             |             |
| Ext. Pet. Hydrocarbon               |         |        |       |              |             |             |             |               |             |             |
| F1 (C6-C10) - BTEX                  | 210     | -      | mg/kg | 11           | <10         | <10         | <10         | <10           | <10         | <10         |
| F2 (C10-C16 Hydrocarbons)           | 150     | -      | mg/kg | 240          | <10         | <10         | 36          | 15            | 17          | <10         |
| F3 (C16-C34 Hydrocarbons)           | 300     | -      | mg/kg | 24           | <10         | <10         | <10         | 19            | <10         | <10         |
| F4 (C34-C50 Hydrocarbons)           | 2800    | -      | mg/kg | <10          | <10         | <10         | <10         | <10           | <10         | <10         |
| TOTAL PETROLEUM HYDROCARBONS        |         |        |       |              |             |             |             |               |             |             |
| Calculated Parameters               |         |        |       |              |             |             |             |               |             |             |
| LEPH (C10-C19 less PAH)             | -       | 1000   | mg/kg | 238          | <100        | <100        | <100        | <100          | <100        | <100        |
| HEPH (C19-C32 less PAH)             | -       | 1000   | mg/kg | <100         | <100        | <100        | <100        | <100          | <100        | <100        |
| Hydrocarbons                        |         |        |       |              |             |             |             |               |             |             |
| EPH (C10-C19)                       | -       | 1000   | mg/kg | 238          | <100        | <100        | <100        | <100          | <100        | <100        |
| EPH (C19-C32)                       | -       | 1000   | mg/kg | <100         | <100        | <100        | <100        | <100          | <100        | <100        |
| Calculated Parameters               |         |        |       |              |             |             |             |               |             |             |
| Volatiles                           |         |        |       |              |             |             |             |               |             |             |
| VPH (VH6 to 10 - BTEX)              | -       | 200    | mg/kg | 12           | <10         | <10         | <10         | <10           | <10         | <10         |
| Methyl-tert-butylether (MTBE)       | -       | -      | mg/kg | <0.10        | <0.10       | <0.10       | <0.10       | <0.10         | <0.10       | <0.10       |
| Benzene                             | 0.011   | 0.04   | mg/kg | <0.0050      | <0.0050     | <0.0050     | 0.029       | <0.0050       | <0.0050     | <0.0050     |
| Toluene                             | 0.37    | 1.5    | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Ethylbenzene                        | 0.082   | 1      | mg/kg | 0.064        | <0.010      | <0.010      | 0.11        | <0.010        | <0.010      | <0.010      |
| m & p-Xylene                        | -       | -      | mg/kg | 0.20         | <0.040      | <0.040      | <0.040      | <0.040        | <0.040      | <0.040      |
| o-Xylene                            | -       | -      | mg/kg | 0.12         | <0.040      | <0.040      | <0.040      | <0.040        | <0.040      | <0.040      |
| Styrene                             | 5       | 5      | mg/kg | <0.030       | <0.030      | <0.030      | <0.030      | <0.030        | <0.030      | <0.030      |
| Xylenes (Total)                     | 11      | 5      | mg/kg | 0.32         | <0.040      | <0.040      | <0.040      | <0.040        | <0.040      | <0.040      |
| VH C6-C10                           | -       | -      | mg/kg | 12           | <10         | <10         | <10         | <10           | <10         | <10         |
| (C6-C10)                            | -       | -      | mg/kg | 12           | <10         | <10         | <10         | <10           | <10         | <10         |
| Polycyclic Aromatics                |         |        |       |              |             |             |             |               |             |             |
| 2-Methylnaphthalene                 | -       | -      | mg/kg | 0.35         | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Acenaphthene                        | 0.28    | -      | mg/kg | 0.058        | <0.0050     | <0.0050     | 0.026       | <0.0050       | <0.0050     | <0.0050     |
| Acenaphthylene                      | 320     | -      | mg/kg | <0.011 ( 1 ) | <0.0050     | <0.0050     | <0.0050     | <0.0050       | <0.0050     | <0.0050     |
| Anthracene                          | -       | -      | mg/kg | <0.0040      | <0.0040     | <0.0040     | <0.0040     | <0.0040       | <0.0040     | <0.0040     |
| Benzo(a)anthracene                  | 1       | 1      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Benzo(a)pyrene                      | 0.6     | 1      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Benzo(b)fluoranthene                | 1       | 1      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Benzo(b&j)fluoranthene              | -       | -      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Benzo(g,h,i)perylene                | -       | -      | mg/kg | <0.050       | <0.050      | <0.050      | <0.050      | <0.050        | <0.050      | <0.050      |
| Benzo(k)fluoranthene                | 1       | 1      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Chrysene                            | -       | -      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Dibenz(a,h)anthracene               | 1       | 1      | mg/kg | <0.050       | <0.050      | <0.050      | <0.050      | <0.050        | <0.050      | <0.050      |
| Fluoranthene                        | 15.4    | -      | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Fluorene                            | 0.25    | -      | mg/kg | 0.11         | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Indeno(1,2,3-cd)pyrene              | 1       | 1      | mg/kg | <0.050       | <0.050      | <0.050      | <0.050      | <0.050        | <0.050      | <0.050      |
| Naphthalene                         | 0.013   | 5      | mg/kg | 0.16         | <0.010      | <0.010      | 0.025       | <0.010        | <0.010      | <0.010      |
| Phenanthrene                        | 0.046   | 5      | mg/kg | 0.030        | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Pyrene                              | 7.7     | 10     | mg/kg | <0.020       | <0.020      | <0.020      | <0.020      | <0.020        | <0.020      | <0.020      |
| Low Molecular Weight PAH's          | -       | -      | mg/kg | 0.70         | <0.050      | <0.050      | 0.051       | <0.050        | <0.050      | <0.050      |
| High Molecular Weight PAH's         | -       | -      | mg/kg | <0.050       | <0.050      | <0.050      | <0.050      | <0.050        | <0.050      | <0.050      |
| Total PAH                           | -       | -      | mg/kg | 0.70         | <0.050      | <0.050      | 0.051       | <0.050        | <0.050      | <0.050      |
| Index of Additive Cancer Risk(IACR) | 1       | -      |       | 0.31         | 0.31        | 0.31        | 0.31        | 0.31          | 0.31        | 0.31        |
| B[a]P TPE                           | 0.6     | -      |       | <0.10        | <0.10       | <0.10       | <0.10       | <0.10         | <0.10       | <0.10       |

**Notes**

RDL = Reportable Detection Limit

EDL = Estimated Detection Limit

(1) RDL raised due to sample matrix interference.

(2) RDL raised due to sample dilution.

Red shading indicates parameter exceeds CCME RL.

Cyan shading indicates parameter exceeds BC CSR RL.

- CCME RL - Canadian Council Ministers of the Environment Soil Quality Guideline for Residential Land Use. Soil Guideline protective of aquatic life and drinking water

- CSR RL - Contaminated Sites Regulation Residential Land Use Standard. Standard also protective of freshwater aquatic life and drinking water.

- The Index of Additive Cancer Risk (IACR) assesses potential threats to potable groundwater water quality from leaching of carcinogenic PAH mixtures from soil. The IACR is calculated by dividing the soil concentration (numerator) of each carcinogenic PAH by its soil quality guideline for protection of potable water component value (denominator) to calculate a hazard index for each PAH, and then summing the hazard indices for the entire PAH mixture.

For the above results the IACR is non detect

Table 3. Soil Analytical Results, January 2014

| PETROLEUM HYDROCARBONS (CCME) |  | CMC RL | CRR RL | UNITS | BH13-4.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | BH13-4.4 |  | BH13-4.5 |  | BH13-4.6 |  | BH13-4.7 |  | BH13-4.8 |  | BH13-4.9 |  | BH13-4.10 |  | BH13-4.11 |  | BH13-4.12 |  | BH13-4.13 |  | BH13-4.14 |  | BH13-4.15 |  | BH13-4.16 |  | BH13-4.17 |  | BH13-4.18 |  | BH13-4.19 |  | BH13-4.20 |  | BH13-4.21 |  | BH13-4.22 |  | BH13-4.23 |  | BH13-4.24 |  | BH13-4.25 |  | BH13-4.26 |  | BH13-4.27 |  | BH13-4.28 |  | BH13-4.29 |  | BH13-4.30 |  | BH13-4.31 |  | BH13-4.32 |  | BH13-4.33 |  | BH13-4.34 |  | BH13-4.35 |  | BH13-4.36 |  | BH13-4.37 |  | BH13-4.38 |  | BH13-4.39 |  | BH13-4.40 |  | BH13-4.41 |  | BH13-4.42 |  | BH13-4.43 |  | BH13-4.44 |  | BH13-4.45 |  | BH13-4.46 |  | BH13-4.47 |  | BH13-4.48 |  | BH13-4.49 |  | BH13-4.50 |  | BH13-4.51 |  | BH13-4.52 |  | BH13-4.53 |  | BH13-4.54 |  | BH13-4.55 |  | BH13-4.56 |  | BH13-4.57 |  | BH13-4.58 |  | BH13-4.59 |  | BH13-4.60 |  | BH13-4.61 |  | BH13-4.62 |  | BH13-4.63 |  | BH13-4.64 |  | BH13-4.65 |  | BH13-4.66 |  | BH13-4.67 |  | BH13-4.68 |  | BH13-4.69 |  | BH13-4.70 |  | BH13-4.71 |  | BH13-4.72 |  | BH13-4.73 |  | BH13-4.74 |  | BH13-4.75 |  | BH13-4.76 |  | BH13-4.77 |  | BH13-4.78 |  | BH13-4.79 |  | BH13-4.80 |  | BH13-4.81 |  | BH13-4.82 |  | BH13-4.83 |  | BH13-4.84 |  | BH13-4.85 |  | BH13-4.86 |  | BH13-4.87 |  | BH13-4.88 |  | BH13-4.89 |  | BH13-4.90 |  | BH13-4.91 |  | BH13-4.92 |  | BH13-4.93 |  | BH13-4.94 |  | BH13-4.95 |  | BH13-4.96 |  | BH13-4.97 |  | BH13-4.98 |  | BH13-4.99 |  | BH13-5.00 |  | BH13-5.01 |  | BH13-5.02 |  | BH13-5.03 |  | BH13-5.04 |  | BH13-5.05 |  | BH13-5.06 |  | BH13-5.07 |  | BH13-5.08 |  | BH13-5.09 |  | BH13-5.10 |  | BH13-5.11 |  | BH13-5.12 |  | BH13-5.13 |  | BH13-5.14 |  | BH13-5.15 |  | BH13-5.16 |  | BH13-5.17 |  | BH13-5.18 |  | BH13-5.19 |  | BH13-5.20 |  | BH13-5.21 |  | BH13-5.22 |  | BH13-5.23 |  | BH13-5.24 |  | BH13-5.25 |  | BH13-5.26 |  | BH13-5.27 |  | BH13-5.28 |  | BH13-5.29 |  | BH13-5.30 |  | BH13-5.31 |  | BH13-5.32 |  | BH13-5.33 |  | BH13-5.34 |  | BH13-5.35 |  | BH13-5.36 |  | BH13-5.37 |  | BH13-5.38 |  | BH13-5.39 |  | BH13-5.40 |  | BH13-5.41 |  | BH13-5.42 |  | BH13-5.43 |  | BH13-5.44 |  | BH13-5.45 |  | BH13-5.46 |  | BH13-5.47 |  | BH13-5.48 |  | BH13-5.49 |  | BH13-5.50 |  | BH13-5.51 |  | BH13-5.52 |  | BH13-5.53 |  | BH13-5.54 |  | BH13-5.55 |  | BH13-5.56 |  | BH13-5.57 |  | BH13-5.58 |  | BH13-5.59 |  | BH13-5.60 |  | BH13-5.61 |  | BH13-5.62 |  | BH13-5.63 |  | BH13-5.64 |  | BH13-5.65 |  | BH13-5.66 |  | BH13-5.67 |  | BH13-5.68 |  | BH13-5.69 |  | BH13-5.70 |  | BH13-5.71 |  | BH13-5.72 |  | BH13-5.73 |  | BH13-5.74 |  | BH13-5.75 |  | BH13-5.76 |  | BH13-5.77 |  | BH13-5.78 |  | BH13-5.79 |  | BH13-5.80 |  | BH13-5.81 |  | BH13-5.82 |  | BH13-5.83 |  | BH13-5.84 |  | BH13-5.85 |  | BH13-5.86 |  | BH13-5.87 |  | BH13-5.88 |  | BH13-5.89 |  | BH13-5.90 |  | BH13-5.91 |  | BH13-5.92 |  | BH13-5.93 |  | BH13-5.94 |  | BH13-5.95 |  | BH13-5.96 |  | BH13-5.97 |  | BH13-5.98 |  | BH13-5.99 |  | BH13-6.00 |  | BH13-6.01 |  | BH13-6.02 |  | BH13-6.03 |  | BH13-6.04 |  | BH13-6.05 |  | BH13-6.06 |  | BH13-6.07 |  | BH13-6.08 |  | BH13-6.09 |  | BH13-6.10 |  | BH13-6.11 |  | BH13-6.12 |  | BH13-6.13 |  | BH13-6.14 |  | BH13-6.15 |  | BH13-6.16 |  | BH13-6.17 |  | BH13-6.18 |  | BH13-6.19 |  | BH13-6.20 |  | BH13-6.21 |  | BH13-6.22 |  | BH13-6.23 |  | BH13-6.24 |  | BH13-6.25 |  | BH13-6.26 |  | BH13-6.27 |  | BH13-6.28 |  | BH13-6.29 |  | BH13-6.30 |  | BH13-6.31 |  | BH13-6.32 |  | BH13-6.33 |  | BH13-6.34 |  | BH13-6.35 |  | BH13-6.36 |  | BH13-6.37 |  | BH13-6.38 |  | BH13-6.39 |  | BH13-6.40 |  | BH13-6.41 |  | BH13-6.42 |  | BH13-6.43 |  | BH13-6.44 |  | BH13-6.45 |  | BH13-6.46 |  | BH13-6.47 |  | BH13-6.48 |  | BH13-6.49 |  | BH13-6.50 |  | BH13-6.51 |  | BH13-6.52 |  | BH13-6.53 |  | BH13-6.54 |  | BH13-6.55 |  | BH13-6.56 |  | BH13-6.57 |  | BH13-6.58 |  | BH13-6.59 |  | BH13-6.60 |  | BH13-6.61 |  | BH13-6.62 |  | BH13-6.63 |  | BH13-6.64 |  | BH13-6.65 |  | BH13-6.66 |  | BH13-6.67 |  | BH13-6.68 |  | BH13-6.69 |  | BH13-6.70 |  | BH13-6.71 |  | BH13-6.72 |  | BH13-6.73 |  | BH13-6.74 |  | BH13-6.75 |  | BH13-6.76 |  | BH13-6.77 |  | BH13-6.78 |  | BH13-6.79 |  | BH13-6.80 |  | BH13-6.81 |  | BH13-6.82 |  | BH13-6.83 |  | BH13-6.84 |  | BH13-6.85 |  | BH13-6.86 |  | BH13-6.87 |  | BH13-6.88 |  | BH13-6.89 |  | BH13-6.90 |  | BH13-6.91 |  | BH13-6.92 |  | BH13-6.93 |  | BH13-6.94 |  | BH13-6.95 |  | BH13-6.96 |  | BH13-6.97 |  | BH13-6.98 |  | BH13-6.99 |  | BH13-7.00 |  | BH13-7.01 |  | BH13-7.02 |  | BH13-7.03 |  | BH13-7.04 |  | BH13-7.05 |  | BH13-7.06 |  | BH13-7.07 |  | BH13-7.08 |  | BH13-7.09 |  | BH13-7.10 |  | BH13-7.11 |  | BH13-7.12 |  | BH13-7.13 |  | BH13-7.14 |  | BH13-7.15 |  | BH13-7.16 |  | BH13-7.17 |  | BH13-7.18 |  | BH13-7.19 |  | BH13-7.20 |  | BH13-7.21 |  | BH13-7.22 |  | BH13-7.23 |  | BH13-7.24 |  | BH13-7.25 |  | BH13-7.26 |  | BH13-7.27 |  | BH13-7.28 |  | BH13-7.29 |  | BH13-7.30 |  | BH13-7.31 |  | BH13-7.32 |  | BH13-7.33 |  | BH13-7.34 |  | BH13-7.35 |  | BH13-7.36 |  | BH13-7.37 |  | BH13-7.38 |  | BH13-7.39 |  | BH13-7.40 |  | BH13-7.41 |  | BH13-7.42 |  | BH13-7.43 |  | BH13-7.44 |  | BH13-7.45 |  | BH13-7.46 |  | BH13-7.47 |  | BH13-7.48 |  | BH13-7.49 |  | BH13-7.50 |  | BH13-7.51 |  | BH13-7.52 |  | BH13-7.53 |  | BH13-7.54 |  | BH13-7.55 |  | BH13-7.56 |  | BH13-7.57 |  | BH13-7.58 |  | BH13-7.59 |  | BH13-7.60 |  | BH13-7.61 |  | BH13-7.62 |  | BH13-7.63 |  | BH13-7.64 |  | BH13-7.65 |  | BH13-7.66 |  | BH13-7.67 |  | BH13-7.68 |  | BH13-7.69 |  | BH13-7.70 |  | BH13-7.71 |  | BH13-7.72 |  | BH13-7.73 |  | BH13-7.74 |  | BH13-7.75 |  | BH13-7.76 |  | BH13-7.77 |  | BH13-7.78 |  | BH13-7.79 |  | BH13-7.80 |  | BH13-7.81 |  | BH13-7.82 |  | BH13-7.83 |  | BH13-7.84 |  | BH13-7.85 |  | BH13-7.86 |  | BH13-7.87 |  | BH13-7.88 |  | BH13-7.89 |  | BH13-7.90 |  | BH13-7.91 |  | BH13-7.92 |  | BH13-7.93 |  | BH13-7.94 |  | BH13-7.95 |  | BH13-7.96 |  | BH13-7.97 |  | BH13-7.98 |  | BH13-7.99 |  | BH13-8.00 |  | BH13-8.01 |  | BH13-8.02 |  | BH13-8.03 |  | BH13-8.04 |  | BH13-8.05 |  | BH13-8.06 |  | BH13-8.07 |  | BH13-8.08 |  | BH13-8.09 |  | BH13-8.10 |  | BH13-8.11 |  | BH13-8.12 |  | BH13-8.13 |  | BH13-8.14 |  | BH13-8.15 |  | BH13-8.16 |  | BH13-8.17 |  | BH13-8.18 |  | BH13-8.19 |  | BH13-8.20 |  | BH13-8.21 |  | BH13-8.22 |  | BH13-8.23 |  | BH13-8.24 |  | BH13-8.25 |  | BH13-8.26 |  | BH13-8.27 |  | BH13-8.28 |  | BH13-8.29 |  | BH13-8.30 |  | BH13-8.31 |  | BH13-8.32 |  | BH13-8.33 |  | BH13-8.34 |  | BH13-8.35 |  | BH13-8.36 |  | BH13-8.37 |  | BH13-8.38 |  | BH13-8.39 |  | BH13-8.40 |  | BH13-8.41 |  | BH13-8.42 |  | BH13-8.43 |  | BH13-8.44 |  | BH13-8.45 |  | BH13-8.46 |  | BH13-8.47 |  | BH13-8.48 |  | BH13-8.49 |  | BH13-8.50 |  | BH13-8.51 |  | BH13-8.52 |  | BH13-8.53 |  | BH13-8.54 |  | BH13-8.55 |  | BH13-8.56 |  | BH13-8.57 |  | BH13-8.58 |  | BH13-8.59 |  | BH13-8.60 |  | BH13-8.61 |  | BH13-8.62 |  | BH13-8.63 |  | BH13-8.64 |  | BH13-8.65 |  | BH13-8.66 |  | BH13-8.67 |  | BH13-8.68 |  | BH13-8.69 |  | BH13-8.70 |  | BH13-8.71 |  | BH13-8.72 |  | BH13-8.73 |  | BH13-8.74 |  | BH13-8.75 |  | BH13-8.76 |  | BH13-8.77 |  | BH13-8.78 |  | BH13-8.79 |  | BH13-8.80 |  | BH13-8.81 |  | BH13-8.82 |  | BH13-8.83 |  | BH13-8.84 |  | BH13-8.85 |  | BH13-8.86 |  | BH13-8.87 |  | BH13-8.88 |  | BH13-8.89 |  | BH13-8.90 |  | BH13-8.91 |  | BH13-8.92 |  | BH13-8.93 |  | BH13-8.94 |  | BH13-8.95 |  | BH13-8.96 |  | BH13-8.97 |  | BH13-8.98 |  | BH13-8.99 |  | BH13-9.00 |  | BH13-9.01 |  | BH13-9.02 |  | BH13-9.03 |  | BH13-9.04 |  | BH13-9.05 |  | BH13-9.06 |  | BH13-9.07 |  | BH13-9.08 |  | BH13-9.09 |  | BH13-9.10 |  | BH13-9.11 |  | BH13-9.12 |  | BH13-9.13 |  | BH13-9.14 |  | BH13-9.15 |  | BH13-9.16 |  | BH13-9.17 |  | BH13-9.18 |  | BH13-9.19 |  | BH13-9.20 |  | BH13-9.21 |  | BH13-9.22 |  | BH13-9.23 |  | BH13-9.24 |  | BH13-9.25 |  | BH13-9.26 |  | BH13-9.27 |  | BH13-9.28 |  | BH13-9.29 |  | BH13-9.30 |  | BH13-9.31 |  | BH13-9.32 |  | BH13-9.33 |  | BH13-9.34 |  | BH13-9.35 |  | BH13-9.36 |  | BH13-9.37 |  | BH13-9.38 |  | BH13-9.39 |  | BH13-9.40 |  | BH13-9.41 |  | BH13-9.42 |  | BH13-9.43 |  | BH13-9.44 |  | BH13-9.45 |  | BH13-9.46 |  | BH13-9.47 |  | BH13-9.48 |  | BH13-9.49 |  | BH13-9.50 |  | BH13-9.51 |  | BH13-9.52 |  | BH13-9.53 |  | BH13-9.54 |  | BH13-9.55 |  | BH13-9.56 |  | BH13-9.57 |  | BH13-9.58 |  | BH13-9.59 |  | BH13-9.60 |  | BH13-9.61 |  | BH13-9.62 |  | BH13-9.63 |  | BH13-9.64 |  | BH13-9.65 |  | BH13-9.66 |  | BH13-9.67 |  | BH13-9.68 |  | BH13-9.69 |  | BH13-9.70 |  | BH13-9.71 |  | BH13-9.72 |  | BH13-9.73 |  | BH13-9.74 |  | BH13-9.75 |  | BH13-9.76 |  | BH13-9.77 |  | BH13-9.78 |  | BH13-9.79 |  | BH13-9.80 |  | BH13-9.81 |  | BH13-9.82 |  | BH13-9.83 |  | BH13-9.84 |  | BH13-9.85 |  | BH13-9.86 |  | BH13-9.87 |  | BH13-9.88 |  | BH13-9.89 |  | BH13-9.90 |  | BH13-9.91 |  | BH13-9.92 |  | BH13-9.93 |  | BH13-9.94 |  | BH13-9.95 |  | BH13-9.96 |  | BH13-9.97 |  | BH13-9.98 |  | BH13-9.99 |  | BH13-10.00 |  | BH13-10.01 |  | BH13-10.02 |  | BH13-10.03 |  | BH13-10.04 |  | BH13-10.05 |  | BH13-10.06 |  | BH13-10.07 |  | BH13-10.08 |  | BH13-10.09 |  | BH13-10.10 |  | BH13-10.11 |  | BH13-10.12 |  | BH13-10.13 |  | BH13-10.14 |  | BH13-10.15 |  | BH13-10.16 |  | BH13-10.17 |  | BH13-10.18 |  | BH13-10.19 |  | BH13-10.20 |  | BH13-10.21 |  | BH13-10.22 |  | BH13-10.23 |  | BH13-10.24 |  | BH13-10.25 |  | BH13-10.26 |  | BH13-10.27 |  | BH13-10.28 |  | BH13-10.29 |  | BH13-10.30 |  | BH13-10.31 |  | BH13-10.32 |  | BH13-10.33 |  | BH13-10.34 |  | BH13-10.35 |  | BH13-10.36 |  | BH13-10.37 |  | BH13-10.38 |  | BH13-10.39 |  | BH13-10.40 |  | BH13-10.41 |  | BH13-10.42 |  | BH13-10.43 |  | BH13-10.44 |  | BH13-10.45 |  | BH13-10.46 |  | BH13-10.47 |  | BH13-10.48 |  | BH13-10.49 |  | BH13-10.50 |  | BH13-10.51 |  | BH13-10.52 |  | BH13-10.53 |  | BH13-10.54 |  | BH13-10.55 |  | BH13-10.56 |  | BH13-10.57 |  | BH13-10.58 |  | BH13-10.59 |  | BH13-10.60 |  | BH13-10.61 |  | BH13-10.62 |  | BH13-10.63 |  | BH13-10.64 |  | BH13-10.65 |  | BH13-10.66 |  | BH13-10.67 |  | BH13-10.68 |  | BH13-10.69 |  | BH13-10.70 |  | BH13-10.71 |  | BH13-10.72 |  | BH13-10.73 |  | BH13-10.74 |  | BH13-10.75 |  | BH13-10.76 |  | BH13-10.77 |  | BH13-10.78 |  | BH13-10.79 |  | BH13-10.80 |  | BH13-10.81 |  | BH13-10.82 |  | BH13-10.83 |  | BH13-10.84 |  | BH13-10.85 |  | BH13-10.86 |  | BH13-10.87 |  | BH13-10.88 |  | BH13-10.89 |  | BH13-10.90 |  | BH13-10.91 |  | BH13-10.92 |  | BH13-10.93 |  | BH13-10.94 |  | BH13-10.95 |  | BH13-10.96 |  | BH13-10.97 |  | BH13-10.98 |  | BH13-10.99 |  | BH13-11.00 |  | BH13-11.01 |  | BH13-11.02 |  | BH13-11.03 |  | BH13-11.04 |  | BH13-11.05 |  | BH13-11.06 |  | BH13-11.07 |  | BH13-11.08 |  | BH13-11.09 |  | BH13-11.10 |  | BH13-11.11 |  | BH13-11.12 |  | BH13-11.13 |  | BH13-11.14 |  | BH13-11.15 |  | BH13-11.16 |  | BH13-11.17 |  | BH13-11.18 |  | BH13-11.19 |  | BH13-11.20 |  | BH13-11.21 |  | BH13-11.22 |  | BH13-11.23 |  | BH13-11.24 |  | BH13-11.25 |  | BH13-11.26 |  | BH13-11.27 |  | BH13-11.28 |  | BH13-11.29 |  | BH13-11.30 |  | BH13-11.31 |  | BH13-11.32 |  | BH13-11.33 |  | BH13-11.34 |  | BH13-11.35 |  | BH13-11.36 |  | BH13-11.37 |  | BH13-11.38 |  | BH13-11.39 |  | BH13-11.40 |  | BH13-11.41 |  | BH13-11.42 |  | BH13-11.43 |  | BH13-11.44 |  | BH13-11.45 |  | BH13-11.46 |  | BH13-11.47 |  | BH13-11.48 |  | BH13-11.49 |  | BH13-11.50 |  | BH13-11.51 |  | BH13-11.52 |  | BH13-11.53 |  | BH13-11.54 |  | BH13-11.55 |  | BH13-11.56 |  | BH13-11.57 |  | BH13-11.58 |  | BH13-11.59 |  | BH13-11.60 |  | BH13-11.61 |  | BH13-11.62 |  | BH13-11.63 |  |
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Table 3. Soil Analytical Results, January 2014

| Monitoring Wells                    |        |        |       |          |          |              |          |           |           |           |         |
|-------------------------------------|--------|--------|-------|----------|----------|--------------|----------|-----------|-----------|-----------|---------|
| PETROLEUM HYDROCARBONS (CME)        |        |        |       |          |          |              |          |           |           |           |         |
| Sample Depth (m)                    | CME RL | CSR RL | UNITS | MW13-6.3 | MW13-6.4 | DUP MW13-6.4 | MW13-6.3 | MW13-10.4 | MW13-11.3 | MW13-11.4 |         |
| Sampling Date                       |        |        |       | 6/09/09  | 6/09/09  | 6/09/09      | 6/09/09  | 6/09/09   | 6/09/09   | 6/09/09   |         |
| Units                               |        |        |       | mg/kg    | mg/kg    | mg/kg        | mg/kg    | mg/kg     | mg/kg     | mg/kg     |         |
| Physical Properties                 |        |        |       |          |          |              |          |           |           |           |         |
| Moisture %                          | -      | -      | %     | 10       | 6.6      | 8.6          | 15       | 5.3       | 11        | 11        | 11      |
| PETROLEUM HYDROCARBONS              |        |        |       |          |          |              |          |           |           |           |         |
| Ex. Pet. Hydrocarbon                |        |        |       |          |          |              |          |           |           |           |         |
| F1 (C6-C10) - BTX                   | 210    | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| F2 (C10-C18 H-dicarbons)            | 150    | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| F3 (C16-C24 H-dicarbons)            | 700    | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| F4 (C24-C36 H-dicarbons)            | 2800   | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| TOTAL PETROLEUM HYDROCARBONS        |        |        |       |          |          |              |          |           |           |           |         |
| Calculated Parameters               |        |        |       |          |          |              |          |           |           |           |         |
| LEPH (C10-C12 Iers PAH)             | -      | 1000   | mg/kg | <100     | <100     | <100         | <100     | <100      | <100      | <100      | <100    |
| HEPH (C16-C32 Iers PAH)             | -      | 1000   | mg/kg | <100     | <100     | <100         | <100     | <100      | <100      | <100      | <100    |
| Hydrocarbons                        |        |        |       |          |          |              |          |           |           |           |         |
| EPH (C10-C18)                       | -      | 1000   | mg/kg | <100     | <100     | <100         | <100     | <100      | <100      | <100      | <100    |
| EPH (C18-C32)                       | -      | 1000   | mg/kg | <100     | <100     | <100         | <100     | <100      | <100      | <100      | <100    |
| Volatiles                           |        |        |       |          |          |              |          |           |           |           |         |
| Methyl-ter-butyl (MTBE)             | -      | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| Benzene                             | 0.011  | 0.04   | mg/kg | <0.0050  | <0.0050  | <0.0050      | <0.0050  | <0.0050   | <0.0050   | <0.0050   | <0.0050 |
| Toluene                             | 0.011  | 1.5    | mg/kg | <0.0050  | <0.0050  | <0.0050      | <0.0050  | <0.0050   | <0.0050   | <0.0050   | <0.0050 |
| Ethylbenzene                        | 0.002  | 1      | mg/kg | <0.010   | <0.010   | <0.010       | <0.010   | <0.010    | <0.010    | <0.010    | <0.010  |
| m & p-Xylene                        | -      | -      | mg/kg | <0.040   | <0.040   | <0.040       | <0.040   | <0.040    | <0.040    | <0.040    | <0.040  |
| o-Xylene                            | -      | -      | mg/kg | <0.040   | <0.040   | <0.040       | <0.040   | <0.040    | <0.040    | <0.040    | <0.040  |
| Styrene                             | 5      | 5      | mg/kg | <0.030   | <0.030   | <0.030       | <0.030   | <0.030    | <0.030    | <0.030    | <0.030  |
| Xylenes (Total)                     | 11     | 5      | mg/kg | <0.040   | <0.040   | <0.040       | <0.040   | <0.040    | <0.040    | <0.040    | <0.040  |
| Polycyclic Aromatics                | -      | -      | mg/kg | <10      | <10      | <10          | <10      | <10       | <10       | <10       | <10     |
| Naphthalene                         | 0.013  | 5      | mg/kg | <0.010   | <0.010   | <0.010       | <0.010   | <0.010    | <0.010    | <0.010    | <0.010  |
| 2-Methylnaphthalene                 | -      | -      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Acenaphthylene                      | 320    | -      | mg/kg | <0.0050  | <0.0050  | <0.0050      | <0.0050  | <0.0050   | <0.0050   | <0.0050   | <0.0050 |
| Acenaphthene                        | 0.28   | -      | mg/kg | <0.0050  | <0.0050  | <0.0050      | <0.0050  | <0.0050   | <0.0050   | <0.0050   | <0.0050 |
| Fluorene                            | 0.25   | -      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Phenanthrene                        | 0.048  | 5      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Anthracene                          | -      | -      | mg/kg | <0.0050  | <0.0050  | <0.0050      | <0.0050  | <0.0050   | <0.0050   | <0.0050   | <0.0050 |
| Pyrene                              | 7.7    | 10     | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Fluoranthene                        | -      | -      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Benzofluoranthene                   | 1      | 1      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Chrysene                            | -      | -      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Benzoperylene                       | -      | -      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Benzofluoranthene                   | 1      | 1      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Benzoperylene                       | 0.6    | 1      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Indeno(1,2,3-cd)pyrene              | 1      | 1      | mg/kg | <0.020   | <0.020   | <0.020       | <0.020   | <0.020    | <0.020    | <0.020    | <0.020  |
| Dibenz(a,h)anthracene               | 1      | 1      | mg/kg | <0.050   | <0.050   | <0.050       | <0.050   | <0.050    | <0.050    | <0.050    | <0.050  |
| Benzg(a,i)perylene                  | -      | -      | mg/kg | <0.050   | <0.050   | <0.050       | <0.050   | <0.050    | <0.050    | <0.050    | <0.050  |
| Low Molecular Weight PAH's          | -      | -      | mg/kg | <0.050   | <0.050   | <0.050       | <0.050   | <0.050    | <0.050    | <0.050    | <0.050  |
| High Molecular Weight PAH's         | -      | -      | mg/kg | <0.050   | <0.050   | <0.050       | <0.050   | <0.050    | <0.050    | <0.050    | <0.050  |
| Total PAH                           | -      | -      | mg/kg | <0.050   | <0.050   | <0.050       | <0.050   | <0.050    | <0.050    | <0.050    | <0.050  |
| Index of Additive Cancer Risk(IACR) | 1      | -      | mg/kg | 0.31     | 0.31     | 0.31         | 0.31     | 0.31      | 0.31      | 0.31      | 0.31    |
| EQIP TPE                            | 0.5    | -      | mg/kg | <0.10    | <0.10    | <0.10        | <0.10    | <0.10     | <0.10     | <0.10     | <0.10   |

Notes

RDL = Reportable Detection Limit

EDL = Estimated Detection Limit

(1) RDL raised due to sample matrix interference.

(2) RDL raised due to sample dilution.

- Can Shading indicates parameter exceeds CME RL, CME RL - Ca

- The Index of Additive Cancer Risk (IACR) measures potential threats to

from soil. The IACR is calculated by dividing the soil concentration (num

erator) by the potability water component value (denominator) to calculate a hazard index



## **Appendix 2**





|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1400 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

## 1400 SUBDIVISION ROADS CHAPTER

### 1410 SUBDIVISION ROAD CONSTRUCTION SPECIFICATIONS

|  |        |
|--|--------|
| 1410.01 GENERAL .....                                | 1410-1 |
| 1410.01.01 Right-Of-Way Width .....                  | 1410-1 |
| 1410.01.02 Inspections .....                         | 1410-1 |
| 1410.01.03 Other Regulating Agencies .....           | 1410-1 |
| 1410.01.04 Miscellaneous .....                       | 1410-1 |
| 1410.02 CLEARING AND GRUBBING .....                  | 1410-2 |
| 1410.03 ROADWAY AND DRAINAGE EXCAVATION .....        | 1410-2 |
| 1410.04 EARTH EMBANKMENTS .....                      | 1410-2 |
| 1410.05 ROCK EMBANKMENTS .....                       | 1410-2 |
| 1410.06 SPECIAL SLOPE TREATMENT .....                | 1410-3 |
| 1410.07 GRANULAR SURFACING, BASE AND SUB-BASES ..... | 1410-3 |
| 1410.07.01 Aggregate Quality .....                   | 1410-3 |
| 1410.07.02 Pavement Design Standards .....           | 1410-3 |
| 1410.07.03 Aggregate Gradation and Surfacing .....   | 1410-4 |
| 1410.08 CONSTRUCTION .....                           | 1410-5 |
| 1410.09 STORM DRAINAGE .....                         | 1410-5 |
| 1410.09.01 General .....                             | 1410-5 |
| 1410.09.02 Drainage Plan .....                       | 1410-5 |
| 1410.09.03 Calculations .....                        | 1410-6 |
| 1410.10 HAMMERHEADS/CUL-DE-SACS .....                | 1410-6 |
| 1410.11 PAVING .....                                 | 1410-6 |

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1400 |  | TAC Section | Not Applicable |
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## 1420 DESIGN PARAMETERS

|            |                                  |         |
|------------|----------------------------------|---------|
| 1420.01    | CONSIDERATIONS .....             | 1420-1  |
| 1420.02    | ROAD CLASSIFICATION.....         | 1420-1  |
| 1420.02.01 | Arterial/Primary .....           | 1420-1  |
| 1420.02.02 | Collector/Secondary.....         | 1420-1  |
| 1420.02.03 | Local .....                      | 1420-1  |
| 1420.02.04 | Cul-de-sac .....                 | 1420-1  |
| 1420.02.05 | Frontage Road/Backage Road ..... | 1420-1  |
| 1420.03    | PLANS.....                       | 1420-1  |
| 1420.04    | ACCOMMODATING CYCLISTS .....     | 1420-1  |
| 1420.05    | ALIGNMENT.....                   | 1420-2  |
| 1420.05.01 | Arterials/Primary .....          | 1420-2  |
| 1420.05.02 | Collectors (Network Roads) ..... | 1420-2  |
| 1420.05.03 | Locals.....                      | 1420-6  |
| 1420.05.04 | Cul-de-sac .....                 | 1420-6  |
| 1420.05.05 | Frontage Roads .....             | 1420-13 |
| 1420.05.06 | Backage Roads.....               | 1420-13 |
| 1420.05.07 | Cross Slopes.....                | 1420-13 |
| 1420.05.08 | Superelevation .....             | 1420-13 |
| 1420.06    | INTERSECTIONS/ACCESSES.....      | 1420-13 |
| 1420.06.01 | General.....                     | 1420-13 |
| 1420.07    | UTILITY SETBACK.....             | 1420-13 |
| 1420.08    | DRIVEWAYS.....                   | 1420-13 |
| 1420.09    | BRIDGES .....                    | 1420-16 |
| 1420.10    | SIGNING/SPEEDS.....              | 1420-16 |

|             |      |  |             |                |
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| MoT Section | 1400 |  | TAC Section | Not Applicable |
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**1400 SUBDIVSION ROADS CHAPTER  
TABLES**

1420.A Design Parameters..... 1420-12

1420.E Finished Top and Shoulder Widths ..... 1420-14

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1400 |  | TAC Section | Not Applicable |
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## 1400 SUBDIVISION ROADS CHAPTER FIGURES

|   |         |
|---|---------|
| 1420.B Two-Lane Urban Cross Section .....     | 1420-3  |
| 1420.C Two-Lane Two-Way Asphalt Surface ..... | 1420-4  |
| 1420.D Two Lane Two-Way Gravel Surface .....  | 1420-5  |
| 1420.F Collector/Rural Cul-de-sac .....       | 1420-7  |
| 1420.G Local Rural/Cul-de-sac .....           | 1420-8  |
| 1420.H Collector/Local Urban Cul-de-sac ..... | 1420-9  |
| 1420.I Local/Urban Cul-de-sac .....           | 1420-10 |
| 1420.J Offset Cul-de-sac .....                | 1420-11 |
| 1420.K Typical Hammerhead .....               | 1420-12 |
| 1420.L Modified Hammerhead .....              | 1420-12 |
| 1420.M Culvert Installation .....             | 1420-14 |
| 1420.N Driveway Cross Section .....           | 1420-14 |
| 1420.O Installation Layout .....              | 1420-15 |

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1410 | TAC Section | Not Applicable |
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## 1410 SUBDIVISION ROAD CONSTRUCTION SPECIFICATIONS

Where there are existing agreements between the Ministry of Transportation and other parties, those agreements shall prevail. Where excerpts from the Standard Specifications for Highway Construction or from the MoT Supplement to TAC Geometric Design Guide are different from the said current version, the actual publications shall prevail.

Exceptions to these standards shall be directed through the District Manager, Transportation to the Regional Director.

### 1410.01 GENERAL

1. All construction practices and procedures shall conform to the **current** edition of the Ministry's *Standard Specifications for Highway Construction* book unless specified otherwise in the text below or by the Ministry Representative. Excerpts from that book have been included in an attempt to provide a more comprehensive handout for one or two lot subdivisions. Copies of the Standard Specifications can be obtained from the MoT website ([www.gov.bc.ca/tran](http://www.gov.bc.ca/tran)) by going to the Site Index, then to Standard Specifications.
2. The developer shall conform to the conditions contained in the Standard Specifications as well as any Special Provisions specified by the District Manager, Transportation and/or the Ministry Representative\*. These Special Provisions shall take precedence over the Standard Specifications.
3. Roadways may not be approved:
  - a) If road construction has been undertaken during periods of snow, heavy rains, freezing, or other such unsuitable weather conditions.
  - b) If granular aggregate has been placed upon a frozen, wet, muddy, or rutted subgrade or base course.
  - c) Without a Ministry accepted design plan.

\* This and all further references to the Ministry Representative include the District Manager, Transportation.

#### 1410.01.01 Right-Of-Way Width

Right-of-Way shall be of sufficient width to include the road fill, ditches and backslopes, plus a minimum 3 metres on each side or as directed by the District Manager, Transportation. For all subdivision roads other than lanes, frontage roads and pedestrian facilities, the minimum Right-of-Way width shall be 20 metres.

### 1410.01.02 Inspections

Testing and/or inspections by an independent testing agency with Professional Engineer or ASCT registration shall be considered as an acceptable alternate if or when requested by the Ministry Representative. Inspections shall be carried out upon completion of each of the following stages of construction:

- a) Clearing and Grubbing and Subgrade Slope Staking.
- b) Roadway and Drainage Excavation and Subgrade Construction Slope Stakes.
- c) Select Granular Sub-Base Construction and Slope Stakes for Surface Course Construction.
- d) Paving (when required).

The developer shall give a minimum of one (1) week's notice prior to completion of each stage to allow for the scheduling of inspections. If required notice is not given, the roadways may not be approved.

### 1410.01.03 Other Regulating Agencies

The developer shall comply with any and all statutory regulations and bylaws and all applicable Federal, Provincial, Regional District, and Improvement District regulations during construction work.

### 1410.01.04 Miscellaneous

All roads shall be slope staked as requested by the Ministry Representative. The Ministry Representative may also request that all utilities be staked when the project is greater than 100 metres in length.

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| MoT Section | 1410 | TAC Section | Not Applicable |
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## 1410.02 CLEARING AND GRUBBING

The Right-of-Way shall be cleared and grubbed to the full width specified by the Ministry Representative or the default shall be the full Right-of-Way width. Trees, stumps, roots, brush and embedded logs, and all debris shall be grubbed to a depth of 600 mm and shall be disposed of to the satisfaction of the Ministry Representative. No debris shall be buried within the fill.

*NOTE: Inspection and approval of clearing and grubbing by the Ministry Representative are required prior to proceeding with sub-grade construction. See Section 200 of the Standard Specifications.*

## 1410.03 ROADWAY AND DRAINAGE EXCAVATION

**Description:** Roadway and Drainage Excavation shall include all necessary excavation and the construction of all embankments required for the formation of the roadbed and associated drainage works and additional work as outlined in subsection 201.01 of the Standard Specifications.

## 1410.04 EARTH EMBANKMENTS

Subsections 201.37 and 201.38 of the Standard Specifications will apply. The entire roadway including the roadbed, slopes and ditches shall be neatly finished and trimmed to the designed cross section. Density tests shall be the responsibility of the developer. See 1410.01.02.

## 1410.05 ROCK EMBANKMENTS

Rock embankments shall be in accordance with Subsection 201.36 of the Standard Specifications.



|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1410 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

**1410.06 SPECIAL SLOPE TREATMENT**

Slopes shall be treated in accordance with Drawing SP201-01 in the Standard Specifications. Hydro seeding shall be done as directed by the Ministry Representative.

**1410.07 GRANULAR SURFACING, BASE AND SUB-BASES****1410.07.01 Aggregate Quality**

Aggregate quality shall conform to Subsection 202.04 of the Standard Specifications.

**1410.07.02 Pavement Design Standards**

Four Design Standards, based on general roadway classification, are used to categorize British Columbia's provincial road network. Twenty (20) year design Equivalent Single Axle Loads (ESALs) are the primary criteria used for selection of the appropriate standard with additional subgrade material criteria applied to low volume roads and subdivision roads. These are summarized as follows:

NOTE: one ESAL = one standard axle load = 8,165 kg (18,000 lb.)(i.e. Benkelman Beam Truck)

| STANDARD TYPE | ROADWAY DESIGNATION | 20 YEAR DESIGN ESAL CRITERIA |
|---------------|---------------------|------------------------------|
| TYPE "A"      | HIGH VOLUME ROADS   | > 1,000,000                  |
| TYPE "B"      | MEDIUM VOLUME ROADS | 100,000 to 1,000,000         |
| TYPE "C"      | LOW VOLUME ROADS    | < 100,000                    |
| TYPE "D"      | SUBDIVISION ROADS   | < 100,000                    |

**TYPE "A"****HIGH VOLUME ROADS: > 1,000,000 ESAL's**

100 mm A.P.

150 mm C.B.C. (-25 mm)

150 mm C.B.C. (75 mm MAXIMUM size)

S.G.S.B. (See 1410.07.03)

**TYPE "B" (See Figure 1420.B)****MEDIUM VOLUME ROADS 100,000 to 1,000,000 ESAL's**

75 mm A.P.

150 mm C.B.C. (-25 mm)

150 mm C.B.C. (75 mm MAXIMUM size)

S.G.S.B. (See 1410.07.03)

**TYPE "C"(see Type "D" below)****LOW VOLUME ROADS****TYPE "D"(See Figures 1420.C & D)****SUBDIVISION ROADS < 100,000 ESAL's**

50 mm A.P.

225 mm C.B.C. (-25 mm MAXIMUM size)

S.G.S.B. (See 1410.07.03)

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1410 |  | TAC Section | Not Applicable |
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### 1410.07.03 Aggregate Gradation and Surfacing

The Ministry Representative, in consultation with the Regional Geotechnical and Materials Engineer, may specify alternative designs than stated below in consideration of local soils and climatic conditions. Granular surfacing, base and sub bases shall be in accordance with Section 202 of the Standard Specifications.

There are typically three gravel courses:

1. The lower course (S.G.S.B). shall consist as follows:

- A minimum thickness of 300 mm of S.G.S.B. shall be applied over fine-grained subgrade (Unified Soils Classification System - ML-CL-OL-MH-CH-OH)
- A minimum thickness of 150 mm of S.G.S.B. shall be applied over coarse-grained subgrade (Unified Soils Classification System - GW-GP-GM-GC-SW-SP-SM-SC) where ground water does not pose a drainage problem and frost penetration does not affect the structure.
- A minimum 150 mm S.G.S.B. shall be applied over rock.
- No S.G.S.B. is required in exceptional circumstances where the following criteria has been met:
  - Structural Design Criteria is satisfied and
  - Subgrade material consists of clean granular deposits that satisfy the S.G.S.B. gradation and construction criteria of the BC MoT Standard Specifications for Highway Construction - Section 202 "Granular Surfacing, Base and Sub-bases", (Subsection 202.06).

Note: All leveling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.

2. The mid course shall consist of 150 mm of 50 mm or 75 mm Crushed Base Course (C.B.C.) in accordance with Subsection 202.05 of the Standard Specifications.

3. The upper course shall consist of 225 mm of 25 mm minus Crushed Base Course (C.B.C.) in accordance with the following:

- a) Crushed Surfacing Aggregate gradation used for surfacing gravel roads is defined in Table 202-B of the Standard Specifications.
  - b) Where paving is required or anticipated in the reasonable future, 25 mm crushed Base Course Aggregate as specified in Subsection 202.05 of the Standard Specifications, shall be used.
- Gravel depths are the compacted measurements. Subject to local conditions, the Ministry Representative may request additional gravel depths.
  - Roadways shall be graded and compacted with crossfall for road drainage as follows:
    - a) For paved roads -- 0.02 m/m crossfall (normal crown) on tangents and appropriate superelevation as specified on curves.
    - b) For gravel roads -- 0.04 m/m crossfall on tangents and appropriate superelevation as specified on curves.
  - Gravel shall be spread and compacted in lifts not exceeding 150 mm in depth or as specified by the Ministry Representative. If requested by the Ministry Representative, water shall be applied during gravel compaction to achieve 100% proctor density as described in the Standard Specifications for Highway Construction Sections 202.33 and 202.34.
  - The owner/contractor shall hire a qualified inspector (see 1410.01.02), to provide written confirmation of compliance with Section 202 of the Standard Specifications.

THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

*NOTE: Inspection and approval by the Ministry Representative (or at their request, a qualified Professional Engineer or Limited Licensee practicing in this scope of engineering) of granular material used for each gravel course is required prior to placement of the upper gravel courses (see 1410.01.02)*

|             |      |             |                |
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| MoT Section | 1410 | TAC Section | Not Applicable |
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## 1410.08 CONSTRUCTION

1. Back slopes shall be 1.5:1 or flatter, except in sand or similar material which shall be 2:1 or flatter, except as specified by the Ministry Representative. For rock ditches refer to Figure 1420.D
2. All fill slopes shall be 2:1 or flatter, with the exception of slopes qualifying for road side barrier.
3. All materials, silts, sands and gravels shall be laid in 150 mm lifts. The contractor should use the appropriate equipment required to obtain the compaction as specified in the Standard Specifications for Highway Construction Book. Watering shall be carried out as required to provide optimum water content during compaction. Grades containing soft spots will not be approved until such sections have been excavated and backfilled with suitable material and compacted. Other methods of compaction will be considered by the Ministry Representative upon request.

## 1410.09 STORM DRAINAGE

### 1410.09.01 General

This guideline is intended for the use of personnel competent to evaluate the significance and limitations of its content and recommendations, and who will accept responsibility for the application of the material it contains. The Ministry of Transportation disclaims any or all responsibility for the application of the stated guidelines and for the accuracy of the material contained herein.

Drainage shall be adequate to the satisfaction of the Ministry Representative. All ditches and storm drainage pipes are to be carried to a natural drainage course. The original drainage pattern for the site shall not be altered without permission of the Provincial Ministry of Environment, Water Management Branch.

Drainage easements or statutory Rights-of-Way may be required. Drainage easements shall be a minimum of 6 metres in width or as determined by the Ministry Representative.

1. Only Ministry approved Corrugated Steel, Concrete, PVC or High Density Polyethylene pipe may be used for storm sewers.

2. The minimum size driveway culvert shall be 400 mm diameter with a minimum required cover of 300 mm. The minimum size culvert for a frontage road or collector (network) road shall be 500 mm diameter (some areas may require a 600 mm minimum) with a minimum cover of 450 mm. See Table 1040.A for a comprehensive listing of minimum cover requirements for network roads. These minimum dimensions may be increased at the discretion of the Ministry Representative.
3. Culvert grade shall be a minimum of 0.5% percent unless otherwise approved by the Ministry Representative.
4. Culverts shall be bedded and backfilled within the subgrade zone with a fine graded gravel free of rock over 25 mm.
5. The ditch invert grade shall be a minimum of 150 mm below the bottom of select granular sub base but shall be deep enough to ensure adequate cover, regardless of pipe size.
6. All cul-de-sacs must be drained and all drainage across private property shall be carried on registered easements or statutory Rights-of-Way.
7. The inlet and/or outlet of culverts subject to erosion shall have sandbags or a headwall respecting clear zone principles and shall not introduce a further hazard.

### 1410.09.02 Requirements for Drainage Design

When information is presented in two locations or publications, difficulties can arise if both are not synchronized for changes. Rather than run that risk, Drainage Design is discussed as part of Chapter 1000, **Hydraulics and Structures** of the BC Supplement to TAC.

The Ministry's design philosophy for subdivision storm drainage is such that all storm drainage facilities be designed according to the major/minor storm drainage concept.

The Subdivision Development Drainage Plan must provide sufficient information to allow the reviewer to understand the developer's objectives and to thoroughly assess the hydraulic impacts of the development.

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| MoT Section | 1410 | TAC Section | Not Applicable |
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### 1410.09.03 Hydrology and Design Flow Calculations

For Hydrology and Design Flow Calculations see Section 1020 of the BC Supplement to TAC.

#### NOTES:

*Inspection and approval of drainage and subgrade construction are required prior to gravelling, (see 1410.01.02.).*

### 1410.10 HAMMERHEADS/CUL-DE-SACS

Cul-de-sac turnarounds shall be constructed on all rural dead end roads and dead end roads that cannot be further extended. Construction shall be in accordance with 1420.05.04 of this Guideline. In general, most cul-de-sacs are locals, except design Standards for Commercial or Industrial subdivisions may be considered collectors as per 1420.02.03

*NOTE: Hammerhead and temporary turnarounds shall be considered instead of cul-de-sacs in rural situations where it is reasonable to expect a road extension within five years. Dimensions and widths shall be in accordance with 1420.05.04. Where temporary turnarounds cannot be constructed within standard Right-of-Way, a statutory Right-of-Way plan to encompass the additional width is recommended.*

### 1410.11 PAVING

1. All gravel surfaces shall be primed prior to paving in accordance with subsection 501.19 of the Standard Specifications.
2. A minimum 50 mm asphalt pavement thickness may be adequate in certain situations where traffic volumes are low and there is very little heavy truck traffic. As determined by the Pavement Designer, a 75 mm asphalt pavement thickness may be warranted in situations where traffic volumes, in particular heavy truck traffic, is high.
3. In rural areas, other methods of hard surfacing (such as seal coat) may be considered by the Ministry Representative.
4. Prior to paving, the developer shall contact the Ministry Representative to ensure that on-site inspection will take place before and during paving operations.
5. The decision to pave and the pavement design shall be as directed by the Ministry Representative. Considerations for paving are as follows:
  - When leaving a paved road.
  - More than four lots under five acres each.
  - Proximity to the batch plant.
  - Availability of materials.
6. Upon completion of paving, shoulders will consist of either 19 mm Shouldering Aggregate or 25 mm Well Graded Base Course. Compaction of the shouldering material shall be in accordance with the Standard Specifications.

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

## 1420 SUBDIVISION ROAD DESIGN PARAMETERS

### 1420.01 CONSIDERATIONS

A Road Network Plan is based on a hierarchy of streets that is related to the amount and type of traffic served. It takes into account such factors as public transit, shopping and community facilities, and other land uses. The changing nature of the area over time is also a major factor. For example, a rural area may change into an urban one in the course of time. The future requirements for the entire road network are considered when a subdivision application is evaluated.

- Municipal and Regional District Major Road Network plans must be checked to ensure that the major roads are protected by the proposed subdivision.
- Where possible, new developments should have at least two connections to the existing road network in case of emergency.
- Pedestrian and cyclist volumes should be considered and walkways provided where considered necessary.

### 1420.02 ROAD CLASSIFICATION

#### 1420.02.01 Arterial/Primary

A general term denoting a road primarily for through traffic usually on a continuous route. Direct access to abutting land is not a priority. Arterial roads will not be discussed in these guidelines.

#### 1420.02.02 Collector/Secondary

A road that provides for traffic movement between arterials and local streets with some direct access to adjacent property.

#### 1420.02.03 Local

A road primarily for access to residences, businesses, or other abutting property.

*Note: Local streets intended for commercial or industrial development are considered as collector roads.*

#### 1420.02.04 Cul-de-sac

A road termination providing a U-turn area of constant radius.

#### 1420.02.05 Frontage Road/ Backage Road

A local road that parallels the major through road and that provide access to property or business.

*Note: For this guideline, URBAN implies a curb and gutter cross section and RURAL implies an open shoulder cross section.*

### 1420.03 PLANS

The developer shall submit metric road design plans to the Ministry which include:

1. **Location Plan:** Scale 1:500 or 1:1000 showing horizontal alignment, lot lines, legal description of lots, proposed subdivision, signing, existing and proposed culvert locations and proposed drainage pattern.
2. **Profile:** Scale 1:1000 horizontal and 1:100 vertical, showing the existing ground line and proposed finished road grade.
3. **Laning Drawings:** Same scale as plan drawings, road markings, location and type of warning, regulatory, directional, and if necessary, special signs to be installed.
4. **Cross Sections** when required by the Ministry Representative.
5. **Typical Cross Sections:** as required.

The developer will commence road construction only after the Ministry Representative has accepted the road design.

### 1420.04 ACCOMMODATING CYCLISTS

It is recognized by the nature of subdivision roads, that cyclists will use these roads for travel within the subdivision and to connect to collectors and the general roadway system. As such, cycle traffic simply shares the roadway with motorized traffic.

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

## 1420.05 ALIGNMENT

The developer shall complete all road designs within the design speed range of 30 km/h to 80 km/h, as determined by the road classification, or as requested by the Ministry Representative. When selecting a design speed, the ultimate road classification must be considered (e.g. if a dead end road will be extended as a through road in the future, it should be designed to the ultimate classification).

Vertical curves shall be standard parabolic curves. The length of vertical curve (in metres) should not be less than the design speed (in km/h).

The developer shall demonstrate that every reasonable effort has been made to minimize the road grades. Short pitches of steeper grades may be acceptable on tangent sections provided the overall grade is less than 8%.

Minimum parameters for various design speeds shall be as shown in **Table 1420.A**. The developer shall consult with the local Ministry Maintenance Contractor to ensure that road maintenance equipment can manoeuvre within the proposed parameters. Design speeds of 40 km/h should typically be limited to lot access roads that do not perform a collector function. The developer must submit written justification when proposing roads with 30 km/h design speeds.

### 1420.05.01 Arterials/Primary

Arterials are generally network roads which are built and maintained by the Ministry of Transportation and shall not be discussed in this guideline.

**Table 1420.A – Design Parameters**

| Road Classification                              | Local Roads*** |        | Local/Collector | Collector Roads |         |         |
|--|----------------|--------|-----------------|-----------------|---------|---------|
| Speed (km/h)                                     | 30             | 40     | 50              | 60              | 70      | 80      |
| Radius, (metres)*                                | 20             | 40     | 75              | 120             | 190     | 250     |
| Minimum stopping sight distance, (metres)        | 30             | 45     | 65              | 85              | 110     | 140     |
| Decision Sight Distance, DSD (metres)**          | 40-110         | 55-110 | 75-145          | 95-175          | 125-200 | 155-230 |
| K value crest, vertical curves, taillight height | 2              | 4      | 7               | 13              | 23      | 36      |
| K value sag, vertical curves, Headlight control  | 4              | 7      | 12              | 18              | 25      | 32      |
| Minimum Overhead Clearance (metres)              | 5.0            | 5.0    | 5.0             | 5.0             | 5.0     | 5.0     |
| Maximum desirable grade in percent*              | 8              | 8      | 8               | 8               | 8       | 8       |

Parameters based on E max: 0.06 m/m, normal crown: 0.02 m/m.

\* Avoid the combined use of maximum grade and minimum radius. Maximum grades are to be reduced by 1% for each 30 metres of radius below 150 metres.

\*\* Lower DSD values are appropriate at intersections within a subdivision, while the higher values should be used at more complex intersections. DSD along numbered highways may even be higher.

\*\*\* This includes cul-de-sacs, frontage roads, and backage roads.

### 1420.05.02 Collectors (Network Roads)

#### Rural Collector/Secondary

The Right-of-Way shall be 25 metres wide or the cross section width, plus 3 metres on each side, whichever is greater.

- Minimum finished top: 10 metres.
- Minimum paved top: 8 metres.
- Gravel Shoulder: 1.0 metres.

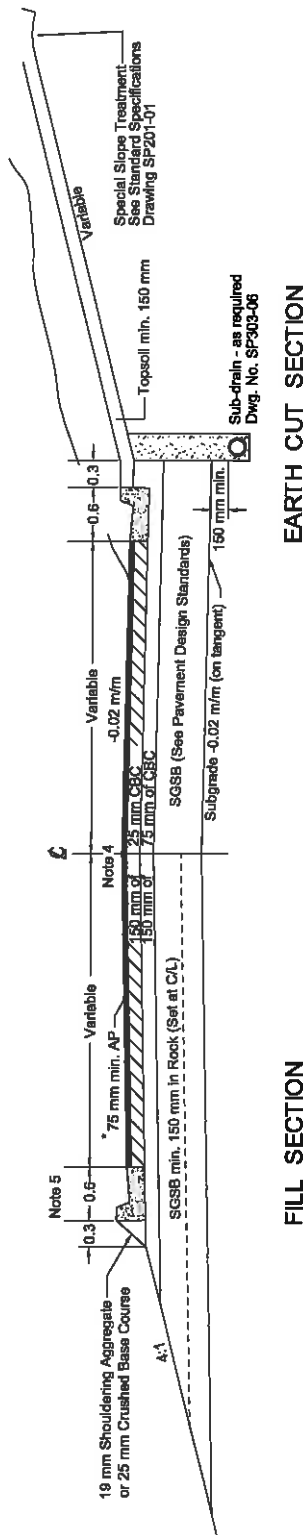
#### Urban Collector /Secondary (Curb and Gutter)

The desirable minimum Right-of-Way width is 25 metres, or the cross section width plus 3 metres on each side, whichever is greater.

- Minimum finished top: 10 metres.
- Minimum paved top: 8.2 metres to leading edge of curb (parking one side).
- Gravel Shoulder: 0.3 metres behind curb, see **Figure 1420.B**.

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

Figure 1420.B Two-Lane Urban Subdivision Road  
N.T.S.



EARTH CUT SECTION

FILL SECTION

PAVEMENT DESIGN STANDARDS - When "Equivalent Single Axle Loads, (ESAL's)" are >100,000 and <1,000,000. See 1410.07.02

- These are typical gravel and asphalt depths to be used in the absence of geotechnical investigation.
- 75 mm A.P. to be constructed in 2 lifts for 19 mm MAXIMUM size aggregate and 1 lift for 25 mm MAXIMUM size aggregate. (In accordance with the latest version of the B.C. MOT Standard Specifications for Highway Construction - Section 501, Subsection 501.23.06)
- No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:

Structural Design Criteria is satisfied  
and

Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MOT Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES"

- MINIMUM 150 mm S.G.S.B. in Rock.
- All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.
- THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

\* When "Equivalent Single Axle Loads, (ESAL's)" are > 1,000,000 use 100 mm A.P.

Notes:

1. For bikeway design, see Section 430 and TAC
2. For roadside barrier and drainage curb details, see Section 440
3. Utility setback is 2 m from the base of fill/top of cut slope or 2 m from property boundary, whichever gives the greater offset from the road
4. For variable shoulder and top widths, refer to Table 1420.E
5. For typical curbs see SP582-01.01 to SP582-01.03 in the Standard Specifications
6. For rock ditches, see Section 440

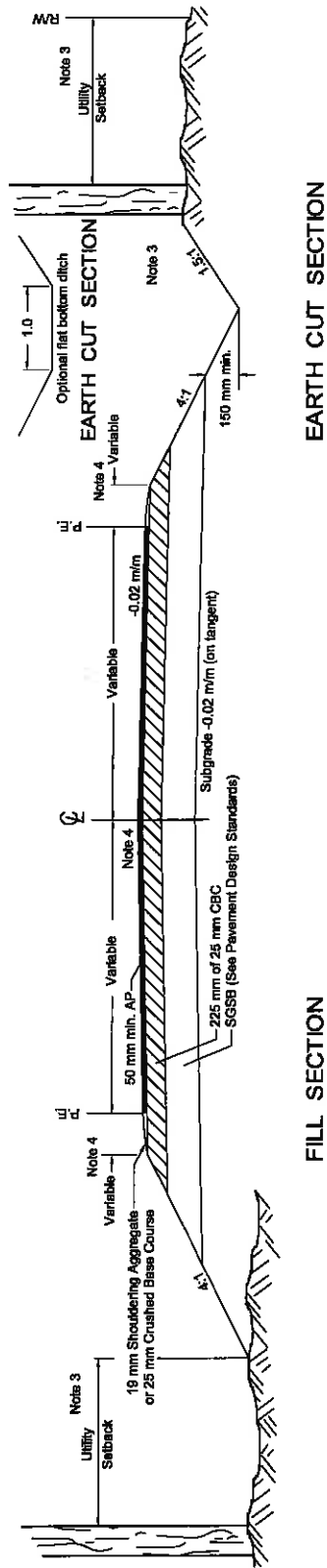
Abbreviations:

- AP Asphalt Pavement
- CBC Crushed Base Course
- SGSB Select Granular Sub Base



|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

Figure 1420.C Two-Lane Two-Way Subdivision Road  
N.T.S.



EARTH CUT SECTION

FILL SECTION

- PAVEMENT DESIGN STANDARDS** - When "Equivalent Single Axle Loads, (ESAL's)" are <100,000. See 1410.07.02
- These are typical gravel and asphalt depths to be used in the absence of geotechnical investigation.
  - MINIMUM 150 mm S.G.S.B. on Coarse Grained Subgrades (Unified Soils Classification System - GW/GP/GM/GC/SW/SP/SM/SC) where groundwater does not pose a drainage problem and frost penetration does not affect the structure.
  - MINIMUM 300 mm S.G.S.B. on Fine Grained Subgrades (Unified Soils Classified System - ML/CL/OL/MH/CH/OH).
  - No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:  
Structural Design Criteria is satisfied  
and  
Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MoT Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES"
  - MINIMUM 150 mm S.G.S.B. in Rock.
  - All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.
  - THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

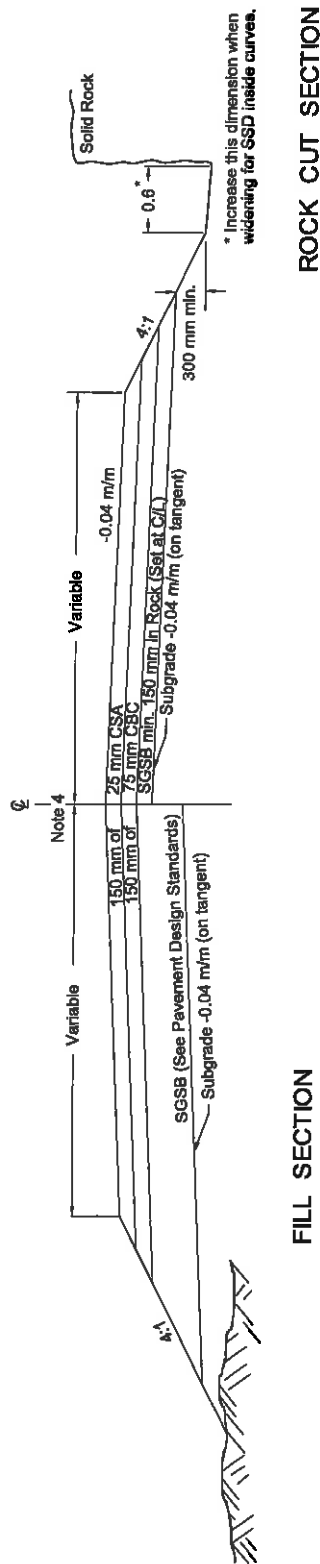
- Notes:**
1. For bikeway design, see Section 430 and TAC
  2. For roadside barrier and drainage curb details, see Section 440
  3. Utility setback is 2 m from the base of fill/top of cut slope or 2 m from property boundary, whichever gives the greater offset from the road
  4. For variable shoulder and top widths, refer to Table 1420.E
  5. For typical curbs see SP582-01.01 to SP582-01.03 in the Standard Specifications
  6. For rock ditches, see Section 440

**Abbreviations:**

- AP Asphalt Pavement
- CBC Crushed Base Course
- SGSB Select Granular Sub Base

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

Figure 1420.D Gravel Subdivision Road  
N.T.S.



PAVEMENT DESIGN STANDARDS - When "Equivalent Single Axle Loads, (ESAL's)" are <100,000. See 1410.07.02

- These are typical gravel and asphalt depths to be used in the absence of geotechnical investigation.
- MINIMUM 150 mm S.G.S.B. on Coarse Grained Subgrades (Unified Soils Classification System - GW/GP/GM/GC/SW/SP/SM/SC) where groundwater does not pose a drainage problem and frost penetration does not affect the structure.
- MINIMUM 300 mm S.G.S.B. on Fine Grained Subgrades (Unified Soils Classified System - ML/CL/OL/MH/CH/OH).
- No S.G.S.B. is required in exceptional circumstances where the following criteria have been met:

Structural Design Criteria is satisfied  
and

Subgrade material consists of clean granular deposits that satisfy S.G.S.B. gradation and construction criteria (i.e. rutting criteria) in accordance with the latest version of the B.C. MoT Standard Specifications for Highway Construction - Section 202 "GRANULAR SURFACING, BASE AND SUB-BASES"

- MINIMUM 150 mm S.G.S.B. in Rock.
- All levelling materials applied directly to blasted rock cuts shall be of S.G.S.B. quality.
- THE FINAL S.G.S.B. THICKNESS MUST BE APPROVED BY THE REGIONAL GEOTECHNICAL AND MATERIALS ENGINEER.

Notes:

1. For bikeway design, see Section 430 and TAC
2. For roadside barrier and drainage curb details, see Section 440
3. Utility setback is 2 m from the base of fill/top of cut slope or 2 m from property boundary, whichever gives the greater offset from the road
4. For variable shoulder and top widths, refer to Table 1420.E
5. For typical curbs see SP582-01.01 to SP582-01.03 in the Standard Specifications
6. For rock ditches, see Section 440

Abbreviations:

- CSA Crushed Surfacing Aggregate
- CBC Crushed Base Course
- SGSB Select Granular Sub Base

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

### 1420.05.03 Locals

#### Rural Local

The Right-of-Way width is 20 metres, or the cross section width plus 3 metres on each side, whichever is greater.

- Minimum finished top: 8 metres\*, \*\*.
- Minimum paved top: 7 metres\*, \*\*.
- Ditch inverts: earth cut - minimum 150 mm below subgrade, see Figure 1420.C; rock cut – minimum 300 mm below subgrade, see Figure 1420.D
- Gravel shoulder: 0.5 metre.

\*Add 1 metre per side snow storage when requested by the Ministry Representative.

\*\*Add 1 metre per side for pedestrian walkway in high volume, low speed tourist areas when requested by the Ministry Representative. Sidewalks may be a considered option where the minimum sidewalk width would be 1.5 metres.

For Two-Lane Two-Way asphalt & gravel surfaces, See Figures 1420.C & 1420.D

#### Urban Local (Curb and Gutter)

The Right-of-Way width is 20 metres, or the cross section width plus 3 metres on each side, whichever is greater.

- Curb and gutter:  
Finished top – 11.8 metre top, 10.0 paved, on street parking, both sides.  
Finished top – 10.0 metre top, 8.2 paved, on street parking, one side.
- Ditch inverts minimum: 150 mm below subgrade, see Figure 1420.B.
- Gravel shoulder: 0.3 metres behind curb, see Figure 1420.B.

### 1420.05.04 Cul-de-sac

**Rural:** 15 metre radius finished top  
14.5 and 14.0 metre radius paved top  
0.5 and 1.0 metre gravel shoulder,  
see Figures 1420.F and 1420.G

**Urban:** 15 metre radius finished top  
14.1 metre radius paved top  
0.6 metre curb width  
0.3 metre gravel shoulder, see Figure 1420.H and 1420.I

Maximum length: 150 metres

**Offset Cul-de-Sac** - see Figure 1420.J

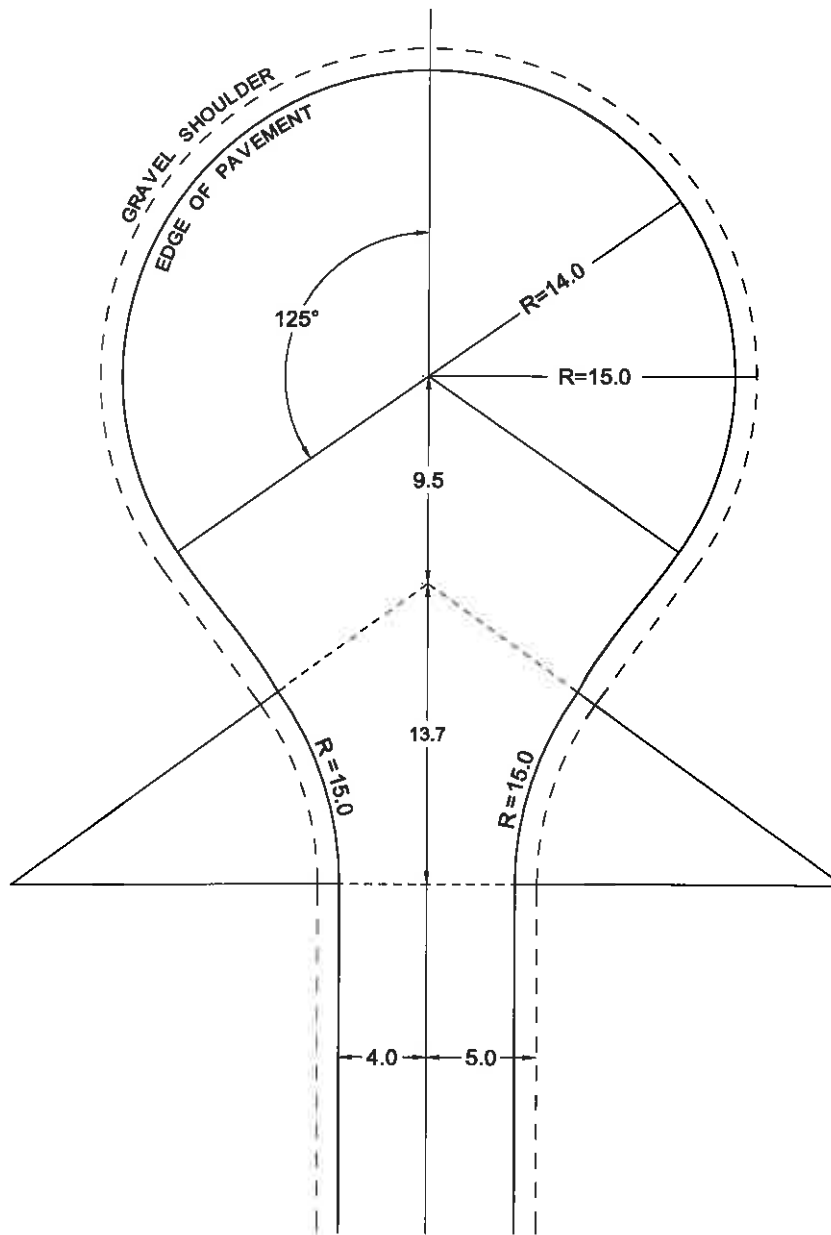
**Hammerhead Cul-de-Sac** - see Figures 1420.K and 1420.L

**Table 1420.E – Finished Top and Shoulder Widths**

| Collector           |             |                                   |             |            |
|---------------------|-------------|-----------------------------------|-------------|------------|
| Rural (Fig. 1420.F) |             | Urban (Fig. 1420.H)               |             |            |
| Top Width           | Paved Width | Top Width                         | Paved Width | Parking    |
| 10.0                | 8.0         | 10.0                              | 8.2         | one side   |
| 1.0 gravel shoulder |             | 0.6 curb plus 0.3 gravel shoulder |             |            |
| Local               |             |                                   |             |            |
| Rural (Fig. 1420.G) |             | Urban (Figs. 1420.H and I)        |             |            |
| Top Width           | Paved Width | Top Width                         | Paved Width | Parking    |
| 8.0                 | 7.0         | 11.8                              | 10.0        | both sides |
|                     |             | 10.0                              | 8.2         | one side   |
| 0.5 gravel shoulder |             | 0.6 curb plus 0.3 gravel shoulder |             |            |

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.F Collector/Rural Cul-de-Sac  
N.T.S.



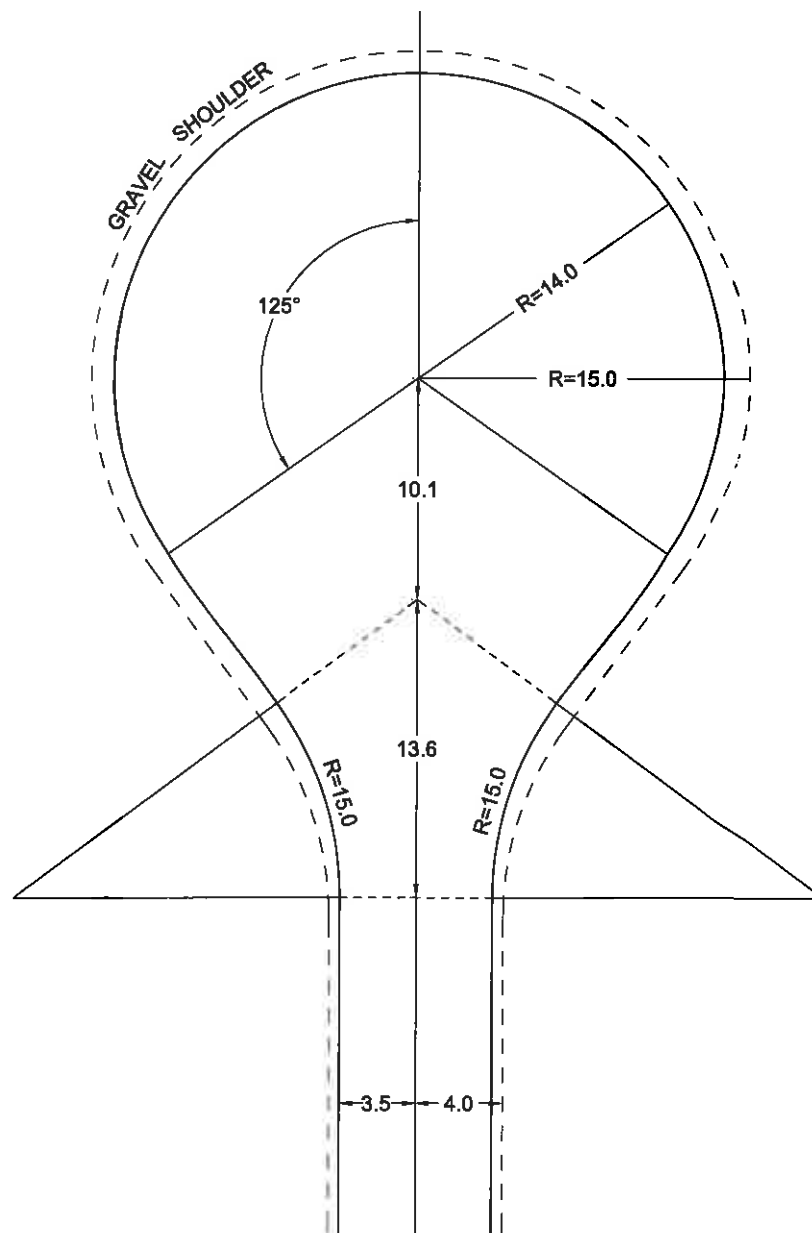
**Note:**

The distance from centreline of the intersecting road to the radius point of the Cul-de-Sac is maximum 150 metres.

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.G Local/Rural Cul-de-Sac

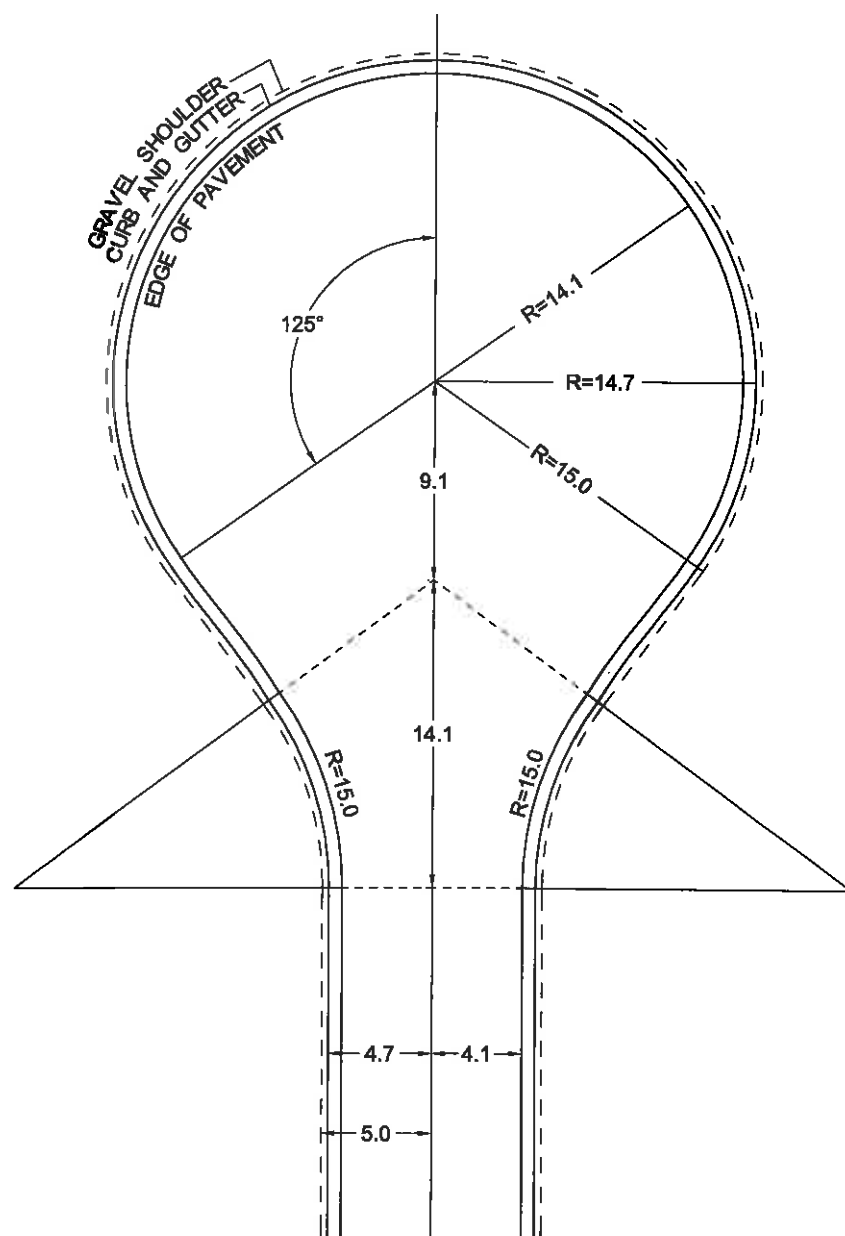
N.T.S.

**Note:**

This is a local rural road with Cul-de-Sac; therefore, the distance from the centreline of the intersecting road to the radius point of the Cul-de-Sac is variable.  
Maintain shoulder dimensions for gravel roads.

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.H Collector/Local Urban Cul-de-Sac  
N.T.S.



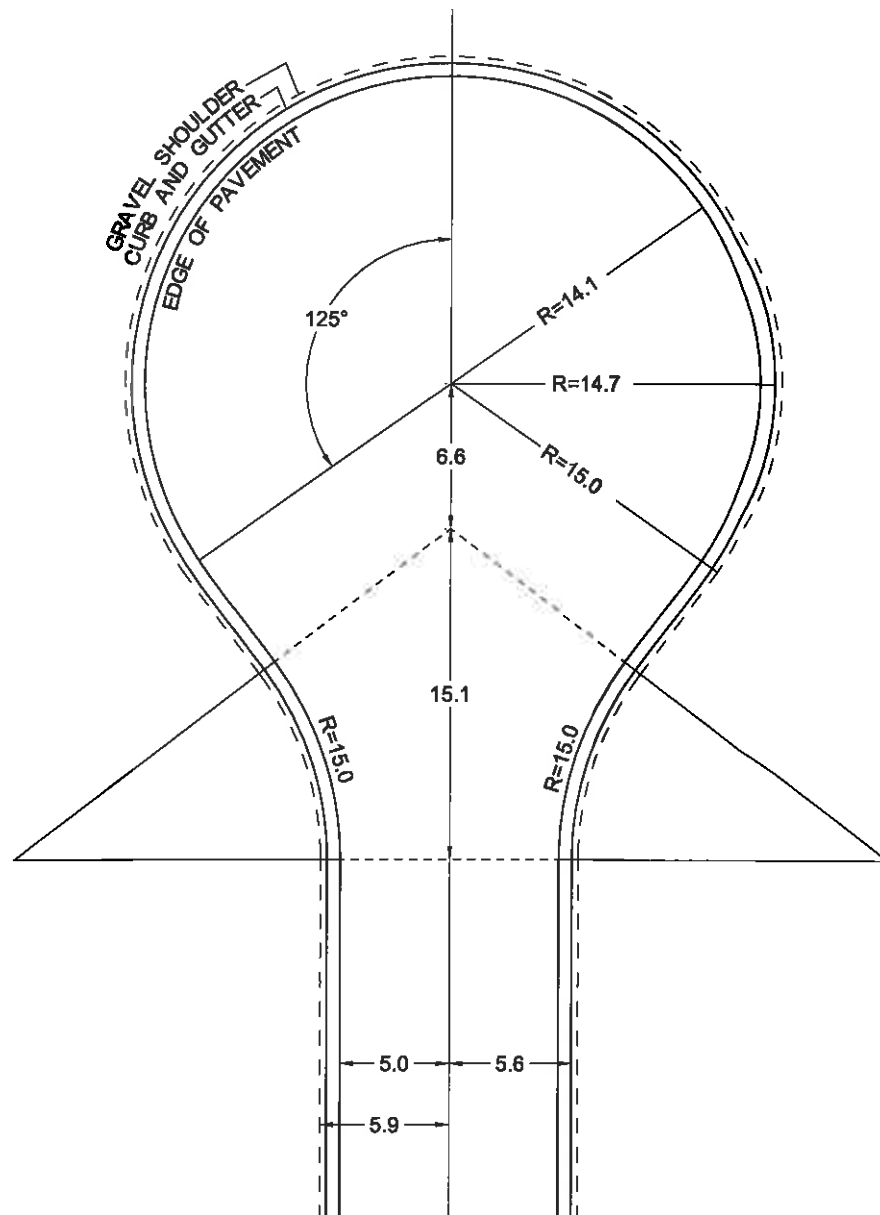
**Note:**

The distance from centreline of the intersecting road to the radius point of the Cul-de-Sac is maximum 150 metres.

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.1 Local/Urban Cul-de-Sac

N.T.S.

**Note:**

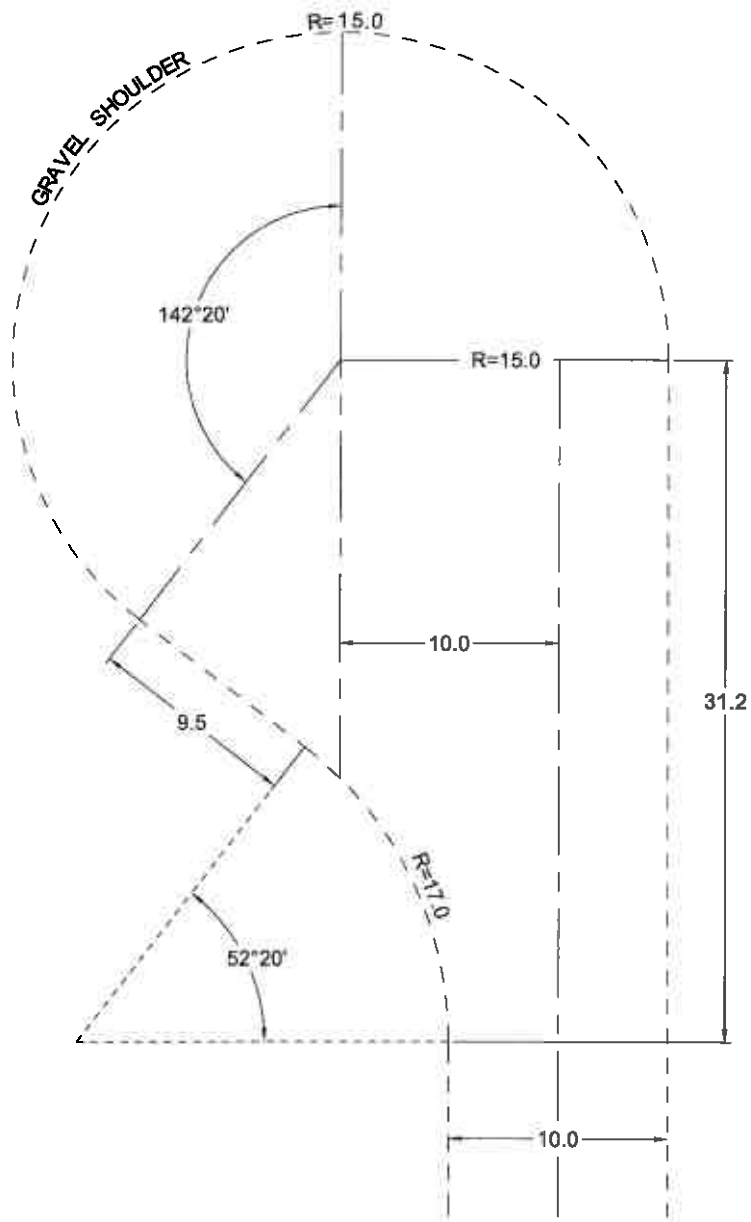
The distance from centreline of the intersecting road to the radius point of the Cul-de-Sac is maximum 150 metres.



|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

## 1420.J Offset Cul-de-Sac

N.T.S.



|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.K Typical Hammerhead  
N.T.S.

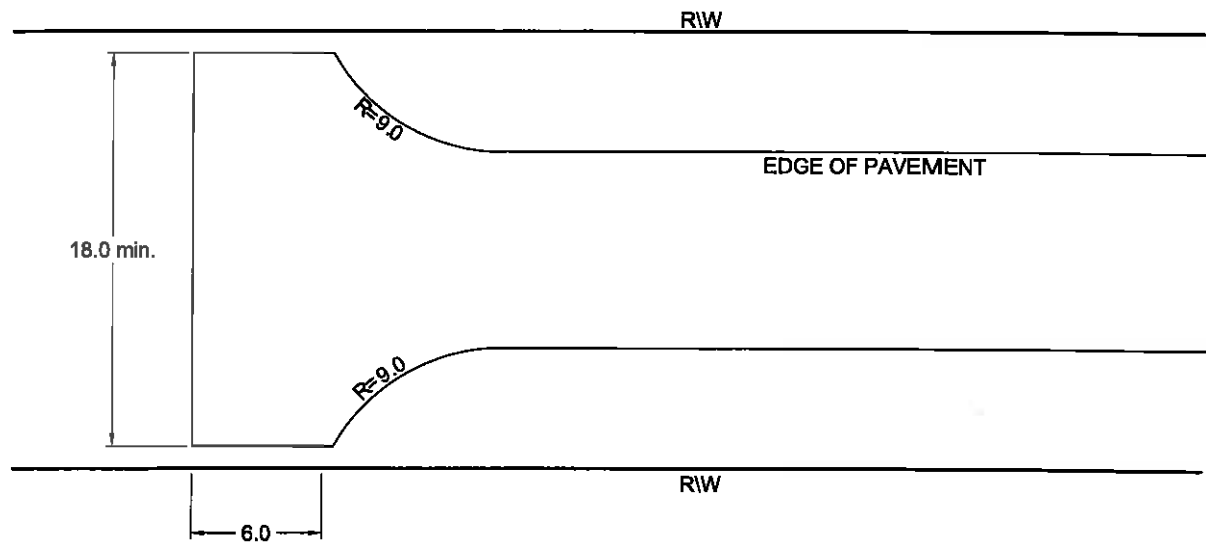
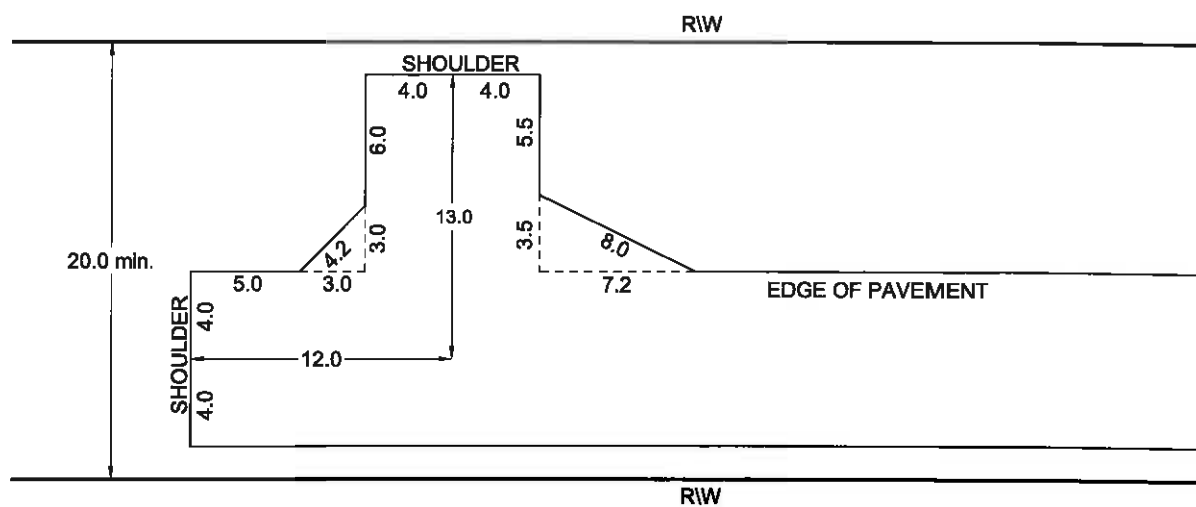


Figure 1420.L Modified Hammerhead



|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

### 1420.05.05 Frontage Roads

The Right-Of-Way width shall be 15 metres or the cross section width plus 3 metres, whichever is greater. (This is additional to the through road requirements.) Ensure sufficient setback at intersections to accommodate turn slots, etc., thus ensuring a bulbed connection is necessary at all frontage road intersections.

### 1420.05.06 Backage Roads

For these standards, backage roads shall be considered local roads.

### 1420.05.07 Cross Slopes

All roadways shall be constructed using a centerline crown and shall be graded and compacted with the following crossfall to ensure road drainage:

- Normal cross slopes shall be 2% for paved roads and 4% for gravel roads.

### 1420.05.08 Superelevation

Superelevation is generally not applied on local subdivision roads or cul-de-sacs; reverse crown is usually maintained in  $\leq 800$  metre radius curves @  $\leq 50$  km/h. Rural roads of a continuous nature that provide access to a subdivision would be better classified as Low-volume roads and should be superelevated accordingly. Refer to the Low-volume Road Chapter of the BC Supplement to TAC. When the decision has been made to superelevate curves, a maximum rate of 0.04 m/m shall be used for local urban street systems. This is appropriate for design speeds up to 70 km/h and where surface icing and interrupted traffic flow are expected. Superelevation rates of 0.04 m/m and 0.06 m/m are applicable for design of new urban streets in the upper range of the classification system where uninterrupted flow is expected and where little or no physical constraints exist.

## 1420.06 INTERSECTIONS/ACCESSES

### 1420.06.01 General

Intersections shall be as near as possible to right angles. The minimum skew angle of the intersection shall be 70 degrees and the maximum skew angle shall be 110 degrees.

### 1420.07 UTILITY SETBACK

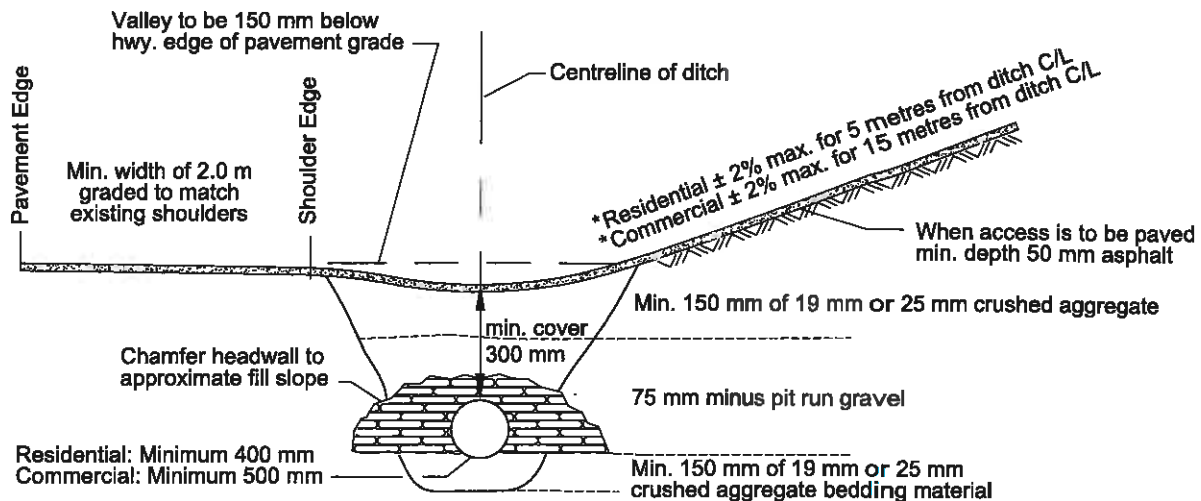
Utility poles or signs should be within 2 metres of the property boundary or a minimum 2 metres beyond the toe of the fill, whichever gives the greater offset from the road. See Figure 1420.C.

### 1420.08 DRIVEWAYS

1. Driveway location, spacing and approval shall be at the discretion of the Ministry Representative.
2. The first 5 metres (measured from the ditch centerline) of all residential driveways shall be constructed at or near a right angle ( $70^\circ$  to  $110^\circ$ ) to the road and at a maximum  $\pm 2\%$  grade.
3. All open shoulder driveways with a level or rising grade are to be constructed with a "valley" or "swale" over the ditch line to ensure surface water enters the ditch and does not enter the road. See Figure 1420.N
4. Driveway grades shall not exceed 8% within the Right-of-Way.
5. Driveway radius and widths:
  - Residential/Farm – 6 metre radius and minimum width
  - Logging/Commercial – 9 metre radius and minimum width
6. All lots with cuts or fills greater than 1.8 metres shall have engineered drawings when requested by the Ministry representative.

|             |      |             |                |
|-------------|------|-------------|----------------|
| MoT Section | 1420 | TAC Section | Not Applicable |
|-------------|------|-------------|----------------|

Figure 1420.M Culvert Installation  
N.T.S.



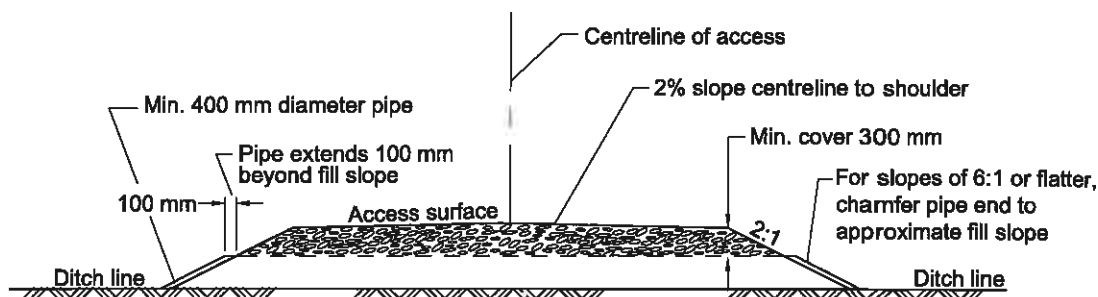
\*Note: Curb and gutter profile, 5 metres or 15 metres measured from back of curb

**Note:**

- Refer to Chapter 1000 for comprehensive bedding and backfill details.
- Minimum pipe size may be increased at the discretion of the Ministry representative.
- Minimum cover shall dictate invert elevation.
- Inlet and/or outlet of culverts subject to erosion shall have sandbags or headwall respecting clearzone principles and shall not introduce a further hazard.

See notes under Figure 1420.B

Figure 1420.N Driveway Cross Section



**Driveway Culvert Installation:** See Figures 1420.M, 1420.N, and 1420.O

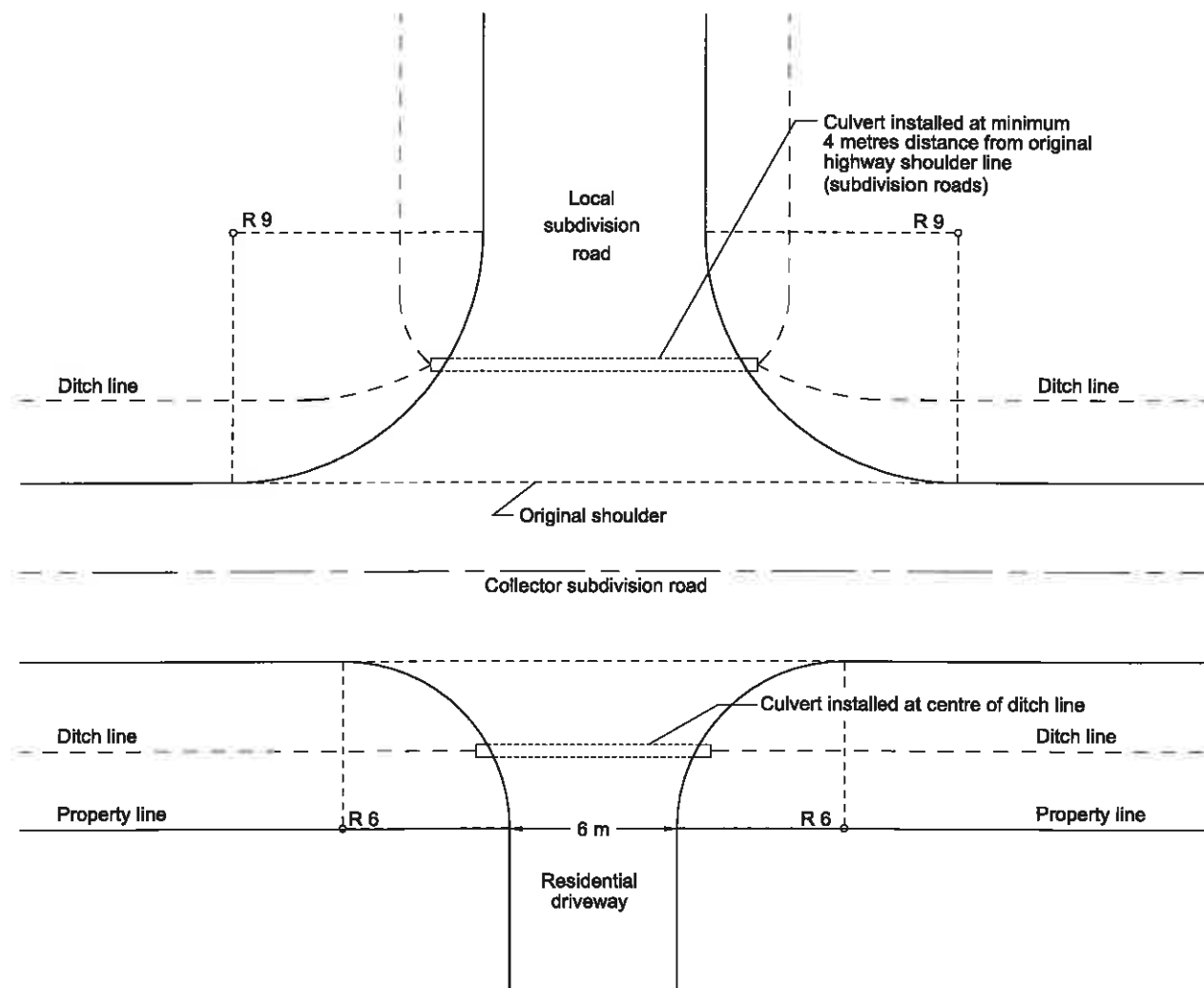
**Residential Driveways:** All driveway culverts shall be a minimum 400 mm diameter but may be increased at the discretion of the Ministry Representative.

**Commercial Driveways:** Cross and side culverts require a 500 mm minimum diameter.

Hydraulic requirements may necessitate larger diameter culverts.

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

Figure 1420.O Driveway and Culvert Installation Layout  
N.T.S



Residential Driveway:  
Logging/Commercial Driveway:

Minimum 6 metre width at property line.  
Minimum 9 metre width at property line.

Turning Radius:

|                    |               |
|--------------------|---------------|
| Residential/Farm   | Min. 6 metres |
| Logging/Commercial | Min. 9 metres |

|             |      |  |             |                |
|-------------|------|--|-------------|----------------|
| MoT Section | 1420 |  | TAC Section | Not Applicable |
|-------------|------|--|-------------|----------------|

### 1420.09 BRIDGES

All bridges must be designed to Ministry bridge design standards by a Professional Engineer who is registered in British Columbia and is experienced in bridge design. The design must be reviewed and approved by the Regional Bridge Engineer. The Professional Engineer shall certify that the completed structure has been constructed to Ministry standards.

### 1420.10 SIGNING/SPEEDS

All unregulated/unposted roads in unorganized territory in British Columbia are limited to a maximum speed of 80 km/h ( Motor Vehicle Act 146.1); therefore, all roads designed at less than 80 km/h shall be posted accordingly.

## **Appendix 3**





## SECTION 202

### GRANULAR SURFACING, BASE AND SUB-BASES

#### PART A – SCOPE OF SPECIFICATION

**202.01 Preliminary and General** – This specification describes the classification, the materials and the professional standards required for the production of granular aggregates and the construction of granular surfacing, granular base and select granular sub-base.

#### PART B – MATERIALS

##### **202.02 Aggregate Classification**

###### **202.02.01 Crushed Surfacing Aggregates:**

i) **High Fines Granular Surfacing Aggregate (HFSA):** HFSA is used for surfacing of gravel roads. Cohesion for this aggregate is achieved by plastic fines.

**202.02.02 Crushed Base Course Aggregates** – These are high strength, high load bearing, high quality, crushed granular base materials. As these materials are not well suited for long-term traffic, they are usually overlaid by surface course materials (HFSA or asphalt/concrete pavement).

i. **Well Graded Base (WGB):** WGB is the standard base course material used for pavement structures. It is well graded with moderate permeability.

ii. **Intermediate Graded Base (IGB):** IGB is intermediate in gradation and permeability between well graded aggregate and open graded aggregate.

iii. **Open Graded Base (OGB):** OGB is a highly permeable, gap graded aggregate.

**202.02.03 Sub-Base Aggregates** – A granular material placed between the sub-grade and the base course aggregates, providing strength and drainage to the pavement structure.

i. **Granular Sub-Base (SGSB):** SGSB is the standard aggregate, crushed or screened, placed directly above subgrade, with moderate permeability and a wide gradation.

ii. **Intermediate Graded Sub-Base (IGSB):** IGSB is a higher permeability, crushed sub-base aggregate.

iii. **Open Graded Sub-Base (OGSB):** OGSB is a highly permeable, crushed sub-base aggregate.

**202.02.04 Bridge End Fill (BEF)** – BEF is quality granular fill placed behind and below a bridge abutment to provide good drainage, a smooth transition from the bridge approaches to the bridge structure, and a suitable material through which to drive piles.

**202.03 General Description of Work** – The aggregates for granular surfacing, base and sub-base may be supplied either by the Contractor or produced from a Ministry provided source. Production of granular surfacing and granular base requires crushing and placing in stockpile. Production of select granular sub-base may be by crushing, screening or direct excavation.

Granular aggregate shall be loaded from the stockpile, crushing and screening plant, or pit face, as may be applicable; hauled out to the highway, placed accurately without segregation and thoroughly compacted to established line and grade.

The Contractor shall maintain the prepared surface of the base course aggregate until it has been paved or until completion of the contract, whichever is applicable.

##### **202.04 Aggregate Quality**

**202.04.01 General** – Granular aggregate shall be composed of inert, clean, tough, durable particles of crushed rock, gravel, sand and fines capable of withstanding the deleterious effects of exposure to water, freeze-thaw, handling, spreading and compacting. The aggregate particles shall be uniform in quality and free from clay lumps, wood and free from an excess of flat or elongated pieces.

Aggregates for surfacing, base, sub-base and bridge end fill will be tested in accordance with the Table 202-A.

**202.04.02 Primary Quality Tests** – All aggregates for surfacing, base, sub-base, and bridge end fill shall meet the requirements of Table 202-B.

Where the Ministry has pre-existing test results, the Ministry will make this information available to the Contractor and the Contractor will be able to rely on the factual data and not have to perform the corresponding primary quality tests on materials extracted from the investigated portions of the pit or quarry.

In circumstances where historic performance of material from a source has proven satisfactory, the Ministry may, by Special Provision, waive any or all of the testing required in SS\_202.04.

## SECTION 202

## GRANULAR SURFACING, BASE AND SUB-BASES

**202.04.03 Secondary Quality Tests** – All aggregates for surfacing, base, sub-base, and bridge end fill failing any primary quality test indicated in SS 202.04.02 shall further be tested as follows to determine acceptability or, at the Contractor's option and at the Contractor's expense, a new source shall be found.

**TABLE 202-A AGGREGATE QUALITY TESTS**

| <b>BASED ON<br/>ASTM</b> | <b>TITLE OF TEST</b>   |
|--------------------------|--|
| C 136                    | Sieve Analysis of Fine and Coarse Aggregates                               |
| C 117                    | Wash Test of Aggregates  |
| C 88                     | Soundness of Aggregate by Use of Magnesium Sulphate.                       |
| D 2419                   | Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate |
| D 6928                   | Abrasion Loss by Micro-Deval   |
| D 4318                   | Plastic Limit Determination  |
| <b>BASED ON<br/>MoT</b>  | <b>TITLE OF TEST</b>   |
| SS 202 Appendix 1        | Fracture Count on Coarse Aggregate   |
| SS 202 Appendix 2        | Petrographic Test  |

i) If the Micro Deval test results show that the material fails, then the soundness shall be reassessed by use of Magnesium Sulphate (ASTM C 88). The material will be considered acceptable if the loss after 5 cycles is less than:20% for coarse aggregate (the material retained on or above the 4.75 mm sieve)

- 25% for fine aggregate (the material passing the 4.75 mm sieve)

ii) If the aggregate fails any of the Sand Equivalent, Micro-Deval or Magnesium Sulphate tests, then the Contractor shall perform the Ministry's petrographic test (SS 202, Appendix 2) to determine the cause of failure. The Ministry Representative may review the test results and determine whether the material is acceptable or not.

### **202.05 Aggregate Gradation**

Gradation shall be determined in accordance ASTM C 117 (Wash Test).

**202.05.01** \_Aggregate shall have a gradation that defines a curve (% passing versus log sieve size) with a slope between adjacent sieves, equal or intermediate to the corresponding slopes of the boundary curves defined by the specification. Gradations shall fall within the limits, for the specified classification, shown in Table 202-C.

**202.05.02 Rut Resistance** – Any aggregate supplied must, in addition to meeting the gradation requirements specified above, not rut when proof rolled with a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600kPa. Any aggregate which does rut shall be removed and replaced, or blended with suitable aggregates, to meet both the gradation requirement and the rut resistance requirement.

### **PART C – USE OF MINISTRY-PROVIDED PITS OR QUARRIES**

**202.06 General** – Ministry-provided pits and quarries are those identified in the Special Provisions which the Ministry is offering to the Contractor as potential aggregate sources.

**SECTION 202**
**GRANULAR SURFACING, BASE AND SUB-BASES**
**TABLE 202-B AGGREGATE PROPERTIES**

| TEST                             | Test Result             |                   |                   |                   |                     |                   |                   |                    |
|----------------------------------|-------------------------|-------------------|-------------------|-------------------|---------------------|-------------------|-------------------|--------------------|
|                                  | Surfacing<br>Aggregates | Base Course       |                   |                   | Sub-Base Aggregates |                   |                   | Bridge<br>End Fill |
|                                  | HFSA                    | 25mm              | 50mm              | 75mm              | SGSB                | IGSB              | OGSB              | BEF                |
| Sand<br>Equivalent               | ≥ 20                    | ≥ 40              | ≥ 40              | ≥ 40              | ≥ 20                | ≥ 20              | ≥ 20              | ≥ 20               |
| Micro-Deval<br>loss factor       | ≤ 25%                   | ≤ 25%             | ≤ 25%             | ≤ 25%             | ≤ 30%               | ≤ 25%             | ≤ 25%             | ≤ 30%              |
| Fractured<br>Faces<br>Method "A" | ≥ 50 <sup>1</sup>       | ≥ 50 <sup>1</sup> | ≥ 50 <sup>1</sup> | ≥ 50 <sup>1</sup> | n/a                 | ≥ 50 <sup>1</sup> | ≥ 50 <sup>1</sup> | n/a                |
| Plasticity                       | ≤ 6                     | n/a               | n/a               | n/a               | n/a                 | n/a               | n/a               | n/a                |

<sup>1</sup> Values are for total sample.

## SECTION 202

They may include pits and quarries:

- a) owned by the Ministry
- b) leased by the Ministry, or
- c) attained by the Ministry through special agreement with the landowner.

Use of such pits and quarries will be at the Contractor's option unless the Special Provisions clearly state that the source must be used for specific purposes.

When a Ministry pit or quarry is provided for the Contractor's optional use under the Contract, the Contractor, by entering the pit or quarry, will be deemed to have accepted all obligations, risks and costs for the production of aggregate meeting the requirements of Part B of this section. The Ministry gives no warranty that its pit or quarry will meet the quality and quantity requirements.

Where a pit or quarry is designated as a mandatory source, the Ministry waives the aggregate quality requirements of SS 202.04.02 except for the Fractured Faces requirement for aggregates required by the Ministry to be produced from that source.

**202.07 Source of Supply** – The Contract documents may identify one or more pits or quarries, for use as aggregate sources at the Contractor's discretion.

The Ministry will provide those gravel pits or quarries and the right-of-way to those pits or quarries and will pay the cost of royalties, and fencing. The cost of constructing and maintaining access roads shall be considered as part of the cost of producing the construction aggregates and shall be payable by the Contractor. The Ministry will exercise its best judgement in the selection of the pit or quarry sites; however, the failure of the pit or quarry to yield materials of uniform quality shall not constitute grounds for a claim by the Contractor against the Ministry.

The Contractor shall be satisfied as to the gradation and other characteristics of the raw material in the Ministry provided pit or quarry and as to the nature and amount of work required to produce materials which will meet all gradation requirements, and the Contractor shall, at the Contractor's expense, remove any objectionable materials from the aggregate.

**202.08 Development of Pit or Quarry** – Before any material for aggregate is excavated from the pit or quarry, the site shall be cleared and grubbed, and all debris disposed of as ordered by the Ministry Representative. If topsoil or undesirable overburden exists, these materials shall be stripped and placed in separate stockpiles as

## GRANULAR SURFACING, BASE AND SUB-BASES

shown on the Ministry pit development plan or as directed by the Ministry Representative.

The Contractor shall not operate the pit or quarry in a manner which will contaminate remaining granular material nor leave the pit or quarry in a condition which will limit its future use. The Contractor shall follow the Ministry pit development plan, where provided. Stockpile areas in Ministry-provided sources shall be per the pit development plan. If the Ministry pit development plan conflicts with the Health, Safety, and Reclamation Code for Mines in British Columbia, then the code will prevail.

**202.09 Use of All Materials** – Any Ministry provided pit or quarry, once entered and developed, shall be used to its full potential. Normally, the Contractor shall produce select granular sub-base by selection or screening, provided that oversize reject aggregate is removed and properly placed in a stockpile for later crushing and use. However, if excessive (5% or greater) oversize occurs, the Ministry Representative may order that pit run aggregate be crushed to produce 75 mm crushed granular base for use in place of select granular sub-base.

For the production of crushed surfacing and base aggregates, as well as IGSB and OGSB, the Contractor shall provide crushing equipment such that all aggregate which will pass through 375 mm x 450 mm slotted openings shall be used for the production of crushed aggregate; rocks which will not pass through these openings shall be stockpiled as shown on the pit development plan or disposed of to the satisfaction of the Ministry Representative. Crushing and screening equipment shall be provided with adequate facilities and capacity to bleed off reject aggregate in usable condition, or otherwise remove any excess of fine aggregate, dust or objectionable aggregate coatings that may be present in or on the aggregate, so as to make it generally acceptable for use. No portion of the products of crushers or screening plants that can be used shall be wasted, but shall be stockpiled or used as directed by the Ministry Representative.

**202.10 Modification of Materials** – The rejection or addition of any particular size material necessary to produce aggregate conforming to specification requirements shall be the responsibility of the Contractor, and no additional compensation will be paid therefore.

**202.11 Change of Ministry Provided Pit or Quarry** – No payment will be made to the Contractor for moving the plant from one Ministry provided pit or quarry to another Ministry provided pit or quarry.

## SECTION 202

## GRANULAR SURFACING, BASE AND SUB-BASES

TABLE 202-C – AGGREGATE GRADATIONS

| Percent Passing (%) Sieve Size |                        |             |          |          |          |         |          |         |          |          |         |                     |         |          |          |                    |          |
|--------------------------------|------------------------|-------------|----------|----------|----------|---------|----------|---------|----------|----------|---------|---------------------|---------|----------|----------|--------------------|----------|
| Sieve Size<br>(mm)             | Surfacing<br>Aggregate | Base Course |          |          |          |         |          |         |          |          |         | Sub-Base Aggregates |         |          |          | Bridge<br>End Fill |          |
|                                |                        | WGB         |          |          |          |         | IGB      |         |          |          |         | SGSB                | IGSB    | OGSB     | BEF      |                    |          |
|                                |                        | 25mm        | 50mm     | 75mm     | 25mm     | 50mm    | 75mm     | 25mm    | 50mm     | 75mm     |         |                     |         |          |          |                    |          |
|                                |                        |             |          |          |          |         |          |         |          |          |         |                     |         |          |          |                    |          |
| 75                             |                        |             |          | 100      |          |         | 100      |         |          |          |         | 100                 |         | 100      | 100      |                    | 100      |
| 50                             |                        |             | 100      |          |          |         | 100      |         |          | 55 - 100 |         | 100                 |         |          | 55 - 100 | 75 - 100           | 30 - 100 |
| 37.5                           |                        |             | 80 - 100 | 60 - 100 |          |         | 60 - 100 | 40 - 80 |          |          |         | 75 - 100            | 50 - 85 |          | 40 - 80  | 50 - 85            |          |
| 25                             | 100                    | 100         |          |          |          | 100     | 40 - 75  |         | 100      |          |         | 100                 |         |          |          |                    |          |
| 19                             | 85 - 100               | 80 - 100    | 50 - 100 | 35 - 80  | 65 - 100 |         |          | 17 - 40 | 75 - 100 | 35 - 65  | 15 - 55 |                     |         | 15 - 100 | 17 - 40  | 15 - 55            | 20 - 100 |
| 12.5                           |                        |             |          |          |          |         | 15 - 40  |         |          |          |         |                     |         |          |          |                    |          |
| 9.5                            | 60 - 85                | 50 - 85     | 35 - 75  | 25 - 60  | 30 - 70  |         |          |         | 30 - 65  | 5 - 35   |         |                     |         | 0 - 100  |          |                    |          |
| 6.3                            |                        |             |          |          |          |         |          |         |          |          | 0 - 20  |                     |         |          |          | 0 - 20             |          |
| 4.75                           | 40 - 70                | 35 - 70     | 25 - 55  | 20 - 40  | 15 - 40  |         |          |         | 5 - 30   | 0 - 15   |         |                     |         |          |          |                    | 10 - 60  |
| 2.36                           |                        | 25 - 50     | 20 - 40  | 15 - 30  | 10 - 30  | 10 - 25 | 10 - 25  | 10 - 25 | 0 - 10   | 0 - 10   | 0 - 10  |                     |         |          | 10 - 25  | 0 - 10             |          |
| 1.18                           | 20 - 50                | 15 - 35     | 15 - 30  | 10 - 20  |          |         |          |         |          |          |         |                     |         |          |          |                    | 6 - 32   |
| 0.600                          |                        |             |          |          |          |         |          |         |          |          |         |                     |         | 0 - 100  |          |                    |          |
| 0.300                          | 10 - 30                | 5 - 20      | 5 - 15   | 3 - 10   | 5 - 15   | 5 - 15  | 5 - 15   | 4 - 15  | 0 - 8    | 0 - 8    | 0 - 8   |                     |         | 0 - 15   | 4 - 15   | 0 - 8              | 4 - 15   |
| 0.075                          | 5 - 15                 | 0 - 5       | 0 - 5    | 0 - 5    | 0 - 15   | 0 - 5   | 0 - 5    | 0 - 5   | 0 - 5    | 0 - 5    | 0 - 5   |                     |         | 0 - 5    | 0 - 15   | 0 - 5              | 0 - 5    |

## SECTION 202

If the Ministry Representative requires a move to a new Ministry provided pit or quarry the Contractor will be given notice in writing. On completion of the move, the Contractor will be paid a lump sum of \$7,500 for moving the existing crushing operation and any additional equipment that may be required for material processing at the new pit. The payment will be deemed to be full compensation for all costs and expenses of the move and set-up of the crusher. If the Contractor moves the crushing plant without first securing a written order to do so from the Ministry Representative it will be considered sufficient proof that the move was unnecessary, and no allowance or compensation will be made to cover such a move.

**202.12 Pit Cleanup** – When the Contractor discontinues operations in any pit or quarry, the Contractor shall trim the face of pit excavations, waste piles and stockpiles to a 1.5H to 1V slope, or such other slope as the Ministry Representative may direct, open up such drains or ditches as may be required to prevent water standing therein, and leave the site in a neat condition, all to the satisfaction of the Ministry Representative. The sloping of pit excavations shall be with in place materials and shall not be contaminated with topsoil, overburden or any reject aggregates. The trimming, sloping, ditching and draining of the pit or quarry, as well as maintenance of the access roads, shall be considered part of the cost of producing the granular aggregate and no additional payment will be allowed.

If a pit has been fully depleted and is to be abandoned, the Contractor may be requested to reshape the pit faces to a slope not steeper than 2H to 1V using the stockpiled overburden if necessary, and cover same with any topsoil previously removed and stockpiled, all as directed by the Ministry Representative. In such cases, the replacing of stockpiled overburden and topsoil will be paid for in accordance with SS 202.32.

**202.13 Work in Ministry Pits or Quarries** – All work in a Ministry pit or quarry will be in accordance with SS 145.26.

### **PART D – CONTRACTOR SUPPLIED AGGREGATES**

**202.14 Preliminary and General** – Aggregates shall meet the requirements of SS 202, Part B.

**202.15 Development and Clean Up of Private Pits or Quarries** – Pit or quarry development and cleanup shall be in accordance with local and Provincial regulatory agency requirements.

## GRANULAR SURFACING, BASE AND SUB-BASES

**202.16 Contractor to Pay All Costs** – The Contractor shall bear and pay all costs including, applicable royalties, construction and maintenance of access roads to borrow sites, mobilization/demobilization of weigh scales, and any move of the equipment that may be ordered or required because a pit or quarry of the Contractor's choosing proves unsuitable for production of the contracted quantity of granular aggregates meeting the requirements of SS 202.

### **PART E – PRODUCTION OF CRUSHED AGGREGATE**

**202.17 Equipment and Plant** – The Contractor shall provide and maintain in good operating condition, all plant and equipment necessary to comply with the requirements of this specification. Such plant and equipment shall be of a type and capacity to ensure proper construction and maintenance of access roads, development of the pit or quarry, maximum use of the pit or quarry, production of granular aggregates to the standard of uniformity required, and adherence to the construction schedule.

Adequate sampling facilities shall be installed by the Contractor at the discharge end of the production conveyor.

The Contractor shall ensure that the plant and equipment meet the requirements of SS145.26.

**202.18 Working of Pit** – A pit shall be worked in such a manner as to ensure that granular material excavated and fed to the crushers, screening plants or loaders shall be as uniform as possible. This may require the use of equipment capable of deep excavating through horizontal gravel layers or carrying out selective digging or cross blending over a large area of the pit. Before commencing production, the Contractor's quality control plan shall describe the proposed method of production for the Ministry Representative and obtain the Ministry Representative's general approval.

**202.19 Crushing Operations** – The Contractor shall adjust the crushers and/or screening plants and provide such screens as may be necessary to produce and maintain acceptable gradations of granular aggregates.

### **202.20 Crusher Gradation Control**

**202.20.01 Design Aggregate Gradation** – For each aggregate gradation classification specified for production, field and/or laboratory tests will be performed by the Contractor to select a single gradation curve within the "banana" specification (Table 202-C), the "Design Aggregate Gradation" (DAG), which will be the target for crusher control. The Contractor shall declare the DAG, in



## SECTION 202

writing to the Ministry Representative, within production of the first 10% of the Approximate Quantity of a given aggregate classification.

As part of the Ministry's quality assurance program and for payment purposes, the Ministry may sample the stockpile to assess aggregate gradation compliance to contractual requirements.

**202.20.02 Variation Limits** The running average of four (4) consecutive tests, on each applicable individual sieve size specified in Table 202-C, must be maintained at all times within the limits specified in that Table. Also, each individual test must be within the specifications of Table 202-C

The maximum permissible variation from the DAG curve, on each applicable individual sieve size specified in Table 202-C, of the mean of any four (4) consecutive tests shall also be within the limits specified in Table 202-D.

**TABLE 202-D AGGREGATE GRADATION VARIATION LIMITS**

| SIEVE SIZE               | VARIATION LIMITS<br>(% PASSING) |
|--------------------------|---------------------------------|
| 4.75 mm and larger       | ± 5                             |
| 1.18 mm to 2.36 mm       | ± 3.5                           |
| 0.300 mm and<br>0.600 mm | ± 2                             |
| 0.075 mm                 | ± 1                             |

**202.20.03 Field Adjustment of Design Aggregate Gradation** – The Contractor may make a maximum of two (2) field adjustments to the Design Aggregate Gradation, to accommodate minor changes in pit characteristics or to enhance production efficiency. A field adjustment to the Design Aggregate Gradation is defined as a change in declared target gradation of the various aggregate sizes within the specified limits shown in Table 202-C which does not require a supplementary formal review. The maximum adjustment for individual sieve sizes for each adjustment are as permitted in the Table 202-E.

## GRANULAR SURFACING, BASE AND SUB-BASES

**TABLE 202-E – FIELD ADJUSTMENT OF DESIGN AGGREGATE GRADATION**

| Sieve Designation<br>(mm) | Maximum Field Adjustment<br>(% Passing) |
|---------------------------|---|
| 19 and larger             | ± 3.0                                   |
| 9.5                       | ± 2.5                                   |
| 2.36 and 4.75             | ± 2.0                                   |
| 0.600 and 1.18            | ± 1.5                                   |
| 0.150 and 0.300           | ± 1.5                                   |
| 0.075                     | ± 1.0                                   |

A proposed Design Aggregate Gradation field adjustment shall be submitted in writing with supporting documentation (showing original DAG, current stockpile average gradation, and proposed field adjustment and the new DAG) to the Ministry Representative. Upon receipt of the proposed field adjustments, the Ministry Representative will assess the adjustment for conformance with the contract requirements and notify the Contractor whether or not it is acceptable in a timely fashion.

No field adjustment will be acceptable if it results in a change from the current Design Aggregate Gradation which fall outside the limits defined in Tables 202-C. The variation limits specified in SS 202.20.02 will apply to the adjusted DAG.

The Contractor shall have the moisture/density relationship established per ASTM test method for Standard Proctor D 698 for each original DAG, and one after each field adjustment thereto.

**202.20.04 Declaration of a New Design Aggregate Gradation (DAG)** Should there be a substantial change in the character of aggregate exposed in the pit face as the work proceeds, the Ministry Representative may authorize a change in the declared Design Aggregate Gradation, which would then also be eligible for field adjustment in accordance with SS 202.20. A maximum of one change to the declared DAG will be permitted.

### 202.21 Stockpiling

**202.21.01** Unless it is specified in the Special Provisions or ordered otherwise in writing by the Ministry Representative, all crushed aggregates shall be stockpiled prior to use on the Highway.

**202.21.02** Stockpile sites shall be cleared of all vegetation, trees, brush, rocks or other debris and a uniform gravel surface prepared before the stockpile material is deposited on the stockpile site.

**202.21.03** Stockpiles shall be constructed on the designated site and when completed shall be neat and



## SECTION 202

regular in shape, occupying as small an area as is practicable. Spilling of material over the edges of the piles will not be permitted.

**202.21.04** The Contractor shall ensure that stockpiles shall be built up in layers not to exceed 1 m in thickness.

**202.21.05** The Contractor shall ensure that plank or protected runways shall be provided for operating trucks on stockpiles when the Ministry Representative deems them necessary to prevent dirt being tracked onto the crushed aggregate.

**202.21.06** The Ministry Representative may, on receipt of a written request from the Contractor, permit the Contractor to build the final stockpile by bulldozing the aggregate from a feed pile at the end of a production belt provided that the following are maintained:

- i) The bulldozer(s) to be used shall be equipped with U-shaped pushing blades.
- ii) The aggregate does not become contaminated with oversize material, mud or other objectionable material picked up from the pit floor or general working areas.
- iii) The crushed granular aggregate is distributed evenly over the final stockpile area in lifts not greater than 150 mm in depth.
- iv) The cone of the feeder pile at the end of the production belt shall not, without express permission, be allowed to build up to a greater height than 2 m.
- v) No appreciable segregation or degradation shall occur in the main stockpile as a result of using this method.

## PART F – CONSTRUCTION METHOD

### **202.22 Weather and Job Conditions**

**202.22.01** No construction shall be undertaken during snow, heavy rain, freezing or other unsuitable conditions. Aggregate shall not be placed upon a frozen, wet, muddy or rutted sub-grade, sub-base, base or surface unless otherwise directed by the Ministry Representative.

**202.22.02** When the sub-grade is soft due to excessive moisture, the placing of granular sub-base shall be stopped until rutting or displacement of the initial sub-base layers can be prevented by reduced loading or by other means approved by the Ministry Representative.

### **202.23 Bridge End Fill – Construction of the bridge end**

## GRANULAR SURFACING, BASE AND SUB-BASES

fill shall not commence until the Ministry Representative has assessed the pertinent foundation conditions that may affect the future stability of both the bridge and embankments and has authorized continuation of construction. Unless the procedure for construction is stated in the Special Provisions, the Contractor's proposed method must be submitted to the Ministry Representative for approval before commencing work.

Generally the bridge end fill shall be laid out by extending back from the bridge abutment station, as shown on the Drawings; a distance of 8.0 m along centreline (and transversely parallel to the abutment) at finished grade and thence to a 1.5:1 backslope. The front slope, as shown on the Drawings, shall start at the bridge abutment station.

The bridge end fill shall be constructed to the subgrade elevation.

The material shall consist of mineral soil with properties and gradation in accordance with SS 202.04 and SS 202.05.

The bridge end fill shall be constructed in successive horizontal layers not exceeding 150 mm in loose thickness.

Each layer shall be compacted to a minimum 100% of the laboratory density obtained by the current ASTM test method D 698.

The determination of field density will follow a method approved by the Ministry Representative.

**202.24 Thickness of Granular Courses –** Crushed surfacing course, crushed base courses and sub-base courses shall be constructed to the specified thickness and dimensions as shown on the Contract Drawings or as described in the Special Provisions, unless otherwise directed by the Ministry Representative.

Normally, on new construction, crushed bases shall be constructed 300 mm thick (in individual lifts with compacted thickness of 150 mm) unless otherwise approved by the Ministry Representative. Additional base or sub-base granular materials will be of such thickness as may be considered necessary to provide supporting strength for the flexible pavement structure.

### **202.25 Construction of Sub-Base**

**202.25.01** Aggregates for sub-base shall be delivered to the roadbed as uniform mixtures and shall be spread in layers without segregation, preferably through an approved aggregate spreader. Granular aggregate shall not be end

## SECTION 202

dumped from trucks in piles on the grade. The Ministry Representative may permit spreading from the tailgate of trucks or from centre dump units, provided the Ministry Representative is satisfied that the work will be well controlled and segregation will not occur.

When the sub-grade below granular aggregate sub-bases consists of material inaccessible to wheeled equipment, and written permission is granted by the Ministry Representative, a portion of the granular aggregate sub-base or base may be dumped in piles upon the sub-grade and spread ahead in sufficient quantity to stabilize the sub-grade. Segregation of aggregates shall be avoided and the material as spread shall be free from pockets of large or fine material. Segregated materials shall be remixed until uniform. Static compaction shall be used in areas of sensitive soil subgrades.

Where the required thickness is 150 mm or less, the granular base or sub-base may be spread and compacted in one layer. Where the required thickness is more than 150 mm, the aggregate shall be spread and compacted in two or more layers of approximately equal thickness; the maximum compacted thickness of any one layer shall not exceed 150 mm. Each layer shall be spread and compacted in a similar manner. At locations where the granular base or sub-base is to be placed over areas inaccessible to the spreading equipment, the granular sub-base or base may be spread by any means to obtain the specified results.

**202.25.02** Immediately following spreading, the material shall be compacted to a minimum 100% of the laboratory density obtained by the current ASTM test method D 698.

If, because of the nature of the granular aggregate, the Ministry Representative considers that the results from the above test will be unreliable or the use of the test for density measurements is impractical, then the Ministry Representative may order that each lift or course of aggregate shall be continuously and thoroughly rolled until successive passes of a vibratory roller results in an increase in density of less than  $10 \text{ kg/m}^3$ .

The vibrating roller shall have a minimum steel drum diameter of 1.15 m, a minimum drum width of 1.5 m, and shall be capable of being loaded so as to have a gross mass of 20 kg per lineal centimetre of drum width.

However, if the Contractor elects to use alternate compaction equipment, then upon written request by the Contractor, the Ministry Representative may give written permission for the substitution of new or alternative compaction equipment if the Ministry Representative is satisfied that such equipment will provide equal or superior compaction performance.

## GRANULAR SURFACING, BASE AND SUB-BASES

**202.25.03** Subject to the concurrence of the Ministry Representative, the Contractor may water the sub-base aggregates as required to aid in attaining the specified density.

**202.25.04** The completed surface of the sub-base course shall conform to the required line, grade and cross section as shown on the Drawings to an accuracy of  $\pm 15 \text{ mm}$ , neither uniformly high nor low.

### **202.26 Construction of Crushed Base Course**

**202.26.01** Crushed base course aggregate shall be placed on a properly prepared sub-base surface to such depth or at such rates as may be specified. If the Ministry Representative is of the opinion that the finished surface of the sub-base does not meet the requirements of SS 202.25.04 but has been thoroughly and densely compacted and should not be disturbed, the Ministry Representative may order that the surface of the sub-base be corrected to the true cross section, line and grade, and within the tolerances specified by use of a levelling course of crushed 25 mm base course aggregate. In such event, the crushed 25 mm base course aggregate so used will be paid for only at the rates bid for sub-base, provided the same Contractor is responsible for the construction of both the crushed base, and sub-base.

The crushed base course shall be constructed in such a manner that the aggregate is neither segregated, contaminated nor degraded. End dumping will not be permitted. The thickness of the crushed base course shall be substantially uniform and the minimum thickness shall not be less than the nominal thickness shown on the drawings or ordered by the Ministry Representative. If the Contractor is unable to provide adequate manually operated equipment or workers of sufficient skill to lay the crushed base course aggregate within the tolerances specified, the Ministry Representative may require that the Contractor lay the aggregate through an approved electronically controlled spreading machine.

**202.26.02** Compaction – Immediately following spreading, the crushed base course aggregate shall be compacted to a minimum 100% of the laboratory density obtained by the current ASTM test method D 698.

The method of compaction to be employed may be selected by the Contractor, but shall be subject to approval by the Ministry Representative

**202.26.03** Watering – Subject to the agreement of the Ministry Representative, the Contractor may water the base course aggregates as required to aid in attaining the specified density.

**202.26.04** Tolerance of Completed Surface – The

## SECTION 202

completed surface of the granular base course shall conform to the required line, grade and cross section as shown on the Drawings to an accuracy of  $\pm 10$  mm, neither uniformly high nor low.

**202.27 Equipment for Watering** – Water shall be applied from a pressure type distributor, equipped with spray bar mounting nozzles similar to those used on asphalt distributors and capable of applying the water accurately and uniformly. Splash plate type distributors or those equipped with spray bars that eject fine streams of water will not be permitted. The distributor must be provided with a satisfactory means for accurately measuring the quantity of water sprayed. If the Ministry Representative so requires, measuring equipment shall be calibrated under the Ministry Representative's inspection. The Contractor shall make all necessary arrangements and permits for obtaining water at the Contractor's expense.

### **202.28 (not used)**

**202.29 Proof Rolling and Stabilizing Crushed Base Course** – Before acceptance, each compacted course of base course aggregate shall receive one complete coverage by the tires of a truck having a 9 tonne single axle dual tire or 17 tonne tandem axle group with dual tires with a tire pressure of 600 kPa.

Any areas where rutting or displacement occurs shall be either excavated or replaced and proof rolled or stabilized by the addition of suitable blending material incorporated uniformly into the base to the satisfaction of the Ministry Representative.

The supply, load, haul, placing, proof rolling, and mixing of such stabilizing aggregates as necessary to correct deficiencies in aggregate stability shall be incidental to the Work for Base aggregates. Blending may be performed at the pit or quarry or on the highway in a manner acceptable to the Ministry Representative.

**202.30 Benkelman Beam Testing** – At any time during the course of the work, when considered necessary by the Ministry Representative, Benkelman Beam testing may be undertaken at the Ministry's expense.

## **PART G – MEASUREMENT AND PAYMENT**

**202.31 Water Applied to the Highway** – Water for compaction or dust control shall be incidental to the bid price for the granular material.

**202.32 Development and Cleanup of Ministry-Provided Pits and Quarries** - Authorized clearing and grubbing of Ministry provided pits and quarries and construction of the

## **GRANULAR SURFACING, BASE AND SUB-BASES**

access road is the responsibility of the Contractor. Removal and stockpiling of overburden/topsoil during development of the proposed work areas, and spreading overburden on a depleted pit or quarry shall be the responsibility of the Contractor and the work shall be completed to the satisfaction of the Ministry Representative.

Unless explicitly stated otherwise in the Special Provisions, no separate payment will be made for clearing, grubbing, disposal or relocation of stockpiles, debris or contaminated materials, or for any other costs of site preparation, pit development, or access, or for any delay or other cost arising from the use of Ministry-provided pits or quarries by the Contractor, and all costs thereof shall be covered in the prices for the Items under which payment is provided for the applicable materials.

### **202.33 Stockpile Reject Aggregate**

**202.33.01 Aggregate** from screening or crushing operations in a Ministry-provided pit or quarry, whether:

i) Oversize under SS 202.09, or

ii) Rejected at the crusher in order that the product meets the requirements of SS 202.05,

shall be stockpiled separately according to size in accordance with SS 202. Stockpiles of reject aggregate shall not be contaminated by organic or other deleterious materials.

**202.33.02 No** payment will be made for any reject aggregate.

**202.34 Blending Materials for Stabilizing Aggregates on the Highway** – Blending materials, supplied, loaded, hauled, placed and mixed into the granular aggregate on the highway to correct deficiencies in aggregate stability, will be paid for at the same rate as the granular aggregate which has to be stabilized. The final blended gradation must still meet the design aggregate gradation.

Normally, no additional payment will be made to cover the costs of work required to correct stability failure in the aggregate unless the Ministry Representative is satisfied that such instability is inherent in the type of aggregate available to the Contractor from a mandatory use Ministry-provided pit or quarry, and that the lack of stability has not risen because of unsatisfactory production methods or improper construction practices. In these circumstances, the Ministry Representative will issue an Order for Extra Work to the Contractor to cover the additional cost of mixing blending material into the granular aggregate to

## SECTION 202

correct the stability deficiency.

**202.35 Aggregate Supplied in Stockpile Only – Aggregate,** supplied in stockpile only, will be paid for at the Unit Price bid per CUBIC METRE, measured in stockpile and computed by surface to surface or, at the Ministry Representative's option, average end areas.

Payment at the unit price bid price shall be accepted as full compensation for everything furnished and done to supply (where applicable), produce and stockpile the crushed aggregate.

### **202.36 Aggregates Supplied in Place**

**202.36.01 Unit Price Payment –** Crushed or screen aggregates (surfacing, base, sub-base and bridge end fill) supplied and constructed in place will be paid on a neat line basis for at the applicable Unit Price bid per CUBIC METRE. Payment shall be full compensation for everything furnished and done, including without limitation costs for acquisition, development, and payment of royalties for private pits or quarries, purchase price of aggregate, access road maintenance, screening, crushing, stockpiling, loading, hauling, spreading, compaction and moisture adjustment (watering or drying) in place as specified.

**202.36.02 Advance Payment – Crushed or Screened Aggregates Supplied in Place –** An advanced payment of the greater of 70% of the demonstrated production costs or 30% of the extended amount for the Item will be made for crushed or screened aggregates (surfacing, base or sub-base) in stockpile. No advance payment will be made for pit run aggregates. Recovery of the advance payment will be made on each progress estimate as the respective aggregate is subsequently withdrawn from the stockpile, with an additional adjustment on the final progress estimate for any material remaining in stockpile such that the entire advance payment is recovered.

**202.36.03 Surplus Aggregate** Where actual aggregate needs on the Contract fall below the Approximate Quantity indicated on Schedule 7, the Ministry will compensate the Contractor at the rates indicated in Table 202-F for a portion of surplus aggregates produced by the Contractor which meet all the applicable quality and gradation specifications of the contract.

## GRANULAR SURFACING, BASE AND SUB-BASES

**TABLE 202- F COMPENSATION FOR SURPLUS AGGREGATE**

| Stockpile Location | Compensation for Surplus Aggregates (\$/m <sup>3</sup> ) |          |
|--------------------|--|----------|
|                    | Crushed  | Screened |
| Ministry land      | \$6.00   | \$3.00   |
| Private land       | \$4.00   | \$2.00   |

For each classification of aggregate, the maximum quantity of surplus aggregate eligible for compensation shall be the Approximate Quantity of that aggregate on Schedule 7 minus the quantity of that aggregate paid on the final progress estimate.

There will be no compensation for surplus aggregate for pit run aggregates or for any portion of the production on other aggregates which are beyond the Approximate Quantity. Where aggregates are purchased from a pre-existing commercial pit or quarry operation, there will be no compensation for any aggregate beyond that actually used in the Contract.

Surplus aggregates originating from private land in stockpile on Ministry lands are the property of the Ministry and no additional compensation will be paid. Surplus aggregate stockpiles on private lands will be the property of the Contractor and there will be no compensation for any aggregate beyond that actually used in the contract.

### **202.37 Stockpile Volume Determination**

The Ministry will determine the volume of aggregate by surveying the stockpile(s) using string-line techniques, determine volume using prismatic volumes between surfaces, and deducting 10% for stockpile loss. Alternatively, the Ministry Representative may elect to survey using cross-section techniques and/or determine volumes using end-area volumes. The base of the pile will be determined from a pre-stockpile survey or, where such a survey is not available, from a surface determined by the Ministry Representative as being a reasonable interpolation from the intersection of the pile sides with the adjacent ground level. Where there are two or more stockpiles of aggregate meeting the same gradation classification, the compensation will be based on the cumulative quantity of those stockpiles.

### Appendix 1 Fracture Count for Coarse Aggregate (BCH 1-13)

**Purpose:**

This test determines the amount of fractured material in the coarse part of an aggregate sample.

**Method "A"** is used for crushed granular surfacing and base aggregates.

**Method "B"** is used for paving aggregates.

| Maximum Nominal Size (mm) | Minimum Dry Mass (kg) |
|---------------------------|-----------------------|
| 37.5                      | 4.0                   |
| 25.0                      | 2.5                   |
| 12.5                      | 1.5                   |
| 9.5                       | 1.0                   |

**Apparatus:**

1. Drying oven, preferably forced draft, capable of maintaining a uniform temperature of  $110 \pm 5^\circ$  C.
2. A nest of sieves of the following sizes:  
Method "A": 37.5 mm, 25.0 mm, 19.0 mm, 12.5 mm, 9.5 mm, 4.75 mm  
Method "B": 19.0 mm, 13.2 mm, 9.5 mm
3. Balance with sufficient capacity and accurate within 0.1 percent of the mass of sample.

**Test Sample:**

The sample of aggregate to be tested shall be representative, oven-dry, and reduced to an amount suitable for testing. The mass of the sample shall conform to the following:

**Procedure: Method "A"**

1. Sieve the coarse aggregate to be tested on the 37.5 mm, 25.0 mm, 19.0 mm, 12.5 mm, 9.5 mm 4.75 mm sieves.
2. Separate each sieve size into two groups, fractured and unfractured. Each rock in the fractured group shall have at **least one** fractured face or shall be naturally angular with sharp edges. (See Discussion 1).
3. For each sieve size, count the number of fractured rocks and the total number of rocks (fractured and unfractured).
4. Calculate and record the % fracture for each sieve size and report the total % fracture for the sample using the following formulas:

**FOR EACH SIEVE SIZE: (i.e. 19 mm)**

$$\% \text{ Fracture (19 mm)} = \frac{\text{Number of Fractured Rocks (19 mm)}}{\text{Total No. of Rocks (19 mm)}} \times 100\%$$

**FOR THE TOTAL SAMPLE:**

$$\text{Total \% Fracture} = \frac{\text{Number of Fractured Rocks (All Sieve Sizes)}}{\text{Total No. of Rocks (All Sizes)}} \times 100\%$$

**Procedure: Method "B"**

1. Separate the coarse aggregate to be tested from the fine aggregate by sieving it over the 4.75 mm screen.
2. Separate the coarse aggregate for each sieve size into two groups, fractured and unfractured. Each rock in the fractured group shall have **two or more** fractured faces produced by a crusher or shall be naturally

angular with sharp edges. Each rock in the unfractured group shall be unfractured or fractured only in one dimension.

3. Obtain the mass of the fractured group, also the mass of the total coarse aggregate (fractured + unfractured groups).
4. Calculate and report the total % fracture for the sample using the following formula:

$$\% \text{ Fracture} = \frac{\text{Mass of Fractured Rock}}{\text{Mass of Total Rocks}} \times 100 \%$$

**Discussion:**

-**Fractured face** shall be defined as a fracture in any plane whose area is 15% or more of the largest cross-section area in a parallel plane.

-The required sample can be conveniently obtained from the separated fractions of the Dry or Wash Sieve Test.



## Appendix 2 Petrographic Analysis Test

### Purpose:

The purpose of the Petrographic Analysis Test is to identify the various rock types and rock characteristics in the aggregate fraction of material retained on the 9.5 mm sieve of a gravel deposit. The test is performed after a micro deval soundness test or a magnesium sulphate soundness test indicates that the granular materials are weak, non durable or suspect. The petrographic analysis test is to prove or determine the cause of the poor performance of the aggregate and to determine the extent or contributing factors of specific rock types or the extent of deleterious materials or clay particles. This information will be used to determine the possible use of the materials.

### Scope:

The test shall be performed by a qualified professional with experience in rock type identification, rock classification and gravel/aggregate sources and use; and shall be presented in a signed report that details findings. Recognized procedures for rock identification shall be used. The procedures involve simple physical and chemical tests, such as the hardness scratch test, hydrochloric acid reaction and visual surface examination assisted by magnifying lens. The predominance of easily distinguishable types in petrographic samples will permit reasonably accurate testing. Important accessories are a sample kit, the rock and mineral descriptions and a good text.

Rock types are to be listed by percentage weight under the broad categories of origin (sedimentary-metamorphic-igneous) with condition descriptions (i.e. hardness, weathering and cementation). Note that the descriptions of quality regarding durability or soundness (good, fair, poor, deleterious) are vital to the test results.

Additional information on general condition including weathering, shape, porosity, coatings etc. shall also be recorded.

### Apparatus

- 1 Balance – 20,000 gram capacity, accuracy  $\pm 0.1$  gram.
- 2 Oven capable of maintaining 110 ° C.
- 3 Sieves 19 mm (3/4 inch) and 9.5 mm (3/8 inch) and shaker.

- 4 Sample splitter with pans.
- 5 Hand-lens (10X magnification).
- 6 A ten percent solution of hydrochloric acid.
- 7 Aluminum pans.
- 8 A stereoscopic microscope.

### Sample Preparation

A 1500 gram sample of representative aggregate passing 19 mm and retained on 9.5 mm screen is required.

1. For pit run materials, a minimum of 18 kg, or one full gravel bag of representative aggregate is required.
2. This material is oven-dried at 110°C  $\pm 5^\circ\text{C}$  overnight, or for 16 hours.
3. After drying, the sample is quartered in the sample splitter.
4. A one-quarter sample is sieved to obtain passing 19 mm aggregate. Additional quarters are sieved if the initial quarter provides less than 1500 grams of the required sizes.
5. The passing 19 mm retained on 9.5 mm aggregate is mixed and 1500 grams separated by splitter.
6. Fractured materials are separated from non-fractured materials and a fracture count test shall be performed using method A (see above)
7. Following removal (by hand) of clay balls and very soft weak material, the non-fractured rocks are washed to assist visual identification of mineral characteristics. The soft fractured rocks shall be washed with great care as their degradation may prevent correct identification. The clay balls and lumps shall be weighed and the percent of sample noted.

### Rock Type Classification

Assignment of each particle to rock type and character is required.

## SECTION 202

Identification of specific rock type may be preceded by general identification under the major rock categories of: igneous, sedimentary and metamorphic. Following simple physical, chemical and visual tests, each particle is then identified with a specific rock type and description.

Rock types are weighed to the nearest 0.1 gram. Weights are recorded on the test sheet and the percentage of each is calculated from the total sample weight.

Comments on each rock type include descriptions of physical and chemical qualities such as:

- Hardness: hard, medium, soft.
- Weathering: non weathered, slightly or intensely weathered.
- Porosity
- Cementation: firmly cemented to friable.
- Coatings

**Quality Characterization** (good, fair, poor, deleterious)

### Basis of Quality System

The following quality distinctions are relative estimates of a rock's physical and chemical condition and of probable engineering quality.

- Good: Particles are hard, durable, free from fracture potential, little or no capillary absorption.
- Fair: Particles are soft but sound and tough, medium hard, slightly to moderately weathered, have small to moderate capillary absorption, are relatively smooth and impermeable.
- Poor: Particles are soft to very soft, friable, potential slaking when wetted and dried, highly fractured potential, capillary absorption moderate to high.
- Deleterious: Particles react chemically with alkali in Portland Cement causing expansion in concrete, although they may be suitable in base course.

## GRANULAR SURFACING, BASE AND SUB-BASES

### Report Submission Requirements

The report shall describe tests performed, present test results, including descriptions of weathering, shape, porosity, coatings, angularity and provide a petrographic number.

A description of suitability shall be stated by the individual performing the test.

The report shall contain an executive summary of rock types and conditions as shown in the example below.

(e.g. Igneous granodiorite 90% hard, non weathered. Volcanics 10% hard and fresh, with some volcanics (30% of volcanics) slightly weathered and some volcanics (5% of volcanics) are vesicular, soft and intensely weathered. No clay lumps, some particles (less than 5% of sample) contained coatings of clay.

### Sample Petrographic Number

The Petrographic Number (PN) for the sample is calculated by multiplying the percentage of each of the four quality classification by the following multipliers:

- Good 1
- Fair 3
- Poor 6
- Deleterious 10

and then summing the results.

| Sample Petrographic Number | Overall Sample Rating |
|----------------------------|-----------------------|
| 100 to 125                 | Good                  |
| >125 to 140                | Fair                  |
| >140 to 155                | Poor                  |
| > 155                      | Deleterious           |

## **Appendix 4**





Project Name: Lower Post

## BOREHOLE : BH13-01

Project Number: 00069

Location: Lower Post, BC

### Coordinates

Northing: 6643181

Easting: 528360

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Dec. 5, 2013 Drillhole Diameter (inch): 4"

Drill Method: odex/SPT Other:

| Lithologic Description |  | Soil Sampling |             |            |            | Headspace Analysis    |            | Elevation (masl) |
|------------------------|--|---------------|-------------|------------|------------|-----------------------|------------|------------------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID  |                  |
|                        |  |               |             |            |            |                       | PPM        | % LEL            |
| 0                      |  | 0             |             |            |            |                       |            |                  |
|                        | Gravel and Sand: Brown, SAND and Gravel, Tr Silt, Dry, Loose | 1             |             |            |            | N                     |            | 2.0              |
| 1                      |  | 2             |             |            |            |                       |            |                  |
|                        |  | 3             |             |            |            | N                     |            | 0.2              |
| 2                      |  | 4             |             |            |            |                       |            |                  |
|                        |  | 5             |             |            |            | N                     |            | 0.0              |
| 3                      |  | 6             |             |            |            |                       |            |                  |
|                        |  | 7             |             |            |            |                       |            |                  |
|                        |  | 8             |             |            |            | N                     |            | 0.0              |
| 4                      |  | 9             |             |            |            |                       |            |                  |
|                        |  | 10            |             |            |            | N                     |            | 0.0              |
|                        |  | 11            |             |            |            |                       |            |                  |
|                        |  | 12            |             |            |            |                       |            |                  |
|                        | Sand: Gray Coarse SAND, Dry, Loose                           | 13            |             |            |            | Y                     | BH13-01-5  | 0.0              |
| 5                      |  | 14            |             |            |            |                       |            |                  |
|                        |  | 15            |             |            |            |                       |            |                  |
|                        | Sand: Gray SAND, some cobbles, Tr Silt, Damp, Loose          | 16            |             |            |            | Y                     | BH13-01-6  | 0.0              |
| 6                      |  | 17            |             |            |            |                       |            |                  |
|                        |  | 18            |             |            |            |                       |            |                  |
|                        |  | 19            |             |            |            | Y                     | BH13-01-7  | 0.8              |
| 7                      |  | 20            |             |            |            |                       |            |                  |
|                        |  | 21            |             |            |            | Y                     | BH13-01-8  | 1.3              |
|                        |  | 22            |             |            |            |                       |            |                  |
|                        |  | 23            |             |            |            |                       |            |                  |
|                        |  | 24            |             |            |            | Y                     | BH13-01-9  | 373              |
| 8                      |  | 25            |             |            |            |                       |            |                  |
|                        |  | 26            |             |            |            | Y                     | BH13-01-10 | 4.3              |
|                        |  | 27            |             |            |            |                       |            |                  |
|                        |  | 28            |             |            |            |                       |            |                  |
|                        |  | 29            |             |            |            | Y                     | BH13-01-11 | 9.5              |
| 9                      |  |               |             |            |            |                       |            |                  |



Report Date: March 3, 2014 Approved by: JT

Client: PWGSC Logged by: VR

**Project Name:** Lower Post

## BOREHOLE: BH13-02

**Project Number:** 00069

**Location:** Lower Post, BC

### Coordinates

**Northing:** 6643174

**Easting:** 528344








**Datum:** n/a

### Drilling Details

Drill Contractor: **Geotech** Depth of Drilled Hole (mbgs): **9.90**

Drill Date: **Dec. 5, 2013** Drillhole Diameter (inch): **4"**

Drill Method: **Odex/SPT** Other:

| Lithologic Description |  | Soil Sampling  |  |  |            |                       | Headspace Analysis |        | Elevation (masl) |        |        |
|------------------------|--|--|--|--|------------|-----------------------|--------------------|--------|------------------|--------|--------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs)  | Sample Type  | % Recovery   | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM    |                  | % LEL  |        |
| 0                      |    | Sand: Brown, Coarse SAND, Tr Gravel, Dry, Loose                                    |  |  |            |                       |                    |        |                  | 581633 |        |
| 1                      |  |  | N  |  |            |                       |                    |        |                  | 0.0    | 581632 |
| 2                      |  |   | Gravel and Sand: Brown SAND and Gravel, Tr Silt, Dry, Loose              |  |            |                       |                    |        |                  | N      | 0.6    |
| 3                      |  |  | N  | 1.6  | 581630     |                       |                    |        |                  |        |        |
| 4                      |  |  | Sand: Brown Coarse SAND, Tr Silt, Dry, Loose                             |  | N          | 0.7                   | 581629             |        |                  |        |        |
| 5                      |  |  | Y  | 0.0  | 581628     |                       |                    |        |                  |        |        |
| 6                      |  |  | Sand: Black, Medium to fine SAND, Moist to Wet                           |  | Y          | BH13-02-5             | 0.0                | 581627 |                  |        |        |
| 7                      |  |  | Y  | BH13-02-6  | 0.2        | 581626                |                    |        |                  |        |        |
| 8                      |  |  | Sand: Gray Coarse SAND, Tr Gravel, Some Staining, PHC Odour, Wet @ 7.01m |  | Y          | BH13-02-7             | 0.0                | 581625 |                  |        |        |
| 9                      |  |  | Y  | BH13-02-8  | 0.0        | 581624                |                    |        |                  |        |        |
|                        |  |  | Sand: Gray Coarse SAND, Tr Gravel, Dense, Wet                            |  | Y          | BH13-02-9             | 2.5                |        |                  |        |        |
|                        |  |  | Y  | BH13-02-10   | 2.0        |                       |                    |        |                  |        |        |
|                        |  |  | Y  | BH13-02-11   | 0.0        |                       |                    |        |                  |        |        |
|                        |  |  |  | Y  | BH13-02-12 | 1.8                   |                    |        |                  |        |        |



Report Date: **March 3, 2014**

Approved by: **JT**

Client: **PWGSC**

Logged by: **VR**

Project Name: Lower Post

# BOREHOLE: BH13-03

Project Number: 00069

Location: Lower Post, BC

## Coordinates

Northing: 6643163

Easting: 528344

Datum: n/a

## Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Dec 7, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |  | Soil Sampling |             |            |            | Headspace Analysis    |            | Elevation (masl) |       |
|------------------------|--|---------------|-------------|------------|------------|-----------------------|------------|------------------|-------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID  | PPM              | % LEL |
| 0                      |  | 0             |             |            |            |                       |            |                  |       |
|                        | Sand: Brown Medium SAND, Some Gravel, Dry, Loose               | 1             |             |            |            | N                     |            | 1.2              |       |
| 1                      |  | 2             |             |            |            |                       |            |                  | 581   |
|                        | Sand: Brown, Medium SAND, Dry, Loose                           | 3             |             |            |            | N                     |            | 0.3              |       |
|                        |  | 4             |             |            |            |                       |            |                  |       |
|                        | Sand: Gray, Coarse SAND, fine Gravel, Tr Silt, Dry, Loose      | 5             |             |            |            |                       |            |                  | 580   |
| 2                      |  | 6             |             |            |            | N                     |            | 0.6              |       |
|                        |  | 7             |             |            |            |                       |            |                  |       |
|                        |  | 8             |             |            |            |                       |            |                  |       |
|                        |  | 9             |             |            |            | N                     |            | 1.4              | 579   |
| 3                      |  | 10            |             |            |            |                       |            |                  |       |
|                        | Sand: Brown, Coarse to Medium SAND, Dry, Loose                 | 11            |             |            |            | N                     |            | 0.5              | 578   |
|                        |  | 12            |             |            |            |                       |            |                  |       |
| 4                      |  | 13            |             |            |            |                       |            |                  |       |
|                        | Sand: Brown, Coarse to Medium SAND, Dry, Loose with Some Chips | 14            |             |            |            | N                     |            | 0.3              |       |
|                        |  | 15            |             |            |            |                       |            |                  |       |
|                        | Gravel Pack: Brown, Coarse to Medium SAND, Rock,               | 16            |             |            |            | Y                     | BH13-03-7  | 0.6              | 577   |
| 5                      |  | 17            |             |            |            |                       |            |                  |       |
|                        | Sand: Brown, coarse to Medium SAND, Tr Gravel, Wet             | 18            |             |            |            | Y                     | BH13-03-8  | 0.5              | 576   |
|                        |  | 19            |             |            |            |                       |            |                  |       |
| 6                      |  | 20            |             |            |            |                       |            |                  |       |
|                        |  | 21            |             |            |            | Y                     | BH13-03-9  | 3.0              | 575   |
|                        |  | 22            |             |            |            |                       |            |                  |       |
| 7                      |  | 23            |             |            |            |                       |            |                  |       |
|                        |  | 24            |             |            |            | Y                     | BH13-03-10 | 1.1              | 574   |
|                        |  | 25            |             |            |            |                       |            |                  |       |
| 8                      |  | 26            |             |            |            | Y                     | BH13-03-11 | 0.0              |       |
|                        | Sand: Grayish Brown, Coarse to Medium SAND, Wet                | 27            |             |            |            |                       |            |                  |       |
|                        |  | 28            |             |            |            |                       |            |                  |       |
|                        | SP: Gray, Gravelly SAND, Tr Silt, Wet, Loose                   | 29            |             |            |            | Y                     | BH13-03-12 | 0.2              | 573   |
| 9                      |  |               |             |            |            |                       |            |                  |       |



Report Date: March 3, 2014

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-04

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643198

Easting: 528345

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |  | Soil Sampling |             |            |            |                       | Headspace Analysis |     | Elevation (masl) |       |
|------------------------|--|---------------|-------------|------------|------------|-----------------------|--------------------|-----|------------------|-------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM |                  | % LEL |
| 0                      |  | 0             |             |            |            |                       |                    |     |                  |       |
|                        | Gravel: Brown, Some GRAVEL, Fine Sand, Dense                         | 1             |             |            |            | N                     | BH13-04-1          | 0.0 |                  | 581   |
|                        |  | 2             |             |            |            |                       |                    |     |                  |       |
| 1                      | SAND: Brown, Medium to fine SAND, Dry, Loose                         | 3             |             |            |            | N                     | BH13-04-2          | 0.0 |                  |       |
|                        |  | 4             |             |            |            |                       |                    |     |                  |       |
|                        | SAND: Brown, Medium to fine SAND, Some Silt, Some Gravel, Dry, Loose | 5             |             |            |            | N                     | BH13-04-3          | 0.0 |                  | 580   |
| 2                      |  | 6             |             |            |            |                       |                    |     |                  |       |
|                        |  | 7             |             |            |            |                       |                    |     |                  |       |
|                        |  | 8             |             |            |            |                       |                    |     |                  | 579   |
|                        |  | 9             |             |            |            | N                     | BH13-04-4          | 0.0 |                  |       |
| 3                      | Shattered: No Recovery, Chips  | 10            |             |            |            |                       |                    |     |                  |       |
|                        |  | 11            |             |            |            | N                     | BH13-04-5          | 0.0 |                  | 578   |
|                        |  | 12            |             |            |            |                       |                    |     |                  |       |
| 4                      |  | 13            |             |            |            |                       |                    |     |                  |       |
|                        |  | 14            |             |            |            | N                     | BH13-04-6          | 0.0 |                  | 577   |
|                        | SAND: Brown, Medium to fine SAND, Some Gravel, Moist                 | 15            |             |            |            |                       |                    |     |                  |       |
| 5                      |  | 16            |             |            |            | Y                     | BH13-04-7          | 0.0 |                  |       |
|                        |  | 17            |             |            |            |                       |                    |     |                  |       |
|                        |  | 18            |             |            |            |                       |                    |     |                  | 576   |
|                        |  | 19            |             |            |            | Y                     | BH13-04-8          | 0.0 |                  |       |
| 6                      |  | 20            |             |            |            |                       |                    |     |                  |       |
|                        | SAND: Brown, Medium to fine SAND, Coarse Gravel, Wet @ 6.858m        | 21            |             |            |            | Y                     | BH13-04-9          | 0.1 |                  | 575   |
|                        |  | 22            |             |            |            |                       |                    |     |                  |       |
| 7                      | Gravel: Dark Brown, Coarse GRAVEL, Medium to coarse Sand, Wet        | 23            |             |            |            | Y                     | BH13-04-10         | 0.1 |                  | 574   |
|                        |  | 24            |             |            |            |                       |                    |     |                  |       |
|                        | SAND: Dark Brown, Some Medium to fine SAND, Some Gravel, Wet         | 25            |             |            |            |                       |                    |     |                  |       |
|                        |  | 26            |             |            |            | Y                     | BH13-04-11         | 0.0 |                  |       |
| 8                      |  | 27            |             |            |            |                       |                    |     |                  |       |
|                        | SAND: Brown, Medium to fine SAND, Tr Gravel, Wet                     | 28            |             |            |            | Y                     | BH13-04-12         | 0.0 |                  | 573   |
| 9                      |  | 29            |             |            |            |                       |                    |     |                  |       |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-05

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643198

Easting: 528345

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: odex/SPT Other:

| Lithologic Description |        | Soil Sampling |             |            |            | Headspace Analysis    |            | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|------------|-----------------------|------------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID  |                  |
|                        |        |               |             |            |            |                       | PPM        | % LEL            |
| 0                      |        | 0             |             |            |            | N                     | 2.0        | 581              |
| 1                      |        | 1             |             |            |            | N                     | 0.0        | 580              |
| 2                      |        | 2             |             |            |            | N                     | 0.0        | 579              |
| 3                      |        | 3             |             |            |            | N                     | 0.0        | 578              |
| 4                      |        | 4             |             |            |            | N                     | 0.0        | 577              |
| 5                      |        | 5             |             |            |            | Y                     | BH13-05-1  | 576              |
| 6                      |        | 6             |             |            |            | Y                     | BH13-05-2  | 575              |
| 7                      |        | 7             |             |            |            | Y                     | BH13-05-3  | 574              |
| 8                      |        | 8             |             |            |            | Y                     | BH13-05-4  | 573              |
| 9                      |        | 9             |             |            |            | Y                     | BH13-05-5  |                  |
|                        |        | 10            |             |            |            | Y                     | BH13-05-6  |                  |
|                        |        | 11            |             |            |            | Y                     | BH13-05-7  |                  |
|                        |        | 12            |             |            |            | Y                     | BH13-05-8  |                  |
|                        |        | 13            |             |            |            | Y                     | BH13-05-9  |                  |
|                        |        | 14            |             |            |            | Y                     | BH13-05-10 |                  |
|                        |        | 15            |             |            |            | Y                     | BH13-05-11 |                  |
|                        |        | 16            |             |            |            | Y                     | BH13-05-12 |                  |
|                        |        | 17            |             |            |            | Y                     | BH13-05-13 |                  |
|                        |        | 18            |             |            |            | Y                     | BH13-05-14 |                  |
|                        |        | 19            |             |            |            | Y                     | BH13-05-15 |                  |
|                        |        | 20            |             |            |            | Y                     | BH13-05-16 |                  |
|                        |        | 21            |             |            |            | Y                     | BH13-05-17 |                  |
|                        |        | 22            |             |            |            | Y                     | BH13-05-18 |                  |
|                        |        | 23            |             |            |            | Y                     | BH13-05-19 |                  |
|                        |        | 24            |             |            |            | Y                     | BH13-05-20 |                  |
|                        |        | 25            |             |            |            | Y                     | BH13-05-21 |                  |
|                        |        | 26            |             |            |            | Y                     | BH13-05-22 |                  |
|                        |        | 27            |             |            |            | Y                     | BH13-05-23 |                  |
|                        |        | 28            |             |            |            | Y                     | BH13-05-24 |                  |
|                        |        | 29            |             |            |            | Y                     | BH13-05-25 |                  |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

**BOREHOLE : BH13-06**

Project Number: 00069

Location: Lower Post

**Coordinates**

Northing: 6643171

Easting: 528379







Datum: n/a

**Drilling Details**

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 25, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |  | Soil Sampling  |             |            |            |                       | Headspace Analysis |     | Elevation (masl) |       |
|------------------------|--|--|-------------|------------|------------|-----------------------|--------------------|-----|------------------|-------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs)  | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM |                  | % LEL |
| 0                      |    | SAND: Light Brown, Medium to fine SAND, Some Gravel, Dry, Loose            |             | 0          |            |                       |                    |     |                  |       |
| 1                      |  |  |             |            |            |                       |                    |     |                  | 581   |
| 2                      |  |  |             |            |            |                       |                    |     |                  |       |
| 3                      |  |  |             |            |            |                       |                    |     |                  | 580   |
| 4                      |  |  |             |            |            |                       |                    |     |                  |       |
| 5                      |  |  |             |            |            |                       |                    |     |                  |       |
| 6                      |  |  |             |            |            |                       |                    |     |                  |       |
| 7                      |  |  |             |            |            |                       |                    |     |                  |       |
| 8                      |   | Gravel: Light Brown, Medium to fine GRAVEL, Some Sand, Tr Silt, Dry, Loose |             | 8          |            |                       |                    |     |                  |       |
| 9                      |  |  |             |            |            |                       |                    |     |                  | 579   |
| 10                     |  |  |             |            |            |                       |                    |     |                  |       |
| 11                     |  |  |             |            |            |                       |                    |     |                  |       |
| 12                     |  |  |             |            |            |                       |                    |     |                  | 578   |
| 13                     |  |  |             |            |            |                       |                    |     |                  |       |
| 14                     |  |  |             |            |            |                       |                    |     |                  |       |
| 15                     |  |  |             |            |            |                       |                    |     |                  |       |
| 16                     |  | SAND: Brown, Medium to fine SAND, Some Gravel, Dry, Dense                  |             | 16         |            |                       |                    |     |                  |       |
| 17                     |  |  |             |            |            |                       |                    |     |                  | 577   |
| 18                     |  |  |             |            |            |                       |                    |     |                  |       |
| 19                     |  |  |             |            |            |                       |                    |     |                  |       |
| 20                     |  |  |             |            |            |                       |                    |     |                  | 576   |
| 21                     |  |  |             |            |            |                       |                    |     |                  |       |
| 22                     |  |  |             |            |            |                       |                    |     |                  |       |
| 23                     |  |  |             |            |            |                       |                    |     |                  |       |
| 24                     |  | SAND: Brown, Medium to fine SAND, Tr Gravel, Moist, Dense                  |             | 24         |            |                       |                    |     |                  |       |
| 25                     |  |  |             |            |            |                       |                    |     |                  | 575   |
| 26                     |  |  |             |            |            |                       |                    |     |                  |       |
| 27                     |  |  |             |            |            |                       |                    |     |                  |       |
| 28                     |  |  |             |            |            |                       |                    |     |                  |       |
| 29                     |  |  |             |            |            |                       |                    |     |                  |       |
| 30                     |  |  |             |            |            |                       |                    |     |                  |       |
| 31                     |  |  |             |            |            |                       |                    |     |                  |       |
| 32                     |  | SAND: Black, Medium to fine SAND, Tr Silt, Wet @ 7.62m                     |             | 32         |            |                       |                    |     |                  |       |
| 33                     |  |  |             |            |            |                       |                    |     |                  | 574   |
| 34                     |  |  |             |            |            |                       |                    |     |                  |       |
| 35                     |  |  |             |            |            |                       |                    |     |                  |       |
| 36                     |  |  |             |            |            |                       |                    |     |                  |       |
| 37                     |  |  |             |            |            |                       |                    |     |                  |       |
| 38                     |  |  |             |            |            |                       |                    |     |                  |       |
| 39                     |  |  |             |            |            |                       |                    |     |                  |       |
| 40                     |  |  |             | 40         |            |                       |                    |     |                  |       |
| 41                     |  |  |             |            |            |                       |                    |     |                  | 573   |
| 42                     |  |  |             |            |            |                       |                    |     |                  |       |
| 43                     |  |  |             |            |            |                       |                    |     |                  |       |
| 44                     |  |  |             |            |            |                       |                    |     |                  |       |
| 45                     |  |  |             |            |            |                       |                    |     |                  |       |
| 46                     |  |  |             |            |            |                       |                    |     |                  |       |
| 47                     |  |  |             |            |            |                       |                    |     |                  |       |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-07

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643175

Easting: 528336

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 25, 2014 Drillhole Diameter (inch): 4"

Drill Method: ODEX/SPT Other:

| Lithologic Description |        | Soil Sampling |  |            |            | Headspace Analysis    |           | Elevation (masl) |
|------------------------|--------|---------------|--|------------|------------|-----------------------|-----------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type  | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID |                  |
|                        |        |               |  |            |            |                       | PPM       | % LEL            |
| 0                      |        | 0             |  |            |            | N                     | 0.2       |                  |
| 1                      |        | 1             | SAND: Dark Brown, Medium to fine SAND, Tr Silt, Dry, Loose         |            |            | N                     | 0.3       | 581              |
| 2                      |        | 2             | SAND: Brown, Medium to fine SAND, Tr Silt, Dry, Loose              |            |            | N                     | 0.0       | 580              |
| 3                      |        | 3             | SAND: Brown, Medium to fine SAND, Some Gravel, Tr Silt, Dry, Dense |            |            | N                     | 0.1       | 579              |
| 4                      |        | 4             | SAND: Dark Brown, Fine SAND, Tr Silt, Dry, Loose                   |            |            | N                     | 0.2       | 578              |
| 5                      |        | 5             | SAND: Brown, Medium to fine SAND, Some Gravel, Tr Silt, Dry, Loose |            |            | N                     | 0.2       | 577              |
| 6                      |        | 6             | SAND: Dark Brown, Medium to fine SAND, Dry, Loose                  |            |            | Y                     | BH13-07-1 | 576              |
| 7                      |        | 7             | SAND: Brown, Medium to fine SAND, Wet @7.62m                       |            |            | Y                     | BH13-07-2 | 575              |
| 8                      |        | 8             |  |            |            | Y                     | BH13-07-3 | 574              |
| 9                      |        | 9             |  |            |            | Y                     | BH13-07-4 | 573              |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR



Project Name: Lower Post

# BOREHOLE : BH13-08

Project Number: 00069

Location: Lower Post

## Coordinates

Northing: 6643192

Easting: 528335














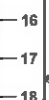

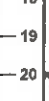



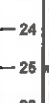

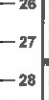


Datum: n/a

## Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |  | Soil Sampling   |             |            |            |                       | Headspace Analysis |           | Elevation (masl) |       |
|------------------------|--|---|-------------|------------|------------|-----------------------|--------------------|-----------|------------------|-------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs)   | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM       |                  | % LEL |
| 0                      |    |    |             |            |            |                       | N                  |           | 0.5              | 581   |
| 1                      |    |    |             |            |            |                       | N                  |           | 0.3              |       |
| 2                      |    |    |             |            |            |                       | N                  |           | 0.3              | 580   |
| 3                      |   |   |             |            |            |                       | N                  |           | 1.0              | 579   |
| 4                      |  |  |             |            |            |                       | N                  |           | 0.0              | 578   |
| 5                      |  |  |             |            |            |                       | N                  |           | 0.0              | 577   |
| 6                      |  |  |             |            |            |                       | Y                  | BH13-08-1 | 0.3              | 576   |
| 7                      |  |  |             |            |            |                       | Y                  | BH13-08-2 | 0.5              | 575   |
| 8                      |  |  |             |            |            |                       | Y                  | BH13-08-3 | 0.8              | 574   |
| 9                      |  |  |             |            |            |                       | Y                  | BH13-08-4 | 0.0              | 573   |
|                        |  |  |             |            |            |                       | Y                  | BH13-08-5 | 0.0              |       |
|                        |  |  |             |            |            |                       | Y                  | BH13-08-6 | 0.2              |       |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-09

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643191

Easting: 528342

Datum: n/a

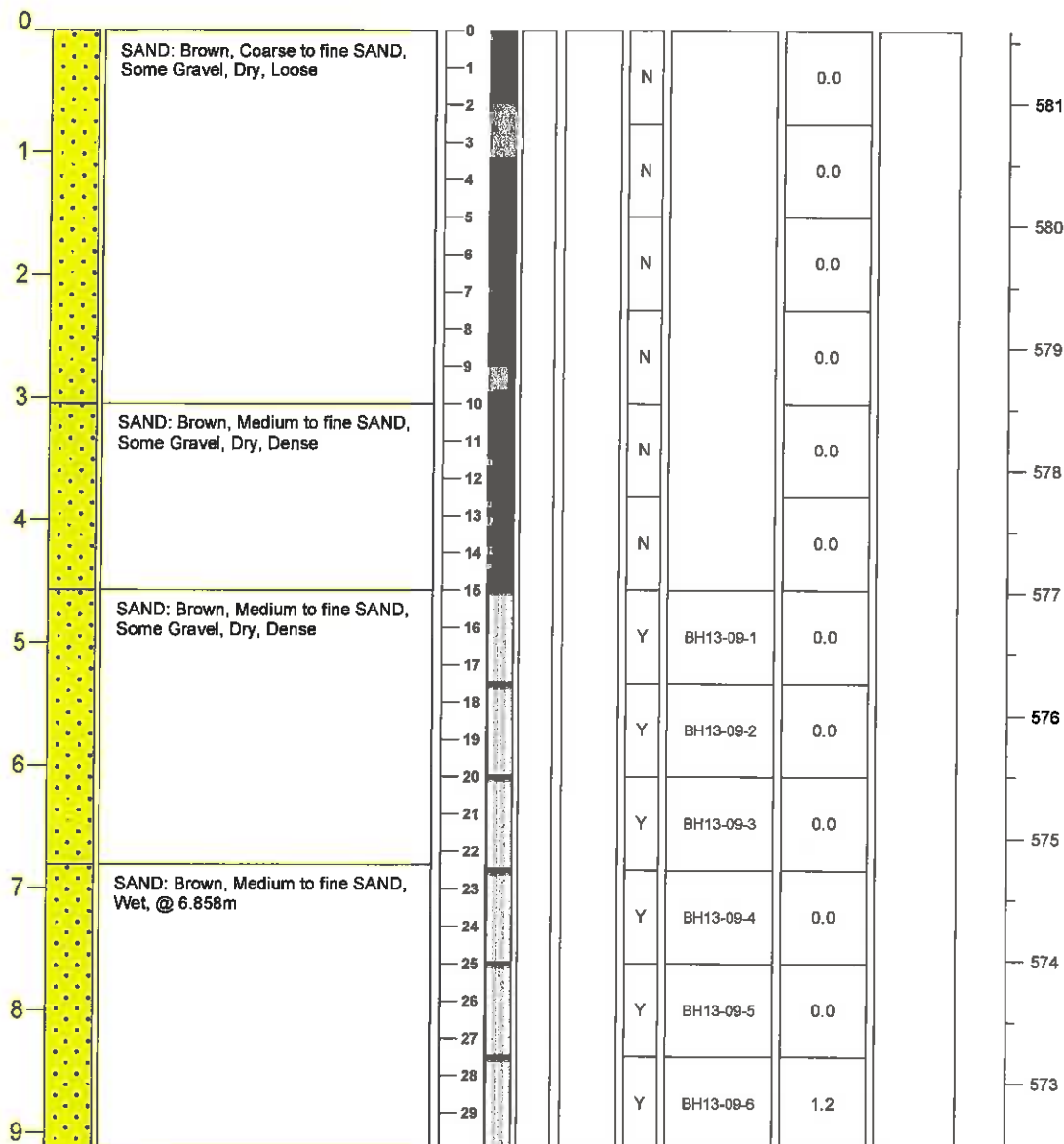
### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: odex/SPT Other:

| Lithologic Description |        | Soil Sampling |   | Headspace Analysis    |           | Elevation (masl) |
|------------------------|--------|---------------|---|-----------------------|-----------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type<br>% Recovery<br>Blow Count | Sample Analyzed (Y,N) | Sample ID |                  |
|                        |        |               |   |                       |           |                  |
|                        |        |               |   |                       | PPM       | % LEL            |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-10

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643207

Easting: 528329

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |        | Soil Sampling |             |            | Headspace Analysis |                       | Elevation (masl) |           |     |
|------------------------|--------|---------------|-------------|------------|--------------------|-----------------------|------------------|-----------|-----|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count         | Sample Analyzed (Y,N) |                  | Sample ID | PPM |

|   |  |    |   |           |     |     |
|---|--|----|---|-----------|-----|-----|
| 0 | SAND: Dark Brown, Medium to fine SAND, Some Silt, Dry, Loose | 0  | N |           | 0.3 | 581 |
| 1 | SAND: Brown, Coarse to fine SAND, Some Gravel, Dry, Loose    | 1  | N |           | 0.0 | 580 |
| 2 | SAND: Brown, Medium to fine SAND, Tr Gravel, Dry, Loose      | 2  | N |           | 0.0 | 579 |
| 3 |  | 3  | N |           | 0.2 | 578 |
| 4 | Fine Sand: Gray, Fine SAND, Dry, Loose                       | 4  | N |           | 0.0 | 577 |
| 5 | SAND: Brown, Medium to fine SAND, Dry, Loose                 | 5  | N |           | 0.1 | 576 |
| 6 | SAND: Brown, Medium to fine SAND, Tr Silt, Moist, Loose      | 6  | Y | BH13-10-1 | 0.0 | 575 |
| 7 | SAND: Brown, Coarse to Medium SAND, Wet @ 7.62m              | 7  | Y | BH13-10-2 | 0.0 | 574 |
| 8 |  | 8  | Y | BH13-10-3 | 0.0 | 573 |
| 9 |  | 9  | Y | BH13-10-4 | 0.0 |     |
|   |  | 10 | Y | BH13-10-5 | 0.0 |     |
|   |  | 11 | Y | BH13-10-6 | 0.0 |     |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-11

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643187

Easting: 528374

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 24, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |   | Soil Sampling |             |            |            | Headspace Analysis    |           | Elevation (masl) |
|------------------------|---|---------------|-------------|------------|------------|-----------------------|-----------|------------------|
| Depth (mbgs)           | Symbol  | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID |                  |
|                        |   |               |             |            |            |                       | PPM       | % LEL            |
| 0                      |   | 0             |             |            |            |                       |           |                  |
|                        | SAND: Dark Brown, Medium to fine SAND, Some Silt, Dry, Loose      | 1             |             |            |            | N                     |           | 0.0              |
| 1                      |   | 2             |             |            |            |                       |           |                  |
|                        |   | 3             |             |            |            | N                     |           | 0.0              |
| 2                      |   | 4             |             |            |            |                       |           |                  |
|                        | SAND: Brown, Coarse to Medium GRAVEL, Some Sand, Dry, Loose       | 5             |             |            |            |                       |           |                  |
|                        |   | 6             |             |            |            | N                     |           | 0.0              |
|                        |   | 7             |             |            |            |                       |           |                  |
|                        | SAND: Brown, Coarse to fine SAND, Tr Gravel, Dry, Loose           | 8             |             |            |            | N                     |           | 0.0              |
| 3                      |   | 9             |             |            |            |                       |           |                  |
|                        |   | 10            |             |            |            | N                     |           | 0.0              |
|                        | Gravel and Sand: Brown Medium to Fine SAND and GRAVEL, Dry, Loose | 11            |             |            |            |                       |           |                  |
|                        |   | 12            |             |            |            | N                     |           | 0.0              |
| 4                      |   | 13            |             |            |            |                       |           |                  |
|                        |   | 14            |             |            |            | N                     |           | 0.0              |
|                        |   | 15            |             |            |            |                       |           |                  |
|                        | SAND: Brown, Medium to fine SAND, Tr Gravel, Dry, Loose           | 16            |             |            |            | Y                     | BH13-11-1 | 0.8              |
| 5                      |   | 17            |             |            |            |                       |           |                  |
|                        |   | 18            |             |            |            | Y                     | BH13-11-2 | 0.8              |
|                        |   | 19            |             |            |            |                       |           |                  |
|                        |   | 20            |             |            |            | Y                     | BH13-11-3 | 1.0              |
| 6                      |   | 21            |             |            |            |                       |           |                  |
|                        | SAND: Brown, Medium to fine SAND, Some Gravel, Wet @ 6.858m       | 22            |             |            |            |                       |           |                  |
|                        |   | 23            |             |            |            | Y                     | BH13-11-4 | 0.9              |
| 7                      |   | 24            |             |            |            |                       |           |                  |
|                        |   | 25            |             |            |            | Y                     | BH13-11-5 | 0.5              |
|                        |   | 26            |             |            |            |                       |           |                  |
| 8                      |   | 27            |             |            |            | Y                     | BH13-11-6 | 0.3              |
|                        |   | 28            |             |            |            |                       |           |                  |
| 9                      |   | 29            |             |            |            |                       |           |                  |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-12

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643174

Easting: 528358

Datum: n/a

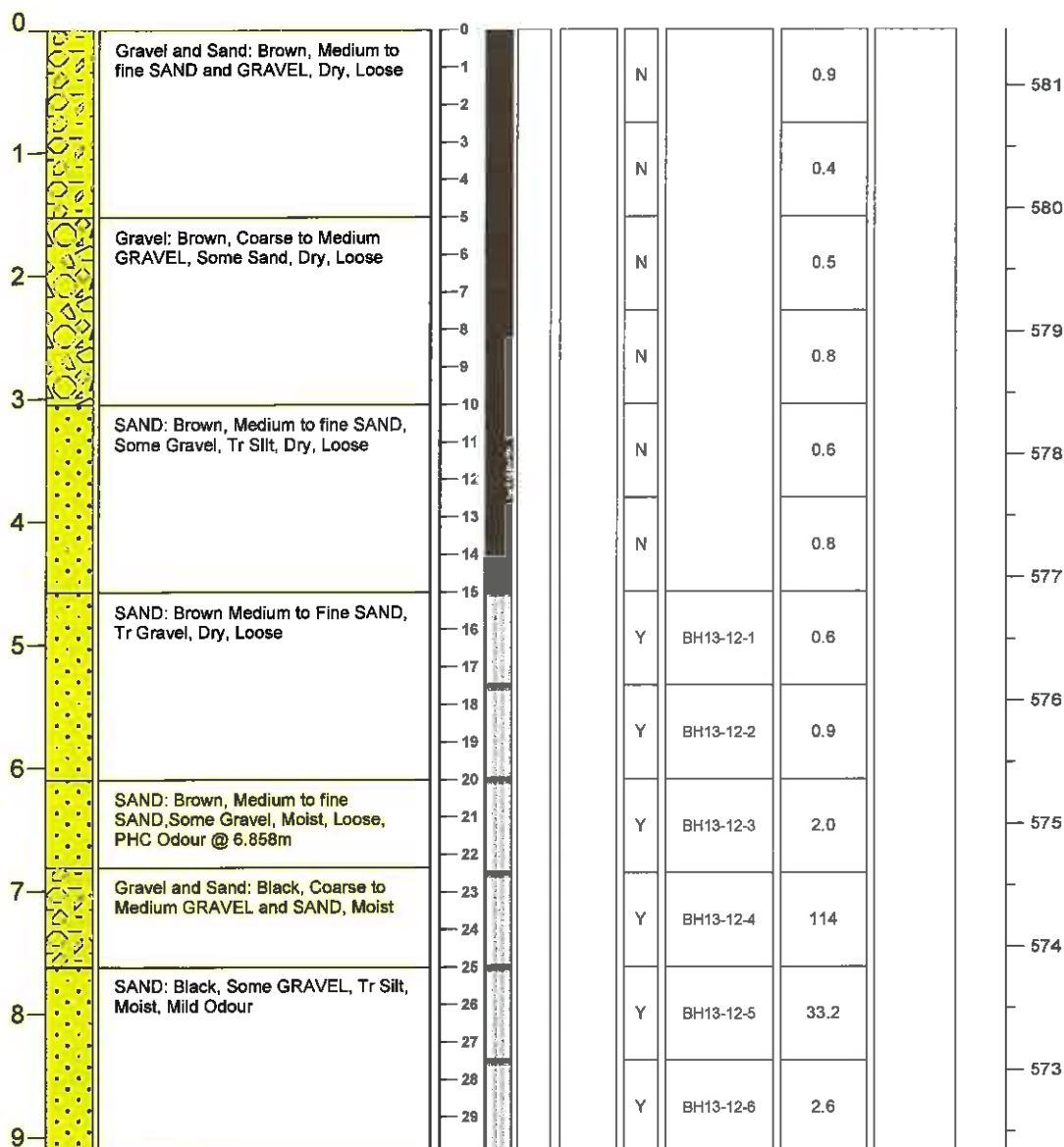
### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 28, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description | Soil Sampling  | Headspace Analysis |       | Elevation (masl) |
|------------------------|--|--------------------|-------|------------------|
|                        |  | PPM                | % LEL |                  |
| Depth (mbgs)<br>Symbol | Depth (ftbgs)<br>Sample Type<br>% Recovery<br>Blow Count<br>Sample Analyzed (Y,N)<br>Sample ID |                    |       |                  |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR



Project Name: Lower Post

## BOREHOLE : BH13-13

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643173

Easting: 528365

Datum: n/a

### Drilling Details

Drill Contractor: Geotech

Depth of Drilled Hole (mbgs): 9.14

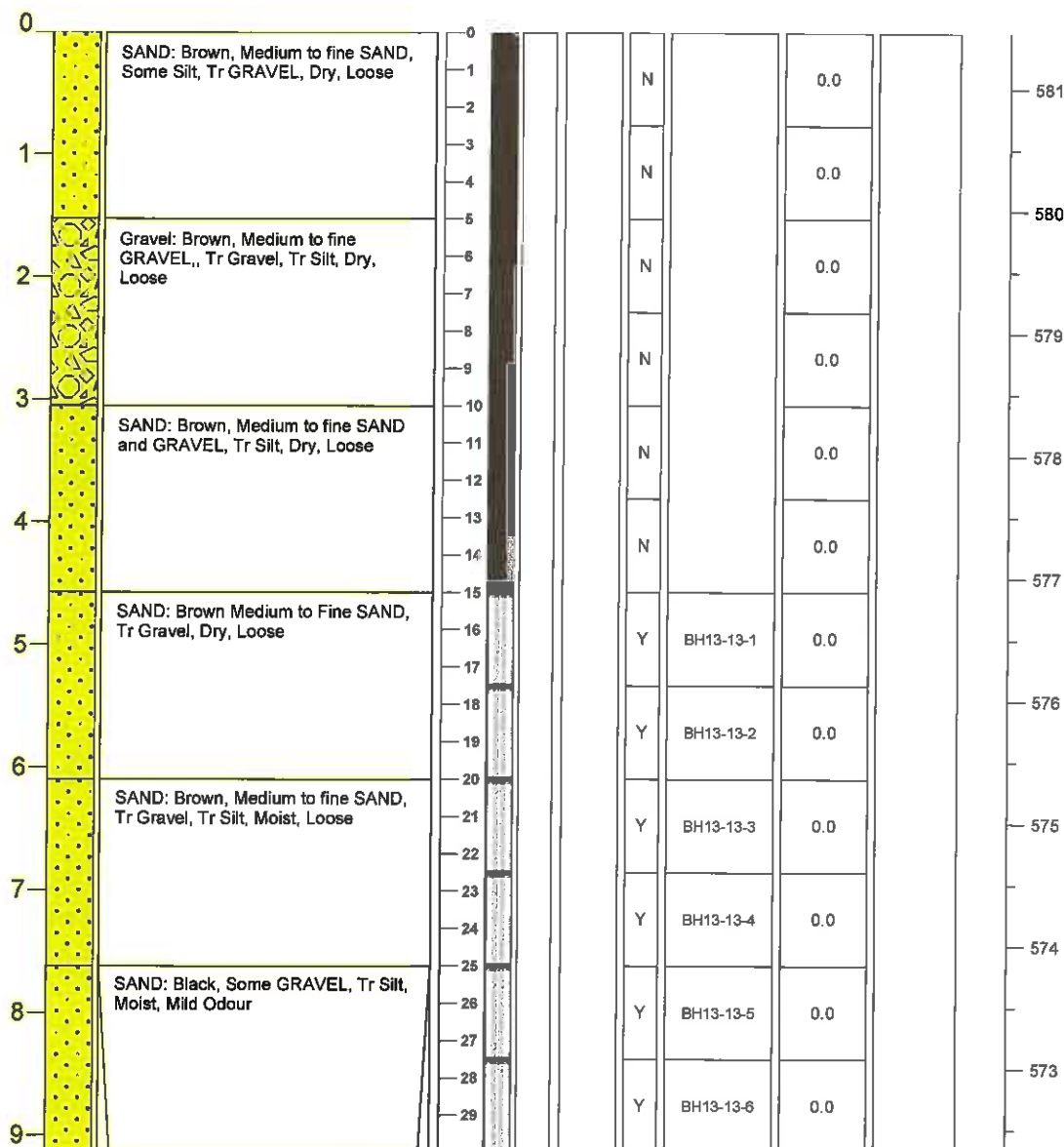
Drill Date: Jan 28, 2014

Drillhole Diameter (inch): 4"

Drill Method: ODEX/SPT

Other:

| Lithologic Description |        | Soil Sampling |             |            |            | Headspace Analysis    |           | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|------------|-----------------------|-----------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID |                  |
|                        |        |               |             |            |            |                       | PPM       | % LEL            |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-13

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643173

Easting: 528365

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 28, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |        | Soil Sampling |             |            |            |                       | Headspace Analysis |     | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|------------|-----------------------|--------------------|-----|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM | % LEL            |

SAND: Brown, Medium to fine SAND,  
Tr Gravel, Tr Silt, Moist, Loose, wet @  
8.382m



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR

Project Name: Lower Post

## BOREHOLE : BH13-14

Project Number: 00069

Location: Lower Post

### Coordinates

Northing: 6643184

Easting: 528336

Datum: n/a

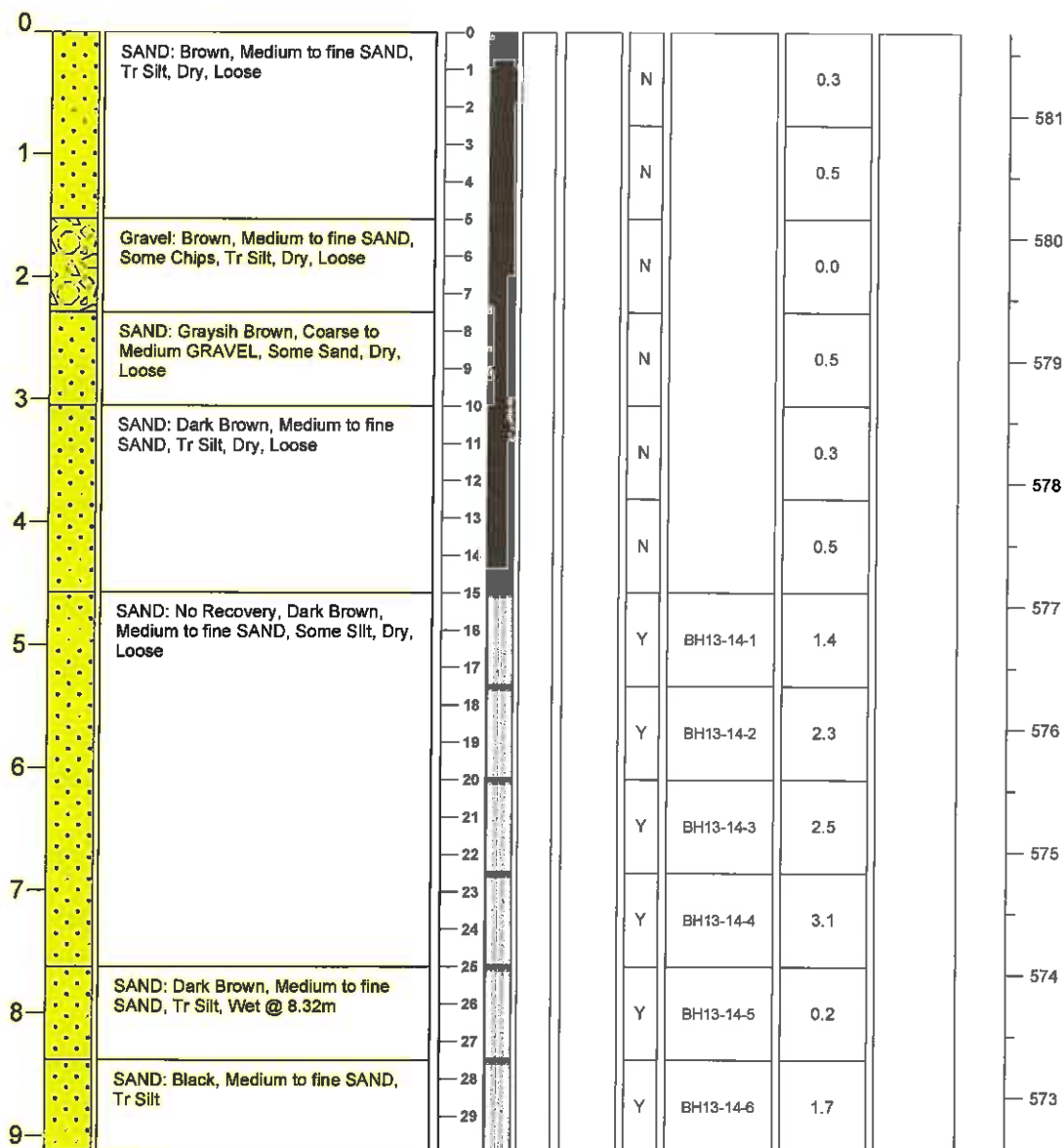
### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 29, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |        | Soil Sampling |             |            | Headspace Analysis |                       | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|--------------------|-----------------------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count         | Sample Analyzed (Y,N) |                  |
|                        |        |               |             |            |                    |                       |                  |
|                        |        |               |             |            |                    | Sample ID             |                  |
|                        |        |               |             |            |                    | PPM                   | % LEL            |



Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR



Project Name: Lower Post

# BOREHOLE : BH13-15

Project Number: 00069

Location: Lower Post

## Coordinates

Northing: 6643193

Easting: 528372

Datum: n/a

## Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Jan 28, 2014 Drillhole Diameter (inch): 4"

Drill Method: odex/SPT Other:

| Lithologic Description |  | Soil Sampling |             |            |            |                       | Headspace Analysis |     | Elevation (masl) |       |
|------------------------|--|---------------|-------------|------------|------------|-----------------------|--------------------|-----|------------------|-------|
| Depth (mbgs)           | Symbol   | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM |                  | % LEL |
| 0                      |  | 0             |             |            |            |                       |                    |     |                  | 581   |
|                        | SAND: Brown, Medium to fine SAND, Tr Silt, Dry, Loose                  | 1             |             |            |            | N                     |                    | 0.0 |                  |       |
| 1                      |  | 2             |             |            |            | N                     |                    | 0.0 |                  | 580   |
|                        | SAND: Brown, Medium to fine SAND, Some Gravel, Dry, Loose              | 3             |             |            |            | N                     |                    | 0.0 |                  |       |
| 2                      |  | 4             |             |            |            | N                     |                    | 0.0 |                  | 579   |
|                        | Gravel: Brown, Coarse GRAVEL, Medium to fine Sand, Tr Silt, Dry, Loose | 5             |             |            |            | N                     |                    | 0.0 |                  |       |
| 3                      |  | 6             |             |            |            | N                     |                    | 0.0 |                  | 578   |
|                        | SAND: Brown, Medium to fine SAND, Some Gravel, Dry, Loose              | 7             |             |            |            | N                     |                    | 0.0 |                  |       |
| 4                      |  | 8             |             |            |            | N                     |                    | 0.0 |                  | 577   |
|                        | SAND: Brown, Coarse to Medium GRAVEL, Dry, Loose                       | 9             |             |            |            | N                     |                    | 0.0 |                  |       |
| 5                      |  | 10            |             |            |            | N                     |                    | 0.0 |                  | 576   |
|                        | SAND: Brown, Coarse to Medium GRAVEL, Dry, Loose                       | 11            |             |            |            | N                     |                    | 0.0 |                  |       |
| 6                      |  | 12            |             |            |            | N                     |                    | 0.0 |                  | 575   |
|                        | SAND: Dark Brown, Medium to fine SAND, Some Silt, Moist                | 13            |             |            |            | N                     |                    | 0.0 |                  |       |
| 7                      |  | 14            |             |            |            | N                     |                    | 0.0 |                  | 574   |
|                        | SAND: Black, Coarse GRAVEL, Medium to fine Sand, Wet @ 7.62m           | 15            |             |            |            | N                     |                    | 0.0 |                  |       |
| 8                      |  | 16            |             |            |            | N                     |                    | 0.0 |                  | 573   |
|                        | SAND: Black, Medium to fine SAND, Some Gravel, Tr Silt, Wet            | 17            |             |            |            | N                     |                    | 0.0 |                  |       |
| 9                      |  | 18            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 19            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 20            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 21            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 22            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 23            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 24            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 25            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 26            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 27            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 28            |             |            |            | N                     |                    | 0.0 |                  |       |
|                        |  | 29            |             |            |            | N                     |                    | 0.0 |                  |       |

Report Date: March 04

Approved by: JT

Client: PWGSC

Logged by: VR



Project Name: Lower Post

## BOREHOLE : BH13-16

Project Number: 00069

Location: Lower Post, BC

### Coordinates

Northing: 6643199

Easting: 528334

Datum: n/a

### Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Feb 21, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |        | Soil Sampling |             |            |            | Headspace Analysis    |           | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|------------|-----------------------|-----------|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID |                  |
|                        |        |               |             |            |            |                       | PPM       | % LEL            |
| 0                      |        | 0             |             |            |            | N                     | 25        | 581              |
| 1                      |        | 1             |             |            |            | N                     | 5         | 580              |
| 2                      |        | 2             |             |            |            | N                     | 10        | 579              |
| 3                      |        | 3             |             |            |            | N                     | 10        | 578              |
| 4                      |        | 4             |             |            |            | N                     | 5         | 577              |
| 5                      |        | 5             |             |            |            | N                     | 0         | 576              |
| 6                      |        | 6             |             |            |            | N                     | 0         | 575              |
| 7                      |        | 7             |             |            |            | N                     | 0         | 574              |
| 8                      |        | 8             |             |            |            | N                     | 140       | 573              |
| 9                      |        | 9             |             |            |            | N                     | 15        |                  |
|                        |        | 10            |             |            |            | N                     | 0         |                  |
|                        |        | 11            |             |            |            | N                     | 0         |                  |
|                        |        | 12            |             |            |            | N                     | 0         |                  |
|                        |        | 13            |             |            |            | N                     | 0         |                  |
|                        |        | 14            |             |            |            | N                     | 0         |                  |
|                        |        | 15            |             |            |            | N                     | 0         |                  |
|                        |        | 16            |             |            |            | N                     | 0         |                  |
|                        |        | 17            |             |            |            | N                     | 0         |                  |
|                        |        | 18            |             |            |            | N                     | 0         |                  |
|                        |        | 19            |             |            |            | N                     | 0         |                  |
|                        |        | 20            |             |            |            | N                     | 0         |                  |
|                        |        | 21            |             |            |            | N                     | 0         |                  |
|                        |        | 22            |             |            |            | N                     | 0         |                  |
|                        |        | 23            |             |            |            | N                     | 0         |                  |
|                        |        | 24            |             |            |            | N                     | 0         |                  |
|                        |        | 25            |             |            |            | N                     | 0         |                  |
|                        |        | 26            |             |            |            | N                     | 0         |                  |
|                        |        | 27            |             |            |            | N                     | 0         |                  |
|                        |        | 28            |             |            |            | N                     | 0         |                  |
|                        |        | 29            |             |            |            | N                     | 0         |                  |



Report Date: March 3, 2014 Approved by: JT

Client: PWGSC Logged by: VR

Project Name: Lower Post

# BOREHOLE : BH13-17

Project Number: 00069

Location: Lower Post, BC

## Coordinates

Northing: 6643175

Easting: 528335




Datum: n/a

## Drilling Details

Drill Contractor: Geotech Depth of Drilled Hole (mbgs): 9.14

Drill Date: Feb 21, 2014 Drillhole Diameter (inch): 4"

Drill Method: Odex/SPT Other:

| Lithologic Description |   | Soil Sampling |  |            |            |                       | Headspace Analysis |            | Elevation (masl) |       |     |
|------------------------|---|---------------|--|------------|------------|-----------------------|--------------------|------------|------------------|-------|-----|
| Depth (mbgs)           | Symbol  | Depth (ftbgs) | Sample Type  | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM        |                  | % LEL |     |
| 0                      |   | 0             |  |            |            |                       |                    |            |                  |       |     |
|                        |   | 1             |  |            |            |                       | N                  |            | 10               |       | 581 |
| 1                      |   |               |  | 2          |            |                       | N                  |            | 15               |       |     |
|                        |   |               |  | 3          |            |                       | N                  |            | 5                |       | 580 |
| 2                      |   |               |  | 4          |            |                       | N                  |            | 20               |       | 579 |
|                        |   |               |  | 5          |            |                       | N                  |            | 5                |       | 578 |
| 3                      |   |               |  | 6          |            |                       | N                  |            | 10               |       | 577 |
|                        |   |               |  | 7          |            |                       | N                  |            | 15               |       | 576 |
| 4                      |   |               |  | 8          |            |                       | N                  | BH13-16-08 | 15               |       | 575 |
|                        |   |               |  | 9          |            |                       | N                  |            | 10               |       |     |
| 5                      |  | 10            |  |            |            |                       |                    |            |                  |       |     |
|                        |   | 11            |  |            |            | Y                     | BH13-16-10         | 5          |                  | 574   |     |
| 6                      |   |               | 12   |            |            | N                     |                    | 5          |                  |       |     |
|                        |   |               | 13   |            |            | Y                     |                    | 0          |                  | 573   |     |
| 7                      |   |               | 14   |            |            |                       |                    |            |                  |       |     |
|                        |   |               | 15   |            |            |                       |                    |            |                  |       |     |
| 8                      |   |               | 16   |            |            |                       |                    |            |                  |       |     |
|                        |   |               | 17   |            |            |                       |                    |            |                  |       |     |
| 9                      |   |               | 18   |            |            |                       |                    |            |                  |       |     |
|                        |   |               | 19   |            |            |                       |                    |            |                  |       |     |

Report Date: March 3, 2014 Approved by: JT

Client: PWGSC Logged by: VR



**Project Name:** Lower Post

# BOREHOLE : BH13-19

**Project Number:** 00069

**Location:** Lower Post

## Coordinates

**Northing:** 6643191

**Easting:** 528345

**Datum:** n/a

## Drilling Details

**Drill Contractor:** Geotech

**Depth of Drilled Hole (mbgs):** 9.14

**Drill Date:** Jan 29, 2014

**Drillhole Diameter (inch):** 4"

**Drill Method:** Odex/SPT

**Other:**

| Lithologic Description |        | Soil Sampling |             |            |            |                       | Headspace Analysis |     | Elevation (masl) |
|------------------------|--------|---------------|-------------|------------|------------|-----------------------|--------------------|-----|------------------|
| Depth (mbgs)           | Symbol | Depth (ftbgs) | Sample Type | % Recovery | Blow Count | Sample Analyzed (Y,N) | Sample ID          | PPM | % LEL            |

|   |   |    |   |  |  |           |  |     |  |     |
|---|---|----|---|--|--|-----------|--|-----|--|-----|
| 0 |   |    |   |  |  |           |  |     |  |     |
|   | Sand: Brown, Medium to fine SAND, Tr Gravel, Tr Silt, Dry, Loose            | 0  |   |  |  | N         |  | 0.1 |  |     |
| 1 |   | 1  |   |  |  |           |  |     |  | 581 |
|   | Gravel and Sand: Brown, Medium to fine SAND and Gravel, Tr Silt, Dry, Loose | 2  |   |  |  | N         |  | 0.0 |  |     |
| 2 |   | 3  |   |  |  |           |  |     |  |     |
|   |   | 4  |   |  |  |           |  |     |  |     |
| 3 |   | 5  |   |  |  |           |  |     |  | 580 |
|   | Gravel: Light Brown, Coarse GRAVEL, Some Sand, Dry                          | 6  |   |  |  | N         |  | 0.0 |  |     |
| 4 |   | 7  |   |  |  |           |  |     |  |     |
|   | Sand: Brown, Medium to fine Sand, Some Gravel, Dry                          | 8  |   |  |  |           |  |     |  |     |
| 5 |   | 9  |   |  |  | N         |  | 0.0 |  | 579 |
|   |   | 10 |   |  |  |           |  |     |  |     |
| 6 |   | 11 |   |  |  |           |  |     |  |     |
|   | Sand: Brown, Medium to fine SAND, Tr Gravel, Dry                            | 12 |   |  |  | N         |  | 0.0 |  | 578 |
| 7 |   | 13 |   |  |  |           |  |     |  |     |
|   |   | 14 |   |  |  |           |  |     |  |     |
| 8 |   | 15 |   |  |  | N         |  | 1.7 |  |     |
|   |   | 16 |   |  |  |           |  |     |  |     |
| 9 |   | 17 |   |  |  |           |  |     |  | 577 |
|   | Sand: Brown, Medium to fine SAND, Tr Gravel, Dry                            | 18 | Y |  |  | BH13-19-1 |  | 0.0 |  |     |
|   |   | 19 |   |  |  |           |  |     |  |     |
|   |   | 20 | Y |  |  | BH13-19-2 |  | 0.0 |  | 576 |
|   |   | 21 |   |  |  |           |  |     |  |     |
|   | Sand: Dark Brown, Medium to fine SAND, Tr Gravel, Tr Silt, Moist            | 22 | Y |  |  | BH13-19-3 |  | 0.0 |  | 575 |
|   |   | 23 |   |  |  |           |  |     |  |     |
|   | Sand: Brown, Medium to fine SAND, Some Silt, Moist                          | 24 | Y |  |  | BH13-19-4 |  | 0.0 |  |     |
|   |   | 25 |   |  |  |           |  |     |  |     |
|   | Sand: Black, Medium to fine SAND, Tr Gravel, Wet @ 8.382m                   | 26 | Y |  |  | BH13-19-5 |  | 0.0 |  | 574 |
|   |   | 27 |   |  |  |           |  |     |  |     |
|   | Sand: Black, Medium to fine SAND, Tr Gravel, Tr Silt, Wet                   | 28 | Y |  |  | BH13-19-6 |  | 0.0 |  | 573 |
|   |   | 29 |   |  |  |           |  |     |  |     |



**Report Date:** March 04

**Approved by:** JT

**Client:** PWGSC

**Logged by:** VR

