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Peer Review

*Supplemental Geotechnical Survey and Testing Report –
Part of Lots 14 & 15, Concession 1, Geographic Township of
Dummer, prepared by WSP Canada Inc. dated March 23,
2020 (Report)*



Purpose:

- Cambium's peer review was performed to evaluate and ensure that the conclusions in the supplemental report meet the purpose of the investigation and are supported by the testing and background information including:
- Current availability and future potential of aggregate resources within the Edwards Pit (Site)
 - More frequent sampling and testing of the deposits within the esker in order to better assess it's potential use and value
- Assess the suitability of re-licensing the Site, or a portion of the Site, as a quarry
 - Sampling and testing the Bobcaygeon Formation Limestone to assess its potential to be used as aggregate materials
- *The following slides provide a summary of the report including Cambiums comments*

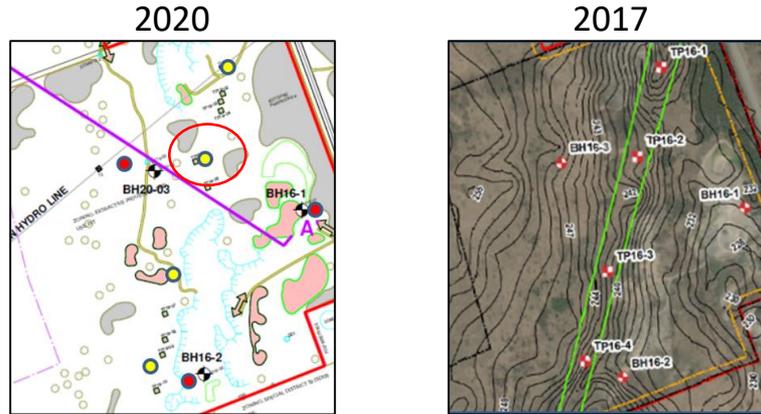


2020 Investigation



Esker Test Pitting (Section 2.1)

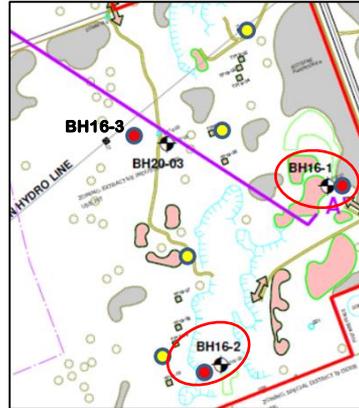
- a total of ten (10) additional TPs were advanced within the Esker deposit



- *Field work program was a reasonable choice*
 - *Consideration could have been given to space test pits more evenly throughout the deposit, although access may have been a limiting factor*
 - *T19-05 is located at approximately the same location as TP16-2*

Bedrock Investigation (Section 2.2)

- Three (3) additional bore holes were advanced at the Site for the purpose of sampling and testing Bobcaygeon Formation Limestone
 - Cored Bobcaygeon Fm limestone from BH16-1 was incorporated into the testing of this supplemental investigation, for a total of four (4) Bobcaygeon Fm samples



- *More accurate elevations and coordinates could have been obtained, using an RTK (or similar) unit, in order to tie into and supplement future investigations or development at the site.*

Laboratory Testing (Section 2.3)

- Material from each of the ten (10) Test Pits were tested for Gradation and Physical Properties
 - Gradation, Micro-Deval Abrasion (Fine and Coarse Fraction), Relative Density/Absorption (Fine and Coarse Fraction), Plasticity of Fines
- Material from four (4) Bobcaygeon Fm bedrock cores were tested for Physical Properties
 - Gradation, Micro-Deval Abrasion (Fine and Coarse Fraction), Relative Density/Absorption (Fine and Coarse Fraction), Freeze-Thaw Loss
- *In general the types of testing and number of tests are considered sufficient*
- *As stated in Cambium's previous peer review, "it is somewhat misleading and unnecessary to compare the gradations of the 1" minus crushed limestone product (or 19 mm size in this report), which was purposely created from the bedrock cores to allow for other testing, to the gradation envelopes for Granular A", Granular B, etc."*



Laboratory Testing (Section 2.3)

- A sufficient number of samples tested for each of:
 - unconsolidated esker material
 - Bobcaygeon Fm bedrock,
- Verulam Fm bedrock, may be underrepresented:
 - additional Verulam Fm cored during the course of the supplementary investigation.
 - The original investigation showed varying results from the two cores tested.

| Test Pit ID | Sample ID | Gradation with Wash (%) Result | Micro-Deval Coarse (Loss %) Result | Micro-Deval Fine (Loss %) Result | Absorption Result | Plastic Fines (Y/N) | Freeze-Thaw |
|---|---------------------|--------------------------------|------------------------------------|----------------------------------|-------------------|---------------------|-------------|
| A) Unconsolidated Material (Esker) | | | | | | | |
| TP16-4 | CGS2 | 3.1 | 24.2 | 14.0 | 2.4 | N | |
| B) Consolidated Material (Bedrock) | | | | | | | |
| BH16-3 | 238.8 to 248.0 mASL | -- | 21.7 | 22.9 | 0.9 | -- | 5.6% |
| BH16-4 | 250.5 to 256.4 mASL | -- | 28.4 | 19.8 | 1.1 | -- | 11.7% |



Laboratory Analysis Aggregate (Sect. 3.3)

- A note in Appendix E-1 states that some Micro-Deval (coarse) results were not completed to the standard of testing (LS-618) due to insufficient amount of samples provided, and that results may not be accurate
 - This is not reflected in Table 3-2 (TP19-01, TP19-08, TP19-09, TP19-10)
 - Sample sizes from test pits should not have been an issue
- Micro-Deval (coarse) % loss for TP19-08 is presented as 20.3 in Table 3-2, but appears as 20.6 in Appendix E-1.



Conclusions



Unconsolidated Esker Material (Section 4.1)

- *OPSS Physical Quality Requirements*
 - *In general, reported results comply with OPSS 1010 physical quality requirements for both Granular A & B, except TP19-06, which had a MD(coarse) result 0.1% higher than maximum allowable of 25.0% loss*
- *OPSS Gradation Requirements*
 - *All samples meet requirements for Granular B Type I, except TP19-01 & TP19-03*
 - *Granular A, and Granular B Type I for the two samples above, require some combination of screening, crushing, blending to meet OPSS Requirements*



Unconsolidated Esker Material (Section 4.1)

- *Winter Sand*
 - It is agreed that the total fines (<75 um) of the samples range between 1.95% and 7.2%, however
 - *sand fraction appears to ranges 7% to 62%, not 2.6% to 21%, based on particle size distribution results from Appendix E-3 of the report*
 - The report states “maximum percent for sand fraction is 5% for Winter Sand”
 - *although it is believed this is an editing error, and should be maximum acceptable fines for winter sand is 5%.*
 - *Based on this, the report incorrectly states that eight out of ten test pit samples were unacceptable for use as winter sand due to excess fines, and should read three out of ten samples were unacceptable for use as winter sand due to excess fines.*



Unconsolidated Esker Material (Section 4.1)

- *Absorption*
 - Report discussed absorption results of fine fraction (LS-605) exceeding 2 % maximum allowable
 - *Superpave 12.5 and HMA are based on the absorption of the coarse fraction (LS-604)*
 - *Absorption of the coarse fraction (LS-604) range from 0.71% to 1.65 %, well below 2 % and acceptable for use in most HMA, if it weren't for the failing Micro-Deval Results*
 - *Micro-Deval (coarse fraction) does not meet the OPSS requirement for concrete and asphalt*
 - *Absorption (fine fraction LS-605) was not required for the unconsolidated material*
 - *Absorption (coarse fraction LS-604) was only required to assess potential for use as in surface treatment, otherwise not required for the unconsolidated material as*
 - *M-D (coarse) > 21 % loss in 8/10 samples, therefore not acceptable for HMA and concrete*
 - *The discussion of absorption results is misleading and incorrect and should be removed or edited.*
- *The above discussion has no impact on the proposed uses for the material*



Unconsolidated Esker Material (Section 4.1)

- *It would be beneficial to include a summary table showing exactly what OPSS aggregate materials each unconsolidated sample may be used for and where some form of screening, crushing, blending may be required to achieve the desired product*



Consolidated Material (Section 4.2)

- *As previously stated, it is somewhat misleading and unnecessary to compare the gradations of the 1" minus crushed limestone product (or 19 mm size in this report), which was purposely created from the bedrock cores to allow for other testing, to the gradation envelopes for Granular A", Granular B, etc.*
- The report states that samples analysed for Micro-Deval (coarse fraction) from BH20-03 and BH16-1 meet the OPSS requirement for concrete and asphalt but,
 - *fails to state that the samples analysed for Micro-Deval (fine fraction) do not meet the OPSS requirement for concrete, some Superpave surface courses, HL3, HL3F, and HL3HS. These results should be reviewed*
- *It would be beneficial to include a summary table showing exactly what OPSS aggregate materials each consolidated sample may be used for*

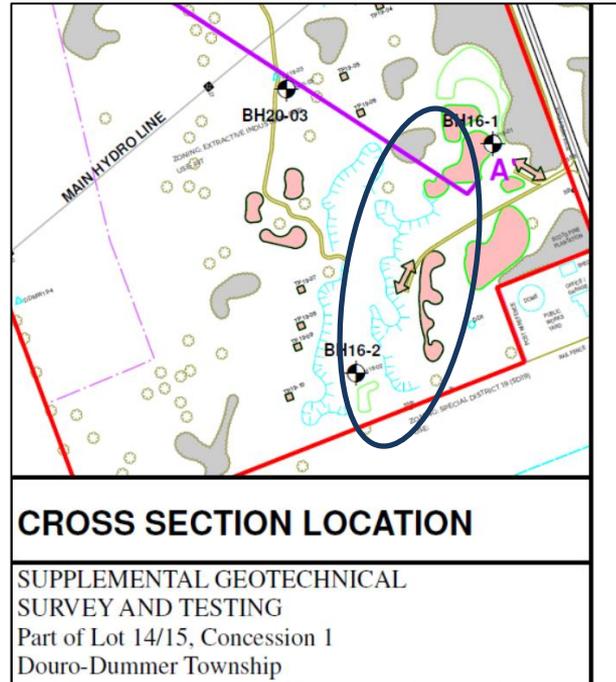


Appendices



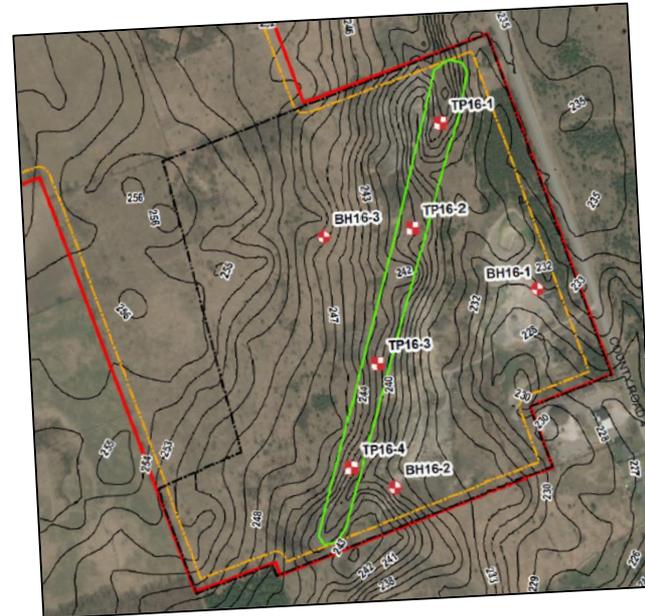
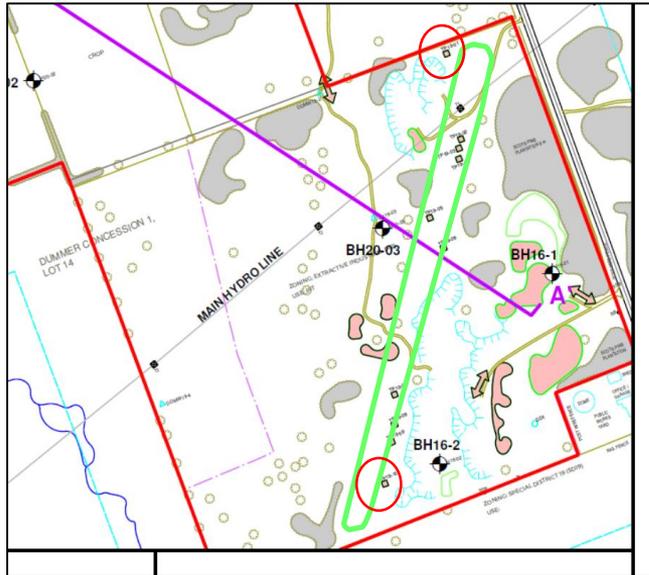
Appendix A

- It appears the extraction face is drawn backwards on the SE corner of the pit, behind the public works yard*



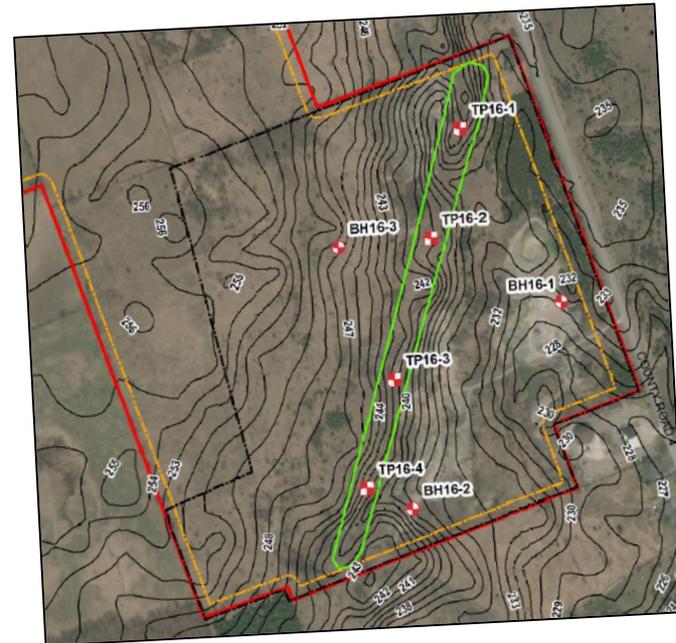
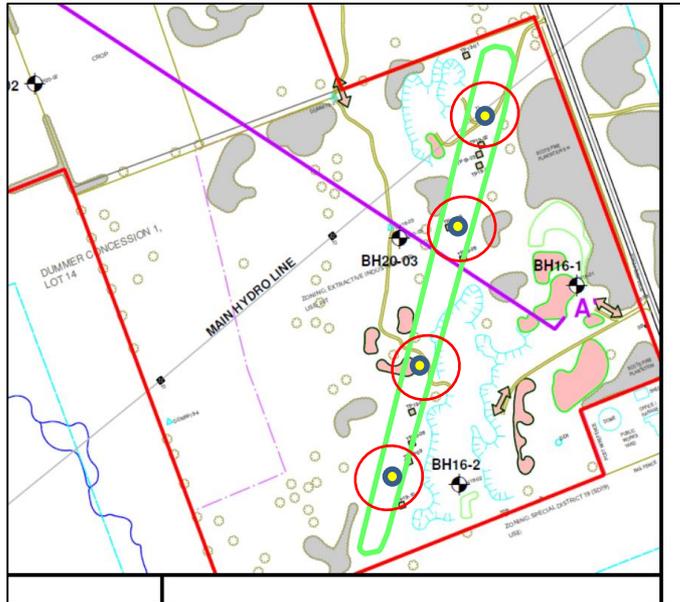
Appendix A

- Test Pits TP19-01 and TP19-10 appear to be located outside the boundary of the esker, yet still possess quality material.
 - Is the Esker wider than anticipated
 - Is there quality material adjacent to the esker



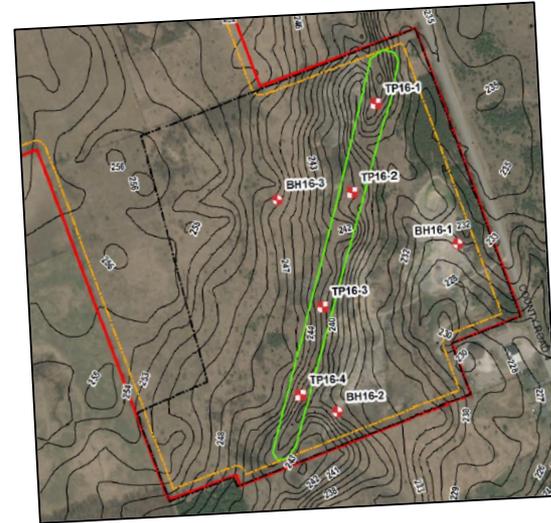
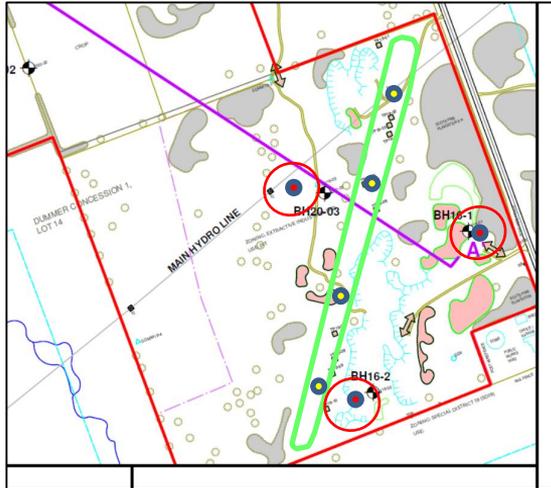
Appendix A

- It would be beneficial for the Client, and to anyone reading the report, to include the location of the four (4) original test pits, from the 2016 investigation, on this plan.



Appendix A

- It would be beneficial for the Client, and to anyone reading the report, to include the location of all original boreholes, from the 2016 investigation, on this plan.



- More accurate elevations and coordinates could have been obtained, using an RTK (or similar) unit, in order to tie into and supplement future investigations or development at the site.

Appendix D

- Section 2.1 states that representative samples were collected from each stratigraphic layer for inspection and subsequent laboratory analysis.
 - The test pit logs in Appendix C indicate that in many test pits there are several samples taken.
 - It is not clear as to which samples were used for analysis for each test pit and why.

| wsp | | TEST PIT NO. 19-08 | | PAGE 1 of 1 | | | | | | | | | | | | |
|---|--|------------------------------|-----------------|-------------|---------|------------|---------------|------------------|---|----|-----------------|----|---|---------|---|---|
| PROJECT NAME: EDWARDS PIT | | PROJECT NO.: 161-16604-00 | | | | | | | | | | | | | | |
| CLIENT: CORPORATION OF THE TOWNSHIP OF DOURO DUMMER | | DATE COMPLETED: Dec 05, 2019 | | | | | | | | | | | | | | |
| TEST PIT TYPE: OPEN HOLE EXCAVATION | | SUPERVISOR: MN | | | | | | | | | | | | | | |
| GROUND ELEVATION: 246.6 m | | REVIEWER: GB | | | | | | | | | | | | | | |
| DEPTH (m) | STRATIGRAPHIC DESCRIPTION | STRATIGRAPHIC | MONITOR DETAILS | | SAMPLE | | | CORE PENETRATION | | | WATER CONTENT % | | | REMARKS | | |
| | | | TYPE | DPT VALUE | % WATER | % RECOVERY | FIELD'S GRAIN | DPT VALUE | 1 | 10 | 20 | 30 | W | | W | W |
| 0.0 | TOPSOIL | ALL | | | | | | | | | | | | | | |
| 0.3 | SAND Brown coarse to medium SAND, some gravel, trace silt, most | | 001 | | | | | | | | | | | | | SAND |
| 1.2 | SAND AND GRAVEL Brown SAND AND GRAVEL, some cobbles, trace silt, most | | 002 | | | | | | | | | | | | | SAND AND GRAVEL |
| 3.5 | COBBLES AND BOULDERS Brown frequent large COBBLES AND BOULDERS, and sand and gravel, most | | | | | | | | | | | | | | | COBBLES AND BOULDERS (no sample taken) |
| 5.0 | Test pit terminated at 5 m below ground surface in COBBLES AND BOULDERS | | | | | | | | | | | | | | | Test pit open and dry upon completion. |

| wsp | | TEST PIT NO. 19-02 | | PAGE 1 of 1 | | | | | | | | | | | | |
|---|---|------------------------------|-----------------|-------------|---------|------------|---------------|------------------|---|----|-----------------|----|---|---------|---|--|
| PROJECT NAME: EDWARDS PIT | | PROJECT NO.: 161-16604-00 | | | | | | | | | | | | | | |
| CLIENT: CORPORATION OF THE TOWNSHIP OF DOURO DUMMER | | DATE COMPLETED: Nov 28, 2019 | | | | | | | | | | | | | | |
| TEST PIT TYPE: OPEN HOLE EXCAVATION | | SUPERVISOR: MN | | | | | | | | | | | | | | |
| GROUND ELEVATION: 239.9 m | | REVIEWER: GB | | | | | | | | | | | | | | |
| DEPTH (m) | STRATIGRAPHIC DESCRIPTION | STRATIGRAPHIC | MONITOR DETAILS | | SAMPLE | | | CORE PENETRATION | | | WATER CONTENT % | | | REMARKS | | |
| | | | TYPE | DPT VALUE | % WATER | % RECOVERY | FIELD'S GRAIN | DPT VALUE | 1 | 10 | 20 | 30 | W | | W | W |
| 0.0 | TOPSOIL | ALL | | | | | | | | | | | | | | |
| 0.3 | SAND AND GRAVEL Brown SAND AND GRAVEL, trace rootlets, trace organic, most | | 001 | | | | | | | | | | | | | SAND AND GRAVEL |
| 1.0 | COBBLES AND BOULDERS COBBLES AND BOULDERS, some sand and gravel, some silt, most | | 002 | | | | | | | | | | | | | COBBLES AND BOULDERS |
| 4.0 | SAND AND GRAVEL Light brown SAND AND GRAVEL, some cobbles, some silt, most | | 003 | | | | | | | | | | | | | SAND AND GRAVEL |
| 5.0 | Test pit terminated at 5 m below ground surface in SAND AND GRAVEL. | | | | | | | | | | | | | | | Test pit open and dry upon completion. |



Appendix E-1

- Notes in Appendix E-1 state that samples analysed from test pits TP19-01, TP19-08 and TP19-10 were not completed to LS-618 (Micro-Deval abrasion for coarse aggregate) due to insufficient samples provided, and that results may not be accurate
- Test pit TP19-09 also did not contain a representative amount of course material to complete the analysis
 - These notes should be presented in the text of the report or at the very least in comments below the tables presented within the report
 - Insufficient sample size should not be an issue when collecting samples, knowingly for this purpose, from a test pit or the pit face

| | | | |
|--|---------------|-------|-----------------|
| Notes: Sample soaked in 2000 ml of tap water for 1 hour | | | |
| Aver. Charge Weight (g): 5000.5 | | | |
| Reference Sample Control Range: | 11.4% - 14.8% | | |
| Reference Sample Percent Loss: | 14.3 | | |
| Reference Sample Average Percent Loss: | 13.8 | | |
| TP19-01, TP19-08 & TP19-10 not completed to LS-618. Insufficient amount of sample provided for test. Results may not be accurate | | | |
| TP19-09 did not contain a representative amount of coarse material to complete. | | | |
| Tested by: | WGH/NLO | Date: | January 8, 2020 |
| Verified by: | KLC | Date: | January 8, 2020 |



Appendix E-1

- The percent loss stated for test pit TP19-08 is presented as 20.6 in Appendix E-1, but appears as 20.3 in Table 3-2 of the report. One of these should be corrected.

Table 3-2: Summary of Laboratory Analysis (Physical Quality Requirements)

| SAMPLE ID | REL. DENS. & ABSORB. COARSE | REL. DENS. & ABSORB. FINES | MICRO-DEVAL COARSE (LOSS %) RESULT | MICRO-DEVAL FINE (LOSS %) RESULT | PLASTIC FINES (Y/N) | FREEZE THAW |
|---------------------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------------|---------------------|-------------|
| Unconsolidated Material (Esker) | | | | | | |
| TP19-01* | 2.658/0.71 | 2.623/1.26 | 21.4 | 10.1 | N | -- |
| TP19-02 | 2.609/1.35 | 2.554/2.36 | 24.1 | 15.5 | N | -- |
| TP19-03 | 2.620/1.13 | 2.573/1.70 | 24.5 | 14.9 | N | -- |
| TP19-04 | 2.622/1.04 | 2.545/2.26 | 20.2 | 11.0 | N | -- |
| TP19-05 | 2.601/1.50 | 2.554/2.16 | 23.7 | 18.6 | N | -- |
| TP19-06 | 2.605/1.63 | 2.570/2.25 | 25.1* | 15.5 | N | -- |
| TP19-07 | 2.616/1.22 | 2.554/2.52 | 22.6 | 13.9 | N | -- |
| TP19-08 | 2.613/1.19 | 2.563/1.83 | 20.3 | 11.6 | N | -- |
| TP19-09 | 2.601/1.48 | 2.607/1.25 | | 9.0 | N | -- |
| TP19-10 | 2.595/1.65 | 2.583/1.66 | 24.2 | 15.4 | N | -- |
| RANGE | 0.71 to 1.65 (Absorption) | 1.25 to 2.52 (Absorption) | 20.2 to 25.1 | 9.0 to 18.6 | N | -- |

| wsp Micro Deval Abrasion Test Method LS-618 - Coarse | | | | | |
|--|--------------------------------------|-----------------------|--------------------------|--|--|
| Project Name: | Douro-Dummer Aggregate Investigation | Client: | Township of Douro-Dummer | | |
| Project No: | 161-16604-00 | Date Tested: | January 8, 2020 | | |
| Sampled By: | MSN | Material Type: | Sand and Gravel | | |
| Date Sampled: | December 5, 2019 | Source: | Quarry | | |

| Sample No. | Test Pit No. | Original Mass (g) | Final Mass (g) | Mass Loss (g) | Percent Loss |
|------------|--------------|-------------------|----------------|---------------|--------------|
| TP19-01 | TP19-01 | 1248.9 | 982.1 | 266.8 | 21.4 |
| TP19-02 | TP19-02 | 1499.26 | 1138.24 | 361.0 | 24.1 |
| TP19-03 | TP19-03 | 1500.6 | 1133.34 | 367.3 | 24.5 |
| TP19-04 | TP19-04 | 1493.2 | 1192.27 | 300.9 | 20.2 |
| TP19-05 | TP19-05 | 1501.9 | 1145.88 | 356.0 | 23.7 |
| TP19-06 | TP19-06 | 1500.7 | 1124.77 | 375.9 | 25.1 |
| TP19-07 | TP19-07 | 1499.1 | 1159.61 | 339.5 | 22.6 |
| TP19-08 | TP19-08 | 1438.6 | 1142.71 | 295.9 | 20.6 |
| TP19-09 | TP19-09 | 0 | 0 | N/A | N/A |
| TP19-10 | TP19-10 | 1497 | 1134.3 | 362.7 | 24.2 |



Appendix E-2

- *Results for Relative Density and Absorption - Coarse Aggregates LS-604 is not presented in Appendix E-2.*
 - *Only Fine Aggregate (LS-605) is presented, which is not critical for the unconsolidated samples*



Appendix I-1

- Micro-Deval Abrasion for fine aggregates (LS-619) was conducted on BH16-01 in the original study and presented in the appendix of this report, but not included in Table 3-2 of this report.

|  Micro Deval Abrasion Test Method LS-619 - Fine | | | |
|---|--------------------------------------|----------------|--------------------------|
| Project Name: | Douro-Dummer Aggregate Investigation | Client: | Township of Douro-Dummer |
| Project No: | 161-16604-00 | Date Tested: | December 10, 2019 |
| Sampled By: | IAA | Material Type: | Crushed Core |
| Date Sampled: | December 2, 2016 | Source: | N/A |

| Sample No. | Test Pit No. | Original Mass (g) | Final Mass (g) | Mass Loss (g) | Percent Loss |
|------------|--------------|-------------------|----------------|---------------|--------------|
| BH16-1 | 0 | 502.1 | 420.8 | 81.3 | 16.2 |
| | | | | | |
| | | | | | |

Table 3-2: Summary of Laboratory Analysis (Physical Quality Requirements)

| SAMPLE ID | REL. DENS. & ABSORB. COARSE | REL. DENS. & ABSORB. FINES | MICRO-DEVAL COARSE (LOSS %) RESULT | MICRO-DEVAL FINE (LOSS %) RESULT | PLASTIC FINES (Y/N) | FREEZE THAW |
|--|----------------------------------|----------------------------------|------------------------------------|----------------------------------|---------------------|-------------|
| Unconsolidated Material (Esker) | | | | | | |
| TP19-01* | 2.658/0.71 | 2.623/1.26 | 21.4 | 10.1 | N | -- |
| TP19-02 | 2.609/1.35 | 2.554/2.36 | 24.1 | 15.5 | N | -- |
| TP19-03 | 2.620/1.13 | 2.573/1.70 | 24.5 | 14.9 | N | -- |
| TP19-04 | 2.622/1.04 | 2.545/2.26 | 20.2 | 11.0 | N | -- |
| TP19-05 | 2.601/1.50 | 2.554/2.16 | 23.7 | 18.6 | N | -- |
| TP19-06 | 2.605/1.63 | 2.570/2.25 | 25.1* | 15.5 | N | -- |
| TP19-07 | 2.616/1.22 | 2.554/2.52 | 22.6 | 13.9 | N | -- |
| TP19-08 | 2.613/1.19 | 2.563/1.83 | 20.3 | 11.6 | N | -- |
| TP19-09 | 2.601/1.48 | 2.607/1.25 | - | 9.0 | N | -- |
| TP19-10 | 2.595/1.65 | 2.583/1.66 | 24.2 | 15.4 | N | -- |
| RANGE | 0.71 to 1.65 (Absorption) | 1.25 to 2.52 (Absorption) | 20.2 to 25.1 | 9.0 to 18.6 | N | -- |
| Consolidated Material (Bedrock) | | | | | | |
| BH20-01 | 2.651/0.77 | 2.532/2.54 | 16.0 | 22.5 | -- | 2.7 |
| BH20-02 | 2.658/0.69 | 2.519/2.61 | 15.4 | 22.3 | -- | 1.8 |
| BH20-03 | 2.674/0.50 | 2.521/2.64 | 13.8 | 20.6 | -- | 2.5 |
| BH16-1 | 2.689/0.37 | 2.634/1.06 | 13.0 | -- | | 1.7 |



Appendix I-2

- The material type presented on the first page of Appendix I-2 (Relative Density and Absorption – Coarse Aggregate LS604) indicates Sand and Gravel, however the samples listed would suggest that it is crushed core from boreholes.



Relative Density and Absorption - Coarse Aggregate LS604

| | | | |
|-------------------------|---------------------------------------|-----------------------|-------------------|
| Project Name: | Douro-Dummer Aggregate Investigations | Material Type: | Sand and Gravel |
| Project No: | 161-16604-00 | Date Sampled: | February 18, 2020 |
| Client: | Douro-Dummer Township | Sampled By: | MSN |
| Sample Location: | Boreholes | Date Tested: | February 27, 2020 |



Appendix I-2

- Relative Density & Absorption – Coarse Aggregate LS-604 does not include a reference sample control mean for comparison to the control range for each absorption and mean relative density.

wsp Relative Density and Absorption - Coarse Aggregate LS604

| | | | |
|------------------|---------------------------------------|----------------|-------------------|
| Project Name: | Douro-Dummer Aggregate Investigations | Material Type: | Sand and Gravel |
| Project No.: | 161-16604-00 | Date Sampled: | February 18, 2020 |
| Client: | Douro-Dummer Township | Sampled By: | MSN |
| Sample Location: | Boreholes | Date Tested: | February 27, 2020 |

| Sample No. | Surface-Dry Sand Mass in Air (B) | Oven-Dry Sand Mass in Air (A) | Aggregate Mass in Water (C) | Bulk Relative Density (A/B-C) | Bulk Relative Density SSD (B/B-C) | Apparent Relative Density (A/A-C) | Absorption (B-A/A)*100 |
|------------|----------------------------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------|
| BH20-01 | 3061.90 | 3038.60 | 1916.00 | 2.652 | 2.672 | 2.707 | 0.77 |
| BH20-01 | 3056.90 | 3033.40 | 1912.00 | 2.649 | 2.670 | 2.705 | 0.77 |
| Average | | | | 2.651 | 2.671 | 2.706 | 0.77 |
| BH20-02 | 3043.10 | 3022.90 | 1906.10 | 2.659 | 2.676 | 2.707 | 0.67 |
| BH20-02 | 3048.00 | 3026.70 | 1908.84 | 2.657 | 2.676 | 2.708 | 0.70 |
| Average | | | | 2.658 | 2.676 | 2.707 | 0.69 |
| BH20-03 | 3085.90 | 3069.00 | 1936.30 | 2.670 | 2.684 | 2.709 | 0.55 |
| BH20-03 | 3085.90 | 3072.20 | 1938.90 | 2.678 | 2.690 | 2.711 | 0.45 |
| Average | | | | 2.674 | 2.687 | 2.710 | 0.50 |

| Sample Size Reference ASTM C-127/LS-602 | |
|---|-----------------|
| Nominal Sieve Size | Min. Mass (kgs) |
| 63.0 mm | 12.0 |
| 50.0 mm | 8.0 |
| 37.5 mm | 5.0 |
| 25.0 mm | 4.0 |
| 19.0 mm | 3.0 |
| 12.5 mm | 2.0 |

| Control Range | |
|----------------------------------|---------------------|
| Absorption | Range 0.55 - 0.81 % |
| Mean Relative Density (Oven Dry) | Range 2.656 - 2.682 |

Tested by: WGN Date: 18 Feb 20
 Verified by: [Signature] Date: 18 Feb 20

wsp Relative Density and Absorption - Fine Aggregate LS605/ ASTM C128

| | | | |
|---------------|--------------------------------------|----------------|-----------------------|
| Project Name: | Douro Dummer Aggregate Investigation | Client: | Douro Dummer Township |
| Project No.: | 161-16604-00 | Date Tested: | February 27, 2020 |
| Sampled By: | MSN | Material Type: | Crushed Rock Core |
| Date Sampled: | February 18, 2020 | Source: | Quarry |

| Sample No. | Temp. (°C) T | Pycnometer No. | Pycnometer Mass (g) | Mass of SSD Sand in Air (g) S | Mass of Sand/Pycnometer/Water (g) C | Mass of Pycnometer in Cal Pot (g) (B-T) | Mass of Dry Sand in Air A | Relative Density (Oven Dry) | Relative Density (SSD) | Apparent Relative Density | Absorption (%) |
|------------|--------------|----------------|---------------------|-------------------------------|-------------------------------------|---|---------------------------|-----------------------------|------------------------|---------------------------|----------------|
| BH20-01 | 22.30 | Z | 167.19 | 500.18 | 972.60 | 665.38 | 487.9 | 2.529 | 2.592 | 2.700 | 2.51 |
| BH20-01 | 22.50 | O | 166.02 | 500.16 | 971.76 | 663.97 | 487.7 | 2.535 | 2.600 | 2.711 | 2.56 |
| Average | | | | | | | | 2.532 | 2.596 | 2.706 | 2.54 |
| BH20-02 | 21.90 | O | 166.02 | 500.08 | 970.71 | 664.03 | 487.3 | 2.520 | 2.586 | 2.698 | 2.62 |
| BH20-02 | 22.30 | Z | 167.19 | 500.03 | 971.91 | 665.44 | 487.4 | 2.518 | 2.583 | 2.694 | 2.59 |
| Average | | | | | | | | 2.519 | 2.585 | 2.696 | 2.61 |
| BH20-03 | 21.50 | O | 166.02 | 501.23 | 971.45 | 664.08 | 488.0 | 2.517 | 2.585 | 2.701 | 2.70 |
| BH20-03 | 21.90 | Z | 167.19 | 500.40 | 972.60 | 665.44 | 487.9 | 2.525 | 2.590 | 2.700 | 2.57 |
| Average | | | | | | | | 2.521 | 2.587 | 2.701 | 2.64 |

| Reference Sample Control Mean | |
|--|-------|
| Reference Sample Average Percent Absorption: | 1.92 |
| Reference Sample Average Relative Density: | 2.597 |

| Control Range | |
|----------------------------------|---------------------|
| Absorption | Range 1.58 - 2.12% |
| Mean Relative Density (Oven Dry) | Range 2.593 - 2.629 |

Operator: NLO Date: 27-Feb-20
 Verified by: [Signature] Date: 27-Feb-20



Appendix I-2

- The dates on the project samples are dated February 2020, whereas the control samples (MM-8564) were dated December 2019. Control samples should be run simultaneously with the project samples.

| wsp | | Relative Density and Absorption - Coarse Aggregate LS604 | |
|-------------------------|---------------------------------------|--|-------------------|
| Project Name: | Douro-Dummer Aggregate Investigations | Material Type: | Sand and Gravel |
| Project No: | 161-16604-00 | Date Sampled: | February 18, 2020 |
| Client: | Douro-Dummer Township | Sampled By: | MSN |
| Sample Location: | Boreholes | Date Tested: | February 27, 2020 |

| wsp | | Relative Density and Absorption of Coarse Aggregate (LS-604) | |
|----------------|--------------------------------------|--|--------------|
| Sample No.: | MM-8564 | Date Sampled: | Dec.02, 2019 |
| Job No.: | 161-16604-00 | Date Tested: | Dec.11, 2019 |
| Job Name: | Douro-Dummer Aggregate Investigation | Tested By: | John |
| Source: | | Product Code: | |
| Material Type: | Crushed Aggregate | | |
| | | Trial Number | |

| wsp | | Relative Density and Absorption - Fine Aggregate LS605 / ASTM C128 | |
|----------------------|--------------------------------------|--|-----------------------|
| Project Name: | Douro Dummer Aggregate Investigation | Client: | Douro Dummer Township |
| Project No: | 161-16604-00 | Date Tested: | February 27, 2020 |
| Sampled By: | MSN | Material Type: | Crushed Rock Core |
| Date Sampled: | February 18, 2020 | Source: | Quarry |

| wsp | | Relative Density and Absorption of Fine Aggregate (LS-605) | |
|----------------|--------------------------------------|--|--------------|
| Sample No.: | MM-8564 | Date Sampled: | Dec.02, 2019 |
| Job No.: | 161-16604-00 | Date Tested: | Dec.12, 2019 |
| Job Name: | Douro-Dummer Aggregate Investigation | Tested By: | John |
| Source: | | Product Code: | |
| Material Type: | Crushed Aggregate | | |
| | | Trial Number | |



Appendix I-2

- The control (or trial) results presented on the fourth page of Appendix I-2 (Relative Density and Absorption of Fine Aggregates LS-605) appear to be outside the acceptable range for both bulk relative density and absorption.
- The industry standard (Sunderland Pit) has certified acceptable range for relative density is 2.593 g/cc – 2.629 g/cc
 - average control result was 2.634 g/cc, slightly above acceptable range
- Certified acceptable range for absorption is 1.58 % - 2.12 %
 - average control result was 1.063 %, well below the acceptable minimum.

wsp

Relative Density and Absorption of Fine Aggregate (LS-605)

Sample No.: MM8564 Date Sampled: Dec 02, 2019
 Job No.: 181-18664-00 Date Tested: Dec 12, 2019
 Job Name: Duoro-Dummer Aggregate Investigation Tested By: John
 Source: Product Code:
 Material Type: Crushed Aggregate

| Tare Name | Trial Number | | Average |
|--|--------------|--------|---------|
| | 1 | 2 | |
| A Weight Sample Oven Dry & Tare | 1194.2 | 1194.2 | |
| B Weight Tare | 685.4 | 687.4 | |
| C Weight Sample Oven Dry (A-B) | 508.8 | 506.8 | |
| D Water Temperature (23 C +/- 1.7 C) | 23 | 23 | |
| E Weight Flask & Water | 670.5 | 664.4 | |
| F Weight Sample & Flask & Water | 991.6 | 984.1 | |
| G Weight Sample SSD - (if other than 500g) | 514.2 | 512.2 | |

| Flask Number | Control | |
|---|---------|-------|
| Bulk Relative Density (C/(G-(F-E))) | 2.635 | 2.633 |
| Bulk Relative Density SSD (G/(G-(F-E))) | 2.663 | 2.661 |
| Apparent Relative Density (C/(C-(F-E))) | 2.711 | 2.709 |
| Absorption (G-C)/C*100 | 1.061 | 1.066 |

| Flask Number | | | Control |
|---|-------|-------|---------|
| Bulk Relative Density (C/(G-(F-E))) | 2.635 | 2.633 | 2.634 |
| Bulk Relative Density SSD (G/(G-(F-E))) | 2.663 | 2.661 | 2.662 |
| Apparent Relative Density (C/(C-(F-E))) | 2.711 | 2.709 | 2.710 |
| Absorption (G-C)/C*100 | 1.061 | 1.066 | 1.063 |



Time Line & Processing



Time Line & Processing

- Early Stage - Granular B Type II (esker)
 - Most of the material tested within the esker is useable as Granular B Type II in its current state, requiring very little to no screening, and no crushing or blending.
- Middle Stage – Winter Sand (esker)
 - The material present in the esker could be used for winter sand, but would require screening which would take a great toll on the aggregate supply.
 - Consideration could be made for material near TP19-08 & TP19-09, where 72% and 68% of the sample could be used for winter sand, respectively.
 - Clarification is required regarding which samples were used from each pit for testing purposes. The sand may be in a lens not present throughout the entire vertical face at each test location.
 - Further delineation would be required.
- Middle-Late Stage - Granular A (esker)
 - Crushing and screening required to generate Granular A from esker material
 - Could also be performed on cobble and boulder remaining from screened winter sand.
- Late Stage – Granular A & B (bedrock – Verulam Fm)
 - Potential for Granular A from Verulam Fm limestone, although further testing/delineation is required to assess the hardness (Micro-Deval Coarse)
 - Both 2016 Verulam Fm samples meet Granular B Type I & II requirements for physical properties.



Closing Remarks



Closing

- Overall, the approach and scope of work undertaken by WSP was satisfactory for the purpose of the investigation.
- In general, sample analysis methods and quantity of samples analyzed are considered sufficient for the purpose of the investigation.
- *Points for consideration*
 - *If it hasn't already been discussed with the client, consideration should be taken as to whether additional testing should be completed on the Verulam Fm., which appears to have varied test results and may be underrepresented with only two samples.*
 - *It would be beneficial for the Client to have locations of test pits and boreholes from the original study incorporated into the mapping presented in the recent report*
 - *It would be beneficial for the Client if a table (or something similar) was provided in order to concisely indicate which samples are acceptable for use as aggregates for specific purposes, and where production techniques may be used to achieve the desired product.*



Closing

- Overall, the approach and scope of work undertaken by WSP was satisfactory for the purpose of the investigation.
- In general, sample analysis methods and quantity of samples analyzed are considered sufficient for the purpose of the investigation.
- *Some follow up should be undertaken to address*
 - Grammatical, numerical and unit errors presented both in this presentation and our report
 - Conclusion discussion regarding the unconsolidated esker material
 - Information missing from Appendix E-2
 - Issues regarding the failure of control samples and absent control samples for some of the lab results in Appendix I-2



Questions?

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