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May 15, 2020

Township of Douro-Dummer
894 South Street,
Warsaw, ON K0L 3A0

Attn: Martina Chait-Hartwig, Temporary C.A.O.

**Re: Supplemental Geotechnical Survey and Testing Report – Peer Review
Edwards Pit – Part of Lots 14 & 15, Concession 1, Township of Douro-
Dummer
Cambium Reference No.: 9732-002**

Dear Ms. Chait-Hartwig,

Cambium Inc. (Cambium) was retained by The Corporation of the Township of Douro-Dummer (Client) to conduct a peer review of the following report:

- *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).*

This is the second of two peer reviews that Cambium has performed on this project, and is focused solely on the recommendations of Cambium's original peer review and new information presented by WSP in the supplemental report.

Cambium's recommendations from the original peer review (9732-001) were:

- Consideration could have been given to advancing more test pits based on the variability of the esker deposits
- It would be preferable for the locations and elevations of the test pits and boreholes to have been surveyed using an RTK or other system that is more accurate and able to provide geodetic elevations
- Gradation testing on a large number of samples from the esker deposit would have been an inexpensive way to provide more detailed information about the volume of useful aggregates in the esker



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- Investigation and comments should also have been provided on the Bobcaygeon Formation.
- It is somewhat misleading and unnecessary to compare the gradations of the 1" minus crushed limestone product, which was purposely created from the bedrock cores to allow for other testing, to the gradation envelopes for Granular A, Granular B, etc.

Cambium's comments on specific sections of the Supplemental Report, dated March 23, 2020, are as follows. Any comments requiring clarifications and/or responses from the Proponent are provided in *italics*.

2. 2020 INVESTIGATION

Section 2.1

The additional scope of ten (10) test pits located and excavated within the esker deposit are deemed sufficient given the size of the deposit and the variability noted in the original four (4) test pits.

Coordinates were once again collected using GPS and elevations were inferred from a topographic plan based on GPS coordinates. While this data is sufficient consider the high-level assessment and broad assumptions used in volume calculations, *more accurate elevations could have been obtained, using an RTK (or similar) unit in order to tie into and supplemental future investigations or development at the site.*

Section 2.2

The additional three (3) boreholes (cores) advanced at the site, targeting Bobcaygeon Formation is deemed to be sufficient for the purposes of providing a high-level assessment of the bedrock quality. All three boreholes were completed as piezometers to assist in the continued hydrogeological investigation of the Site.

Section 2.3



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The type of analysis conducted and the number of esker samples tested is deemed to be sufficient for the purposes of this study, which was conducted to provide more detailed information about the variable nature of the material and better assess the volume of useful aggregates in the esker.

The number of locations sampled for testing the Bobcaygeon Formation bedrock is deemed sufficient for the purposes of this investigation however, not all of the tests conducted are deemed necessary. *As stated in the 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.*

Table 2-3 states that sieve analysis was performed ten (10) times for Bobcaygeon Formation bedrock core samples, however it is presumed this is a copy and past error and should be four (4) samples.

3. SUMMARY OF FINDINGS

Section 3.2:

Bedrock cores from within the Bobcaygeon Formation were collected in three borehole locations. In drilling these boreholes an additional 59 m of Verulam Formation were collected. *Based on RQD values presented in the borehole logs, some portions of the Verulam Formation, not already investigated may be of interest, however the shaly nature of the limestone observed in the core photos provides evidence that there may not be value in further testing. Verulam Formation samples from only two locations were analysed in the original investigation and Micro-Deval Abrasion results were variable, limiting use of the material to granular and miscellaneous materials, but not all granular materials. As such, discussion with the Client is warranted regarding further testing of the overlying Verulam Formation, as the material has already been collected in the coring process of this recent investigation.*



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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 is not included in Table 3-2 of this report.

Table 3-3

The sieve size of samples presented in Table 3-3 is in mm; the lower sieve sizes should be 0.300 mm and 0.075 mm, not 300 and 75. In addition, no units were assigned to some of the parameters in Table 3-2 and Table 3-3. While it can easily be inferred by somebody with knowledge of the testing, inclusion of the units would be useful.

4. CONCLUSIONS

Section 4.1:

It is agreed that the total fines of the unconsolidated samples range between 1.95% and 7.2% however, based on particle size distribution results the sand fraction ranges between 17% and 62%, not 2.6% and 21% as stated in the report. The report also states that the maximum percent 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.

The report discusses test results of absorption for the fine fraction exceeding 2%, yet requirements for Superpave 12.5 and HMA are based on absorption of the coarse fraction (LS-604), not the fine fraction (LS-605). Absorption results from the coarse fraction range from 0.71% to 1.65%, which would make this material acceptable for use in most HMA, if it weren't for the fact that Micro-Deval (coarse fraction) results have already ruled out the use of the unconsolidated material in concrete and asphalt. This section of the report should be edited or removed.

It would be beneficial to the Client, or anyone reading the report, to include a summary table stating exactly what each unconsolidated sample may be use for,



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and where some form of screening crushing or blending may be required to achieve the desired product. This would simplify the interpretation of the results and aid in more accurately estimating both the distribution of resources within the esker and their associated value.

In section 4.1 the word course is also used instead of coarse.

Section 4.2:

As previously stated, it is somewhat misleading and unnecessary to compare the gradations of the crushed limestone product, 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 it 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 the Client, or anyone reading the report, to include a summary table stating exactly what each sample may be use for. This would simplify the interpretation of the results and aid in more accurately estimating the value of the bedrock resource throughout the site.

There are also a couple of grammatical errors in Section 4.2 however those to not impact the clarity of the report.

5. APPENDICES

Appendix A:

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

Both test pits TP19-01 and TP19-05 appear to be located NW of the esker, yet still possess quality material. As such, additional material may be present adjacent to the esker, or the esker may be wider than anticipated.



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

There are currently two pages labelled Existing Conditions Plan within Appendix A, yet they both appear to be the same image.

Appendix C:

In Section 2.1 it is stated 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.

Appendix E-1:

Notes within the analysis 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. Furthermore, insufficient sample size should not be an issue when collecting samples from a test pit or the pit face, knowingly for this purpose.

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.

Appendix E-2:

Results for Relative Density and Absorption - Coarse Aggregates LS604 is not presented in Appendix E-2.

Appendix E-2:

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 it not included in Table 3-2 of this report.



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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. Also, unlike other test results presented in the appendix, this page does include the reference sample control mean for comparison to the control range for each absorption and mean relative density.

In addition to this, 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 used as a control sample for this analysis is that of the Sunderland Pit. The certified acceptable range for relative density is 2.593 g/cc – 2.629 g/cc, where as the average control result was 2.634, which is just slightly above the acceptable maximum. Similarly, the certified acceptable range for absorption is 1.58 % - 2.12 %, whereas the average control result was 1.063 %, which is well below the acceptable minimum.

The dates on the project samples are dated February 2020, whereas the control samples were dated December 2020. Control samples should be run simultaneously with the project samples.

This data should be reviewed and corrected where required and any errors or inaccuracy of the results should be discussed both in the appendix and the text of the report itself.

Closing

Overall the report was thorough, and the methodology well thought out. The report and findings met the purpose of the investigation which was to further assess the aggregate resources at this Site, which includes both the unconsolidated aggregates located within the Esker and consolidated bedrock, reaching down to and including, the Bobcaygeon bedrock formation. The



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laboratory testing that was completed was, in general, consistent with the needs of the report, however there are a few minor issues that should be addressed.

Considering the variable nature of the two samples of Verulam Formation from the original investigation, discussion with the client is warranted regarding testing of additionally acquired Verulam cores from this recent investigation.

We trust that the contents of this peer review meet your current needs. Please contact the undersigned if you have any questions.

Best regards,

Cambium Inc.

Stuart Baird, P.Eng., M.Eng.
General Manager – Geotechnical

Brian Peterkin, P.Geo., M.Eng.
Senior Project Manager

SEB/bjp

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