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M E M O R A N D U M

November 3, 2025

TO: Connor Frazer
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: Shawn Trimper
Hydrogeologist
Technical Support Section
Eastern Region

RE: Hydrogeological Assessment Report
Proposed Soil Bank Site – Leahy Excavations Inc.
Part Lot 3, Concession 9, Geographic Township of Douro
County of Peterborough
ECHO Request No. 1-1524031617

At your request I have reviewed the report titled "Hydrogeological Assessment, County Road 4, Peterborough, Ontario, Leahy Excavations Inc." prepared by GHD and dated October 5, 2023 and related to a proposed soil bank site located on County Road 4 in the County of Peterborough. This report is an updated version of a previous report dated January 30, 2023, and was prepared to address comments on the original report provided by ministry specialists related to groundwater (memo dated April 27, 2023) and surface water (memo dated March 27, 2023). Review of the updated/current report was previously completed by a ministry surface water specialist in a memorandum dated November 7, 2023. In addition to reviewing the report I have reviewed previous ministry comments.

An Environmental Impact Study Report prepared by GHD and dated May 31, 2024 was also provided for my review. After a cursory review it is apparent that this report contains no groundwater related information, and as such, no comments have been provided with respect to this report.

Based on my review of the above noted items I offer the following comments.

Site Use

The site is understood to have been used as a wayside pit during the construction of County Road 4 in the early 1900's. Currently the site is used for the following activities: topsoil screening and stockpiling for reuse offsite; Granular materials are stockpiled, screened, and reused offsite or onsite; Non-granular materials are re-used onsite; Asphalt and concrete are crushed and sorted and sold as recycled material; and, hydro-vac material is deposited in settling ponds.

Site Description

The site is located in a mixed-use rural area on the south side of County Road 4 and is located approximately 3 kilometres east of the Trent-Severn Waterway and approximately 700 metres east of the City of Peterborough municipal boundary. The site and surrounding area is not municipally serviced and rely on private septic systems and private supply wells. The site is bordered to the south by an operating aggregate pit.

Meade Creek transects the eastern portion of the site, and a tributary to Meade Creek transects the western portion of the site, both flowing toward the south. The Meade Creek Provincially Significant Wetland (PSW) Complex flanks Meade Creek and is considered Environmentally Sensitive under O. Reg. 407/19.

The topography of the site slopes largely to the southwest Meade Creek and a tributary to Meade Creek. It is reported that an earthen berm has been constructed around the operational area and the environmentally sensitive portion of the site.

Proposed Site Development

The site is proposed to be filled and regraded. A proposed final contour plan has been prepared and provided for the site and includes a 2% downward slope toward the east across the created plateau, and a 4:1 slope along the toe of the fill area that terminates along the existing treeline. A cut fill analysis was completed and provided and estimates that the fill volume is approximately 1,600,000 cubic metres.

Hydrogeological Assessment Activities

Previously completed hydrogeological investigations included the following activities:

- Review of existing geological information, water resource mapping, and well records
- Six boreholes were installed in overburden and completed as monitoring wells
- Soil samples were submitted for the analysis of grain size and moisture content
- Groundwater elevations were measured on one occasion
- Single well response tests were completed at three monitoring wells
- Two surface water samples and two groundwater samples were collected and sampled for a number of parameters
- One soil sample was collected and analysed for a number of parameters to determine background soil quality

Additional supplementary hydrogeological investigation (completed since the time of the initial report) included the following activities:

- Six additional boreholes were advanced and completed as monitoring wells, five of which were cored into and screened in the bedrock
- Soil samples were submitted for the analysis of grain size
- Groundwater levels were measured in all monitoring wells on one occasion

- Groundwater quality sampling was completed at the same two monitoring wells previously sampled.

Geology

The site is reported to be located within the Peterborough Drumlin Field physiographic region. The site is characterized as being located within a drumlin, drumlinized till plain, and an esker.

Based on the conditions identified at the eleven boreholes on the site, the geology on the site is reported to consist of the following units:

- Gravelly Sand Unit - A gravelly sand unit was identified at surface and extended to a depths ranging from 0.8 to 2.3 metres.
- Till Unit – A dense till unit consisting silty sand with clay and gravel was identified beneath the gravelly sand unit in all locations and extended to a maximum depth of 9.1 metres.
- Bedrock - Limestone bedrock was encountered at depths ranging from 2.9 (MW1-22) metres to greater than 9.3 metres (MW6D-23). Shallow bedrock was reported to be in a moderately weathered state with competency increasing with depth.

I note the following related to the reported geological conditions:

- Some of the summary details provided in the report are inaccurate or perhaps have not been updated and should be reviewed for accuracy in future submissions/reports. The values provided above in this memo are not those reported within the report, but instead have been determined based on interpretation of the borehole logs.

- Greater discussion of relevant contextual details would be helpful in future submissions when describing the site conditions encountered, to build a conceptual understanding of the physical conditions. For example, describing where overburden thickness is greatest and least would be helpful, as would providing and discussing thicknesses of the various layers, especially the till layer which is interpreted to isolate flow in the overburden and bedrock. Discussion and details as to the slope of the till layer surface and the bedrock surface is important to the conceptual understanding of flow and contaminant migration on the site.

Hydrogeology

Groundwater levels have been measured on three occasions, including once after the installation of deeper and bedrock monitoring wells. Based on the completed hydrogeological assessment activities, the following hydrogeological conditions and related conclusions are reported by GHD:

- Monitoring wells MW1-22 and MW4-22 were dry on all occasions.

- Water levels in overburden monitoring wells have ranged from 1.2 to 4.9 metres below ground surface (mbgs).
- Water levels in bedrock monitoring wells have ranged from 4.7 to 6.6 mbgs.
- It is reported that groundwater flow is in an east to southeast direction toward Meade Creek.
- The hydraulic conductivity of the gravelly sand was estimated to range from 1.0 x 10^{-6} m/s (MW2-22) to 2.1 x10^{-7} m/s (MW3-22).
- The hydraulic conductivity of the till unit is estimated to be 3.5x10^{-6} m/s (MW6-22)
- Vertical gradients were assessed at monitoring well nests MW2, MW3, and MW5, and MW6 on a single occasion in 2023. Downward flow conditions were identified at MW2, MW3, and MW6. Upward flow conditions were identified at MW5.
- While there is evidence of vertical migration of groundwater, it is inferred to be minor based on relatively small downward vertical gradients calculated.
- The dense layer of glacial till is interpreted to further reduce the amount of vertical groundwater migration.
- It is reported that no significant vertical fractures were identified during the drilling program.

Water Quality

Groundwater

Groundwater samples were collected at two monitoring wells (MW2-22 and MW6-22) on one occasion as part of the initial investigation in 2022. The 2022 samples were analysed for general chemistry, metals, polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons (PHCs), and volatile organic carbons (VOCs). The 2023 samples were analyzed only for general chemistry and metals. The results were compared against the Ontario Drinking Water Quality Standards (ODWQS) as well as Table 8 SCS (potable conditions within 30 metres of a water body).

All parameters were reported to meet ODWQS with the exception of hardness and turbidity in those samples collected in 2022 but are interpreted to be natural occurring. No parameters exceeded the Table 8 SCS. PHCs, PAHs, and VOCs were below method detection limits in all samples, with the exception of toluene which was detected at MW6-22 (0.6µg/L).

Surface Water

Surface water samples were collected at two locations (Creek #1 and Creek #2) on two occasions, once in 2022 and again in 2023. The 2022 samples were analysed for general chemistry, metals, PAHs, PHCs, and VOCs. The 2023 samples were analyzed only for general chemistry and metals. The results were compared against Provincial Water Quality Objectives (PWQO).

All parameters are reported to meet the applicable PWQO with the exception of iron in the Creek #2 sample in 2022 but has been attributed to organic material in the sample. PHCs, PAHs, and VOCs were below method detection limits, with the exception of trichloroethylene (TCE) which was detected (1.1µg/L) in the Creek #1 sample (2022).

Soil Quality

A single soil sample (GS-1) was collected and analysed as part of the initial investigation completed in 2022 and is reported to have been collected immediately downgradient of the settling pond. It is reported that the purpose of the soil sample was to assess background soil conditions.

The sample was analysed for metals, PAHs, PHCs, VOCs, as well as pH, conductivity, and sodium adsorption ratio (SAR). The results were compared against the Table 1 SCS for residential / parkland / institutional / industrial / commercial / community property uses.

All parameters are reported to meet the applicable Table 1 SCS. PHCs, VOCs, and PAHs were below method detection limits in the sample.

Private Water Wells and Source Water Protection Considerations

Private water wells are used for water supply in the area surrounding the site, and based on an assessment of the ministry's well record data base, it is understood that both the overburden and bedrock are utilized for water supply, with bedrock monitoring wells being more common. GHD reports that no private wells are located downgradient of the site within 250 metres.

The site is not located within a wellhead protection area. The site is not located within an Intake Protection Zone (IPZ) 1 or IPZ 2.

Conclusions & Recommendations (GHD)

GHD concludes that from a hydrogeological perspective the site is suitable for use as a soil bank facility and the continued use as a hydro-vac receiving site, and would have minimal impact on surface water or groundwater so long as the site continues to operate in an environmentally responsible manner.

GHD recommended (very generally) that ongoing monitoring be completed at the site and include the following:

- Surface water sampling at location Creek #1 and Creek #2 should continue.
- Groundwater level monitoring should continue to be conducted to assess seasonal fluctuations and temporal trends.
- Sampling at select shallow and deep monitoring wells.
- Sampling should be completed for those parameters tested for previously.
- The monitoring results are to be documented in an annual report.

GHD indicates that a Design and Operations Report will be prepared following ministry review of the current report.

Conclusions & Recommendations

I offer the following conclusions and recommendations based on my review of the available information:

- Limited details are provided within the reports regarding the proposed activities. A Design & Operations report (or similar) is required which describes in detail the various activities to be completed at the site, as well as the procedures to be implemented with respect to the operations. Additional information about soil quality standards that have and are to be applied to soil deposited at the site. This information is essential to determining the suitability of the site and the adequacy of the assessment and understanding of site conditions.

- With respect to the completed environmental assessment activities, I have a number of comments that should be considered when preparing future reports/submissions. The level of assessment and need to address each of these comments will depend on the details of the proposed activities and associated procedures. My comments are as follows:

    - The interpreted groundwater flow direction is an inferred flow direction based the physical setting and has not been determined based on groundwater level measurements as may be assumed by a reader of the report. The inferred flow direction appears to accurately describe the regional flow direction based on topography and physical conditions; however, groundwater flow on the site is likely more complex and spatially variable based on more localised conditions. Localised flow conditions have not been fully resolved and may change as the conditions of the site are altered.

    - I disagree with GHDs interpretation that the magnitude of the downward vertical gradients (ranging from approximately 0.2 to 1.0) are relatively small. The measured vertical gradients are in fact extremely high. These large vertical gradients would not support the argument of reduced vertical flow potential as indicated by GHD. Having said this, large vertical gradients can be an indication of poor hydraulic connection between the two zones, and could be a line of evidence to support hydraulic isolation of the overburden and bedrock units.

    - Vertical hydraulic gradients can also be highly variable; however, groundwater elevations have only been measured on a single occasion in both overburden and bedrock, and additional monitoring would be required to better understand vertical gradients.

    - The conclusion that no vertical bedrock fractures were identified during drilling, should be given limited weight and interpreted with caution. Vertical boreholes are not an appropriate investigation method for assessing vertical fracturing, as they are very unlikely to encounter vertical fractures.

- No hydraulic testing was completed in bedrock, which represents a further gap and uncertainty in the conceptual understanding of groundwater flow and contaminant migration on the site.

- It is reported that core photographs are provided in Appendix B; however, no core photographs are provided.

- No monitoring wells are currently located between the operational area and the tributary (i.e. southwest of the operational area).

- Those monitoring wells where groundwater sampling was completed are not expected to be located downgradient of the settling pond. Groundwater sampling would be expected to be completed in those areas of greatest risk based on historical and proposed activities.

- It is unclear why VOCs were sampled in groundwater and surface water on only a single occasion, as VOCs were detected in both surface water (TCE at location Creek #1)) and groundwater (toluene at MW6-22). Additional sampling would be warranted to determine if detected VOCs were anomalous. Groundwater and surface water sampling programs should include all parameters of potential concern based on the activities completed and proposed.

- It is unclear why groundwater sampling has been limited to MW2-22 and MW6-22.

- A single soil sample (GS-1) was collected and submitted for soil quality analysis in 2022. It appears that this single soil sample is being relied upon to represent background soil quality at the site. An appropriate assessment of soil quality should be completed and should include onsite sampling, and also provide and consider information and data related to the source of imported soils.

Shawn Trimper

Shawn Trimper, P.Eng.

ec: Victor Castro
David Fisher