



December 15, 2022
Our File: 221093

John Bradley
Abraflex (2004) Ltd.
3437 Bruce Rd 3
Paisley, ON, N0H 2C0

Via Email: jbradley@abraflex.com

RE: Preliminary Sewage System Feasibility
Assessment for Private Servicing of
Proposed Severance: 3437 Bruce
Road 3, Municipality of Arran-Elderslie

Dear Mr. Bradley,

GM BluePlan Engineering Limited (GMBP) has been retained to provide hydrogeologic services to support the approval for a potential residential lot severance in the community of Paisley within the Municipality of Arran-Elderslie. The lands under consideration (i.e., the "Site") are located at 3437 Bruce Road 3 which is subsequently located north of the North Street right-of-way. The current property is further defined as Part of Lots 16 & 17 Plan 156 Lot 3 to 25, Concession A, Geographic Township of Paisley, Municipality of Arran-Elderslie, County of Bruce.

The Site is 17.25 ha (42.62 acres) and currently supports a private commercial business (i.e., Abraflex (2004) Ltd.) with private well water supply and municipal sewage services. The proposed severance will ultimately result in three additional properties, for a total of four individual lots with additional portions of the subject land being allotted for servicing easements. The retained lot is proposed to be reduced to a size of 14.71 ha (36.35 acres), while the onsite business would become 1.54 ha (3.80 acres) in size, and two proposed residential lots located in an undeveloped portion of the Site will be 0.53 ha (1.31 acres) and 0.39 ha (0.96 acres), respectively. See the attached enclosure for an illustration of the proposed site layout plan.

At the time of this report, the retained lands will remain undeveloped, the existing onsite buildings and business operations will continue to operate with a reduced property size, and the proposed residential properties will support single detached homes with private individual on-site servicing (i.e., wells and sewage systems). This preliminary hydrogeological feasibility assessment is intended to establish whether it will be feasible to service the severed residential lots with a private on-site sewage system. This Study is completed in reference to the Ministry of Environment, Conservation and Parks (MECP) Guideline D-5-4 for water quality impact risk assessment for the on-site sewage systems.

GEOLOGICAL SETTING

Physiographic mapping indicates that the Site lies within an Undrumlinized Till Plains landform (NDMNRF, 2007). This landform consists generally of large flat areas with little changes in topography with exceptions near river valleys and floodplains. Additionally, the Site lies within the Huron Slope physiographic region which generally consists of a clay till plain modified by a narrow strip of sand where the till is formed from calcareous clay containing a minimum of pebbles and boulders (Chapman & Putnam, 1984).

According to map sets available from the Ontario Ministry of Northern Development and Mines (NDMNRF, 2000; 2010; 2011), the geological materials underlying the Site are briefly summarized as comprising of ice-contact stratified deposits consisting of sand, gravel, minor silt, clay and till materials derived from glaciolacustrine deposits or shale as the overlying overburden with sedimentary bedrock and shale of the Salina Formation.

The overlying till overburden soils have developed Saugeen Series soil which covers the area of the Site. The topography of these soil deposits is generally smooth and moderately sloping (Hoffman & Richards, 1954). Saugeen Series soil generally features 4 inches of grey silty clay loam over stone-free soil layers which are known to be well defined with this soil series with stone-free clay as the parent material. As a result of the soil texture and local topography, the hydraulic conductivity and natural drainage conditions are expected to be good.

Following the proposed residential severances, a dwelling would be constructed on each of these lots. A tile bed to service the new dwelling would likely be constructed behind or beside (i.e., north of) the new dwellings.

Nearby water well records indicate that the depth to bedrock is in the range of 4.9 to 62.5 mbgs (meters below grade surface) with an average depth of 21.0 mbgs based on the surrounding wells within a 400 m radius.

SERVICING CONSIDERATIONS

On-Site Sewage Systems: Nitrogen Attenuation

The primary concern related to on-site sewage systems for residential development is the effect that these systems may have on the concentration of nitrate in local groundwater. The proposed development must ensure that its sewage management does not negatively impact groundwater quality and preclude its use for other purposes or by others (i.e., off-site users). The most prevalent use for groundwater is domestic consumption and so typically this means that a given development must not result in nitrate concentrations of 10 mg/L or greater (per Ontario Drinking Water Standards) in the groundwater going off the Site.

To estimate the potential for impacts to shallow groundwater, the assessment process described in the MECP Procedure D-5-4 (1996) is consulted. The Guideline states that for developments where the lot size for each private residence within the development is one hectare or larger, it can be assumed that attenuative processes will be sufficient to reduce the nitrate-nitrogen to an acceptable concentration in groundwater below adjacent properties. In this case, the Site is proposing residential lots 0.53 and 0.39 hectares in size, therefore additional consideration is required to determine potential attenuation impacts. Nitrogen attenuations calculations have subsequently been calculated per the calculation methods given in the MECP D-5-4 Procedure and are summarized in Table 1. The calculations are typically completed for the site holistically (i.e., the combined lot size and with the combined use) and can be further assessed using the smallest lot. Since the calculations are based on lot area versus proposed sewage use, and the proposed lots are different in size, it follows that the calculations for each individual lot will vary in comparison to the calculated value for the combined Site. This is shown below in Tables 1 and 2.

Table 1: Nitrogen Attenuation for the Combined Site

Line	Item	Value	Source
1	Average Annual Precipitation (mm/yr)	1,294	Environment Canada (Tara)
2	Average Annual Evapotranspiration (mm/yr)	550	MNR (1984)
3	Impervious Area Factor	0.3	Estimated, for suburban residential usage (MTO Drainage Management Manual, Chart 1.07)
4	Lot Area (m ²)	172,461	From Conceptual Plan (see Enclosure)
5	Hydrologic Input (L/yr)	89,817,689	Line 4 * (Line 1 – Line 2) * (1 – Line 3), units converted

6	Number of Lots	3	Retained parcel plus 2 Severed Lots
7	Sewage Effluent Input Rate (L/lot/day)	1,000	Specified by Procedure D-5-4
8	Annual Sewage Effluent Input (L/yr)	1,095,000	Line 6 * Line 7, units converted
9	Total Water Input (L/yr)	90,912,689	Line 5 + Line 8, units converted
10	Nitrate Output (g/lot/day)	40	Specified by Procedure D-5-4
11	Annual Nitrogen Loading (g/yr)	43,800	Line 6 * Line 10, units converted
12	Attenuated Nitrogen Concentration (mg/L)	0.48	Line 11 / Line 9, units converted

Table 2: Nitrogen Attenuation for the Smallest Single Lot

Line	Item	Value	Source
1	Average Annual Precipitation (mm/yr)	1,294	Environment Canada (Tara)
2	Average Annual Evapotranspiration (mm/yr)	550	MNR (1984)
3	Impervious Area Factor	0.3	Estimated, for suburban residential usage (MTO Drainage Management Manual, Chart 1.07)
4	Lot Area (m ²)	3,867	Smallest Lot From Conceptual Plan (see Enclosure)
5	Hydrologic Input (L/yr)	2,013,934	Line 4 * (Line 1 – Line 2) * (1 – Line 3), units converted
6	Number of Lots	1	Proposed Severed Lot
7	Sewage Effluent Input Rate (L/lot/day)	1,000	Specified by Procedure D-5-4
8	Annual Sewage Effluent Input (L/yr)	365,000	Line 6 * Line 7, units converted
9	Total Water Input (L/yr)	2,378,934	Line 5 + Line 8, units converted
10	Nitrate Output (g/lot/day)	40	Specified by Procedure D-5-4
11	Annual Nitrogen Loading (g/yr)	14,600	Line 6 * Line 10, units converted
12	Attenuated Nitrogen Concentration (mg/L)	6.14	Line 11 / Line 9, units converted

Using the dilution approach, the attenuated nitrogen concentration for the entire site (i.e., retained property and proposed severances) are estimated to be 0.48 mg/L and meets the maximum allowable concentration of 10 mg/L. The calculated attenuated nitrogen for the smallest proposed residential lot is estimated to be 6.14 mg/L which also meets the maximum allowable concentration for the Ontario Drinking Water Standards criteria. These calculations are a conservative estimate since they do not account for other attenuation mechanisms that are known to occur, such as dilution in groundwater and biological/geochemical attenuation processes. Consequently, servicing both the existing onsite operations and proposed residential developments would be feasible with a standard Class 4 sewage system constructed under the requirements of the *Ontario Building Code*.

On-Site Sewage Systems: Sewage System Sizing

The feasibility of the sewage servicing also depends on whether the lot is large enough to accommodate the onsite sewage system. For conservative estimations, it may be assumed the T-time of the native soils is 50 min/cm. This high percolation estimate will usually require a relatively large leaching to be constructed to ensure proper subsurface disposal of the sewage effluent.

Based on design guidance from the *Ontario Building Code* and assuming a single proposed lot will host a 4-bedroom residence, the expected rate of sewage generation would be 2,000 L/day. Using this estimated design flow, the compatibility of a conventional leaching bed for each of the proposed lots is established. Due to the varying ground water

levels noted from local well records, it may be reasonable to account for relatively shallow groundwater conditions to occur as a conservative effort for design. Following this, it may be assumed that the leaching bed will be required to be at least partially raised to provide the minimum separation distance from any high groundwater levels.

Per *Ontario Building Code* article 8.7.2, a Leaching Bed consists of an absorption system constructed as absorption trenches or as a filter bed, located wholly in ground or raised or partly raised above ground, as required by local conditions, to which effluent from a treatment unit is applied for treatment and disposal.

Each component of the leaching bed must be designed and constructed appropriately according to the rate of sewage generation, existing soil conditions, and groundwater or bedrock elevations. To achieve the necessary vertical separation from groundwater, the dispersal bed may be raised using leaching bed fill to ensure a sufficient distance from the shallow groundwater that is compliant with the *Ontario Building Code*.

For the purposes of establishing feasibility of the proposed servicing scheme, a preliminary sizing of the Conventional Leaching Bed is provided herein. However, it is recommended that the design of the sewage system be completed by a licensed septic system installer in respect to the *Ontario Building Code*, the locations of other features (e.g., buildings, property lines, and set-backs), and the soil and groundwater conditions occurring at the Site.

The underlying soils at the Site are assumed to have a T-time greater than 15 minutes, and so the contact area for the leaching bed will be determined by multiplying the length of each run of distribution pipe with the bed width as per Sentence 8.7.3.1 of the *Ontario Building Code*. Assuming a sewage generation rate ("Q") of 2,000 L/d and a T-time of 50 min/cm, the contact area must be at least 576 m² in size. The area of the leaching bed must also extend a minimum of 15 m beyond the distribution pipe in any direction that the effluent may flow (this extension is often referred to as the "mantle").

Assuming a nominal length of one run of distribution pipe of 20 m, the dimensions of the leaching bed will be approximately 20 m long by 30 m wide to achieve a minimum total length of 500 m of distribution pipe while also respecting the given maximum length of one run of distribution pipe and the spacing requirements between each run. An additional buffer of 2 m would be required around the upgradient and cross-gradient sides of the bed to provide the required 4H:1V sloping for a bed raised 500 mm.

The nominal dimensions of the bed will be approximately 37 m by 30 m, including the required mantle space and shoulder slopes from the raised installation. Based on the proposed lot dimensions for the smallest proposed residential lot, it appears that this would be a manageable size to construct the leaching bed while still retaining some amenity space on the lot.

Anecdotally, it is well established that standard "1 acre" lots have sufficient space to support standard individual residential lots with on-site Class 4 sewage systems and wells. Consideration will be required to make sure that set-back requirements of the OBC are met during development of the lots, including between neighbouring lots. In the event smaller sewage system footprints are desired, filter beds and or treatment systems with dispersal could be used.

CONCLUSION

A preliminary hydrogeological assessment has been conducted for a proposed lot severance to create two additional residential lots in addition to the severance of the existing onsite commercial property from the vacant retained lands on the Site at 3437 Bruce Road 3, located within Part of Lots 16 & 17 Plan 156 Lot 3 to 25, Concession A, Geographic Township of Paisley, Municipality of Arran-Elderslie, County of Bruce. This study has been conducted to assess the feasibility for the Site to support the proposed severance, which will be serviced by private on-site sewage. The retained lot and each severed lot (i.e., a total of 3 developed lots) are proposed to have a total area of approximately 17.25 ha (42.62 acres).

The findings of the assessment indicate that:

- with respect to nitrogen attenuation, the proposed severed lots have been determined to be suitable for servicing with standard Class 4 on-site sewage systems with a low potential for impact to local water resources. Using the MECP D-5-4 estimation method, the resultant nitrate concentration for the entire proposed lot layout (i.e., one existing facility on the Site and two proposed residential properties) was calculated to be 0.48 mg/L, which is below the ODWS criteria of 10 mg/L.
- based on our review, it is reasonable to expect that the lot will be able to accommodate a Class 4 on-site sewage system constructed with a raised conventional leaching bed as per Section 8.7.2 of the *Ontario Building Code*.

We recommend that:

- The construction of sewage systems conforms to the OBC with respect to the T-time of soils underlying the proposed tile bed, minimum separation from the bedrock or high groundwater table, and required set-backs from all applicable features confirmed as part of the design and construction.
- The new on-site sewage systems be designed and constructed by a licensed septic system installer per the *Ontario Building Code* and in respect of the required setbacks from applicable features, including neighbouring lots.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED

Per:

A handwritten signature in black ink, appearing to read 'Cuirin Cantwell'.

Cuirin Cantwell, M.Eng., E.I.T.

Per:

A handwritten signature in black ink, appearing to read 'Matthew Nelson'.

Matthew Nelson, P.Eng., P.Geo.

Enclosures:

Site Layout Plan (provided by MHBC Planning)

REFERENCES

- Chapman, L., & Putnam, D. (1984). *The Physiography of Southern Ontario* (Third ed., Vol. Special Volume 2). (O. G. Survey, Ed.) Toronto, Ontario, Canada: Ontario Ministry of Natural Resources.
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- MECP. (1996a). *D-5-4 Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment*. (Ontario Ministry of the Environment, Conservation and Parks) Retrieved from Government of Ontario: <https://www.ontario.ca/page/d-5-4-individual-site-sewage-systems-water-quality-impact-risk-assessment>
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- OMNR. (1984). *Water Quantity Resources of Ontario*. Retrieved from Ontario Ministry of Natural Resources.



Severance Sketch

3437 Bruce County Rd 3
Paisley
Bruce County

LEGEND

- Subject Lands
(± 172,461m² / 42.62 ac)
- Proposed Abraflex Severance
- Part 1 (± 15,385m² / 3.80 ac)
- OPA/ZBA and Severance for Residential
- Part 2 (± 5,289m² / 1.31 ac)
- Part 3 (± 3,867m² / 0.96 ac)
- Servicing Easement
- Part 4 (± 822m² / 0.20 ac)
- Part 5 (± 225m² / 0.06 ac)
- Retained Lands
- Part 6 (± 147,098m² / 36.35 ac)
- OPA/ZBA to delete Special Policy Areas (± 9,010m² / 2.23 ac)

Notes
- Areas approximate, to be verified by survey

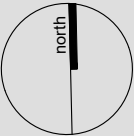
Sources
- Google Satellite Imagery
- Property Boundary: received from GM BluePlan Engineering Limited Sept. 22, 2022
- Contains information licensed under the Open Government Licence - Bruce County

DATE Oct. 4, 2022

SCALE 1:2,500

DRN PL

FILE 22306A



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