



**PATERSON
GROUP**

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Attention: **Mr. Colin Haskin**

Subject: **Landfill Impact Assessment
245/275 Lamarche Avenue
(Orleans Village Phase 4)
Ottawa, Ontario**

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Dear Sir,

Further to your request, Paterson Group (Paterson) has prepared a Landfill Impact Assessment for the proposed residential development at 245-275 Lamarche Avenue in the City of Ottawa, Ontario.

1.0 Introduction

To comply with the City of Ottawa's Official Plan (2022), which has extended the influence area for development near an operating solid waste disposal site from 500 m to 3 km. Currently, Paterson has prepared a Landfill Impact Assessment for the subject property to demonstrate that the Waste Connections Canada (WCC) Navan Waste Recycling and Disposal Facility (referred to herein the WCC Navan Facility) will not have adverse affects on the proposed residential development.

The following report has been prepared specifically and solely for the aforementioned project which is described herein, in general accordance with the Ministry of the Environment, Conservation and Parks (MECP) 'D-4 Land Use on or Near Landfills and Dumps' Guideline.





2.0 Proposed Development

It is our understanding that the proposed development will be comprised of a low-rise, ground-oriented residential subdivision, and a park. Associated walkways, driveways and landscaped areas are further anticipated, in addition to new roadways and on-street parking space.

3.0 Background Information

As part of this assessment Paterson has reviewed the 2019, 2020 and 2021 Operations and Monitoring Reports prepared by Golder Associates (Golder) for Waste Connections Canada (WCC).

Based on the findings presented in more recent 2021 environmental monitoring report the following summarizes the highlighted key points:

- ❑ No significant change in groundwater flow patterns has been observed.
- ❑ Groundwater was monitored at various levels in the subsoil units and within various zones and locations including down-gradient of the landfill.
- ❑ From a hydrogeology perspective, the site appeared to have a recharge area north of the landfill (north of Navan Road) with a downward groundwater flow component. South of the site, a typical discharge area having a slightly upward groundwater flow component (Mer Bleue bog) was noted. Based on the groundwater quality, only minor differences existed in the groundwater quality across the site.
- ❑ WSP Golder stated “Leachate quality monitoring results for 2021 indicate that leachate generated at the WCC Navan Facility is not significantly different from previous monitoring events. Leachate at the WCC Navan Facility continues to be relatively weak wastewater when compared to municipal landfill leachate.”
- ❑ Exceedances were discussed by phone with the local MECP Ottawa District Office where WCC presented a proposed course of action which was implemented in 2021. The exceedances that were observed in the 2021 monitoring report included a manganese concentration in the weathered clay and an ammonia concentration in the intact clay. The monitoring wells with the identified exceedances are located in the southeastern portion of the landfill.



- WSP Golder was said to be presenting to the MECP their results from the spring 2022 monitoring session to confirm the effectiveness of the measures implemented in 2021 and determine the need for a formal contingency plan which will be assessed in collaboration with the MECP.
- The proposed 2022 Environmental Monitoring Program was stated to be the same as the 2021 program apart from testing of VOCs, which were proposed to be discontinued from the groundwater and sediment monitoring program.

3.0 Landfill Impact Assessment

3.1 Introduction

The subject parcel of land, currently referred to as 245-275 Lamarche Avenue, also known as Orleans Village Phase 4, is situated at the southeastern corner of the Innes Road and Lamarche Avenue intersection. The subject lands are zoned as a Development Reserve Zone (DR) and are approximately 4.69 hectares in size and are situated approximately 2.3 km northwest of the landfill footprint (approved waste limit) at their closest limit. The boundary of the WCC property is situated approximately 2.0 km southeast of the subject lands.

3.2 Existing Waste Disposal Facility

The Navan Waste Recycling and Disposal Facility is owned and operated by WCC under the amended Environmental Compliance Approval (ECA) for a waste disposal site and industrial sewage works. Significant activities performed at the Navan Facility include the following:

- Landfilling operations (solid asbestos waste, non-hazardous waste – domestic, industrial, commercial and institutional waste, contaminated soil and wood waste, excluding putrescible waste)
- Recycling of waste materials at the facility
- Pre-treatment of collected leachate and disposal to Robert O. Pickard Environmental Centre (ROPEC) for off-site treatment
- Adding Clay Cover to completed fill areas of landfill
- Treatment of hydrocarbon impacted soils in the material processing area
- Screening of coarse granular soils to separate rock from soil for re-use

Composting of leaf and yard material was previously performed but has not been accepted since 2009.



Under the present ECA, the remaining life of the Navan Facility is estimated to be 5.1 to 5.2 years, as of December 31, 2021, based on future projected maximum annual waste receipts for landfilling and a 5-year average waste density. The actual life of the landfill will vary based on annual fill rates, in-place waste densities, waste diversion and recycling initiatives at the Facility, as well as the rate of air space development.

3.3 Local Geology

Local geology in the area of the WCC Waste Facility consists of a thick silty clay deposit overlain by silty sands of varying thickness. An escarpment which runs east-west through the WCC Waste Facility was once covered by such silty sand deposits, which were mostly eroded below the escarpment. Above the escarpment, silty sand deposits are found to be 0.6 to 2 m thick. A thick (20 to 35 m) marine silty clay deposit underlies the entire area. Bedrock in the area consists of shale from the Billings Formation.

According to the Geological Survey of Canada website on the Urban Geology of the National Capital Area, overburden soils in the area of the subject lands are reported to consist of Paleozoic rocks on the northernmost portion and offshore marine sediments composed of clay and silt on the southernmost portion. Drift thickness varies throughout the subject lands, reported to range from 0 to 15 m. Bedrock in the area of the subject lands is predominately reported to consist of limestone of the Bobcaygeon Formation, however, a very small portion in the southernmost portion of the subject lands is reported to consist of interbedded limestone and shale of the Lindsay Formation.

3.4 Surface Runoff

Surface runoff from the east side of the WCC Navan Facility site drains to Bear Brook drainage basin, which is part of the South Nation River watershed. Surface runoff from the west side of the WCC Navan Facility drains into the Mud Creek drainage basin, which in turn drains into Green's Creek, part of the Ottawa River and Rideau River watershed. The Mer Bleue bog, a unique and recognized ecological feature, is located south of the Navan Facility.

Studies performed during the approval process for the expansion of the Navan Waste Facility found that surface water runoff is not having adverse effects on surface water receptors downstream of the landfill. Surface water stations up-gradient of the landfill experiencing current or historical increases in parameter concentrations are not considered to be impacted by leachate, based on their up-gradient locations.



The existing approved surface water management system at the Navan Waste Facility is comprised of a network of drainage ditches and roadside swales to intercept runoff generated on-site and direct it to stormwater retention ponds located at the southeast or southwest corners of the landfill. Landfill operations are carried out such that surface water is directed away from the waste to minimize water infiltration. Furthermore, a clay cover is placed once the final waste grades have been reached. Soil stockpiles are also covered with topsoil and/or compost and are seeded for surface water and erosion control.

As the Navan Waste Facility is an engineered landfill, potential contamination from the leachate releases would be apparent in groundwater prior to surface water. An on-going, yearly monitoring program is performed to assess the surface water quality up-gradient and down-gradient of the landfill. The monitoring results from 2019 to 2021 indicate that surface water runoff has not caused adverse effects on surface water quality down-gradient from the Navan Waste Facility. Given the monitoring results in combination with the significant separation distance from the subject lands, surface water at the subject site will not be adversely affected by the Navan Waste Facility.

3.5 Local Groundwater Flow

The local groundwater flow in the area is from north to south, from the escarpment towards the edge of the Mer Bleue bog located south of the Navan Facility. The thick clay deposit acts as an aquitard or hydraulic barrier to groundwater movement, such that lateral flow occurs only through the surficial silty sand deposit and the upper weathered desiccated silty clay crust zone, which has a total thickness of only a few metres. Based on measurements recovered at up-gradient monitoring well locations, north of the escarpment, the shallow water table is between 1 to 2 m below ground surface, with only small fluctuations in water levels for recent years. Measurements taken at downgradient well locations, south of the escarpment, indicate the shallow water table is closer to ground surface elevations, with seasonal variations of nearly 1m. There is also the possibility of a perched groundwater condition in water trapped in the silty sand deposit overlying the impervious silty clay deposit.

3.6 Hydrogeological Review

The infiltration of rainwater into the landfill and decomposing waste creates a liquid called leachate which, if not managed properly, has the potential to impact groundwater in the vicinity of a landfill. In assessing the potential for groundwater contamination by leachate, the local geology and hydrology, approved engineering controls, and continued groundwater monitoring programs were considered.



The natural hydrogeological aquitard imposed by the thick silty clay deposit, that underlies the area, impedes the flow of groundwater, which flows from north to south, hydraulically down-gradient relative to the subject lands. The subject lands are situated up-gradient of the Navan Waste Facility.

3.7 Landfill Leachate

3.7.1 Leachate Characteristics

Landfill leachate is water that comes into contact with waste and leaches soluble material from the waste. Its composition is a function of the solid waste characteristics, prevailing meteorology, hydrogeology, and parameters within the landfill such as pH, moisture content, degree of compaction, geometry, etc.

Leachate composition varies not only with landfill age but also with changes in seasons and waste characteristics. It is noted that leachate containment at the Navan Waste Facility is currently provided by a thick (20 to 35 m) marine silty clay deposit which underlies the entire site. The thick silty clay deposit has a hydraulic conductivity (K) of less than 10^{-9} m/s, such that it acts as a natural liner. As such, leachate present at the Navan Facility is not leachate-impacted groundwater, but rather consists predominantly of precipitation that has infiltrated through the waste pile. The leachate may also consist of porewater from the underlying clay as a result of upward gradients and/or consolidation.

3.7.2 Leachate Management and Groundwater Protection System

The existing leachate management system at the Navan Facility includes a perimeter leachate collection system along the west and south perimeter of the waste pile, and an underlain leachate collection system (LCS) below the waste in the northeast, central, east, and southeast areas of the site. The perimeter leachate collection system generally consists of a granular-filled trenches and perforated drainage pipes. The leachate collection system is designed such that the groundwater elevation within the landfill is maintained at a lower level than the groundwater elevation in the surrounding area, creating a hydraulic trap, which causes groundwater to flow towards the landfill, rather than away from it.

Leachate is drained or pumped to a wet well and a pre-treatment/pump station where the leachate is pre-treated prior to discharge for final treatment at the City's municipal sewage treatment plant.



A vertical manhole, connected to the leachate collection system in the centre of site, provides an alternative point of access to evacuate leachate from this part of leachate collection system in the event that gravity drainage to the wet well and pump station cannot be maintained due to sub-grade settlement.

Low permeability cover soils are currently used to minimize infiltration of precipitation into the waste column. Clay soil cover is placed on the north, west, and south facing slopes, as well as the completed fill areas of the site.

3.7.3 Leachate Monitoring Program

Prior to the construction of the leachate collection system (LCS), leachate was sampled and analyzed in areas where surface breakout was observed. Breakout of leachate usually occurred at the down-gradient toe of the landfill. The monitoring of leachate quality is mainly focused on the LCS. The leachate sampled is wastewater that has not been treated or subjected to natural attenuation.

The results from leachate quality monitoring from 2019 to 2021 indicate that the leachate generated at Navan Facility continues to be a relatively weak wastewater when compared to municipal landfill leachate.

Furthermore, groundwater monitoring is currently performed on an 18-month basis, such that potentially impacted groundwater would be detected prior to any migration off-site. Additionally, groundwater trigger mechanisms are in place which use the results of the ongoing groundwater monitoring program to evaluate site compliance and to trigger the implementation of the contingency plans, when and if needed, to prevent leachate-impacted groundwater from exceeding a certain threshold.

In summary, there is no mechanism by which landfill leachate can affect groundwater quality beneath the subject site.

3.8 Ground Settlement

Ground settlement on the subject site is not expected to occur as a result of landfilling activities. Significant drawdown of the water table can cause ground settlement in silty clay deposits. Water table drawdown resulting from excavation during landfill construction, in combination with the hydraulic trap design of the leachate collection system, is limited in lateral extent due to the low permeability of the thick silty clay deposit. Therefore, ground settlement on the subject site will not be caused by operations of the Navan Facility, as confirmed by the on-going monitoring of groundwater levels within 10 m of the Navan Facility.



3.9 Visual Impact

Existing measures to mitigate visual impacts at the Navan Waste Facility include landscaped vegetation and planting, which are considered to provide adequate visual barrier from viewpoints north of the Navan Facility. Continued growth of vegetation will further decrease the landfill visibility with time. Furthermore, the excavating, filling, and landscaping operations at Phases 2 and 4 have been completed. Therefore, it is understood that there is a buffer zone of 85 m between the northern limit of waste placement and the northern limit of active operation area. Given the measures in place, in combination with the separation distance of approximately 2km, landfill visibility from the subject site and the potential for any resulting impact, is expected to be low.

3.10 Landfill Gas and Odours

The predictive modelling of potential off-site impacts related to air quality, dust, odour and noise carried out as part of the approvals processes for the Navan Waste Facility expansion includes a variety of potential receptor locations both on and off the landfill property. The modelling prediction results indicated that the site operations were expected to meet Provincial requirements and not cause adverse effects off-site.

There are a number of design and operation mitigation measures in place at the Navan Waste Facility, to control and minimize the potential for off-site atmospheric impacts, including a buffer area and natural barrier system, a constructed barrier system, an interim odour control system (until the installation of a landfill gas collection system) and a passive ventilation system.

Buffer area and natural barriers are designed with the consideration that methane gas migration of any significance may extend for a distance ten times the depth of the landfill between the ground surface and the water table, as specified in the MECP Guideline for Assessing Methane Hazards from Landfill Sites. Based on the depth of less than 2.5 metres between the ground surface and the water table, methane migration would be expected to extend for a distance of approximately 25 metres. It is noted that the zone of influence between the Navan Waste Facility and the proposed development is at least 2km, a distance within which adequate natural venting would negate any adverse effects on the subject property.

Ontario Regulation 232/98 states that the design of landfill must ensure that the subsurface migration of LFG meets several conditions including:

- The concentration of CH₄ gas below the surface of the land at the boundary of site must be less than 2.5% by volume.



- The concentration of CH₄ gas must be less than 1.0% by volume in any on-site building or enclosed structure.

These requirements were met at the Navan Facility based on the findings of the 2019-2021 monitoring results.

When odour complaints are received at the time of occurrence, the typical WCC practice is to carry out an investigation of the source of odour. Complainants are subsequently informed of the corrective measures taken or, if the source is deemed to be an off-site source, complainants are notified of the potential source of the odour. A log is also maintained at site to record the date and time of any odour complaints. This log describes activities related to the investigation of the complaint, and the mitigative measures implemented, if required, to address concerns. According to the 2019 to 2021 monitoring and operating reports, the number of odour related complaints drastically reduced from 2019 (20 complaints) to 2021 (1 complaint).

Given that the ongoing monitoring programs demonstrate that the Navan Waste Facility is performing acceptably as expected based on predictions, in combination with the separation distance of at least 2.0 km between the subject land and the landfill site, as well as northerly and western prevailing winds typically observed in the Ottawa area, the Navan Waste Facility is not expected to have any adverse affects on the proposed development.

3.11 Dust Management Plan

The landfill has the potential to generate fugitive dust emissions. The practices implemented at site to minimize the potential for off-property impacts include the following:

- Spreading aggregate over unpaved roads to reduce silt loading.
- Watering unpaved roads to increase the moisture content of surface material and reduce the potential for fugitive dust generation, and using dust suppressants as required.
- Enforcing a speed limit of 15 km/hr while vehicles are travelling on unpaved roads.
- Keeping short travel distances to material transfers and drop points.
- Constructing the wheel wash station to wash vehicles exiting the landfill and to reduce mud drag-out onto Navan Road (operational during non-freezing months of the year).



Based on the findings of the 2019 to 2021 monitoring and operating reports, no dust related complaints were noted. As such, it is not expected that there will be any adverse effects related to noise, at the proposed residential development.

3.12 Noise Control Plan

The noise level at the landfill site is dominated by road traffic noise along Navan Road and landfill activities at active fill areas. The noise control plan includes having a sufficient set-back between active fill areas and Navan Road and placing berms and soil stockpiles as a sound barrier between active fill areas and nearby homes and offices.

Based on the findings of the 2019 to 2021 monitoring and operating reports, no dust related complaints were noted. As such, it is not expected that there will be any adverse effects related to noise, at the proposed residential development.

3.13 Contaminated Soil and Groundwater

Soil

Contamination of soil at the subject site is not expected to occur as a result of the Navan Facility. Hazardous waste is not accepted at the Navan Facility.

Hydrocarbon contaminated soils are received at the treatment area (soil processing area of the landfill) and re-used as a construction fill material in accordance with ECA conditions for the site. Based on the separation distance between the subject lands and the Navan Facility, no impacts related to the treatment of hydrocarbon impacted soils are expected at the subject site.

Groundwater

For this landfill impact assessment, the results from up-gradient wells were chosen to be discussed, as proposed development lands are located up-gradient of the landfill.

Sand Layer

The background groundwater quality within the sand layer was monitored during the 2019 groundwater monitoring program using up-gradient monitoring wells. Based on analytical testing completed as part of the 2019 monitoring program, as well as historical data, chloride, manganese, iron, sodium, and TDS concentrations exceeding the ODWQS are present. Golder stated that since 2012, the up-gradient groundwater quality is indicative of elevated, but stable, chloride and hardness (calcium and magnesium) concentrations at MW05-1D.



Weathered Clay Deposit

The background groundwater quality within the weathered clay deposit was monitored during the 2019-2021 groundwater monitoring program using up-gradient monitoring wells. Based on analytical testing completed as part of the 2019-2021 monitoring program, as well as historical data, chloride, manganese, iron, sodium, and TDS concentrations exceeding the ODWQS are present.

It should be noted that according to the groundwater and surface water trigger mechanism report prepared by Golder in 2007, there is an evident difference between up-gradient (north) and south property boundary water quality on the east side of the property, where there are no potential impacts from landfill activities. Boron, copper, iron, arsenic, lead, sodium, alkalinity, bicarbonate, TDS, COD, and chloride concentrations are all considered to be naturally elevated in this area.

Golder stated that the MECP accepted that Guideline B-7 (RUPO) does not apply due to the varied hydrogeology across the WCC Waste Facility and the very saline environment of the clay deposit that underlies Mer Bleue bog. Thus, the leachate parameter indicator list includes alkalinity, ammonia, boron, chloride, hardness, magnesium, manganese, and potassium.

The landfill is underlain by a thick natural clay deposit with a very low hydraulic conductivity ($<10^{-9}$ metres per second), enabling it to act as a natural liner. Therefore, as mentioned in the Golder report, the leachate collected at the WCC Waste Facility is not leachate impacted groundwater, but rather it generally consists of precipitation that has infiltrated through the waste.

Golder stated that the average concentrations of several parameters measured in leachate from WCC Waste Facility are much lower in comparison to most landfill sites in Ontario. This suggests that WCC Waste Facility generates a comparatively low strength leachate, which Golder states is since the leachate is not generated from municipal waste.

Golder reported that the up-gradient groundwater wells are indicative of background concentrations, and that surface water monitoring stations up-gradient are not impacted by landfill leachate. As contaminated groundwater has not been identified, in combination with the separation distance and orientation of the subject land relative to the landfill site, there is no potential for an adverse affect on the subject land.



4.0 Conclusion

Based on a review of the available environmental monitoring reports prepared for the Waste Connections Canada Navan Waste Recycling and Disposal Facility and the separation distance between the landfill and the subject lands, it is our opinion that the Navan Waste Facility will not have any adverse effects on the subject lands and proposed development, nor will the landfill pose any risks to human health and safety.

5.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Caivan is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of this report.

Paterson Group Inc.

Karyn Munch, P.Eng., Q.P.ESA



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