PLANNING JUSTIFICATION REPORT
and
AGGREGATE RESOURCES ACT
SUMMARY STATEMENT

THAMES VALLEY AGGREGATES PIKE PIT

PART LOT 18, CONCESSION 3 N.T.R
MUNICIAPALITY OF THAMES CENTRE
COUNTY OF MIDDLESEX

Prepared by:

ESHER PLANNING INC.
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1.0 INTRODUCTION

Thames Valley Aggregates (TVA) is submitting an application to amend the Zoning by-law for the Municipality of Thames Centre, to permit the establishment of a sand and gravel pit operation. The proposed pit would extract sand and gravel from above and below the water table, with rehabilitation to a pond.

In addition to the municipal Planning Act application, TVA is submitting an application to the Ministry of Natural Resources and Forestry (MNRF) under the *Aggregate Resources Act* (ARA) for Class A, Category 1 License application (pit below the water table). The provincial standards under the Aggregate Resources Act include requirements for Site Plans together with a Summary Statement as part of the license application process. The Summary Report outlines the information and conclusions of the technical reports prepared in support of the application.

The property is within the Planning jurisdiction of the County of Middlesex and the Municipality of Thames Centre. This report evaluates the proposed land use within the context of both Official Plans, as well as within the context of Provincial legislation including the Planning Act, and the Provincial Policy Statement (2020).

The applications for the proposed aggregate operation are supported by a series of technical studies that have assessed the impact the natural environment, water resources, and on neighbouring residents. These technical studies conclude that, with the implementation of the recommended mitigation measures, there will be no significant adverse impacts on the neighbouring residents, or the natural environment. The Site Plans detail the manner in which operations will be carried out as described by the sequence of mining and progressive rehabilitation.

The following information and reports have been prepared in support of this application:

- Natural Environment Level 1 and 2 Technical Report, Terrastory Environmental
- Water Resources Assessment Report: LDS Consultants Inc.
- Stage 1 and 2 Archaeology Assessment, Lincoln Environmental Consulting Group
- Noise Impact Assessment Report: HCG Engineering
- License Pit Site Plans, Harrington McAvan Ltd.

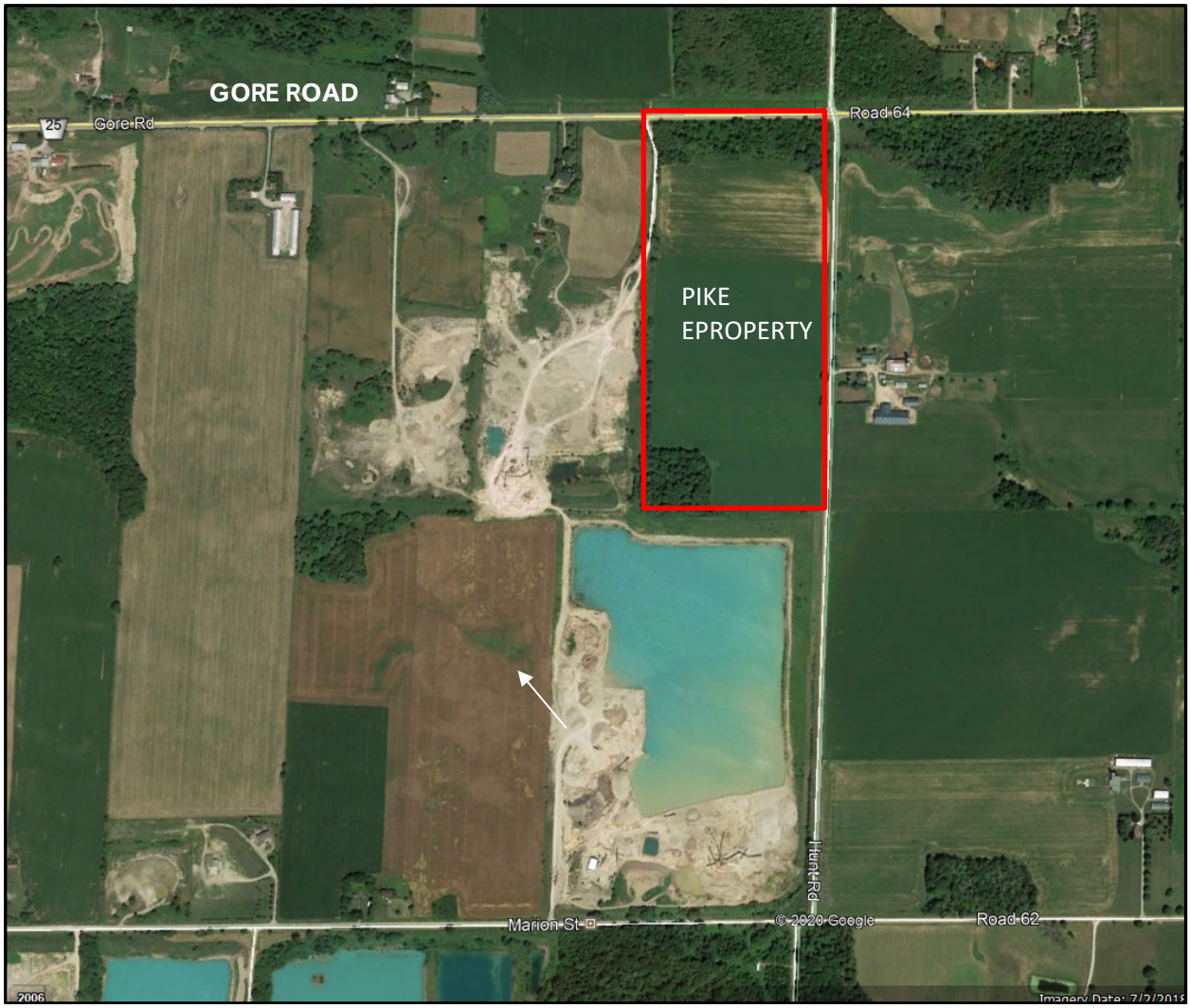
This report has been prepared to meet the requirements of both the Planning Act and the Aggregate Resources Act applications. The operational notes on the license site plans under the Aggregate Resources Act, have incorporated conditions based on specific technical recommendations ensuring no negative impacts on the natural environment or surrounding community. For reference, a copy of the Site Plans can be found in Appendix E.

2.0 LOCATION

The subject property is located at the southwest corner of Gore Road and Hunt Road. The area to be licensed covers and area of approximately 22 hectares, and described as part of Lots 18, Concession 3. NTR, geographic Township of North Dorchester, Municipality of Thames Centre.

The site is rectangular in shape, with frontage on both Hunt Road and Gore Road. The property is currently in agricultural use. There are no existing buildings or structures at the property.

Figure 1: Site Location



3.0 SITE DESCRIPTION AND SURROUNDING LAND USES

The surrounding lands are rural and are characterized by agricultural and aggregate land use. The community of Thamesford is located approximately 2.5 kilometers northeast of the site, and the community of Dorchester is located approximately 4.5 kilometers southwest of the site.

The lands immediately south of the property are occupied by a 32-hectare gravel pit operation, owned by Nicli Aggregates, with a maximum annual tonnage of 500,000. There are also aggregate operations located south and west of the site, including a 42-hectare gravel pit, which has a maximum annual tonnage of 227,000 (Spivak) and a 21-hectare gravel pit with a maximum annual tonnage of 250,000, both operated by Aaroc Aggregates Ltd.

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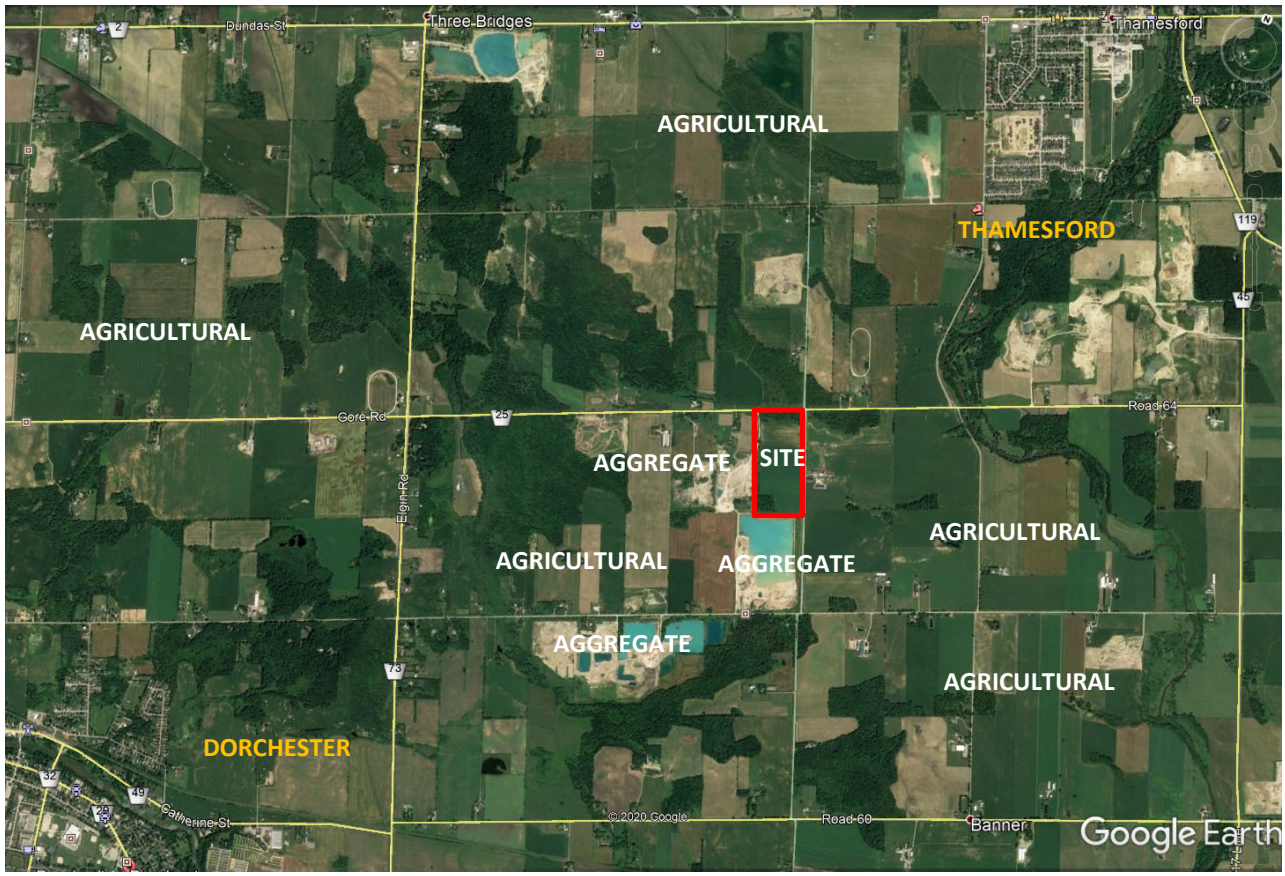
To the east of Hunt Road, the lands are predominantly agricultural, and support a dairy operation and are used for agricultural cultivation.

Figure 2: Surrounding Lands



4.0 DESCRIPTION OF THE PROPOSAL

The proposed sand and gravel operation would operate on a licensed area of approximately 21 hectares, with extraction proposed on a portion (16.3 ha) of the subject lands. The pit operation will include extraction of material from above and below the water table, with onsite processing and shipping. The proposed annual tonnage limit is 500,000 tonnes.

As extraction occurs, the operational area will be stripped of topsoil and subsoil, and this material will be stored on-site within berms, or used for progressive rehabilitation. The operations plan phasing shows extraction in 3 phases or areas, starting in the south limit of the site and moving towards Gore Road. The berms will be vegetated and maintained to help prevent erosion and control dust.

Extraction would remove approximately 5-7 metres of material from above the water table and below water extraction would to a depth of approximately 10 metres. The finished pond area is expected to be about 11.33 hectares in size, at completion.

The hours of operation of the Pit will be within daytime hours, 7 a.m. to 7 p.m on weekdays, and 7am – noon on Saturdays, with no operations on Sundays or Statutory holidays.

An application to remove the trees in the small, wooded area at the southwest corner of the site was submitted to the municipality prior to the ARA application and it is anticipated that the trees would be removed prior to commencement of extraction. The aggregate operations will utilize conventional construction equipment, including trucks, loaders, excavators, backhoes, bulldozers, scrapers, and conveyors. Portable processing equipment will be utilized at the site.

The primary site access will be located at the northeast corner of the site, south of the existing woodlot, and the primary truck route will be located along the easterly limit of the site. Rehabilitation will be undertaken progressively, and the final rehabilitation will create a pond with sideslopes. The details of the operations and rehabilitation are shown on the Site Plans, which have been prepared in accordance with Provincial Standards for aggregate resource operations. The proposed rehabilitation will be compatible with the surrounding land uses.

Careful consideration and planning has gone into the design of the operations and the rehabilitation to minimize and mitigate impacts on the surrounding environment and nearby residents. The Site Plans are included in the Appendices to this report.

The site plans have incorporated the technical recommendations from all the reports to mitigate any negative impacts on the adjacent land uses from the proposed pit.

5.0 AGGREGATE RESOURCES SUMMARY STATEMENT

The provincial standards under the Aggregate Resources Act include requirements for Site Plans together with a Summary Statement as part of the license application process. The Summary Report outlines the information and conclusions of the technical reports prepared in support of the application.

5.1 Planning and Land Use Considerations

The subject lands fall within the Planning jurisdiction of the County of Middlesex and the Municipality of Thames Centre. The proposed pit will require approvals from the municipality, specifically amendments to both the Official Plan and the Zoning Bylaw for Thames Centre are required to permit the proposed use.

The property is designated as 'Agricultural' in both the County and Township Official Plans. As per the County Official Plan, mineral aggregate uses are permitted in Agricultural areas provided they meet the other requirements of the Official Plan, and provided that appropriate zoning is in place.

The technical studies prepared in support of the proposal assess the impact of the proposed pit operation on neighbouring residents, the natural environment, and ground and surface water resources. The Site Plans detail the manner in which operations will be carried out as described by the sequence of mining and progressive rehabilitation.

The operations and the rehabilitation of the pit have been designed to minimize impacts. The Natural Environment Report has evaluated the impacts of the proposal on significant wetlands, woodlands, fish habitat, and habitat of endangered species and threatened species. The recommended mitigative measures are incorporated to ensure no negative impacts on these natural features or their functions.

The protection and management of aggregate resources has also been deemed to be of provincial significance and their development is regulated by specific legislation. In addition to the Aggregate Resources Act (ARA), the development of aggregate extraction operations must respect the provisions of the Planning Act and give appropriate consideration to the policy framework established by the regional and municipal planning documents.

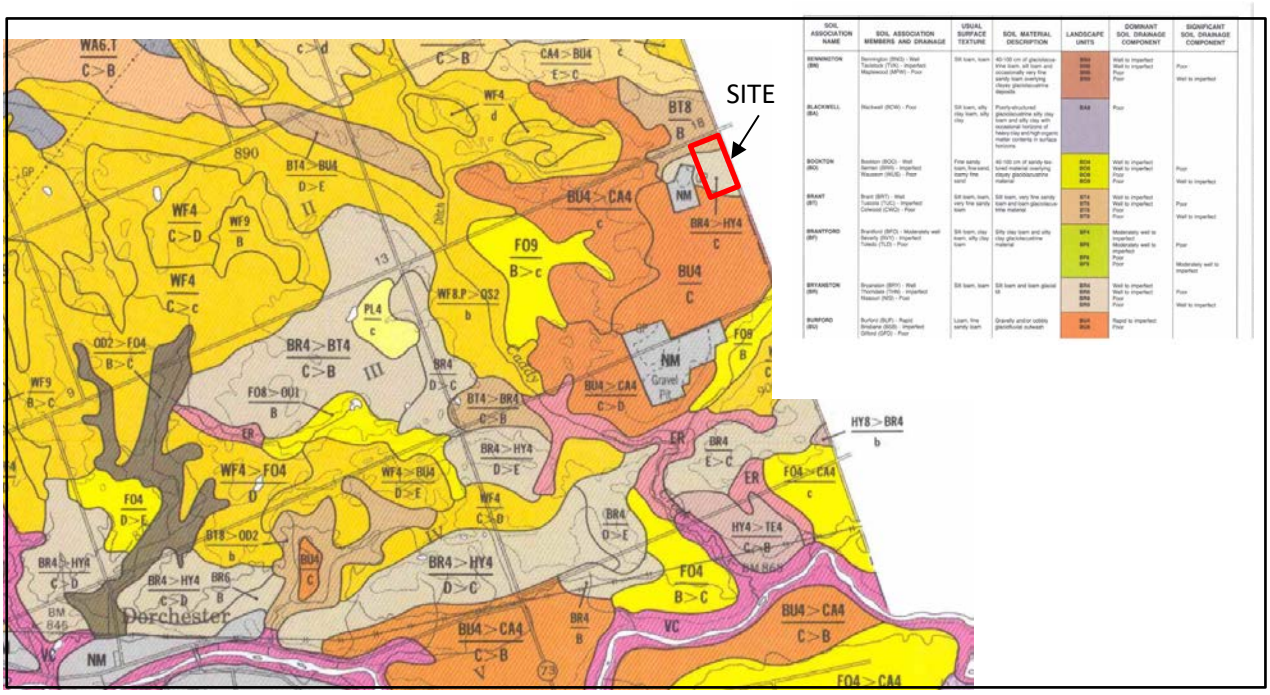
The Planning analysis is further detailed in Section 7 of this report.

5.2 Agricultural Classification

According to the Soils of Middlesex County mapping (OMAFRA 1992) the soils on the subject property are comprised of Bryanston or Thorndale loam (see Figure 4). The soil is characterized by brown sandy loam over roughly stratified sand and gravel. The topography of the area is gently undulating with some knolls present along the north edge and in the central part of the property. The property slopes down in a long, steady decline to the west and east from the central part of the site.

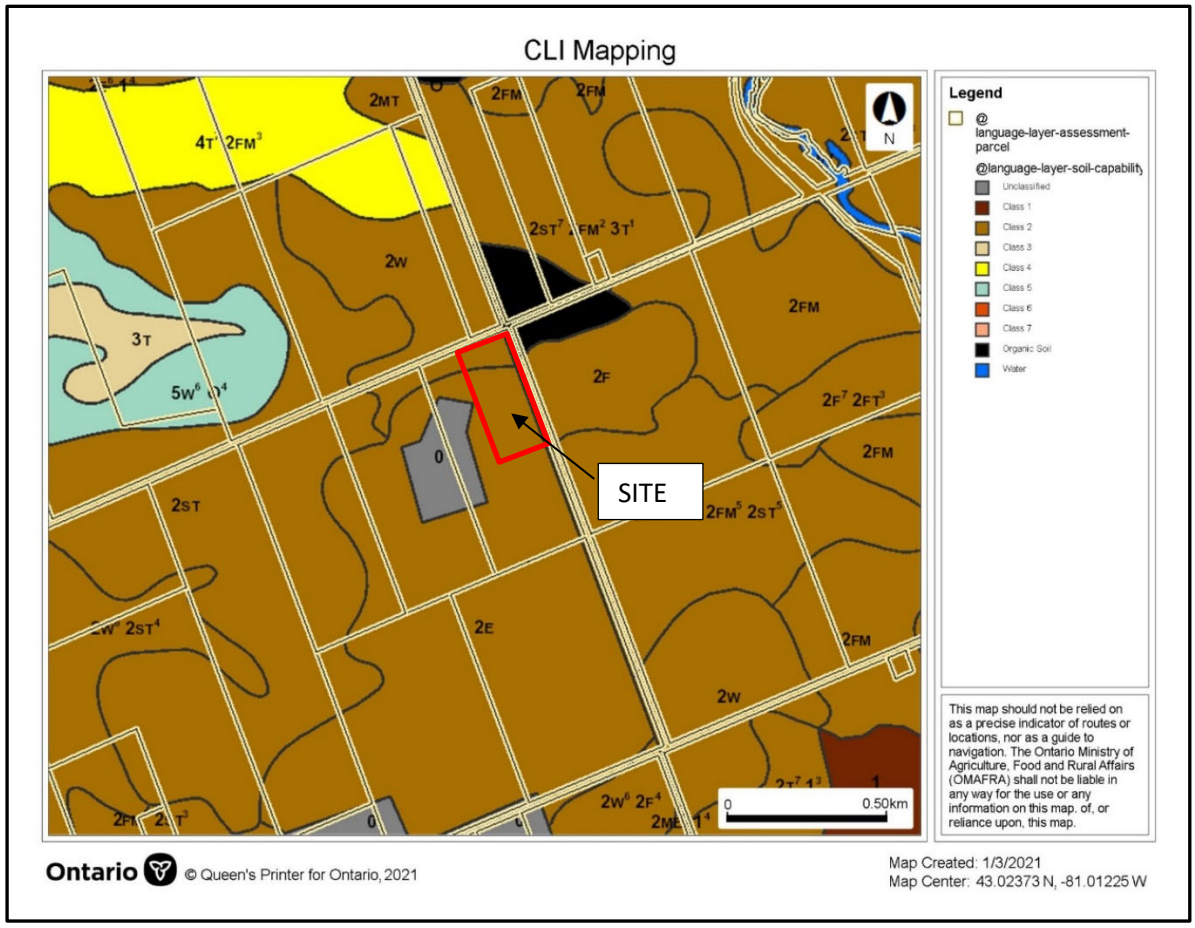
The Bryanston Association has developed in the loamy-textured till, on nearly level to undulating topography. The gravel content of the till is greater than 10%. Cobbles and stones are common. Bryanston Association soils are used extensively for the production of common field crops in Middlesex County, and they are also suitable for a variety of special crops

Figure 3: Excerpt from Soils of Middlesex County, OMAFRA 1992



The Canada Land Inventory Mapping indicates that the soils on the subject property are primarily Class 2 Soils, and exhibit limitations that restrict the choice of crops, or require special conservation practices and very careful management, or both (see Figure 5). The area to be extracted is primarily class 2E, indicating limitations for agriculture associated with loss of topsoil and subsoil from erosion. The woodlot at the northern edge of the property, outside the area to be extracted, is soil class 2W, This subclass indicates the presence of excess soil moisture due to poor or very poor soil drainage. These lands are considered prime agricultural lands and are subject to relevant Provincial and local planning policies.

Figure 4: Excerpt from Canada Land Inventory Mapping, OMAFRA 2020



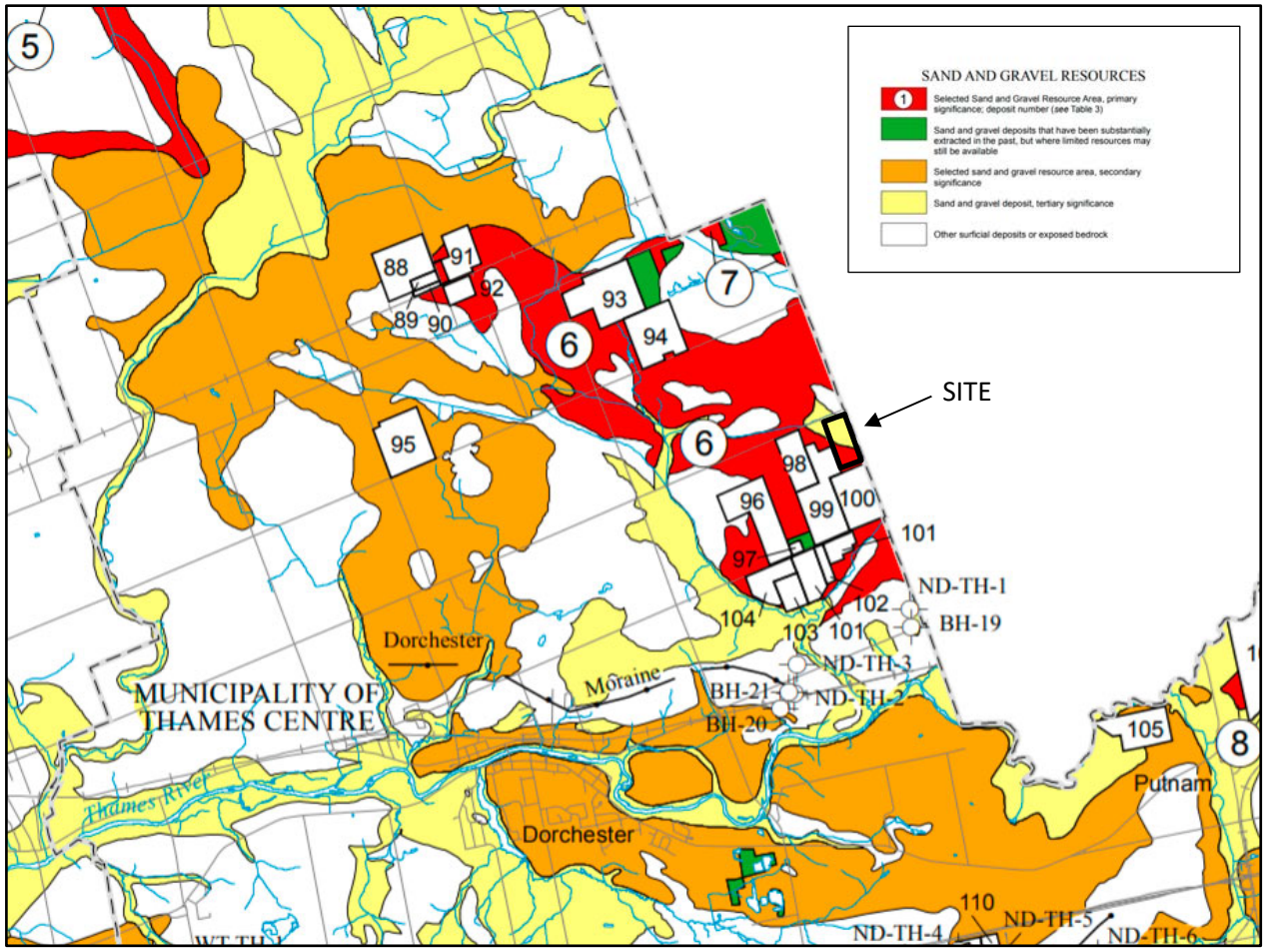
5.3 Quality and Quantity of Aggregate Resource

Quaternary geology mapping for the area indicates that the study area consists of ice-contact stratified drift deposits of silt with some sand and gravel in the north half of the site, and ice-contact gravel deposits with some re-worked glacial till in the south part of the site.

According to the Aggregate Resource Inventory Paper for the County of Middlesex and the City of London (Ontario Geological Survey Paper 78, 2016) the majority of the site is identified as an aggregate resource area of primary significance for sand and gravel. The deposit is associated with the Dorchester moraine, a feature with sand and gravel deposits often overlain by or interbedded with till.

There are several licensed pits within this deposit with face heights ranging from 2 to 6 metres with material that varies from medium sand with medium to coarse gravel with pockets of material with higher gravel content in some areas. Portions of these resources are below the water table. A number of licenced operations are extracting material from below the water table. Water-well and borehole records indicate that the deposit may yield up to 20 m of material, when above and below water extraction is considered.

Figure 5: Aggregate Resource Inventory Mapping (ARIP)



Geotechnical investigations in 2019 confirmed the presence of commercially viable sand and gravel, with a significant portion of the resource located below the water table. The resources in this deposit are known to be of high quality and suitable for a wide range of construction products including granular products and sand and gravel for asphalt and concrete products. Records of the boreholes and grain size analysis can be found in the Hydrogeological Report (LDS Consulting, Dec 2020).

The proposed pit will extract approximately 7 metres of material from above the water table and up to 10 metres from below the water table. The deposit is shallower in the northern portion of the property, where the till layer is encountered, and below water extraction in this part of the site is expected to be approximately 3 metres in depth.

There is an estimated 4.04 Million tonnes of sand and gravel within the area proposed to be licensed. Approximately 60 percent of the resource is found below the water table.

5.4 Haul Routes and Truck Traffic

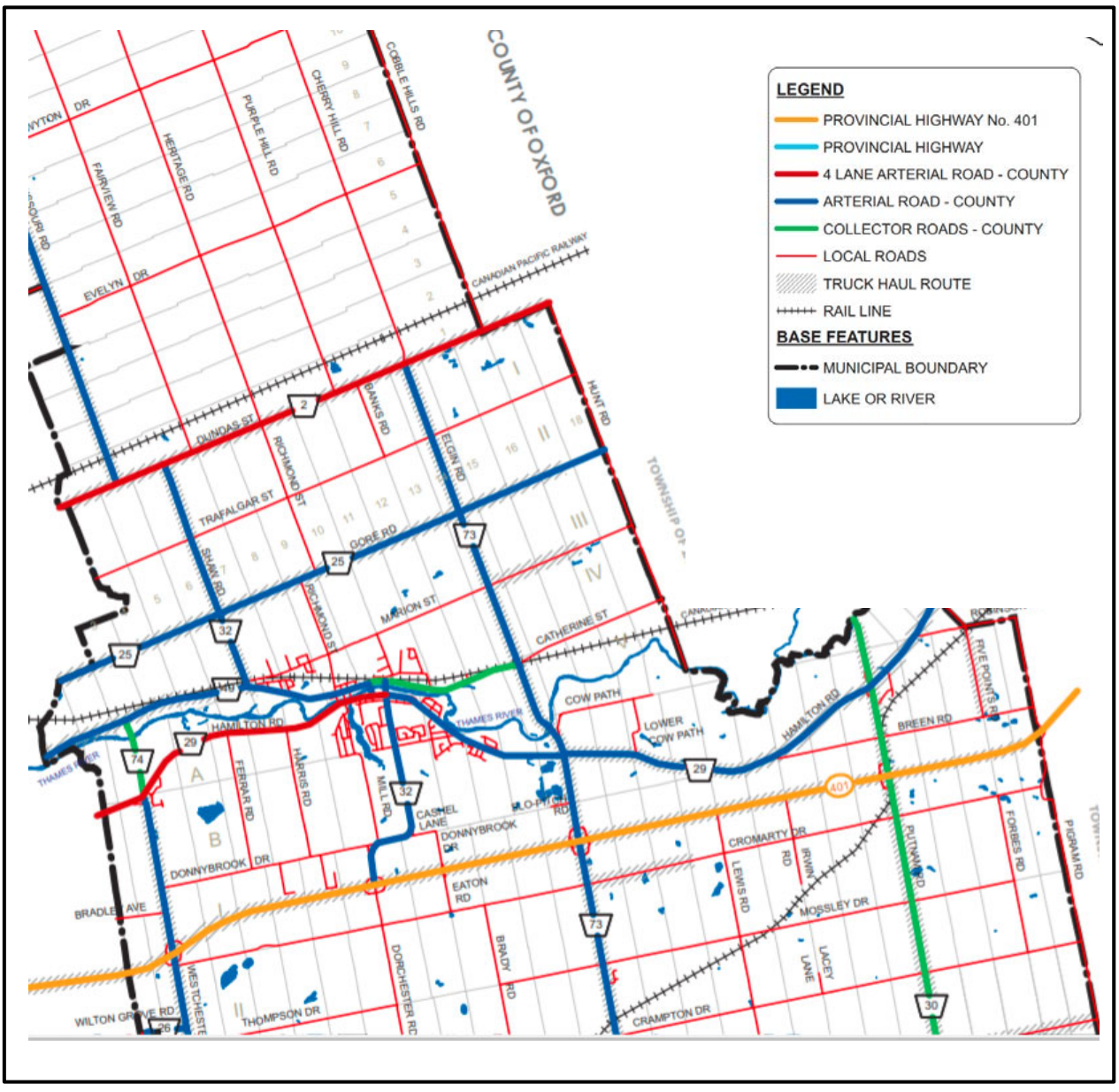
The proposed access to the site is located at the north end of the site onto Hunt Road (see site plans). This is currently used as a haul route for the existing aggregate operations in this area.

On a typical day during construction season, it is anticipated that approximately 5 trucks would enter and exit the site per hour.

INTERSECTION OF GORE ROAD AND HUNT ROAD, FACING WEST ON GORE ROAD.

The Official Plan for Thames Centre identifies Gore Road as a "County Arterial Road" and a "Truck Haul Route". According to the Official Plan, "the function of the arterial roads is to facilitate the inter-municipal and intra-municipal movement of high volumes of traffic to and from major traffic generating sectors in the Municipality" (OP Section 5.4). Truck Haul Routes are also identified in the Official Plan to ensure that trucks utilize roads that are suitably constructed or improved for these purposes (see OP Schedule "C" and Section 5.9). The proposed entrance to the Pike Pit is located on Hunt Road, a local road which forms the boundary between the Municipality of Thames Centre, in Middlesex County and the Township of Zorra, in Oxford County.

Figure 6: Thames Centre Official Plan, Schedule "C": Transportation Plan



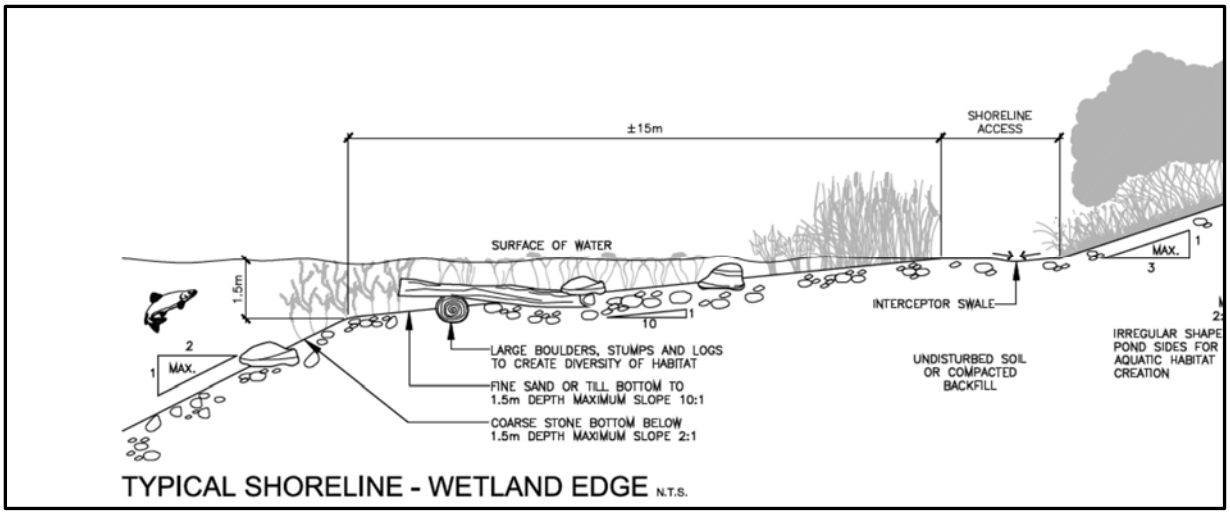
5.5 Progressive and Final Rehabilitation

In accordance with the requirements of the Aggregate Resources Act Provincial Standards, the extracted area will be progressively rehabilitated, as outlined on the Site Plans.

All topsoil and overburden on site will be stripped and stockpiled separately in berms or stockpiles and replaced as quickly as possible in the progressive rehabilitation process. Berms and stockpiles will be constructed on the perimeter of the site to attenuate noise and provide visual screening. The material (overburden and topsoil) in the berms will be used for progressive and final rehabilitation of the site.

As below water extraction progresses across the site, a pond will be created which, when final rehabilitation is completed, will be approximately 11.3 hectares in area. The northern margins of the out pond will be rehabilitated to wetland habitat through contouring (shallow nearshore slopes) shoreline plantings and inclusion of woody debris to create habitat. Additional native upland planting will be installed around the perimeter of the site.

The proposed final rehabilitation is compatible with the surrounding lands and land use.



6.0 Technical Reports and Site Plans

The Planning Act and Aggregate Resources Act applications are supported by the technical studies assessing the impact of the proposed operation on neighbouring residents, the natural environment, the agricultural capabilities of the land, impact on roads, and municipal water supply. These technical reports have been prepared in accordance with the requirements under the Aggregate Resources Act.

The following technical reports were completed as part of this application:

- Water Resources Assessment Report, LDS Consulting
- Natural Environment Level 1 and 2 Technical Report, Terrastory Environmental
- Stage 1 and 2 Archaeological Assessment, Lincoln Environmental Consulting Group
- Noise Impact Assessment, HGC Associates

The Site Plans detail the manner in which pit operations will be carried out as described by the sequence of mining and progressive rehabilitation. The Site Plans form the basis of the pit license application under the Aggregate Resources Act and also form an integral part of the review process of the applications.

The proposed operation has been carefully designed to reflect the recommendations of the accompanying technical reports. The operational notes on the license site plans under the ARA, have incorporated conditions to reflect specific recommendations to mitigate any negative environmental effects.

6.1 Water Resources/Hydrogeology (Appendix A)

In support of the proposed aggregate excavation, LDS Consulting completed a background review of the available geological, hydrogeological, and natural environment data to develop a conceptual understanding of the site hydrogeology and hydrogeology.

LDS carried out a field program consisting of a series of seven boreholes, drilled between July 10 and 22, 2019. Monitoring wells were installed in all of the boreholes, with the exception of Borehole BH3, to allow for monitoring the stabilized groundwater level at the site. Details of monitoring well construction are provided in the Hydrogeology report. The monitoring wells have been registered with the Ministry of Environment, Conservation, and Parks (MECP), in accordance with Ontario Regulation (O.Reg.) 903.

There is no proposed dewatering of the gravel pit. Aggregate extraction is proposed for excavation below the water table using an excavator or a drag line. According to the LDS report, predicted changes to water balance are small and inconsequential, and localized changes which are expected to result in a flattening of the groundwater gradient are not expected to have an adverse impact on natural features including the northern woodlot and wetland areas which are being maintained.

The report concludes, that based on the setting, scale of projected groundwater volume and level changes there is no significant potential for negative impacts to local water supplies associated with the proposed Pike Pit. The hydrogeology report recommends monitoring of groundwater levels on the site through the operating season and this recommendation is included as a condition on the Site Plans.

6.2 Natural Environment (Appendix B)

Under the ARA, a Level 2 Natural Environment impact assessment and report is required when natural heritage features (e.g., wetlands, species at risk habitat) have been identified on, or within, 120 m of a site during preliminary investigations (i.e., a Level 1 assessment). During Terrastory's preliminary review of available data sources and initial site reconnaissance, natural heritage features were identified as occurring on the site, or within 120 m of the Study Area. The Natural Environment Report addresses the requirements for an aggregate license application.

The Terrastory report identified potential habitat for species at risk, significant woodlands and valleylands, and locally significant wetlands on or adjacent to the site. The report includes an assessment of potential impacts of the proposed aggregate extraction on natural features and functions. The report includes recommendation to mitigate any impact on species at risk, significant wildlife habitat areas ad significant woodlands. These include protection measures such as sediment and erosion control during construction and site clearing, together with replacement of habitat through the proposed progressive and final rehabilitation plan.

The report concludes that the phased extraction approach and progressive rehabilitation being proposed, along with mitigation measures described in their report, will ensure that potential impacts to natural heritage features on and within 120 m of the site will be mitigated. The features and their ecological functions will be maintained over the long-term consistent with provincial and local policy requirements.

6.3 Cultural Heritage/Archaeology (Appendix C)

Lincoln Environmental Consulting Group completed a Stage 1 and 2 archaeological assessment for the Site in 2019. The field work and report (dated Jan 2020) were completed in compliance with the provincial standards and guidelines set out in the Ministry of Tourism, Culture and Sport's (MTCS) 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011).

The Stage 2 archaeological assessment of the study area did not result in the identification of archaeological resources on the property.

The report was been provided to the Minister of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c. O.18 (Government of Ontario 1990b) and a letter of clearance from the Ministry is included in Appendix C of this report.

6.4 Noise Impact Assessment (Appendix D)

HCG Engineering Ltd. prepared an assessment of the potential impact of noise from the proposed aggregate operations in accordance with the Ontario Ministry of Environment, Conservation and Parks, MECP, guidelines for noise assessment, NPC-3002 and NPC-2333. The noise study considered the impacts at noise sensitive points of reception near the proposed pit operation.

There are 2 residences located within 150 metres of the proposed pit operation. One is located to the west and is part of the property which is licensed to Spivak (Gore Pit). The other is located to the west, on the east side of Hunt Road, and is the Pike farmhouse.

The noise report sets out noise mitigation measures which are designed to ensure all operations are in compliance with the applicable sound level limits. These measures include construction of a berm along Hunt Road, and screening around plant equipment. It is noted that the residents of the Pike house indicated in writing when the sold the portion of the farm that is now subject to this application, that they have no objection to the pit operations.

7.0 LAND USE PLANNING CONSIDERATIONS

The subject lands fall within the Planning jurisdiction of the Township of Thames Centre and the County of Middlesex. This report evaluates the proposed land use within the context of both of the Official Plans, as well as within the context of Provincial legislation including the Planning Act, and the Provincial Policy Statement (2020).

Land use planning decisions are informed by a review of provincial interests, and a detailed assessment of the impacts of the proposed development or change in land use. In the case of aggregate operations, it is common to have overlapping provincial interests (e.g., agriculture, natural heritage and aggregate resources). It is the goal of good land use planning to balance and protect these overlapping interests in the most effective manner, keeping in mind the long- term planning horizon.

The protection and management of aggregate resources has been deemed to be of provincial significance and is regulated by specific legislation. In addition to the Aggregate Resources Act (ARA), the development of aggregate extraction operations must respect the provisions of the Planning Act and give appropriate consideration to the provincial and local policy framework. The proposed pit will provide additional reserves to extend the life of the Sunderland pit and sustain a close to market supply of high-quality sand and gravel. The extension area is recognized as an important mineral aggregate resource area in the regional official plan.

The Provincial Policy Statement, 2020 establishes a policy-led system of planning. These policies are intended to enable protection and utilization of aggregate resources, while maintaining important agricultural areas; conserving cultural and natural heritage resources; and protecting existing settlements, ground and surface water resources.

The following analysis provides an assessment of the Pike pit proposal in the context of relevant Provincial and local planning policies. The evaluation is based on the findings of the technical studies forming part of the application submission, an evaluation and an analysis of the surrounding land use, and the environmental impact of the proposal. For ease of reference, this report includes tables which outline a review the proposal against the applicable current planning policies.

7.1 Planning Act

When carrying out its responsibilities under the Planning Act, a municipality or any other authority that affects a planning matter must have regard for the provincial interests as identified in Section 2 of the Planning Act. The provincial interests contained in Section 2 of the Planning Act are outlined in the table below. The proposal has been evaluated in the context of these prescribed provincial interests:

Provincial Interests	Pike Pit Proposal
2(a)The protection of ecological systems, including natural areas, features and functions.	The Natural Environmental Report screening and technical evaluation prepared by Terrastory identified the following natural areas and features within the area to be licensed or within 120 metres of the subject property: • Significant woodlands • Significant wildlife habitat • Potential Habitat of Species at Risk (barn swallow, little brown myotis, northern myotis, bobolink and Eastern Meadowlark) The proposed extraction operations have been assessed for impacts on the natural environment. The Terrastory report recommends measures to mitigate impacts on the natural environment. These recommendations are detailed in their report and have been incorporated into the Site Plans. The Terrastory report concludes that there will be no negative impacts to the significant natural features and functions on the site or adjacent lands.
2(b) The protection of the agricultural resources of the Province	There are overlapping provincially interests on this site (aggregate and agriculture). Provincial policy allows for the extraction of aggregate resources in agricultural areas and does not require rehabilitation to agriculture where there is a significant quantity of material below the water table.
2(c) The conservation and management of natural resources and the mineral resource base.	Aggregate resources are a provincial interest and should be protected from incompatible land uses and developed responsibly. The proposed pit will provide a high-quality supply of mineral aggregate material to the local and regional markets.
2(d) The conservation of features of significant architectural, cultural, historical, archaeological or scientific interest.	The Archaeology Assessment Report completed by Lincoln Environmental Consulting Group confirmed that there are no significant archaeological resources on the subject property. This report was reviewed and a letter of clearance was issued by the Ministry of Heritage, Sport, Culture and Tourism.

2(e) The supply, efficient use and conservation of energy and water	Ground and surface water features have been studied and documented in the report prepared by LDS Consulting. Mitigation measures included on the Operations Plan including, groundwater level monitoring, annual water quality monitoring and management of surface activities (e.g., fuel handling) to minimize the potential for groundwater disturbance or contamination in accordance with provincial guidelines.
2(k) The adequate provision of employment opportunities.	The proposed aggregate extension will result in the continued availability of employment opportunities locally. These primary resource jobs present a multiplier effect that can result in the creation of additional supplemental service jobs in the Township.
2(l) The protection of the financial and economic well-being of the Province and its municipalities.	In addition to the employment opportunities created by the proposed operation, the Township will receive financial contributions through property tax assessment and TOARC levies as well as providing a source of aggregate to contribute to competition in the local market.
2(m) The coordination of planning activities of public bodies.	The interests of public bodies and agencies are considered by the circulation requirements of the Planning Act and the ARA and have been incorporated into the Site Plans.
2(n) The resolution of planning conflicts involving public and private interests.	The land use planning process, as well as the ARA licensing process, enables municipalities, agencies and the public to participate in the evaluation of this proposal. The appropriate agencies (i.e., MNRF, MECP, GRCA) will be included in the review of the ARA application.
2(o) The protection of public health and safety.	The operational plan contains mitigation measures that have been developed to minimize the social impact of the proposed pit operation. For example, measures to mitigate impacts from noise, and dust, and visual screening measures have been incorporated into the Site Plans. The requirements of the Operation Plan and site plan notes are legally binding and enforceable through the ARA.
2(p) The appropriate location of growth and development.	On- site investigation has confirmed the quality and extent of the aggregate resource on this property. No significant natural or cultural heritage features will be negatively impacted by the proposed pit operation.

7.2 Provincial Policy Statement (PPS) 2020

The Minister of Municipal Affairs and Housing, under Section 3 of the Planning Act, can issue policy statements that provide direction to other ministries, municipalities and agencies on matters of provincial interest as they relate to land use planning. These policy statements are developed in consultation with other ministries and are updated from time to time. The latest PPS came into effect on May 1, 2020 and any land use decision by any authority that affects a planning matter must be consistent with the PPS. The 2020 Provincial Policy Statement provides a policy-led planning approach that recognizes the complex inter-relationship among environmental, economic and social factors in land use planning. The PPS supports a comprehensive, integrates and long-term approach to planning and recognizes linkages among policy areas.

The 2020 Provincial Policy Statement provides a policy-led planning approach that recognizes the complex inter-relationship among environmental, economic and social factors in land use planning. The PPS supports a comprehensive, integrates and long-term approach to planning and recognizes linkages among policy areas. (Part III)

The PPS recognizes that the Province's natural heritage resources, water, agricultural lands, mineral aggregate resources, cultural heritage and archaeological resources provide important environmental, economic and social benefits. The wise use and management of these resources over the long term is a key provincial interest. The province must ensure that its resources are managed in a sustainable way to conserve biodiversity, protect essential ecological processes and public health and safety, provide for the production of food and fiber, minimize environmental and social impacts and meet its long term economic needs. (PPS, Part IV)

While the PPS provides strong measures for the protection of prime agricultural lands, the provincial policies also recognize the importance of mineral aggregate resources.

The following table provides an evaluation of the proposal in the context of the relevant policies of the PPS. The evaluation is based largely on findings of the technical studies prepared in support of the applications.

Provincial Policy Statement – Consistency Analysis

PPS (2020) Policies	Pike Pit Proposal
1.1.4. Rural Areas in Municipalities *Healthy, integrated and viable rural areas should be supported by:* *f) promoting the diversification of the economic base and employment opportunities through goods and services, including value-added products and the sustainable management or use of resources.*	The proposed Pike Pit is located in a rural area. The sustainable management or use of mineral aggregate resources, contributes to the local economic base. The proposed pit provides access to a provincially significant resource and the rehabilitation to agriculture is consistent with provincial policy. The use of existing transportation infrastructure also promotes efficient development.
1.1.5 Rural Lands in Municipalities: *permitted uses are:* *a) to the management or use of resources;* *b) resource-based recreational activities;* *c) limited residential development;* *d) home occupation and home industries* *e) cemeteries;* *f) other rural land uses*	The proposal represents to the use of a provincially significant natural resource (mineral aggregate) and is an appropriate rural land use. The lands are designated Agricultural and are also identified as a Mineral Aggregate Resource Area. The Official Plan recognizes sand and gravel extraction as a permitted use in the rural area.
1.2.6 Land Use Compatibility *1.2.6.1 Major facilities and sensitive land uses should be planned to ensure they are appropriately designed, buffered and/or separated from each other to prevent or mitigate adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term viability of major facilities.*	The site plans for the proposed Pike Pit have been designed to ensure that appropriate mitigation measures are in place to minimize the effects of noise and dust from the operation. The recommendations of the Noise Assessment Report are incorporated into the design of the pit. The Site Plans have been to include recommended buffers and/or setbacks from nearby sensitive lands uses to prevent and mitigate adverse effects from dust and noise. and dust on the surrounding land uses.
1.6.7.1 Efficient use shall be made of existing and planned infrastructure.	Truck traffic from the proposed Pike Pit will utilize the existing Truck Haul Route (Gore Road). This route is currently used by several other gravel pits in the area.

PPS (2020) Policies	Pike Pit Proposal
1.7.1 Long-term economic prosperity should be supported by: *b) optimizing the long-term availability and use of land, resources, infrastructure, electricity generation facilities and transmission and distribution systems and public service facilities;*	The proposed Pike Pit provides a close-to-market supply of high-quality aggregate resource. The progressive rehabilitation plan ensures that the subject lands will be returned to a use that is compatible with the surrounding landscape. In addition to employment, the pit will provide a source of revenue from TOARC levies and property taxes over the life of the operation.
2.1.1 Natural features and areas shall be protected for the long term.	The Natural Heritage Report has evaluated the impacts of the proposal on significant wetlands, woodlands, fish habitat, and habitat of endangered species and threatened species. Based on the field work and site assessment, a provincially significant wetland and potential habitat for Species at Risk were identified on site or on the adjacent lands. The recommended mitigative measures are incorporated to ensure no negative impacts on these natural features or their functions.
2.2.1 Planning authorities shall protect, improve or restore the quality and quantity of water by: *a) using the watershed as the ecologically meaningful scale for integrated and long-term planning;* *b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;* *c) identifying surface water resource systems consisting of ground water features, hydrologic functions and natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed;* *d) maintaining linkages and related functions among ground water features, hydrologic functions and natural heritage features and areas and surface water*	No surface water features, hydrologic features or municipal drinking water sources are located on or within 120 metres of the Pike Pit property. Several operational conditions and best practices have been included on the Operations Plan in order to minimize any potential for surface activities to impact groundwater quality. These include groundwater level monitoring and restriction of surface activities in accordance with provincial guidelines. Further, contingency measures have been implemented on the site plans in order to provide for appropriate corrective actions should groundwater be encountered during extraction.

PPS (2020) Policies	Pike Pit Proposal
features including shoreline areas; *e) implementing necessary restrictions on development and site alteration to:* *1. protect all municipal drinking water supplies and designated vulnerable areas; and* *2. protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;* *f) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality; and*	
2.3 Agriculture *2.3.1 Prime agricultural areas shall be protected for long-term use for agriculture.* *2.3.6 Non-Agricultural Uses in Prime Agricultural Area* *2.3.6.1 Planning authorities may only permit non-agricultural uses in prime agricultural areas for:* *a) extraction of minerals, petroleum resources and mineral aggregate resources in accordance with policies 2.4 and 2.5* *b) limited non-residential uses*	The Pike property is identified in the Canada Land Inventory Agricultural Capabilities Mapping as class 2 agricultural land. Extraction of minerals is a permitted use according to PPS policy 2.3.6.1 (a). The proposal ensures that rehabilitation will be undertaken progressively to generally restore the extracted area to an agricultural after-use. The site will be protected for the cultivation of field crops over the long term. The proposed extraction of sand and gravel, and progressive rehabilitation is in-keeping with the PPS section 2.3.6.
2.5 Mineral Aggregate *2.5.2.1 As much of the mineral aggregate resources as is realistically possible shall be made available as close to markets as possible.* *Demonstration of need for mineral aggregate resources, including any type of supply/demand analysis, shall not be required, notwithstanding the availability, designation or licensing for extraction of mineral aggregate resources locally or elsewhere.*	The proposed pit will provide a supply of commercially viable aggregate material for the local and regional market. The proposed pit will increase access to close-to-market supply of aggregates in local construction markets. This site is identified in the Regional and Township Official Plan as an important area of Mineral Aggregate Resources.

PPS (2020) Policies	Pike Pit Proposal
2.5.2.2 Extraction shall be undertaken in a manner which minimizes social, economic, and environmental impacts.	The technical studies prepared in support of the proposed pit demonstrate that no natural or cultural heritage features will be impacted by the development. The hydrogeological study has confirmed groundwater elevations and a series of operational practices designed to restrict activities which could present threats to groundwater have been included on the operations plan. Adherence to the applicable provincial standards for noise and dust will minimize any potential social impacts and nuisances. The TOARC contributions will provide a sustained fund to the Township for road maintenance along the proposed haul route and ensure safe vehicular access to and from the site is provided over the long-term with minimal disruption to existing traffic flows.
2.5.2.3 Mineral aggregate resource conservation shall be undertaken, including through the use of accessory aggregate recycling facilities within operations, where feasible.	The proposed pit extension does not propose recycling of construction materials for re-use as part of the expanded pit operations.
2.5.3 Rehabilitation *2.5.3.1 Progressive and final rehabilitation shall be required to accommodate subsequent land uses, to promote land use compatibility, to recognize the interim nature of extraction, and to mitigate negative impacts to the extent possible. Final rehabilitation shall take surrounding land use and approved land use designations into consideration.*	As described previously in this report, the site will be progressively rehabilitated to a use that is compatible with the rural nature of the surrounding area and reflects the requirements of the PPS.

PPS (2020) Policies	Pike Pit Proposal
2.5.4 Extraction in Prime Agricultural Areas *2.5.4.1* In *prime agricultural areas, on prime agricultural land, extraction of mineral aggregate resources is permitted as an interim use provided that the site will be rehabilitated back to an agricultural condition.* *Complete rehabilitation to an agricultural condition is not required if: a) outside of a specialty crop area, there is a substantial quantity of mineral aggregate resources below the water table warranting extraction, or the depth of planned extraction in a quarry makes restoration of pre-extraction agricultural capability unfeasible; b) in a specialty crop area, there is a substantial quantity of high quality mineral aggregate resources below the water table warranting extraction, and the depth of planned extraction makes restoration of pre-extraction agricultural capability unfeasible; c) other alternatives have been considered by the applicant and found unsuitable. The consideration of other alternatives shall include resources in areas of Canada Land Inventory Class 4 through 7 lands, resources on lands identified as designated growth areas, and resources on prime agricultural lands where rehabilitation is feasible. Where no other alternatives are found, prime agricultural lands shall be protected in this order of priority: specialty crop areas, Canada Land Inventory Class 1, 2 and 3 lands; and d) agricultural rehabilitation in remaining areas is maximized.*	Through the life of the operation, agricultural uses will continue on the site in areas that are not being extracted. The geotechnical investigation has confirmed the quantity and quality of aggregate material below the water table, warranting extraction. The subject property is outside of a specialty crop area. The depth of planned extraction makes restoration to an agricultural use unfeasible. In considering other alternatives, it is noted that all of the lands within the County of Middlesex, with the exception of wetland areas, meet the criteria and are recognized as prime agricultural lands. There are no alternative locations within the County on non-prime agricultural lands.

PPS (2020) Policies	Pike Pit Proposal
2.6 Cultural Heritage and Archaeology *2.6.2 Development and site alteration shall only be permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved.*	A Stage l and II Archeological Assessment was completed by Lincoln consulting. No further work has been recommended and the reports have been submitted to the Ministry of Heritage, Sport, Tourism, and Culture (MHSTCI) for review and acceptance. The proposal meets the PPS requirements.

7.3 Official Plan Policies: County of Middlesex

The County of Middlesex Official Plan was adopted by County Council on September 9, 1997 and approved by the Minister of Municipal Affairs and Housing on December 17, 1997. The County Plan was amended on July 11, 2006 by OPA No. 2. The County Plan provides the broad framework for planning and development and sets a framework for coordination of planning issues which cross local municipal boundaries. Detailed strategies, policies and land use designations are addressed in the local municipal planning documents. The strategic priorities for Middlesex County planning include: the protection of the agricultural community; the management of growth; and, a vibrant economy.

"The County recognizes the importance of the protection, conservation and sustainable utilization of natural resources to the continuation of economic growth and development. An integrated approach to land use planning is intended to protect the quality of the natural environment and conserve those natural resources necessary for future economic growth, on a sustainable basis." (Section 2.2 Resource Management)

The Pike Pit property is designated "Agricultural Area" as shown on County OP Schedule A, Land Use. The County OP policies allow for mineral aggregate extraction in Agricultural Areas, subject to meeting the other policy requirements of the plan (OP Section 3.3.3).

The County Plan and associated mapping Schedules also identify a "Natural System" which includes important ecological features such as significant woodlands, wildlife habitat, endangered and threated species habitat and fish habitat (see Figure 6). The County Natural System also includes aggregate resource areas. The Pike Pit property is identified in the County OP as an aggregate resource area.

Section 2.2.3 of the County OP outlines the policies for Aggregate Resources. The areas identified on Schedule C are to be protected for extraction purposes (Section 2.2.3.2). The policies in the Official Plan recognize the importance of protecting aggregate resources within the County, as well as the need to balance resource extraction with protection of agricultural lands and the natural environment.

The proposed pit will supply mineral aggregate material to the local and regional markets. No significant natural heritage features will be impacted by the pit operation and the site will be rehabilitated progressively as the site is extracted.

Section 2.2.3.3 outlines the criteria to be considered in making a decision on an amendment to a local official plan or zoning by-law to permit a new extractive use. As outlined in this report, the applications to permit the development of the Pike Pit are supported by a series of technical studies which have assessed the impact of the proposed operation on neighbouring residents, the natural environment, the agricultural capabilities of the land, and water resources. The Site Plans detail the manner in which operations will be carried out as described by the sequence of mining and progressive rehabilitation. Careful consideration and planning have gone into the design of the operations and the rehabilitation of the pit to minimize impacts and ensure that the lands are returned to agricultural use.

The Natural Heritage Report has evaluated the impacts of the proposal on significant wetlands, woodlands, fish habitat, and habitat of endangered species and threatened species. The recommended mitigative measures are incorporated to ensure no negative impacts on these natural features or their functions. The report is consistent with the "Development Assessment Report" outlined in the County OP (Section 2.3.10).

The Site Plans have been prepared in accordance with the Aggregate Resources Act requirements and include a description of: Existing Features, Operations Plan and Phasing, Rehabilitation as well as a series of cross sections to depict the elevation, grades and drainage of the land before during and after extraction on the property (Section 2.2.3.4).

7.4 Official Plan Policies: Municipality of Thames Centre

The Official Plan for the Municipality of Middlesex Centre was approved by Council on June 30, 2015 and came into full force and effect on September 15, 2015. The Pike Pit property is currently designated as Agricultural (A) in the Official Plan. The majority of the property is also identified in the Official Plan as a Primary Mineral Resource Area. The Pike pit proposal has been reviewed in the context of the Municipality of Thames Centre Official Plan.

The Thames Centre policies require both an Official Plan Amendment and a Zoning By-Law Amendment to establish a new aggregate use (Section 1.10.4). The criteria for assessing applications is found in Section 3.3.3 and includes an assessment of potential impacts on adjacent lands uses, natural heritage system, cultural heritage features, the existing road network, and groundwater resources. The application should detail the manner in which operations would be carried out and outline the nature of progressive and final rehabilitation.

The Pike Pit property contains significant mineral aggregate resources as identified in the Township's Official Plan. The proposed pit will allow for the utilization of these resources to produce a supply of local construction materials.

The Natural Environment Report includes an assessment of impact on woodlands, wetlands and species and risk and proposes mitigation measures including setbacks to ensure that there will be no negative impacts from the proposed development. These recommendations have been incorporated into the design of the operations and site rehabilitation.

Section 2.25.1 of the Thames Centre Official Plan outlines the matters to be addressed in considering proposals for changes in land use. The items outlined for the Planning Impact Analysis in the OP are noted below in italics, with a response provided below each item.

1) *Compatibility of proposed uses with surrounding land uses;*

The proposed Pike pit is located in an Agricultural area of Thames Centre and is also recognized as an important mineral aggregate resource area. The surrounding lands are in mainly agricultural use and extractive industrial. There are farm residences located nearby and there are several existing licensed gravel pits located near the site. Mineral aggregate uses are permitted in Agricultural areas provided they meet the other requirements of the Official Plan, and provided that appropriate zoning is in place. The proposed Pike pit is compatible with surrounding land uses.

2) *The likely impact of the proposed development on present and future land uses in the area and on the character and stability of the surrounding neighbourhood;*

The Pike pit is compatible with the present and future uses in the area. Once extraction is completed, the lands will be rehabilitated. The proposal will not adversely impact the character or stability of the surrounding neighbourhood.

3) *If the proposed development is within an Agricultural designation, a demonstrated need for the land use and proof of no reasonable alternative locations that avoid prime agricultural lands or lands of a lower agricultural rating;*

In addition to being in an Agricultural designation, the subject lands are also identified as a Mineral Aggregate Resource Area in the Official Plan. According to the Provincial Policy Statement "demonstration of need for mineral aggregate resources, including any type of supply/demand analysis, shall not be required, notwithstanding the availability, designation or licensing for extraction of mineral aggregate resources locally or elsewhere" (PPS 2020, Sec 2.5.2.1)

4) *The height, location and spacing of any buildings in the proposed development, and any potential impacts on surrounding land uses*

There are no buildings proposed as part of this development. This section is not applicable.

5) *The extent to which the proposed development provides for the retention of any desirable vegetation or natural features that contribute to the visual character of the surrounding area*

The woodlot and wetland feature located along the northern limit of the property will be maintained together with a 30 metre buffer to protect the feature. A berm will be constructed along the perimeter of the pit and will serve as an acoustic and visual screen. The berms will be taken down once the pit operations are complete.

6) *The proximity of any proposal for medium density residential development to public open space and recreational facilities, community facilities, municipal services, transit services, and the adequacy of these facilities and services to accommodate the development proposed*

This section is not applicable to the proposed development.

7) *The size and shape of the parcel of land on which a proposed development is to be located, and the ability of the site to accommodate the intensity of the proposed use*

This section is not applicable to the proposed development.

8) *The location of vehicular access points and the likely impact of traffic generated by the proposal on streets, on pedestrian and vehicular safety, and on surrounding properties*;

The proposed pit entrance will be located on Hunt Road, just south of the intersection with Gore Road. Gore Road is used by several other pit operations in the areas.

9) *The exterior design and layout of buildings and the integration of these uses with present and future land uses in the area*

This section is not applicable to the proposed development.

10) *The location of lighting and screening and the adequacy of parking areas*

This section is not applicable to the proposed development.

11) *The provisions for landscaping and fencing*

The site has been designed in accordance with Aggregate Resources Act Provincial Standards, which includes a standard requirement for fencing (1.2 metre height) around the boundary of the licensed area. The perimeter berms are designed as both an acoustic and visual screen, and these berms will be seeded and maintained through the life of the operation. Existing vegetation along Heritage Road will be maintained.

12) *The location of outside storage, garbage and loading facilities*

The Aggregate Resources Act standards are reflected in the design of the site and include provisions for stockpile height, loading and shipping of aggregate materials. Compliance with the Site Plan requirements is enforced by the Ministry of Natural Resources and Forestry (MNRF). Copies of annual Compliance Assessment Reports are provided to the Municipality.

13) *Conformity with the provisions of the Site Plan Control By-law*

This section is not applicable to the proposed development (ARA Standards apply).

14) *The design and location of signs, and the compliance of signs with the Sign Control By-law*

This section is not applicable to the proposed development.

15) *Measures planned by the applicant to mitigate any adverse impacts on surrounding land uses and streets that have been identified as part of the Planning Impact Analysis, and*

The site plans for the proposed Pike pit have been designed to ensure that appropriate mitigation measures are in place to minimize the effects of noise and dust from the operation. The recommendations of the Noise Assessment Report prepared by HGC Engineering have been incorporated into the design of the pit.

Based on the planning analysis, the proposed Pike Pit conforms with the Official Plan policies for the County of Middlesex and the Municipality of Thames Centre.

7.5 Municipality of Thames Centre Zoning By-law

An application for a zoning by-law amendment is being submitted to the Municipality of Thames Centre Zoning By-Law 75-2006, to rezone the lands from "Agricultural" (A) to Extractive Industrial (M3) to permit the establishment of a Class A pit license, Category 3, above the water table.

8.0 PLANNING CONCLUSION

The zoning by-law amendment and ARA license applications are supported by the land use planning analysis, the Summary Statement, the ARA site plans and related requirements, and the associated technical reports referenced in this document.

Based on these submissions it is concluded that:

1) The proposed pit extension is located in a provincially, regionally and locally recognized aggregate resource area.

2) The deposit can be extracted in such a manner that potential environmental and social impacts are minimized.

3) The matters of provincial interest as identified in Section 2 of the Planning Act have been properly assessed and the proposal has appropriate regard to these provincial interests.

4) The proposed pit, through its Operations Plan, Rehabilitation Plan and the recommendations of the supporting technical reports, is consistent with provincial policy as set out in the 2020 Provincial Policy Statement.

5) The Provincial Policy Statement 2020, contains policy requiring mineral aggregate resources to be protected and that as much of the resource as possible be made available as close to market as is possible. The proposal is consistent with this provincial objective as well as provincial policy related to the protection of natural heritage, water and cultural resources and the protection of public health and safety.

6) The proposal is consistent with the relevant policies of the Official Plan for the County of Middlesex and the Municipality of Thames Centre with regard to amendments for new aggregate extraction applications.

7) The ARA site plans, prepared by taking into consideration the technical studies, surrounding land uses and legislative requirements, will minimize any environmental and social impacts in accordance with the Provincial Standards established under the ARA.

8) The modifications proposed to the local municipal planning documents represent good rural land use planning principles.

9) The proposed pit operation has been carefully designed and reflects recommendations of the accompanying technical reports. The operational notes on the license site plans under the Aggregate Resources Act, have incorporated conditions to reflect specific recommendations and measure to mitigate any negative environmental effects.

Prepared By:

Melanie Horton, MCIP. RPP
Esher Planning Inc.

December 2020

STATEMENT OF QUALIFICATIONS

Esher Planning Inc.
Melanie Horton, MCIP, RPP

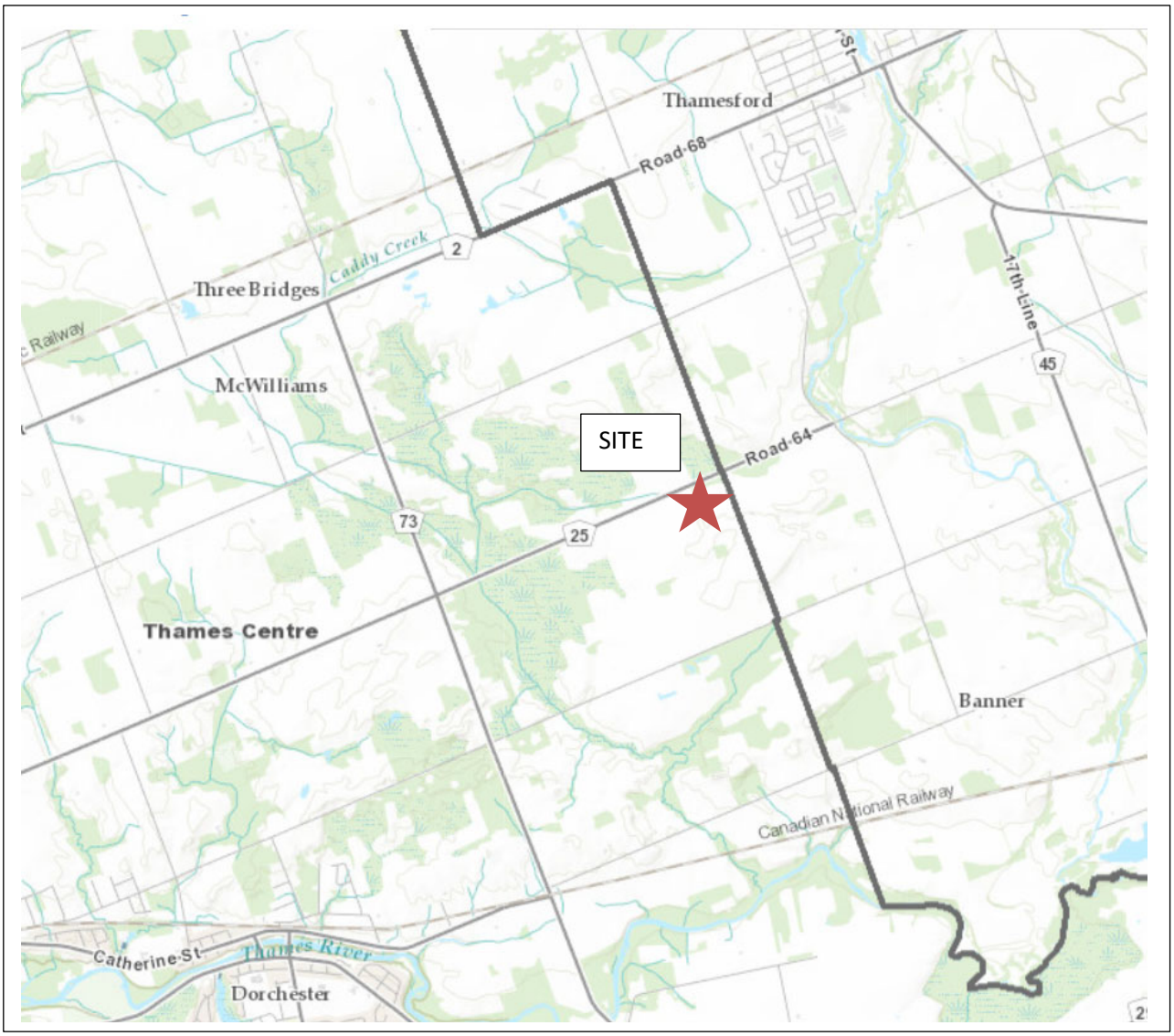
Esher Planning Inc. has expertise in land use planning and resource management with extensive experience in aggregate resource planning. The firm is an associate member of the Ontario Stone, Sand & Gravel Association (OSSGA).

Ms. Melanie Horton is a Registered Professional Planner and is a member in good standing of the Ontario Professional Planners Institute and the Canadian Institute of Planners. She is past chair of the Natural Resource Working Group for the Ontario Professional Planners Institute (OPPI) and has represented Ontario Planners on a variety of Natural Resource Policy initiatives. Melanie has over 25 years of experience in Aggregate Resource Management and Planning, working in both the public and private sector. She has been coordinating applications for over twenty-five years for pits and quarries across the province.

Ms. Horton has served on numerous provincial advisory committees including the State of the Aggregate Resources Report, and the Aggregate Strategy Working Group.

FIGURES

Figure 7: Location

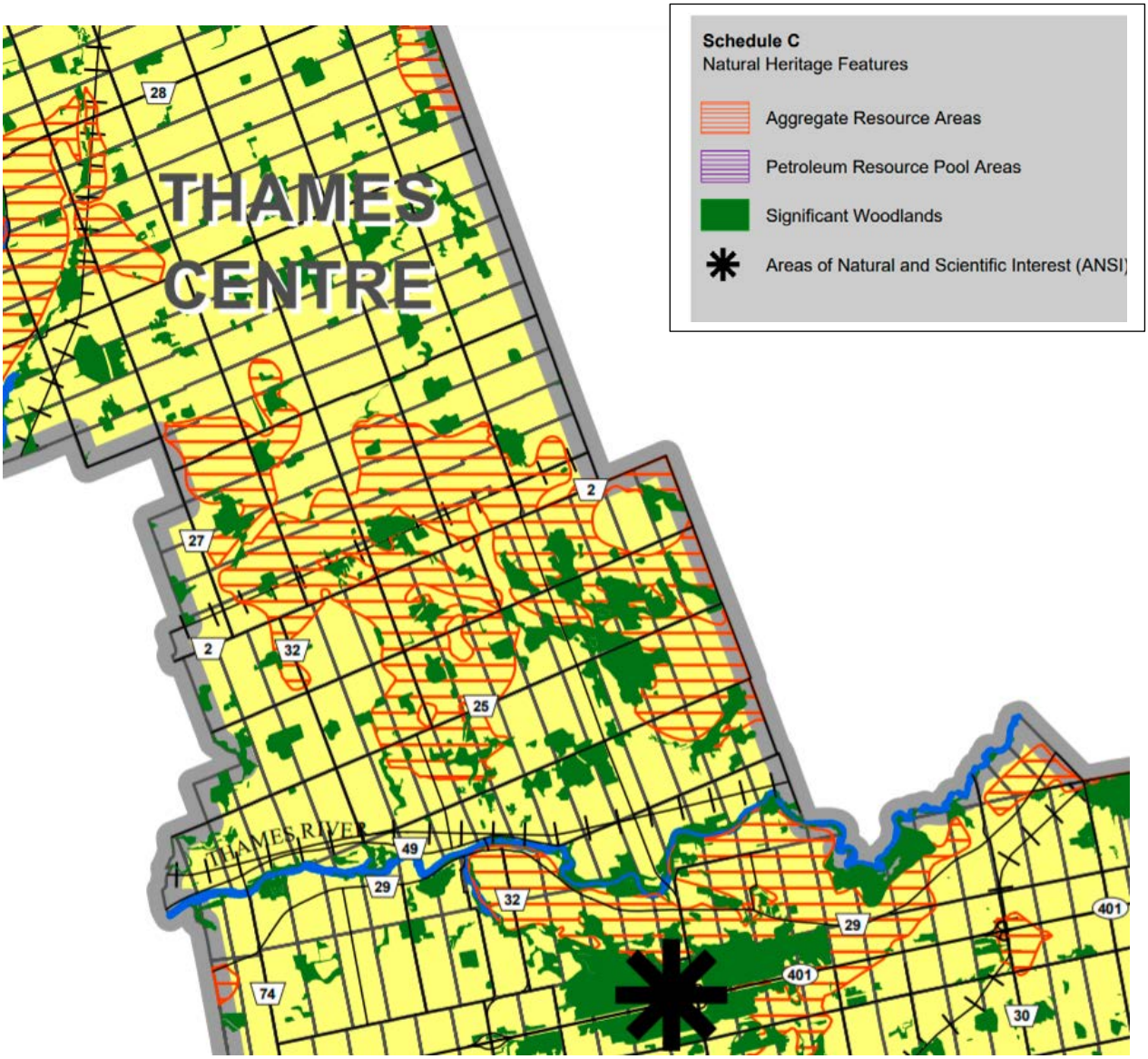


Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

Figure 8: County of Middlesex Official Plan

Schedule C Natural Heritage Features

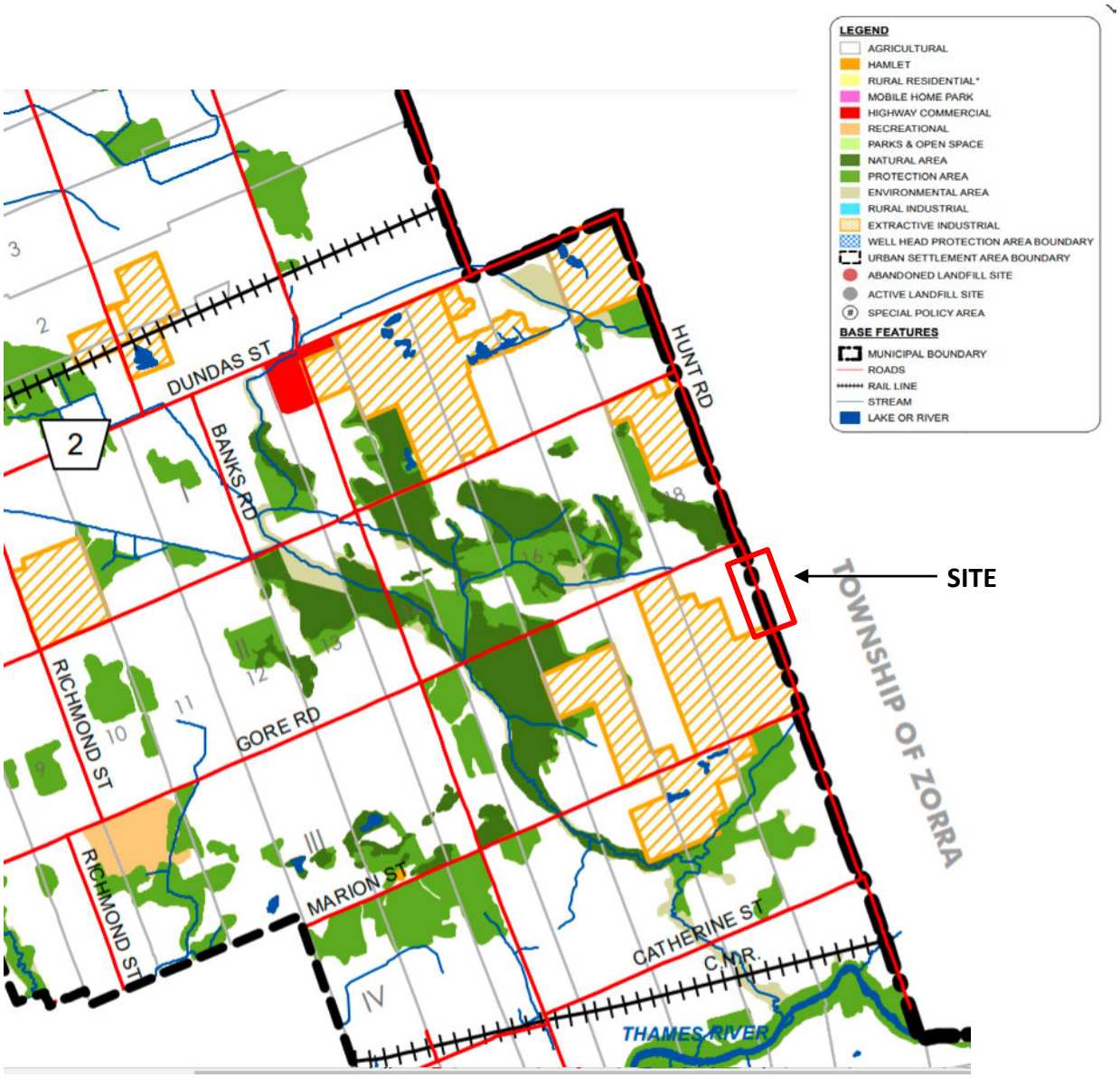


Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

Figure 7: Thames Centre Official Plan

Schedule A: Land Use

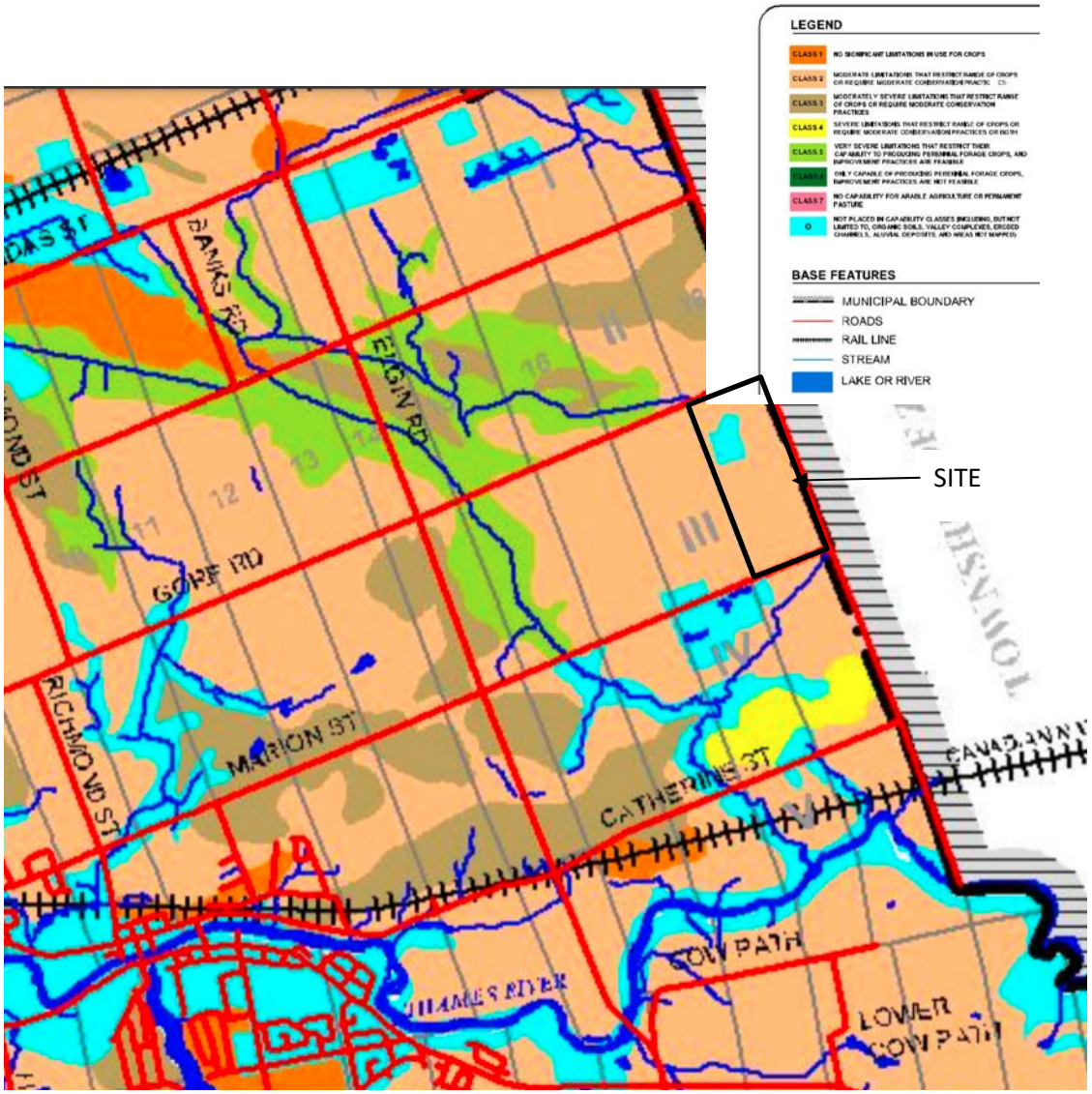


Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

Figure 8: Thames Centre Official Plan

Appendix 2: Soil Capability for Agriculture

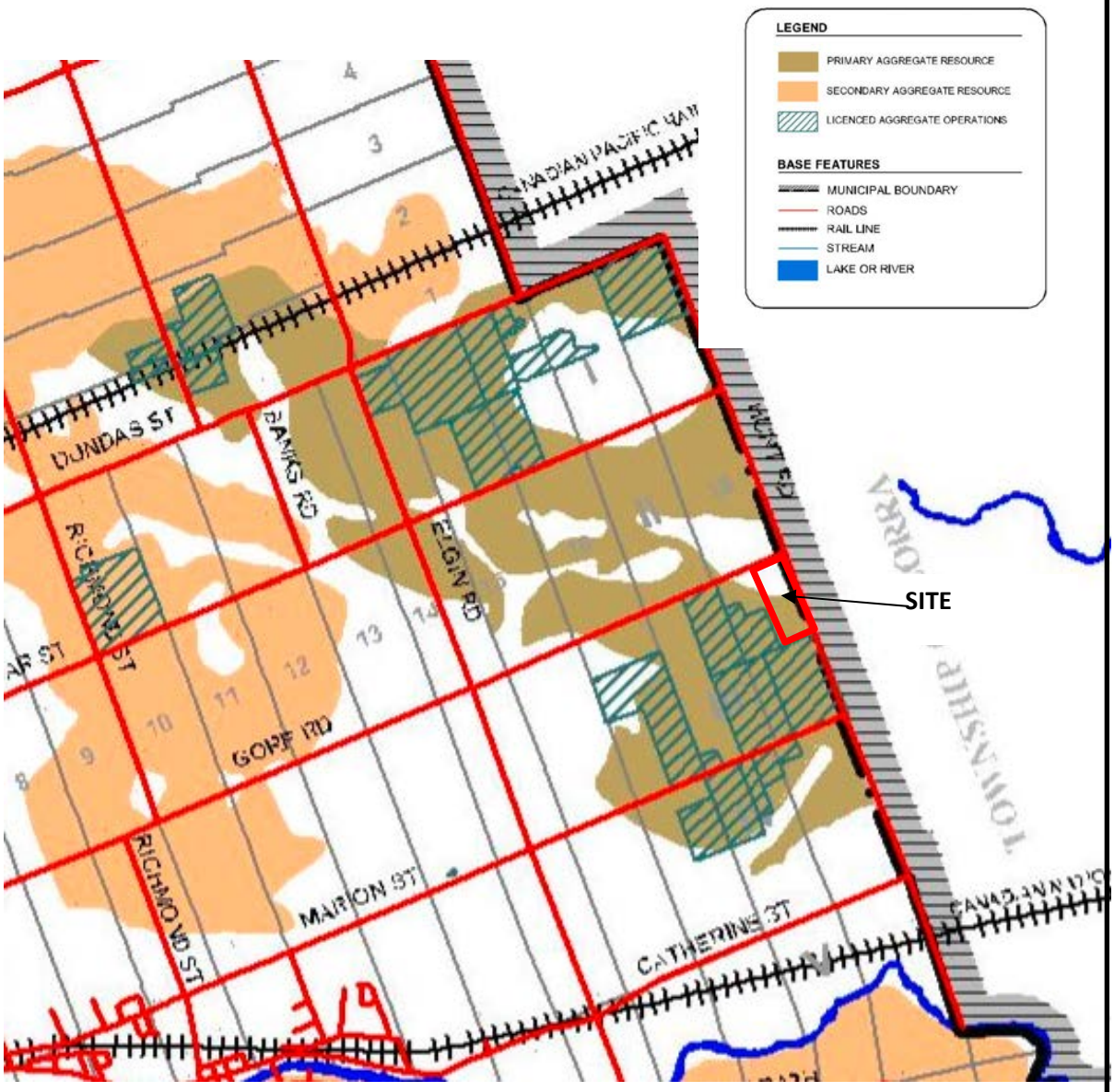


Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

Figure 9: Thames Centre Official Plan

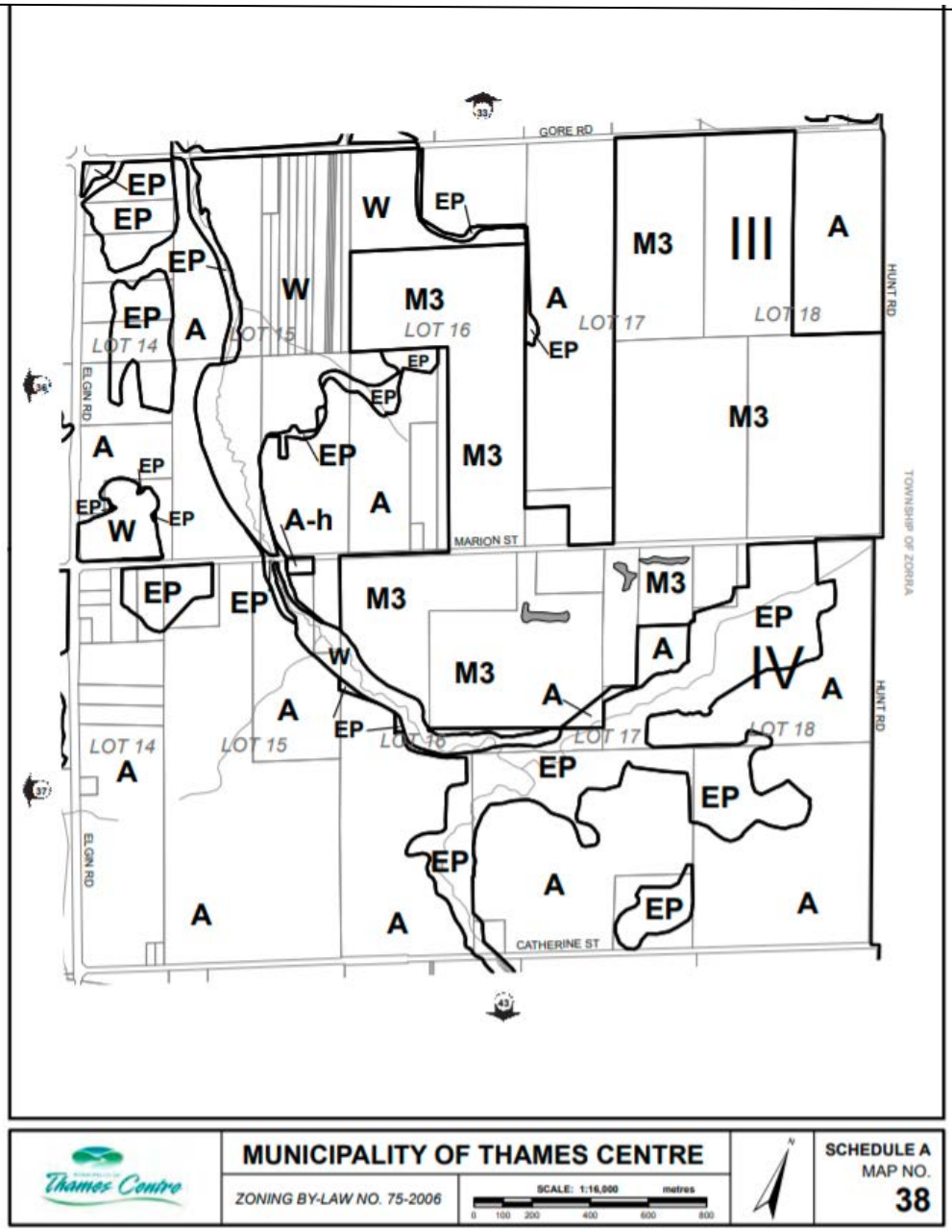
Appendix 3: Aggregate Resources



Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

Figure 10: Thames Centre Zoning By-Law



Pike Pit

Part Lot 18, Concession 3 NRT,
Municipality of Thames Centre
County of Middlesex

HYDROGEOLOGICAL ASSESSMENT

LEVEL I AND II ASSESSMENT REPORT

PROPOSED AGGREGATE PIT (PIKE FARM)
PT LOT 18, CONCESSION 3, NRT
GEOGRAPHIC TOWNSHIP OF NORTH DORCHESTER
MUNICIPALITY OF THAMES CENTRE

LDS PROJECT NO. GE-00260

JANUARY 4, 2021

Submitted to:

THAMES VALLEY AGGREGATES

Distribution (via email):

Vito Frijia, Thames Valley Aggregates
vito@southsidegroup.ca

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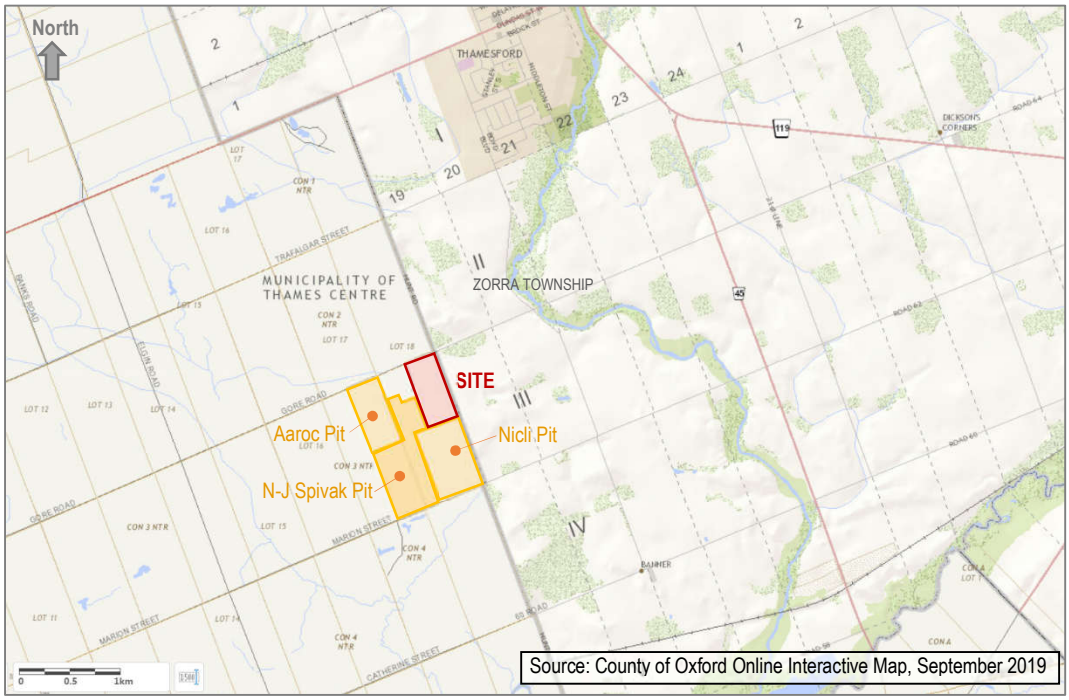
1. INTRODUCTION

LDS Consultants Inc. (LDS) has been retained by Thames Valley Aggregates to conduct a Hydrogeological Assessment for a proposed aggregate pit, located on the southwest corner of Hunt Road, and Gore Road, in the Municipality of Thames Centre, in Middlesex County. The legal description of the property is as follows:

- Part Lot 18, Concession 3 NRT
  Geographic Township of North Dorchester, Middlesex County

A Key Plan showing the site location is provided on Figure 1, below.

Figure 1: Key Plan



The subject lands are approximately 20.2 hectares in size. The neighbouring gravel pit operations which immediately border the property are also shown on Figure 1 (above), and operate under Class A Licenses. Additional gravel pit operations are also located within Thames Centre, within 1 km of the site.

The scope of work for the Hydrogeological Assessment was outlined in LDS' proposal (reference G2019-019, dated May 13, 2019). Authorization to carry out this work was received from Vito Frijia on behalf of Thames Valley Aggregates to proceed with the investigation and preparation of the report.

This Report has been prepared for the purposes of examining hydrogeological characteristics of the site. Based on the hydrogeological conditions, groundwater use in the area, the amount of collected field data, and subsequent interpretation, this report should be regarded as a Hydrogeological Level 1 and Level 2 Assessment.

According to the Ontario Provincial Standards, this report includes the requirements for Category 1, Class A license for a pit which intends to extract aggregate material from above and below the established groundwater table.

The Level 1 Hydrogeological Assessment included in this report provides a preliminary evaluation to determine the final extraction depth relative to the established groundwater table(s) and the potential for adverse effects to groundwater and surface water resources and their uses. As such, the following information has been incorporated into this report:

- Summary of borehole and shallow groundwater information based on drilling program and monitoring wells which have been installed at the site – monitoring commenced in July 2019, and continues on a monthly basis at the site;
- Characteristics of the shallow groundwater conditions, including stabilized water level, flow direction, gradient;
- Information compiled from a review of available publications and geological mapping for the area, including adjacent land uses, site topography, surface drainage and site features;
- Information compiled from a review of MECP Well Records, and supplemental data collected for the area through a well survey delivered to nearby properties;
- Discussion on potential adverse impacts which could result from the proposed gravel pit operation.

This report also includes the analyses associated with a Level 2 Hydrogeological Assessment, which expands on the discussion of potential adverse impacts, with discussion of mitigation measures and contingency measures to address potential concerns with contamination which could occur as a result of typical operations and aggregate extraction activities. Baseline groundwater chemistry has been documented with analytical testing on water samples collected from onsite monitoring wells.

This report is provided on the basis of the terms noted above, and is expected to form part of a submission to the Ministry of Natural Resources and Forestry (MNRF) to comply with the requirements of the Aggregate Resources Act.

The format and content of this report has been guided to address specific client needs. LDS has provided engineering guidelines for the geotechnical design and construction at the site. Laboratory testing, where applicable, follows ASTM or CSA Standards. The information in this report in no way reflects on the environmental aspects of the soil.

2. SITE PHYSICAL FEATURES

2.1 Site Location and Description

The subject property is located on the southwest corner of Hunt Road, and Gore Road, in the Municipality of Thames Centre, in Middlesex County. The site is rectangular in shape, and comprises an area of approximately 20.2 hectares. A 60 m wide band of trees are located along the northern edge of the property, bordering Gore Road.

A small wooded area (approximately 100 m by 100 m in size) is located in the southwest corner of the site. The remainder of the site is occupied with agricultural lands used for cultivating. There are no existing buildings or structures at the property. Select Site Photographs are provided in Appendix A, for reference.

2.2 Topography and Surface Drainage

The site topography is gently rolling throughout, with a topographic relief of approximately 5 m across the site, ranging from Elevation 275 to 280 m above sea level (ASL). This is consistent with the Topographic Map for the area (which is provided on Drawing 1, in Appendix A), and reports the ground surface elevation at Elevation 280 m ASL.

The ground surface elevation along the north side of the site sits below Gore Road. Surface water drainage along Gore Road flows through a drainage ditch, along the south side of the road. Similarly, a drainage ditch follows the west side of Hunt Road.

Norsworthy Municipal Drain is located along the north side of Road 64, and conveys flows which flows westward for just over 2 kilometres before discharging into the Caddy Creek Municipal Drain east of Elgin Road. Leslie Municipal Drain is located to the south, at the intersection of Hunt Road and Marion Street, south of the Nicli Pit, approximately 700 m south of the southeast corner of the site.

Surface drainage enters the north part of the site (northern woodlot, described in Section 2.3) via a 525 mm wide corrugated plastic culvert at Hunt Road, flows diffusely westward through the central part of the northern woodlot, and exits the site via a second corrugated plastic culvert beneath Gore Road. This drainage is not mapped as a distinct surface water drainage feature within publicly-available aquatic resource or watercourse mapping available from Upper Thames Region Conservation Authority (UTRCA) or through the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Following conveyance northward beneath Gore Road, the drainage enters the Norsworthy Drain.

There is open water within the gravel pit lands to the south of the property, associated with the aggregate extraction within those lands.

Observations at the site did not identify any significant surface erosion or swales, which generally indicate that stormwater run-off tends to sheet flow off the site, or is absorbed into the surficial soils.

The Thames River is located approximately 1.1 km east of the northeast corner of the site. Caddy Creek is located approximately 2 km west of the site. A tributary drain extends along the north side of Gore Road, north of the site limits.

2.3 Natural Heritage Features

As noted in Section 2.1, two wooded areas are present at the site, one along the northern site boundary which is approximately 60 m long along the length of the site; the second, a small wooded area in the southwest corner of the site, approximately 100 m by 100 m in size.

Based on the Natural Environment Report prepared by Terrastory Environmental Consulting Inc. (Terrastory), it is understood that the northern woodlot contains a variety of upland and wetland vegetation communities – including a deciduous swamp and meadow marsh in the central part of the woodlot, and upland forest/woodland communities on either side of the wetland area.

The wetland area receives base flow contributions from surface water conveyed from offsite wetlands to the east, through a culvert which extends below Hunt Road. It is understood that the wetland area experiences seasonally dry periods, as documented in Terrastory's Report. The ground surface elevation of the western portions of the deciduous swamp appear to be at or slightly below the elevation of BH1. Based on seasonal high groundwater levels recorded in the monitoring well at this location, it is anticipated that under seasonal conditions, that a portion of the wetland may be supported by shallow groundwater under seasonal conditions, in addition to the surface water inputs noted above.

The Topographic Plan provided on Drawing 1 and the aerial photographs provided on Drawing 2, shows the lands on the north side of Gore Road being occupied with a wetland feature. It is understood that the wetland area north of Gore Road is identified as a Provincially Significant Wetland.

No other natural heritage features were noted onsite.

2.4 Adjacent Land Use

The lands immediately south of the property are occupied by a 32-hectare gravel pit operation, owned by Nicli Aggregates, with a maximum annual tonnage of 500,000. South and west of the site, N-J Spivak Ltd operates a 42-hectare gravel pit, which has a maximum annual tonnage of 227,000. West of the N-J Spivak operation, Aaroc Aggregates operates a 21-hectare gravel pit with a maximum annual tonnage of 250,000. The neighbouring gravel pit operations which immediately border the property are shown on Figure 1 (Section 1) and on Drawing 1, in Appendix A.

To the east of Hunt Road, the lands are agricultural, and support a dairy operation and are used for agricultural cultivation.

2.5 Extraction Plan

Overall extraction details are outlined below, and are denoted on the Project Drawings prepared by Harrington McAvan Ltd.:

- Total area to be licensed – 21.0 hectares
- Total area to be extracted and rehabilitated – 16.30 hectares
- Maximum tonnage to be removed – 500,000 tonnes per year

The small wooded parcel at the southwest corner of the site is expected to be removed as part of the site preparation works. Extraction is expected to be carried out from south to north across the site, using conventional construction equipment, including trucks, loaders, excavators, backhoes, bulldozers, scrapers, and conveyors. Portable processing equipment will be utilized at the site, and the location will be shifted to accommodate the aggregate extraction operation. It is understood that existing vegetation within the licensed area will be maintained under sequential stripping begins or until the rehabilitation is completed.

The northern extent of the extraction limit is expected to be set at the greater setback limit of either 15 m from the woodland dripline or 30 m from the wetland which is contained within the northern woodlot.

The primary site access will be located at the northeast corner of the site, south of the existing woodlot, and the primary truck route will be located along the easterly limit of the site. Drawing 3 (in Appendix A) shows the various operation stages which denote the extraction zones for each phase of the project, and the site rehabilitation plan which denotes the presence of a pond at completion. The finished pond area is expected to be about 11.33 hectares in size, at completion.

The rehabilitation plan also identifies a reforestation area of approximately 0.76 ha, within the northern part of the site to compensate for the wooded area at the south end of the property which is expected to be removed.

3. STUDY METHODOLOGY

3.1 Review of Geologic Mapping

Physiography & Quaternary Geology

In Southwestern Ontario, the last continental scale glaciation was during the Wisconsinan Time. The glaciers extended south of Southwestern Ontario. When the glaciers began to retreat during the Late Wisconsinan, this resulted in the deposition of material contained in the glaciers. Lakes, rivers, and spillways created by the meltwater from the retreating glaciers deposited massive amounts of glacial debris and shaped the landscape of Southwestern Ontario.

Physiographic mapping for Southwestern Ontario *(Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release-Data 228)*, identifies that the site is located within the physiographic region known as the Oxford Till Plain, and is set in an undrumlinized till plain. Soil conditions are expected to be comprised of silt till soils and sand and gravel deposits.

Quaternary geology mapping for the Zorra area *(Quaternary Geology, Ontario Geological Survey Map P1048, Lucan Area, Scale 1:50,000, 1975)* indicates that the study area consists of ice-contact stratified drift deposits of silt with some sand and gravel in the north half of the site, and ice-contact gravel deposits with some re-worked glacial till in the south part of the site. This is demonstrated on Drawing 4, in Appendix A.

The Quaternary geology mapping also shows the site being located along the eastern side of the Dorchester moraine, which was formed at the most northward advance of the Erie Lobe. The Dorchester moraine is comprised of sandy drift till identified as Catfish Creek Till. Catfish Creek Till is associated with the Nissouri Stadial period, and is typically characterized of several layers of subglacial till and stratified sediments of glaciofluvial or glaciolacustrine origin.

Bedrock Geology

Bedrock geology mapping for Southwestern Ontario *(Ontario Geological Survey. 1:250 000 scale, Bedrock Geology of Ontario. Ontario Geological Survey, Miscellaneous Release Data 126, Revised 2006)* indicates that bedrock in the general area consists of limestone, dolostone and shale from the Dundee formation, from the Middle Devonian Period. Geological publications describe the limestone as grey – brown medium to thickly bedded limestone and dolostone, containing fossils, bituminous partings and microstylolites.

Bedrock was not encountered during the fieldwork for this investigation, but is expected to be at approximately Elevation 250-260 m (~25 m depth), based on the following Bedrock Topography mapping: *Bedrock Topography of the Lucan Area, Southern Ontario, Ontario Geological Survey, Preliminary Map P291, scale 1:50,000, 1980 compilation.* This is documented on Drawing 4, in Appendix A.

3.2 MECP Well Record Review

A review of local well records available through the Ministry of Environment, Conservation, and Parks (MECP) for this area was carried out to review the water levels recorded in the nearby wells. Drawing 9 in Appendix A shows the location of the wells (with corresponding Well Registration No.) which are in close proximity (within 500 m) of the site.

Table 1: MECP Well Record Summary

MECP Well ID	Completion Date	Depth (m)	Water Found (m)	Static Level (m)	Pump Rate (L/min)	Northing (m N)	Easting (m E)
Water Supply Wells							
4105642	1971-10-28	26.5	7.6	9.1	38.0	4763593.0	498383.7
4704458	1976-09-02	20.1	11.6	10.4	38.0	4763443.0	499313.7
7192459*	2012-11-02	*22.2*	*NR*	10.3	102.6	4763441.0	499330.0
Observation / Test Holes							
4102842	1955-05-06	24.7	*NR*	*NR*	*NR*	4763653.0	498403.7
4102844	1955-05-19	27.1	*NR*	*NR*	*NR*	4763963.0	498523.7
7339805	2019-07-22	Well Cluster – LDS monitoring wells for current assessment					
Abandoned – Water Supply							
4104822	1969-10-15	11.6	8.2	8.2	15.2	4763543.0	498673.7

**Well Record 7192459 is for a 2.1 m extension installed on Well #4704458.*

One active shallow water supply well is noted in the above table. The shallow well was located at the residence on the north side of Road 64, about 300 m west of the site. The shallow groundwater in this well, appears to be sourced from the shallow water-bearing sand soils encountered in the boreholes and monitoring wells drilled at the site.

The remainder of the water supply wells are set into the intermediate overburden aquifers contained within sand and gravel soils. Pump rates indicate strong yield capacities in the shallow and intermediate depth overburden aquifers, and in the bedrock aquifer.

A well survey was delivered to nearby properties in an effort to validate the information available in the MECP well records. Additional information is provided in this regard, in Section 3.7.

3.3 Source Water Protection Mapping

Where proposed developments are being planned, it is important to determine the presence of Significant Groundwater Recharge Areas and High Vulnerability Aquifers in the area. These areas are protected under the Clean Water Act (2006). In general, Significant Groundwater Recharge Areas are defined as areas where water seeps into an aquifer from rain and melting snow, supplying water to the underlying aquifer. A highly vulnerable aquifer occurs where the subsurface material offers limited protection from contamination resulting from surface activities.

The Thames-Sydenham and Region Source Protection Plan (approved September 2015) presents the framework for assessing lands within the City of London and surrounding area. The Source Protection Plan also presents the assessment work which has been done by the Thames-Sydenham and Region Source Protection Committee.

A more detailed discussion is provided below.

Significant Groundwater Recharge Areas (SGRA)

Groundwater recharge is largely controlled by soil conditions, and typically occurs in upland areas. As discussed previously, regional groundwater flow directions identified in the Middlesex-Elgin Groundwater Study for overburden and bedrock aquifers are typically indicated to be in a southerly or westerly direction.

As defined in the Clean Water Act (2006), an area is a significant groundwater recharge area if,

- the area annually recharges water to the underlying aquifer at a rate that is greater than the rate of recharge across the whole of the related groundwater recharge area by a factor of 1.15 or more; or,
- the area annually recharges a volume of water to the underlying aquifer that is 55% or more of the volume determined by subtracting the annual evapotranspiration for the whole of the related groundwater recharge area from the annual precipitation for the whole of the related groundwater recharge area.

The Thames-Sydenham and Region Source Protection Committee has prepared an assessment report for the Upper Thames River Source Protection Area. As defined by the Clean Water Act (2006) and identified by the Thames-Sydenham and Region Source Protection Committee, the south-eastern portion of site is located within a Significant Groundwater Recharge Area (SGRA) with a Vulnerability rating of 2, as demonstrated on Drawing 10 in Appendix A. Vulnerability of SGRA's is determined by cross referencing aquifer vulnerability maps with SGRA mapping. Those areas which have high intrinsic vulnerability are classified as 6, and those with low vulnerability as 4 and 2. It should be noted that the site is **not** included in the SGRA.

High Vulnerability Aquifers

The susceptibility of an aquifer to contamination is a function of the susceptibility of its recharge area to the infiltration of contaminants.

In the Thames-Sydenham and Region, HVA’s were mapped using the Intrinsic susceptibility index (ISI) method, which is an indexing approach using existing provincial Water Well Information System (WWIS) database. The ISI method is described in detail in the MOE’s Technical Terms of Reference (2001), and is an empirical scoring system that takes into consideration the unique hydrogeologic conditions at a particular location.

The scores are determined using a combination of the saturated thickness of each unit and an index number related to the soil type, and as such, the scores reflect the susceptibility of the aquifer to contamination. As defined in the MOE's 2008 Technical Rules:

- Low Vulnerability – ISI score greater than 80
- Medium Vulnerability – ISI score of 30 to 80
- High Vulnerability – ISI score less than 30

Using the method described above, the Thames-Sydenham and Region Source Protection Committee has determined, that the Site is **not** within highly vulnerable aquifer zone.

Wellhead Protection Area

The Thames-Sydenham and Region Source Protection Report outlines that Wellhead Protection Areas (WHPA's) are defined as the vulnerable areas around groundwater sources that have been delineated using three-dimensional groundwater flow models. The WHPA for each well field (or well) is based on an estimate of the groundwater travel time to the well, with defined zones extending out to a period of 25-years for groundwater travel to the well.

Based on the aforementioned Report, the subject lands are **not** within or near a WHPA.

Summary Comments

Although the previous discussion identifies that the site is not situated within an area of concern related to Source Water protection concerns, the site development should still have regard for the sensitivity of the shallow aquifer, and operations associated with the aggregate extraction operations should incorporate suitable measures to minimize negative effects to the shallow groundwater aquifer. This can be addressed through the use of best-management practices for equipment maintenance and fuelling activities, incorporating contingency and mitigation measures into operational plans, and effective monitoring.

3.4 Field Program

LDS carried out a field program consisting of a series of seven boreholes, drilled between July 10 and 22, 2019. The boreholes were advanced at the site by a local drilling-contractor, using a track-mounted drill-rig. The boreholes (denoted as BH1 through BH7) were advanced to depths ranging from 3.5 to 11.1 m (11.5 to 36.5 feet) below existing grade.

Ground surface elevations at the borehole locations were surveyed by LDS using a Trimble R10 GPS rover. The location of the boreholes is summarized in Table 2, and illustrated on Drawing 5, in Appendix A.

Table 2: Borehole Locations

Location	Northing, m N	Easting, m E	Ground Surface Elevation (m asl)
BH 1 (MW)	4763648.538	498827.222	275.256
BH 2 (MW)	4763697.658	499125.391	276.442
BH 3	4763562.324	499062.029	277.674
BH 4 (MW)	4763408.326	498917.724	277.866
BH 5 (MW)	4763363.492	499256.096	280.899
BH 6 (MW)	4763125.449	499138.749	279.946
BH 7 (MW)	4763187.026	499297.877	281.124

Monitoring wells were installed in all of the boreholes, with the exception of Borehole BH3, to allow for monitoring the stabilized groundwater level at the site. The wells are comprised of 50 mm diameter CPVC pipes with slotted and filtered screens. Details of monitoring well construction are provided on the borehole logs in Appendix B, and summarized in the table below. The monitoring wells have been registered with the Ministry of Environment, Conservation, and Parks (MECP), in accordance with Ontario Regulation (O.Reg.) 903.

Table 3: Monitoring Well Installation Details

Location	Ground Surface Elevation (m asl)	Well Installation Depth, m	Screened Length, m	Screened Strata
BH 1 (MW)	275.256	3.1	1.5	Silty Sand / Sandy Silt
BH 2 (MW)	276.442	3.1	1.5	Fine Sand, trace Silt
BH 4 (MW)	277.866	6.6	1.5	Sand, some Gravel
BH 5 (MW)	280.899	10.7	1.5	Silty Sand and Gravel
BH 6 (MW)	279.946	10.7	1.5	Fine to Medium Sand, trace Silt
BH 7 (MW)	281.124	10.7	1.5	Fine Sand, some Silt

Within Borehole BH3, the borehole was examined for signs of groundwater seepage prior to backfilling. The borehole was backfilled with a mixture of bentonite chips and cuttings, to restore the backhoe back to level conditions with the ground surface.

A monitoring program has been carried out to record the groundwater conditions from July 2019 to present. A submersible pressure transducer with a data logger (Onset Hobo U20L unit) was installed at boreholes BH2, BH5 and BH6 to provide a continuous set of water level measurements at the site. Pressure corrections for changes in barometric pressure have been applied to the continuous water level measurements, based information from the Environment Canada Weather Station at London International Airport.

The fieldwork was supervised by members of LDS' technical staff. All samples recovered from the site were returned to LDS for detailed examination and selective testing. Collected samples will be disposed of, following the issuance of the Hydrogeological Report, unless prior arrangements have been made for longer term storage.

3.5 Laboratory Testing – Soils

All samples recovered from the site were returned to LDS for detailed examination and selective testing. Select samples were collected from the boreholes for further review and laboratory testing.

Six grain size analyses were carried out on select samples of the predominant subgrade soils, where shallow groundwater conditions were identified. Routine moisture content determinations were also carried out on select samples from each borehole.

Collected samples will be disposed of, following the issuance of the Hydrogeological Report, unless prior arrangements have been made for longer term storage.

3.6 Laboratory Testing – Water Quality

Groundwater samples were collected from select boreholes at the site on September 20, 2019. The monitoring wells at BH2 and BH6 were developed 24 hours in advance of the testing, including the removal of the equivalent of three water-columns of water. The water samples were collected using designated bailer tubes.

The laboratory was contacted in advance to order sufficient soil and groundwater pre-cleaned (and pre-preserved, where applicable) sample containers for the desired analyses, pre-labelled with the LDS project number and project location.

All water samples collected at the site were secured and transported to Maxxam Analytics in designated lab-supplies containers, and stored in a chilled cooler for transport. The water samples were submitted for general chemistry analyses, which included pH, inorganics and dissolved metals, as well as calculated parameters for anion and cation summaries, hardness and total dissolved solids.

The Certificate of Analysis provided by the laboratory is provided in Appendix C, along with piper diagrams which provide a graphical representation of the cations and anions on ternary plots.

3.7 Well Survey

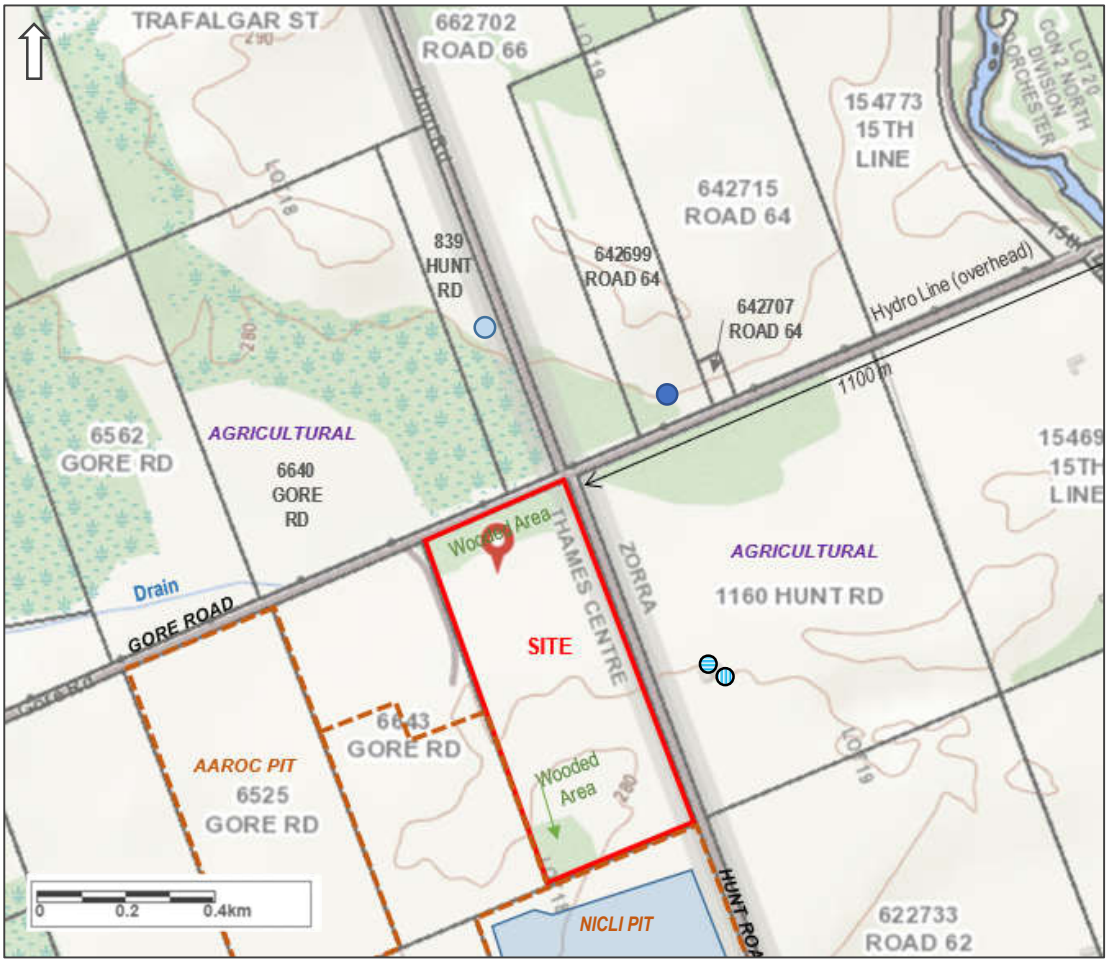
A well survey questionnaire was delivered to the neighbouring properties in an effort to validate the information about water supply wells in the area which is available in the MECP well records. A copy of the covering letter and questionnaire are provided in Appendix F, along with the responses which were received by LDS. Two copies of the covering letter and questionnaire were delivered (in August and September 2019), and included return options via mail, email, or to phone LDS directly to relay the information.

Responses which were received are summarized in Table 4.

Table 4: Well Survey Summary

Address	Well Type	Static Water Level	Water Quality	Comments
839 Hunt Road, Dorchester	18.5 ft depth	16 ft depth	No issues reported	Well used as domestic water supply Water treatment units include water softener and UV screen Unknown age of well Approx. Location denoted with ○ in Figure 2
1160 Hunt Road, Ingersoll	Well 1 - Drilled 65 ft depth	Not reported	No issues reported	Well used as domestic water supply and for dairy farm operations Iron filter at house Corresponds with MECP Well No. 4704458 Approx. Location denoted with ⊖ in Figure 2
1160 Hunt Road, Ingersoll	Well 2 - Drilled, 250 ft depth	Not reported	No issues reported	Well used for agricultural use – cattle Reportedly contains high sulphur content Approx. Location denoted with ◍ in Figure 2
642699 Road 64, Ingersoll	Drilled, 180 ft depth	15-20 ft depth	No issues reported	Well used as domestic water supply No water treatment units Estimated drill date in late 1980s / early 1990s Approx. Location denoted with ● in Figure 2

Figure 2: Well Survey Response Locations



The well located at 839 Hunt Road is reportedly a shallow overburden well, which is not identified in the MECP well records. The well is located approximately 300 m north of the northern site limit, and on the north side of the wetland area which is north of Gore Road.

The two wells located at 1160 Hunt Road are approximately 100 m east of the site, and the shallower of the two wells correspondence with MECP Well No. 4704458. The deeper well does not appear to be included in the well records, based on the reported depth. Based on the overall depth of these two wells, adverse impacts to the water supply are not anticipated, since they are set well below the anticipated excavation depths associated with aggregate extraction at the site.

The deep drilled well located at 642699 Road 64 is located approximately 300 m northeast of the northeast limits of the site, and is also not included in the MECP well records. Based on the overall depth of the well, adverse impacts to the water supply for this well is not anticipated, since it is set well below the anticipated excavation depths associated with aggregate extraction at the site.

4. BOREHOLE FINDINGS

4.1 Soil Conditions

A series of seven boreholes were advanced at the site to examine soil and shallow groundwater conditions. The borehole locations are shown on Drawing 5, in Appendix A. In general, soils observed in the boreholes consisted of topsoil overlying silt, sand and/or sand and gravel soils, which in turn overlie natural silt till soils. General descriptions of subsurface conditions are summarized in the following sections. Borehole logs are provided in Appendix B, for reference.

It should be noted that boundaries of soil indicated in the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

Topsoil

Each borehole was surfaced with a layer of topsoil. The topsoil consisted of brown sandy loam, and the thickness ranging from 450 to 600 mm across the site. The topsoil was in a damp to moist state at the time of the fieldwork, based on visual and tactile examination. Some mixed soil was observed in the underlying subgrade soils, likely as a result of the cultivation of the field.

Silt

A near surface layer of silt was encountered below the topsoil in borehole BH 1. The silt was approximately 1.0 m thick, and generally described as brown in colour, and in a weathered condition, containing trace amounts of sand. The silt is generally noted to be in a compact state, based on augering resistance.

Sand / Silty Sand

Sand or Silty Sand was contacted in each of the boreholes, with the exception of borehole BH3. The sand was found to have a variable texture, ranging from silty sand, to sand with some silt and some gravel. The sandy soils were generally found to be in a compact to dense state, based on auger resistance, and Standard Penetration Test (SPT) blow counts in the range of 17 to 32 blows per 0.3 m penetration of the split-spoon sampler. Five samples were submitted for gradation analyses. The results of the grain size analyses are provided graphically in Appendix B, and are summarized below, in the following table.

Table 5: Sand / Silty Sand Gradation Results

Sample ID	% Gravel	% Sand	% Fines (Silt and Clay)
BH1, SA 3 – Silty Sand / Sandy Silt	0.0	44.4	55.6
BH2, SA 4 – Fine Sand, trace silt	0.0	88.7	10.9
BH4, SA 6 – Sand, some Gravel	19.5	77.1	3.4
BH6, SA 8 - Fine to Medium Sand, trace Silt	0.1	91.6	8.3
BH7, SA 9 – Fine Sand, some silt	0.0	83.8	16.2

In-situ moisture contents within the sandy soils were generally found to be in the range of 3 to 8 percent above the stabilized groundwater table, and in the range of 10 to 26 percent within the saturated soils.

Sand and Gravel

The predominant soils encountered in the boreholes comprise of sand, and sand and gravel soils. These soils were observed to be well graded, and were observed to contain occasional cobbles, based on augering resistance. The sand and gravel soils were generally found to be in a compact to dense state.

For the purposes of characterising the soil permeability, a sample was submitted for gradation analysis. The results of the grain size analysis is provided graphically in Appendix B, and summarized below.

Table 6: Sand and Gravel Gradation Results

Sample ID	% Gravel	% Sand	% Fines (Silt and Clay)
BH5 – Silty Sand and Gravel	26.8	51.9	21.3

Silt Till

A layer of silt till was encountered immediately below the topsoil in borehole BH3, and at the base of boreholes BH 1 and 4. The silt till generally contained trace sand, trace to some fine gravel. The silt till is in a dense to very dense state. Moisture content determinations conducted on recovered samples of the till generally range between 17 percent, generally indicative of moist soil conditions. The silt till was observed to contain intermittent when sand seams within borehole BH1.

4.2 Soil Permeability

The hydraulic conductivity of a soil depends on a number of factors, including particle size distribution, degree of saturation, compactness, adsorbed water (which depends on clay content). The heterogeneous nature of glacial deposits can also contribute to variations in soil permeability where the soil composition may include localized areas with increased fine material or sandy material which can influence soil permeability at different points within the soil strata.

Grain Size analyses were carried out on select samples of the sand, and sand and gravel soils encountered at the site. The results of the testing are provided below for reference, and shown graphically in Appendix B. In addition to the soil composition outlined below, the following table also provides a saturated hydraulic conductivity and factored infiltration rate, based on the gradation results for each sample. The results of the grain size analyses were used to correlate the gradation results to the hydraulic conductivity, using Hazen's method. This correlation is based on the following relationship:

$$k\ (cm/s) = C(d_{10})^2$$

where, d_{10} is the diameter (size measured in mm) at which 10% of the sample passes; and,
C is an empirical coefficient (average value of 1.0).

Table 7: Saturated Hydraulic Conductivity

Sample ID	Gradation Results			Saturated Hydraulic Conductivity (m/s)
	Fines (% Silt & Clay)	% Sand	% Gravel	
BH1, SA 3 – Silty Sand / Sandy Silt	55.6	44.4	0.0	4.84×10^{-6}
BH2, SA 4 – Fine Sand, trace silt	10.9	88.7	0.0	4.23×10^{-5}
BH4, SA 6 – Sand, some Gravel	3.4	77.1	19.5	9.00×10^{-4}
BH5 – Silty Sand and Gravel	21.3	51.9	26.8	9.61×10^{-4}
BH6, SA 8 – Well Graded Sand, trace Silt	8.3	91.6	0.1	6.40×10^{-5}
BH7, SA 9 – Fine Sand, some silt	16.2	83.8	0.0	2.50×10^{-5}

4.3 Cross Sections

Two geologic cross sections have been created for the site, with the cross-section locations shown on Drawing 5, and the cross sections presented on Drawing 6, in Appendix A. Results of the onsite drilling indicates that a surficial topsoil layer covers much of the Site, which in turn is underlain by discontinuous deposits of silt, sand and/or sand and gravel. A lower silt till layer was identified at the bottom of some of the boreholes, which extend to the termination depth of the boreholes.

5. HYDROGEOLOGICAL SETTING

5.1 Regional Setting

Within the broad, regional setting, three aquifers have been identified, and are characterized below:

- Shallow unconfined overburden aquifer, typically contained within surficial deposits of sandy soils, generally encountered at relatively shallow depth;
- Intermediate confined overburden aquifer, typically contained within outwash sand and gravel soils which are generally set between glacial till soils; and,
- Bedrock aquifer contained within the shale or limestone bedrock.

For the purposes of this study, the focus is on the shallow unconfined aquifer, contacted in the boreholes and monitoring wells installed at the site. This shallow aquifer is also identified as being a high vulnerability aquifer, susceptible to impacts from surface and near surface activities.

The regional predominant groundwater flow direction within the shallow aquifer is generally expected to follow the surface topography, with water flow towards the Thames River, located to the east /southeast from the site. However, tributary creeks and streams which outlet to the Thames River, and artificially created surface water features in the area are also expected to influence the shallow groundwater flow direction.

In general, source water for the shallow overburden aquifer is relatively local, being precipitation falling on nearby Lots and Concessions and possibly on a Township scale. Local topography will define the source area for the unconfined shallow aquifer.

5.2 Shallow Groundwater Conditions

The wells installed into the LDS boreholes were advanced using 6-inch (152.4 mm) outer diameter hollow stem augers. The monitoring wells were constructed with 2-inch (50.8 mm) diameter CPVC pipe. The screens on each well are mill-slotted, with a slot spacing of 0.5 mm, and were backfilled with Type 2 Silica Sand. Above the screened depth, the annular space was backfilled with a Bentonite slurry, up to ground surface.

The following sections outline the short term and stabilized groundwater measurements recorded at the site.

5.2.1 Manual Groundwater Measurements

Short term water level observations were recorded from the open boreholes and newly installed monitoring wells at the time of installation. Groundwater observations in the open boreholes and a review of soil moisture contents are indicative of the shallow groundwater generally being contained within the sand and gravel soils. Short term water levels are summarized in Table 8..

Table 8: Short Term Groundwater Measurements

Borehole	Ground Surface Elevation, m bgs	Groundwater Observations	Groundwater Elevation, m asl
BH1 (MW)	275.26	Water measured at 1.8 m	273.46
BH2 (MW)	276.44	Water measured at 1.3 m	275.14
BH3	277.67	Open and dry at completion of drilling	N/A
BH4 (MW)	277.87	Water measured at 5.6 m	272.27
BH 5 (MW)	280.90	Water measured at 9.8 m	271.10
BH6 (MW)	279.95	Water measured at 9.0 m	270.95
BH 7 (MW)	281.12	Water measured at 9.0 m	272.12

Stabilized groundwater levels were measured at the site from July 2019 to present on a monthly basis, as shown in Table 9. For design purposes, it is recommended that the manual water level measurements from March 2020 be used as a reasonable representation of the seasonal high groundwater condition at the site.

As demonstrated by the manual groundwater level measurements recorded at the site, the shallow groundwater will vary in response to climatic or seasonal conditions, with the highest levels possible in wet seasons, particularly under spring conditions.

The shallowest groundwater levels were encountered in Boreholes BH1 and BH2, which are located in the north end of the site. Boreholes BH1, BH2 and BH4, which are located in the north half of the site demonstrate the most fluctuation in the stabilized groundwater levels, with total fluctuations ranging from 1.40 to 3.48 m. Borehole BH5, BH6 and BH7, which are located in the south half of the site demonstrate the least seasonal fluctuation, with groundwater.

Table 9: Manual Water Level Measurements

Location	Ground Surface Elev. (m)	Depth to Groundwater (m, bgs) *Groundwater Elevation (m, asl)*																
		July 22, 2019	Aug 08, 2019	Sep 04, 2019	Oct 24, 2019	Nov 07, 2019	Dec 02, 2019	Jan 06, 2020	Feb 11, 2020	March 05, 2020	April 03, 2020	May 28, 2020	June 12, 2020	July 14, 2020	Aug 24, 2020	Sep 21, 2020	Oct 14, 2020	Nov 19, 2020	Dec 14, 2020
BH 1	275.26	1.53 *273.73*	1.91 *273.35*	2.06 *273.20*	2.29 *272.97*	2.07 *273.19*	2.12 *273.14*	1.12 *274.14*	0.22 *275.04*	0.15 *275.11*	0.40 *274.86*	1.00 *274.26*	1.23 *274.03*	1.76 *273.50*	2.14 *273.12*	2.24 *273.02*	2.30 *272.96*	2.20 *273.06*	2.02 *273.24*
BH2	276.44	0.59 *275.85*	1.37 *275.07*	1.65 *274.79*	1.30 *275.14*	0.49 *275.95*	0.37 *276.07*	0.30 *276.14*	0.30 *276.14*	0.25 *276.19*	0.35 *276.09*	0.64 *275.80*	0.65 *275.79*	1.56 *274.88*	1.68 *274.76*	1.48 *274.96*	1.28 *275.16*	*0.64* *275.80*	*0.27* *276.17*
BH4	277.87	5.26 *272.61*	5.61 *272.26*	6.00 *271.87*	6.50 *271.37*	6.14 *271.73*	6.81 *271.06*	5.91 *271.96*	3.33 *274.54*	4.10 *273.77*	3.85 *274.02*	4.37 *273.50*	4.81 *273.06*	5.45 *272.42*	6.10 *271.77*	6.20 *271.67*	6.44 *271.43*	*6.45* *271.42*	*6.28* *271.59*
BH5	280.90	9.75 *271.15*	9.82 *271.08*	9.96 *270.94*	10.29 *270.61*	10.14 *270.76*	10.20 *270.70*	10.07 *270.83*	9.68 *271.22*	9.69 *271.21*	9.60 *271.30*	9.73 *271.17*	9.81 *271.09*	9.96 *270.94*	10.12 *270.78*	10.20 *270.70*	10.26 *270.64*	*10.30* *270.60*	*10.32* *270.58*
BH6	279.95	8.88 *271.07*	9.00 *270.95*	9.11 *270.84*	9.23 *270.72*	9.16 *270.79*	9.20 *270.75*	9.15 *270.80*	8.86 *271.09*	8.61 *271.34*	8.69 *271.26*	8.86 *271.09*	8.91 *271.04*	9.07 *270.88*	9.19 *270.76*	9.25 *270.70*	9.30 *270.65*	9.33 *270.62*	9.31 *270.64*
BH7	281.12	9.92 *271.20*	10.09 *271.03*	10.23 *270.89*	10.30 *270.82*	10.28 *270.84*	10.33 *270.79*	10.28 *270.84*	9.96 *271.16*	9.90 *271.22*	9.86 *271.26*	9.93 *271.19*	10.04 *271.08*	10.17 *270.95*	10.33 *270.79*	10.34 *270.78*	10.40 *270.72*	10.44 *270.68*	10.43 *270.69*

Table 10: Seasonal Fluctuations in Stabilized Water Levels

Location	Ground Surface Elev. (m)	Depth to Groundwater (m, bgs) *Groundwater Elevation (m, asl)*		Total Fluctuation (m)
		High Water Levels	Low Water Levels	
BH 1	275.26	0.15 *275.11*	2.29 *272.97*	2.14
BH2	276.44	0.25 *276.19*	1.68 *274.76*	1.43
BH4	277.87	3.33 *274.54*	6.81 *271.06*	3.48
BH5	280.90	9.60 *271.30*	10.29 *270.61*	0.69
BH6	279.95	8.61 *271.34*	9.33 *270.62*	0.72
BH7	281.12	9.86 *271.26*	10.44 *270.68*	0.58

5.2.2 Continuous Groundwater Measurements – LDS Datalogger Installations

Dataloggers were installed in monitoring wells installed at boreholes BH2, BH5 and BH6, to allow for regular continuous temperature and water level readings. The data loggers have been downloaded on a regular basis, with manual groundwater measurements collected to confirm the accuracy of the data collected by the dataloggers. Groundwater Hydrographs are provided in Appendix D, for reference.

Hydrographs also include water temperatures recorded in the monitoring wells with the dataloggers. The hydrographs include precipitation data, and indicate that water levels within the shallow boreholes (BH2) are significantly influenced by precipitation events and seasonal conditions. The hydrographs in the deeper boreholes (BH5 and BH6) appear less responsive to rain events.

These findings are not surprising, given that the presence of a confining layer is at a much shallower depth in the north end of the site, where the shallow boreholes are located. The finer grained soils and unconfined aquifer in this part of the site has less vertical capacity to absorb water infiltrated from rain events, without altering the stabilized water level. Whereas in the deeper wells, the deeper underlying confining layer and the more permeable sand, and sand and gravel soils can more readily accommodate the addition of infiltrated surface water.

5.3 Groundwater Flow Direction and Hydraulic Gradients

The groundwater flow direction interpreted from the water level measurements collected by LDS indicates groundwater flow in a southerly direction, towards the open water on the adjacent lands. This is demonstrated on the Groundwater Contour Plans provided on Drawings 7 and 8 in Appendix A, which shows the groundwater contours and general flow direction, based on the manual groundwater measurements recorded at the site in the fall of 2019 and spring of 2020. Monitoring wells are being maintained for the purposed of collecting seasonal groundwater measurements. It is noteworthy to mention that the spring and summer groundwater contour plans demonstrate some seasonality on the shallow groundwater flow direction and with the overall depth of the shallow groundwater, with summer water levels being approximately 0.3 to 0.6 m lower in summer conditions. Groundwater gradients under spring and summer conditions are summarized below:

Table 11: Hydraulic Gradient

Seasonal Condition	Gradient, m/m		
	Maximum [1, 2]	Minimum [1, 3]	Average [4]
Fall Conditions – September 2019	0.021	0.004	0.011
Spring Conditions – March 2020	0.021	0.007	0.014

Notes:

1. Maximum and minimum gradients determined from groundwater contours, as shown on Drawings 7 and 8.
2. Maximum gradient measured along east property limit, in central part of the site.
3. Minimum gradient measured along the west property limit, in central part of the site.
4. Average gradient determined using water levels at monitoring wells BH/MW2 and BH/MW5.

The relatively small change groundwater elevation in the south end of the Site is attributed to the presence of pond on the lands to the south, and the relatively high permeability sand and gravel deposits. Sand and gravel deposits are highly transmissive and therefore do not support high hydraulic gradients. In the north and central part of the Site groundwater flow occurs within the finer grained silty sand and sandy silt soils. The fine sand and silt deposits have lower transmissivity and groundwater contours are spaced closer together indicating higher horizontal hydraulic gradients.

5.4 Groundwater Chemistry

Groundwater samples were collected from select boreholes at the site on September 20, 2019. The rationale for selecting the sampling locations was that one sample (taken from BH2) was at the north end of the site, close the wooded area and Hunt Road, and another sample (taken from BH6) was at the south end of the site, closest to the open water on the adjacent property.

The monitoring wells at BH2 and BH6 were developed 24 hours in advance of the testing, including the removal of the equivalent of three water-columns of water. The water samples were collected using designated bailer tubes. Each well was fitted with a dedicated bailer to allow purging and sampling of the well and avoid cross-contamination. The monitoring well and piezometer were purged of at least 3 times the volume of water prior to sampling.

The analytical testing included the following sampling parameters.

- Nutrients: Nitrate, Nitrite, total ammonia;
- Dissolved Metals: Standard Metals Package for General Chemistry;
- General Inorganic Parameters and Calculated Parameters: pH, Total Dissolved Solids, Electrical Conductivity, Hardness, Anion and Cation Sums.

Samples were collected by a technician wearing disposable Nitrile gloves, and samples were placed in laboratory-supplied sample bottles, labelled with a unique sample number, dated, and recorded on the laboratory chain of custody form. Samples were immediately placed in a cooler with ice for delivery to an accredited laboratory (Maxxam Analytics depot in London Ontario) under the chain of custody.

Copies of the Certificate of Analysis for each round of testing are provided in Appendix C, and results are summarized in Table 12.

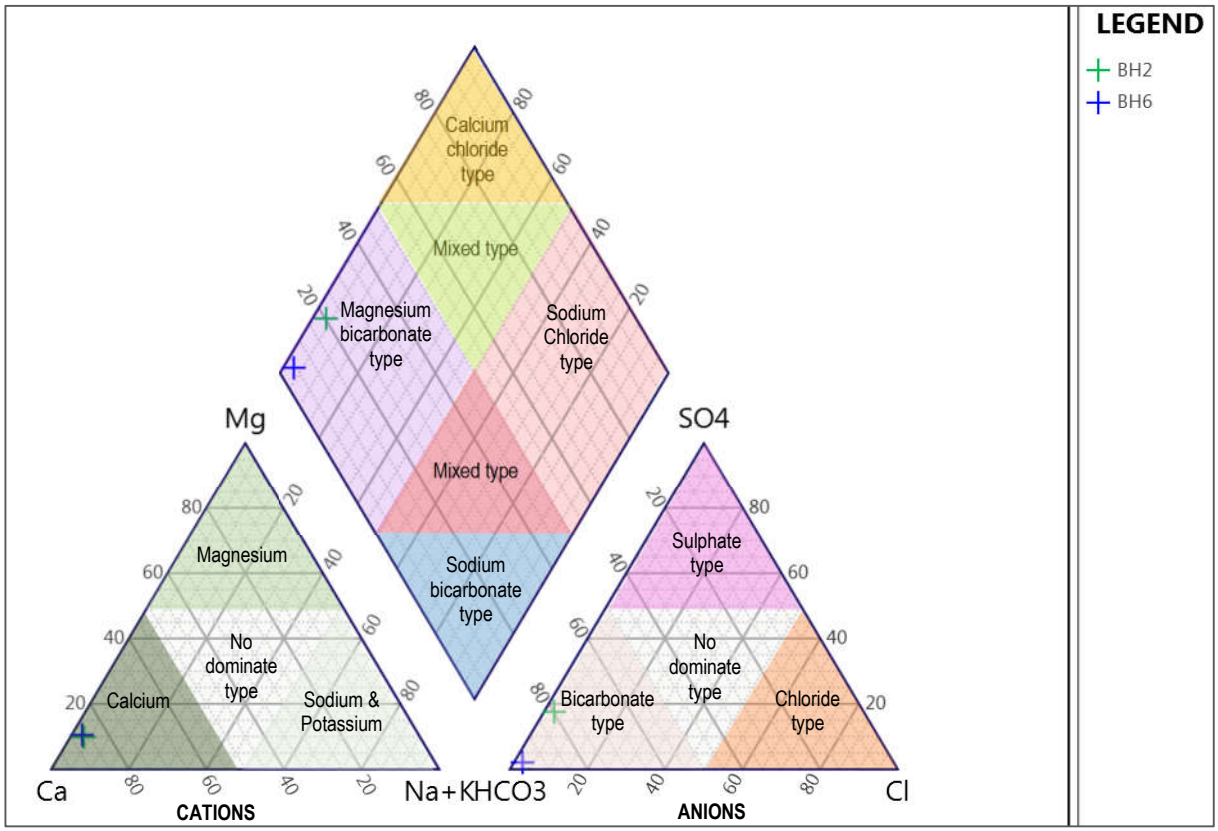
Table 12: Analytical Test Results

PARAMETER	UNITS	BH2 Groundwater Sample	BH6 Groundwater Sample
Metals			
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50
Dissolved Arsenic (As)	ug/L	<1.0	<1.0
Dissolved Barium (Ba)	ug/L	33	39
Dissolved Beryllium (Be)	ug/L	<0.50	<0.50
Dissolved Boron (B)	ug/L	12	<10
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10
Dissolved Calcium (Ca)	ug/L	96000	120000
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0
Dissolved Cobalt (Co)	ug/L	0.63	<0.50
Dissolved Copper (Cu)	ug/L	<1.0	1.1
Dissolved Iron (Fe)	ug/L	<100	<100
Dissolved Lead (Pb)	ug/L	<0.50	<0.50
Dissolved Magnesium (Mg)	ug/L	18000	24000
Dissolved Manganese (Mn)	ug/L	600	48
Dissolved Molybdenum (Mo)	ug/L	1.9	0.80
Dissolved Nickel (Ni)	ug/L	1.2	<1.0
Dissolved Phosphorus (P)	ug/L	<100	<100
Dissolved Potassium (K)	ug/L	1000	890
Dissolved Selenium (Se)	ug/L	<2.0	<2.0
Dissolved Silicon (Si)	ug/L	5000	5400
Dissolved Silver (Ag)	ug/L	<0.10	<0.10
Dissolved Sodium (Na)	ug/L	5000	4900
Dissolved Strontium (Sr)	ug/L	140	130
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0
Dissolved Uranium (U)	ug/L	1.9	0.39
Dissolved Vanadium (V)	ug/L	0.65	<0.50
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0
Calculated Parameters			
Anion Sum	me/L	6.10	7.67
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	250	330
Calculated TDS	mg/L	330	410
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.9	2.9
Cation Sum	me/L	6.48	8.16
Hardness (CaCO3)	mg/L	310	400
Ion Balance (% Difference)	%	3.00	3.09
Langelier Index (@ 20C)	N/A	1.05	1.12
Langelier Index (@ 4C)	N/A	0.804	0.873

PARAMETER	UNITS	BH2 Groundwater Sample	BH6 Groundwater Sample
Calculated Parameters - *continued*			
Saturation pH (@ 20C)	N/A	7.05	6.85
Saturation pH (@ 4C)	N/A	7.30	7.10
Inorganics			
Total Ammonia-N	mg/L	0.17	0.11
Conductivity	umho/cm	570	700
Dissolved Organic Carbon	mg/L	1.6	1.5
Orthophosphate (P)	mg/L	<0.010	<0.010
pH	pH	8.10	7.97
Dissolved Sulphate (SO4)	mg/L	35	4.6
Alkalinity (Total as CaCO3)	mg/L	250	330
Dissolved Chloride (Cl-)	mg/L	14	13
Nitrite (N)	mg/L	<0.010	<0.010
Nitrate (N)	mg/L	<0.10	7.79
Nitrate + Nitrite (N)	mg/L	<0.10	7.79

A review of the piper diagram provided on Figure 2, below, indicates that the shallow groundwater samples from each end of the site have a very similar water chemistry, with high levels of calcium and magnesium, which are consistent with hard water.

Figure 2: Piper Diagram



5.5 Groundwater Temperature Profiles

Temperature profiles were recorded in the monitoring wells in October 2019, November 2019 and January 2020.

A submersible pressure transducer with a data logger (Onset Hobo U20L unit) was used to record water temperatures at variable depths within each monitoring well. The temperature data points relative to depth in the water column for each location is shown graphically in Figure 3 (refer to page 26).

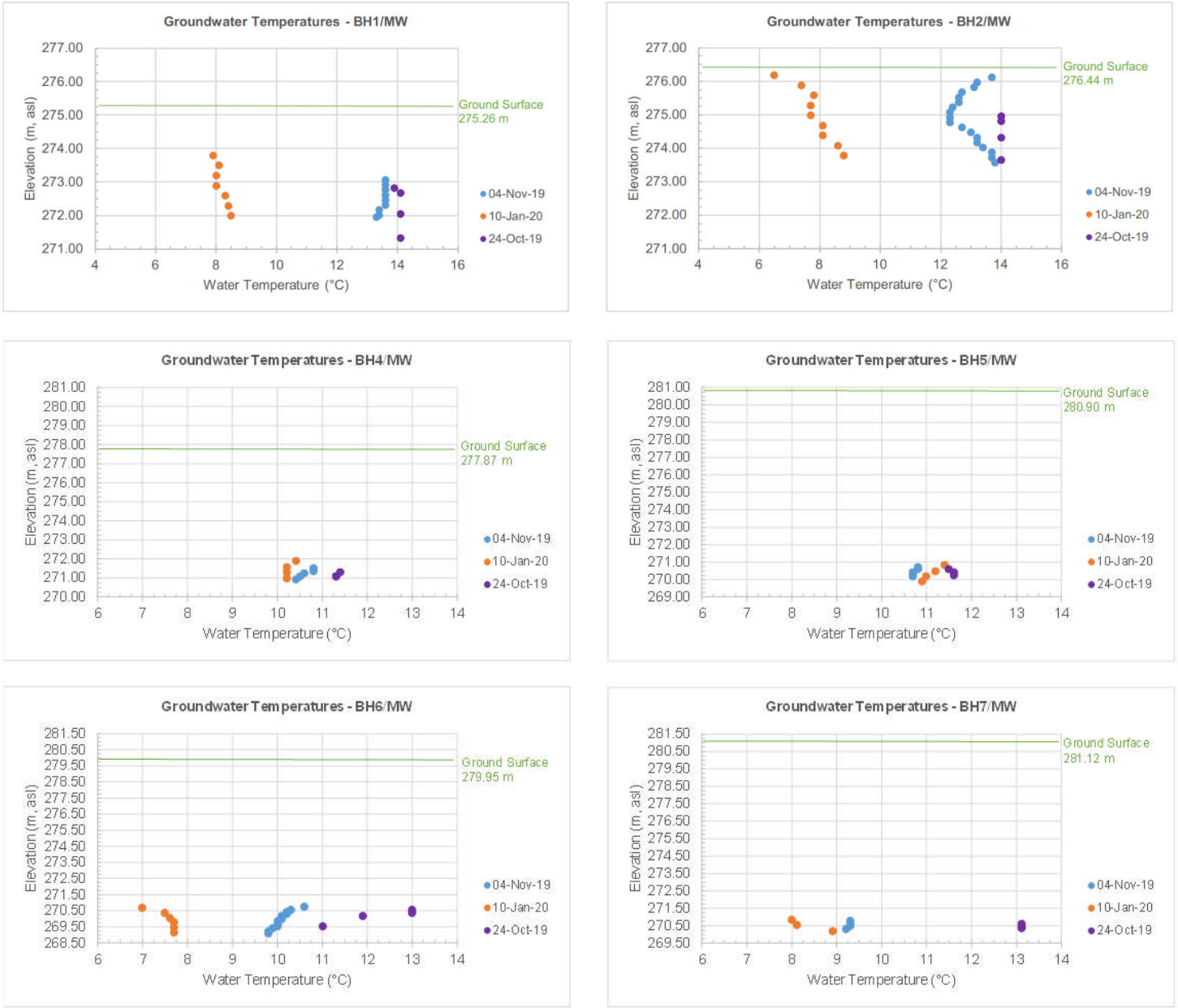
Shallow groundwater exhibits relatively wide temperature differences, while deeper groundwater has a much narrower range of temperature fluctuations. As the air and ground surface cools off, the colder air temperatures progressively move into the subsurface, resulting in water temperatures in the shallow groundwater being more significantly influenced by the ambient air and ground temperatures near surface since there is less ground cover to act as insulation for the groundwater. At greater depths, this effect is less pronounced.

As the depth to the saturated zone increases, the temperature spread becomes significantly narrower, which is demonstrated particularly well in boreholes BH5 and BH6.

Continuous groundwater temperatures were also recorded in Boreholes BH2, BH5 and BH6 for the period between August 15, 2019 and April 7, 2020 to document the baseline groundwater temperatures in the respective wells, and to note seasonal variations which occur within the shallow groundwater in the north end of the site and in the deeper wells set in the south and central part of the site. The results of the temperature monitoring are presented graphically on the hydrographs presented in Appendix D.

Figure 3

Groundwater Temperature Profiles



5.6 Groundwater and Surface Water Interaction

There is no open water body, watercourse or groundwater springs observed within the site limits.

Surface water drainage along Gore Road flows through a drainage ditch, along the south side of the road. Similarly, a drainage ditch follows the west side of Hunt Road. There is no proposed water diversion or storage, nor any proposed construction of drainage facilities on the Site.

Shallow groundwater encountered at the site is contained within a shallow groundwater aquifer, which is generally characterized as being unconfined, due to the limited thickness and variable permeability of the overburden silt which was documented in the boreholes. The shallow groundwater generally flows in a southerly direction throughout the site, towards the open gravel pit excavation/pond on the lands to the south.

It is important to note that the pond on the adjacent lands to the south was created as a result of the removal of overburden silts and excavation of aggregate/ sand and gravel material. As such, the water contained in the pond is expected to be directly connected to the shallow groundwater contacted in the boreholes in the south part of the study area. The large open body of water has the potential to contribute to increases in the temperature regime of the shallow groundwater, since the surface water temperature directly correlates with the ambient air temperature, however due to the depth of the shallow groundwater at the south end of the site, there is no discernable influence in the groundwater temperatures recorded in the wells closest to the south end of the site.

6. IMPACTS OF PROPOSED OPERATIONS

6.1 Proposed Aggregate Extraction

A test pit program completed at the site by Thames Valley Aggregates, and the findings of this report confirm the presence of granular materials which have commercial value to the owner. The natural sand and gravel soils encountered at the site extend below the shallow groundwater table. As such, extraction of the granular material will require excavation below the stabilized groundwater table, if extraction of materials above the natural strata of silt till is planned. It is anticipated that these materials will be extracted with hydraulic excavator. Consideration may also be given to extraction methods below the groundwater table may also utilize a dragline set-up.

It is understood that aggregate extraction operations at the site will involve the excavation of sand, and sand and gravel soils from above and below the water table. Aggregate deposits are relatively fine grained and thin in the north part of the site, limited by a layer of silt till which was contacted within the boreholes. However, in the central and south end of the site, the thickness of the granular deposits increases significantly, extending below the borehole exploration depth of 11.1 m in the south end of the site. The deepest extraction activity is expected at the south end of the site, with the overall extraction depths in the south end of the site are expected to be similar to those at the Nicli Pit, located immediately south of the site.

Where possible, sand and gravel soils are expected to be completely removed until the clayey silt till is reached. The elevation of the clayey silt till, which underlies the aggregate deposits, is delineated on the cross sections provided on Drawing 6. During the active extraction operation, it is anticipated that portions of the site will be occupied by ponds where extraction extends below the water table. As noted in the Rehabilitation Plan prepared by Harrington McAvan Ltd., the finished pond area is expected to be about 11.33 hectares in size, at completion.

Given the local presence of nearby water supply wells, and wetland areas to the north, a Level 2 evaluation as described by the Ministry of Natural Resources and Forestry standards for aggregate licence applications, is warranted.

6.2 Impacts to the Shallow Groundwater Level

The aggregate extraction will be carried out using an excavator and/or dragline, without the need for dewatering, and when extraction is complete, an 11.97 hectare pond is expected to remain at the site. As noted above, the depth of excavation is expected to vary across the site, to effectively extract and utilize the aggregate.

The proposed aggregate extraction activities which extend below the water table have the potential to cause temporary lowering of the water table in the vicinity of the proposed operation during active excavation. Two primary causes have been identified, as follows:

- The removal of sand and gravel may initially and temporarily result in short-duration localized effects on the groundwater level being lowered near the perimeter of the pond area.

- The potential change in water budget due to the increase in evaporation from an open water body and increased surface runoff into the pond.

Both aspects were examined, and subsequent calculations were made to see if these aspects have any realistic chances of having any negative impacts. The following subsections address the analyses which was carried out for the site.

6.2.1 Groundwater Lowering from Active Excavation

Removal of aggregate material may cause a small lowering of the water level in the pond as the extraction progresses, as a result of a localized zone of depression where active excavation occurs. When a given volume of aquifer material (saturated sand and gravel) is removed, most of the water in the excavator bucket or dragline drains back into the pond. In addition, the excavated material is typically stockpiled near the pond are, so excess moisture in the gravel can drain back towards the pond. A volume of water roughly equal to the volume of excavated sand and gravel flows from the existing pond, and groundwater, into the void created by extracting the sand and gravel. The overall water level drops slightly as the void space is filled. The effect of this marginal drawdown can instantly be observed at the pond edge, but will be localized to the area of excavation.

Using an estimated porosity of the granular material of 0.30, the volume of aquifer solids removed in 1 m^3 bucket is 0.70 m^3. When an excavated pond is small, the change in volume caused by the removal of granular material has the greatest effect on the water level in the pond. As pond size increases, there is more water available in relation to the extraction of one bucket of material, so the effects of extraction become lessened.

Using an estimated daily tonnage of 3000 tonnes, a typical aggregate density of 1780 kg/m^3, a porosity of 0.30, the following calculation can be carried out:

$$Volume\ of\ water\ to\ fill\ excavation = (1 - soil\ porosity)\ x\ \frac{aggregate\ tonnage}{aggregate\ density}$$

The volume of excavated water that will need to flow into the excavated area to replace the sand and gravel is approximately 1180 m^3.

The following calculations (refer to Table 13) are provided for approximate pond sizing for Area 1, 2 and 3 as outlined on the Harrington McAvan Operations Drawings, which have been estimated as a 4 ha pond, an 8 ha pond and the ultimate pond configuration of 11.33 ha. Although the pond base is expected to be stepped up towards the northerly extent of the extraction area, an average pond depth of 5 m has been used in the calculations, to demonstrate the maximum daily drawdown caused by aggregate excavation.

Water level in the pond during the early phase of extraction for the smaller pond size may show daily lowering of less than 3 cm but is expected to be temporary and recover within 24 hours. During later phase of extraction when the pond approaches its maximum size, this lowering is expected to be much less, as noted above. This value is insignificant and would not cause any groundwater drawdown for any significant distance outside of the immediate pond area.

Table 13: Drawdown Calculations during Active Extraction

Inputs	4.0 ha pond	8.0 ha pond	11.33 ha pond
Estimated Volume of Water in Pond = AxB, Where: A = area of Pond B = depth of Pond	A = 40,000 m^2 B = 5 m Pond Volume =200,000 m^3	A = 80,000 m^2 B = 5 m Pond Volume = 400,000 m^3	A = 113,300 m^2 B = 5 m Pond Volume = 566,500 m^3
Maximum daily drawdown caused by extraction = ho – [(V1-V2)/A] Where: ho = Initial Pond level V1 = Pond volume (calculated above) V2 = Volume of excavation void A = area of Pond (shown above)	*Maximum daily drawdown caused by extraction* *= ho – [(V1-V2)/A]* = 5.0 – [(200,000-1180)/40,000] = 0.029 m	*Maximum daily drawdown caused by extraction* *= ho – [(V1-V2)/A]* = 5.0 – [(400,000-1180)/80,000] = 0.015 m	*Maximum daily drawdown caused by extraction* *= ho – [(V1-V2)/A]* = 5.0 – [(566,500-1180)/113,300] = 0.010 m

The domestic wells nearest to the Site are located north and east of the site. Although some of them obtain water from the water table aquifer, lowering water levels in the pond due to the proposed operation is inconsequential to water quantity in these domestic wells. The zone of influence associated with the minor changes to the water level do not extend far enough to reach the neighbouring properties.

6.2.2 Water Budget and Increased Evaporation

LDS has carried out a monthly water balance analysis for the site, under both existing and proposed rehabilitated conditions. As noted previously, the predominant soils encountered at the site are comprised of sand or sand and gravel soils, which in turn overlie silt till. Shallow groundwater is contained within the unconfined aquifer within the sand and gravel soils. The following table summarizes the recommended elements of the assessment, and provides a reference to the corresponding material within this report.

Table 14: Components of Water Balance Analysis

Conservation Ontario Recommended Element of the Water Balance Assessment	Reference
Obtain precipitation values from a reliable source such as Environment Canada Meteorological Services	Environment Canada Climate Normals 1981 – 2010, London International Airport - Station ID 6144475, London, Ontario Precipitation = 984 mm/year
Estimate of local values for major water balance components (evapotranspiration, surplus, runoff, and infiltration) for pre-development, post-development and post-development with mitigation conditions	Estimated pre and post-development values of evapotranspiration, surplus, runoff, and infiltration are summarized in the following paragraphs. Calculation Work Sheets prepared by LDS are provided in Appendix G. The relationship between precipitation, evapotranspiration, run-off and infiltration is prorated using the local precipitation amount (determined, as noted above), and based on the relationship shown on Table 3.1 of the MOECC Stormwater Management Planning and Design Manual.
The water balance is required to take into account the changes to grading / topography and land cover	Variables such as elevation, surficial soils, hydrologic soil group, vegetation, root zone, grading and topography are taken into account when estimating the existing and proposed post development water balance components.
Appropriate catchments should be used within the analysis (i.e. delineate catchments based on drainage, grades, vegetation, soils and show how infiltration and runoff will change within these zones for both pre and post development)	The site limits have been identified as the pre-development and post-development catchment area.
All calculations should be provided in a table format which clearly demonstrates that inputs (precipitation, additional runoff, water from municipal well, etc.) are equal to outputs (i.e. infiltration runoff, water use)	Calculations are presented in table format on the attached water balance calculation sheets provided in Appendix G.

Precipitation, evapotranspiration, total runoff, and infiltration was reviewed utilizing a method authored by C. W. Thornthwaite and J. R. Mather in their 1957 paper titled Instructions and Tables for Computing Potential Evapotranspiration and the Water Balance. The methodology can be found in the MECP SWM Planning and Design Manual, Section 3.2.

The basic water balance for a region can be expressed as:

$$P = RO + ET + I + \Delta S$$

Where, P = Precipitation (rain and snow)
RO = Runoff
ET = Evapotranspiration
I = Infiltration (Groundwater Recharge)
ΔS = Change in Groundwater Storage (assumed to be zero under steady state conditions).

Precipitation is a measured value, with the averages (1981 to 2010) used in this assessment being obtained from the Environment Canada operated London International Airport Climate Station. Evapotranspiration is calculated based on measured air temperatures. Infiltration and runoff are calculated based on precipitation and evapotranspiration, where the difference between these components is the water surplus available for infiltration and recharge.

Water balance calculation worksheets (including a description of the methodology and assumptions) are provided in Appendix G. The following summarizes the existing water balance volumes under existing (pre-development) and post-development (rehabilitation) conditions.

Annual water budget for the Site in its current state indicates that: of the 984 mm of annual precipitation, 548 mm is lost to evapotranspiration, 240 mm infiltrates into the ground, and 219 mm leaves the Site as runoff. After rehabilitation, a portion of the post-development run-off will be split between evaporation and infiltration, and as a result, the water balance calculations result in evaporation increasing to 645 mm, infiltration increasing to 273 mm, and 66 mm of run-off remaining. Under the rehabilitated site conditions, there is an increase in water lost to evaporation (evapotranspiration under existing conditions) and an increase to infiltration; however, runoff leaving the site would be reduced. This results in a small net gain to the groundwater system, which is interconnected to the surface water within the future pond.

6.3 Permanent Changes to Shallow Groundwater

As noted previously, the wetland area within the northern wooded area is primarily supported from surface flows which are conveyed through a culvert at Hunt Road, and disperse through the wetland area. Under seasonal (spring-high) conditions, a portion of the wetland may also be supported by shallow groundwater conditions. Within the wetland area, seasonal fluctuations and dry periods in the summer months have been identified by the project ecologist. A physical outlet in the form of a culvert beneath Gore Road is present for surface flows leaving the site, and provides an outlet control to prevent flooding within the wetland area.

The presence of the pond, as identified in the final site configuration shown on the Site Rehabilitation Plan will result in a decreased gradient in the shallow groundwater throughout the site. Under current conditions, the shallow groundwater table drops approximately 5 m from north to south, and a higher flow gradient is present in the east end of the site. The final pond elevation is expected to be at Elevation +/- 273 m, asl, which falls within the central range of the stabilized water levels recorded at the site. Similar to the groundwater characteristics which are currently present at the site, it is anticipated that a higher flow gradient will remain at the northerly limit of the site, in proximity to the northern wooded area where shallow perched groundwater will continue to remain within the unconfined aquifer set above the less permeable silt till soils.

Alterations to the site within the extraction area and the creation of the pond are not expected to significantly alter the base flows which sustain the northern woodland and the wetland area contained there-in, since surface water flow contributions will be unaltered by the development, and the predominant shallow groundwater flow direction from north to south (which provides a base flow contribution under seasonal conditions) will also be unaffected by the proposed aggregate operations.

6.4 Impacts to Groundwater Temperatures

The Groundwater Contour Plans provided on Drawings 7 and 8 show a shallow groundwater flow direction to the south, away from both the Thames River (to the east),Caddy Creek and its tributary drains (to the west), and the wetland area (to the north). Given that in both late summer and spring conditions, the groundwater flow direction remains predominantly to the south, and away from the natural surface water features and surface water-dependent features, it is anticipated that the introduction of a pond at the site as a result of below water gravel extraction will not result in thermal impacts being imposed on the natural surface water features.

Further, an existing pond exists at the Nicli Pit, on the lands to the south. Water temperatures within the onsite pond is expected to be similar to that of the existing pond. The cumulative effect of groundwater warming as a result of the warm groundwater conditions that are anticipated in the pond during warm summer months, relative to the groundwater temperature have the potential to impact down-gradient groundwater and surface water features. However, infiltration into the subgrade soils, and the time required for the infiltration along with the lateral and vertical migration of infiltrated water will provide time for water temperatures to adjust to levels similar to those within the shallow groundwater. As such, the effects of localized warming of surface water at the site is not expected to cause a detrimental effect to nearby upgradient or downgradient natural features.

7. CONTINGENCY PLAN AND MITIGATION MEASURES

7.1 Construction Equipment

The proposed aggregate extraction operation is expected to involve excavation of sand, and sand and gravel materials from above and below the water table. In such a situation, the use of equipment for site operations may pose a potential risk of petroleum hydrocarbons such as fuels, oil and grease to enter the exposed groundwater system unless the proper operation and refuelling procedures are followed.

There are best management and good construction practices that should be followed to reduce the potential and mitigate risks associated with the equipment operation. The following recommendations are provided for consideration:

- Onsite fuel storage tanks will be installed and maintained in accordance with the Gasoline Handling Act;
- Designated fuelling and equipment maintenance area, located at least 30 m away from surface water features, where possible;
- Crushers, stackers and screening plants shall be re-fuelled and maintained on the pit floor during daylight hours. Any minor drips or spills shall be immediately cleaned up and properly disposed of; and,
- Implement spill contingency measures and spill action response plans for construction equipment.

7.2 Sediment and Erosion Control Measures

It is anticipated that surficial topsoil and overburden soils will be stripped as part of the site preparation works, and stored onsite for reuse during the site restoration. It is recommended that stockpiled materials which have been stripped during the site preparation be stored in areas where stormwater run-off will not drain directly into roadside drainage ditches, or into the woodlot being maintained at the north end of the site.

Earthen berms constructed at the site should be vegetated as soon as possible after placement, to help stabilize the berm side slopes.

7.3 Potable Water Supply Interference

The following water well interference complaint protocol is recommended to address water supply interference to domestic and farm water supplies for properties located in proximity (within 150 m) to the site.

1. Nearby and neighbouring properties shall be provided with 24-hour emergency contact information for the Licensee, to facilitate reporting of perceived water supply impacts.
2. Nearby and neighbouring properties which experience disruption or quality problems shall notify the Licensee, who will be responsible to report the well interference complain to MNRF and MECP.
3. In the event that the well owner experiences a significant disruption in their water supply, or experience significant adverse effects upon their water quality; and if the operation of the pit cannot obviously and definitively be excluded as the cause, the licensee shall provide a temporary water supply within 24

hours and thereafter until such time as the cause of the disturbance can be determined and the situation addressed.

4. The Licensee shall investigate the cause of the water supply disturbance and shall report to the MNRF, MECP and the well owner.
5. If it is determined that the aggregate extraction at the pit has been found to have caused a domestic or farm water supply to be adversely affected, the Licensee shall, at the Licensees expense, either restore or replace the water supply to ensure that historic water supply and quality are restored for such a resident. If it is determined that the operation of the pit has not caused any domestic or farm water supply to be adversely affected, the temporary water supply will be maintained for an additional 24 hours to allow the resident to make alternate water supply arrangements.

8. MONITORING PROGRAM

There is no proposed dewatering of the gravel pit. Aggregate extraction is proposed for excavation below the water table using an excavator or a drag line. Changes to water balance are small and inconsequential, and localized changes which are expected to result in a flattening of the groundwater gradient are not expected to have an adverse impact on the northern woodlot and wetland areas which are being maintained.

In the event that there is a perceived impact identified through environmental monitoring at the site, or in the event that interference of disturbance is identified for nearby water supply wells is reported by nearby or neighbouring properties, interim water quality testing should be carried out within 24 hours of the reported incident, to document conditions which may have been impacted. Scoping for the required testing will depend on the incident report.

Groundwater quality has been assessed for existing / baseline conditions, as presented in Section 5.4. If future groundwater quality testing is required, it can be compared against the existing baseline information provided in this report.

The existing monitoring wells which are located around the perimeter of the site may be suitable for continued use for monitoring water levels. A site plan showing all wells to be maintained and protected at the site should be provided to the Licensee working, to ensure that monitoring wells are not inadvertently damaged during site preparation works and removal of overburden materials. Vertical extensions or risers for the monitoring wells may be required to accommodate changes in site grades or the construction of earthen berms around the perimeter of the site. The use of a datalogger would provide continuous monitoring of both water levels and water temperatures at the site.

Manual water level measurements should be carried out on a quarterly basis once the site is licensed and continue until extraction is completed and the site has been rehabilitated. Timing of the quarterly reporting should coincide with annual regulatory compliance reporting requirements which are required to be submitted on September 30 of each year, to ensure that data submitted to the Ministry of Natural Resources is as current as possible.

When the monitoring wells are determined to be no longer required, the wells should be properly decommissioned in accordance with Ontario Regulation 903. This regulation identifies that only certified and qualified well drilling technicians are permitted to direct the decommissioning work for existing wells. Decommissioning a well which is no longer in use helps to ensure the safety of those in the vicinity of the well, prevents surface water infiltration into an aquifer via the well, prevents the vertical movement of water within a well, conserves aquifer yield and hydraulic head and can potentially remove a physical hazard.

9. CONCLUSIONS AND RECOMMENDATIONS

Based on the information collected in the field and analysis of available data, the following conclusions are made:

1. There is a substantial thickness of sand, and sand and gravel soils at the site, which has been deemed to be a financially viable aggregate extraction resource. Aggregate extraction is expected to include both above and below water operations.
2. Above and below water aggregate extraction is already occurring on adjacent licensed aggregate pits, and have resulted in surface water features, particularly on the lands immediately south of the site.
3. The shallow unconfined groundwater aquifer is the most likely aquifer to have a risk of adverse impacts associated with the proposed site activities.
4. Only a limited number of water supply wells are present in proximity to the site, and well records generally indicate that wells are set into intermediate depth overburden deposits.
    - Aggregate extraction operations are not expected to involve active dewatering efforts, therefore significant impacts to nearby water supply wells are expected to be negligible.
    - Provided that the contractor follows best management practices for equipment maintenance and fuelling activities, the risk of water quality impact is expected to be negligible.
5. Groundwater flow direction has been identified to be in a southerly direction. The wetland area located on the north side of Gore Road is upgradient of the site, and as such, is not expected to be adversely impacted by operations at the site.
6. The hydrogeological site assessment and associated calculations indicate that the proposed aggregate extraction from below the water table will not have any adverse effect on local water resources, including domestic water wells, nor on any of the natural environment features in the area.

Based on the conclusions drawn from the work described herein, the following recommendations are made and should be incorporated into the site plans:

1. Fuel storage, equipment filling, and equipment maintenance should be carried out in accordance with best management practices outlined in Section 6.1, including designated fuelling locations and implementation of spills management response plans, as appropriate to reduce the potential and mitigate risks associated with the equipment operation.
2. Water levels have been carried out on a monthly basis since the inception of the monitoring wells which were installed onsite. Groundwater level monitoring should continue at the site on a quarterly basis after the pit is licensed, and continue until site restoration is complete.
3. Groundwater samples have been collected at the site to establish baseline water quality conditions for shallow groundwater within the unconfined aquifer which is expected to be encountered during the aggregate extraction operation. Future water quality testing can be compared to the background information presented in this report, if required.
4. If complains are received from nearby or neighbouring property owners (within 120 m of the site), the Water Supply Interference Protocols outlined in Section 6.2 of this report should be adhered to.

10. ASSESSOR QUALIFICATIONS

This report was prepared by Ms. P.E. 'Tara' Sieg, BA Env. MA, Geo-Environmental Scientist. Ms. Sieg has over 15 years of experience in conducing Environmental, Geotechnical and Ecological studies under the supervision of Professional Engineers and/or Geoscience QPs, and is routinely engaged in Environmental and Hydrogeological field work.

This assessment was supervised and reviewed by Mrs. Rebecca Walker, P. Eng., QPESA, who has been thoroughly trained in conducting geotechnical and hydrogeological assessments. Mrs. Walker is a licensed professional engineer in the Province of Ontario. She obtained a Bachelor of Applied Science in Geological Engineering from Queen's University in 1998 and is a Qualified Person (QPESA) registered with MECP, under the requirements of Ontario Regulation 153.

Rebecca provides geotechnical and geoscience services under the *Guideline of Professional Engineers Providing Geotechnical Engineering Services* under the Professional Engineers Act in Ontario. Rebecca is qualified to provide geoscience (hydrogeological) services under the Professional Geoscientists Act as an exempted engineer, by virtue of her training and experience, as prescribed by the Professional Engineers Act.

Mrs. Walker has over 20 years of direct experience in the geotechnical and hydrogeological consulting industry. Over 3,800 projects have been completed under her supervision. Mrs. Walker is also a recognized expert in the industry and has testified as an expert witness in Ontario Municipal Board and Local Planning Appeals Tribunal hearings, and Municipal Councils related to groundwater hydrogeology and geotechnical matters for land development, aggregate extraction and various types of construction projects. She has been retained for many projects, both directly and indirectly by local municipalities as a hydrogeological and geotechnical consultant.

11. REFERENCES

Chapman, L.J. and Putnam, D.F., 1984. The Physiography of Southern Ontario Third Edition. Ontario Geological Survey Special Volume 2. Ministry of Natural Resources.

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Ontario Division of Mines, Quaternary Geology, Lucan Area, Southern Ontario, Preliminary Map P1048, scale 1:50,000, 1975

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Singer, S.N., Cheng, C.K., Scafe, M,G, 2003 The Hydrogeology of Southern Ontario, 2nd Edition, Environmental Monitoring and Reporting Branch, Ontario Ministry of the Environment.

Thames-Sydenham and Region Source Protection Committee, 2015. Thames-Sydenham and Region Source Protection Committee, Upper Thames River Source Protection Area, Assessment Report, Approved September 17, 2015.

12. CLOSING

The information presented in this report is based on a scoped investigation designed to provide information to support an assessment of the hydrogeological setting at the subject property, for the project described in the text of the report.

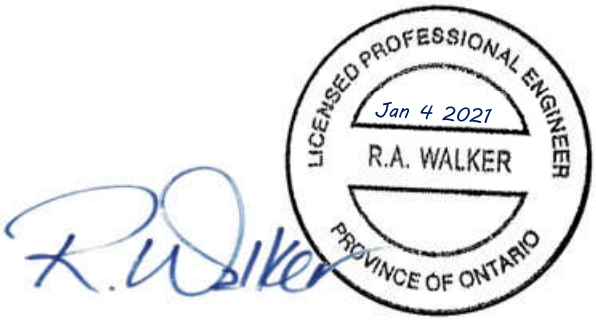
It is important to note that this assessment involves a limited sampling of the subsurface conditions at specific borehole locations. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation and a review of available information which has been presented in the report. Should subsurface conditions be encountered which vary materially from those observed in the boreholes, we recommend that LDS be consulted to review the additional information and verify if there are any changes to the recommendations and discussion provided in this report.

No portion of this report may be used as a separate entity. It is intended to be read in its entirety. LDS should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented.

We trust this satisfies your present requirements. If you have any questions or require anything further, please feel free to contact our office.

Respectfully Submitted,

LDS CONSULTANTS INC.



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APPENDIX A

DRAWINGS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Site Features & Surrounding Land Use

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	**1**

2006 AERIAL PHOTOGRAPH

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 499062 m E, 4763562 m N,
Imagery date 05/06/2006

2018 AERIAL PHOTOGRAPH

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 499062 m E, 4763562 m N,
Imagery date 07/02/2018

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

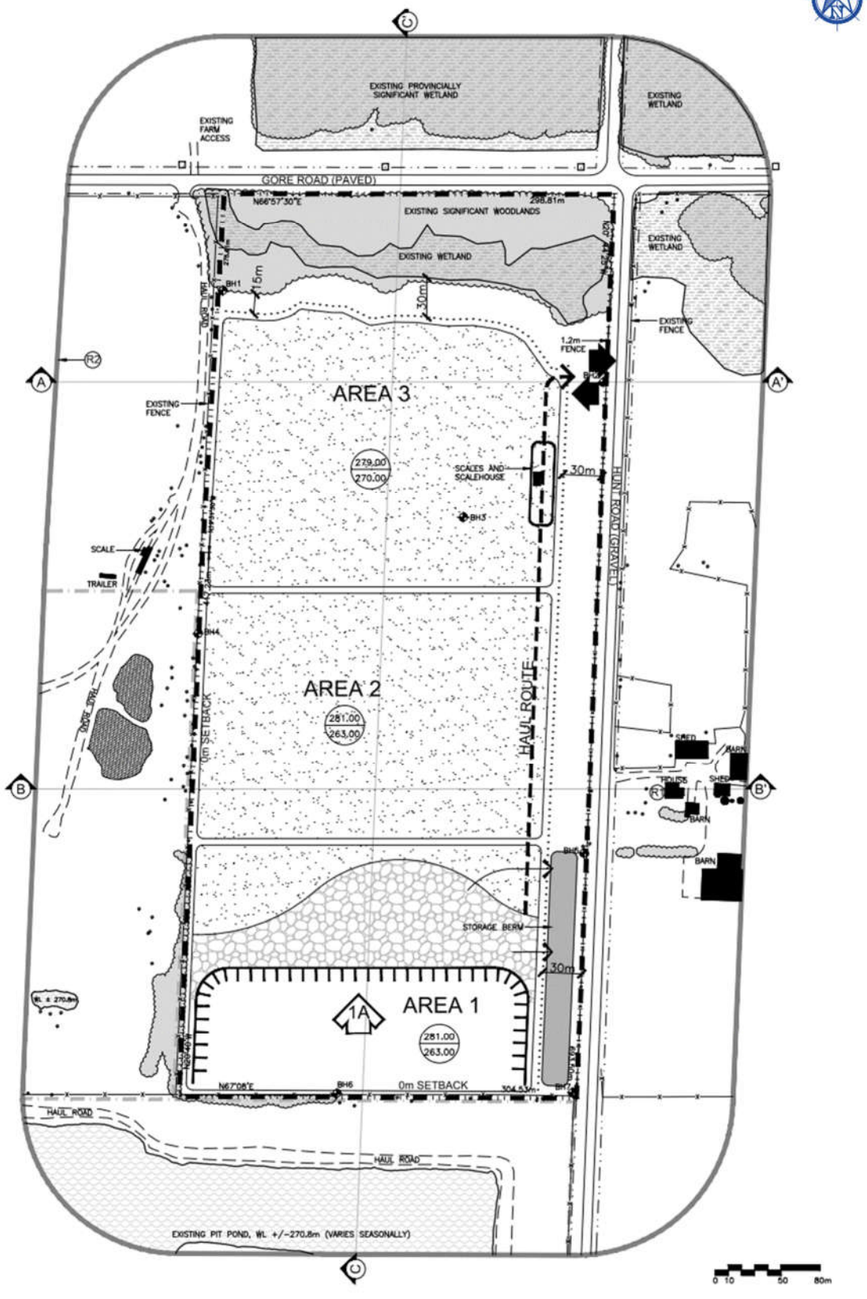
Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

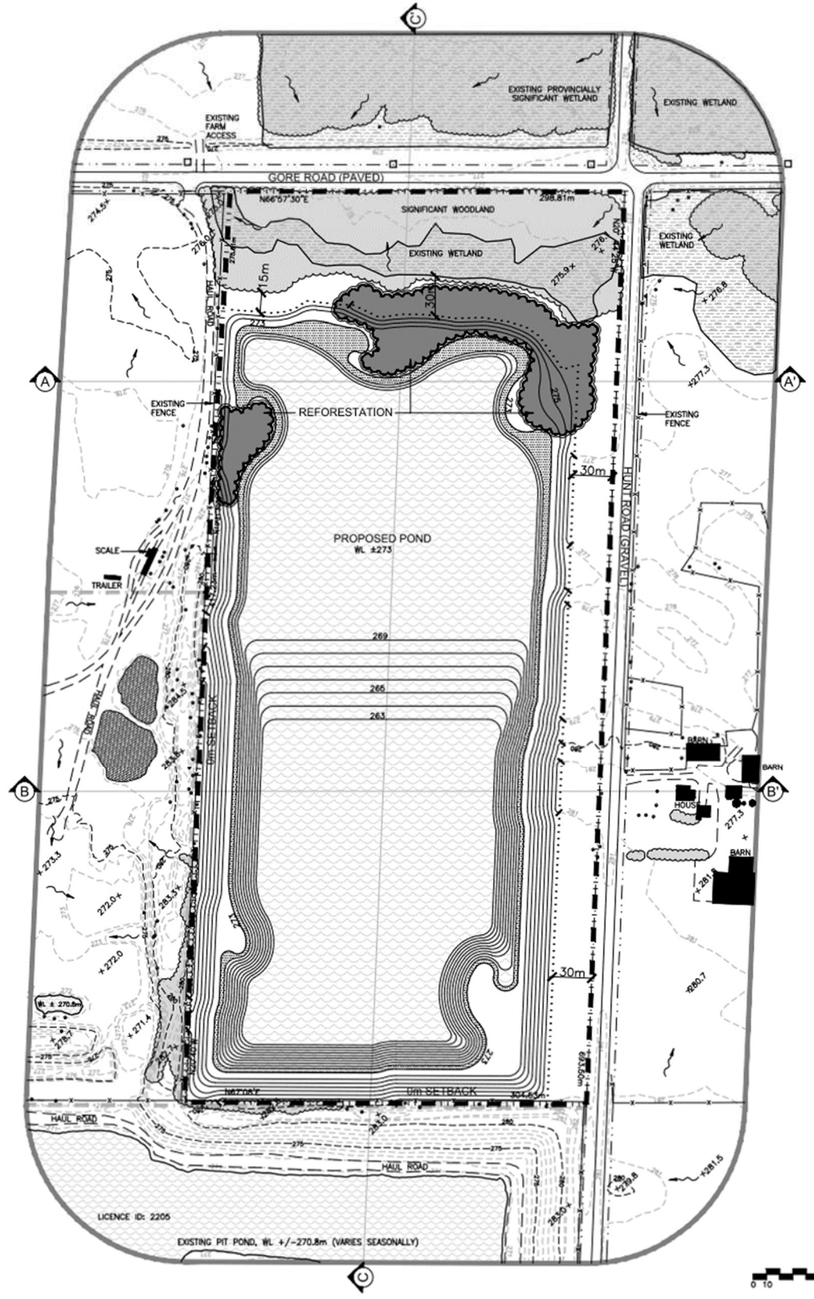
Aerial Photographs

SCALE	PROJECT NO.
As Shown	GE-00260
DATE	**DRAWING NO.**
January 2021	**2**

Operations Plan – Phase A



Rehabilitation Plan



SOURCE:
Project Drawings, prepared by Harrington McAvan Ltd., Project Number 20-23, December 2020

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

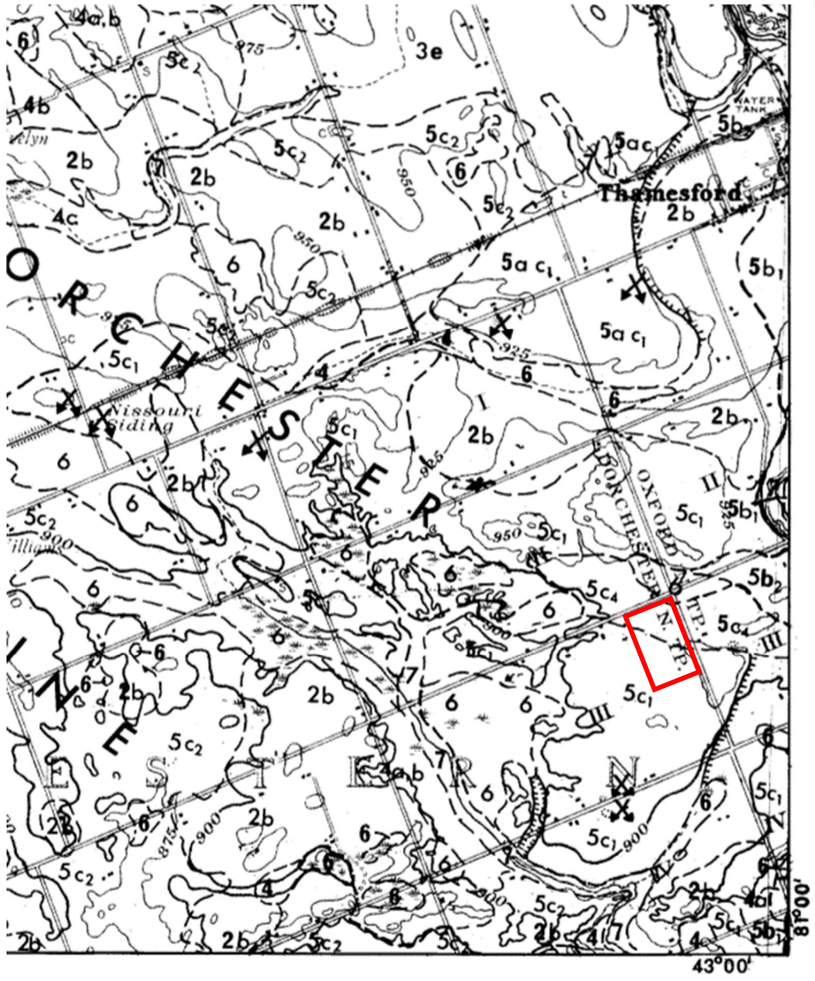
Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Operations and Rehabilitation Plan
(Excerpts)

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	3

QUATERNARY GEOLOGY



PLEISTOCENE
LATE WISCONSINAN

5 Gravels and Related Sediments[a]: Gravel, gravelly sand, sand

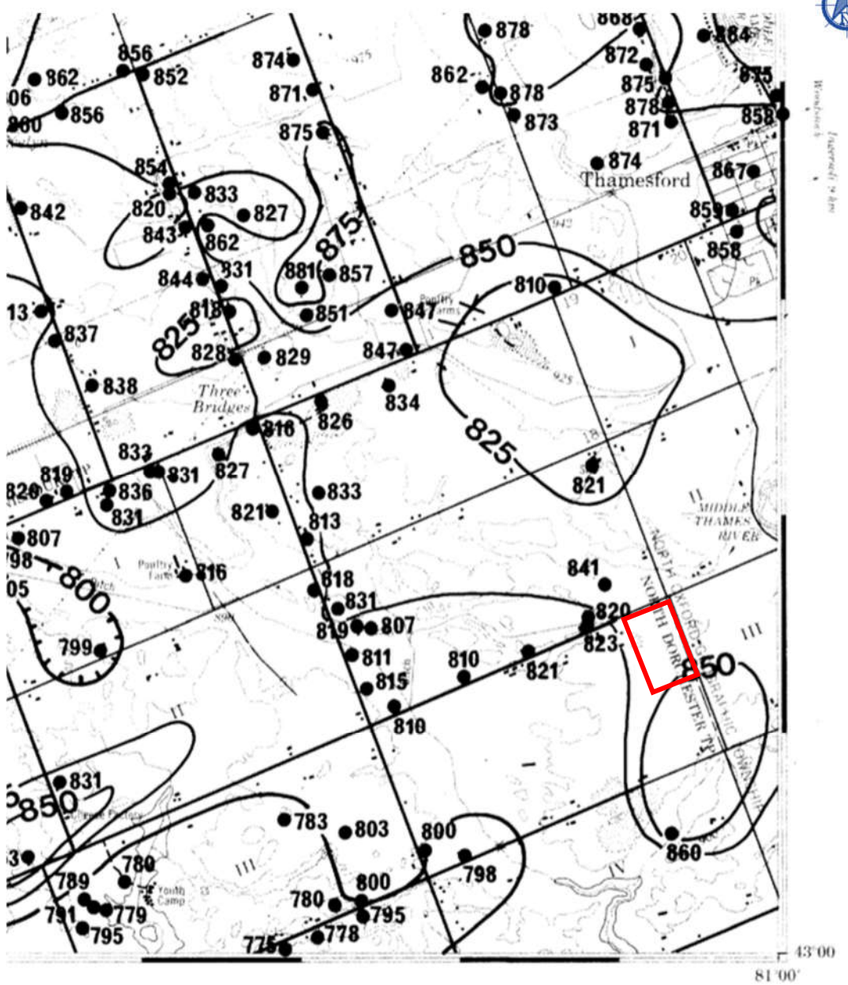
(a) Deltaic and some beach complex deposits
1. gravel
2. gravelly sand

(b) Outwash
1. predominantly gravel (some sand)
2. predominantly sand (some gravel)

(c) Ice-contact Stratified Drift
1. predominantly gravel (some sand, silt and till)
2. predominantly sand (some gravel, silt and till)
3. predominantly till (some gravel, sand and silt)
4. predominantly silt (some gravel, sand and till)

SOURCE:
Quaternary Geology, Lucan Area, Southern Ontario, Ontario Division of Mines, Preliminary Map P1048, scale 1:50,000, 1975

BEDROCK TOPOGRAPHY



● 926 Elevation of bedrock surface as obtained from water well record (feet above sea level)*

757 Elevation of bedrock surface as obtained from oil or gas well record (feet above sea level)*

■ 932 Elevation of bedrock surface as obtained from geo-technical reports (consultants) and from boreholes for stratigraphic control (Sado). (feet above sea level)*

125 Contour line of bedrock elevation (interval, 25 feet)

SOURCE:
Bedrock Topography of the Lucan Area, Southern Ontario, Ontario Geological Survey, Preliminary Map P291, scale 1:50,000, 1980 compilation.

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

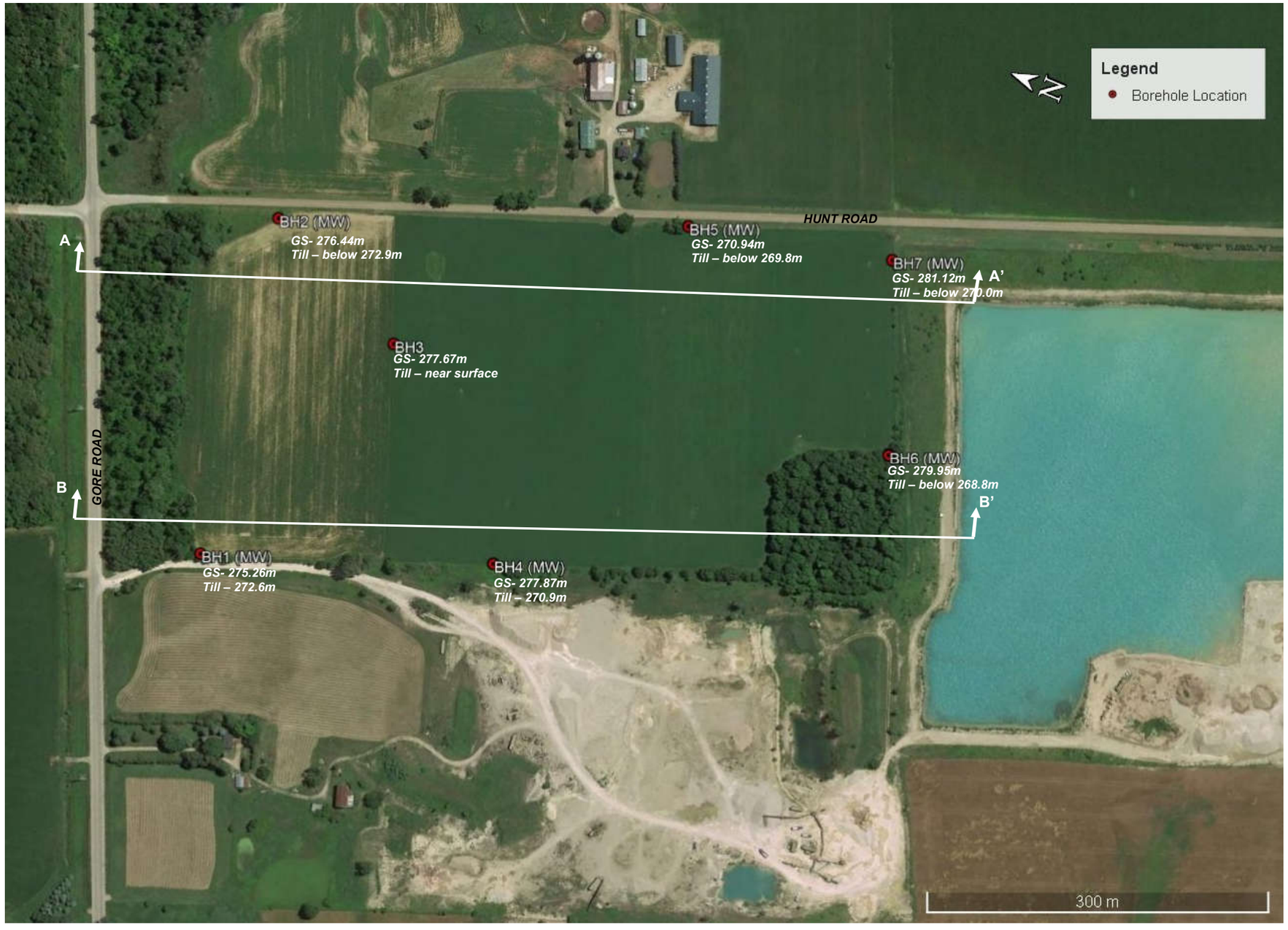
PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Geologic Mapping

SCALE	PROJECT NO.
As Shown	GE-00260
DATE	**DRAWING NO.**
January 2021	**4**



LEGEND

GS-276.44 m	Ground Surface Elevation (m, asl)
Till – 272.9 m	Elevation of Silt Till Strata (m, asl)

NOTE:
Refer to Drawing 4 for Cross Section Drawings

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 499062 m E, 4763562 m N,
Imagery date 7/2/2018

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

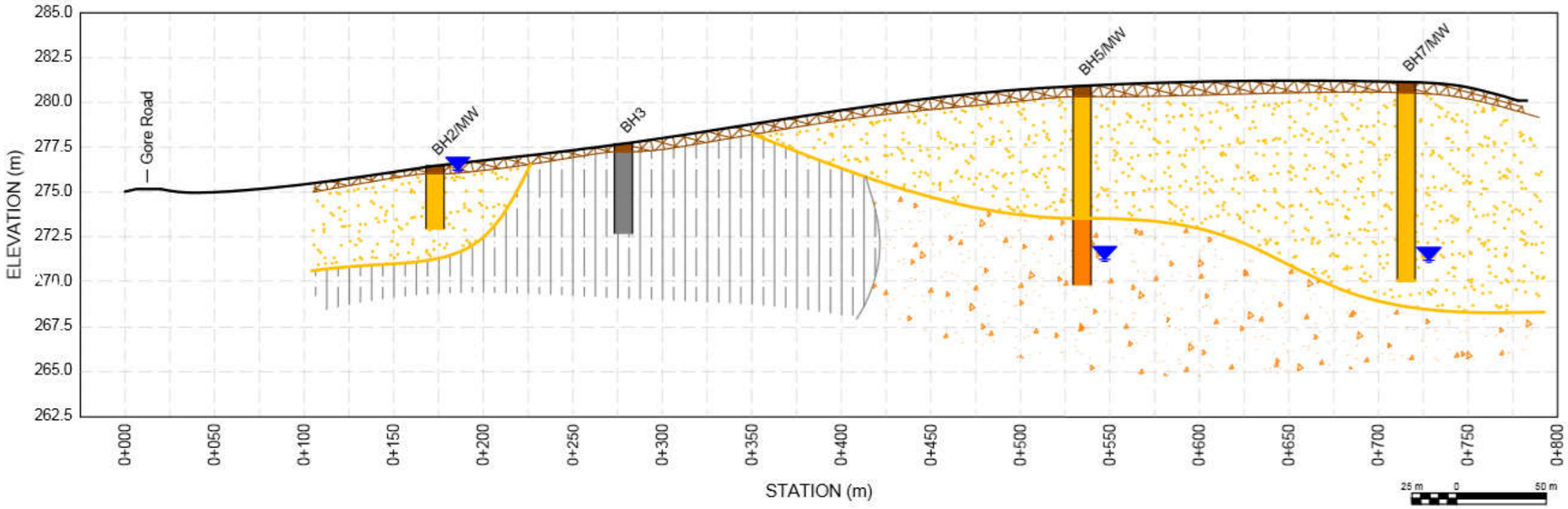
Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

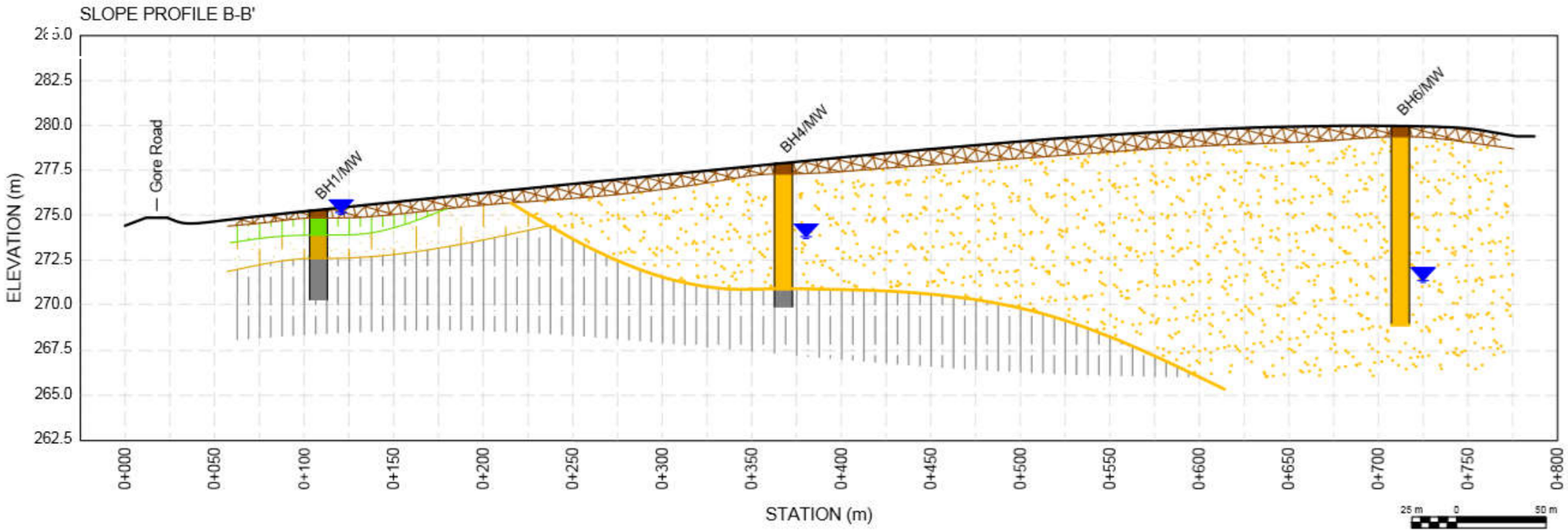
Borehole Location Plan

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	**5**

SLOPE PROFILE A-A'



SLOPE PROFILE B-B'



LEGEND:

- TOPSOIL
- SAND
- SILTY SAND
- SAND AND GRAVEL
- SILT
- SILT TILL
- GROUNDWATER LEVEL (March 2020)

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

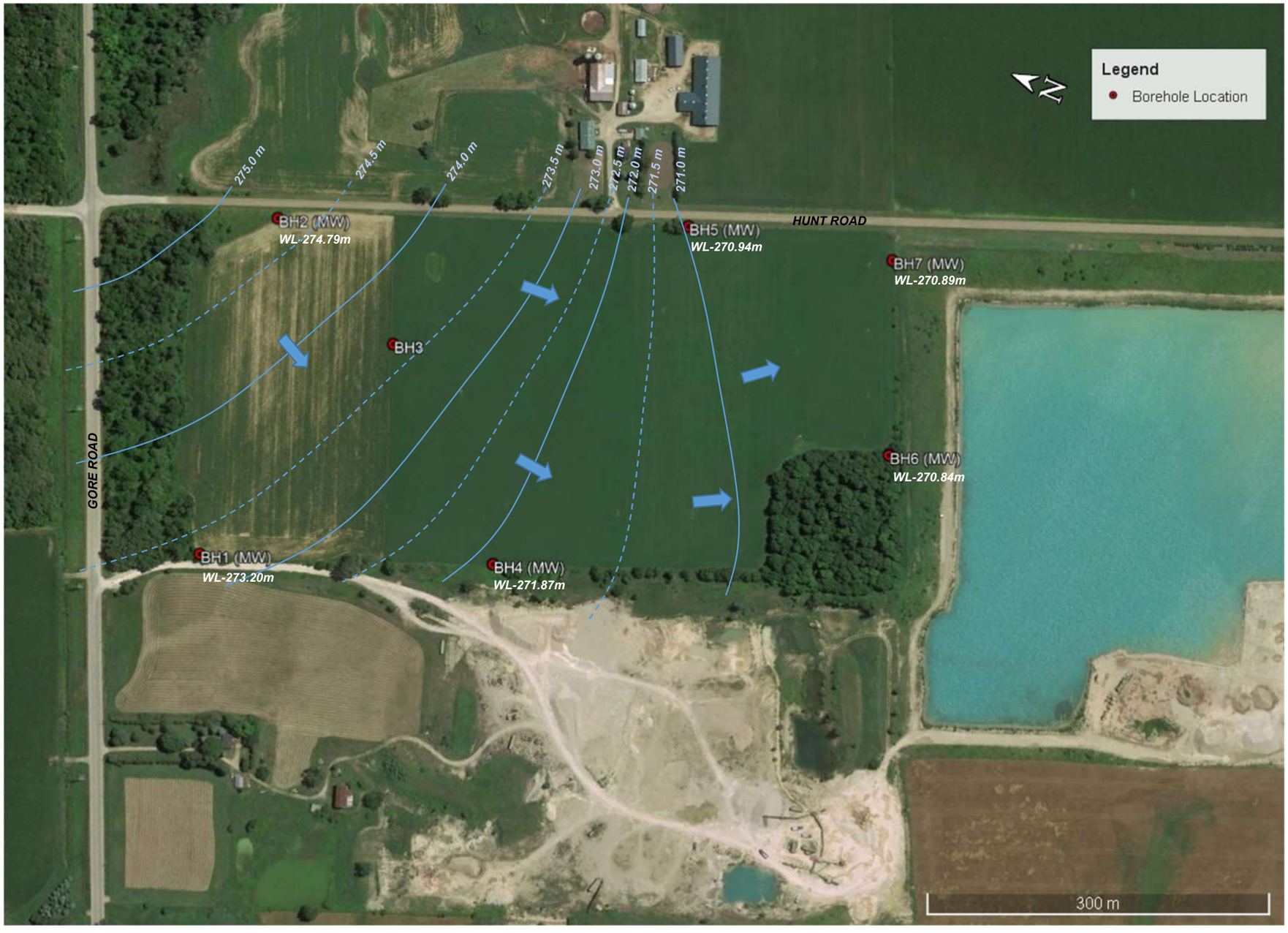
PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Cross Sections

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	**6**



LEGEND

	Groundwater Contour
WL-237.22m	Groundwater Elevation, m
	Groundwater Flow Direction (inferred)

NOTES

1. Groundwater measurements taken on September 29, 2019.
2. Groundwater contours and groundwater flow direction have been inferred from groundwater measurements, as shown.

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 499062 m E, 4763562 m N,
Imagery date 7/2/2018

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Groundwater Contour Plan
(Fall 2019)

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	***DRAWING NO.***
January 2021	**7**

LEGEND

	Groundwater Contour
WL-275.11m	Groundwater Elevation, m
	Groundwater Flow Direction (inferred)

NOTES

1. Groundwater measurements taken on March 5, 2020
2. Groundwater contours and groundwater flow direction have been inferred from groundwater measurements, as shown.

SOURCE:
Google Earth Pro, Version 7.3.2.5776,
Coordinates 17T, 499062 m E, 4763562 m N,
Imagery date 7/2/2018

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

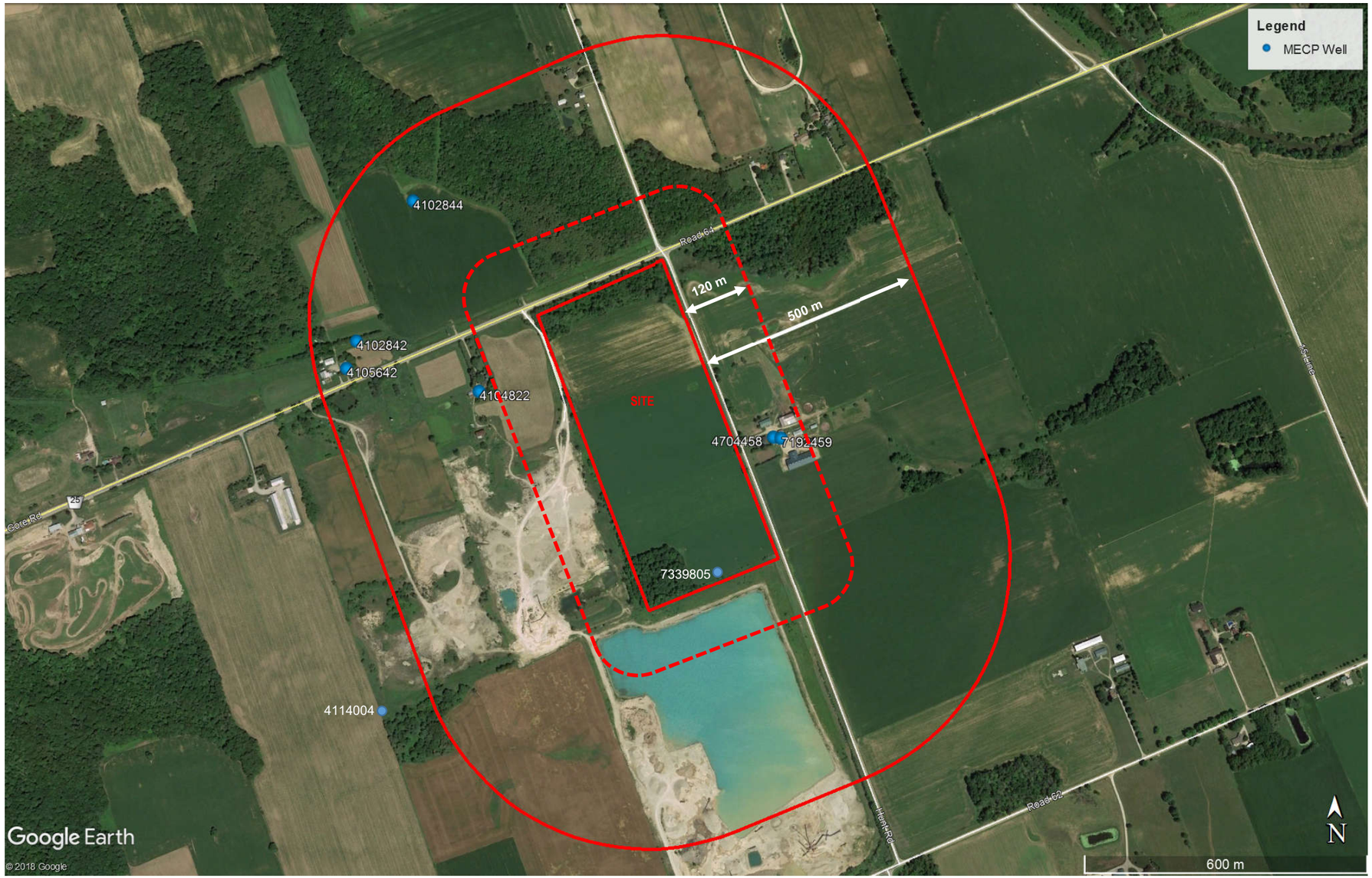
PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Groundwater Contour Plan
(Spring 2020)

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	***DRAWING NO.***
January 2021	**8**



SOURCE:

MECP Well Records: www.ontario.ca/environment-and-energy/map-well-records, updated January 24, 2020

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

MECP Well Locations

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	9

Ontario **Source Protection Information Atlas**
Ministry of the Environment, Conservation and Parks

Result Details

Searched By:
Map location
Value:
User identified location

Water Quality | Policy Search by SPA | Water Quality

Location Information

Zoom in to confirm your location and results.

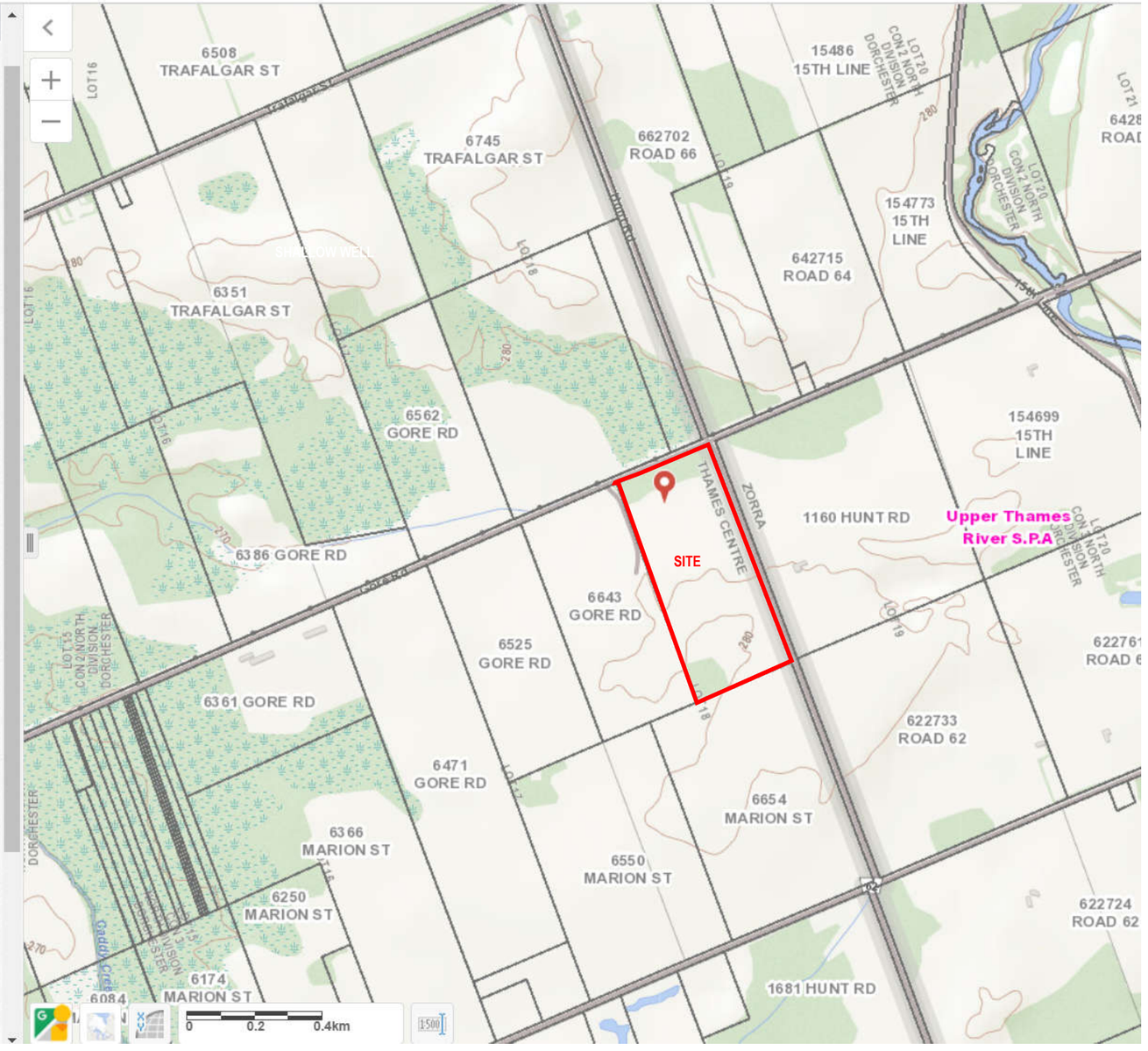
Latitude: **43.02558** Longitude: **-81.013**
UTM Zone: **17** Easting: **498940.71** Northing: **4763655.65**
Upper Tier Municipality: **COUNTY OF MIDDLESEX**
Lower/Single Tier Municipality: **MUNICIPALITY OF THAMES CENTRE**
Township Concession and Lot: **DORCHESTER CON 3 NORTH DIVISION, LOT 18**
Assessment Parcel Address: **N/A**
Assessment Roll #: **39260000201250000000**
MECP District: **London**
MECP Region: **Southwestern**

Source Protection Details for Location

Source Protection Area. **Upper Thames River**
Wellhead Protection Area: **No**
Wellhead Protection Area E (GUDI): **No**
Intake Protection Zone: **No**
Issue Contributing Area: **No**
Significant Groundwater Recharge Area: **No**
Highly Vulnerable Aquifer: **No**
Event Based Area: **No**
Wellhead Protection Area Q1: **No**
Wellhead Protection Area Q2: **No**
Intake Protection Zone Q: **No**

Use the Policy search tab to see if any policies apply – for more details see the source protection plan

Information is current as of: **January 10, 2020**



SOURCE:
MECP Source Protection Information Atlas Mapping, www.gisapplication.lrc.gov.on.ca/SourceWaterProtection, current to January 10, 2020

LDS

PROJECT NAME
Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION
Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME
Source Protection Information Atlas

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	10

Looking Northwest from the southeast corner of the property, at Hunt Road.

Looking Northwest along the east side of the property, towards the wooded area.

Looking west across the central part of the property.

Looking West into the wooded area at the north end of the site.

SOURCE:
Photographs taken by LDS field inspector.
September 27, 2019

LDS

PROJECT NAME

Proposed Aggregate Pit (Pike Farm)

PROJECT LOCATION

Part Lot 18, Concession 3 NRT,
Geographic Township of North Dorchester

DRAWING NAME

Site Photographs
September 2019

SCALE	PROJECT NO.
As Shown	GE-00251
DATE	**DRAWING NO.**
January 2021	11

APPENDIX B

BOREHOLE SUMMARY &
GRAIN SIZE ANALYSES

NOTES ON SAMPLE DESCRIPTIONS

1. All descriptions included in this report follow the Canadian Foundation Engineering Manual soil classification system, based on visual and tactile examination which are consistent with the field identification procedures. Soil descriptions and classifications are based on the Unified Soil Classification System (USCS), based on visual and tactile observations. Where grain size analyses have been specified, mechanical grain size distribution has been used to confirm the soil classification.

Soil Classification (based on particle diameter)
Clay: < 0.002 mm
Silt: 0.002 – 0.075 mm
Sand: 0.075 – 4.75 mm
Gravel: 4.75 mm – 75 mm
Cobbles: 75 – 200 mm
Boulders: > 200 mm

Terminology & Proportion
Trace: < 10%
Some: 10-20%
Adjective, sandy, gravelly, etc.: 20-35%
And, and gravel, and silt, etc.: > 35%
Noun, Sand, Gravel, Silt, etc.: > 35% and main fraction

2. The compactness condition of cohesionless soils is based on excavator / drilling resistance, and Standard Penetration Test (SPT) N-values where available. The Canadian Foundation Engineering Manual provides the following summary for reference.

Compactness of Cohesionless Soils	SPT N-Value (# blows per 0.3 m penetration of split-spoon sampler)
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	50+

3. Topsoil Thickness - It should be noted that topsoil quantities should not be established from information provided at the test hole locations only. If required, a more detailed analysis with additional test holes may be recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

4. Fill material is heterogeneous in nature, and may vary significantly in composition, density and overall condition. Where uncontrolled fill is contacted, it is possible that large obstructions or pockets of otherwise unsuitable or unstable soils may be present beyond the test hole locations.

5. Where glacial till is referenced, this is indicative of material which originates from a geological process associated with glaciation. Because of this geological process, till must be considered heterogeneous in composition and as such, may contain pockets and / or seams of material such as sand, gravel, silt or clay. Till often contains cobbles or boulders and therefore, contractors may encounter them during excavation, even if they are not indicated on the test hole logs. Where soil samples have been collected using borehole sampling equipment, it should be understood that normal sampling equipment can not differentiate the size or type of obstruction. Because of horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with excavations in till material.

6. Consistency of cohesive soils is based on tactile examination and undrained shear strength where available. The Canadian Foundation Engineering Manual provides the following summary for field identification methods and classification by corresponding undrained shear strength.

Consistency of Cohesive Soils	Field Identification	Undrained Shear Strength (kPa)
Very Soft	Easily penetrated several cm by the fist	0 – 12
Soft	Easily penetrated several cm by the thumb	12 – 25
Firm	Can be penetrated several cm by the thumb with moderate effort	25 – 50
Stiff	Readily indented by the thumb, but penetrated only with great effort	50 – 100
Very Stiff	Readily indented by the thumb nail	100 – 200
Hard	Indented with difficulty by the thumbnail	200+

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **1/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 1*
	Project Number	**GE-00260**	

Date Drilled	**July 19, 2019**	Ground Surface Elevation (m asl)	**275.26**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**1.8 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**N. Ungerer**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
					0.45 m	**TOPSOIL** - brown, sandy loam, 450 mm	
0.5						**SILT** - brown, trace sand, compact, moist	
1.0	☒	1	AS		1.40 m		
1.5						**SILTY SAND / SANDY SILT** - brown, fine grained, compact, wet	
2.0	☒	2	AS		▼		*MC - 25.9%*
2.5	☒	3	AS		2.70 m	*Gradation Results* *55.6% Silt, 44.4% Sand*	*MC - 20.6%*
3.0	◪	4	70	49		**SILT TILL** - grey, trace sand and fine gravel, dense, moist - 60 mm wet sand and gravel seam encountered at	
3.5							
4.0							
4.5	◪	5	70	30	5.00 m		*MC - 17%*
5.0						*Borehole terminated at 5.0 m depth.* *Well Installed upon completion.*	
5.5							
6.0							
6.5							
7.0							
7.5							
8.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**3.1 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 1.2 m**

Additional Notes

MC - denotes moisture content

WATER LEVEL MEASUREMENTS

Date	Depth (m)	Elev (m asl)
22-Jul-19	1.53	273.73
08-Aug-19	1.91	273.35

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **2/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 1*
	Project Number	**GE-00260**	

Date Drilled	**July 22, 2019**	Ground Surface Elevation (m asl)	**276.44**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**1.3 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**N. Houlton, EIT**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
					0.45 m	**TOPSOIL** - brown, sandy loam, 450 mm	
0.5						**SAND** - brown, fine grained, trace to some silt, loose to compact, very moist	
1.0	☒	1	AS				*MC - 19.7%*
1.5	☒	2	AS				*MC - 18.3%*
2.0							
2.5	☒	3	AS			- saturated below 2.3 m depth.	*MC - 17.8%*
3.0	◢	4	100	20	*3.50 m*	*Gradation Results* *10.9% Silt, 88.7% Sand*	*MC - 19.6%*
3.5						*Borehole terminated at 3.5 m depth.* *Well Installed upon completion.*	
4.0							
4.5							
5.0							
5.5							
6.0							
6.5							
7.0							
7.5							
8.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**3.1 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 1.2 m**

Additional Notes

MC - denotes moisture content

WATER LEVEL MEASUREMENTS

Date	Depth (m)	Elev (m asl)
22-Jul-19	0.59	275.85
08-Aug-19	1.37	275.07

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **3**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 1*
	Project Number	**GE-00260**	

Date Drilled	**July 22, 2019**	Ground Surface Elevation (m asl)	**277.67**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**No seepage observed**
Drilling Method	**Hollow Stem Auger**	Technician	**N. Houlton, EIT**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
					0.45 m	**TOPSOIL** - brown, sandy loam, 450 mm	
0.5						**SILT TILL** - brown, trace sand and fine gravel, compact, moist	
1.0	⊠	1	AS				
1.5							
2.0	⊠	2	AS				*MC - 10.2%*
2.5	⊠	3	AS				*MC - 10.5%*
3.0						- grey below 3.0 m depth	
3.5	◪	4	80	27			
4.0							
4.5							
5.0	◪	5	AS		5.00 m		*MC - 16.3%*
5.5						*Borehole terminated at 5.0 m depth.* *Open and dry upon completion.*	
6.0							
6.5							
7.0							
7.5							
8.0							

Legend

- ◪ SPT Sample
- ⊠ Bulk Sample
- ▥ Shelby Tube
- ▼ Stabilized Groundwater
- ▽ Inferred Groundwater

Well Construction Details

Pipe Diameter	**No well installation**
Installation Depth	--
Screen Length	--
Depth of Bentonite Seal	--

Additional Notes

MC - denotes moisture content

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **4/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 1*
	Project Number	**GE-00260**	

Date Drilled	**July 18, 2019**	Ground Surface Elevation (m asl)	**277.87**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**5.6 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**N. Houlton, EIT**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.0						**TOPSOIL** - brown, sandy loam, 600 mm	
					0.60 m		
1.0	Bulk	1	AS			**SAND** - brown, fine grained, trace to some gravel, trace	
1.5						- becoming compact below 1.4 m depth	
2.0	Bulk	2	AS				*MC - 11.9%*
2.5	Bulk	3	AS				*MC - 3.9%*
3.0	SPT	4	90	17		- medium to coarse grained sand with some gravel below 2.6 m depth	*MC - 3.8%*
4.0							
4.5							
5.0	Bulk	5	AS				
5.5						- becoming saturated below 5.5 m depth	
6.0	SPT	6	80	19		*Gradation Results* *3.4% Silt, 77.1% Sand, 19.5% Gravel*	*MC - 11.9%*
6.5							
7.0					*7.00 m*		
7.5	Bulk	7	AS			**SILT TILL** - grey, trace sand and fine gravel, dense, moist	
8.0					*8.00 m*		
						Borehole terminated at 8.0 m depth. *Well Installed upon completion.*	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**6.6 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 5.0 m**

Additional Notes

MC - denotes moisture content

WATER LEVEL MEASUREMENTS

Date	Depth (m)	Elev (m asl)
22-Jul-19	5.26	272.61
08-Aug-19	5.61	272.26

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **5/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**280.90**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.8 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						**TOPSOIL** - brown, sandy loam, 600 mm	
					0.60 m		
1.0	X	1	AS			**SAND** - brown, fine grained, trace to some gravel,	*MC - 8.6%*
1.5	X	2	AS				
2.0							
2.5	X	3	AS			- compact with some gravel below 2.6 m depth	*MC - 3.2%*
3.0	◢	4	40	32			*MC - 3.2%*
3.5							
4.0							
4.5	X	5	AS				
5.0							
5.5							
6.0	◢	6	70	26			*MC - 2.8%*
6.5							
7.0							
					7.40 m		
7.5	X	7	AS			**SILTY SAND AND GRAVEL** - brown, well-graded, dense, moist	
8.0							
						continued on the following page	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

MC - denotes moisture content

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **5/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 2 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**280.90**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.8 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
8.5							
9.0							
		8	80	50			*MC - 10.4%*
9.5						- becoming saturated below 9.5 m depth	
10.0							
10.5							
		9	70	49	*11.1 m*	*Gradation Results* *21.3% Silt, 51.9% Sand, 26.8% Gravel*	*MC - 9.7%*
11.0							
11.5						*Borehole terminated at 11.1 m depth.* *Well Installed upon completion*	
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

WATER LEVEL MEASUREMENTS

Date	Depth (m)	Elev (m asl)
22-Jul-19	9.75	271.149
08-Aug-19	9.82	271.079

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **6/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**279.95**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.0 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						**TOPSOIL** - brown, sandy loam, 600 mm	
					0.60 m		
1.0	Bulk	1	AS			**SILTY SAND** - brown, fine grained, trace to some gravel, loose, moist	
1.5	Bulk	2	AS				*MC - 7.6%*
2.0							
2.5	Bulk	3	AS			- trace to some cobbles (up to 50 mm) present near 2.5 m	
3.0	SPT	4	70	43			*MC - 2.8%*
3.5							
4.0							
4.5	Bulk	5	AS			- becoming medium grained, trace silt below 4.5 m depth.	*MC - 3.4%*
5.0							
5.5							
6.0	SPT	6	80	16			*MC - 3.5%*
6.5							
7.0							
7.5	Bulk	7	AS				
8.0							
						continued on the following page	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

MC - denotes moisture content

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **6/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 2 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**279.95**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.0 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
8.5						- saturated below 9.5 m depth	
9.0							
	SPT	8	70	22		*Gradation Results* *8.3% Silt, 91.6% Sand, 0.1% Gravel*	*MC - 16.6%*
9.5							
10.0							
10.5							
11.0	SPT	9	70	24	*11.1 m*		*MC - 20%*
11.5						*Borehole terminated at 11.1 m depth.* *Well Installed upon completion*	
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

WATER LEVEL MEASUREMENTS

Date	Depth (m)	Elev (m asl)
22-Jul-19	8.88	271.066
08-Aug-19	9.00	270.946

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **7/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 1 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**281.12**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.0 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
0.5						**TOPSOIL** - brown, sandy loam, 600 mm	
					0.60 m		
1.0	☒	1	AS			**SILTY SAND** - brown, fine grained, trace to some gravel, compact, moist	
1.5	☒	2	AS				*MC - 2.4%*
2.0							
2.5	☒	3	AS			- trace to some cobbles (up to 50 mm) present near 2.5 m	
3.0	◪	4	70	22		- medium grained below 3.0 m depth.	*MC - 3.2%*
3.5							
4.0							
4.5	☒	5	AS				
5.0							
5.5							
6.0	◪	6	80	20		- fine sand with trace silt below 6.0 m depth.	*MC - 3.3%*
6.5							
7.0							
7.5	☒	7	AS				*MC - 3.2%*
8.0							
						continued on the following page	

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

MC - denotes moisture content

LDS	Project	**Proposed Aggregate Pit (Pike Farm)**	Borehole ID **7/MW**
	Project Location	**Pt Lot 18, Conc 3 NRT, Twp. of North Dorchester**	*Sheet 2 of 2*
	Project Number	**GE-00260**	

Date Drilled	**July 10, 2019**	Ground Surface Elevation (m asl)	**281.12**
Drill Rig	**D50 - Turbo**	Groundwater Level at Completion (m)	**9.0 m, bgs**
Drilling Method	**Hollow Stem Auger**	Technician	**R. Walker**
Drilling Contractor	**London Soil Test Ltd**	Checked By	**N. Houlton, EIT**

Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT N-value (blows/0.3 m)	Graphic Log	Material Description	Remarks and Other Tests
8.5						- becoming saturated below 9.5 m depth	
9.0					▼		
	SPT	8	70	22			
9.5							
10.0							
10.5							
11.0	SPT	9	70	24	*11.1 m*	*Gradation Results* *16.2% Silt, 83.8% Sand*	*MC - 16.3%*
11.5						*Borehole terminated at 11.1 m depth.* *Well Installed upon completion*	
12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							
15.5							
16.0							

Legend

- SPT Sample
- Bulk Sample
- Shelby Tube
- Stabilized Groundwater
- Inferred Groundwater

Well Construction Details

Pipe Diameter	**50 mm**
Installation Depth	**10.7 m**
Screen Length	**1.5 m**
Depth of Bentonite Seal	**0 - 8.9 m**

Additional Notes

WATER LEVEL MEASUREMENTS

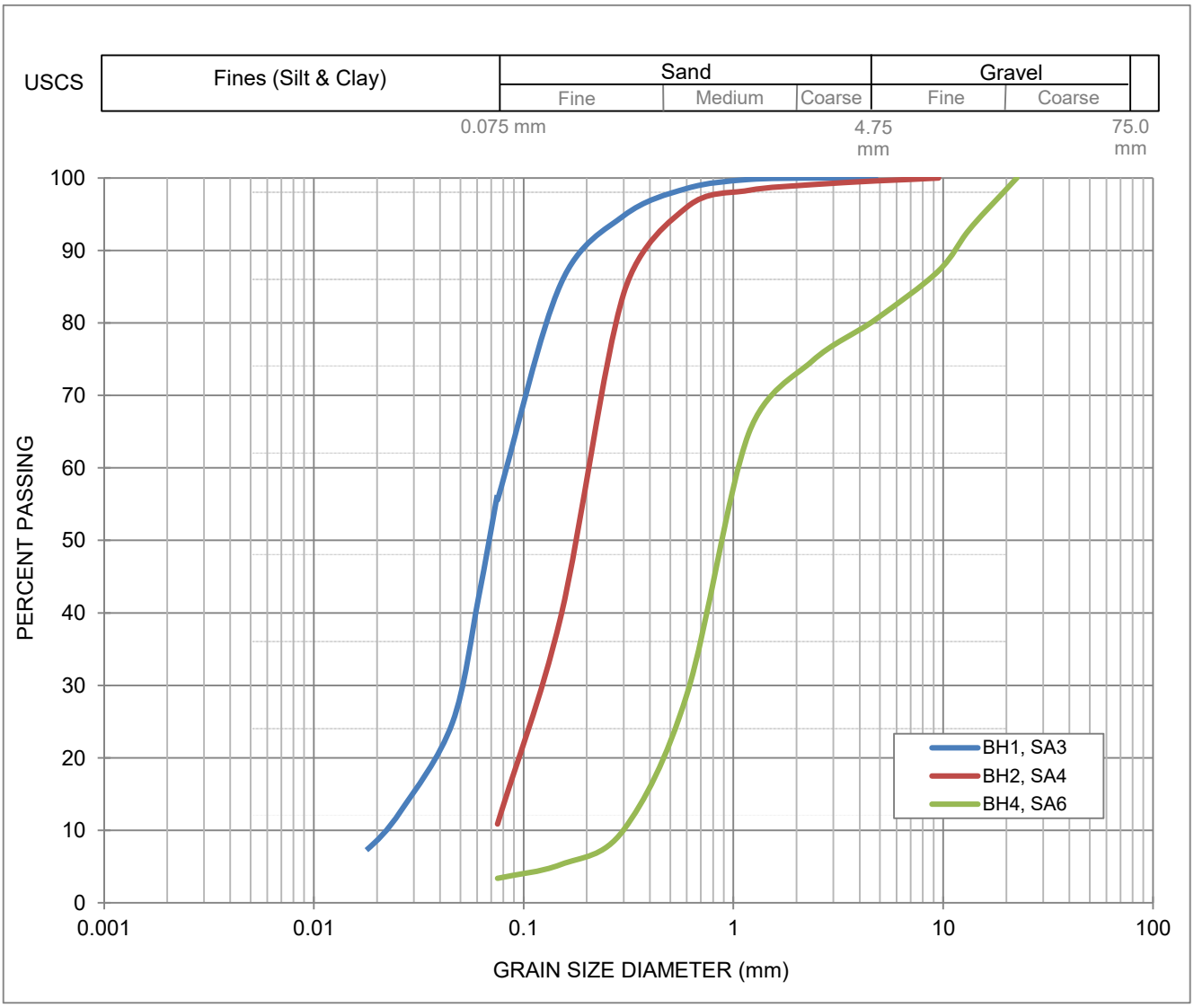
Date	Depth (m)	Elev (m asl)
22-Jul-19	9.92	271.204
08-Aug-19	10.09	271.034

Particle Size Distribution
Results of Sieve Analysis

Project Name: Aggregate Pit Site **Date:** 19-Sep-19

Project Location: Part Lot 18, Concession 3 NRT
Geographic Township of North Dorchester **Project No.:** GE-00260

Sample ID	Unified Soil Classification				Moisture Content (%)
	Fines (Silt & Clay)	% Sand	% Gravel	% Cobbles	
BH1, SA3	55.6%	44.4%	0.0%	0.0%	20.6
BH2, SA4	10.9%	88.7%	0.4%	0.0%	19.6
BH4, SA6	3.4%	77.1%	19.5%	0.0%	11.9

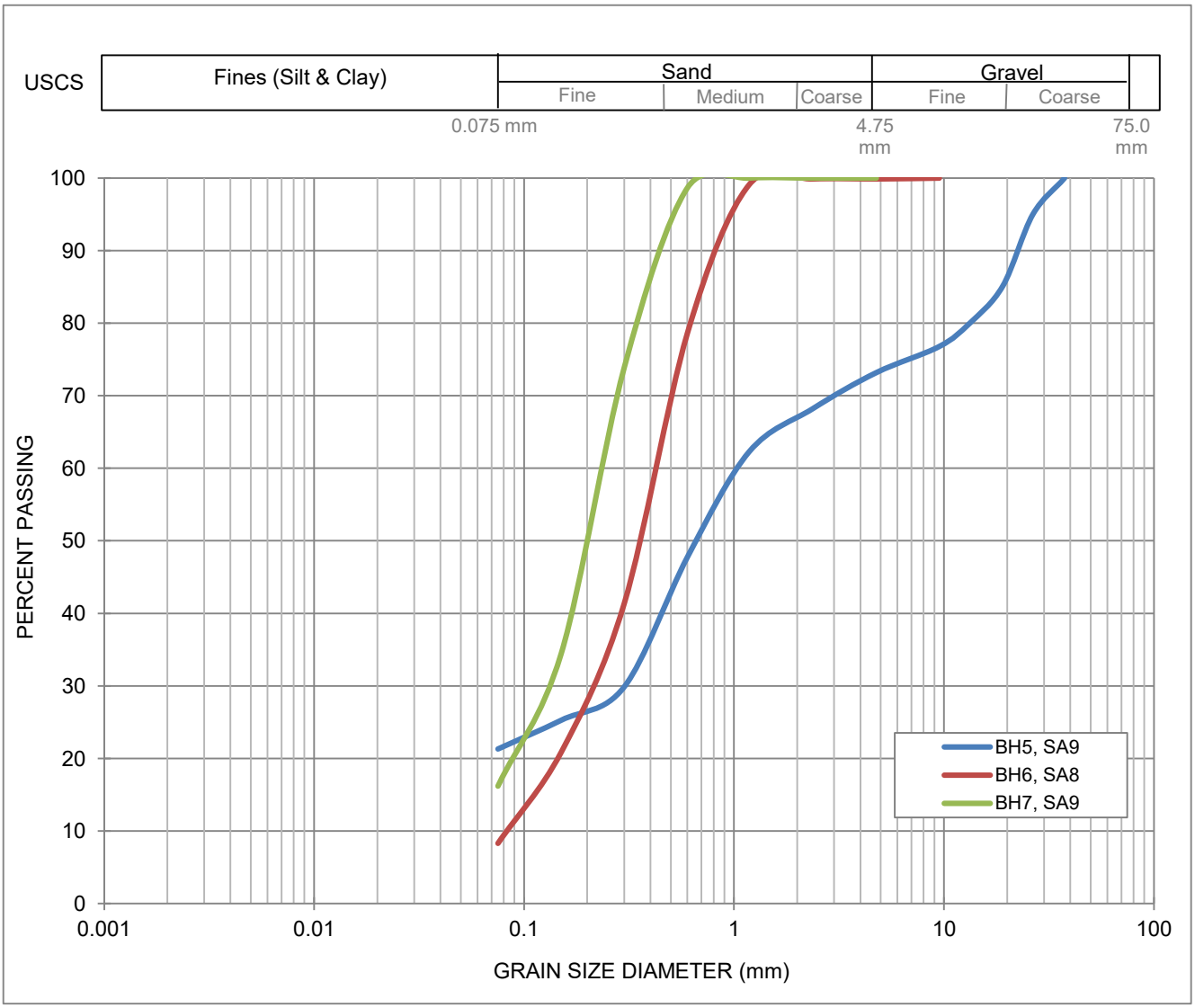


Particle Size Distribution
Results of Sieve Analysis

Project Name: Aggregate Pit Site **Date:** 19-Sep-19

Project Location: Part Lot 18, Concession 3 NRT
Geographic Township of North Dorchester **Project No.:** GE-00260

Sample ID	Unified Soil Classification				Moisture Content (%)
	Fines (Silt & Clay)	% Sand	% Gravel	% Cobbles	
BH5, SA9	21.3%	51.9%	26.8%	0.0%	8.7
BH6, SA8	8.3%	91.6%	0.1%	0.0%	16.6
BH7, SA9	16.2%	83.8%	0.0%	0.0%	16.3



APPENDIX C

ANALYTICAL LAB RESULTS

Your Project #: GE-00260
Site#: ONTARIO
Site Location: PIKE FARMS GRAVEL PIT
Your C.O.C. #: na

Attention: Rebecca Walker

LDS Consultants Inc
15875 Robins Hill Road
Unit 1
London, ON
CANADA N5V 0A5

Report Date: 2019/09/26
Report #: R5896771
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9Q4887
Received: 2019/09/20, 14:30

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	2	N/A	2019/09/26	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2019/09/26	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	2	N/A	2019/09/24	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	N/A	2019/09/26	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2019/09/23	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	2	N/A	2019/09/24	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	2	2019/09/23	2019/09/24	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2019/09/26		
Anion and Cation Sum	2	N/A	2019/09/26		
Total Ammonia-N	2	N/A	2019/09/25	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2019/09/24	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2019/09/23	2019/09/26	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2019/09/24	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2019/09/26		
Sat. pH and Langelier Index (@ 4C)	2	N/A	2019/09/26		
Sulphate by Automated Colourimetry	2	N/A	2019/09/24	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	2	N/A	2019/09/26		

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and

Your Project #: GE-00260
Site#: ONTARIO
Site Location: PIKE FARMS GRAVEL PIT
Your C.O.C. #: na

Attention: Rebecca Walker

LDS Consultants Inc
15875 Robins Hill Road
Unit 1
London, ON
CANADA N5V 0A5

Report Date: 2019/09/26
Report #: R5896771
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9Q4887
Received: 2019/09/20, 14:30

use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bvlabs.com
Phone# (519)652-9444
==========
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		KVN232	KVN233		
Sampling Date		2019/09/20	2019/09/20		
COC Number		na	na		
	UNITS	BH2	BH6	RDL	QC Batch
Calculated Parameters					
Anion Sum	me/L	6.10	7.67	N/A	6347011
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	250	330	1.0	6347007
Calculated TDS	mg/L	330	410	1.0	6347015
Carb. Alkalinity (calc. as CaCO3)	mg/L	2.9	2.9	1.0	6347007
Cation Sum	me/L	6.48	8.16	N/A	6347011
Hardness (CaCO3)	mg/L	310	400	1.0	6347009
Ion Balance (% Difference)	%	3.00	3.09	N/A	6347010
Langelier Index (@ 20C)	N/A	1.05	1.12		6347013
Langelier Index (@ 4C)	N/A	0.804	0.873		6347014
Saturation pH (@ 20C)	N/A	7.05	6.85		6347013
Saturation pH (@ 4C)	N/A	7.30	7.10		6347014
Inorganics					
Total Ammonia-N	mg/L	0.17	0.11	0.050	6347604
Conductivity	umho/cm	570	700	1.0	6347669
Dissolved Organic Carbon	mg/L	1.6	1.5	0.50	6347050
Orthophosphate (P)	mg/L	<0.010	<0.010	0.010	6348115
pH	pH	8.10	7.97		6347670
Dissolved Sulphate (SO4)	mg/L	35	4.6	1.0	6348114
Alkalinity (Total as CaCO3)	mg/L	250	330	1.0	6347644
Dissolved Chloride (Cl-)	mg/L	14	13	1.0	6348108
Nitrite (N)	mg/L	<0.010	<0.010	0.010	6347620
Nitrate (N)	mg/L	<0.10	7.79	0.10	6347620
Nitrate + Nitrite (N)	mg/L	<0.10	7.79	0.10	6347620
Metals					
Dissolved Aluminum (Al)	ug/L	<5.0	<5.0	5.0	6347131
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	0.50	6347131
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	1.0	6347131
Dissolved Barium (Ba)	ug/L	33	39	2.0	6347131
Dissolved Beryllium (Be)	ug/L	<0.50	<0.50	0.50	6347131
Dissolved Boron (B)	ug/L	12	<10	10	6347131
Dissolved Cadmium (Cd)	ug/L	<0.10	<0.10	0.10	6347131

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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BV Labs Job #: B9Q4887
Report Date: 2019/09/26

LDS Consultants Inc
Client Project #: GE-00260
Site Location: PIKE FARMS GRAVEL PIT

RCAP - COMPREHENSIVE (LAB FILTERED)

BV Labs ID		KVN232	KVN233		
Sampling Date		2019/09/20	2019/09/20		
COC Number		na	na		
	UNITS	BH2	BH6	RDL	QC Batch
Dissolved Calcium (Ca)	ug/L	96000	120000	200	6347131
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5.0	6347131
Dissolved Cobalt (Co)	ug/L	0.63	<0.50	0.50	6347131
Dissolved Copper (Cu)	ug/L	<1.0	1.1	1.0	6347131
Dissolved Iron (Fe)	ug/L	<100	<100	100	6347131
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	0.50	6347131
Dissolved Magnesium (Mg)	ug/L	18000	24000	50	6347131
Dissolved Manganese (Mn)	ug/L	600	48	2.0	6347131
Dissolved Molybdenum (Mo)	ug/L	1.9	0.80	0.50	6347131
Dissolved Nickel (Ni)	ug/L	1.2	<1.0	1.0	6347131
Dissolved Phosphorus (P)	ug/L	<100	<100	100	6347131
Dissolved Potassium (K)	ug/L	1000	890	200	6347131
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	2.0	6347131
Dissolved Silicon (Si)	ug/L	5000	5400	50	6347131
Dissolved Silver (Ag)	ug/L	<0.10	<0.10	0.10	6347131
Dissolved Sodium (Na)	ug/L	5000	4900	100	6347131
Dissolved Strontium (Sr)	ug/L	140	130	1.0	6347131
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	0.050	6347131
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	5.0	6347131
Dissolved Uranium (U)	ug/L	1.9	0.39	0.10	6347131
Dissolved Vanadium (V)	ug/L	0.65	<0.50	0.50	6347131
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.0	6347131

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6347050	KRM	Matrix Spike	Dissolved Organic Carbon	2019/09/23		89	%	80 - 120
6347050	KRM	Spiked Blank	Dissolved Organic Carbon	2019/09/23		97	%	80 - 120
6347050	KRM	Method Blank	Dissolved Organic Carbon	2019/09/23	<0.50		mg/L	
6347050	KRM	RPD	Dissolved Organic Carbon	2019/09/23	1.7		%	20
6347131	PBA	Matrix Spike [KVN232-01]	Dissolved Aluminum (Al)	2019/09/24		104	%	80 - 120
			Dissolved Antimony (Sb)	2019/09/24		104	%	80 - 120
			Dissolved Arsenic (As)	2019/09/24		102	%	80 - 120
			Dissolved Barium (Ba)	2019/09/24		98	%	80 - 120
			Dissolved Beryllium (Be)	2019/09/24		105	%	80 - 120
			Dissolved Boron (B)	2019/09/24		103	%	80 - 120
			Dissolved Cadmium (Cd)	2019/09/24		104	%	80 - 120
			Dissolved Calcium (Ca)	2019/09/24		NC	%	80 - 120
			Dissolved Chromium (Cr)	2019/09/24		97	%	80 - 120
			Dissolved Cobalt (Co)	2019/09/24		102	%	80 - 120
			Dissolved Copper (Cu)	2019/09/24		103	%	80 - 120
			Dissolved Iron (Fe)	2019/09/24		103	%	80 - 120
			Dissolved Lead (Pb)	2019/09/24		102	%	80 - 120
			Dissolved Magnesium (Mg)	2019/09/24		100	%	80 - 120
			Dissolved Manganese (Mn)	2019/09/24		NC	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/09/24		105	%	80 - 120
			Dissolved Nickel (Ni)	2019/09/24		98	%	80 - 120
			Dissolved Phosphorus (P)	2019/09/24		104	%	80 - 120
			Dissolved Potassium (K)	2019/09/24		105	%	80 - 120
			Dissolved Selenium (Se)	2019/09/24		103	%	80 - 120
			Dissolved Silicon (Si)	2019/09/24		104	%	80 - 120
			Dissolved Silver (Ag)	2019/09/24		102	%	80 - 120
			Dissolved Sodium (Na)	2019/09/24		101	%	80 - 120
			Dissolved Strontium (Sr)	2019/09/24		98	%	80 - 120
			Dissolved Thallium (Tl)	2019/09/24		101	%	80 - 120
			Dissolved Titanium (Ti)	2019/09/24		104	%	80 - 120
			Dissolved Uranium (U)	2019/09/24		101	%	80 - 120
			Dissolved Vanadium (V)	2019/09/24		98	%	80 - 120
			Dissolved Zinc (Zn)	2019/09/24		102	%	80 - 120
6347131	PBA	Spiked Blank	Dissolved Aluminum (Al)	2019/09/24		103	%	80 - 120
			Dissolved Antimony (Sb)	2019/09/24		99	%	80 - 120
			Dissolved Arsenic (As)	2019/09/24		100	%	80 - 120
			Dissolved Barium (Ba)	2019/09/24		93	%	80 - 120
			Dissolved Beryllium (Be)	2019/09/24		101	%	80 - 120
			Dissolved Boron (B)	2019/09/24		99	%	80 - 120
			Dissolved Cadmium (Cd)	2019/09/24		99	%	80 - 120
			Dissolved Calcium (Ca)	2019/09/24		107	%	80 - 120
			Dissolved Chromium (Cr)	2019/09/24		96	%	80 - 120
			Dissolved Cobalt (Co)	2019/09/24		102	%	80 - 120
			Dissolved Copper (Cu)	2019/09/24		101	%	80 - 120
			Dissolved Iron (Fe)	2019/09/24		104	%	80 - 120
			Dissolved Lead (Pb)	2019/09/24		97	%	80 - 120
			Dissolved Magnesium (Mg)	2019/09/24		106	%	80 - 120
			Dissolved Manganese (Mn)	2019/09/24		100	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/09/24		99	%	80 - 120
			Dissolved Nickel (Ni)	2019/09/24		98	%	80 - 120
			Dissolved Phosphorus (P)	2019/09/24		120	%	80 - 120
			Dissolved Potassium (K)	2019/09/24		106	%	80 - 120

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Selenium (Se)	2019/09/24		101	%	80 - 120
			Dissolved Silicon (Si)	2019/09/24		105	%	80 - 120
			Dissolved Silver (Ag)	2019/09/24		97	%	80 - 120
			Dissolved Sodium (Na)	2019/09/24		104	%	80 - 120
			Dissolved Strontium (Sr)	2019/09/24		98	%	80 - 120
			Dissolved Thallium (Tl)	2019/09/24		98	%	80 - 120
			Dissolved Titanium (Ti)	2019/09/24		104	%	80 - 120
			Dissolved Uranium (U)	2019/09/24		94	%	80 - 120
			Dissolved Vanadium (V)	2019/09/24		98	%	80 - 120
			Dissolved Zinc (Zn)	2019/09/24		100	%	80 - 120
6347131	PBA	Method Blank	Dissolved Aluminum (Al)	2019/09/24	<5.0		ug/L	
			Dissolved Antimony (Sb)	2019/09/24	<0.50		ug/L	
			Dissolved Arsenic (As)	2019/09/24	<1.0		ug/L	
			Dissolved Barium (Ba)	2019/09/24	<2.0		ug/L	
			Dissolved Beryllium (Be)	2019/09/24	<0.50		ug/L	
			Dissolved Boron (B)	2019/09/24	<10		ug/L	
			Dissolved Cadmium (Cd)	2019/09/24	<0.10		ug/L	
			Dissolved Calcium (Ca)	2019/09/24	<200		ug/L	
			Dissolved Chromium (Cr)	2019/09/24	<5.0		ug/L	
			Dissolved Cobalt (Co)	2019/09/24	<0.50		ug/L	
			Dissolved Copper (Cu)	2019/09/24	<1.0		ug/L	
			Dissolved Iron (Fe)	2019/09/24	<100		ug/L	
			Dissolved Lead (Pb)	2019/09/24	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2019/09/24	<50		ug/L	
			Dissolved Manganese (Mn)	2019/09/24	<2.0		ug/L	
			Dissolved Molybdenum (Mo)	2019/09/24	<0.50		ug/L	
			Dissolved Nickel (Ni)	2019/09/24	<1.0		ug/L	
			Dissolved Phosphorus (P)	2019/09/24	<100		ug/L	
			Dissolved Potassium (K)	2019/09/24	<200		ug/L	
			Dissolved Selenium (Se)	2019/09/24	<2.0		ug/L	
			Dissolved Silicon (Si)	2019/09/24	<50		ug/L	
			Dissolved Silver (Ag)	2019/09/24	<0.10		ug/L	
			Dissolved Sodium (Na)	2019/09/24	<100		ug/L	
			Dissolved Strontium (Sr)	2019/09/24	<1.0		ug/L	
			Dissolved Thallium (Tl)	2019/09/24	<0.050		ug/L	
			Dissolved Titanium (Ti)	2019/09/24	<5.0		ug/L	
			Dissolved Uranium (U)	2019/09/24	<0.10		ug/L	
			Dissolved Vanadium (V)	2019/09/24	<0.50		ug/L	
			Dissolved Zinc (Zn)	2019/09/24	<5.0		ug/L	
6347131	PBA	RPD [KVN232-01]	Dissolved Aluminum (Al)	2019/09/24	NC		%	20
			Dissolved Antimony (Sb)	2019/09/24	NC		%	20
			Dissolved Arsenic (As)	2019/09/24	NC		%	20
			Dissolved Barium (Ba)	2019/09/24	0.34		%	20
			Dissolved Beryllium (Be)	2019/09/24	NC		%	20
			Dissolved Boron (B)	2019/09/24	2.8		%	20
			Dissolved Cadmium (Cd)	2019/09/24	NC		%	20
			Dissolved Calcium (Ca)	2019/09/24	0.19		%	20
			Dissolved Chromium (Cr)	2019/09/24	NC		%	20
			Dissolved Cobalt (Co)	2019/09/24	6.3		%	20
			Dissolved Copper (Cu)	2019/09/24	NC		%	20
			Dissolved Iron (Fe)	2019/09/24	NC		%	20
			Dissolved Lead (Pb)	2019/09/24	NC		%	20

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Magnesium (Mg)	2019/09/24	2.8		%	20
			Dissolved Manganese (Mn)	2019/09/24	2.7		%	20
			Dissolved Molybdenum (Mo)	2019/09/24	0.96		%	20
			Dissolved Nickel (Ni)	2019/09/24	18		%	20
			Dissolved Phosphorus (P)	2019/09/24	NC		%	20
			Dissolved Potassium (K)	2019/09/24	3.1		%	20
			Dissolved Selenium (Se)	2019/09/24	NC		%	20
			Dissolved Silicon (Si)	2019/09/24	1.4		%	20
			Dissolved Silver (Ag)	2019/09/24	NC		%	20
			Dissolved Sodium (Na)	2019/09/24	0.96		%	20
			Dissolved Strontium (Sr)	2019/09/24	3.1		%	20
			Dissolved Thallium (Tl)	2019/09/24	NC		%	20
			Dissolved Titanium (Ti)	2019/09/24	NC		%	20
			Dissolved Uranium (U)	2019/09/24	1.4		%	20
			Dissolved Vanadium (V)	2019/09/24	4.3		%	20
			Dissolved Zinc (Zn)	2019/09/24	NC		%	20
6347604	MT4	Matrix Spike	Total Ammonia-N	2019/09/25		100	%	75 - 125
6347604	MT4	Spiked Blank	Total Ammonia-N	2019/09/25		102	%	80 - 120
6347604	MT4	Method Blank	Total Ammonia-N	2019/09/25	<0.050		mg/L	
6347604	MT4	RPD	Total Ammonia-N	2019/09/25	4.9		%	20
6347620	C_N	Matrix Spike	Nitrite (N)	2019/09/24		120	%	80 - 120
			Nitrate (N)	2019/09/24		90	%	80 - 120
6347620	C_N	Spiked Blank	Nitrite (N)	2019/09/24		102	%	80 - 120
			Nitrate (N)	2019/09/24		96	%	80 - 120
6347620	C_N	Method Blank	Nitrite (N)	2019/09/24	<0.010		mg/L	
			Nitrate (N)	2019/09/24	<0.10		mg/L	
6347620	C_N	RPD	Nitrite (N)	2019/09/24	NC		%	20
			Nitrate (N)	2019/09/24	1.6		%	20
6347644	NYS	Spiked Blank	Alkalinity (Total as CaCO3)	2019/09/26		98	%	85 - 115
6347644	NYS	Method Blank	Alkalinity (Total as CaCO3)	2019/09/26	<1.0		mg/L	
6347644	NYS	RPD [KVN233-01]	Alkalinity (Total as CaCO3)	2019/09/26	0.72		%	20
6347669	NYS	Spiked Blank	Conductivity	2019/09/26		101	%	85 - 115
6347669	NYS	Method Blank	Conductivity	2019/09/26	<1.0		umho/cm	
6347669	NYS	RPD [KVN233-01]	Conductivity	2019/09/26	0.14		%	25
6347670	NYS	Spiked Blank	pH	2019/09/26		102	%	98 - 103
6347670	NYS	RPD [KVN233-01]	pH	2019/09/26	0.13		%	N/A
6348108	DRM	Matrix Spike [KVN232-01]	Dissolved Chloride (Cl-)	2019/09/24		98	%	80 - 120
6348108	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2019/09/24		103	%	80 - 120
6348108	DRM	Method Blank	Dissolved Chloride (Cl-)	2019/09/24	<1.0		mg/L	
6348108	DRM	RPD [KVN232-01]	Dissolved Chloride (Cl-)	2019/09/24	0.81		%	20
6348114	ADB	Matrix Spike [KVN232-01]	Dissolved Sulphate (SO4)	2019/09/24		NC	%	75 - 125
6348114	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/09/24		100	%	80 - 120
6348114	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/09/24	<1.0		mg/L	
6348114	ADB	RPD [KVN232-01]	Dissolved Sulphate (SO4)	2019/09/24	0.10		%	20
6348115	ADB	Matrix Spike [KVN232-01]	Orthophosphate (P)	2019/09/24		105	%	75 - 125
6348115	ADB	Spiked Blank	Orthophosphate (P)	2019/09/24		100	%	80 - 120
6348115	ADB	Method Blank	Orthophosphate (P)	2019/09/24	<0.010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6348115	ADB	RPD [KVN232-01]	Orthophosphate (P)	2019/09/24	NC		%	25

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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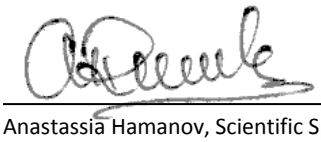
BV Labs Job #: B9Q4887
Report Date: 2019/09/26

LDS Consultants Inc
Client Project #: GE-00260
Site Location: PIKE FARMS GRAVEL PIT

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

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BUREAU VERITAS

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Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/5

CHAIN OF CUSTODY RECORD

Page ____ of ____

Invoice Information
Company Name: LDS Consultants
Contact Name: Rebecca Walker
Address:
Phone: Fax:
Email: Rebecca.Walker@LDSConsultants.ca

Report Information (if differs from invoice)
Company Name:
Contact Name:
Address:
Phone: Fax:
Email:

Project Information (where applicable)
Quotation #:
P.O. #/ AFE#:
Project #: GE-00260
Site Location: Pike Farms Gravel Pit
Site #:
Site Location Province: Ontario
Sampled By: Rob Walker

Turnaround Time (TAT) Required
☑ Regular TAT (5-7 days) Most analyses
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Rush TAT (Surcharges will be applied): ☐ 1 Day ☐ 2 Days ☐ 3-4 Days
Date Required:
Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES DRINKING WATER CHAIN OF CUSTODY

Regulation 153: ☐ Table 1 ☐ Res/Park ☐ Med/ Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/ Other ☐ Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ MISA ☐ Storm Sewer Bylaw ☐ PWQO Region ____ ☐ Other (Specify) ☐ REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	General Chemistry							HOLD- DO NOT ANALYZE
1	BH2	2019/09/20	PM	water	3								✓							
2	BH6	2019/09/20	PM	water	3								✓							
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

20-Sep-19 14:30
Christine Gripton
B9Q4887
WVL ENV-1242

LABORATORY USE ONLY
CUSTODY SEAL Y / N — Present / Intact
COOLER TEMPERATURES: 16, 15, 16 °C
11 / 13 / 13
COOLING MEDIA PRESENT: (Y) / N
COMMENTS

REC'D IN LONDON

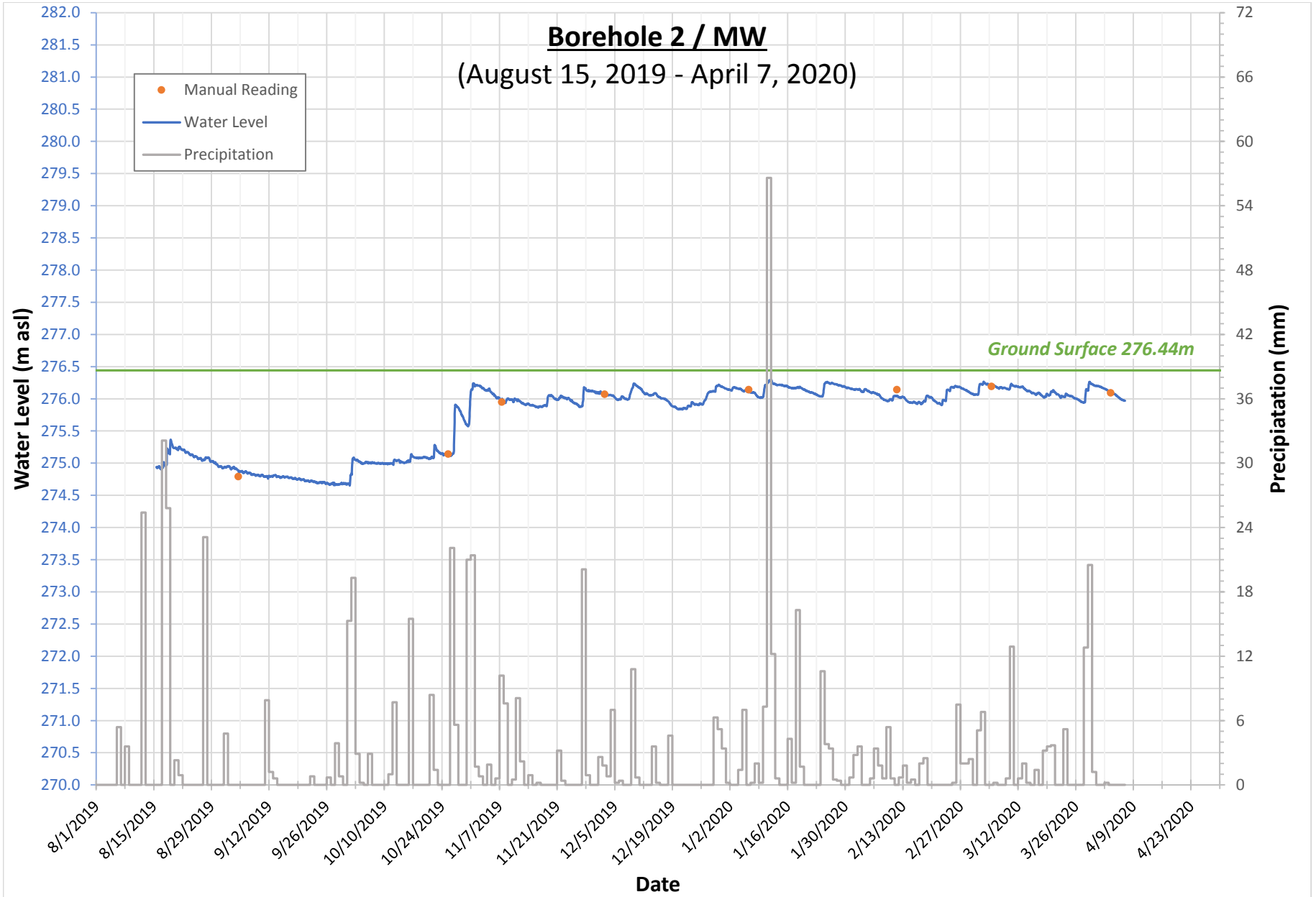
RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	BV JOB #
Rob Walker / Rob Walker	2019/09/20	14:30	C Gripton / C Gripton	2019/09/20	14:30	
			[signature] / Ashim Dua Sukumar	2019/09/20	18:30	

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas Laboratories' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of our terms available at http://www.bvlabs.com/terms-and-conditions

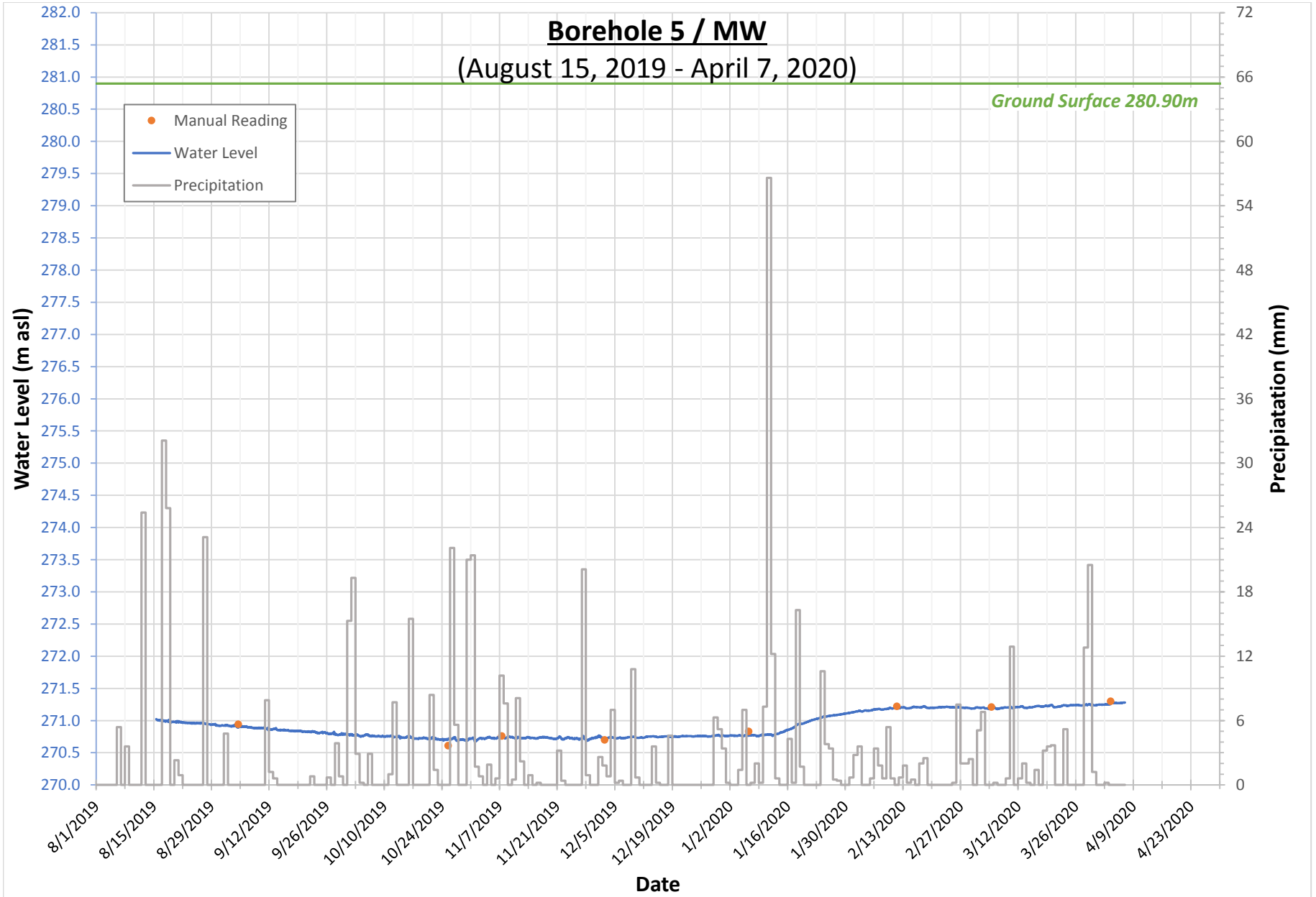
WBH 1496W

APPENDIX D

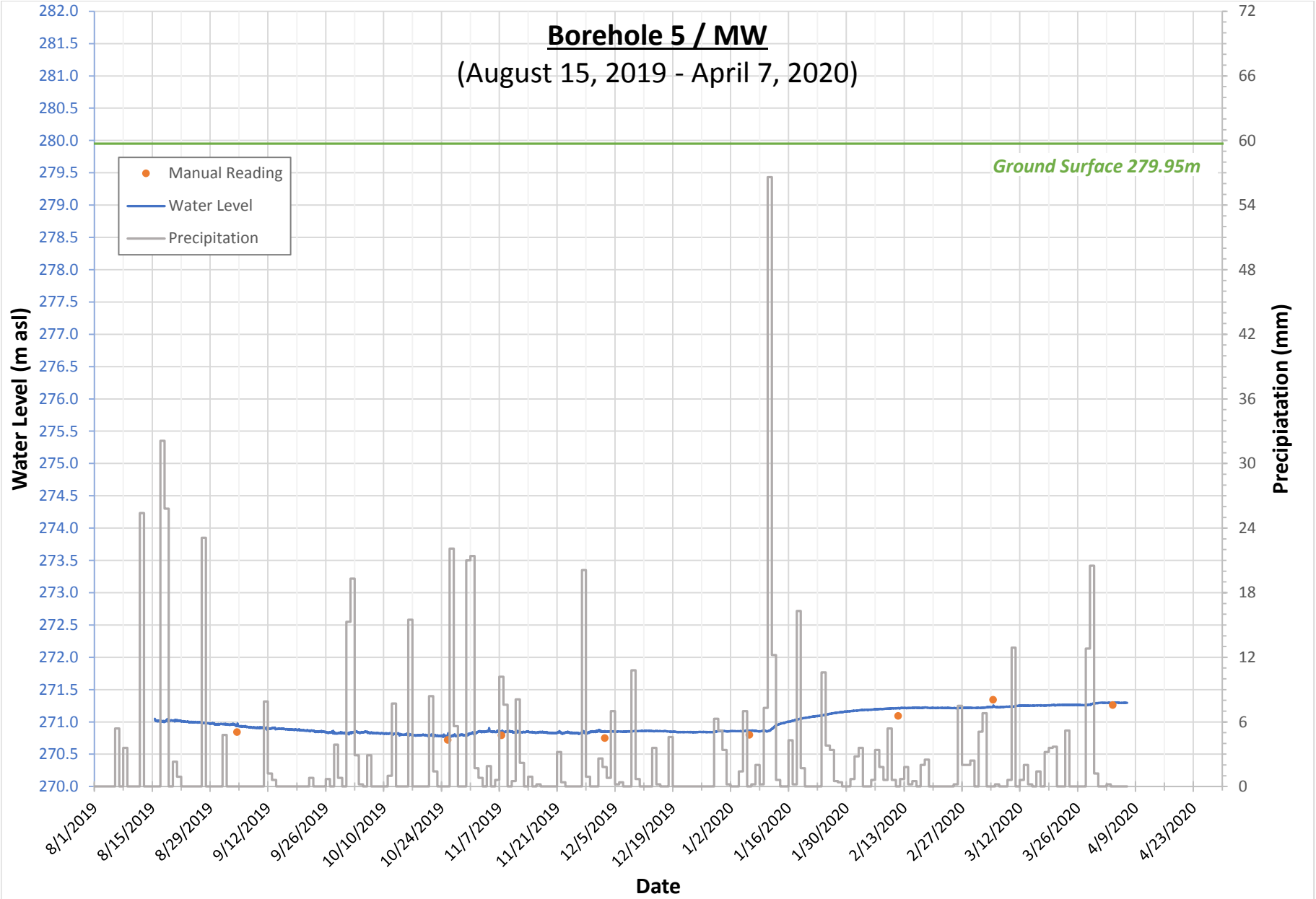
GROUNDWATER HYDROGRAPHS



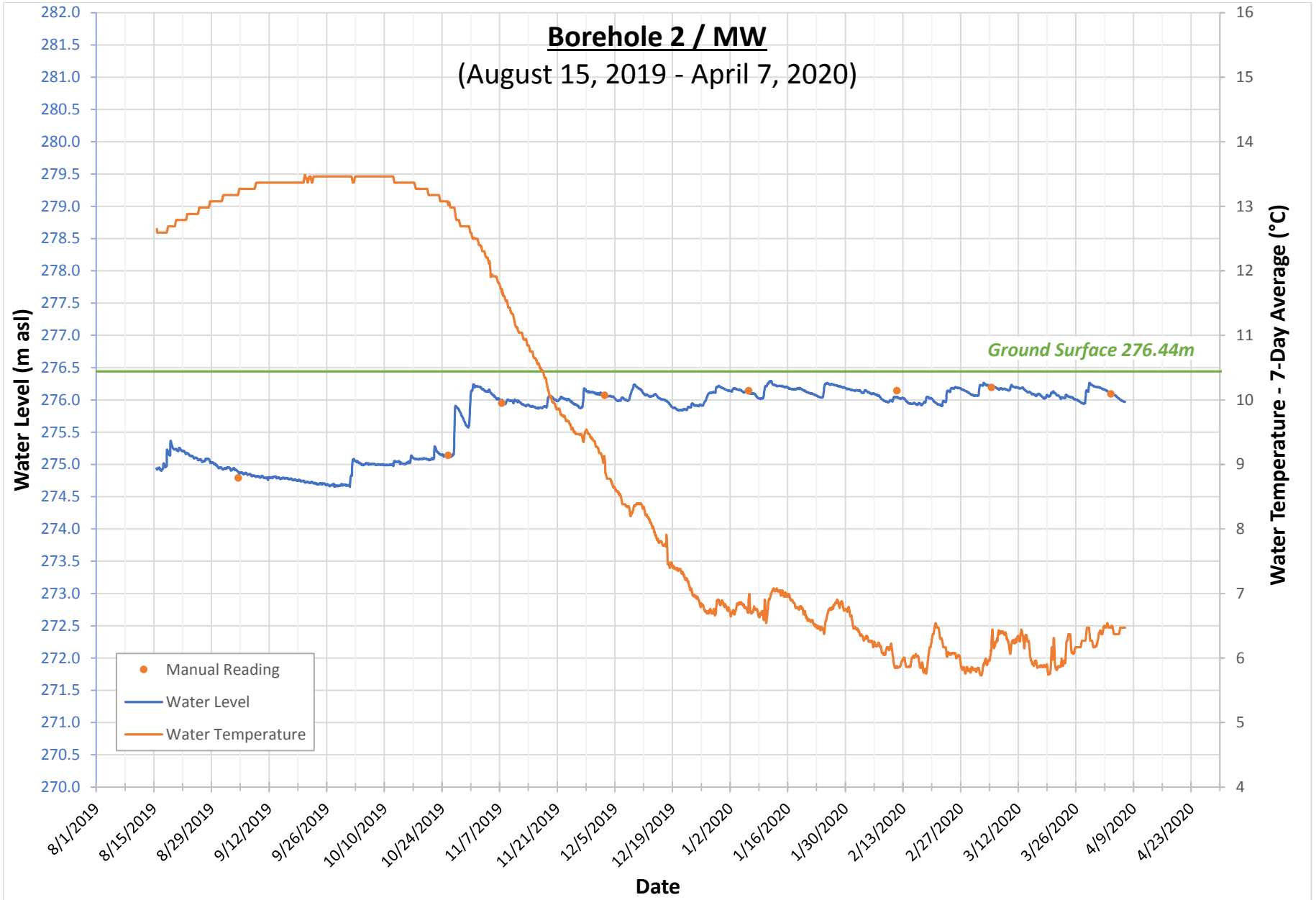
1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.



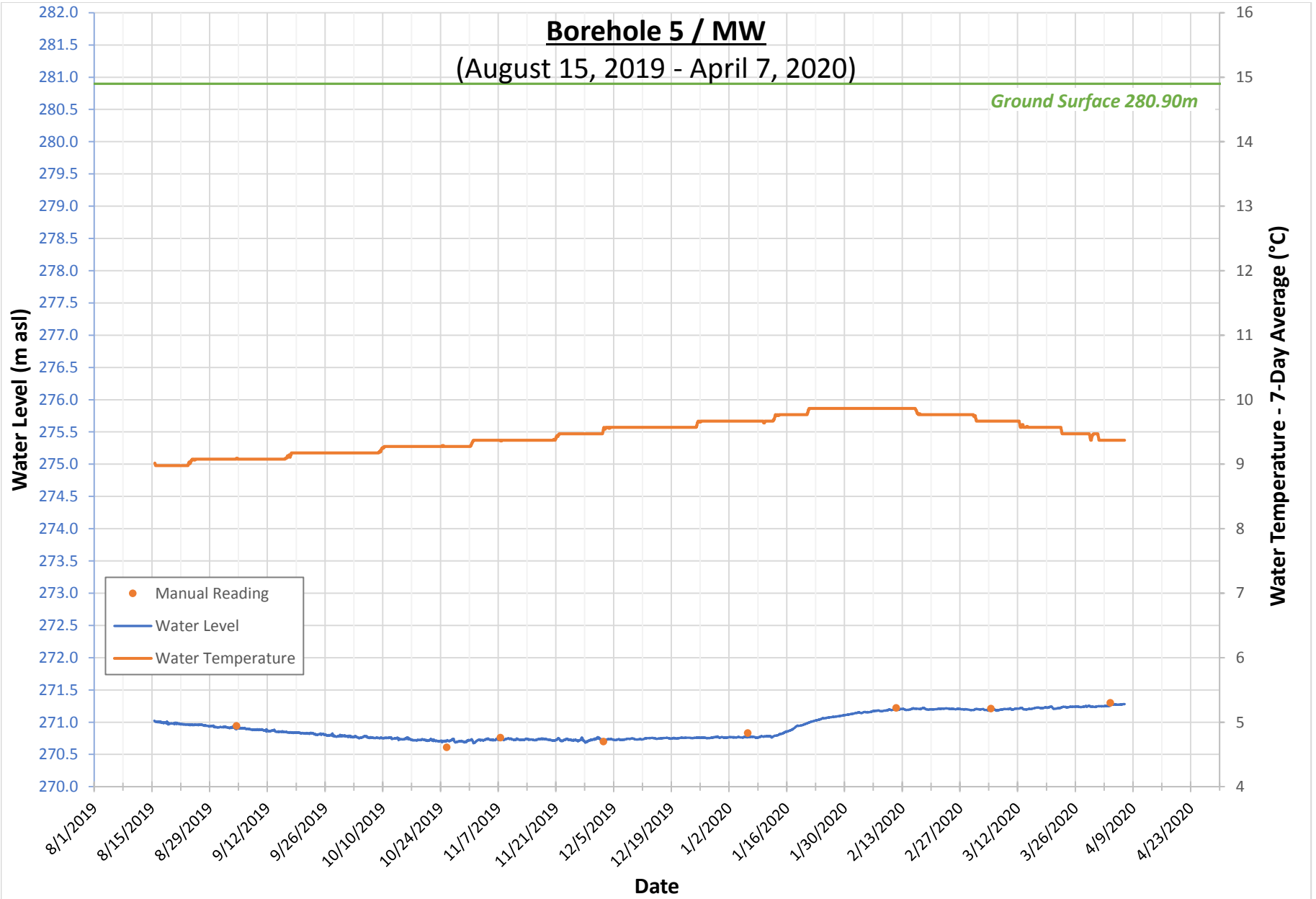
1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.



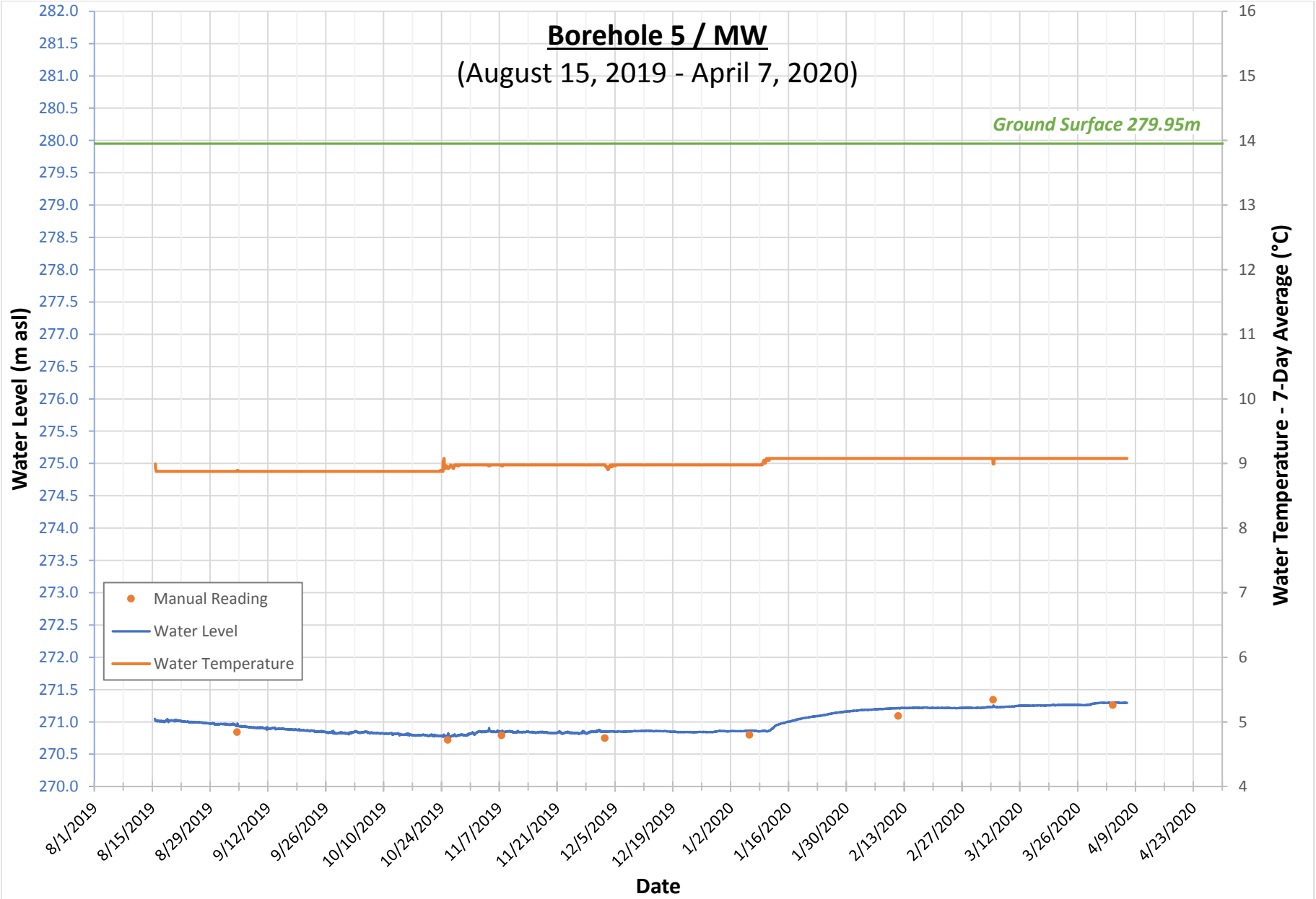
1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.



1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.



1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.



1. Water Levels collected using Onset Hobo U20L Unit. Pressure Corrections based on hourly atmospheric data from Environment Canada Station at London International Airport.
2. Precipitation data sourced from Environment Canada London Internation Airport Weather Station.

APPENDIX E

MECP WELL RECORD REVIEW

SUMMARY OF MECP WELL RECORD SEARCH

MECP Well ID	Completion Date	Type	Depth (m)	Water Found (m)	Static Level (m)	Pump Rate (L/min)	Northing	Easting
4703123	01/03/1971	Water Supply	9.4	4.9	4.9	19.0	4766238.00	499433.70
4706154	29/10/1987	Water Supply	109.7	54.9	13.7	11.4	4766233.00	499573.70
4706929	12/09/1991	Water Supply	107.3	107.3	30.5	57.0	4766459.00	499650.70
4707391	12/06/1995	Water Supply	20.1	18.9	5.2	38.0	4765619.00	499659.70
4707408	20/06/1995	Water Supply	21.3	19.5	5.8	38.0	4765264.00	499027.70
4708709	26/06/2003	Water Supply	18.3	18.0	4.3	76.0	4766162.00	499166.00
7248186	17/08/2015	Water Supply	29.6	18.9	9.2	38.0	4765724.00	499856.00
4708986	28/01/2005	Observation Wells	8.5	*NR*	*NR*	*NR*	4765859.00	498965.00
4704030	01/08/1974	Abandoned-Supply	27.4	20.4	6.7	*NR*	4766344.00	499443.70
4708621	24/01/2003	Abandoned-Other	*NR*	*NR*	*NR*	*NR*	4766400.00	499725.00
7166212	20/07/2011	Abandoned-Other	*NR*	*NR*	*NR*	*NR*	4766201.00	499560.00
7166215	20/07/2011	Abandoned-Other	*NR*	*NR*	*NR*	*NR*	4766201.00	499560.00
7283858	28/02/2016		*NR*	*NR*	*NR*	*NR*	4765239.00	499051.00

Source: MECP Online Interactive Database, www.ontario.ca/environment-and-energy/map-well-records, updated January 24, 2020

GE-00260

Ontario — Ministry of the Environment and Climate Change

Well Record for Well Cluster – Part 1 of 3

(Only for Multiple Test Holes or Dewatering Wells)

Regulation 903 Ontario Water Resources Act

All measurements recorded in: ☐ Metric ☒ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag No. of Deepest Well: *(Print Well Tag No.)* A273529

Well No. on Drawing of Deepest Well:

☐ Dewatering wells
☒ Test holes
No. of wells reported 6

Page 1 of 2

Well Cluster Location Information

Address of Well Location (Street Number(s)/Name(s), RR, if available)	Lot(s)	Concession(s)	Geographic Township	County/District/Upper Tier Municipality
6693 Gore Road (Cty Rd 25)				Middlesex

City, Town, Village or Hamlet	Province	GPS Unit Make	Model	Unit Mode of Operation
Thames Centre	Ontario			☒ Undifferentiated ☐ Averaged ☐ Differentiated, specify:

Mandatory Attachments/Additional Information

☒ Land Owner Consent Form must be attached.
☒ Detailed Drawing of All Well Locations must be attached.

I, the person constructing the well, will promptly submit to the Director, on request, any additional information in my custody or control related to any well in the well cluster that I have constructed.

Signature of Technician/Contractor — Date (yyyy/mm/dd): 2019/07/22

Well Details

Well # on Drawing	UTM Coordinates Zone	Easting	Northing	Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing (m/ft) From	Casing (m/ft) To	Screen Interval (m/ft) From	Screen Interval (m/ft) To	Annular Space Material (m/ft) From	Annular Space Material (m/ft) To	Annular Space Material: Material:	Overburden/Bedrock or Abandonment Filing Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)
1	17	499131	4763126	35	8	rotary	2"	+5	-30	30	35	0	29	Bent	0-2' Topsoil	29'	2019/07/10
												29	35	sand	2' 35' sand & gravel		
2	17	499219	4763135	35	8	rotary	2"	+5	-30	30	35	0	26	Bent	0-2' Topsoil	30'	2019/07/10
												26	35	Sand	2-35 Sand & gravel		
3	17	499251	4763137	35	8	rotary	2"	+5	-30	30	35	0	26	Bent	0-2' Top soil	31'	2019/07/10
												26	35	Sand	2-35 Sand & gravel		
4	17	499191	4763141	25	8	rotary	2"	+5	-18'	18	23	0	18	Bent	0-2' Topsoil		2019/07/10
												18	25	sand	2'-18' brown sand & gravel	18'	
															18'-22.5' brown sand		
															22.5-25' clay & some gravel		

LONDON SOIL TEST LTD.
712078 Southgate Sdrd. 71
Dundalk, ON N0C 1B0
519-455-5777 info@londonsoil.com

Contractor Information

Business Address (Street Number/Name, RR)	Municipality	Province

Well Contractor's Licence No.	Business E-mail Address
7190	

Name of Well Technician (First Name, Last Name)	Well Technician's Licence No.	Signature of Well Technician	Date Submitted (yyyy/mm/dd)
[illegible] Tross	2970		2019/08/13

Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)	Date Last Well in Cluster Completed (yyyy/mm/dd)
2019/07/10	2019/07/22

Well Abandonment

Person Abandoning the Wells:

Name _____
(Print or Type) - See instruction 11 on the back of this form

Ministry Use Only

Date Received (yyyy/mm/dd)	Audit No
	L 37595

Comments

1991E (2015/10)

Well Owner's Copy

LDS MONITORING WELLS

Ontario — Ministry of the Environment and Climate Change

Well Record for Well Cluster – Part 1 of 3

(Only for Multiple Test Holes or Dewatering Wells)

Regulation 903 Ontario Water Resources Act

All measurements recorded in: ☐ Metric ☑ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag No. of Deepest Well: *(Print Well Tag No.)* A273529

Well No. on Drawing of Deepest Well:

☐ Dewatering wells
☑ Test holes
No. of wells reported 6

Page 2 of 2

Well Cluster Location Information

Address of Well Location (Street Number(s)/Name(s), RR, if available)	Lot(s)	Concession(s)	Geographic Township	County/District/Upper Tier Municipality
16693 Gore Rd (Cty Rd 25)				Middlesex

City, Town, Village or Hamlet	Province	GPS Unit Make	Model	Unit Mode of Operation
Thames Centre	Ontario			☑ Undifferentiated ☐ Averaged ☐ Differentiated, specify:

Mandatory Attachments/Additional Information

☒ Land Owner Consent Form must be attached.
☒ Detailed Drawing of All Well Locations must be attached.

I, the person constructing the well, will promptly submit to the Director, on request, any additional information in my custody or control related to any well in the well cluster that I have constructed.

Signature of Technician/Contractor — Date (yyyy/mm/dd) 2019/07/22

Well Details

Well # on Drawing	UTM Coordinates Zone	Easting	Northing	Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing From (m/ft)	Casing To (m/ft)	Screen Interval From (m/ft)	Screen Interval To (m/ft)	Annular Space Material From (m/ft)	Annular Space Material To (m/ft)	Annular Space Material: Material:	Overburden/Bedrock or Abandonment Filing Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)
5	17	493818	4761615	15	8"	Rotary	2"	+5	-5'	5'	10'	0	4	Bentonite	0-1 Topsoil	dry	2019/07/22
							4"	-6"	2'			4'	10.5	sand	1-7' silty clay trace gravel		
												10.5'	15	Bentonite	7-8 sand gravel		
															8-15 grey hard silt till trace sand & gravel		
6	17	499128	4763697	10'	8'	Rotary	2"	+5'	-5'	5'	10'	0	4	Bentonite	0-1.5' Topsoil	5	2019/07/22
							4"	1.5'	3'			4	10	sand	1.5-5' Brown wet silt/sand		
															5'-10' coarse sand (SAND)		

Contractor and Well Technician Information

LONDON SOIL TEST LTD.
712078 Southgate Sdrd. 71
Dundalk, ON N0C 1B0
519-455-5777 info@londonsoil.com

Business Address (Street Number/Name, RR)	Municipality	Province

Well Contractor's Licence No.	Business E-mail Address
7198	

Name of Well Technician (First Name, Last Name)	Well Technician's Licence No.	Signature of Well Technician	Date Submitted (yyyy/mm/dd)
Trevor Ross	2970		2019/08/13

Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)	Date Last Well in Cluster Completed (yyyy/mm/dd)
2019/07/10	2019/07/22

Well Abandonment

Person Abandoning the Wells:

Name _____
(Print or Type) - See Instruction 11 on the back of this form

Ministry Use Only

Date Received (yyyy/mm/dd)	Audit No
	C 45003

Comments

1991E (2015/10)

Well Owner's Copy

LDS MONITORING WELLS

LDS
MONITORING
WELLS

Ontario

Ministry of the Environment
Conservation and Parks

Well Record for Well Cluster – Part 2 of 3
Land Owner Consent

This form is to be completed by the person who constructs or abandons test holes or dewatering wells that form all or part of a well cluster. If this form is being used to report any well abandonment, these wells must have been previously reported as part of a single well cluster.

Note: For well cluster records, only the owner of the land on which the wells are situated are to give written consent. If the well purchaser (e.g. a consultant who hires the driller) is not the owner of the land, then the well purchaser cannot sign the consent form.

By signing this form, land owners are providing consent to use one well record to report a well cluster of test holes or dewatering wells in accordance with section 16.4 of Regulation 903 made under the *Ontario Water Resources Act*.

This completed **Well Record for Well Cluster Part 2 – Land Owner Consent** must be attached to Parts 1 and 3.

* Please PRINT if completing by hand.

Well Tag Number: # A273529

"Well Record for Well Cluster" Audit Number: # C37595, C45003

Well # on Detailed Drawing	Property Location Description	Land Owner's Name	Signature of Land Owner	Date Signed *(yyyy/mm/dd)*
MW1	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW2	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW3	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW4	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW5	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW6	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
MW7	6693 Gore Road (County Road 25) Thames Centre, Ontario	Thames Valley Aggregates 75 Blackfriars Street London, Ontario N6H 1K8		2019/07/25
Note: Well locations shown on attached plan.				

Ministry's Copy

A273529-

LDS
MONITORING
WELLS

APPENDIX F

WELL SURVEY QUESTIONNAIRES

December 3, 2019
LDS File: GE-00260

Attention: **House Owner / Resident**

Reference: **REQUEST FOR INFORMATION**
WELL SURVEY QUESTIONNAIRE

LDS Consultants Inc. (LDS) has been retained to prepare background hydrogeological information for a proposed aggregate pit for the property located at the southeast corner of Hunt Road and Gore Road in Thames Centre, Ontario.

As part of the due diligence work required for the proposed development, we are collecting information regarding shallow wells and shallow groundwater conditions which may be present in proximity to the project site, to supplement the Ministry of Environment Conservation and Parks (MECP) well records and our site investigation work.

You are kindly requested to fill-in the attached Questionnaire to the best of your knowledge. Please return the completed forms to LDS at your earliest convenience. The form can be sent via email, to Rebecca.Walker@LDSconsultants.ca. It is noted that this is our second attempt to contact you.

Your participation in completing this survey is greatly appreciated, and will assist LDS in the preparation of the Hydrogeological Report, to ensure that suitable recommendations are included in our report to ensure that design and construction for the proposed development incorporates suitable measures to minimize potential impacts to your water supply.

If you have any questions about this request, or would like to provide the requested information over the phone (rather than completing the attached form), please don't hesitate to contact the undersigned.

Respectfully,

LDS CONSULTANTS

Rebecca Walker, P.Eng.
Principal, Geotechnical Services
Office: 226-289-2952
Cell: 519-200-3742
rebecca.walker@LDSconsultants.ca

LDS

Proposed Aggregate Pit
Hunt Road and Gore Road
GE-00260

Well Survey Questionnaire

Contact Name: JAY THORNTON
Address: 642699 ROAD 64 RR#3
INGERSOLL ON
N5C 3J6
Contact (email or phone): Jays-yj@hotmail.com

Please be advised that any information that is provided to LDS for the above address may be circulated to various approval authorities, including but not limited to City of London and Upper Thames River Conservation Authority, and may be available to the public through a Freedom of Information request.

☑ ***I agree to provide the following information*** *(please sign and date the bottom of the form):*

Confirmation of Existing Water Supply Well

☐ No – There are no water supply wells present at the address noted above

☑ Yes – There is one (or more) water supply wells at the address noted above. Additional details outlined below.

Location of Well *(Provide description - If preferred, you can provide a sketch on the back of this page)*	IN FRONT OF HOUSE WEST SIDE 300' FROM ROAD
Depth of Well (estimate, if not known) 180'	**Date Drilled** (estimate, if not known) LATE 80'S EARLY 90'S
Water Usage: (i.e.: Domestic Water Supply / Landscaping / Irrigation)	**Is the property serviced with municipal/city water?** Please circle: YES (NO)
Type of Well: (Dug / Bored or Drilled) DRILLED	**Static Water Level:** (estimate, if not known) 15'-20'
Do you use water treatment units? If yes, please specify type of treatment (i.e.: water softener, UV) NO	
Have you experienced water quality issues, or water quantity issues? If yes, please provide a brief description (i.e.: seasonal periods when well goes dry) NO	
Have you experienced any issues with shallow groundwater? If yes, please provide a brief description (i.e.: frequent sump pump running, wet basement) NO	

☐ ***I prefer not to participate and decline to provide information for the above noted address.***

Signature _____ Date AUG 12/19

LDS

Proposed Aggregate Pit
Hunt Road and Gore Road
GE-00260

Well Survey Questionnaire

Contact Name: Brentridge Holsteins Ltd.
Address: 1160 Hunt Rd
Ingersoll ON N5C 3J6
Contact (email or phone): 519-649-8847 Claire + Brent Pike

Please be advised that any information that is provided to LDS for the above address may be circulated to various approval authorities, including but not limited to City of London and Upper Thames River Conservation Authority, and may be available to the public through a Freedom of Information request.

[X] ***I agree to provide the following information*** *(please sign and date the bottom of the form):*

Confirmation of Existing Water Supply Well

☐ No – There are no water supply wells present at the address noted above

☒ Yes – There is one (or more) water supply wells at the address noted above. Additional details outlined below.

Location of Well
(Provide description - If preferred, you can provide a sketch on the back of this page)

Depth of Well (estimate, if not known) 65 ft	**Date Drilled** (estimate, if not known) ?
Water Usage: Domestic + Dairy farm (i.e.: Domestic Water Supply / Landscaping / Irrigation)	**Is the property serviced with municipal/city water?** Please circle: YES (NO)
Type of Well: (Dug / Bored or Drilled) Drilled	**Static Water Level:** (estimate, if not known) ?

Do you use water treatment units? Yes, Iron filter
If yes, please specify type of treatment (i.e.: water softener, UV)

Have you experienced water quality issues, or water quantity issues? NO.
If yes, please provide a brief description (i.e.: seasonal periods when well goes dry)

Have you experienced any issues with shallow groundwater? NO.
If yes, please provide a brief description (i.e.: frequent sump pump running, wet basement)

☐ ***I prefer not to participate and decline to provide information for the above noted address.***

C. Pike
Signature

Apr 20/20
Date

Newbarn/House well 1 of 2.

LDS

Proposed Aggregate Pit
Hunt Road and Gore Road
GE-00260

Well Survey Questionnaire

Contact Name: Brentridge Holsteins Ltd.
Address: 1160 Hunt Rd
Ingersoll ON N5C 3J6
Contact (email or phone): 519-649-8847 Claire + Brent Pike

Please be advised that any information that is provided to LDS for the above address may be circulated to various approval authorities, including but not limited to City of London and Upper Thames River Conservation Authority, and may be available to the public through a Freedom of Information request.

[X] ***I agree to provide the following information*** *(please sign and date the bottom of the form):*

Confirmation of Existing Water Supply Well

☐ No – There are no water supply wells present at the address noted above

☒ Yes – There is one (or more) water supply wells at the address noted above. Additional details outlined below.

Location of Well
(Provide description - If preferred, you can provide a sketch on the back of this page)

Depth of Well (estimate, if not known) 250ft	**Date Drilled** (estimate, if not known) ?
Water Usage: He. Cattle (i.e.: Domestic Water Supply / Landscaping / Irrigation)	**Is the property serviced with municipal/city water?** Please circle: YES (NO)
Type of Well: (Dug / Bored or Drilled) Drilled	**Static Water Level:** (estimate, if not known) ?

Do you use water treatment units? NO.
If yes, please specify type of treatment (i.e.: water softener, UV)

Have you experienced water quality issues, or water quantity issues?
If yes, please provide a brief description (i.e.: seasonal periods when well goes dry) NO, lots of sulfur

Have you experienced any issues with shallow groundwater?
If yes, please provide a brief description (i.e.: frequent sump pump running, wet basement) NO.

☐ ***I prefer not to participate and decline to provide information for the above noted address.***

C Pike
Signature

Apr 20/20.
Date

Old barn well 2 of 2

Proposed Aggregate Pit
Hunt Road and Gore Road
GE-00260

Well Survey Questionnaire

Contact Name: Mike Albright

Address: 839 Hunt Road Dorchester Ont

Contact (email or phone): malbright839@gmail.com 519 902 0797

Please be advised that any information that is provided to LDS for the above address may be circulated to various approval authorities, including but not limited to City of London and Upper Thames River Conservation Authority, and may be available to the public through a Freedom of Information request.

☑ ***I agree to provide the following information*** *(please sign and date the bottom of the form):*

Confirmation of Existing Water Supply Well

☐ No – There are no water supply wells present at the address noted above

☑ Yes – There is one (or more) water supply wells at the address noted above. Additional details outlined below.

Location of Well
(Provide description - If preferred, you can provide a sketch on the back of this page)
See attached for rough dwg

Depth of Well (estimate, if not known)	**Date Drilled** (estimate, if not known) ?
Water Usage: Domestic (i.e.: Domestic Water Supply / Landscaping / Irrigation)	**Is the property serviced with municipal/city water?** Please circle: YES (NO)
Type of Well: (Dug / Bored or Drilled) ?	**Static Water Level:** (estimate, if not known) 16' from ground level

Do you use water treatment units?
If yes, please specify type of treatment (i.e.: water softener, UV) Softener UV Trojan.

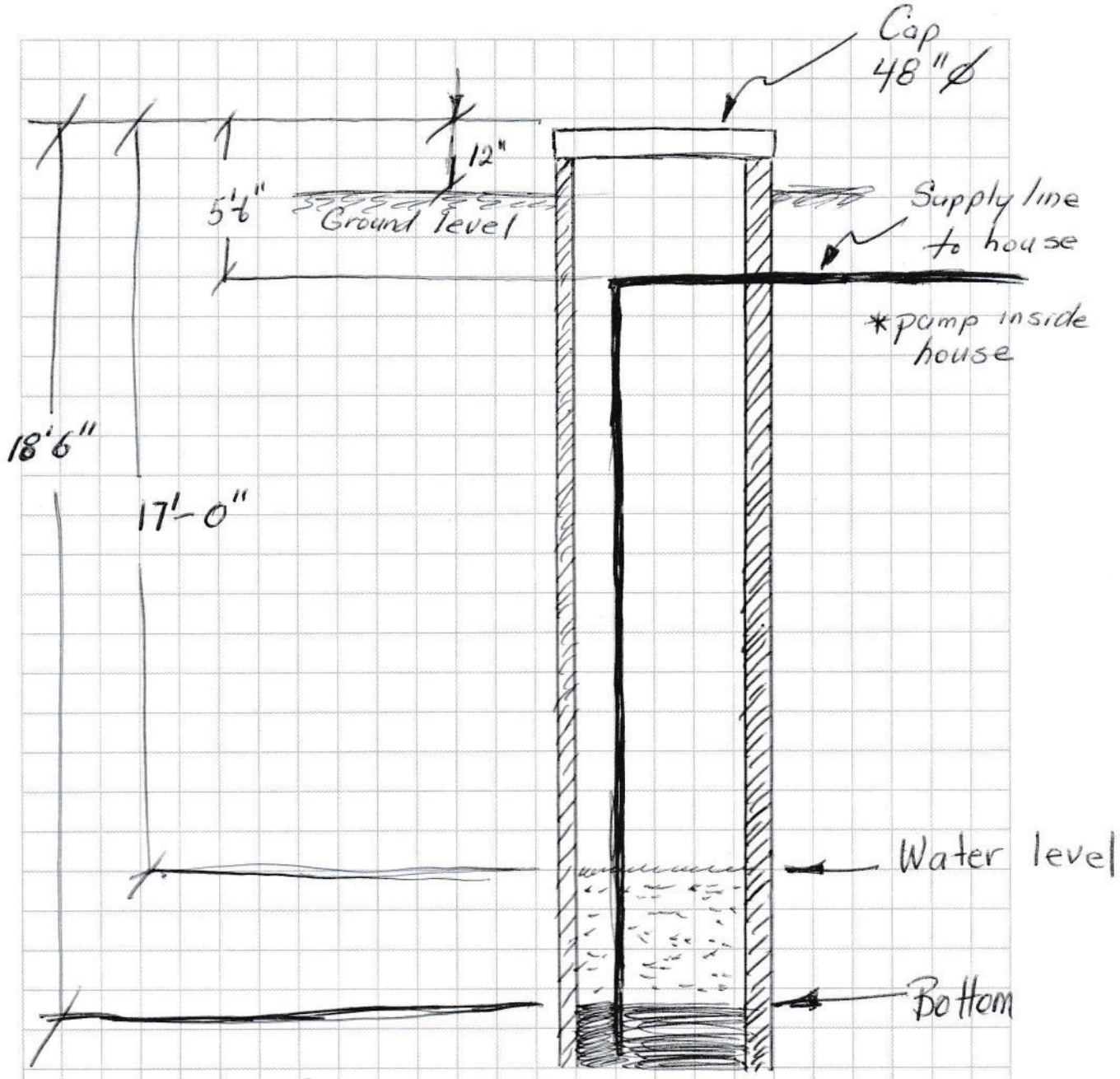
Have you experienced water quality issues, or water quantity issues?
If yes, please provide a brief description (i.e.: seasonal periods when well goes dry)
No

Have you experienced any issues with shallow groundwater?
If yes, please provide a brief description (i.e.: frequent sump pump running, wet basement)
No

☐ ***I prefer not to participate and decline to provide information for the above noted address.***

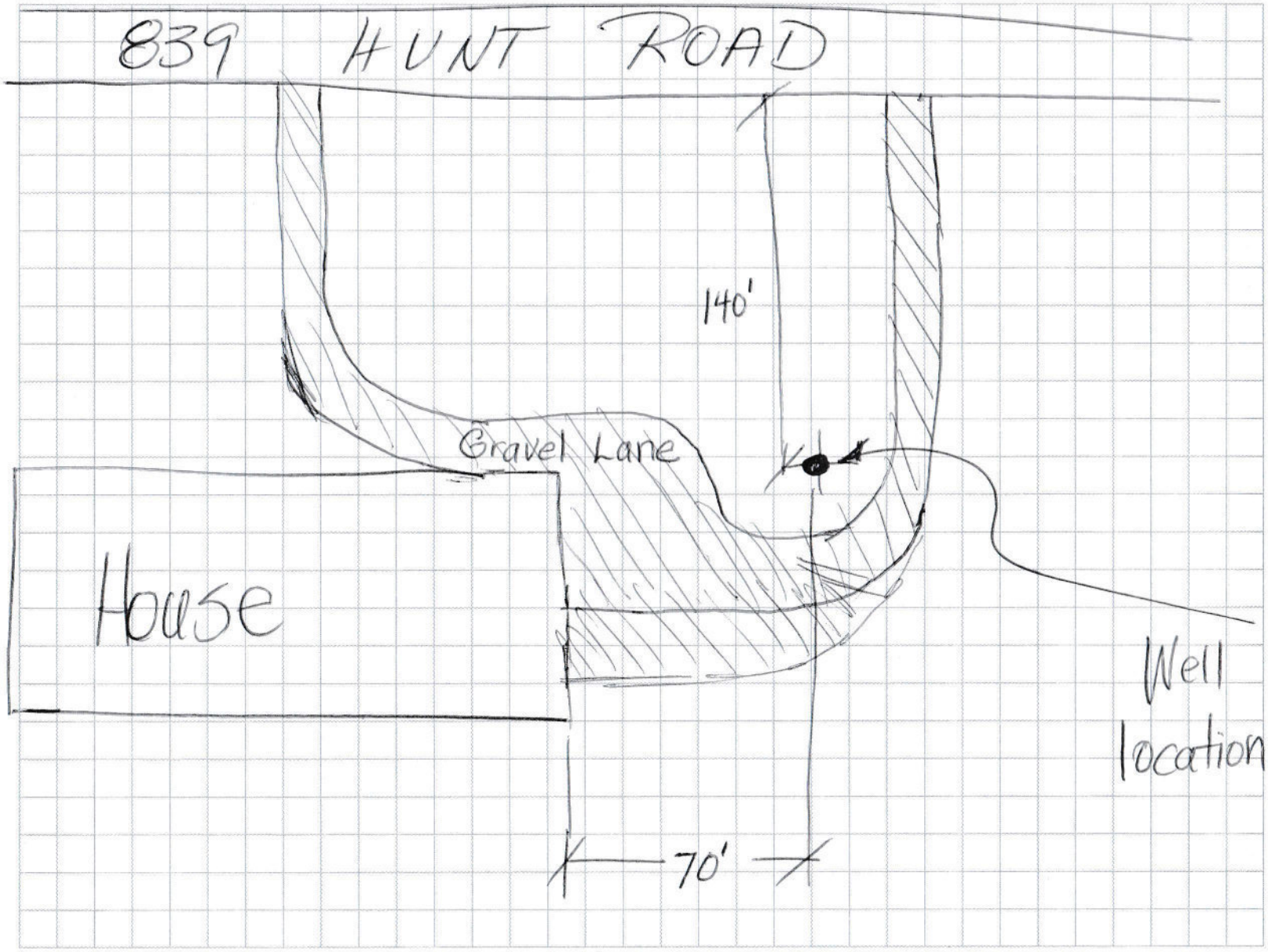
Mike Albright
Signature

Sept 2, 2019
Date



839 Hunt Road
Dorchester Ont
Mike Albright

Sept 2019


839 HUNT ROAD
140'
Gravel Lane
House
Well location
70'

APPENDIX G

WATER BALANCE CALCULATIONS

LDS

WATER BALANCE CALCULATION WORKSHEET

Pre Development Condition

Site Parameters		Month	Temperature °C	Precipitation (mm)	Actual Evapotranspiration (mm)	Adjusted ET (mm)	Soil Storage (mm)	Surplus Water (mm)	Potential Infiltration (mm)	Actual infiltration depth (mm)	Actual infiltration Volume (m^3)	Potential Runoff (mm)	Actual Runoff depth (mm)	Actual Runoff Volume (m^3)	
Area (ha):	21.0	January	-6.4	72.48	8.85	8.85	149.27	63.63	31.82	0.00	0.00	31.82	0.00	0.00	
Impervious	0%	February	-5.5	59.84	10.44	10.44	149.50	49.39	24.70	0.00	0.00	24.70	0.00	0.00	
Soil Type	A	March	-0.4	76.67	20.14	20.14	150.00	56.52	28.26	0.00	0.00	28.26	0.00	0.00	
Soil Moisture Capacity (mm)	150	April	6.4	81.57	37.43	37.43	150.00	44.14	22.07	114.87	24123.42	22.07	83.94	17627.20	
INFILTRATION FACTOR		May	13.1	82.73	69.78	69.78	145.56	12.95	6.48	37.41	7855.97	6.48	88.81	18650.63	
Topography factor	0.1	June	18.0	85.72	98.57	98.57	126.49	-12.85	-6.43	0.00	0.00	-6.43	0.00	0.00	
Soils Factor	0.3	July	20.5	80.91	107.61	107.61	93.81	-26.70	-13.35	0.00	0.00	-13.35	0.00	0.00	
Cover Factor	0.1	August	19.6	82.25	84.38	84.38	87.29	-2.13	-1.06	0.00	0.00	-1.06	0.00	0.00	
Total INFIL Factor	0.5	September	15.3	97.33	52.52	52.52	106.36	44.82	22.41	22.41	4705.64	22.41	22.41	4705.64	
		October	9.1	81.48	30.74	30.74	130.86	50.73	25.37	25.37	5326.78	25.37	25.37	5326.78	
		November	3.3	95.32	16.23	16.23	145.71	79.08	39.54	39.54	8303.86	39.54	39.54	8303.86	Check
		December	-3.0	88.03	10.10	10.10	148.90	77.93	38.96	0.00	0.00	38.96	0.00	0.00	P=ET+I+R
		Total:		984.31	546.7875	546.79			218.76	239.60	50,315.67	218.76	260.07	54,614.11	984.31

Post Development Condition

Site Parameters		Month	Temperature °C	Precipitation (mm)	Actual Evapotranspiration (mm)	Adjusted ET (mm)	Soil Storage (mm)	Surplus Water (mm)	Potential Infiltration (mm)	Actual infiltration depth (mm)	Actual infiltration Volume (m^3)	Potential Runoff (mm)	Actual Runoff depth (mm)	Actual Runoff Volume (m^3)	
Area (ha):	21.0	January	-6.4	72.48	8.85	23.16	149.27	63.63	39.77	0.00	0.00	9.55	0.00	0.00	
Impervious	0%	February	-5.5	59.84	10.44	21.56	149.50	49.39	30.87	0.00	0.00	7.41	0.00	0.00	
Soil Type	C	March	-0.4	76.67	20.14	32.86	150.00	56.52	35.33	0.00	0.00	8.48	0.00	0.00	
Soil Moisture Capacity (mm)	150	April	6.4	81.57	37.43	47.36	150.00	44.14	27.59	143.59	30154.28	6.62	25.18	5288.16	
Total Pond Area (ha):	*11.33*	May	13.1	82.73	69.78	72.69	145.56	12.95	8.09	46.76	9819.96	1.94	20.50	4305.66	
Total Reforestation (ha):	*0.76*	June	18.0	85.72	98.57	95.68	126.49	-12.85	-8.03	0.00	0.00	-1.93	0.00	0.00	
Total Meadow Area (ha):	*3.41*	July	20.5	80.91	107.61	101.60	93.81	-26.70	-16.69	0.00	0.00	-4.01	0.00	0.00	
Total Wetland Area (ha):	*0.8*	August	19.6	82.25	84.38	83.90	87.29	-2.13	-1.33	0.00	0.00	-0.32	0.00	0.00	
INFILTRATION FACTOR		September	15.3	97.33	52.52	62.60	106.36	44.82	28.01	28.01	6066.92	6.72	6.72	1411.69	
Topography factor	0.1	October	9.1	81.48	30.74	42.16	130.86	50.73	31.71	31.71	6867.74	7.61	7.61	1598.03	
Soils Factor	0.2	November	3.3	95.32	16.23	34.03	145.71	79.08	49.43	49.43	10706.05	11.86	11.86	2491.16	Check
Cover Factor	0.1	December	-3.0	88.03	10.10	27.64	148.90	77.93	48.70	0.00	0.00	11.69	0.00	0.00	P=ET+I+R
Total INFIL Factor	0.4	Total:		984.31	546.7875	645.23			273.45	299.50	63,614.94	65.63	71.88	15,094.70	984.31

Summary		Units	Notes
Runoff	- 39,519.41	m^3	Net reduction in run-off from existing to proposed site conditions
Infiltration	13,299.27	m^3	Net increase in infiltration (groundwater recharge)

Total Area to be Licensed 21.0 ha

Restoration Plan

Open water pond	11.33 ha
Wetland	0.80 ha
Reforestation	0.76 ha
Sideslope/meadow	3.41 ha
Total Area	16.30 ha
Note: Reforestation outside extraction area	0.46 ha

General Assumptions

-Infiltration factor is applied to surplus water
-When surplus is negative, moisture is drawn from the soil
-No Infiltration or runoff in winter months (<0°C)
-Winter runoff volumes is runoff in April (50%) and May (50%)
-Winter infiltration volumes infiltrated in April (75%), and May (25%)
-Actual ET is adjusted based on increased evaporation from the pond surface, (pond area noted above)
-25mm event represents 90% of annual runoff.
-Due to the resulting pond planned onsite, 75% of actual post developmet runoff will be evaporated or infiltrated
  -37.5% of Post development runoff will be added to the infiltration total
  -37.5% of Post development runoff will be added to the evapotranspiration total

Infiltration Factors

TOPOGRAPHY	Flat Land, average slope < 0.6 m/km (<0.1%)	0.30
	Rolling Land, average slope 2.8 m to 3.8 m/km (0.3%)	0.20
	Hilly Land, average slope 28 m to 47 m/km (5%)	0.10
SOILS	Fine sand	0.40
	Fine sandy loam	0.30
	Silt loam	0.20
	Clay loam	0.15
	Clay	0.10
COVER	Urban lawns / Shallow rooted crops	0.05
	Moderately rooted crops	0.10
	Pasture and shrubs	0.15
	Mature forest	0.20

† Infiltration factors after Ontario Ministry of the Environment, 2003. Stormwater Management Planning and Design Manual. March 2003.

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NATURAL ENVIRONMENT REPORT (Level I & II)

Aggregate Resources Act Application

Pike Pit, Municipality of Thames Centre

20 December 2020

TERRASTORY

environmental consulting inc.

NATURAL ENVIRONMENT REPORT (Level I &II)

Aggregate Resources Act Application
Pike Pit, Municipality of Thames Centre

Prepared for:

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Senior Ecologist | President

Project No.: 1944
20 December 2020

TERRASTORY
environmental consulting inc.

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1 INTRODUCTION

1.1 Study Background

Terrastory Environmental Consulting Inc. (hereinafter "Terrastory") was retained by Thames Valley Aggregates Inc. (hereinafter "the Applicant") to prepare this Level I & II Natural Environment Report (NER) in support of a Category 1, Class A pit application pursuant to the *Aggregate Resources Act* (ARA) in the Municipality of Thames Centre (hereinafter "the Municipality"). The extraction area is referred to as "Pike Pit". The lands proposed for licensing are situated within an approximately 21 hectare (54 acre) parcel located at the southwest corner of Gore Road and Hunt Road. The Subject Property is currently designated Agricultural per Schedule A of the Municipality's Official Plan (OP) and also zoned Agricultural per Map 38 of Zoning By-law No. 75-2006. The location of the Study Area within its broader landscape setting is shown in **Figure 1**.

The following terminology is employed throughout this NER to describe certain noteworthy areas and features which are shown spatially on **Figure 1**.

- **Site** – proposed area to be licensed.
- **Subject Property** – parcel/property in which the ARA licence is situated (equivalent to the "Site" for this application).
- **Adjacent Lands** – areas within 120 meters of the Subject Property/Site.
- **Study Area** – Site, Subject Property, and Adjacent Lands collectively.
- **Northern Woodlot** – approximately 2.5 hectare complex of deciduous woodland and wetland along Gore Road.
- **Southern Woodlot** – approximately 1.4 hectare deciduous woodland at the southwest corner of the Subject Property.

The licence application includes a 21 ha licensed area and 16.30 ha extraction area. The operations plan consists of five (5) phases of extraction/rehabilitation (A-E) which commence from a 0 m setback along the southern limit of the Site and proceed northward. The Site will remain in agricultural use until extraction commences. All phases will involve below-water extraction. Portable processing equipment will be shifted to accommodate different phases of aggregate extraction. Entrance to and exit from the Site will be gained from Hunt Road.

1.2 Study Purpose

This Level I & II NER has been prepared to address the requirements of the ARA and its associated regulation (O. Reg. 244/97) and policy standards. ARA licence applications must be made in accordance with the Provincial Standards (i.e., Aggregate Resources of Ontario: Provincial Standards, Version 1.0) per section 7 of O. Reg. 244/97. The Provincial Standards for Category 1, Class A pit licences require the submission of a supporting NER which may be either a Level I or II assessment depending upon the natural features present on or within 120 of the Site. "Site" is defined per section 1 of the ARA as "*the land or land under water to which a licence or permit or an application therefor relates*".

Per MNRF's Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006), the purpose of a Level I NER is to describe the existing natural environmental conditions on

and within 120 m of the Site, and to determine whether any of the following natural features are present:

- Significant Wetlands;
- Habitat of Endangered and Threatened Species;
- Significant Areas of Natural and Scientific Interest (ANSIs);
- Significant Woodlands (south and east of the Canadian Shield);
- Significant Valleylands (south and east of the Canadian Shield);
- Significant Wildlife Habitat (SWH); and,
- Fish Habitat

When any of the above natural features are identified through a Level I NER, a Level II NER is required to assess the potential for negative impacts on the identified significant natural feature(s). If potential impacts are identified, the Level II NER must provide recommendations for appropriate preventative, mitigative, and remedial measures. As certain significant natural features were known within the Site at project commencement, this NER satisfies the requirements for both a Level I and II assessment.

In addition to satisfying ARA requirements, this NER is also submitted in support of the Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) applications to the Municipality to facilitate aggregate extraction. This NER further considers and assesses the consistency of the licence application with other applicable natural heritage policies including the Provincial Policy Statement (PPS), provincial *Endangered Species Act* and federal *Fisheries Act*.

2 APPROACH AND METHODS

This study is composed of five (5) discrete components which are bulleted below and further described in the following sections.

- **Acquire background biophysical information and mapping** available for the Study Area and local landscape (see **Section 2.1**).
- **Conduct site assessments and ecological surveys** to field-verify the accuracy of the acquired background biophysical information and collect additional biophysical information as necessary (see **Section 2.2**).
- **Assess the significance** of the biophysical information collected and natural features identified within the context of applicable natural heritage and environmental policies (see **Section 2.3**).
- **Predict the effects** of the application on the identified significant natural features and natural environment, particularly the net effects once mitigation measures and technical recommendations are implemented (see **Section 2.4**).
- **Determine whether the proposed application addresses applicable natural heritage and environmental policies** at municipal, provincial, and federal levels (see **Section 2.5**).

All items associated with the preparation of this Level I & II NER – including background information gathering, site assessments and surveys, graphics, and reporting – were undertaken by Terrastory's Senior Ecologist/President (T. Knight). A curriculum vitae is provided in **Appendix 1**.

2.1 Background Biophysical Information Assessment

This study is supported by background biophysical information and mapping acquired and reviewed from a variety of sources which are listed below in **Table 1**.

Table 1. Background Biophysical Information Acquired and Reviewed.

Type of Information Acquired	Description
Ortho-rectified Aerial Photographs	• 1954, 2006, 2009, 2012-2013, 2015-2018.
Natural Feature Mapping	• Municipality of Thames Centre Official Plan (October 2020) Schedules. • County of Middlesex Official Plan (2006 consolidation) Schedules. • Land Information Ontario (LIO) accessed via MNRF's "Make a Map" web-based platform (accessed 6 November 2020). • Upper Thames River Conservation Authority (UTRCA) regulation mapping (accessed 6 November 2020).
Physiographic Resource Mapping and Datasets	• Topographic Survey of the Subject Property. • Ontario Base Mapping produced by MNR (1:10,000) with 5 m contours. • Ontario Well Records (publicly-available). • The Soils of Middlesex County (Hagerty and Kingston 1992). • Agricultural Information Atlas (accessed 6 November 2020). • Paleozoic Geology of Southern Ontario (Armstrong and Dodge 2007). • Surficial Geology of Southern Ontario (Ontario Geological Survey 2010). • Physiography of Southern Ontario (Chapman and Putnam 1984).
Ecological Resource Mapping and Datasets	• Natural Heritage Information Centre (NHIC) database accessed via MNRF's "Make a Map" web-based platform (squares: 17MH9864, 17MH9964, 17MH9863, 17MH9963, 17MH9862; accessed 6 November 2020). • iNaturalist "(NHIC) Rare species of Ontario" project (accessed 6 November 2020). • iNaturalist "Herps of Ontario" project (accessed 6 November 2020). • Ontario Breeding Bird Atlas (OBBA) database and the Atlas of the Breeding Birds of Ontario, 2001–2005 (Cadman et al. 2007) (square: 17MH96). • Ontario Butterfly Atlas database (square: 17MH96; accessed 6 November 2020). • Aquatic Species at Risk Maps by Fisheries and Oceans Canada (accessed 6 November 2020). • Atlas of the Mammals of Ontario (Dobbyn 2005).
Natural Heritage Objectives and Strategies	• Middlesex Natural Heritage Systems Study (UTRCA 2014). • Dorchester Corridor Watershed Report Card (UTRCA 2017). • Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2 (Henson and Brodribb 2005). • Great Lakes Conservation Blueprint for Aquatic Biodiversity, Volume 2 (Phair et al. 2005)

2.2 Site Assessments and Surveys

The acquired background information per **Table 1** helped direct several site assessments and surveys carried out by Terrastory staff (T. Knight). Additional site assessments and surveys were undertaken within the Southern Woodlot by others (MTE Engineering) as commissioned and

coordinated directly by the Applicant. **Table 2** below indicates the primary assessments/surveys performed during each site visit, weather conditions, and time on-site.

Table 2. Site Assessments and Ecological Surveys performed within the Subject Property.

Date	Assessments/Surveys Performed	Company (Staff)	Weather Conditions	Time On-site
24 May 2019	Site reconnaissance, stick nest survey, breeding bird survey #1, spring vascular plant survey.	Terrastory (T. Knight)	Air temperature 11-19°C, Beaufort wind 0-3; cloud cover 0-80%, no precipitation.	7:15-12:30
1 July 2019	Breeding bird survey #2, summer vascular plant survey, Ecological Land Classification.	Terrastory (T. Knight)	Air temperature 16-18°C, Beaufort wind 0-1; cloud cover 0-10%, no precipitation.	7:15-11:30
9 August 2019	Ecological Land Classification, late-summer vascular plant survey, natural feature delineation.	Terrastory (T. Knight)	Clear, hot.	9:30-15:00
27 September 2019	Vascular plant survey.	MTE ("WH"?)	n/a	n/a
18 November 2019	Bat maternity roost assessment.	MTE ("E.B., L.M.")	n/a	n/a
16 May 2020	Review of standing water conditions in the Northern Woodlot.	Terrastory (T. Knight)	Clear, warm.	13:30
5-19 June 2020	Bat acoustic monitoring (Southern Woodlot only).	MTE (H. Arsenault)	n/a	n/a
"August 2020"	American Ginseng survey.	MTE (L. McKay, ?)	n/a	n/a

The site assessments and surveys centred on characterizing the land use (e.g., historical development patterns, existing built features, land maintenance, etc.), physiographic (e.g., topography, drainage, surface water features, etc.), and ecological (e.g., vegetation, wildlife, habitats, etc.) conditions and features of the Subject Property and (where appropriate) Adjacent Lands. All land-use, physiographic, and ecological information described for Adjacent Lands was collected from either current aerial photographs or observations from inside the Subject Property and/or publicly-accessible areas (e.g., rights-of-way, etc.). The locations and boundaries of significant natural features and/or habitats were recorded on-site with a high-accuracy GPS (Mesa II) supported by representative photographs.

In addition to collecting general biophysical information, the following targeted assessments (i.e., feature- or species-specific surveys) were undertaken:

- **Vegetation Mapping according to Ecological Land Classification (ELC)**: Vegetation communities on the Subject Property were characterized and mapped according to Ecological Land Classification (Lee et al. 1998) and the 2008 update to the Vegetation Type List (Lee 2008). Vegetation communities were initially identified based on current aerial photographs and then verified and refined (as necessary) on-site. ELC mapping was scaled to the finest level of resolution deemed appropriate (i.e., either Ecosite or Vegetation Type). Vegetation communities mapped on Adjacent Lands were delineated predominantly via aerial photograph interpretation.
- **Wetland Boundaries:** Where wetlands were identified via ELC, their boundaries were delineated consistent with the "50% wetland vegetation rule" and presence of hydric soils per the procedures of the Ontario Wetland Evaluation System (OWES) (OMNRF 2014). All wetlands mapped on Adjacent Lands were delineated via aerial photograph interpretation.
- **Vascular Plant Survey:** Vascular plants were recorded based on a comprehensive area search ("wandering transects") within naturally-occurring (i.e., non-planted) or naturalizing areas of vegetation. Particular effort was paid to areas with the greatest potential to support significant vascular plants (i.e., designated Species at Risk, provincially rare, etc.) and areas with the greatest potential for impact based on the proposed development plan. Nomenclature and common names for the recorded vascular plant species are generally consistent with the Southern Ontario Vascular Plant Species List (Bradley 2013) except where a name change has more recently been adopted by NHIC.
- **Breeding Bird Surveys according to the Ontario Breeding Bird Atlas Protocol:** Two rounds of breeding bird surveys were conducted in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al. 2001). Surveys occurred within the appropriate season (May 24–July 10), time of day (between dawn and approximately 5 hours after dawn), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). While the OBBA protocol recommends that stations be situated at least 300 m apart (to avoid double counting), the stations established herein were often closer together to ensure more comprehensive survey coverage. Surveys occurred for a minimum duration of 10 minutes at each station.
- **Bat Roosting Habitat Assessment and Ultrasonic Acoustic Monitoring:** A targeted bat habitat survey within the Southern Woodlot focusing on identifying candidate maternity roost sites was undertaken by others (MTE) in fall 2019. Ultrasonic acoustic monitors were also deployed by others in 2020 to document the local bat community. Terrastory requested but has not received the raw data files associated with bat ultrasonic monitoring by others.

2.3 Significance Assessment

2.3.1 Definitions and Criteria

"Significant natural features" as described herein represent natural features and habitats that have recognized status (and therefore policy significance) within the planning jurisdiction in which an application is proposed. Significant natural features are defined herein to include those outlined in the Natural Environment Report Standards policy document (No. A.R. 2.01.07; OMNR 2006), namely:

- Significant Wetlands;
- Habitat of Endangered and Threatened Species;
- Significant Areas of Natural and Scientific Interest (ANSIs);

- Significant Woodlands (south and east of the Canadian Shield);
- Significant Valleylands (south and east of the Canadian Shield);
- Significant Wildlife Habitat (SWH); and
- Fish Habitat

It is noted that the County OP provides provisions that consider and/or protect additional natural features beyond the requirements of the ARA Provincial Standards. The potential presence of these regionally significant features are outlined in section 2.2.1.1 of the County OP and include:

- Natural Hazards (e.g., steep slopes, unstable soils, fill regulated areas);
- Natural Environment Areas (e.g., floodplains, flood regulated watercourses, wetlands);
- Natural Heritage Features (e.g., significant woodlands, wildlife habitat, aquatic ecosystems, river, stream, ravines, and upland corridors, ANSIs, etc.); and
- Groundwater Features (e.g., recharge areas, discharge/headwater areas, well-head protection areas).

Criteria used to determine the presence or absence of the above significant natural features within the Study Area were considered from a variety of sources including the Natural Heritage Reference Manual (MNR 2010a) and (for Significant Wildlife Habitat) the Ecoregion 7E Criteria Schedule (MNRF 2015).

Like significant natural features, "significant species" represent individuals of wild species which have recognized status (and therefore policy significance) within the planning jurisdiction in which an application is proposed. Significant species are defined herein to include:

- Species designated Endangered, Threatened, or Special Concern under O. Reg. 230/08 pursuant to the provincial *Endangered Species Act, 2007*.
- Species designated Provincially Rare (i.e., S1, S2, or S3) by NHIC.
- Species considered Regionally Rare in Middlesex County pursuant to the *List of the Vascular Plants of Ontario's Carolinian Zone* (Oldham 2017).

2.3.2 Determination

After collecting the background biophysical information and conducting the site assessments the data was interpreted to determine whether any significant natural features and/or significant species occur within the Study Area. If a natural feature or species met the significance criteria, it is considered "confirmed". If a natural feature or species may be present within the Study Area and/or Adjacent Lands given the prevailing biophysical or habitat conditions but was not confirmed based on either background or site-specific biophysical data, it is considered potential or "candidate". Candidate significant natural features and species are treated as confirmed where no additional information is available.

2.4 Effects Assessment and Mitigation

The potential ecological effects of an application can be understood spatially as zones that radiate outward from the direct project footprint (e.g., building envelope, etc.) and associated areas of site

alteration (e.g., grading, etc.). While the greatest potential for effects typically occurs within areas directly subject to development or disturbance, surrounding areas may also be affected indirectly. Such indirect effects can include light or noise pollution that affects wildlife communities on Adjacent Lands, or degradation of water quality within a downstream receptor resulting from sediment runoff during extraction.

The following five-pronged approach is employed herein to assess the effects of an application on significant natural features and species and (where warranted) the natural environment in general:

1. **Scope** the effects assessment to environmental components that warrant consideration. The effects assessment herein centres principally on significant natural features and species (i.e., those that have policy significance within the planning jurisdiction, as defined in **Section 2.3**) but may also consider general environmental effects where warranted.
2. **Identify the predicted direct and indirect effects** of the application on each significant natural feature or species during all project stages (i.e., pre- to -post-development) in the absence of mitigation. Direct effects are those where there is a cause-effect relationship between a proposed activity and an effect on a natural feature or species (e.g., tree clearance within a building footprint, etc.). Indirect effects result when an activity is linked to a direct effect through a chain of foreseeable interactions or steps.
3. **Evaluate the significance** of the predicted effects for each environmental component based on their attributes (i.e., spatial extent, magnitude, timing, frequency, and duration) and likelihood (i.e., high, medium, low).
4. Where the potential for negative effects are anticipated, **recommend ecologically-meaningful mitigation measures** to avoid such impacts first (where possible), and where impacts cannot be avoided to minimize, compensate, and/or enhance as appropriate.
5. **Identify the predicted residual or net effect**s of the application assuming implementation of all recommended mitigation measures.

Per step 4, mitigation measures are offered where the potential for negative effects are anticipated to a degree that cannot be supported given the prevailing policy context. Whenever possible, Terrastory works iteratively with the project team as a means to identify extraction options that avoid negative effects first; options that would minimize or mitigate such negative effects are less preferred and considered secondarily. In general, avoidance measures that have already been incorporated into the application or project design are not duplicated as technical recommendations herein. The Site Plans (phasing, operations, and rehabilitation) are described in **Section 5** while the effects assessment and recommended mitigation measures are provided in **Section 6**.

2.5 Natural Heritage Policy Context

There is an overlapping municipal, provincial, and federal policy framework respecting the protection of natural heritage features and areas across southern Ontario. These requirements include objectives, policies, and directives which are principally contained in federal and provincial statutes, regulations, policy statements, Official Plans, and guidance documents. The overarching natural heritage policy framework directing development activities within the Subject Property is outlined below in **Table 3**. A determination of whether the applications considered herein address such policies is provided in **Section 7**.

Table 3. Applicable Natural Heritage Policies.

Level of Government	Natural Heritage or Environmental Policy Requirements
Municipal	Municipality of Thames Centre Official Plan (October 2020 consolidation). County of Middlesex Official Plan (2006 consolidation).
Provincial	*Aggregate Resources Act* (ARA), R.S.O. 1990, c. A.8, including • Ontario Regulation 244/97 – General • Provincial Standards of Ontario – Category 1, Class A Pit Below Water • Natural Environment Report Standards (A.R. 2.01.07) Provincial Policy Statement 2020, pursuant to the *Planning Act*, R.S.O. 1990, c. P.13, including: • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005 (MNR 2010a). • Significant Wildlife Habitat Technical Guide (MNR 2010b). • Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (MNRF 2015) • Significant Wildlife Habitat Mitigation Support Tool (MNRF 2014). *Endangered Species Act* (ESA), S.O. 2007, c. 6, including: • Ontario Regulation 230/08 – Species at Risk in Ontario List. • Ontario Regulation 242/08 – General. *Fish and Wildlife Conservation Act,* S.O. 1997, c. 41.
Federal	*Fisheries Act*, R.S.C. 1985, c. F-14, including: • Fish and Fish Habitat Protection Policy Statement (DFO 2019). *Migratory Birds Convention Act*, S.C. 1994, c. 22, including: • Migratory Birds Regulations, C.R.C., c. 1035.

3 EXISTING BIOPHYSICAL CONDITIONS

The following is a description of the biophysical features and conditions of the Site, which are shown spatially on **Figure 2**. Representative photographs are provided in **Appendix 2**.

3.1 Land-use and Landscape Setting

The Site is situated in a rural setting with a mixture of land-uses and land cover classes including agricultural fields (mostly cash crops), woodlots, and aggregate extraction areas. The communities of Dorchester (Thames Centre) and Thamesford (Zorra) occur to the southwest and northeast, respectively.

3.2 Physical Setting

3.2.1 Bedrock Geology and Groundwater Resources

The bedrock underlying the Subject Property is characterized as Devonian-aged (i.e., 458 to 470 million-year-old) fossiliferous limestone and minor dolostone associated with the Dundee Formation (Armstrong and Dodge 2007). In Ontario, the Dundee Formation subcrops (i.e., acts as the stratigraphic unit closest to the ground surface) from Long Point to the shoreline of Lake Huron across most of Huron County. Bedrock was not encountered at the Site in any borehole advanced as

part of the Hydrogeological Assessment (LDS Consultants Inc.) but is expected to be at an elevation of approximately 250-260 metres above sea level (masl), or roughly 25 m in depth, based on bedrock topography mapping.

3.2.2 Surficial Geology and Groundwater Resources

The Site is situated within the Oxford Till Plain physiographic region (Chapman and Putnam 1984) and overlaps with several surficial deposits (Ontario Geological Survey 2010). An area of ice-contact stratified gravel (with some sand, silt, and till) is mapped from the southern portion of the Subject Property. These deposits are of glaciofluvial origin. The central and northern portion of the Subject Property contains sand, silt, and clay deposits of glaciolacustrine origin which were laid down in a foreshore/basin environment beneath a glacial lake. A soils assessment in association with Ecological Land Classification vegetation mapping (see **Section 3.3.1**) confirmed the preponderance of sandy silt substrate in the Northern Woodlot area. A small portion of the northeast corner of the Subject Property is mapped as organic deposits associated with a wetland environment.

Boreholes advanced in support of the Hydrogeological Assessment revealed the preponderance of surficial till across the Subject Property. Till depth ranges in height from 1 m below the ground surface (BGS) at BH6 to 4 m BGS at BH2.

Based on the results of the Hydrological Assessment, a shallow groundwater aquifer was encountered and is generally characterized as unconfined due to the limited thickness and variable permeability of the overburden silt. The shallow groundwater aquifer generally flows in a southerly direction throughout the Site towards the excavated pit pond on Adjacent Lands to the south. Additional aquifers identified include an intermediate confined overburden aquifer (contained within outwash sands and gravel beneath underlying till) and a bedrock aquifer contained in the shale or limestone bedrock at a depth of 25 m or more.

3.2.3 Topography, Drainage, and Surface Water Features

The Subject Property contains gently rolling topography and is situated between approximately 276-281 masl, with overall relief of 5 m. The 280-281 masl contour is associated with a slope crest situated in the southcentral and southeastern portions of the Subject Property. The 276 masl contour is associated with a lowland swamp within the Northern Woodlot.

An area of discrete surface water drainage flows westward through a swamp (see **Section 3.3.1**) in the Northern Woodlot. Surface drainage enters the Northern Woodlot via a 525 mm wide corrugated plastic culvert at Hunt Road, flows diffusely westward through the swamp, and exits the Subject Property via another corrugated plastic culvert beneath Gore Road. This drainage is not mapped as a distinct surface water feature within publicly-available aquatic resource or watercourse mapping. Following conveyance northward beneath Gore Road, the drainage enters the Norsworthy Drain and then flows westward for just over 2 kilometres before discharging into the Caddy Creek Municipal Drain east of Elgin Road.

The overall direction of surface runoff within the Site is indicated on **Figure 2** based on existing topographic information. There is an absence of significant surface erosion or swales within the agricultural portions of the Site, indicating that stormwater runoff likely tends to sheet flow off-site or is absorbed into the surficial soils.

3.3 Ecological Setting

3.3.1 Vegetation Communities

Vegetation communities overlapping with the Northern Woodlot, Southern Woodlot, and Adjacent Lands are described below and mapped in **Figure 2**.

3.3.1.1 Northern Woodlot

The Northern Woodlot contains a variety of upland and wetland vegetation communities. The central portion of the Northern Woodlot contains deciduous swamp (SWDM4) dominated by Freeman's Maple (*Acer x freemanii*) with abundant Hybrid Crack Willow (*Salix x fragilis*). Portions of this community were observed to contain expansive standing water in the spring (see Photographs 9 and 10 in **Appendix 2**), which had dried out by mid-summer in 2019 (see Photograph 12 in **Appendix 2**). Eastern White Cedar (*Thuja occidentalis*), Green Ash (*Fraxinus pennsylvanica*), and White Elm (*Ulmus americana*) are occasional in this community and restricted to areas with less depth and duration of standing water. Thicket areas with dense Spicebush (*Lindera benzoin*) occur in places, while the herbaceous flora consists of Virginia Wild Rye (*Elymus virginiana*), Skunk Cabbage (*Symplocarpus foetidus*), and Fowl Meadow Grass (*Glyceria striata*). Marsh Marigold (*Caltha palustris*) is abundant in the western portion of the swamp in spring (see Photograph 10 in **Appendix 2**). Abutting the deciduous swamp is a meadow marsh (MAMM1-3) dominated by Reed-canary Grass (*Phalaris arundinacea*) with occasional Spotted Joe-pye Weed (*Eutrochium maculatum*), Wild Black Currant (*Ribes americanum*), Ostrich Fern (*Matteucia struthiopteris*), Fowl Meadow Grass, and Skunk Cabbage (see Photograph 12 in **Appendix 2**). As described in **Section 3.2.2**, surface water is conveyed to the deciduous swamp and meadow marsh from other identified wetlands to the east via a culvert beneath Hunt Road.

While surface water inputs to the wetland were confirmed during the 2019/2020 site assessments (based on visible flow entering and exiting the wetland via culverts at Hunt Road and Gore Road, respectively), this feature may also be supported by seasonal groundwater inputs. Monitoring well BH1 was situated in proximity to the Northern Woodlot at a ground surface elevation of 275.26 m based on the Hydrogeological Assessment (LDS Consultants Inc). The groundwater elevation within BH1 was found to be 0.15 m BGS on 5 March 2020. The ground surface elevation of the western portions of the deciduous swamp are around or slightly below the elevation of BH1, suggesting that the water table in the wetland was elevated and near (or at) the ground surface at this time. This indicates that at least a portion of the wetland in the Northern Woodlot may be supported by seasonal groundwater inputs (in addition to surface water inputs).

Upland forest/woodland communities occur on either side of the wetlands in the Northern Woodlot. The southwest corner consists of deciduous forest (FODM4) dominated by Sugar Maple (*Acer saccharum*) with lesser amounts of Black Cherry (*Prunus serotina*), Black Walnut (*Juglans nigra*), Red Oak (*Quercus rubra*), and Eastern White Pine (*Pinus strobus*). The shrub layer contains Choke Cherry (*Prunus virginiana*), Prickly Gooseberry (*Ribes cynosbati*), and regenerating White Ash (*Fraxinus americana*). The herbaceous layer contains Enchanter's Nightshade (*Circaea canadensis*), Virginia Creeper (*Parthenocissus quinquefolia*), and Jack-in-the-Pulpit (*Arisaema triphyllum*). The soils in this community were assessed as sandy silt. North of the wetland is a moist, open woodland (WODM5) dominated by Black Walnut with American Basswood (*Tilia americana*) and European Buckthorn (*Rhamnus cathartica*). Ostrich Fern, White Avens (*Geum canadense*), Rough-leaved Goldenrod (*Solidago rugosa*) are also common. East of the open woodland is a deciduous forest (FODM7) dominated by American Basswood with several associates including Black Walnut, Bitternut Hickory (*Carya*

cordiformis), Hackberry (*Celtis occidentalis*), and Glossy Buckthorn (*Frangula alnus*). A small, moist meadow dominated by Tall Goldenrod (*Solidago altissima*), Kentucky Bluegrass (*Poa pratensis*), Redtop (*Agrostis gigantea*), Panicled Aster (*Symphyotrichum lanceolatum*), and Dudley's Rush (*Juncus dudleyi*) abuts the southeast corner of the Northern Woodlot along Hunt Road.

3.3.1.2 Southern Woodlot

The Southern Woodlot consists of a mature deciduous woodland (FODM5-9) dominated by Sugar Maple. Black Cherry (*Prunus serotina*), Ironwood (*Ostrya virginiana*), Bitternut Hickory (*Carya cordiformis*), and American Basswood are secondary associates, while Choke Cherry and European Buckthorn are the most commonly encountered shrubs. The extreme northern section of the forest contains dense carpets of Garlic Mustard (*Alliaria petiolata*), while the southerly areas contain a rich spring ephemeral flora including Wild Ginger (*Arisaema triphyllum*), Blue Cohosh (*Caulophyllum giganteum*), and Wild Leek (*Allium tricoccum*). The sedge flora is diverse and includes James' Sedge (*Carex jamesii*), Hitchcock's Sedge (*Carex hitchcockiana*), White Bear Sedge (*Carex albursina*), and Wood's Sedge (*Carex woodii*). The assemblage of summer herbaceous flora consists of Zig-zag Goldenrod (*Solidago flexicaulis*), Enchanter's Nightshade (*Circaea canadensis*), Herb Robert (*Geranium robertianum*), and Virginia Waterleaf (*Hydrophyllum virginianum*). The Southern Woodlot appears to have been recently logged and contains an old shed (use unknown; see Photograph 7 in **Appendix 2**).

A fencerow (TAGM5) extends northward from the Southern Woodlot along the western boundary of the Subject Property. This community contains a variety of deciduous tree species including Manitoba Maple (*Acer negundo*), Freeman's Maple, Black Cherry, and Hackberry.

3.3.1.3 Adjacent Lands

Wetlands associated with the Provincially Significant North Dorchester Swamp (UT 24) occur on the north side of Gore Road. Minor updates to the wetland mapping based on aerial photograph interpretation are shown on **Figure 2**. Additional identified wetlands occur east of Hunt Road (both north and south of Gore Road). West and south of the Subject Property are lands that are currently (or formerly) used for aggregate extraction. The remaining Adjacent Lands are under agricultural uses.

3.3.2 Vascular Plants

A total of 231 vascular plant species were recorded within the Subject Property (see **Appendix 3**). No provincially rare or species at risk vascular plants were documented. James' Sedge (*Carex jamesii*) was documented by Terrastory in the Southern Woodlot in several locations and while considered "Uncommon" in Middlesex County is rare across the Carolinian Zone (Oldham 2017).

3.3.3 Breeding Birds

Breeding bird surveys were undertaken at five (5) stations on 24 May and 1 July 2019. A total of 41 bird species were recorded during the breeding bird surveys. One (1) additional bird species (Yellow-billed Cuckoo) was recorded incidentally during the course of other field activities (i.e., August 2019 site assessment). The assemblage and abundance of birds recorded generally reflects the prevailing structure and composition of on-site vegetation communities and variable habitats of the Study Area (e.g., forest, woodland, treed swamp, fencerow, tilled agricultural fields, etc.). The locations of each survey station are shown on **Figure 2** while the full survey results indicating each species' breeding status by survey station can be found in **Appendix 4**. The locations of significant bird species

recorded are shown on **Figure 2**. A general summary of the breeding bird communities present within the Study Area is provided below.

Station BB-1 was situated to capture breeding birds in the Southern Woodlot. Bird species considered confirmed or probable breeders in the Southern Woodlot include (amongst others) American Robin (*Turdus migratorius*), Brown-headed Cowbird (*Molothrus ater*), Eastern Wood-pewee (*Contopus virens*), Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*), Warbling Vireo (*Vireo gilvus*), and Yellow Warbler (*Setophaga petechia*). Stations BB-2 and BB-5 focused on the agricultural fields (including their treed margins) and Adjacent Lands. Birds documented as probable breeders at these stations include (amongst others) American Goldfinch (*Spinus tristis*), American Robin, Brown-headed Cowbird, European Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), Killdeer (*Charadrius vociferus*), Red-winged Blackbird, Savannah Sparrow (*Passerculus sandwichensis*), and Song Sparrow. Stations BB-3 and BB-4 focused on the Northern Woodlot. Birds documented as probable breeders at these stations include (amongst others) American Goldfinch, American Robin, Baltimore Oriole (*Icterus galbula*), Common Yellowthroat (*Geothlypis trichas*), Grey Catbird (*Dumetella carolinensis*), Indigo Bunting (*Passerina cyanea*) Red-winged Blackbird, Song Sparrow, and Warbling Vireo.

Four (4) significant bird species were recorded during the targeted breeding bird surveys: Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*), Eastern Meadowlark (*Sturnella magna*), and Eastern Wood-pewee. All documented locations of these species within the Study Area along with their habitat requirements are described in **Section 4.3**.

3.3.4 Bats

Ultrasonic acoustic monitoring for bats was undertaken in the Southern Woodlot by others (see **Table 1**) through coordination directly with the Applicant. It is understood that one (1) unit was deployed from 5-19 June (exact location unknown) resulting in a total of 71 passes of Little Brown Myotis (*Myotis lucifugus*) over 12 of the 14 nights, and 3 passes of Northern Myotis (*Myotis septentrionalis*) over 2 of 14 nights. Terrastory notes that distinguishing between *Myotis* species based on spectral signatures alone is often not possible given significant overlap. It is further understood that a total of 1630 bat vocalizations ("passes") were recorded during the survey period; however, Terrastory has not received any raw data files which would permit assigning each recording to a particular bat species.

4 SIGNIFICANCE ASSESSMENT

Based on the biophysical information collected during background information gathering (per **Table 1**) and the results of the site assessments and surveys (per **Sections 2.2** and **3**), **Table 4** below provides a determination of the presence (or potential presence) of each significant natural feature considered herein. Shaded rows denote features which were confirmed or may be present within the Subject Property or Adjacent Lands and are considered further as part of the effects assessment in **Section 5**. Significant natural feature mapping is provided in **Figure 3**.

Table 4. Summary of the Assessment of Significant Natural Features within the Subject Property and Adjacent Lands.

Significant Natural Feature	Status on the Subject Property	Status on Adjacent Lands (i.e., < 120 m from the Subject Property)
Significant Natural Features per ARA Provincial Standards		
Significant Wetlands	**Absent**. See **Section 4.1.**	**Present**. See **Section 4.1.**
Significant Woodlands	**Present**. See **Section 4.2.**	**Present**. See **Section 4.2.**
Significant Valleylands	**Absent**.	**Absent**.
Significant Wildlife Habitat	**Confirmed/Candidate**. See **Section 4.3.**	**Candidate**. See **Section 4.3.**
Significant Areas of Natural and Scientific Interest	**Absent**.	**Absent**.
Habitat of Endangered and Threatened Species (per ESA)	**Present**. See **Section 4.4.**	**Present**. See **Section 4.4.**
Fish Habitat (per *Fisheries Act*)	**Absent**. See **Section 4.5.**	**Candidate**. See **Section 4.5.**
County Natural System (certain components not considered by ARA Provincial Standards)		
Natural Hazards, Natural Environment Areas, Natural Heritage Features, Groundwater Features	**Confirmed**. See **Section 4.6.**	**Confirmed**. See **Section 4.6.**

4.1 Identified and Provincially Significant Wetlands

Identified wetlands are present within the Northern Woodlot including deciduous swamp and meadow marsh communities (see **Section 3.3.1**). Neither of these wetlands have been evaluated pursuant to the Ontario Wetland Evaluation System (OWES). While the identified/unevaluated wetlands are not considered significant natural features per the ARA Provincial Standards, they contain candidate Significant Wildlife Habitat (SWH; see **Section 4.3**) and form part of the County Natural System. Wetland units associated with the Provincially Significant North Dorchester Swamp (UT 24) occur on the north side of Gore Road. Additional identified wetlands also occur on Adjacent Lands east of Hunt Road (Township of Zorra).

An assessment of potential effects to identified and significant wetlands associated with the proposed pit operations plan is provided in **Section 6.1**.

4.2 Significant Woodlands

The Northern Woodlot is a designated Significant Woodland per Schedule C of the County's OP. The dripline associated with the Northern Woodlot is shown on **Figure 3**. The Southern Woodlot is not mapped as a Significant Woodland per the Municipality's or County's OP Schedules and does not contain interior habitat (maximum width from dripline to dripline is approximately 130 m).

An assessment of potential effects to the Significant Woodland in the Northern Woodlot associated with the proposed pit operations plan is provided in **Section 6.2**.

4.3 Significant Wildlife Habitat

An assessment of the likelihood that any candidate or confirmed SWH features or areas occur within the Subject Property or Adjacent Lands is provided in **Appendix 5**. Based on the results of this assessment, six (6) SWH features are considered further through this study:

- Seasonal Concentration Areas of Animals
    1. Bat Maternity Colonies
    2. Reptile Hibernaculum
- Rare Vegetation Communities or Specialized Habitats for Wildlife
    3. Amphibian Breeding Habitat (Woodlands)
- Habitat of Species of Conservation Concern
    4. Terrestrial Crayfish
    5. Special Concern and Rare Wildlife Species
- Animal Movement Corridors
    6. Amphibian Movement Corridors

Also based on this assessment, a total of three (3) Special Concern or provincially rare species are considered to have a possible likelihood of occurrence on the Subject Property (or were confirmed) given their habitat associations and current distribution in southern Ontario:

1) Eastern Wood-pewee (*Contopus virens*)
2) Monarch (*Danaus plexippus*)
3) Yellow-banded Bumblebee (*Bombus terricola*)

A general description of each SWH type and Special Concern/provincially rare species and their habitat within the Site is offered below. An assessment of potential effects to the candidate/confirmed SWH type and Special Concern/provincially rare species associated with the proposed pit operations plan is provided in **Section 6.3**.

4.3.1 Bat Maternity Colonies

Big Brown Bat (*Eptesicus fuscus*) and Silver-haired Bat (*Lasionycteris noctivagans*) form maternity colonies that roost with pups in various features, particularly cracks, cavities, or loose bark associated with large-diameter trees (≥25 cm diameter at breast height), snags, and buildings. Snags/cavity trees in earlier stages of decay (i.e., decay classes 1-3) may be preferred.

Ultrasonic acoustic monitoring for bats was undertaken in the Southern Woodlot by others (see **Table 1**) through coordination directly with the Applicant. Terrastory requested but has not received any raw data files associated with the ultrasonic acoustic monitoring; however, it is known that 1630 bat recordings ("passes") were made during the survey period. The Northern Woodlot was not surveyed for bats and contains candidate significant habitat for bat maternity colonies.

4.3.2 Reptile Hibernaculum

Snakes in Ontario hibernate in areas which provide access below the frost line or that do not freeze during winter. A wide array of features may function as snake hibernacula, including natural (e.g., small mammal burrows, crevices in bedrock, etc.) and human-built (e.g., rock piles, old stone foundations, etc.) features. Survey methodologies for confirming snake use of a potential hibernacula typically involve spring or (less preferred) fall surveys to identify congregations of snakes

near their point of exit or emergence from a hibernaculum; however, such surveys may still produce a false negative (i.e., fail to successfully identify hibernacula) given the camouflaged, cryptic nature of snakes and variability in emergence/exit dates.

While it is recognized that snakes may hibernate in non-descript features (i.e., small mammal burrows), the Site lacks features that have a high potential to support significant congregations of overwintering snakes.

4.3.3 Amphibian Breeding Habitats (Wetlands and Woodlands) and Movement Corridors

Wetland communities in the Northern Woodlot may provide breeding habitat for early-season breeding Anurans, particularly Spring Peeper (*Pseudacris crucifer*), Western Chorus Frog (*Pseudacris triseriata*), and Wood Frog (*Lithobates sylvaticus*). Although it is possible that the extent of standing water in spring is not of a sufficient depth and duration to support successful amphibian breeding (i.e., egg laying, tadpole development, etc.) under average weather conditions, Anuran calling surveys were not undertaken as part of this study to confirm the presence or absence of this SWH type. As such, both wetland communities in the Northern Woodlot are considered candidate significant habitat for breeding amphibians.

4.3.4 Terrestrial Crayfish

Historically, terrestrial (or "burrowing") crayfish in Ontario have been referred to two species: Digger Crayfish (*Creaserinus fodiens*) and Devil Crayfish (*Lacunicambarus diogenes*). These species are considered primary burrowers and spend most of their lives underground. A third species – Calico Crayfish (*Faxonius immunis*) – is a secondary burrower which may only dig burrows to escape drying waterbodies. A fourth species – Paintedhand Mudbag (*Lacunicambarus polychromatus*) – was recently documented at three sites in the Windsor area (Jones and Glon 2019).

Terrestrial crayfish excavate burrows in areas of moist/wet soil with a high water table such as marshes, wet meadows, and even manicured lawn. The burrows are flooded by groundwater and open to the ground surface by a "chimney" consisting of rounded soil pellets. Burrows produced from clay often exhibit the definitive chimney structure while those excavated from organic substrate (i.e., peat) may appear as a circular collapsed mound.

One (1) terrestrial crayfish chimney was recorded at the interface of the agricultural field and meadow marsh in the Northern Woodlot (see **Figure 3** and Photograph 16 in **Appendix 2**). The terrestrial crayfish species responsible for excavating the chimney is unknown as no individuals were observed.

4.3.5 Eastern Wood-pewee

Eastern Wood-pewee is designated Special Concern in Ontario per O. Reg. 230/08 pursuant to the *Endangered Species Act* (ESA) and is federally designated Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This species is most commonly associated with relatively open, deciduous and mixed forests of various sizes, as well as forest edges and other areas with relatively continuous canopy cover (e.g., parks, cemeteries, etc.). This species' preference for open forests and forest edges may be attributed to its aerial foraging behaviour (COSEWIC 2012). Territory sizes were shown to average approximately 1.75 ha (representing a circle with a radius of 75 m) in a study in southern Ontario (as cited in COSEWIC 2012).

Eastern Wood-pewee was documented as a probable breeder at BB-1 in the Southern Woodlot.

4.3.6 Monarch

Monarch is designated Special Concern in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Endangered by COSEWIC. Monarch is well-known to be host-specific and oviposits exclusively on species of milkweed (*Asclepias* spp.). This species is a generalist forager and may nectar in any area with wildflowers.

Monarch was observed within the Site and is expected to be relatively common in the wider landscape. While no confirmed breeding via observations of ovipositing individuals, eggs, or caterpillars was documented, the presence of Common Milkweed (*Asclepias syriaca*) indicates that Monarch may breed within the Site.

4.3.7 Yellow-banded Bumble Bee

Yellow-banded Bumble Bee is designated Special Concern in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Special Concern by COSEWIC. This species occupies a range of open areas that contain nectaring sites and nests underground in abandoned rodent burrows or decomposing logs, typically in woodlands.

Current records in southern Ontario suggest that this species is associated with more densely forested landscapes north of the Carolinian zone. Notwithstanding this, given that the Site provides potentially suitable nectaring, nesting, and overwintering habitat for this species, and bumble bee surveys were not undertaken as part of this study, the Site is assumed to contain suitable habitat for Yellow-banded Bumble Bee.

4.4 Habitat of Endangered and Threatened Species

An assessment of the likelihood that any Endangered and Threatened species or their habitats occur within the Subject Property or Adjacent Lands is provided in **Appendix 6**. A total of five (5) Endangered or Threatened species are considered to have a possible likelihood of occurrence on the Subject Property (or were confirmed) given their habitat associations and current distribution in southern Ontario:

1) Little Brown Myotis (*Myotis lucifugus*)
2) Northern Myotis (*Myotis septentrionalis*)
3) Barn Swallow (*Hirundo rustica*)
4) Bobolink (*Dolichonyx oryzivorus*)
5) Eastern Meadowlark (*Sturnella magna*)

A general description of each Endangered/Threatened species and their habitat is offered below. An assessment of potential effects to these Endangered/Threatened species associated with the proposed pit operations plan is provided in **Section 6.4**.

4.4.1 Myotis Bats

Little Brown Myotis and Northern Myotis are designated Endangered in Ontario per O. Reg. 230/08 pursuant to the ESA and are federally designated Endangered by COSEWIC. Both species form maternity colonies that roost in large-diameter trees with cracks, crevices, and/or exfoliating bark; Little Brown Myotis will also frequently roost in buildings (e.g., attics, barns, etc.). Individuals

(i.e., non-reproductive females and males) of both bat species may roost in smaller diameter trees and other spaces (e.g., beneath house siding, etc.) which are not occupied by maternity colonies. Overwintering habitat includes caves and mines that maintain temperatures above 0°C. White Nose Syndrome (a fungal disease caused by an introduced pathogen) has devastated populations of each species across their ranges. The fungus causes hibernating individuals to become dehydrated, leading to excessive arousal, depleted fat reserves, and ultimately emaciation and/or death.

Little Brown Myotis and Northern Myotis were documented in the Southern Woodlot via ultrasonic acoustic monitoring by others (the Northern Woodlot was not surveyed as it is proposed for protection through this application). It is understood that a total of 71 passes of Little Brown Myotis were recorded over 12 of the 14 survey nights, and 3 passes of Northern Myotis were recorded over 2 of 14 survey nights. Terrastory notes that distinguishing between *Myotis* species based on spectral signatures alone is often not possible given significant overlap.

4.4.2 Barn Swallow

Barn Swallow is designated Threatened in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Threatened by COSEWIC. Prior to European settlement Barn Swallow nested in or on natural features (e.g., caves, cliff faces, etc.); today most nesting is associated with built structures such as barns, bridge/culvert undersides, and awnings/overhangs on the sides of buildings (COSEWIC 2011a). Foraging habitat includes a variety of open areas such as agricultural lands, old fields, and open water. Foraging distances from nest sites depend on habitat quality and social characteristics, but have been found to extend greater than one (1) kilometre (Brown and Brown 1999) though may only average a few hundred metres for most forays (Turner 1981).

Barn Swallow was documented foraging over agricultural fields within the Subject Property at stations BB-2, BB-4, and BB-5. These individuals may be associated with breeding colonies that occupy barns west of the Subject Property and east of Hunt Road.

4.4.3 Bobolink and Eastern Meadowlark

Bobolink is designated Threatened in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Prior to European settlement this species may have been rare in Ontario and was likely restricted to tallgrass prairie habitats in the southwest. With widespread conversion of forests to forage crops, Bobolink's range shifted eastward with Ontario containing a significant portion of the current breeding population (COSEWIC 2010). This species is semi-colonial and nests in hayfields, pastures, meadows, grasslands, and prairies, particularly those with tall, dense vegetation, moderate litter depths, and very limited woody cover. While territory size has been found to range between 0.5 ha to 2.5 ha (with higher quality sites permitting smaller territories), Bobolink is well-recognized as area-sensitive and generally will not occupy habitat patches that are less than 4-10 ha (Dechant et al. 2001).

Eastern Meadowlark is also designated Threatened in Ontario federally designated Threatened by COSEWIC. Like Bobolink, Eastern Meadowlark may have been rare in southern Ontario prior to European settlement and was likely restricted to tallgrass prairie habitats in the southwest. While Eastern Meadowlark and Bobolink often occupy the same habitats and both are considered area-sensitive, Eastern Meadowlark has a greater tolerance for woody cover and may be found in fields with as much as 25% shrub cover (COSEWIC 2011b).

Both Bobolink and Eastern Meadowlark were documented in a hayfield on Adjacent Lands to the west. This field was rotated to oats in 2020 and likely did not provide suitable breeding habitat for these species during the 2020 breeding season.

4.5 Fish Habitat

The Norsworthy Drain is a Class F Municipal Drain flowing westward on the north side of Gore Road. While Class F drains are intermittent, they may provide direct (seasonal) fish habitat during periods of flow.

An assessment of potential effects to fish habitat associated with the proposed pit operations plan is provided in **Section 6.5**.

4.6 County Natural System

The Northern Woodlot is designated Significant Woodland per Schedule C of the County's OP. The Northern Woodlot also contains wetland (not currently mapped on provincial or municipal natural feature datasets). The presence of Significant Woodland and wetland indicates that the Northern Woodlot forms part of the County Natural System and is therefore subject to applicable policies outlined in section 2.2.1 of the County OP.

5 PHASING, OPERATIONS, AND REHABILITATION PLANS

Thames Valley Aggregates Inc. is applying for a new Category 1, Class A licence to facilitate below-water pit extraction within the Site. The ARA plans are provided in **Appendix 7**. The total area to be licensed, extracted, and rehabilitated is as follows:

- Total area to be licensed: 21.00 hectares
- Total area to be extracted: 16.30 hectares
- Total area to be rehabilitated: 16.30 hectares, plus 0.46 ha of reforestation outside the extraction area.

The operations plan consists of five phases of extraction (A-E) that proceed northward from a 0 m setback along the southern property boundary. Extraction within each of the designated three (3) Areas will generally occur as follows:

- Construct or upgrade the perimeter fencing.
- Remove trees and other vegetation within the Southern Woodlot, allowing salvage of large stumps and trees for habitat creation along the Northern Woodlot (Phase 1, Area 1 only).
- Strip topsoil and overburden separately and use to construct acoustic berms (or store for progressive rehabilitation).
- Commence above-water extraction, followed by below-water extraction.
- Continue/complete progressive rehabilitation in previously extracted Areas.

Upon completion of extraction (Phase E), areas below approximately ±273 masl will become permanently flooded encompassing 11.33 ha. The northern margins of the pit pond will be rehabilitated to wetland habitat through contouring (shallow nearshore slopes), shoreline plantings, and inclusion of woody debris and other structural elements. Additional native upland plantings are also identified on the Rehabilitation Plan.

6 EFFECTS ASSESSMENT AND MITIGATION

The purpose of this NER is to present a biophysical characterization of the Study Area as a means to identify the potential for adverse effects on the natural environment and natural heritage features stemming from the proposed pit extraction activities. Several significant natural features and species were documented (or may occur) within the Site pursuant to the assessments in **Section 4**. The following effects assessment provides an evaluation of the potential for the proposed pit application to result in negative effects to such environmental components and offers technical recommendations to mitigate such effects where warranted. Certain technical recommendations offered herein apply to several natural features and/or species simultaneously; as such, all technical recommendations should be read and considered in their entirety. The baseline or existing conditions against which the application is assessed are treated as the state of the Site at the time of the site assessments. The effects assessment herein is based on the Site Plans provided in **Appendix 7**.

All pits and quarries in Ontario are subject to a set of standards and conditions which are specific to the type of licence being applied for. The effects assessment herein assumes that all pit operations within the Site will be undertaken consistent with the Prescribed Conditions for Category 1, Class A licences and the Operational Standards which pertain to all licence categories. Such conditions and standards that have bearing on protection of the natural environment are not duplicated as technical recommendations herein as they already represent licence requirements. Relevant Prescribed Standards and Operational Standards include the following:

- Dust will be mitigated, and the use of dust suppressants will be applied to internal haul roads and processing areas as required (Prescribed Standard 3.1 and 3.2).
- A Spills Contingency Program will be developed prior to site preparation (Prescribed Standard 3.5).
- Fuel storage tanks will be installed and maintained according to the *Gasoline Handling Act* (Prescribed Standard 3.6).
- An Environmental Compliance Approval will be secured for water discharged off-site (Prescribed Standard 3.7).
- A Permit to Take Water will be secured if required (Prescribed Standard 3.9).
- Topsoil will be stripped sequentially prior to aggregate extraction (Operational Standard 5.4).
- Topsoil and overburden stripped during the operation will be stored separately with vegetated stable slopes (Operational Standard 5.6).
- Adequate vegetation will be established and maintained to control erosion of any berm or stockpile (Operational Standard 5.7).
- Scrap cannot be located within 30 m of any body of water and 30 metres from the boundary of the Site (Operational Standard 5.9).
- Excavation is to be set back 15 metres from the boundaries of the Site and 30 metres from any body of water that is not the result of excavation below the water table (Operational Standard 5.10).
- All excavation faces are to be stabilized to prevent erosion (Operational Standard 5.12).
- All stripped topsoil or overburden will be used in the rehabilitation of the Site (Operational Standard 5.17).

- Adequate vegetation is established and maintained to control erosion of any topsoil or overburden replaced for rehabilitation purposes (Operational Standard 5.18).
- Rehabilitation will ensure adequate drainage and vegetation is provided and any compaction is alleviated (Operational Standard 5.21).

Technical recommendations above and beyond the aforementioned conditions and standards are offered herein to avoid and/or minimize impacts to the significant natural features identified, particularly removal of the Southern Woodlot and protection of the Northern Woodlot. Certain technical recommendations apply to several natural features and/or species simultaneously; as such, all technical recommendations should be read and considered in their entirety. All technical recommendations offered herein are incorporated into the ARA Site Plans provided in **Appendix 7** while the recommended feature and habitat setbacks from the Northern Woodlot are also shown in **Figure 3**.

6.1 Identified and Provincially Significant Wetlands

Where development and/or site alteration activities are proposed adjacent to wetlands, adverse effects may occur via the following pathways:

- Alterations to surface water and/or groundwater contributions to the wetland from construction (e.g., dewatering, etc.), grading that modifies the existing topography or drainage, and/or increased coverage of impervious surfaces (e.g., roads, roofs, etc.);
- Increased sediment loadings and/or nutrient enrichment within the wetland via runoff exiting from development areas during and post construction. This may alter wetland water quality and vegetation communities via increased turbidity, eutrophication, contamination by toxic substances, changes in pH, etc.
- Noise and/or light pollution that may adversely affect the ability of wetland wildlife to successfully carry out their life processes (e.g., breeding, feeding, etc.); and
- Increased human activity (i.e., encroachment) within the wetland which may result in soil compaction, dumping, etc.

Terrastory worked closely and iteratively with the project team to define an ecologically appropriate extraction limit during preparation of the Site Plans. The extraction limit in the vicinity of the Northern Woodlot (and wetlands therein) incorporates the greater of the following two (2) setbacks:

- 15 m from the Significant Woodland dripline, or
- 30 m from the wetland boundary as delineated by Terrastory staff in 2019 in accordance with OWES protocols.

The extraction limit incorporated into the Site Plans (see **Appendix 7**) reflects the setbacks outlined above.

A detailed assessment of potential impacts to the shallow groundwater aquifer stemming from below-water pit extraction within the Site was undertaken through the Hydrological Assessment (LDS Consultants Inc.). The following potential impacts were identified:

- The removal of sand/gravel during below-water pit extraction may have short-duration localized effects on the groundwater elevation along the pond perimeter.

- Changes in the water budget of the Site may result from either 1) increases in evaporation from the pit pond (deficit) and/or 2) increased surface runoff into the pond (surplus).
- Permanent changes may result from an overall flattening of the groundwater elevation in the pit pond which will stabilize at the central range of groundwater elevations (±273 masl) present under existing conditions.
- Increases in groundwater temperature would be anticipated once the groundwater surface is exposed in the pit pond.

The results of the Hydrogeological Assessment suggest that the potential for adverse effects to the wetlands in the Northern Woodlot in association with alterations to the Site water balance or groundwater elevation would be negligible. Localized, short-duration groundwater elevation changes along the pond perimeter during early extraction were calculated to be less than 3 cm (recovering in 24 hours) and are less when the pond approaches its maximum size. Evapotranspiration losses from the pit pond are expected to be offset by greater runoff entering the pond, resulting in a small net gain to the groundwater system. The Hydrogeological Assessment further substantiates that "[*a*]*lterations to the Site within the extraction area and the creation of the pond are not expected to significantly alter the base flows which sustain the northern woodland and the wetland area contained there-in* (p. 33). As the groundwater flow direction is predominantly southward, any warming effects due to sun exposure in the pit pond would not be expected to adversely affect the wetland, which is upgradient.

The area between the dripline of the Northern Woodlot and extraction limit will be extensively planted per a Northern Woodlot Enhancement Plan (see **Section 6.6** and the Rehabilitation Plan) to address the removal of probable breeding habitat for Eastern Wood-pewee (see **Section 6.3**) and overlapping considerations related to loss of this mature woodland feature. Additional upland plantings are incorporated into the Rehabilitation Plans along the north side of the eventual pit pond which will further expand the limit of the Northern Woodlot southward. These plantings and enhancements will provide greater ecological function and buffering capacity to the Northern Woodlot between the extraction limit and wetlands to the north.

6.2 Significant Woodlands

Where development and/or site alteration activities are proposed within or adjacent to forests or woodlands, adverse effects may occur via the following pathways:

- Direct vegetation removal (e.g., trees, shrubs, herbaceous vegetation, etc.), resulting in loss of woodland area and functions (e.g., wildlife habitat, carbon sequestration, runoff attenuation, etc.).
- Mechanical injury to the trunk, roots, branches, and/or foliage of retained woody vegetation.
- Soil compaction from the use of heavy machinery.
- Smothering or exposure of roots due to changes in grade.
- Noise and/or light pollution that may adversely affect the ability of woodland wildlife to successfully carry out their life processes (e.g., breeding, feeding, etc.).
- Increased human activity (i.e., encroachment) within or adjacent to the woodland which may result in soil compaction, dumping, etc.

The Northern Woodlot is a designated Significant Woodland per Schedule C of the County's OP. The dripline associated with the Northern Woodlot is shown on **Figure 3**. The extraction limit in

the vicinity of the Northern Woodlot incorporates the greater of a 15 m setback from the dripline or 30 m setback from wetlands therein. The area between the dripline of the Northern Woodlot and extraction limit will be extensively planted per a Northern Woodlot Enhancement Plan (see **Section 6.6**) to address the removal of probable breeding habitat for Eastern Wood-pewee (see **Section 6.3**) and overlapping considerations related to loss of this mature woodland feature. This will increase the size of the Significant Woodland by >0.6 ha. Additional upland plantings are incorporated into the Rehabilitation Plans along the north side of the eventual pit pond which will further expand the limit of the Northern Woodlot southward.

6.3 Significant Wildlife Habitat

Per the assessment in **Section 4.3**, a total of six (6) SWH features were considered further through this study:

- Seasonal Concentration Areas of Animals
    1. Bat Maternity Colonies
    2. Reptile Hibernaculum
- Rare Vegetation Communities or Specialized Habitats for Wildlife
    3. Amphibian Breeding Habitat (Woodlands)
- Habitat of Species of Conservation Concern
    4. Terrestrial Crayfish
    5. Special Concern and Rare Wildlife Species
- Animal Movement Corridors
    6. Amphibian Movement Corridors

Also based on this assessment, a total of three (3) Special Concern or provincially rare species are considered to have a possible likelihood of occurrence on the Subject Property (or were confirmed) given their habitat associations and current distribution in southern Ontario:

1) Eastern Wood-pewee (*Contopus virens*)
2) Monarch (*Danaus plexippus*)
3) Yellow-banded Bumblebee (*Bombus terricola*)

All SWH types and Special Concern/provincially rare species associated with the Northern Woodlot will be adequately protected by recommended extraction limit setback. This includes candidate habitat for bat maternity colonies, candidate woodland Anuran breeding and movement habitats, and confirmed habitat for terrestrial crayfish.

No specific recommendations are offered herein to minimize impacts to potential foraging and breeding habitat for Monarch or Yellow-banded Bumblebee. Both species are habitat generalists and abundant nectaring habitat exists within the wider landscape surrounding the Subject Property. Oviposition sites for Monarch (e.g., Common Milkweed), overwintering habitat for Yellow-banded Bumblebee, and general nectaring habitat for both species is present within the wider local landscape.

Probable breeding habitat for Eastern Wood-pewee was documented in the Southern Woodlot, which is proposed for removal through this application. Terrastory has worked closely with the project team as part of preparation of the Site Plans to allow for replacement of Eastern Wood-pewee habitat along the southern margin of the Northern Woodlot through enhancement plantings

and other measures. Eastern Wood-pewee was not documented within the Northern Woodlot based on 2019 surveys; implementation of the Northern Woodlot Enhancement Plan would provide greater opportunities for occupation of this feature by this species during the breeding season over the long-term. Technical recommendations to compensate for loss of the Eastern Wood-pewee habitat in the Northern Woodlot are outlined in **Section 6.6**.

6.4 Habitat of Endangered and Threatened Species

Per the assessment in **Appendix 6**, a total of five (5) Endangered or Threatened species are considered to have a possible likelihood of occurrence on the Subject Property (or were confirmed) given their habitat associations and current distribution in southern Ontario:

1) Little Brown Myotis (*Myotis lucifugus*)
2) Northern Myotis (*Myotis septentrionalis*)
3) Barn Swallow (*Hirundo rustica*)
4) Bobolink (*Dolichonyx oryzivorus*)
5) Eastern Meadowlark (*Sturnella magna*)

No impacts to individuals or the habitat of Barn Swallow, Bobolink, or Eastern Meadowlark are anticipated through this application. All breeding sites/habitats for these species occur on Adjacent Lands at a sufficient distance from the limit of pit extraction.

An Information Gathering Form (IGF) was prepared and submitted to MECP in late August 2020 by others to ascertain whether removal of the Southern Woodlot would contravene section 10 of the *Endangered Species Act*. As noted in **Section 3.3.4**, it is understood that a total of 71 passes of Little Brown Myotis were recorded in the Southern Woodlot over 12 of the 14 survey nights, while 3 passes of Northern Myotis were recorded over 2 of the 14 survey nights. It is further understood that MECP has not yet confirmed whether or not the proposed removal of the Southern Woodlot would result in loss of habitat for Endangered *Myotis* bats (i.e., contravention of section 10) or if any specific mitigation measures will be requested through a Letter of Advice or other guidance. Confirmation that the proposed pit operations plan is consistent with the requirements of the ESA is necessary as part of the ARA and *Planning Act* application review process.

At a minimum, a timing restriction on tree removal within the Southern Woodlot is required to avoid potential impacts to roosting bats (including both individuals and maternity colonies). This recommendation is provided in **Section 6.6** below. To simplify the site plan requirements, the tree removal timing window combines both the principal bat activity period and bird nesting period (in Ecoregion 7E) to address the overlapping requirements of the *Migratory Birds Convention Act*.

6.5 Fish Habitat

Where development and/or site alteration activities are proposed adjacent to watercourses that support (or are assumed to support) fish and/or aquatic organisms, adverse effects may occur via the following pathways (amongst others):

- Alterations to surface water and/or groundwater contributions to the watercourse from construction (e.g., dewatering, etc.), grading that modifies the existing topography or drainage, and/or increased coverage of impervious surfaces (e.g., roads, roofs, etc.);

- Increased sediment loadings and/or nutrient enrichment within the watercourse via runoff exiting from development areas during and post construction. This may alter water quality and/or degrade habitat quality via increased turbidity, eutrophication, contamination by toxic substances, changes in pH, etc.
- Introduction of invasive species including aquatic organisms and aquatic plants.
- Increased human activity (i.e., encroachment) in the vicinity of the watercourse which may result in bank compaction, exploitation of fish, dumping, etc.

The Norsworthy Drain is a Class F Municipal Drain and may contain seasonal fish habitat. This feature is over 120 m from the limit of extraction. As the Hydrogeological Assessment (LDS Consultants Inc.) has confirmed no negative impacts to the wetland in the Northern Woodlot as part of the proposed pit operations, and this wetland outlets directly into the Norsworthy Drain, no impacts to fish habitat are anticipated to occur within (or downstream of) the Norsworthy Drain.

6.6 Natural Environment Technical Recommendations

The Southern Woodlot was found to contain the following significant characteristics/habitats:

- Feeding and potential roosting habitat for Endangered *Myotis* bats.
- Probable breeding habitat for Eastern Wood-pewee (Special Concern species).
- Mature forest dominated by native tolerant hardwoods and (in places) a diverse, remnant herbaceous flora consisting of spring ephemerals and upland sedges.

The entirety of the Southern Woodlot within the Subject Property is proposed for removal. Only a small portion of the woodland edge that extends onto Adjacent Lands will remain as a fencerow/hedgerow following removal of this feature. While the Southern Woodlot is not a designated Significant Woodland per the County's OP, it contains SWH (probable breeding habitat for Eastern Wood-pewee). Per the PPS and ARA Provincial Standards, development/extraction activities cannot engender negative impacts to SWH.

Removal of the Southern Woodlot is proposed to occur during Phase A since pit extraction will commence from a 0 m setback along the southern property boundary and will proceed northward. The following recommendations are offered to address loss of the Southern Woodlot (and significant features/habitats therein):

- **The Northern Woodlot Enhancement Area shown in Figure 3 is to be removed from cultivation and planted with native species during (or before) removal of the Southern Woodlot. A Northern Woodlot Enhancement Plan is to be prepared which includes the following elements (minimum):**
  - **Composition, density, and sizing of woody plant material. All plant installations are to be native to Middlesex County.**
  - **Measures to transplant native saplings (e.g., Sugar Maple, Bitternut Hickory, etc.) from the Southern Woodlot to the Northern Woodlot Enhancement Area.**
  - **Measures to transplant soils mats (containing native herbaceous flora, mycorrhizal fungi, etc.) from the Southern Woodlot to the**

Northern Woodlot Enhancement Area. Soil mats will not be excavated from areas containing dense coverage of Garlic Mustard or other non-native flora. Some soil mats are to contain populations of the regionally rare James' Sedge (*Carex jamesii*) and other spring ephemerals and upland sedges.

- **Structural elements (e.g., coarse woody debris such as stumps, logs, etc.) will be added to the Northern Woodlot Enhancement Area from material removed from the Southern Woodlot.**
- **A monitoring plan will be prepared for the purposes of determining the success of the plantings (including the new plant installations and transplanted flora/soil mats) for a period of no less than three (3) growing seasons.**

There is a potential for impacts to nesting birds and roosting bats during removal of the Southern Woodlot. To eliminate this potential, the following timing restriction on vegetation removal is recommended:

- **All tree and shrub removals within the Southern Woodlot will be completed outside the primary bird nesting and bat activity periods (i.e., to be completed between October 1 and March 31).**

To minimize impacts to wildlife habitat and activities within the Northern Woodlot during the proposed future pit operations, the following measure is recommended:

- **Any necessary lighting to support pit operations will be directed away from the Northern Woodlot to the extent practicable.**

The above technical recommendations have been incorporated directly onto the Site Plans.

7 APPLICABLE NATURAL HERITAGE AND ENVIRONMENTAL POLICIES

The following sections summarize the various municipal, provincial, and federal environmental policies that apply to the proposed pit operations plan and describe how the recommendations provided in this study will address these policies (where applicable).

7.1 Municipality of Thames Centre Official Plan (October 2020 consolidation)

The Municipality's OP is a legal document prepared as required under section 14.7(3) of the *Planning Act*. An OP sets out goals, objectives, and policies that direct and manage land-use and future development activities and their effects on the social and natural environment of a municipality. Provincial plans that offer direction on matters of provincial interest are implemented principally through the Municipality's OP. Provided herein is a description of relevant environmental and natural heritage policies contained within the Municipality's OP and an assessment of whether the application addresses such policies.

The Subject Property is designated Agricultural per Schedule A (Land Use Plan) of the Municipality's OP and is also zoned Agricultural per Map 38 of the Township's Zoning Bylaw (No.

75-2006). The Northern Woodlot contains a natural feature overlay designation (Woodland Under 4 Hectares in Area), while the Southern Woodlot does not.

A list of key natural heritage provisions of the Municipality's OP that pertain to the pit application considered herein is provided below.

- **Section 3.2** outlines the Natural Heritage Feature and Natural Hazard Area policies.
- **Section 3.2.1** outlines the components of the Thames Centre "Green-space" System, which includes:
    - Group A Features – Provincially Significant Wetlands, Habitat for Endangered and Threatened Species, and Fish Habitat.
        - Development or site alteration is generally prohibited in Group A Features.
    - Group B Features – Regionally Significant Woodlands, Significant Woodlands and woodland patches identified by the Middlesex Natural Heritage Study, Significant Valleylands, Significant Wildlife Habitat, Provincially Significant ANSIs, Regionally Significant ANSIs, and ESAs.
        - Development and site alteration may be permitted in Group B Features provided no negative impacts to the features or their associated functions.
    - Group C Features – Stream Corridors and Floodplains, natural hazard lands.
        - Development and site alteration may be permitted where compliance with the natural heritage and hazard policies of the OP can be demonstrated and Conservation Authority requirements are addressed.
- **Section 3.2.2** offers the goals of the Natural Heritage "Green-Space" System, including (amongst others) 1) the identification, protection, and enhancement of natural and environmental features and functions, and 2) recognition that natural heritage and environmental features relate to one another and are best protected through a landscape approach.
- **Section 3.2.3.1** requires the submission of an Environmental Impact Study (EIS) in support of proposals for new development or site alteration where such applications are near or within the general locations of all Group A, B, or C Features.

The results of this study have confirmed the presence of the following Natural Heritage "Green-Space" System components:

- Habitat for Endangered Myotis Bats (Group A Feature).
- Significant Woodland and candidate/confirmed Significant Wildlife Habitat within the Northern Woodlot (Group B Feature).
- Confirmed Significant Wildlife Habitat (probable breeding habitat for Eastern Wood-pewee) within the Southern Woodlot (Group B Feature).
- Wetland in the Northern Woodlot which may be considered a "natural hazard" (Group C Feature).

Terrastory reviewed potential impacts to the identified Green-space System components in **Section 6** of this NER. The Site Plan includes an extraction setback no closer than 15 m from the dripline of the Northern Woodlot or 30 m from wetlands therein. Provided that Terrastory's recommended mitigation measures related to replacement of the Southern Woodlot are implemented in full (per **Section 6.6**), no negative impacts are anticipated to any natural feature that forms part of the

Municipality's Green-Space System with the possible exception of habitat for Endangered *Myotis* Bats. The project team is awaiting MECP review of the application for consistency with the requirements of the *Endangered Species Act*.

7.2 Middlesex County Official Plan (2006 consolidation)

A list of key provisions from Middlesex County's OP that pertain to the protection of natural heritage features and areas are provided below.

- **Section 2.2.1** identifies the components of the County Natural System as including the following:
  - Natural Hazards (e.g., steep slopes, unstable soils, fill regulated areas);
  - Natural Environment Areas (e.g., floodplains, flood regulated watercourses, wetlands);
  - Natural Heritage Features (e.g., significant woodlands, wildlife habitat, aquatic ecosystems, river, stream, ravines, and upland corridors, ANSIs, etc.); and
  - Groundwater Features (e.g., recharge areas, discharge/headwater areas, well-head protection areas).
- **Section 2.2.1.2** provides general policies for the County's Natural System, including the need to direct new development away from the Natural System (where possible) and the need to prepare a Development Assessment Report (DAR) which summarizes the proposed development, on-site natural features, potential impacts, and recommended mitigation measures.
- **Section 2.2.1.3** provides more specific policies for the County's Natural System, including:
  - A prohibition on development in Natural Environment Areas on Schedule A (including wetlands) and Significant portions of Endangered Species Habitats.
  - An allowance for limited development within portions of the County's Natural System where it can be demonstrated that no negative impact on the natural features or their ecological functions will occur.

The Northern Woodlot is a designated Significant Woodland per Schedule C of the County's OP. The Northern Woodlot also contains wetland (not currently mapped on provincial or municipal natural feature datasets). The presence of Significant Woodland and wetland indicates that the Northern Woodlot forms part of the County Natural System and is therefore subject to applicable Natural System Policies of the County OP. The Southern Woodlot is not considered a Significant Woodland per Schedule C but contains SWH (probable breeding habitat for Eastern Wood-pewee) and regionally rare flora (James' Sedge).

The County's natural heritage policies are generally consistent with the Municipality's OP as described in **Section 7.1**. Provided that Terrastory's technical recommendations are implemented in full, no impacts to any significant natural heritage feature protected by the County's OP are anticipated with the possible exception of habitat for Endangered *Myotis* Bats. The project team is awaiting MECP review of the application for consistency with the requirements of the *Endangered Species Act*.

7.3 Aggregate Resources Act, R.S. O. 1990, c. A.8

The information and recommendations provided in this report satisfy the requirements for Natural Environment Level 1 and Level 2 Assessments pursuant to a Category 1, Class A licence:

2.2.1 Natural Environment Level 1: determine whether any of the following features exist on and within 120 metres of the site: significant wetland, significant portions of the habitat of endangered or threatened species, fish habitat, significant woodlands (south and east of the Canadian Shield), significant valley lands (south and east of the Canadian Shield), significant wildlife habitat and significant areas of natural and scientific interest; and

2.2.2 Natural Environment Level 2: impact assessment where the Level 1 identified any features on and within 120 metres of the site in order to determine any negative impacts on the natural features or ecological functions for which the area is identified, and any proposed preventative, mitigative or remedial measures.

The following significant natural features per ARA policies were identified within the Study Area:

- Provincially Significant Wetland (Adjacent Lands only).
- Significant Woodland (Northern Woodlot).
- Candidate or Confirmed Significant Wildlife Habitat, including:
    - Bat Maternity Colonies (candidate);
    - Reptile Hibernaculum (candidate);
    - Woodland Amphibian Breeding Habitats and Movement Corridors (candidate);
    - Terrestrial Crayfish (confirmed);
    - Eastern Wood-pewee (confirmed);
    - Monarch (candidate);
    - Yellow-banded Bumble Bee (candidate).
- Confirmed Habitat of Endangered and Threatened Species, including:
    - Barn Swallow (foraging habitat only);
    - Bobolink and Eastern Meadowlark (Adjacent Lands only);
    - Little Brown Myotis and Northern Myotis.
- Candidate Fish Habitat (Norsworthy Drain).

The extraction limit incorporated into the Site Plan reflects the greater of a minimum 15 m setback from the Significant Woodland dripline or 30 m setback from wetlands (which contain candidate SWH) within the Northern Woodlot. These setbacks, in combination with a determination of no negative impacts to the Northern Woodlot wetlands made herein and through the Hydrogeological Assessment (LDS Consultants Inc.), allow for adequate protection of all significant natural features overlapping with the Northern Woodlot consistent with ARA Provincial Standards.

Probable breeding habitat for Eastern Wood-pewee in the Southern Woodlot will be replaced through implementation of a Northern Woodlot Enhancement Plan (see **Section 6.6**). Additional plantings along the northern pond perimeter will further expand the Northern Woodlot southward as part of final rehabilitation (see **Appendix 7**).

The project team is awaiting MECP review of the proposed removal of the Southern Woodlot for potential impacts on Endangered *Myotis* Bats. Consistency of the proposed pit application with the requirements of the ESA will be determined once MECP has reviewed and responded to an IGF submitted in late August 2020 by others.

7.4 Provincial Policy Statement 2020, pursuant to the Planning Act, R.S.O. 1990, c. P. 13

The Provincial Policy Study (PPS) is promulgated under the authority of the *Planning Act* and came into effect on 1 May 2020. The PPS provides direction to municipalities on land-use matters of provincial interest and sets the policy framework for regulating the use and development of land. Municipal OP's must be consistent with the PPS. Per its preamble, the PPS *provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment*.

The principal PPS policies that apply to natural heritage protection are outlined in section 2.1. While recognizing that the natural heritage protection framework is not intended to limit the ability of agricultural uses to continue (Policy 2.1.9), the PPS instructs that *natural features and areas shall be protected for the long term* (Policy 2.1.1) and that their diversity and connectivity be *maintained, restored or, where possible, improved* (Policy 2.1.2). In Ecoregions 6E and 7E the PPS separates significant features into three categories:

1) Those in which development and site alteration are not permitted, including 1) Provincially Significant Wetlands and 2) Significant Coastal Wetlands (Policy 2.1.4);
2) Those in which development and site alteration are not permitted unless it can be demonstrated that no negative impacts on the significant natural feature and/or its functions will occur, including: 1) Significant Woodlands, 2) Significant Valleylands, 3) Significant Wildlife Habitat, 4) Significant Areas of Natural and Scientific Interest, 5) Non-significant Coastal wetlands, and 6) Adjacent Lands (Policy 2.1.5 and 2.1.8).
3) Those in which development and site alteration are not permitted except in accordance with federal/provincial requirements, including: 1) fish habitat (Policy 2.1.6) and 2) habitat of Endangered and Threatened Species (Policy 2.1.7).

In considering the aforementioned PPS policies, it has been determined that the proposed pit operations plan addresses relevant natural heritage provisions of the PPS for the following reasons:

- Per **Table 4** of this report, no Significant Areas of Natural or Scientific Interest or Valleylands are present within the Study Area.
- Per **Section 6** of this report, no negative impacts to the Significant Woodland and overlapping candidate/confirmed Significant Wildlife Habitat in the Northern Woodlot are anticipated given the setbacks incorporated into the proposed pit operations plan.
- Per **Section 6.5** of this report, no impacts to potential (seasonal) fish habitat in the Norsworthy Drain are anticipated.

The project team is awaiting MECP review of the proposed removal of the Southern Woodlot for potential impacts on Endangered *Myotis* Bats. Consistency of the proposed pit application with the requirements of the ESA will be determined once MECP has reviewed and responded to an IGF submitted in late August 2020 by others.

7.5 Provincial Endangered Species Act, S.O. 2007, c. 6

The *Endangered Species Act* (ESA) is administered by MECP and protects designated Endangered and Threatened species in Ontario from being killed, harmed, or harassed (s. 9) or having their habitat damaged or destroyed (s. 10). The protection afforded to Endangered and Threatened species

"habitat" is either prescribed by O. Reg. 242/08, or (for those species that lack regulated habitat) is defined as *an area on which the species depends, directly or indirectly, to carry on its life processes, including life processes such as reproduction, rearing, hibernation, migration or feeding.* Activities that constitute habitat damage and/or destruction can only proceed subject to requirements of s. 17 or (in limited circumstances) an activity registration under O. Reg. 242/08.

A detailed assessment of potential Endangered and Threatened habitat within the Study Area is provided in **Appendix 6**. The project team is awaiting MECP review of the proposed removal of the Southern Woodlot for potential impacts on Endangered *Myotis* Bats. Consistency of the proposed pit application with the requirements of the ESA will be determined once MECP has reviewed and responded to an IGF submitted in late August 2020 by others.

7.6 Federal *Fisheries Act*, R.S.C. 1985, c. F-14

The amended federal *Fisheries Act* (Bill C-68) received Royal Assent in June 2019 while the updated fish and fish habitat protection provisions came into force in August 2019. Subsection 34.4(1) of the amended *Fisheries Act* prohibits all work, undertaking, or activity from causing the death of fish (other than fishing). Subsection 35(1) requires that project activities not result in the "*harmful alteration, disruption or destruction of fish habitat*" (HADD) unless undertaken in accordance with the requirements of a statutory exemption per subsection 35(2). Based on the Fish and Fish Habitat Protection Policy Statement (August 2019), HADD is interpreted by DFO to include "*any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish*".

No in-water works or fill placement below the high-water mark of a surface water feature containing fish habitat is proposed through this application. Consistent with the assessment carried out in **Section 6.5**, it has been determined that the proposed pit operations plan is consistent with the fish and fish habitat protection provisions outlined in the *Fisheries Act*.

7.7 Federal *Migratory Birds Convention Act*, S.C. 1994, c. 22

Section 6 of the Migratory Birds Regulations under the *Migratory Birds Convention Act, 1994* (MBCA) prohibits the disturbance or destruction of nests, eggs, or nest shelters of a migratory bird. The provincial *Fish and Wildlife Conservation Act, 1997* extends the protection of bird nests and eggs to certain species not listed under the Migratory Birds Regulations (e.g., Corvids, Strigids, Accipitrids, etc.).

Provided that the recommendations outlined in **Section 6.6** are implemented in full (i.e., prohibition on vegetation removal during the bird breeding season), no impacts to breeding birds or bird nests protected by the MBCA or FWCA are anticipated.

8 CONCLUSIONS

In accordance with the application standards for Category 1, Class A pit licences pursuant to the *Aggregate Resources Act*, the preceding Level I & II Natural Environment Report provides a detailed characterization of the natural environment occurring within and adjacent to the proposed Pike Pit. This NER has been prepared in support of the ARA licence application along with Official Plan Amendment and Zoning By-law Amendment applications to the Municipality of Thames Centre. Included herein is a comprehensive approach to identifying the presence or absence of several significant natural features afforded varying degrees of protection by applicable environmental

policies, particularly the ARA Provincial Standards, PPS, Municipal/County OPs, and *Endangered Species Act*. Potential negative impacts to the identified significant natural features are described with mitigation measures and technical recommendations offered to avoid or minimize such impacts and/or offer enhancements as appropriate.

Based on the findings presented in this report, the following natural features with ecological and/or policy significance have been identified within the Study Area:

- **Significant Woodland, Identified Wetlands**, and **Significant Wildlife Habitat** within the Northern Woodlot.
- **Provincially Significant Wetland (North Dorchester Swamp)** and additional **Identified Wetlands** on Adjacent Lands to the north/northeast of the Site.
- Feeding habitat and potential roosting habitat for **Endangered Myotis Bats**, probable breeding habitat for **Eastern Wood-pewee**, and **Regionally Rare Flora** (James' Sedge) in the Southern Woodlot.
- Probable breeding habitat for the **Threatened Barn Swallow**, **Eastern Meadowlark**, and **Bobolink** on Adjacent Lands in 2019.

The extraction limit incorporates a minimum 15 m dripline setback or 30 m wetland setback from the Northern Woodlot. The proposed removal of the Southern Woodlot (and habitats therein) will be addressed through a Northern Woodlot Enhancement Plan to be prepared as indicated on the Site Plan notes. The project team is awaiting MECP review of the proposed removal of the Southern Woodlot for potential impacts on Endangered *Myotis* Bats. Consistency of the proposed pit application with the requirements of the ESA will be determined once MECP has reviewed and responded to an IGF submitted in late August 2020 by others.

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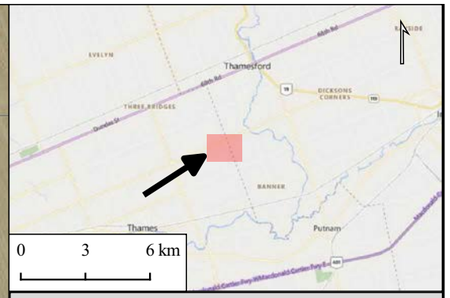


Legend

Study Area

- Subject Property / Site
- Adjacent Lands (Subject Property + 120 m)

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.

TERRASTORY
environmental consulting inc.

1:5,000	0 50 100 150 200 m		
N	Project No.: 1944	By: TK	Date: 2020-11-12

Orthophotograph Date: 2015 (SWOOP).

Location: Pike Pit, Municipality of Thames Centre.

Figure 1. Location of the Subject Property.

Legend

Study Area
- Subject Property
- Adjacent Lands (Subject Property + 120 m)

Survey Stations
- Breeding Bird Survey Stations

Built Structures and Infrastructure
- Culvert
- Shed

Biophysical Conditions - Terrastory
- Vegetation Communities
- Runoff Direction

Significant Natural Features - Agency Identified
- Norsworthy Drain
- Flow Direction

Vegetation Community Codes:

UPLAND
FODM5-9: Dry - Fresh Sugar Maple - Hardwood Forest
FODM7: Fresh - Moist Lowland Deciduous Forest
FODM4: Dry - Fresh Upland Deciduous Forest
WODM5: Fresh - Moist Deciduous Woodland
TAGM5: Fencerow
MEMM4: Fresh - Moist Mixed Meadow

WETLAND
SWDM4: Mineral Deciduous Swamp
SWD: Deciduous Swamp
SWM: Mixed Swamp
SWC: Coniferous Swamp
MAMM1: Graminoid Mineral Meadow Marsh

TERRASTORY environmental consulting inc.

1:4,500

0 50 100 150 m

N

Project No.: 1944 | By: TK | Date: 2020-11-12

Orthophotograph Date: 2015 (SWOOP).

Location: Pike Pit, Municipality of Thames Centre.

Figure 2. Biophysical Features and Conditions.

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.

Legend

Study Area
- Subject Property
- Adjacent Lands (Subject Property + 120 m)

Significant Natural Features - Agency Identified
- Provincially Significant North Dorchester Swamp (UT 24)
- Norsworthy Drain

Significant Natural Features - Terrastory
- Terrestrial Crayfish Chimney
- Dripline
- Wetland Boundary (OWES)
- Significant Woodland
- Identified Wetland
- Probable Breeding Habitat for Eastern Wood-pewee

Mitigation Measures Recommended
- Greatest Natural Feature Limit (15 m from Dripline or 30 m from Wetland)
- Northern Woodlot Enhancement Area

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.

TERRASTORY
environmental consulting inc.

1:4,500	0 50 100 150 m		
N	Project No.: 1944	By: TK	Date: 2020-11-12

Orthophotograph Date: 2015 (SWOOP).

Location: Pike Pit, Municipality of Thames Centre.

Figure 3. Significant Natural Features and Technical Recommendations.

Appendix 1. Curriculum Vitae

TERRASTORY
environmental consulting inc.

Tristan L. Knight, M.E.S., M.Sc.
Senior Ecologist / President

CAREER AND ACADEMIC HISTORY

2018 – Present	**Senior Ecologist / President, Terrastory Environmental Consulting Inc.**
2014 – 2018	Ecologist / Botanist, RiverStone Environmental Solutions Inc.
2013 – 2014	Watershed Restoration Technician, Credit Valley Conservation Authority
2012 – 2013	Terrestrial Ecologist, Aquafor Beech Ltd.
2011 – 2012	Wetland Biologist / Asst. SAR Biologist, Ontario Ministry of Natural Resources
2009 – 2011	Master of Science, SUNY College of Environmental Science and Forestry, Syracuse, NY
2007 – 2009	Master of Environmental Studies, York University, Toronto, ON
2003 – 2007	Hons. Bachelor of Arts, University of Western Ontario, London, ON

PROFESSIONAL EXPERIENCE

Tristan has ten years of experience as an environmental professional acting in diverse private- and public-sector roles. He has assisted a wide array of clients across the development industry (e.g., residential, aggregates, municipal infrastructure, green energy, etc.) and has extensive project management experience with projects big and small. Tristan is an accomplished field ecologist and certified Arborist with professional training in a vast array of provincial data collection protocols including but not limited to Ecological Land Classification, Ontario Wetland Evaluation System, Ontario Stream Assessment Protocol, Ontario Benthos Biomonitoring Network, and Vegetation Sampling Protocol. He is regularly involved in providing opinions and conformity assessments associated with federal, provincial, and municipal environmental policies, conducting environmental impact assessments, and identifying creative solutions to development challenges. Tristan is single-mindedly focused on generating high quality, time-sensitive, cost-competitive environmental reporting and advice.

The following is a partial list of Tristan's consulting project experience since 2012.

Environmental Impact Studies / Natural Heritage Assessments

- Natural Environment Level 1 & 2 Technical Report in the **Municipality of Huron East**; *for private client*; **Key Tasks:** extensive terrestrial/wetland/aquatic surveys, species at risk surveys (birds, turtles, bats, etc.), significant wildlife habitat assessments, graphics, reporting in support of a quarry application for a licence expansion and new licence.
- Environmental Impact Statement in the **Township of Southgate**; *Flato Developments Inc.*; **Key Tasks:** extensive terrestrial/wetland/aquatic surveys, species at risk surveys, significant wildlife habitat assessments, *Endangered Species Act* approvals, *Fisheries* Act authorization, graphics, reporting in support of a ~500-unit plan of subdivision.
- Natural Environment Report in the **Town of Caledon/City of Brampton**; *for the Regional Municipality of Peel*; **Key Tasks:** ELC, breeding bird surveys, tree inventory and health assessment, fish and aquatic habitat surveys, anuran calling surveys, botanical inventory, identification and assessment of significant natural heritage features, mitigation opportunities, permitting under the *Endangered Species Act* (Redside Dace), permitting under the *Conservation Authorities Act*, graphics, and reporting in support of 14 km of improvements to Mayfield Road.

- Natural Environment Addendum in the **City of Kawartha Lakes**; *for Giofam Investments Inc.*; **Key Tasks:** breeding bird surveys, significant wildlife habitat assessment, graphics, reporting in support of a quarry application.
- Environmental Impact Study in the **Town of Huntsville**; *for private client*; **Key Tasks**: ELC, breeding bird surveys, graphics, and reporting in support of a multiple lot severance.
- Natural Heritage Impact Statement in the **City of Toronto**; *for the City of Toronto*; **Key Tasks**: ELC, aquatic habitat assessment, tree inventory and health assessment, identification of mitigation opportunities, graphics, *Conservation Authorities Act* approval, and reporting in support of bridge works on Bloor Street over Etobicoke Creek.
- Environmental Impact Statement in the **Town of Georgina**; *for private client*; **Key Tasks**: ELC, identification and assessment of significant natural heritage features, mitigation opportunities, graphics, reporting in support of a lot severance.
- Environmental Impact Statement in the **Town of Aurora**; *for private client*; **Key Tasks**: ELC, identification and assessment of significant natural heritage features, mitigation opportunities, graphics, reporting in support of a rezoning application.
- Site Evaluation Report in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks**: ELC, wetland boundary delineation, identification and assessment of significant natural heritage features, mitigation opportunities, graphics reporting in support of a lot severance.
- Natural Heritage Evaluation in the **Township of Hamilton**; *for private client*; **Key Tasks**: ELC, identification and assessment of significant natural heritage features, Butternut Health Assessment, mitigation opportunities, graphics, reporting in support of a site plan application.
- Environmental Impact Statement and Site Evaluation Report in the **Town of Gravenhurst**; *for private client;* **Key Tasks**: ELC, identification and assessment of significant natural heritage features, mitigation opportunities, graphics, reporting in support of a multiple lot severance.
- Natural Heritage Evaluation in the **Township of King**; *for private client*; **Key Tasks:** ELC, identification and assessment of significant natural heritage features, significant woodland assessment, mitigation opportunities, graphics, reporting in support of a site plan application.
- Site Evaluation Report in the **Municipality of Dysart et al.**; *for private client*; **Key Tasks:** ELC, identification and assessment of significant natural heritage features, fish and aquatic habitat assessment, mitigation opportunities, graphics, reporting in support of a single lot severance.

Municipal Class Environmental Assessments

- Municipal Class Assessment (Schedule B) in the **Town of Caledon**; *for IBI Group*. **Key Tasks:** fish habitat assessments, vegetation surveys, tree inventory, breeding bird surveys, graphics, alternatives assessment for a bridge replacement project.
- Municipal Class Environmental Assessment (Schedule C) in the **Town of Milton**; *for Delcan Corporation*. **Key Tasks:** calling anuran surveys, significant woodland assessment, graphics, reporting in support of the expansion of Britannia Road.

Environmental Servicing/Implementation Reports

- Environmental Implementation Report in the **Township of Southgate**; *for Flato Developments Inc.* **Key Tasks:** comprehensive construction mitigation plan integrating a variety of disciplines and construction activities (i.e., grading, installation of watercourse crossing structures, landscaping for stormwater retention ponds, etc.).

- Master Environmental Servicing Plan in the **City of Brampton**; *for Candevcon Ltd.* **Key Tasks:** ELC, summer and fall botanical inventories, significant wildlife habitat assessment, hedgerow assessment, natural heritage system recommendations, mitigation opportunities, graphics, reporting in support of a Master Environmental Servicing Plan.

Species at Risk Surveys and Habitat Assessments

- Surveys for Pale-bellied Frost Lichen in the County of Hastings; *for private client*; **Key Tasks**: two (2) days of inventories for Pale-bellied Frost Lichen, reporting.
- Species at Risk Habitat Assessment in the **Township of Guelph/Eramosa**; *for River Valley Developments Inc.*; **Key Tasks**: assessment and collection of background information, identification and assessment of species at risk habitat in support of a new quarry licence application.
- SAR Habitat Assessment in the **City of Brampton**; *for Planmac Inc.*; **Key Tasks:** Redside Dace, Eastern Meadowlark and Bobolink habitat assessment in support of bridge works.
- Butternut Health Assessment in the **Town of Caledon**; *for the Town of Caledon*; **Key Tasks**: Butternut Health Assessment in support of culvert works.
- Butternut Health Assessment in the **City of Toronto;** *for the City of Toronto*; **Key Tasks:** Butternut Health assessment in support of watercourse works.
- Butternut Health Assessment in the **Town of Orangeville;** *for the City of Toronto*; **Key Tasks:** Butternut Health Assessment in support of watercourse works.

Fisheries and Fish Habitat Assessments

- Fish Habitat Impact Assessment in the **Township of Muskoka Lakes**; *for private client;* **Key Tasks**: fish and aquatic habitat assessment, graphics, reporting in support of a quarry application.
- Fish Sampling and Habitat Assessments **across eastern Ontario**; *for Trans Canada Pipelines*; **Key Tasks:** fish sampling, fish habitat assessments in support of a pipeline expansion.
- Fish Rescue in the **Township of Muskoka Lakes**; *for private client*; **Key Tasks:** fish rescue in support of bridge works.
- Water Quality Monitoring in the **Village of Burks Falls**; *for private client*; **Key Tasks:** water quality sampling in support of post-construction monitoring efforts on a wind farm.

Tree Inventories and Arborist Reports

- Tree Inventory and Recommendations in the **Town of Richmond Hill**; *for The Municipal Infrastructure Group*; **Key Tasks**: tree inventory and health assessment, tree retainment recommendations in support of stormwater pond maintenance activities.
- Tree Inventory and Preservation Plan in the **Town of Georgina**; *for Oxford Developments*; **Key Tasks**: tree inventory and health assessment, tree retainment recommendations in support of a sidewalk extension.
- Arborist Report in the **Town of Aurora**; *for private client*; **Key Tasks**: tree inventory and health assessment, tree retainment recommendations, significant species presence/absence survey, mitigation options, reporting in support of watercourse and culvert works.
- Tree Inventory and Health Assessment in the **Town of New Tecumseth**; *for Granite Condos*: **Key Tasks:** tree inventory and health assessment, tree retainment recommendations, mitigation options, graphics, reporting in support of a site plan application for a retirement home.

- Tree Inventory and Health Assessment in the **City of Burlington;** *for private client*; **Key Tasks:** tree inventory and health assessment, tree retainment recommendations, mitigation options, graphics, reporting in support of watercourse works.
- Tree Inventory and Health Assessment in the **City of Mississauga;** *for private client*; **Key Tasks:** tree inventory and health assessment, tree retainment recommendations, mitigation options, graphics, reporting in support of watercourse works.
- Tree Inventory and Health Assessment in the **City of Toronto;** *for private client*; **Key Tasks:** tree inventory and health assessment, tree retainment recommendations, mitigation options, graphics, reporting in support of watercourse works.

Environmental Constraints Analyses

- Environmental Constraints Analysis in the **Town of Fort Erie**; *for private client*; **Key Tasks:** natural feature constraints analysis, assessment of significant natural heritage features, guidance as part of due diligence.
- Environmental Protection Zone Assessment in the **Town of Gravenhurst**; *for private client*; **Key Tasks:** ELC, identification and assessment of significant natural heritage features, graphics, reporting in support of a site plan application.
- Environmental Constraints Analysis in the **Town of Gravenhurst**; *for private client*; **Key Tasks**: identification and assessment of species at risk habitat and significant natural heritage features, graphics, reporting in support of a multiple lot severance.
- Environmental Constraints Analysis in the **Town of Huntsville**; *for private client*; **Key Tasks**: wetland boundary delineation, graphics, reporting in support of a site plan application for a resort development.
- Construction Mitigation Plan in the **Town of Caledon**; *for private client*; **Key Tasks:** significant wildlife habitat assessment, mitigation opportunities, graphics, reporting in support of a site plan application.

Peer Review

- Peer Review and Opinion Letter in the **City of Kawartha Lakes**; *for private client*; **Key Tasks**: critical assessment of several reports pertaining to flooding/environmental damages, wetland conditions and functional assessment.

Policy Research

- Multi-Jurisdictional Review of Endangered Species Act Concepts report; *for the Ontario Ministry of Natural Resources*; **Key Tasks:** intensive literature review, interviews, policy guidance, reporting.

Restoration Plans

- Restoration Options Plan in the **Village of Burks Falls**; *for private client*; **Key Tasks:** identification of restoration opportunities to minimize soil erosion in support of post-construction monitoring efforts on a wind farm.
- Shoreline Stabilization and Restoration Plan in the **Town of Gravenhurst**; *for private client;* **Key Tasks:** existing conditions assessment, vegetation plan, shoreline stabilization plan in support of shoreline stabilization efforts.
- Watercourse and Riparian Zone Restoration Plan in the **Town of Innisfil**; *for private client*; **Key Tasks**: identification of restoration opportunities to restore watercourse and riparian zone functions, graphics, reporting in support of efforts to restore a degraded watercourse.

Bird Nesting Surveys

- Bird Nesting Survey in the **Town of East Gwillimbury**; *for AECOM*; **Key Tasks:** area-search for nesting birds in support of a development application.
- Bird Nesting Survey in the **Town of Smooth Rock Falls**; *for private client*; **Key Tasks:** area-search for nesting birds in support of the construction of a new hydroelectric plant.

RELEVANT CERTIFICATIONS AND TRAINING COURSES

2018 MTO RAQS Terrestrial and Fisheries Assessment Specialist (pending)
2016 Tree Risk Assessment Qualification (TRAQ)
2016 Managed Forest Plan Approver (#421)
2015 Vegetation Sampling Protocol
2014 Ontario Stream Assessment Protocol
2014 Fish Identification "Level 2"
2014 Electrofishing "Class 2"
2014 Butternut Health Assessor (#268)
2013 ISA Certified Arborist #ON-1663A
2012 Ontario Benthos Biomonitoring Network
2012 Ontario Wetland Evaluation System Instructor
2011 Family-level Benthic Invertebrate ID Workshop
2011 Ontario Wetland Evaluation System
2011 Ecological Land Classification

PUBLICATIONS

Knight, T. (2010). *Enhancing the flow of ecological goods and services to society: Key principles for the design of marginal and ecologically significant agricultural land retirement programs in Canada*. Canadian Institute for Environmental Law and Policy.

De Costa, R., & Knight, T. (2011). Asymmetric encounters in Native Canada. *American Review of Canadian Studies*, 41:3, 212-227.

Appendix 2. Representative Photographs

Photo 1. Corn and alfalfa fields looking west from the eastern Subject Property boundary along Hunt Road (9 August 2019).

Photo 2. Southern Woodlot looking northward from the fencerow (24 May 2019).

Photo 3. Southern Woodlot looking west from the eastern Subject Property boundary along Hunt Road (24 May 2019).

Photo 4. Southern Woodlot showing density of Garlic Mustard (24 May 2019).

Photo 5. Southern Woodlot with dense carpet of Wild Ginger and cut stump (9 August 2019).

Photo 6. Southern Woodlot (9 August 2019).

Photo 7. Shed in Southern Woodlot (9 August 2019).

Photo 8. Northern Woodlot looking northwest from the mixed meadow (9 August 2019).

Photo 9. Deciduous swamp with Skunk Cabbage (24 May 2019).

Photo 10. Deciduous swamp with Marsh Marigold (16 May 2020).

Photo 11. Deciduous swamp after standing water recedes by mid-summer (9 August 2019).

Photo 12. Meadow marsh with dense Reed-canary Grass and Spotted Joe-pye Weed (9 August 2019).

Photo 13. Outlet of drainage from the deciduous swamp in the Northern Woodlot at the Gore Road culvert looking south (16 May 2020).

Photo 14. Upland forest in the Northern Woodlot (9 August 2019).

Photo 15. Mixed meadow adjacent to the Northern Woodlot looking southward (9 August 2019).

Photo 16. Terrestrial crayfish chimney (9 August 2019).

Appendix 3. Vascular Plant List

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Acer negundo	Manitoba Maple	Aceraceae	x		S5	0	0
Acer nigrum	Black Maple	Aceraceae	x		S4?	7	3
Acer saccharum	Sugar Maple	Aceraceae	x	x	S5	4	3
Acer x freemanii	Freeman's Maple	Aceraceae	x		SNA	6	-5
Actaea pachypoda	White Baneberry	Ranunculaceae	x	x	S5	6	5
Actaea rubra	Red Baneberry	Ranunculaceae	x		S5	6	3
Agrimonia gryposepala	Hooked Agrimony	Rosaceae	x		S5	2	3
Agrostis gigantea	Redtop	Poaceae	x		SNA	n/a	-3
Alliaria petiolata	Garlic Mustard	Brassicaceae	x	x	SNA	n/a	0
Allium tricoccum	Wild Leek	Liliaceae	x	x	S4	7	3
Ambrosia artemisiifolia	Common Ragweed	Asteraceae	x		S5	0	3
Angelica atropurpurea	Purple-stemmed Angelica	Apiaceae	x		S5	6	-5
Aralia nudicaulis	Wild Sarsaparilla	Araliaceae	x		S5	4	3
Arctium lappa	Great Burdock	Asteraceae	x		SNA	n/a	3
Arctium minus	Common Burdock	Asteraceae	x	x	SNA	n/a	3
Arenaria serpyllifolia	Thyme-leaved Sandwort	Caryophyllaceae	x		SNA	n/a	0
Arisaema triphyllum	Jack-in-the-pulpit	Araceae	x	x	S5	5	-3
Asarum canadense	Canada Wild-ginger	Aristolochiaceae	x	x	S5	6	5
Asclepias syriaca	Common Milkweed	Asclepiadaceae	x		S5	0	5
Athyrium filix-femina var. angustum	Northeastern Lady Fern	Dryopteridaceae	x		S5	4	0
Barbarea vulgaris	Bitter Wintercress	Brassicaceae	x		SNA	n/a	0
Betula alleghaniensis	Yellow Birch	Betulaceae	x		S5	6	0
Bidens frondosa	Devil's Beggarticks	Asteraceae	x	x	S5	3	-3
Boehmeria cylindrica	False Nettle	Urticaceae	x		S5	4	-5
Bromus inermis	Smooth Brome	Poaceae	x		SNA	n/a	5
Caltha palustris	Yellow Marsh Marigold	Ranunculaceae	x		S5	5	-5
Capsella bursa-pastoris	Common Shepherd's Purse	Brassicaceae	x		SNA	n/a	3
Carex albursina	White Bear Sedge	Cyperaceae	x		S5	7	5
Carex bromoides	Brome-like Sedge	Cyperaceae	x		S5	7	-3
Carex crinita	Fringed Sedge	Cyperaceae	x		S5	6	-5
Carex cristatella	Crested Sedge	Cyperaceae	x		S5	3	-3
Carex gracillima	Graceful Sedge	Cyperaceae	x		S5	4	3
Carex hirtifolia	Pubescent Sedge	Cyperaceae	x		S4S5	5	5
Carex jamesii	James' Sedge	Cyperaceae	x		S4	8	5
Carex lupulina	Hop Sedge	Cyperaceae	x		S5	6	-5
Carex plantaginea	Plantain-leaved Sedge	Cyperaceae	x		S5	7	5
Carex radiata	Eastern Star Sedge	Cyperaceae	x		S5	4	0
Carex rosea	Rosy Sedge	Cyperaceae	x		S5	2	5
Carex sprengelii	Sprengel's Sedge	Cyperaceae	x		S5	6	0
Carex vulpinoidea	Fox Sedge	Cyperaceae	x		S5	3	-5

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Carex woodii	Wood's Sedge	Cyperaceae	x		S4	6	3
Carya cordiformis	Bitternut Hickory	Juglandaceae	x	x	S5	6	0
Caulophyllum giganteum	Giant Blue Cohosh	Berberidaceae	x	x	S5	5	5
Celastrus scandens	Climbing Bittersweet	Celastraceae	x		S5	3	3
Celtis occidentalis	Common Hackberry	Ulmaceae	x		S4	8	0
Chenopodium album	White Goosefoot	Chenopodiaceae	x		SNA	n/a	3
Circaea canadensis subsp. canadensis	Canada Enchanter's Nightshade	Onagraceae	x	x	S5	2	3
Cirsium arvense	Canada Thistle	Asteraceae	x		SNA	n/a	3
Cirsium vulgare	Bull Thistle	Asteraceae	x		SNA	n/a	3
Clematis virginiana	Virginia Virgin's-bower	Ranunculaceae	x		S5	3	0
Cornus alternifolia	Alternate-leaved Dogwood	Cornaceae	x		S5	6	3
Cornus racemosa	Gray Dogwood	Cornaceae	x	x	S5	2	0
Cornus stolonifera	Red-osier Dogwood	Cornaceae	x		S5	2	-3
Crataegus crus-galli	Cockspur Hawthorn	Rosaceae	x		S4	4	0
Crepis tectorum	Narrow-leaved Hawksbeard	Asteraceae	x		SNA	n/a	5
Cystopteris bulbifera	Bulblet Fern	Dryopteridaceae	x		S5	5	-3
Dactylis glomerata	Orchard Grass	Poaceae	x	x	SNA	n/a	3
Daucus carota	Wild Carrot	Apiaceae	x	x	SNA	n/a	5
Dianthus armeria	Deptford Pink	Caryophyllaceae	x		SNA	n/a	5
Dicentra cucullaria	Dutchman's Breeches	Fumariaceae	x		S5	6	5
Digitaria sanguinalis	Hairy Crabgrass	Poaceae	x		SNA	n/a	3
Dryopteris carthusiana	Spinulose Wood Fern	Dryopteridaceae	x		S5	5	-3
Dryopteris marginalis	Marginal Wood Fern	Dryopteridaceae	x		S5	5	3
Echinochloa crus-galli	Large Barnyard Grass	Poaceae	x		SNA	n/a	-3
Echinocystis lobata	Wild Mock-cucumber	Cucurbitaceae	x	x	S5	3	-3
Elymus hystrix	Bottlebrush Grass	Poaceae	x		S5	5	5
Elymus repens	Creeping Wildrye	Poaceae	x		SNA	n/a	3
Elymus virginicus var. virginicus	Virginia Wildrye	Poaceae	x		S5	5	-3
Epilobium coloratum	Purple-veined Willowherb	Onagraceae	x		S5	3	-5
Epilobium hirsutum	Hairy Willowherb	Onagraceae	x		SNA	n/a	-3
Epilobium parviflorum	Small-flowered Willowherb	Onagraceae	x	x	SNA	n/a	3
Epipactis helleborine	Eastern Helleborine	Orchidaceae	x		SNA	n/a	3
Eragrostis cilinensis	Stinkgrass	Poaceae	x		SNA	n/a	3
Erigeron annuus	Annual Fleabane	Asteraceae	x	x	S5	0	3
Erigeron canadensis	Canada Horseweed	Asteraceae	x	x	S5	0	3
Erigeron philadelphicus var. philadelphicus	Philadelphia Fleabane	Asteraceae	x		S5	1	-3
Erigeron strigosus	Rough Fleabane	Asteraceae	x		S5	4	3
Erucastrum gallicum	Common Dogmustard	Brassicaceae	x		SNA	n/a	5
Erythronium americanum subsp. americanum	Yellow Trout-lily	Liliaceae	x		S5	5	5
Euonymus obovatus	Running Strawberry Bush	Celastraceae	x	x	S4	6	5

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Eupatorium perfoliatum	Common Boneset	Asteraceae	x		S5	2	-3
Euthamia graminifolia	Grass-leaved Goldenrod	Asteraceae	x		S5	2	0
Eutrochium maculatum var. maculatum	Spotted Joe Pye Weed	Asteraceae	x		S5	3	-5
Fagus grandifolia	American Beech	Fagaceae	x		S4	6	3
Fallopia convolvulus	Black Bindweed	Polygonaceae	x		SNA	n/a	3
Fragaria virginiana	Wild Strawberry	Rosaceae	x		S5	2	3
Frangula alnus	Glossy Buckthorn	Rhamnaceae	x	x	SNA	n/a	0
Fraxinus americana	White Ash	Oleaceae	x		S4	4	3
Fraxinus nigra	Black Ash	Oleaceae	x		S4	7	-3
Fraxinus pennsylvanica	Green Ash	Oleaceae	x		S4	3	-3
Galium aparine	Cleavers	Rubiaceae	x		S5	4	3
Geranium maculatum	Spotted Geranium	Geraniaceae	x	x	S5	6	3
Geranium robertianum	Herb-Robert	Geraniaceae	x	x	S5	2	3
Geum aleppicum	Yellow Avens	Rosaceae	x	x	S5	2	0
Geum canadense	White Avens	Rosaceae	x		S5	3	0
Glyceria striata	Fowl Mannagrass	Poaceae	x		S5	3	-5
Hepatica acutiloba	Sharp-lobed Hepatica	Ranunculaceae	x	x	S5	8	5
Hesperis matronalis	Dame's Rocket	Brassicaceae	x	x	SNA	n/a	3
Hydrophyllum canadense	Canada Waterleaf	Hydrophyllaceae	x	x	S4	8	0
Hydrophyllum virginianum	Virginia Waterleaf	Hydrophyllaceae	x	x	S5	6	0
Hypericum majus	Larger Canadian St. John's-wort	Clusiaceae	x		S5	5	-3
Hypericum perforatum	Common St. John's-wort	Clusiaceae	x		SNA	n/a	5
Juglans nigra	Black Walnut	Juglandaceae	x		S4?	5	3
Juncus dudleyi	Dudley's Rush	Juncaceae	x		S5	1	-3
Lactuca biennis	Tall Blue Lettuce	Asteraceae	x	x	S5	6	0
Laportea canadensis	Wood Nettle	Urticaceae	x	x	S5	6	-3
Leonurus cardiaca subsp. cardiaca	Common Motherwort	Lamiaceae	x	x	SNA	n/a	5
Lindera benzoin	Spicebush	Lauraceae	x		S4	6	-3
Lobelia inflata	Indian-tobacco	Campanulaceae	x		S5	3	3
Lobelia siphilitica	Great Blue Lobelia	Campanulaceae	x		S5	6	-3
Lolium arundinaceum	Tall Fescue	Poaceae	x		SNA	n/a	3
Lolium pratense	Meadow Fescue	Poaceae	x		SNA	n/a	3
Lonicera tatarica	Tartarian Honeysuckle	Caprifoliaceae	x		SNA	n/a	3
Lysimachia ciliata	Fringed Loosestrife	Primulaceae	x		S5	4	-3
Maianthemum canadense	Wild Lily-of-the-valley	Liliaceae	x		S5	5	3
Maianthemum racemosum	Large False Solomon's Seal	Liliaceae	x	x	S5	4	3
Maianthemum stellatum	Star-flowered False Solomon's Seal	Liliaceae	x		S5	6	0
Malus pumila	Common Apple	Rosaceae	x		SNA	n/a	5
Malva neglecta	Dwarf Cheeseweed	Malvaceae	x		SNA	n/a	5
Matteuccia struthiopteris	Ostrich Fern	Dryopteridaceae	x		S5	5	0

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Medicago lupulina	Black Medic	Fabaceae	x	x	SNA	n/a	3
Medicago sativa subsp. sativa	Variable Alfalfa	Fabaceae	x		SNA	n/a	5
Morus alba	White Mulberry	Moraceae	x		SNA	n/a	0
Nepeta cataria	Catnip	Lamiaceae	x	x	SNA	n/a	3
Oenothera biennis	Common Evening Primrose	Onagraceae	x		S5	0	3
Oenothera perennis	Perennial Evening Primrose	Onagraceae	x		S5	6	0
Onoclea sensibilis	Sensitive Fern	Dryopteridaceae	x		S5	4	-3
Osmorhiza longistylis	Smooth Sweet Cicely	Apiaceae	x		S5	6	3
Ostrya virginiana	Eastern Hop-hornbeam	Betulaceae	x	x	S5	4	3
Oxalis stricta	Upright Yellow Wood-sorrel	Oxalidaceae	x	x	S5	0	3
Panicum capillare	Common Panicgrass	Poaceae	x		S5	0	0
Parthenocissus quinquefolia	Virginia Creeper	Vitaceae	x		S4?	6	3
Parthenocissus vitacea	Thicket Creeper	Vitaceae	x		S5	4	3
Persicaria maculosa	Spotted Lady's-thumb	Polygonaceae	x		SNA	n/a	-3
Phalaris arundinacea	Reed Canary Grass	Poaceae	x		S5	0	-3
Phleum pratense	Common Timothy	Poaceae	x		SNA	n/a	3
Phlox divaricata	Wild Blue Phlox	Polemoniaceae	x		S4	7	3
Phryma leptostachya	Lopseed	Verbenaceae	x		S4S5	6	3
Picris hieracioides	Hawkweed Oxtongue	Asteraceae	x		SNA	n/a	5
Pilea pumila	Dwarf Clearweed	Urticaceae	x	x	S5	5	-3
Pinus strobus	Eastern White Pine	Pinaceae	x		S5	4	3
Plantago lanceolata	English Plantain	Plantaginaceae	x		SNA	n/a	3
Poa compressa	Canada Bluegrass	Poaceae	x		SNA	n/a	3
Poa pratensis subsp. pratensis	Kentucky Bluegrass	Poaceae	x		SNA	n/a	3
Podophyllum peltatum	May-apple	Berberidaceae	x		S5	5	3
Polygonatum pubescens	Hairy Solomon's Seal	Liliaceae	x		S5	5	5
Polygonum aviculare	Prostrate Knotweed	Polygonaceae	x		S4?	0	3
Polystichum acrostichoides	Christmas Fern	Dryopteridaceae	x		S5	5	3
Populus deltoides	Eastern Cottonwood	Salicaceae	x		S5	4	0
Populus tremuloides	Trembling Aspen	Salicaceae	x		S5	2	0
Potentilla recta	Sulphur Cinquefoil	Rosaceae	x		SNA	n/a	5
Prunus pensylvanica	Pin Cherry	Rosaceae	x		S5	3	3
Prunus serotina	Black Cherry	Rosaceae	x	x	S5	3	3
Prunus virginiana	Choke Cherry	Rosaceae	x	x	S5	2	3
Quercus macrocarpa	Bur Oak	Fagaceae	x		S5	5	3
Quercus rubra	Northern Red Oak	Fagaceae	x		S5	6	3
Ranunculus abortivus	Kidney-leaved Buttercup	Ranunculaceae	x		S5	2	0
Ranunculus acris	Tall Buttercup	Ranunculaceae	x		SNA	n/a	0
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	Ranunculaceae	x		S5	4	-3
Rhamnus cathartica	Common Buckthorn	Rhamnaceae	x	x	SNA	n/a	0

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Rhus typhina	Staghorn Sumac	Anacardiaceae	x		S5	1	3
Ribes americanum	Wild Black Currant	Grossulariaceae	x		S5	4	-3
Ribes cynosbati	Prickly Gooseberry	Grossulariaceae	x	x	S5	4	3
Ribes rubrum	Northern Red Currant	Grossulariaceae	x		SNA	n/a	5
Ribes triste	Swamp Red Currant	Grossulariaceae	x		S5	6	-5
Robinia pseudoacacia	Black Locust	Fabaceae	x		SNA	n/a	3
Rorippa palustris subsp. palustris	Marsh Yellowcress	Brassicaceae	x		S5?	3	-5
Rubus allegheniensis	Allegheny Blackberry	Rosaceae	x		S5	2	3
Rubus idaeus subsp. Strigosus	Wild Red Raspberry	Rosaceae	x		S5	2	3
Rubus occidentalis	Black Raspberry	Rosaceae	x	x	S5	2	5
Rubus odoratus	Purple-flowering Raspberry	Rosaceae	x		S5	3	5
Rumex crispus	Curly Dock	Polygonaceae	x		SNA	n/a	0
Rumex obtusifolius	Bitter Dock	Polygonaceae	x	x	SNA	n/a	-3
Salix amygdaloides	Peach-leaved Willow	Salicaceae	x		S5	6	-3
Salix bebbiana	Bebb's Willow	Salicaceae	x		S5	4	-3
Salix eriocephala	Heart-leaved Willow	Salicaceae	x		S5	4	-3
Salix x fragilis	(Salix alba X Salix euxina)	Salicaceae	x		SNA	n/a	0
Salix x sepulcralis	(Salix alba X Salix babylonica)	Salicaceae	x		SNA	n/a	0
Sambucus canadensis	Common Elderberry	Caprifoliaceae	x		S5	5	-3
Sambucus racemosa subsp. pubens	Red Elderberry	Caprifoliaceae	x	x	S5	5	3
Sanguinaria canadensis	Bloodroot	Papaveraceae	x	x	S5	5	3
Scirpus atrovirens	Dark-green Bulrush	Cyperaceae	x		S5	3	-5
Setaria pumila subsp. pumila	Yellow Foxtail	Poaceae	x		SNA	n/a	0
Setaria viridis	Green Foxtail	Poaceae	x		SNA	n/a	5
Silene latifolia	White Campion	Caryophyllaceae	x		SNA	n/a	5
Sisymbrium officinale	Common Tumble Mustard	Brassicaceae	x		SNA	n/a	5
Solanum dulcamara	Bittersweet Nightshade	Solanaceae	x	x	SNA	n/a	0
Solidago altissima	Tall Goldenrod	Asteraceae	x	x	S5	1	3
Solidago flexicaulis	Zigzag Goldenrod	Asteraceae	x	x	S5	6	3
Solidago rugosa subsp. rugosa	Northern Rough-stemmed Goldenrod	Asteraceae	x		S5	4	0
Sonchus arvensis subsp. arvensis	Smooth Sow-thistle	Asteraceae	x		SNA	n/a	3
Sonchus arvensis subsp. uliginosus	Smooth Sow-thistle	Asteraceae	x		SNA	n/a	3
Sonchus asper	Prickly Sow-thistle	Asteraceae	x		SNA	n/a	3
Sorbus aucuparia	European Mountain-ash	Rosaceae	x		SNA	n/a	5
Sphenopholis intermedia	Slender Wedge Grass	Poaceae	x		S4S5	6	0
Stellaria media	Common Chickweed	Caryophyllaceae	x	x	SNA	n/a	3
Symphyotrichum firmum	Glossy-leaved Aster	Asteraceae	x		S4?	4	-3
Symphyotrichum lanceolatum	Panicled Aster	Asteraceae	x	x	S5	3	-3
Symphyotrichum lateriflorum var. lateriflorum	Calico Aster	Asteraceae	x		S5	3	0
Symphyotrichum novae-angliae	New England Aster	Asteraceae	x	x	S5	2	-3

Scientific Name	Common Name	Family	Documented by Terrastory	Documented by MTE	S-Rank (per NHIC)	Coefficient of Conservatism	Coefficient of Wetness
Symphyotrichum pilosum	White Heath Aster	Asteraceae	x	x	S5	0	3
Symphyotrichum urophyllum	Arrow-leaved Aster	Asteraceae	x	x	S4	6	5
Symplocarpus foetidus	Skunk Cabbage	Araceae	x		S5	7	-5
Taraxacum officinale	Common Dandelion	Asteraceae	x		SNA	n/a	3
Thalictrum dioicum	Early Meadow-rue	Ranunculaceae	x		S5	6	3
Thalictrum pubescens	Tall Meadow-rue	Ranunculaceae	x		S5	5	-3
Thelypteris palustris var. pubescens	Eastern Marsh Fern	Thelypteridaceae	x		S5	5	-3
Thuja occidentalis	Eastern White Cedar	Cupressaceae	x		S5	4	-3
Tiarella cordifolia	Heart-leaved Foam-flower	Saxifragaceae	x		S5	6	3
Tilia americana	American Basswood	Tiliaceae	x	x	S5	4	3
Toxicodendron radicans var. radicans	Eastern Poison Ivy	Anacardiaceae	x	x	S5	2	0
Trifolium hybridum	Alsike Clover	Fabaceae	x		SNA	n/a	3
Trifolium pratense	Red Clover	Fabaceae	x		SNA	n/a	3
Trillium erectum	Red Trillium	Liliaceae	x		S5	6	3
Trillium grandiflorum	White Trillium	Liliaceae	x		S5	5	3
Tussilago farfara	Colt's-foot	Asteraceae	x		SNA	n/a	3
Typha latifolia	Broad-leaved Cattail	Typhaceae	x		S5	1	-5
Ulmus americana	American Elm	Ulmaceae	x		S5	3	-3
Urtica dioica subsp. gracilis	Slender Stinging Nettle	Urticaceae	x		S5	2	0
Verbascum thapsus	Common Mullein	Scrophulariaceae	x	x	SNA	n/a	5
Verbena hastata	Blue Vervain	Verbenaceae	x		S5	4	-3
Verbena urticifolia	White Vervain	Verbenaceae	x	x	S5	4	0
Veronica persica	Bird's-eye Speedwell	Scrophulariaceae	x		SNA	n/a	5
Viburnum lentago	Nannyberry	Caprifoliaceae	x		S5	4	0
Viburnum opulus subsp. trilobum var. americanum	Highbush Cranberry	Caprifoliaceae	x		S5	5	-3
Viola canadensis	Canada Violet	Violaceae	x		S5	6	3
Viola labradorica	Labrador Violet	Violaceae	x		S5	3	0
Viola sororia	Woolly Blue Violet	Violaceae	x		S5	4	0
Vitis riparia	Riverbank Grape	Vitaceae	x		S5	0	0
Zanthoxylum americanum	Common Prickly-ash	Rutaceae	x		S5	3	3

Appendix 4. Breeding Bird Survey Results

Common Name	Scientific Name	Breeding Bird Stations[1] and Breeding Status[2]					
		BI-1	BI-2	BI-3	BI-4	BI-5	Comments
Alder Flycatcher	*Empidonax alnorum*				Po		
American Crow	*Corvus brachyrhynchos*	Po	Po		Po	Po	
American Goldfinch	*Spinus tristis*	Po	Pr	Pr			
American Redstart	*Setophaga ruticilla*					Po	Recorded on adjacent lands to the west only.
American Robin	*Turdus migratorius*	Co	Co	Po	Pr	Pr	
Baltimore Oriole	*Icterus galbula*			Pr	Po	Po	
Bank Swallow	*Riparia riparia*		O				
Barn Swallow	***Hirundo rustica***		**O**		**O**	**O**	**Individual s recorded may be associated with breeding colonies occupying barns/structures west of the Site and east of Hunt Road.**
Bobolink	***Dolichonyx oryzivorus***		**Pr**				**Recorded on adjacent lands to the west only.**
Brown-headed Cowbird	*Molothrus ater*	Pr	Pr	Po		Po	
Canada Goose	*Branta canadensis*	O		O			
Cedar Waxwing	*Bombycilla cedrorum*					Po	
Chipping Sparrow	*Spizella passerina*				Po	Po	
Common Grackle	*Quiscalus quiscula*	Po					
Common Yellowthroat	*Geothlypis trichas*		Po	Pr			
Downy Woodpecker	*Picoides pubescens*			Po			
Eastern Kingbird	*Tyrannus tyrannus*		Po				
Eastern Meadowlark	***Sturnella magna***		**Po**				**Recorded on adjacent lands to the west only.**
Eastern Wood-pewee	***Contopus virens***	**Pr**					
European Starling	*Sturnus vulgaris*	Pr		Po	Pr	Pr	
Field Sparrow	*Spizella pusilla*		Pr				
Gray Catbird	*Dumetella carolinensis*	Po	Co	Pr			
Great Crested Flycatcher	*Myrarchus crinitus*			Po	Pr		
House Sparrow	*Passer domesticus*					Pr	
House Wren	*Troglodytes aedon*			Po	Po		
Indigo Bunting	*Passerina cyanea*			Po	Pr		
Killdeer	*Charadrius vociferus*					Pr	
Mourning Dove	*Zenaida macroura*			Po		Po	
Northern Cardinal	*Cardinalis cardinalis*	Po		Po			
Northern Flicker	*Colaptes auratus*			Po	Po		
Red-bellied Woodpecker	*Melanerpes carolinus*					Po	
Red-tailed Hawk	*Buteo jamaicensis*				O		Recorded on adjacent lands to the east only.
Red-winged Blackbird	*Agelaius phoeniceus*	Pr	Pr	Po	Pr	Po	
Rock Pigeon	*Columba livia*					Po	

Common Name	Scientific Name	Breeding Bird Stations[1] and Breeding Status[2]					
		BI-1	BI-2	BI-3	BI-4	BI-5	Comments
Savannah Sparrow	*Passerculus sandwichensis*		Pr			Pr	
Song Sparrow	*Melospiza melodia*	Pr	Pr	Pr	Pr	Po	
Tree Swallow	*Tachycineta bicolor*		Po				
Turkey Vulture	*Cathartes aura*					O	
Warbling Vireo	*Vireo gilvis*	Pr		Pr			
Willow Flycatcher	*Empidonax traillii*		Po				
Yellow Warbler	*Setophaga petechia*	Pr	Po				

[1] Locations of breeding bird survey stations are indicated on **Figure 2**.

[2] **Co** = Confirmed Breeder; **Pr** = Probable Breeder; **Po** = Possible Breeder; **O** = Observed (no evidence of breeding). Breeding status principally determined based on the results of the formal breeding bird surveys; however, where a higher level of breeding status was documented incidentally (i.e., during other field surveys), this is also captured in the above table.

Appendix 5. Significant Wildlife Habitat Assessment

1 SIGNIFICANT WILDLIFE HABITAT ASSESSMENT METHODOLGY

The PPS protects Significant Wildlife Habitat (SWH) from development and site alteration unless it can be demonstrated that no negative impacts on the feature or its function will occur. As outlined in the SWH Technical Guide (OMNR 2000) and supporting Ecoregion Criteria Schedules (OMNRF 2015), SWH is composed of four (4) principal components:

- Seasonal Concentration Areas of Animals
- Rare Vegetation Communities or Specialized Habitats;
- Habitat of Species of Conservation Concern; and
- Animal Movement Corridors.

The process for identifying SWH is outlined in s. 9.2.3 of the Natural Heritage Reference Manual (OMNR 2010). Step 1 considers the nature of the development application proposed and involves the assembly of background ecological information for the study area and adjacent lands. If the application triggers a need to protect SWH (e.g., change in land-use that requires approval under the Planning Act, etc.), a more thorough investigation of potential SWH features within the study area or adjacent lands must occur. Any confirmed SWH for the study area and adjacent lands as identified in relevant planning documents or by the MNRF should be noted at this stage.
Where a need to protect SWH is triggered, step 2 involves undertaking a more thorough analysis of features, functions, and habitats within the study area via Ecological Land Classification (see Section 2.8). The list of ELC Ecosite codes generated for the study area is compared to those codes considered candidate SWH in the relevant Ecoregion Criterion Schedule (i.e., 5E, 6E, or 7E) in step 3. Where a positive match between an ELC Ecosite and candidate SWH exists, the area is considered candidate SWH.

Two options are available for candidate SWH: 1) the area may be protected without further study, or 2) the area may be evaluated to ascertain whether confirmed SWH is present. Evaluation may involve generating more detailed maps of vegetation cover or conducting surveys of the wildlife population within the candidate SWH including reproductive, feeding, and movement patterns. If the area is confirmed SWH, the final step in the process is the completion of an impact assessment to demonstrate that no negative impacts to the confirmed SWH or its function will occur. The impact assessment process is assisted by SWH Mitigation Support Tool (OMNRF 2014).

2 RESULTS

Table 1. Results of the Significant Wildlife Habitat Assessment.

Ecoregion 7E	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Candidate SWH?	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Confirmed SWH?	Likelihood that Negative Effects to SWH (i.e., "degradation that threatens the health and integrity" as defined in the 2020 PPS) will occur based on the Proposed Development Plan and any related Site Alteration Activities.
Seasonal Concentration Areas of Animals			
Waterfowl Stopover and Staging Areas (Terrestrial)	**No.** Meadows, fields, and/or thickets that annually flood during spring and could support significant congregations of migrating waterfowl are absent.	--	--
Waterfowl Stopover and Staging Areas (Aquatic)	**No.** Large surface water features (e.g., ponds, lakes, bays, coastal inlets, large watercourses, etc.) and/or wetlands that annually flood during spring could support significant congregations of migrating waterfowl are absent.	--	--
Shorebird Migratory Stopover Areas	**No.** Unvegetated open areas adjacent to surface water features (e.g., shorelines, beaches, mudflats, etc.) and could support significant congregations of migrating shorebirds are absent	--	--
Raptor Wintering Areas	**No.** While forest and (to a lesser extent) meadow habitats are present, which may occasionally support wintering raptors, such habitats are too small to support significant congregations of wintering raptors. Agricultural fields within the Subject Property are routinely tilled, and therefore are expected to provide minimal habitat for small mammals during winter (major prey item for wintering raptors).		--
Bat Hibernacula	**No.** Natural features and habitats that could support hibernating bats (e.g., caves, mine shafts, crevices, karsts, etc.) are absent.	--	--
Bat Maternity Colonies	**Yes.** Mature deciduous and mixed forests with a high-density (i.e., >10/ha) of large-diameter (i.e., ≥25 cm DBH) trees containing cracks/cavities may be present.	**Possible.** A survey for potential bat maternity roosts by others confirmed the presence of 11 candidate features in the Southern Woodlot. This includes trees ≥25 cm DBH containing knot holes, cracks, loose bark, and/or cavities. As the Southern Woodlot is 1.42 ha in size, candidate roost density is 7.7/ha which is less than the minimum threshold for candidate SWH. The Northern Woodlot contains potential bat maternity roosts but was not surveyed in detail as it will be protected through this application.	**Negligible.** Extraction activities are restricted from the Northern Woodlot plus an ecologically appropriate setback (15-30 m). All necessary removal of trees within the Southern Woodlot, several of which may support bat maternity colonies based on surveys by others, will be subject to a timing restriction. See report for greater details.
Turtle Wintering Areas	**No.** Surface water features and/or wetlands with soft, muddy substrate which do not freeze to the bottom during winter are absent.	--	--
Reptile Hibernaculum	**Yes.** Features (e.g., small mammal burrows, rock crevices, etc.) and/or habitats (e.g., certain wetlands with a fluctuating water table, etc.) that could provide snakes with access below the frost line may be present.	**Unknown.** Spring emergence surveys for snakes were not undertaken.	**Negligible.** The Southern Woodlot (proposed to be removed) lacks discrete features (e.g., rock piles, old stone foundations, etc.) that have a greater potential to support significant congregations of overwintering snakes.
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)	**No.** Features that could support nesting by Cliff Swallow and Northern Rough-winged swallow (e.g., eroding banks, sandy hills, borrow pits, steep slopes, cliff faces, etc.) are absent.	--	--
Colonially - Nesting Bird Breeding Habitat Breeding Habitat (Tree/Shrubs)	**Yes.** Swamp communities are present.	**No.** Colonial waterbird nests are absent.	--

Ecoregion 7E	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Candidate SWH?	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Confirmed SWH?	Likelihood that Negative Effects to SWH (i.e., "degradation that threatens the health and integrity" as defined in the 2020 PPS) will occur based on the Proposed Development Plan and any related Site Alteration Activities.
Colonially - Nesting Bird Breeding Habitat (Ground)	**No.** Rocky islands or peninsulas along lakes or large rivers are absent.	--	--
Migratory Butterfly Stopover Areas	**No.** A mixture of fields and forests within 5 km from the shoreline of Lake Erie or Lake Ontario are absent.	--	--
Landbird Migratory Stopover Areas	**No.** While migrating landbirds may temporarily stopover to feed and rest, the Subject Property is unlikely to support significant congregations of migrating landbirds as it is greater than 5 km from the shoreline of Lake Erie.	--	--
Deer Winter Congregation Areas	**No.** The Subject Property and/or Adjacent Lands have not been identified as a deer wintering area by MNRF.	--	--
Rare Vegetation Communities or Specialized Habitats for Wildlife			
Cliffs and Talus Slopes	**No.** Cliffs and talus slope communities are absent.	--	--
Sand Barren	**No.** Sand barren communities are absent.	--	--
Alvar	**No.** Flora characteristic of alvars are absent.	--	--
Old Growth Forest	**Yes.** The Southern and Northern Woodlots are visible in historical aerial photographs dating back to1954.	**No.** While the Southern Woodlot contains certain old-growth characteristics (e.g., mature trees, snags and downed woody debris, rich herbaceous flora, etc.) it has been subject to extensive logging recently and portions are heavily dominated by Garlic Mustard. The Northern Woodlot contains some larger, mature Freeman's Maple but otherwise would not be appropriately characterized as old growth.	--
Savannah	**No.** Flora characteristic of savannahs are absent.	--	--
Tallgrass Prairie	**No.** Flora characteristic of tallgrass prairies are absent.	--	--
Other Rare Vegetation Community	**No.** Provincially rare vegetation communities are absent.	--	--
Waterfowl Nesting Area	**No.** Wetland that could support nesting waterfowl are absent.	--	--
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	**Yes.** The Southern Woodlot is adjacent to a large waterbody on Adjacent Lands (back-flooded aggregate pond).	**No.** Neither Bald Eagle nor Osprey were documented within the Subject Property or Adjacent Lands during site assessments by Terrastory. No nests associated with this species are present in the Southern Woodlot or other portions of the Subject Property.	--
Woodland Raptor Nesting Habitat	**Yes.** Southern and Northern Woodlots may support raptor nesting.	**No.** While no stick nests were documented in either the Northern or Southern Woodlots, tree cavities that may support Barred Owl are present. Notwithstanding this, the Subject Property does not contain interior forest habitat and is therefore unlikely to support nesting Barred Owl, which is rare in the local landscape.	--
Turtle Nesting Areas	**No.** Exposed mineral soils adjacent to surface water features (e.g., lakes, ponds, etc.) and/or wetlands that may support turtles are absent.	--	--

Ecoregion 7E	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Candidate SWH?	Do any Features, Habitats, or Areas on the Subject Property or Adjacent Lands meet relevant criteria (Ecoregion 7E Criteria Schedule) as Confirmed SWH?	Likelihood that Negative Effects to SWH (i.e., "degradation that threatens the health and integrity" as defined in the 2020 PPS) will occur based on the Proposed Development Plan and any related Site Alteration Activities.
Seeps and Springs	**No.** Areas where groundwater emerges at the surface and may support specialized habitat for plants and wildlife are absent.	--	--
Amphibian Breeding Habitat (Woodland)	**Yes.** The deciduous swamp in the Northern Woodlot may support significant congregations of breeding amphibians.	**Unknown.** Anuran calling surveys and/or other amphibian surveys were not undertaken as part of this study.	**Negligible.** Wetlands in the Northern Woodlot which may support significant Anuran breeding are protected by a 30 m setback from extraction.
Amphibian Breeding Habitat (Wetlands)	**No.** Marsh wetlands and surface water features (e.g., ponds, lakes, etc.) that may support significant congregations of breeding amphibians are absent.	--	--
Woodland Area-Sensitive Bird Breeding Habitat	**No.** Interior forest interior conditions (i.e., >200 m from edge) are absent.	--	--
Habitat for Species of Conservation Concern			
Marsh Bird Breeding Habitat	**No.** Wetlands with shallow water and emergent aquatic vegetation are absent.	--	--
Open Country Bird Breeding Habitat	**No.** Meadow habitats of sufficient size are absent.	--	--
Shrub/Early Successional Bird Breeding Habitat	**No.** Shrub/early-successional habitats of sufficient size are absent.	--	--
Terrestrial Crayfish	**Yes.** Marsh and swamp communities and/or wet fields are present	**Yes.** One (1) Terrestrial crayfish chimney was documented (see **Figure 3**).	**Negligible.** The documented crayfish chimney and its associated habitat are protected by a 30 m setback from extraction.
Special Concern and Rare Wildlife Species	**Yes.** See **Table 2** below.	**Yes.** See **Table 2** below.	**Possible.** See **Table 2** below.
Animal Movement Corridors			
Amphibian Movement Corridors	**Yes.** Candidate amphibian breeding habitat (woodlands) is present. Subject Property is not expected to act as a significant movement corridor between breeding and summer habitat for amphibians.	**Unknown.** Anuran movement surveys and/or other amphibian surveys were not undertaken as part of this study.	**Negligible.** Wetlands that may support significant Anuran breeding are protected by a 30 m setback from extraction. Areas proposed for extraction will not bisect any anticipated amphibian movement corridors.

Table 2. Results of the Special Concern and Provincially Rare Species Assessment.

Species	Status per O. Reg. 230/08 under the ESA and/or NHIC	Rationale for Consideration in this Study	General Description of Habitats and Features which the Species is Known to Occupy or Use within the Ecoregion in which this Study is Located	Likelihood that the Species Occupies the Area within or adjacent to proposed Development or Site Alteration[1]	Likelihood that Negative Effects to the Species or its Habitat (i.e., "degradation that threatens the health and integrity" as defined in the 2014 PPS) will occur based on the Proposed Development Plan and any related Site Alteration Activities.
Birds					
Eastern Wood-pewee (*Contopus virens*)	SC	OBBA, documented on-site.	• Breeds and forages in relatively open, deciduous and mixed forests of various sizes (including urban forest fragments) and along forest edges.	**Confirmed.** Species documented as a probable breeder in the Northern Woodlot.	**Low.** While this species may not be rare in the local landscape, removal of the Southern Woodlot will result in a loss of breeding habitat within the Site. Implementation of the Northern Woodlot Enhancement Plan will replace breeding habitat for this species over the long-term. Additional plantings are incorporated into the Rehabilitation Plan to extend the Northern Woodlot further south through site rehabilitation. See report for greater details.
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	SC	OBBA	• Breeds and forages in open forests, savannahs, and forest edges that tend to contain large, mature trees.	**Negligible**. Species not documented during breeding bird surveys.	--
Wood Thrush (*Hylocichla mustelina*)	SC	OBBA	• Breeds and forages in second-growth and mature deciduous and mixed forests with a well-developed understory.	**Negligible**. Species not documented during breeding bird surveys.	--
Insects					
Monarch (*Danaus plexippus*)	SC	Ont. Butterfly Atlas	• Oviposits on Milkweeds (*Asclepias* spp.). • Generalist foraging that nectars in most areas with wildflowers.	**Possible.** Ovipositing sites (i.e., species in the genus *Asclepias*) are present, and species may forage on the Subject Property.	**Negligible.** Areas of proposed extraction do not contain large stands of Milkweed. The landscape surrounding the Subject Property provides relatively abundant nectaring and ovipositing sites for this species.
Yellow Banded Bumble Bee (*Bombus terricola*)	SC	Habitat and distribution	• Occupies a range of open areas with nectaring sites. • Nests underground in abandoned rodent burrows or decomposing logs.	**Possible.** Species is a habitat generalist and occupies a wide range of areas.	**Negligible.** Areas of proposed extraction will not adversely affect nectaring opportunities for this species within the local landscape..
Reptiles					
Snapping Turtle (*Chelydra serpentina*)	SC	Habitat and distribution	• Occupies a variety of aquatic habitats with slow moving water. • Nests in exposed, usually coarse, friable substrate. • Known to make long-distance overland movements (i.e., several kilometers) between habitats.	**Unlikely**. While the deciduous swamp in the Northern Woodlot could theoretically support feeding activities by this species during spring and early summer (e.g., when standing water is at a maximum, etc.), habitat potential is low. Deciduous swamp would not support all life processes for this species (e.g., basking, overwintering, etc.).	--

[1] Likelihood categories should be interpreted as follows:

Negligible: so limited that the assessed species can be assumed absent.

Unlikely/Low: while theoretically conceivable, species presence very improbable or temporary based on available information (e.g., habitat conditions, range, abundance in local landscape, etc.).

Possible: species presence plausible based on available information; no convincing evidence suggesting species could not occur on-site.

Probable: while not confirmed, available information suggests species has a high likelihood of being present.

Confirmed: species observed and/or evidence of occupation (e.g., tracks, etc.) documented.

Appendix 6. Endangered and Threatened Species Assessment

Species	Status per O. Reg. 230/08 of the ESA	Rationale for Consideration in this Study	General Description of Habitats and Features which the Species is Known to Occupy within the Ecoregion in which this Study is Located	Likelihood that the Species Occupies the Area within or adjacent to proposed Development or Site Alteration[1]	Likelihood that Negative Effects to the Species or its Habitat (i.e., "Damage" or "Destruction" as defined in the ESA) will occur based on the Proposed Development Plan and any related Site Alteration Activities
Birds					
Bank Swallow (*Riparia riparia*)	THR	OBBA	• Nests in natural or anthropogenically derived exposed, sandy substrates on vertical or steep surfaces. • Forages in a variety of open areas including agricultural lands, meadows, prairies, woodland clearings, marshes, and above waterbodies.	**Negligible.** While this species may forage over open areas within the Site for brief periods during migration or forays from adjacent breeding sites, suitable breeding sites are absent from the Subject Property.	--
Barn Swallow (*Hirundo rustica*)	THR	OBBA	• Nests in barns, bridge/culvert undersides, awnings/overhangs on sides of buildings, and (historically) tree cavities. • Forages in a variety of open areas including agricultural lands, meadows, prairies, woodland clearings, marshes, and above waterbodies.	**Negligible.** Species documented foraging over the Site during breeding bird surveys. Suitable breeding sites are absent from the Subject Property.	--
Bobolink (*Dolichonyx oryzivorus*)	THR	OBBA	• Breeds and forages in hayfields, pastures, meadows, grasslands, and prairies which are often (but not always) greater 4 ha. • May be found in more marginal habitats (e.g., shrubby fields, smaller fields, etc.) during migration or following disturbance to breeding habitats (e.g., hay cutting).	**Negligible.** While this species was documented as a probable breeder in a hayfield on Adjacent Lands to the west, suitable breeding sites are absent from the Site.	--
Eastern Meadowlark (*Sturnella magna*)	THR	OBBA	• Breeds and forages in hayfields, savannahs, pastures, meadows, grasslands, prairies, and shrubby fields.	**Negligible.** While this species was documented as a probable breeder in a hayfield on Adjacent Lands to the west, suitable breeding sites are absent from the Site.	--
Mammals					
Eastern Small-footed Myotis (*Myotis leibii*)	END	On-site habitats and distribution in southern Ontario.	• Maternal roosting sites include exposed rock outcrops, crevices, and cliffs. • Overwinters in caves and mines that maintain temperatures above 0°C.	**Unlikely.** While this species may forage above open habitats on the Site or Adjacent Lands, potential maternal roosting habitat (e.g., rock outcrops, cliffs, etc.) is absent.	--
Little Brown Myotis (*Myotis lucifugus*)	END	On-site habitats and distribution in southern Ontario.	• Maternity roosts sites most often include buildings and large diameter trees with cracks, crevices, and/or exfoliating bark. • Overwinters in caves and mines that maintain temperatures above 0°C.	**Confirmed.** Species documented during bat acoustic monitoring surveys by others.	**Unknown.** A timing window restriction will be applied to tree removal activities within the Southern Woodlot to avoid impacting roosting bats (individuals or maternity colonies). MECP to confirm whether or not the proposed removal of the Southern Woodlot will contravene section 10 of the ESA through previous submission of an IGF in August 2020 by others.
Northern Myotis (*Myotis septentrionalis*)	END	On-site habitats and distribution in southern Ontario.	• Maternity roosts most often include large diameter trees with cracks, crevices, and/or exfoliating bark (buildings rarely used). • Overwinters in caves and mines that maintain temperatures above 0°C.	**Confirmed.** Species documented during bat acoustic monitoring surveys by others.	**Unknown.** A timing window restriction will be applied to tree removal activities within the Southern Woodlot to avoid impacting roosting bats (individuals or maternity colonies). MECP to confirm whether or not the proposed removal of the Southern Woodlot will contravene section 10 of the ESA through previous submission of an IGF in August 2020 by others.
Tri-colored Bat (*Perimyotis subflavus*)	END	On-site habitats and distribution in southern Ontario.	• Maternal roosting sites include Maple (*Acer* spp.) and Oak (*Quercus* spp.) with dead/dying leaf clusters.	**Negligible.** Species was not documented during bat acoustic monitoring.	--

Species	Status per O. Reg. 230/08 of the ESA	Rationale for Consideration in this Study	General Description of Habitats and Features which the Species is Known to Occupy within the Ecoregion in which this Study is Located	Likelihood that the Species Occupies the Area within or adjacent to proposed Development or Site Alteration[1]	Likelihood that Negative Effects to the Species or its Habitat (i.e., "Damage" or "Destruction" as defined in the ESA) will occur based on the Proposed Development Plan and any related Site Alteration Activities
			• Overwinters in caves and mines that maintain temperatures above 0°C.		
Plants					
American Ginseng (*Panax quinquefolius*)	END	Known from Middlesex County.	• Occupies rich, relatively undisturbed deciduous forests.	**Negligible.** Species was not documented during vascular plant surveys.	--
Butternut (*Juglans cinerea*)	END	Known from Middlesex County.	• Occupies a variety of treed habitats including mature forests, early-successional forests, and hedgerows.	**Negligible.** Species was not documented during vascular plant surveys.	--
Goldenseal (*Hydrastis canadensis*)	THR	Known from Middlesex County.	• Occupies rich deciduous forests.	**Negligible.** Species was not documented during vascular plant surveys.	--
Wood-poppy (*Stylophorum diphyllum*)	END	Known from Middlesex County.	• Occupies rich mixed and deciduous woodlands, forested ravines and slopes.	**Negligible.** Species was not documented during vascular plant surveys.	--

[1] Likelihood categories are to be interpreted as follows:

Negligible: so limited that the assessed species can be assumed absent.

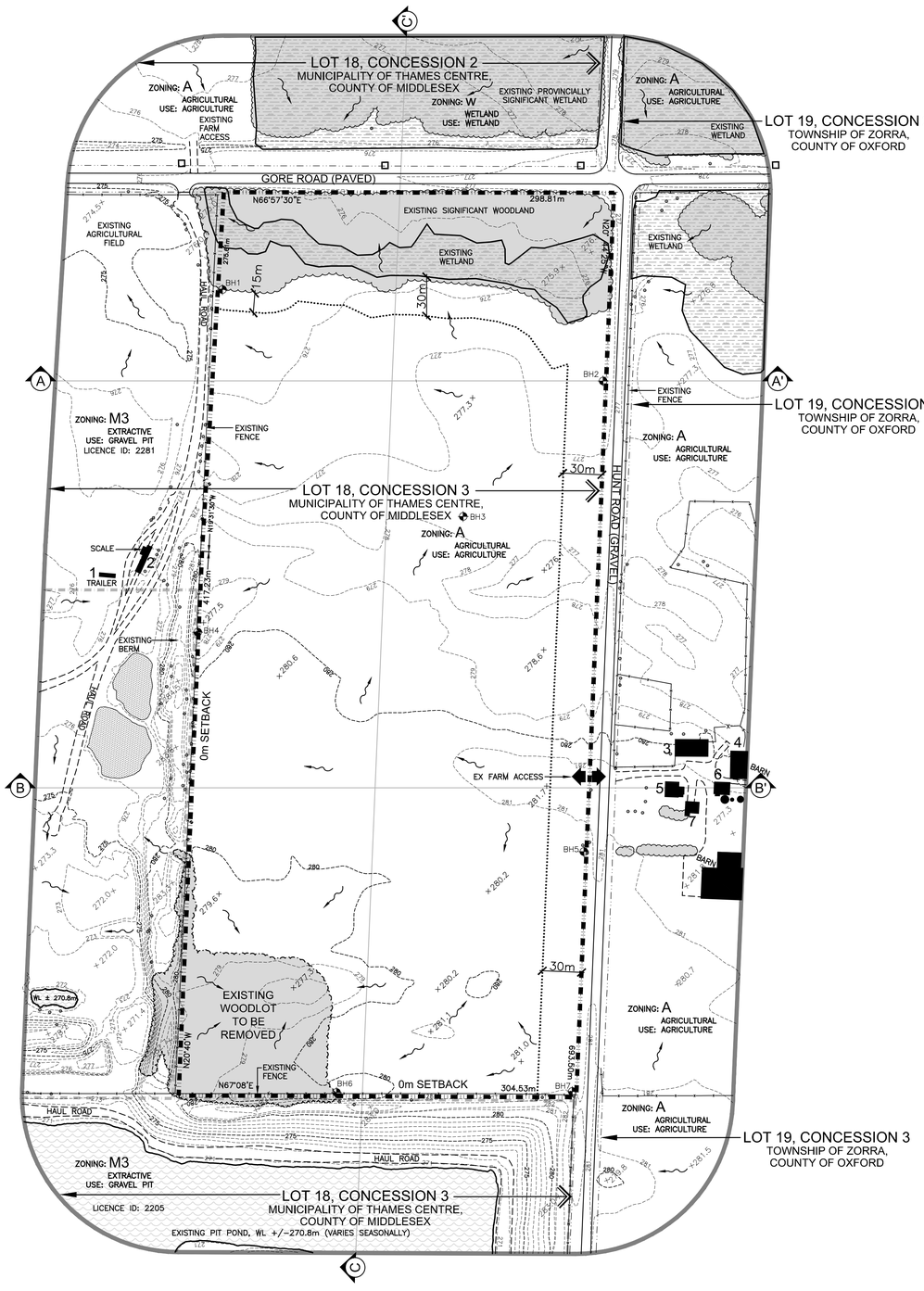
Low/Unlikely: while theoretically conceivable, species presence very improbable or temporary based on available information (e.g., habitat conditions, range, abundance in local landscape, etc.).

Possible: species presence plausible based on available information; no convincing evidence suggesting species could not occur on-site.

Probable: while not confirmed, available information suggests species has a high likelihood of being present.

Confirmed: species observed and/or evidence of occupation (e.g., tracks, etc.) documented.

Appendix 7. Site, Operations, Phasing and Final Rehabilitation Plans



EXISTING FEATURES NOTES

GENERAL SITE PLAN INFORMATION

1. THIS SITE PLAN CONSISTS OF 5 DRAWINGS AND MUST BE READ COLLECTIVELY.
2. ALL MEASUREMENTS SHOWN ON THIS SITE PLAN ARE IN METRES.

LICENCE INFORMATION

3. THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES AND FORESTRY UNDER THE AGGREGATE RESOURCES ACT FOR A CATEGORY 1 - CLASS 'A' LICENCE, PIT BELOW THE WATER TABLE.
4. APPLICANT:
   THAMES VALLEY AGGREGATES
   174751 17TH LINE
   INGERSOLL, ON
   N5C 3J6
5. TOTAL AREA TO BE LICENCED: 21.0 ha
   TOTAL AREA TO BE EXTRACTED: 16.30 ha
   TOTAL AREA TO REHABILITATED: 16.30 ha

BASE INFORMATION

6. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM FIRST BASE SOLUTIONS UTILIZING 2015 AIR PHOTOGRAPHY. ALL ELEVATIONS ARE GEODETIC AND ABOVE SEA LEVEL (ASL).

   THE SITE WAS FIELD CHECKED BY HARRINGTON MCAVAN LTD., APRIL 18, 2016.
7. THE PROPOSED LICENCE AREA IS ZONED A, GENERAL AGRICULTURE. AN APPLICATION FOR AN AMENDMENT TO THE ZONING BYLAW TO CHANGE THE DESIGNATION TO ME, AGGREGATE INDUSTRIAL HAS BEEN MADE TO THE MUNICIPALITY OF THAMES CENTRE. THE OFFICIAL PLAN DESIGNATES THE MAJORITY OF THIS SITE AS PRIMARY AGGREGATE RESOURCE.

HYDROGEOLOGICAL INFORMATION

8. HYDROGEOLOGICAL INFORMATION INCLUDING GROUNDWATER ELEVATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS. DATED NOVEMBER 12, 2020.
9. THE WATER TABLE ELEVATION WITHIN THESE PROPERTIES IS ESTIMATED TO BE BETWEEN ± 276.5 - 271.5m ABOVE SEA LEVEL (A.S.L.) BASED ON ABOVE REPORT.

TECHNICAL REPORTS

10. HYDROGEOLOGICAL INFORMATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS DATED NOVEMBER 12, 2020 (REFER TO SHEET 3 OF 5 FOR TECHNICAL RECOMMENDATIONS).
11. NATURAL ENVIRONMENT INFORMATION WAS OBTAINED FROM REPORT BY TERRASTORY DATED NOVEMBER 2020 (REFER TO SHEET 4 OF 5 FOR TECHNICAL RECOMMENDATIONS).
12. ARCHAEOLOGICAL INFORMATION WAS OBTAINED FROM REPORT BY TIMMINS MARTELLE HERITAGE CONSULTANTS INC. DATED JUNE 2016 (REFER TO SHEET 3 OF 5 FOR TECHNICAL RECOMMENDATIONS).
13. ACOUSTICAL INFORMATION WAS OBTAINED FROM NOISE REPORT BY HGC ENGINEERING DATED DECEMBER 9, 2020 (REFER TO SHEET 4 OF 5 FOR TECHNICAL RECOMMENDATIONS).

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENCED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- 285 EXISTING 5m CONTOUR LINE
- 284 EXISTING 1m CONTOUR LINE
- +283.95 EXISTING SPOT ELEVATION
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- 1 EXISTING BUILDING AND NUMBER
- HP EXISTING HYDRO POLE
- DIRECTION OF SURFACE WATER DRAINAGE
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019
- B' LOCATION OF SECTION
- EX FARM ACCESS (NO GATES)

BUILDING LIST

No.	
1.	TRAILER
2.	SCALE AND SCALEHOUSE
3.	SHED
4.	BARN
5.	HOUSE
6.	SHED
7.	BARN

Harrington McAvan Ltd
41 Main Street, Unit 102
Unionville, Ontario L3R 2E5
Tel: 905-294-8282 Fax: 905-294-7623
www.harringtonmcavan.com

Project Name

Thames Valley Aggregates Inc.

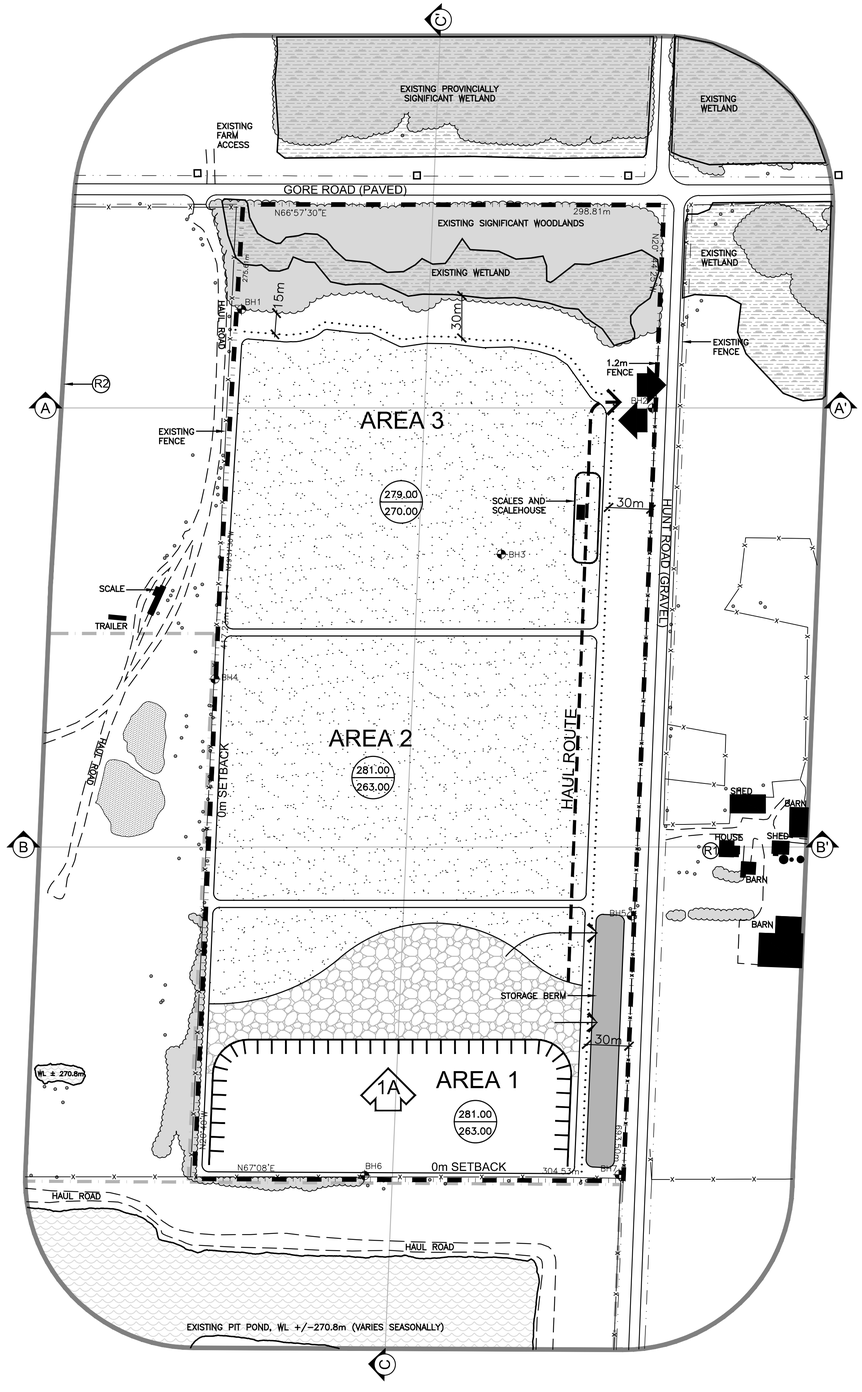
PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH/RM	Issue Date DEC 2020
Drawing Title: EXISTING FEATURES		Project Number 20-23
		Drawing Number 1 OF 5

FILE NAME: 20-23/COMP/2023-1.DWG
PLOT DATE: DECEMBER 23, 2020

PHASE A



PHASE A

PHASE A NOTES

1. **ESTABLISH THE ENTRANCE EXIT AND HAUL ROAD INTO THE SITE, ACCORDING TO THE APPROPRIATE MUNICIPAL STANDARDS.**
2. **PRIOR TO ANY ON SITE OPERATIONS, CONSTRUCT OR UPGRADE THE FENCING ON THE LICENCED BOUNDARIES (EXCEPT WHERE OVERRIDES EXIST) TO THE STANDARDS OF THE AGGREGATE RESOURCES ACT (1.2m HIGH POST AND WIRE FENCE). ALL FENCING SHALL BE MAINTAINED.**
3. **PREPARE SITE WITHIN AREA 1 BY REMOVING EXISTING TREES AND SCRUB VEGETATION IN THE AREA TO BE EXTRACTED. SALVAGE LARGER STUMPS AND TREES FOR HABITAT CREATION DURING PROGRESSIVE REHABILITATION.**
4. **PRIOR TO ANY ON SITE OPERATIONS, STRIP TOPSOIL AND OVERBURDEN SEPARATELY USE THE MATERIALS TO CONSTRUCT STORAGE BERM ALONG HUNT ROAD.**
5. **CONSTRUCT THE HAUL ROAD THROUGH AREA 1, 2 AND 3.**
6. **EXTRACTION OF AREA 1 WILL PROCEED IN DIRECTION SHOWN.**
7. **UNDISTURBED PORTIONS OF AREAS 2 AND 3 REMAIN IN AGRICULTURAL USE.**

OPERATIONS NOTES

GENERAL INFORMATION

1. THIS PLAN DEPICTS A SCHEMATIC OPERATIONS AND REHABILITATION SEQUENCE FOR THIS PROPERTY BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION. PHASES SHOWN ARE SCHEMATIC AND MAY SLIGHTLY VARY WITH MATERIAL QUALITY, SITE HYDROLOGY AND HYDROGEOLOGY OR MARKET DEMAND. PHASES DO NOT REPRESENT ANY SPECIFIC OR EQUAL TIME PERIOD.

   EXTRACTION SHALL GENERALLY FOLLOW THE SEQUENCE SHOWN. WHEN PARTIAL REHABILITATION OF A PHASE IS POSSIBLE IT SHALL BE CARRIED OUT. NOT WITHSTANDING THE EXTRACTION AND REHABILITATION PROCESS ABOVE, DEMAND FOR CERTAIN PRODUCTS OR BLENDING OF MATERIALS MAY REQUIRE SOME DEVIATION IN THE EXTRACTION AND REHABILITATION PHASING. ANY MAJOR DEVIATIONS FROM THE OPERATIONS SEQUENCE SHOWN WILL REQUIRE APPROVAL FROM MNRF.

2. REFER TO DRAWING 1 OF 5, EXISTING FEATURES, FOR A DESCRIPTION OF EXISTING VEGETATION AND BUILDINGS WITHIN THE 120 METRE BOUNDARY AND ON SITE.

3. SITE PLAN OVERRIDES ARE LISTED IN THE SITE PLAN OVERRIDE TABLE SHOWN ON THIS PAGE.

EXTRACTION/PROCESSING/HAULING INFORMATION

4. TOTAL AREA TO BE EXTRACTED IS 16.3 HECTARES.

5. MAXIMUM NUMBER OF TONNES OF AGGREGATE TO BE REMOVED FROM THE SITE IN ANY CALENDAR YEAR IS 500,000 TONNES.

   EXTRACTION OF SAND AND GRAVEL ABOVE WATER TABLE WILL TAKE PLACE IN TWO OR THREE BENCHES, WITH A MAXIMUM HEIGHT OF ±8 METRES. THE GROUNDWATER TABLE IS ESTIMATED TO BE BETWEEN ±276.5 - 271.5m ASL (SEE REPORT BY LDS DATED NOVEMBER 12, 2020) THERE WILL BE ONE LIFT BELOW THE WATER TABLE TO A MAXIMUM DEPTH OF ±263m ASL TO BE EXTRACTED BY EXCAVATOR, BACKHOE OR DRAG LINE. FRONT END LOADERS WILL BE USED TO EXTRACT MATERIAL AND HAUL TRUCKS OR CONVEYORS WILL CARRY MATERIAL TO THE PLANT FOR FURTHER PROCESSING. REFER TO SECTIONS A-A', B-B', AND C-C' ON DRAWING 4 OF 5 FOR FURTHER DETAILS.

   PORTABLE PROCESSING EQUIPMENT, FOR CRUSHING AND SCREENING WILL BE USED ON SITE AND WILL BE LOCATED ON THE PIT FLOOR AND WILL FOLLOW THE EXTRACTION FACE. STOCKPILES OF PROCESSED AGGREGATE WILL BE PLACED BETWEEN R1 AND THE PROCESSING PLANT AS A NOISE BUFFER. IN ADDITION TO PROCESSING, SITE ACTIVITIES WILL INCLUDE STRIPPING AND REHABILITATION, OPERATIONAL EQUIPMENT MAY INCLUDE TRUCKS, LOADERS, EXCAVATOR, BACKHOES, BULLDOZERS, SCRAPERS, CONVEYORS AND OTHER RELATED EQUIPMENT. PROCESSING EQUIPMENT, STACKERS AND PRODUCT STOCKPILES WILL NOT EXCEED ±15 METRES IN HEIGHT AND WILL BE LOCATED IN THE PROCESSING AREA AND/OR CLOSE TO PIT FACES. MATERIAL FROM OTHER PROPERTIES MAY BE IMPORTED INTO THE SITE FOR BLENDING, CUSTOM PRODUCTS AND/OR RESALE.

6. OFFICE/STORAGE BUILDING AND/OR SCALE/SCALEHOUSE MAY BE CONSTRUCTED WHERE SHOWN.

AGGREGATE RECYCLING

7. THERE MAY BE RECYCLING OF MATERIAL (ASPHALT AND CONCRETE) ON THIS SITE. MATERIAL IMPORTED FOR RECYCLING WILL BE STORED IN SEGREGATED STOCKPILES WITHIN THE PROCESSING AREA. RECYCLABLE ASPHALT MATERIALS WILL NOT BE STOCKPILED WITHIN 30m OF ANY WATER BODY OR MAN-MADE POND; OR 2m OF THE SURFACE OF THE ESTABLISHED WATER TABLE. ANY REBAR AND OTHER STRUCTURAL METAL MUST BE REMOVED FROM THE RECYCLED MATERIAL DURING PROCESSING AND PLACED IN A DESIGNATED SCRAP PILE ON SITE WHICH WILL BE REMOVED ON AN ON-GOING BASIS. REMOVAL OF RECYCLED AGGREGATE IS TO BE ONGOING. ONCE THE AGGREGATE ON SITE HAS BEEN DEPLETED THERE WILL BE NO FURTHER IMPORTATION OF RECYCLABLE MATERIALS PERMITTED. ONCE FINAL REHABILITATION HAS BEEN COMPLETED AND APPROVED IN ACCORDANCE WITH THE SITE PLAN, ALL RECYCLING OPERATIONS MUST CEASE.

8. EQUIPMENT, SCRAP AND MACHINERY ASSOCIATED WITH THE EXTRACTION OPERATIONS WILL BE REMOVED UPON COMPLETION OF EXTRACTION.

HYDROGEOLOGICAL INFORMATION

9. THE WATER TABLE ELEVATION VARIES ACROSS THIS LICENCE FROM APPROXIMATELY ±276.5 - ± 271.5m ABOVE SEA LEVEL (A.S.L.), BASED ON THE HYDROGEOLOGICAL REPORT. REFER TO SECTIONS ON SHEET 4 OF 5.

10. SURFACE DRAINAGE WILL BE DIRECTED TO THE POND, AND/ OR LOW AREAS FOR WATER TO INFILTRATE INTO THE GRANULAR MATERIALS ON THE PIT FLOOR.

NOISE MITIGATION INFORMATION

11. HOURS OF OPERATION:

SITE PREPARATION AND REHABILITATION:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
EXCAVATION AND PROCESSING	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
SHIPPING:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS

AIR QUALITY INFORMATION

12. WATER OR CALCIUM CHLORIDE WILL BE APPLIED TO INTERNAL HAUL ROADS AND PROCESSING AREAS AS OFTEN AS REQUIRED TO MITIGATE DUST.

SITE MANAGEMENT INFORMATION

MAINTENANCE/ PROTECTION OF VEGETATION INFORMATION

13. EXISTING VEGETATION WITHIN THE LICENCED AREA SHALL BE MAINTAINED IN A HEALTHY VIGOROUS GROWING CONDITION UNTIL SEQUENTIAL STRIPPING BEGINS OR UNTIL THE REHABILITATION IS COMPLETE. ANY VEGETATION PLANTED AS PART OF SITE IMPROVEMENTS OR PROGRESSIVE AND FINAL REHABILITATION WILL ALSO BE MAINTAINED IN A HEALTHY, VIGOROUS GROWING CONDITION.

FENCING INFORMATION

14. BOUNDARIES OF THE AREA TO BE LICENCED THAT ARE PRESENTLY FENCED ARE SHOWN ON DRAWING 1 OF 5 EXISTING FEATURES. PRIOR TO ANY STRIPPING OR PREPARATION, FENCING ON THE LICENCED BOUNDARIES (EXCEPT WHERE OVERRIDES ARE EXIST) WILL BE UPGRADED TO 1.2m HIGH POST AND WIRE TO COMPLY WITH THE AGGREGATE RESOURCES ACT WHERE REQUIRED. ALL FENCING SHALL BE MAINTAINED.

TOPSOIL/SUBSOIL/OVERBURDEN STORAGE INFORMATION

15. TOPSOIL AND OVERBURDEN SHALL BE STRIPPED AND STORED SEPARATELY IN BERMS WHERE SHOWN AND STOCKPILES ON PIT FLOOR CLOSE TO EXTRACTION FACE.

BERM INFORMATION

16. BERMS SHALL BE A MINIMUM OF ±2.5 METRES ABOVE THE EXISTING GRADE, OR AS SPECIFIED IN THE NOISE ASSESSMENT REPORT DATED DECEMBER 9, 2020 AND SHOWN ON OPS PLAN. BERMS SHALL NOT EXCEED 2:1. REFER TO TYPICAL BERM CROSS SECTION ON DRAWING 4 OF 5 DETAILS AND SECTIONS. ALL BERMS SHALL BE SEEDED (USING GRASS/ LEGUME MIXTURE, SEE REHABILITATION PLAN) IMMEDIATELY UPON COMPLETION TO MINIMIZE NOISE, DUST AND EROSION.

17. ON COMPLETION OF THE BERMS, EXCESS ON-SITE OVERBURDEN WILL BE USED TO PROGRESSIVELY BACKFILL AND REHABILITATE THE SITE. TOPSOIL CAN BE TEMPORARILY STOCKPILED ON THE PIT FLOOR.

SCRAP STORAGE INFORMATION

18. ALL SCRAP, USED MACHINERY AND STUMPS GENERATED THROUGH THE OPERATIONS WITHIN THIS LICENCE WILL BE STORED IN THE PROCESSING AREA, A MINIMUM OF 30m FROM THE BOUNDARY OF THE SITE AND NOT WITHIN 30m OF ANY BODY OF WATER AND SHALL BE DISPOSED OF ON AN ONGOING BASIS. STUMPS/ WOODY MATERIAL MAY BE CHIPPED AND USED FOR SOIL ENHANCEMENT DURING PROGRESSIVE REHABILITATION. TREES WILL BE HARVESTED AND SOLD AS LUMBER OR UTILIZED FOR FIREWOOD AND/ OR THEIR BEST USE, UPON COMPLETION OF EXTRACTION, ALL SCRAP EQUIPMENT AND USED MACHINERY SHALL BE REMOVED.

PETROLEUM STORAGE INFORMATION

19. FUEL, OIL, RADIATOR AND HYDRAULIC FLUID, AND OTHER CHEMICALS NEEDED FOR THE MAINTENANCE AND FUNCTIONING OF ON-SITE AGGREGATE PROCESSING EQUIPMENT SHALL BE APPROPRIATELY STORED IN ABOVE-GROUND CONTAINERS AND SHALL MEET THE REQUIREMENTS OF THE GASOLINE HANDLING ACT, AS AMENDED, AND THE GASOLINE HANDLING CODE AND REGULATIONS, AS AMENDED BY THE TECHNICAL STANDARDS AND SAFETY ACT (TSSA) AND LIQUID FUELS HANDLING CODE, AND IN ACCORDANCE WITH THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARK'S CHEMICAL STORAGE GUIDELINES. ALL REFUELING SHALL BE WITHIN A CONTAINMENT PAD. ALL SPILLS TO THE ENVIRONMENT MUST BE REPORTED TO THE SPILLS ACTION CENTRE OF MECP. ANY SPILL SHALL BE REMOVED AND DISPOSED OF AT AN APPROPRIATE MECP APPROVED FACILITY.

IMPORTATION OF FILL INFORMATION

20. IN ORDER TO MAXIMIZE RESOURCE RECOVERY, IMPORTATION OF CLEAN INERT FILL (EG. TOPSOIL AND/OR OVERBURDEN) MAY BE IMPORTED TO FACILITATE 3:1 SIDESLOPE REHABILITATION (ABOVE WATER TABLE SIDESLOPES). ONLY NATIVE ON SITE OVERBURDEN AND/OR OFF-SPEC MATERIALS WILL BE USED FOR BELOW WATER REHABILITATION. ONLY SUFFICIENT MATERIAL TO CREATE FINAL GRADES AS SHOWN MAY BE IMPORTED.

   IMPORTED MATERIAL SHALL MEET THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARK'S PARAMETERS UNDER TABLE "1" OF MECP'S "SOIL, GROUND WATER AND SEDIMENT STANDARDS FOR USE UNDER PART XV.1 OF THE ENVIRONMENTAL PROTECTION ACT".

   SAMPLING AND TESTING OF ALL IMPORTED MATERIAL SHALL BE PERFORMED AT SOURCE PRIOR TO THE IMPORTATION OF MATERIAL ONTO THE LICENSED SITE BY A QUALIFIED PERSON (QP) UNDER EPA. A QP SHALL ALSO DESIGN FILL MONITORING PROGRAM. RANDOM SAMPLING OF ALL IMPORTED MATERIAL SHALL BE CONDUCTED AT THE REQUEST OF MNRF.

   THE LICENSEE SHALL KEEP DETAILED RECORDS OF THE AMOUNT OF MATERIAL BROUGHT ON SITE FOR REHABILITATION AND THE TESTING RESULTS OF ALL SAMPLES. ALL RECORDS AND TESTING RESULTS SHALL BE AVAILABLE UPON REQUEST BY MNRF OR MECP.

WASH PLANT INFORMATION

21. SHOULD A WASH PLANT BE REQUIRED WITH A PREDICTED WATER USAGE OF 50,000L/DAY OR MORE, THE PRODUCER SHALL OBTAIN PERMIT TO TAKE WATER FROM MECP AND HAVE IT READY FOR INSPECTION. THE PERMIT TO TAKE WATER (PTTW) WILL BE ACCOMPANIED BY THE APPROPRIATE SUPPORTING DOCUMENTATION.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXTRACTION FACE
- BERM (MIN. HEIGHT AS SHOWN)
- UNDISTURBED AREA
- AREA STRIPPED OF TOPSOIL AND OVERBURDEN
- PROPOSED OPEN WATER
- EXISTING BUILDING
- HP EXISTING HYDRO POLE
- B' LOCATION OF SECTION
- ENTRANCE/ EXIT
- DIRECTION OF EXTRACTION
- DIRECTION OF TOPSOIL AND OVERBURDEN MOVEMENT
- PRODUCT TRANSPORTATION VIA HAUL ROAD
- R3 LOCATION OF NOISE RECEPTOR
- 296.00 / 286.00 EXISTING ELEVATION / PROPOSED ELEVATION
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019

SITE PLAN OVERRIDE (VARIANCE)

THE FOLLOWING CONDITIONS ILLUSTRATED ON THESE PLANS VARY FROM THE OF THE PROVINCIAL STANDARDS MADE UNDER THE AGGREGATE RESOURCES ACT

ITEM	SECTION
1. SETBACK IS REDUCED TO 0m ALONG SOUTH AND WEST BOUNDARIES. ADJACENT LANDS LICENSED FOR AGGREGATE EXTRACTION. AS PER AGREEMENT WITH ADJACENT LICENSEE/ LANDOWNER.	5.10.1
2. NO FENCE ON NORTH BOUNDARY. ACCESS IS RESTRICTED DUE TO NATURAL FEATURES.	5.1

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Project Name

Thames Valley Aggregates Inc.

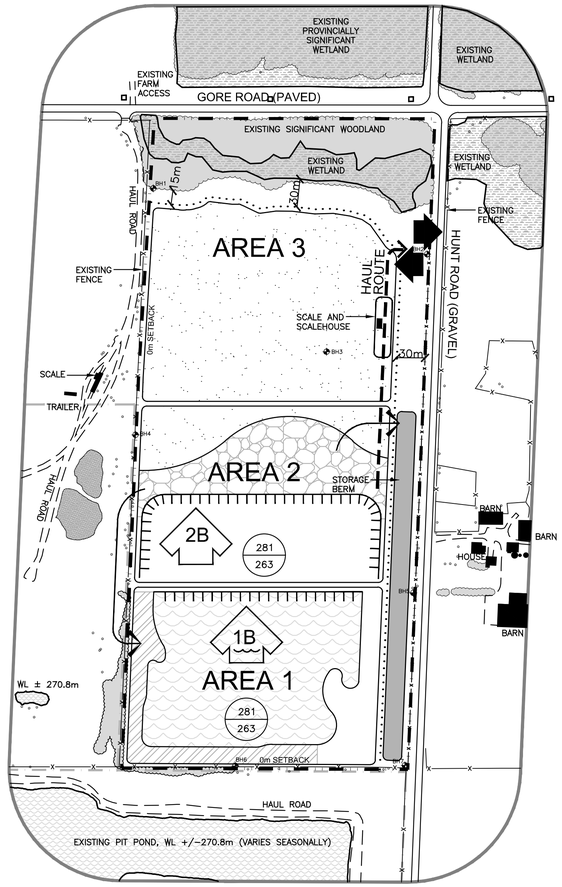
PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: OPERATION PLANS PHASE A		Project Number 20-23
		Drawing Number 2 OF 5

FILE NAME: 20-23/COMP/2023-2.DWG
PLOT DATE: DECEMBER 23, 2020

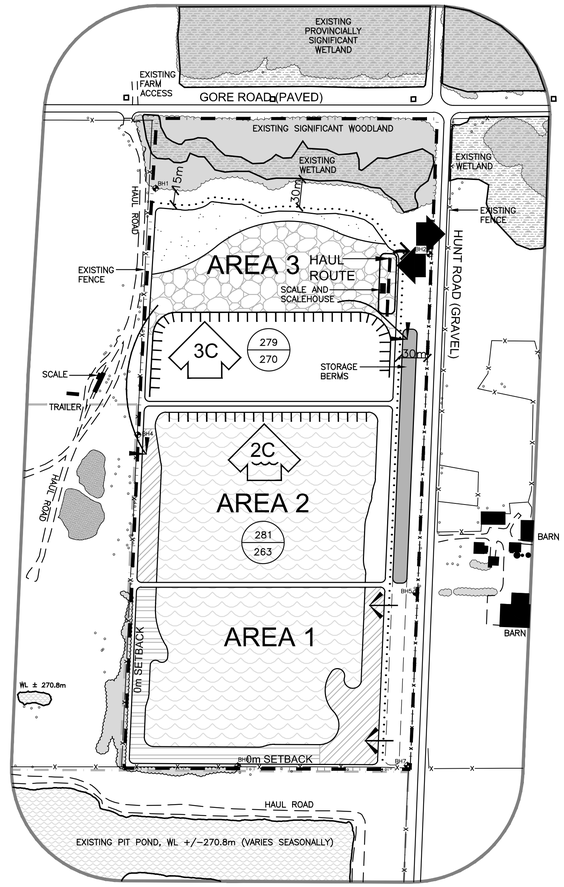
PHASE B



PHASE B

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 3 AND USE THE MATERIAL TO EXTEND THE STORAGE BERM ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE SOUTHERN AND WESTERN PARTS OF AREA 1.
2. BEGIN ABOVE WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
3. BEGIN BELOW WATER EXTRACTION OF AREA 1 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
4. UNDISTURBED PORTION OF AREA 2 & 3 TO REMAIN IN AGRICULTURAL USE.
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

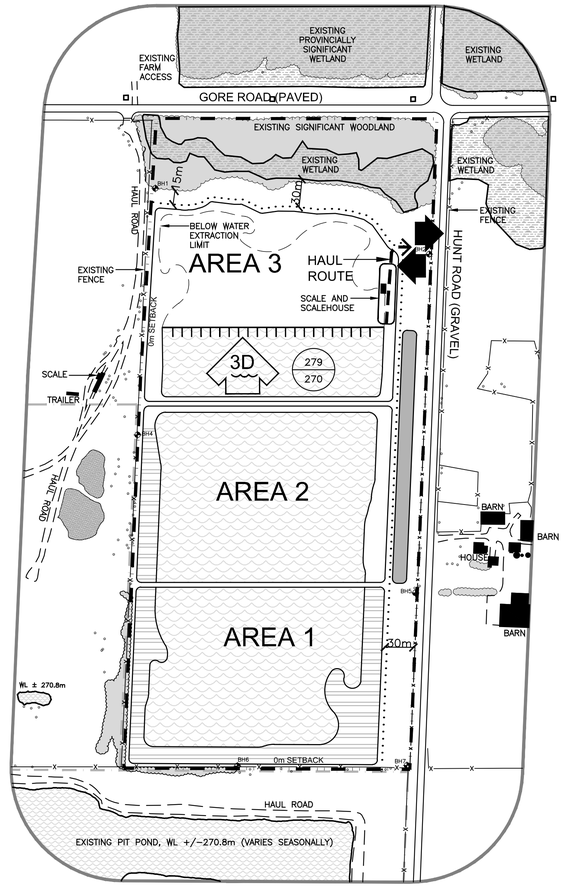
PHASE C



PHASE C

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 3 AND USE THE MATERIAL TO EXTEND STORAGE BERM (ASS REQUIRED) ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA 2.
2. COMPLETE PROGRESSIVE REHABILITATION OF SOUTHERN AND WESTERN PARTS OF AREA1, THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/OPEN SPACE AFTER-USE.
3. BEGIN PROGRESSIVE REHABILITATION OF EASTERN PART OF AREA 1 USING TOPSOIL AND OVERBURDEN STOCKPILED IN BERM ALONG AREA 1 OF HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA /OPEN SPACE AFTER-USE.
4. BEGIN ABOVE WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. BEGIN BELOW WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
6. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE D



PHASE D

1. COMPLETE PROGRESSIVE REHABILITATION OF AREA 1. THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE AFTER-USE.
2. COMPLETE PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA 2, THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE AFTER-USE.
3. COMPLETE BELOW WATER EXTRACTION IN AREA 2.
4. BEGIN BELOW WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE E (NOT SHOWN)

1. BEGIN PROGRESSIVE REHABILITATION OF EAST SIDE OF AREA 2 AND AREA 3 USING TOPSOIL AND OVERBURDEN STOCKPILED IN THE BERM ALONG AREA 3 OF HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
2. REMOVE ALL EQUIPMENT, STRUCTURES, STOCKPILES AND SCRAP FROM THE SITE AND REHABILITATE ALL HAUL ROADS USING TOPSOIL AND OVERBURDEN STOCKPILED IN REMAINING BERMS.
3. COMPLETE PROGRESSIVE REHABILITATION IN AREA 3 USING MATERIAL REMAINING IN BERMS. AREA 1 & 2 RETURN TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
4. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

TECHNICAL RECOMMENDATIONS

THE FOLLOWING ARE THE TECHNICAL RECOMMENDATIONS FROM ALL OF THE EXPERTS' REPORTS AS OF FEBRUARY 2019. ADDITIONAL RECOMMENDATIONS MAY BE INCLUDED AS A RESULT OF THE LICENCE REVIEW PROCESS.

ARCHAEOLOGICAL ASSESSMENT - TIMMINS MARTELLE HERITAGE CONSULTANTS INC. DATED JUNE 2016

1. SHOULD PREVIOUSLY UNDOCUMENTED (I.E., UNKNOWN OR DEEPLY BURIED) ARCHAEOLOGICAL RESOURCES BE DISCOVERED, THEY MAY BE A NEW ARCHAEOLOGICAL SITE AND THEREFORE SUBJECT TO SECTION 48(1) OF THE ONTARIO HERITAGE ACT. THE PROPONENT OR PERSONA DISCOVERING THE ARCHAEOLOGICAL RESOURCES MUST CEASE ALTERATION OF THE SITE IMMEDIATELY AND ENGAGE A LICENSED CONSULTANT ARCHAEOLOGIST TO CARRY OUT ARCHAEOLOGICAL FIELDWORK, IN COMPLIANCE WITH SECTION 48 (1) OF THE ONTARIO HERITAGE ACT. FURTHER ARCHAEOLOGICAL SITES RECOMMENDED FOR FURTHER ARCHAEOLOGICAL FIELDWORK OR PROTECTION REMAIN SUBJECT TO SECTION 48 (1) OF THE ONTARIO HERITAGE ACT AND SHALL NOT BE ALTERED, OR HAVE ARTIFACTS REMOVED FROM THEM, EXCEPT BY A PERSON HOLDING AN ARCHAEOLOGICAL LICENCE.
2. THE FUNERAL, BURIAL, AND CREMATION SERVICES ACT 2002, S.O. 2002, C. 33 REQUIRES THAT ANY PERSON DISCOVERING HUMAN REMAINS MUST NOTIFY THE POLICE OR CORONER AND THE REGISTRAR OF CEMETERIES AT THE MINISTRY OF SMALL BUSINESS AND CONSUMER SERVICES. THE REGISTRAR OF CEMETERIES, CEMETERIES REGULATION UNIT CAN BE REACHED AT (416)326-8404 OR (416)326-8393.

HYDROGEOLOGICAL ASSESSMENT - LDS DATED NOVEMBER 12, 2020

1. FUEL STORAGE, EQUIPMENT FILLING, AND EQUIPMENT MAINTENANCE SHALL BE CARRIED OUT IN ACCORDANCE WITH BEST MANAGEMENT PRACTICES OUTLINED IN SECTION 6.1, INCLUDING DESIGNATED FUELING LOCATIONS AND IMPLEMENTATION OF SPILLS MANAGEMENT RESPONSE PLANS, AS APPROPRIATE TO REDUCE THE POTENTIAL AND MITIGATE RISKS ASSOCIATED WITH THE EQUIPMENT OPERATION.
2. WATER LEVELS HAVE BEEN CARRIED OUT ON A MONTHLY BASIS SINCE THE INCEPTION OF THE MONITORING WELLS WHICH WERE INSTALLED ONSITE. GROUNDWATER LEVEL MONITORING SHALL CONTINUE AT THE SITE ON A QUARTERLY BASIS AFTER THE PIT IS LICENSED, AND CONTINUE UNTIL SITE RESTORATION IS COMPLETE.
3. GROUNDWATER SAMPLES HAVE BEEN COLLECTED AT THE SITE TO ESTABLISH BASELINE WATER QUALITY CONDITIONS FOR SHALLOW GROUNDWATER WITHIN THE UNCONFINED AQUIFER WHICH IS EXPECTED TO BE ENCOUNTERED DURING THE AGGREGATE EXTRACTION OPERATION. FUTURE WATER QUALITY TESTING CAN BE COMPARED TO THE BACKGROUND INFORMATION PRESENTED IN THIS REPORT, IF REQUIRED.
4. IF COMPLAINTS ARE RECEIVED FROM NEARBY OR NEIGHBOURING PROPERTY OWNERS (WITHIN 120 M OF THE SITE), THE WATER SUPPLY INTERFERENCE PROTOCOLS OUTLINED AS FOLLOWS SHALL BE ADHERED TO.

THE FOLLOWING WATER WELL INTERFERENCE COMPLAINT PROTOCOL IS RECOMMENDED TO ADDRESS WATER SUPPLY INTERFERENCE TO DOMESTIC AND FARM WATER SUPPLIES FOR PROPERTIES LOCATED IN PROXIMITY (WITHIN 150 M) TO THE SITE.

1. NEARBY AND NEIGHBOURING PROPERTIES SHALL BE PROVIDED WITH 24-HOUR EMERGENCY CONTACT INFORMATION FOR THE LICENSEE, TO FACILITATE REPORTING OF PERCEIVED WATER SUPPLY IMPACTS.
2. NEARBY AND NEIGHBOURING PROPERTIES WHICH EXPERIENCE DISRUPTION OR QUALITY PROBLEMS SHALL NOTIFY THE LICENSEE, WHO WILL BE RESPONSIBLE TO REPORT THE WELL INTERFERENCE COMPLAINT TO MNRF AND MECP.
3. IN THE EVENT THAT THE WELL OWNER EXPERIENCES A SIGNIFICANT DISRUPTION IN THEIR WATER SUPPLY, OR EXPERIENCE SIGNIFICANT ADVERSE EFFECTS UPON THEIR WATER QUALITY; AND IF THE OPERATION OF THE PIT CANNOT OBVIOUSLY AND DEFINITIVELY BE EXCLUDED AS THE CAUSE, THE LICENSEE SHALL PROVIDE A TEMPORARY WATER SUPPLY WITHIN 24 HOURS AND THEREAFTER UNTIL SUCH TIME AS THE CAUSE OF THE DISTURBANCE CAN BE DETERMINED AND THE SITUATION ADDRESSED.
4. THE LICENSEE SHALL INVESTIGATE THE CAUSE OF THE WATER SUPPLY DISTURBANCE AND SHALL REPORT TO THE MNRF, MECP AND THE WELL OWNER.
5. IF IT IS DETERMINED THAT THE AGGREGATE EXTRACTION AT THE PIT HAS BEEN FOUND TO HAVE CAUSED A DOMESTIC OR FARM WATER SUPPLY TO BE ADVERSELY AFFECTED, THE LICENSEE SHALL, AT THE LICENSEES EXPENSE, EITHER RESTORE OR REPLACE THE WATER SUPPLY TO ENSURE THAT HISTORIC WATER SUPPLY AND QUALITY ARE RESTORED FOR SUCH A RESIDENT. IF IT IS DETERMINED THAT THE OPERATION OF THE PIT HAS NOT CAUSED ANY DOMESTIC OR FARM WATER SUPPLY TO BE ADVERSELY AFFECTED, THE TEMPORARY WATER SUPPLY WILL BE MAINTAINED FOR AN ADDITIONAL 24 HOURS TO ALLOW THE RESIDENT TO MAKE ALTERNATE WATER SUPPLY ARRANGEMENTS.

TECHNICAL RECOMMENDATIONS
CONTINUED ON PAGE 4 OF 5

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING VEGETATION
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- ONGOING REHABILITATION
- COMPLETED REHABILITATION
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- EXISTING BUILDING
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- DIRECTION OF ABOVE WATER EXTRACTION
- DIRECTION OF BELOW WATER EXTRACTION
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- R3 LOCATION OF NOISE RECEPTOR
- 296.00 / 286.00 EXISTING ELEVATION / PROPOSED ELEVATION
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019

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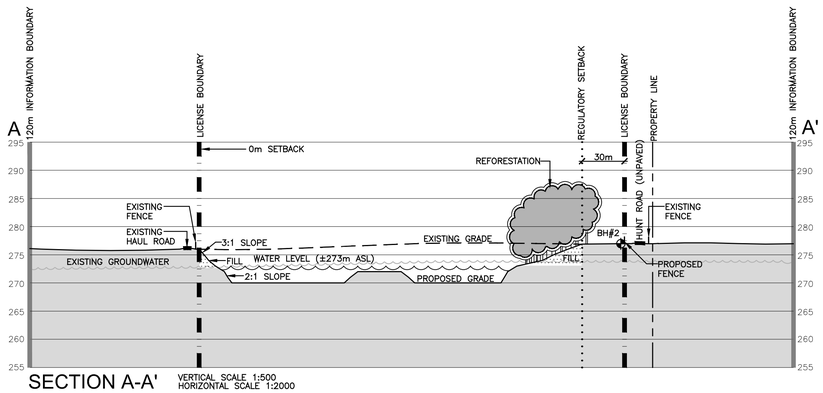
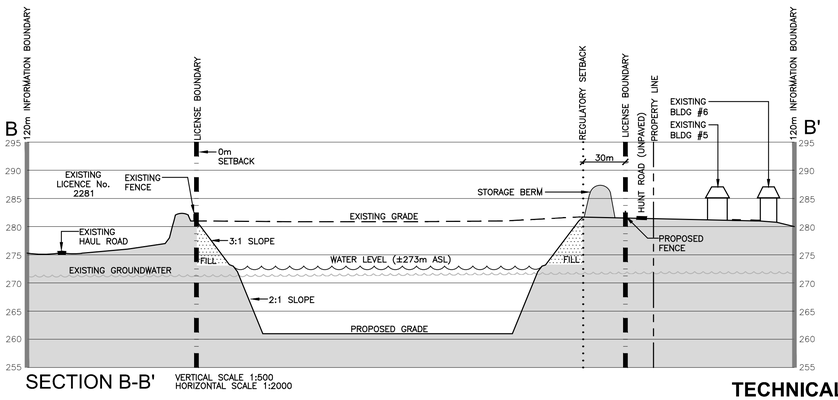
Scale 1:3000 (0 10 50 90 120m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH/RM	Issue Date DEC 2020
Drawing Title: OPERATION PLANS PHASE B TO E		Project Number 20-23
		Drawing Number 3 OF 5

FILE NAME: 20-23/COMP/2023-3.DWG
PLOT DATE: DECEMBER 23, 2020

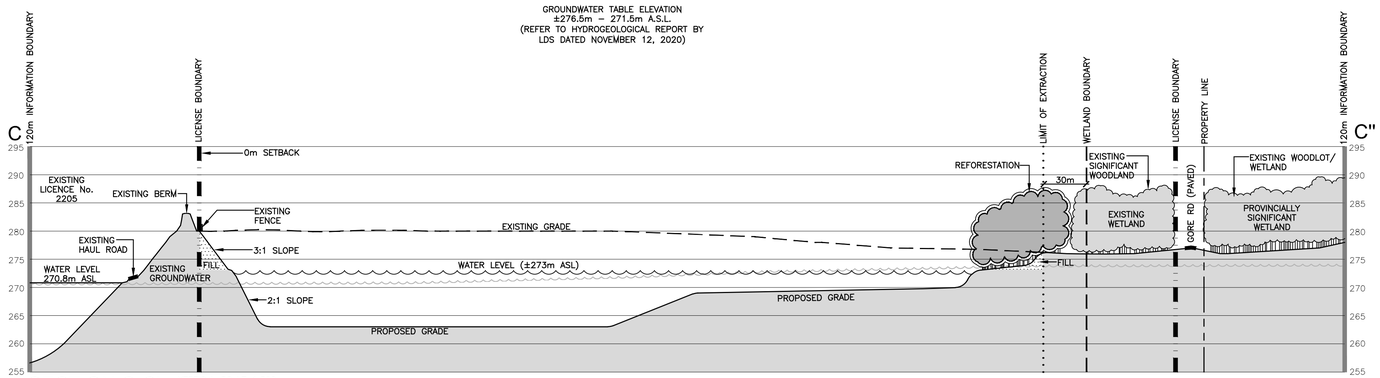


SECTION A-A' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000

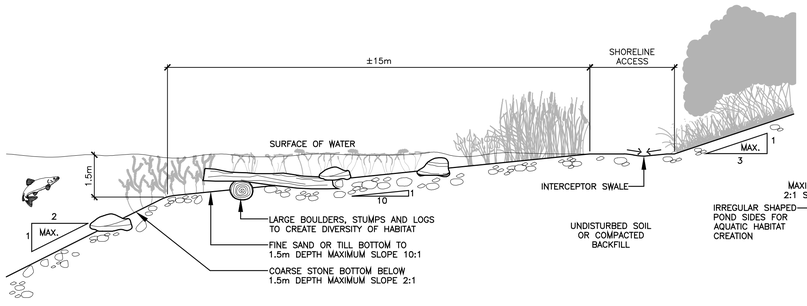


SECTION B-B' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000

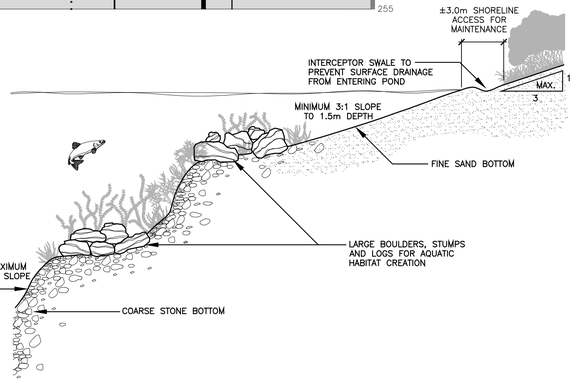
GROUNDWATER TABLE ELEVATION ±276.5m – 271.5m A.S.L. (REFER TO HYDROGEOLOGICAL REPORT BY LDS DATED NOVEMBER 12, 2020)



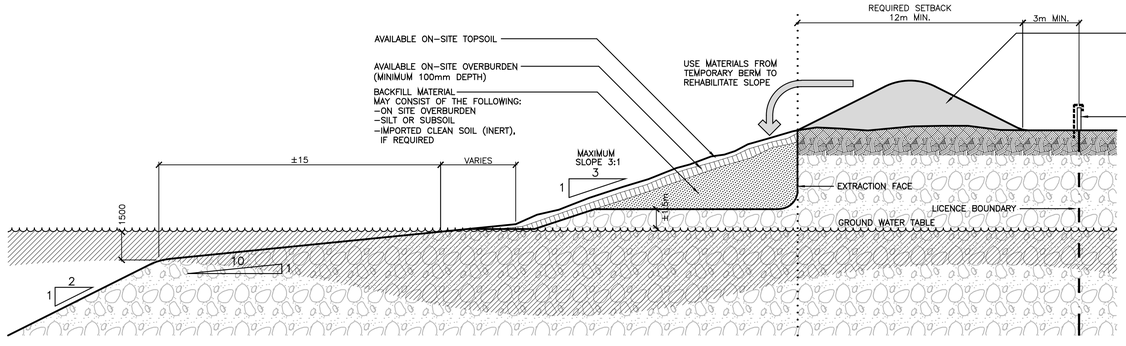
SECTION C-C' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000



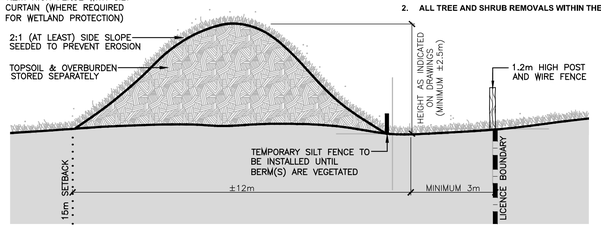
TYPICAL SHORELINE - WETLAND EDGE N.T.S.



TYPICAL SHORELINE - DEEP SECTION N.T.S.



TYPICAL SIDESLOPE REHABILITATION BY BACKFILLING N.T.S.



TYPICAL BERM SECTION N.T.S.

TECHNICAL RECOMMENDATIONS

THE FOLLOWING ARE THE TECHNICAL RECOMMENDATIONS FROM ALL OF THE EXPERTS' REPORTS AS OF FEBRUARY 2019. ADDITIONAL RECOMMENDATIONS MAY BE INCLUDED AS A RESULT OF THE LICENCE REVIEW PROCESS.

ACOUSTIC ASSESSMENT - HGC ENGINEERING - DATED DECEMBER, 2020

1. **THE FOLLOWING TABLE PRESENTS THE REFERENCE SOUND LEVELS USED FOR THE ACOUSTIC MODELING PRESENTED HEREIN. THESE SOUND LEVELS WERE BASED ON SITE MEASUREMENTS OF SIMILAR PROCESSING EQUIPMENT TO BE USED IN THIS PIT.**

REFERENCE SOUND POWER LEVELS OF PROCESSING EQUIPMENT

EQUIPMENT	SOUND POWER LEVEL dBA re: 10^{-12} W
A CRUSHING AND SCREENING PLANT WITH AN ASSOCIATED LOADER	118
EXCAVATOR	108
TRUCKS	103

IF OTHER EQUIPMENT IS PROPOSED FOR OPERATION IN THE GRAVEL PIT, IT SHALL BE CONFIRMED THROUGH MEASUREMENT TO PRODUCE SOUND LEVELS CONSISTENT WITH THE ABOVE REFERENCED SOUND LEVELS OR ADDITIONAL MITIGATION MEASURES MAY BE REQUIRED.

2. **A MINIMUM 5.0 M HIGH PERIMETER BERM (ABOVE EXISTING GRADE) SHALL BE CONSTRUCTED ALONG THE EASTERN BOUNDARY OF THE PIT PRIOR TO THE COMMENCEMENT OF EXTRACTION OR PROCESSING ACTIVITIES IN AREAS 1 AND 2. ONCE PROCESSING AND EXTRACTION IS COMPLETE IN AREA 1 AND ALL ACTIVITIES ARE MOVED INTO AREA 2, THE BERM ADJACENT TO AREA 1 SHALL NO LONGER BE REQUIRED. PRIOR TO THE COMMENCEMENT OF EXTRACTION OR PROCESSING ACTIVITIES IN AREA 3, THE MINIMUM 5.0 M HIGH PERIMETER BERM (ABOVE EXISTING GRADE) SHALL BE CONSTRUCTED ALONG THE EASTERN BOUNDARY OF THE PIT, ADJACENT TO AREA 3. THE 5.0 M HIGH PERIMETER BERM ALONG AREA 2 SHALL REMAIN AFTER ALL ACTIVITIES ARE MOVED INTO AREA 3.**

3. **A MINIMUM 8.0 M HIGH ACOUSTICAL BARRIER SHALL BE CONSTRUCTED AND MAINTAINED ON THE PIT FLOOR BESIDE THE CRUSHING AND SCREENING PLANT IN THE DIRECTION OF R1.**

4. **THE CRUSHING AND SCREENING PLANT SHALL NOT BE OPERATED WITHIN 350 M OF R1.**

5. **THE OWNER OF R1 ALSO OWNS THE LANDS TO BE LICENSED FOR AGGREGATE EXTRACTION. THEY HAVE SIGNED AN AGREEMENT THAT GRANTS THE PIT OPERATOR RELIEF FROM IMPLEMENTING THE NOISE MITIGATION MEASURES AS RECOMMENDED ABOVE IN ITEMS #2, #3 AND #4 WITH REGARD TO R1. SHOULD THE OWNERSHIP OF R1 CHANGE, A SIMILAR AGREEMENT WILL HAVE TO BE REACHED WITH THE NEW OWNERS OR THE MITIGATION AS RECOMMENDED ABOVE IN ITEMS #2, #3 AND #4 SHALL BE IMPLEMENTED WITH RESPECT TO R1.**

6. **A MINIMUM 8.0 M HIGH ACOUSTICAL BARRIER SHALL BE CONSTRUCTED AND MAINTAINED ON THE PIT FLOOR BESIDE THE CRUSHING AND SCREENING PLANT IN THE DIRECTION OF R2 WHEN OPERATING WITHIN AREAS 2 AND 3.**

7. **THE ACOUSTICAL BARRIER MENTIONED ABOVE CAN BE COMPRISED OF THE PIT FACE, AN EARTH BERM, A NOISE WALL, AGGREGATE STOCKPILES OR ANY OTHER CONSTRUCTION WITH A MINIMUM SURFACE DENSITY OF 20 KG/M^2.**

8. **ACTIVITIES USED TO PREPARE THE SITE FOR EXCAVATION, SUCH AS THE STRIPPING OF TOPSOIL AND CONSTRUCTION OF BERMS, OR ACTIVITIES RELATED TO THE REMEDIATION OF THE SITE AFTER THE EXTRACTION IS COMPLETED ARE CONSIDERED TO BE CONSTRUCTION ACTIVITIES. THEY ARE REGULATED UNDER MUNICIPAL BYLAWS AND NPC-115 "SOUND LEVEL LIMITS FOR MOTORIZED CONSTRUCTION EQUIPMENT".**

NATURAL ENVIRONMENT ASSESSMENT - TERRASTORY - DECEMBER 2020

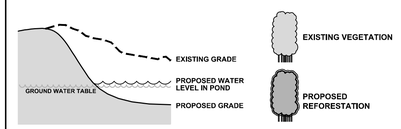
1. **THE NORTHERN WOODLOT ENHANCEMENT AREA IS TO BE REMOVED FROM CULTIVATION AND PLANTED WITH NATIVE SPECIES DURING (OR BEFORE) REMOVAL OF THE SOUTHERN WOODLOT. A NORTHERN WOODLOT ENHANCEMENT PLAN IS TO BE PREPARED WHICH INCLUDES THE FOLLOWING ELEMENTS (MINIMUM):**
   - **COMPOSITION, DENSITY, AND SIZING OF WOODY PLANT MATERIAL. ALL PLANT INSTALLATIONS ARE TO BE NATIVE TO MIDDLESEX COUNTY.**
   - **MEASURES TO TRANSPLANT NATIVE SAPLINGS (E.G., SUGAR MAPLE, BITTERNUT HICKORY, ETC.) FROM THE SOUTHERN WOODLOT TO THE NORTHERN WOODLOT ENHANCEMENT AREA.**
   - **MEASURES TO TRANSPLANT SOILS MATS (CONTAINING NATIVE HERBACEOUS FLORA, MYCORRHIZAL FUNGI, ETC.) FROM THE SOUTHERN WOODLOT TO THE NORTHERN WOODLOT ENHANCEMENT AREA. SOIL MATS WILL NOT BE EXCAVATED FROM AREAS CONTAINING DENSE COVERAGE OF GARLIC MUSTARD OR OTHER NON-NATIVE FLORA. SOME SOIL MATS ARE TO CONTAIN POPULATIONS OF THE REGIONALLY RARE JAMES' SEDGE (CAREX JAMESII) AND OTHER SPRING EPHEMERALS AND UPLAND SEDGES.**
   - **STRUCTURAL ELEMENTS (E.G., COARSE WOODY DEBRIS SUCH AS STUMPS, LOGS, ETC.) WILL BE ADDED TO THE NORTHERN WOODLOT ENHANCEMENT AREA FROM MATERIAL REMOVED FROM THE SOUTHERN WOODLOT.**
   - **A MONITORING PLAN WILL BE PREPARED FOR THE PURPOSES OF DETERMINING THE SUCCESS OF THE PLANTINGS (INCLUDING THE NEW PLANT INSTALLATIONS AND TRANSPLANTED FLORA/SOIL MATS) FOR A PERIOD OF NO LESS THAN THREE (3) GROWING SEASONS.**

2. **ALL TREE AND SHRUB REMOVALS WITHIN THE SOUTHERN WOODLOT WILL BE COMPLETED OUTSIDE THE PRIMARY BIRD NESTING AND BAT ACTIVITY PERIODS (I.E., TO BE COMPLETED BETWEEN OCTOBER 1 AND MARCH 31).**

3. **ANY NECESSARY LIGHTING TO SUPPORT PIT OPERATIONS WILL BE DIRECTED AWAY FROM THE NORTHERN WOODLOT TO THE EXTENT PRACTICAL.**

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- PROPERTY LINE
- WETLAND BOUNDARY



SECTION NOTES

GENERAL INFORMATION

1. **SECTION LINES ARE INDICATED ON DRAWINGS 1, 2 AND 5.**

Harrington McAvan Ltd
41 Main Street, Unit 102
Unionville, Ontario L3R 2E5
Tel: 905-294-8282 Fax: 905-294-7623
www.harringtonmcavan.com

Project Name

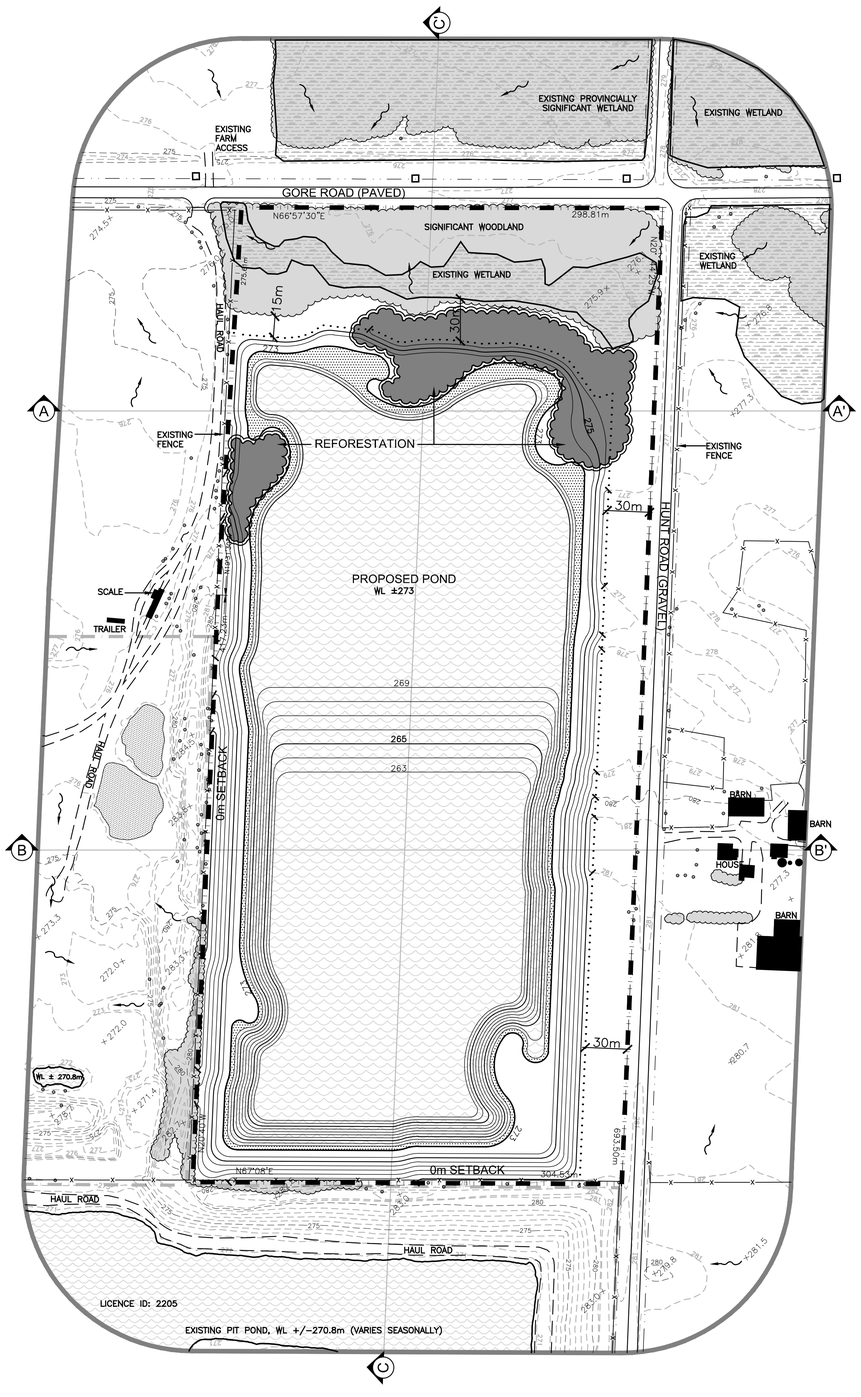
Thames Valley Aggregates Inc.

PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale AS SHOWN	North	Stamp
Drawing Status: PRELIMINARY FOR REVIEW		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: SECTIONS AND DETAILS		Project Number 20-23
		Drawing Number 4 OF 5

FILE NAME:20-23/COMP/2023-4.DWG
PLOT DATE: DECEMBER 23, 2020



REHABILITATION NOTES

GENERAL INFORMATION

1. REFER TO SHEET 4 OF 5 FOR SECTIONS, SHEET 2 AND 3 OF 5 FOR OPERATIONS AND PHASING DIAGRAMS AND NOTES AND SHEET 5 OF 5 FOR FINAL REHABILITATION AND NOTES.
2. PROPERTY SHALL BE REHABILITATED TO:

OPEN WATER POND	11.33 HA
WETLAND	0.80 HA
REFORESTATION	0.76 HA
SIDESLOPE/ MEADOW	3.41 HA
FOR A TOTAL OF	16.30 HECTARES.

REFORESTATION OUTSIDE EXTRACTION AREA 0.46 HA

HYDROGEOLOGICAL INFORMATION

3. HYDROGEOLOGICAL INFORMATION INCLUDING GROUNDWATER ELEVATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS. DATED NOVEMBER 12, 2020.
4. THE WATER TABLE ELEVATION WITHIN THESE PROPERTIES IS ESTIMATED TO BE BETWEEN ± 276.5 - 271.5m ABOVE SEA LEVEL (A.S.L.) BASED ON ABOVE REPORT.

SIDESLOPE/ MEADOW REHABILITATION INFORMATION

GRADING INFORMATION

5. REHABILITATED SLOPES WITHIN THE LICENCED AREA WILL BE CONSTRUCTED AS SHOWN ON THE CROSS SECTIONS. REHABILITATION OF ABOVE WATER SLOPES SHALL BE BY BACKFILLING (MINIMUM 3:1) AND/OR CUT AND FILL METHOD USING AVAILABLE ON-SITE OVERBURDEN AND TOPSOIL FROM WITHIN THE LICENSED AREA AND/OR CLEAN INERT IMPORTED FILL PER OPERATIONAL NOTE 20 ON PAGE 2.

   AVAILABLE OVERBURDEN REPLACED WILL BE APPROXIMATELY 100mm THICK.

   REFER TO DRAWING 4 OF 5, SECTIONS, FOR MORE INFORMATION ON BACKFILLING AND CREATION OF REHABILITATED SIDESLOPES.

TOPSOILING INFORMATION

6. ALL AVAILABLE TOPSOIL ON THE SITE WILL REMAIN TO BE USED FOR REHABILITATION OF THIS SITE.

VEGETATION STABILIZATION INFORMATION

7. TOPSOIL SHALL BE SEEDED WITH A MIXTURE OF GRASSES AND LEGUMES THAT MAY INCLUDE THE FOLLOWING AT A RATE OF APPROXIMATELY 125KG/HA:

BUCKWHEAT	RED CLOVER	WHITE CLOVER
TALL FESCUE	ANNUAL RYE	

OPEN WATER POND REHABILITATION INFORMATION

8. THE AVERAGE WATER LEVEL IN THE POST-EXTRACTION POND IS ESTIMATED TO BE 273m ASL (BASED ON LDS REPORT DATED NOVEMBER 12, 2020).
9. THE SHAPE AND GRADING OF THE PROPOSED POND IS APPROXIMATE, BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME OF LICENSING. ACTUAL EXTRACTION WILL FOLLOW THE BELOW WATER DEPOSIT AND REHABILITATION SHALL FOLLOW THE CONCEPT ILLUSTRATED.

WETLAND REHABILITATION INFORMATION

10. AREAS SHALL BE REHABILITATED TO WETLAND HABITAT AS FOLLOWS:
    - UNDERWATER SLOPES WILL BE FORMED WITH ON-SITE FILL
    - UNDERWATER SLOPES SHALL BE A MAXIMUM OF 2:1
11. RESTORATION OF THE NEARSHORE, SHALLOW WETLAND ZONE AS SHOWN ON THE TYPICAL SHALLOW SHORELINE SECTION, SHEET 4 OF 5 WILL GENERALLY BE ACCOMPLISHED AS FOLLOWS:

- EXTRACTION AND ROUGH GRADING WILL CREATE A NEARSHORE SHORELINE AREA AT A SLOPE OF 10:1
  FINAL SLOPING OF THE SHORELINE TO CREATE PHYSICAL DIVERSITY BY SCALLOPING THE SHORELINE AND ADDING STRUCTURES.
- WOODY DEBRIS- BRANCHES, TREE TRUNKS, STUMPS, ETC. CLEARED IN THE EXTRACTION PROCESS WILL BE SALVAGED WHERE POSSIBLE, FOR USE IN SHORELINE RESTORATION/ UNDERWATER HABITAT ENHANCEMENT.
- STUMPS, LOGS, BRUSH BUNDLES, ETC. SHALL BE INSTALLED ±30m O.C. ALONG THE SHORELINE IN THE SHALLOW ZONE TO CREATE PHYSICAL DIVERSITY.
- OVERSIZE ROCKS NOT UTILIZED IN THE AGGREGATE OPERATIONS WILL ALSO BE PLACED IN THE SHALLOW ZONE TO CREATE PHYSICAL DIVERSITY.
- THE INITIAL SHORELINE RESTORATION AREA WILL BE SPORADICALLY PLANTED WITH TREES AND SHRUBS. SPECIES MAY INCLUDE THE FOLLOWING NATIVE PLANTS:

RED MAPLE	PUSSY WILLOW	SILVER MAPLE	RED OSIER DOGWOOD
LARCH	SPECKLED ALDER	WHITE CEDAR	

12. INITIAL SHORELINE WETLAND AREAS SHALL BE PLANTED WITH CLUMPS OF EMERGENT AND SUBMERGENT NATIVE WETLAND PLANTS TO INITIATE COLONIZATION OF THE SITE AS NUTRIENT LEVELS INCREASE TO SUPPORT THEM. NATIVE WETLAND PLANTS SUCH AS:

FLOATING PONDWEED	COONTAIL	SOFTSTEM BULRUSH	RIVER BULRUSH
BLUE FLAG	PICKERELWEED	WATER-LILY	ARROWHEAD

WILL BE PLANTED IN CLUSTERS OF 5 AT APPROPRIATE DEPTHS TO BEGIN THE COLONIZATION.

13. THE AREA BETWEEN THE POND AND WETLAND WILL BE ALLOWED TO NATURALIZE. THE SIGNIFICANT WOODLANDS WILL PROVIDE A SEED SOURCE FOR PIONEER SPECIES TO ESTABLISH. TREE PLANTING WILL OCCUR IN THIS AREA AND WILL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING SPECIES:

WHITE CEDAR	RED MAPLE	RED OSIER DOGWOOD
WHITE SPRUCE	SILVER MAPLE	ELDERBERRY
EASTERN WHITE PINE	SPECKLED ALDER	TREMBLING ASPEN
BLACK CHERRY	WHITE BIRCH	RED OAK
LARGE-TOOTHED ASPEN		

PLANTINGS IN THE NATURALIZED AREA SHALL INCLUDE SCATTERED POCKETS OF TREES AND SHRUBS TO INCREASE DIVERSITY. PLANTINGS BETWEEN THE SOUTHERN SHORE OF THE POND AND THE SIGNIFICANT WETLAND SHALL BE MAXIMIZED TO FACILITATE THE USE OF THE AREA FOR WILDLIFE MOVEMENT. SMALL BRUSH AND STONE PILES SHALL BE PLACED IN THE NATURAL AREA TO ENHANCE VALUE FOR WILDLIFE HABITAT.

VEGETATION WILL BE MAINTAINED IN A HEALTHY, VIGOROUS GROWING CONDITION.

SETBACK REHABILITATION INFORMATION

14. AFTER SIDESLOPES ARE CREATED AND REQUIRED BERMS ARE REMOVED FROM SETBACKS, THESE AREAS WILL BE IMMEDIATELY STABILIZED WITH A SUITABLE GROUNDCOVER.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING 5m CONTOUR LINE (285)
- EXISTING 1m CONTOUR LINE (284)
- EXISTING SPOT ELEVATION (+283.95)
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- PROPOSED WETLAND
- PROPOSED OPEN WATER
- PROPOSED REFORESTATION
- PROPOSED 5m CONTOUR LINE (285)
- PROPOSED 1m CONTOUR LINE (284)
- EXISTING BUILDING
- HP EXISTING HYDRO POLE
- DIRECTION OF SURFACE WATER DRAINAGE
- B' LOCATION OF SECTION

SITE PLAN OVERRIDE (VARIANCE)

THE FOLLOWING CONDITIONS ILLUSTRATED ON THESE PLANS VARY FROM THE OF THE PROVINCIAL STANDARDS MADE UNDER THE AGGREGATE RESOURCES ACT

ITEM	SECTION
TO MAXIMIZE EXTRACTION BELOW WATER SLOPES MAY BE A MAXIMUM 2:1.	5.19.1

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Project Name

Thames Valley Aggregates Inc.

PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: REHABILITATION PLAN		Project Number 20-23
		Drawing Number 5 OF 5

FILE NAME: 20-23/COMP/2023-5.DWG
PLOT DATE: DECEMBER 23, 2020

Lincoln Environmental Consulting

March, 2019

Vito Frijia
Thames Valley Aggregates
C/O Southside Grouop
75 Blackfriars Street, London
London, ON N6H 1K8

Dear Mr. Frijia,

Regarding: Stage 1-2 Archaeological Assessment for the Gore and Hunt Road Property

Thank you for the opportunity to bid on this project. Lincoln Environmental Consulting Corp. is licensed to conduct archaeological investigations in Ontario under License Number P344. LEC provides archaeological services for many developers and consultants in Southwestern Ontario including Tridon Group, York Developments, Auburn Developments, Royal Premier Homes, Drewlo Holdings, Sifton Properties, Schlegal Urban Development, Crozier and Associates, Cushman and Wakefield, Mattamee Homes, MHBC Planning and Urban Design, and CBRE Land Management. We also provide services for dozens of others across the province. Other clients include Infrastructure Ontario, MTO, and various municipalities. We are pleased to provide you with the following proposal to conduct a Stage 1-2 Archaeological Assessment of an approximately 50 acre property at Gore and Hunt Road.

The intent of the Stage 1 Archaeological Background Study is to assess the property for its potential to contain significant archaeological resources (or be within an archaeologically sensitive boundary). The objectives of Stage 1 are to provide information about the property's geography, history, previous archaeological fieldwork and current land condition; to evaluate in detail the property's archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the property; and to recommend appropriate strategies for Stage 2 survey. A Stage 2 Archaeological Property Assessment provides an overview of archaeological resources on the property and a determination of whether any of the resources might be artifacts and archaeological sites with cultural heritage value or interest. The objectives of Stage 2 are to document all archaeological resources on the property; to determine whether the property contains archaeological resources requiring further assessment; and to recommend appropriate Stage 3 assessment strategies for any archaeological sites identified.

Work Plan

The Stage 1 Archaeological Background Study proposed by LEC will follow the Standards and Guidelines for Consultant Archaeologists, as published by the Ontario Ministry of Tourism and Culture, 2011. This will include the following:

A) Examine the Ontario Site Registration Database to determine the presence of known archaeological sites in and around the project area.
B) Review the land use history and the present condition of the project area.
C) Assess the geomorphological history of the land during the period of possible human occupation, in order to evaluate the potential for buried cultural deposits.
D) Assess any other historical, environmental, planning, or archaeological data applicable for the project area.
E) Report: Evaluating Archaeological Potential. The Stage 1 Archaeological Overview / Background Study leads to an evaluation of the property's potential to contain

archaeological resources. If the research indicates that it is possible that archaeological resources exist anywhere on the property, the study report must include a recommendation to conduct a Stage 2 Property Assessment.

The Stage 2 Archaeological Property Assessment proposed by LEC will follow the Standards and Guidelines for Consultant Archaeologists, as published by the Ontario Ministry of Tourism and Culture, 2011. This will include the following:

A) On-site documentation and inventory of all archaeological resources through systematic means as appropriate to the characteristics of the property

B) The chosen survey methods depend on property characteristics such as the nature and extent of ground cover, the possible depth at which archaeological resources might be located, and the degree and characteristics of past disturbances.

The survey will include the following strategies:

C) Test pit survey: Systematic walking of the property, excavating small pits by hand at regular intervals and examining their contents. It is understood that roughly 15% of property is unable to be ploughed and by MTCS standards will be subject to Test Pit survey

D) Pedestrian Survey: Walking of ploughed agricultural fields to examine the ground surface for cultural artifacts. It is understood that roughly 85% of the property is agricultural field and by MTCS standard must be ploughed and assessed by pedestrian survey.

E) Analysis: identifying archaeological sites

F) Analysis of data to determine the nature of archaeological resources found

G) Measuring archaeological resources against set criteria to determine whether they are archaeological sites with cultural heritage value or interest requiring further assessment

Deliverables

A Stage 1-2 archaeological assessment report will be written and submitted to the Ontario MTCS for review and acceptance into the Provincial Register of archaeological reports. This report will provide the results of the background study and field investigation and will provide the details of any archaeological resources identified on the property including an evaluation of cultural heritage value or interest. The report will be concluded with a recommendation on whether additional Stage 3 archaeological assessment is required.

Budget and Schedule

Stage 1 Archaeological Background Study and Stage 2 Archaeological Property Assessment	**$3,200.00** plus applicable taxes.

The Stage 1-2 assessment may begin upon receipt of signed authorization to proceed and once field conditions are acceptable to MTCS standards for survey to commence. It is estimated that the field work will take a crew of 5 archaeologists 1 day to complete. A draft report detailing the results of the Stage 2 archaeological assessment will be provided for review within two weeks of the fieldwork being completed.

If you are in agreement with the Scope of Work and fees described above, please sign the Work Authorization. A signed pdf sent by email will suffice to authorize Lincoln Environmental Consulting Corp. staff to proceed with the work program. Please do not hesitate to contact Derek Lincoln at 226 977 3441 if you have any questions. We thank you very much for thinking of us for this project. The LEC Corp. archaeological team looks forward to assisting you.

Lincoln Environmental Consulting Corp.

Sincerely,

Derek Lincoln MA RPA
President
Lincoln Environmental Consulting
derek@LECCorp.net

BY: _____

Authorized Representative

Ministry of Heritage, Sport, Tourism, Culture Industries

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Programs and Services Branch
Heritage, Tourism and Culture Division
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Tel.: (416) 314-7137
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Ministère des Industries du patrimoine, du sport, du tourisme et de la culture

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Email: Jessica.Marr@ontario.ca

Ontario

Jan 29, 2020

Derek Lincoln (P344)
Lincoln Environmental Consulting Corp

RE: Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "Stage 1-2 Archaeological Assessment of the Pike Farm, in part of Lot 18, Concession 3 North Division, Geographic Township of North Dorchester, Municipality of Thames Centre, Middlesex County, Ontario", Dated Jan 24, 2020, Filed with MTCS Toronto Office on N/A, MTCS Project Information Form Number P344-0368-2019, MTCS File Number 0011763

Dear Mr. Lincoln:

The above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18, has been entered into the Ontario Public Register of Archaeological Reports without technical review.[1]

Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require further information, please do not hesitate to send your inquiry to Archaeology@Ontario.ca

cc. Archaeology Licensing Officer
Vito Frijia,Southside Group
Vito Frijia,Southside Group

1*In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.*

HGC ENGINEERING

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Noise Feasibility Study for a Category 1 – Class "A" Pit below Water Pike Pit

Part Lot 18, Concession 3
Municipality of Thames Centre
County of Middlesex, Ontario

Prepared for:

Thames Valley Aggregates Inc.
174751 17th Line
Ingersoll, Ontario N5C 3J6

Prepared by:

Mandy Chan, PEng

Reviewed by:

Bill Gastmeier, MASc, PEng

December 21, 2020

Project No. 01900383

Table of Contents

1 INTRODUCTION AND SUMMARY 1

2 SITE DESCRIPTION 1

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3.1 Receptors 2

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4.1 Description of Noise Sources and Aggregate Operations 3

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6 CONCLUSIONS 6

7 REFERENCES 7

Figure 1 – Existing Features Plan
Figure 2 – Aerial Plan
Figures 3 & 4 – Operational Plans Showing Perimeter Berm Locations

Appendix A – Sample Calculations
Appendix B – Curriculum Vitae

1 INTRODUCTION AND SUMMARY

HGC Engineering was retained by Thames Valley Aggregate Inc. to undertake an analysis of the potential impact of noise from a proposed gravel pit at neighbouring noise sensitive receptors (residential dwellings) in accordance with the Ministry of Natural Resources and Forestry (MNRF) and the Ministry of the Environment, Conservation and Park (MECP) Guidelines. The proposed gravel pit is located west of Hunt Road and south of the Gore Road (County Road 64) in the Municipality of Thames Centre in the Municipality of Middlesex.

This assessment was conducted in accordance with MNRF and MECP guidelines and considered the potential effects of noise from extraction, processing and transportation sources with regard to neighbouring noise sensitive receptors.

This assessment is also based on a review of the operational plans prepared by Harrington McAvan Ltd dated September 2020 and sound levels taken from our files based on measurements of similar aggregate processing equipment to be used in the pit.

There are noise sensitive receptors located to the northwest and east of the proposed pit. The equipment and activities which are potential sound sources are outlined in Section 4. This assessment is based on a scenario representing the worst-case operations located closest to the receptors. The results of our analysis indicate that the sound levels produced by the operations in the pit under the worst case operational scenario are expected to comply with MECP Guideline limits with the implementation of noise control measures.

2 SITE DESCRIPTION

The existing features plan attached as Figure 1 and aerial plan attached as Figure 2 show the location of the proposed site, the neighbouring residences and nearby roadways.

The proposed gravel pit is located west of Hunt Road and south of the Gore Road (County Road 64) in the Municipality of Middlesex Centre. The proposed licence area is ±21.0 hectares with a maximum annual tonnage of excavation of 500,000 tonnes. There are existing residential and agricultural land uses to the east and north of the site and existing aggregate extraction facilities to the west and south of the site.

3 CRITERIA

3.1 Receptors

The Provincial Standards – Aggregate Resources of Ontario (Category 1 – Class "A" Pit below Water) state: "If extraction and / or processing facilities are located within 150 meters of a sensitive receptor, a noise assessment report is required to determine whether or not provincial guidelines can be satisfied" and "Sensitive receptors include residences or facilities where people sleep (nursing homes, hospitals, trailer parks, camping grounds, etc); schools; day-care centres."

There are two residential homes located within 150 m of the site boundaries to east and west of the site (R1 and R2). R1 is a 2-storey dwelling and R2 is 1-storey dwelling. Any useable locations on the residential property, within 30 m of the building facade and outside the plane of the residential windows are considered to be points of reception. In this case, the worst case point of reception is generally considered to be outside the upper storey windows due to the potentially increased exposure to activities in the pit. The receptor locations are shown on the Figures.

3.2 Noise Criteria

Appropriate sound level limits used in the assessment of sound from aggregate operations are provided in MECP publication NPC-300, "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning", Part C release date October 21, 2013". Under MECP guidelines, the acoustical environment at the sensitive receptor R1 is classified as rural since the residential home is located a considerable distance away from Gore Road. For sensitive receptor R2, the acoustical environment is classified as semi-urban as the background sound is dominated by traffic noise from Gore Road. The gravel pit will operate during daytime hours only. NPC-300 specifies that the sound level limit at any receptors due to the operation of a stationary source is the higher of the background one hour energy equivalent sound level ($L_{EQ\text{-}1Hr}$) or 45 dBA for rural areas and 50 dBA for semi-urban areas during the daytime hours.

To ensure a conservative analysis, since road traffic sound levels may be relatively low during some daytime hours, the minimum daytime sound levels of 45 dBA and 50 dBA are used in the following sections of this report as the criterion by which the potential noise impact of the proposed aggregate extraction and processing operations are assessed.

Compliance with MECP criteria generally results in acceptable levels of sound at residential receptors, although there may be residual audibility during periods of low background sound. The guidelines of NPC-300 apply to sound from the ongoing day-to-day operations of the subject site. They do not apply to the temporary sound produced during the preparation and rehabilitation of extraction sites, or to the sound produced by road trucks on public roadways. The initial operations of building access roadways, stripping top soil, and building localized shielding and perimeter berms, as well as the final operations of rehabilitation and removal of localized shielding and perimeter berms) are defined as construction activity. In order to satisfy Provincial Standards, the sound levels emitted by the equipment involved in those construction activities must comply with MECP Guideline NPC-115, "Sound Levels due to Construction Equipment" [3].

4 NOISE ASSESSMENT

4.1 Description of Noise Sources and Aggregate Operations

The following details the future above and below water extraction and processing operations in the pit as indicated on the Operational Plan.

1. The gravel pit will typically operate from 07:00 to 19:00 on Monday to Friday, and from 07:00 to 12:00 on Saturday. No other evening or nighttime operations are anticipated.

2. The entrance to the pit is located in the northeast corner of the site.

3. Above and below water pit operations will begin in the south end of Area 1 and proceed in a northerly direction into Areas 2 and 3.

4. The aggregate excavation, processing and loading equipment consists of a crushing and screening plant with an associated loader, and an excavator. The loader and excavator can operate in each area for extraction at the working face or loading of trucks. An excavator will be used for below water excavation.

5. All operations including excavation, processing, and loading will typically occur on the floor of the pit at an elevation of approximately 271 – 272 mASL.

6. Processing equipment will not be located within 90 m of any boundary of the site that abuts

residential land uses as per "The Provincial Standards – Aggregate Resources of Ontario", Operational Standards for Licences, Section 5.13.

7. The peak number of trucks expected to arrive and depart in a typical busy hour is 20.

MECP guidelines require that a worst case hourly scenario be used in the evaluation. This scenario is discussed below.

4.2 Acoustical Modelling

Predictive modeling was used to assess the potential sound emissions of the worst case gravel pit activities. The prediction model is based on established engineering methods from the MECP and ISO Standard 9613 for the prediction of outdoor sound propagation.

To consider a worst-case operational scenario, the following assumptions were made:

- All extraction, processing, and loading could occur simultaneously at the closest possible location to the receptor;
- All equipment will be located on the pit floor at an elevation of approximately 271-272 mASL.
- 20 haul trucks arrive and depart.

The calculations consider the acoustical effects of distance, foliage, topography and shielding by the excavation face where applicable. The noise reducing effect of foliage is included for the existing woodlot located north of the site. Using the sound level data and the assumptions outlined above and the details contained in the operational plan, the sound levels at the receptors were predicted.

5 RECOMMENDATIONS

Using the predictive model and assumptions described in the previous section, the following noise control requirements were developed for the site and should be included as notes on the Operational Plans:

1. The following table presents the reference sound levels used for the acoustic modeling presented herein. These sound levels were based on site measurements of similar processing equipment to be used in this pit.

Table 2 – Reference Sound Power Levels of Processing Equipment

Equipment	Sound Power Level dBA re: 10^{-12} W
A Crushing and Screening Plant with an associated loader	118
Excavator	108
Trucks	103

If other equipment is proposed for operation in the gravel pit, it shall be confirmed through measurement to produce sound levels consistent with the above referenced sound levels or additional mitigation measures may be required.

2. A minimum 5.0 m high perimeter berm (above existing grade) shall be constructed along the eastern boundary of the pit prior to the commencement of extraction or processing activities in Areas 1 and 2. Once processing and extraction is complete in Area 1 and all activities are moved into Area 2, the berm adjacent to Area 1 shall no longer be required. Prior to prior to the commencement of extraction or processing activities in Area 3, the minimum 5.0 m high perimeter berm (above existing grade) shall be constructed along the eastern boundary of the pit, adjacent to Area 3. The 5.0 m high perimeter berm along Area 2 shall remain after all activities are moved into Area 3.

3. A minimum 8.0 m high acoustical barrier shall be constructed and maintained on the pit floor beside the crushing and screening plant in the direction of R1.

4. The crushing and screening plant shall not be operated within 350 m of R1.

5. The owner of R1 formerly owned the lands to be licensed for aggregate extraction. They have signed an agreement that grants the pit operator relief from implementing the noise mitigation measures as recommended above in Items #2, #3 and #4 with regard to R1.

   Should the ownership of R1 change, a similar agreement will have to be reached with the new owners or the mitigation as recommended above in Items #2, #3 and #4 shall be implemented with respect to R1.

6. A minimum 8.0 m high acoustical barrier shall be constructed and maintained on the pit floor beside the crushing and screening plant in the direction of R2 when operating within Areas 2 and 3.

7. The acoustical barrier mentioned above could be comprised of the pit face, an earth berm, a noise wall, aggregate stockpiles or any other construction with a minimum surface density of 20 kg/m^2.

8. Activities used to prepare the site for excavation, such as the stripping of topsoil and construction of berms, or activities related to the remediation of the site after the extraction is completed are considered to be construction activities. They are regulated under municipal bylaws and NPC-115 "Sound Level Limits for Motorized Construction Equipment".

6 CONCLUSIONS

In summary, HGC Engineering has reviewed the operational plan, prepared an acoustical model of the proposed activities in the pit and conducted an analysis of those operations based on a worst-case operational scenario. Using the modeling assumptions detailed in Section 4, along with incorporation of the noise control recommendations detailed in Section 5 and Figure 3, sound levels were predicted at each of the selected receptors as summarized in Table 3. Sample calculations are provided in Appendix A.

Table 3: Predicted Sound Levels at the Residential Receptors [dBA] During Worst-Case Operational Scenarios (With Noise Mitigation)

Receptor	Daytime Criteria (dBA)	Predicted Sound Level (dBA)
R1	45	45
R2	50	49

The results summarized indicate that the sound emissions from the proposed pit operations, with the noise control measures in place, are expected to comply with MECP guideline limits at the neighbouring noise sensitive receptors under worst case operating scenarios.

7 REFERENCES

1. Ontario Ministry of the Natural Resources and Forestry, *Aggregate Resources of Ontario – Provincial Standards*, 1997.

2. Ontario Ministry of the Environment and Climate Change Publication NPC-300, *Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning*, August 2013.

3. Ontario Ministry of the Environment and Climate Change Publication NPC-115, *Sound Level Limits for Motorized Construction Equipment"*.

4. International Organization for Standardization, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*, ISO-9613-2, Switzerland, 1996.

5. Google Maps Aerial Imagery, Internet application: *maps.google.com*.

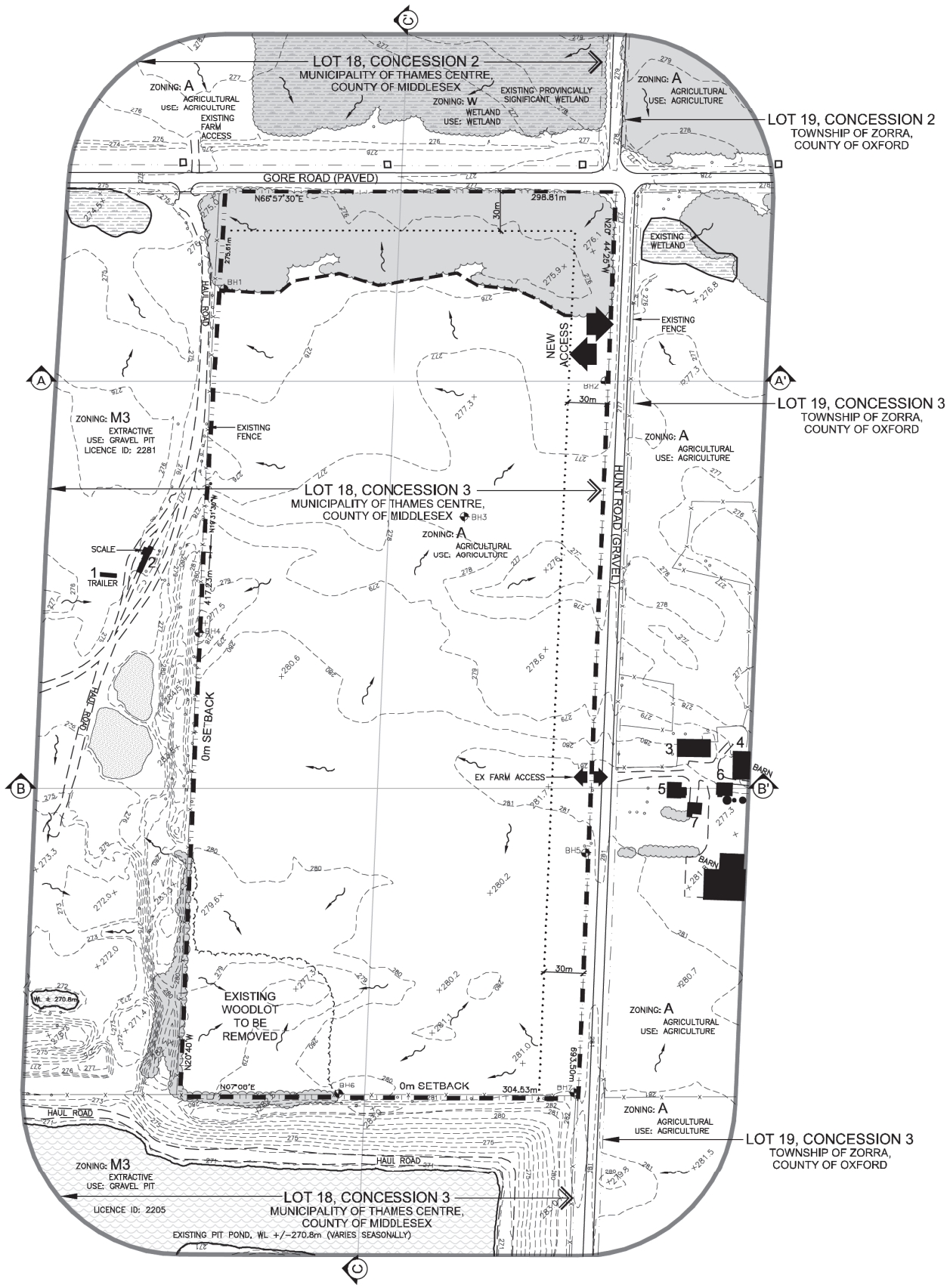

Figure 1: Existing Features Plan

EXISTING FEATURES NOTES

GENERAL SITE PLAN INFORMATION

1. THIS SITE PLAN CONSIST OF 5 DRAWINGS AND MUST BE READ COLLECTIVELY.
2. ALL MEASUREMENTS SHOWN ON THIS SITE PLAN ARE IN METRES.

LICENCE INFORMATION

3. THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES AND FORESTRY UNDER THE AGGREGATE RESOURCES ACT FOR A CATEGORY 1 - CLASS 'A' LICENCE, PIT BELOW THE WATER TABLE.
4. APPLICANT:
   THAMES VALLEY AGGREGATES
   174751 17TH LINE
   INGERSOLL, ON
   N5C 3J6
5. TOTAL AREA TO BE LICENCED: 21.0 ha
   TOTAL AREA TO BE EXTRACTED: 16.97 ha
   TOTAL AREA TO REHABILITATED: 16.97 ha

BASE INFORMATION

6. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM FIRST BASE SOLUTIONS UTILIZING 2015 AIR PHOTOGRAPHY. ALL ELEVATIONS ARE GEODETIC AND ABOVE SEA LEVEL (ASL).

   THE SITE WAS FIELD CHECKED BY HARRINGTON MCAVAN LTD., APRIL 18, 2016.
7. THE PROPOSED LICENCE AREA IS ZONED A, GENERAL AGRICULTURE. AN APPLICATION FOR AN AMENDMENT TO THE ZONING BYLAW TO CHANGE THE DESIGNATION TO ME, AGGREGATE INDUSTRIAL HAS BEEN MADE TO THE MUNICIPALITY OF THAMES CENTRE. THE OFFICIAL PLAN DESIGNATES THE MAJORITY OF THIS SITE AS PRIMARY AGGREGATE RESOURCE.

HYDROGEOLOGICAL INFORMATION

8. HYDROGEOLOGICAL INFORMATION INCLUDING GROUNDWATER ELEVATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS. DATED ———.
9. THE WATER TABLE ELEVATION WITHIN THESE PROPERTIES IS ESTIMATED TO BE BETWEEN ———m ABOVE SEA LEVEL (A.S.L.) BASED ON ABOVE REPORT.

TECHNICAL REPORTS

10. HYDROGEOLOGICAL INFORMATION WAS OBTAINED FROM REPORTY BY LDS CONSULTANTS DATED ———(REFER TO SHEET 3 FOR TECHNICAL RECOMMENDATIONS).
11. NATURAL ENVIRONMENT INFORMATION WAS OBTAINED FROM REPORT BY AWG ENVIRONMENTAL CONSULTING DATED JANUARY 2017 (REFER TO SHEET - FOR TECHNICAL RECOMMENDATIONS).
12. ARCHAEOLOGICAL INFORMATION WAS OBTAINED FROM REPORT BY TIMMINS MARTELLE HERITAGE CONSULTANTS INC. DATED JUNE 2016 (REFER TO SHEET 4 OF 5 FOR TECHNICAL RECOMMENDATIONS).
14. ACOUSTICAL INFORMATION WAS OBTAINED FROM NOISE REPORT BY HGC ENGINEERING DATED JANUARY 2017 (REFER TO SHEET - FOR TECHNICAL RECOMMENDATIONS).

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK LINE
- EXTRACTION LIMIT
- EXISTING FENCE
- EXISTING 5m CONTOUR LINE
- EXISTING 1m CONTOUR LINE
- EXISTING SPOT ELEVATION
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXISTING BUILDING AND NUMBER
- EXISTING HYDRO POLE
- DIRECTION OF SURFACE WATER DRAINAGE
- TEST PIT LOCATION AND NUMBER (DUG BY APPLICANT ON ———)
- BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS ———
- LOCATION OF SECTION
- EX FIELD ENTRANCE (NO GATES)
- NEW SITE ENTRANCE/ EXIT

BUILDING LIST

No.	
1.	TRAILER
2.	SCALE AND SCALEHOUSE
3.	SHED
4.	BARN
5.	HOUSE
6.	SHED
7.	BARN

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Project Name

Thames Valley Aggregates Inc.

PIKE PIT

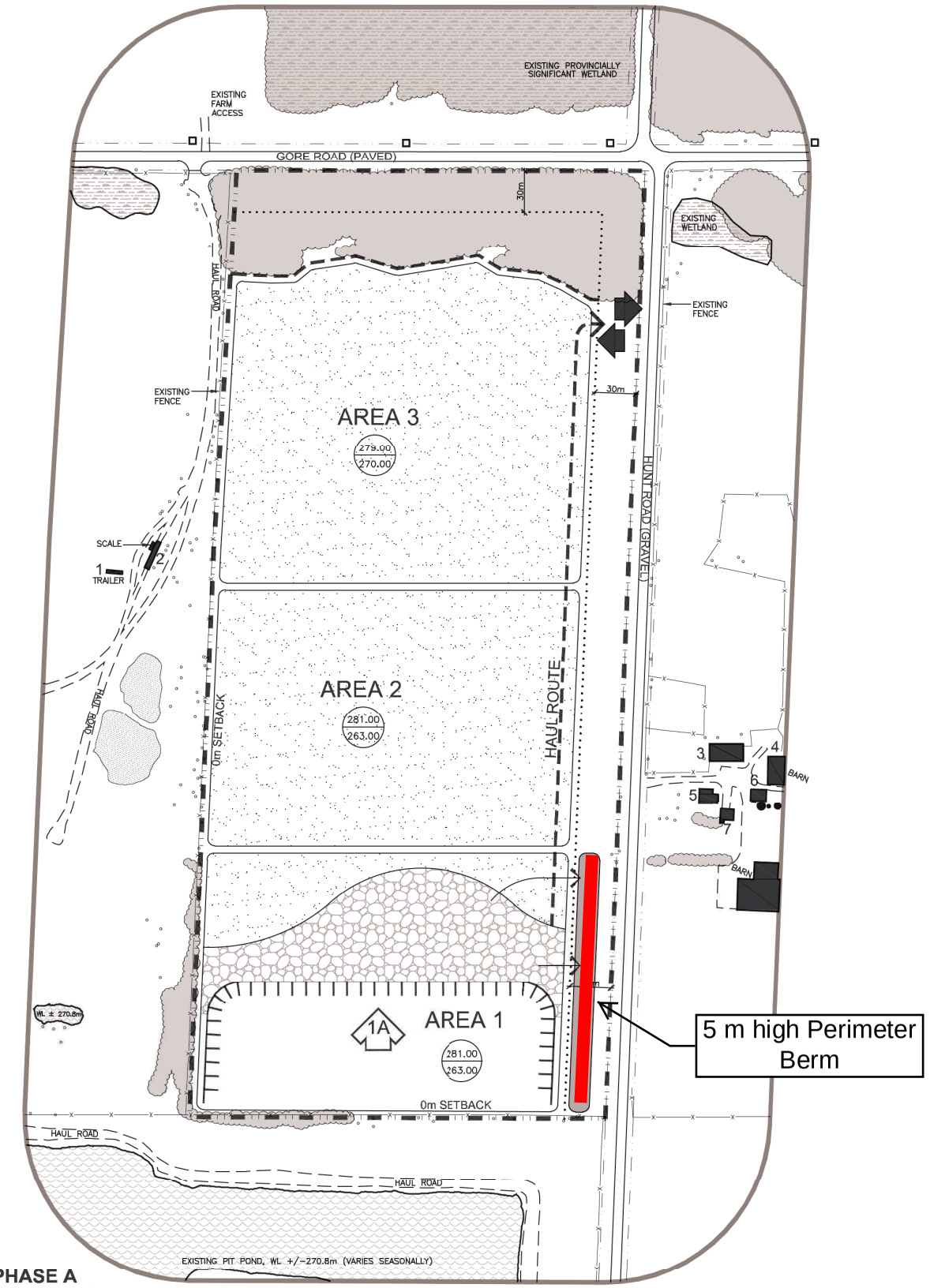
LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp: ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS, RICHARD McAVAN, OALA MEMBER
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM	Checked MH	Issue Date SEPT 2020
Drawing Title: EXISTING FEATURES		Project Number 20-23
		Drawing Number 1 OF 5

FILE NAME: 20-23 CONP 2020-1.DWG
PLOT DATE: SEPTEMBER, 2020

Figure 2: Aerial Photo

PHASE A



PHASE A NOTES

1. ESTABLISH THE ENTRANCE EXIT AND HAUL ROAD INTO THE SITE, ACCORDING TO THE APPROPRIATE MUNICIPAL STANDARDS.
2. PRIOR TO ANY ON SITE OPERATIONS, CONSTRUCT OR UPGRADE THE FENCING ON THE LICENCED BOUNDARIES TO THE STANDARDS OF THE AGGREGATE RESOURCES ACT (1.2m HIGH POST AND WIRE FENCE). ALL FENCING SHALL BE MAINTAINED.
3. PREPARE SITE WITHIN AREA 1 BY REMOVING EXISTING TREES AND SCRUB VEGETATION IN THE AREA TO BE EXTRACTED. SALVAGE LARGER STUMPS AND TREES FOR HABITAT CREATION DURING PROGRESSIVE REHABILITATION.
4. PRIOR TO ANY ON SITE OPERATIONS, STRIP TOPSOIL AND OVERBURDEN SEPARATELY USE THE MATERIALS TO CONSTRUCT ACOUSTICAL BERM ALONG HUNT ROAD.
5. CONSTRUCT THE HAUL ROAD THROUGH AREA 1 AND 2.
6. EXTRACTION OF AREA1 WILL PROCEED IN DIRECTION SHOWN.
7. UNDISTURBED PORTIONS OF AREAS 2 AND 3 REMAIN IN AGRICULTURAL USE AND OPEN SPACE.

OPERATIONS NOTES

GENERAL INFORMATION

1. THIS PLAN DEPICTS A SCHEMATIC OPERATIONS AND REHABILITATION SEQUENCE FOR THIS PROPERTY BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION. PHASES SHOWN ARE SCHEMATIC AND MAY SLIGHTLY VARY WITH MATERIAL QUALITY, SITE HYDROLOGY AND HYDROGEOLOGY OR MARKET DEMAND. PHASES DO NOT REPRESENT ANY SPECIFIC OR EQUAL TIME PERIOD.

   EXTRACTION SHALL GENERALLY FOLLOW THE SEQUENCE SHOWN. WHEN PARTIAL REHABILITATION OF A PHASE IS POSSIBLE IT SHALL BE CARRIED OUT. NOT WITHSTANDING THE EXTRACTION AND REHABILITATION PROCESS ABOVE, DEMAND FOR CERTAIN PRODUCTS OR BLENDING OF MATERIALS MAY REQUIRE SOME DEVIATION IN THE EXTRACTION AND REHABILITATION PHASING. ANY MAJOR DEVIATIONS FROM THE OPERATIONS SEQUENCE SHOWN WILL REQUIRE APPROVAL FROM MNRF.

2. REFER TO DRAWING 1 OF 5, EXISTING FEATURES, FOR A DESCRIPTION OF EXISTING VEGETATION AND BUILDINGS WITHIN THE 120 METRE BOUNDARY AND ON SITE.

3. SITE PLAN OVERRIDES ARE LISTED IN THE SITE PLAN OVERRIDE TABLE SHOWN ON THIS PAGE.

EXTRACTION/PROCESSING/HAULING INFORMATION

4. TOTAL AREA TO BE EXTRACTED IS 16.07 HECTARES.

5. MAXIMUM NUMBER OF TONNES OF AGGREGATE TO BE REMOVED FROM THE SITE IN ANY CALENDAR YEAR IS 150,000 TONNES.

   EXTRACTION OF SAND AND GRAVEL ABOVE WATER TABLE WILL TAKE PLACE IN ONE OR XX BENCHES, WITH A MAXIMUM HEIGHT OF ±8 METRES. THE GROUNDWATER TABLE IS ESTIMATED TO BE BETWEEN XXX ASL (SEE REPORT XXXX) THERE WILL BE XXX LIFT BELOW THE WATER TABLE IN AREA 1 TO A DEPTH OF XXXm ASL TO BE EXTRACTED BY EXCAVATOR, BACKHOE OR DRAG LINE. FRONT END LOADERS WILL BE USED TO EXTRACT MATERIAL AND HAUL TRUCKS OR CONVEYORS WILL CARRY MATERIAL TO THE PLANT FOR FURTHER PROCESSING. REFER TO SECTIONS A-A', B-B', AND C-C' ON DRAWING 4 OF 5 FOR FURTHER DETAILS.

   PORTABLE PROCESSING EQUIPMENT, FOR CRUSHING AND SCREENING WILL BE USED ON SITE AND WILL BE LOCATED ON THE PIT FLOOR IN THE PROCESSING AREA OR AREA 1 AT START UP. IN ADDITION TO PROCESSING, SITE ACTIVITIES WILL INCLUDE STRIPPING AND REHABILITATION. OPERATIONAL EQUIPMENT MAY INCLUDE TRUCKS, LOADERS, EXCAVATOR, BACKHOES, BULLDOZERS, SCRAPERS, CONVEYORS AND OTHER RELATED EQUIPMENT. PROCESSING EQUIPMENT, S' KICKERS AND PRODUCT STOCKPILES WILL NOT EXCEED ±15 METRES IN HEIGHT AND WILL BE LOCATED IN THE PROCESSING AREA AND/OR CLOSE TO PIT FACES. MATERIAL FROM OTHER PROPERTIES MAY BE IMPORTED INTO THE SITE FOR BLENDING, CUSTOM PRODUCTS AND/OR RESALE.

6. OFFICE/STORAGE BUILDING AND/OR SCALE/SCALEHOUSE MAY BE CONSTRUCTED IN PROCESSING AREA.

AGGREGATE RECYCLING

7. THERE MAY BE RECYCLING OF MATERIAL (ASPHALT AND CONCRETE) ON THIS SITE. MATERIAL IMPORTED FOR RECYCLING WILL BE STORED IN SEGREGATED STOCKPILES WITHIN THE PROCESSING AREA. RECYCLABLE ASPHALT MATERIALS WILL NOT BE STOCKPILED WITHIN 30m OF ANY WATER BODY OR MAN-MADE POND, OR 2m OF THE SURFACE OF THE ESTABLISHED WATER TABLE. ANY REBAR AND OTHER STRUCTURAL METAL MUST BE REMOVED FROM THE RECYCLED MATERIAL DURING PROCESSING AND PLACED IN A DESIGNATED SCRAP PILE ON SITE WHICH WILL BE REMOVED ON AN ON-GOING BASIS. REMOVAL OF RECYCLED AGGREGATE IS TO BE ONGOING. ONCE THE AGGREGATE ON SITE HAS BEEN DEPLETED THERE WILL BE NO FURTHER IMPORTATION OF RECYCLABLE MATERIALS PERMITTED. ONCE FINAL REHABILITATION HAS BEEN COMPLETED AND APPROVED IN ACCORDANCE WITH THE SITE PLAN, ALL RECYCLING OPERATIONS MUST CEASE.

8. EQUIPMENT, SCRAP AND MACHINERY ASSOCIATED WITH THE EXTRACTION OPERATIONS WILL BE REMOVED UPON COMPLETION OF EXTRACTION.

HYDROGEOLOGICAL INFORMATION

9. THE WATER TABLE ELEVATION VARIES ACROSS THIS LICENCE FROM APPROXIMATELY ±XXX - ± XXXm ABOVE SEA LEVEL (A.S.L.). BASED ON THE HYDROGEOLOGICAL REPORT (SEE ABOVE). REFER TO SECTIONS ON SHEET 4 OF 5.

10. SURFACE DRAINAGE WILL BE DIRECTED TO THE POND, CENTRAL WETLAND, AND/ OR LOW AREAS FOR WATER TO INFILTRATE INTO THE GRANULAR MATERIALS ON THE PIT FLOOR. THERE WILL BE NO OFF-SITE DITCHING/ DISCHARGE.

NOISE MITIGATION INFORMATION

11. HOURS OF OPERATION:

SITE PREPARATION AND REHABILITATION:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
EXCAVATION AND PROCESSING	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
SHIPPING:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS

AIR QUALITY INFORMATION

12. WATER OR CALCIUM CHLORIDE WILL BE APPLIED TO INTERNAL HAUL ROADS AND PROCESSING AREAS AS OFTEN AS REQUIRED TO MITIGATE DUST.

SITE MANAGEMENT INFORMATION

MAINTENANCE/ PROTECTION OF VEGETATION INFORMATION

13. EXISTING VEGETATION WITHIN THE LICENCED AREA SHALL BE MAINTAINED IN A HEALTHY VIGOROUS GROWING CONDITION UNTIL SEQUENTIAL STRIPPING BEGINS OR UNTIL THE REHABILITATION IS COMPLETE. ANY VEGETATION PLANTED AS PART OF SITE IMPROVEMENTS OR PROGRESSIVE AND FINAL REHABILITATION WILL ALSO BE MAINTAINED IN A HEALTHY, VIGOROUS GROWING CONDITION.

FENCING INFORMATION

14. BOUNDARIES OF THE AREA TO BE LICENCED THAT ARE PRESENTLY FENCED ARE SHOWN ON DRAWING 1 OF 4 EXISTING FEATURES. PRIOR TO ANY STRIPPING OR PREPARATION, FENCING ON THE LICENCED BOUNDARIES WILL BE UPGRADED TO 1.2m HIGH POST AND WIRE TO COMPLY WITH THE AGGREGATE RESOURCES ACT WHERE REQUIRED. ALL FENCING SHALL BE MAINTAINED.

TOPSOIL/SUBSOIL/OVERBURDEN STORAGE INFORMATION

15. TOPSOIL AND OVERBURDEN SHALL BE STRIPPED AND STORED SEPARATELY IN BERMS WHERE SHOWN AND STOCKPILES ON PIT FLOOR CLOSE TO EXTRACTION FACE.

BERM INFORMATION

16. BERMS SHALL BE A MINIMUM OF ±2.5 METRES ABOVE THE EXISTING GRADE, OR AS SPECIFIED IN THE NOISE ASSESSMENT REPORT DATED XXX AND SHOWN ON PLAN. BERMS SHALL NOT EXCEED 2:1. REFER TO TYPICAL BERM CROSS SECTION ON DRAWING 4 OF 5 DETAILS AND SECTIONS. ALL BERMS SHALL BE SEEDED (USING GRASS/ LEGUME MIXTURE, SEE REHABILITATION PLAN) IMMEDIATELY UPON COMPLETION TO MINIMIZE NOISE, DUST AND EROSION.

17. ON COMPLETION OF THE BERMS, EXCESS ON-SITE OVERBURDEN WILL BE USED TO PROGRESSIVELY BACKFILL AND REHABILITATE THE SITE. TOPSOIL CAN BE TEMPORARILY STOCKPILED ON THE PIT FLOOR.

SCRAP STORAGE INFORMATION

18. ALL SCRAP, USED MACHINERY AND STUMPS GENERATED THROUGH THE OPERATIONS WITHIN THIS LICENCE WILL BE STORED IN THE PROCESSING AREA, A MINIMUM OF 30m FROM THE BOUNDARY OF THE SITE AND NOT WITHIN 30m OF ANY BODY OF WATER AND SHALL BE DISPOSED OF ON AN ONGOING BASIS. STUMPS/ WOODY MATERIAL MAY BE CHIPPED AND USED FOR SOIL ENHANCEMENT DURING PROGRESSIVE REHABILITATION. TREES WILL BE HARVESTED AND SOLD AS LUMBER OR UTILIZED FOR FIREWOOD AND OR THEIR BEST USE. UPON COMPLETION OF EXTRACTION, ALL SCRAP EQUIPMENT AND USED MACHINERY SHALL BE REMOVED.

PETROLEUM STORAGE INFORMATION

19 FUEL, OIL, RADIATOR AND HYDRAULIC FLUID, AND OTHER CHEMICALS NEEDED FOR THE MAINTENANCE AND FUNCTIONING OF ON-SITE AGGREGATE PROCESSING EQUIPMENT SHALL BE APPROPRIATELY STORED IN ABOVE-GROUND CONTAINERS AND SHALL MEET THE REQUIREMENTS OF THE GASOLINE HANDLING ACT, AS AMENDED, AND THE GASOLINE HANDLING CODE AND REGULATIONS, AS AMENDED BY THE TECHNICAL STANDARDS AND SAFETY ACT (TSSA) AND LIQUID FUELS HANDLING CODE, AND IN ACCORDANCE WITH THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARKS CHEMICAL STORAGE GUIDELINES. ALL REFUELING SHALL BE WITHIN A CONTAINMENT PAD. ALL SPILLS TO THE ENVIRONMENT MUST BE REPORTED TO THE SPILLS ACTION CENTRE OF MECP. ANY SPILL SHALL BE REMOVED AND DISPOSED OF AT AN APPROPRIATE MECP APPROVED FACILITY.

IMPORTATION OF FILL INFORMATION

20. IN ORDER TO MAXIMIZE RESOURCE RECOVERY, IMPORTATION OF CLEAN INERT FILL (EG. TOPSOIL AND/OR OVERBURDEN) MAY BE IMPORTED TO FACILITATE 3:1 SIDESLOPE REHABILITATION (ABOVE WATER TABLE SIDESLOPES). ONLY NATIVE ON SITE OVERBURDEN AND/OR OFF-SPEC MATERIALS WILL BE USED FOR BELOW WATER REHABILITATION. ONLY SUFFICIENT MATERIAL TO CREATE FINAL GRADES AS SHOWN MAY BE IMPORTED.

    IMPORTED MATERIAL SHALL MEET THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARKS PARAMETERS UNDER TABLE "1" OF MECPS "SOIL, GROUND WATER AND SEDIMENT STANDARDS FOR USE UNDER PART XV.1 OF THE ENVIRONMENTAL PROTECTION ACT".

    SAMPLING AND TESTING OF ALL IMPORTED MATERIAL SHALL BE PERFORMED AT SOURCE PRIOR TO THE IMPORTATION OF MATERIAL ONTO THE LICENSED SITE BY A QP UNDER EPA. A QP SHALL ALSO DESIGN FILL MONITORING PROGRAM (PER L3 NOTES). RANDOM SAMPLING OF ALL IMPORTED MATERIAL SHALL BE CONDUCTED AT THE REQUEST OF MNRF.

    THE LICENSEE SHALL KEEP DETAILED RECORDS OF THE AMOUNT OF MATERIAL BROUGHT ON SITE FOR REHABILITATION AND THE TESTING RESULTS OF ALL SAMPLES. ALL RECORDS AND TESTING RESULTS SHALL BE AVAILABLE UPON REQUEST BY MNRF OR MECP.

WASH PLANT INFORMATION

21. SHOULD A WASH PLANT BE REQUIRED WITH A PREDICTED WATER USAGE OF 50,000L/DAY OR MORE, THE PRODUCER SHALL OBTAIN PERMIT TO TAKE WATER FROM MECP AND HAVE IT READY FOR INSPECTION. THE PERMIT TO TAKE WATER (PTTW) WILL BE ACCOMPANIED BY THE APPROPRIATE SUPPORTING DOCUMENTATION.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK LINE
- EXTRACTION LIMIT
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXTRACTION FACE
- BERM (MIN. HEIGHT AS SHOWN)
- UNDISTURBED AREA
- AREA STRIPPED OF TOPSOIL AND OVERBURDEN
- PROPOSED OPEN WATER
- 1 EXISTING BUILDING AND NUMBER
- HP EXISTING HYDRO POLE
- B' LOCATION OF SECTION
- ENTRANCE/ EXIT
- DIRECTION OF EXTRACTION
- DIRECTION OF TOPSOIL AND OVERBURDEN MOVEMENT
- PRODUCT TRANSPORTATION VIA HAUL ROAD
- R3 LOCATION OF NOISE RECEPTOR
- 286.00 / 286.00 EXISTING ELEVATION / PROPOSED ELEVATION

SITE PLAN OVERRIDE (VARIANCE)

THE FOLLOWING CONDITIONS ILLUSTRATED ON THESE PLANS VARY FROM THE OF THE PROVINCIAL STANDARDS MADE UNDER THE AGGREGATE RESOURCES ACT

ITEM	SECTION
SETBACK IS REDUCED TO 0m ALONG SOUTH AND WEST BOUNDARIES. ADJACENT LANDS LICENSED FOR AGGREGATE EXTRACTION, AS PER AGREEMENT WITH AD JACENT LICENSEE/ LANDOWNER.	5.10.1

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Project Name

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PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)

North

Stamp: ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — RICHARD McAVAN — OALA MEMBER

Drawing Status: PRELIMINARY FOR DISCUSSION

Drawn RM | Checked MH | Issue Date SEPT 2020

Drawing Title: OPERATION PLANS PHASE A

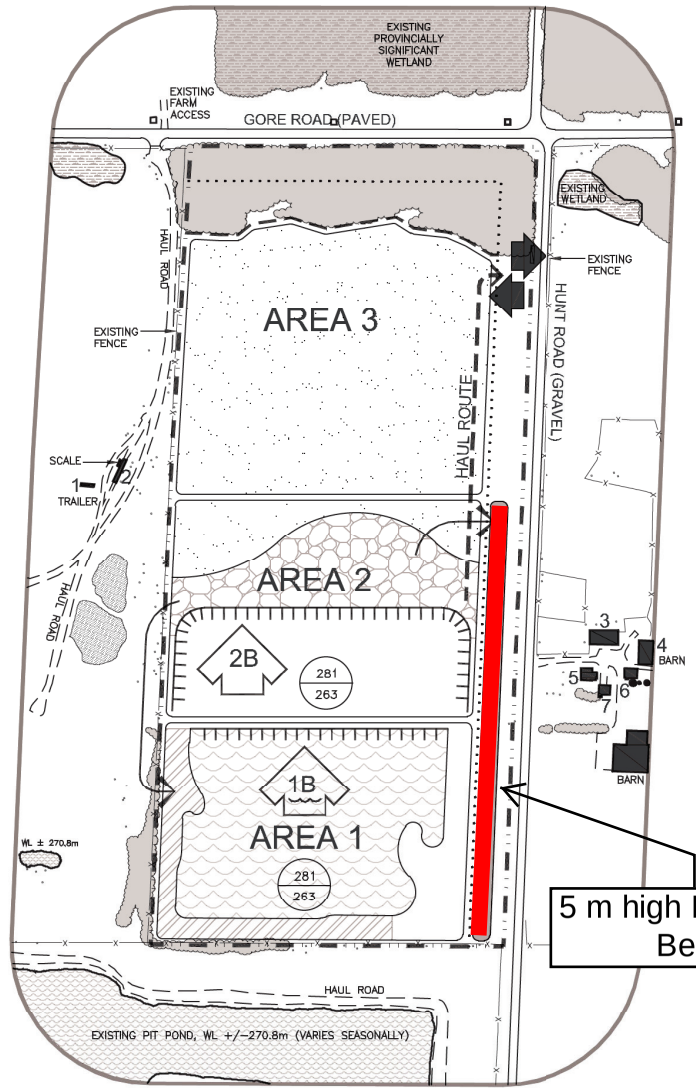
Project Number: 20-23

Drawing Number: 2 OF 5

FILE NAME: 20-23 COMP 2021-2.DWG
PLOT DATE: SEPTEMBER, 2020

Figure 3a - Operation Plans 1

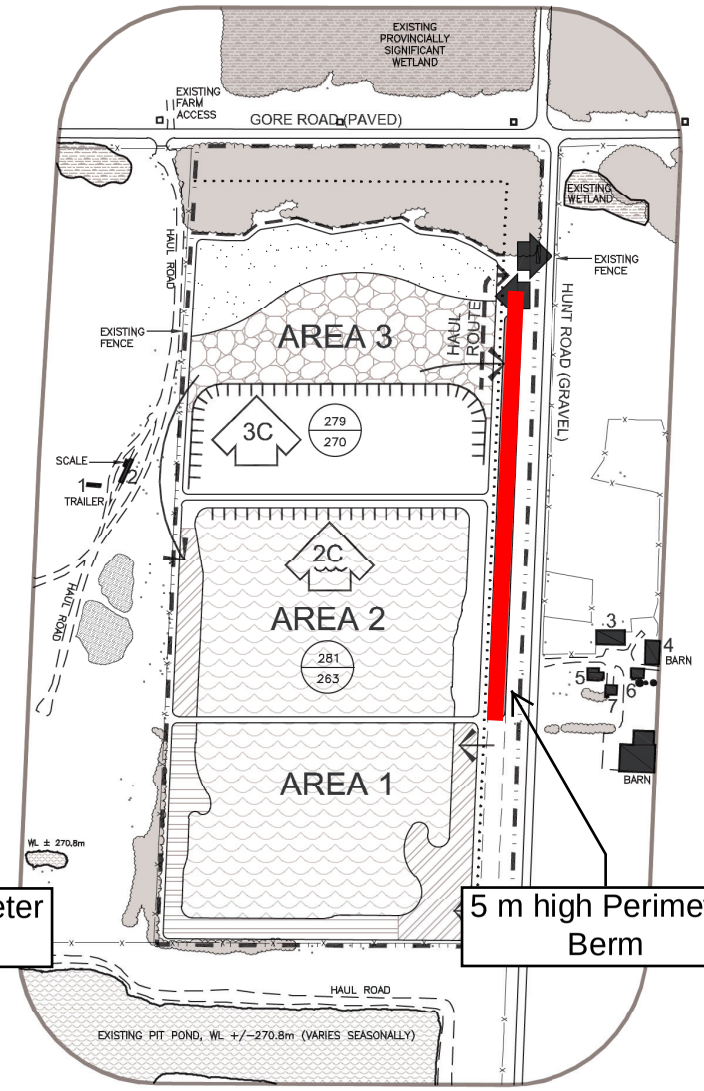
PHASE B



PHASE B

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 2 AND USE THE MATERIAL TO EXTEND BERM ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE SOUTHERN AND WESTERN PARTS OF AREA 1.
2. BEGIN ABOVE WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
3. BEGIN BELOW WATER EXTRACTION OF AREA 1 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
4. UNDISTURBED PORTION OF AREA 2 & 3 TO REMAIN IN AGRICULTURAL USE.
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

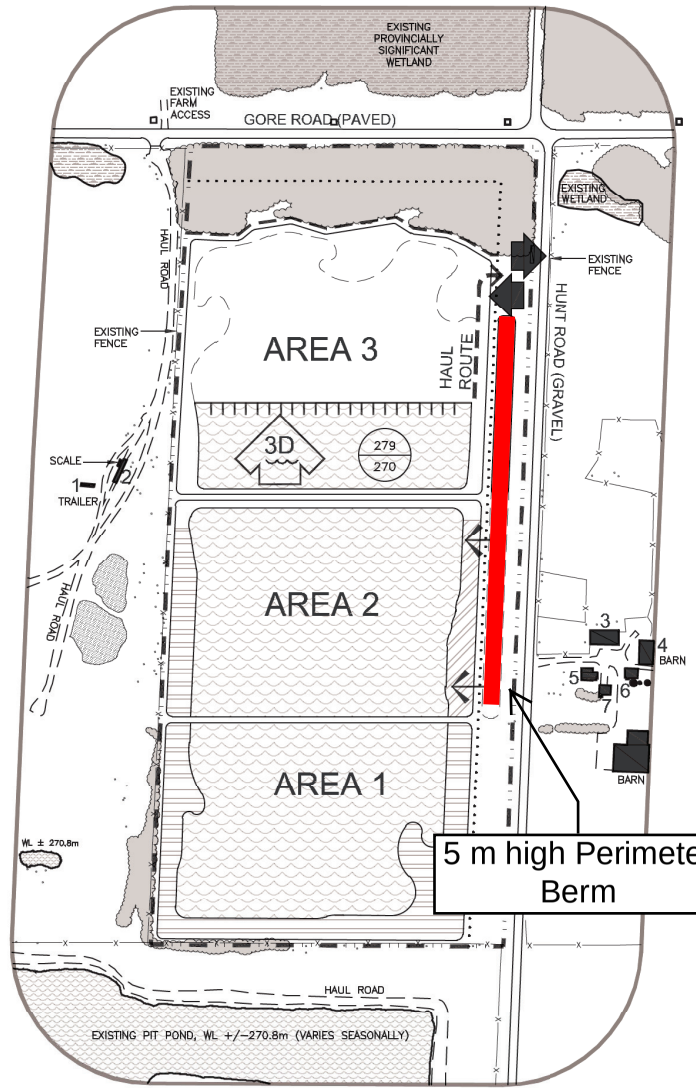
PHASE C



PHASE C

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 3 AND USE THE MATERIAL TO EXTEND BERM ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA 2.
2. COMPLETE PROGRESSIVE REHABILITATION OF SOUTHERN AND WESTERN PARTS OF AREA1, THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
3. BEGIN PROGRESSIVE REHABILITATION OF EASTERN PART OF AREA 1 USING TOPSOIL AND OVERBURDEN STOCKPILED IN THE BERM ALONG HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
4. BEGIN ABOVE WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. BEGIN BELOW WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
6. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE D



PHASE D

1. COMPLETE PROGRESSIVE REHABILITATION OF AREA1, THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
2. COMPLETE PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA2, THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
3. BEGIN PROGRESSIVE REHABILITATION OF EASTERN PART OF AREA 2 USING TOPSOIL AND OVERBURDEN STOCKPILED IN THE BERM ALONG HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
4. BEGIN BELOW WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE E (NOT SHOWN)

1. BEGIN AND COMPLETE PROGRESSIVE REHABILITATION OF AREA 3 USING TOPSOIL AND OVERBURDEN STOCKPILED IN THE BERM ALONG HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
2. REMOVE ALL EQUIPMENT, STRUCTURES, STOCKPILES AND SCRAP FROM THE SITE AND REHABILITATE ALL HAUL ROADS USING TOPSOIL AND OVERBURDEN STOCKPILED IN REMAINING BERMS.
3. COMPLETE PROGRESSIVE REHABILITATION IN AREA 3. AREA 1 & 2 RETURN TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
4. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK LINE
- EXTRACTION LIMIT
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXTRACTION FACE
- BERM (MIN. HEIGHT AS SHOWN)
- UNDISTURBED AREA
- AREA STRIPPED OF TOPSOIL AND OVERBURDEN
- ONGOING/ PROGRESSIVE REHABILITATION
- ONGOING REHABILITATION
- COMPLETED REHABILITATION
- BELOW WATER EXTRACITON
- 1 EXISTING BUILDING AND NUMBER
- HP EXISTING HYDRO POLE
- ENTRANCE/ EXIT
- DIRECTION OF ABOVE WATER EXTRACTION
- DIRECTION OF BELOW WATER EXTRACTION
- DIRECTION OF TOPSOIL AND OVERBURDEN MOVEMENT
- PRODUCT TRANSPORTATION VIA HAUL ROAD
- R3 LOCATION OF NOISE RECEPTOR
- 795.00 / 795.00 EXISTING ELEVATION / PROPOSED ELEVATION

Harrington McAvan Ltd
41 Main Street, Unit 102
Unionville, Ontario L3R 2E5
Tel: 905-294-8282 Fax: 905-294-7623
www.harringtonmcavan.com

Project Name

Thames Valley Aggregates Inc.

PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:3000 (0 10 50 90 120m)	North	Stamp: ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS, RICHARD McAVAN, OALA MEMBER
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM	Checked MH	Issue Date SEPT 2020
Drawing Title: OPERATION PLANS PHASE B TO E		Project Number 20-23
		Drawing Number 3 OF 5

FILE NAME: 20-23 CONP 2020-3.DWG
PLOT DATE: SEPTEMBER, 2020

Figure 3b - Operation Plans 2

APPENDIX A

Sample Calculations

HGC Engineering **Environmental Noise Prediction Summary Sheet**

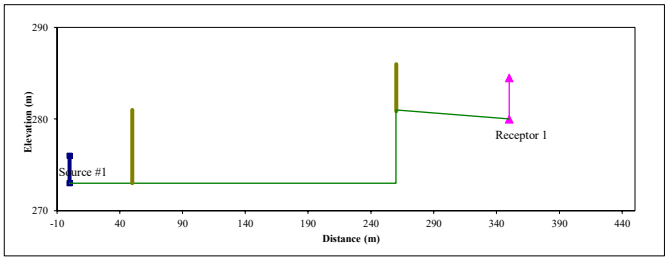
Project Name: Pike Pit
Receptor: Receptor 1, Area 1 - With Mitigation

Source #	Description	Distances			Elevations				Height			
		S-R	S-SB	S-RB	S Elev	R Elev	RB Elev	SB Elev	S Height	R Height	RB Height	SB Height
Source #1	Crusher, Screeners, Diesel Generator, Conveyor, Loader	350	50	260	273	280	281	273	3	4.5	5	8
Source #2	Excavator	140		50	273	280	281		2	4.5	5	
Source #3	Truck at Entrance	350		260	277	280	281		2	4.5	5	
Source #4	Highway Trucks	140		50	273	280	281		2	4.5	5	

Output Summary

	Description	SPL at Receiver	
Source #1	Crusher, Screeners, Diesel Generator, Conveyor	45	
Source #2	Excavator	34	
Source #3	Truck at Entrance	25	
Source #4	Highway Trucks	24	
		0	
	Total	45	dBA
	Criteria	45	dBA

Barrier for Source #1



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TOP

	Description	S-R	S-SB	S-RB	S Ele	R Elev	RB Elev	SB Elev	S Height	R Height	RB Height	SB Height
Source #1	Crusher, Screeners, Diesel Generator, Conveyor	350	50	260	273	280	281	273	3	4.5	5	8

Number of Sources	1	
Time Duration	60	(minutes per hour)
Tonality Penalty	0	dB
Measurement Distance	75	m

	Frequency	63	125	250	500	1000	2000	4000	8000	dBA
	Meas SPL	79.3	72.8	68.9	69.0	65.9	66.9	61.5	55.7	72.5
	# Srcs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Time Dur	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Tonality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Directivity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Air Abs	0.0	-0.1	-0.3	-0.8	-1.4	-2.5	-6.3	-21.1	
	Gnd Atten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Dist Atten	-13.4	-13.4	-13.4	-13.4	-13.4	-13.4	-13.4	-13.4	
	Barr. Att.	-6.3	-7.4	-9.0	-11.3	-14.1	-17.0	-20.0	-23.0	
	SPL @ Rec	59.6	52.0	46.2	43.5	37.1	34.0	21.8	-1.8	44.9

Barrier Calculations

Is there a source barrier:	Y	Source barrier BRIGHT ZONE:	N	SB Intercept Height	1.21
Is there a receiver barrier:	Y	Receiver barrier BRIGHT ZONE:	N	RB Intercept Height	6.31
		S->RB BRIGHT ZONE:	N	S-RB Intercept Height	1.92
		SB->RB BRIGHT ZONE:	N	SB-RB Intercept Height	2.45

|S->SB|	50.25	|S->RB|	260.19
|SB->R|	300.02	|RB->R|	90.01
|SB->RB|	210.06	|S->R|	350.10

Max Attentuation	-6.30438576	-7.35837462	-9.02766973	-11.3251908	-14.0762553	-17.0311469	-20.03575	-23.04583503
Combined								
PLD	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.2182 1
N	0.079919728	0.15857089	0.31714178	0.63428355	1.26856711	2.53713421	5.07426843	10.14853685
Combined Attentuation	-6.30438576	-7.35837462	-9.02766973	-11.3251908	-14.0762553	-17.0311469	-20.03575	-23.04583503
Source Barrier								
PLD	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17 1
N	0.061020264	0.12107195	0.2421439	0.48428781	0.96857562	1.93715124	3.87430247	7.748604941
Source Barrier Attentuation	-6.020338649	-6.87948413	-8.29999469	-10.3635083	-12.9681899	-15.869635	-18.864634	-21.87404898
Receiver Barrier								
PLD	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10 1
N	0.037190763	0.0737912	0.14758239	0.29516478	0.59032957	1.18065914	2.36131828	4.722636552
Source Barrier Attentuation	-5.641935424	-6.21374911	-7.22210478	-8.82427154	-11.0617903	-13.7778799	-16.721182	-19.72396631

HGC Engineering **Environmental Noise Prediction Summary Sheet**

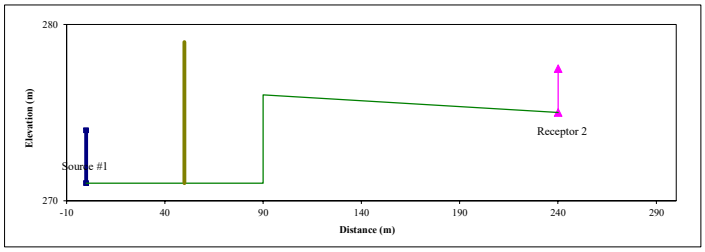
Project Name: Pike Pit
Receptor: Receptor 2, Area 3 - With Mitigation

Source #	Description	Distances S-R	S-SB	S-RB	Elevations S Elev	R Elev	RB Elev	SB Elev	Height S Height	R Height	RB Height	SB Height
Source #1	Crusher, Screeners, Diesel Generator, Conveyor, Loader	240	50	90	271	275	276	271	3	2.5		8
Source #2	Excavator	200		50	271	275	276		2	2.5		
Source #3	Truck at Entrance	450		300	276	275	276		2	2.5		
Source #4	Highway Trucks	200		50	271	275	276		2	2.5		

Output Summary

	Description	SPL at Receiver	
Source #1	Crusher, Screeners, Diesel Generator, Conveyor,	48	
Source #2	Excavator	42	
Source #3	Truck at Entrance	31	
Source #4	Highway Trucks	32	
		0.0	
	Total	49	dBA
	Criteria	50	dBA

Barrier for Source #1



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TOP

	Description	S-R	S-SB	S-RB	S Ele	R Elev	RB Elev	SB Elev	S Height	R Height	RB Height	SB Height
Source #1	Crusher, Screeners, Diesel Generator, Conveyor,	240	50	90	271	275	276	271	3	2.5	0	8

Number of Sources 1
Time Duration 60 (minutes per hour)
Tonality Penalty 0 dB
Measurement Distance 75 m

	Frequency	63	125	250	500	1000	2000	4000	8000	dBA
	Meas SPL	79.3	72.8	68.9	69.0	65.9	66.9	61.5	55.7	72.5
	# Srcs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Time Dur	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Tonality	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Directivity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Air Abs	0.0	0.0	-0.2	-0.5	-0.8	-1.5	-3.8	-12.6	
	Gnd Atten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Dist Atten	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	-10.1	
	Barr. Att.	-6.4	-7.5	-9.2	-11.5	-14.3	-17.3	-20.3	-23.3	
	SPL @ Rec	62.8	55.2	49.4	46.9	40.7	38.1	27.4	9.7	48.4

Barrier Calculations

Is there a source barrier:	Y	Source barrier BRIGHT ZONE:	N	SB Intercept Height	0.73
Is there a receiver barrier:	Y	Receiver barrier BRIGHT ZONE:	N	RB Intercept Height	1.31
		S->RB BRIGHT ZONE:	N	S-RB Intercept Height	1.11
		SB->RB BRIGHT ZONE:	Y	SB-RB Intercept Height	-0.32

|S->SB|	50.25	|S->RB|	90.02
|SB->R|	190.01	|RB->R|	150.01
|SB->RB|	40.11	|S->R|	240.03

Max Attentuation	-6.366348282	-7.460648	-9.17851573	-11.5180342	-14.2925161	-17.2547258	-20.26038963	-23.2705299	
Combined									
PLD	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.2298	1
N	0.084163454	0.166990981	0.333981961	0.667963923	1.335927845	2.671855691	5.343711381	10.68742276	
Combined Attentuation	-6.366348282	-7.460648	-9.17851573	-11.5180342	-14.2925161	-17.2547258	-20.26038963	-23.2705299	
Source Barrier									
PLD	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	1
N	0.084163454	0.166990981	0.333981961	0.667963923	1.335927845	2.671855691	5.343711381	10.68742276	
Source Barrier Attentuation	-6.366348282	-7.460648	-9.17851573	-11.5180342	-14.2925161	-17.2547258	-20.26038963	-23.2705299	
Receiver Barrier									
PLD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
N	0.001538304	0.003052191	0.006104383	0.012208766	0.024417531	0.048835062	0.097670124	0.195340249	
Source Barrier Attentuation	-5.027921408	-5.05527738	-5.11006577	-5.21820646	-5.42894987	-5.82980386	-6.559355598	-7.792101604	

APPENDIX B

Consultant Curriculum Vitae

HGC ENGINEERING

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

Mandy Chan, Senior Engineer PEng.

Education

University of Waterloo, Bachelor of Applied Science, 2006

Professional Memberships

Professional Engineers of Ontario (PEO)
Canadian Acoustical Association (CAA)
Ontario Society of Professional Engineers (OSPE)

Professional History

2014 to Present	Senior Engineer, Associate, HGC Engineering, Mississauga
2010 to 2014	Project Engineer, HGC Engineering, Mississauga
2006 to 2010	Project Consultant, HGC Engineering, Mississauga

Experience

Ms. Chan has been involved in a wide variety of projects related to acoustics, noise and vibration. She has experience with the measurement and analysis of traffic noise and stationary noise sources, architectural acoustic design of learning spaces, office spaces and churches. She has a broad familiarity with Ministry of Environment guidelines regarding noise and vibration and an understanding of Ministry criteria and methods for prediction of noise due to roadway, railway, aircraft traffic, industrial and aggregate facilities. Additionally, Ms. Chan has analysis experience using computer aided modelling and prediction software.

Selected Projects

Banner Pit, *Thamesford, Ontario*
Block 5 Developments, *Brampton, Ontario*
Bremont Homes, *Mississauga, Ontario*
City Centre Condominiums, *Mississauga, Ontario*
Edmonton Clinic, *Edmonton, Alberta*
Greensborough Subdivision, *Markham, Ontario*
Gurney Sands and Gravel, *Brantford, Ontario*
Knox Presbyterian Church, *Waterloo, Ontario*
Inland West Pit, *Warwick, Ontario*
Johnson Bros. Gravel Pits, *Southern Ontario*
Mattamy Homes, *Milton, Ontario*
Liberty Village Condominiums, *Toronto, Ontario*
Linamar Tech Centre, *Guelph, Ontario*
Nelson Granite Quarries, *Kenora, Ontario*
St. Leonard's Boys' Secondary School, *Bermuda*
Tisdale Mining Lands, *Timmins, Ontario*
Waterloo Christian Reformed Church, *Waterloo, Ontario*
Warren Stewart Limestone Quarry, *Cockburn Island, Ontario*
West Village at Stratford, *Stratford, Ontario*

HGC ENGINEERING

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

William J. Gastmeier, Principal, MASc, PEng

Education:

BSc, Honours Physics, University of Waterloo, May 1974.
MASc, Electrical Engineering (Acoustics) University of Waterloo, May 1976.
"Preparing & Presenting Evidence", York University, 1991
"Noise Control in Land Use Planning", Ministry of the Environment, 1987

Memberships:

Designated Consulting Engineer, Province of Ontario
Registered Professional Engineer, Association of Professional Engineers of Ontario (PEO)
Acoustical Society of America (ASA)
Canadian Acoustical Association (CAA), Member, Board of Directors
Canadian Environmental Industries Association (CEIA)

Professional Experience:

1993 to Present
Principal, Howe Gastmeier Chapnik Limited Mississauga, ON

Assess environmental noise and vibration from transportation and industrial sources, mining operations race tracks and gun ranges. Provide expert testimony with regard to noise and vibration in land use planning and land use compatibility. Gained extensive experience with noise control in Land Use Planning including Official Plan and Secondary Plan Amendments and Zone Change Applications across Ontario.

Design architectural acoustics and noise control for council chambers, performance spaces, worship spaces, studios, music rooms, offices, laboratories, museums and public spaces.

Provide third party expert peer review and certification services for clients across North America.

Specify and design noise control measures to ensure compliance with Ministry of the Environment Guidelines and the Occupational Health and Safety Act.

1987 to 1993
Project Coordinator, Vibron Limited, Mississauga, ON, Consulting Engineering Division

Supervised engineering staff in consulting engineering projects in acoustics, noise and vibration. Provided client liason, technical expertise, attended public meetings and hearings.

1981 to 1987
Manager, Unitron Industries, Electroacoustic Design

Hired and supervised staff in the acoustical and electronic design of hearing aids.

Researched the physiology of hearing, hearing loss, psychoacoustics, speech intelligibilty and audiology to design the electroacoustic performance of hearing assistive devices.

1976 to 1978

Project Engineer, Turner Division of Conrac Corporation

Developed a vibration sensor to detect engine knock, designed high intelligibility paging microphones and other new microphone products.

Selected Significant Projects & Studies:

Transportation

- Blue Water Bridge Twinning, Sarnia, Ontario
- Ambassador Bridge Enhancement Project (twinning), Windsor, Ontario
- Highway Widening and Alignments in Sudbury, Port Colborne, Brantford and Thunder Bay
- Winnipeg International Airport
- Layover/Expansion Facilities for Go Transit and CPR
- Golf Links Road Widening, Thunder Bay, 2010
- Pavement Rehabilitation, Highway 140, Port Colborne, 2009
- Highway 11/17, Sault Ste. Marie, 2009
- Ambassador Bridge Twinning, Windsor, 2007 and 2011
- Road Widening/Realignment, RR 35, Sudbury, 2006
- Kingsway Road Widening, Sudbury, 2005
- Fischer Hallman Road Widening, Waterloo, 2003
- Southwest Bypass Extension, Brantford, 2001
- The Kingsway Realignment, Sudbury, 2000
- Blue Water Bridge Twinning, Sarnia, 1995
- Many Noise Impact Studies for Subdivisions (Road, Rail & Air traffic sources) in Ontario

Noise Studies for Expropriation Proceedings:

- Highway 6 South, Puslinch
- Derry Road Mississauga
- Highway 403, Ancaster
- Highway 407, Markham
- Leslie Street, Newmarket

Acoustics

- Lecture and performance theatres, studios and classrooms at McMaster University, Western University, University of Windsor, University of Alberta, University of Waterloo, Upper Canada College, Ryerson University and Fanshawe, Mohawk and Niagara Colleges
- Performance Theatres for Drayton Entertainment in Kitchener and St. Jacobs, Ontario and the Toronto District School Board
- The Carlu (Eaton's Theatre), College Park, Toronto
- Design and Certification of Acoustical Test Facilities across North America

- Acoustical Design of Worship Spaces for many faiths across Canada including 1000+ seat sanctuaries for the Metropolitan Bible Church in Ottawa, Richmond Hill Chinese Community Church and St. Thomas the Apostle Roman Catholic Church in Waterdown.
- Recreational, Library and Civic Facilities in Kitchener, Welland, Ingersoll and Brantford

Land Use Planning and Compatibility

- Transmetro Properties 1500 Unit Residential Development, Scarborough, ON
- Peer Reviews for Toronto, Waterloo Region, Simcoe, Oxford and Wellington Counties
- Hundreds of Road and Rail Traffic Noise and Vibration Impact Studies for new Residential Developments
- Noise Compatibility Studies for Official Plan Amendments and Zone Change Applications for Adjacent Proposed Residential/Industrial Land Uses.

Mines, Pits and Quarries

- Scores of Ministry of Natural Resources applications for licences for pits and quarries across Ontario, above and below water.
- De Beers Diamond Mine, Attawapiskat, Gold Mines in Red Lake, Timmins and Matheson ON
- Vale Inco in Sudbury and Port Colborne.

Power Plants, Pipelines and Utilities

- Combined Cycle Peaking Power Plant, Eastern Power, Missisauga
- Compressor Station Noise Assessments at TransCanada PipeLines Facilities across Canada
- Union Gas Province Wide Certificate of Approval Application and Environmental Noise Management
- Electrical/Steam Cogeneration Facilities, York University and Brock University

Teaching Experience:

1998 to 2010
Lecturer, Dalhousie University, School of Architecture: "Architectural Acoustics Module of ARB 211 Environment"

1988 to 2014
Adjunct Professor, University of Waterloo, Dept of Environmental Studies, School Of Architecture: "Architectural Acoustics, Noise Control, Sound Systems"

1988 to 1990
Lecturer, Ontario Ministry of the Environment: "Noise Control in Land Use Planning"

1982 to 1993
Guest lecturer, Physics Department, University of Waterloo: "Science of Hi-Fidelity"

Expert Testimony:

OMB Hearing, Aggregate License Application, Zoning and OP Amendment, Galway Cavendish, ON, 2014
Provincial Court, Prosecution under the Environmental Protection Act, Race Track, Seguin Twp., 2014
OMB Hearing, Aggregate License, Zone Change Application, Woolwich Township, 2013
OMB Hearing, Aggregate Licence Application, Ashfield- Colborne-Wawanosh, ON, 2011

OMB Hearing, Aggregate Licence Application, Thames Centre ON, 2010
OMB Hearing, Proposed Golf Driving Range, Markham ON, 2010
OMB Hearing, Proposed Commercial Development near a Recycling Facility, Newmarket ON, 2010
OMB Hearing, proposed Quarry, Michipicoten Harbour, Wawa ON, 2009
OMB Hearing, proposed Residential Development near existing Industrial Land Use, Listowel, ON, 2009
OMB Hearing, proposed Mixed Use Development near Industrial Uses, Brampton ON, 2008
OMB Hearing, proposed Power Plant, Mississauga, Ontario, 2007
OMB Hearing, proposed Retirement Complex in Scarborough, 2007
OMB Hearing, compatibility of Residential Development near Feed Mill, Ingersoll, Ontario, 2006
OMB Hearing, proposed gravel pit, Simcoe, Ontario, 2005.
Ontario Superior Court of Justice, matter relating to noise from the St.Thomas Dragway, 2004
OMB Hearing, proposed aviary, Scotland, Ontario, 2004
OMB Hearing, proposed warehousing facility near existing residential neighbourhood, Oakville, 2004
OMB Hearing, proposed gravel pit, Oro-Medonte Township, 2004
OMB Hearing, high-rise residential development near industry and Highway 401, 2002
Provincial Court, Brantford Ontario, Prosecution under the Municipal Noise Bylaw, 2000
OMB Hearing, residential development adjacent to a CPR Classification Yard, Scarborough, 1999
OMB Hearing, Aggregate Extraction Facility, Windy Lake, Ontario, 1998
OMB Hearing, residential development adjacent to railway, Norwood Road, Toronto, 1996
OMB Hearing, proposed rail transfer facility, Shakespeare, Ontario, 1995
OMB Hearing, residential development, Rogers Road, City of Toronto, 1993
Consolidated Board Hearing, residential development in the City of York, 1992
NEC Hearing, Cogeneration Plant, Brock University, St. Catharines, 1992

Patents:

U.S. Patent 4,553,627 "Hearing Aid Wax Guard"

U.S. Patent 4,349,082 "Acoustical Damping Element and Method of Forming Same"

U.S. Patent 4,193,647 "Piezoelectric Ceramic Transducers with uniform Resonant Frequency"

Publications:

“Considerations in the Acoustical Design of Black Box Theatres”, Proceedings of Acoustics Week in Canada, Canadian Acoustics, October 2015

“Recent Trends in the Acoustical Design of Institutional Facilities”, Proceedings of Acoustics Week in Canada, Canadian Acoustics, September 2014

“Architectural Personality” Perspectives, Fall 2010

“Occupational Noise Exposure in Nightclubs” Proceedings of Acoustics Week in Canada, Canadian Acoustics, September 2010.

“The Consumer Handbook on Hearing Loss and Noise - Chapter 11 - Architectural Strategies to Minimize Noise” Edited by Marshall Chasin, Auricle Ink Publishers, 2010

“Acoustical Performance Criteria and Treatment Protocols for Learning Spaces at a Large Institutional Teaching Facility” Proceedings of Acoustics Week in Canada, Canadian Acoustics, September 2009.

“Hearing Loss in Musicians – Prevention and Management - Chapter 8 - Room and Stage Acoustics for Optimal Listening and Playing” Edited by Marshall Chasin, Plural Publishing Inc., 2009

"Acoustical Performance Criteria, Treatment and Guidelines for Multifunctional School Gymnasia" with Kana A. Ananthaganeshan, Canadian Acoustics, December 2007

"Room Acoustics and Modifications for Performing Artists" Hearing Review, March 2006

"The Use of Environmental Noise Standards and Guidelines in Canada", Canadian Acoustics, Sept. 2005

"ISO-1996 'Acoustics-Description and Measurement of Environmental Noise' Round Robin Testing", Canadian Acoustics, December 2001

"Reverberation in Public School Gymnasia" Canadian Acoustics, December, 1999

"Air Traffic Noise", Ontario Planning Journal, Spring, 1998

"Musicians and the Prevention of Hearing Loss, Chapter 7, Room Acoustics" Edited by Marshall Chasin, Singular Publishing Group, San Diego, 1996

"Applying Sound Intensity Methods In-situ to Measure Exhaust Noise levels and Estimate Silencer Performance" Proceedings of the Alberta Energy & Utilities Board 1996 Conference on Environmental Noise Control Engineering

"The Assessment of Rail Traffic Noise and Vibration in Land Use Planning" Ontario Planning Journal, March /April, 1996

"Acoustical Materials" The Canadian Architect, April, 1995

"Environmental Noise & Vibration Part 2" Ontario Planning Journal, Jan/Feb, 1995

"Noise Control & the Building Envelope" Ontario Building Envelope Council Newsletter, 1995

"Environmental Noise & Vibration Part 1" Ontario Planning Journal, Nov/Dec, 1994.

"Occupational Noise Exposure in the High School Music Practice Room" 1994 Congress of the Canadian Acoustical Association.

"Field Sound Transmission Loss of Demising Walls and Floor/Ceiling Assemblies". Proceedings of the 1992 International Congress on Noise Control Engineering.

"The Control of Bus Noise and Vibration in Mixed Use Urban Construction". Proceedings of the 1992 International Congress on Noise Control Engineering, Toronto,1992, pp.857-860.

"Noise Complaints in Residential Condominiums" Proceedings of Noise Control, 1990.

"Noise Control of Underground Bus Stations - A Case Study" Canadian Acoustical Association Conference, Toronto, 1988.

"The Acoustically Damped Earhook" Hearing Instruments No. 10, October 1981

Standardization and Professional Committees:

Canadian Standards Association Member of Occupational Hearing Technical Committee, 2010 to Present

Canadian Standards Association Member of Technical Committee S251 "Acoustics and Noise Control" 2005 to 2010

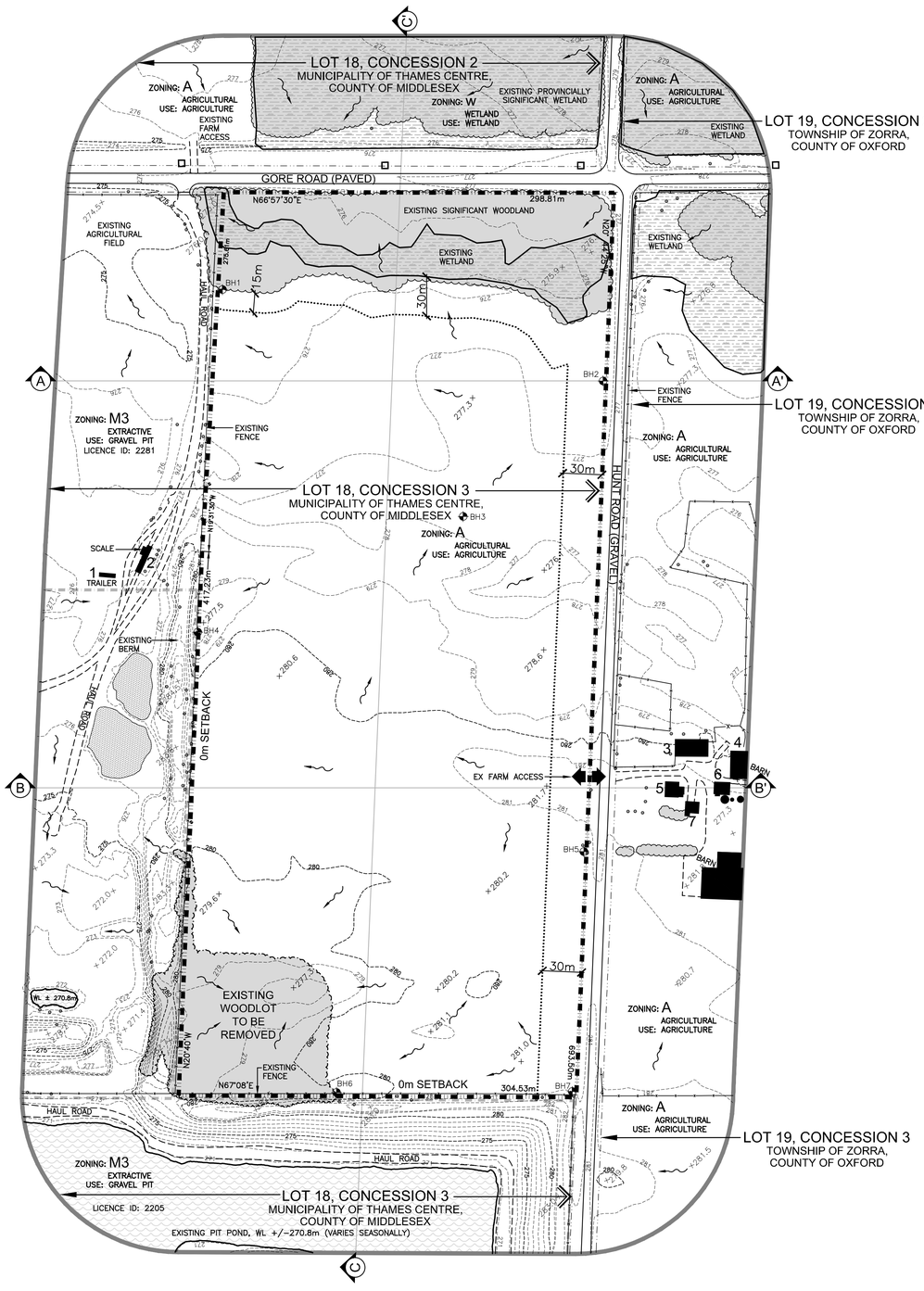
Canadian Standards Association "Chair of Environmental Noise Subcommittee of Technical Committee S251 "Acoustics and Noise Control" 2005 to 2010

Canadian Standards Association ISO 9613 / CSA Z107.55 Working Group on Industrial Noise Propagation, 2002 to 2010

Canadian Standards Association - Working Group for the Adoption of "ISO-1996 'Acoustics-Description and Measurement of Environmental Noise', 2000 – 2007

Acoustical Society of America – Member of Noise Control Technical Committee, 1999 – Present

Association of Professional Engineers of Ontario - Committee for the Establishment of Guidelines for Professional Engineers Providing Acoustical Services in Land Use Planning, 1997



EXISTING FEATURES NOTES

GENERAL SITE PLAN INFORMATION

1. THIS SITE PLAN CONSISTS OF 5 DRAWINGS AND MUST BE READ COLLECTIVELY.
2. ALL MEASUREMENTS SHOWN ON THIS SITE PLAN ARE IN METRES.

LICENCE INFORMATION

3. THIS SITE PLAN IS PREPARED FOR SUBMISSION TO THE MINISTRY OF NATURAL RESOURCES AND FORESTRY UNDER THE AGGREGATE RESOURCES ACT FOR A CATEGORY 1 - CLASS 'A' LICENCE, PIT BELOW THE WATER TABLE.
4. APPLICANT:
   THAMES VALLEY AGGREGATES
   174751 17TH LINE
   INGERSOLL, ON
   N5C 3J6
5. TOTAL AREA TO BE LICENCED: 21.0 ha
   TOTAL AREA TO BE EXTRACTED: 16.30 ha
   TOTAL AREA TO REHABILITATED: 16.30 ha

BASE INFORMATION

6. TOPOGRAPHIC INFORMATION WAS OBTAINED FROM FIRST BASE SOLUTIONS UTILIZING 2015 AIR PHOTOGRAPHY. ALL ELEVATIONS ARE GEODETIC AND ABOVE SEA LEVEL (ASL).

   THE SITE WAS FIELD CHECKED BY HARRINGTON MCAVAN LTD., APRIL 18, 2016.
7. THE PROPOSED LICENCE AREA IS ZONED A, GENERAL AGRICULTURE. AN APPLICATION FOR AN AMENDMENT TO THE ZONING BYLAW TO CHANGE THE DESIGNATION TO ME, AGGREGATE INDUSTRIAL HAS BEEN MADE TO THE MUNICIPALITY OF THAMES CENTRE. THE OFFICIAL PLAN DESIGNATES THE MAJORITY OF THIS SITE AS PRIMARY AGGREGATE RESOURCE.

HYDROGEOLOGICAL INFORMATION

8. HYDROGEOLOGICAL INFORMATION INCLUDING GROUNDWATER ELEVATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS. DATED NOVEMBER 12, 2020.
9. THE WATER TABLE ELEVATION WITHIN THESE PROPERTIES IS ESTIMATED TO BE BETWEEN ± 276.5 - 271.5m ABOVE SEA LEVEL (A.S.L.) BASED ON ABOVE REPORT.

TECHNICAL REPORTS

10. HYDROGEOLOGICAL INFORMATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS DATED NOVEMBER 12, 2020 (REFER TO SHEET 3 OF 5 FOR TECHNICAL RECOMMENDATIONS).
11. NATURAL ENVIRONMENT INFORMATION WAS OBTAINED FROM REPORT BY TERRASTORY DATED NOVEMBER 2020 (REFER TO SHEET 4 OF 5 FOR TECHNICAL RECOMMENDATIONS).
12. ARCHAEOLOGICAL INFORMATION WAS OBTAINED FROM REPORT BY TIMMINS MARTELLE HERITAGE CONSULTANTS INC. DATED JUNE 2016 (REFER TO SHEET 3 OF 5 FOR TECHNICAL RECOMMENDATIONS).
13. ACOUSTICAL INFORMATION WAS OBTAINED FROM NOISE REPORT BY HGC ENGINEERING DATED DECEMBER 9, 2020 (REFER TO SHEET 4 OF 5 FOR TECHNICAL RECOMMENDATIONS).

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENCED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- 285 EXISTING 5m CONTOUR LINE
- 284 EXISTING 1m CONTOUR LINE
- +283.95 EXISTING SPOT ELEVATION
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- 1 EXISTING BUILDING AND NUMBER
- HP EXISTING HYDRO POLE
- DIRECTION OF SURFACE WATER DRAINAGE
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019
- B' LOCATION OF SECTION
- EX FARM ACCESS (NO GATES)

BUILDING LIST

No.	
1.	TRAILER
2.	SCALE AND SCALEHOUSE
3.	SHED
4.	BARN
5.	HOUSE
6.	SHED
7.	BARN

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Project Name

Thames Valley Aggregates Inc.

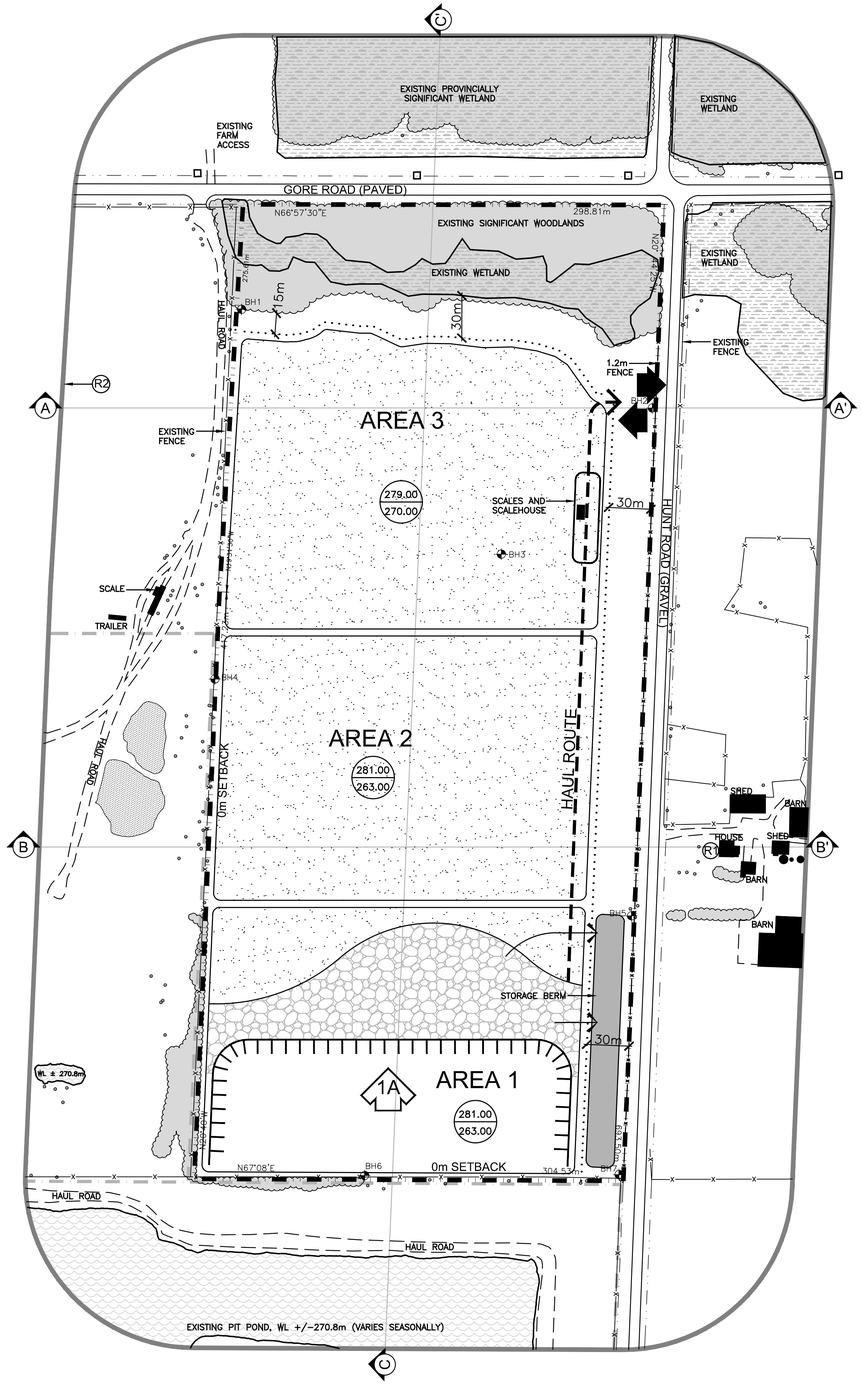
PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH/RM	Issue Date DEC 2020
Drawing Title: EXISTING FEATURES		Project Number 20-23
		Drawing Number 1 OF 5

FILE NAME: 20-23/COMP/2023-1.DWG
PLOT DATE: DECEMBER 23, 2020

PHASE A



PHASE A

PHASE A NOTES

1. **ESTABLISH THE ENTRANCE EXIT AND HAUL ROAD INTO THE SITE, ACCORDING TO THE APPROPRIATE MUNICIPAL STANDARDS.**
2. **PRIOR TO ANY ON SITE OPERATIONS, CONSTRUCT OR UPGRADE THE FENCING ON THE LICENCED BOUNDARIES (EXCEPT WHERE OVERRIDES EXIST) TO THE STANDARDS OF THE AGGREGATE RESOURCES ACT (1.2m HIGH POST AND WIRE FENCE). ALL FENCING SHALL BE MAINTAINED.**
3. **PREPARE SITE WITHIN AREA 1 BY REMOVING EXISTING TREES AND SCRUB VEGETATION IN THE AREA TO BE EXTRACTED. SALVAGE LARGER STUMPS AND TREES FOR HABITAT CREATION DURING PROGRESSIVE REHABILITATION.**
4. **PRIOR TO ANY ON SITE OPERATIONS, STRIP TOPSOIL AND OVERBURDEN SEPARATELY USE THE MATERIALS TO CONSTRUCT STORAGE BERM ALONG HUNT ROAD.**
5. **CONSTRUCT THE HAUL ROAD THROUGH AREA 1, 2 AND 3.**
6. **EXTRACTION OF AREA 1 WILL PROCEED IN DIRECTION SHOWN.**
7. **UNDISTURBED PORTIONS OF AREAS 2 AND 3 REMAIN IN AGRICULTURAL USE.**

OPERATIONS NOTES

GENERAL INFORMATION

1. THIS PLAN DEPICTS A SCHEMATIC OPERATIONS AND REHABILITATION SEQUENCE FOR THIS PROPERTY BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION. PHASES SHOWN ARE SCHEMATIC AND MAY SLIGHTLY VARY WITH MATERIAL QUALITY, SITE HYDROLOGY AND HYDROGEOLOGY OR MARKET DEMAND. PHASES DO NOT REPRESENT ANY SPECIFIC OR EQUAL TIME PERIOD.

   EXTRACTION SHALL GENERALLY FOLLOW THE SEQUENCE SHOWN. WHEN PARTIAL REHABILITATION OF A PHASE IS POSSIBLE IT SHALL BE CARRIED OUT. NOT WITHSTANDING THE EXTRACTION AND REHABILITATION PROCESS ABOVE, DEMAND FOR CERTAIN PRODUCTS OR BLENDING OF MATERIALS MAY REQUIRE SOME DEVIATION IN THE EXTRACTION AND REHABILITATION PHASING. ANY MAJOR DEVIATIONS FROM THE OPERATIONS SEQUENCE SHOWN WILL REQUIRE APPROVAL FROM MNRF.

2. REFER TO DRAWING 1 OF 5, EXISTING FEATURES, FOR A DESCRIPTION OF EXISTING VEGETATION AND BUILDINGS WITHIN THE 120 METRE BOUNDARY AND ON SITE.

3. SITE PLAN OVERRIDES ARE LISTED IN THE SITE PLAN OVERRIDE TABLE SHOWN ON THIS PAGE.

EXTRACTION/PROCESSING/HAULING INFORMATION

4. TOTAL AREA TO BE EXTRACTED IS 16.3 HECTARES.

5. MAXIMUM NUMBER OF TONNES OF AGGREGATE TO BE REMOVED FROM THE SITE IN ANY CALENDAR YEAR IS 500,000 TONNES.

   EXTRACTION OF SAND AND GRAVEL ABOVE WATER TABLE WILL TAKE PLACE IN TWO OR THREE BENCHES, WITH A MAXIMUM HEIGHT OF ±8 METRES. THE GROUNDWATER TABLE IS ESTIMATED TO BE BETWEEN ±276.5 - 271.5m ASL (SEE REPORT BY LDS DATED NOVEMBER 12, 2020) THERE WILL BE ONE LIFT BELOW THE WATER TABLE TO A MAXIMUM DEPTH OF ±263m ASL TO BE EXTRACTED BY EXCAVATOR, BACKHOE OR DRAG LINE. FRONT END LOADERS WILL BE USED TO EXTRACT MATERIAL AND HAUL TRUCKS OR CONVEYORS WILL CARRY MATERIAL TO THE PLANT FOR FURTHER PROCESSING. REFER TO SECTIONS A-A', B-B', AND C-C' ON DRAWING 4 OF 5 FOR FURTHER DETAILS.

   PORTABLE PROCESSING EQUIPMENT, FOR CRUSHING AND SCREENING WILL BE USED ON SITE AND WILL BE LOCATED ON THE PIT FLOOR AND WILL FOLLOW THE EXTRACTION FACE. STOCKPILES OF PROCESSED AGGREGATE WILL BE PLACED BETWEEN R1 AND THE PROCESSING PLANT AS A NOISE BUFFER. IN ADDITION TO PROCESSING, SITE ACTIVITIES WILL INCLUDE STRIPPING AND REHABILITATION, OPERATIONAL EQUIPMENT MAY INCLUDE TRUCKS, LOADERS, EXCAVATOR, BACKHOES, BULLDOZERS, SCRAPERS, CONVEYORS AND OTHER RELATED EQUIPMENT. PROCESSING EQUIPMENT, STACKERS AND PRODUCT STOCKPILES WILL NOT EXCEED ±15 METRES IN HEIGHT AND WILL BE LOCATED IN THE PROCESSING AREA AND/OR CLOSE TO PIT FACES. MATERIAL FROM OTHER PROPERTIES MAY BE IMPORTED INTO THE SITE FOR BLENDING, CUSTOM PRODUCTS AND/OR RESALE.

6. OFFICE/STORAGE BUILDING AND/OR SCALE/SCALEHOUSE MAY BE CONSTRUCTED WHERE SHOWN.

AGGREGATE RECYCLING

7. THERE MAY BE RECYCLING OF MATERIAL (ASPHALT AND CONCRETE) ON THIS SITE. MATERIAL IMPORTED FOR RECYCLING WILL BE STORED IN SEGREGATED STOCKPILES WITHIN THE PROCESSING AREA. RECYCLABLE ASPHALT MATERIALS WILL NOT BE STOCKPILED WITHIN 30m OF ANY WATER BODY OR MAN-MADE POND; OR 2m OF THE SURFACE OF THE ESTABLISHED WATER TABLE. ANY REBAR AND OTHER STRUCTURAL METAL MUST BE REMOVED FROM THE RECYCLED MATERIAL DURING PROCESSING AND PLACED IN A DESIGNATED SCRAP PILE ON SITE WHICH WILL BE REMOVED ON AN ON-GOING BASIS. REMOVAL OF RECYCLED AGGREGATE IS TO BE ONGOING. ONCE THE AGGREGATE ON SITE HAS BEEN DEPLETED THERE WILL BE NO FURTHER IMPORTATION OF RECYCLABLE MATERIALS PERMITTED. ONCE FINAL REHABILITATION HAS BEEN COMPLETED AND APPROVED IN ACCORDANCE WITH THE SITE PLAN, ALL RECYCLING OPERATIONS MUST CEASE.

8. EQUIPMENT, SCRAP AND MACHINERY ASSOCIATED WITH THE EXTRACTION OPERATIONS WILL BE REMOVED UPON COMPLETION OF EXTRACTION.

HYDROGEOLOGICAL INFORMATION

9. THE WATER TABLE ELEVATION VARIES ACROSS THIS LICENCE FROM APPROXIMATELY ±276.5 - ± 271.5m ABOVE SEA LEVEL (A.S.L.), BASED ON THE HYDROGEOLOGICAL REPORT. REFER TO SECTIONS ON SHEET 4 OF 5.

10. SURFACE DRAINAGE WILL BE DIRECTED TO THE POND, AND/ OR LOW AREAS FOR WATER TO INFILTRATE INTO THE GRANULAR MATERIALS ON THE PIT FLOOR.

NOISE MITIGATION INFORMATION

11. HOURS OF OPERATION:

SITE PREPARATION AND REHABILITATION:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
EXCAVATION AND PROCESSING	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS
SHIPPING:	07:00-19:00 WEEKDAYS; 07:00 - NOON SATURDAYS

AIR QUALITY INFORMATION

12. WATER OR CALCIUM CHLORIDE WILL BE APPLIED TO INTERNAL HAUL ROADS AND PROCESSING AREAS AS OFTEN AS REQUIRED TO MITIGATE DUST.

SITE MANAGEMENT INFORMATION

MAINTENANCE/ PROTECTION OF VEGETATION INFORMATION

13. EXISTING VEGETATION WITHIN THE LICENCED AREA SHALL BE MAINTAINED IN A HEALTHY VIGOROUS GROWING CONDITION UNTIL SEQUENTIAL STRIPPING BEGINS OR UNTIL THE REHABILITATION IS COMPLETE. ANY VEGETATION PLANTED AS PART OF SITE IMPROVEMENTS OR PROGRESSIVE AND FINAL REHABILITATION WILL ALSO BE MAINTAINED IN A HEALTHY, VIGOROUS GROWING CONDITION.

FENCING INFORMATION

14. BOUNDARIES OF THE AREA TO BE LICENCED THAT ARE PRESENTLY FENCED ARE SHOWN ON DRAWING 1 OF 5 EXISTING FEATURES. PRIOR TO ANY STRIPPING OR PREPARATION, FENCING ON THE LICENCED BOUNDARIES (EXCEPT WHERE OVERRIDES ARE EXIST) WILL BE UPGRADED TO 1.2m HIGH POST AND WIRE TO COMPLY WITH THE AGGREGATE RESOURCES ACT WHERE REQUIRED. ALL FENCING SHALL BE MAINTAINED.

TOPSOIL/SUBSOIL/OVERBURDEN STORAGE INFORMATION

15. TOPSOIL AND OVERBURDEN SHALL BE STRIPPED AND STORED SEPARATELY IN BERMS WHERE SHOWN AND STOCKPILES ON PIT FLOOR CLOSE TO EXTRACTION FACE.

BERM INFORMATION

16. BERMS SHALL BE A MINIMUM OF ±2.5 METRES ABOVE THE EXISTING GRADE, OR AS SPECIFIED IN THE NOISE ASSESSMENT REPORT DATED DECEMBER 9, 2020 AND SHOWN ON OPS PLAN. BERMS SHALL NOT EXCEED 2:1. REFER TO TYPICAL BERM CROSS SECTION ON DRAWING 4 OF 5 DETAILS AND SECTIONS. ALL BERMS SHALL BE SEEDED (USING GRASS/ LEGUME MIXTURE, SEE REHABILITATION PLAN) IMMEDIATELY UPON COMPLETION TO MINIMIZE NOISE, DUST AND EROSION.

17. ON COMPLETION OF THE BERMS, EXCESS ON-SITE OVERBURDEN WILL BE USED TO PROGRESSIVELY BACKFILL AND REHABILITATE THE SITE. TOPSOIL CAN BE TEMPORARILY STOCKPILED ON THE PIT FLOOR.

SCRAP STORAGE INFORMATION

18. ALL SCRAP, USED MACHINERY AND STUMPS GENERATED THROUGH THE OPERATIONS WITHIN THIS LICENCE WILL BE STORED IN THE PROCESSING AREA, A MINIMUM OF 30m FROM THE BOUNDARY OF THE SITE AND NOT WITHIN 30m OF ANY BODY OF WATER AND SHALL BE DISPOSED OF ON AN ONGOING BASIS. STUMPS/ WOODY MATERIAL MAY BE CHIPPED AND USED FOR SOIL ENHANCEMENT DURING PROGRESSIVE REHABILITATION. TREES WILL BE HARVESTED AND SOLD AS LUMBER OR UTILIZED FOR FIREWOOD AND/ OR THEIR BEST USE, UPON COMPLETION OF EXTRACTION, ALL SCRAP EQUIPMENT AND USED MACHINERY SHALL BE REMOVED.

PETROLEUM STORAGE INFORMATION

19. FUEL, OIL, RADIATOR AND HYDRAULIC FLUID, AND OTHER CHEMICALS NEEDED FOR THE MAINTENANCE AND FUNCTIONING OF ON-SITE AGGREGATE PROCESSING EQUIPMENT SHALL BE APPROPRIATELY STORED IN ABOVE-GROUND CONTAINERS AND SHALL MEET THE REQUIREMENTS OF THE GASOLINE HANDLING ACT, AS AMENDED, AND THE GASOLINE HANDLING CODE AND REGULATIONS, AS AMENDED BY THE TECHNICAL STANDARDS AND SAFETY ACT (TSSA) AND LIQUID FUELS HANDLING CODE, AND IN ACCORDANCE WITH THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARK'S CHEMICAL STORAGE GUIDELINES. ALL REFUELING SHALL BE WITHIN A CONTAINMENT PAD. ALL SPILLS TO THE ENVIRONMENT MUST BE REPORTED TO THE SPILLS ACTION CENTRE OF MECP. ANY SPILL SHALL BE REMOVED AND DISPOSED OF AT AN APPROPRIATE MECP APPROVED FACILITY.

IMPORTATION OF FILL INFORMATION

20. IN ORDER TO MAXIMIZE RESOURCE RECOVERY, IMPORTATION OF CLEAN INERT FILL (EG. TOPSOIL AND/OR OVERBURDEN) MAY BE IMPORTED TO FACILITATE 3:1 SIDESLOPE REHABILITATION (ABOVE WATER TABLE SIDESLOPES). ONLY NATIVE ON SITE OVERBURDEN AND/OR OFF-SPEC MATERIALS WILL BE USED FOR BELOW WATER REHABILITATION. ONLY SUFFICIENT MATERIAL TO CREATE FINAL GRADES AS SHOWN MAY BE IMPORTED.

   IMPORTED MATERIAL SHALL MEET THE MINISTRY OF THE ENVIRONMENT, CONSERVATION, AND PARK'S PARAMETERS UNDER TABLE "1" OF MECP'S "SOIL, GROUND WATER AND SEDIMENT STANDARDS FOR USE UNDER PART XV.1 OF THE ENVIRONMENTAL PROTECTION ACT".

   SAMPLING AND TESTING OF ALL IMPORTED MATERIAL SHALL BE PERFORMED AT SOURCE PRIOR TO THE IMPORTATION OF MATERIAL ONTO THE LICENSED SITE BY A QUALIFIED PERSON (QP) UNDER EPA. A QP SHALL ALSO DESIGN FILL MONITORING PROGRAM. RANDOM SAMPLING OF ALL IMPORTED MATERIAL SHALL BE CONDUCTED AT THE REQUEST OF MNRF.

   THE LICENSEE SHALL KEEP DETAILED RECORDS OF THE AMOUNT OF MATERIAL BROUGHT ON SITE FOR REHABILITATION AND THE TESTING RESULTS OF ALL SAMPLES. ALL RECORDS AND TESTING RESULTS SHALL BE AVAILABLE UPON REQUEST BY MNRF OR MECP.

WASH PLANT INFORMATION

21. SHOULD A WASH PLANT BE REQUIRED WITH A PREDICTED WATER USAGE OF 50,000L/DAY OR MORE, THE PRODUCER SHALL OBTAIN PERMIT TO TAKE WATER FROM MECP AND HAVE IT READY FOR INSPECTION. THE PERMIT TO TAKE WATER (PTTW) WILL BE ACCOMPANIED BY THE APPROPRIATE SUPPORTING DOCUMENTATION.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXTRACTION FACE
- BERM (MIN. HEIGHT AS SHOWN)
- UNDISTURBED AREA
- AREA STRIPPED OF TOPSOIL AND OVERBURDEN
- PROPOSED OPEN WATER
- EXISTING BUILDING
- HP EXISTING HYDRO POLE
- B' LOCATION OF SECTION
- ENTRANCE/ EXIT
- DIRECTION OF EXTRACTION
- DIRECTION OF TOPSOIL AND OVERBURDEN MOVEMENT
- PRODUCT TRANSPORTATION VIA HAUL ROAD
- R3 LOCATION OF NOISE RECEPTOR
- 296.00 / 286.00 EXISTING ELEVATION / PROPOSED ELEVATION
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019

SITE PLAN OVERRIDE (VARIANCE)

THE FOLLOWING CONDITIONS ILLUSTRATED ON THESE PLANS VARY FROM THE OF THE PROVINCIAL STANDARDS MADE UNDER THE AGGREGATE RESOURCES ACT

ITEM	SECTION
1. SETBACK IS REDUCED TO 0m ALONG SOUTH AND WEST BOUNDARIES. ADJACENT LANDS LICENSED FOR AGGREGATE EXTRACTION. AS PER AGREEMENT WITH ADJACENT LICENSEE/ LANDOWNER.	5.10.1
2. NO FENCE ON NORTH BOUNDARY. ACCESS IS RESTRICTED DUE TO NATURAL FEATURES.	5.1

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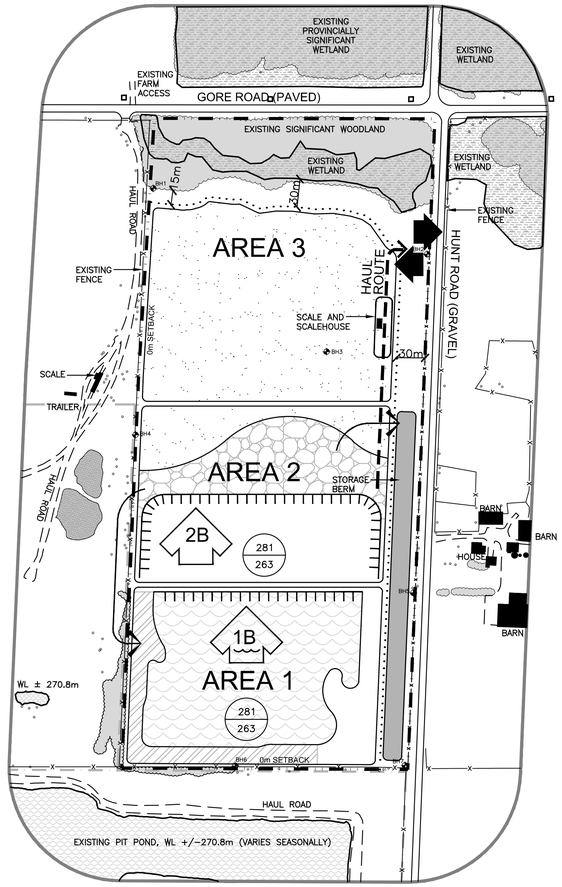
PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:2000 (0 10 50 80m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: OPERATION PLANS PHASE A		Project Number 20-23
		Drawing Number 2 OF 5

FILE NAME: 20-23/COMP/2023-2.DWG
PLOT DATE: DECEMBER 23, 2020

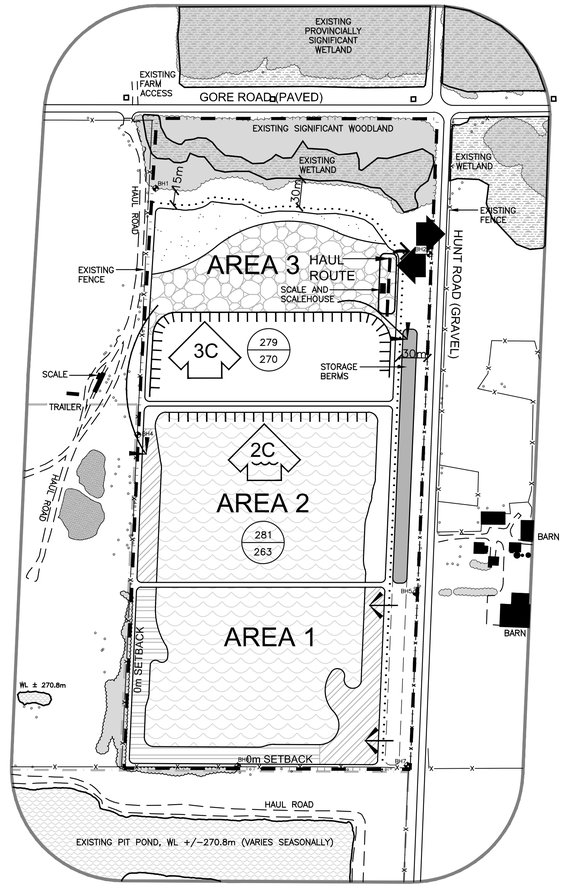
PHASE B



PHASE B

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 3 AND USE THE MATERIAL TO EXTEND THE STORAGE BERM ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE SOUTHERN AND WESTERN PARTS OF AREA 1.
2. BEGIN ABOVE WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
3. BEGIN BELOW WATER EXTRACTION OF AREA 1 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
4. UNDISTURBED PORTION OF AREA 2 & 3 TO REMAIN IN AGRICULTURAL USE.
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

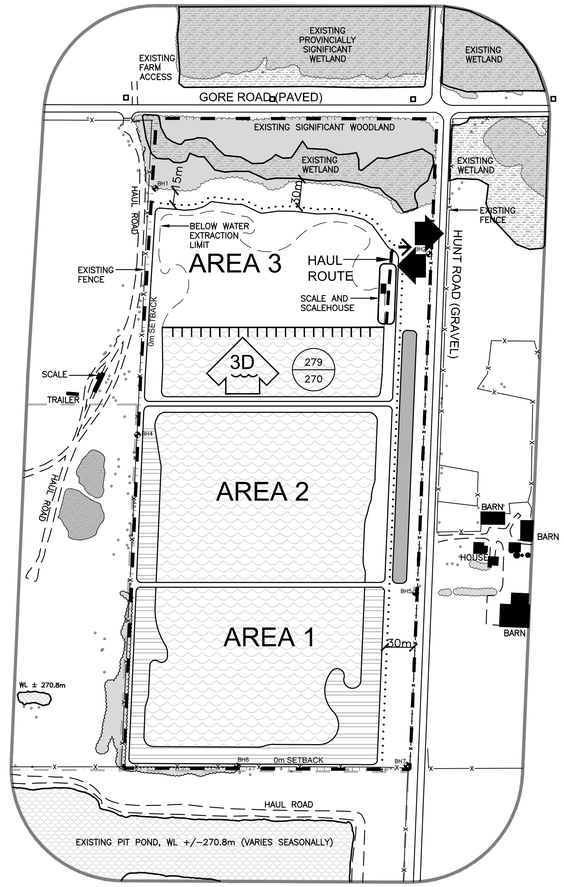
PHASE C



PHASE C

1. STRIP TOPSOIL AND OVERBURDEN SEPARATELY FROM AREA 3 AND USE THE MATERIAL TO EXTEND STORAGE BERM (ASS REQUIRED) ALONG HUNT ROAD, AND TO BEGIN PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA 2.
2. COMPLETE PROGRESSIVE REHABILITATION OF SOUTHERN AND WESTERN PARTS OF AREA1, THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/OPEN SPACE AFTER-USE.
3. BEGIN PROGRESSIVE REHABILITATION OF EASTERN PART OF AREA 1 USING TOPSOIL AND OVERBURDEN STOCKPILED IN BERM ALONG AREA 1 OF HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA /OPEN SPACE AFTER-USE.
4. BEGIN ABOVE WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. BEGIN BELOW WATER EXTRACTION OF AREA 2 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
6. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE D



PHASE D

1. COMPLETE PROGRESSIVE REHABILITATION OF AREA 1. THE AREA RETURNS TO POND/ WETLAND AND/ OR NATURAL AREA/ OPEN SPACE AFTER-USE.
2. COMPLETE PROGRESSIVE REHABILITATION OF THE WESTERN PART OF AREA 2, THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE AFTER-USE.
3. COMPLETE BELOW WATER EXTRACTION IN AREA 2.
4. BEGIN BELOW WATER EXTRACTION OF AREA 3 IN DIRECTION SHOWN. MATERIAL EXTRACTED FROM BELOW WATER WILL BE PLACED IN WINDROWS ON THE PIT FLOOR TO DRAIN BEFORE BEING TRANSPORTED FOR PROCESSING. SHIP MATERIAL TO TEMPORARY PLANT SITE (NOT SHOWN, PORTABLE PROCESSING EQUIPMENT TO BE USED).
5. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

PHASE E (NOT SHOWN)

1. BEGIN PROGRESSIVE REHABILITATION OF EAST SIDE OF AREA 2 AND AREA 3 USING TOPSOIL AND OVERBURDEN STOCKPILED IN THE BERM ALONG AREA 3 OF HUNT ROAD. THE AREA RETURNS TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
2. REMOVE ALL EQUIPMENT, STRUCTURES, STOCKPILES AND SCRAP FROM THE SITE AND REHABILITATE ALL HAUL ROADS USING TOPSOIL AND OVERBURDEN STOCKPILED IN REMAINING BERMS.
3. COMPLETE PROGRESSIVE REHABILITATION IN AREA 3 USING MATERIAL REMAINING IN BERMS. AREA 1 & 2 RETURN TO POND/ WETLAND AND NATURAL AREA/ OPEN SPACE/ REFORESTATION AFTER-USE.
4. MAINTAIN ALL VEGETATION IN A HEALTHY, VIGOROUS CONDITION.

TECHNICAL RECOMMENDATIONS

THE FOLLOWING ARE THE TECHNICAL RECOMMENDATIONS FROM ALL OF THE EXPERTS' REPORTS AS OF FEBRUARY 2019. ADDITIONAL RECOMMENDATIONS MAY BE INCLUDED AS A RESULT OF THE LICENCE REVIEW PROCESS.

ARCHAEOLOGICAL ASSESSMENT - TIMMINS MARTELLE HERITAGE CONSULTANTS INC. DATED JUNE 2016

1. SHOULD PREVIOUSLY UNDOCUMENTED (I.E., UNKNOWN OR DEEPLY BURIED) ARCHAEOLOGICAL RESOURCES BE DISCOVERED, THEY MAY BE A NEW ARCHAEOLOGICAL SITE AND THEREFORE SUBJECT TO SECTION 48(1) OF THE ONTARIO HERITAGE ACT. THE PROPONENT OR PERSONA DISCOVERING THE ARCHAEOLOGICAL RESOURCES MUST CEASE ALTERATION OF THE SITE IMMEDIATELY AND ENGAGE A LICENSED CONSULTANT ARCHAEOLOGIST TO CARRY OUT ARCHAEOLOGICAL FIELDWORK, IN COMPLIANCE WITH SECTION 48 (1) OF THE ONTARIO HERITAGE ACT. FURTHER ARCHAEOLOGICAL SITES RECOMMENDED FOR FURTHER ARCHAEOLOGICAL FIELDWORK OR PROTECTION REMAIN SUBJECT TO SECTION 48 (1) OF THE ONTARIO HERITAGE ACT AND SHALL NOT BE ALTERED, OR HAVE ARTIFACTS REMOVED FROM THEM, EXCEPT BY A PERSON HOLDING AN ARCHAEOLOGICAL LICENCE.
2. THE FUNERAL, BURIAL, AND CREMATION SERVICES ACT 2002, S.O. 2002, C. 33 REQUIRES THAT ANY PERSON DISCOVERING HUMAN REMAINS MUST NOTIFY THE POLICE OR CORONER AND THE REGISTRAR OF CEMETERIES AT THE MINISTRY OF SMALL BUSINESS AND CONSUMER SERVICES. THE REGISTRAR OF CEMETERIES, CEMETERIES REGULATION UNIT CAN BE REACHED AT (416)326-8404 OR (416)326-8393.

HYDROGEOLOGICAL ASSESSMENT - LDS DATED NOVEMBER 12, 2020

1. FUEL STORAGE, EQUIPMENT FILLING, AND EQUIPMENT MAINTENANCE SHALL BE CARRIED OUT IN ACCORDANCE WITH BEST MANAGEMENT PRACTICES OUTLINED IN SECTION 6.1, INCLUDING DESIGNATED FUELING LOCATIONS AND IMPLEMENTATION OF SPILLS MANAGEMENT RESPONSE PLANS, AS APPROPRIATE TO REDUCE THE POTENTIAL AND MITIGATE RISKS ASSOCIATED WITH THE EQUIPMENT OPERATION.
2. WATER LEVELS HAVE BEEN CARRIED OUT ON A MONTHLY BASIS SINCE THE INCEPTION OF THE MONITORING WELLS WHICH WERE INSTALLED ONSITE. GROUNDWATER LEVEL MONITORING SHALL CONTINUE AT THE SITE ON A QUARTERLY BASIS AFTER THE PIT IS LICENSED, AND CONTINUE UNTIL SITE RESTORATION IS COMPLETE.
3. GROUNDWATER SAMPLES HAVE BEEN COLLECTED AT THE SITE TO ESTABLISH BASELINE WATER QUALITY CONDITIONS FOR SHALLOW GROUNDWATER WITHIN THE UNCONFINED AQUIFER WHICH IS EXPECTED TO BE ENCOUNTERED DURING THE AGGREGATE EXTRACTION OPERATION. FUTURE WATER QUALITY TESTING CAN BE COMPARED TO THE BACKGROUND INFORMATION PRESENTED IN THIS REPORT, IF REQUIRED.
4. IF COMPLAINTS ARE RECEIVED FROM NEARBY OR NEIGHBOURING PROPERTY OWNERS (WITHIN 120 M OF THE SITE), THE WATER SUPPLY INTERFERENCE PROTOCOLS OUTLINED AS FOLLOWS SHALL BE ADHERED TO.

THE FOLLOWING WATER WELL INTERFERENCE COMPLAINT PROTOCOL IS RECOMMENDED TO ADDRESS WATER SUPPLY INTERFERENCE TO DOMESTIC AND FARM WATER SUPPLIES FOR PROPERTIES LOCATED IN PROXIMITY (WITHIN 150 M) TO THE SITE.

1. NEARBY AND NEIGHBOURING PROPERTIES SHALL BE PROVIDED WITH 24-HOUR EMERGENCY CONTACT INFORMATION FOR THE LICENSEE, TO FACILITATE REPORTING OF PERCEIVED WATER SUPPLY IMPACTS.
2. NEARBY AND NEIGHBOURING PROPERTIES WHICH EXPERIENCE DISRUPTION OR QUALITY PROBLEMS SHALL NOTIFY THE LICENSEE, WHO WILL BE RESPONSIBLE TO REPORT THE WELL INTERFERENCE COMPLAINT TO MNRF AND MECP.
3. IN THE EVENT THAT THE WELL OWNER EXPERIENCES A SIGNIFICANT DISRUPTION IN THEIR WATER SUPPLY, OR EXPERIENCE SIGNIFICANT ADVERSE EFFECTS UPON THEIR WATER QUALITY; AND IF THE OPERATION OF THE PIT CANNOT OBVIOUSLY AND DEFINITIVELY BE EXCLUDED AS THE CAUSE, THE LICENSEE SHALL PROVIDE A TEMPORARY WATER SUPPLY WITHIN 24 HOURS AND THEREAFTER UNTIL SUCH TIME AS THE CAUSE OF THE DISTURBANCE CAN BE DETERMINED AND THE SITUATION ADDRESSED.
4. THE LICENSEE SHALL INVESTIGATE THE CAUSE OF THE WATER SUPPLY DISTURBANCE AND SHALL REPORT TO THE MNRF, MECP AND THE WELL OWNER.
5. IF IT IS DETERMINED THAT THE AGGREGATE EXTRACTION AT THE PIT HAS BEEN FOUND TO HAVE CAUSED A DOMESTIC OR FARM WATER SUPPLY TO BE ADVERSELY AFFECTED, THE LICENSEE SHALL, AT THE LICENSEES EXPENSE, EITHER RESTORE OR REPLACE THE WATER SUPPLY TO ENSURE THAT HISTORIC WATER SUPPLY AND QUALITY ARE RESTORED FOR SUCH A RESIDENT. IF IT IS DETERMINED THAT THE OPERATION OF THE PIT HAS NOT CAUSED ANY DOMESTIC OR FARM WATER SUPPLY TO BE ADVERSELY AFFECTED, THE TEMPORARY WATER SUPPLY WILL BE MAINTAINED FOR AN ADDITIONAL 24 HOURS TO ALLOW THE RESIDENT TO MAKE ALTERNATE WATER SUPPLY ARRANGEMENTS.

TECHNICAL RECOMMENDATIONS
CONTINUED ON PAGE 4 OF 5

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- EXTRACTION FACE
- BERM (MIN. HEIGHT AS SHOWN)
- UNDISTURBED AREA
- AREA STRIPPED OF TOPSOIL AND OVERBURDEN
- ONGOING/ PROGRESSIVE REHABILITATION
- ONGOING REHABILITATION
- COMPLETED REHABILITATION
- BELOW WATER EXTRACITON
- EXISTING BUILDING
- HP EXISTING HYDRO POLE
- ENTRANCE/ EXIT
- DIRECTION OF ABOVE WATER EXTRACTION
- DIRECTION OF BELOW WATER EXTRACTION
- DIRECTION OF TOPSOIL AND OVERBURDEN MOVEMENT
- PRODUCT TRANSPORTATION VIA HAUL ROAD
- R3 LOCATION OF NOISE RECEPTOR
- 296.00 / 286.00 EXISTING ELEVATION / PROPOSED ELEVATION
- BH1 BOREHOLE LOCATION AND NUMBER DRILLED AND MONITORING WELL INSTALLED BY LDS JUNE 10-22, 2019

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Project Name

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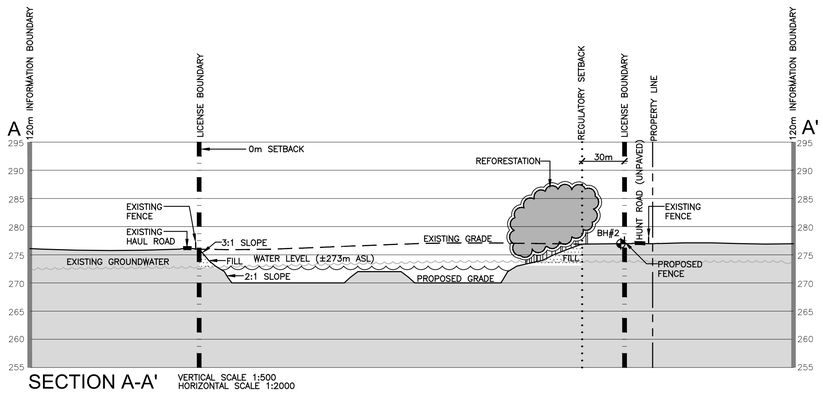
PIKE PIT

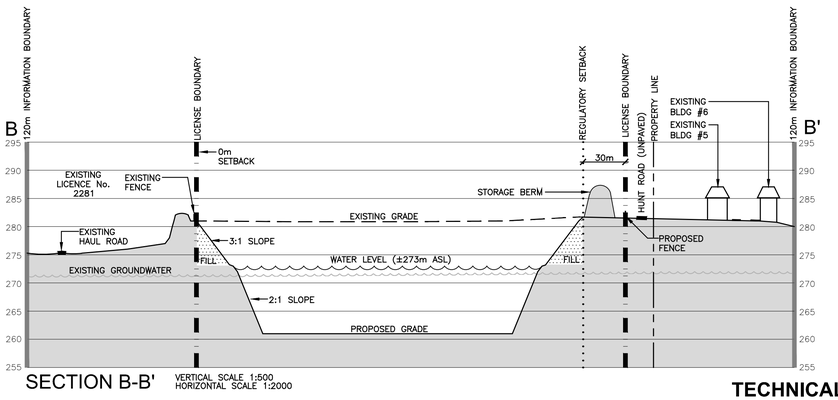
LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale 1:3000 (0 10 50 90 120m)	North	Stamp
Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH/RM	Issue Date DEC 2020
Drawing Title: OPERATION PLANS PHASE B TO E		Project Number 20-23
		Drawing Number 3 OF 5

FILE NAME: 20-23/COMP/2023-3.DWG
PLOT DATE: DECEMBER 23, 2020

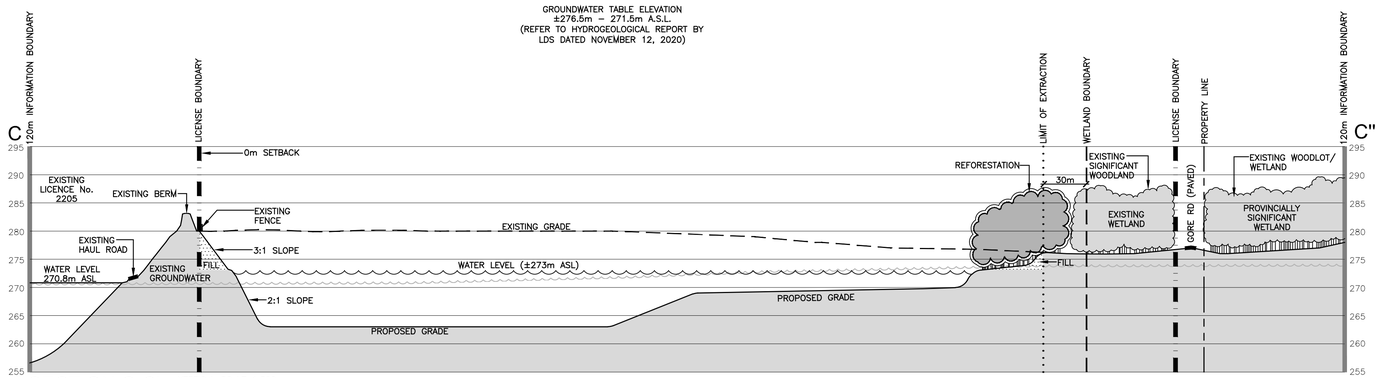


SECTION A-A' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000

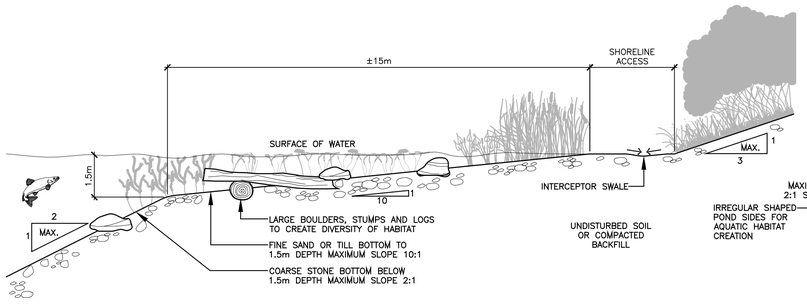


SECTION B-B' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000

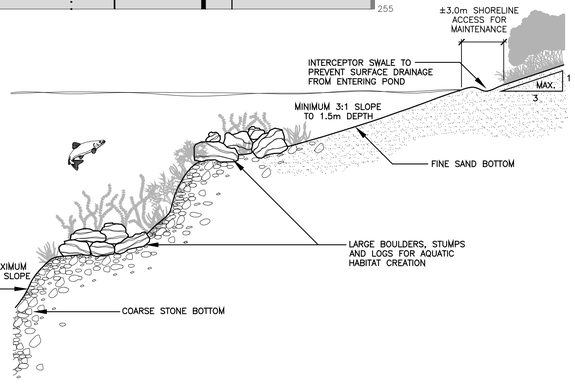
GROUNDWATER TABLE ELEVATION ±276.5m – 271.5m A.S.L. (REFER TO HYDROGEOLOGICAL REPORT BY LDS DATED NOVEMBER 12, 2020)



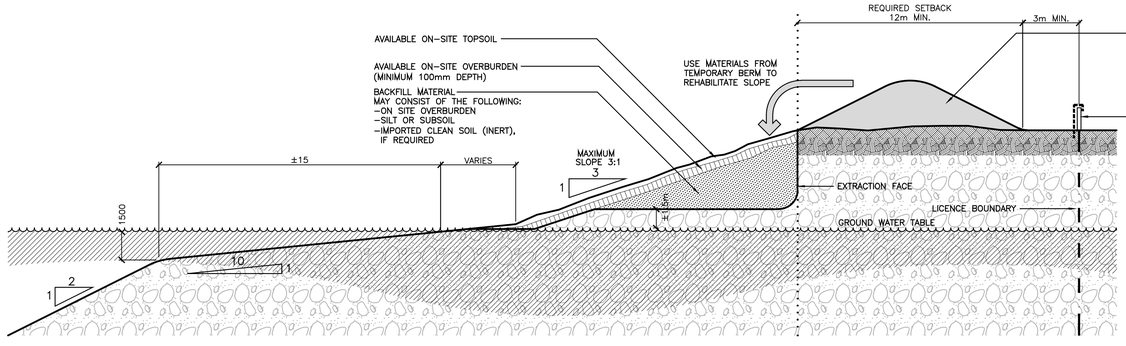
SECTION C-C' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000



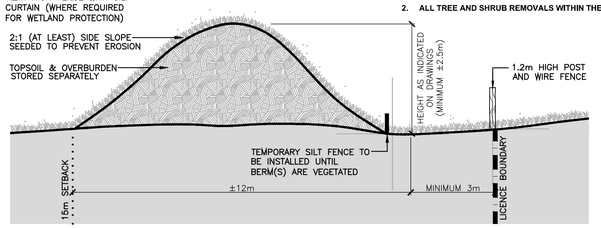
TYPICAL SHORELINE - WETLAND EDGE N.T.S.



TYPICAL SHORELINE - DEEP SECTION N.T.S.



TYPICAL SIDESLOPE REHABILITATION BY BACKFILLING N.T.S.



TYPICAL BERM SECTION N.T.S.

TECHNICAL RECOMMENDATIONS

THE FOLLOWING ARE THE TECHNICAL RECOMMENDATIONS FROM ALL OF THE EXPERTS' REPORTS AS OF FEBRUARY 2019. ADDITIONAL RECOMMENDATIONS MAY BE INCLUDED AS A RESULT OF THE LICENCE REVIEW PROCESS.

ACOUSTIC ASSESSMENT - HGC ENGINEERING - DATED DECEMBER, 2020

1. **THE FOLLOWING TABLE PRESENTS THE REFERENCE SOUND LEVELS USED FOR THE ACOUSTIC MODELING PRESENTED HEREIN. THESE SOUND LEVELS WERE BASED ON SITE MEASUREMENTS OF SIMILAR PROCESSING EQUIPMENT TO BE USED IN THIS PIT.**

REFERENCE SOUND POWER LEVELS OF PROCESSING EQUIPMENT

EQUIPMENT	SOUND POWER LEVEL dBA re: 10^{-12} W
A CRUSHING AND SCREENING PLANT WITH AN ASSOCIATED LOADER	118
EXCAVATOR	108
TRUCKS	103

IF OTHER EQUIPMENT IS PROPOSED FOR OPERATION IN THE GRAVEL PIT, IT SHALL BE CONFIRMED THROUGH MEASUREMENT TO PRODUCE SOUND LEVELS CONSISTENT WITH THE ABOVE REFERENCED SOUND LEVELS OR ADDITIONAL MITIGATION MEASURES MAY BE REQUIRED.

2. **A MINIMUM 5.0 M HIGH PERIMETER BERM (ABOVE EXISTING GRADE) SHALL BE CONSTRUCTED ALONG THE EASTERN BOUNDARY OF THE PIT PRIOR TO THE COMMENCEMENT OF EXTRACTION OR PROCESSING ACTIVITIES IN AREAS 1 AND 2. ONCE PROCESSING AND EXTRACTION IS COMPLETE IN AREA 1 AND ALL ACTIVITIES ARE MOVED INTO AREA 2, THE BERM ADJACENT TO AREA 1 SHALL NO LONGER BE REQUIRED. PRIOR TO THE COMMENCEMENT OF EXTRACTION OR PROCESSING ACTIVITIES IN AREA 3, THE MINIMUM 5.0 M HIGH PERIMETER BERM (ABOVE EXISTING GRADE) SHALL BE CONSTRUCTED ALONG THE EASTERN BOUNDARY OF THE PIT, ADJACENT TO AREA 3. THE 5.0 M HIGH PERIMETER BERM ALONG AREA 2 SHALL REMAIN AFTER ALL ACTIVITIES ARE MOVED INTO AREA 3.**

3. **A MINIMUM 8.0 M HIGH ACOUSTICAL BARRIER SHALL BE CONSTRUCTED AND MAINTAINED ON THE PIT FLOOR BESIDE THE CRUSHING AND SCREENING PLANT IN THE DIRECTION OF R1.**

4. **THE CRUSHING AND SCREENING PLANT SHALL NOT BE OPERATED WITHIN 350 M OF R1.**

5. **THE OWNER OF R1 ALSO OWNS THE LANDS TO BE LICENSED FOR AGGREGATE EXTRACTION. THEY HAVE SIGNED AN AGREEMENT THAT GRANTS THE PIT OPERATOR RELIEF FROM IMPLEMENTING THE NOISE MITIGATION MEASURES AS RECOMMENDED ABOVE IN ITEMS #2, #3 AND #4 WITH REGARD TO R1. SHOULD THE OWNERSHIP OF R1 CHANGE, A SIMILAR AGREEMENT WILL HAVE TO BE REACHED WITH THE NEW OWNERS OR THE MITIGATION AS RECOMMENDED ABOVE IN ITEMS #2, #3 AND #4 SHALL BE IMPLEMENTED WITH RESPECT TO R1.**

6. **A MINIMUM 8.0 M HIGH ACOUSTICAL BARRIER SHALL BE CONSTRUCTED AND MAINTAINED ON THE PIT FLOOR BESIDE THE CRUSHING AND SCREENING PLANT IN THE DIRECTION OF R2 WHEN OPERATING WITHIN AREAS 2 AND 3.**

7. **THE ACOUSTICAL BARRIER MENTIONED ABOVE CAN BE COMPRISED OF THE PIT FACE, AN EARTH BERM, A NOISE WALL, AGGREGATE STOCKPILES OR ANY OTHER CONSTRUCTION WITH A MINIMUM SURFACE DENSITY OF 20 KG/M^2.**

8. **ACTIVITIES USED TO PREPARE THE SITE FOR EXCAVATION, SUCH AS THE STRIPPING OF TOPSOIL AND CONSTRUCTION OF BERMS, OR ACTIVITIES RELATED TO THE REMEDIATION OF THE SITE AFTER THE EXTRACTION IS COMPLETED ARE CONSIDERED TO BE CONSTRUCTION ACTIVITIES. THEY ARE REGULATED UNDER MUNICIPAL BYLAWS AND NPC-115 "SOUND LEVEL LIMITS FOR MOTORIZED CONSTRUCTION EQUIPMENT".**

NATURAL ENVIRONMENT ASSESSMENT - TERRASTORY - DECEMBER 2020

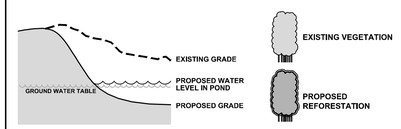
1. **THE NORTHERN WOODLOT ENHANCEMENT AREA IS TO BE REMOVED FROM CULTIVATION AND PLANTED WITH NATIVE SPECIES DURING (OR BEFORE) REMOVAL OF THE SOUTHERN WOODLOT. A NORTHERN WOODLOT ENHANCEMENT PLAN IS TO BE PREPARED WHICH INCLUDES THE FOLLOWING ELEMENTS (MINIMUM):**
   - **COMPOSITION, DENSITY, AND SIZING OF WOODY PLANT MATERIAL. ALL PLANT INSTALLATIONS ARE TO BE NATIVE TO MIDDLESEX COUNTY.**
   - **MEASURES TO TRANSPLANT NATIVE SAPLINGS (E.G., SUGAR MAPLE, BITTERNUT HICKORY, ETC.) FROM THE SOUTHERN WOODLOT TO THE NORTHERN WOODLOT ENHANCEMENT AREA.**
   - **MEASURES TO TRANSPLANT SOILS MATS (CONTAINING NATIVE HERBACEOUS FLORA, MYCORRHIZAL FUNGI, ETC.) FROM THE SOUTHERN WOODLOT TO THE NORTHERN WOODLOT ENHANCEMENT AREA. SOIL MATS WILL NOT BE EXCAVATED FROM AREAS CONTAINING DENSE COVERAGE OF GARLIC MUSTARD OR OTHER NON-NATIVE FLORA. SOME SOIL MATS ARE TO CONTAIN POPULATIONS OF THE REGIONALLY RARE JAMES' SEDGE (CAREX JAMESII) AND OTHER SPRING EPHEMERALS AND UPLAND SEDGES.**
   - **STRUCTURAL ELEMENTS (E.G., COARSE WOODY DEBRIS SUCH AS STUMPS, LOGS, ETC.) WILL BE ADDED TO THE NORTHERN WOODLOT ENHANCEMENT AREA FROM MATERIAL REMOVED FROM THE SOUTHERN WOODLOT.**
   - **A MONITORING PLAN WILL BE PREPARED FOR THE PURPOSES OF DETERMINING THE SUCCESS OF THE PLANTINGS (INCLUDING THE NEW PLANT INSTALLATIONS AND TRANSPLANTED FLORA/SOIL MATS) FOR A PERIOD OF NO LESS THAN THREE (3) GROWING SEASONS.**

2. **ALL TREE AND SHRUB REMOVALS WITHIN THE SOUTHERN WOODLOT WILL BE COMPLETED OUTSIDE THE PRIMARY BIRD NESTING AND BAT ACTIVITY PERIODS (I.E., TO BE COMPLETED BETWEEN OCTOBER 1 AND MARCH 31).**

3. **ANY NECESSARY LIGHTING TO SUPPORT PIT OPERATIONS WILL BE DIRECTED AWAY FROM THE NORTHERN WOODLOT TO THE EXTENT PRACTICAL.**

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- PROPERTY LINE
- WETLAND BOUNDARY



SECTION NOTES

GENERAL INFORMATION

1. **SECTION LINES ARE INDICATED ON DRAWINGS 1, 2 AND 5.**

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Project Name

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PIKE PIT

LICENCE No.
PART LOT 18, CONCESSION 3
MUNICIPALITY OF THAMES CENTRE (FORMERLY TOWNSHIP OF NORTH DORCHESTER, COUNTY OF MIDDLESEX

Scale AS SHOWN	North	Stamp
Drawing Status: PRELIMINARY FOR REVIEW		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: SECTIONS AND DETAILS		Project Number 20-23
		Drawing Number 4 OF 5

FILE NAME:20-23/COMP/2023-4.DWG
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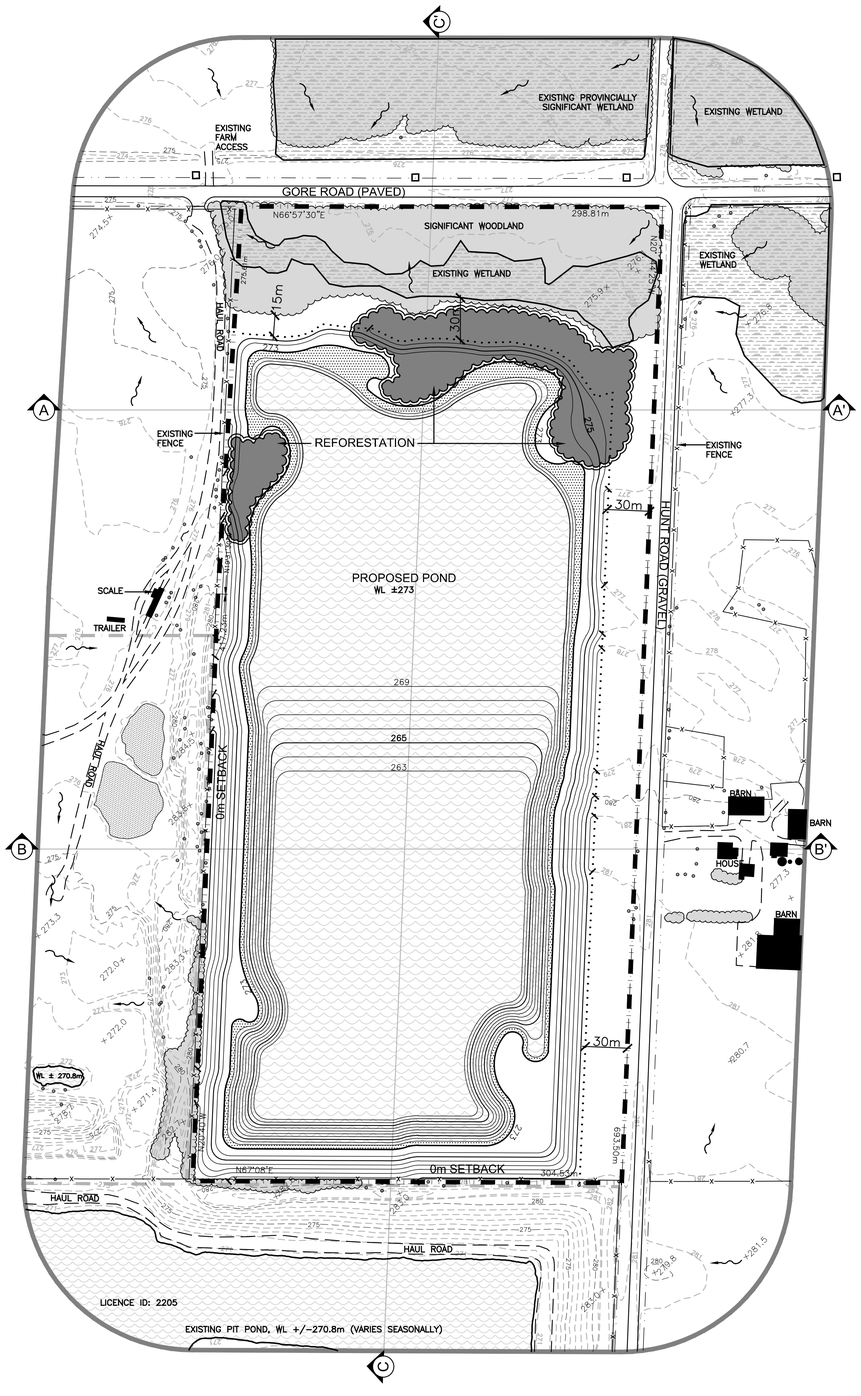

REHABILITATION NOTES

GENERAL INFORMATION

1. REFER TO SHEET 4 OF 5 FOR SECTIONS, SHEET 2 AND 3 OF 5 FOR OPERATIONS AND PHASING DIAGRAMS AND NOTES AND SHEET 5 OF 5 FOR FINAL REHABILITATION AND NOTES.
2. PROPERTY SHALL BE REHABILITATED TO:

OPEN WATER POND	11.33 HA
WETLAND	0.80 HA
REFORESTATION	0.76 HA
SIDESLOPE/ MEADOW	3.41 HA
FOR A TOTAL OF	16.30 HECTARES.

REFORESTATION OUTSIDE EXTRACTION AREA 0.46 HA

HYDROGEOLOGICAL INFORMATION

3. HYDROGEOLOGICAL INFORMATION INCLUDING GROUNDWATER ELEVATION WAS OBTAINED FROM REPORT BY LDS CONSULTANTS. DATED NOVEMBER 12, 2020.
4. THE WATER TABLE ELEVATION WITHIN THESE PROPERTIES IS ESTIMATED TO BE BETWEEN ± 276.5 - 271.5m ABOVE SEA LEVEL (A.S.L.) BASED ON ABOVE REPORT.

SIDESLOPE/ MEADOW REHABILITATION INFORMATION

GRADING INFORMATION

5. REHABILITATED SLOPES WITHIN THE LICENCED AREA WILL BE CONSTRUCTED AS SHOWN ON THE CROSS SECTIONS. REHABILITATION OF ABOVE WATER SLOPES SHALL BE BY BACKFILLING (MINIMUM 3:1) AND/OR CUT AND FILL METHOD USING AVAILABLE ON-SITE OVERBURDEN AND TOPSOIL FROM WITHIN THE LICENSED AREA AND/OR CLEAN INERT IMPORTED FILL PER OPERATIONAL NOTE 20 ON PAGE 2.

   AVAILABLE OVERBURDEN REPLACED WILL BE APPROXIMATELY 100mm THICK.

   REFER TO DRAWING 4 OF 5, SECTIONS, FOR MORE INFORMATION ON BACKFILLING AND CREATION OF REHABILITATED SIDESLOPES.

TOPSOILING INFORMATION

6. ALL AVAILABLE TOPSOIL ON THE SITE WILL REMAIN TO BE USED FOR REHABILITATION OF THIS SITE.

VEGETATION STABILIZATION INFORMATION

7. TOPSOIL SHALL BE SEEDED WITH A MIXTURE OF GRASSES AND LEGUMES THAT MAY INCLUDE THE FOLLOWING AT A RATE OF APPROXIMATELY 125KG/HA:

BUCKWHEAT	RED CLOVER	WHITE CLOVER
TALL FESCUE	ANNUAL RYE	

OPEN WATER POND REHABILITATION INFORMATION

8. THE AVERAGE WATER LEVEL IN THE POST-EXTRACTION POND IS ESTIMATED TO BE 273m ASL (BASED ON LDS REPORT DATED NOVEMBER 12, 2020).
9. THE SHAPE AND GRADING OF THE PROPOSED POND IS APPROXIMATE, BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME OF LICENSING. ACTUAL EXTRACTION WILL FOLLOW THE BELOW WATER DEPOSIT AND REHABILITATION SHALL FOLLOW THE CONCEPT ILLUSTRATED.

WETLAND REHABILITATION INFORMATION

10. AREAS SHALL BE REHABILITATED TO WETLAND HABITAT AS FOLLOWS:
    - UNDERWATER SLOPES WILL BE FORMED WITH ON-SITE FILL
    - UNDERWATER SLOPES SHALL BE A MAXIMUM OF 2:1
11. RESTORATION OF THE NEARSHORE, SHALLOW WETLAND ZONE AS SHOWN ON THE TYPICAL SHALLOW SHORELINE SECTION, SHEET 4 OF 5 WILL GENERALLY BE ACCOMPLISHED AS FOLLOWS:

- EXTRACTION AND ROUGH GRADING WILL CREATE A NEARSHORE SHORELINE AREA AT A SLOPE OF 10:1
  FINAL SLOPING OF THE SHORELINE TO CREATE PHYSICAL DIVERSITY BY SCALLOPING THE SHORELINE AND ADDING STRUCTURES.
- WOODY DEBRIS- BRANCHES, TREE TRUNKS, STUMPS, ETC. CLEARED IN THE EXTRACTION PROCESS WILL BE SALVAGED WHERE POSSIBLE, FOR USE IN SHORELINE RESTORATION/ UNDERWATER HABITAT ENHANCEMENT.
- STUMPS, LOGS, BRUSH BUNDLES, ETC. SHALL BE INSTALLED ±30m O.C. ALONG THE SHORELINE IN THE SHALLOW ZONE TO CREATE PHYSICAL DIVERSITY.
- OVERSIZE ROCKS NOT UTILIZED IN THE AGGREGATE OPERATIONS WILL ALSO BE PLACED IN THE SHALLOW ZONE TO CREATE PHYSICAL DIVERSITY.
- THE INITIAL SHORELINE RESTORATION AREA WILL BE SPORADICALLY PLANTED WITH TREES AND SHRUBS. SPECIES MAY INCLUDE THE FOLLOWING NATIVE PLANTS:

RED MAPLE	PUSSY WILLOW	SILVER MAPLE	RED OSIER DOGWOOD
LARCH	SPECKLED ALDER	WHITE CEDAR	

12. INITIAL SHORELINE WETLAND AREAS SHALL BE PLANTED WITH CLUMPS OF EMERGENT AND SUBMERGENT NATIVE WETLAND PLANTS TO INITIATE COLONIZATION OF THE SITE AS NUTRIENT LEVELS INCREASE TO SUPPORT THEM. NATIVE WETLAND PLANTS SUCH AS:

FLOATING PONDWEED	COONTAIL	SOFTSTEM BULRUSH	RIVER BULRUSH
BLUE FLAG	PICKERELWEED	WATER-LILY	ARROWHEAD

WILL BE PLANTED IN CLUSTERS OF 5 AT APPROPRIATE DEPTHS TO BEGIN THE COLONIZATION.

13. THE AREA BETWEEN THE POND AND WETLAND WILL BE ALLOWED TO NATURALIZE. THE SIGNIFICANT WOODLANDS WILL PROVIDE A SEED SOURCE FOR PIONEER SPECIES TO ESTABLISH. TREE PLANTING WILL OCCUR IN THIS AREA AND WILL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING SPECIES:

WHITE CEDAR	RED MAPLE	RED OSIER DOGWOOD
WHITE SPRUCE	SILVER MAPLE	ELDERBERRY
EASTERN WHITE PINE	SPECKLED ALDER	TREMBLING ASPEN
BLACK CHERRY	WHITE BIRCH	RED OAK
LARGE-TOOTHED ASPEN		

PLANTINGS IN THE NATURALIZED AREA SHALL INCLUDE SCATTERED POCKETS OF TREES AND SHRUBS TO INCREASE DIVERSITY. PLANTINGS BETWEEN THE SOUTHERN SHORE OF THE POND AND THE SIGNIFICANT WETLAND SHALL BE MAXIMIZED TO FACILITATE THE USE OF THE AREA FOR WILDLIFE MOVEMENT. SMALL BRUSH AND STONE PILES SHALL BE PLACED IN THE NATURAL AREA TO ENHANCE VALUE FOR WILDLIFE HABITAT.

VEGETATION WILL BE MAINTAINED IN A HEALTHY, VIGOROUS GROWING CONDITION.

SETBACK REHABILITATION INFORMATION

14. AFTER SIDESLOPES ARE CREATED AND REQUIRED BERMS ARE REMOVED FROM SETBACKS, THESE AREAS WILL BE IMMEDIATELY STABILIZED WITH A SUITABLE GROUNDCOVER.

LEGEND

- BOUNDARY OF AREA TO BE LICENCED
- BOUNDARY OF EXISTING LICENSED PITS
- 120m INFORMATION BOUNDARY
- REGULATORY SETBACK AND EXTRACTION LIMIT LINE
- EXISTING FENCE
- EXISTING 5m CONTOUR LINE (285)
- EXISTING 1m CONTOUR LINE (284)
- EXISTING SPOT ELEVATION (+283.95)
- EXISTING VEGETATION
- EXISTING WETLAND
- EXISTING STOCKPILE
- PROPOSED WETLAND
- PROPOSED OPEN WATER
- PROPOSED REFORESTATION
- PROPOSED 5m CONTOUR LINE (285)
- PROPOSED 1m CONTOUR LINE (284)
- EXISTING BUILDING
- EXISTING HYDRO POLE (HP)
- DIRECTION OF SURFACE WATER DRAINAGE
- LOCATION OF SECTION (B')

SITE PLAN OVERRIDE (VARIANCE)

THE FOLLOWING CONDITIONS ILLUSTRATED ON THESE PLANS VARY FROM THE OF THE PROVINCIAL STANDARDS MADE UNDER THE AGGREGATE RESOURCES ACT

ITEM	SECTION
TO MAXIMIZE EXTRACTION BELOW WATER SLOPES MAY BE A MAXIMUM 2:1.	5.19.1

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Drawing Status: PRELIMINARY FOR DISCUSSION		
Drawn RM/SB	Checked MH	Issue Date DEC 2020
Drawing Title: REHABILITATION PLAN		Project Number 20-23
		Drawing Number 5 OF 5

FILE NAME: 20-23/COMP/2023-5.DWG
PLOT DATE: DECEMBER 23, 2020