Environmental Impact Statement
6150 Thunder Road, Ottawa

Updated Report

April 26, 2021

Submitted To:

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List of Acronyms and Abbreviations

°C – degrees Celsius
AOO – Algonquins of Ontario
cm – centimetres
DBH – Diameter at Breast Height
DFO – Department of Fisheries and Oceans (Fisheries and Oceans Canada)
ECCC – Environment and Climate Change Canada
e.g. – *exempli gratia*
EIS – Environmental Impact Statement
ELC – Ecological Land Classification
ESA – *Endangered Species Act*
ESC – Erosion and Sediment Control

FWCA – *Fish and Wildlife Conservation Act*
i.e. – *id est*
GIS – Geographic Information System
ha – hectare
KAL – Kilgour & Associates Ltd.
km – kilometre
LIO – Land Information Ontario
m – metre
MBCA – *Migratory Birds Convention Act*
MECP – Ministry of Environment, Conservation and Parks
MNR – Ministry of Natural Resources
MNRF – Ministry of Natural Resources and Forestry
NHIC – Natural Heritage Information Centre
OBBA – Ontario Breeding Bird Atlas
OP – Official Plan
PPS – Provincial Policy Statement
PSW – Provincially Significant Wetland
SNCA – South Nation Conservation Authority
SAR – Species at risk
SARA – *Species at Risk Act*
SARO – Species at Risk in Ontario
SWH – Significant Wildlife Habitat

1.0 INTRODUCTION

This Environmental Impact Statement (EIS) was prepared by Kilgour & Associates Ltd. (KAL; Appendix A) on behalf of Avenue 31 Inc. in support of their proposed re-zoning application and official plan amendment to rezone the lands from Rural Countryside (RU) to Rural General Industrial (RG) at 6150 Thunder Road in the east end of Ottawa (herein "the Site", Figure 1). The Site (Gloucester Concession 9 of Part North Lot 1, RP 5R12400 Part 1, Pin: 043240354) is approximately 16.7 hectares (ha) in area. The Official Plan Amendment seeks to add the Employment Land Use overlay to clarify the permissions for warehouse / employment use in the general rural area.

In the City of Ottawa (hereafter referred to as "the City"), an EIS is required when development or site alteration is proposed in or adjacent to natural heritage features (City of Ottawa, 2015a). The purposes of this EIS are to 1) identify natural heritage features on or adjacent to the Site, 2) identify potential impacts of the proposed development to those features, and 3) identify mitigation measures to minimize or eliminate those impacts. The Site is adjacent to and includes areas identified by the City as being potentially part of the Natural Heritage System per Schedule L of the City's Official Plan (OP; City of Ottawa, 2020b; Figure 1). This EIS will examine potential impacts to the Natural Heritage System and to species at risk (SAR) that may potentially occur on or adjacent to the Site if site development were to proceed under the new zoning.

2.0 ENVIRONMENTAL POLICY CONTEXT

Natural heritage policies and legislation relevant to this EIS are outlined below.

2.1 The Provincial Policy Statement, 2020

The Provincial Policy Statement (PPS) was issued under Section 3 of the *Planning Act* (1990). The current PPS came into effect on May 1, 2020. Natural features are afforded protections under Section 2.1 of the PPS. Protections may include maintenance, restoration, and improved function of diversity, connectivity, ecological function, and biodiversity of natural heritage systems. These protections restrict development and site alteration in significant natural areas (e.g. woodlands, wetlands, wildlife habitat) unless it can be demonstrated that there will be no negative effects on the features and ecological functions of those natural areas. Technical guidance for implementing the natural heritage policies of the PPS is found within the second edition of the *Manual for Natural Heritage Policies of the Provincial Policy Statement* (Ministry of Natural Resources (MNR), 2010). This manual recommends the approach and technical criteria for protecting natural heritage features and areas in Ontario.

2.2 City of Ottawa Official Plan

The City of Ottawa OP (2020b) provides direction for future growth in the City of Ottawa and is a policy framework to guide physical development to 2031. The OP was first approved in 2003 and is updated every five years.

2.3 *Species at Risk Act*, 2002

The federal *Species at Risk Act*, 2002 (SARA) is administered by Environment and Climate Change Canada (ECCC) and provides direction to protect and ensure the survival of wildlife species in Canada. The purpose

of the SARA is to prevent populations of wildlife from becoming Extirpated, Endangered, or Threatened, provide recovery strategies for Endangered and Threatened species, and to manage other species to prevent them from becoming Endangered or Threatened.

All species listed on Schedule 1 of SARA are afforded protection on federal lands. Aquatic species and species of migratory birds protected by the *Migratory Birds Convention Act*, 1994 (MCBA) and listed as Endangered, Threatened, or Extirpated under Schedule 1 of SARA are protected wherever they occur in Canada, regardless of land ownership.

2.4 *Endangered Species Act*, 2007

The provincial *Endangered Species Act*, 2007 (ESA) is administered by the Ministry of Environment, Conservation, and Parks (MECP) and provides protection for SAR and their habitat. The Act prohibits killing, harming, harassing, possessing, transporting, buying, or selling Extirpated, Endangered, and Threatened species. Species listed as Endangered, Threatened, or Extirpated and their habitats (e.g. areas essential for breeding, rearing, feeding, hibernation, and migration) are automatically afforded legal protection under the ESA.

2.5 *Fisheries Act*, 1985

The federal *Fisheries Act,* 1985 is administered by Fisheries and Oceans Canada (DFO) and provides protections to fish, fish habitat, and fisheries. Specifically, the *Fisheries Act* provides:

- Protection for all fish and fish habitat;
- Prohibition against the "harmful alteration, disruption or destruction of fish habitat"; and
- Prohibition against causing "the death of fish by means other than fishing".

Projects with a scope that does not fall within DFO defined standards and codes of practice require submission of a request for review to DFO.

2.6 *Migratory Birds Convention Act*, 1994

The MBCA is legislation administered by the ECCC that provides protection for migratory birds listed in the Act. The disturbance, destruction, take and killing of migratory birds, their eggs, and their nests are prohibited in the Act. The “incidental take” and work that would result in the destruction of active nests or the wounding or killing of bird species protected under the MBCA and/or associated regulations (e.g. SARA) are prohibited.

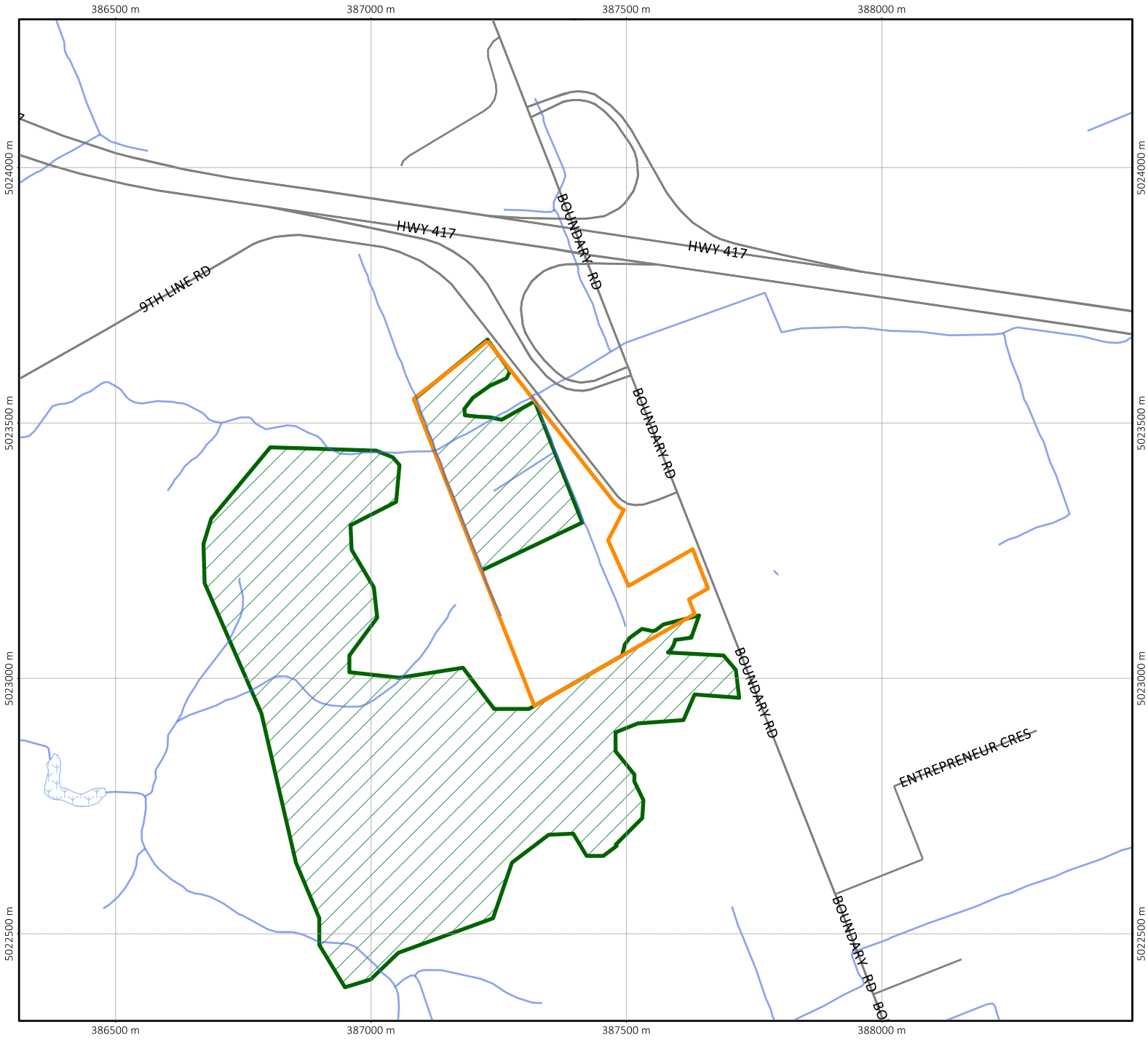

Figure 1 Site context

Legend

- Property Boundary

Surface Water Features

- Wetland
- Channel

- Schedule L

N

0 250 m

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MTM Zone 9
(NAD 83)
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2.7 *Fish and Wildlife Conservation Act,* 1997

The provincial *Fish and Wildlife Conservation Act*, 1997 (FWCA) governs the hunting and trapping of a variety of wildlife including mammals, birds, reptiles, amphibians, and fish in Ontario, thereby facilitating the protection of wildlife and their habitat. The FWCA outlines the prohibition of hunting or trapping specially protected species and the requirement for provincially issued licenses for the hunting or trapping of "furbearing" or "game" animals.

2.8 *Conservation Authorities Act*, 1990

Conservation Authorities were created to address erosion, flooding, and drought concerns regionally by managing at the watershed level. Conservation Authorities were given the ability to regulate under Section 28 of the *Conservation Authorities Act*, 1990. The Act provides mechanisms to regulate works and site alterations that have a potential to affect erosion, flooding, land conservation, and waterbodies within their jurisdiction. It is the obligation of all Conservation Authorities to implement Ontario Regulations 42/06 and 146/06 to 182/06 *Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

3.0 METHODS

3.1 Desktop and Background Data Review

3.1.1 Agency Consultation

The Site is located within the jurisdictions of the Ottawa District of the MECP and South Nation Conservation (SNC). A request for confirmation of SAR potential related to the Site was submitted to the MECP on November 11, 2020 (Appendix B). A response was not yet received at the time of writing this report.

No request for information was submitted to Fisheries and Oceans Canada (DFO) for this specific project as the proposed project will be setback from and will be planned and implemented to prevent impacts to fish-bearing waters located on the Site. Pre-consultation was held in November, 2019, with a follow-up meeting held on January 29, 2020, after the application was submitted but prior to it being deemed completed.

3.1.2 Records Review

The descriptions of the existing natural environment on and adjacent to the Site are based on field investigations and desktop reviews of previously completed studies and information available on publicly accessible databases, including:

- City of Ottawa Urban Natural Areas Environmental Evaluation Study (Muncaster Environmental Planning Inc. and Brunton Consulting Services, 2005).

Online databases queried for SAR, provincially rare species, and natural heritage features included the following:

- Ontario MNRF:
    - Natural Heritage Information Centre (NHIC; MNRF, 2020a)
    - Land Information Ontario (LIO) Provincially Tracked Species Grid Detail (MNRF, 2020b)
    - Species at Risk in Ontario (SARO) List (MNRF, 2020c)
- SARA, Schedule 1 (Government of Canada, 2020)
- Ontario Breeding Bird Atlas (OBBA; Bird Studies Canada *et al*., 2006)
- Ontario Reptile and Amphibian Atlas (Ontario Nature, 2019)
- Atlas of the Mammals of Ontario (AMO; Dobbyn, 1994)
- South Nation Conservation Mapping Geoportal (SNC, 2020)
- City of Ottawa:
    - Official Plan Schedules (City of Ottawa, 2020b)
    - geoOttawa mapping database (City of Ottawa, 2020a)

3.2 Field Surveys

3.2.1 Vegetation

KAL Biologist, Terry Hams, completed an initial tree inventory and an ecological land classification (ELC) of the Site on June 20, 2018. Vegetation cover on the Site was described following standard ELC methods, including the collection of soil samples (Lee *et al*., 1998).

As the south half of the Site was cleared and partially regraded in 2019, the ELC for the Site was updated following brief sited visits by Ed Malindzak (October 15, 2020) and Anthony Francis (on October 18, 2020) to note the cleared area and to confirm the previously tree cover over the remainder of the Site.

3.2.2 Wildlife

Anurans

Site amphibian (anuran) surveys were conducted and lead by KAL biologists, Rob Hallett and Liza Hamilton, following protocols set forth by the Marsh Monitoring Program (Bird Studies Canada *et al.*, 2008). Three surveys are completed to identify early, mid, and, late-season breeding amphibian species generally in April, May, and June, respectfully, though survey dates are temperature dependent. Surveys are completed on nights of calm weather with temperatures above 5 degrees Celsius (°C), 10°C, and 17°C for each of the three respective survey periods. Surveys begin a half-hour after sunset and are finished by midnight with a five-minute recording period at each survey station. Amphibian species are recorded at each point along with the estimated distance from observers, calling code, an estimate of the number of individuals, and estimated directions of calling anurans.

Amphibian surveys were performed on April 23, May 30, and June 21, 2018 (Table 2). Three stations were surveyed in wetland and aquatic habitats (F1 through F3; Figure 2). Station F3 was located at the north

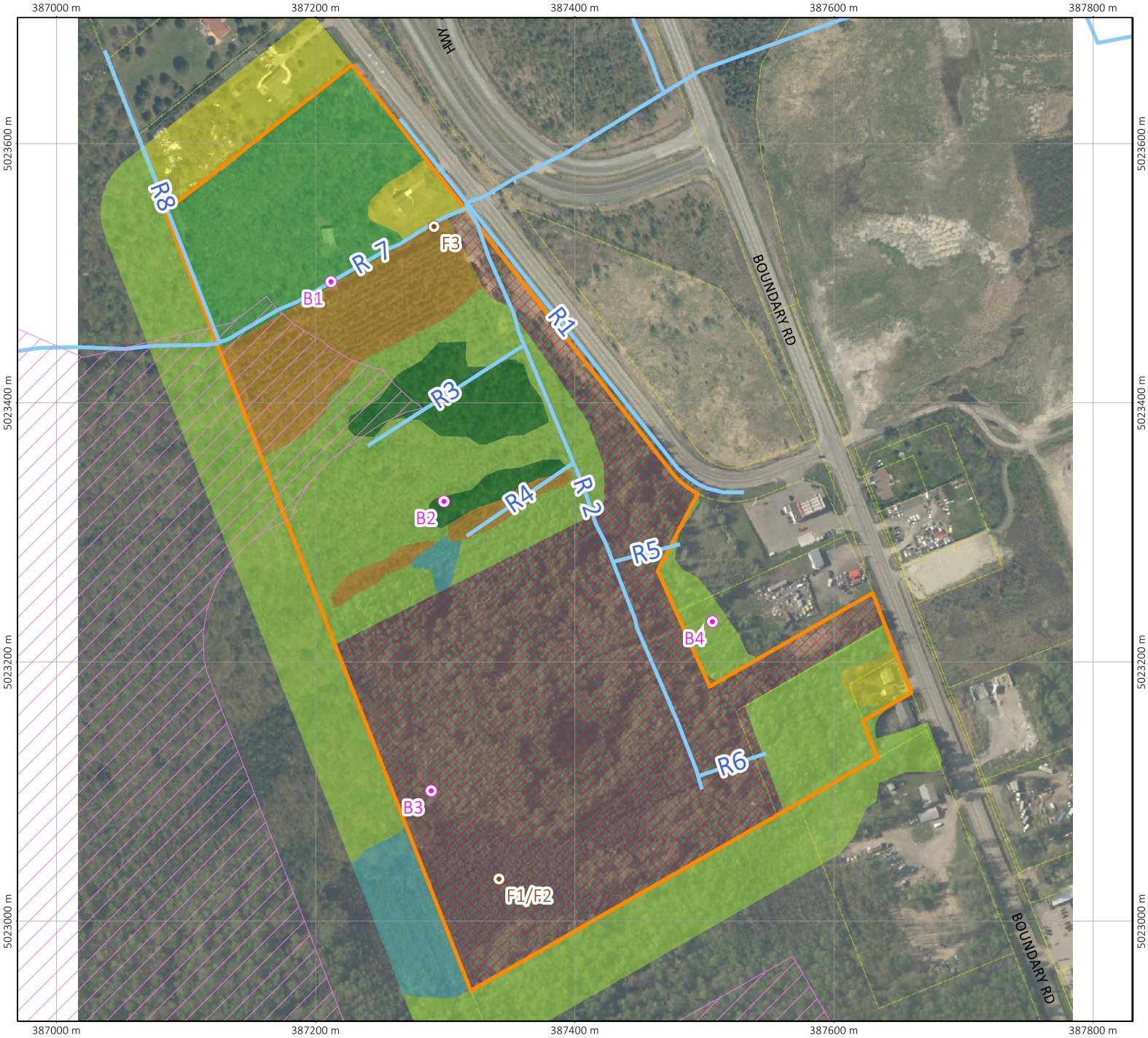

Figure 2 Existing Site conditions

Legend

Property Boundary

Wildlife Surveys

Bird Station

Frog Station

ELC

Residential

FOD7

FOD8-2

FOMM10-2

TAGM1

SWT2

Cleared

Interior Forest

Surface Water Features

N

0 100 m

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end of the Site with the observers facing south. Stations F1 and F2 were the same point located near the southwestern corner of the Site, but with one observer facing south (F1) and one facing north (F2).

Table 1 Summary of frog survey times and weather conditions

Survey Date	Temperature (°C)	Weather conditions	Wind speed (km/hour)
23-Apr-18	10*	Clear	4
30-May-18	21*	Mostly Cloudy	11-14
21-Jun-18	17**	Clear	7 - 10

* Temperatures on these nights were warmer than the preceding nights, with evening temperatures just above 5°C and 10°C, respectively, within a few days of the surveys. Frogs for the period would still be expected to be calling regardless.
** Temperatures on this night just reached the minimum required temperature but had been were warmer the preceding nights, with evening temperatures above 17°C. Frogs for the period would still be expected to be calling regardless.

Birds

Two rounds of breeding bird surveys were completed on the Site in 2018 by Terry Hams. All surveys followed point count guidelines by the Ontario Breeding Bird Atlas (Bird Studies Canada *et al*., 2001). According to these guidelines, breeding bird surveys are to be completed from survey stations that, combined, provide suitable viewing of all habitats on-site on calm weather days with light wind (less than 19 km/hr) and no precipitation. Surveys must take place between sunrise and five hours after sunrise between May 24 and July 10. Surveys were conducted from four survey stations (B1 through B4; Figure 2). The point counts were conducted for at least five minutes at each station on each survey date (Table 2).

Table 2 Summary of breeding bird survey times and weather conditions

Survey Date	Start Time	Temperature (°C)	Precipitation (mm)	% Cloud Cover	Wind speed (km/hour)
20-Jun-2018	06:59	12	0	30	0
05-Jul-2018	06:00	22	0	0	0

3.2.3 Aquatic Habitat

Headwater channels on the Site were investigated in 2018 following *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (Toronto and Region Conservation Authority and Credit Valley Conservation, 2014) to document their hydrological and riparian and terrestrial habitat (Appendix C). On April 12, 2018 (i.e. during the spring freshet), KAL biologists Liza Hamilton and Tyler Peat identified and described seven channelized features on the Site (reaches R1 through R8; Figure 2), noting the channel dimensions, substrate, form, and riparian vegetation. On June 1, 2018, KAL biologists Rob Hallett and Tyler Peat conducted an electrofishing survey of R1, R3, R4, and a portion of R2 north of R4. These channels were deemed at the time to be sufficiently wet to potentially support fish, whereas R2, R5, and R6 were dry at the time of electrofishing surveys and therefore not able to support fish. R7, a permanent stream, was not fished as the project does not propose to alter or build within 30 m of that feature. As a permanently flowing channel connected to larger creeks downstream, R7 is considered to directly support fish regardless.

One additional channel, R8 was noted along the western property line north of R7 during the reviews of Site vegetation in October 2020. No development was under consideration for this area at the time of the HDFA studies.

3.3 Species at Risk

Per the *Client's Guide to Preliminary Screening for Species at Risk* (MECP, 2019), publicly available records of SAR observations in the vicinity of the Site were collected based on data sources identified within Section 3.1.2. A request for a SAR screening for the Site was filed with the MECP on November 11, 2020 (Appendix B), to confirm the completeness of our SAR records search for the area. The MECP had not responded to that request by the date of this report. Regardless, the full list of 71 SAR currently known to occur within the region of the City of Ottawa was reviewed to identify the potential for SAR presence on and adjacent to the Site (Appendix D).

4.0 PROPERTY INFORMATION

4.1 Previous and Current Land Use/Land Cover

The entire Site was under active agriculture in 1976 according to the geoOttawa aerial imagery (City of Ottawa, 2020a). Land to the south at that time was well forested and was similarly covered in 1965, indicating that forest cover adjacent to the Site is more mature (> 50 years old) than that of the Site (less than 45 years old). By 1991, most of the central portion of the Site had been re-ploughed and planted as a conifer plantation. A large portion of the south half of the Site was subject to some sort of excavation through the 1990s (City of Ottawa, 2020a). Following the late 1990s and through the early 2000s, the excavated area showed some signs of tree re-growth and re-naturalization, with more deeply excavated portions taking on apparent wetland characteristics (City of Ottawa, 2020a). This portion of the Site was fully cleared and partially regraded in 2019. It currently consists of bare earth. The north half of the site is currently forested (Figure 2) with a mix of coniferous plantation and young, early-successional forest.

4.2 Landforms, Soils and Geology

Soil mapping shows the entire property is underlain by medium/fine sand deposits (Marshall et al., 1979). Soils in the north half of the cleared area are from the Manotick formation and are underlain by fine-textured marine clay. Soils on the remainder of the Site (i.e. the north half and the southernmost end) are part of the Uplands formation (Marshall et al., 1979). The sand layer here is deeper, with no apparent clay layer within 1.2 metres (m) of the surface based on soil cores dug for the ELC analysis. Soil mottles in the remaining forested areas were evident at depths of > 75 centimetres (cm), indicating fresh-moist but not wetland conditions.

Boreholes for soil sampling were excavated by Paterson Group (2020) in late June of 2020 around the southern half of the site (i.e. through the recently cleared area; Appendix E). In all but one instance, the first 1.5 m or more of the cores, showed loose sandy soils with low soil moisture and only trace organics. The low organic load and lack of stratification may be due to the history of agriculture and extraction across the Site. The soil profiles do not suggest historical wetland presence.

The dept of the sandy soil in Borehole BH4-20 was only 60 cm before changing to firm silty clay, though soil moisture was still low above a 2 m depth. The location of BH4-20 corresponds with a previous excavation pit on the Site and may indicate added fill.

4.3 Vegetation Cover

The northern end of the site – north of R7 – is a Fresh-Moist Poplar Deciduous Forest (FOD8-2). The ecosite is co-dominated by Balsam Poplar (*Populus balsamifera*) and Trembling Aspen (*Populus tremuloides*). These trees have a diameter at breast height (DBH) that ranges from 10 to 35 cm. Other tree species present in small numbers include Red Maple (*Acer rubrum*), European Birch (*Betula pendula*), Eastern Cottonwood (*Populus deltoids*) and Green Ash (*Fraxinus pennsylvanica*). This is the oldest contiguously wooded area on the Site, though it is still no more than 45 years old (City of Ottawa, 2020a).

Immediately south of R7, the Site is spanned by a Coniferous Plantation (TAGM1) composed primarily of White Spruce (*Picea glauca*), with subordinate species of Jack Pine (*Pinus banksiana*) and Red Pine (*Pinus resinosa*). These conifers, growing in a linear orientation, are generally similar in size ranging from 30-35 cm DBH. Air photos from 1991 suggest that most of the area between R7 and R4 (which corresponds approximately with the northern limit of the Site clearing conducted in 2019) were planted with this type of plantation. The bulk of the TAG1 plantation, however, is currently limited to a ~75 m band south of R7 with two other narrow bands remaining near R4.

The remainder of this original plantation area has grown over with species of trees common to the older forested areas south and west of the Site, with most of those areas now consisting of Fresh – Moist Lowland Deciduous Forest (FOD7). This ecosite consists of a mix of Red Maple and Green Ash, with subordinate species of Black Ash (*Fraxinus nigra*), American Elm (*Ulmus americana*), European Birch, Balsam Poplar, Largetooth Aspen (*Populus grandidentata*), Trembling Aspen, and Manitoba Maple (*Acer negundo*). A small number of the Red Maple, Trembling Aspen, and Balsam Poplar in the FOD7 ecosite are as large as 30 cm DBH, but most of the area is composed of smaller trees and saplings, representing a regenerating forest habitat that may be recovering from tree loss to due to occasional beaver-induced flooding. Common Buckthorn (*Rhamnus cathartica*) is also common in the understory. Within the re-naturalizing area of the FOD7 ecosite, some pockets have retained sufficient numbers of White Spruce and to make up a Fresh – Moist White Spruce – Hardwood Mixed Forest (FOMM10-2) inclusions.

In the centre of the Site, immediately adjacent to the cleared area, a small (0.7 ha) depression forms a Willow Mineral Deciduous Thicket Swamp (SWT2) ecosite, dominated by a mix of Bebb's Willow (*Salix bebbiana*) and Speckled Alder (*Alnus incana*) with some buckthorn. Groundcover here includes sedge (*Carex* sp.) and rush (*Juncus* sp.) species.

The southern portion of the Site was fully cleared of all vegetation in 2019. Vegetation cover here had previously consisted of young, early-successional forest with the same FOD7 species mix apparent beyond the south and west site boundaries and present in the central portion of the Site. Trees here though had been the youngest on Site, with the forest cover only starting to develop in the late 1990s. Pockets of heavy shrub cover with Speckled Alder with buckthorn had been present in the southwest corner of the Site. Soil profiles here (Section 4.2) do not suggest the presence of wetland habitat. A remnant spur of this shrub cover is still located on the southeast edge of the adjacent property to the west. Based on the plant coverage, this pocket may be classified as another small SWT2 ecosite, though it appears to be surrounded by FOD7 forest.

4.4 Surface Water and Fish Habitat

Eight headwater features (R1 through R8; Figure 2) occur on the Site. R1 is a roadside ditch along Thunder Road. The other channels on Site had all been located within wooded areas in 2018, but R5, R6, and the upper half of R2 are currently surrounded by a cleared area.

R7 is a permanent stream. R3, R4, and the north half of R2 all contained some water (< 15 cm) until mid-summer in 2018, but only did so because of the presence of beaver dams on R7, which had backed up water onto the Site. Beaver dams have been consistently removed from the Site and neighbouring properties since that time; those channels now dry shortly after the spring freshet.

R5, R6 and the upper half of R2 are ephemeral and were found to dry very quickly after the freshet, even when the beaver dams were present. Fish were observed in all areas below R5. Reaches above R5, being dry, did not have fish. With the beaver dams having been removed since mid-2018, only R7 and the lowermost section of R2 will likely have sufficient water post-freshet to provide fish habitat.

From the HDFA (Appendix C), channels R1, R5, R6 and the upper half of R2, receive management recommendations of “Mitigation”; channels R3 and R4 and R2 (lower end) receive management recommendations of “Conservation”; and channel R7 receives a management recommendation of “Protection”.

Features recommended for mitigation are not required to be maintained per se, but their functionality must be replicated or enhanced through lot level conveyance measures as part of the site stormwater management system. As the features convey runoff to more ecologically important reaches, replacement features/systems, should be vegetated to mimic online wet vegetation pockets to the extent possible, and should convey water to the same final receiver (i.e. R7), though natural channel design is not required.

Channels recommended for conservation may be maintained or, if necessary relocated, using natural channel design techniques to maintain or enhance the overall productivity of the reach. If realigned, the features may be relocated on or off the Site. In any case, the riparian corridors must be maintained or enhanced. If catchment drainage will be removed due to diversion of stormwater flows, lost functions should be restored through enhanced lot level controls (e.g. restore original catchment using clean roof drainage).

Channels recommended for protection may be maintained and/or enhanced, but should not generally be relocated. Improvements, however, could be possible to its overall channel form and thus some minor realignment may be considered within that context. The riparian zone should be protected and enhanced where feasible. The hydro-period must be maintained. Use natural channel design techniques or wetland design to restore and enhance existing habitat features if and where needed. Stormwater management systems must be designed to avoid impacts (i.e. sediment, temperature) to this headwater channel.

The closest provincially significant wetland (PSW) is Mer Bleue, located >5 kilometres (km) to the northwest. The outer edge of the neighbouring lands appears to be a continuation of the fresh moist forest ecosites that occur (or previously occurred) on the Site, other than the small wetland pocket located at the southern end. These forested areas to the west, however, may include some wetland habitat beyond the first 20 m or so of forest observable from the property edge, but they have not been formally evaluated for wetland presence. These lands are part of a recent land-treaty settlement with, and are

subject to development plans by, the Algonquins of Ontario (AOO). Those areas will not be reviewed further by parties not directly associated with AOO. To help guide the provision of appropriate mitigation measures to be considered and employed under future potential development of the Site, this EIS will assume the presence of wetland habitat with that forest area of sufficiently high quality to warrant consideration as PSW.

4.5 Wildlife

4.5.1 Anurans

From station F3 (i.e. covering the north half of the site), the only frog heard was a single Spring Peeper (*Pseudacris crucifer*) during the second anuran survey.

Choruses (i.e. Calling Code 3) from both Spring Peepers and Wood Frogs (*Lithobates sylvaticus*) were heard on the first survey date from station F1/F2 from the wooded areas beyond the western edge of the site. Seven American Toads calling from scattered points around the southern half of the property were the only anurans observed from station F1/F2 on the second visit. No anurans were heard anywhere on the property during the third round of surveys.

Based on the presence of large numbers of two different anuran species, wooded areas southwest of the Site may be considered Significant Wildlife Habitat (SWH; MNR, 2015) for frog breeding The Site itself does not directly support large numbers of any anuran species and so does not constitute SWH. The lack of any calling frogs from the wooded areas west of the Site after the first frog visit suggests the forest there may be too dry following the spring freshet to provide suitable wetland habitat.

4.5.2 Birds

Overall, 32 bird species were observed on or adjacent to the Site during the two rounds of surveys (Table 3). All of the birds observed are common species in the Ottawa region. Song Sparrow (*Melospiza melodia*) was the most abundant species on site followed by Common Grackle (*Quiscalus quiscula*) and Cedar Waxwing (*Bombycilla cedrorum*).

None of the birds observed occurring directly on the Site are species protected under the ESA or SARA. Two observed species – Eastern Wood-pewee (*Contopus virens*) and Wood Thrush (*Hylocichla mustelina*) – are listed as Special Concern. Only a single individual of each species was noted during bird surveys, both from station B3. Both birds were noted at the edge of audible detection during both surveys and were placed as occurring over 100 m to the southwest (Eastern Wood-pewee) and to the southeast (Wood Thrush). These locations are situated within the more mature forest areas to the south of the property. Those forested areas thus constitute SWH for Special Concern and Rare Wildlife Species. As neither species was noted to occur directly within the younger forest features on the Site, the SWH designation does not extend onto the Site.

Table 3 Birds observed during field surveys, 2018

Common Name	Scientific Name	Breeding Potential	Common Name	Scientific Name	Breeding Potential
American Crow	*Corvus brachyrhynchos*	Likely	Least Flycatcher	*Empidonax minimus*	Likely
American Goldfinch	*Spinus tristis*	Likely	Mourning Dove	*Zenaida macroura*	Likely
American Redstart	*Setophaga ruticilla*	Likely	Northern Cardinal	*Cardinalis cardinalis*	Likely
American Robin	*Turdus migratorius*	Likely	Ovenbird	*Seiurus aurocapilla*	Likely
Black-and-white Warbler	*Mniotilta varia*	Likely	Purple Finch	*Haemorhous purpureus*	Likely
Black-capped Chickadee	*Poecile atricapillus*	Likely	Red-eyed Vireo	*Vireo olivaceus*	Likely
Blue Jay	*Cyanocitta cristata*	Likely	Red-winged Blackbird	*Agelaius phoeniceus*	Likely
Canada Goose	*Branta canadensis*	Probable	Song Sparrow	*Melospiza melodia*	Likely
Cedar Waxwing	*Bombycilla cedrorum*	Likely	Swamp Sparrow	*Melospiza georgiana*	Likely
Common Grackle	*Quiscalus quiscula*	Likely	Veery	*Catharus fuscescens*	Likely
Common Yellowthroat	*Geothlypis trichas*	Likely	Warbling Vireo	*Vireo gilvus*	Likely
Downy Woodpecker	*Picoides pubescens*	Likely	White-breasted Nuthatch	*Sitta carolinensis*	Likely
Eastern Wood-pewee *	*Contopus virens*	Likely	White-throated Sparrow	*Zonotrichia albicollis*	Likely
Gray Catbird	*Dumetella carolinensis*	Likely	Wood Thrush *	*Hylocichla mustelina*	Likely
Hairy Woodpecker	*Leuconotopicus villosus*	Likely	Yellow-bellied Sapsucker	*Sphyrapicus varius*	Likely
House Wren	*Troglodytes aedon*	Likely	Northern Flicker	*Colaptes auratus*	Likely

* = Special Concern under the ESA and SARA

Breeding Potential = Likely: Breeding behaviour was observed and preferred nesting habitat occurs on Site, Probable: potential breeding habitat occurs on Site.

4.6 Species at Risk

Based on our review of existing information records, our ELC delineations of the Site to characterize potential habitat areas, and our field surveys (Appendix D), four species were considered to have some probability of transient presence.

Two bird species, Eastern Wood-pewee and Wood Thrush, were noted a single time each in the mature forest areas to the southwest of the Site. These birds, however, were not observed on the Site and the mix of young, scrubby forest and coniferous plantation present there provides only marginally suitable habitat by comparison. While it is possible both species could occur there transiently, the forested portions of the Site are not considered to be suitable habitat areas for these species.

One bat species listed as Endangered, Tri-coloured Bat (*Perimyotis subflavus*), has some potential to occur transiently on the property based on City of Ottawa SAR occurrence records (Appendix D). The young forests of the Site include no oak trees, no larger maple trees (MNRF, 2017) and few snags typical of roosting trees. As such, they are unlikely to provide significant nursery habitat. The sand soils of the area do not include cave-supporting geology for potential hibernacula.

Snapping Turtles (*Chelydra serpentina*) commonly occur in the general vicinity and tend to live and breed in close proximity to permanent watercourse features (MNR, 2012). Watercourse feature R7 has some potential to support the species, though no individuals have previously been noted here. Areas of the Site beyond R7 or its immediate riparian corridor lack any permanent water features and are not considered as potential habitat. As the species is listed as Special Concern, its habitat is not specifically protected under the ESA regardless.

4.7 Other Significant Natural Features

The Site includes areas identified by the City as part of the Natural Heritage System per Schedule L of the City's Official Plan (OP; City of Ottawa, 2020b; Figure 1). Areas flagged under Schedule L are considered to be, or to have some potential to be, significant natural heritage features per the OP (City of Ottawa, 2020b) and/or the *Natural Heritage Reference Manual* (MNR, 2010).

4.7.1 Significant Woodlands

The forest ecosites of the Site are contiguous with an expansive forested area to the west, covering an extended area of >120 ha. Based on the size alone, the extended wooded areas constitute Significant Woodland under the *Natural Heritage Reference Manual* (MNR, 2010). Since the forest cover directly on the Site is contiguous with these wooded areas, it is part of this Significant Woodland. However, the forest cover on the Site forms the youngest portion of the adjacent Significant Woodland, with the oldest parts on Site <40 years old and the youngest parts only ~20 years old. Interior forest habitat (i.e. forested area more than 100 m from a forest edge) covers 1.2 ha of the Site, most of which corresponds with the TAGM1 coniferous plantation ecosite (Figure 2).

5.0 DESCRIPTION OF THE PROPOSED PROJECT

The proposed development consists of a zoning bylaw amendment and an official plan amendment to allow for large-format warehouse and employment uses in the general rural area. Two plans indicating thee proposed development areas on the Site have been developed to indicate future land cover under likely development scenarios (Figure 3a & b). A Site Plan Control application would be required for individual development applications within each development area as they would be put forward to the City of Ottawa. Future development proposals within would be subject to Site Plan Control applications and may require a separate or further updated detailed EIS based on detailed design, including detailed stormwater and grading design.

Site preparation development within the Phase 1 area is proposed to begin in the summer or fall of 2021, with construction to be completed by the fall of 2022. Site preparation for Phase 1 would require the removal of up to 4.1 ha of the exiting forest cover on the site. A forested area ~90 m in with would be retained and/or re-established (depending on grading requirements and watercourse realignments) between the development area within Phase 1 and the permanent watercourse of R7.

The functionality of reaches R6, R5 and the upper portions of R2 would be replicated through LID SWM swales along the south and west sides of the site. The lower reach of R2 would be realigned westward (i.e. away from Thunder Road to be located fully within the forested area). R3 and R4 will either be replaced by new naturalized watercourses on site (Figure 3a) or have their flows managed by LID SWM swaels on site (Figure 3b) with separate off site compensation. Under either scenario, a portion of the site runoff would be managed through a green infrastructure approach based on a treed SWM detention area (i.e. a newly created swamp feature).

The LID SWMP swale features would be created within a treed buffer along the south and west sides of the Site, which would add at least 0.8 ha of new forest cover to be planted along the cleared lands of the southwest corner, re-establishing a natural buffer to the older forest feature to the south and west. Trees species planted within the buffer would be of comparable species to the adjacent FOD7 ecosite.

Figure 3a Proposed development areas with all naturalized channel replacement completed on Site.

Legend

Development Concept

- Development Area
- Forest Cover
- LID SWM Pond/Swamp
- LID SWM Swale
- Left As-Is
- Natural Channel

0 150 m

Project: SIMP 773
Created By: AF
MTM Zone 9
(NAD 83)
Printed on: 2021-04-26

KILGOUR & Associates

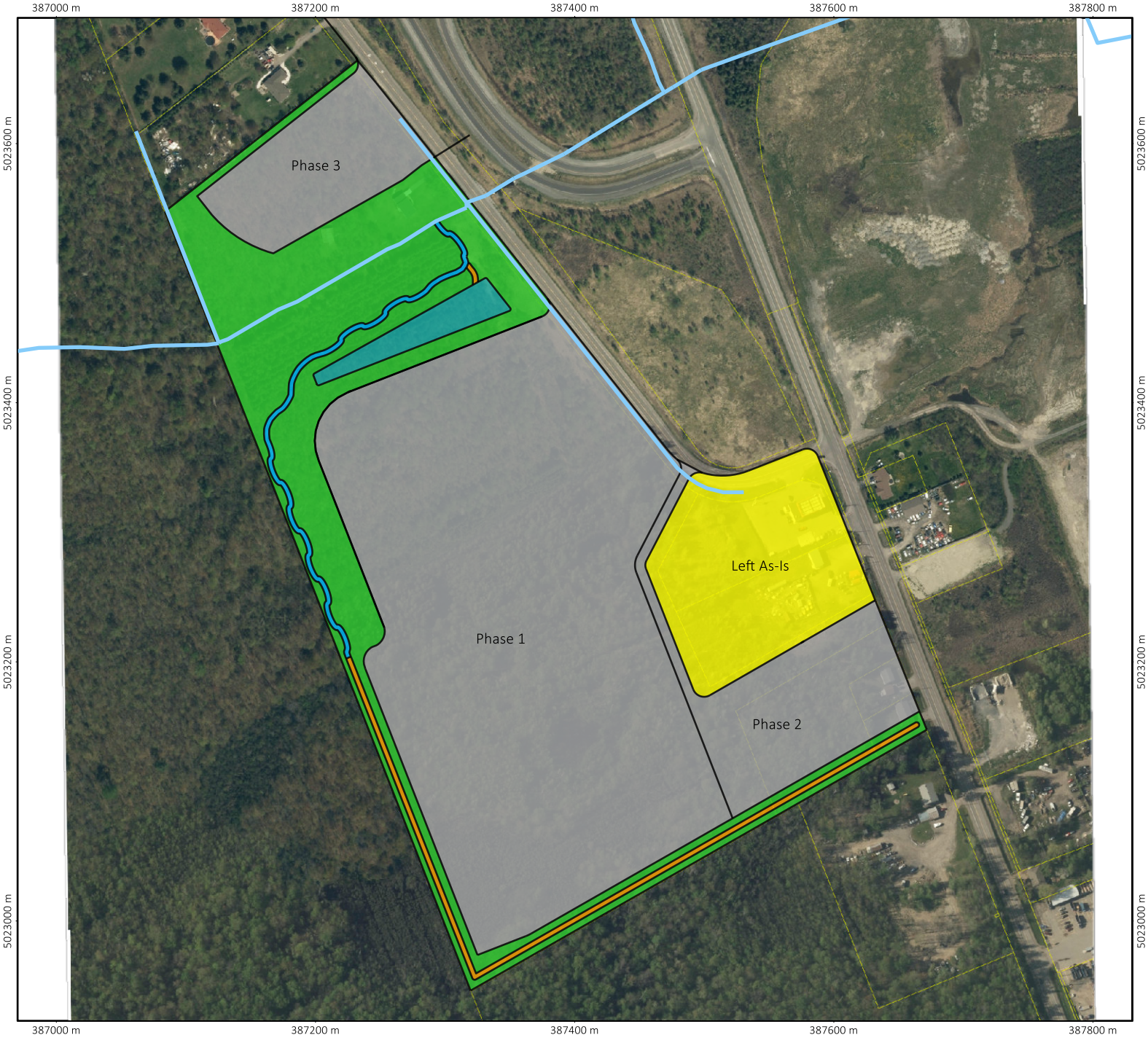


Figure 3b Proposed development areas with some naturalized channel replacement to be completed off Site.

Legend

Development Concept

- Development Area
- Forest Cover
- LID SWM Pond/Swamp
- LID SWM Swale
- Left As-Is
- Natural Channel

0 150 m

Project: SIMP 773
Created By: AF
MTM Zone 9
(NAD 83)
Printed on: 2021-04-26

KILGOUR & Associates

6.0 IMPACT ASSESSMENT

6.1 Aquatic Habitat

Channelized Water Features

Construction of the Phase 1 area would require the removal of channels R3, R4, R5 and R6, and the upper portion of R2 — a total of 756 m of drainage features, 52% of which are currently located on fully cleared lands. None provide direct fish habitat though all convey Site surface water runoff to the east end of R7 while adding allochthonous material. Canopy over the lower end of these features can be anticipated to provide some shading to limit solar heating of the channel waters.

The functionality of site drainage through shaded areas with allochthonous contributions could be replaced with a 3-4 m wide vegetated swale SWM system, situated adjacent to the existing forest to the west (Figure 3b). This swale would be established within with a 15 m wide, treed riparian buffer to be re-established on the site, mostly where no tree cover currently occurs. With a length of ~820 m, a new swale would be ~8% longer than the features being replaced and would include adjacent forest cover along its full length. As such, the new swale would provide improved allochthonous inputs and shading. This new swale is not intended as a naturalized watercourse, but rather would form a green infrastructure component of the Site SWM system. The new swale system could feed through a 3700 m^2 green infrastructure SWM swamp-type detention area providing additional quality control for Site runoff. Water from this system would be outletted to the realigned and naturalized lower R2, then into the east end of R7. This arrangement would replace the *functionality* of all removed channels, as required under the HDFA management recommendations of either Mitigation or Conservation, but would not directly replace the R3 and R4 features themselves as natural channel features per their Conservation recommendations.

Compensation for R3 and R4 could be completed following two different approaches. Firstly, compensatory projects for the features could be planned offsite. Alternatively, the proposed swale feature along the western edge of the property could be enhanced along its lower half and constructed following principles of natural channel design. This would necessitate the retention/restoration of a wider buffer along a portion of the rear of the Site to accommodate a setback of 30 m instead of 15 m (assuming the new channel is created close to the property line). Locating the channel close to the property line would require the agreement of the neighbouring property owners. Channels R3 and R4 have a combined length of only 244 m. The naturized channel would thus not need to extend along the full length of the western property edge. If a future channel here were to be a naturalized watercourse it would not be permitted to flow through any SWM pond features; area SWM ponds would be required to be fully offline.

Under the proposed developments, the lower half of R2 would be realigned to be fully situated within forested area and away from Thunder Road. (i.e. to maintain/establish 30 m of forested setbacks to the channel). All development the Site can be situated ≥ 30 m from the top of bank of R7, which would be full persevered.

Realignment or alteration of these channels can only be completed as per SNCA approval through the detailed design phase.

Reach 8 was not assessed as part of this current study. The proposed Phase 3 development area, however, is located > 30 m from this feature, thus retaining an untouched, natural setback. Further study of that

channel would be required prior to the completion of detailed design plans on adjacent areas on the north end of the Site if such development were proposed within <30 m of the feature.

Wetland Areas

Forested areas to the west of the Site likely contain some wetland areas within 120 m of property line. These lands, however, are now owned by the AOO. We did not complete a formal OWES wetland assessments on their property but assume, that such features could be of sufficient quality to constitute Provincially Significant Wetland. Other than a small, isolated pocket of willow thicket (potentially swamp thicket) off the south end of the site, however, the eastern most edge of the adjacent land (i.e. the portions directly abutting the Site) appear to be forested (i.e. fresh-moist deciduous FOD7, not wetland). The southern portion of site, which has been fully stripped of all vegetation directly to this forested edge, was considered unlikely to have been wetland based on soil core data (Section 4.2). The new forested buffer to be established this along the edge will generate a minimum 15 m of naturalized forest buffer, including a naturalized watercourse and/or vegetated swales adjacent to this boundary. Combined with the ~20 m of forest cover apparent west of the boundary, this renaturalization would provide at least 35 m natural buffer to potential wetland features located further westward (with 15 m along the single pocket of willow thicket).

Water from the existing site drains to the northeast (i.e. away from any wetlands near the western site boundary), where it is conveyed back to the property to the west, and wetland features associated with Bear Brook, via R7. This conveyance route will be maintained by the planned SWM/channel realignments.

Floodplain

While no portion of the site is currently indicated as being within the regulatory floodplain, SNCA has requested floodplain review of the site to be completed separately.

6.2 Vegetation, Trees and Significant Woodland

A 4.1 ha forest area consisting of a mix of young (<30 years old) deciduous forest and coniferous plantation, and 0.8 ha pocket of thicket swamp, will be removed under the proposed development plan for Phase 1. While these wooded areas are part of a Significant Woodland, they are part of small area of regrowth on former farm fields extending out from the main, more-mature forest block to the west. The area to be cleared represents 3% of the broader forested area. The proposed Phase 1 development area re-establishes 15 m of treed cover between the commercial development and mature forest beyond the western property line. As such, impacts anticipated to the Significant Woodland are considered to be minor.

6.3 Species at Risk

Based on our SAR assessment (Appendix D), no protected SAR are considered to have potential to interact with the proposed development directly as individuals (i.e. possibly present at some point during or subsequent to construction) nor does any SAR have protected habitat directly on the Site. Construction on the Site will follow standard best practices to avoid conflicts with area wildlife (Section 7.4), thereby mitigating impacts to possible transient SAR occurrences. Therefore, no negative impacts are anticipated to SAR or SAR habitat.

6.4 Significant Wildlife Habitat

The wooded area to the southwest of the Site supports sufficient numbers and species of anurans in the early spring to be considered SWH. This area will remain untouched by the proposed development and will be buffered by a 15 m wide treed buffer along a naturalized swale to be constructed around the periphery of the Site. The Site itself does not constitute SWH. No negative impacts are anticipated to the ability of the adjacent forest area to support early-breeding frog species. No mid- or late-breeding-season frogs were noted there.

7.0 MITIGATION

7.1 Aquatic Habitat

The realignment of existing headwater channels on the Site can only be completed under a permit to alter a waterway issued by SNC. No alteration of the existing channels will be completed prior the issuance of a permit to alter a waterway; all such works must then be completed in accordance with the conditions of that permit. At minimum, all construction works will require standard erosion and sediment control (ESC) mitigation measures to protect waters in the broader vicinity including:

- a multi-facetted approach to provide erosion and sediment control;
- retention of existing vegetation and stabilization of exposed soils with vegetation where possible;
- limiting the duration of soil exposure and phase construction;
- limiting the size of disturbed areas by minimizing nonessential clearing and grading;
- minimizing the total slope length and the gradient of disturbed areas;
- refueling of machinery should occur >30 m from any watercourse;
- maintaining overland sheet flow and avoid concentrated flows; and
- storing/stockpiling all soil away (e.g. greater than 30 m) from watercourses, drainage features and tops of steep slopes.

7.2 Vegetation / Trees

Existing trees within retained natural areas adjacent to R7 must be maintained. Existing trees along the perimeter buffer will be removed to establish site grading and the swale immediately adjacent to the property line. The swale corridor, however, must be replanted with native trees species consistent with those present in the adjacent FOD7 ecosite. The swale itself is to be seeded with a wetland grass mix to improve natural filtration along the channel length.

To minimize impacts to trees adjacent to the Site, the following general protection measures are recommended as necessary during construction:

- Tree removal on Site should be limited to that which is necessary to accommodate construction.

- To minimize impact to trees adjacent to the Site during construction:
- Erect a fence beyond the critical root zone (CRZ; i.e. 10x the DBH) of trees. The fence should be highly visible (orange construction fence) and paired with erosion and sediment control fencing. Pruning of branches is recommended in areas of potential conflict with construction equipment;
    - Do not place any material or equipment within the CRZ of trees;
    - Do not attach any signs, notices, or posters to any trees;
    - Do not raise or lower the existing grade within the CRZ of trees without approval;
    - Tunnel or bore when digging within the CRZ of a tree;
    - Do not damage the root system, trunk, or branches of any remaining trees; and
    - Ensure that exhaust fumes from all equipment are not directed towards any tree's canopy.

This report does not constitute permission to remove any trees from the Site. Removal of trees can only be undertaken following appropriate consultation with City planning staff.

7.3 Species at Risk

As no SAR habitat exists on the Site and no SAR are anticipated to occur on the Site, no SAR-specific mitigation measures are required beyond standard best practices of ESC (Section 7.1) and general wildlife management (Section 7.4).

7.4 General Wildlife Management

Common wildlife species may occur on Site. The following mitigation measures shall be implemented during construction of the project to generally protect wildlife:

- Areas shall not be cleared during sensitive times of the year for wildlife (i.e. breeding season, which for species potentially occurring on the Site is April 15th to August 15th); unless mitigation measures are implemented and/or the habitat has been inspected by a qualified Biologist within five days of clearing (City of Ottawa, 2015).
- Do not harm, feed, or unnecessarily harass wildlife.
- Manage waste to prevent attracting wildlife to the Site. Effective mitigation measures include litter prevention and keeping all trash secured in wildlife-proof containers and promptly removing it from the Site, especially during warm weather.
- Drive slowly and avoid hitting wildlife.
- Manage stockpiles and equipment on Site to prevent wildlife from being attracted to artificial habitat. Cover and contain any piles of soil, fill, brush, rocks and other loose materials and cap

ends of pipes where necessary to keep wildlife out. Ensure that trailers, bins, boxes, and vacant buildings are secured at the end of each workday to prevent access by wildlife.

- Check the entire work site for wildlife prior to beginning work each day.
- Inspect protective fencing and/or other installed wildlife exclusion measures daily and after each rain event to ensure their integrity and continued function.
- Monitor construction activities to ensure compliance with the project-specific protocol (where applicable) or any other requirements.
- If SAR are encountered on the worksite, immediately stop all work in the vicinity of the observation and contact the MECP.

8.0 SUMMARY AND RECOMMENDATIONS

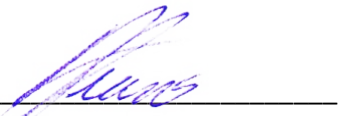
It is our professional opinion that a future site development consistent with the change of land use being proposed for the site could be constructed without imposing significant negative impacts on species-at-risk, SWH, or aquatic habitat present in the broader vicinity under the proposed project if all mitigation recommendations provided within this report are followed. Mitigation measures include standard ESC measures, general wildlife management for construction sites (City of Ottawa, 2015), and tree planting, the latter of which is to be detailed in the site landscape plan. Impacts to the broader Significant Woodland under future development of the Site are anticipated to be minor; the impacted area represents the youngest portion of the extended feature, which includes no uncommon vegetation coverage and does not provide functionality as SWH. Subsequent EIS reviews of each Phase as part of the Site Plan application process for individual buildings will be developed at the time of detailed design.

9.0 CLOSURE

This report was prepared for exclusive use by Avenue 31 Inc. and may be distributed only by or in accordance with the express instructions of Avenue 31 Inc. Questions relating to the data and interpretation can be addressed to the undersigned.

Respectfully submitted,

KILGOUR & ASSOCIATES LTD.



Anthony Francis, PhD
Project Director

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Appendix A – Qualifications of report authors

Anthony Francis, PhD

Dr. Francis is a Senior Ecologist with 20 years' consulting experience to both government agencies and private industry. He has worked on a diversity of projects relating to species at risk, invasive species, terrestrial and aquatic habitat, environmental effects monitoring and mitigation, and fate/effects of contaminants. Within each of these subject areas, Dr. Francis has completed projects addressing specific site concerns and broader policy initiatives.

In the Ottawa area Dr. Francis helps clients work their way through the land development process by producing key supporting studies such Environmental Impact Statements, Integrated Environmental Reviews, and by obtaining various permits and approvals from local regulatory agencies including the conservation authorities and Ministries of Environment and Natural Resources. Dr. Francis is our local in-house geomatics specialist, capable of carrying out detailed and complex analyses of geospatial data of plant and animal distribution. He often utilizes his skills to carry out constraint studies prior to a client purchasing or planning a development for a property.

Appendix B – Preliminary species at risk screening letter sent to the Ministry of Environment, Conservation and Parks

November 11, 2020 **Our File: AVE1118**

Carolyn Hann
Management Biologist
Permissions and Compliance Section
Ontario Ministry of Environment, Conservation and Parks
10-1 Campus Drive
Kemptville, ON
K0G 1J0

Dear Ms. Hann:

Subject: Preliminary species at risk screening for the proposed development of 6150 Thunder Road, Ottawa, Ontario

1.0 INTRODUCTION

This letter provided by Kilgour & Associates Ltd. (KAL) includes information gathered to conduct a preliminary review of species at risk (SAR) for the development of 6150 Thunder Road in the east end of Ottawa as a commercial warehouse facility (Figure 1). This letter uses the resources and guidelines outlined in the draft document, *Client's Guide to Preliminary Screening for Species at Risk* (Ministry of the Environment, Conservation and Parks (MECP), 2019). Following these guidelines, we have obtained available SAR information for the site from all applicable information sources.

Following the preliminary SAR screening presented in this letter, we are seeking advice and guidance related to potential SAR or habitat suitable for SAR that may interact with the proposed development, along with measures that our client should consider to avoid adverse effects on SAR and their habitat. This letter does not include a full assessment of the likelihood of SAR to interact with the proposed development, potential impacts to SAR, or associated mitigation measures. These analyses and recommendations, along with any advice and guidance provided by MECP pertaining to this preliminary SAR screening letter, will be included in a report that KAL will provide to our client.

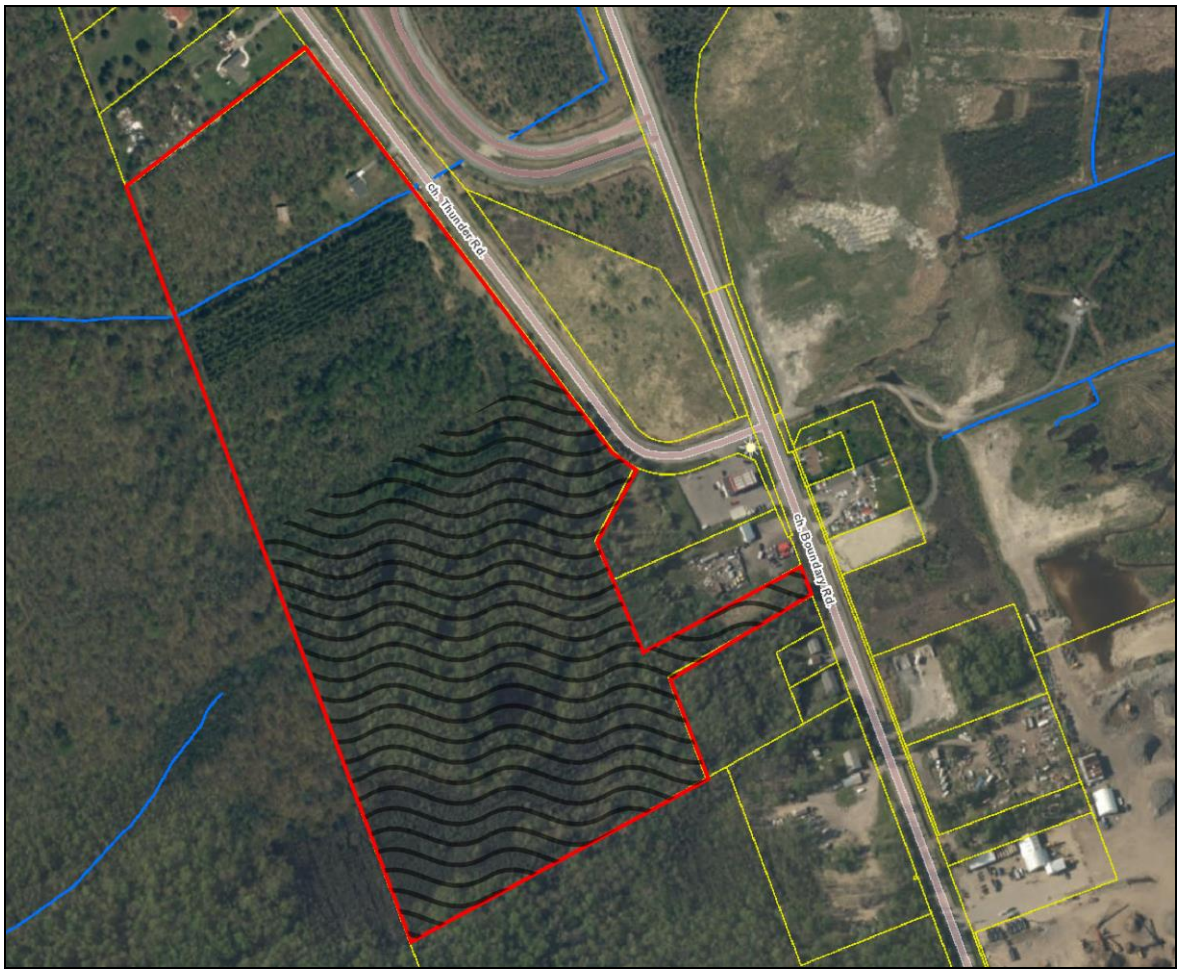


Figure 1 Map of 6150 Thunder Road, Ottawa (project area is marked in red)

Figure Notes: The south half of the site (marked in grey) was cleared and re-graded after the date of the background air photo.

1.1 Site Overview

The proposed work area has been partially cleared but still includes forest and conifer plantation areas adjacent to the watercourse that crosses the north end of the site (Figure 1).

1.2 Project Overview

The proposed work would add warehouse facilities to the north and south ends of the site. Forest cover within 30 m of the north side of the watercourse and within 60 m of the south side of the drain would be retained, leaving a 95 m wide natural corridor (including the width of the drain itself) across the north end of the site.

2.0 SPECIES AT RISK RESOURCES REVIEW AND RESULTS

To perform a preliminary SAR screening for the site, we reviewed the following online resources to determine SAR occurrences on and/or nearby the site.

- Make a Map: Natural Heritage Areas (Ministry of Natural Resources and Forestry (MNRF), 2020) for Natural Heritage Information Centre (NHIC) records;
- Land Information Ontario (LIO; Government of Ontario, 2020);
- Atlas of the Breeding Birds of Ontario (Bird Studies Canada et al., 2009);
- eBird (Cornell Lab of Ornithology, 2020);
- iNaturalist (California Academy of Sciences and National Geographic Society, 2020);
- The Ontario Reptile & Amphibian Atlas (Ontario Nature, 2019); and
- Range maps of species listed by the Committee on the Status of the Endangered Wildlife in Canada (COSEWIC; Government of Canada, 2020).

Thirty-three SAR were identified as having some record of occurrence on or near the site based on our SAR resources review (Table 1). Note that occurrence data in Table 1 from Make a Map: Natural Heritage Areas, LIO, and eBird are occurrences within ~5 km of the site. Occurrences from iNaturalist are within ~2 km of the site. SAR occurrence data from the Atlas of the Breeding Birds of Ontario and the Ontario Reptile & Amphibian Atlas are based on the 10 x 10 km Atlas square that the site falls in (18VR62). In addition to the 33 species for which records of occurrence exist in the vicinity, we also consider two species of bats known to occur in the broader area as having potential to occur in the area based on previous work performed by KAL.

Table 1 Results of our preliminary species at risk screening and the information source associated with occurrence data

Species Name	Information Source
American Ginseng (*Panax quinquefolius*)	COSEWIC
Bank Swallow (*Riparia riparia*)	Atlas of the Breeding Birds of Ontario, COSEWIC
Barn Swallow (*Hirundo rustica*)	Atlas of the Breeding Birds of Ontario, COSEWIC
Blanding's Turtle (*Emydoidea blandingii*)	Ontario Reptile & Amphibian Atlas, COSEWIC
Bobolink (*Dolichonyx oryzivorus*)	NHIC, LIO, Atlas of the Breeding Birds of Ontario, COSEWIC
Butternut (*Juglans cinerea*)	COSEWIC
Canada Warbler (*Cardellina canadensis*)	COSEWIC
Chimney Swift (*Chaetura pelagica*)	Atlas of the Breeding Birds of Ontario, COSEWIC
Common Nighthawk (*Chordeiles minor*)	COSEWIC

Species Name	Information Source
Eastern Meadowlark (*Sturnella magna*)	NHIC, LIO, Atlas of the Breeding Birds of Ontario, COSEWIC
Eastern Musk Turtle (*Sternotherus odoratus*)	COSEWIC
Eastern Whippoorwill (*Antrostomus vociferus*)	COSEWIC
Eastern Wood-pewee (*Contopus virens*)	NHIC, Atlas of the Breeding Birds of Ontario, COSEWIC
Golden-winged Warbler (*Vermivora chrysoptera*)	COSEWIC
Grasshopper Sparrow (*Ammodramus savannarum*)	COSEWIC
Henslow's Sparrow (*Ammodramus henslowii*)	LIO
Gray Fox (*Urocyon cinereoargenteus*)	COSEWIC
Gypsy Cuckoo Bumble Bee (*Bombus bohemicus*)	COSEWIC
Least Bittern (*Ixobrychus exilis*)	Atlas of the Breeding Birds of Ontario, COSEWIC
Little Brown Myotis (*Myotis lucifugus*)	KAL
Loggerhead Shrike (*Lanius ludovicianus*)	LIO
Macropis Cuckoo Bee (*Epeoloides pilosulus*)	COSEWIC
Monarch (*Danaus plexippus*)	COSEWIC
Olive-sided Flycatcher (*Contopus cooperi*)	COSEWIC
Pale-bellied Frost Lichen (*Physconia subpallida*)	COSEWIC
Peregrine Falcon (*Falco peregrinus*)	COSEWIC
Rusty Blackbird (*Euphagus carolinus*)	COSEWIC
Rusty-patched Bumble Bee (*Bombus affinis*)	COSEWIC
Short-eared Owl (*Asio flammeus*)	COSEWIC
Snapping Turtle (*Chelydra serpentina*)	NHIC, LIO, Ontario Reptile & Amphibian Atlas, COSEWIC
Spotted Turtle (*Clemmys guttata*)	COSEWIC
Tricoloured Bat (*Perimyotis subflavus*)	KAL
Western Chorus Frog (*Pseudacris triseriata*)	Ontario Reptile & Amphibian Atlas
Wood Thrush (*Hylocichla mustelina*)	NHIC, OBBA, Ontario Reptile & Amphibian Atlas, COSEWIC
Yellow Rail (*Coturnicops noveboracensis*)	COSEWIC

The local conservation authority (Rideau Valley Conservation Authority) does not have a SAR geodatabase and no additional SAR information was found in their relevant watershed/subwatershed reports. No relevant SAR information for the site was found from local naturalist groups or similar community-based organizations, local indigenous communities, local land trusts, or environmental non-government organizations.

We note that observation records on eBird and iNaturalist are crowd-sourced and rely heavily on data submitted by volunteer citizen scientists that are not necessarily vetted by experts. As such, observation records from eBird and iNaturalist are considered non-

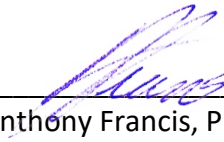
confirmed by KAL, but are included in this preliminary SAR screening per recommendations in MECP's SAR screening guidelines (2019).

3.0 CLOSURE

Thank you for considering this preliminary SAR screening for the proposed development of 6150 Thunder Road, Ottawa. We look forward to any comments you may have. Questions relating to the contents of this letter can be addressed to the undersigned.

Respectfully submitted,

KILGOUR & ASSOCIATES LTD.



Anthony Francis, PhD
Project Lead/Senior Ecologist
E-mail: afrancis@kilgourassociates.com
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Cell: (613) 277-4027
16-2285 St. Laurent Blvd, Ottawa, ON, K1G 4Z6

4.0 REFERENCES

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Appendix C – HDFA

Headwater Drainage Feature Assessment
6150 Thunder Road, Ottawa

April 26, 2021

Submitted To:

Michel Pilon
Avenue31 Capital Inc.

222 Somerset St., Ste. 402,
Ottawa, Ontario,
K2P 2G3

KILGOUR & ASSOCIATES LTD.
www.kilgourassociates.com
Project Number: AVE1118.1

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1.0 INTRODUCTION

This report is a Headwater Drainage Feature Assessment written by Kilgour & Associates Ltd. (KAL) on behalf of Avenue 31 in support of potential future development at 6150 Thunder Road in Ottawa, Ontario (the "Site"). The report provides a detailed description of the headwater drainage features (HDFs) the Site following the field methodologies identified with the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (CVC & TCRA, 2013) (the "HDF Guidelines").

2.0 HEADWATER DRAINAGE FEATURES

2.1 Overview

This study identifies and describes six HDFs (R1 through R6) located on the Site (Figure 1). These features all drain to a permanent water course identified within this report as channel R7. The features were studied during the spring and summer of 2018 as part of a due-diligence review of the site prior to the commencement of planning for the site, though the formal HDFA report was not completed at the time. The site was briefly revisited on October 8, 2020 to note where portions of the Site landcover had been cleared. Landcover descriptions adjacent to reaches have been updated within this report accordingly.

2.2 Assessment Methodology

The Standard level of assessment follows Ontario Stream Assessment Protocol (OSAP) methodologies for descriptions of flow conditions, riparian vegetation and site features that are important components of habitat (headwater sampling protocol OSAP S4.M10), and includes an electrofishing survey to describe fish and fish habitat (OSAP S4.M10). Additionally, an ecological land classification (ELC) was applied to the riparian zone of each channel as a means of documenting community type. Amphibian breeding is assessed following the Marsh Monitoring Protocol (MMP).

2.2.1 Channel Form and Fish

Headwater channels on the Site were investigated three times in 2018 following *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (Toronto and Region Conservation Authority and Credit Valley Conservation, 2014) to document their hydrological and riparian and terrestrial habitat. On April 12, 2018 (i.e. during the spring freshet), KAL biologists Liza Hamilton and Tyler Peat identified and described seven channelized features on the Site (reaches R1 through R7; Figure 2), noting the channel dimensions, substrate, form, and riparian vegetation.

On June 21, 2018, KAL biologists Rob Hallett and Tyler Peat conducted an electrofishing survey of R1, R3, R4, and a portion of R2 north of R4. These channels were deemed at the time to be sufficiently wet to potentially support fish, whereas R2, R5, and R6 were dry at the time of electrofishing surveys and therefore not able to support fish. R7, a permanent stream, was not fished as the project does not propose to alter or build within 30 m of that feature. As a permanently flowing channel connected to larger creeks downstream, R7 is considered to directly support fish regardless.

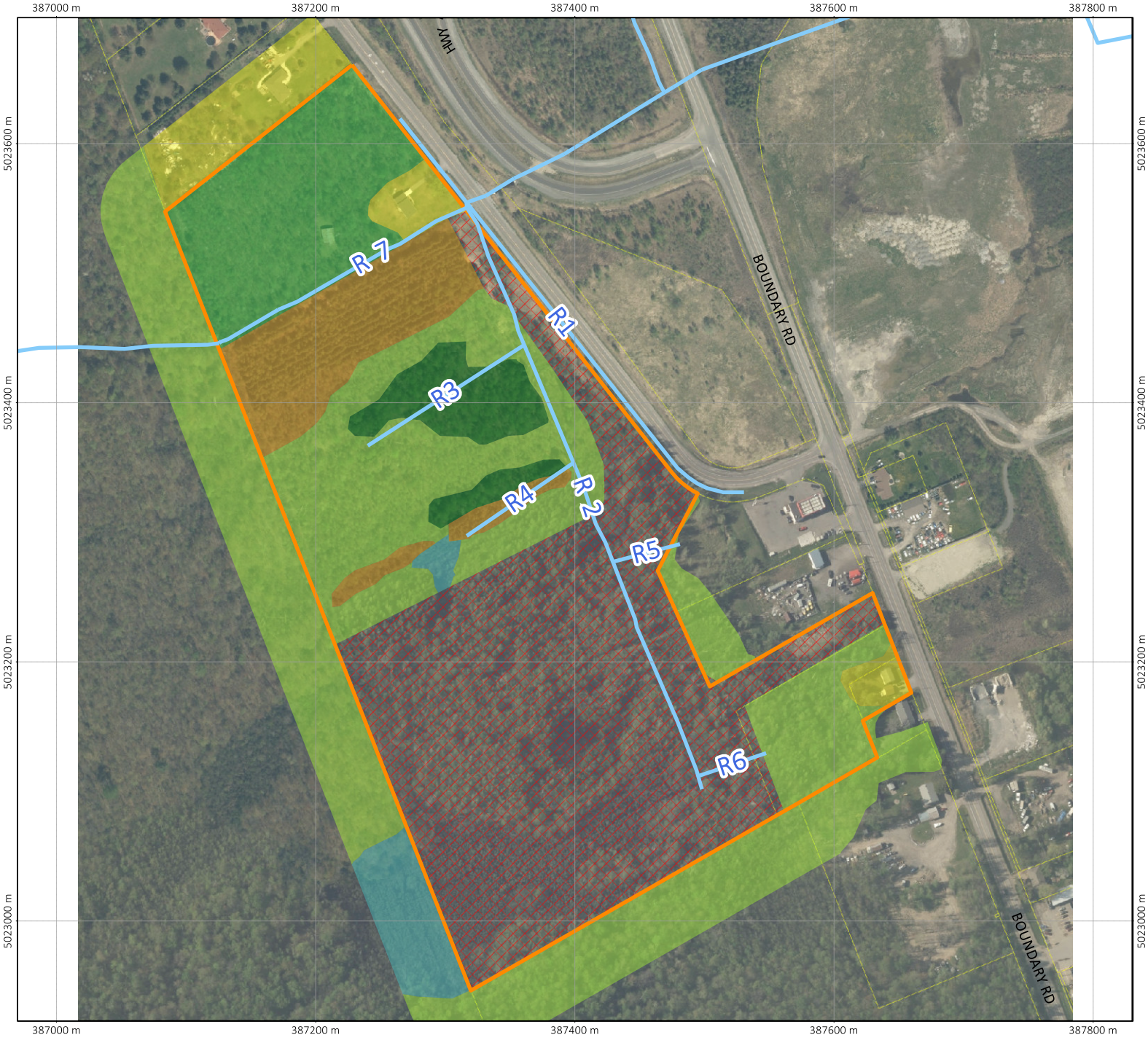


Figure 1 Existing Site conditions

Legend

- Property Boundary

ELC

- Residential
- FOD7
- FOD8-2
- FOMM10-2
- TAGM1
- SWT2
- Cleared

- Surface Water Features

N

0 100 m

Project: AVE1118
Created By: AF
MTM Zone 9
(NAD 83)

KILGOUR & Associates

Several beaver dams were removed from R7 just west of the Site in late June 2018. The affect on Site water levels was observed on July 5, 2018 by KAL biologist Terry Hams while completing bird surveys, with flows R7 noted as being greatly reduced and all other channels having dried.

2.2.2 Vegetation

KAL Biologist, Terry Hams, completed an initial tree inventory and an ecological land classification (ELC) of the Site on June 20, 2018. Vegetation cover on the Site was described following standard ELC methods, including the collection of soil samples (Lee *et al*., 1998).

As the south half of the Site was cleared and partially regraded in 2019, the ELC for the Site and the tree information for the remaining stands were updated by Ed Malindzak (October 15, 2020) and Anthony Francis (on October 18, 2020). The updated tree survey identified the size and species distributions of trees within forested areas of the Site.

2.2.3 Anurans

Site amphibian (anuran) surveys were conducted and lead by KAL biologists, Rob Hallett and Liza Hamilton, following protocols set forth by the Marsh Monitoring Program (Bird Studies Canada *et al.*, 2008). Three surveys are completed to identify early, mid, and, late-season breeding amphibian species generally in April, May, and June, respectfully, though survey dates are temperature dependent. Surveys are completed on nights of calm weather with temperatures above 5 degrees Celsius (°C), 10°C, and 17°C for each of the three respective survey periods. Surveys begin a half-hour after sunset and are finished by midnight with a five-minute recording period at each survey station. Amphibian species are recorded at each point along with the estimated distance from observers, calling code, an estimate of the number of individuals, and estimated directions of calling anurans.

Amphibian surveys were performed on April 23, May 30, and June 21, 2018 (Table 2). Three stations were surveyed in wetland and aquatic habitats (F1 through F3; Figure 2). Station F3 was located at the north end of the Site with the observers facing south. Stations F1 and F2 were the same point located near the southwestern corner of the Site, but with one observer facing south (F1) and one facing north (F2).

Table 1 Summary of frog survey times and weather conditions

Survey Date	Temperature (°C)	Weather conditions	Wind speed (km/hour)
23-Apr-18	10*	Clear	4
30-May-18	21*	Mostly Cloudy	11-14
21-Jun-18	17**	Clear	7 - 10

* Temperatures on these nights were warmer than the preceding nights, with evening temperatures just above 5°C and 10°C, respectively, within a few days of the surveys. Frogs for the period would still be expected to be calling regardless.

** Temperatures on this night just reached the minimum required temperature but had been were warmer the preceding nights, with evening temperatures above 17°C. Frogs for the period would still be expected to be calling regardless.

2.3 General Reach Descriptions

Channel R1 is the roadside ditch along Thunder Road. This feature is unlikely to altered (realigned) in any meaningful way under future development plans. All other channels on site had been (i.e. in 2018) located

within young, early successional wooded areas and coniferous plantation covering former agricultural fields. A single small wetland pocket was observed at the upstream end of the Channel R4. Natural landcover along Channels R6, R5 and most of R2 was completely removed in 2019.

Channel 7, the permanent watercourse crossing the north end of the Site is highly linearized, U-shaped drainage channel, though it does not have status as a municipal or ward drain. All other channels are small, shallow, linear, U-shaped agricultural ditches that ultimately connect to Channel 7.

Channels 3 and 4, and north half of Channel 2 were all wet until mid-summer in 2017, but only so because of the presence of beaver dams along Channel 7, which prevented the site from draining normally. With the dams having been removed, Channels other than 7, can be expected to run dry shortly after the spring freshet. Channels 5, 6 and the upper half of Channel 2 are ephemeral and ran dry very quickly after the freshet, even when beaver dams were present. Small numbers of fish were observed in all areas below Channel 5 in 2017. However, with the beaver dams having been removed, only Channel 7 is considered as a potential fish habitat.

2.4 Component Classifications

The following tables summarize the functions provided by the Site channels.

Table 2. Hydrology Classification, 2018

Drainage Feature	Hydrology Classification					
	Assessment Period	Flow Conditions		Flow Classification	Modifiers	Hydrological Function
		Description	(OSAP Code)			
R1	April 12 June 21 July 5	Standing water Standing water Dry	4	Ephemeral	Road sided ditch. Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	**Contributing Functions**
R2	April 12 June 21 July 5	Standing water Upper channel: Dry Lower channel: standing water Dry	3	Intermittent (lower half) Ephemeral (upper half)	Water remained in lower portion of this reach for a longer period of time than usual due to beaver dams in R7.	**Valued Functions (lower half)** **Contributing Functions (upper half)**
R3	April 12 June 21 July 5	Standing water Standing water Dry	4	Intermittent	Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	**Valued Functions**
R4	April 12 June 21 July 5	Standing water Standing water Dry	4	Intermittent	Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	**Valued Functions**
R5	April 12 June 21 July 5	Standing water Standing Dry Dry	1	Ephemeral		**Contributing Functions**
R6	April 12 June 21 July 5	Standing water Standing Dry Dry	3	Ephemeral		**Contributing Functions**
R7	April 12 June 21 July 5	Surface flow Surface flow Surface flow	1	Perennial	Conducts flows from the east across the Site and on to neighbouring properties to the west. As a permanent perennial feature, this channel is not considered an HDF.	**Important Functions**

Table 3. Riparian Classification (Updated 2020)

Drainage Feature	Riparian Classification			
	OSAP Descriptions	**OSAP Riparian Codes**	**ELC Codes**	**Riparian Conditions**
R1	RUB – Cleared LUB – Road shoulder	RUB – 1 LUB – 1	- -	**Limited Functions**
R2	RUB – Cleared/Forest LUB – Cleared	RUB – 2 LUB – 4	- -	**Limited Functions (Upper half)** **Important Functions (Lower half)**
R3	RUB – Forest LUB – Forest	RUB – 6/2 LUB – 6/2	CUF CUF	**Important Functions**
R4	RUB – Forest LUB – Forest	RUB – 6/2 LUB – 6/2	CUW CUW	**Important Functions**
R5	RUB – Cleared LUB – Cleared	RUB – 6 LUB – 6	- -	**Limited Functions**
R6	RUB - Cleared LUB - Cleared	RUB – 2 LUB – 6	- -	**Limited Functions**
R7	RUB - Forest LUB – Meadow	RUB – 6 LUB – 4/6	CUW FOD	**Important Functions***

RUB – right upstream bank
LUB – left upstream bank
* "Important Function" level is discussed further in Section 3.1

Table 4. Fish and Fish Habitat Classification, June 21, 2018

Drainage Feature	Riparian Classification		
	Fish Observation • **Fishing effort**	**Fish & Fish Habitat Designation***	**Modifiers/Notes**
R1	Incidental fish present, no SAR present. • 630 SS = ~5.3s/m^2	Contributing Functions	20 fish (13 Central Mudminnows, 3 Brassy Minnows, 1 Brook Stickleback, and 3 Northern Redbelly Dace. These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R2	Fish present lower half only, no SAR present. • 721 SS = 2.7 s/m2	Valued Functions (lower half) Contributing Functions (upper half)	155 fish (60 Central Mudminnows, 52 Brook Stickleback, 15 Northern Redbelly Dace, 8 Pumpkinseeds, 1 Fathead Minnow, and 1 Creek Chub). These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Bottom most end may provide some habitat in wet years regardless.
R3	Incidental fish, no SAR present. • 339 SS = 4.8 s/m2	Contributing Functions	130 fish (73 Central Mudminnows, 52 Brook Stickleback, and 3 Fathead Minnows, and 2 Pumpkinseeds). These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R4	Incidental fish, no SAR present. • 327 SS = 2.7 s/m^2	Contributing Functions	32 Brook Stickleback were observed. This species is very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R5	No fish present, no SAR present. • Dry	Contributing Functions	
R6	No fish present, no SAR present. • Dry	Contributing Functions	
R7	Fish assumed present.	Valued Functions	Permanent channel assumed to have fish at all times of the year.

*Fish and Fish Habitat Designation is constrained by the HDF Guidelines definitions. "Modifiers" provides significant caveats to those designations.
SS = shocking seconds

Table 5. Terrestrial Habitat Classification (Updated 2020)

Drainage Feature	Description	Amphibians	Terrestrial Classification
R1	Roadside ditch.	No frogs were observed in the feature.	**Limited Functions**
R2	Lower half includes some portions within plantation forest. Upper half was located within moist forest/plantation (no adjacent wetland evident during sruveys), but surrounding area has now been fully cleared.	No frogs were observed in the feature.	**Contributing Functions (lower half)** **Limited Functions (upper half)**
R3	Flows through plantation forest.	No frogs were observed in the feature.	**Contributing Functions**
R4	Upstream end is a small wetland pocket. Flows through plantation forest very near the clearing edge.	No frogs were observed in the feature.	**Valued Functions**
R5	All surrounding vegetation has been cleared.	No frogs were observed in the feature.	**Limited Functions**
R6	All surrounding vegetation has been cleared.	No frogs were observed in the feature.	**Limited Functions**
R7	Permanent stream within a forested area.	No frogs were observed in the feature.	**Valued Functions**

2.5 Reach Summary

Dimensions of the HDF reaches are summarized in Table 5.

Table 6. Reach Dimensions During Spring Freshet (April 12, 2018)

Drainage Feature	Length (m)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Depth (m)
R1	401 (along the Site edge)	4.0	1.6	0.19
R2	485	3.0	90	0.90
R3	144	2.0	2.0	0.18
R4	100	3.0	3.0	-
R5	54	2.0	1.4	0.26
R6	55	2.5	1.2	0.32
R7	218 (on the Site)	5.1	3.2	-

3.0 MANAGEMENT RECOMMENDATIONS

The classification categories identified in Section 2 provide the basis of the management recommendations provided here. The following flow chart (Figure 2) combines and translates the classification results to management recommendations.

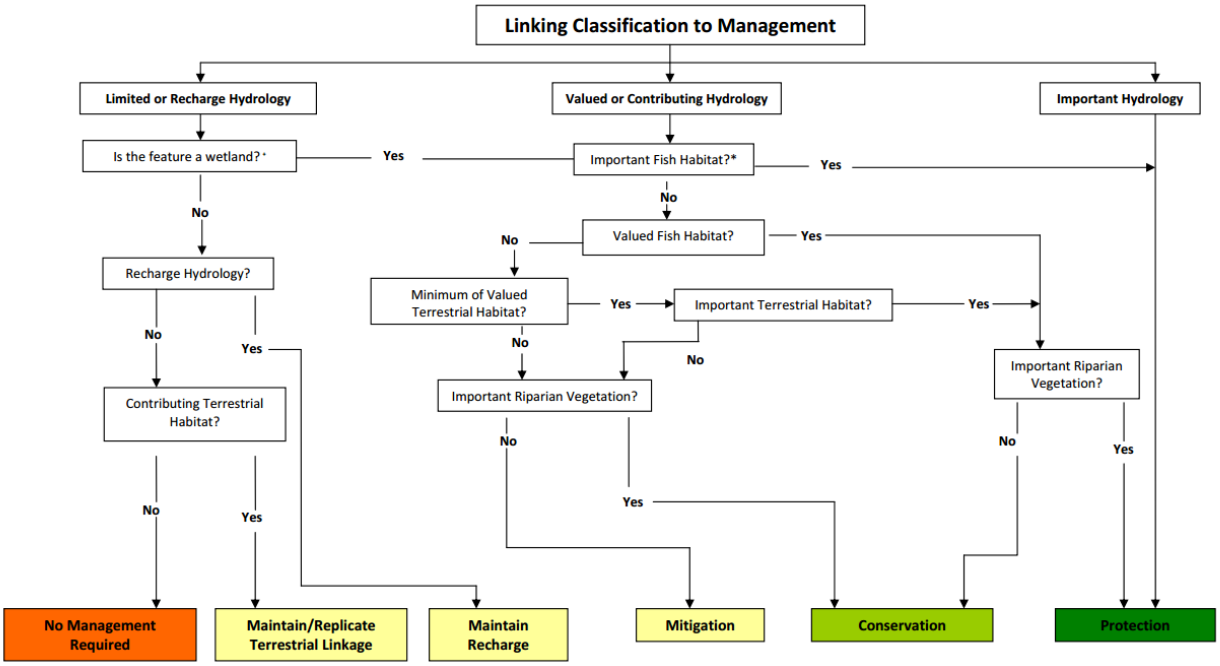


Figure 2. Headwater Drainage Feature Assessment (HDFA) flow chart providing direction on management options

3.1 Management Recommendations for Reaches

Channels R1, R5, R6 and the upper half of R2

These features are fully within the cleared area. They are ephemeral channels that do not provide fish habitat. Following the HDFA Guide flow chart linking component classification to management directives (Figure 2), these reaches:

1. Provide Contributing Hydrology.
2. Do not provide Important Fish Habitat;
3. Do not provide Valued Fish Habitat;
4. Do not provide Valued Terrestrial Habitat;
5. Do not provide Important Riparian Vegetation.

This chain of classification descriptors leads to a management directive of **Mitigation**. These features are not required to be maintained per se, but their functionality must be replicated or enhanced through lot level conveyance measures as part of the site stormwater management system. As the features convey runoff to more ecologically important reaches, replacement features/systems, should be vegetated to mimic online wet vegetation pockets to the extent possible, and should convey water to the same final receiver (i.e. R7), though natural channel design is not required.

Channels R3 and R4

These reaches are small, ephemeral to intermittent drainage features located entirely within a treed area. While some fish were observed when beaver dams backed up water into them, they are not considered valued fish habitat. The HDFA Guide flow chart linking component classification to management directives (Figure 2) progresses as follows:

1. Provides Contributing/Valued Hydrology;
2. Does not provide Important Fish Habitat;
3. Does provide Valued Fish Habitat;
4. Does not provide Valued Terrestrial Habitat; and
4. Provides Important Riparian Vegetation.

This chain of classification descriptors leads to a management directive of **Conservation** for this reach. The feature may be maintained or, if necessary relocated, using natural channel design techniques to maintain or enhance the overall productivity of the reach. If realigned, the features may be relocated on or off the Site. In any case, the riparian corridors must be maintained or enhanced. If catchment drainage will be removed due to diversion of stormwater flows, lost functions should be restored through enhanced lot level controls (e.g. restore original catchment using clean roof drainage).

Channels R2 (lower half)

This reach, with its direct connection to R7 likely retains some water well into summer providing some potential fish habitat for tolerant forage fish. The HDFA Guide flow chart linking component classification to management directives (Figure 2) progresses as follows:

1. Provides Contributing/Valued Hydrology;
2. Does not provide Important Fish Habitat;
3. Provides Valued Fish Habitat;
4. Provides Important Riparian Vegetation.

This chain of classification descriptors would typically lead to a management directive of **Protection** for this reach, based in part on the assessment of “Important Riparian Vegetation”. Under a management directive of **Protection,** the feature should not generally be relocated. For this feature, however, the assessment of “Important Riparian Vegetation” comes from only the west side. The east side of the channel has limited vegetation and is generally located within <30 m of the Thunder Road (it connects with R7 within 3 m of the roadway), thus preventing options for an undisturbed, naturalized buffer on that side. The management recommendation for this feature is thus **Conservation** to allow its relocation.

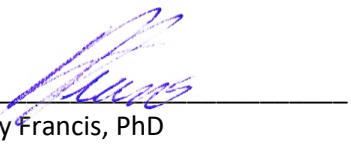
The feature should be realigned westward to allow for an improved, naturalized setback with an enhancement of the riparian corridors. Drainage must still be conveyed to R7 and stormwater management systems on the site must be designed to avoid impacts (i.e. sediment, temperature) to this headwater channel.

Channel R7

This perennial channel conveys off-site flows across the property. As a permanent stream, it does not qualify as headwater feature. As feature with important hydrology, it automatically receives a management directive of **Protection**. As such, this reach may be maintained and/or enhanced, but should not generally be relocated. Improvements, however, could be possible to its overall channel form and thus some minor realignment may be considered within that context. The riparian zone should be protected and enhanced where feasible. The hydro-period must be maintained. Use natural channel design techniques or wetland design to restore and enhance existing habitat features if and where needed. Stormwater management systems must be designed to avoid impacts (i.e. sediment, temperature) to this headwater channel.

4.0 CLOSURE

This report provides detailed descriptions of the HDFs on the Thunder Road site, as well as management recommendations to direct future development near those features. Points of clarification can be addressed to the undersigned.



Anthony Francis, PhD
KILGOUR & ASSOCIATES LTD.

5.0 REFERENCES

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Appendix A: Site Photos

Note: Reach numbers located within the comment lines directly on photos indicate the order in which they were originally photographed and do not necessarily reflect the final assigned reach numbers used throughout this report.

Reach 1

Upstream view

Downstream view

Reach 2

Upstream view

Downstream view

Reach 3

Upstream view

Downstream view

Reach 4

Upstream view

Downstream view

Reach 5

Upstream view

Downstream view

Reach 6

Upstream view

Downstream view

Reach 7

Upstream view

Downstream view

Appendix B: Field Notes

KILGOUR & Associates

Daily Work Plan for Field Work

Client/Project #: SIMP 773

Date: 2018/04/12

Personnel Data: LH, TP

Staff Name	Date of Birth YYYY/MM/DD	Emergency contact and number	Staff hazard review initials@
L. Hamilton	1983/05/02	M. Vegiard 613-993-5683	LH.
T. Peat.	1988/07/19	Miranda Miller 613-985-6611	TP

If there are more than four crew, use a second sheet; *indicates person responsible for check in / check out; @ initial if staff has had the opportunity to review the hazard assessment and mitigations for this project, is aware of risks, and agrees the work can be done safely.

Vehicle (circle those that apply)	Owner	Licence
KAL Truck (Chev Silverado), Grey	Bruce Kilgour	685 7JZ (Ontario)
QUAD	Bruce Kilgour	2CK47 (Ontario)
QUAD Trailer	2317833 Ontario	M7807M (Ontario)
Tracker	2317833 Ontario	C23182ON (Transport Canada)
Tracker Trailer	2317833 Ontario	J3161S (Ontario)
Red Inflatable	2317833 Ontario	C23183ON (Transport Canada)
Inflatable Trailer	Bruce Kilgour	J7553K (Ontario)
White inflatable	Kilgour & Associates Ltd.	unmarked
LIZA'S HONDA FIT	L. HAMILTON.	NE9 H2W

Describe Anticipated Daily Activities Including Location(s), Route(s) and Access Points and approx. schedule

HJFA visit #1 @ 9150 Thunder Rd., Carlsruhe, ON.

Map is attached? Y☒ N☐

Check in / Check out Procedure

KAL Contact Person and cell number:	Charles Hatsy
Hotel Details	N/A
Client Contact Person and cell number:	N/A.
Check in method and frequency:	upon arrival / departure.

Both injured, out of reach of cell phones.

Anticipated Worst Outcome/ Catastrophic Failure (describe):

If CH hasn't heard from us in over 4 hrs, he calls both. If no one answers, he calls 911

Emergency Response Procedure (describe):

FINAL FIELD PACKAGE: P ____ OF ____

Home Base:	Field Location:
Time leaving 8:30	Time arriving 8:50
Time returning 11:15	Time Leaving 11:00

Person	Pre-Field Condition	Post-Field Condition
LIZA	GOOD	GOOD
TYLER	GOOD.	GOOD
Vehicle	**Pre-Field Condition**	**Post-Field Condition**
LIZA'S HONDA FIT	GOOD. Start km: 82125	GOOD. End km: 82155

Calibration										
Unit	Serial No.	Pre / Post	pH			Cond.	Turbidity			DO
			4	7	10	1413	0			100% Sat.
pH pen		Pre								
		Post								
YSI Pro Plus		Pre								
		Post								
HI Turb. Meter		Pre								
		Post								
Lamotte Turb. Meter		Pre								
		Post								
		Pre								
		Post								

Rules of thumb (when to flag your result):

- DO (mg/L): < 5 mg/L, check that YSI is calibrated to 100% saturation, if yes, then use HACH kit to confirm low DO
- pH: If < 6.5 or > 9, check pH meter vs buffer solutions
- If unit cannot calibrate, it must be serviced, so notify Bruce Kilgour

Issues with field equipment

Do not forget to mention all equipment issues to Rob Hallett as soon as possible

Datasheet Log

KILGOUR & Associates

Field Map

Client/Project #: SIMP773

Crew: LH, TP

Date: 2018/04/12

Location: 6150 Thunder Rd.

HDFA Visit #1

Notes

CREW INITIALS:

FINAL FIELD PACKAGE: P___ OF ___

KILGOUR & Associates

General Notes Sheet

Client/Project #: SIMPTT3

Crew: CH, TP

Date: 2018/04/12

Location: 1650 Thunder Rd.

Time (hh:mm)	Map Pin	Easting	Northing	Description/Note
9:30	3			- defined channel
	start	465023	5021492	- frozen over
	end	464905	5021419	- depth 18cm
				- substrate frozen.
				~ 9.0 m approx. wetted & estimated since cent measure.
				- forest on either side of channel
				- Moderate birch forest on (B). Moderate to dense mixed birch and coniferous on (U)
				- 2°C water temp.
				- 2°C air temp.
9:50	4			
	start	465056	5021398	- defined channel
	end	464980	5021348	- frozen over
				- wetted ~ 3m (best guess)
				- coniferous forest on either side (dense)
				- air temp 2°C
				- beaver dam on channel 2 (D) confluence w channel 4.
				- deep
				- very dense forest on either side of length of channel
				- scrubby brush then planted coniferous forest
				- ends in wetland area lots of tree and scrubby brush
				- difficult to see perimeter.

CREW INITIALS:

FINAL FIELD PACKAGE: P ____ OF ____

Headwater Drainage Features - Up- and Down- Stream

Stream Code	Site Code	Zone	Easting	Northing	Date (YYYY)	(MM)	(DD)	Time (24hr)
	1	10N	465007	5621564	2021	06	12	0900

Stream Name: Roadside Ditch

Discharge Approximates Baseflow? ○ Baseflow ⊗ Freshet ○ Spate

Upstream Site Length (m):

Access Route: Thunder Rd.

Site Description: Roadside Ditch along Thunder Rd.

Optional Features

Water Temp (C)	Air Temp (C)	pH	Conductivity (Ns)	Turbidity (NTV)	Dissolved O_2 (ppm)
2	2				

Number of upstream features:

Upstream Roughness:

Photo #	Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport: Adjacent Feature	Sediment Deposition	Width MT	~~Feature~~ Wetted Width (m)	~~BF~~ Wetted Depth (mm)	~~Entrenchment~~ Bankfull Width (m)	Feat. Veg	Riparian Vegetation 0-1.5 m Left	0-1.5 m Right	1.5-10 m Left	1.5-10 m Right	10-30 m Left	10-30 m Right
1			3	2		2		1.57	190	4.0	6	4	4	5	1	7	4
2																	
3																	
4																	

Upstream Longitudinal Gradient

Method Used	Distance (m)	Elevation Rise (cm)

Upstream Flow Measure(s) — Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm) 1	2	3	Hydraulic Head (mm) 1	2	3	Volume (lt) 1	2	3	Distance (m) 1	2	3	Time (sec) 1	2	3

Comments

- C2 tails in ditch (80% cover)
- Substrate is mud, silt, organic matter.
- SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (°): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code	Site Code	Zone	Easting	Northing	Date (YYYY)	(MM)	(DD)	Time (24hr)
	2	19	464999	5021573	2018	04	12	09:15

Stream Name: Ditch #1

Discharge Approximates Baseflow? ○ Baseflow ◉ Freshet ○ Spate

Upstream Site Length (m):

Access Route: Thurber Rd.

Site Description: Ditch running along length of property parallel to Thurber Rd.

Optional Features

Water Temp (C)	Air Temp (C)	pH	Conductivity (Ns)	Turbidity (NTV)	Dissolved O_2 (ppm)
2	2				

Number of upstream features:

Upstream Roughness: **Photo #:** **Photo Name:**

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport: Adjacent	Sediment Transport: Feature	Sediment Deposition	Width MT	Wetted Feature Width (m)	Wetted ~~BF~~ Depth (mm)	Bankfull ~~Entrenchment~~ Width (m)	Feat. Veg	Riparian Vegetation 0-1.5 m Left	0-1.5 m Right	1.5-10 m Left	1.5-10 m Right	10-30 m Left	10-30 m Right
1			1	2			3		0.90	90	3.0	1	4	4	4	4	7	4
2																		
3																		
4																		

Upstream Longitudinal Gradient: Method Used | Distance (m) | Elevation Rise (cm)

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm) 1	2	3	Hydraulic Head (mm) 1	2	3	Volume (lt) 1	2	3	Distance (m) 1	2	3	Time (sec) 1	2	3

Comments

Substrate - muddy, silt
SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (°): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code	Site Code	Zone	Easting	Northing	Date (YYYY)	(MM)	(DD)	Time (24hr)
	5	18	465102	5021327	2018	04	12	10:15

Stream Name: ditch

Discharge Approximates Baseflow? ○ Baseflow ⊗ Freshet ○ Spate

Upstream Site Length (m):

Access Route:
start - 465094 5021327.
end - 465102 5021327

Site Description:
- perpendicular to main ditch
- behind petro-C2.

Optional Features

Water Temp (C)	Air Temp (C)	pH	Conductivity (Ns)	Turbidity (NTV)	Dissolved O_2 (ppm)
2	2				

Number of upstream features:

Upstream Roughness:

Photo #	Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport: Adjacent	Sediment Transport: Feature	Sediment Deposition	Width MT	~~Feature~~ Wetted Width (m)	~~BF~~ Wetted Depth (mm)	~~Entrenchment~~ Bankfull Width (m)	Feat Veg	Riparian Vegetation 0-1.5 m Left	Riparian Vegetation 0-1.5 m Right	Riparian Vegetation 1.5-10 m Left	Riparian Vegetation 1.5-10 m Right	Riparian Vegetation 10-30 m Left	Riparian Vegetation 10-30 m Right
1			1	2			3		1.4	260	2.0M	1	5	5	5	5	5	5
2																		
3																		
4																		

Upstream Longitudinal Gradient

Method Used	Distance (m)	Elevation Rise (cm)

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm) 1	Depth (mm) 2	Depth (mm) 3	Hydraulic Head (mm) 1	Hydraulic Head (mm) 2	Hydraulic Head (mm) 3	Volume (lt) 1	Volume (lt) 2	Volume (lt) 3	Distance (m) 1	Distance (m) 2	Distance (m) 3	Time (sec) 1	Time (sec) 2	Time (sec) 3

Comments

- substrate - mud, sand.
- SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (°): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code	Site Code	Zone	Easting	Northing	Date (YYYY)	(MM)	(DD)	Time (24hr)
	6	18	465135	5021245	2018	04	12	

Stream Name

Discharge Approximates Baseflow? ○ Baseflow ⊗ Freshet ○ Spate

Upstream Site Length (m)

Access Route

Site Description

ditch runs perpendicular to MDN ditch runs along property.

Optional Features

Water Temp (C)	Air Temp (C)	pH	Conductivity (Ns)	Turbidity (NTV)	Dissolved O_2 (ppm)
1	20C	✓	✓	✓	✓

Number of upstream features

Upstream Roughness

Photo #	Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport Adjacent	Sediment Transport Feature	Sediment Deposition	Width MT	~~Wetted~~ Feature Width (m)	~~Wetted~~ ~~Bf~~ Depth (mm)	B-Full Entrenchment Width (m)	Feat Veg	Riparian Vegetation 0-1.5 m Left	0-1.5 m Right	1.5-10 m Left	1.5-10 m Right	10-30 m Left	10-30 m Right
1			1	2			2		1.15	320	2.50	1	5	5	5	5	5	5
2																		
3																		
4																		

Upstream Longitudinal Gradient

Method Used	Distance (m)	Elevation Rise (cm)

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm) 1	Depth (mm) 2	Depth (mm) 3	Hydraulic Head (mm) 1	Hydraulic Head (mm) 2	Hydraulic Head (mm) 3	Volume (lt) 1	Volume (lt) 2	Volume (lt) 3	Distance (m) 1	Distance (m) 2	Distance (m) 3	Time (sec) 1	Time (sec) 2	Time (sec) 3

Comments

substrate - mud, silt, partially frozen still.
SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (°): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code | Site Code: 7 | Zone: 18 | Easting: 469981 | Northing: 5921600 | Date (YYYY): 2018 | (MM): 04 | (DD): 12 | Time (24hr): 1040

Stream Name

Discharge Approximates Baseflow? ○ Baseflow ⊗ Freshet ○ Spate

Upstream Site Length (m)

Access Route

Site Description: Main channel runs perpendicular to Thunder Rd.

Optional Features: Water Temp (C): 2 | Air Temp (C): 2°C | pH: / | Conductivity (Ns): / | Turbidity (NTV): / | Dissolved O_2 (ppm): /

Number of upstream features

Upstream Roughness | Photo # | Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport: Adjacent	Sediment Transport: Feature	Sediment Deposition	Width MT	~~Wetted~~ Feature Width (m)	~~Wetted~~ Bf Depth (mm)	B-Full ~~Entrenchment~~ Width (m)	Feat. Veg	Riparian Vegetation 0-1.5 m Left	0-1.5 m Right	1.5-10 m Left	1.5-10 m Right	10-30 m Left	10-30 m Right	Upstream Longitudinal Gradient: Method Used	Distance (m)	Elevation Rise (cm)
1			1	4			3		3.20	150	5.1	6	5	2	5	2	7	2			
2																					
3																					
4																					

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm) 1	Depth (mm) 2	Depth (mm) 3	Hydraulic Head (mm) 1	Hydraulic Head (mm) 2	Hydraulic Head (mm) 3	Volume (lt) 1	Volume (lt) 2	Volume (lt) 3	Distance (m) 1	Distance (m) 2	Distance (m) 3	Time (sec) 1	Time (sec) 2	Time (sec) 3

Comments

Flow = 0.13 M/S. pockets of sediment > 40cm.
Substrate - Muck
- channel choked in wetland very close to road, thin patchy as you go downstream.

- SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:

Downstream WP# _____ ☐ Sample 2 ☐ Not connected

Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
1.5 - 10 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
10 - 30 m	Left Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)
	Right Bank	☐ None (1)	☐ Lawn (2)	☐ Cropped (3)	☐ Meadow (4)	☐ Scrubland (5)	☐ Wetland (6)	☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ _____ _____ Elevation (cm) : _____ _____ _____ Gradient (°): _____

	Clay (Hard Pan)	Silt	Sand (0.06-2 mm)	Gravel (22-66 mm)	Cobble (67-249 mm)	Boulder (250 mm)	Bedrock
Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐
Sub-Dominant Substrate (S2.M3)	☐	☐	☐	☐	☐	☐	☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	**Wetted Depth (mm)**			**Hydraulic head (mm)**			**Volume (L)**			**Distance (m)**			**Time (s)**		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Feature ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____ _____ _____ _____ _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

KILGOUR & Associates

Daily Work Plan for Field Work

Client/Project #: 773

Date: 2018/06/12

Personnel Data:

Staff Name	Date of Birth YYYY/MM/DD	Emergency contact and number	Staff hazard review initials@
R. HOLLETT	1990/11/25	KATIE 613 851 5951	RH
T. POAT	1985/07/19	MICHELLE 613 436 6611	TP

If there are more than four crew, use a second sheet; *indicates person responsible for check in / check out; @ initial if staff has had the opportunity to review the hazard assessment and mitigations for this project, is aware of risks, and agrees the work can be done safely.

~~Vehicle (circle those that apply)~~	Owner	Licence
KAL Truck (Chev Silverado), Grey	Bruce Kilgour	685 7JZ (Ontario)
QUAD	Bruce Kilgour	2CK47 (Ontario)
QUAD Trailer	2317833 Ontario	M7807M (Ontario)
Tracker	2317833 Ontario	C23182ON (Transport Canada)
Tracker Trailer	2317833 Ontario	J3161S (Ontario)
Red Inflatable	2317833 Ontario	C23183ON (Transport Canada)
Inflatable Trailer	Bruce Kilgour	J7553K (Ontario)
White inflatable	Kilgour & Associates Ltd.	unmarked

Describe Anticipated Daily Activities Including Location(s), Route(s) and Access Points and approx. schedule

complete HOFA Fishing @ Thrasher Road

Map is attached? Y☑ N☐

Check in / Check out Procedure

KAL Contact Person and cell number:	A Francis
Hotel Details	
Client Contact Person and cell number:	
Check in method and frequency:	

Traffic encounter

Anticipated Worst Outcome/ Catastrophic Failure (describe):

911

Emergency Response Procedure (describe):

FINAL FIELD PACKAGE: P ____ OF ____

Home Base: KAC Time leaving 1206 Time returning 1730	**Field Location:** Thunder road Time arriving 1245 Time Leaving 1700

Person	Pre-Field Condition	Post-Field Condition
AM TP C	good	good
Vehicle	**Pre-Field Condition**	**Post-Field Condition**
	Start km:	End km:

Calibration									
Unit	Serial No.	Pre / Post	pH			Cond.	Turbidity			DO
			4	7	10	1413	0			100% Sat.
pH pen		Pre								
		Post								
YSI Pro Plus	unit 2	Pre	4.00	7.03	—	1410	—			—
		Post	4.03	7.00	—	1396	—			—
HI Turb. Meter		Pre								
		Post								
Lamotte Turb. Meter		Pre								
		Post								
		Pre								
		Post								

Rules of thumb (when to flag your result):

- DO (mg/L): < 5 mg/L, check that YSI is calibrated to 100% saturation, if yes, then use HACH kit to confirm low DO
- pH: If < 6.5 or > 9, check pH meter vs buffer solutions
- If unit cannot calibrate, it must be serviced, so notify Bruce Kilgour

Issues with field equipment

Do not forget to mention all equipment issues to Rob Hallett as soon as possible

none

Datasheet Log

DWP, map, fish x 4, notes

KILGOUR & Associates

Field Map

Client/Project #: SIMP773

Crew: ~~[illegible]~~

Date: 2018/06/21

Location: 6150 Thunder Rd.

HDFA Visit #1

Notes

New notes are in red.

CREW INITIALS:

FINAL FIELD PACKAGE: P___ OF ___

KILGOUR & Associates

Fish Collection Record

Client/Project #:

Date: 2018/06/21 Start Time: ~~—~~

Location: Thurcler Road	**Stream type:** Ditch	**Crew:** RH TP
(UTM NAD 83): 18	**Reach Classification:** unk	**Task:** I/DFA
Watercourse: unk	**Temperature:** 26.0°C	**Gear type:** E-
Reach/Station: Reach 1	**Conductivity:** 365 2 uS/cm	**Seconds/ Set + Pull Time:** 630
W-Depth: 0.45m	**pH:** 6.49	**Length fished:** 260m
W-Width: 3.0m	**DO:** 1.65mg/L / 20.8%	

Fishing Details/Other Comments:

START : 465078 5021483

END : 465032 5021542 Fish were barely being shocked. no major issues

Species	Number	Total	Notes/Stage + Health Observations
CNMD	⊠ ::	13	
BRMN	::	3	
BRST	•	1	
NRDC	::	3	

FINAL FIELD PACKAGE: P ____ OF ____

KILGOUR & Associates

Fish Collection Record

Client/Project #:

Date: 2018/06/21 Start Time:

Location: Thunder Road	**Stream type:** Perm.	**Crew:** RA
(UTM NAD 83): 18	**Reach Classification:** Unk	**Task:** TD
Watercourse: Unk	**Temperature:** 22.5°C	**Gear type:**
Reach/Station: 2A.	**Conductivity:** 4036	**Seconds/ Set + Pull Time:** 721
W-Depth: ~~3.5m~~ 0.40m	**pH:** 7.61.	**Length fished:**
W-Width: 3.5m	**DO:** 51.9% 4.4 mg/L	

Fishing Details/Other Comments:
Start: 465001 5021575
End: 465028 5011494
very high spCond, not much fish response.
Catch was netted not shocked

Species	Number	Total	Notes/Stage + Health Observations
CNMN	☒ ☒ ☒ ☒ ☒ ☒	60	
BRST	☒ ☒ ☒ ☒ ☒ ..	52	
NRDC	☒ ÷	15	
PMSD	☐	8	
FTMN	•	1.	
CRCH	•	1	

FINAL FIELD PACKAGE: P ____ OF ____

KILGOUR & Associates

Fish Collection Record

Client/Project #:

Date: 2016/06 / Start Time:

Location: Thunder Road	**Stream type:** perm.	**Crew:**
(UTM NAD 83): 18	**Reach Classification:** cnk	**Task:** HOFA
Watercourse: cnk	**Temperature:** 25°C	**Gear type:** /
Reach/Station: Reach 3	**Conductivity:** 3083	**Seconds/ Set + Pull Time:** 338.7
W-Depth: 30cm	**pH:** 7.62	**Length fished:** 70m
W-Width: 1m	**DO:** <8% 4.75mg/L	

Fishing Details/Other Comments:

START 465028 5021496

END 464977 5021475

Species	Number	Total	Notes/Stage + Health Observations
CHMP	⊠⊠⊠⊠⊠⊠⊠ ∴	73	
BRST	⊠⊠⊠⊠ ⊠ ∴	52	
FTHN	∴	3	
PNSD	∴	2	

FINAL FIELD PACKAGE: P ____ OF ____

KILGOUR & Associates

Fish Collection Record

Client/Project #:

Date: 2018/06/21 Start Time:

Location: Thunder Road	**Stream type:** Perm.	**Crew:** RH - TD
(UTM NAD 83): 18	**Reach Classification:** —	**Task:** HDFA
Watercourse: onK	**Temperature:** 17.8	**Gear type:** Back Pack
Reach/Station: Reach 4	**Conductivity:** 123.9	**Seconds/ Set + Pull Time:** 327
W-Depth: 40-45cm	**pH:** 6.98	**Length fished:** 66m
W-Width: 3m	**DO:** 13.6% 1.28mg/L	

Fishing Details/Other Comments:

START 465065 5021389

END 465039 5021373

Species	Number	Total	Notes/Stage + Health Observations
BRST	⊠ ⊠ ∴	23	

FINAL FIELD PACKAGE: P ____ OF ____

Appendix D – Regional SAR Screening

Species Name (*Taxonomic Name*)	Status under Ontario *Endangered Species Act* (ESA)	Status under federal *Species at Risk Act* (SARA) - Schedule 1	Habitat Description	Ottawa Regional Occurrence (*Observation records in the vicinity*)	Potential to Occur in the Project Area (Yes / No)	Probability of Interaction with the Project (None, Low, Moderate, High)
Birds						
Bald Eagle (*Haliaeetus leucocephalus*)	**Special Concern**	**No Status**	Nest in mature forests near open water. In large trees such as Pine and Poplar.	Confirmed nest at Shirley's Bay since 2012.	No	None. No suitable nesting or feeding areas and no observations of the species on or near subject site.
Bank Swallow (*Riparia riparia*)	**Threatened**	**Threatened**	Colonial nester; burrows in eroding silt or sand banks, sand pit walls, and human-made settings, which are often found on banks of rivers and lakes.	12 confirmed, 2 probable and 8 possible nests in recent OBBA. *(OBBA)*	No	None. No suitable nesting or feeding areas and no observations of the species on or near subject site. OBBA observations are only within 10 km.
Barn Swallow (*Hirundo rustica*)	**Threatened**	**Threatened**	Nests on barns and other structures; forages in open areas for flying insects. Live in close association with humans and prefer to nest in structures such as open barns, under bridges, and in culverts.	33 confirmed, 2 probable and 3 possible nests during recent OBBA. (*OBBA*)	No	None. No suitable nesting areas and no observations of the species on or near subject site. OBBA observations are only within 10 km.
Black Tern (*Chlidonias niger*)	**Special Concern**	**No Status**	Build floating nests in loose colonies in shallow marshes, especially cattails.	Four confirmed nests in recent OBBA.	No	None. No suitable nesting or feeding areas on subject site and no observations of the species near by.
Bobolink (*Dolichonyx oryzivorus*)	**Threatened**	**Threatened**	Live in tall grass prairie and other open meadows. With major clearing of prairies, Bobolink are moving to hayfields. Build nests on the ground in dense grasses.	Widespread; confirmed or probable nests found in 39 out of 40 local atlas squares during recent OBBA. (*LIO, OBBA, NHIC*)	No	None. No suitable nesting or feeding areas and no observations of the species on subject site.
Canada Warbler (*Cardellina canadensis*)	**Special Concern**	**Threatened**	Prefers wet forests with dense shrub layers. Nests located on or near the ground on mossy logs or roots, along stream banks or on hummocks.	One confirmed nest, two probable and six possible reported in recent OBBA. No critical habitat identified.	No	None. Suitable habitat is present but there are no observations of the species on or near subject site.
Cerulean Warbler (*Setophaga cerulea*)	**Threatened**	**Endangered**	Prefers mature deciduous forests with an open under storey.	Unlikely but within range (found on Gatineau side)	No	None. No suitable habitat and outside of known range.
Chimney Swift (*Chaetura pelagica*)	**Threatened**	**Threatened**	Nests in traditional-style open brick chimneys (and rarely in hollow trees). Tend to stay close to water	Confirmed nests in 3 squares, 2 probable and 11 possible reported in recent OBBA. No critical habitat identified. (*OBBA*)	No	None. No suitable nesting areas on subject site.
Common Nighthawk (*Chordeiles minor*)	**Special Concern**	**Threatened**	Nests in wide variety of open sites, including beaches, fields and gravel rooftops with little to no ground vegetation. They also nest in cultivated fields, orchards, urban parks, mine tailings and along gravel roads/railways but tend to occupy more natural sites.	Six probable and five possible nests reported in recent OBBA. No critical habitat identified.	No	None. Habitat suitability is limited and no individuals have been observed in the immediate vicinity.
Eastern Meadowlark (*Sturnella magna*)	**Threatened**	**Threatened**	Typically nest in tall grasslands (pastures/hayfields) but also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open	22 confirmed, 11 probable and 3 possible nests during recent OBBA. (*LIO, NHIC, OBBA*)	No	None. Habitat potential in cleared areas is limited and there are no observations of the species on the subject site.

			areas. Often use trees, shrubs, or fence posts to elevate song perches.			
Eastern Whip-poor-will (*Antrostomus vociferus*)	**Threatened**	**Threatened**	Nests on the ground in open deciduous or mixed woodlands with little underbrush.	Seven squares with probable nests and 10 with possible nests reported in recent OBBA. Critical habitat tentatively identified in 4 squares in western Ottawa.	No	None. Dense, young, scrubby forest cover provides low habitat suitability and the species is not identified as present in the vicinity.
Eastern Wood-pewee (*Contopus virens*)	**Special Concern**	**Special Concern**	Woodland species, often found in the mid-canopy layer near clearings and edges of deciduous and mixed forests.	4 possible, 15 probable and 19 confirmed nests in recent OBBA. (*NHIC, OBBA*)	Yes	Low. Presence is possible, but the young forest cover of the subject site provides low habitat suitability. The species was noted off site in more mature forest areas to the west, which provide greater habitat suitability.
Golden Eagle (*Aquila chrysaetos*)	**Endangered**	**No Status**	Nest in remote, undisturbed areas, usually building their nests on ledges on a steep cliff/riverbank or large trees if needed. Most hunting is done near open areas such as large bogs or tundra.	Migrant only; no reported nests.	No	None. Not identified in the vicinity.
Golden-winged Warbler (*Vermivora chrysoptera*)	**Special Concern**	**Threatened**	Ground nesting in areas of young shrubs surrounded by mature forest. Often areas that have recently been disturbed such as field edges, hydro or utility right-of-ways, or logged areas.	One confirmed nest, one probable nest reported during recent OBBA. Critical habitat identified in Québec (adjacent to northwestern Ottawa).	No	None. Not identified in the vicinity.
Grasshopper Sparrow (*Ammodramus savannarum*)	**Special Concern**	**Special Concern**	Lives in open grassland areas with well-drained sandy soil. Will also nest in hayfields and pastures, as well as alvars, prairies and occasionally grain crops such as barley. It prefers areas that are sparsely vegetated and its nests are well hidden in the field, woven from grasses in a small cup-like shape.	4 confirmed, 5 probable and 2 possible nests in recent OBBA.	No	None. No suitable nesting or feeding areas on subject site.
Evening Grosbeak (*Coccothraustes vespertinus*)	**Special Concern**	**Special Concern**	Nest in trees or large shrubs; prefer mature coniferous forests but will also use deciduous forests, parklands and orchards.	Five confirmed nests, six probable and eight possible during recent OBBA (mostly in west).	No	Low. Forest habitat of the site is not the preferred habitat and the replacement of the cottage with a house would not alter the overall suitability of the site regardless.
Henslow's Sparrow (*Ammodramus henslowii*)	**Endangered**	**Endangered**	Tends to avoid fields that have been grazed or are crowded with trees and shrubbs. Prefers extensive, dense, tall grasslands where it can more easily conceal its small ground nest.	No nests reported during recent OBBA. (*LIO*)	No	None. No suitable habitat and not identified in the vicinity.
Horned Grebe (*Podiceps auritus)*	**Special Concern**	**No Status**	Nest in small ponds, marshes and shallow bays that contain areas of open water and emergent vegetation.	Migrant only; no reported nests.	No	None. No suitable habitat and not identified in the vicinity.
Least Bittern (*Ixobrychus exilis*)	**Threatened**	**Threatened**	Found in a variety of wetland habitats, but strongly prefers cattail marshes with a mix of open pools and channels.	Confirmed nesting in 1 square, 3 probable and 4 possible reported during recent OBBA. (*OBBA*)	No	None. No suitable nesting or feeding areas on subject site.

Loggerhead Shrike (*Lanius ludovicianus*)	**Endangered**	**Endangered**	The Loggerhead prefers pasture or other grasslands with scattered low trees and shrubs. Lives in fields or alvars (areas of exposed bedrock) with short grass, which makes it easier to spot prey.	One possible nest reported in recent OBBA. Critical habitat identified in Montague Township. (*LIO*)	No	None. No suitable habitat and not identified in the vicinity.
Olive-sided Flycatcher (*Contopus cooperi*)	**Special Concern**	**Threatened**	Found along natural forest edges and openings. Will use forests that have been logged or burned, if there are ample tall snags and trees to use for foraging perches.	One probable and one possible nest reported in recent OBBA. No critical habitat identified.	No	None. Habitat is suitable, though not optimal, but the species has not been observed in the vicinity.
Peregrine Falcon (*Falco peregrinus*)	**Special Concern (as of January 2013)**	**Special Concern**	Nest on tall, steep cliff ledges close to large bodies of water. Urban peregrines raise their young on ledges of tall buildings, even in busy downtown areas.	One confirmed nest (101 Lyon) in recent OBBA. Second nest (875 Heron) established in 2011.	No	None. No suitable nesting or feeding areas on subject site.
Red Knot (*Calidris canutus rufa*)	**Endangered**	**Endangered**	Prefer open beaches, mudflats, and coastal lagoons, where they feast on molluscs, crustaceans, and other invertebrates.	Migrant only; Ottawa River shores, area lagoons, etc.	No	None. No suitable nesting or feeding areas on subject site.
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	**Special Concern**	**Threatened**	Lives in open woodland and woodland edges, and is often found in parks, golf courses, and cemeteries. These areas typically have many dead trees, which the birds use for nesting and perching.	One confirmed nest, one probable and two possible during recent OBBA.	No	None. Habitat has only limited suitability and the species has not been observed in the vicinity.
Rusty Blackbird (*Euphagus carolinus*)	**Special Concern**	**Special Concern**	Prefers wet wooded or shrubby areas (nests at edges of boreal wetlands and coniferous forests). These areas include bogs, marshes and beaver ponds.	No nests reported during recent OBBA. Primarily occurs during migration.	No	None. Habitat is suitable but the species has not been observed in the vicinity.
Short-eared Owl (*Asio flammeus*)	**Special Concern**	**Special Concern**	Lives in open areas such as grasslands, marshes and tundra where it nests on the ground and hunts for small mammals.	One confirmed nest, two probable and two possible nests reported during recent OBBA.	No	None. No suitable nesting or feeding areas on subject site.
Wood Thrush (*Hylocichla mustelina*)	**Special Concern**	**Threatened**	Lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing and perches. Usually build nests in sugar maple or American beech.	5 possible, 15 probable and 16 confirmed nests in recent OBBA. (*NHIC, OBBA*)	Yes	Low. Presence is possible, but the young forest cover of the subject site provides low habitat suitability. The species was noted off site in more mature forest areas, which provide greater habitat suitability.
Fish						
American Eel (*Anguilla rostrata*)	**Endangered**	**No Status**	Primarily nocturnal, hiding in soft substrate or submerged vegetation during the day.	Ottawa, Mississippi, Carp (including Poole Creek), South Nation and Rideau Rivers (including Rideau Canal)	No	None. No suitable habitat.
Bridle Shiner (*Notropis bifrenatus*)	**Special Concern**	**Special Concern**	Prefers clear water with abundant vegetation over silty or sandy substrate.	Rideau River	No	None. No suitable habitat.
Channel Darter (*Percina copelandi*)	**Special Concern**	**Threatened**	Prefers clean streams and lakes with moderate current over sandy or rocky substrate.	Ottawa River	No	None. No suitable habitat.
Lake Sturgeon (*Acipenser fulvescens*)	**Endangered**	**No Status**	Only found in large lakes and rivers. Forages in cool water, 4-9 m deep over soft substrate; spawns in shallower, fast-flowing areas over rocks or gravel.	Ottawa River	No	None. No suitable habitat.

Northern Brook Lamprey (*Ichthyomyzon fossor*)	**Special Concern**	**Special Concern**	Non-parasitic species; prefers shallow areas with warm water. Larvae live in burrows in soft substrate for up to 7 years.	Ottawa River	No	None. No suitable habitat.
Northern Sunfish (*Lepomis peltastes*)	**Special Concern**	**No Status**	Lives in shallow vegetated areas of quiet, slow flowing rivers and streams, as well as warm lakes and ponds, with sandy banks or rocky bottoms.	Ottawa River	No	None. No suitable habitat.
River Redhorse (*Moxostoma carinatum*)	**Special Concern**	**Special Concern**	Prefers fast-flowing, clear rivers over rocky substrate.	Ottawa and Mississippi Rivers; unconfirmed reports from Rideau River	No	None. No suitable habitat.
Silver Lamprey (*Ichthyomyzon unicuspis*)	**Special Concern**	**Special Concern**	Require clear water for they can find fish hosts, relatively clean stream beds of sand and organic debris for larvae to live in, and unrestricted migration routes for spawning. Larvae live 4-7 years in burrows (prefer soft substrates); filter-feed on plankton.	Ottawa River and mouths of tributaries from Rideau Canal east (downstream)	No	None. No suitable habitat.
Molluscs						
Hickorynut (*Obovaria olivaria*)	**Endangered**	**Endangered**	Live on sandy beds in large, wide, deep rivers. Usually more than two or three metres deep. Larval host believed to be Lake Sturgeon.	Ottawa River	No	None. No suitable habitat.
Mammals						
Algonquin Wolf (*Canis sp.*)	**Threatened**	**Special Concern**	Not restricted to any specific habitat type but typically occurs in deciduous and mixed forest landscapes.	Occasional reports	No	None. Presence is unlikely.
Eastern Cougar (*Puma concolor*)	**Endangered**	**No Status**	Live in large, undisturbed forests or other natural areas where there is little human activity	Occasional reports	No	None. No suitable habitat.
Eastern Small-footed Myotis (*Myotis leibii*)	**Endangered**	**No Status**	In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. Overwinters in caves and abandoned mines.	Historical record in downtown Ottawa	No	None. No suitable habitat and the species is not known to occur in the vicinity.
Gray Fox (*Urocyon cinereoargenteus*)	**Threatened**	**Threatened**	Live in deciduous forests and marshes. Their dens are usually found in dense shrubs close to a water source but they will also use rocky areas, hollow trees, and underground burrows dug by other animals.	Recent reports to south and west of Ottawa (2016 COSEWIC status report).	No	None. Habitat is suitable but the species is not known to occur in the vicinity.
Little Brown Myotis (*Myotis lucifugus*)	**Endangered**	**Endangered**	During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. They can squeeze through very tiny spaces (as small as six millimetres across) allowing them access to many different roosting areas.	Various sites in central and western parts of City; no critical habitat (hibernacula) identified in Ottawa to date.	No	None. Young forest areas provide only marginal habitat suitability and the species is not generally known to occur in the east end of Ottawa.
Northern Myotis / Northern Long-eared Bat (*Myotis septentrionalis*)	**Endangered**	**Endangered**	Associated with boreal forests, choosing to roost under loose bark and in the cavities of trees.	Historical record in downtown Ottawa, more recent sites to east (Orleans, Clarence-Rockland); no critical habitat (hibernacula) identified in Ottawa to date.	No	None. No suitable habitat. Coniferous trees within the plantation areas are too small and healthy to replicate boreal forest conditions or provide suitable nesting snags.

Tri-coloured Bat / Eastern Pipistrelle (*Perimyotis subflavus*)	**Endangered**	**Endangered**	Roosts mainly in trees during summer; overwinters in caves and mines along with other species, but often uses deeper parts of the hibernaculum.	Unknown; historical records from sites in urban Ottawa, Lanark County. No critical habitat (hibernacula) identified in Ottawa to date.	Yes	Low. Young forest areas with few large snags provide limited habitat suitability. Transient presence on the Site is possible if roosting in mature forest to the west, but the Site is not considered to provide important habitat.
Amphbians						
Western Chorus Frog (*Pseudacris triseriata*)	**No Status**	**Threatened**	Inhabits forest openings around woodland ponds but can also be found in or near damp meadows, marshes, bottomland swamps and temporary ponds in open country, or even urban areas.	Scattered throughout, with numerous sites in western half of City. Critical habitat identified in several atlas squares in western Ottawa. (*Ontario Nature*)	No	None. No individuals observed during frog surveys.
Reptiles						
Blanding's Turtle (*Emydoidea blandingii*)	**Threatened**	**Threatened**	Quiet lakes, streams and wetlands with abundant emergent vegetation; also frequently occurs in adjacent upland forests.	Scattered throughout, with numerous sites in western half of City. Critical habitat present in Ottawa. (*Ontario Nature*)	No	None. Limited suitable aquatic channels (most are too small and dry (R7 lacks an organic substrate) and no observations of the species on or near subject site. Ontario Nature observations are within 10 km.
Eastern Musk Turtle / Stinkpot (*Sternotherus odoratus*)	**Special Concern**	**Special Concern**	Found in ponds, lakes, marshes, and rivers that are generally slow-moving have abundant emergent vegetation and muddy bottoms that they burrow into for winter hibernation.	Scattered	No	None. No suitable habitat.
Eastern Ribbonsnake (*Thamnophis sauritus*)	**Special Concern**	**Special Concern**	Found in marshy edges of wetlands and watercourses. Livebearer (does not lay eggs).	Few reported; mostly from northwestern Ottawa	No	None. No suitable habitat.
Milksnake (*Lampropeltis triangulum*)	**No Status**	**Special Concern**	Found in variety of open, scrubby or edge habitats, including pastures.	Scattered throughout the northern half of the City	No	Not applicable as this species is not protected on private lands.
Northern Map Turtle (*Graptemys geographica*)	**Special Concern**	**Special Concern**	Lives in rivers and lakeshores where it basks on emergent rocks and fallen trees throughout the spring and summer. In winter, they hibernate on the bottom of deep, slow-moving sections of river.	Ottawa River, Rideau River (Burritt's Rapids area), South Nation River (LIO, NHIC, Ontario Nature)	No	None. No suitable habitat.
Snapping Turtle (*Chelydra serpentina*)	**Special Concern**	**Special Concern**	Spend most of their lives in the water. Prefer shallow waters so they can hide under the soft mud and leaf litter with only their noses exposed to the surface to breathe.	Widespread and abundant *(LIO, NHIC, Ontario Nature)*	No	None. No suitable habitat.
Spiny Softshell (*Apalone spinifera*)	**Endangered**	**Threatened**	Found primarily in rivers and lakes but also in creeks, ditches and ponds near rivers. Habitat requirements are open sand or gravel nesting areas, shallow muddy or sandy areas to bury in, deep pools for hibernation, areas for basking, and suitable habitat for crayfish and other food species.	Few historical records along Ottawa River, outside of Ottawa. No critical habitat identified in Ottawa.	No	None. No suitable habitat.
Spotted Turtle (*Clemmys guttata*)	**Endangered**	**Endangered**	Semi-aquatic and prefers ponds, marshes, bogs, and even ditches with slow-moving, unpolluted water and an abundant supply of aquatic vegetation.	Few reported (locations confidential). Critical habitat present in Ottawa	No	None. No suitable habitat.

Wood Turtle (Glyptemys insculpta)	**Endangered**	**Threatened**	The wood turtle prefers clear rivers, streams, or creeks with a slight current and sandy or gravelly bottom. Wooded areas are essential habitat for the Wood Turtle, but they are found in other habitats, such as wet meadows, swamps, and fields.	Few historical records in NHIC, NESS7 (may have been extirpated locally). No regulated habitat identified in Ottawa. Critical habitat may be present to northwest.	No	None. No suitable habitat.
Plants						
American Chestnut (*Castanea dentata*)	**Endangered**	**Endangered**	Typical habitat is upland deciduous forests on sandy acidic soils, occuring with red oak, black cherry, sugar maple and beech.	One population reported along Dolman Ridge Road (federal property); may have been extirpated.	No	None. Does not occur in the vicinity.
American Ginseng (*Panax quinquefolius*)	**Endangered**	**Endangered**	Grows in rich, moist, but well-drained, and relatively mature, deciduous woods dominated by Sugar Maple, White Ash, and American Basswood.	Various (locations confidential) Critical habitat broadly identified in Ottawa area.	No	None. No suitable habitat.
Butternut (*Juglans cinerea*)	**Endangered**	**Endangered**	Commonly found in riparian habitats, but is also found on rich, moist, well-drained loams, and well-drained gravels, especially those of limestone origin.	Widespread	No	None. While the area may generally be suitable, no individuals were observed on or adjacent to the site.
Eastern Prairie Fringed-orchid (Platanthera leucophaea)	**Endangered**	**Endangered**	Populations are found in three main habitat types: fens (peat-forming wetlands fed by groundwater), tallgrass prairie, and moist old fields	Richmond Fen (2 locations)	No	None. No suitable habitat.
Lichens						
Flooded Jellyskin (*Leptogium rivulare*)	**No Status**	**Threatened**	It grows in seasonally flooded habitats, typically on the bark of deciduoud trees and rocks along the margins of seasonal ponds and on rocks along shorelines and stream/riverbeds.	Stony Swamp, Marlborough Forest	No	None. No suitable habitat.
Pale-bellied Frost Lichen (*Physconia subpallida*)	**Endangered**	**Endangered**	Typically grows on the bark of hardwood trees such as White ash, Black walnut, and American elm. Could also be found growing on fence posts and boulders.	Historical records in downtown area (extirpated locally). No critical or regulated habitat identified in Ottawa.	No	None. No longer known to occur in Ottawa.
Insects						
Bogbean Buckmoth (Hemileuca sp. 1)	**Endangered**	**Endangered**	Restricted to open, chalky, low shrub fens containing large amounts of bogbean, an emergent wetland flowering plant.	Richmond Fen (2 locations)	No	None. No suitable habitat.
Gypsy Cuckoo Bumble Bee (*Bombus bohemicus*)	**Endangered**	**Endangered**	Live in diverse habitats including open meadows, mixed farmlands, urban areas, boreal forest and montane meadows. Host nests occur in abandoned underground rodent burrows and rotten logs.	Historic occurrences only; no known recent occurrences.	No	None. No suitable habitat.
Monarch butterfly (*Danaus plexippus*)	**Special Concern**	**Special Concern**	Milkweeds are the sole food plant for Monarch caterpillars. These plants predominantly grow in open and periodically disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests.	Widespread	No	None. No suitable habitat.
Mottled Duskywing (*Erynnis martialis*)	**Endangered**	**No Status**	Requires host plants such as the New Jersey Tea and the Prairie Redroot. These plants grow in dry,	Constance Bay area, Burnt Lands Alvar	No	None. No suitable habitat.

			well-drained soils or alvar habitat within oak woodland, pine woodland, roadsides, riverbanks, shady hillsides and tall grass prairies.			
Nine-spotted Lady Beetle (*Coccinella novemnotata*)	**Endangered**	**No Status**	Occur within agricultural areas, suburban gardens, parks, coniferous forests, deciduous forests, prairie grasslands, meadows, riparian areas and isolated natural areas.	Unknown – historically present, but COSSARO reports no Ontario records since mid-1990s	No	Low. Habitat is suitable, presence is possible, but as a habitat generalist, no portion of the Site provides necessary habitat.
Rapids Clubtail (*Gomphus quadricolor*)	**Endangered**	**Endangered**	Inhabit a wide variety of riverine habitats ranging in size from the St. Lawrence River to small creeks Larvae are typically found in microhabitats with slow to moderate flow and fine sand or silt substrates where they burrow into the stream bed. Adults disperse from the river after emerging and feed in the forest canopy and other riparian vegetation.	None known. No regulated habitat identified in Ottawa.	No	None. No suitable habitat.
Rusty-patched Bumble Bee (*Bombus affinis*)	**Endangered**	**Endangered**	Can be found in open habitat such as mixed farmland, urban settings, savannah, open woods, and sand dunes.	Historic records only from scattered sites in Ottawa and Gatineau.	No	None. No suitable habitat.
Transverse Lady Beetle (*Coccinella transversoguttata*)	**Endangered**	**Special Concern**	Able to live in a wide range of habitats, including agricultural areas, suburban gardens, parks, coniferous forests, deciduous forests, prairie grasslands, meadows and riparian areas.	Unknown – historically present, but COSSARO reports no southern Ontario records since 1985.	No	None. Not identified in the vicinity.
West Virginia White butterfly (*Pieris virginiensis*)	**Special Concern**	**No Status**	Lives in moist, deciduous woodlots. Requires a supply of toothwort, a small, spring-blooming plant that is a member of the mustard family, since if it the only food source for larvae.	Unknown; no records in NESS or NHIC	No	None. Not identified in the vicinity.
Yellow-banded Bumble Bee (*Bombus terricola*)	**Special Concern**	**Special Concern**	Forage and habitat generalist, able to use a variety of nectaring plants and environmental conditions.	Sporadic sightings submitted throughout	No	None. No suitable habitat.

Appendix E – Geotech Report

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Geotechnical Investigation

Proposed Warehouse Development
Boundary Road at Thunder Road
Ottawa, Ontario

Prepared For

Exit96Developments

August 18, 2020

Report PG5161-1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Exit96Developments to conduct a geotechnical investigation for the proposed warehouse development to be located at Boundary Road and Thunder Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the investigation were to:

- ❏ Determine the subsoil and groundwater conditions at this site by means of boreholes.

- ❏ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

Based on the preliminary plans, it is understood that the proposed development will consist of a series of single-storey warehouse buildings at the south western portion of the site. A gas station is proposed at the eastern portion of the site.

The proposed buildings will be of slab-on-grade construction. Parking areas, loading docks and associated driveways connecting to both Thunder Road and Boundary Road are expected. Truck traffic will be a large component of the vehicle loading on the pavement structure.

3.0 Method of Investigation

3.1 Field Investigation

Field Programs

Prior to undertaking this new assignment, existing geotechnical information was available from a previous environmental investigation carried out by Paterson for the subject site on December 19, 2018. At that time, a total of 3 boreholes were drilled to a maximum depth of 4.2 m to assess the subsurface soil conditions. The test hole locations are shown on the enclosed drawing PG5161-1 - Test Hole Location Plan.

The current investigation was carried out on June 30 and July 2, 2020. At that time a total of 7 boreholes were drilled to a maximum depth of 19.6 m to assess the subsurface soil conditions. The test hole locations are shown on the enclosed drawing PG5161-1 - Test Hole Location Plan.

The boreholes were completed with a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The borehole procedure consisted of augering, or advancing a casing by rotary drilling, to the required depths at the selected locations, and sampling and testing the overburden soils.

Sampling and In Situ Testing

Soil samples were recovered using a split-spoon sampler or from the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are shown as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of each of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) at 2 borehole locations. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Boreholes of the previous investigation were outfitted with 51 mm water monitoring well. Flexible standpipe piezometers were installed in all other boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. The groundwater observations are discussed in subsection 4.3 and noted on the Soil Profile and Test Data sheets presented in Appendix 1.

Sample Storage

All samples from the supplemental geotechnical investigation will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are directed otherwise.

3.2 Field Survey

The test hole locations were selected by Paterson personnel in a manner to provide general coverage of the proposed development, taking into consideration site features.

The borehole locations and ground surface elevations completed for our previous environmental investigation were surveyed by Annis, O'Sullivan, Vollebekk Ltd. The current investigation borehole locations and ground surface elevations were surveyed by Paterson personnel and reference a geodetic datum (NAD83). Both are presented on Drawing PG5161-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. A total of 6 samples were submitted to Atterberg Limits testing and sieves and/or hydrometer analysis was completed on 2 representative samples.

All samples will be stored in the laboratory for a period of one month after issuance of this report. The samples will then be discarded unless otherwise directed.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is undeveloped and trees have been recently cleared on the south portion of the site. The north western portion of the site consists of a mature treed area. The site is bordered by Thunder Road to the northeast, residential dwellings and wooden area to the northwest, Boundary Road and commercial properties to the east, and treed land to the south and west. The existing ground surface is relatively flat and range across from an elevations of approximately 76 to 78 m. Excavated drainage ditches were also encountered at the subject site. Wet ground and surface water was encountered along the south and southwestern property borders.

4.2 Subsurface Profile

Overburden

The subsurface profile encountered at the test hole locations generally consists of topsoil and/or organic material extending to approximate depths of 100 to 250 mm below the existing ground surface. A brown silty sand, trace clay was generally encountered underlying the topsoil, extending to depths of 0.7 to 1.3 m below ground surface. A firm, brown to grey silty clay deposit with sand seams was observed underlying the silty sand to sand layer. Practical refusal to the DCPT was encountered at a depth of 16 to 21 m. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in this area consists of shale of the Carlsbad formation with an overburden drift thickness of 25 to 35 m.

4.3 Groundwater

Groundwater levels were measured in the piezometers at the boreholes BH 1-20 through BH 7-20, as well as in the monitoring wells from the previous investigation (BH 1 and BH 2) on January July 22, 2020. The measured groundwater level (GWL) readings are presented in Table 1 below. Based on our field observations, experience with the local area, moisture levels and the colouring of the recovered samples, it is expected that the groundwater level is between 0.5 to 2 m below the existing grade. It should be noted that groundwater levels are subject to seasonal fluctuations and therefore groundwater levels could differ at the time of construction.

Table 1 - Summary of Groundwater Levels

Borehole Number	Ground Surface Elev. (m)	Measured Groundwater Level		Recording Date
		Depth (m)	Elevation (m)	
BH 1-20	76.32	5.87	70.45	July 22, 2020
BH 2-20	76.62	0.70	75.92	July 22, 2020
BH 3-20	76.90	0.98	75.92	July 22, 2020
BH 4-20	76.46	3.12	73.34	July 22, 2020
BH 5-20	77.03	2.23	74.80	July 22, 2020
BH 6-20	76.93	3.09	73.84	July 22, 2020
BH 7-20	76.90	1.15	75.75	July 22, 2020
BH 1	77.10	1.49	75.61	July 22, 2020
BH 2	76.82	0.92	75.90	July 22, 2020

Note: Ground surface elevations at the test hole locations were recorded by Paterson Personnel and are referenced to a geodetic datum.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered satisfactory for the proposed warehouse development. It is expected that the proposed buildings can be supported on conventional shallow footings.

Due to the presence of the deep silty clay deposit, a permissible grade raise restriction will be applied for the subject site.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and fill, containing deleterious (debris and unusable fill) or organic materials, should be stripped from under any building, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the proposed building should be in accordance with the recommendations provided in Subsection 5.6 - Slab-on-Grade below. These materials should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern, in accordance with the permissible grade raise recommendations provided in Subsection 5.4. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

5.3 Foundation Design

Bearing Resistance Values

Pad footings, up to 3 m wide, and strip footings, up to 2 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at SLS of **90 kPa** and a factored bearing resistance value at ULS of **150 kPa.**

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in-situ or not, have been removed, prior to the placement of concrete for footings.

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in-situ soil of the same or higher capacity as the bearing medium soil.

Settlement

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when buildings are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

5.4 Permissible Grade Raise Recommendations

Permissible grade raise recommendations have been determined for the proposed development based on the consolidation testing results of samples of the silty clay obtained during the geotechnical investigation. Based on our findings, a permissible grade raise of **0.9 m** is recommended for the site.

For design purposes, the total and differential settlements associated with the combination of grade raises and slab loading conditions are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

To reduce potential long term liabilities, consideration should be given to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the structures, etc).

5.5 Design for Earthquakes

A seismic site response **Class D** should be used for design of the proposed buildings at the subject site according to the OBC 2012. The soils underlying the site are not susceptible to liquefaction.

5.6 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the existing fill subgrade approved by the geotechnical consultant at the time of excavation will be considered an acceptable subgrade surface on which to commence backfilling for slab-on-grade construction. A vibratory drum roller should complete several passes over the subgrade surface as a proof-rolling program. Any poor performing areas should be removed and reinstated with an engineered fill, such as Granular B Type II.

It is recommended that the upper 200 mm of sub-floor fill consist of OPSS Granular A crushed stone. All backfill materials required to raise grade within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.7 Pavement Structure

Minimum Pavement Structure Recommendations

Car only parking areas, heavy truck parking areas and access lanes are anticipated at this site. The proposed pavement structures are presented in Tables 5 and 6.

Table 2 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete
150	BASE - OPSS Granular A Crushed Stone
300	SUBBASE - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 3 - Recommended Pavement Structure
Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course - HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course - HL-8 or Superpave 19.0 Asphaltic Concrete
150	BASE - OPSS Granular A Crushed Stone
450	SUBBASE - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

Due to the soft nature of the subgrade, it is recommended to placed a layer of non-woven geotextile such as Terrafix 270R or equivalent on the finished subgrade followed by a biaxial geogrid, such as Terrafix TBX2000, under heavy traffic areas.

Pavement Structure Drainage

The pavement structure performance is dependent on the moisture condition at the contact zone between the subgrade material and granular base. Failure to provide adequate drainage under conditions of heavy wheel loading could result in the subgrade fines pumped into the stone subbase voids, thereby reducing the load bearing capacity.

Due to the impervious nature of the subgrade materials consideration should be provided to installing subdrains during the pavement construction. The subdrains should extend in four orthogonal directions and longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be provided for the proposed building. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage layer connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter foundations of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover should be provided for adequate frost protection for heated structures.

Exterior unheated foundations, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations at the site should be cut back at acceptable slopes from the start of the excavation until the structure is backfilled. It is expected that sufficient room will be available for the excavation to be undertaken by open-cut methods.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. It's expected that during the initial excavation program, once the initial influx of groundwater is addressed, the steady state condition for water infiltration will permit excavation side slopes to remain at 1H:1V.

The subsurface soil is considered to be mainly Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not remain open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 95% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the site materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material standard Proctor maximum dry density.

For areas where rigid insulation will be used to provide frost protection. It is recommended that the rigid insulation be placed at the pipe obvert to allow for the maximum amount of granular cover over the pipe. Having the insulation at the obvert will provide a more effective insulation detail.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site mostly consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderate to very aggressive corrosive environment.

6.8 Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. A shrinkage limit test and sieve analysis testing was also completed on selected soil samples. The shrinkage limit testing indicates a shrinkage limit of 14% with a shrinkage ratio of 1.92. The results of our atterberg limit and sieve testing are presented in Appendix 1.

Based on the results of our testing, the silty clay on site is a low to medium plasticity silty clay (Plasticity index < 40%). **In accordance with the city of Ottawa guidelines, the tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided all the following conditions are met:**

- ❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- A small tree must be provided with a minimum of 25 m3 of available soil volume while a medium tree must be provided with a minimum of 30 m3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect. The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- Grading surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❑ Review the final grading plan from a geotechnical perspective.
- ❑ Review of LWF recommendations and design along with the confirmation of its installation.
- ❑ Observation of all pile installations and review of dynamic monitoring results.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

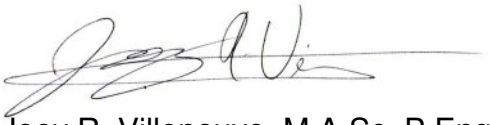
The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test hole locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Exit96Developments or their agents is not authorized without review by Paterson for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.



August 18, 2020

Joey R. Villeneuve, M.A.Sc. P.Eng.

David J. Gilbert, P.Eng.

Report Distribution

- ❑ Exit96Developments
- ❑ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS TESTING RESULTS

SIEVE/HYDROMETER ANALYSIS RESULT

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

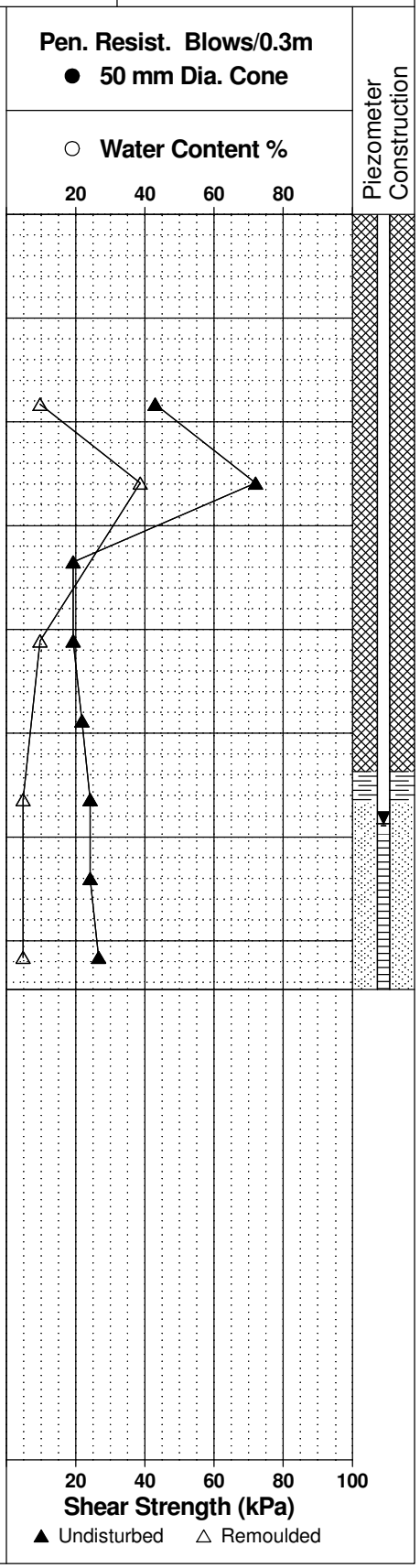
FILE NO. PG5161

REMARKS

HOLE NO. BH 1-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.32
TOPSOIL 0.25		AU	1				
Brown **SILTY SAND** 0.38		SS	2	83	3	1	75.32
Firm, brown **SILTY SAND**						2	74.32
- soft to firm and grey by 3.0m depth						3	73.32
						4	72.32
						5	71.32
						6	70.32
7.47						7	69.32
End of Borehole							
(GWL @ 5.87m - July 22, 2020)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

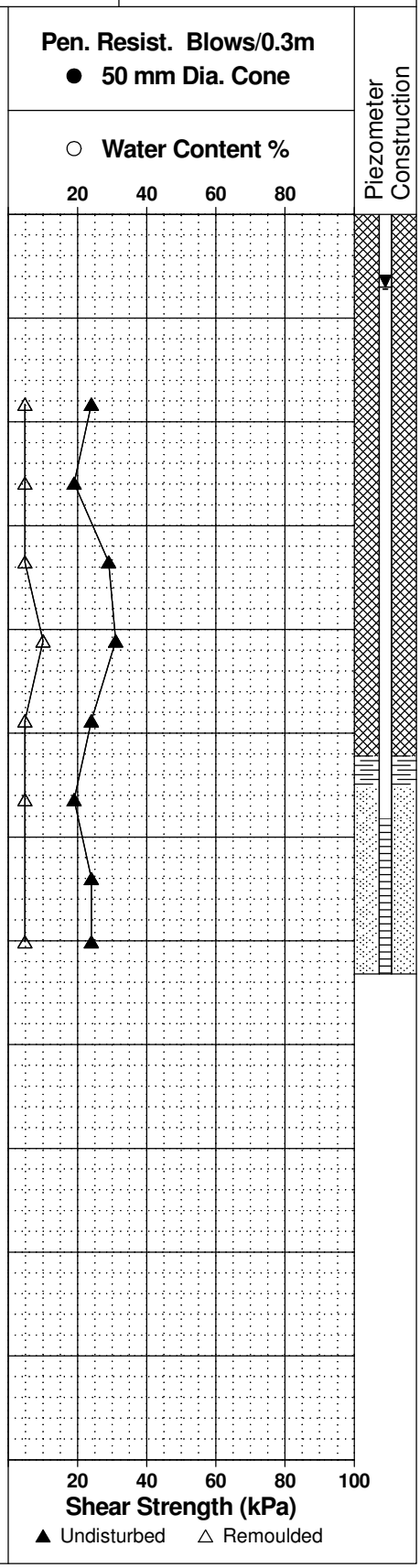
FILE NO. PG5161

REMARKS

HOLE NO. BH 2-20

BORINGS BY Track-Mount Power Auger **DATE** July 1, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.62
Very loose, brown **SILTY SAND,** some organics		AU	1				
0.56							
Brown **SILTY SAND** with sand seams		SS	2	79	3	1	75.62
1.52						2	74.62
						3	73.62
Firm to soft, grey **SILTY CLAY**						4	72.62
						5	71.62
						6	70.62
7.32						7	69.62
Dynamic Cone Penetration Test commenced at 7.32m depth. Cone pushed to 19.5m depth.						8	68.62
						9	67.62
						10	66.62
						11	65.62
						12	64.62



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

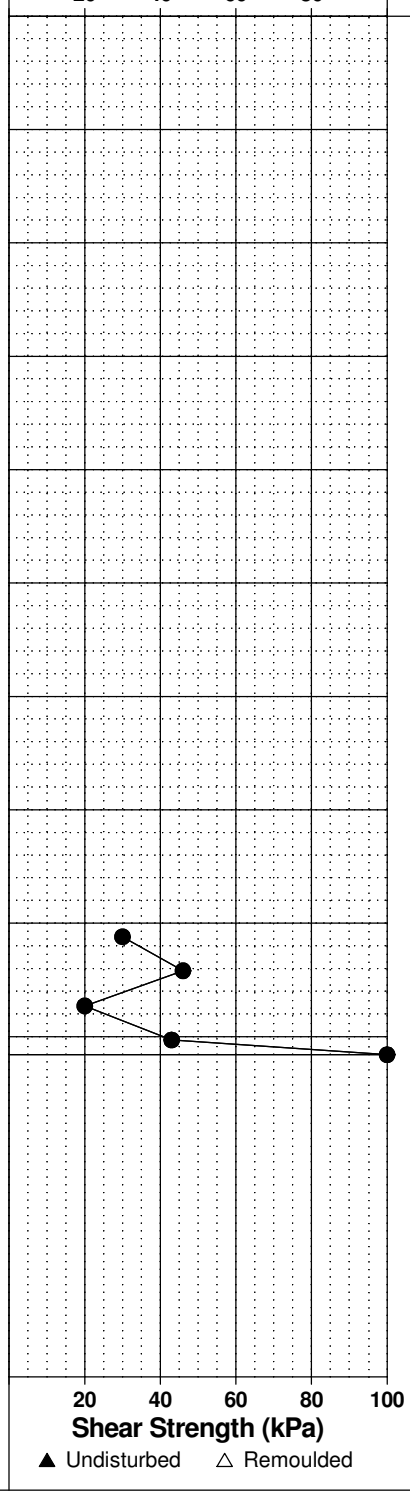
FILE NO. PG5161

REMARKS

HOLE NO. BH 2-20

BORINGS BY Track-Mount Power Auger **DATE** July 1, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						12	64.62		
						13	63.62		
						14	62.62		
						15	61.62		
						16	60.62		
						17	59.62		
						18	58.62		
						19	57.62		
						20	56.62		
21.16						21	55.62		
End of Borehole									
Practical DCPT refusal at 21.16m depth									
(GWL @ 0.70m - July 22, 2020)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

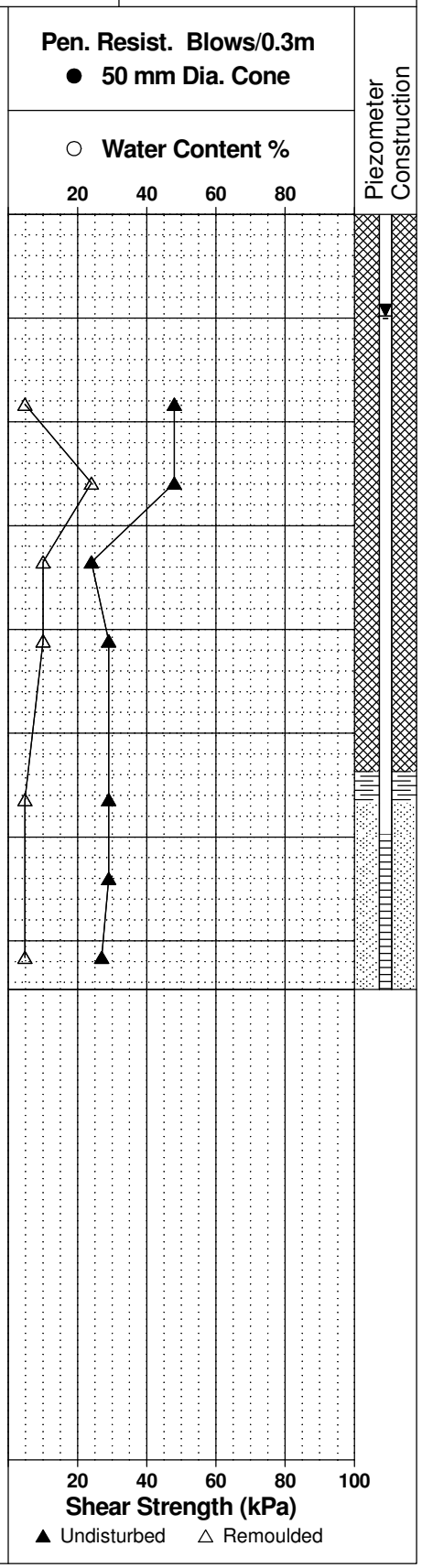
FILE NO. PG5161

REMARKS

HOLE NO. BH 3-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.90
Loose, brown **SILTY SAND,** some organics, trace clay		AU	1				
		SS	2	58	8	1	75.90
1.27							
Firm, brow **SILTY CLAY**						2	74.90
- grey by 3.0m depth						3	73.90
						4	72.90
		SS	3	100	1	5	71.90
						6	70.90
						7	69.90
7.47							
End of Borehole							
(GWL @ 0.98m - July 22, 2020)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

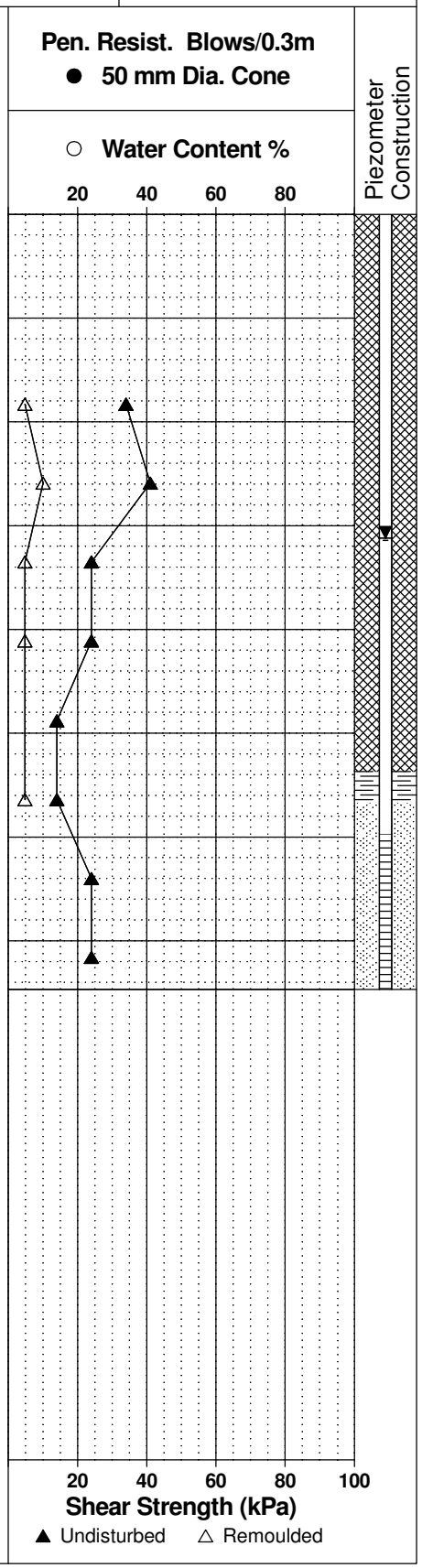
FILE NO. PG5161

REMARKS

HOLE NO. BH 4-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.46
TOPSOIL 0.08		AU	1				
Very loose, brown **SILTY SAND,** trace organics 0.60		SS	2	46	2	1	75.46
						2	74.46
Firm, brown **SILTY CLAY**						3	73.46
- soft and grey by 3.0m depth						4	72.46
						5	71.46
						6	70.46
7.47						7	69.46
End of Borehole							
(GWL @ 3.12m - July 22, 2020)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

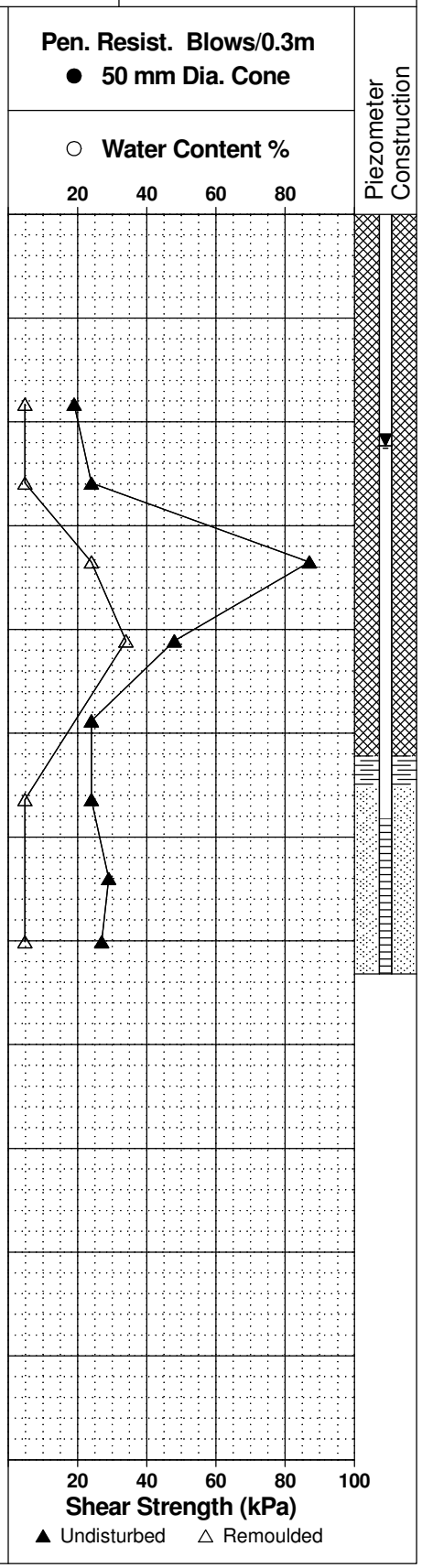
FILE NO. PG5161

REMARKS

HOLE NO. BH 5-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	77.03
TOPSOIL 0.10		AU	1				
Loose, brown **SILTY SAND,** trace organics		SS	2	42	4	1	76.03
1.30							
Firm, brown **SILTY CLAY** 1.52						2	75.03
						3	74.03
						4	73.03
Soft to firm, grey **SILTY CLAY,** trace sand seams						5	72.03
						6	71.03
7.32						7	70.03
Dynamic Cone Penetration Test commenced at 7.32m depth. Cone pushed to 15.2m depth.						8	69.03
						9	68.03
						10	67.03
						11	66.03
						12	65.03



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

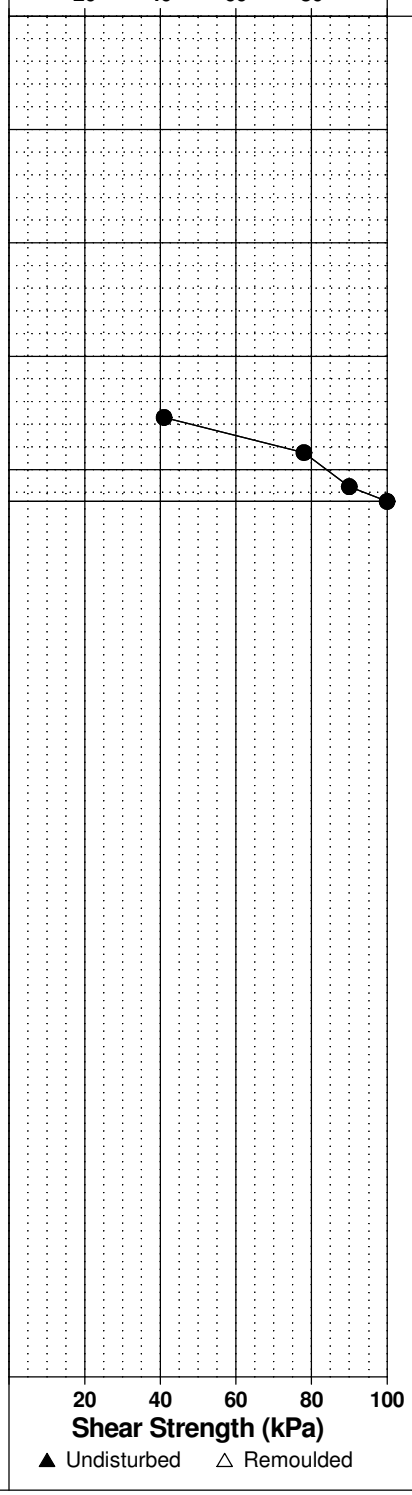
FILE NO. PG5161

REMARKS

HOLE NO. BH 5-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
						12	65.03		
						13	64.03		
						14	63.03		
						15	62.03		
						16	61.03		
16.28									
End of Borehole Practical DCPT refusal at 16.28m depth (GWL @ 2.23m - July 22, 2020)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

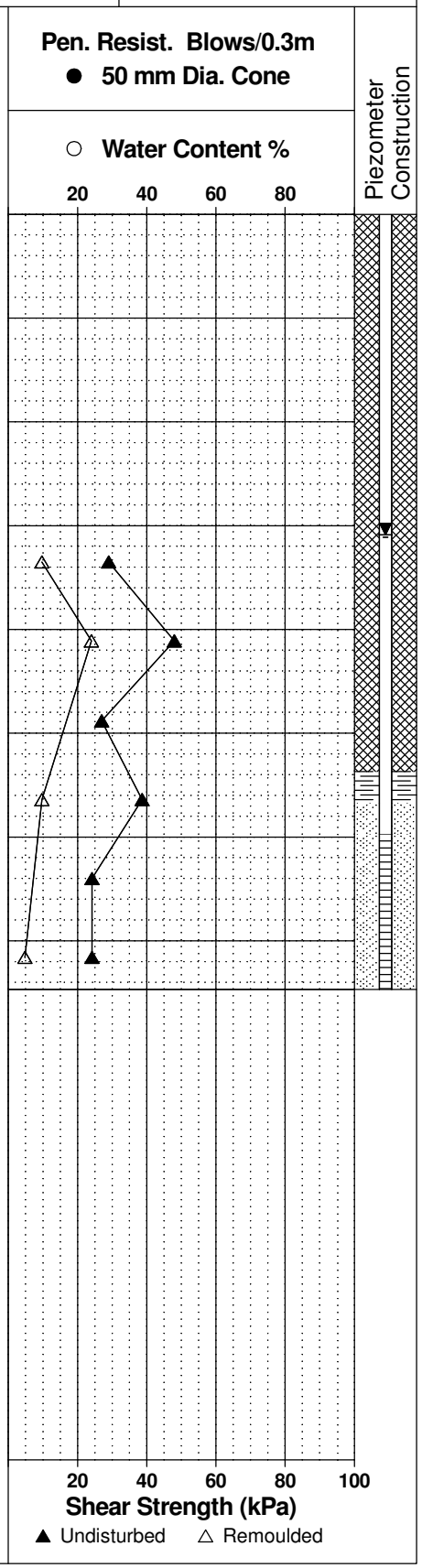
FILE NO. PG5161

REMARKS

HOLE NO. BH 6-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.93
Compact, brown **SILTY SAND**		AU	1				
		SS	2	33	10	1	75.93
1.37							
		SS	3	100	1	2	74.93
						3	73.93
Firm to soft, grey **SILTY CLAY**						4	72.93
						5	71.93
						6	70.93
7.47						7	69.93
End of Borehole							
(GWL @ 3.09m - July 22, 2020)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Warehouse Development - Thunder Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5161

REMARKS

HOLE NO. BH 7-20

BORINGS BY Track-Mount Power Auger **DATE** June 30, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.90
TOPSOIL 0.15		AU	1				
FILL: Brown silty sand 0.81		SS	2	100	2	1	75.90
Very loose, brown **SILTY SAND** with clay		SS	3	100	W	2	74.90
- grey by 2.3m depth						3	73.90
3.81						4	72.90
Soft, grey **SILTY CLAY**						5	71.90
5.94							
End of Borehole							
(GWL @ 1.15m - July 22, 2020)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5368 Boundary Road and 6150 Thunder Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PE4480

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** December 19, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	77.22
TOPSOIL							
0.30		AU	1				
Loose, brown **SILTY SAND**		SS	2	42	6	1	76.22
1.52							
		SS	3	83	W	2	75.22
Brown **SILTY CLAY**							
		SS	4	83	W		
- grey by 2.7m depth						3	74.22
		SS	5	71	9		
						4	73.22
		SS	6	96	W		
4.42							
End of Borehole							
(GWL @ 0.93m - Jan. 14, 2019)							

Photo Ionization Detector
● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5368 Boundary Road and 6150 Thunder Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PE4480

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** December 19, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.76
TOPSOIL							
0.25		AU	1				
Very loose, brown **SILTY SAND**						1	75.76
1.07		SS	2	38	2		
Brown **SILTY CLAY**		SS	3	88	W	2	74.76
- grey by 2.2m depth		SS	4	83	4		
		SS	5	100	W	3	73.76
		SS	6	100	W	4	72.76
4.42							
End of Borehole							
(GWL @ 0.46m - Jan. 14, 2019)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
5368 Boundary Road and 6150 Thunder Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PE4480

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** December 19, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	76.90
TOPSOIL							
0.30		AU	1				
Very loose, brown **SILTY SAND**							
0.97		SS	2	88	3	1	75.90
		SS	3	12	W	2	74.90
Brown **SILTY CLAY**							
		SS	4	100	W		
- grey by 3.0m depth						3	73.90
		SS	5	92	W		
						4	72.90
		SS	6	100	W		
4.42							
End of Borehole							
(GWL @ 0.42m - Jan. 14, 2019)							

Photo Ionization Detector

● Volatile Organic Rdg. (ppm)

○ **Lower Explosive Limit %**

20 40 60 80

100 200 300 400 500

RKI Eagle Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

Monitoring Well Construction

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

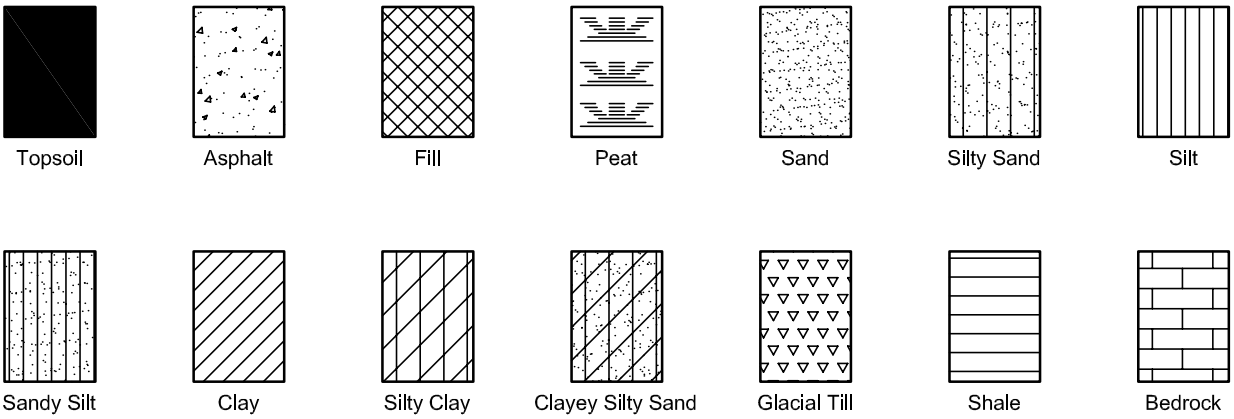
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

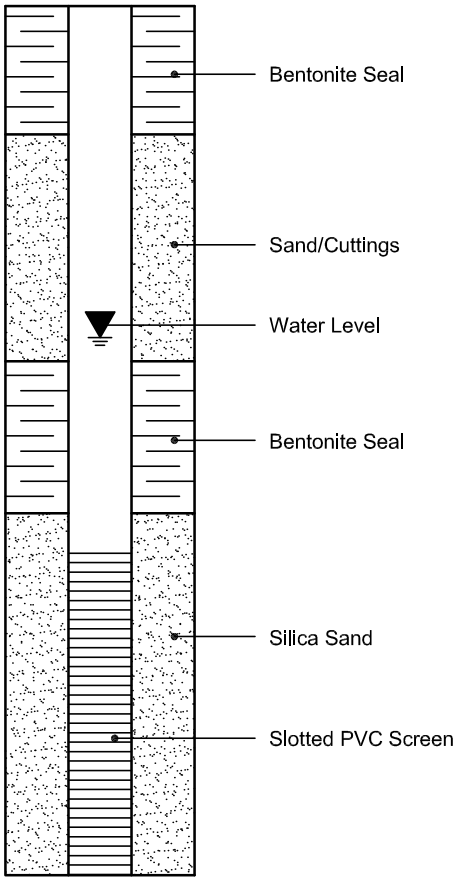
SYMBOLS AND TERMS (continued)

STRATA PLOT

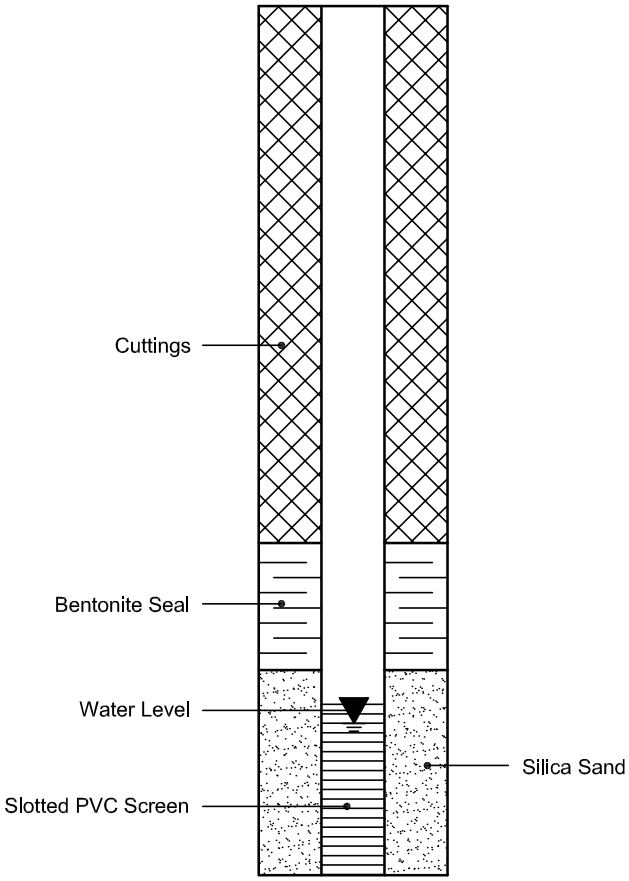


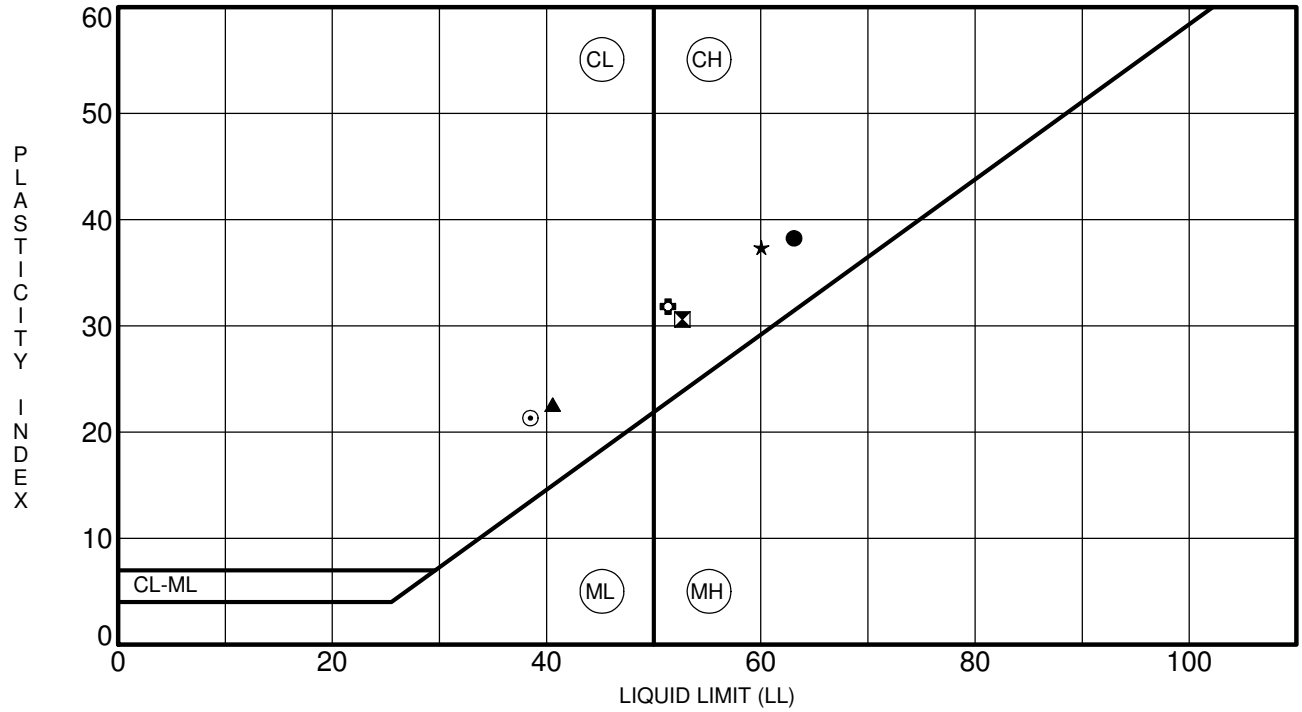
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification			LL	PL	PI	Fines	Classification
●	BH 1-20	SS 2	63	25	38		CH - Inorganic clays of high plasticity
⊠	BH 2-20	SS 2	53	22	31		CH - Inorganic clays of high plasticity
▲	BH 3-20	SS 2	41	18	23		CL - Inorganic clays of low plasticity
★	BH 4-20	SS 2	60	23	37		CH - Inorganic clays of high plasticity
⊙	BH 5-20	SS 2	38	17	21		CL - Inorganic clays of low plasticity
✿	BH 6-20	SS 3	51	20	32		CH - Inorganic clays of high plasticity

CLIENT	**Exit 96 Developments**	FILE NO.	**PG5161**
PROJECT	**Geotechnical Investigation - Prop. Warehouse Development - Thunder Road**	DATE	**30 Jun 20**

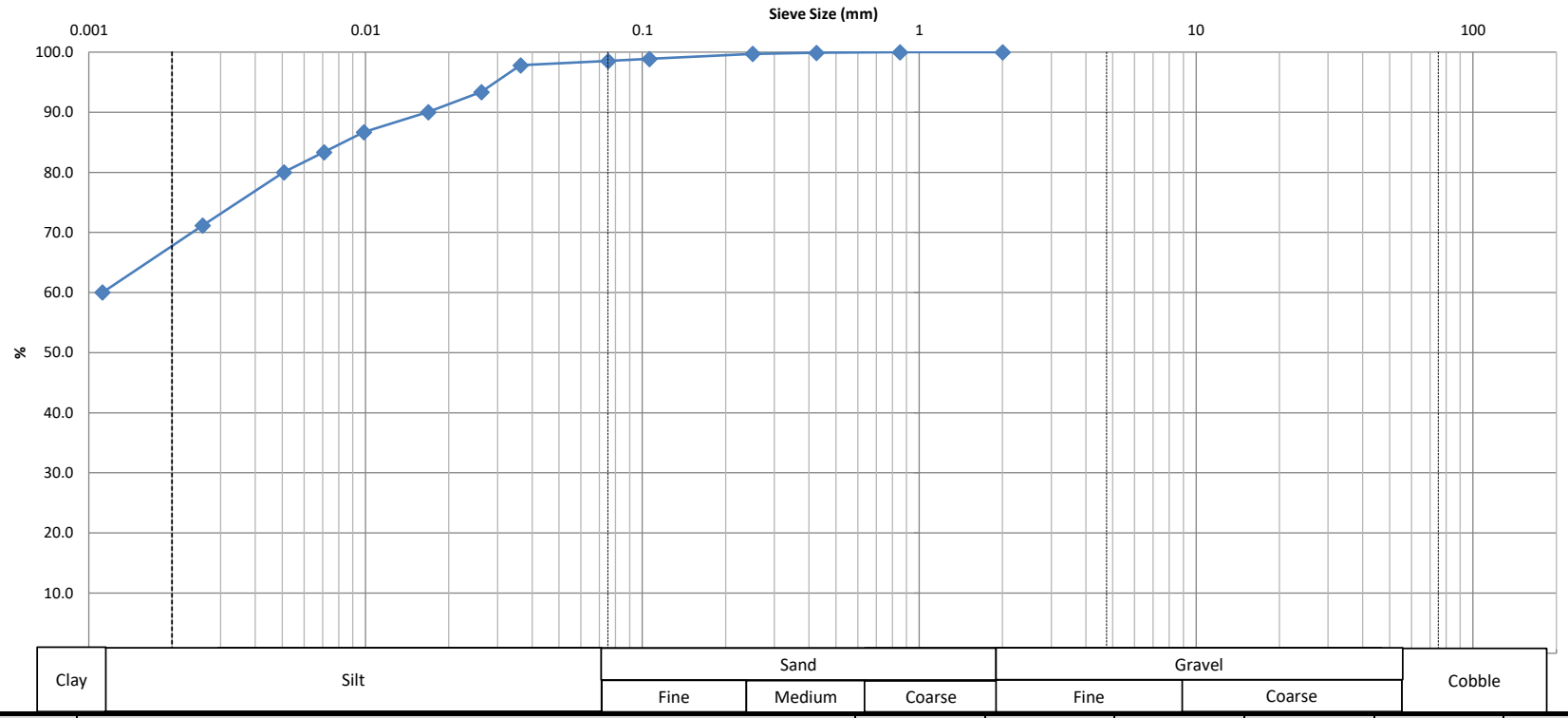
patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

patersongroup
consulting engineers

SIEVE ANALYSIS **ASTM C136**

CLIENT:	Exit 96 Developments	DEPTH:	5' - 7'	FILE NO:	PG5161
CONTRACT NO.:		BH OR TP No.:	BH6 SS3	LAB NO:	18125
PROJECT:	Thunder Road @ Boundary Road			DATE RECEIVED:	22-Jul-20
				DATE TESTED:	23-Jul-20
DATE SAMPLED:	22-Jul-20			DATE REPORTED:	0-Jan-00
SAMPLED BY:	A.C.			TESTED BY:	DB



Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
						40.3					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
					0.0	1.5		28.0		70.5	

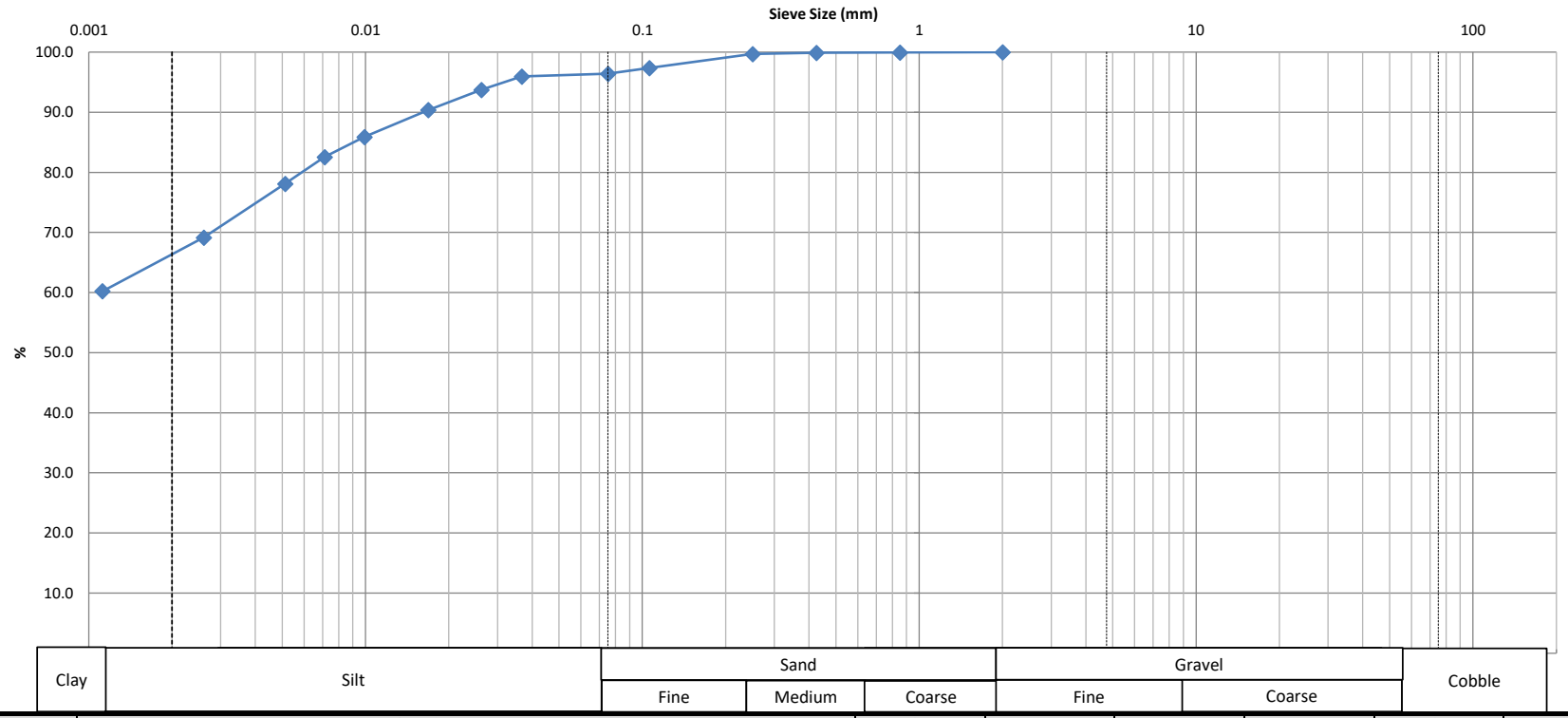
Comments:

REVIEWED BY:	Curtis Beadow	Joe Fosyth, P. Eng.

patersongroup
consulting engineers

SIEVE ANALYSIS **ASTM C136**

CLIENT:	Exit 96 Developments	DEPTH:	5' - 7 '	FILE NO:	PG5161
CONTRACT NO.:		BH OR TP No.:	BH2 SS3	LAB NO:	18126
PROJECT:	Thunder Road @ Boundary			DATE RECEIVED:	22-Jul-20
				DATE TESTED:	23-Jul-20
DATE SAMPLED:	22-Jul-20			DATE REPORTED:	1-Aug-20
SAMPLED BY:	A.C.			TESTED BY:	DB



Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		38.7					

D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
				0.0	3.6	25.9	70.5

Comments:

REVIEWED BY:	Curtis Beadow	Joe Fosyth, P. Eng.

Certificate of Analysis

Report Date: 14-Jul-2020

Client: Paterson Group Consulting Engineers

Order Date: 8-Jul-2020

Client PO: 30331

Project Description: PG5161

	Client ID:	BH6-SS3	-	-	-
	Sample Date:	02-Jul-20 11:00	-	-	-
	Sample ID:	2028331-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	65.5	-	-	-
General Inorganics					
pH	0.05 pH Units	8.28	-	-	-
Resistivity	0.10 Ohm.m	30.3	-	-	-
Anions					
Chloride	5 ug/g dry	17	-	-	-
Sulphate	5 ug/g dry	58	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5161-1 - TEST HOLE LOCATION PLAN

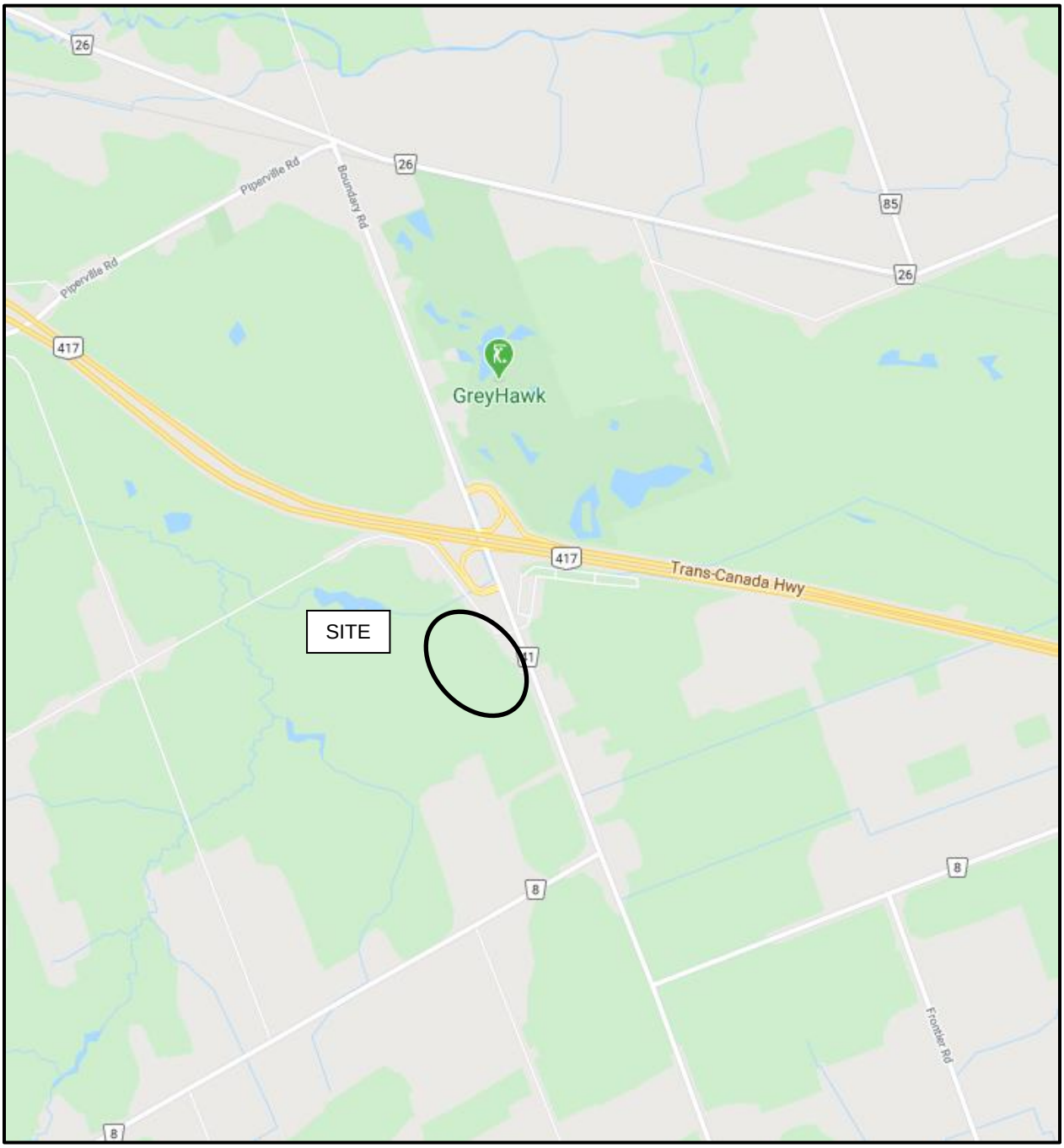
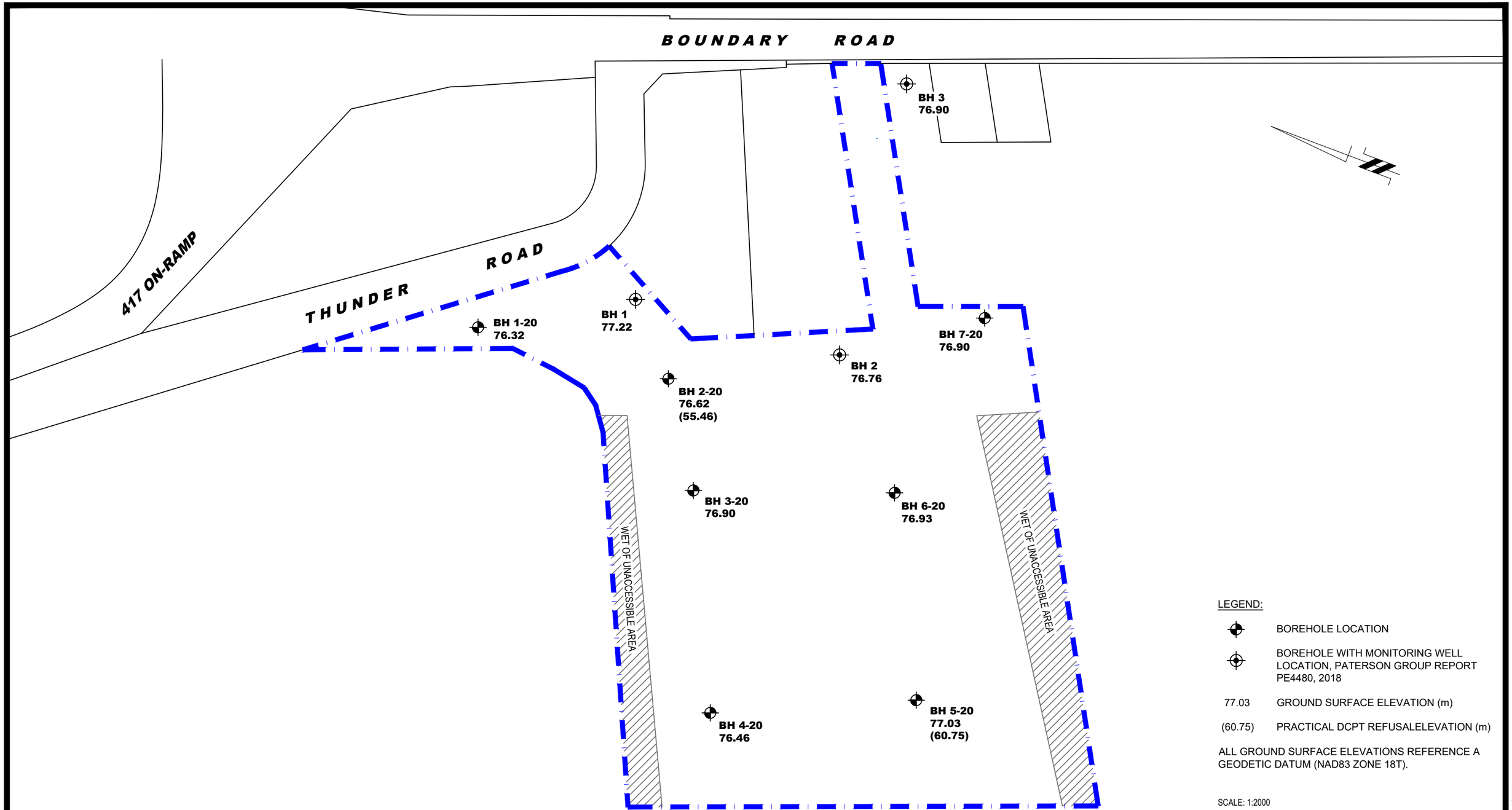


FIGURE 1

KEY PLAN



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PE4480, 2018
- 77.03 GROUND SURFACE ELEVATION (m)
- (60.75) PRACTICAL DCPT REFUSALELEVATION (m)

ALL GROUND SURFACE ELEVATIONS REFERENCE A GEODETIC DATUM (NAD83 ZONE 18T).

SCALE: 1:2000

0 25 50 75 100 125 150m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

EXIT 96 DEVELOPMENTS INC.

GEOTECHNICAL INVESTIGATION
6150 THUNDER ROAD AND 5368 BOUNDARY ROAD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:2000	Date: 08/2020
Drawn by: NFRV	Report No.: PG5161-1
Checked by: JV	PG5161-1
Approved by: DJG	Revision No.:

p:\autocad drawings\geotechnical\pg51xx\pg5161\pg5161-1 thlp.dwg