Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology •

(613) 860-0923
FAX: (613) 258-0475

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

LIGHT INDUSTRIAL BUILDING
140 Reis Road
OTTAWA, ONTARIO

Prepared For:

City Wye'd Electric
132 Reis Road, Carp,
Ottawa, Ontario

PROJECT #: 210430

DISTRIBUTION
City of Ottawa
City Wye'd Electric Ltd
Kollaard Associates Inc.

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1 INTRODUCTION

Mr. Scott Winch of City Wye'd Electric Ltd has retained the services of Kollaard Associates Inc. to complete Site Servicing and Stormwater Management designs and prepare a report for the proposed Light Industrial Building at 140 Reis Road, Ottawa, Ontario.

The report will address the serviceability of the proposed light industrial building development with respect to the water and sanitary demands and outline the proposed design to meet these requirements.

The report shall also summarize the stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions and will identify any stormwater servicing concerns. The report will describe any measures to be taken during construction to minimize erosion and sedimentation for the proposed development.

For the purposes of this report, Reis Road is considered to be oriented along an east west axis. The development being proposed by Mr. Scott Winch is located on the north side of Reis Road about 100 metres east of Tansley Drive within the City of Ottawa. The site is located in an industrial subdivision that is known as the Reis Business Park, is zoned RG4 and is within the Carp Road Corridor.

The site has a total area of 0.1819 hectares and is currently undeveloped. There are no watercourses or easements effecting development on the proposed site. The site is located within the Carp River subwatershed. The nearest receiving water body is the Huntley Creek about 350 metres south of the site.

The proposed works will consist of an approximately 465 square metre pre-engineered steel building with an asphalt surfaced entrance driveway and a gravel surfaced parking area and driveway at the rear of the building. The building will be utilized as an automotive service station.

1.1 Pre-consultation Meeting

A pre-consultation meeting was held with the City of Ottawa and was attended by the Client, Krishon Walker (Planner), Brian Morgan (Infrastructure Project Manager) and others from the City of Ottawa as well as Erica Ogden, (Planner) from Mississippi Valley Conservation Authority. A summary of the design requirements are provided in an email in Appendix D.

2 STORMWATER DESIGN

2.1 Stormwater Management Design Criteria

Design of the storm sewer system was completed in conformance with the City of Ottawa Design Guidelines. (October 2012). Section 5 "Storm and Combined Sewer Design".

2.1.1 Design Criteria

The development falls within the Reis Road Business Park. The allowable runoff rate from sites within the Reis Road Business Park is governed by the design assumptions used in the approved Engineering Report contained in Schedule H of the subdivision agreement.

- The design of the internal drainage for the subdivision was based on site developments that would be: 50% building (C=1.0), 25% parking (C=0.9) and 25% undeveloped (C=0.2).
- Inlet time of 20 min max.

2.1.2 Minor System Design Criteria

Stormwater management design for a minor event is required if the proposed development exceeds the design allowances provided in the drainage report for the Reis Road Business Park. If the proposed development exceeds the allowances, the minor storm event is to be controlled to meet the allowance in accordance with the Major System Design Criteria.

2.1.3 Major System Design Criteria

If the post-development C-value is below 0.775, no on-site SWM from a quantity control perspective will be required. If SWM is required, the allowable release will be based on the 5-year storm event.

2.1.4 Quality Control Design Criteria

The water quality objective was provided by the Mississippi Valley Conservation Authority. As per the Carp River Watershed Subwatershed Study, the water quality should include a normal level of protection which is 70% Total Suspended Solids removal.

2.2 Stormwater Quantity Control

Peak Flow for runoff quantities for the Pre-Development and Post-Development stages of the project were calculated using the rational method. The rational method is a common and straightforward calculation, which assumes that the entire drainage area is subject to uniformly distributed rainfall. The formula is:

$$Q = \frac{CiA}{360}$$

Where
Q is the Peak runoff measured in ***m^3/s***
C is the Runoff Coefficient, **Dimensionless**
A is the runoff area in ***hectares***
i is the storm intensity measure in ***mm/hr***

All values for intensity, i, for this project were derived from IDF curves provided by the City of Ottawa for data collected at the Ottawa International airport. For this project two return periods were considered, 5 and 100-year events. The formulae for each are:

5-Year Event

$$i = \frac{998.071}{(t_c + 6.053)^{0.814}}$$

100-Year Event

$$i = \frac{1735.688}{(t_c + 6.014)^{0.82}}$$

where t_c is time of concentration

2.2.1 Pre-development Site Conditions

The site is currently undeveloped and zoned as Rural General Industrial (RG4). The existing ground surface covering consists of mulch, bare earth and thin grass. The existing ground surface is sloped from west to east across the site directing runoff by sheet flow to the east side of the site. The center of the east side of the site is slightly higher than the north (back) and south (roadside) of the site directing runoff by shallow concentrated flow to the undeveloped land north of the site and to the roadside ditch south of the site.

2.2.1.1 Pre-development Off-Site Drainage Patterns

The existing property west of the site has been partially developed with a gravel surfaced parking area. Runoff from the first about 15 metres of this property is direct by sheet flow onto the site. The existing property to the east of the site has been developed with a building and gravel surfaced parking area/roadway. The building is located on the side of the property closest to the site. Runoff from half of the roof of this building and from the area between the building and the site is directed by sheet flow onto the site.

The existing ground surface north and south of the site is lower than the site so no runoff is directed onto the site from either the north or south.

2.2.2 Runoff Coefficients

Runoff coefficients for a 5 year return period for the following surfaces are:

Impervious
- Roofs – C=1.0
- Asphalt – C = 0.9
- Gravel – C = 0.9

Pervious surfaces
- Grass and Vegetative Landscaping – C = 0.20.

It is noted that Gravel is normally considered to be a semi-pervious surface with a runoff coefficient of 0.7. The design assumptions used in the approved Engineering Report contained in Schedule H of the subdivision agreement do not account for gravel surfaces. In addition, it is considered that the gravel surfaces could be paved in the future.

A 25% increase for the 100-year runoff coefficients was used as per City of Ottawa guidelines. Refer to Appendix A for pre-development and post development runoff coefficients.

2.2.3 Time of Concentration

As previously indicated, the runoff pattern during pre-development conditions is directed west to east across the site by sheet flow, then north and south by concentrated flow. The site has a width of about 30 metres with the east about 2 m portion of the site sloping back towards the centre.

The time of concentration for pre-development conditions was calculated using the Velocity method. The velocity method assumes that the time of concentration is the sum of travel times for segments along the hydraulically most distant flow path. The segments used in the velocity method may be of three types: sheet flow T_s, shallow concentrated flow T_{sc}, and open channel flow T_c. Since the area of consideration for the stormwater analysis consists of a single site, open channel flow will not be present and is not considered.

Travel time for sheet flow:

$$T_s = \frac{0.091(nl)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

Where T_s = travel time, h
n = Manning's roughness coefficient sheet flow = 0.3

l = sheet flow length, 28 m
P_2 = 2-year 24-hour rainfall, = 48.47 mm
S = Slope of land surface m/m = 0.027

T_s = 0.31 hours

Travel time for shallow concentrated flow:

The flow velocity used to calculate the time of travel for shallow concentrated flow was determined using Figure 15-4 of Chapter 15 of the USDA handbook (Included in Appendix A of this Report). This figure can be used to determine the velocity when the slope and ground cover is known. The ground cover to be used in reading Figure 15-4 was determined as follows: Short Grass (poor condition) - Manning's n for concentrated flow = 0.073. From Figure 15-4 of the USDA Handbook using a slope of 2.7% and Nearly bare conditions, the velocity is estimated at 0.34 m/s (1.1 ft/s).

$$T_{sc} = \frac{l}{3600\,V}$$

Where T_{sc} = travel time, h
l = distance of shallow concentrated flow = 30 (half site length)
V = average velocity = 0.34 m/s
T_{sc} = 0.02 hrs

Total time of concentration for pre-development conditions is equal to T_s = 0.31 hours + T_{sc} = 0.02 hrs = 0.33 hrs = 20 min.

The calculated time of concentration is in keeping with the design assumptions from the approved engineering report of the subdivision.

2.2.4 Total Allowable Runoff Rate

Based on the stormwater management criteria, the stormwater management during post-development conditions must be controlled to the levels that match the subdivision design assumptions.

The total allowable runoff rate was established using the rational method. A twenty-minute duration yields an intensity of 70.25 mm/hr for a 5-year storm event and of 119.95 mm/hr for a 100-year storm event. The runoff coefficients were set to C = 0.775 for both the five year and 100 year storm based on the specific design criteria provided in the stormwater management study for the Reis Business Park.

The total allowable runoff for the site based on the subdivision design assumptions was calculated as follows:

For the 5-year Storm event
= (0.775 x 70.25 x 0.1819)/360
= 0.0275 m^3/s
= 27.7 Litres per second

For the 100-year Storm event
= (0.775 x 119.95 x 0.1819)/360
= 0.0470 m^3/s
= 47.0 Litres per second

2.2.5 Post Development Site Area and Quantity Control Requirements

2.2.5.1 Post Development Runoff Coefficient

The proposed development will consist of a 465 square metre building, while 475 square metres will be gravel surfaced and 120 square metres will be asphalt surfaced. All remaining areas will be grassed/landscaped areas. The proposed building will be serviced by a Class 4 onsite septic system and a drilled cased well.

The runoff coefficient for the 5 year and 100 year storm events for post-development were calculated based on a weighted average for the proposed development area as shown in the following table 2.1:

Table 2.1 – Post-Development Runoff Coefficients

Description	Surface Area	Runoff Coefficient	
	m^2	5 year	100 year
Roof	465	0.9	1
Asphalt and Gravel	595	0.9	1
Landscaping	759	0.2	0.25
Weighted Average Entire Site	1819	0.633	0.687

2.2.5.2 Quantity Control Requirements

Based on Guidance provided by the City of Ottawa as included in Appendix D:

Stormwater Management – The allowable runoff rate from sites within the Reis Industrial Park is governed by the design assumptions used in the approved Engineering Report contained in

Schedule "H" of the subdivision agreement. If the resulting runoff from the proposed site will be less than the allowable rate, no on-site SWM will be required. The design parameters used in the approved subdivision Engineering Report are as follows:

The design of the internal drainage for the subdivision was based on site developments that would be: 50% building (C=1.0), 25% parking (C=0.9) and 25% undeveloped (C=0.2). Based on City of Ottawa interpretation of design assumptions in the subdivision Engineering Report, sites in this subdivision can be developed without a requirement for on-site SWM as long as the combined C-value does not exceed 0.775.

Since the post-development runoff coefficient for the proposed development during a 100 year event using runoff coefficients increased by 25% to a maximum of 1.0 is less than 0.775, no onsite stormwater management is required from a quantity control perspective.

2.2.6 Consideration for Post-development Runoff from Off-Site.

As previously indicated, the existing property west of the site has been partially developed with a gravel surfaced parking area. Runoff from the first about 15 metres of this property is direct by sheet flow onto the site. The existing property to the east of the site has been developed with a building and gravel surfaced parking area/roadway. The building is located on the side of the property closest to the site. Runoff from half of the roof of this building and from the area between the building and the site is directed by sheet flow onto the site.

Since a portion of the adjacent properties direct runoff onto the subject site, the proposed grading of the subject site has to accommodate this runoff. The development of the subject site cannot negatively impact the adjacent properties.

The proposed grading of the subject site will incorporate shallow sub-drained swales along both the west and east sides of the site. These swales will direct runoff to the roadside ditch along the front of the site.

2.2.7 Post Development Restricted Flow and Storage

Since there is no requirement for on-site stormwater management from a quantity control perspective, there is no quantity control storage volume required.

Storage is required in order to achieve the required quality control for the site. The quality control storage has been divided between two subdrained swales on either side of the site. The swales will discharge by infiltration and by means of the subdrain during minor storm events and by overflow over a weir during major storm events.

The quality storage swales have been designed as follows:

- The storage swale along the west side of the site will have a flat bottom with a width of 0.5 metres beginning 0.5 metres from the adjacent property.
- The side slopes of the storage swale will extend down to the bottom of the swale from the existing ground surface along the property line and from the edge of the parking lot/driveway pavement structure.
- The side slopes will be covered with a topsoil layer having a minimum thickness of 0.1 metres and will be seeded with grass.
- The subdrain for the swale will be constructed as follows:
    - The clear stone will be exposed to the surface in the flat part of the bottom of the swale.
    - The subdrain will extend a total of a 1.5 metres below the topsoil towards the pavement structure and will be comprised of a 1.0 metres width of clearstone followed by a 0.5 metre width of filter sand then a 0.5 metre width of clearstone.
    - A 250 mm diameter HDPE perforated pipe will be located in the 0.5 metre width of clearstone closest to the pavement structure.
    - The clear stone will have a minimum depth of 0.7 metres below the flat bottom of the swale a layer and minimum depth of 0.6 metres below the topsoil.
    - The bottom of the clearstone will extend 0.25 metres below the perforated pipe.
    - The clear stone and sand will be wrapped with a 6 ounce per square yard non-woven geotextile fabric.
- Discharge from the swale and subdrain will be by means of infiltration through the bottom of the subdrain, through the perforated pipe and by overflow.
- For the purposes of the design, infiltration is only assumed to occur through the bottom of each subdrain. The depth of infiltration is only considered for the upper metre of soil below the subdrain due to the low permeability of the soil.
- Discharge from the perforated pipe will be controlled by the rate at which water flows through the sand filter to the perforated pipe. Since the bottom 0.25 metres of the sand layer is below the invert of the perforated pipe, it was not considered as part of the filter area.
- Overflow through the weir will occur once the water level in the swale reaches the invert of the weir.

Since there is no quantity storage requirement from a stormwater management perspective, the rate of discharge from the filter is only significant to ensure that the swale and subdrain will empty within the allowable range of draw down times following a storm event.

2.3 Storm Sewer Design

The storm sewers on site consist of the perforated HDPE pipe in the subdrains. The perforated pipe will have a diameter of 250 mm and will be installed at a slope of 0.1 percent.

The Runoff from the west half of the roof, the portion of the parking area and driveway west of the building and the adjacent grassed surface will be directed to the swale west of the building. This catchment has an area of about 708 square metres.

The runoff from the east side of the building, the parking area and driveway north of the building, and the adjacent grassed surface will be directed to the swale east of the building. This catchment has an area of about 829 square metres.

Calculations showing the capacity of the perforated storm pipes in each subdrain are shown in Appendix A. From the appendix, the perforated pipe does not have sufficient capacity to convey the flow from a 5 year storm event. It is noted that the perforated pipe in not intended to convey the flow resulting from the 5 year design storm event. The perforated pipe is intended to convey the flow that passes through the filter and is intended to facilitate the low slope of the swales.

2.4 Stormwater Quality Control

Stormwater treatment of 70% TSS removal will be provided by a treatment train approach. The treatment train consists of sedimentation within the grass surfaced side slopes of the storage swales followed by filtration through a sand filter.

In the Ministry of Environment Stormwater Management Planning and Design Manual (March 2003) (MOE Manual) provides guidance on design for stormwater quality control. Quality control design is completed with the fundamental understanding that the majority of sediment and particulate pollutants are washed from the site surfaces during minor (frequent) storm events. Section 3.3.1 of the MOE Manual indicates that in most cases, quality control design storms range from 12.5 mm to 25 mm. The MOE Manual also indicates that an alternate approach to the volumetric sizing of stormwater facilities for quality control has been applied in Ontario. The alternate approach is summarized in Table 3.2 *Water Quality Storage Requirements Based on Receiving Waters* which provides the required quality control volume as a function of protection level, SWMP type and impervious level.

In Part 4, the MOE Manual details the design requirements of several types of end of pipe stormwater management facilities. The proposed stormwater management design for quality control will consist of filtration. Design guidance for filtration is provided in Part 4 Section 4.6.7 Filters of the MOE Manual.

As previously indicated, the stormwater management design consists of directing runoff by means of sheet flow to subdrained swales along the east and west sides of the site. The

subdrained swales provide quality control storage and discharge to the roadside ditch at the front of the site. The quality storage swales have been designed to outlet the quality storage volume horizontally through a sand filter and vertically through infiltration. Section 4.6.7 provides the design guidance with respect to the use of a filter as summarized in the table below. A column has been added to indicate how the proposed design conforms to the Criteria.

Design Element	Design Objective	Minimum Criteria	Design Conformance
Drainage Area		< 5 hectares	~ 0.1819 hectares
Pre-treatment	Longevity	Pre-treatment by means of sedimentation chamber, or forebay, vegetated filter strip, swale or oil/grit separator	Pre-treatment by vegetated filteration on grassed side slope of swale.
Storage Depth	Avoid Filter Compaction	Subsurface sand and organic filters: 0.5 m Maximum 1.0 m	Maximum storage depth of 0.6 m
Filter Media Depth	Filtering	Sand: 0.5 m	Filter width 0.5m
Under-drain	Discharge	Minimum 100 mm perforated pipes bedded in 150 – 300 mm of 50 mm gravel	250 mm perforated pipe in minimum 200 mm of 25-50 mm clear stone.
Land use		any land use, often employed for commercial and industrial	light industrial
Volumetric Sizing		provided in Table 3.2 under infiltration. By-pass flows should not occur below a 4 hr 15 mm design event	Quality storage volume sufficient to contain entire volume of a 15 mm storm event before by-pass for the catchment area of each swale
Filter Size		Determined using the Darcy Equation	Determined using the Darcy Equation
Filter Lining	prevent clogging	liner to prevent native material from entering filter	Non-woven geotextile filter clothe used between native material and filter and between filter and clearstone
Overflow / by-pass		required	overflow is provided above the quality storage requirement
Drawdown time	prevent standing water	maximum from 24 to 48 hours 24 hours preferred	Design drawdown time of between 9 and 11 hours

2.4.1.1 Volumetric Sizing and Filter Size

From Table 3.2 under infiltration it was determined that the water quality storage requirement for a 58 percent impervious ratio at an enhanced level of treatment is 31 cubic metres per hectare. Based on a quality storage requirement of 31 cubic metres per hectare and the surface area of the site, the total water quality storage requirement is 5.6 cubic metres. The manual however requires that by-pass does not occur below a 4 hr 15 mm design event. In order to ensure that by-pass would not occur below a 4 hr 15 mm design event, each quality storage swale was designed to accommodate the entire volume of a 15 mm rainfall assuming all of the rainfall originating on the catchment area of each respective swale runs off into the quality storage swale. It is noted that a runoff coefficient of 0.69 indicates that only 69% of the rainfall will result in runoff. Further this design conservatively assumes no discharge through the filter during the 4 hr 15 mm design event.

The MOE Manual indicates that the size of the filter be designed to ensure a specified volume is discharged within a specified time period using the Darcy Equation. The size of the filter and storage volume must be sufficient to ensure that no overflow or by-pass occurs below the 4 hr 15 mm design storm.

The total area contributing to the west swale is 708 square metres and to the east swale is 829 square metres. A 15 mm storm event will result in a runoff volume of 10.6 m^3 in the west swale and 12.4 m^3 in the east swale. The west quality storage swale has a storage volume of 10.8 m^3 below the outlet weir and the east quality storage swale has a storage volume of 13.0 m^3 below the outlet weir.

The proposed filter has been sized based on the space available for the filter. The flow rate through the filter was calculated and the drawdown time was determined based on the volume of the quality storage.

Quality assurance will be provided by filtration through horizontal sand filters located below each quality storage swale. The proposed filters will be constructed with a width of 0.5 metres. The sand used to construct the filter will consist of a septic sand having a percolation rate “T” time of 8 min/cm and a maximum of 3 percent passing the 0.08 millimetre sieve size. This corresponds to a coefficient of permeability of k = 75 millimetres per hour. The sand will be placed as shown in the details on Kollaard Associates Inc. drawing # 210430-GRD will have a depth of 0.5 metres. The filter will be protected with 25-50 mm clear stone. A non-woven

geotextile filter fabric (such as Terrafix 270R or an approved alternative) will be placed between the sand and the clearstone and around the clearstone and sand to avoid contamination of the filter sand from the underlying native material and mixing of the filter sand with the clearstone. This fabric offers medium tensile strength at high elongation and good filtration, coupled with high permeability to allow for proper filtration, while holding the filter sand in place as designed. The Terrafix Geosynthetics Inc. specification Sheet can be found in Appendix B.

The flow rate through the sand filter was calculated using Darcy's Equation to be:
$Q = A\ k\ i$
Where A = cross-sectional area of filter = 0.35 (height) * 50 (min perimeter Length) = 17.5 m^2 for the swale along the west side and 0.35 x 60 = 21 m^2 for swale along the east side.
k =coefficient of permeability = 2.1 x 10^{-5} m/s
i = hydraulic gradient = average head across the filter / flow path across the filter = varies

At a ponding level equal to the overflow over the weir the flow rate through the filter equals
West swale:
Q = 17.5 x 0.000021 x (0.55)/0.5 = 0.0004 m^3/sec
East swale
Q = 21 x 0.000021 x (0.55)/0.5 = 0.0005 m^3/sec

Additional Calculations are provided in Appendix A.

From initial field investigation done by Kollaard Associates Inc, the underlying soils consist mostly of silty sand, silt or silty clay within the first 1 metre below the ground surface consist of grey brown silty sand having a percolation rate of 15 min/cm. From Ontario Building Code, SB-6 Table 2, the average coefficient of permeability for this type of soil would be expected to be in the range of 1.0 x 10^{-4} cm/sec.

The flow rate through the bottom of the quality storage subdrained swales would be:
$Q = A\ k\ i$
Where A = combined surface area of the bottom of the clearstone and sand = 100 m^2 for the west swale and 120 m^2 for the east swale.
k =coefficient of permeability = 1 x 10^{-6} m/s
i = varies = ((h+d)/d) where d is the upper 1.0 m of soil below the storage swale and h is the ponding depth above the bottom of the clearstone and equals

At a ponding level equal to the overflow over the weir the flow rate through the bottom equals
West swale:
Q = 100 x 0.000001 x (0.8+1)/1 = 0.0002 m^3/sec

East swale
Q = 120 x 0.000001 x (0.8+1)/1 = 0.0002 m^3/sec

With a combined flow rate of 0.4 L/s through the filter and 0.2 L/s through bottom of the subdrained swale, the draw down time for the 10.8 m^3 in the west swale would be approximately 9.4 hours and for the 13 m^3 in the east swale would be approximately 10.3 hours.

Since there is not quantity control requirement, the outlet rate from each swale is appropriate to ensure that the swales drain at a sufficient rate to prevent standing water and to ensure sufficient available volume for subsequent storm events.

2.4.1.2 Grey Water from Building

There are no proposed floor drains within the building. As such there is not anticipated to be any grey water generated within the proposed building.

Notwithstanding the current plans, if floor drains are to be installed and grey water is generated from a proposed use within the building, the grey water should be collected within the building in a storage tank below the floor slab of the building. The storage tank will then be emptied by a company licensed to collect, transport and dispose of waste water. As such the interior building use will not contribute flow to the storm water management facility.

2.5 Infiltration Design as per the Carp River Watershed Subwatershed Study

The stormwater management design implemented to achieve the desired water quality control by filtration will also provide the means of meeting the targeted infiltration of 104 mm/year for the site as follows:

- As shown in the stormwater calculation design sheets included in Appendix A of the Report Outlet Control Design Sheet – West Swale and Outlet Control Design Sheet – East Swale, there is a calculated infiltration rate below each swale of 0.0001 to 0.0002 m^3/sec for each swale. Assuming infiltration during half of the year to exclude frozen conditions, this equates to a potential infiltrated volume of about 4000 m^3/year. This assumes a conservative estimate of the soil percolation rate of 3.6 mm/hr. The geotechnical report indicates that the soils below the infiltration trench will consist of sand and gravel with silt which from Table 4.4 of the MECP stormwater management planning and design manual would indicate a percolation rate of 25 to 60 mm/hr.
- An infiltration target of 104 mm/year for a site area of 1819 m^2 equals a volume of about 188 m^3.

- The subwatershed study indicates that there is a average annual precipitation of 950 mm (25% snow) with 550 mm of evapotranspiration. This leaves approximately 300 mm of precipitation available to infiltrate.
- There is 0.25 m of clear stone below the subdrain outlet in each swale. The swales have a combined area of 200 metres providing a storage of 15 m^3 below the subdrains which will outlet by infiltration only.
- In general, greater than 60 percent of the rainfall in the Ottawa area occurs during rain fall events with an intensity of less than 1 mm/hr.
- A rainfall intensity of 1 mm/hr would result in a runoff volume of about 1.8 m^3/hr. The above noted infiltration rate will result in the infiltration of about 0.7 m^3/hr resulting in a accumulation of about 0.9 m^3/hr within the swales. This would result in the available storage within the clearstone below the subdrain being exceeded in just over 15 hours.
- Since a 15 mm rainfall accumulation in 1 day would exceed most normal rainfall events, the proposed storm swales have the capacity to infiltrated the runoff from most normal rainfall events. Since normal rainfall events are the source of more than 60 percent of the accumulated rainfall during the year, the system will infiltration more than the target 104 mm/year.

2.6 Operation and Maintenance

During winter operation, the predominant sediment load on the storage area will result from sand placed during de-icing salting/sanding of the parking and gravel surfaces of the site and from sand carried onto the site from vehicles. During spring melt, the sediment will be transported towards the storage area. The runoff will be directed over the grasses side slopes of the swales and through the clearstone prior to encountering the filter. Sedimentation within the grassed side slope and through the clearstone will provide pre-treatment reducing the sediment load on the filters.

The subdrained swales should be inspected on a weekly basis and after any rain fall event during and after construction until vegetation is well established. Any areas of erosion or distress should be repaired immediately. .

The subdrained swales should be inspected after major storm events and after snow melt in the spring. Water ponding within the upper portion of the clearstone would indicate that the swale and/or subdrain is either partially or completely blocked. If the subdrained swale becomes filled with sediment, the clearstone and subdrain will require maintenance. The maintenance would consist of excavating the swale and subdrain and either cleaning and returning the cleaned clearstone or replacing the clearstone.

Once the vegetation is well established, the storage areas should be visually inspected on a bi-monthly basis and following significant storm events. Any debris should be removed from the storage areas if present.

The grassed side slopes of the swales should be subjected to the same maintenance schedule as the remainder of the grass covered landscaped "lawn" surfaces. That is, the grass should be mowed and cared for as required to maintain a normal healthy appearance. Minimum recommended grass height in the swales is 75 mm.

Removal of accumulated sediment from the grassed storage areas should be conducted when the accumulation of the sediment begins to significantly affect the quality of the grass growth and/or the drainage patterns along the grassed surfaces. The sand filter should be replaced when the drawdown time increases such that there is visible surface ponding above the clear stone more than 1 day after the rainfall event.

If long term ponding occurs within the storage area upstream of the filter, the engineer should be notified. At this point the engineer could make an assessment of the material in the upper portion of the subdrain and filter. If the assessment indicates that the subdrain and filter has become compromised with sediment, the filter will require maintenance.

2.6.1 Winter Operation

The MOE Manual indicates that filters suffer in performance during winter operation due to freezing of the filter medium. As previously indicated, Filters receive runoff from parking areas and roads which are subject to sanding and salting.

The sediment and particulate matter resulting from these sanding and salting operations tend to be coarser in nature and are more prone to sedimentation within the grass surfaces immediately adjacent to swales. As such, during winter operation, the primary quality control mechanism will be storage and sedimentation as opposed to filtration.

3 WATER DEMAND - DOMESTIC

The facility is to be serviced by a drilled well to be located 4 metres from the east property line about 2 metres from the northeast corner of the building. Information regarding the quality and quantity capabilities of this well can be found in the Hydrogeology Report prepared by Kollaard Associates, *Hydrogeological Study 140 Reis Road, City of Ottawa, Ontario, File Number 210430* dated August 13, 2021. This report also contains a copy of the Ministry of Environment Conservation and Parks (MECP) Certificate of Well Compliance.

The water demand is calculated using the information from the sewage system daily design flow and the City of Ottawa Water Distribution Guidelines, 2010. The sewage design flows are provided below, based on the sewage design which was carried out by Kollaard Associates Inc.

Daily sewage design flow:

- Office building, per employee per eight hour shift = 75 Litres/employee/day x 7 = 525 L/day
- Warehouse, per water closet (1) And per loading bay (3) = 950 L/day + 150 L/bay/day x 3 = 1400 L/day
- Total daily design flow = 1,925 litres / day

Since sewage system design is based on the maximum expected daily use, it is equivalent to the Average Daily Demand (ADD). The ADD is based on an eight hour operation schedule (i.e. full day occurs over an eight hour period and not over 24 hours

City of Ottawa calculates the Maximum Hour Demand (MHD) for a commercial or industrial demand to be 1.8 x ADD

ADD = 1925 litres/day x 1 day / 8 hours x 1 hour / 60 minutes
= 4.0 litres/minute

MHD = 1.8 x ADD
= 1.8 x 4.0 litres/minute
= 7.2 litres/minute

Alternatively, the City of Ottawa Water Distribution Guideline Section 4.2.8 indicates that the average daily demand for light industrial usage is 35,000 L/gross ha/day. The gross area of the developable area of the site is 0.1819 hectares.
ADD = 0.1819 x 35,000 = 6,367 L/day = 4.4 L/min
MHD = 4.4 L/min x 1.8 = 7.9 L/min.

Since the calculated demand using Section 4.2.8 of the Water Distribution Guideline is greater than the water demand using the sewage design, the average daily demand and maximum hourly demand for the site will be considered to be 4.4 L/m and 7.9 L/min respectively.

The Maximum Hourly Demand for the site based on its proposed use is expected to be about 7.9 litres/minute, compared to the pumping test rate which was 13.7 litres/minute.

The water system shall be pressurized with a submersible well pump, capable of supplying water at a minimum flow rate of about 13.7 litres/minute (3.5 usgpm) and no greater than the recommended pump rate of 6 GPM found in the certificate of well compliance. The pump should be set at a depth of about 83.8 metres aslo as recommended in the certificate of well compliance. The well shall be fitted with a pitless adapter and protrude from the ground at least 400mm. The top of the well casing shall be extended to a minimum elevation of at least 115.63 metres to ensure that it is at least 400 millimetres above the finished grade of 115.23 at the well location. Additionally, the ground surface shall be graded such that it is the highest point on the ground surface within 3 metres radially from the exterior of the well casing and shall ensure that water does not collect or pond near the well head. A seamless 1.25" polyethylene pipe rated at 160psi shall be installed between the well and the building at a depth of at least 2.4m.

3.1 Water Demand – Fire Fighting Supply and Storage

Fire water supply and storage on site is a requirement under Part 3 of the Ontario Building Code. Since the proposed building is under 600 square metres and has a major occupancy of F2/D, the building is considered to be a Part 9 Building with respect to the Ontario Building Code. As such, onsite fire water supply and storage is not required for this site.

4 SANITARY SERVICE

No municipal sanitary services are available at this site.

As per Ontario Building Code (OBC) table 8.2.1.3.B, the daily design sanitary sewage flow for the proposed occupancy is 1,925 litres/day. Sanitary sewage will be disposed of in an onsite Class 4 sewage system with a level IV treatment unit. The onsite system will include a partially raised Type A disposal field preceded by an Ecoflo STB-730PR treatment unit. A sewage system application has been prepared for approval through the Ottawa Septic System Office. Details can be found on the septic design plan prepared by Kollaard Associates.

The septic system design has been submitted to the Ottawa Septic Office for Permit. The septic system design and permit has been added to the report in Appendix C for reference purposes. It is noted that the permit lapses 12 months following the date of issue. As such the permit will be reapplied for with no changes to the original application.

Contribution to the Sanitary Sewer Demand from Floor Drains

There are no proposed floor drains within the building. As such there is not anticipated to be any grey water generated within the proposed building.

Notwithstanding the current plans, if floor drains are to be installed and grey water is generated from a proposed use within the building, the grey water should be collected within the building in a storage tank below the floor slab of the building. The storage tank will then be emptied by a company licensed to collect, transport and dispose of waste water. As such, any potential floor drains within the building will not contribute flow to the sanitary sewer system.

5 EROSION AND SEDIMENT CONTROL

The owner (and/or contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current best management practices for erosion and sediment control. It is considered to be the owners and/or contractors responsibility to ensure that the erosion control measures are implemented and maintained.

In order to limit the amount of sediment carried in stormwater runoff from the site during construction, it is recommended to install a silt fence along the property, as shown in Kollaard Associates Inc. Drawing #210430-ESC Erosion and Sediment Control Plan. The silt fence may be polypropylene, nylon, and polyester or ethylene yarn.

If a standard filter fabric is used, it must be backed by a wire fence supported on posts not over 2.0 m apart. Extra strength filter fabric may be used without a wire fence backing if posts are not over 1.0 m apart. Fabric joints should be lapped at least 150 mm (6") and stapled. The bottom edge of the filter fabric should be anchored in a 300 mm (1 ft) deep trench, to prevent flow under the fence. Sections of fence should be cleaned, if blocked with sediment and replaced if torn.

The proposed landscaping works should be completed as soon as possible. The proposed granular and asphaltic concrete surfaced areas should be surfaced as soon as possible.

The silt fences should only be removed once the site is stabilized and landscaping is completed.

These measures will reduce the amount of sediment carried from the site during storm events that may occur during construction.

6 CONCLUSIONS

Based on the analysis provided in this report, the conclusions are as follows:

SWM for the proposed development will be provided in keeping with the design assumptions used in the approved engineering report for the Reis Business Park.

Quantity Control measures are not required as the post-development level of imperviousness is in keeping with the approved engineering report as interpreted by the City of Ottawa.

A normal level of Quality Control will be achieved by means of vegetative filtration followed by filtration through a sand filter.

Discharge from the site will be conveyed to the roadside ditch in accordance with the Reis Business Park design.

The daily design sanitary sewage flow rate from the proposed development will be 1,925 litres/day. Sanitary sewage will be disposed of in an onsite Class 4 sewage system with a level IV treatment unit.

The facility is to be serviced by a drilled cased well.

During all construction activities, erosion and sedimentation shall be controlled.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,
Kollaard Associates, Inc.

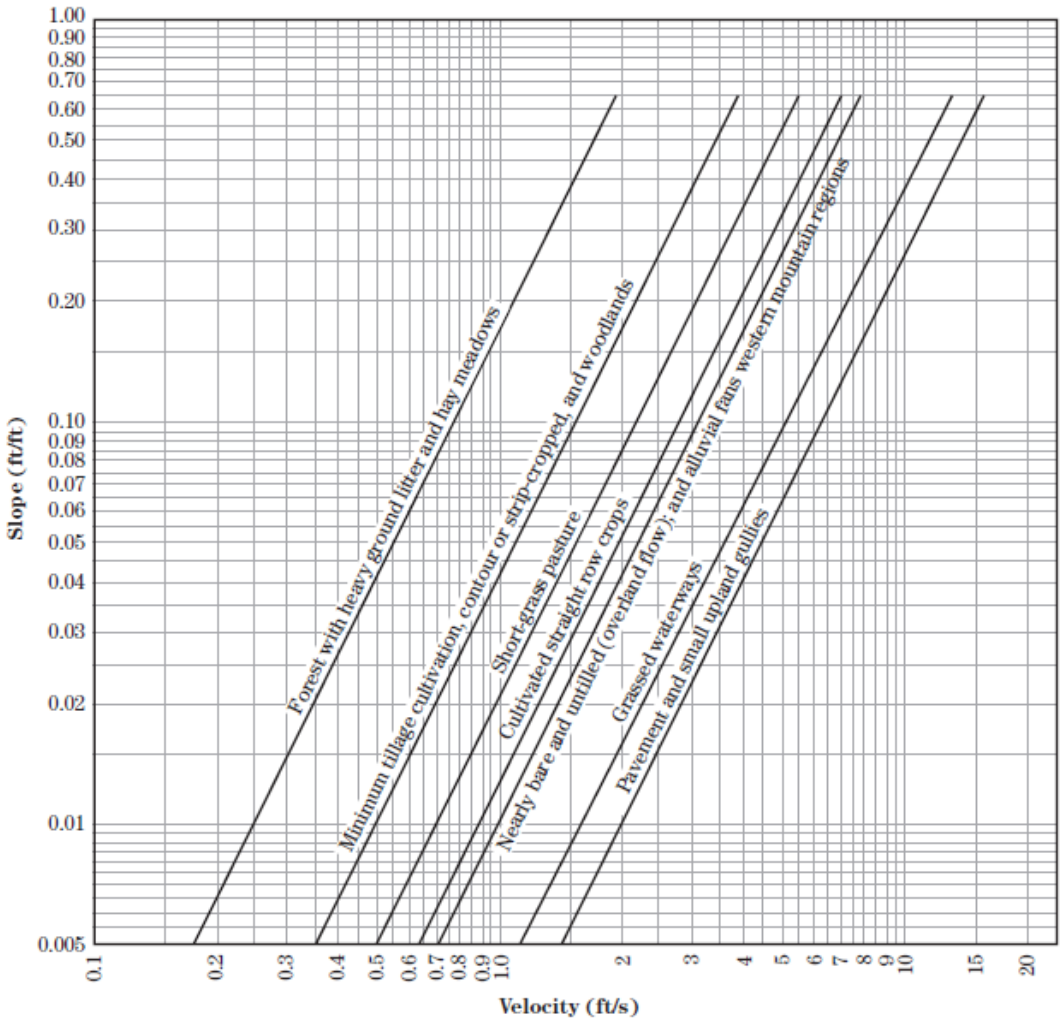
Steven deWit, P.Eng.

Appendix A: Storm Design Information

Appendix A has been reinserted from the original report dated August 13, 2021 without revision.

- Figure 15-4 of Chapter 15 of the USDA handbook
- Post-Development Runoff Coefficient Calculation And Unrestricted Flow
- Outlet Control Design Sheet – West Swale
- Outlet Control Design Sheet –East Swale
- Sewer Design Sheet

Figure 15–4 Velocity versus slope for shallow concentrated flow



210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil ●
Geotechnical ●
Hydrogeological ●
Inspection Testing ●
Septic Systems Grading ●
Structural ● Environmental ●

APPENDIX A: STORMWATER MANAGEMENT MODEL

POST-DEVELOPMENT RUNOFF COEFFICIENT CALCULATION AND UNRESTRICTED FLOW

Client: City Wye'd Electric
Job No.: 210430
Location: 140 Reis Road
Date: November 17, 2022

TOTAL SITE AREA

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area (ha)	**Surface**	**Area (ha)**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Roof	0.0465	1.00	**0.633**	1.00	**0.687**
0.1819	Asphalt	0.0120	0.90		1.00	
	Gravel	0.0475	0.90		1.00	
	Grass	0.0759	0.20		0.25	
Impervious Ratio		0.58				

Post-development unrestricted flow

2 Year Event

Pre Dev.	**C**	**Intensity**	**Area**	
2 Year	0.63	2.02	0.182	
2.78CIA= 0.65				48.47317392
0.6 L/S				

**Use a 1440 minute time of concentration for 5 year

5 Year Event

Pre Dev.	**C**	**Intensity**	**Area**
5 Year	0.63	104.19	0.182
2.78CIA= 33.38			
33.4 L/S			

**Use a 10 minute time of concentration for 5 year

100 Year Event

Pre Dev.	**C***	**Intensity**	**Area**
100 Year	0.69	178.56	0.182
2.78CIA= 62.04			
62.0 L/S			

**Use a 10 minute time of concentration for 100 year

*C value multiplied by 1.25 for 100 year event

Equations:

Flow Equation

Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Notes:

* City of Ottawa Sewer Design Guidelines October 2012 - Section 5.4.5.2.1
** Post-Development Time of Concentration discussed in the text of the Report

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

APPENDIX A: STORMWATER MANAGEMENT MODEL

OUTLET CONTROL DESIGN SHEET - WEST SWALE

Client: City Wye'd Electric
Job No.: 210430
Location: 140 Reis Road
Date: November 17, 2022

Infiltration Information

Percolation Time T =	50	min/cm
Percolation Rate =	3.6	mm/hr
Permeability k =	1.0E-06	m/s
Depth of Layer =	1	

Filter Information

Percolation Time T =	8	min/cm
Percolation Rate =	75	mm/hr
Permeability k =	2.1E-05	
Depth of Layer =	0.5	

Weir

Weir Width (m):	0.60
Weir Coefficient:	0.62
Weir Invert (m):	114.75

Stage, WSE Elev (m)	Comments	Layer Thickness (m)	Top Layer Area (m^2)	Bottom Layer Area (m^2)	Volume in Swale (m^3)	Incremental Volume in Subdrain / Clearstone (m^3)	Total Storage (m3)	Infiltration			Filter Flow			Weir		Total Outflow (m^3/sec)	Total Outflow (L/sec)	Draw Down Time (s)	Draw Down Time (hrs)
								Head* (m)	Hydraulic Gradient	Infiltration Rate (m^3/sec)	Head* (m)	Hydraulic Gradient	Filter Flow (m^3/sec)	Head (m)	Weir Flow (m^3/sec)				
114.85	OVERFLOW	0.050	72.0	57.0	3.2	0.0	15.8	0.90	1.9	0.0002	0.65	1.3	0.0005	0.10	0.0554	0.0560	56.0	57.425	0.0
114.80	OVERFLOW	0.050	57.0	45.0	1.3	0.5	12.6	0.85	1.8	0.0002	0.60	1.2	0.0004	0.05	0.0196	0.0202	20.2	88.168	0.0
114.75		0.050	45.0	35.0	1.0	0.4	10.8	0.80	1.8	0.0002	0.55	1.1	0.0004	0.00	0.0000	0.0006	0.6	2403.166	0.7
114.70		0.050	35.0	25.0	0.7	0.3	9.4	0.75	1.7	0.0002	0.50	1.0	0.0004	0.00	0.0000	0.0005	0.5	1936.873	0.5
114.65	bottom of pond	0.050	25.0	50.0	0.0	0.4	8.4	0.70	1.7	0.0002	0.45	0.9	0.0003	0.00	0.0000	0.0005	0.5	738.472	0.2
114.60	Sand Filter	0.050	50.0	50.0	0.0	1.0	8.0	0.65	1.6	0.0002	0.40	0.8	0.0003	0.00	0.0000	0.0005	0.5	2189.781	0.6
114.55		0.050	50.0	50.0	0.0	1.0	7.0	0.60	1.6	0.0002	0.35	0.7	0.0003	0.00	0.0000	0.0004	0.4	2408.430	0.7
114.50		0.050	50.0	50.0	0.0	1.0	6.0	0.55	1.5	0.0002	0.30	0.6	0.0002	0.00	0.0000	0.0004	0.4	2675.585	0.7
114.45		0.050	50.0	50.0	0.0	1.0	5.0	0.50	1.5	0.0001	0.25	0.5	0.0002	0.00	0.0000	0.0003	0.3	3009.404	0.8
114.40		0.050	50.0	50.0	0.0	1.0	4.0	0.45	1.4	0.0001	0.20	0.4	0.0001	0.00	0.0000	0.0003	0.3	3438.395	1.0
114.35		0.050	50.0	50.0	0.0	1.0	3.0	0.40	1.4	0.0001	0.15	0.3	0.0001	0.00	0.0000	0.0002	0.2	4010.025	1.1
114.30		0.050	50.0	50.0	0.0	1.0	2.0	0.35	1.3	0.0001	0.10	0.2	0.0001	0.00	0.0000	0.0002	0.2	4809.619	1.3
114.25		0.050	50.0	50.0	0.0	1.0	1.0	0.30	1.3	0.0001	0.05	0.1	0.0000	0.00		0.0002	0.2	6007.509	1.7
114.20	Outlet of Subdrain	0.000	50.0	50.0	0.0	0.0	0.0	0.25	1.3	0.0001	0.00	0.0	0.0000	0.00		0.0001	0.1	0.000	0.0

Draw down time (hours) 9.4

Weir Flow

$Qweir = 0.66\ C\ B\ (2\ g)^{0.5}\ H^{1.5}$

where:

C = Weir Discharge Coefficient
B = Weir Width
g = Accel due to Gravity
H = Head above weir crest

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

APPENDIX A: STORMWATER MANAGEMENT MODEL

OUTLET CONTROL DESIGN SHEET - EAST SWALE

Client: City Wye'd Electric
Job No.: 210430
Location: 140 Reis Road
Date: November 17, 2022

Infiltration Information

Percolation Time T = 15 min/cm
Percolation Rate = 3.6 mm/hr
Permeability k = 1.0E-06 m/s
Depth of Layer = 1

Filter Information

Percolation Time T = 8 min/cm
Percolation Rate = 75 mm/hr
Permeability k = 2.1E-05 m/s
Depth of Layer = 0.5

Weir

Weir Width (m): 0.60
Weir Coefficient: 0.62
Weir Invert (m): 114.15

Stage, WSE Elev (m)	Comments	Layer Thickness (m)	Top Layer Area (m^2)	Bottom Layer Area (m^2)	Volume in Swale (m^3)	Incremental Volume in Subdrain / Clearstone (m^3)	Total Storage (m3)	Infiltration			Filter Flow			Weir		Total Outflow (m^3/sec)	Total Outflow (L/sec)	Draw Down Time (s)	Draw Down Time (hrs)
								Head* (m)	Hydraulic Gradient	Infiltration Rate (m^3/sec)	Head* (m)	Hydraulic Gradient	Filter Flow (m^3/sec)	Head (m)	Weir Flow (m^3/sec)				
114.25	OVERFLOW	0.050	86.4	68.4	3.9	0.0	19.0	0.90	1.9	0.0002	0.65	1.3	0.0006	0.10	0.0554	0.0561	56.1	68.794	0.0
114.20	OVERFLOW	0.050	68.4	54.0	1.5	0.6	15.1	0.85	1.8	0.0002	0.60	1.2	0.0005	0.05	0.0196	0.0203	20.3	105.346	0.0
114.15		0.050	54.0	42.0	1.2	0.5	13.0	0.80	1.8	0.0002	0.55	1.1	0.0005	0.00	0.0000	0.0007	0.7	2534.000	0.7
114.10		0.050	42.0	30.0	0.9	0.4	11.3	0.75	1.7	0.0002	0.50	1.0	0.0004	0.00	0.0000	0.0006	0.6	2047.552	0.6
114.05	bottom of pond	0.050	30.0	60.0	0.0	0.4	10.0	0.70	1.7	0.0002	0.45	0.9	0.0004	0.00	0.0000	0.0006	0.6	783.009	0.2
114.00	Sand Filter	0.050	60.0	60.0	0.0	1.2	9.6	0.65	1.6	0.0002	0.40	0.8	0.0003	0.00	0.0000	0.0005	0.5	2330.097	0.6
113.95		0.050	60.0	60.0	0.0	1.2	8.4	0.60	1.6	0.0002	0.35	0.7	0.0003	0.00	0.0000	0.0005	0.5	2573.727	0.7
113.90		0.050	60.0	60.0	0.0	1.2	7.2	0.55	1.5	0.0002	0.30	0.6	0.0003	0.00	0.0000	0.0004	0.4	2874.251	0.8
113.85		0.050	60.0	60.0	0.0	1.2	6.0	0.50	1.5	0.0001	0.25	0.5	0.0002	0.00	0.0000	0.0004	0.4	3254.237	0.9
113.80		0.050	60.0	60.0	0.0	1.2	4.8	0.45	1.4	0.0001	0.20	0.4	0.0002	0.00	0.0000	0.0003	0.3	3750.000	1.0
113.75		0.050	60.0	60.0	0.0	1.2	3.6	0.40	1.4	0.0001	0.15	0.3	0.0001	0.00	0.0000	0.0003	0.3	4423.963	1.2
113.70		0.050	60.0	60.0	0.0	1.2	2.4	0.35	1.3	0.0001	0.10	0.2	0.0001	0.00	0.0000	0.0002	0.2	5393.258	1.5
113.65		0.050	60.0	60.0	0.0	1.2	1.2	0.30	1.3	0.0001	0.05	0.1	0.0000	0.00		0.0002	0.2	6906.475	1.9
113.60	Outlet of Subdrain	0.000	60.0	50.0	0.0	0.0	0.0	0.25	1.3	0.0001	0.00	0.0	0.0000	0.00		0.0001	0.1	0.000	0.0

Draw down time (hours) 10.3

Weir Flow

$Qweir = 0.66\ C\ B\ (2\ g)^{0.5}\ H^{1.5}$

where:

C = Weir Discharge Coefficient
B = Weir Width
g = Accel due to Gravity
H = Head above weir crest

APPENDIX A: STORMWATER MANAGEMENT MODEL

Storm Sewer Design Sheet

Client: City Wye'd Electric
Job No.: 210430
Location: 140 Reis Road
Date: November 17, 2022 **Revision 2**

Storm Sewer Design Sheet (5-yr storm)

Catchment Area	FROM	TO	Total Area (ha)	C 0.20	C 0.70	C 0.90	Actual R ('C')	INDIV 2.78 AR	ACCUM 2.78 AR	TIME OF CONC.	RAINFALL INTENSITY I	PEAK FLOW Q (l/s)
CA1	West Side		0.0708	0.0150	0.0000	0.0558	0.75	0.15	0.15	10.00	104.19	15.42
OFFSITE	West Side		0.0744	0.0254	0.0490	0.0000	0.53	0.11	0.26	10.00	104.19	26.82
CA2	East Side		0.0829	0.0353	0.0000	0.0476	0.60	0.14	0.14	10.00	104.19	14.45
OFFSITE	East Side		0.0492	0.0245	0.0070	0.0177	0.52	0.07	0.21	10.00	104.19	21.91

	PROPOSED SEWER										SWALE			
Catchment Area	TYPE OF PIPE	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	EXCESS CAPACITY (l/s)	Q/Qfull	Controlled /Uncontrolled	Controlled Flow (l/s)		SHAPE / SLOPE	MIN FLOW DETPH (m)	MIN CAPACITY (l/s)	EXCESS CAPACITY (l/s)
West Side	PVC	250	0.10	50.0	18.82	-8.00	0.82	Controlled	0.4	Sand Filter	Trapazoid 0.50%	0.10	44.30	17.48
East Side	PVC	250	0.10	50.0	18.82	-3.08	0.77	Controlled	0.5		Trapazoid 0.50%	0.10	44.30	22.39

Rainfall Intensity = $998.071/(T+6.053)^{\wedge-0.814}$ T= time in minutes
(City of Ottawa, 5 year storm)

APPENDIX A: STORMWATER MANAGEMENT MODEL

Storm Sewer Design Sheet

Client: City Wye'd Electric
Job No.: 210430
Location: 140 Reis Road
Date: November 17, 2022 **Revision 2**

Storm Sewer Design Sheet (5-yr storm)

Catchment Area	FROM	TO	Total Area (ha)	C 0.25	C 0.88	C 1.00	Actual R ('C')	INDIV 2.78 AR	ACCUM 2.78 AR	TIME OF CONC.	RAINFALL INTENSITY I	PEAK FLOW Q (l/s)
CA1	West Side		0.0708	0.0150	0.0000	0.0558	0.84	0.17	0.17	10.00	178.56	29.56
OFFSITE	West Side		0.0744	0.0254	0.0490	0.0000	0.66	0.14	0.30	10.00	178.56	54.12
CA2	East Side		0.0829	0.0353	0.0000	0.0476	0.68	0.16	0.16	10.00	178.56	28.01
OFFSITE	East Side		0.0492	0.0245	0.0070	0.0177	0.61	0.08	0.24	10.00	178.56	42.89

	PROPOSED SEWER										SWALE			
Catchment Area	TYPE OF PIPE	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	EXCESS CAPACITY (l/s)	Q/Qfull	Controlled /Uncontrolled	Controlled Flow (l/s)		SHAPE / SLOPE	MIN FLOW DETPH (m)	MIN CAPACITY (l/s)	EXCESS CAPACITY (l/s)
West Side	PVC	250	0.10	50.0	18.82	-35.29	1.57	Controlled	0.4	Sand Filter	Trapazoid 0.50%	0.10	44.30	-9.82
East Side	PVC	250	0.10	50.0	18.82	-24.07	1.49	Controlled	0.5		Trapazoid 0.50%	0.10	44.30	1.41

Rainfall Intensity = $998.071/(T+6.053)^{\wedge-0.814}$ T= time in minutes
(City of Ottawa, 5 year storm)

Note: The capacity of the west swale and subdrain combined = 18.82 + 44.30 = 63.12 L/s which is in excess of the total demand of 54.12 L/s in the west swale

Appendix B: Product Information and Certificate of Well Compliance

Appendix B has been reinserted from the original report dated August 13, 2021 without revision.

- Geotextile
- Certificate of Well Compliance

Terrafix 270R - Geotextile

Function: Filtration & Drainage.

Terrafix 270R is a needle-punched nonwoven geotextile made of 100% virgin polypropylene staple fibers, which are formed into a random network for dimensional stability. Terrafix 270R resists ultraviolet deterioration, rotting, biological degradation, naturally encountered alkalis and acids. Polypropylene is stable within the pH range of 2-13.

Types of applications for 270R are: Subdrains, French Drains, Foundation Drains, Trench Drains, Blanket Drains.

270R provides good lateral drainage and is suitable for a wide spectrum of soil permeabilities.

Property	ASTM Test Method	Value Metric Units
Typical Geotextile Properties		
• Weight (Typical)	D 5261	140 g / m^2 (4.0 oz/sqyd)
• Grab Tensile Strength	D 4632	445 N
• Grab Elongation	D 4632	50%
• Tear Resistance	D 4533	200 N
• Puncture CBR	D 6241	1320 N
• Permittivity	D 4491	2.00 sec^{-1}
• Water Flow	D 4491	6095 l/min/m^2
• Apparent Opening Size	D 4751	0.300 mm
• U.V. Stability	D 4355	70% @ 500hrs

CERTIFICATE OF WELL COMPLIANCE

Ottawa

I (Jeremy Hanna) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have

supervised the drilling of the water well on the property of :

OWNER: WINCH HOLDINGS LTD.

Location: # 140 REIS ROAD, Corp

LOT: 8 CON: 2 PLAN # 4M-745 ~~SUB#~~ Block 2

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 25TH Day of MAY, 2021

Jeremy Hanna (T3632) Air Rock Drilling Co. Ltd. (C-7681)

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

Signed this 7TH day of JUNE, 2021

LICENSED PROFESSIONAL ENGINEER
R. A. PASSMORE
100008723
JUNE 7/21
PROVINCE OF ONTARIO

(Engineer)

221338
A 318400

Ontario — Ministry of the Environment, Conservation and Parks

Tag#:A318400 (Print Below)

A318400

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	Winch Holdings Ltd		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
Box 502	Stittsville	ON	K2S 1A6	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
140 Reis Road	West Carleton	8	2

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Carp	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	423097	5017388	4M-745	Block 2

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Sand & Gravel	+ Boulders		0'	16'
Grey & Brown	Limestone			16'	105'
Grey & Brown	Limestone			105'	294'
Grey & Brown	Limestone			294'	300'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/cy)
22'	12'	Neat cement	10.92
12'	0'	Bentonite slurry	4.2

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify SURGED

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6 1/4"	Steel	.188"	+2'	22'
6"	Open Hole		22'	300'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Status of Well

☐ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From (m/ft)	Depth To (m/ft)	Diameter (cm/in)
105 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	0'	22'	9 3/4"
294 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	22'	300'	6"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 280

Pumping rate (l/min/GPM): 6

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 169' 1"

If flowing give rate (l/min/GPM): X

Recommended pump depth (m/ft): 280 (280)

Recommended pump rate (l/min/GPM): 5

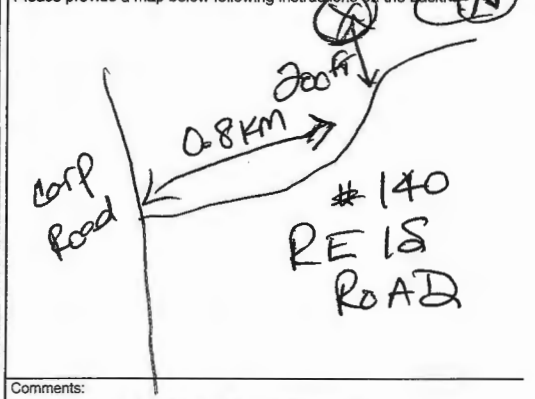
Well production (l/min/GPM): 5

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	10' 1"		169' 1"
1	17	1	158
2	22.3	2	155
3	27.2	3	151
4	32	4	147
5	36.7	5	143
10	57.9	10	126
15	76.3	15	109
20	92.2	20	94.6
25	106	25	81
30	118	30	68.7
40	140	40	47.6
50	156	50	27.1
60	169' 1"	60	10' 1"

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
3/4 HP @ 5 GPM SET AT 280 FEET

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	7681

Business Address (Street Number/Name)	Municipality
6659 Franktown Road	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (Y Y Y Y M M D D)
T3632		2021 05 31

Well owner's information package delivered	Date Package Delivered (Y Y Y Y M M D D)	Date Work Completed (Y Y Y Y M M D D)
☒ Yes ☐ No	2021 05 26	2021 05 25

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Ministry's Copy

Appendix C: Sewage System Design

Not included with this submission. An updated permit is required and must be obtained by the owner/developer.

Appendix D: Correspondence

Appendix D has been reinserted from the original report dated August 13, 2021 without revision.

- City of Ottawa – Pre-consultation
- City of Ottawa – Interpretation of the Reis Business Park Stormwater Management Criteria

Pre-Application Consultation
Site Plan Control (*Rural Small*)
140 Reis Road

Applicant:	Scott Winch	**Owner:**	Winch Holding Ltd
Ward	5 - West-Carleton-March	**Councillor**	Eli El-Chantiry
Proposal Summary:	Development of a 464.52 square metre (*5,000 sq. ft.*) pre-engineered steel building on the subject site. The proposed building will be used as an automotive service station.		
Attendees:	Krishon Walker, Planner, PIEDD, City of Ottawa Brian Morgan, Infrastructure Project Manager, PIEDD, City of Ottawa Sami Rehman, Environmental Planner, PIEDD, City of Ottawa Neeti Paudel, Transportation Project Manager, PIEDD, City of Ottawa Erica Ogden, Planner, Mississippi Valley Conservation Authority		

Meeting Notes

Planning Comments (Provided by Krishon Walker, Planner)

- As per Schedule A of the Official Plan, the site is designated Rural Employment Area. The Rural Employment Area is intended to support and encourage clustering of primarily industrial uses not suitable in the Urban Area or General Rural Area. Uses permitted in this designation includes but is not limited to new; heavy and light industrial uses, transportation uses, and warehouse and storage operations. As per Schedule 1 of the Carp Road Corridor Community Design Plan (CDP), the site is designated as Light Industrial. The proposed development is consistent with the policies of both the Official Plan and CDP.
- As per the City's Zoning By-law, the site is zoned as Rural General Industrial Zone, Subzone 4 (RG4).

  The Zoning By-law defines an automotive service station as *"a place that:*

  a. *has one or more service bays or facilities for a mechanic to service and repair motor vehicles other than heavy vehicles, which may also retail fuel and other automotive products; or*
  b. *has one or more service bays which provide one or more single or specialized service product installation for motor vehicles other than heavy vehicles such as mufflers or oil changes; and*
  c. *may include sales of motor vehicles other than heavy vehicles in association with the automobile service station."*

  Please ensure that your proposal complies with all applicable provisions of the Zoning By-law.

  Additionally, please ensure that the proposed parking complies with the provisions of Part 4 of the Zoning By-law. Parking areas should be screened from the street.

  If any aspect of the proposal does not comply with the zoning provisions of the applicable zone, a Minor Variance may be required through the Committee of Adjustment. If a Minor Variance is required, please note approval from the Committee of Adjustment would be required before a decision is made on the Site Plan Control application.

- Cash-in-Lieu of Parkland will be requested as a condition of Site Plan Control. CIL would be taken at 2% of the gross land area being developed, including roads, parking lot and other associated land used for the development.
- Please note that, as per Table 219 of the RG zone, any proposed outdoor storage is not permitted within the front yard and must be screened from the public street by an opaque screen at least 1.8 metres in height from finished grade.
- Please contact the Mississippi Valley Conservation Authority (MVCA), amongst other federal and provincial departments/agencies, to identify all the necessary permits and approvals required to facilitate the development. Responsibility rests with the developer and their consultant for obtaining all external agency approvals. The address shall be in good standing with all approval agencies. Copies of confirmation of correspondence will be required by the City of Ottawa from all approval agencies that a form of assent is given. No construction shall commence until after a commence work notification is given.
- Please ensure that the Site Plan shows the full extent of the property and that a complete zoning table is provided. The Site Plan should also clearly show the dimensions of all proposed buildings, roads, radii of turns, overhead clearances, parking areas with defined parking spaces, steps, terraces, fences, walks, aisles and private approaches.
- Please show the location for snow storage on both the Site Plan and Landscape Plan. Storage shall not interfere with approved grading and drainage patterns or servicing. If snow is to be removed from the site, then please make a note of that on the Site Plan and include where the snow will be placed in the interim. Temporary snow storage areas should not conflict with utility box, landscaping, required parking, and site circulation.
- Be sure to follow the City's guide to preparing plans and studies (*see link below*) to ensure a high quality of your submission.

  Feel free to contact Krishon Walker at Krishon.Walker@ottawa.ca, for follow-up questions.

Engineering Comments (Provided by Brian Morgan, Infrastructure Project Manager)

- Grading

  Please provide a few more existing and proposed grades along the side property lines.

  Please include details of the proposed retaining wall. Please confirm that the retaining wall is not over 1.0 metre in height. Retaining walls over 1.0m in height must be designed by an Engineer licensed in the Province of Ontario.

  A short section of the drainage swale and the rear-yard graveled area drains to the west. Where does these areas outlet too?

  Is the anagram TOF referring to the Top of Foundation Wall? The City will need elevations for Top of Foundation Wall and for the Top of Finished Floor.

- Stormwater Management

  Stormwater Management requirements for this lot are determined by the subdivision agreement. Please review Schedule H, page 44 of the Reis Road Business Park. See attached. Also, see attached City internal memo dated 06-Sep-2016.

  The Stormwater Management must be designed as per page 8.11 of the 'Ottawa Sewer Design Guidelines'. Typically, this is referred to as pre-to-post, but is more accurately described as 100-year post-development to 5-year pre-development.

The Stormwater Management Report/Brief should include a drawing indicating the 5-year and the 100-year flood line contours. Please ensure that the finished floor elevation is 300mm above the 100-year flood level.

The minimum diameter for rear-yard or side-yard perforated subdrain pipes is 250 mm. Perforated pipes shall be installed in a granular trench and protected from fines by a filter cloth as per the City of Ottawa standards. Ref: Ottawa Sewer Design Guidelines. Section 5.4.9.4.

Stormwater outlet pipes must stop at the property line.

Will catch-basins be used at the top end of the side yard subdrain pipes?

- Services

The hydrogeological report should discuss the impact the proposed well may have on the existing well on the neighbouring lot.

- The discharge of oils, grit, VOC's, and other harmful fluids resulting from the assembly or repair of vehicles are not permitted to discharge to the septic system as these chemicals will interfere with the processes necessary for the breakdown of human waste. Development Review requires that all runoff be directed to a legal and sufficient outlet, typically the right-of-way. It is understood that an oil/grit separator requires an ECA from the MECP. Please contact the MECP for additional information regarding this application.
- The City requires a drawing note that expressly states that site elevations are referenced to a geodetic benchmark. Please include a note referencing the following:

1. Original registered survey plan (4R-PLAN),
2. Geodetic site benchmark (not a TBM), and
3. CSRS survey monument and its geodetic elevation. (Please include sufficient information to permit a lay-person to locate these benchmarks in the field.) A sample note might read:

> "Reference CSRS Survey monument no. 2212235, located at the corner of Smith and Wesson Street, in the church yard near the front steps. Geodetic elevation = 108.12 metres ASL."

Feel free to contact Brian Morgan at Brian.Morgan@ottawa.ca, for follow-up questions.

Environmental Comments (Provided by Sami Rehman, Environmental Planner)

- The site plan will need to have a Tree Conservation Report (TCR). The TCR will also need to reflect current requirements regarding butternuts and other Official Plan policies.

Feel free to contact Sami Rehman at Sami.Rehman@ottawa.ca, for follow-up questions.

Transportation Comments (Provided by Neeti Paudel, Transportation Project Manager)

- Comments are forthcoming.

Feel free to contact Neeti Paudel at Neeti.Paudel@ottawa.ca, for follow-up questions.

Conservation Authority Comments (Provided by Erica Ogden, Planner, MVCA)

- The property is not regulated under Ontario Regulation 153/06 and there are no natural hazard or natural heritage features identified.
- As per the Carp River Watershed Subwatershed Study the site is within the moderate recharge area which has an annual infiltration target of 104 mm/yr. The water quality should include a normal level of protection which is 70% Total Suspended Solids removal.

Feel free to contact Planner, Erica Ogden, at eogden@mvc.on.ca, for follow-up questions.

Application Submission Information

Applications Type**: Site Plan Control, Rural Small**.
Application processing timeline generally depends on the quality of the submission. For more information on standard processing timelines, please visit: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/development-application-forms#site-plan-control

Prior to submitting a formal application, it is recommended that you pre-consult with the Ward Councillor.

For information on application fees, please visit: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/fees-and-funding-programs/development-application-fees

To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre: InformationCentre@ottawa.ca or (613) 580-2424 ext. 44455

Application Submission Requirements

For information on the preparation of Studies and Plans and the City's requirements, please visit: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans

Please provide hard copies and electronic copy (PDF) of all plans and studies required.

All plans and drawings must be produced on A1-sized paper and folded to 21.6 cm x 27.9 cm (8½"x 11").

Note that many of the plans and studies collected with this application must be signed, sealed and dated by a qualified engineer, architect, surveyor, planner or designated specialist.

Reis Business Park
Stormwater Management

Ref Info: Reis Road, Tansley Road, & Maple Creek Court
15-86-3062 (Phase 1)
D07-17-4M745

Stormwater Management – The allowable runoff rate from sites within the Reis Industrial Park is governed by the design assumptions used in the approved Engineering Report contained in Schedule "H" of the subdivision agreement. If the resulting runoff from the proposed site will be less than the allowable rate, no on-site SWM will be required. The design parameters used in the approved subdivision Engineering Report are as follows:

- The design of the internal drainage for the subdivision was based on site developments that would be: 50% building (C=1.0), 25% parking (C=0.9) and 25% undeveloped (C=0.2). By my interpretation of design assumptions in the subdivision Engineering Report, sites in this subdivision can be developed without a requirement for on-site SWM as long as the combined C-value does not exceed 0.775.

It is important to note that the original subdivision design used constant C-values, while the newer City of Ottawa Sewer Design Guidelines (see Section 5.4.5.2.1 and Table 5.7) now stipulate that C-values be increased by 25% during the 100-year event (to a maximum of C=1.0). Accordingly, I would ask that you use the City's increased 100-year runoff coefficients when determining the post-development combined C-value for the site. If the post-development C-value is below 0.775, no on-site SWM will be required. If SWM is required, the allowable release will be based on the 5-year flow, with a C-value of 0.775.

As per Tim Newton, Project Manager, City of Ottawa
Edits supplied by Damien Whittaker and Brian Morgan. 06-Sep-2016