Civil and Municipal Engineering

ARK Engineering and Development

Servicing Report:
Potable Water Supply Assessment, Sewage, Storm and Stormwater

6075 Bank St.
Greely Village Centre
Greely, Ontario

Prepared For
Greely Family Farm Inc.

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POTABLE WATER SUPPLY ASSESSMENT, SEWAGE, STORM AND STORMWATER

TABLE OF CONTENT

1.0 BACKGROUND

1.1 General 1

1.2 Existing Services 1

1.3 Geotechnical Report 1

2.0 PROPOSED SERVICES 2

2.1 Existing Potable Water Supply Assessment Findings 2

2.2 Supplemental Potable Water Supply Assessment 2

2.3 Sewage 8

2.4 Storm Sewer 9

2.5 Stormwater Management 10

3.0 CONCLUSION 11

Appendix "A"

SK-1	Location Map
SK-2	Pedestrian Connections
SK-3	Vehicular Movement
Table 2	Excerpt from Approved Paterson Potable Water Supply
Page 15	Excerpt from Approved Paterson Potable Water Supply
Pond Sizing	Excerpt from Approved J.F. Sabourin SWM Report

Appendix "B"

MOE Well Record
Eurofins Laboratory Subdivision Package Results
Drawdown Plot
Langelier Saturation Index

Appendix "C"

Sanitary Sewer Design Sheet
Storm Sewer Design Sheet

SERVICEABILITY REPORT

1.0 BACKGROUND

1.1 General

The proposed site plan situated at 6075 Bank St. located on the East-Southern side of the intersection of Parkway Rd. and Bank St. (refer to the location map SK-1 in appendix A). The proposed site plan will consist of 1 x 10,000 ft^2 and 3 x 6,000ft^2 retail/office building mix. These buildings will be serviced by some existing private infrastructure which will be described below.

1.2 Existing Services

This area of commercial development in Greely has no City sanitary, storm and watermain to service this land. All proposed services will be privately owned. The sanitary sewer will be connected to an existing private network system. The storm runoff will be directed to an existing SWM facility and private individual wells will provide the drinking water to these buildings.

An internal Road Network as shown on the location map in Appendix A, will provide this site plan with one main connection access point from Village Center Place to the existing site plan located just north of the proposal. A vehicular and pedestrian linkage sketch is also enclosed.

All utilities (Hydro, Bell Cable and Gas) are available and have been installed up to the property line.

1.3 Geotechnical Report

For all Geotechnical inquiries refer to the Paterson Group following documentation:

- Letter: PG4777-LET.01, December 28, 2018
- Report: No. PG3957-1R, dated March 27, 2017

2.0 PROPOSED SERVICES

2.1 Existing Potable Water Supply Assessment Findings

Back on November 2016, a *Potable Water Supply Assessment* was prepared by Paterson Group for this 20 acre parcel to confirm whether a well could provide adequate water supply (quantity and quality) to support a 4.7 acre commercial development.

At the time, a test well test was drilled. A pumping test was completed at this well which showed a very high yield. The drawdown was approximately 5 cm and achieved a 95% recovery almost immediately. Furthermore, as identified in Table 2 of this report the recommended pump rate for this well is 91 L/min (1.52 L/s), excerpt found in Appendix A.

This existing commercial development has an estimated peak daily water demand of 36,763 L/day, based on Table 8.2.1.3 B of the OBC (excerpt from page 16 of the approved report). This demand is still far less than the 131,040 L/day recommended pump rate of this test well.

Furthermore, as added comfort, page 15 of the approved report (excerpt found in Appendix A) states the following:

*"The results of the 20 year safe yield analysis show that the well could be pumped at up to **1370 L/min** continuously without causing an adverse impact to surrounding well users."*

2.2 Supplemental Potable Water Supply Assessment

As part of the commercial phasing another 3.5 acres will be developed and serviced by a private well. The following will demonstrate once again that that the targeted aquifer is more than adequate to support this new commercial phase.

The scope of the report is limited to the description of the potential yield quantity and quality of the bedrock water supply aquifer intercepted by a drilled well, as it relates to the future servicing potential for the proposed development within the area of the subject site.

A new drilled well (designated TW1, refer to Appendix "B" for MOE well record) was installed at the site on March 21, 2019 by D & R Drilling of St-Albert, Ontario (Well Contractor License No.3773). The new well was drilled to a total depth of 109.09 m. Steel casing was installed to a depth of approximately 70m. The test well was constructed in general conformance with the well construction requirements for the adjacent development within plan 4M-1398. As per the approved "Consolidated Terrain Analysis and Hydrogeological Study Report", which requires all wells to be cased "through the limestone formation and extend into the sandstone formation".

Table 1: Test Well summary

Well ID	Year Drilled	Depth to Bedrock (m)	Depth of Water Bearing Fractures (m)	Total Depth (m)	Recommended Pumping Rate (L/min)
A258613	2019	6.96	30.30 57.57 **108.18**	109.09	45.0

Water Quantity

The pump test was conducted in general accordance with Ontario Ministry of the Environment, Conservation and Parks (MECP) guidance document Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment (MOEE, 1996).

A pumping test at TW1 on March 21, 2019 was conducted. A pumping rate of 54 L/min was selected with the expectation that the rate would stress the aquifer enough to result in a demonstrable reduction in potentiometric head (i.e. a lowering of the static water level) within the test well. The pumping test was carried out for a 6 hour duration.

During the test the pumping rate was monitored at regular intervals to ensure the rate of discharge remained constant (i.e. < 5% variation). Drawdown observations during pumping and recovery were recorded using manual measurements taken with an electronic water level tape.

Drawdown observations during the pumping and recovery were recorded using manual measurements using an electronic water level tape. Over the course of the pumping test, the water level in the well dropped by 0.04m within minutes then it maintained its level through out the 6 hours in which it was then allowed to recover. No real recovery data was collected for the well following the completion of pumping since the 95% recovery was achieved almost immediately.

Field testing for chlorine was carried out at the time of sampling. Groundwater samples were collected in laboratory supplied bottles and preserved in the field using established sampling protocol. The samples were stored in a dedicated sample cooler maintained at a temperature between 4 and 10 degrees Celsius. The water samples were submitted to the Eurofins within one (1) hour of collection for standard "Sub. Package", refer to Appendix "B".

Turbidity measurements were taken using a Hanna C114 turbidity meter at the well head at regular intervals during the pumping test and the reading at the time of the sampling (6 hour mark) was below 1.0 NTU. Free chlorine residual measurements were taken using a HachTM Pocket Colorimeter IITM handheld unit immediately prior to the collection of each groundwater sample.

Table 1: Testing Results

Parameters	Results
Pumping Rate (L/min)	54.0
Static Water Level at start of test (m)	3.26
Static Water Level at end of test (m)	3.22
Total Drawdown during test (m)	0.04
Available Drawdown (m)	105.83
% Drawdown during pumping test	0.037%
Transmissivity	1,095
Specific Capacity (L/min/m)	1,350

The pumping test drawdown plot for TW1 is provided in Appendix "B". As for the recovery data since it was practically instantaneous no data was able to be recorded. The drawdown data provided was measured with reference to the top of the well casing at the test well location.

The pumping test data for the test well was analyzed using the method of Cooper and Jacob (1946). This method provides a reasonable estimate of the aquifer transmissivity.

Transmissivity was calculated using the following relationship:

$$T = \frac{2.3Q}{4\pi ds}$$

Where:

Q = pump rate, m^3/day
ds = change in drawdown over one time log cycle, m
T = transmissivity, m^2/day

Based on the pumping test drawdown data the transmissivity of the aquifer is estimated to be about **1095m^2/day**.

For the new proposed commercial buildings the daily water demands have been estimated based on Section 4.4.1.2 of the City guidelines, Appendix 4-A. In accordance to Appendix 4-A, the proposed development would have a demand of 12.5 L/min. Refer to Section 2.3 Sewage for a

summary of the estimated sewage flow.

This is approximately 23% less than the rate utilized during the pumping test (54 L/min.). Given that the well totally recovered practically immediately of termination of pumping at a rate of 54 L/min, the water supply aquifer intercepted will provide the necessary well yield without mining the aquifer in the long term.

Based on the above there is water of sufficient quantity present in the water supply aquifer beneath the site to support the four new commercial buildings on a single well.

Water Quality

Water quality analysis data from TW1 is summarized in Table 2 (below). Laboratory certificates of analysis are included in Appendix "B".

Table 2: Groundwater Geochemistry – TW1

PARAMETER	UNITS	ODWS		6045 Bank St.	NEW
		TYPE	LIMIT	Ex. Well*	TW1
MICROBIOLOGICAL PARAMETERS					
Escherichia Coli	ct/100 mL	MAC	0	0	**0**
Faecal Coliforms	ct/100 mL	-	-	0	**0**
Heterotrophic Plate Count	ct/100 mL	-	-	21	**0**
Total Coliforms	ct/100 mL	MAC	0	0	**0**
CHEMICAL PARAMETERS (HEALTH)					
F	mg/L	MAC	2.4	0.28	**0.39**
N-NO2	mg/L	MAC	10	<0.10	**<0.10**
N-NO3 (Nitrate)	mg/L	MAC	10	<0.10	**<0.10**
CHEMICAL PARAMETERS WITH AESTHETIC OBJECTIVES/OPERATIONAL GUIDELINES					
Alkalinity	mg/L	OG	500	223	**226**
Cl	mg/L	AO	250	127	**122**
Colour	TCU	AO	5	<2	**<2**
DOC	mg/L	A0	5	1.2	**1.3**
pH		OG	6.5-8.5	8.0	**8.5**
SO4	mg/L	AO	500	82	**78**
Hardness	mg/L	OG	100	298	**297**
Na	mg/L	AO	200	76	**84**
Fe	mg/L	AO	0.30	0.20	**0.66**
Mn	mg/L	AO	0.05	0.03	**0.03**
TDS	mg/L	AO	500	606	**625**
Turbidity (lab)	NTU	AO/MAC	5/1	2.1	**1.3**
S2-	mg/L	AO	0.05	<0.02	**<0.01**

* water results from 6045 Bank St. - *Potable Water Supply Assessment* prepared by Paterson Group

The water results of this targeted aquifer are well in line with the results from the 6045 Bank St. *Potable Water Supply Assessment* prepared by Paterson Group which are also included above for reference.

The analytical results show that water quality at the subject site is acceptable and that there are no exceedances of the applicable **health related parameter limits of the Ontario Drinking Water Standards (ODWS)**.

With respect to aesthetic objectives and operational guidelines, the analytical results indicate the following exceedances:

- Hardness
- TDS
- Iron

Hardness
Hardness, an operational guideline, does not appear in the ODWS. Rather it appears in the Technical Support Documents for Drinking Water Standards, Objectives, Guidelines (Technical Support Documents) as a parameter with an operational guideline of 100 mg/L. At the measured concentrations, the water is considered to be very hard, however it is below the reasonable treatment limit of 500 mg/L specified in Table 3 of the guidance document, titled, " Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment", published by MOECC (MOE, 1995).

TDS
Total dissolved solids (TDS) refers to the concentration of inorganic substances dissolved in water. The main constituents are typically chloride, sulphates, calcium, magnesium and bicarbonates. Procedure D-5-5 does not provide a 'treatability limit' for TDS, but it does require written rationale that corrosion, encrustation, or taste problems will not occur.

The Langelier Saturation Index is used to predict the calcium carbonate stability of water. It indicates whether the water will precipitate, dissolve, or be in equilibrium with calcium carbonate. The results of the Langelier calculation (LSI = +1.3) indicate that the water is supersaturated with respect to calcium carbonate (CaCO3) and scale forming may occur but non corrosive. Refer to Appendix "B".

Iron
The iron level at TW1 after the six hours of pumping was 0.66mg/L, which exceeds the ODWS aesthetic objective of 0.30 mg/L. The iron level is well within the MOE treatability limit of 5.0 milligrams per litre using a water softener.

Sodium
The sodium level in the water was reported to be 84 mg/L. The ODWSOG states that *"the local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/l so that this information may be communicated to local physicians for their use with patients on sodium restricted diets."*

Well Water Treatment
The water within the bedrock aquifer displays slightly elevated hardness and iron. Installation of a standard commercial grade water softener will reduce the concentrations of hardness to acceptable levels. Some softeners can remove iron alternatively an iron filter can also installed. Conventional water softeners introduce sodium into the water supply, so it may be appropriate to bypass the water softener with a separate tap for drinking water.

2.2 Sewage

The entire commercial development will be serviced by an existing private sanitary sewage treatment facility and an existing underground gravity sewer system all in accordance to MOE reference #2418-AVJRJ5 (refer to approved MOE report "Greely Village Centre - Sanitary sewer serviceability brief dated Aug. 2010)

As mentioned above, in order to determine the water demand for these four proposed buildings, Section 4.4.1.2 of the City guidelines, Appendix 4-A was consulted.

	Area (m^2)	Flows	L/day
Building 1	929	6.53 L/day per 1.0m^2	6,066
Building 2	565	75 L/day per 9.3m^2	4,556
Building 3	565	75 L/day per 9.3m^2	4,556
Building 4	565	5 L/day per 1.0m^2	2,825
			18,003

A sanitary sewer design sheet for the proposed internal sanitary sewers is provided in Appendix C. All internal sewers will be flowing well within their capacity. Further, based on the foregoing calculations, the receiving existing sanitary sewers have capacity for the proposed development.

2.3 Storm Sewer

The proposed site plan will be serviced by a network of storm sewers complete with catch basins in order to capture the runoff from the site. It will then be conveyed thru an existing open channel ditch which then discharges to the existing SWM facility.

These sewers will be designed to the 2 year event, a sewer design sheet for the proposed internal storm sewers is provided in Appendix C.

The City of Ottawa published a Technical Bulletin amending the *Sewer Design Guidelines* (October 2012) titled *Technical Bulletin PIED TB-2016-01 Revisions to Ottawa Design Guidelines - Sewer* (September 2016). The points identified in the technical bulletin applying to this development are summarized as follows.

1. Minimum storm sewer design and maximum HGL (Section 5.1.3.1) – The minimum sewer size for local streets is to the 2-year event without ponding.

2. Maximum allowable depth of flow on streets (Section 5.1.4) – The allowable flow depth in 2-year to 100-year storms is 350mm at the edge of pavement in 100-year storms + 20%.

3. Hydraulic Grade Line (HGL) in 100-year storm event (Section 5.1.4) – The HGL shall be 0.30m beneath the underside of footings of adjacent buildings in 100-year storm events.

4. The water level/HGL in the system must not touch any part of the building envelope and must remain below the lowest building opening during the 100-year storm event + 20%. (Section 5.1.4)

5. The maximum flow depth on streets (both public and private and on parking lots) under either static or dynamic conditions shall be 350mm during the 100-year storm event (Section 8.3.9.7).

6. The emergency overflow spill elevation must be 30cm below the lowest building opening. The plan view drawing must show the maximum ponding elevation based on the emergency spill contour line as opposed to the 100-year ponding limit.

A storm sewer design sheet for the proposed internal storm sewers is provided in Appendix C complete with the open channel capacity calculations. All internal sewers will be flowing well within their capacity including the existing open channel ditch. Further, based on the foregoing calculations, the receiving existing storm sewers have capacity for the proposed development.

2.4 Stormwater Management

The following is to demonstrate that the proposed site plan application for 6075 Bank St. meets the SWM criteria previously approved in the J.F Sabourin report SWM Pond Design Brief – Commercial Phase Ultimate Conditions.

On the first table found in Appendix C, of the approved J.F. Sabourin report (refer to Appendix A for this table), the author applied an impervious value of 69% for entire rural commercial area identified as COM-1 (refer to enclosed Figure 4b.) Applying a total impervious of 69% is a conservative approach in calculating runoff generated by different storm events for commercial development since it assumed a weighted runoff coefficient of C=0.68. The Tables 1 and 2 summarizes the modeled/approved conditions vs the proposed conditions of the imperviousness for these Blocks.

Table 1: Modeled Imperviousness

Hard (m^2)	Soft (m^2)	Area (m^2)
-	-	14,160
Runoff Coefficient		**0.68**
Total Impervious		**69.0%**

Table 2: Proposed Imperviousness

Hard (m^2)	Soft (m^2)	Total (m^2)
9,210	4,950	14,160
Runoff Coefficient		**0.66**
Total Impervious		**66.0%**

As shown above, once developed these blocks will still yield a "total impervious" below the value of 69% applied in the modeling. Thus, this will have no impact on stormwater management, since the pond has been designed and sized to accommodate this portion of the development.

3.0 CONCLUSION

From the above statements the following can be concluded:

i) This entire site can be serviced as proposed above.
ii) The buildings will be serviced by a private sanitary/storm sewer and well.
iii) The proposed site will drain overland towards the existing roadside ditch which ultimately discharges into an existing SWM pond which will provide adequate protection to the site and the environment.
iv) The subject site is considered to be suitable for commercial development based on the available well water yield and quality as determined by this investigation.

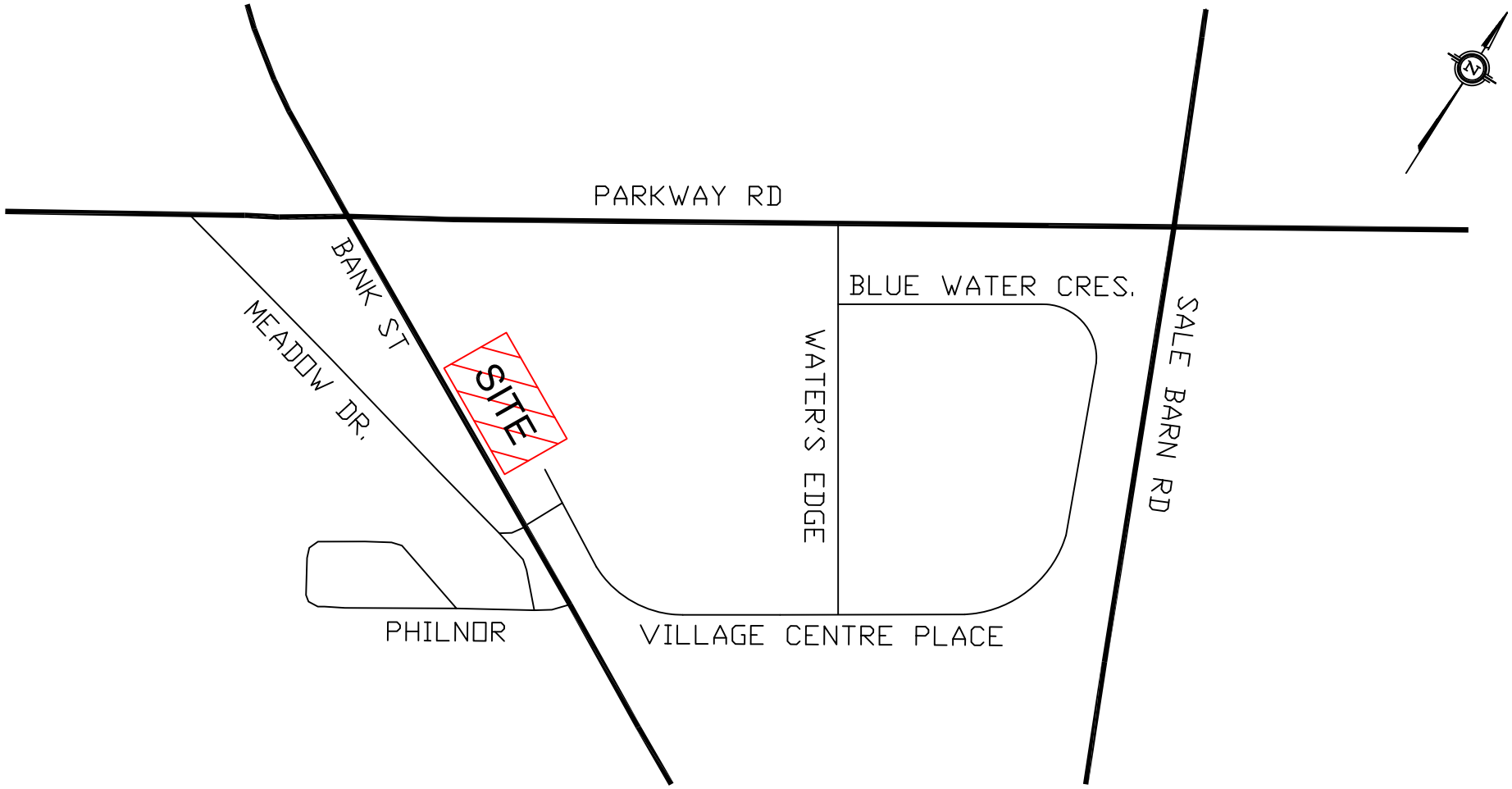
Prepared by:

ARK Engineering and Development

Daniel Payer, P.Eng.
President

APPENDIX "A"

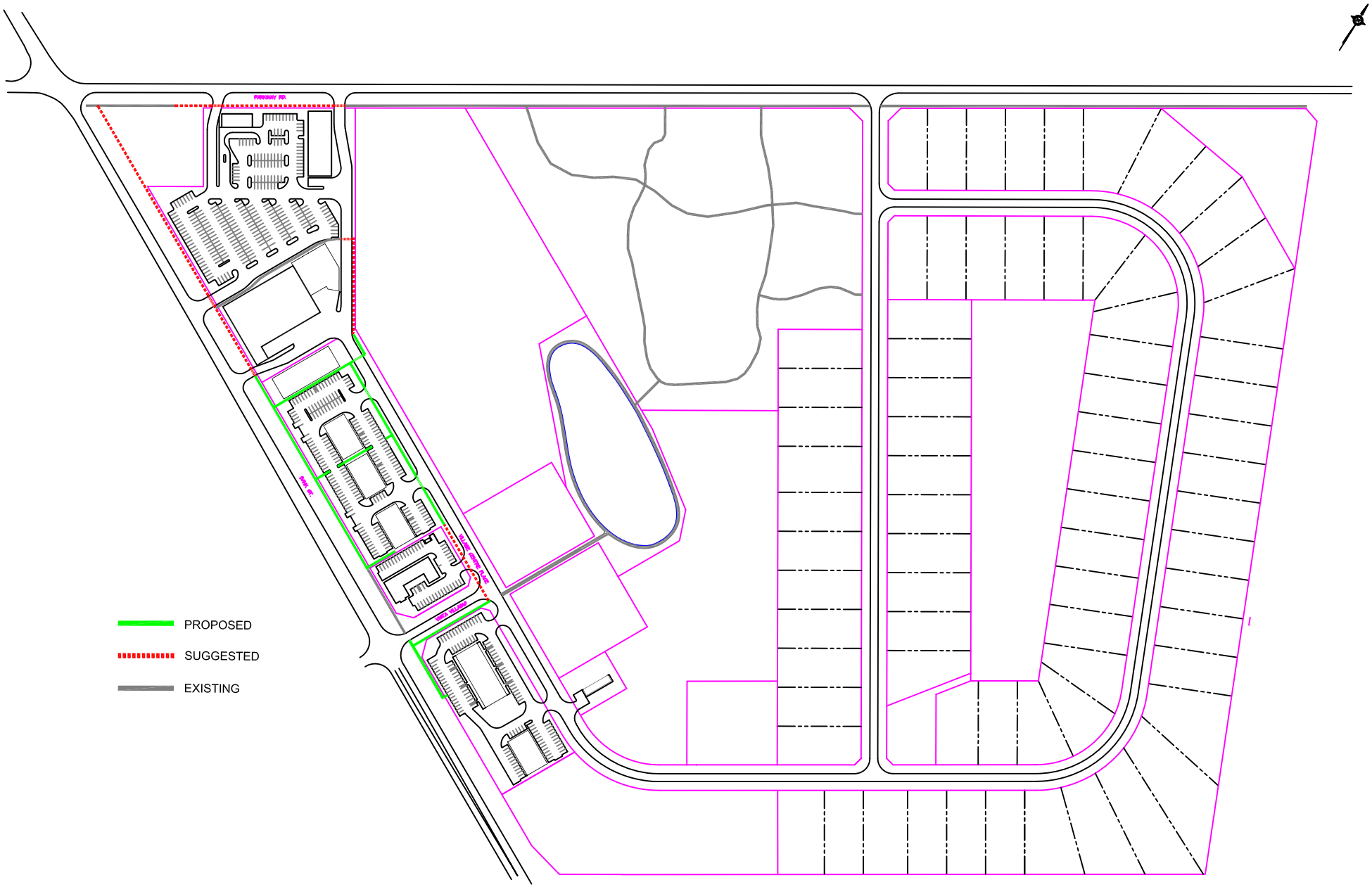
SK-1	Location Map
SK-2	Pedestrian Connections
SK-3	Vehicular Movement
Table 2	Excerpt from Approved Paterson Potable Water Supply
Page 15	Excerpt from Approved Paterson Potable Water Supply
Pond Sizing	Excerpt from Approved J.F. Sabourin SWM Report



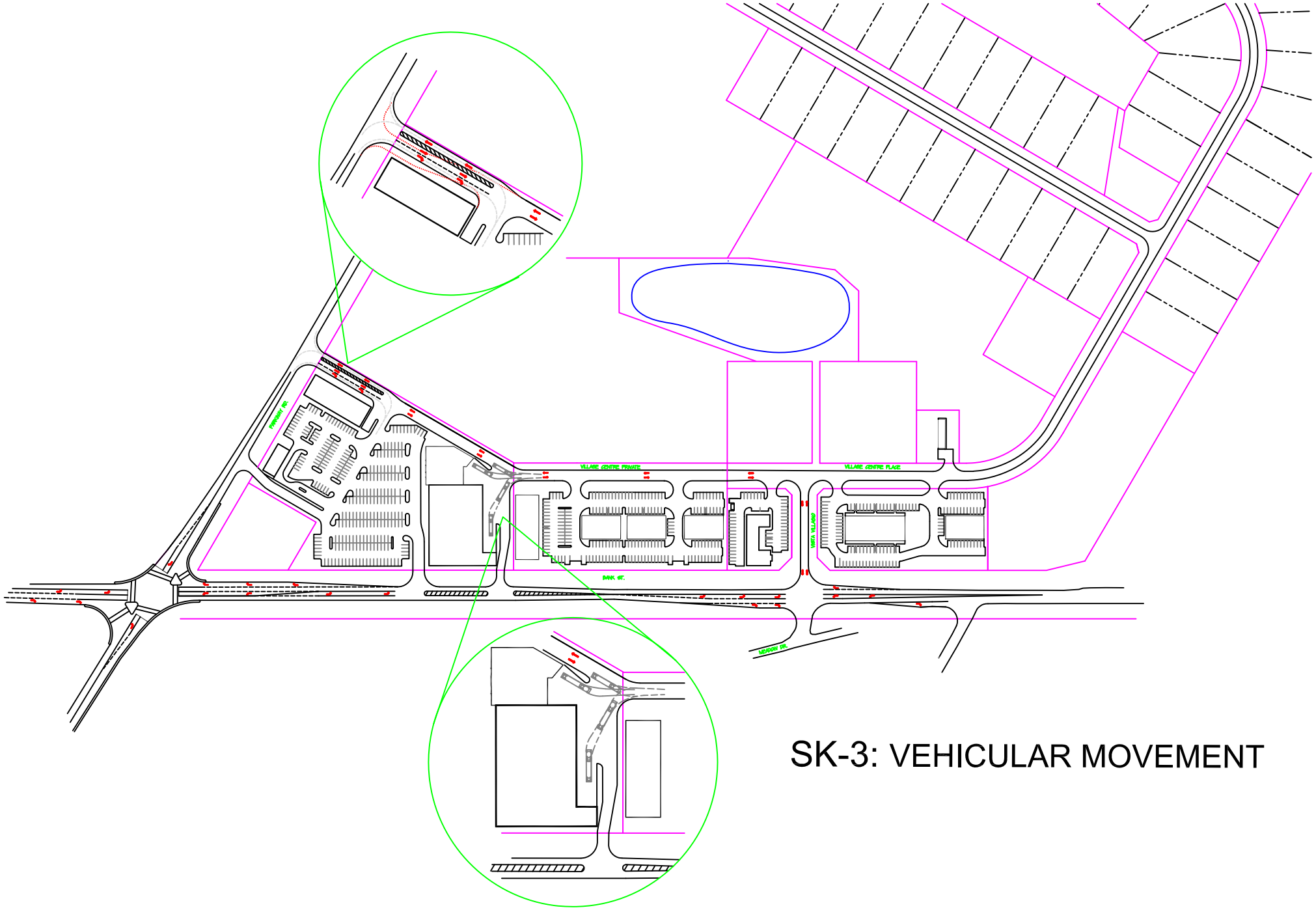
LOCATION MAP

CITY OF OTTAWA - Formerly TOWNSHIP OF OSGOODE

Completed By:	Drawing No.:
ARK ENGINEERING AND DEVELOPMENT	SK-1
Scale: NTS / Date: JAN 2019	



SK-2: PEDESTRIAN CONNECTIONS



SK-3: VEHICULAR MOVEMENT

Air Rock Drilling rig at 6045 Bank Street

The test well was constructed in general conformance with the well construction requirements for the adjacent 'Water's Edge' residential subdivision and Greely Commercial Centre, which requires all wells to be cased "through the limestone formation and extend into the sandstone formation".

The existing drilled well (TW1) was used as an observation well. This well terminates in the Oxford Formation at approx. 30.5 m bgs, and the well casing only extends to 9.1 m bgs. This well configuration does not conform to the City's requirements for the adjacent developments.

Table 2 - Test Wells Summary

Test Wells Summary							
Test Well ID	**Year Drilled**	**Depth to Bedrock (m)**	**Casing Depth (m)**	**Depth to Water Bearing Fractures (m)**		**Total Depth (m)**	**Recommended Pumping Rate (L/min)**
TW2	2016	8.23	60.35	105.2		106.98	91
TW1	2005	7.62	9.14	28.0		30.48	not available
TW8	2007	8.69	56.39	61.87		64.00	91
Dental Clinic	2012	11.28	60.35	87.8	109.1	110.95	91
City Park	2015	6.10	60.35	79.2	83.8	85.95	91

Table 5 - Summary of Aquifer Characteristics

SUMMARY OF AQUIFER CHARACTERISTICS	
Parameter	**TW2**
Transmissivity (m^2/d)	6960
Storativity	1.0E-04
Average Test Pumping Rate (L/min)	100
Average Test Pumping Rate (m^3/day)	144
Available Draw dow n (m)	102.75
Draw dow n at 100 mins (m)	4.511
Maximum Test Draw dow n (m)	4.553
Draw dow n at 20 years (extrapolated)	5.25
% of available draw dow n	5.1%
Specific Capacity (L/min/m)	22
Q20 safe w ell yield (m^3/day)Farvolden	341918
Q20 safe w ell yield (m^3/day) Maarthius & van der Kamp	1973
Q20 safe w ell yield (L/min) Maarthius & van der Kamp	1370
Farvolden, 1959	
Maathius & van der Kamp, 2006	

Pumping at TW2 did not have any effect on the nearby wells that were monitored (TW1, City Park, Dental Clinic and TW8). Dataloggers placed on TW1 and in the City Park well did not show any response to pumping. TW8 and the Dental Clinic well were also monitored manually during the pumping test and did not show any indication of the pumping at TW2.

There appears to be a significant degree of hydraulic isolation between the upper bedrock aquifer (Oxford and March Formations) and the Nepean Sandstone aquifer. Pumping at TW2 did not have any significant effect on TW1.

5.2 Groundwater Quantity

The pumping test results show that test well TW2 has a very high yield. Drawdown at a pumping rate of 34 L/min for 24 hours was approx. 5 cm. 95% recovery was achieved almost immediately. The drawdown at a pumping rate of 100 L/min for 6 hours was 22 cm. 95% recovery was achieved approximately 4.25 hours after the end of pumping.

A determination of the long term safe yield (i.e. Q20 pumping rate) of test well TW2 was calculated using the method described by Fervolden (Fervolden, 1959) as described in Maathius & van der Kamp, 2006. The inputs and results of the calculation are presented in Table 3 (above). The results of the 20 year safe yield analysis show that the well could be pumped at up to **1370 L/min** continuously without causing an adverse impact to surrounding well users.

Project: Greely Village Centre - Commercial Phase
Project No.: 64707
Quality Pond Sizing

Date: May 28, 2008
By: JHF

POND CMRC
Lands to be developped
(Final Conditions)
(All land is developped)

Catchment No.	Description	Drainage Area (ha)	Imp. (%)		Area incl.	Area (ha)	Imp (ha)	
COM-1	Commercial lands	14.64	69		X	14.64	10.10	
RES-1	Residential lands (Phase 1)	5.83	21					
RES-2	Residential lands (Phase 2 incl. Phase 1)	9.34	21					
POND-1	Pond block (Phase 1)	3.57	48					
POND-2	Pond block (Phase 2)	5.03	47					
PK-1	Green space	4.26	0					
UND-1	Undevelopped Lands (Phase 1 & 2)	6.85	0					
EX4	Existing Residential (EX4)	0.50	22		X	0.50	0.11	
POND-C	Pond block (Commercial)	1.57	66		X	1.57	1.04	

Totals= 16.71 11.25

Avg Imp= 67.31 %

As per MOEE,

Req'd Pond Vol.=	219	cu.m/ha
Total Pond Volume :	3655	cu.m
Permanent Pool=	2987	cu.m
Ext.Det. Volume=	668	cu.m

LEGEND :

- SW3 / 2.66 ha / 30% — Subwatershed ID; Subwatershed Area; Total Imperviousness
- SW4 / 15.67 ha / 75 | 65 — Subwatershed ID; Subwatershed Area; Time to Peak (hrs); CN
- Subwatershed delineation
- Phase limits
- Proposed subwatershed delineation
- Proposed pond outline
- Overland flow direction
- Node
- N-EX2 — Node ID
- Uncontrolled areas

NOTE :
All base information provided by Atrel Engineering Inc.

Scale : 1:1250
0 25 50 75 100 125 m

BY :
JFSA inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS

CLIENT :
ATREL Engineering Ltd.
Engineers - Ingénieurs
380 LAURIER ST., ROCKLAND, ONTARIO K4K 1G2
TEL.: (613) 446-7423 FAX: (613) 446-7425

PROJECT :
GREELY VILLAGE CENTRE - OTTAWA

No.	BY	DATE	DESCRIPTION	BY

TITLE :
PROPOSED DRAINAGE CONDITIONS
COMMERCIAL PHASE - DETAIL

FIGURE 4b

DESIGNED:	
DRAWN:	J.H.F.
VERIFIED:	J.F.S.
APPROVED:	J.F.S.
DATE	PROJECT No.
Dec/08	647-07

DRAWING REF.
J:_Commercial Greely REV-1.dwg

APPENDIX "B"

MOE Well Record
Eurofins Laboratory Subdivision Package Results
Drawdown Plot
Langelier Saturation Index

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☑ Metric ☐ Imperial

Well Tag No. Tag#:A258613 — A258613

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
Greely	Family Farms		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
1705 old Prescott Rd	Greely	ON	K4P1M8	6139961422

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Bank St	Osgoods	1	

County/District/Municipality	City/Town/Village	Province	Postal Code
OTTAWA - City	Greely	Ontario	K4P1M8

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	445666	5012311	4R-15291	

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
Grey	Sand	Gravel	Soft	0	6.96
Grey	Limestone		Hard	6.96	109.09

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	69.69	Quick Crete	44 Bags

Method of Construction

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

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	Depth (m/ft) To
15.55	Steel	0.49	0.60	69.69

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) 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	Kind of Water	
30.30 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☑ Other, specify	Salty
57.57 (m/ft) ☐ Gas	☐ Fresh ☐ Untested ☑ Other, specify	Salty
108/8 (m/ft) ☐ Gas	☑ Fresh ☐ Untested ☐ Other, specify	

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	69.69	25.40
0	109.09	15.55

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft): 30.30

Pumping rate (l/min / GPM): 54.00

Duration of pumping: 3 hrs + 1/2 min

Final water level end of pumping (m/ft): 3.22

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

Recommended pump depth (m/ft): 30.30

Recommended pump rate (l/min / GPM): 45.00

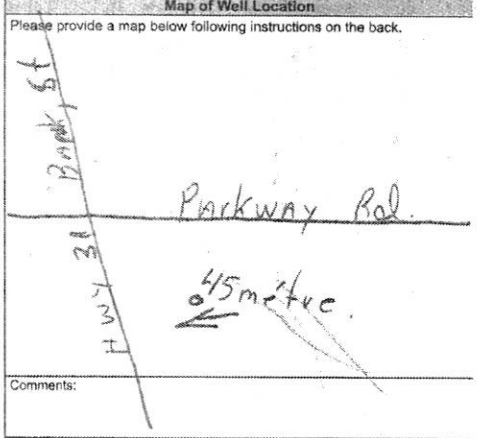
Well production (l/min / GPM): 90.00

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	3.26		3.22
1	3.25	1	3.22
2	3.25	2	3.22
3	3.25	3	3.22
4	3.25	4	3.22
5	3.25	5	3.22
10	3.25	10	3.22
15	3.23	15	3.22
20	3.23	20	3.22
25	3.22	25	3.22
30	3.22	30	3.22
40	3.22	40	3.22
50	3.22	50	3.22
60	3.22	60	3.22

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
DXR - WATER - well-Drilling	7152 16

Business Address (Street Number/Name)	Municipality
1763 - Route 500 west	Nation

Province	Postal Code	Business E-mail Address
ON	K0A 3C0	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
613 678 7558	Monette Karl

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3717	Karl Monette	2019 03 25

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☑ Yes ☐ No	2019 03 25	2019 03 26

Ministry Use Only

Audit No. Z299783

Received

0508E (2014/11)

Well Owner's Copy

eurofins | Environment Testing

Certificate of Analysis

Client: Sunset Lakes Development Corp.
6598 Pebble Trail Way
Greely, ON
K4P 0B6
Attention: Mr. Dan Payer
PO#:
Invoice to: Sunset Lakes Development Corp.

Report Number: 1903947
Date Submitted: 2019-03-20
Date Reported: 2019-03-24
Project:
COC #: 92656

				Lab I.D.	1416283
				Sample Matrix	Water
				Sample Type	
				Sampling Date	2019-03-20
				Sample I.D.	TW1
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	Cl	1	mg/L	AO 250	122
	F	0.10	mg/L	MAC 1.5	0.39
	N-NO2	0.10	mg/L	MAC 1.0	<0.10
	N-NO3	0.10	mg/L	MAC 10.0	<0.10
	SO4	1	mg/L	AO 500	78
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG 500	226
	Colour	2	TCU	AO 5	<2
	Conductivity	5	uS/cm		962
	pH	1.00		6.5-8.5	8.50
	S2-	0.01	mg/L	AO 0.05	<0.01
	TDS (COND - CALC)	1	mg/L	AO 500	625*
	Turbidity	0.1	NTU	AO 5.0	1.3
Hardness	Hardness as CaCO3	1	mg/L	OG 100	297*
Indices/Calc	Ion Balance	0.01			1.02
Metals	Ca	1	mg/L		68
	Fe	0.03	mg/L	AO 0.3	0.66*
	K	1	mg/L		7
	Mg	1	mg/L		31
	Mn	0.01	mg/L	AO 0.05	0.03
	Na	2	mg/L	AO 200	84
Microbiology	Escherichia Coli	0	ct/100mL	MAC 0	0
	Faecal Coliforms	0	ct/100mL		0
	Heterotrophic Plate Count	0	ct/1mL		0
	Total Coliforms	0	ct/100mL	MAC 0	0
Subcontract-Inorg	DOC	0.5	mg/L	AO 5	1.3

Guideline = ODWSOG *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

eurofins | Environment Testing

Certificate of Analysis

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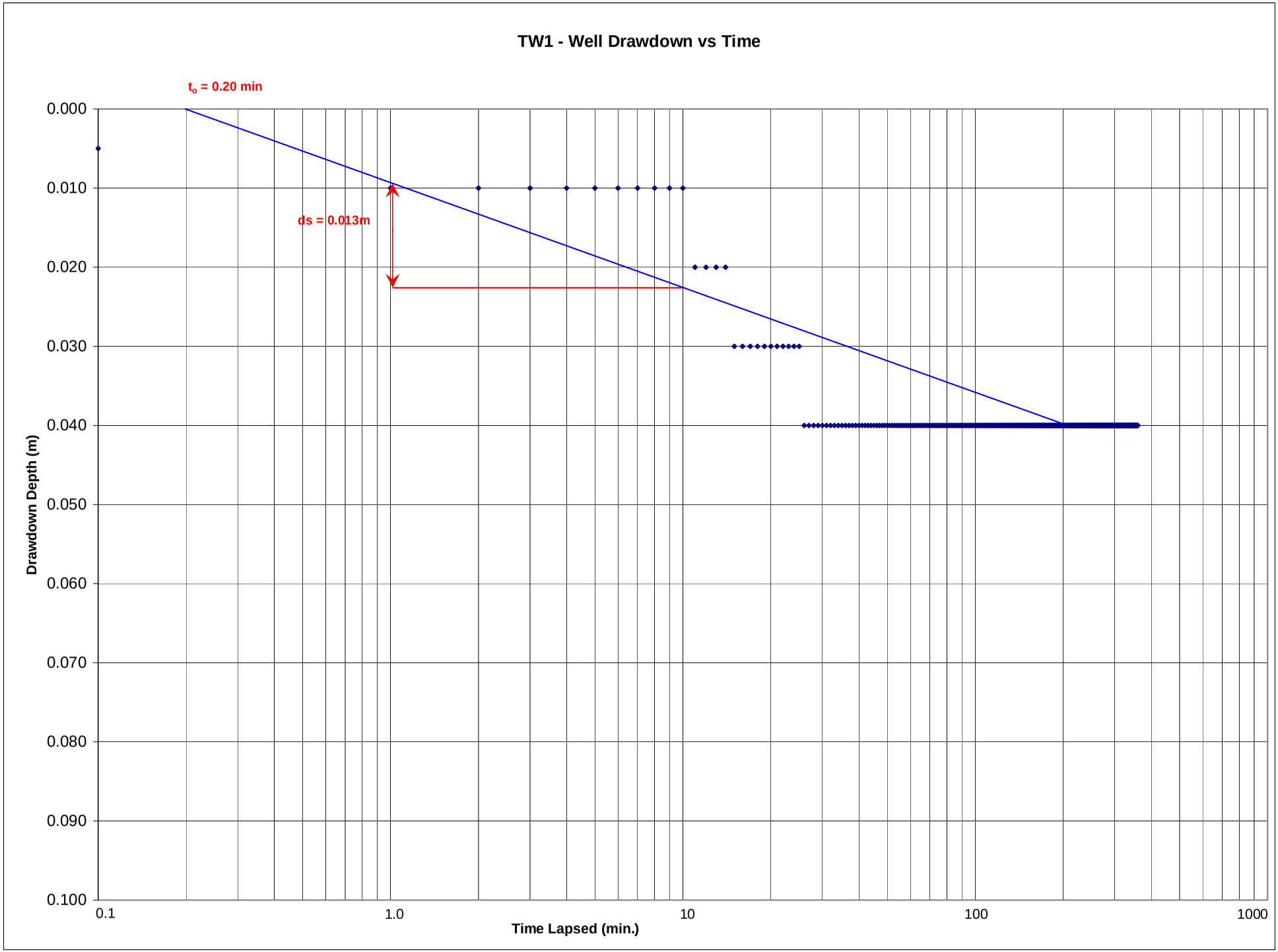
				Lab I.D.	1416283
				Sample Matrix	Water
				Sample Type	
				Sampling Date	2019-03-20
				Sample I.D.	TW1
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Subcontract-Inorg	N-NH3	0.01	mg/L		0.13
	Phenols	0.001	mg/L		0.003
	Tannin & Lignin	0.1	mg/L		<0.1
	Total Kjeldahl Nitrogen	0.1	mg/L		0.2

Guideline = ODWSOG *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range


TW1 - Well Drawdown vs Time
t_o = 0.20 min
ds = 0.013m
0.000
0.010
0.020
0.030
0.040
0.050
0.060
0.070
0.080
0.090
0.100
Drawdown Depth (m)
0.1
1.0
10
100
1000
Time Lapsed (min.)

LENNTECH +31 152 610 900

Home / Calculators / Langelier index calculator

Langelier Saturation Index Calculator

This calculator helps you determine the scaling potential of the water by using the Langelier Saturation Index.

Give the values of your water analysis. All the fields with * are required.

Table 1: Input table

pH *	8.5	
Conductivity / TDS *	625	mg/L
$[Ca^{2+}]$ *	297	mg/L
$[HCO3^-]$ *	226	mg/L
Water temperature *	9.2	degree C

If you do not have a water analysis you can use th table 2. Click on a button at the bottom of table 2

Table 2 : Additional data

pH =	7.7	8	8.6
TDS =	20	34483	273
$[Ca^{2+}]$ =	5	400	49
$[HCO_3^-]$ =	10	140	121
T =	20	20	20

Calculate the Langlier Saturation Index

Example Seawater Tap wat

Erase input values

Table 3: Results Langelier Saturation Index

pH_s	7.2
LSI	1.3
Indication based on Langelier (1936)	Water is supersaturated with respect to calcium carbonate (CaCO3) and
Indication based on improved Langelier by Carrier (1965)	Scale forming but non corrosive.

The Langelier Saturation Index formula is

$$LSI = pH - l$$

For an explanation of the formula click here.

APPENDIX "C"

Sanitary Sewer Design Sheet
Storm Sewer Design Sheet

SANITARY SEWER COMPUTATION FORM

PROJECT: Greely Village Centre

DATE: **Jan 29, 2019**

CLIENT: Greely Family Farm

DESIGNED BY: DRP

LOCATION				COMMERCIAL , INSTITUTIONAL						**DESIGN FLOW**	SEWER DATA					
				INDIVIDUAL		CUMULATIVE		PEAKING	FLOW		DIA.	SLOPE	LENGTH	CAP.	Remaining	VEL.
FROM (Up)		TO (Down)		AREA (ha.)	POP.	AREA (ha.)	POP.	FACTOR M	Q(p) (L/S)	**(L/S)**	(mm)	(%)	(m)	(L/s)	Capacity	(m/s)
MH	Bldg A	MH	1							**0.070**	200	1.00	23.0	33.31	100%	1.05
MH	Bldg B	MH	1							**0.053**	200	1.00	8.0	33.31	100%	1.05
MH	1	MH	2							**0.123**	200	0.60	86.0	25.80	100%	0.81
MH	Bldg C	MH	2							**0.053**	200	1.00	22.0	33.31	100%	1.05
MH	Bldg D	MH	2							**0.033**	200	1.00	8.0	33.31	100%	1.05
MH	2	MH	Ex.							**0.209**	200	0.50	32.0	23.55	99%	0.74

	Area	Flows		
Building A	929	5 L/day per 1.0m^2	and	75 L/day per 9.3m^2
Building B	565	75 L/day per 9.3m^2		
Building C	565	75 L/day per 9.3m^2		
Building D	565	5 L/day per 1.0m^2		

NOTE:

The sanitary sewer demands were tabulated as instructed in Section 4.4.1.2 of the City guidelines for site plans which references Appendix 4-A.

STORM SEWER COMPUTATION FORM

LOCATION								RATIONAL METHOD		2 YEAR		ACTUAL	SEWER DATA							UpStream		DwStream	
								INDIV.	ACCUM.	TIME	RAINF.	PIPE	DIA.	SLOPE	LENGTH	CAP.	Remaining	VEL.	TIME OF	Obv.	Inv.	Obv.	Inv.
FROM (Up)		TO (Down)		0.90	0.450	0.50	0.72	2.78AR	2.78AR	CONC. (MIN)	INTENS. (MM/HR)	FLOW (L/S)	(mm)	(%)	(M)	(L/S)	Capacity (%)	(M/S)	FLOW (MIN)	(M)	(M)	(M)	(M)
MH	CB1	MH	CB2				0.150	0.30	0.30	10.00	76.81	**23.06**	200	1.00	35.0	33.31	31%	1.05	0.56	89.56	89.36	89.21	89.01
MH	CB2	MH	100				0.150	0.30	0.60	10.56	74.73	**44.87**	250	1.00	25.0	60.40	26%	1.22	0.34	89.21	88.96	88.96	88.71
										10.90													
MH	CB3	MH	100				0.300	0.60	0.60	10.00	76.81	**46.12**	250	1.00	15.5	60.40	24%	1.22	0.21	89.12	88.87	88.96	88.71
										10.21													
MH	100	MH	101						1.20	10.90	73.52	**88.29**	375	0.40	36.0	104.25	15%	0.99	0.61	88.96	88.59	88.82	88.45
										11.51													
MH	CB4	MH	CB5				0.120	0.24	0.24	10.00	76.81	**18.45**	200	1.00	40.0	33.31	45%	1.05	0.64	89.47	89.27	89.07	88.87
MH	CB5	MH	101				0.120	0.24	0.48	10.64	74.45	**35.76**	250	1.00	25.0	60.40	41%	1.22	0.34	89.07	88.82	88.82	88.57
										10.98													
MH	CB6	MH	101				0.240	0.48	0.48	10.00	76.81	**36.90**	250	1.00	15.5	60.40	39%	1.22	0.21	88.98	88.73	88.82	88.57
										10.21													
MH	101	MH	102						2.16	11.51	71.47	**154.50**	450	0.30	21.0	162.91	5%	0.99	0.35	88.82	88.37	88.76	88.31
										11.86													
MH	CB10	MH	102		0.195			0.24	0.24	10.00	76.81	**18.74**	200	1.00	31.0	33.31	44%	1.05	0.49	89.07	88.87	88.76	88.56
										10.49													
MH	102	MH	103		0.141			0.18	2.58	11.86	70.34	**181.62**	525	0.30	78.0	245.74	26%	1.10	1.18	88.76	88.24	88.53	88.01
MH	103	MH	104						2.58	13.04	66.81	**172.51**	600	0.20	15.0	286.47	40%	0.98	0.25	88.53	87.93	88.50	**87.90**
										13.30													
*Ex.MH**	*105*	*Ex.MH*	*104*	*1.960*				*4.90*	*4.90*	*12.03*	*69.80*	***342.29***	*750*	*0.29*	*2.6*	*625.44*	*45%*	*1.37*	*0.03*	*88.66*	*87.91*	*88.65*	*87.90*
										12.06													
Ex.MH	*104*	*Open Ditch*							*7.49*	*13.30*	*66.11*	***494.90***	*750*	*0.20*	*70.0*	*519.40*	*5%*	*1.14*	*1.02*	*88.65*	*87.90*	*88.51*	*87.76*
										14.32													

***Note**: 2yr flow discharge amount taken from THE ODAN/DETECH GROUP INC. servicing report.

2 yr FLOW

DESCRIPTION	FUNCTION	VALUES / UNITS
INPUT VALUES		
BOTTOM WIDTH	B=	1.50 m
SIDE SLOPE LEFT	SSL= (X:1)	3.000
SIDE SLOPE RIGHT	SSR= (X:1)	3.000
ROUGHNESS COEFFICIENT	n=	0.030
DITCH SLOPE	S=	0.20 %
WATER DEPTH	D=	**0.343** m
OUTPUT VALUES		
AREA	A=	0.87 m^2
WET PERIMETER	P=	3.67 m
HYDRAULIC RADIUS	R= (A/P)	0.24 m
VELOCITY	**V=**	**0.57 m/s**
FLOW	**Q=**	**495 L/s**
DESIGNED BY:	ARK ENGINEERING	