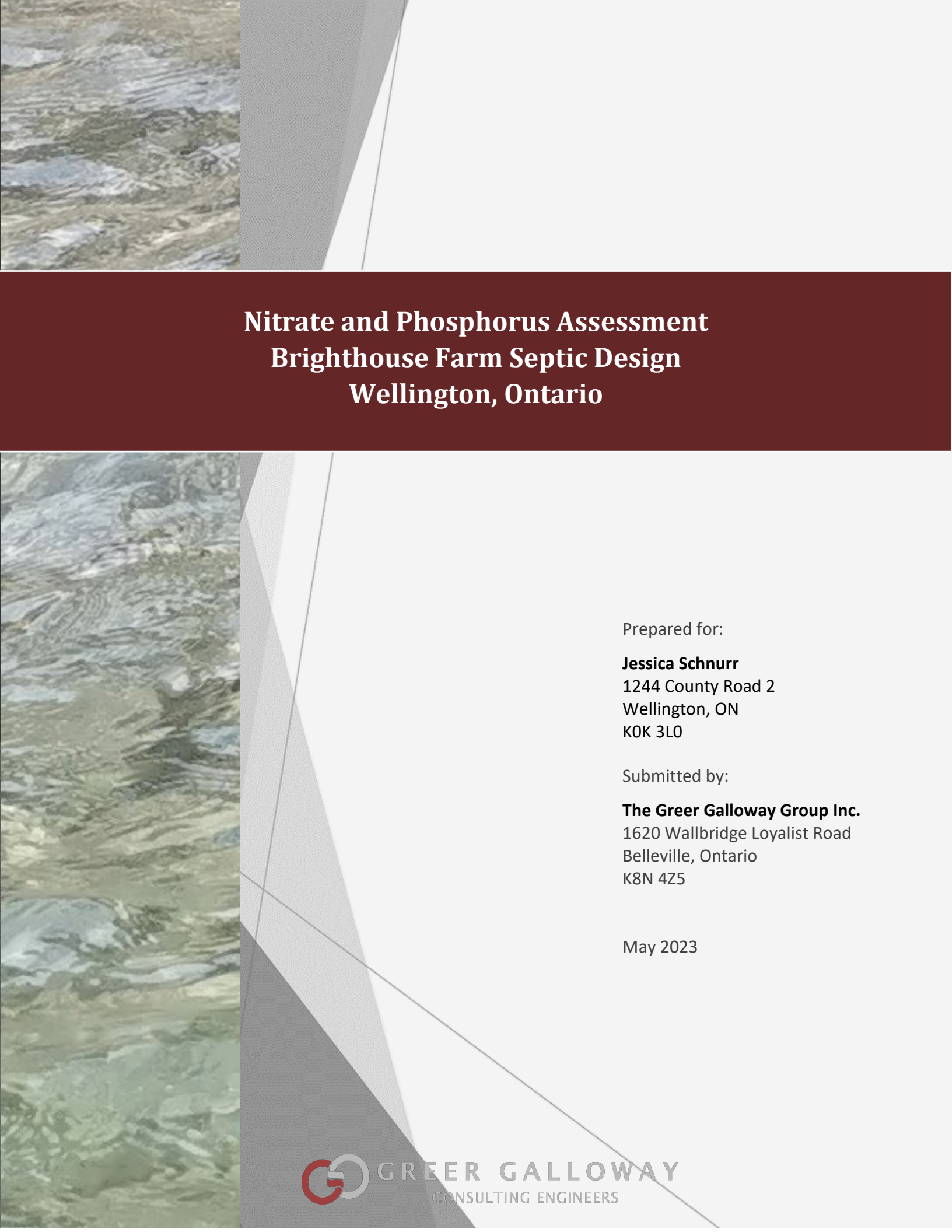




Nitrate and Phosphorus Assessment Brighthouse Farm Septic Design Wellington, Ontario

Prepared for:

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Submitted by:

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May 2023

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1.0 Introduction

In response to discussions with the MECP about the applicability of the nitrate dilution calculations in the Hydrogeology and Servicing Report dated September 2020, we have completed additional nitrate and phosphorus calculations that account for the radial flow outward from the mounded area containing the proposed septic bed. These calculations were carried out in accordance with the Ministry of the Environment's Design Guidelines for Sewage Works Chapter 22: Large Subsurface Sewage Disposal Systems.

2.0 Dilution Area

Groundwater flow direction in the area surrounding the proposed septic bed is dominated by local topography. As the septic bed is to be located near the crest of a mounded area, groundwater will flow outward from the centre of the "mound" before mixing with groundwater and surface water flows entering the surrounding wetland area. In general, groundwater at the southern half of the property trends towards the southwest, with significant mixing caused by the outward radial flow. The predicted approximate dilution area for the septic system is 26.6 ha, containing most of the southern half of the site. A sketch showing predicted directions of local groundwater flow across the dilution area has been provided in Appendix A.

3.0 Average Daily Sewage Flows (ADSF)

Sanitary sewage flows have been estimated based on the number of bedrooms in the design. Note that this breakdown contains only the flows associated with the southern septic system, as was agreed upon during a consultation with the MECP. Occupancy for the cabins is calculated as 2 occupants per bedroom as per OBC guidelines. Average sewage flows were determined using Chapter 22 of the Ontario Sewage Design Guidelines assuming full occupancy with average flows of 225 L/day per occupant.

Dwellings	Count	X	Volume per Count (L)	=	Total (L)
1-bedroom dwelling	5	x	450	=	2,250
2-bedroom dwelling	8	x	900	=	7,200
3-bedroom dwelling	3	x	1350	=	4,050
Average Daily Sewage Flow				=	13,500

4.0 Nitrates

Previous testing of groundwater from the existing dug well on the property revealed elevated background nitrates (approximately 6 mg/L) however this "background" may reflect agricultural run-off from within the property rather than background nitrogen in groundwater flowing onto the property. During the pre-application consultation, it was agreed that this value should not be taken as a

background nitrogen level. Instead, we estimated background nitrogen by sampling shallow groundwater within the wetland area downgradient from the proposed new LSSDS. The sample was submitted to Caduceon Laboratories in Kingston, Ontario. The Certificate of Analysis for this sample has been included in Appendix B, and the results are presented in the following table.

Parameter	Unit	Concentration
Nitrate (N)	mg/L	< 0.05
Nitrite (N)	mg/L	< 0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	2.0
Ammonia (N) Total (NH ₃ +NH ₄)	mg/L	0.08
Total Organic Nitrogen	mg/L	2.0

The TKN value of 2.0 mg/L was used as the background Nitrogen concentration for the purposes of the B-7 analysis. Dilution of Nitrates from sewage within the dilution area of the subject property was calculated in accordance with Chapter 22 of the MOE's Design Guidelines for Sewage Works. Values used in calculation are tabulated below.

Item	Value	Source
Number of Bedrooms	30	Proponent
Occupancy (persons)	60	2 persons per bed, OBC
Average Daily Sewage Flow (ADSF, L/day)	13,500	60 occupants * 225 L/day (Chapter 22 of the Design Guidelines for Sewage Works)
Nitrogen Load (g/day)	540	ADSF * 40 mg/L (22.5.10 Effluent Quality, Chapter 22 of the Design Guidelines for Sewage Works)
Annual Nitrogen Load (g/year)	197,100	540 g/day x 365 days
Dilution area (ha)	26.6	Estimate
Recharge (mm)	250	Chapter 22 of the Design Guidelines for Sewage Works
Annual Recharge (m ³)	66,500	$0.250 \text{ m} * 10,000 \frac{\text{m}^2}{\text{ha}} * 26.6 \text{ ha}$
Annual sewage volume (m ³)	4,925	$13,500 \frac{\text{L}}{\text{day}} * 365 \text{ days} * \frac{1 \text{ m}^3}{1000 \text{ L}}$
Total annual dilution (VT, m ³)	71,425	Annual recharge + annual sewage volume
Nitrate concentration at property boundary (mg/L)	2.76	Annual Nitrogen Load / Total Dilution

The Nitrates concentration at the property boundary is predicted to be 2.76 mg/L. Under MECP Guideline B-7-1: it is permissible to raise the level of nitrogen in groundwater leaving the site by up to 25% of the difference between the background concentration (2.0 mg/L) and the Ontario Drinking Water Standard of 10 mg/L, for a total permissible concentration of 4.5 mg/L at the property boundary. The predicted nitrate concentration at the property boundary would therefore be considered acceptable under the assumed (and conservative) occupancy.

5.0 Phosphorus

The pond at the southwestern corner of the property is not considered to be particularly sensitive to phosphorus due to its swampy and eutrophic character and fairly rapid turnover. The groundwater flow

from the site mixes with surface water flows and ultimately enters Lake Ontario via Huycks Bay. Total Phosphorus (TP) is the relevant parameter of concern with respect to surface water impacts.

Annual per capita phosphorus contributions are estimated as 0.66 kg per person per year (Paterson et al., 2006). The proposed cabins are not intended to be occupied continuously, and during the day the cabins will largely be vacant as preparations are made for the next wedding. Furthermore, the venue will be closer to maximum capacity on Fridays, Saturdays, and Sundays. Assuming 100% occupancy (60 persons) on Friday-Sunday and 33% occupancy (20 persons) from Monday-Thursday, with each person being accommodated for 12 hours, average annual phosphorus contributions are expected to be 12.3 kg for the proposed development. This is lower than the amount of phosphorus typically applied annually for crop production of 23 to 60 kg per hectare for cereal crops or legumes. Since the 3.1 ha "mound" area will be removed from agricultural use under the proposed development, this will result in a reduction of agriculturally related phosphorous loading and an over-all reduction in phosphorous loading to Huycks Bay relative to existing conditions.

6.0 Summary

Our assessment found that the predicted increase in groundwater nitrates leaving the downgradient property boundary is within the limits given in MECP Guideline B-7-1. Phosphorus contributions are expected to be lower than the existing agricultural usage for the subject property, and impact is expected to be negligible.

All of which is respectfully submitted.

THE GREER GALLOWAY GROUP INC. CONSULTING ENGINEERS



Kirby Magee-Dittburner, E.I.T.
Project Hydrogeologist



Charles Mitz, M.Eng., Ph.D., P.Geo
Senior Project Manager

7.0 References

Ontario Agricultural College, 1962: Soil Survey of Hastings County. Report No. 10 of the Ontario Soil Survey, Scale 1:63 360.

MECP (Ministry of Environment Conservation and Parks) 1996: D-5-4 Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment, updated April 14, 2016.

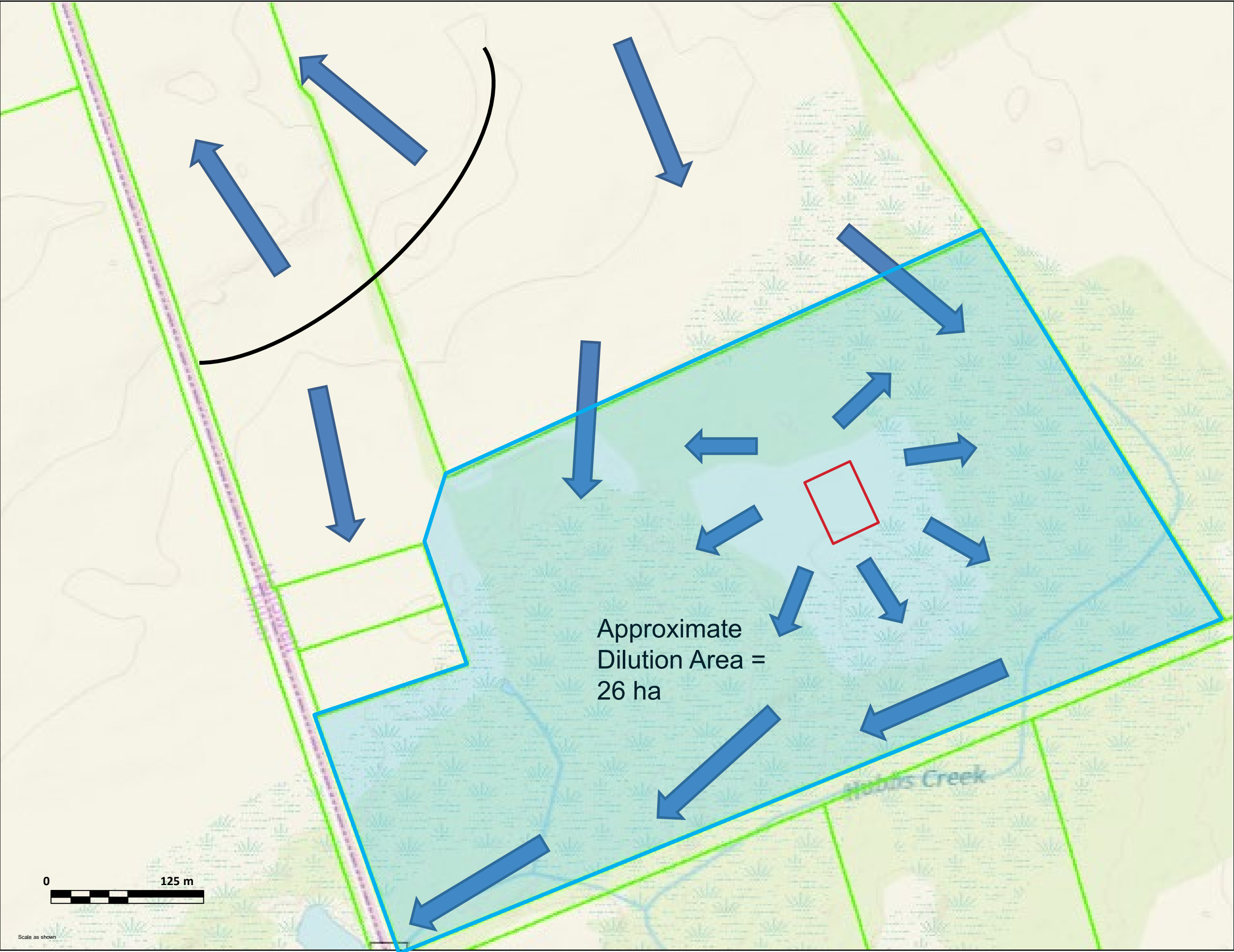
MECP (Ministry of Environment Conservation and Parks) 2016: B-7-1 Determination of Contaminant Limits and Attenuation Zones, updated July 12, 2023.

MECP (Ministry of Environment Conservation and Parks) 1996: B-7 Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities, updated July 12, 2021.

Paterson et al., 2006. A review of the components, coefficients, and technical assumptions of Ontario's Lakeshore Capacity Model. Lake Res Manage. 22(1): 7–18.

Appendix A

Map of Dilution Area



GREER GALLOWAY
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NOTES:

- 1) Base drawing and information: obtained from Prince Edward County GIS
https://maps.thecounty.ca/Html5Viewer/index.html?configBase=https://maps.thecounty.ca/Geocortex/Essentials/Public/REST/sites/PECPublicViewer/viewers/HTML5_Viewer/virtualdiectory/Resources/Config/Default

LEGEND:

-  Dilution Area
-  Suspected Groundwater Divide



PROJECT 1836383:

NITRATE AND PHOSPHORUS ASSESSMENT
1244 PRINCE EDWARD COUNTY ROAD 2
WELLINGTON, ONTARIO

DRAWING 1:

SITE PLAN SHOWING DILUTION AREA

Appendix B

Laboratory Certificates of Analysis

C.O.C.: Brightonhouse

REPORT No: 23-007935 - Rev. 0

Report To:

The Greer Galloway Group
1620 Wallbridge-Loyalist Road, RR #5
Belleville, ON K8N 4Z5

CADUCEON Environmental Laboratories

285 Dalton Ave
Kingston, ON K7K 6Z1

Attention: Kirby Magee-Dittburner

DATE RECEIVED: 2023-Apr-20
DATE REPORTED: 2023-May-01
SAMPLE MATRIX: Ground Water

CUSTOMER PROJECT: Brightonhouse
P.O. NUMBER: 1836383

Analyses	Qty	Site Analyzed	Authorized	Date Analyzed	Lab Method	Reference Method
Anions (Liquid)	1	OTTAWA	PCURIEL	2023-Apr-24	A-IC-01	SM 4110B
Ammonia (Liquid)	1	KINGSTON	AMANIYA	2023-Apr-24	NH3-001	SM 4500NH3
Organic Nitrogen (Liquid)	1	KINGSTON	KDIBBITS	2023-May-01	TPTKN-001	MECP E3516.2
TP & TKN (Liquid)	1	KINGSTON	KDIBBITS	2023-Apr-28	TPTKN-001	MECP E3516.2

R.L. = Reporting Limit

NC = Not Calculated

Test methods may be modified from specified reference method unless indicated by an *

			Client I.D.	GW1
			Sample I.D.	23-007935-2
			Date Collected	2023-04-19
Parameter	Units	R.L.		
Nitrate (N)	mg/L	0.05	<0.05	
Nitrite (N)	mg/L	0.05	<0.05	
Total Kjeldahl Nitrogen	mg/L	0.1	2.0	
Ammonia (N)-Total (NH3+NH4)	mg/L	0.05	0.08	
Organic Nitrogen	mg/L	0.1	2.0	



Michelle Dubien
Laboratory Manager