S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix A

Consultation Material

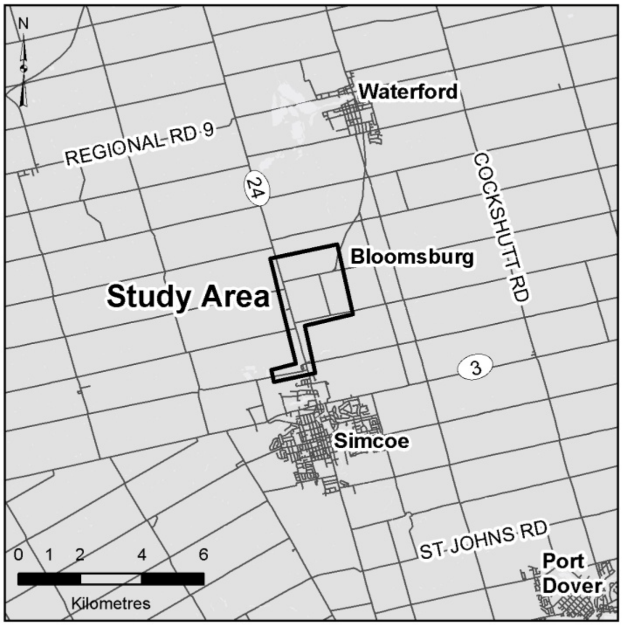
S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix A1

Notice of Commencement – November 2010

Simcoe Water Supply
Class Environmental Assessment

Notice of Study Commencement



Background

Groundwater is the sole water supply source for the Community of Simcoe. The water is drawn from nine wells and an infiltration gallery/well system. Maximum daily water supply requirements for the community are expected to increase and additional sources are required to augment these existing sources. Earlier this year, Norfolk County completed a groundwater investigation to evaluate the potential of developing a groundwater source capable of providing the anticipated additional capacity. The main conclusion of the final report was that a groundwater supply could be developed from a location northeast of Simcoe to meet the required additional supply (see adjacent map).

Class EA Study

The Corporation of Norfolk County has initiated a study to identify, evaluate, and document a recommended solution for new supply sources in the identified study area with consideration for environmental, cultural, social, natural, technical, and economic factors. This study is being developed as a Schedule "B" Municipal Class Environmental Assessment (Class EA) under Ontario's *Environmental Assessment Act*.

Public Involvement

Public involvement is an important part of the Class EA process. Residents and community organizations are encouraged to participate by providing their comments to the contacts identified below and/or attending a Public Information Centre (PIC) that will be held in the upcoming months. Details regarding the PIC will be publicized in local newspapers, distributed through direct mail, and posted by way of a link on the Norfolk County website at www.norfolkcounty.ca

Please contact either of the following team members if you would like more information or to be added to the mailing list to receive direct notice of future study events.

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
8 Sagewood Place
Guelph, ON N1G 3M6
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng., Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
183 Main Street of Delhi
Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1600
Email: John.Hamilton@norfolkcounty.ca

Public and Agency Consultation – 2011 to 2015

Ministry of the Environment
West Central Region

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement

119 rue King ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

Ontario

December 22, 2010

Mr. Bill Banks
Banks Groundwater Engineering Limited
8 Sagewood Place
Guelph, Ontario
N1G 3M6

Dear Mr. Banks:

Re: Simcoe Water Supply
Class Environmental Assessment
Notice of Study Commencement

Thank you for your letter advising of the County's commencement of an Environmental Assessment for the Simcoe Water Supply, to determine the optimal means of augmenting the current groundwater-based municipal water supply for Simcoe. You have indicated that this project will be undertaken in accordance with the MEA Class EA for Schedule "B" activities following the positive results of the groundwater investigation which suggests that a viable groundwater supply can be realized northeast of Simcoe. In accordance with the MEA Class EA, Schedule "B" projects require that a Project File be prepared. The Project File shall be organized in such a way as to clearly demonstrate that the appropriate steps in Phases 1 and 2 have been followed and explain the following:

- background to the project and any earlier studies that may have been done;
- the nature and extent of the problem or opportunity, to explain the source of the concern or issue and the need for a solution;
- description/inventory of the environment;
- the alternative solutions considered and the evaluation process followed to select the preferred solution;
- follow-up commitments, including any monitoring necessary; and,
- the public consultation program employed and how concerns raised have been addressed.

The Project File must contain a complete record of all activities associated with the planning of the Project and shall include:

- correspondence;
- copies of notices, letters, bulletins relating to public consultation;
- memoranda to file explaining the proponent's rationale in developing stages of the project; and,
- copies of reports prepared by consultants and others.

The project documentation must be maintained in such a way that it is suitable for easy review by the public at any time. Once the Project File is finalized a Notice of Completion is required to be issued, allowing the public at least a 30 calendar day period during which documentation may be reviewed and comment and input submitted to the municipality. Please note that as this study progresses, you may determine the need to reclassify the project differently and augment the process accordingly.

As part of the required stakeholder and agency consultation, proponents are advised to contact the following agencies to determine potentially affected Aboriginal communities in the project area. You are encouraged to visit the ministry's website at http://www.ene.gov.on.ca/en/eaab/aboriginal-resources.php for the most up to date contact list in this regard. Once identified, you are advised to provide notification directly to the Aboriginal communities who may be affected by the project and provide them with an opportunity to participate in any planned public consultation sessions and comment on the project.

Thank you for bringing this project to our attention. Given our future role in issuing approvals for an expanded water supply system, we would like to be involved throughout the EA process. Would you be able to provide me with a copy of the groundwater study that is referred to in the Notice? Also, in the future, please provide a copy of the actual Notice of Commencement with your correspondence. During the course of the EA process, I am your MOE contact. All documentation (ie. Notices of upcoming PICs, final Project File Report) should be provided to my attention. If you have any questions about MOE requirements with respect to the above issues, please contact me at (905) 521-7864 or at Barbara.slattery@ontario.ca.

Sincerely,

Barbara Slattery

Barbara Slattery
EA/Planning Coordinator

Canadian Environmental
Assessment Agency

Agence canadienne
d'évaluation environnementale

55 St. Clair Avenue East
Suite 907
Toronto, Ontario
M4T 1M2

55, avenue St-Clair Est
Bureau 907
Toronto (Ontario)
M4T 1M2

December 29, 2010

Bill Banks
Banks Groundwater Engineering Limited
8 Sagewood Place
Guelph, ON N1G 3M6

Dear Mr. Banks,

Re: **Simcoe Water Supply Class Environmental Assessment Station**

Thank you for your Notice of Study Commencement, related to the above-noted project.

The *Canadian Environmental Assessment Act* (the Act) may apply to federal authorities when they contemplate certain actions or decisions in relation to a project that would enable it to proceed in whole or in part. A federal environmental assessment may be required when a federal authority: is the proponent of a project; provides financial assistance to the proponent; makes federal lands available for the project, or issues a permit, license or any other approval as prescribed in the *Law List Regulations*.

In the case of projects that are subject to the Ontario *Environmental Assessment Act,* if there is uncertainty as to whether the Act may also apply, the Agency can help proponents answer this question. For projects that are subject to the Act, the Agency will act as the federal environmental assessment coordinator and facilitate the involvement of the federal authorities in a co-ordinated assessment aimed at meeting all agencies' needs simultaneously.

In order for the Agency to undertake either of these roles, it must have a project description that can be distributed to various federal authorities to determine their interest in the project. It is recognized that at the early stages of the planning process, there may not be much detailed information to provide. However, proponents should try to provide some information on:

- the nature of the project and its location;
- federal decisions which may be made in relation to the project;
- whether federal funding is being contemplated or federal lands are required.

…/2

To better assist proponents, the Agency has developed an Operational Policy Statement, which provides guidance in preparing project descriptions. This is available on the Agency's website at: http://www.ceaa-acee.gc.ca/013/0002/ops_ppd_e.htm

If your purpose in sending us notification of your project is to determine whether the *Canadian Environmental Assessment Act* applies, please be aware that simple notification will not be sufficient. A project description for the preferred alternative will be required.

Important Note: Please be aware that release of documents to the public may be part of the EA process. Information provided by you related to the EA for this project will be part of the Canadian Environmental Assessment Registry and will be made available to members of the public, if requested. A package with additional information will be provided to you upon submission of the project description. Should you provide any documents that contain confidential or sensitive information that you believe should be protected from release to the public, please contact the undersigned to obtain an Exclusion Form. This Form can be used to identify the information to be considered for exclusion from the Canadian Environmental Assessment Registry and the rationale for the exclusion.

If you have any questions regarding any of the above, please contact the undersigned at 416-952-6063.

Sincerely,

Jim Chan, Project Manager
Canadian Environmental Assessment Agency, Ontario Region

JC/ka

4 January 2011

Ms. Barbara Slattery
Regional EA/Planning Coordinator
Ministry of the Environment, West Central Region
119 King Street West, 12th Floor
Hamilton, ON L8P 4Y7

Re: Simcoe Water Supply Class Environmental Assessment
Notice of Study Commencement

Dear Ms. Slattery,

Thank you for your response to the recently-issued Notice of Study Commencement for the Simcoe Water Supply Class Environmental Assessment (Class EA). The enclosed letter was sent to our current list of agency, municipal, Aboriginal, and stakeholder contacts, to provide further insight into the project and the consultation planned.

In accordance with the MEA Class EA, a Project File is being prepared. We have assembled a project team that are well-acquainted with the requirements of a Class EA and we look forward to working with you on this project.

As you requested, also enclosed on a compact disk is a copy of the Simcoe / Waterford Groundwater Investigation Final Report. Please let me know if you have any questions related to this report.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Principal – Senior Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: John Hamilton, P.Eng., Norfolk County

encl.

4 January 2011

Template for Agency Letter

Re: Simcoe Water Supply Class Environmental Assessment
Notice of Study Commencement

Dear M,

You may have recently received a Notice of Study Commencement for the Simcoe Water Supply Class Environmental Assessment (Class EA). A supplementary copy is enclosed for reference. This letter is a follow-up to invite your agency to submit comments and questions with respect to the Class EA. A Public Information Centre will be held during the study period and you will receive a notice outlining the location, date and time.

In anticipation of increased daily water supply requirements for the community, a groundwater investigation has been completed by Norfolk County. This study identified that a possible groundwater supply could be developed from a location northeast of Simcoe. This Class EA was initiated to identify, evaluate, and document a recommended solution for groundwater supply sources. The study is being developed as a Schedule 'B' Municipal Class EA and will therefore consider environmental, cultural, social, natural, technical, and economic factors as required under Ontario's *Environmental Assessment Act*.

Written comments can be submitted to my attention. Should you have any questions, please contact me by telephone or email. Alternatively, you may contact John Hamilton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or John.Hamilton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Principal – Senior Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: John Hamilton, P.Eng., Norfolk County

encl.

Notice of Commencement Distribution List

Ms. Pam Wheaton, Director
Aboriginal & Ministry Relationships Branch
Ministry of Aboriginal Affairs
160 Bloor Street East, 4th Floor
Toronto, ON M7A 2E6

The Secretary, Attn: Ms. Lise Hansen
Ministry of Aboriginal Affairs
160 Bloor Street East, 4th Floor
Toronto, ON M7A 2E6

Mr. David Cooper
Negotiations Branch
Ministry Agriculture, Food and Rural Affairs
1 Stone Road W, 3rd Floor
Guelph, ON N1G 4Y2

Mr. Drew Crinklaw
Rural Planner South West Region
Ministry Agriculture, Food and Rural Affairs
667 Exeter Road
London, ON N6E 1L3

Ms. Lynn Peterson
Manager Planning Innovation Section
Ministry of Municipal Affairs & Housing
777 Bay Street, 13th Floor
Toronto, ON M5G 2E5

Mr. Bruce Curtis, Manager
Community Planning and Development
Ministry of Municipal Affairs & Housing
659 Exeter Road, 2nd Floor
London, ON N6E 1L3

Ms. Sharon Rew, Team Leader Env. Planning
Ministry of Natural Resources
300 Water Street, PO Box 7000, 5th Floor,
North Tower
Peterborough, ON K9J 4R5

Ms. Amanda McCloskey
District Planner - Aylmer District
Ministry of Natural Resources
615 John Street North
Aylmer, ON N5H 2S8

Ms. Audrey Guillot
Manager Strategic Policy Branch
Ministry of Infrastructure
880 Bay St, 2nd Floor
Toronto, ON M7A 2C1

Ms. Tija Dirks, Director
Growth Policy, Planning and Analysis
Ministry of Infrastructure
777 Bay St, 4th Floor, Suite 425
Toronto, ON M5G 2E5

Ms. Louise Knox, Regional Director
Canadian Env. Assessment Agency
55 St. Clair Avenue East, 9th Floor
Toronto, ON M4T 1M2

Mr. Joe Farwell, P.Eng.
Chief Administrative Officer
Grand River Conservation Authority
400 Clyde Road, P.O. Box 729
Cambridge, ON N1R 5W6

Ms. Lorrie Minshall, P.Eng.
Water Management Plan Director
Grand River Conservation Authority
400 Clyde Road, P.O. Box 729
Cambridge, ON N1R 5W6

Mr. Martin Keller
Source Protection Program Manager
Grand River Conservation Authority
400 Clyde Road, P.O. Box 729
Cambridge, ON N1R 5W6

Mr. John Warbick, P.Eng., Hydrogeologist
Ministry of the Environment
West Central Region
119 King St. West, 12th Floor
Hamilton, ON L8P 4Y7

Mr. Rob Dobos, Manager EA Section
Environmental Protection Operations Div.
Environment Canada
867 Lakeshore Rd.
Burlington, ON L7R 4A6

Mr. Cliff Evanitski
Chief Administrative Officer
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Mr. Craig Jacques
Source Water Protection Technician
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Mr. Roger Geysens
Board Member
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Mr. Michael Columbus
Board Member
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Ms. Betty Chanyi
Board Member
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Mr. Jim Oliver
Board Member
Long Point Region Conservation Authority
4 Elm St.
Tillsonburg, ON N4G 0C4

Ms. Barbara Slattery, Regional EA Coord.
Ministry of the Environment
West Central Region
119 King Street West, 12th Floor
Hamilton, ON L8P 4Y7

Mr. Jeffrey Cyr, Senior Policy Analyst
Department of Indian and Northern Affairs
66 Slater Street
Ottawa, ON K1A 0H4

Mr. Glenn Gilbert
Department of Indian and Northern Affairs
25 St. Clair Ave. East, 8th Floor
Toronto, ON M4T 1M2

Mr. Dennis Travale
Mayor, Norfolk County
50 Colborne Street South
Simcoe, ON N3Y 4H3

Mr. Eric R. D'Hondt, P.Eng.
Public Works and Environmental Services
Norfolk County
183 Main Street of Delhi
Delhi, ON N4B 2M3

Ms. Betty Chanyi
Ward 1 Councillor, Norfolk County
1699 Lakeshore Road, R.R. #1
Port Rowan, ON N0E 1M0

Mr. Roger Geysens
Ward 2 Councillor, Norfolk County
1473 Highway 3, RR#3
Delhi, ON N4B 2W6

Mr. Michael Columbus
Ward 3 Councillor, Norfolk County
577 Larch Street
Delhi, ON N4B 3A7

Mr. Jim Oliver
Ward 4 Councillor, Norfolk County
1567 East 1/4 Line, RR#6
Simcoe, ON N3Y 4K5

Mr. Peter Black
Ward 5 Councillor, Norfolk County
124 Robinson Street
Simcoe, ON N3Y 1W9

Mr. Charlie Luke
Ward 5 Councillor, Norfolk County
591 Hillcrest Road, RR#2
Simcoe, ON N3Y 4K1

Mr. John Wells
Ward 6 Councillor, Norfolk County
1 Regent St.
Port Dover, ON N0A 1N0

Mr. Harold Sonnenberg
Ward 7 Councillor, Norfolk County
1809 Concession 7 Townsend, RR#4
Waterford, ON N0E 1Y0

Chief William Montour and Council
Six Nations of the Grand River First Nation
1695 Chiefswood Rd.
Ohsweken, ON N0A 1M0

Chief Bryan LaForme and Council
Mississaugas of the New Credit First Nation
8545 Townline Rd., RR1
Hagersville, ON N0A 1H0

Haudenosaunee Confederacy
c/o Pallas Communications
P.O. 550
Ohsweken, ON N0A 1M0

Métis Nation of Ontario
500 Old St. Patrick St., Unit 3
Ottawa, ON K1N 9G4

Ms. Kim Goodman
General Manager
Centre for Sustainable Watersheds
14 Water Street, P.O. Box 280
Portland, ON K0G 1V0

Ms. Charmaine Quigley, Treasurer
Haldimand-Norfolk Organization for a Pure Environment
994 Townline Rd. E., RR#1
Canfield, ON N0A 1C0

Long Point Basin Land Trust
P.O. Box 468
Port Rowan, ON N0E 1M0

Norfolk Field Naturalists
PO Box 995
Simcoe, ON N3Y 5B3

Bill Banks

Forwarded to Ian C.

From: Alana Newbury [Alana.Newbury@ainc-inac.gc.ca]
Sent: 14-Jan-11 9:12 AM
To: Bill.Banks@banksgroundwater.ca
Subject: RE: Simcoe Water Supply Class EA

Follow Up Flag: Follow up
Flag Status: Flagged

The Office of the Federal Interlocutor for Métis and Non-Status Indians (OFI) would like to inform you that there are no known Métis Nation of Ontario (MNO) assertions in the vicinity of the Simcoe Water Supply project in the Norfolk County, Simcoe , Ontario.

If you have further questions please contact:

Jeffrey Betker
Senior Policy Analyst
Aboriginal Relations
Office of the Federal Interlocutor for Metis and Non-Status
Indians(OFI)
Bureau de l'interlocuteur Federal aupres des Metis et des Indiens Non
Inscrits(BIF)
Indian and Northern Affairs Canada
Affaires Indiennes et du Nord Canada
66 Slater St, Room 1225
Ottawa, Ontario, K1A OH4

T: (613) 992-7037
C: (613) 219-9578
F: (613) 996-1737
E: Jeffrey.Betker@inac.gc.ca

Thank you,

Alana Newbury
Research Assistant/ Junior Policy Analyst (Co-op Student) Aboriginal Relations Office of the Federal Interlocutor for Métis and Non-status Indians
(OFI)
Indian and Northern Affairs
alana.newbury@ainc-inac.gc.ca

rec'd 2 Feb 11

Ministry of the Environment
West Central Region

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement

119 rue King ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

Ontario

January 14, 2011

Mr. Bill Banks
Banks Groundwater Engineering Limited
8 Sagewood Place
Guelph, Ontario
N1G 3M6

Dear Mr. Banks:

Re: Simcoe Water Supply
Class Environmental Assessment

Further to my comments of December 22, 2010 wherein I requested a copy of the groundwater study, we have completed our review of the FINAL REPORT, SIMCOE/WATERFORD, GROUNDWATER INVESTIGATION, NORFOLK COUNTY PW-E-07-075, Gerrits Drilling and Engineering Ltd and Banks Groundwater Engineering Limited, March 2010 and offer the following comments for your consideration.

- The report documents 72 hour pumping tests performed on two wells located just north of Simcoe. The wells were tested to determine if sufficient groundwater is available for a new municipal well supply. Based on the results of the testing the report concludes that a safe perennial yield of 1,035 ipgm can be obtained from this area.

Comments:

We would like to caution the County that the above-noted report would not be adequate to support the required Permit to Take Water (PTTW) that the County would eventually require to establish a new municipal well supply at 1,035 igpm for the following reasons:

1. The surface water resources are not adequately described and documented;
2. There is an alleged interference with a dugout pond which is not sufficiently documented or investigated;
3. On-site precipitation records are not provided;
4. The discharge locations were not clearly indicated as well as the fate of the discharge water;
5. During the 72 hour test on SW11/09 there is an apparent water level recovery at about 30 hours ; and
6. This is an area of significant agricultural irrigation, neighbouring landowners/farmers should be asked about supplies used for fields within 1000m.

- The report does not appear to consider Source Water Protection Issues such as:

(i) Potential well head protection area;
(ii) Aquifer vulnerability;
(iii) Water quality changes during pumping;
(iv) Potentially contaminated railway soil;
(v) Local aquifer delineation;
(vi) Local watershed quantity stress level; and
(vii) Potential for lower quality bedrock water to be induced into the shallow aquifer

Please note that these comments are meant to assist you in undertaking this EA study, and to identify issues so that they can be considered and dealt with at this time, and not result in delay or approvals-related issues.

Should you wish to discuss these comments, please feel free to contact me at any time at (905) 521-7864 or at Barbara.slattery@ontario.ca.

Sincerely,

Barbara Slattery

Barbara Slattery
EA/Planning Coordinator

Ministry of Aboriginal Affairs

160 Bloor St. East, 9th Floor
Toronto, ON M7A 2E6
Tel: (416) 326-4740
Fax: (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ministère des Affaires Autochtones

160, rue Bloor Est, 9e étage
Toronto ON M7A 2E6
Tél. : (416) 326-4740
Téléc. : (416) 325-1066
www.aboriginalaffairs.gov.on.ca

Ontario

FEB - 7 2011

Reference: 6

Bill Banks, Project Manager
Banks Groundwater Engineering Limited
8 Sagewood Place, Guelph ON
N1G 3M6

Re: Simcoe Water Supply Class Environmental Assessment – Notice of Commencement

Dear Mr. Banks:

Thank you for your inquiry dated January 4, 2011 regarding the above-noted project.

As a member of the government review team, the Ministry of Aboriginal Affairs (MAA) identifies First Nation and Métis communities who may have the following interests in the area of your project:

- reserves;
- land claims or claims in litigation against Ontario;
- existing or asserted Aboriginal or treaty rights, such as harvesting rights; or
- an interest in your project's potential environmental impacts.

MAA is not the approval or regulatory authority for your project, and receives very limited information about projects in the early stages of their development. In circumstances where a Crown-approved project may negatively impact a claimed Aboriginal or treaty right, the Crown may have a duty to consult the Aboriginal community advancing the claim. The Crown often delegates procedural aspects of its duty to consult to proponents. Please note that the information in this letter should not be relied on as advice about whether the Crown owes a duty to consult in respect of your project, or what consultation may be appropriate. Should you have any questions about your consultation obligations, please contact the appropriate ministry.

You should be aware that many First Nations and Métis communities either have or assert rights to hunt and fish in their traditional territories. For First Nations, these territories typically include lands and waters outside of their reserves.

In some instances, project work may impact aboriginal archaeological resources. If any Aboriginal archaeological resources could be impacted by your project, you should contact your regulating or approving Ministry to inquire about whether any additional Aboriginal communities should be contacted. Aboriginal communities with an interest in archaeological resources may include communities who are not presently located in the vicinity of the proposed project.

With respect to your project, and based on the brief materials you have provided, we can advise that the project appears to be located in an area where Six Nations may have existing or asserted rights or claims in MAA's land claims process or litigation, that could be impacted by your project. Contact information is below:

Six Nations of the Grand River Territory P.O. Box 5000 Ohsweken, Ontario N0A 1M0	Chief William K. Montour (519) 445-2201 (Fax) 445-4208 wkm@sixnations.ca arleenmaracle@sixnations.ca
Haudenosaunee Confederacy Chiefs Council 2634 6th Line Road RR 2 Ohsweken, Ontario N0A 1M0	Chief Allen MacNaughton (519) 755-2769

The Government of Canada sometimes receives claims that Ontario does not receive, or with which Ontario does not become involved. For information about possible claims in the area, MAA recommends you contact the following federal contacts:

Ms. Janet Townson Claims Analyst, Ontario Team Specific Claims Branch Indian and Northern Affairs Canada 1310-10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 953-4667 Fax: (819) 997-9873	Mr. Sean Darcy Manager Assessment and Historical Research Indian and Northern Affairs Canada 10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 997-8155 Fax: (819) 997-1366

For federal information on litigation contact:

Mr. Marc-André Millaire
Litigation Team Leader for Ontario
Litigation Management and Resolutions Branch
Indian and Northern Affairs Canada
10 Wellington St.
Gatineau, QC K1A 0H4
Tel: (819) 994-1947
Fax: (819) 953-1139

Additional details about your project or changes to it that suggest impacts beyond what you have provided to date may necessitate further consideration of which Aboriginal communities may be affected by or interested in your undertaking. If you think that further consideration may be required, please bring your inquiry to whatever government body oversees the regulatory process for your project.

The information upon which the above comments are based is subject to change. First Nation or Métis communities can make claims at any time, and other developments can occur that could result in additional communities being affected by or interested in your undertaking.

Yours truly,

H. Levecque

Heather Levecque
Manager, Consultation Unit
Aboriginal Relations and Ministry Partnerships Division

From:	Heintzman, Cristal (MNR) [Cristal.Heintzman@ontario.ca]
Sent:	04-Aug-11 4:05 PM
To:	Bill.Banks@banksgroundwater.ca
Cc:	Heintzman, Cristal (MNR)
Subject:	Simcoe Water Supply Class Environmental Assessment
Follow Up Flag:	Follow up
Flag Status:	Flagged

Good Afternoon Mr. Banks,

We have received the Notice of Study Commencement for the Simcoe Water Supply Class Environmental Assessment – I apologize for the late response. We have reviewed the study area and would like to provide the following:

Species At Risk
The Species at Risk in Ontario (SARO) List is Ontario Regulation 230/08 issued under the *Endangered Species Act*, 2007. The *Endangered Species Act*, 2007 (ESA 2007) came into force on June 30, 2008 and provides both individual protection (section 9) and habitat protection (section 10) to species listed as endangered or threatened on the SARO List. The current SARO List, issued under the ESA 2007, can be found on e-laws (http://www.e-laws.gov.on.ca/navigation?file=home&lang=en). If an activity or project will result in adverse effects to species and/or habitat protected under the ESA 2007, an authorization under the ESA 2007 would be required. Please note that authorizations are not guaranteed and that the review timelines for Authorization Request Packages can be several months. Site-specific investigation within and adjacent to the study area may find additional species and/or habitat location on or adjacent to the site.

An initial ESA screening of the Simcoe Water Supply study area, Norfolk County has been completed. There are a number of known occurrences for Species at Risk that are located within or around your study area. These include:

American Badger (END)
American Chestnut (END)
Northern Map Turtle (SC)
Milksnake (SC)
Eastern Hognosed Snake (THR)
Eastern Flowering Dogwood (END)

Provincially Significant Wetlands, Areas of Natural and Scientific Interest
The LR-13 Wetland Complex is located within the southern extent of your study area.
There are no ANSIs within your study area.

Significant Wildlife Habitat
Significant wildlife habitat has may be present on the subject lands. Please consult the *Significant Wildlife Habitat Technical Guide,* (OMNR, 2000). Significant wildlife habitat is identified by planning authorities using the criteria and processes recommend in the Significant Wildlife Habitat Technical Guide (OMNR, 2000). Link to the guide: http://www.mnr.gov.on.ca/en/Business/FW/Publication/MNR_E001285P.html The Natural Heritage Reference Manual (please see below) also provides guidance in section 9.0.

Significant Woodlands
According to the map provided within the Notice of Study Commencement, it appears there are woodlands on or adjacent to the site. We recommend you check the Norfolk County Official Plan and the Natural Heritage Reference Manual for information on significant woodlands.

Fisheries
Please note that the Lynn River watercourse, a cold water ecosystem, flows through the centre of your study area. It is expected that any development taking place will not impact the fishery populations within this watercourse. If in-water work will be taking place or there is the potential for work to impact aspects of the river (flows, temperature, etc.), please contact our district office to obtain more information.

Please be advised, the initial screening is based on the limited information we currently have regarding the study limits. Additional information can be obtained once a more detailed study area/project description becomes available.

I hope the above is useful to you. If you feel that anything we have stated here requires further discussion or clarification then please contact me.

Thanks,
Cristal.

Cristal Heintzman
Planning Intern - Aylmer District
Ministry of Natural Resources
615 John St. N.
Aylmer, Ontario N5H 2S8
Tel: (519) 773-4737
Email: cristal.heintzman@ontario.ca

From: Heather Surette (LPRCA) [mailto:HSurette@lprca.on.ca]
Sent: Thursday, October 20, 2011 1:05 PM
To: Evers, Andrew
Cc: Bonnie Bravener (LPRCA); Ben Hodi (LPRCA); Craig Jacques (LPRCA); Paul Gagnon (LPRCA)
Subject: Simcoe Water Supply EA
Importance: High

Dear Mr. Evers,

My sincerest apologies for not providing your organization with these comments prior to this time and I apologize for any inconvenience this may have caused.

Long Point Region Conservation Authority (LPRCA) staff have now had an opportunity to review your request and can offer the follow for your consideration:

A portion of the proposed works does fall within the LPRCA Regulation Limit, under Ontario Regulation (O. Reg) 178/06, and a permit is required from this office for any site alteration or development within the Regulation Limit. I have attached a map displaying the Regulation lines. The blue line identifies

Ministry of Natural Resource (MNR) wetland boundaries and the red line shows the setbacks for the various features affected (i.e., watercourses and wetlands).

Various alterations to watercourses are proposed as well as being within the 120 m setback of a Provincially Significant Wetland (PSW). Under O. Reg. 178/06 development is prohibited in or around wetlands and watercourses unless it can be shown that all works will not have a negative impact on the natural features and functions of the attributes.

- The proposed wells are located at the top end of Davis Creek which becomes a coldwater system downstream. LPRCA staff are concerned with the potential of decreasing baseflows to Davis Creek thereby increasing stresses on the system during dry periods. Lowering of the nearby water table may result in stresses/changes to the hydrologic regime supporting nearby natural communities such as riparian zones, wetlands, forests and coldwater habitats.
- Throughout the construction period, a sediment and erosion control plan is required for the entire site. The temporary placement of sediment and erosion control measures are required to be maintained until the site has fully stabilized.
- Any works completed in water are subject to timing windows and a letter of advice issued by LPRCA on behalf of Fisheries and Oceans Canada. Depending on the proposed works, authorization from Fisheries and Oceans Canada may also be required.
- As stated in the correspondence the watermains cross a PSW. Any specific information pertaining to this wetland is held with the Aylmer District MNR. The contact at this office would be Amanda McCloskey, District Planner, Amanda.McCloskey@ontario.ca. A screening for species at risk under the *Endangered Species Act* may also be required through this agency.
- Permit applications must be approved by LPRCA's Board of Directors. This is typically completed the first Wednesday of every month. Submission of a complete application must allow sufficient time for staff to review and provide a recommendation to the Board.
- Any permit issued by LPRCA does not preclude any approvals required by any other laws or regulations.

Through LPRCA's involvement with Source Water Protection LPRCA staff can also offer the following information:

1. Consideration of land uses within the area which will constitute the well-head protection area of the proposed well.
    - Economic/Social: new well-head protection areas may result in the identification of new significant/moderate/low drinking water threats due to activities occurring within nearby areas. Under the *Clean Water Act*, policies must be developed for significant drinking water threats such that the activity never becomes a significant drinking water threat; or that if the activity is being engaged in, that it ceases to be a significant drinking water threat. These policies may result in changes to how/what/when property owners manage their property; and/or costs to the property owner/municipality.
2. Consideration of the potential interference due to a localized lowering of the water table, including but not limited to:
    - Environmental/economic/social: reductions in the low flows to the Simcoe WWTP due to decreased flow inputs to the Lynn River from Davis Creek; which would impact the 7Q20 and the effluent output site meaning associated effluent/treatment limits/flows are no longer accurate; possibility leading to required changes to the wastewater treatment there.
    - Social/economic: lowering of the water table, resulting in loss of supply/interference for water takings not requiring permits, including private domestic and livestock supplies and/or for nearby permitted takings (PTTW), including surface water from nearby ponds or Davis Creek and decreased pumping ability from nearby groundwater wells.
3. Consideration of how other current/future water takings may interfere with the proposed taking.

If you have any questions in this regard or if you require anything please do not hesitate to contact me.

Sincerely,
Heather Surette

Heather Surette, M.Sc.
Manager, Watershed Services

Long Point Region Conservation Authority
4 Elm Street
Tillsonburg, ON
N4G 0C4

Phone: (519) 842-4242 ext. 231
Toll Free: 1-888-231-5408
Fax: (519) 842-7123

Email: hsurette@lprca.on.ca
Web: www.lprca.on.ca

Long Point Region Conservation Authority

Proposed Water Supply
Norfolk County - Simcoe

Universal Transverse Mercator - Zone 17 (N)
Map Centre: East 555696.60 m North 4746490.88 m
Created: 10/20/20119:42:20 AM
Copyright LPRCA GIS Services 2011
-80.32:42.87

Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

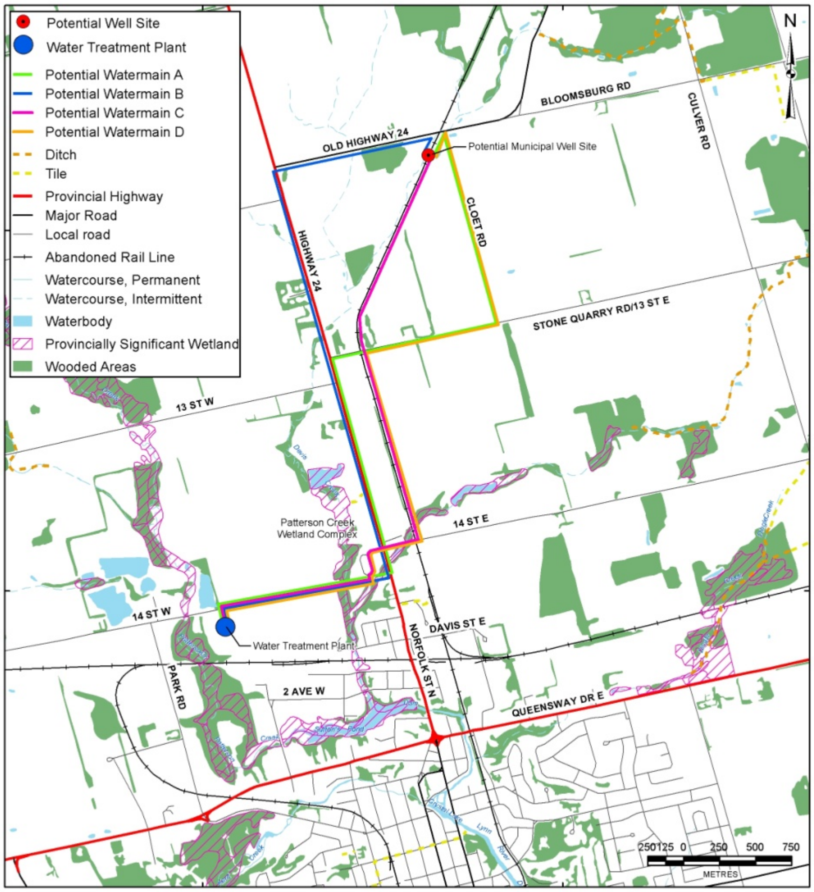
Notice of Public Information Centre

Background

Norfolk County is proposing to develop an additional groundwater supply source with a capacity of up to 4,300 cubic metres per day to provide additional water to the urban area of Simcoe. Groundwater is the sole source of water supply in the Community of Simcoe, and in anticipation of increased daily water supply requirements for the community, a groundwater investigation and Municipal Class Environmental Assessment (EA) is being conducted by Norfolk County.

Municipal Class EA Study

The potential environmental effects of the proposed undertaking are being assessed as a Schedule "B" Municipal Class EA under Ontario's *Environmental Assessment Act*. This assessment will define the problem/ opportunity, as well as identifying and evaluating well sites and water main routes (refer to adjacent map) in order to determine a preferred solution.



Public Information Centre

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate by providing their comments and attending a Public Information Centre (PIC). The PIC will consist of an informal drop-in centre, where background information on the study, the various alternatives considered, and any potential effects and mitigation measures will be provided. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC to answer questions and discuss the next steps in the study. The PIC is scheduled for:

DATE: **Wednesday, November 30, 2011**
TIME: **5:30 – 7:30 pm**
LOCATION: **Bloomsburg Public School, 25 Concession 12**

If you have any questions prior to the PIC or cannot attend and would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South,
RR1
Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng., Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
183 Main Street of Delhi
Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1600
Email: John.Hamilton@norfolkcounty.ca

Community of Simcoe Additional Water Supply Environmental Assessment

Welcome

Thank you for coming to learn about the Community of Simcoe Additional Water Supply Project

We want to hear what you think

Municipal Class Environmental Assessment Public Information Centre

Bloomsburg Public School

Wednesday, November 30, 2011
5:30 - 7:30 pm

Norfolk COUNTY

Background

- Groundwater resources are the only source of water supply for the Community of Simcoe
- The Community of Simcoe withdraws water from nine wells and an infiltration gallery/well system
- Maximum daily water supply requirements for the community are expected to increase
- The current water supply system capacity is 19,364 m^3/day
    - An additional capacity of 4,300 m^3/day is required to meet the expected increased demand
- In 2007, Norfolk County began a groundwater investigation to evaluate the development of a groundwater source that could meet this additional capacity requirement

Problem/Opportunity Statement:

An additional capacity of 4,300 m^3/day is needed to accommodate the expected increase for water supply requirements in the Community of Simcoe

Community of Simcoe Additional Water Supply Environmental Assessment

Project Description

- The proposed Project includes the development of a new well site with a permitted capacity of 4,300 m^3/day
- The wells will be pumped into a watermain to transmit raw water to the existing water treatment plant
- This Project will include construction and operations phase activities, as described below

Construction

- Construction of the new wells at the well site
- Installation of a new watermain
    - The watermain will be constructed along the selected route below ground surface
- Construction of a pumphouse building adjacent to the wells

Operations

- Routine maintenance at the well site and along the watermain route - includes inspection, monitoring and testing

Community of Simcoe Additional Water Supply Environmental Assessment

Municipal Class Environmental Assessment Process

- A Municipal Class Environmental Assessment (EA) is a planning process that meets the requirements of Ontario's *Environmental Assessment Act*
- It is a streamlined EA process for projects that share the following aspects:
    - are recurring;
    - are usually similar in nature;
    - are typically limited in scale;
    - have a predictable range of environmental effects; and
    - have environmental effects that can be effectively mitigated
- This Project is following a Schedule "B" Municipal Class EA process
- For a Schedule B Class EA, two Project phases must be completed before construction activities begin
- Schedule B Class EA phases are described below

Municipal Class EA Phase Descriptions

Phase 1 - Problem or Opportunity	Identify the problem or opportunity (see Background display board)
Phase 2 - Alternative Solutions	Identify alternative solutions to the problem Identify the preferred solution Assess the effects of the Project on the existing environment

Community of Simcoe Additional Water Supply Environmental Assessment

Municipal Class EA Schedule

Project Schedule

Nov 2010
Dec 2010
Jan 2011
Feb 2011
Mar 2011
Apr 2011
June 2011
July 2011
Aug 2011
Sept 2011
Oct 2011
Nov 2011
Dec 2011
Jan 2012
Feb 2012
Mar 2012
Apr 2012

Notice of Commencement

Identify Problem/ Opportunities

Evaluate Alternatives and Conduct Studies

Identify Preferred Alternative

Public Information Centre

Confirm Preferred Alternative and Additional Studies

Notice of Completion

Norfolk COUNTY

Project Alternatives

Well Alternative Solutions

- Part of the Municipal Class EA process is to identify and assess alternative solutions that address the Problem Statement
- The solutions described in the table below were identified and considered

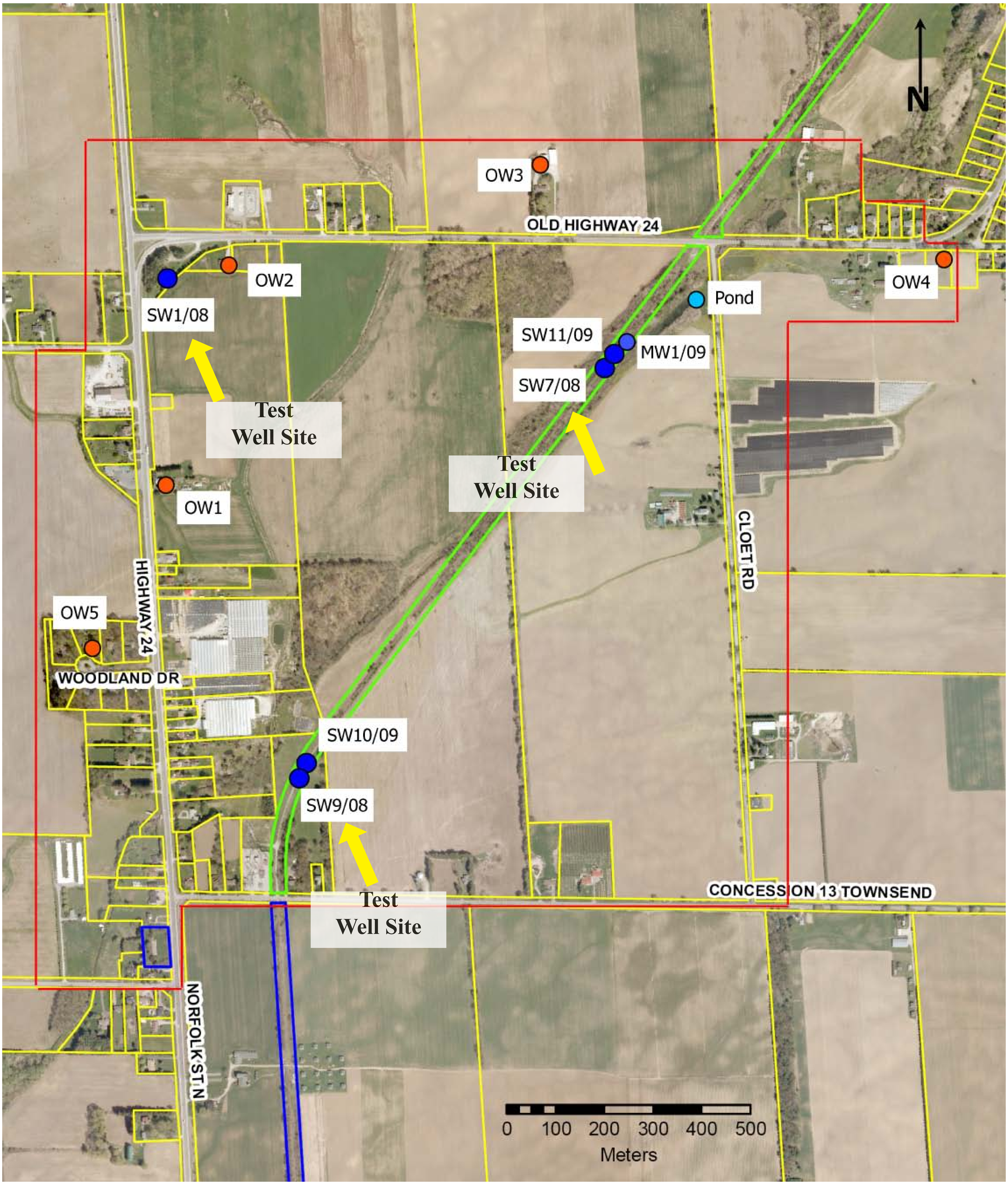
Solution	Addresses the Problem Statement?
Do Nothing	No
Water Conservation	No - water conservation on its own cannot provide the required 4,300 m^3/day
Limiting Community Growth	No - limiting community growth on its own cannot provide the required 4,300 m^3/day and is not part of the Community of Simcoe's planning vision
New Well Site	Yes - alternative well site selected

Evaluation of New Well Sites

- After test well drilling at nine locations north and east of Simcoe, three test wells initially showed the potential for adequate water supply (See Well Survey and Testing Area display board)
- Following the short-term test pumping, two of the three test wells showed sufficient production capacity
- Larger wells were drilled at these two locations and tested further
- The preferred well site is located within a rail line easement where permission may be granted

Community of Simcoe Additional Water Supply Environmental Assessment

Well Survey and Testing Area



Norfolk COUNTY

Community of Simcoe Additional Water Supply Environmental Assessment

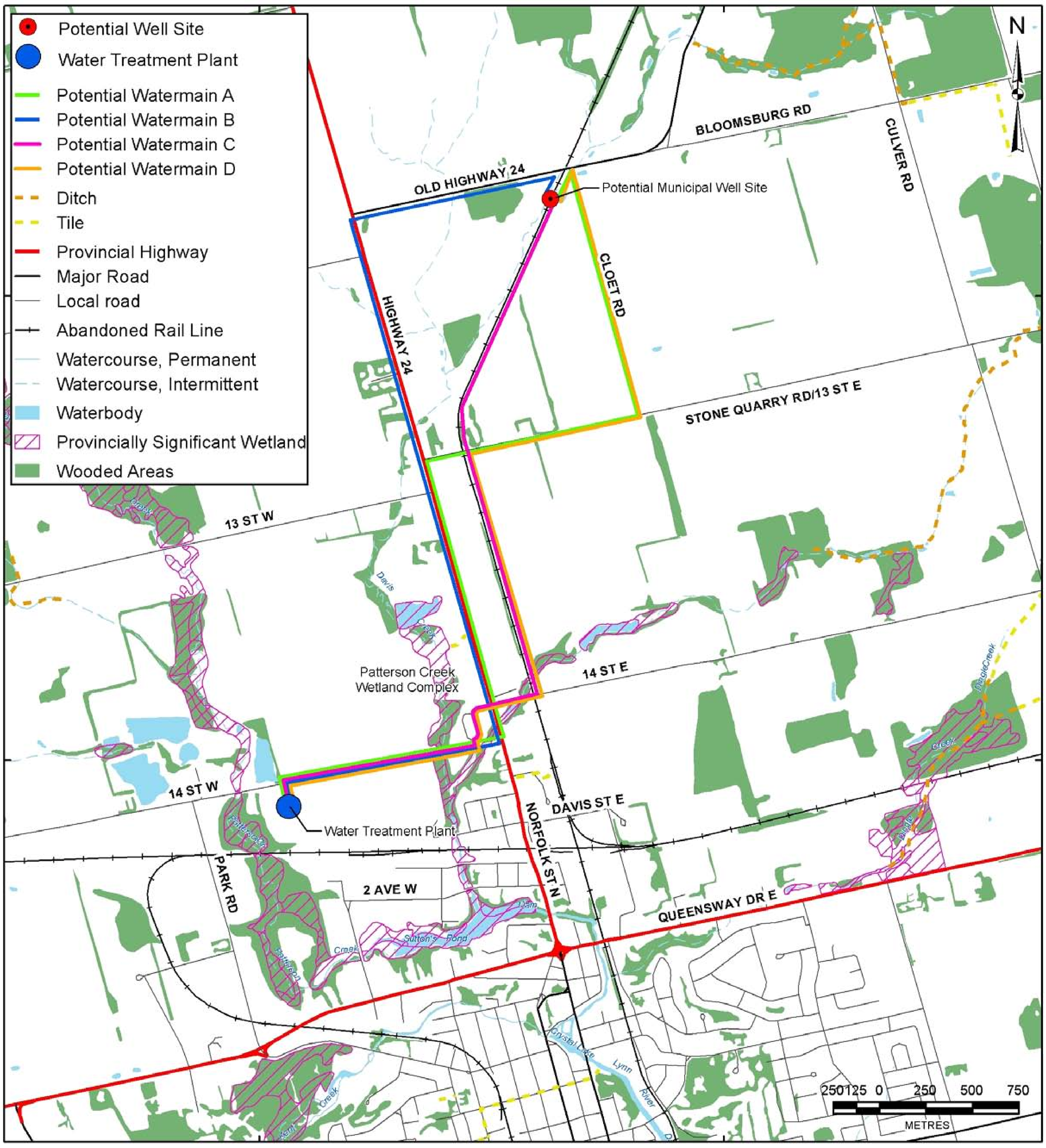
Project Alternatives

Watermain Route Alternatives

- Four potential routes have been considered, as shown on the map below
- For all options, the watermain would connect to the existing water treatment plant

Evaluation of New Watermain Route

- Potential watermain routes A and B would have the greatest effect on local businesses, traffic and utilities
- Potential watermain route C requires permission from the Ontario Realty Corporation (ORC)
- Route C (the preferred route) is the most cost effective option, and is least disruptive to traffic, landowners, utilities and local businesses



Alternative Watermain Routes

Norfolk County

Studies

- A Municipal Class EA requires environmental studies be carried out on the Project
- Environmental studies have the following purpose:
    - understand existing environmental conditions; and
    - assess the effects of the Project on these conditions

- The required studies are listed below and described in further detail on the following display boards

Physical Studies
- Groundwater
- Surface Water
- Air Quality
- Noise

Biological Studies
- Wildlife
- Vegetation
- Aquatic Ecology

Social Studies
- Socio-economics
- Cultural and Heritage Resources

Community of Simcoe Additional Water Supply Environmental Assessment

Groundwater

- Groundwater studies were carried out to determine if the Project would affect groundwater quality and groundwater quantity
- Drawdown (lowering of water levels) ranged from 1.2 m (5 m from the well) to zero (400 m from the well) - see Biological Studies display board
- Studies involved the installation of test wells and a number of pumping tests to measure drawdown
- Testing results showed that:
  - there were no changes in water levels in any monitored local private wells
  - Pumping did not disrupt private water supply
- The studies determined that municipal water supply wells could be developed at this site to provide the required capacity, without disrupting private water supplies
- Potential adverse effects include:
  - Deterioration of groundwater resources as a result of accidental spills during construction
- Effects on groundwater resources, if any, would occur during the construction phase only, and are fully reversible once mitigation measures are implemented
- Mitigation measures are activities that help reduce or eliminate the effects of a Project on the environment (e.g., development of a spill prevention program)
- Ongoing monitoring of groundwater quality and flow will occur during operation activities

Norfolk COUNTY

Community of Simcoe Additional Water Supply Environmental Assessment

Surface Water

- Surface water studies were carried out to determine potential effects of the Project on surface water resources (e.g., watercourses such as rivers and streams)
- Studies involved the installation of test wells and observation of water levels in nearby surface water sources
- Studies showed that groundwater pumping at this new well site would not reduce water levels in ponds near the test well
- The part of Davis Creek adjacent to the site is not expected to be significantly affected by drawdown (lowering of water levels) because:
    - Davis Creek is not heavily influenced by groundwater (e.g. groundwater does not contribute significantly to the water in Davis Creek)
    - Groundwater studies predict that there will be minimal observed reductions in groundwater levels around the new well site (See Biological Studies display board)
- The EA identified the following potential adverse effects and proposed mitigation measures, described below:
    - Erosion of watercourses during construction of the watermain - mitigated by restoring ground cover immediately after construction
    - Sediment runoff at well site during construction - mitigated by using stockpile covers or silt fencing to prevent sediment from entering watercourses
    - Accidental spills during construction- mitigated by developing a spill prevention program, emergency response plan and designated refuelling area for construction equipment

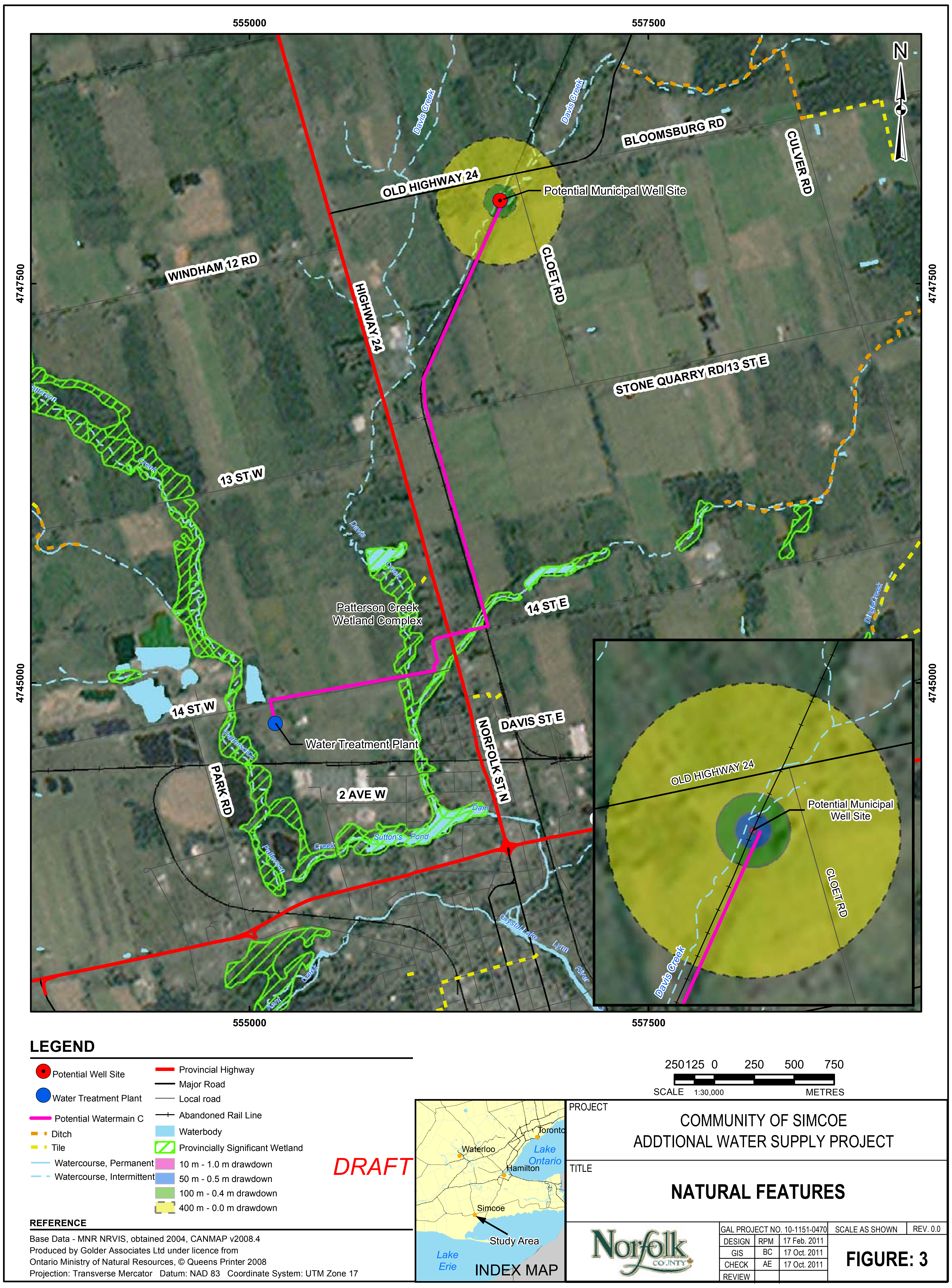
Community of Simcoe Additional Water Supply Environmental Assessment

Biological Studies

- The study area includes part of Davis Creek, which is a tributary of Lynn River
- Ministry of Natural Resources classifies Davis Creek as a coldwater creek
- The part of Davis Creek that is adjacent to the proposed water well flows intermittently, which suggests that there is limited, and at times, no influence of groundwater
- The study area also contains portions of the Patterson Creek Provincially Significant Wetland Complex - a wetland complex that occurs on portions of Patterson Creek and Davis Creek
- The Species At Risk (SAR) screening identified a number of species that may be found in the study area including Northern Map Turtle, Eastern Flowering Dogwood and American Badger
- The EA identified the following potential adverse effects and proposed mitigation measures, described below
    - Installation of the watermain has the potential to disturb vegetation communities and disrupt wildlife habitat - mitigated by:
        - Installing watermain along existing corridor of abandoned railroad
        - Directional drilling under watercourses
    - Construction of the watermain across portions of Davis Creek and Patterson Creek could cause erosion and sedimentation - mitigated by:
        - Avoiding the removal of vegetation
        - Directional drilling under watercourses
- All required municipal, provincial and, if required, federal work permits and approvals will be obtained prior to construction

Biological Studies

- The figure below shows natural heritage features near the well site and the predicted drawdown in water levels resulting from operation of the wells
- Groundwater studies identified the groundwater ‘area of influence’ and potentially affected watercourses as shown in the figure below



REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

Socio-Economic

- Studies were carried out to determine potential effects of the Project on the following aspects of the socio-economic environment:
  - Adjacent land use;
  - Public health and safety;
  - Reliability of drinking water supply;
  - Visual aesthetics;
  - Built heritage and archaeological resources;
  - Municipal infrastructure; and
  - Traffic
- Effects on visual aesthetics and reliability of drinking water supply are expected to be minimal or non-existent
- The EA identified the following potential adverse effects and proposed mitigation measures, described below:
  - Lane closures may occur along sections of the watermain route - mitigation includes development and implementation of a traffic control plan
  - Construction activities could affect public health and safety - mitigation includes the development of health and safety plans
  - Archaeological resources (Aboriginal and/or historical artifacts) may be present and therefore a Stage 1 Archaeological Assessment has been conducted and a Stage 2 Archaeological Assessment is recommended

Community of Simcoe Additional Water Supply Environmental Assessment

Air and Noise

- Studies were carried out to determine potential effects of the Project on existing noise levels and air quality
- Effects on air quality and existing noise levels are expected to be limited to construction phase activities (several weeks)
- Like operation of any vehicle, the operation of construction equipment will release emissions
- Air emissions are not expected to significantly affect local air quality and will be below Ministry of Environment (MOE) acceptable levels
- Noise from operation of construction equipment will be limited to daylight hours and will not exceed MOE acceptable noise levels
- Operations of the well and pumphouse will generate minimal noise and are not expected to affect local air quality

Norfolk
COUNTY

Community of Simcoe Additional Water Supply Environmental Assessment

Thank you

Thank you for taking the time to learn about the Project and give us your feedback

Please fill out a questionnaire, your input is important to us

Ways in which you can comment on the Project:

1. Fill in a questionnaire today
2. Telephone or email us (see below)

For more information, please visit the Norfolk County website (www.norfolkcounty.ca) or contact one of the following people:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South
RR 1
Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng., Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
183 Main Street of Delhi
Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1600
Email: John.Hamilton@norfolkcounty.ca

Norfolk COUNTY

Community of Simcoe Additional Water Supply Project

Public Meeting, November 30, 2011, Bloomsburg Public School

Please take a moment to fill out this questionnaire and place it in the box provided, or mail it to the address below. Your input is important. Comments will become part of the public record with the exception of personal information.

1. How did you learn about this Public Information Centre (please check all that apply)?

☐ Newspaper Advertisement ☐ Website

☐ Personal Letter or Email

☐ Word of Mouth

☐ Other:

2. What was your main reason for attending this Public Information Centre?

____

____

3. Did this Public Information Centre meet your information needs?

☐ Yes ☐ Somewhat ☐ No

Please explain:

____

____

____

4. If you asked questions tonight, did you get a satisfactory response?

☐ Yes ☐ I didn’t speak to anyone

☐ Somewhat ☐ No

Please explain:

____

____

____

6. **Please provide any other comments or questions related to the Community of Simcoe Additional Water Supply Project:**

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If you would like to be kept informed about the status of the Project, please provide your contact information below. Please note that your personal information will not be affiliated with your comments and will be kept confidential.

Name: ____

Street Address: ____

City/Province: ____

Postal Code: ______________________ Email: _________________________________

Thank you for taking the time to fill out this questionnaire. If you require more time, you are welcome to take the questionnaire home and send it back to:

Bill Banks, P.Eng, Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR 1
Puslinch, ON N0B 2J0
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng, Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
180 Main Street of Delhi
Delhi, ON N4B 2M3
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Comments From Comment Forms – Public Information Centre #1
November 30, 2011:

- What could/will be the effect/impact on our well?
- What happens when my well goes dry?
- We are concerned about our water levels.
- Will the proposed well drawdown the aquifer below the level of my well?
- What guarantees that our well water will not be affected?
- What rights doe we have if they are affected?
- Why this location less than 0.5 km from Bloomsburg – a Hamlet that depends only on well water?
- If I have issues with my well related to the withdrawal of water from this well, what are my options?
- How many homes have to be impacted with well issues (e.g. going dry or souring from sulphur) before the project is stopped?
- How can you possibly know if we will not lose our water supply until the 4,300 m3/day is taken on a constant basis?
- What would be the effects on surrounding farms in terms of land use and irrigation?
- What is the refresh rate of the well?
- How deep is the well?
- It rained 2 out of 3 days that they tested the wells here. They didn't take the water away, they put it into Davis Creek, which runs beside our home and keeps our water level up.
- How did you get the right of way for a pipe on public land (trail)?
- I am concerned about the Waterford Heritage Trail.
- I was interested in the proposed water main routes.
- Is there a plan to connect local homes to the municipal supply?
- Where can I obtain a copy of the study conducted to review thoroughly at my leisure?
- What is the true need for water in the Simcoe are?
- Why the expense?
- How much is the true cost?
- Impact on property taxes?

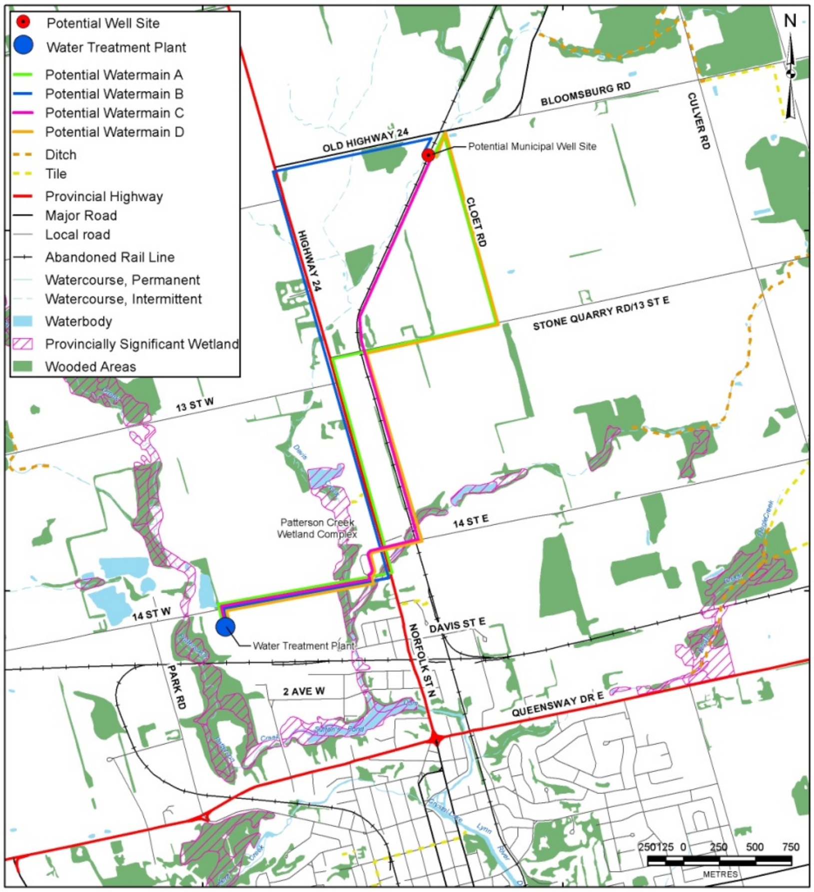
Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment
Notice of Public Information Centre No. 2

Background

Norfolk County is proposing to develop an additional groundwater supply source with a capacity of up to 4,300 cubic metres per day to provide additional water to the urban area of Simcoe. Groundwater is the sole source of water supply in the Community of Simcoe, and in anticipation of increased daily water supply requirements for the community, a groundwater investigation and Municipal Class Environmental Assessment (EA) is being conducted by Norfolk County.

Municipal Class EA Study

The potential environmental effects of the proposed undertaking are being assessed as a Schedule "B" Municipal Class EA under Ontario's *Environmental Assessment Act*. This assessment will define the problem/ opportunity, as well as identifying and evaluating well sites and water main routes (refer to adjacent map) in order to determine a preferred solution.



Public Information Centre

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate by attending this second Public Information Centre (PIC). The purpose of the PIC is to present a planned testing and monitoring program to be conducted this spring, and to begin identifying potential local private wells and irrigation ponds to be monitored as part of this testing program. The PIC will include a presentation, followed by a question and answer period, and then an opportunity for local well and irrigation pond owners to provide information regarding their wells and ponds that will assist in selecting suitable monitoring locations. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC. The PIC is scheduled for:

DATE: **Wednesday, April 25, 2012**
TIME: **5:30 – 7:30 pm**
LOCATION: **Bloomsburg Public School, 25 Concession 12**

If you have any questions prior to the PIC or cannot attend and would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South
RR1 Puslinch, ON N0B 2J0
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Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

Public Information Centre No. 2

Bloomsburg School

April 25, 2012

Banks Groundwater Engineering Limited
Golder Associates Ltd.
G. Douglas Vallee Limited
Gerrits Drilling & Engineering Ltd.

Norfolk
COUNTY

Presentation Overview

- Public Information Centre No. 1 – November 30, 2011 - Questions and comments received
- Answers
  - Study background
  - Results of previous testing and monitoring
  - Proposed additional testing and monitoring
  - Sharing and presentation of testing and monitoring results
- Additional questions and answers
- Water Well Survey completion and submission
- Next Steps

PIC No. 1 Questions & Comments

- What could/will be the effect/impact on our well?
- What happens when my well goes dry?
- We are concerned about our water levels.
- Will the proposed well drawdown the aquifer below the level of my well?
- What guarantees that our well water will not be affected?
- What rights do we have if they are affected?
- Why this location less than 0.5 km from Bloomsburg - a Hamlet that depends only on well water?
- If I have issues with my well related to the withdrawal of water from this well, what are my options?

PIC No. 1 Questions & Comments cont'd

- How many homes have to be impacted with well issues (e.g. going dry or souring from sulphur) before the project is stopped?
- How can you possibly know if we will not lose our water supply until the 4,300 m^3/day is taken on a constant basis?
- What would be the effects on surrounding farms in terms of land use and irrigation?
- What is the refresh rate of the well?
- How deep is the well?
- It rained 2 out of 3 days that they tested the wells here. They didn't take the water away, they put it into Davis Creek, which runs beside our home and keeps our water level up.

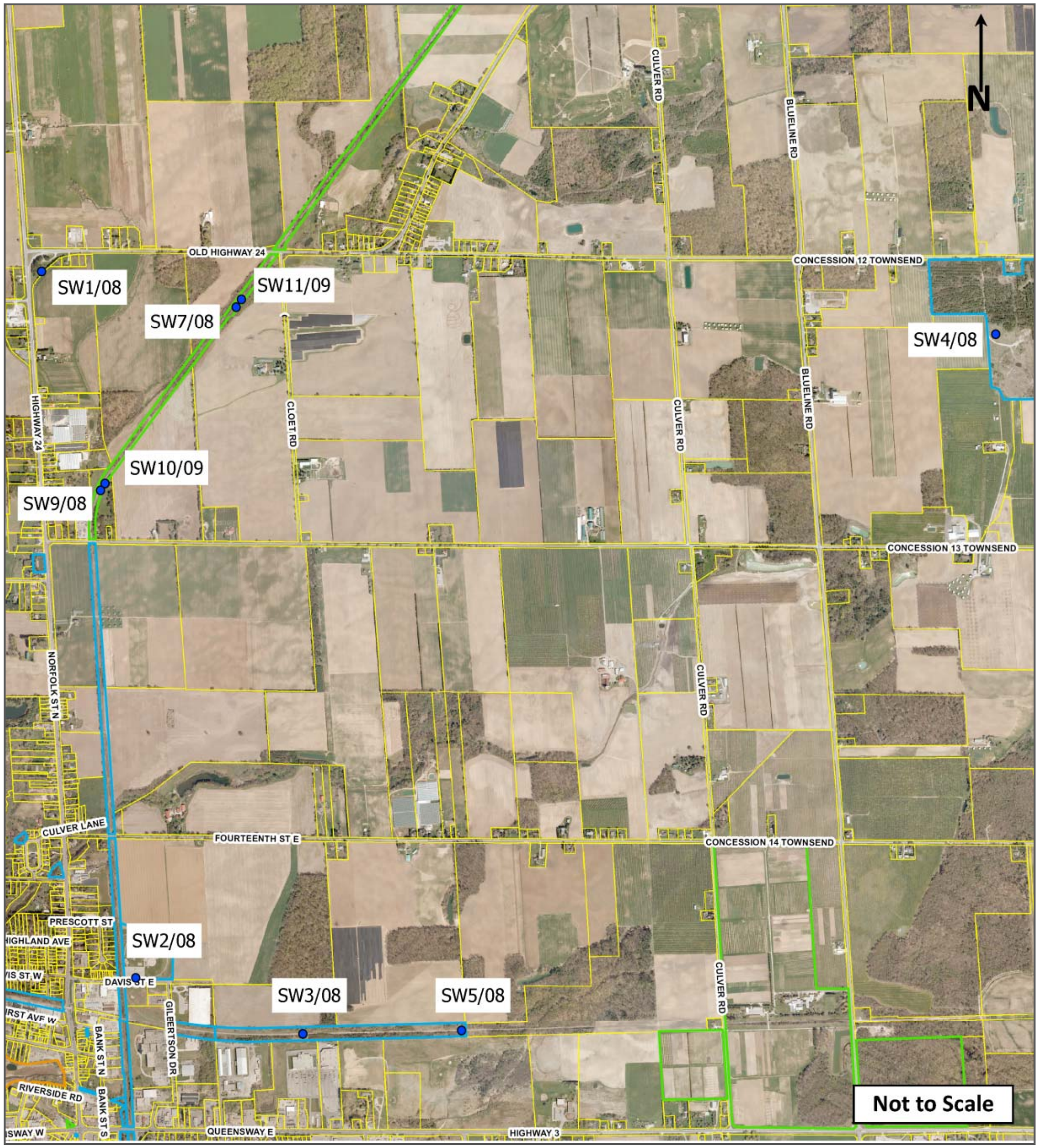
PIC No. 1 Questions & Comments cont'd

- How did you get the right of way for a pipe on public land (trail)?
- I am concerned about the Waterford Heritage Trail.
- I was interested in the proposed water main routes.
- Is there a plan to connect local homes to the municipal supply?
- Where can I obtain a copy of the study conducted to review thoroughly at my leisure?
- What is the true need for water in the Simcoe area?
- Why the expense?
- How much is the true cost?
- Impact on property taxes?

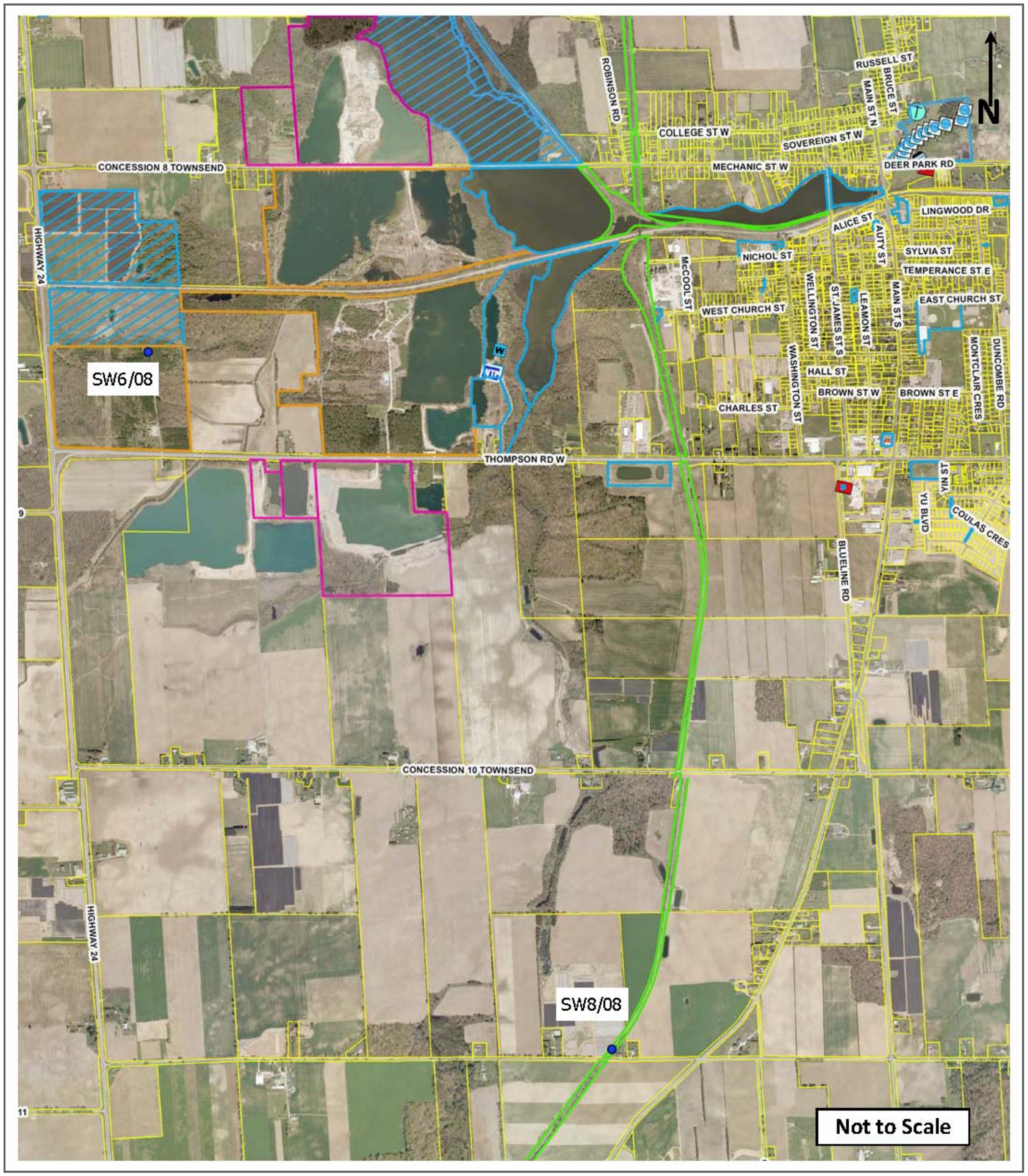
Study Background

- Simcoe / Waterford Area Groundwater Investigation 2008-2010
  - Test well drilling
  - Well testing Phase 1
  - Well testing Phase 2
  - Analysis and Report
- Simcoe Additional Water Supply Environmental Assessment 2010-Present

Simcoe Area Test Well Drilling

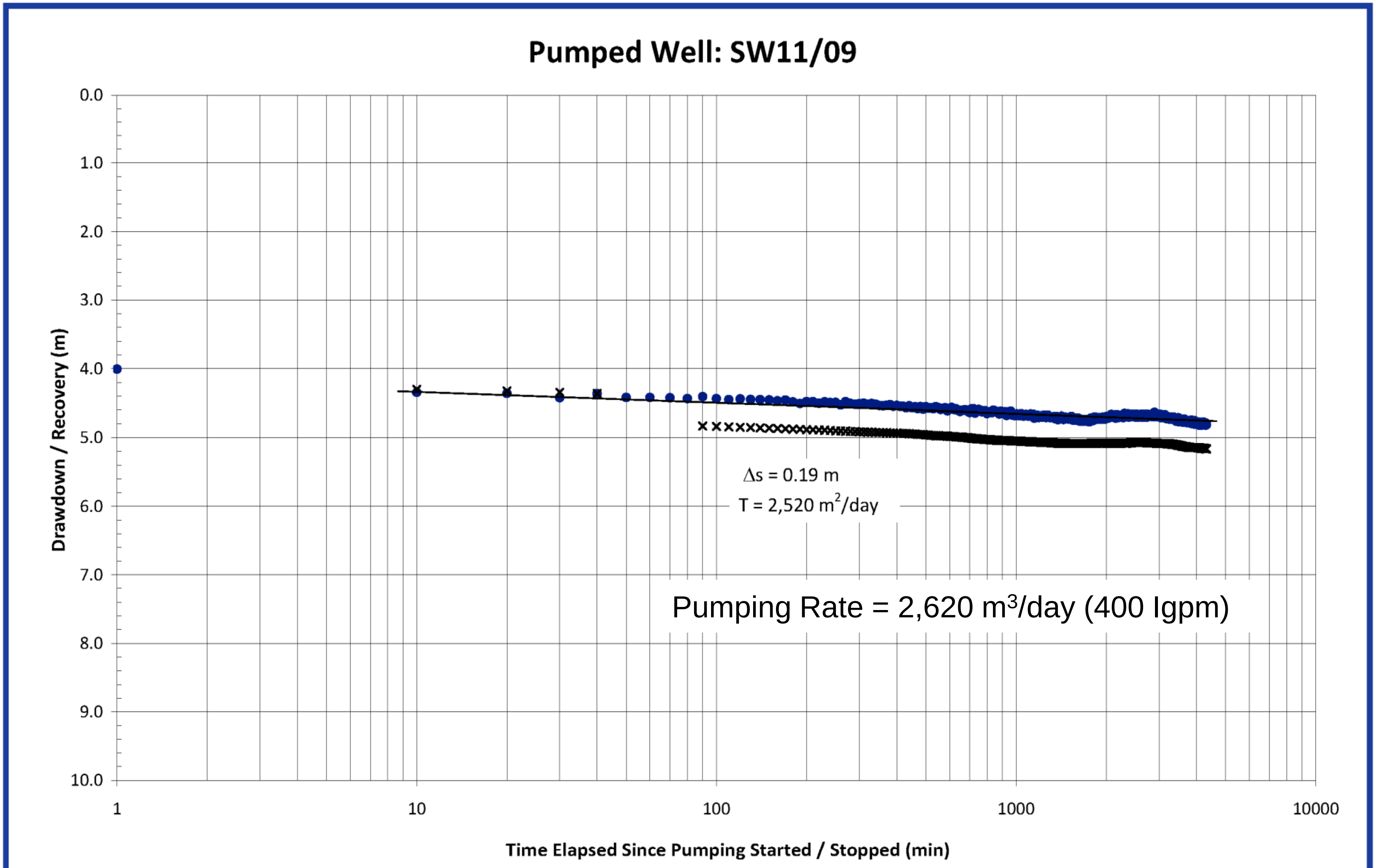


Waterford Area Test Well Drilling



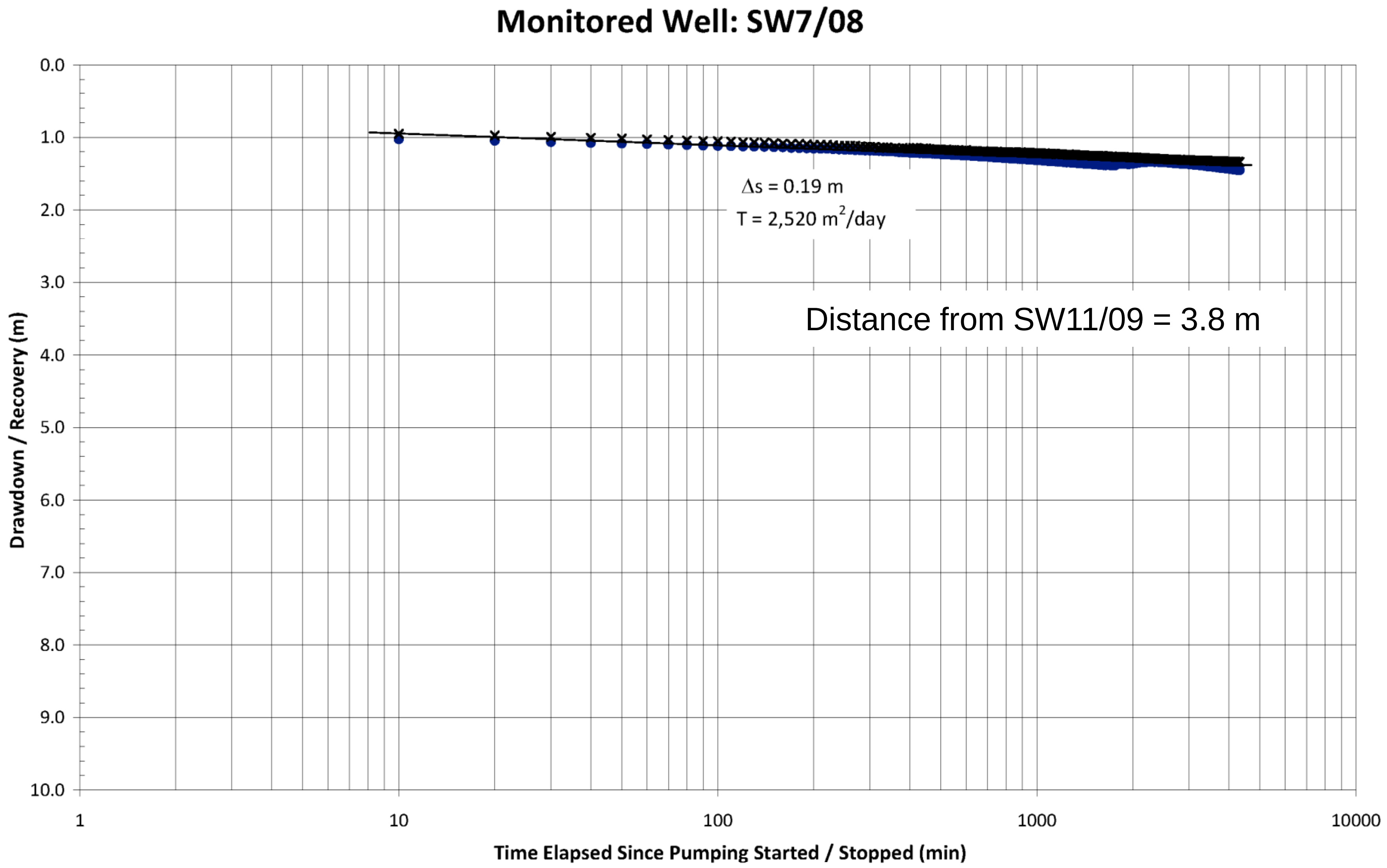
Well Testing Phases 1 and 2

Test Well SW11/09 72-Hour Test



Pumping Rate = 2,620 m³/day (400 Igpm)

Adjacent Monitored Well 72-Hour Test



Monitored Well: SW7/08

$\Delta s = 0.19$ m

T = 2,520 m^2/day

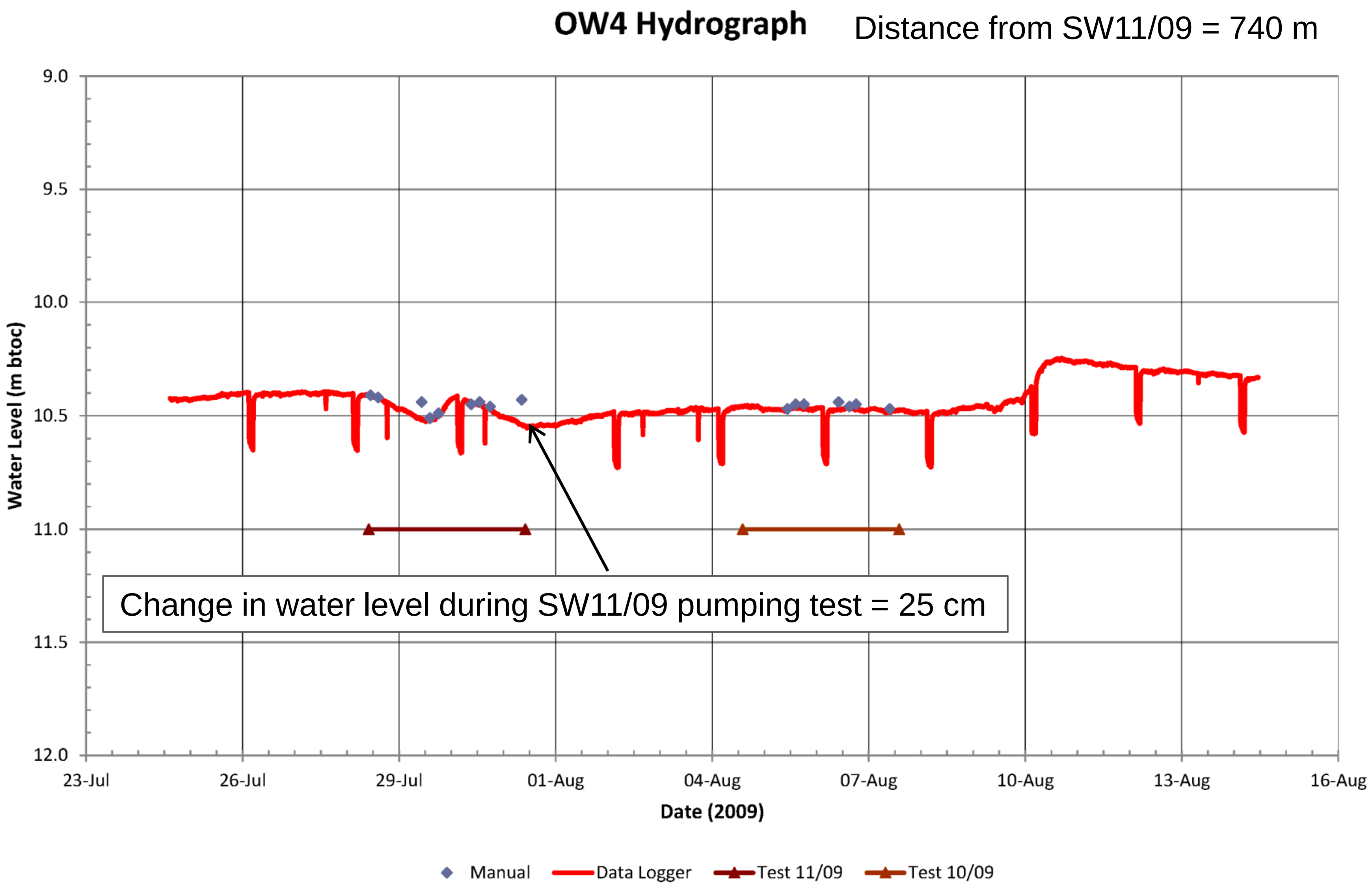
Distance from SW11/09 = 3.8 m

Gerrits Drilling & Engineering Ltd.

Banks Groundwater Engineering Limited

Groundwater Investigation - Simcoe, Norfolk County

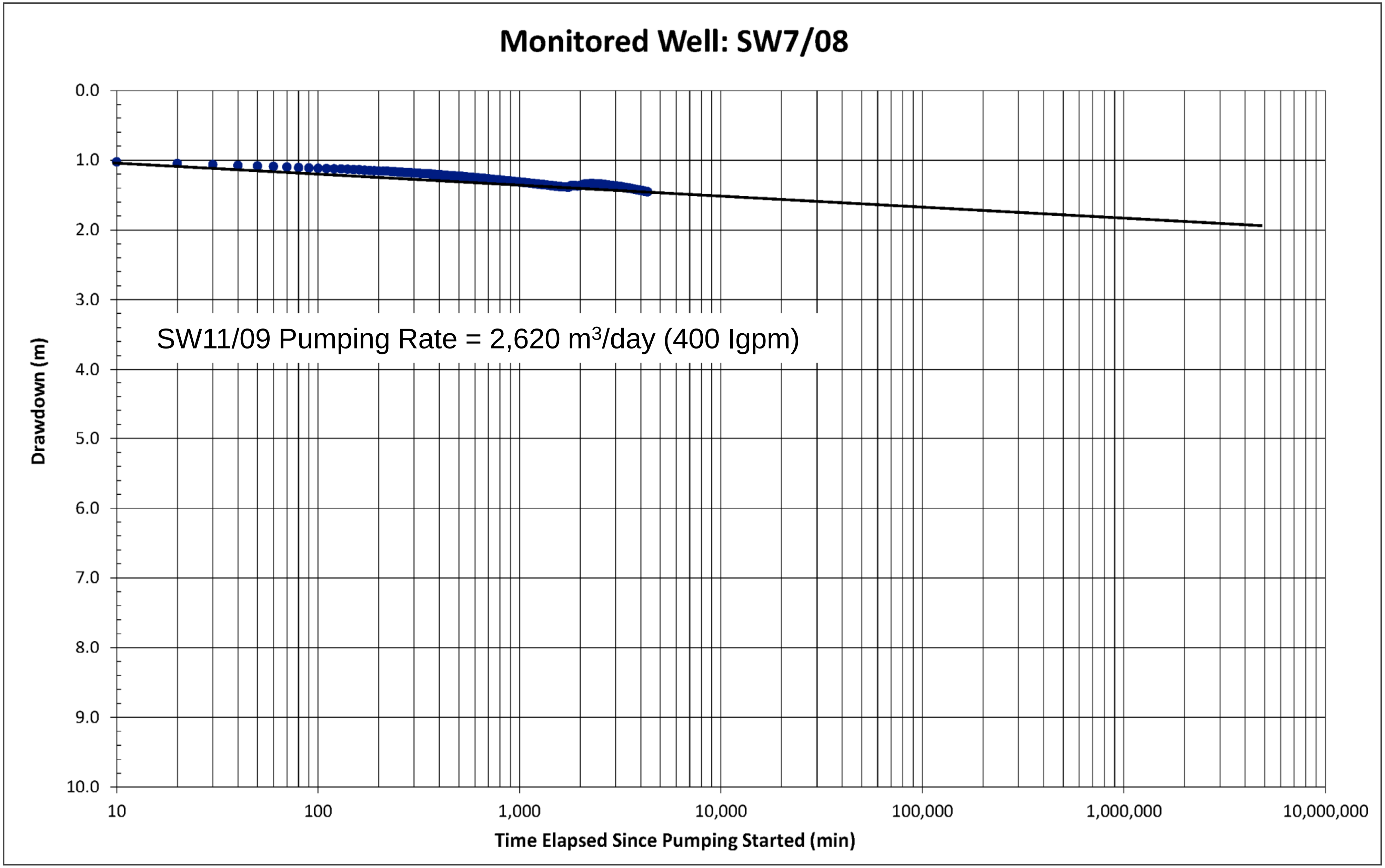
Local Private Well



OW4 Hydrograph Distance from SW11/09 = 740 m

Change in water level during SW11/09 pumping test = 25 cm

Adjacent Monitored Well - at 10 Years



Proposed Testing & Monitoring Program

Monitoring Locations

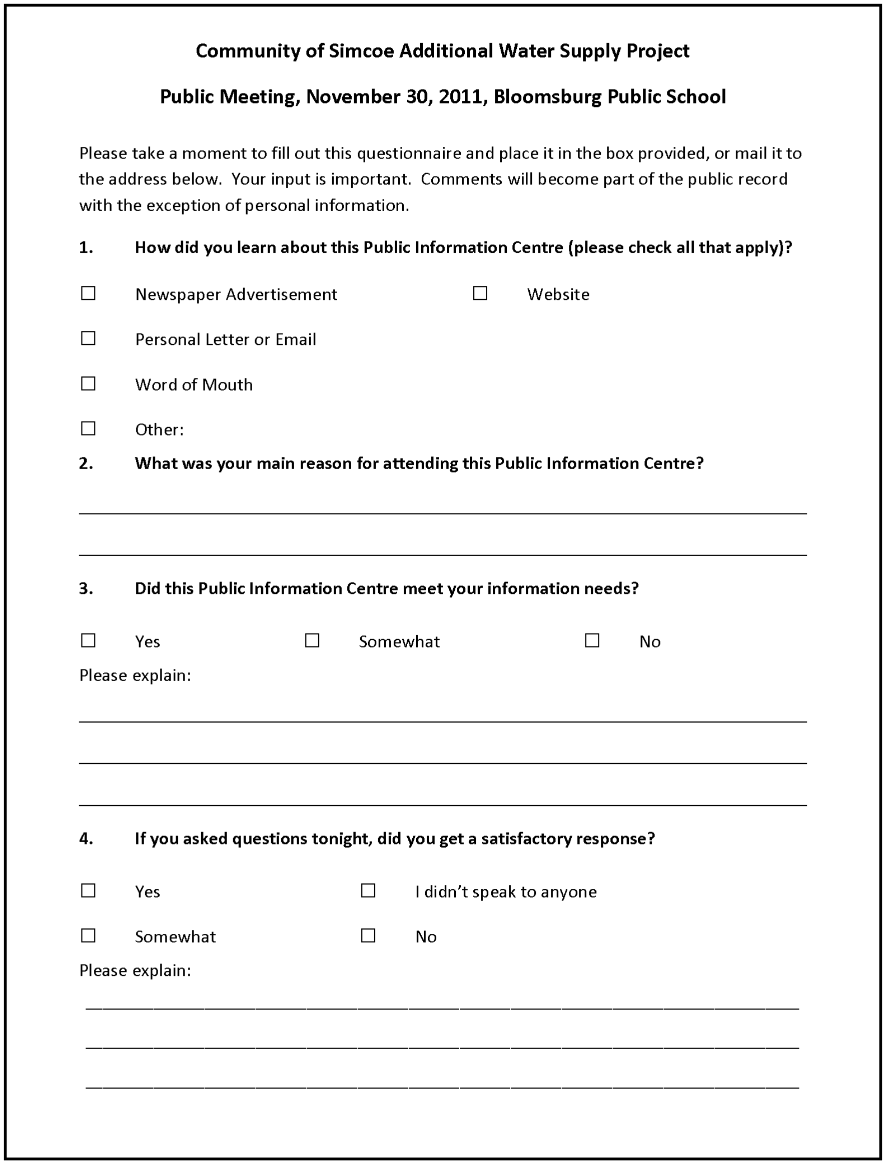
Summarizing....

- Groundwater is a shared renewable resource.

- Our goal is:

  To determine if there is enough groundwater to share with the Community of Simcoe, without affecting current supplies.

Questions or Comments?



Community of Simcoe Additional Water Supply Project

Public Meeting, November 30, 2011, Bloomsburg Public School

Please take a moment to fill out this questionnaire and place it in the box provided, or mail it to the address below. Your input is important. Comments will become part of the public record with the exception of personal information.

1. How did you learn about this Public Information Centre (please check all that apply)?

☐ Newspaper Advertisement ☐ Website

☐ Personal Letter or Email

☐ Word of Mouth

☐ Other:

2. What was your main reason for attending this Public Information Centre?

____

____

3. Did this Public Information Centre meet your information needs?

☐ Yes ☐ Somewhat ☐ No

Please explain:

____

____

____

4. If you asked questions tonight, did you get a satisfactory response?

☐ Yes ☐ I didn't speak to anyone

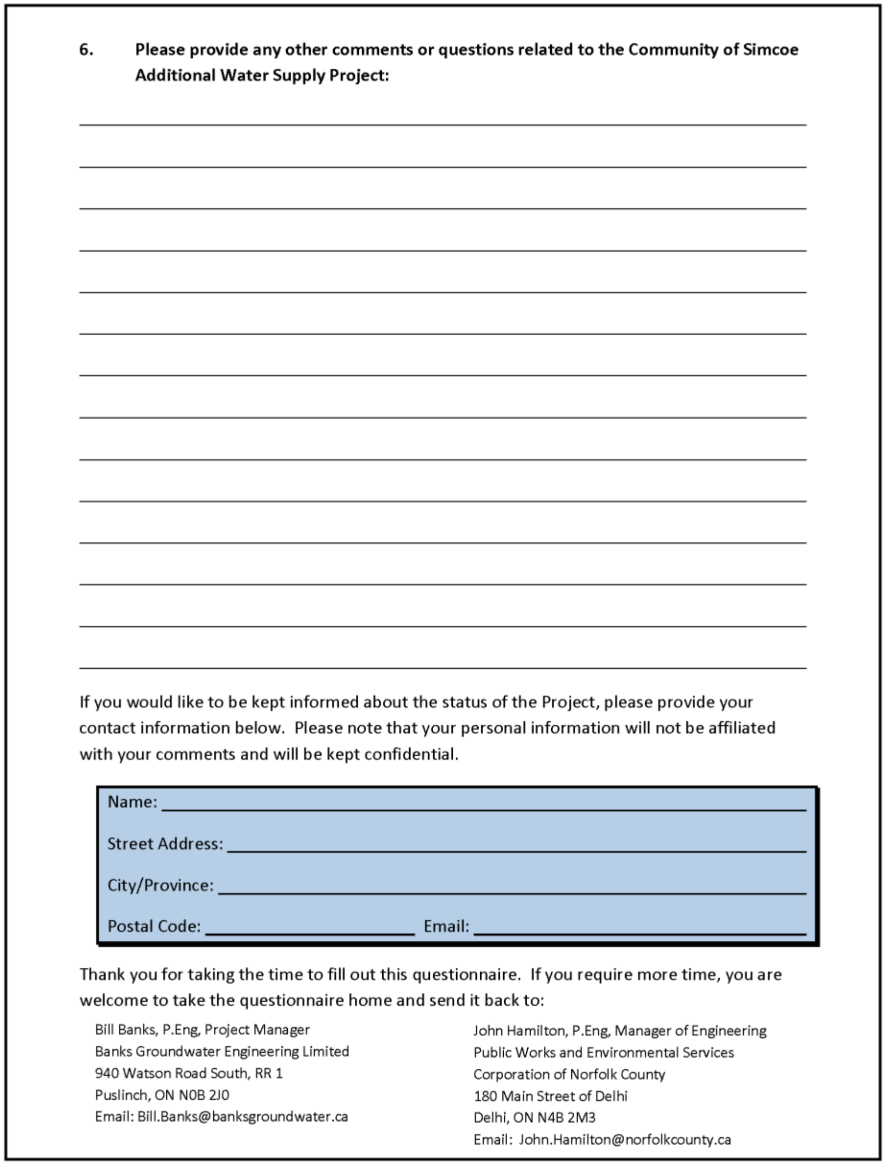
☐ Somewhat ☐ No

Please explain:

____

____

____



6. Please provide any other comments or questions related to the Community of Simcoe Additional Water Supply Project:

____

____

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____

____

If you would like to be kept informed about the status of the Project, please provide your contact information below. Please note that your personal information will not be affiliated with your comments and will be kept confidential.

Name: ______________________________

Street Address: ______________________________

City/Province: ______________________________

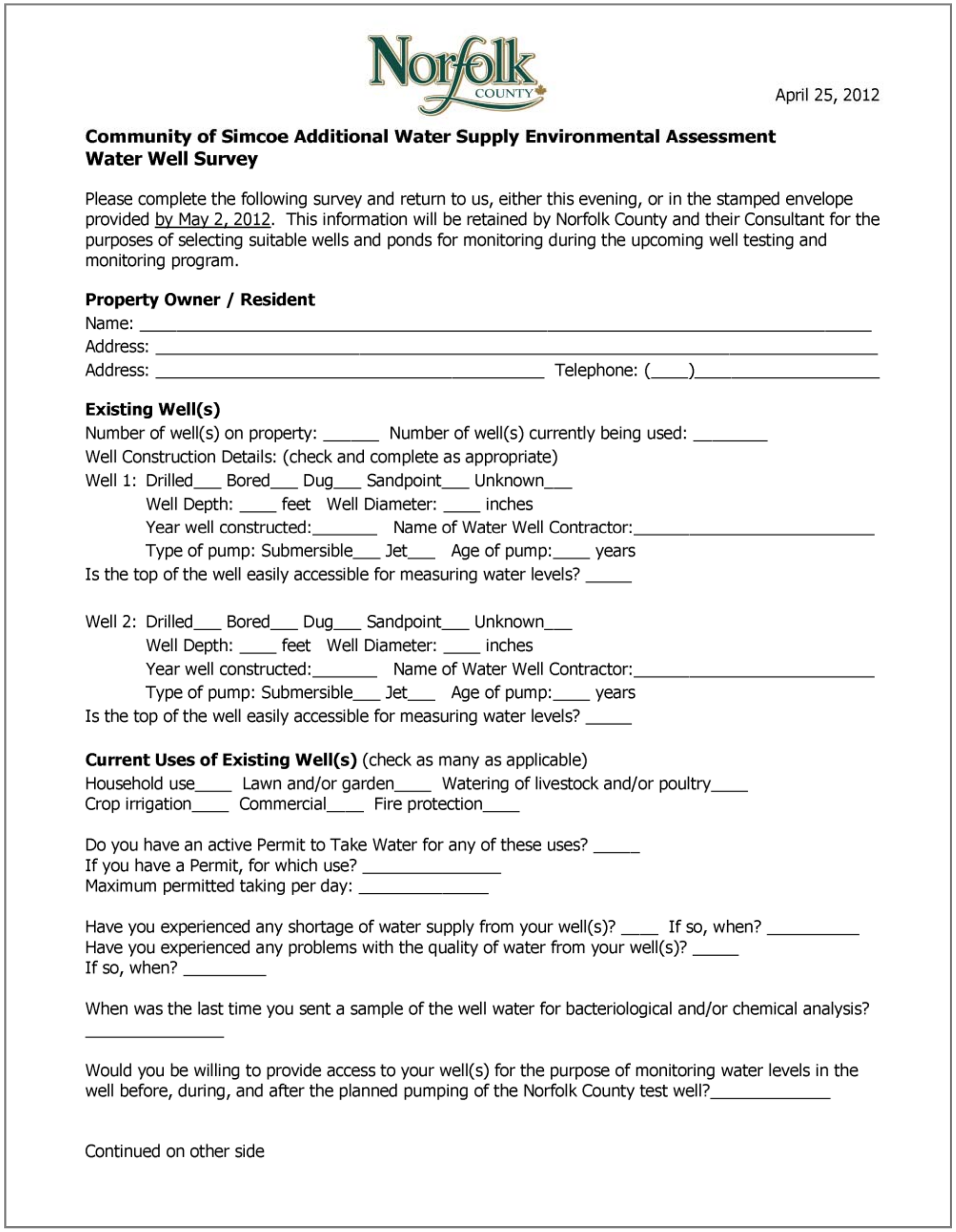
Postal Code: ______________ Email: ______________

Thank you for taking the time to fill out this questionnaire. If you require more time, you are welcome to take the questionnaire home and send it back to:

Bill Banks, P.Eng, Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR 1
Puslinch, ON N0B 2J0
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng, Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
180 Main Street of Delhi
Delhi, ON N4B 2M3
Email: John.Hamilton@norfolkcounty.ca

Water Well Survey



April 25, 2012

Community of Simcoe Additional Water Supply Environmental Assessment
Water Well Survey

Please complete the following survey and return to us, either this evening, or in the stamped envelope provided by May 2, 2012. This information will be retained by Norfolk County and their Consultant for the purposes of selecting suitable wells and ponds for monitoring during the upcoming well testing and monitoring program.

Property Owner / Resident

Name: ____
Address: ____
Address: ________________________________ Telephone: (____)______________

Existing Well(s)

Number of well(s) on property: ______ Number of well(s) currently being used: ________
Well Construction Details: (check and complete as appropriate)
Well 1: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:____________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

Well 2: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:____________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

Current Uses of Existing Well(s) (check as many as applicable)
Household use____ Lawn and/or garden____ Watering of livestock and/or poultry____
Crop irrigation____ Commercial____ Fire protection____

Do you have an active Permit to Take Water for any of these uses? _____
If you have a Permit, for which use? _______________
Maximum permitted taking per day: ______________

Have you experienced any shortage of water supply from your well(s)? ____ If so, when? __________
Have you experienced any problems with the quality of water from your well(s)? _____
If so, when? _________

When was the last time you sent a sample of the well water for bacteriological and/or chemical analysis?
____

Would you be willing to provide access to your well(s) for the purpose of monitoring water levels in the well before, during, and after the planned pumping of the Norfolk County test well?_____________

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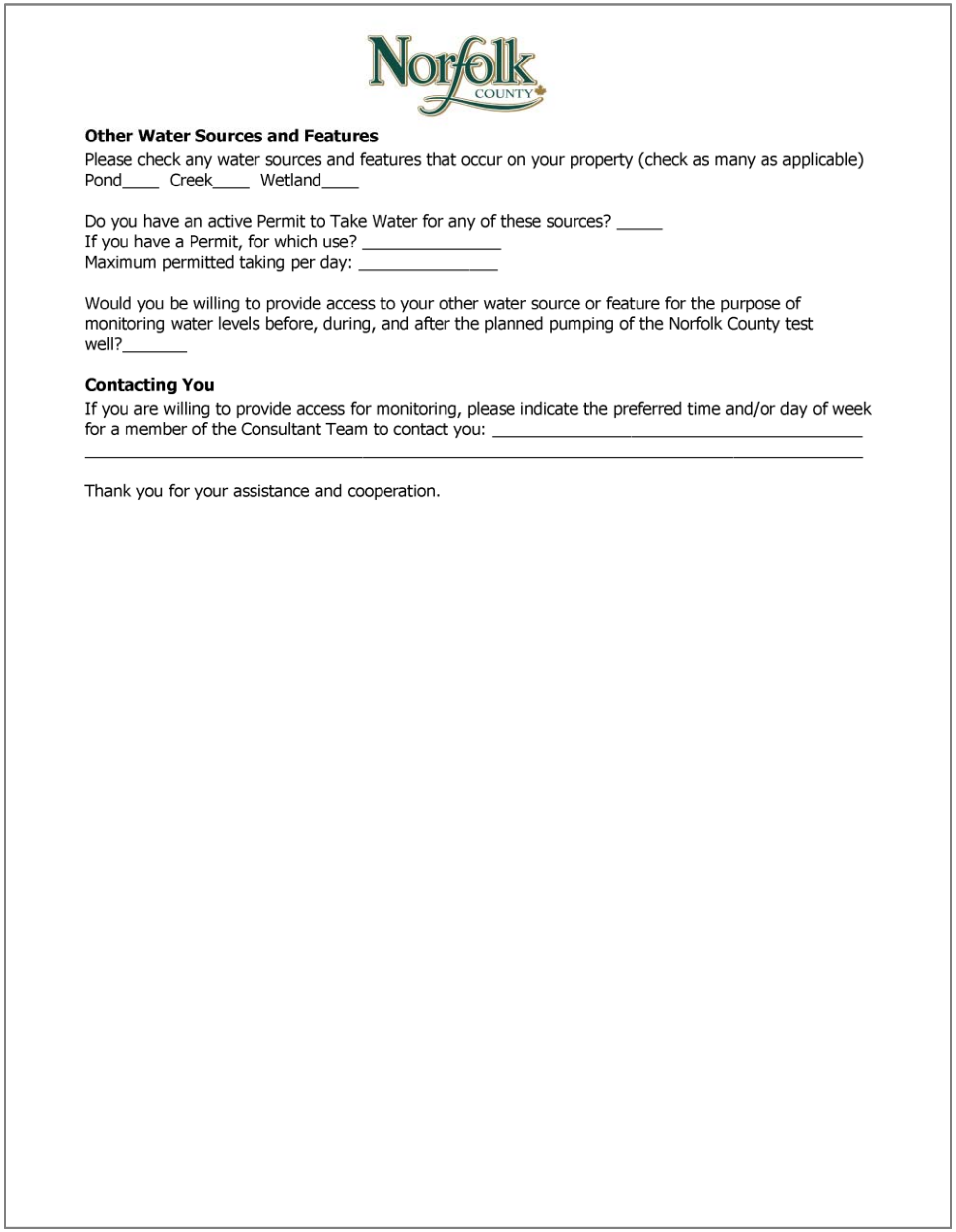

Other Water Sources and Features
Please check any water sources and features that occur on your property (check as many as applicable)
Pond____ Creek____ Wetland____

Do you have an active Permit to Take Water for any of these sources? _____
If you have a Permit, for which use? _______________
Maximum permitted taking per day: _______________

Would you be willing to provide access to your other water source or feature for the purpose of monitoring water levels before, during, and after the planned pumping of the Norfolk County test well?_______

Contacting You
If you are willing to provide access for monitoring, please indicate the preferred time and/or day of week for a member of the Consultant Team to contact you: ____
____

Thank you for your assistance and cooperation.

Next Steps

- Receive and review Water Well Surveys
- Identify potential locations and contact owners
- Inspect wells (Licensed Water Well Technician) and ponds
- Select monitoring locations and contact owners
- Receive Permit to Take Water – mid-May?
- Install monitoring equipment and begin monitoring water levels in advance of pumping – 1 week
- Perform 72-Hour Pumping Test
- Monitor water levels following pumping – 1 week
- Share data with owners throughout monitoring period
- Analyze results
- Present results at Public Information Centre 3 – June / July

April 25, 2012

Community of Simcoe Additional Water Supply Environmental Assessment
Water Well Survey

Please complete the following survey and return to us, either this evening, or in the stamped envelope provided by May 2, 2012. This information will be retained by Norfolk County and their Consultant for the purposes of selecting suitable wells and ponds for monitoring during the upcoming well testing and monitoring program.

Property Owner / Resident

Name: ____
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Address: ____________________________________ Telephone: (____)____________________

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Number of well(s) on property: ______ Number of well(s) currently being used: ________
Well Construction Details: (check and complete as appropriate)
Well 1: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

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Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

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Household use____ Lawn and/or garden____ Watering of livestock and/or poultry____
Crop irrigation____ Commercial____ Fire protection____

Do you have an active Permit to Take Water for any of these uses? _____
If you have a Permit, for which use? _______________
Maximum permitted taking per day: ______________

Have you experienced any shortage of water supply from your well(s)? ____ If so, when? __________
Have you experienced any problems with the quality of water from your well(s)? _____
If so, when? _________

When was the last time you sent a sample of the well water for bacteriological and/or chemical analysis?
____

Would you be willing to provide access to your well(s) for the purpose of monitoring water levels in the well before, during, and after the planned pumping of the Norfolk County test well?_____________

Continued on other side

Other Water Sources and Features

Please check any water sources and features that occur on your property (check as many as applicable)
Pond____ Creek____ Wetland____

Do you have an active Permit to Take Water for any of these sources? _____
If you have a Permit, for which use? _______________
Maximum permitted taking per day: _______________

Would you be willing to provide access to your other water source or feature for the purpose of monitoring water levels before, during, and after the planned pumping of the Norfolk County test well?_______

Contacting You

If you are willing to provide access for monitoring, please indicate the preferred time and/or day of week for a member of the Consultant Team to contact you: ____
____

Thank you for your assistance and cooperation.

Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

Notice of Well Testing and Monitoring

Well Testing and Monitoring Program

As indicated in our previous notice to you and as presented at a recent Public Information Centre, a Well Testing and Monitoring Program is being performed to assess the potential of developing a municipal groundwater supply source. The well to be pumped is located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted as the Potential Municipal Well Site in the figure below). This program will include pumping the well initially for up to 4 hours to establish a suitable pumping rate. Following this initial testing, and starting on a subsequent day, the well will be pumped continuously for up to 72 hours. Water levels in the test well will be measured and recorded frequently before, during, and after each test. In order to determine the local effects of this test pumping, water levels will also be measured and recorded frequently before, during, and after each test in selected local operating private wells, irrigation ponds, monitoring wells, and in Davis Creek. We appreciate the assistance of residents who have agreed to provide access to their wells and/or irrigation ponds for this program.

The purpose of this notice is to advise you that the initial monitoring recently started and that pumping will begin during the week of Monday, May 28, 2012. It is expected that the 72-hour pumping period will be completed on, or before, Sunday, June 3, 2012.

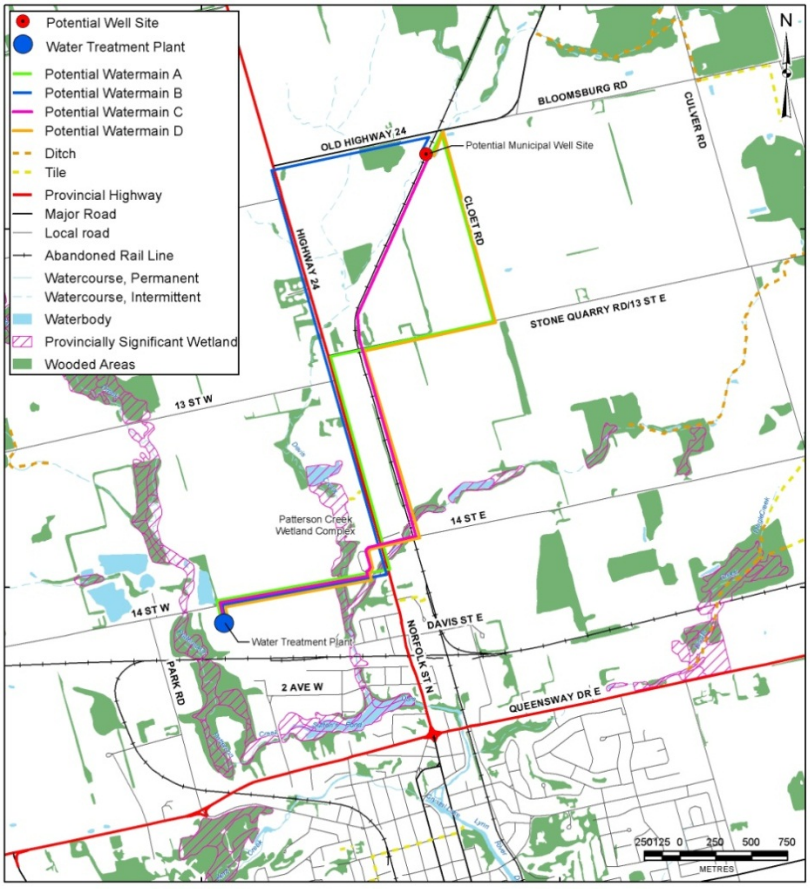
During the pumping period if you experience problems with your water supply, please contact Jeff Demeulemeester at Norfolk County during the hours of 8:30 am to 4:30 pm (telephone: 519-582-2100 extension 1609), or Bill Banks at Banks Groundwater Engineering at any time (telephone: 1-519-829-4808). We appreciate your cooperation and assistance with this program.

Public Involvement

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC. A notice of the date and location of the PIC will be issued in advance. If you have any questions prior to the PIC or cannot attend and would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

John Hamilton, P.Eng., Manager of Engineering
Public Works and Environmental Services
Corporation of Norfolk County
183 Main Street of Delhi, Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1600
Email: John.Hamilton@norfolkcounty.ca



Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 banksgroundwater.ca

6 January 2014

Ms. Barbara Slattery
Regional EA/Planning Coordinator
Ministry of the Environment, West Central Region
119 King Street West, 12th Floor
Hamilton, ON L8P 4Y7

Re: Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Ms. Slattery,

The above-referenced project is on-going and has reached a stage where the project team believes it would be beneficial to obtain comments and/or recommendations from your Ministry and other government agencies. This input is being sought in advance of additional site monitoring, well construction and testing that is being planned.

Enclosed is a draft report that presents the results and analyses of a monitoring and aquifer testing program that was completed in 2012. This program was conducted in response to comments received following a Public Information Centre (PIC), held on 30 November 2011 in the nearby Community of Bloomsburg, as well as comments from your Ministry and others. A second PIC was held on 25 April 2012 in advance of the monitoring and testing program. Further background information is provided in the report.

We kindly request that this report be reviewed by staff from your Ministry and their comments and/or recommendations be provided by 7 February 2014. By requesting input from the Ontario Ministries of Agriculture and Food, Environment, and Natural Resources, as well as the Long Point Region Conservation Authority, we anticipate that valuable input will be received relative to the various technical aspects of this report.

Written comments can be submitted to my attention. Should you have any questions, please contact me by telephone or email. Alternatively, you may contact Gary Houghton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or Gary.Houghton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County

encl. (1 printed report and 1 pdf version)

BGE.59.101

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 banksgroundwater.ca

6 January 2014

Ms. Sherry Pineo
Area Supervisor, Aylmer/Long Point - Aylmer District
Ministry of Natural Resources
615 John Street North
Aylmer, ON N5H 2S8

Re: Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Ms. Pineo,

The above-referenced project is on-going and has reached a stage where the project team believes it would be beneficial to obtain comments and/or recommendations from your Ministry and other government agencies. This input is being sought in advance of additional site monitoring, well construction and testing that is being planned.

Enclosed is a draft report that presents the results and analyses of a monitoring and aquifer testing program that was completed in 2012. This program was conducted in response to comments received following a Public Information Centre (PIC), held on 30 November 2011 in the nearby Community of Bloomsburg, as well as comments from your Ministry and others. A second PIC was held on 25 April 2012 in advance of the monitoring and testing program. Further background information is provided in the report.

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Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County

encl. (1 printed report and 1 pdf version)

BGE.59.101

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 banksgroundwater.ca

6 January 2014

Mr. Drew Crinklaw
Rural Planner South West Region
Ministry of Agriculture and Food
667 Exeter Road
London, ON N6E 1L3

Re: Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Mr. Crinklaw,

The above-referenced project is on-going and has reached a stage where the project team believes it would be beneficial to obtain comments and/or recommendations from your Ministry and other government agencies. This input is being sought in advance of additional site monitoring, well construction and testing that is being planned.

Enclosed is a draft report that presents the results and analyses of a monitoring and aquifer testing program that was completed in 2012. This program was conducted in response to comments received following a Public Information Centre (PIC), held on 30 November 2011 in the nearby Community of Bloomsburg, as well as comments from government agencies. A second PIC was held on 25 April 2012 in advance of the monitoring and testing program. Further background information is provided in the report.

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Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County

encl. (1 printed report and 1 pdf version)

BGE.59.101

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 banksgroundwater.ca

6 January 2014

Mr. Craig Jacques
Source Water Protection Technician
Long Point Region Conservation Authority
4 Elm Street
Tillsonburg, ON N4G 0C4

Re: Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Mr. Jacques,

The above-referenced project is on-going and has reached a stage where the project team believes it would be beneficial to obtain comments and/or recommendations from the LPRCA and other government agencies. This input is being sought in advance of additional site monitoring, well construction and testing that is being planned.

Enclosed is a draft report that presents the results and analyses of a monitoring and aquifer testing program that was completed in 2012. This program was conducted in response to comments received following a Public Information Centre (PIC), held on 30 November 2011 in the nearby Community of Bloomsburg, as well as comments from the LPRCA and other government agencies. A second PIC was held on 25 April 2012 in advance of the monitoring and testing program. Further background information is provided in the report.

We kindly request that this report be reviewed by staff from your organization and their comments and/or recommendations be provided by 7 February 2014. By requesting input from the Ontario Ministries of Agriculture and Food, Environment, and Natural Resources, as well as the Long Point Region Conservation Authority, we anticipate that valuable input will be received relative to the various technical aspects of this report.

Written comments can be submitted to my attention. Should you have any questions, please contact me by telephone or email. Alternatively, you may contact Gary Houghton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or Gary.Houghton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County

encl. (1 printed report and 1 pdf version)

BGE.59.101

Ministry of the Environment **Ministère de l'Environnement**

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

119 rue King ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

MEMORANDUM

January 24, 2014

TO: Barbara Slattery
Environmental Assessment and Planning Coordinator
West Central Region

FROM: John Warbick P.Eng
Hydrogeologist
Technical Support

RE: Hydrogeological Comments
Water Supply Municipal Class Environmental Assessment
Draft Report – 2012 Monitoring and Aquifer Testing Program
Simcoe, Ontario
IDS 8815-8CBSLW

The purpose of this memorandum is to provide hydrogeological comments on the following document:

DRAFT REPORT – 2012 MONITORING AND AQUIFER TESTING PROGRAM, COMMUNITY OF SIMCOE, NORFOLK COUNTY, ADDITIONAL WATER SUPPLY MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT, Banks Groundwater Engineering Ltd., December 30, 2013.

The report was submitted to selected government agencies for comment prior to proceeding with additional site testing. Technical Support comments on a previous report were provided to the proponent in a letter dated January 14, 2011.

The report describes the 72 hour pumping test of one well and associated monitoring of wells, piezometers, ponds and surface water. The report concludes that taking of water at 4560 m3/day (700 igpm) will not have a significant impact on domestic wells, ponds or surface water resources.

The comments provided below are based on a general review of the report and do not represent a detailed review that would be conducted for issuing a Permit to Take Water.

Comments:

1. The following Ministry comments of January 14, 2011 do not appear to be addressed by this report.

(i.)The surface water resources are not adequately described and documented. There is no indication that the Long Point Conservation Authority, Ministry of Natural Resources or Department of Fisheries and Oceans were contacted to confirm the sensitivity of the surface water resources and what level, if any, of impact would be acceptable. The LPRCA have informed the Ministry that down stream locations support Brook Trout.

(ii.)There is no discussion regarding the alleged interference with a dugout pond during previous testing.

(iii.)The discharge location is not indicated on any Figure and as described in the report appears to be upstream from piezometer PZ5/12.

(iv.)There is no indication that local farmers were contacted regarding their irrigation supplies.

(v.)The estimated area of influence and potential wellhead protection area, including local aquifer delineation is not provided. There is no indication of watershed quantity stress levels (Low Water Response, etc.) or a detailed hydrogeological cross-section.

2. The conclusions presented in the report are premature at this point in time for the following reasons.

(i.)The report documents an apparent impact to surface water resources (PZ5/12). This extent of impact has not been delineated with respect to area or time. The LPRCA, MNR and DFO should be consulted to determine what level of impact, if any, is acceptable. The impact must be assessed above and beyond existing takings and consider Level III Low Water Response conditions, minimum acceptable baseflow and brook trout spawning. Please refer to MOE Technical Guidance Documents in Support of Category 3 Permits To Take Water.

(ii.)Not all of the ponds within the area of influence were assessed for impact.

(iii.)The report indicates three domestic wells were monitored, OW1/13, OW2/13 and OW3/13. The well numbers could not be located on any of the Figures and appear to correspond to OW1/12, OW2/12 and OW3/12. This also appears to be the same issue with dedicated monitoring wells MW4/13 and MW5/13.

(iv.)The report suggests that drawdowns in domestic wells from the 2009 Pumping Test at the same rate would be the same as this Pumping Test. Although no hydrogeologic cross-section(s) were provided in the report it appears that the pumped aquifer may be partially confined in the area of the pumping well and unconfined in other areas. Pumping tests completed elsewhere in the province have produced significantly different drawdowns at the same wells as a result of seasonal changes in unconfined aquifer levels and boundary conditions.

(v.)The report suggests that a water level drop of 0.5 m to 0.7 m would have no effect on the supply derived from any type of water well. The Ministry has investigated many water well interference and low water level complaints. Some water wells are marginal, just able to supply sufficient water for domestic needs, and any drop in the static level will result in an insufficient supply. The Ministry may request the completion of a door-to-door water well survey and detailed interference assessment if a PTTW application is submitted.

(vi.)The water from the test was reported to be discharged 450 m southwest of the test well. Piezometer PZ5/12 is reported to be located 460 m southwest of the test well and apparently downstream from the discharge point.

(vii.)There appears to be at least one bedrock irrigation well within 1 km southeast of this taking. Review of Ministry files indicate that interference occurs between bedrock irrigation wells in the area. If there is a hydraulic connection between the bedrock aquifer and the proposed municipal aquifer then the influence of the bedrock taking would have to be considered in the cumulative impact assessment. The impact from this proposed taking has to be assessed above and beyond all existing takings.

The current Report is not sufficient to issue a Permit at the rate of 4,560 m3/day (700 igpm). It is strongly recommended that the County contact the LPRCA, MNR and DFO to determine the sensitivity of the surface water resources and level of acceptable impact, if any. If it is determined that there can be no changes in surface water resources above the current level of water takings then the Ministry may not be in a position to issue a water taking permit for 4,560 m3/day. It is worth noting that for over 10 years the Ministry has been encouraging water takers to move away from streams to lessen the impact on surface water resources.

J. Warbick

cc: P. Odom

From: Craig Jacques (LPRCA) [cjacques@lprca.on.ca]
Sent: Tuesday, January 28, 2014 2:30 PM
To: Bill.Banks@banksgroundwater.ca
Cc: Heather Surette (LPRCA)
Subject: Draft Report-2012 Simcoe Monitoring and Aquifer Testing Program

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Bill:

Thank you for providing LPRCA with the opportunity to comment on the draft report. For your information the previous comments provided on October 11, 2011 have been included below to address Ontario Regulation 178/06. Regarding page 3&4, Section 3.4 that discusses aquatic habitat, LPRCA does have information supporting the identification of Davis Creek as being able to support cool and coldwater species. In recent years brook trout have been observed in areas of Davis Creek, further downstream of the study area. Please note, however, that LPRCA is no longer reviewing proposed projects on behalf of Fisheries and Oceans Canada (DFO) for impact on fish and fish habitat, as recent changes to the Fisheries Act have now made it the responsibility of the project proponent to perform a self-evaluation of their projects. Resources to perform these self-evaluations can be found at http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html. DFO can also be contacted directly by phone at 1-855-852-8320 or email at fisheriesprotection@dfompo.gc.ca.

Further to the above noted Regulatory comments, LPRCA's would like to offer the following comments for consideration in finalizing the report and with regard to future steps:

- On p. 11, 12 and 14, mention is made of a stoppage of flow in Davis Creek. Given the relatively close (to the stream and other water taking(s)) proposed site of the municipal well(s) and associated long-term pumping that might occur, there is potential for both perceived or actual interference to the watercourse or to other water users.
- On p. 11, top of page, there is mention of decline in piezometer water levels for at least one location (i.e. PZ5/12), and it appeared the piezometer water level (again at PZ5/12) was continuing to decline at the conclusion of the 72-hour pumping period; further details on the potential impacts (e.g., declines and extent of area impacted) of long-term municipal pumping may be beneficial information.
- On p. 12, Section 5.5 mentions stream depths and temperatures; if available, it may be useful to include these data in the Appendices.
- Last paragraph of p. 15 (also in conclusion #2 & #3 on p. 17) mentions that there is no projected "measurable effect on flow in Davis Creek" at the projected 4560 m3 pumping rate and that is not expected to have "deleterious effects" on Davis Creek, further testing/monitoring (associated with conclusion #1 and recommendation #2) may be useful to confirm this.
- A few editorial comments to clarify content in the report include:
    - Some of the well numbers included in the text (e.g. MW2/10, MW4/13, MW5/13 on p.5) do not appear to match the figures (e.g. MW2/11, MW4/12, MW5/12 in Figure 3).
    - It appears there is a slight typo on p. 11 when discussing Pond 1; it should read **northeast** of the test well.
    - At the top of p.6, it is mentioned that OW4/09 would be incorporated into the discussion in Section 6, however mention of OW4/09 was not specifically made in Section 6, or any information provided on that well's results in the Appendices.
    - On p.6, in Section 4.3, it mentions the location of SW-1 as being 10 m downstream of Old Hwy 24; however in figure 4 the location is marked at a different location upstream of Old Hwy 24.
    - Figure 6 could also include drawdown values that were measured 0 or near 0.

Please feel free to contact me if you have any questions or require further clarification,

Craig Jacques

From: McCloskey, Amanda (MNR) [Amanda.McCloskey@ontario.ca]
Sent: Monday, March 3, 2014 4:33 PM
To: Bill.Banks@banksgroundwater.ca
Cc: McCloskey, Amanda (MNR); Pineo, Sherry (MNR); gary.houghton@norfolkcounty.ca
Subject: FW: MOE Review of DRAFT REPORT - 2012 MONITORING AND AQUIFER TESTING PROGRAM, COMMUNITY OF SIMCOE, NORFOLK COUNTY, ADDITIONAL WATER SUPPLY MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT, Banks Groundwater Engineering Ltd., December 30, 2013.

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Bill,

Thank you for circulating MNR on the Draft Report 2012, Monitoring and Aquifer Testing Program, Community of Simcoe, Additional Water Supply, Class EA. MNR has reviewed the report provided and we would like to offer the following comments:

Based on the information provided MNR understands that the extent of monitoring for impacts on the aquatic environment consisted of the following:

- Monitoring stream flows downstream and upstream of the testing site prior to, during and after the test (on May 23, 31 and June 8, 2012 with testing occurring from May 29-31)
- Monitoring ground water impacts during the same time period
- Assessing the risk to fish in the east branch for one day during the test pumping period (day 2 of 3) with considerations of risk being an observable loss of flow, rapid increase in water temperature or observations of fish stranding

Section 3.4 Watercourses and Aquatic Habitat
The report describes Davis Creek as an intermittent tributary of the Lynn River. The report states the species observed are indicative of a warm to cool water regime and no cold water species, such as trout, were observed. Please clarify, what criteria are being used to determine the permanency of this stream. MNR records indicate that Davis Creek is a permanent stream with a cold water regime. Brook trout were captured during some 2012 sampling downstream near the confluence with Paterson Creek. Further, there are species other than brook trout that can provide indicators thermal regime preference. The presence of watercress (ground water indicator) indicates that there may in fact be some critical habitat associated with cold water species. MNR recommends any assessment of impacts on the Davis Creek fishery should be based upon the presence of a cool to cold water fish community in a permanent stream.

Section 4.4 Qualitative Aquatic Monitoring of Davis Creek
Monitoring appears to focus on the measurement of water levels, temperatures and observations for possible fish stranding or barriers to fish migration. How were measurements of water levels recorded and are the results available or was it simply a subjective measurement? This measure was one parameter used to assess the risk to fish but are there records of these water level measurements that we can review?

Figure 6, Drawdown at 72 Hours, indicates ground water impacts at the magnitude of 0.10m (460 m downstream of pumping site) to 1.51 m (3.8 m from pumping site). MNR anticipates this type of drawdown would have negative impacts on the fishery for a creek of this size (depth, width, flow) that relies upon groundwater inputs to maintain its thermal regime. The drawdown will also likely be further exacerbated during the summer months and in years experiencing drought conditions. Impacts to the waterlevel will ultimately impact the fishery. The actual estimated drawdowns of 0.17 m to 2.63 m (page 15 section 7.2) would have even greater negative impacts. Maximum observed drawdowns occurred at some monitoring stations (i.e. PZ5/12) just prior to the end of pumping yet there was no Qualitative Aquatic Monitoring carried out during the last day of pumping. Overall MNR is concerned with the long term impacts to the Davis Creek cool to cold water fishery as a result of drawing water from the system at the proposed location.

Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping

The report concludes that water depths in pools and over riffles were unaltered during the pumping and that flows remained stable. Please clarify how the water levels were measured and why only one day worth of fisheries monitoring was completed when drawdowns increased through until the end of pumping and beyond? Based upon the estimated drawdowns (pg 15) MNR anticipates that there may actually be some negative impacts to water depths in pools and over riffles, especially during drier summer months. The report states that water flows actually remained the same during pumping as those recorded prior to the test (27.5 vs 25.8 L/s) for SW-3, the station located immediately downstream of the test site. There was 12.6 mm of rain recorded during this time period. Would this not suggest that, without this rain accumulation occurring, there may have actually been a measurable decrease in flow that may have been attributable to the pumping test? Please clarify.

The report identifies random stream temperatures were taken for one day and measured between 19 to 21 deg C. Air temperatures on May 30, 2012 were from 10 to 23 deg. C. Given the short timeframe of the monitoring and similar air temperatures, the water temperatures would be expected to be in this range and we wouldn't expect a drastic change. Based on the short-term monitoring timelines (10 hours) undertaken in this report, MNR suggests this may not be a definitive way to measure/ determine risk to Fish. Changes to the thermal regime would impact the Davis Creek fishery by reducing the amount of area available to cool and cold water species during the warmer periods.

It is noted on page 9 (Domestic Wells) that water levels in domestic well OW1/12, located 590 m NE of the test well observed drawdowns of as much as 0.36 m in response to the pumping of the test well. However, there was not apparent qualitative aquatic monitoring carried out in this section of Davis Creek. Please clarify why aquatic monitoring was not carried out in this location. MNR recommends that adequate monitoring needs to be carried out within any portion of the Davis Creek watershed potentially influenced by pumping ground water at the proposed location.

Based upon this report MNR anticipates impacts (e.g. change to the thermal regime and water quantity) in the aquatic ecosystem of Davis Creek from pumping ground water over the long term at this site. A change in thermal regime could move Davis Creek toward a warm to cool water system thus losing important cold water refuge for cold water species including brook trout should they continue to recolonize upstream since removal of the dam on Sutton Pond.

It is noted on page 10 that piezometer PZ4/12 was installed in a wetland adjacent to the east branch of Davis Creek, located about 75 m southwest of the test well. Although this report does not cover impacts to natural heritage features, we look forward to your assessment of impacts from pumping on other natural heritage features such as wetlands.

Please note: MNR is not the commenting agency with respect to impacts on fish habitat. The Department of Fisheries and Oceans should be circulated on this report to provide comments on impacts to fish habitat in Davis Creek.

Thank you for the opportunity to provide comments. We look forward to receiving a response to the comments above as well as being circulated the Environmental Assessment.

Thank you,

Amanda McCloskey

Amanda McCloskey
District Planner
Ministry of Natural Resources
519-773-4750
amanda.mccloskey@ontario.ca

From: McCloskey, Amanda (MNR)
Sent: March 3, 2014 11:55 AM
To: Pineo, Sherry (MNR); Mccauley, Cam (MNR); Markham, Kathryn (MNR)

S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix A3

2015 Updated Draft Report – Responses to Agency Comments

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 www.banksgroundwater.ca

16 September 2015

Ms. Barbara Slattery
Regional EA/Planning Coordinator
Ministry of the Environment and Climate Change, West Central Region
119 King Street West, 12th Floor
Hamilton, ON L8P 4Y7

Re: Revised Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Ms. Slattery,

Further to our recent communication regarding this project, enclosed is a revised Draft Report that addresses all agency comments received following review of the December 2013 Draft Report. This previous report was circulated in January 2014 to the Ontario Ministries of Agriculture and Food, Environment, and Natural Resources, and the Long Point Region Conservation Authority for review and comment. This input was sought in advance of additional site monitoring, well construction and testing that is planned. Comments were received from each agency, with the exception of the Ministry of Agriculture and Food. Following receipt and consideration of the comments, our project team also met with staff from your Ministry and from Natural Resources to discuss and clarify some of the comments.

As noted in the revised Draft Report, since December 2013 additional information has become available from the Long Point Tier 3 Water Budget and Local Area Risk Assessment (i.e. Source Protection Study). This study included the municipal well systems in Norfolk County. The reports completed during the various stages of this study to-date have provided technical information that has been beneficial to our project. We have utilized this information to prepare responses to a number of the comments.

Based on the results of the Tier 3 Risk Assessment modelling scenarios for the Simcoe municipal well system, part of the system was assigned a Significant Risk Level, with High certainty. One of the available options for addressing this significant risk is to proceed with developing a new groundwater supply source. The current Municipal Class EA is considered to have the greatest potential for providing a new source and therefore the timeline for the project has become more urgent.

We therefore kindly request that this report be reviewed by staff from your Ministry and their comments and/or recommendations be provided as soon as possible, such that we can proceed with the next phase of work on this project this fall. To assist your reviewer, included is a separate table that lists all of the comments from your letter of 14 January 2014, and the respective project team responses and reference to the relevant report sections.

Our project team has also obtained additional fisheries information from the Long Point Region Conservation Authority. Copies of the report will also be distributed to the Ministry of Natural Resources and Forestry and the Long Point Region Conservation Authority. These agencies

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16 September 2015

Ms. Sherry Pineo
Resources Operations Supervisor - Aylmer District
Ministry of Natural Resources and Forestry
615 John Street North
Aylmer, ON N5H 2S8

Re: Revised Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Ms. Pineo,

Enclosed is a revised Draft Report that addresses all agency comments received following review of the December 2013 Draft Report. This previous report was circulated in January 2014 to the Ontario Ministries of Agriculture and Food, Environment, and Natural Resources, and the Long Point Region Conservation Authority for review and comment. This input was sought in advance of additional site monitoring, well construction and testing that is planned. Following receipt and consideration of the comments, our project team also met with staff from your Ministry and from Environment to discuss and clarify some of the comments.

In response to the recommendations that were included in the comments from your staff, as well as from Long Point Region Conservation Authority (LPRCA) staff, our project team has also obtained additional fisheries information from the LPRCA. It was recommended that concerns related to fisheries and fish habitat be reviewed in accordance with the requirements of the Federal Department of Fisheries and Oceans (DFO). A Preliminary Fisheries Risk Assessment has been completed using the DFO assessment criteria and is included in this report.

At this stage, we have requested that staff from the Ministry of Environment and Climate Change review our responses to each of their respective comments. As we have followed the recommendations from your staff related to fisheries assessment, we are not requesting a further review at this time. The fisheries monitoring recommendations will be incorporated into our future site monitoring and testing program. The results from this program will then be shared with the agencies for review and comment.

Should you wish to provide comments on this revised report, please submit them to my attention. Please contact me by telephone or email if you have any questions. Alternatively, you may contact Gary Houghton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or Gary.Houghton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County
Barb Slattery, EA Coordinator, MOECC

encl. (1 printed report and 1 pdf version)

BGE.59.101

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
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16 September 2015

Mr. Craig Jacques
Source Water Protection Technician
Long Point Region Conservation Authority
4 Elm Street
Tillsonburg, ON N4G 0C4

Re: Revised Draft Report - 2012 Monitoring and Aquifer Testing Program
Community of Simcoe, Norfolk County
Additional Water Supply Municipal Class Environmental Assessment

Dear Mr. Jacques,

Enclosed is a revised Draft Report that addresses all agency comments received following review of the December 2013 Draft Report. This previous report was circulated in January 2014 to the Ontario Ministries of Agriculture and Food, Environment, and Natural Resources, and the Long Point Region Conservation Authority for review and comment. This input was sought in advance of additional site monitoring, well construction and testing that is planned. Following receipt and consideration of the comments, our project team also met with staff from the MNR and MOE to discuss and clarify some of the comments.

In response to the recommendations that were included in the comments from your staff, as well as from MNR staff, our project team requested and you provided obtained additional fisheries information. It was recommended that concerns related to fisheries and fish habitat be reviewed in accordance with the requirements of the Federal Department of Fisheries and Oceans (DFO). A Preliminary Fisheries Risk Assessment has been completed using the DFO assessment criteria and is included in this report.

At this stage, we have requested that staff from the Ministry of Environment and Climate Change review our responses to each of their respective comments. As we have followed the recommendations from your staff related to fisheries assessment, we are not requesting a further review at this time. The fisheries monitoring recommendations will be incorporated into our future site monitoring and testing program. The results from this program will then be shared with the agencies for review and comment.

Should you wish to provide comments on this revised report, please submit them to my attention. Please contact me by telephone or email if you have any questions. Alternatively, you may contact Gary Houghton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or Gary.Houghton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County
Barb Slattery, EA Coordinator, MOECC

encl. (1 printed report and 1 pdf version) recommended that concerns related to fisheries and fish habitat be reviewed in accordance with the requirements of the Federal Department of Fisheries and Oceans (DFO). A Preliminary Fisheries Risk Assessment has been completed using the DFO assessment criteria and is included in this report.

Please address the comments to my attention. Should there be any questions, please contact me by telephone or email. Alternatively, you may contact Gary Houghton, Manager of Engineering, Norfolk County Public Works and Environmental Services, at 519-582-2100 extension 1600, or Gary.Houghton@norfolkcounty.ca.

Sincerely,
Banks Groundwater Engineering Limited

William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

c: Gary Houghton, P.Eng., Norfolk County

encl. (1 printed report and 1 pdf version)

MOE Comments and Project Team Responses (with reference to the Revised Draft Report, 15 September 2015)

Ref. No.	MOE Comment	Project Team Response
1	The (December 2013) report was submitted to selected government agencies for comment prior to proceeding with additional site testing. Technical support (MOE) comments on a previous report were provided to the proponent in a letter dated January 14, 2011. The (December 2013) report describes the 72-hour pumping test of one well and associated monitoring of wells, piezometers, ponds and surface water. The report concludes that taking of water at 4,560 m^3/day (700 Igpm) will not have a significant impact on domestic wells, ponds or surface water resources. The comments provided below are based on a general review of the report and do not represent a detailed review that would be conducted for issuing a Permit to Take Water.	Refer to Section 1 Introduction and Background, for a description of this previous report and reference to the MOE's 2011 comments. This conclusion has been refined and is supported by this revised report. The revisions made to the draft report are in response to the comments provided by the MOE, MNR and LPRCA, with the intention of resolving most outstanding issues before proceeding with additional site monitoring and testing. This is considered by our project team as a key stage in Phase 2 of the Municipal Class EA.
2	1. The following Ministry comments of January 14, 2011 do not appear to be addressed by this report. (i.) The surface water resources are not adequately described and documented. There is no indication that the Long Point Conservation Authority, Ministry of Natural Resources or Department of Fisheries and Oceans were contacted to confirm the sensitivity of the surface water resources and what level, if any, of impact would be acceptable. The LPRCA have informed the Ministry that downstream locations support Brook Trout.	Refer to Section 1 Introduction and Background, for reference to 2011 comments and information received from MNR and LPRCA. Refer to Section 4.4 Surface Water and Aquatic Habitat, for augmented description / documentation of surface water resources. Refer to Section 9.1 Assessment of the Effects of Existing Permitted Water Use on the Local Environment, for reference to additional information related to the existing condition of fisheries in Davis Creek that was received from LPRCA during preparation of this revised report. This information is summarized as background to a Preliminary Fisheries Risk Self Assessment, which is based on the Department of Fisheries and Oceans assessment criteria. The additional information and assessment are presented in Appendix G.
3	(ii.) There is no discussion regarding the alleged interference with a dugout pond during previous testing.	Refer to Section 5.3.2 Irrigation Ponds, for discussion regarding this particular pond.
4	(iii.) The discharge location is not indicated on any Figure and as described in the report appears to be upstream from piezometer PZ5/12.	Refer to Section 6.1 Testing Methodology, for the description of and Figures 4 and 5 for the illustration of the discharge location upstream of piezometer PZ5/12.
5	(iv.) There is no indication that local farmers were contacted regarding their irrigation supplies.	Refer to Section 3 Public Consultation, for description of methods used to contact local farmers regarding their irrigation supplies (i.e. wells and ponds). Refer to Section 5.3.2 Irrigation Ponds, for description of authorized irrigation supply monitoring that was conducted.

Ref. No.	MOE Comment	Project Team Response
6	(v.) The estimated area of influence and potential wellhead protection area, including local aquifer delineation is not provided. There is no indication of watershed quantity stress levels (Low Water Response, etc.) or a detailed hydrogeological cross-section.	Refer to Section 2 Source Water Protection, for reference to watershed quantity stress. Refer to Section 7 Hydrogeological Cross-Sections, for a description of the interpreted hydrogeology illustrated by the hydrogeological cross-sections presented in Appendix F. Delineation of wellhead protection areas at this stage of the Municipal Class EA has been considered premature, a conclusion that has been supported by the Source Protection Manager for the Lake Erie Source Protection Region. In late 2013, the Municipal Engineers Association recommended to the Minister of the Environment that Source Water Protection be included in amendments to the Municipal Class Environmental Assessment. It is therefore anticipated that the delineation of new wellhead protection areas, new vulnerable areas, and potential drinking water threats will be completed at a later stage of this Municipal Class EA for Simcoe, but not until further testing, monitoring and analysis of groundwater withdrawals is completed. Refer to Section 8 Well and Aquifer Yield, for discussion of the interpreted area of influence and to Figure 9 for illustration of interpreted area of influence in the pumped aquifer. Refer to Section 9.3 Low Water Response Program, as it applies to this potential municipal water supply source.

Ref. No.	MOE Comment	Project Team Response
7	2. The conclusions presented in the report are premature at this point in time for the following reasons. (i.) The report documents an apparent impact to surface water resources (PZ5/12). This extent of impact has not been delineated with respect to area or time. The LPRCA, MNR and DFO should be consulted to determine what level of impact, if any, is acceptable. The impact must be assessed above and beyond existing takings and consider Level III Low Water Response conditions, minimum acceptable baseflow and brook trout spawning. Please refer to MOE Technical Guidance Documents in Support of Category 3 Permits To Take Water.	Refer to Section 2 Source Water Protection, for reference to watershed quantity stress. Refer to Section 6.5 Aquatic Habitat Observations in Davis Creek During Pumping and Appendix E, for additional information related to aquatic habitat observations and recommendations for future monitoring. This information was submitted in response to the comments provided by Staff of MNR following their review of the December 2013 version of this draft report. Refer to Section 8 Well and Aquifer Yield and Section 9.2 Assessment of the Effects of Potential Municipal Groundwater Withdrawals on the Local Environment, for discussion of PZ5/12 and further investigation required. Refer to Section 9.1 Assessment of the Effects of Existing Permitted Water Use on the Local Environment, for reference to additional information related to the existing condition of fisheries in Davis Creek that was received from LPRCA during preparation of this revised report. This information is summarized as background to a Preliminary Fisheries Risk Self Assessment, which is based on the Department of Fisheries and Oceans assessment criteria. The additional information and assessment are presented in Appendix G. Refer to Section 9.3 Low Water Response Program, as it applies to this potential municipal water supply source.
8	(ii.) Not all of the ponds within the area of influence were assessed for impact.	Refer to Section 3 Public Consultation, for description of methods used to contact local farmers regarding their irrigation supplies. Refer to Section 5.3.2 Irrigation Ponds, for description of authorized irrigation supply monitoring that was conducted.
9	(iii.) The report indicates three domestic wells were monitored, OW1/13, OW2/13 and OW3/13. The well numbers could not be located on any of the Figures and appear to correspond to OW1/12, OW2/12 and OW3/12. This also appears to be the same issue with dedicated monitoring wells MW4/13 and MW5/13.	Refer to Section 5.2 Groundwater Monitoring, for the corrected numbering that corresponds to Figures 4 and 6. This was a typographical error in the previous version of the report.
10	(iv.) The report suggests that drawdowns in domestic wells from the 2009 Pumping Test at the same rate would be the same as this Pumping Test. Although no hydrogeologic cross-section(s) were provided in the report it appears that the pumped aquifer may be partially confined in the area of the pumping well and unconfined in other areas. Pumping tests completed elsewhere in the province have produced significantly different drawdowns at the same wells as a result of seasonal changes in unconfined aquifer levels and boundary conditions.	Refer to Section 7 Hydrogeological Cross-Sections, for a description of the interpreted hydrogeology illustrated by the hydrogeological cross-sections presented in Appendix F. Refer to Section 8 Well and Aquifer Yield and Section 9.2 Assessment of the Effects of Potential Municipal Groundwater Withdrawals on the Local Environment, for discussion of the interpreted aquifer conditions

Ref. No.	MOE Comment	Project Team Response
11	(v.) The report suggests that a water level drop of 0.5 m to 0.7 m would have no effect on the supply derived from any type of water well. The Ministry has investigated many water well interference and low water level complaints. Some water wells are marginal, just able to supply sufficient water for domestic needs, and any drop in the static level will result in an insufficient supply. The Ministry may request the completion of a door-to-door water well survey and detailed interference assessment if a PTTW application is submitted.	Refer to Section 9.2 Assessment of the Effects of Potential Municipal Groundwater Withdrawals on the Local Environment, for refined discussion and clarification. A water well and pond survey was conducted in 2009 within a radius of 500 m from the two test wells. This area was expanded for the Municipal Class EA (refer to Section 3 Public Consultation). Another water well and pond survey will be completed in advance of additional testing at the potential municipal well site.
12	(vi.) The water from the test was reported to be discharged 450 m southwest of the test well. Piezometer PZ5/12 is reported to be located 460 m southwest of the test well and apparently downstream from the discharge point.	Refer to Section 6.1 Testing Methodology, for the description of and Figures 4 and 5 for the illustration of the discharge location upstream of piezometer PZ5/12.
13	(vii.) There appears to be at least one bedrock irrigation well within 1 km southeast of this taking. Review of Ministry files indicate that interference occurs between bedrock irrigation wells in the area. If there is a hydraulic connection between the bedrock aquifer and the proposed municipal aquifer then the influence of the bedrock taking would have to be considered in the cumulative impact assessment. The impact from this proposed taking has to be assessed above and beyond all existing takings.	Refer to Section 4.1 Land and Water Use, for a description of the Permitted irrigation sources within 1.0 km of the test well site and Figure 3 for the locations. Refer to Section 4.3.1 Bedrock Aquifers, for reference to irrigation wells located beyond 1.0 km to the east and southeast of the test well site that were identified from MOE water well records. Should this information differ from the referenced bedrock irrigation well in the Ministry's files, the project team would appreciate receiving this information for comparison and assessment. We would also appreciate receiving any relevant information in the Ministry's files related to interference between bedrock irrigation wells and other information that would assist in a cumulative impact assessment if required. Refer to Section 7 Hydrogeological Cross-Sections, for a description of the interpreted hydrogeology illustrated by the hydrogeological cross-sections presented in Appendix F, which are based on the Tier 3 Water Budget characterization of overburden deposits. The bedrock is overlain by a regionally extensive Wentworth/Port Stanley Till that would be expected to function as an aquitard, minimizing the connection between the municipal supply aquifer and the bedrock aquifer(s).

Ref. No.	**MOE Comment**	**Project Team Response**
14	The current Report is not sufficient to issue a Permit at the rate of 4,560 m^3/day (700 Igpm). It is strongly recommended that the County contact the LPRCA, MNR and DFO to determine the sensitivity of the surface water resources and level of acceptable impact, if any. If it is determined that there can be no changes in surface water resources above the current level of water takings then the Ministry may not be in a position to issue a water taking permit for 4,560 m^3/day.	Refer to Section 8 Well and Aquifer Yield, for discussion of the confirmed safe perennial yield of the well and aquifer as defined by accepted hydrogeological procedures. The report is not intended to be considered suitable as support for a Permit at the rate of 4,560 m^3/day (700 Igpm). The aquifer has not been pumped at this rate at this location. Comments have been received from MNR and LPRCA and both have indicated they are no longer the commenting agency regarding fish. Refer to Section 9.1 Assessment of the Effects of Existing Permitted Water Use on the Local Environment, for reference to additional information related to the existing condition of fisheries in Davis Creek that was received from LPRCA during preparation of this revised report. This information is summarized as background to a Preliminary Fisheries Risk Self Assessment, which is based on the Department of Fisheries and Oceans assessment criteria. The additional information and assessment are presented in Appendix G. As explained in the Memorandum in Appendix G, it is considered premature to submit the Self Assessment to the DFO at this stage in the Municipal Class EA.
15	It is worth noting that for over 10 years the Ministry has been encouraging water takers to move away from streams to lessen the impact on surface water resources.	Refer to Sections 1 through 4 for updated discussion supporting the rationale for the selection of the test well site. The results of the Long Point Tier 3 Water Budget and Local Area Risk Assessment are also offered as support for the continued assessment of this preferred site under a Municipal Class EA project.

September 2, 2014 Project No. 10-1151-0470

William Banks, P.Eng.
Banks Groundwater Engineering Limited
940 Watson Road S.
Puslinch, Ontario
N0B 2J0

RESPONSES TO MNR COMMENTS – SIMCOE PUMPING TEST REPORT (FISHERIES)

Dear Mr. Banks

I have noted all fisheries related Ministry of Natural Resources (MNR) comments originating from their review of the Simcoe Pumping Test interim report, and have provided clarification or responses to them below.

The primary thought presented by the MNR through their comments relates to a lack or, limitation of the fisheries studies undertaken. The MNR's comments appear to be largely due to a misunderstanding in the intention of the report provided to them for review. Based on our conversations on the subject, this seems reasonable. I was pleased to see MNR engaged in commenting and believe their comments will be useful in scoping the requirements of future fisheries related studies for Simcoe.

Below is Golder's reply or clarifications to the MNR comments provided:

MNR 1. Based on the information provided MNR understands that the extent of monitoring for impacts on the aquatic environment consisted of the following:

- Monitoring stream flows downstream and upstream of the testing site prior to, during and after the test (on May 23, 31 and June 8, 2012 with testing occurring from May 29-31, 2012)
- Monitoring groundwater impacts during the same time period
- Assessing the risk to fish in the east branch for one day during the test pumping period (day 2 of 3) with considerations of risk being an observable loss of flow, rapid increase in water temperature or observations of fish stranding

Golder 1. Based on review of the comments provided, it is important to note that this study was intended to provide monitoring of fish and aquatic habitats during the pumping test, and within a very specific area of Davis Creek. The work completed was scoped to the specific needs of the

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pumping test. The information presented is not intended to meet the requirements for any permitting related to approval for construction of a new groundwater supply. Additionally, the results are not intended to form the basis for any impact assessment of mitigation and compensation requirements that may apply. The primary purpose of this report was to solicit comments from relevant agencies that would assist in the preparation of work plans in advance of additional testing and monitoring. On this basis, comments are addressed below.

MNR 2. Section 3.4 Watercourses and Aquatic Habitat. The report describes Davis Creek as an intermittent tributary of the Lynn River. The report states the species observed are indicative of a warm to cool water regime and no cold water species, such as trout, were observed. Please clarify, what criteria are being used to determine the permanency of this stream. MNR records indicate that Davis Creek is a permanent stream with a cold water regime. Brook trout were captured during some 2012 sampling downstream near the confluence with Paterson Creek. Further, there are species other than brook trout that can provide indicators thermal regime preference. The presence of watercress (groundwater indicator) indicates that there may in fact be some critical habitat associated with cold water species. MNR recommends any assessment of impacts on the Davis Creek fishery should be based upon the presence of a cool to cold water fish community in a permanent stream.

Golder 2. We acknowledge that Davis creek is a coldwater system in the downstream reaches as it confluences Patterson Creek, and that much of the lower reaches are likely cool to coldwater in thermal characteristics. The specific reference to the watercourse being more warmwater in nature in the upstream reaches that formed the primary investigation area during the pumping test came from communications received from LPRCA “The proposed wells are located at the top end of Davis Creek which becomes a coldwater system downstream. LPRCA staff are concerned with the potential of decreasing baseflows to Davis Creek thereby increasing stresses on the system during dry periods. Lowering of the nearby water table may result in stresses/changes to the hydrologic regime supporting nearby natural communities such as riparian zones, wetlands, forests and coldwater habitats” (Heather Surette, Manager Watershed Services, by email). With respect to fish species, we did not undertake fish surveys under the intended purpose of this study so we cannot comment in this regard. Any studies intended to support permitting would include relevant and required studies, including detailed studies of fish and fish habitat.

We acknowledge that Davis Creek has permanent stream flow in the lower reaches and would not argue this classification. However, in the upstream reaches near the pumping test, flows are much lower than those downstream, there is limited evidence of groundwater input, although there is some; but more importantly, flow in the upper reach of the creek (in the area of the pumping test) is markedly affected by other water taking activities. In fact, prior to the pumping test, BGE observed and recorded data showing that creek flow stopped during specific irrigation periods and aquatic habitats went dry for a period of time. Because irrigation is permitted and actively undertaken during the typical crop growing season, the impact of irrigation on the creek cannot be dismissed and we stand behind the statement that flows are intermittent in the upstream reaches. We would welcome a discussion with MNR or DFO in regards to future study needs to support project permitting.

MNR 3. Section 4.4 Qualitative Aquatic Monitoring of Davis Creek. Monitoring appears to focus on the measurement of water levels, temperatures and observations for possible fish stranding or barriers to fish migration. How were measurements of water levels recorded and are the results available or was it simply a subjective measurement? This measure was one parameter used to assess the risk to fish but are there records of these water level measurements that we can review?

Golder 3. The intention of this scoped fisheries study was to monitor the fish and fish habitat of the upstream reaches of Davis Creek for possible risks (i.e. low water and potential stranding) during the pumping test period only. The intention was not to make an assessment of risk to fish associated with a future proposed groundwater supply. Appropriate field studies would be completed in support of future permitting.

MNR 4. Section 4.4 Qualitative Aquatic Monitoring of Davis Creek. . Figure 6, Drawdown at 72 Hours, indicates groundwater impacts at the magnitude of 0.10 m (460 m downstream of pumping site) to 1.51 m (3.8 m from pumping site). MNR anticipates this type of drawdown would have negative impacts on the fishery for a creek of this size (depth, width, flow) that relies upon groundwater inputs to maintain its thermal regime. The drawdown will also likely be further exacerbated during the summer months and in years experiencing drought conditions. Impacts to the water level will ultimately impact the fishery. The actual estimated drawdowns of 0.17 m to 2.63 m (page 15 section 7.2) would have even greater negative impacts. Maximum observed drawdowns occurred at some monitoring stations (i.e. PZ5/12) just prior to the end of pumping yet there was no Qualitative Aquatic Monitoring carried out during the last day of pumping. Overall MNR is concerned with the long term impacts to the Davis Creek cool to cold water fishery as a result of drawing water from the system at the proposed location.

Golder 4. The MNR's concerns are noted. In this regard, this study was not intended to be a comprehensive impact assessment. Appropriate data would be collected and provided to respective agencies as support to impact assessment and permitting requirements. In this regard, the MNR does not acknowledge that Davis creek has existing impacts that profoundly reduce or stop flows in the monitored reach of Davis Creek. Specifically, there is no acknowledgement or comment on BGE's observation (and data) showing that creek flow stopped (instream habitats went dry) during a 2 day period prior to the pumping test when irrigation was being undertaken. The observed impacts of irrigation on the creek flow and habitat is far greater than that observed during the pumping test, and point to an existing series of impacts to the creek that must be acknowledged. We would welcome a discussion with MNR or DFO in this regards. Comments related to drawdown observed and potential effects will be addressed separately by the project hydrogeologists.

MNR 5. Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping. The report concludes that water depths in pools and over riffles were unaltered during the pumping and that flows remained stable. Please clarify how the water levels were measured and why only one day worth of fisheries monitoring was completed when drawdowns increased through until the end of pumping and beyond? Based upon the estimated drawdowns (pg. 15) MNR anticipates that there may actually be some negative impacts to water depths in pools and over riffles, especially during drier summer months. The report states that water flows actually remained the same during pumping as those recorded prior to the test (27.5 vs 25.8 L/s) for SW-3, the station located immediately downstream of the test site. There was 12.6 mm of rain recorded during this time period. Would this not suggest that, without this rain accumulation occurring, there may have actually been a measurable decrease in flow that may have been attributable to the pumping test? Please clarify.

Golder 5. Water depth measurements were intended to provide an indication of potential risk to fish during the pumping test and form a ‘trigger’ to inform BGE when risks to fish were imminent. Data collected under the fish monitoring program were not intended as scientific support for stream hydrology assessment. The MNR’s comment on flow and water depth is acknowledged but requires understanding beyond the intentions of this fisheries assessment.

Also, in noting potential effects on flows/water depths, again the MNR does not acknowledge that Davis creek has existing impacts that profoundly reduce or stop flows in the monitored reach of Davis Creek. Specifically, there is no acknowledgement or comment on BGE’s observation (and data) showing that creek flow stopped (instream habitats went dry) during a 2 day period prior to the pumping test when irrigation was being undertaken. The observed impacts of irrigation on the creek flow and habitat is far greater than that observed during the pumping test, and point to an existing series of impacts to the creek that must be acknowledged. We would welcome a discussion with MNR or DFO in this regards.

MNR 6. Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping. The report identifies random stream temperatures were taken for one day and measured between 19 to 21 deg C. Air temperatures on May 30, 2012 were from 10 to 23 deg. C. Given the short timeframe of the monitoring and similar air temperatures, the water temperatures would be expected to be in this range and we wouldn’t expect a drastic change. Based on the short-term monitoring timelines (10 hours) undertaken in this report, MNR suggests this may not be a definitive way to measure/ determine risk to fish. Changes to the thermal regime would impact the Davis Creek fishery by reducing the amount of area available to cool and cold water species during the warmer periods.

Golder 6. The intention of this scoped fisheries study was to monitor the fish and fish habitat of the upstream reaches of Davis Creek for possible risks (i.e. low water and potential stranding) during the pumping test period only. The intention was not to make an assessment of risk to fish associated with a future proposed groundwater supply. Therefore we agree with MNR’s comment regarding applicability of short term monitoring for assessment of risk. Appropriate field studies would be completed in support of future permitting.

MNR 7. Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping. It is noted on page 9 (Domestic Wells) that water levels in domestic well OW1/12, located 590 m NE of the test well observed drawdowns of as much as 0.36 m in response to the pumping of the test well. However, there was not apparent qualitative aquatic monitoring carried out in this section of Davis Creek. Please clarify why aquatic monitoring was not carried out in this location. MNR recommends that adequate monitoring needs to be carried out within any portion of the Davis Creek watershed potentially influenced by pumping groundwater at the proposed location.

Golder 7. The fisheries study was intended to monitor potential risks to fish (i.e. stranding, blocked migration) during the pumping test. The scope and spatial range was limited to the expected area of influence. Comments related to drawdown observed and potential effects will be addressed separately by the project hydrogeologists.

MNR 8. Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping. Based upon this report MNR anticipates impacts (e.g. change to the thermal regime and water quantity) in the aquatic ecosystem of Davis Creek from pumping groundwater over the long term at this site. A change in thermal regime could move Davis Creek toward a warm to cool water system thus losing important cold water refuge for cold water species including brook trout should they continue to recolonize upstream since removal of the dam on Sutton Pond.

Golder 8. We cannot comment specifically on MNR's anticipated effects at this time. The report was not intended for this purpose. Again, we point to information that suggests the upper reaches of Davis Creek are already warmwater in nature and likely undergo repeated changes in flow as a result of currently permitted irrigation that derive water from groundwater sources or online ponds. Existing reductions in flow would pose barriers to fish migration and reduce overall habitat quality in the upstream reaches. The removal of the dam at Sutton pond cannot be used to support suitability of upstream habitats for fish species, and brook trout in particular.

MNR 9. Section 5.5 Aquatic Habitat Observations in Davis Creek During Pumping. It is noted on page 10 that piezometer PZ4/12 was installed in a wetland adjacent to the east branch of Davis Creek, located about 75 m southwest of the test well. Although this report does not cover impacts to natural heritage features, we look forward to your assessment of impacts from pumping on other natural heritage features such as wetlands.

Golder 9. MNR will continue to be consulted in regards the potential effects of the project and studies to assess such on aquatic and terrestrial environments.

MNR 10. Please note: MNR is not the commenting agency with respect to impacts on fish habitat. The Department of Fisheries and Oceans should be circulated on this report to provide comments on impacts to fish habitat in Davis Creek.

Golder 10. MNR's comment is noted. We feel it is important to continue discussions with all relevant agencies, including the MNR for this project. Appropriate supporting information and consultation will be undertaken with DFO in regards to project authorizations relating to fish and fish habitat.

Should the MNR have any further comments or questions related to the pumping test report, I am happy to comment further or speak directly with you in regards.

Thank you,

GOLDER ASSOCIATES LTD.

Richard Booth, Ph.D.
Associate, Senior Ecologist

RKB/RKB/asb

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Ontario

April 8, 2016

Mr. G. Houghton
Public Works & Environmental Services Department
Norfolk County

Mr. Bill Banks
Banks Groundwater Engineering Ltd.

Re: Revised Draft Report - 2012 Monitoring and Testing Program
Simcoe Additional Water Supply Class EA

Being sent via email only

Messrs. Houghton and Banks:

Please be advised that we have completed the review of the "*Revised Draft Report, 2012 Monitoring and Aquifer Testing Program, Community of Simcoe, Additional Water Supply, Class Environmental Assessment*", dated September 2015, prepared by Banks Groundwater Engineering Ltd. for Norfolk County. As you are aware we provided comments on the original submission of this report in January 2014 identifying a number of issues, but most notably stating that insufficient work had been done to support an operational PTTW for what we understand to be the desired rate of 4,560m^3/day deemed necessary to meet future growth predictions for Simcoe.

While we fully recognize that this revised submission has provided much of the detail that was originally identified as missing by this agency, MNRF and the LPRCA, we also note that since 2012, no additional work has been done to fully demonstrate that Well SW11/09 (or any future well drilled in the immediate area) will in fact be capable of a perennial yield of 4,560m^3/day. We have not conducted any review of the additional information that was provided in the revised report as it is based on an aquifer testing program of only 2,620m^3/day and not on the required rate of 4,560m^3/day.

While the extrapolation of impacts based on the observations of the 2012 pumping test suggests that a taking at the higher rate will be viable, we agree that additional hydrogeological investigation that includes a pumping test at 4,560m^3/day is required to confirm the feasibility and impact of the proposed water supply. The revised report also recommends that further input from the MOECC would be beneficial. Should the County adopt this recommendation, we suggest that our input be in the form of reviewing a work plan for this pumping test to ensure that the breadth of monitoring will be adequate prior to submitting the application for the temporary PTTW application for the pumping test at the desired rate of 4,560m^3/day. The MNRF and the LPRCA may also wish to see the work plan to ensure that their interests will be addressed.

Sincerely,

Barbara Slattery

EA/Planning Coordinator

cc. Sherry Pineo, MNRF
Craig Jacques, LPRCA

S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix A4

Public and Agency Consultation – 2019 to 2023

Norfolk County

Simcoe Northeast - Groundwater Supply Testing Program Work Plan (Updated 2019)

Table of Contents

1 Simcoe Northeast - Groundwater Supply Testing Program Work Plan (Updated 2019)

The purpose of this program is to confirm a sustainable groundwater supply of 4,560 m^3/day (700 Igpm) is available from two test production wells, without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies and the local environment, including local wetlands and streamflow in Davis Creek. Provided the measured effects and projected future effects are acceptable, the next steps will be to complete the Municipal Class Environmental Assessment (EA) and apply for a Permit to Take Water (PTTW) for a new groundwater supply source for the Community of Simcoe in Norfolk County.

Reference should be made to the following report when reviewing this work plan:

> *Revised Draft Report, 2012 Monitoring and Aquifer Testing Program, Community of Simcoe Additional Water Supply Class Environmental Assessment. September 2015. Prepared for the Public Works & Environmental Services Department of Norfolk County, by Banks Groundwater Engineering Limited.*

Specific Figures from this report are referenced in the description of the planned monitoring program.

The following updated work plan has been prepared jointly by Banks Groundwater Engineering Limited (BGE) and Natural Resource Solutions Inc. (NRSI). During preparation of the work plan in 2016, NRSI staff reviewed all comments received previously from agencies, with particular interest in those provided by staff from the Ministry of Natural Resources and Forestry (MNRF), and Long Point Region Conservation Authority (LPRCA), and the respective responses of our project team that are provided in the above-referenced report. This updated work plan reflects comments received following circulation of the 2016 version, as well as updates to information sources.

This updated work plan was prepared to be submitted to the Ministry of the Environment, Conservation and Parks (MOECP), in support of an Application for a Category 3 PTTW for the completion of the testing and monitoring program described herein. It is intended that the above report and this work plan be reviewed together by MOECP staff for the application.

2 Natural Environment Characterization

2.1 Background Review

Available background information on natural heritage features will be compiled from the following information sources:

- Natural Heritage Information Centre Biodiversity Explorer (MNRF 2014)
- Ontario Ministry of Natural Resources and Forestry (MNRF)
- Long Point Region Conservation Authority
- Fisheries and Oceans Canada online Species at Risk mapping (2019)
- Ontario Breeding Bird Atlas (BSC et al. 2008)
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2018)
- Mammal Atlas of Ontario (Dobbyn 1994)
- Ontario Butterfly Atlas Online (Toronto Entomologists' Association 2018)
- Ontario Odonate Atlas (OMNR 2005).

A comprehensive list of Species at Risk (SAR) known from the vicinity, as identified during the background review process, will be screened against the habitat features present within the study area.

The study area will also be screened for the presence of potential Significant Wildlife Habitats (SWH) based on MNRF criteria identified in the Ecoregion Criterion Schedules (MNRF 2015).

2.2 Terrestrial Habitat Assessment

Vegetation Inventory

A three-season vegetation inventory will be conducted to identify the existing plant species within the study area. Spring, summer, and fall site visits will be conducted. The vegetation inventory provides a detailed list of all vegetation species present, including shrubs, grasses, and herbaceous vegetation. Vegetation communities will be mapped, where appropriate, during the vegetation inventory using the Ecological Land Classification (ELC) System (Lee et al. 1998).

Breeding Bird Surveys

Breeding bird surveys will follow the Ontario Breeding Bird Atlas protocol (BSC 2001). In order to identify bird species that may be breeding within the study area, 2 surveys will be conducted beginning after dawn and ending no later than 5 hours after dawn. An area search of the study area will be conducted and all observed species will be noted. These field surveys will be conducted in June and early July.

Anuran Call Surveys

Anuran Call Surveys will be completed once per month in April, May and June using the Marsh Monitoring Protocol. Monitoring stations will reflect areas of ponding, potential wetland areas, as well as ponds anthropogenic in origin throughout the study area.

Turtle Basking Surveys

Turtle Basking Surveys will be conducted along with other field visits in order to achieve efficiencies, and will be focused around the anthropogenic ponds within the study area.

Incidental Observations

Incidental observations of all wildlife species will be recorded while on the subject property. This will include direct observations, as well as observations of signs such as tracks, scat, vocalizations, etc.

2.3 Aquatic Habitat Assessment

The aquatic habitat will be initially assessed through a reconnaissance site visit. The tributaries of Davis Creek within the Study Area will be walked wherever property access is available. The general habitat characteristics and key features such as ponds or barriers will be visually assessed and documented. This will provide a more fulsome characterization of the existing conditions and will provide context for the detailed quantitative information that is gathered at the monitoring stations as part of the pumping test monitoring.

3 Test Production Well Drilling, Construction and Development

As presented in detail in the September 2015 report, an existing test production well has been tested at 2,620 m^3/day (400 Igpm). A second test production well is required to complete a testing program at the combined rate of 4,560 m^3/day (700 Igpm). The steps required to complete the second well in preparation for the testing program are as follows:

- Identify preferred sites at a sufficient distance from the existing test well (SW11/09) to minimize mutual interference and effects on groundwater and surface water
- Identify preferred sites at a sufficient distance from other natural environment features
- Select a preferred site based on access (i.e. within rail allowance or private land agreement) and the above considerations

- Prepare tender documents and an estimated cost, issue a Request for Tender, review submitted tenders and recommend/select a water well contractor
- Notify the public (refer to Section 6: Public Consultation/Notification)
- Test production well drilling, construction and development
- Perform initial step-drawdown pumping tests to confirm a constant combined rate for the longer aquifer testing program
- Collect and analyze water samples for selected chemical parameters (i.e. for pre-screening purposes).

As of the end of April 2019, the first three tasks had been completed and a Request for Tender had been issued by Norfolk County. Following selection of a water well contractor, the public will be initially notified of the planned well construction and testing program. It is anticipated that well construction will begin in early-July 2019. Once well development has confirmed the new test production well is capable of a sustained rate of at least 1,940 m^3/day (300 Igpm), the monitoring program described below will be initiated.

4 Monitoring Program

To measure the effects of the planned testing, a monitoring program would be established in advance that includes groundwater and surface water, aquatic habitat, and fish community. These components are described below.

The monitoring program shall be initiated in advance of the testing program to sufficiently establish background conditions for each monitoring location and site. Additional streambed and wetland piezometer locations and streamflow stations will be identified during a site reconnaissance conducted at the outset of the program.

Water levels in all groundwater and surface water monitoring stations will be recorded with the use of data loggers, but also supported/confirmed by manual measurements throughout the monitoring period. Monitoring will also include measuring and recording climate with data loggers, including precipitation (i.e. rain gauge), temperature and barometric pressure (i.e. for compensation of groundwater and surface water data loggers).

It is expected that the monitoring period will be at least two weeks (preferably more) in advance of the test pumping period and will continue for up to two weeks following the end of pumping.

4.1 Groundwater

Monitoring of groundwater will include the following:

- Measuring and recording water levels in previously-installed groundwater monitoring wells - a total of 14 monitors (refer to report Figure 4)
- Measuring and recording water levels in selected private wells that were monitored during previous testing of this site (with renewed approval from owners) (refer to report Figures 4 and 6), additional available/accessible wells that are within the area of influence, and irrigation wells identified by MOECP staff (if approved and accessible)
- Measuring and recording water levels and temperature in streambed and wetland piezometers at previously-monitored locations and additional locations along Davis Creek (i.e. in vicinity of observed drawdown at PZ5/12 - refer to report Figure 4) and other locations where groundwater discharge is apparent within the estimated area of influence (i.e. report Figure 10) and where access is approved
- Measuring and recording water levels in the test production wells.

4.2 Surface Water

Monitoring of surface water will include the following:

- Measuring and recording streamflow, stage and temperature within the tributaries of Davis Creek at a minimum of four locations that are upstream and downstream of the test production wells, within and beyond the estimated area of influence (i.e. similar to locations shown in report Figure 5)
- Periodic instantaneous flow rate measurements throughout the testing period to further calibrate the data loggers at each surface water station
- Measuring and recording water levels and temperature in on-line and off-line irrigation ponds (active and inactive) that are within the estimated area of influence (i.e. report Figure 10) and where access is approved
- As noted above, precipitation will be monitored for the duration of the monitoring period using a data logging rain gauge to correct for the potential influence of additional rain input.

4.3 Aquatic Habitat

Assessment and monitoring of the aquatic habitat associated with the estimated area of influence will be conducted at daily intervals prior to, during, and following the pumping test. Three monitoring stations will be established prior to the pumping test, with initial habitat assessment completed in each branch of Davis Creek following the Point Transect Methodology as described in the Ontario Stream Assessment Protocol (2013). The Ontario Stream Assessment Protocol (OSAP) is used to collect detailed assessments of the in-stream habitat and adjacent lands. It uses both qualitative and quantitative parameters including wetted width, depth, hydraulic head, substrate size, available cover, bank angle, bank composition and riparian and aquatic vegetation communities present. All parameters of the OSAP Point Transect method will be collected during the initial habitat assessment before the pumping test begins.

During and immediately following the pumping test, daily habitat assessments will be conducted using a subset of measurements from the OSAP Point Transect method to detect short-term changes in the habitat caused by any changes in stream flow. The parameters will include detailed width, depth and hydraulic head data for the duration of the pumping test using the same established monitoring sites and transects. The remaining habitat parameters from the protocol, such as substrate type and bank vegetation, need not be recorded as they will not change in the short term. Thus, the full range of data can be compiled for any of the days of monitoring and can be repeated in future years as part of a long-term monitoring program if required.

4.4 Fish Community

Fish community composition will be assessed prior to the pumping test within the habitat monitoring stations established during the aquatic habitat assessments following the Single Pass fish collection method from the Ontario Stream Assessment Protocol (2013). This methodology places emphasis on the assessment of all habitats observed throughout each monitoring station. Fish community assessment will be completed prior to the pumping test in order to assess the fish community within the tributaries of Davis Creek. An electrofishing backpack and dip net will be used for fish collection to sample the fish.

The fish sampling will clearly establish the fish community that is present and will help to define the thermal regime and permanency of flow in Davis Creek. It will also help to interpret the results of the habitat monitoring during the pumping test. Fish sampling will not be carried out during and immediately following the pumping test, because the habitat sampling activities will disturb the fish and confound any fish sampling results. The habitat sampling during the pumping test is more valuable and therefore the preferred approach.

Water temperature data from the data loggers installed at surface water monitoring stations will assist in the classification of the temperature regime within the tributaries of Davis Creek and assist in determining the suitability for the fish species known from within the vicinity of the study area.

5 Well Development, Well Testing and Aquifer Testing

As part of the construction phase for new test production well, it will be necessary to develop the well by means of short-interval pumping, air-lifting, jetting, and possibly surging. It is expected that as the well is developed to a sand-free condition, the amount of groundwater withdrawn will exceed 50,000 L/day. Development work will occur only during working hours, but could continue intermittently for more than seven days. A Category 3 PTTW would therefore be required.

Subsequent short-term pumping of the well will include stop-start sand-free pumping and step-drawdown testing. The short-term (i.e. 60 minutes or less) pumping rates are expected to vary from about 650 to 3,500 m^3/day (100 to 535 Igpm). The total volume withdrawn during these tests is also expected to exceed 50,000 L/day. Step-drawdown testing is also planned for the existing test production well at comparable rates. These tests are expected to be conducted within the two weeks prior to the start of the aquifer performance test.

As stated previously, the two test production wells are to be pumped at a combined rate of 4,560 m^3/day (700 Igpm), following receipt of a Category 3 PTTW. If possible, the wells will be pumped at the same rate of 2,280 m^3/day, which is preferred for data interpretation purposes. Other key aspects of the testing include:

- During pumping the water will be discharged into Davis Creek downstream of the test wells at a location that is beyond the estimated area of influence (i.e. report Figure 10)
- The pumping rates will be held constant throughout the test period (this will be a requirement of the contractor) and the actual daily volume will be measured with a totalizing meter and recorded
- Groundwater levels in all monitoring wells will be manually measured and recorded by the water well contractor on a set schedule throughout the pumping and recovery period
- Groundwater levels in all piezometers and surface water levels and flow at each station will be manually measured and recorded by the consultant team on a set schedule throughout the pumping and recovery period
- The pumping period will be at least 72 hours, but is planned to be up to 168 hours (7 days)
- The pumping period should be scheduled for a time when irrigation in the local area is not planned or expected (e.g. fall)
- Water samples will be collected near the start, at the mid-point and just before the end of the pumping period, for analysis of municipal drinking water quality parameters
- Continue to monitor groundwater and surface water levels for a recovery period that is at least one-third the duration of the pumping period and data loggers will remain for at least two weeks following the pumping period
- At the conclusion of the monitoring period all equipment, piezometers, streamflow stations and data loggers will be removed. The test wells and monitoring wells are to be secured to minimize/prevent vandalism.

6 Public Consultation/Notification

Public consultation and notification activities during this phase of work are required as part of the Municipal Class EA, and as a condition of the pumping test Permit to Take Water. A project mailing list of local residents, property owners, and others (such as farmers that are renting local land) has been established. Activities will include the following:

- Issue an EA update and notification of pending well construction and additional testing by mail to those on the EA mailing list and by newspaper and website. Include an estimated timeline and further notifications that are planned. Update the mailing list if additional responses are received.
- Issue a water well survey as a request for access to private wells for monitoring, by mail to the mailing list
- Issue a request to access and monitor ponds to those property owners with ponds in the estimated area of influence, by mail to the mailing list
- Contact and visit each well and pond owner to inspect and confirm access for monitoring
- Issue notification of timing for the pumping test, with contact information if residents believe water supply interference occurs, by mail to the mailing list (as per typical condition of PTTW)
- At the conclusion of this phase of work, following analysis of all data and preparation of a draft final report for the EA, arrange for and present the findings (preferred solution) at a Public Information Centre (PIC). Make reports and displays available for review.

7 Data Analysis and Reporting

At the conclusion of the testing and monitoring program and subsequent analysis of data collected and observations recorded, a report will be prepared documenting the results of all testing and analyses. This will include for example:

- The area of influence within the groundwater regime created by the pumping of the two test production wells at the constant combined rate of 4,560 m^3/day (700 Igpm)
- Identify and quantify the effects observed at all monitored locations, including private wells, monitoring wells, streambed and wetland piezometers, surface water stage/flow stations, and irrigation ponds
- Surface water and groundwater connections to aquatic and wetland habitats, and the sensitivity of these habitats to changes in water regime.

In addition to the above, the presence of habitat suitable for significant species will be described, according to the Significant Wildlife Habitat Technical Guide as well as habitats for SAR. This information will be used to refine the SWH and SAR screenings prepared as part of the background review and will identify candidate and/or confirmed SWH. The species' habitat preferences will be compared to available habitats to evaluate the likelihood of the species to be present.

Based on these results, potential terrestrial and aquatic environmental constraints will be identified to be considered in the construction of an additional water supply source for the Community of Simcoe. Species and habitats identified in the study area which are most sensitive and significant, including SAR and their habitat, will be identified as constraints. Opportunities for aquatic and wildlife enhancements and/or compensation will be identified. Once the details of the undertaking are fully developed, an impact assessment will be completed to address potential direct, indirect, induced and cumulative impacts.

Prior to finalizing the report, a Public Information Centre would be held to present the results, respond to questions, and request input to the Selection of a Preferred Solution, in accordance with Phase 2 of a Schedule "B" Municipal Class Environmental Assessment.

Following the public consultation, a final report would be prepared to complete the Municipal Class EA. A notice of Completion would then be issued to review agencies and the public. It is intended that this report will also be suitable for submission in support of an Application for a PTTW for a new groundwater supply source serving the Community of Simcoe.

Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

Notice of Municipal Test Well Construction, Testing and Monitoring – Issued August 7, 2019

Previous Testing Results

In 2012 a testing and monitoring program was performed on an existing municipal test well, as part of a Municipal Class Environmental Assessment for a Community of Simcoe Additional Water Supply Source. The testing and monitoring were conducted to determine the effects of pumping the well on local private water wells, ponds, nearby Davis Creek and adjacent wetlands. The results confirmed water supplies from local private water wells were unaffected. Davis Creek flows and wetland water levels were also unaffected by the pumping test. These results were presented in a report, which has been reviewed by technical staff of Provincial Ministries and the Long Point Region Conservation Authority. From the comments and recommendations received, a work plan was developed to continue with the project to assess the sustainable capacity of the groundwater supply source for existing water supply wells and potential additional municipal wells.

Municipal Test Well Construction

The next step in this project will begin with the construction of a second municipal test well. Drilling operations are planned to begin during the week of August 19, 2019. The site of the planned second well and the existing municipal test well are located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted on the map). Well drilling and construction will be completed in several stages. Following construction, the municipal test well will undergo short-duration periods of pumping over several working days. This procedure is referred to as well development. Once it is determined that the well is properly developed, it will be ready for a longer-term continuous pumping test of both wells.

Well Testing and Monitoring Program

Prior to longer-term testing of the municipal test wells, a monitoring program will be initiated. It is expected this program will include frequent measuring and recording of water levels in selected local operating private water wells, multiple local monitoring wells, the two test wells, irrigation ponds, Davis Creek, and wetlands. Water level monitoring will begin several days before pumping begins, and will continue during the pumping period, and for several days after the end of pumping. A pumping period of seven days is currently planned to occur this Fall. As with previous testing, a notice will be issued in advance to provide the expected start date and contact information should local well owners experience problems with their water supply during the test.

Water Well Survey

This notice was also mailed to local addresses in the vicinity of the test well site, along with a Water Well Survey form. Local well owners have been requested to complete the survey and to please return it to Norfolk County before September 6, 2019. Our Consultant will review the completed surveys and contact respondents that have indicated their well and/or pond is available for monitoring. We appreciate everyone's cooperation and assistance with this program.

Public Involvement

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC. A notice of the date and location of the PIC will be issued in advance (expected to be early 2020). If you have any questions or would like more information, please contact one of the following team members:

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Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

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In 2012 a testing and monitoring program was performed on an existing municipal test well, as part of a Municipal Class Environmental Assessment for a Community of Simcoe Additional Water Supply Source. The testing and monitoring were conducted to determine the effects of pumping the well on local private water wells, ponds, nearby Davis Creek and adjacent wetlands. The results confirmed water supplies from local private water wells were unaffected. Davis Creek flows and wetland water levels were also unaffected by the pumping test. These results were presented in a report, which has been reviewed by technical staff of Provincial Ministries and the Long Point Region Conservation Authority. From the comments and recommendations received, a work plan was developed to continue with the project to assess the sustainable capacity of the groundwater supply source for existing water supply wells and potential additional municipal wells.

Municipal Test Well Construction

The next step in this project will begin with the construction of a second municipal test well. Drilling operations are planned to begin during the week of August 19, 2019. The site of the planned second well and the existing municipal test well are located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted on the map on the other side of this page). Well drilling and construction will be completed in several stages. Following construction, the municipal test well will undergo short-duration periods of pumping over several working days. This procedure is referred to as well development. Once it is determined that the well is properly developed, it will be ready for a longer-term continuous pumping test of both wells.

Well Testing and Monitoring Program

Prior to longer-term testing of the municipal test wells, a monitoring program will be initiated. It is expected this program will include frequent measuring and recording of water levels in selected local operating private water wells, multiple local monitoring wells, the two test wells, irrigation ponds, Davis Creek, and wetlands. Water level monitoring will begin several days before pumping begins, and will continue during the pumping period, and for several days after the end of pumping. A pumping period of seven days is currently planned to occur this Fall. As with previous testing, a notice will be issued in advance to provide the expected start date and contact information should local well owners experience problems with their water supply during the test.

Water Well Survey

Enclosed with this notice is a Water Well Survey form. We kindly request that you complete this survey to the best of your knowledge and return it in the included stamped envelope to Norfolk County before September 6, 2019. Our Consultant will review the completed surveys and contact respondents that have indicated their well and/or pond is available for monitoring. We appreciate your cooperation and assistance with this program.

Public Involvement

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC. A notice of the date and location of the PIC will be issued in advance (expected to be early 2020). If you have any questions or would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Scott Zerbes, C.Tech., Project Manager
Public Works, Corporation of Norfolk County
183 Main Street of Delhi, Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1614
Email: Scott.Zerbes@norfolkcounty.ca

August 7, 2019

Community of Simcoe Additional Water Supply Environmental Assessment
Water Well Survey

Please complete the following survey and return to us in the stamped envelope provided by September 6, 2019. This information will be retained by Norfolk County and their Consultant for the purposes of selecting suitable wells and ponds for measuring water levels and collecting water samples during the upcoming well testing and monitoring program.

Property Owner / Resident

Name: ____
Address: ____
Address: _________________________________ Telephone: (____)__________________

Existing Well(s)

Number of well(s) on property: _______ Number of well(s) currently being used: ________
Well Construction Details: (check and complete as appropriate)
Well 1: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

Well 2: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

If you have more than two water wells on your property, please provide additional information on other side of this page.

Current Uses of Existing Well(s) (check as many as applicable)
Household use____ Lawn and/or garden____ Watering of livestock and/or poultry____
Crop irrigation____ Commercial____ Fire protection____

Do you have an active Permit to Take Water for any of these uses? _____
If you have a Permit, for which use? ______________________________
Maximum permitted taking per day: ______________________________

Have you experienced any shortage of water supply from your well(s)? ____ If so, when? __________
Have you experienced any problems with the quality of water from your well(s)? ______
If so, when? ________________________________

When was the last time you sent a sample of the well water for bacteriological and/or chemical analysis?
____

Continued on other side

Permission to Access Well(s) for Monitoring Purposes

Would you be willing to provide access to your well(s) for the purpose of measuring water levels in the well before, during, and after the planned pumping of the Norfolk County test wells?______________

If selected, would you be willing to provide access to your well(s) for the purpose of collecting water samples for submission to a private laboratory for general chemical analysis?____________________

Please note the laboratory results would be provided to you upon receipt.

Other Water Sources and Features

Please check any water sources and features that occur on your property (check as many as applicable)

Pond____ Creek____ Wetland____

Do you have an active Permit to Take Water for any of these sources? _____

If you have a Permit, for which use? __________________________________

Maximum permitted taking per day: __________________________________

Would you be willing to provide access to your other water source or feature for the purpose of measuring water levels before, during, and after the planned pumping of the Norfolk County test wells?_______

Contacting You

If you are willing to provide access for monitoring, please indicate the preferred time and/or day of week and a telephone number for a member of the Consultant Team to contact you:

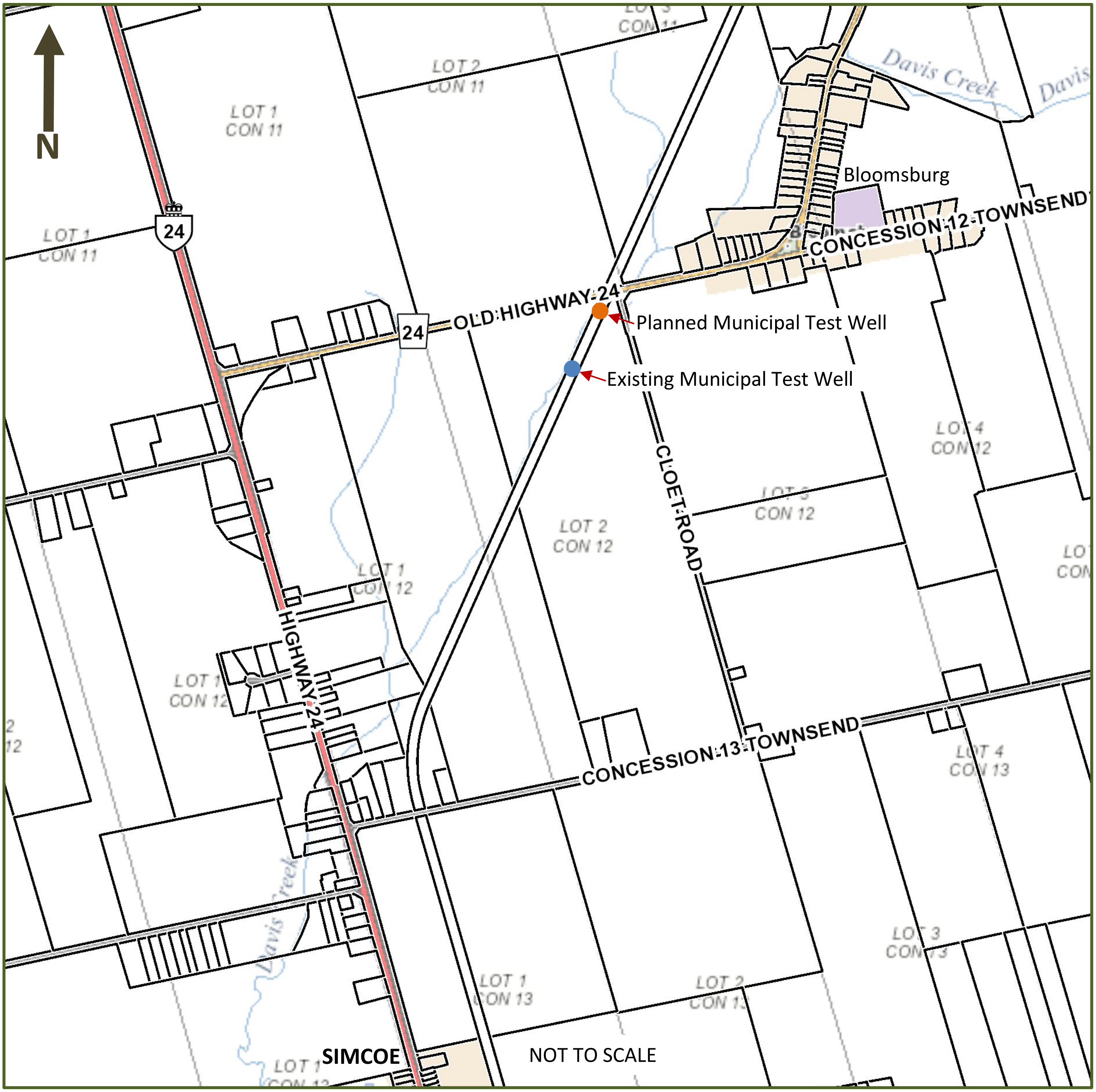
____

____

Thank you for your assistance and cooperation.

Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

Site Map
Municipal Test Well Construction



Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

Notice of Well Testing and Monitoring
Issued: 9 October 2020

Previous Testing Results

As indicated in our previous notice to you, in 2012 a testing and monitoring program was performed on an existing municipal test well, as part of a Municipal Class Environmental Assessment for a Community of Simcoe Additional Water Supply Source. The testing and monitoring were conducted to determine the effects of pumping the well on local private water wells, ponds, nearby Davis Creek and adjacent wetlands. The results confirmed water supplies from local private water wells were unaffected. Davis Creek flows and wetland water levels were also unaffected by the pumping test. These results were presented in a report, which was reviewed by technical staff of Provincial Ministries and the Long Point Region Conservation Authority. From the comments and recommendations received, a work plan was developed to continue with the project to assess the sustainable capacity of the groundwater supply source for existing water supply wells and potential additional municipal wells.

Municipal Test Well Construction

The next step in this project was the construction of a second municipal test well. Drilling operations began in August 2019 at a site located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted on the map on the other side of this page). After unforeseen delays this past year, well drilling and construction was completed during the spring and summer of 2020. Following construction, the municipal test well required short-duration periods of pumping over several working days. This procedure is referred to as well development. Once it was determined the well was properly developed, our project team began preparations for a longer-term continuous pumping test of both wells.

Well Testing and Monitoring Program

Prior to the longer-term testing of the municipal test wells, a monitoring program was established and initiated. This program includes frequent measuring and recording of water levels in selected local operating private water wells, multiple local monitoring wells, the two test wells, irrigation ponds, Davis Creek, and wetlands. The water level monitoring began recently, before pumping begins, and will continue during the pumping period, and for several days after the end of pumping.

The purpose of this notice is to advise you the pre-test monitoring recently started, and that pumping will begin during the week of 19 October 2020. Test pumping is planned to continue for a duration of seven days.

During the pumping period if you experience problems with your water supply, please contact Scott Zerbes at Norfolk County during the hours of 8:30 am to 4:30 pm (telephone: 519-582-2100 extension 1614), or Bill Banks at Banks Groundwater Engineering at any time (telephone: 1-519-829-4808). We appreciate your cooperation and assistance with this program.

Public Involvement

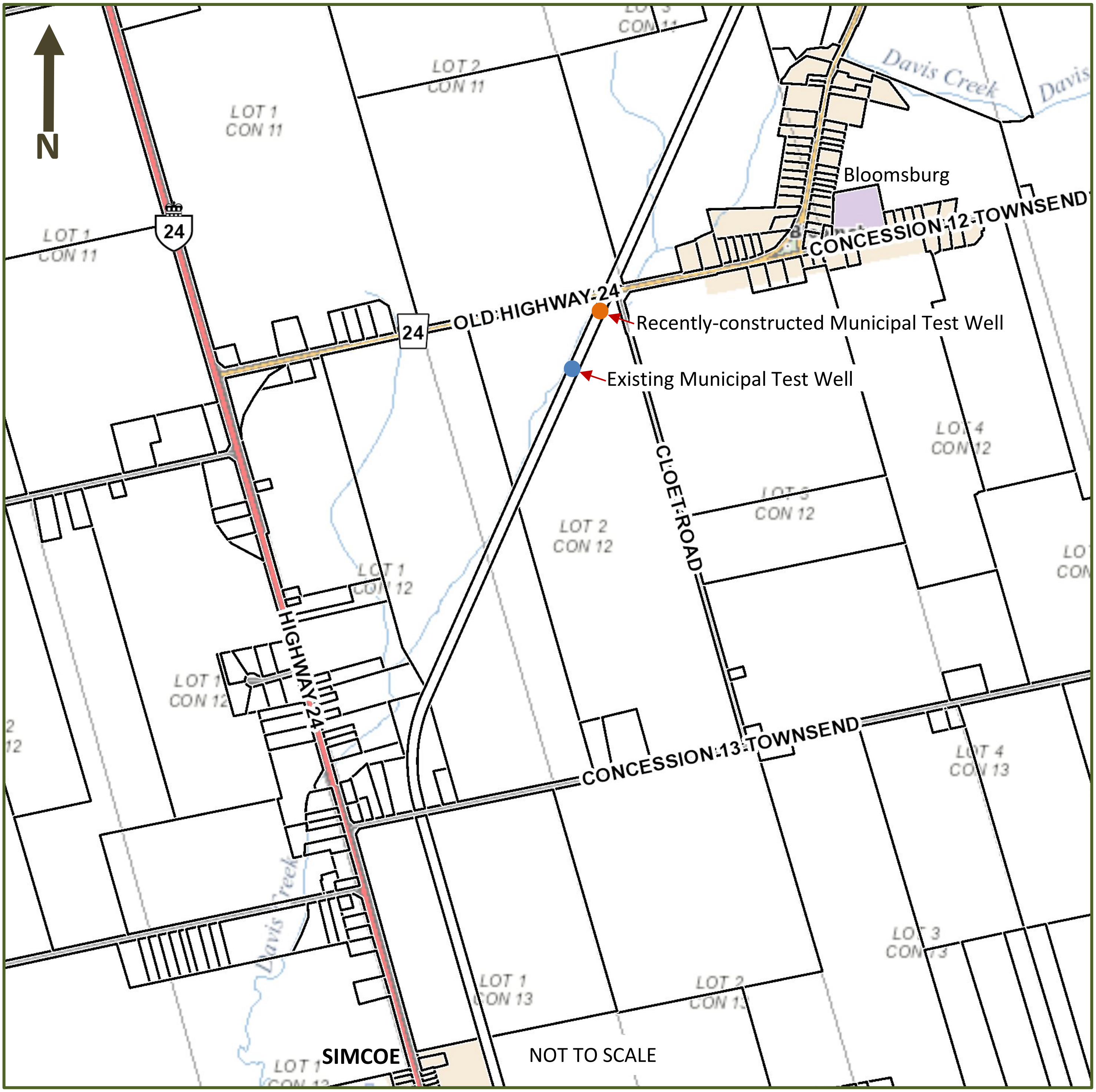
Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. The timing of the PIC will be confirmed at a later date. If you have any questions or would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Scott Zerbes, C.Tech., Project Manager
Public Works, Corporation of Norfolk County
183 Main Street of Delhi, Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1614
Email: Scott.Zerbes@norfolkcounty.ca

Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

Site Map
Municipal Test Well Construction

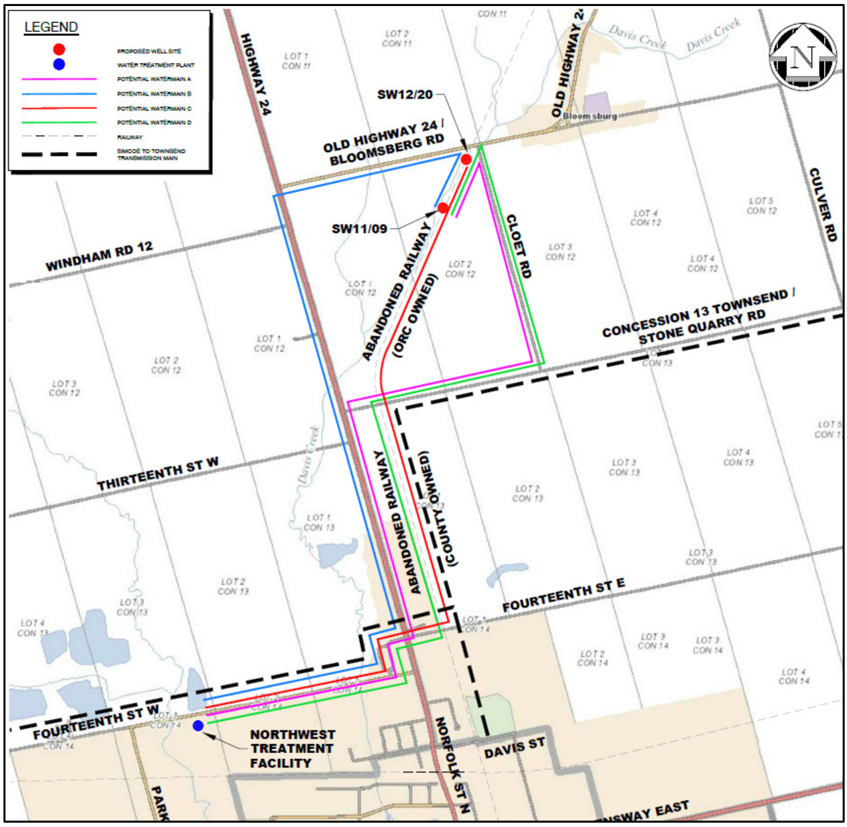


Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

Notice of Public Information Centre No. 3

Background

Norfolk County is proposing to develop an additional groundwater supply source with a capacity of up to 5,040 cubic metres per day to provide additional water to the urban area of Simcoe. The Project will help meet water supply demand until the Townsend-Simcoe watermain is operational.



Municipal Class EA Study

This Schedule "B" assessment is being conducted in accordance with the Municipal Class EA process (Municipal Engineers Association, October 2000, as amended in 2007, 2011, and 2015).

Public Information Centre

Public involvement is an important part of the Municipal Class EA process. This final public information centre (PIC) is an opportunity to learn about work completed to date and study recommendations.

DATE:	**Wednesday, March 22, 2023**
TIME:	**5:00 – 7:00 pm**
LOCATION:	**Norfolk County Robinson Administration Building 2nd Floor** **185 Robinson Street, Simcoe, ON**

If you have any questions prior to the PIC or cannot attend and would like more information, please contact one of the following team members:

Scott Zerbes, C.Tech., Project Manager
Environmental and Infrastructure Services Division
Norfolk County
185 Robinson Street, Suite 200, Simcoe, Ontario, N3Y 5L6
Tel: 519-426-5870 ext. 8014
Email: scott.zerbes@norfolkcounty.ca

Bill Banks, P.Eng., EA Manager
Banks Groundwater Engineering Limited
940 Watson Road South
RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Norfolk
COUNTY

March 3, 2023

Re: Community of Simcoe
Additional Water Supply Municipal Class Environmental Assessment
Public Information Centre #3

To Whom It May Concern,

Norfolk County is proposing to develop an additional groundwater supply source with a capacity of up to 5,040 cubic meters per day to provide additional water to the urban area of Simcoe. The Project will help meet water supply demand until the Townsend-Simcoe watermain is operational.

Public, First Nations, and Métis input and comments are an important part of the MCEA process, and in this Public Information Centre (PIC), the recommendations of assessment will be to obtain feedback and to confirm they should be advanced as the preferred alternative solutions.

Public Information Centre #3

DATE: Wednesday, March 22, 2023
TIME: 5:00 – 7:00 pm
LOCATION: Norfolk County Robinson Administration Building 2nd Floor
185 Robinson St, Simcoe, ON

If you have any questions prior to the PIC or cannot attend and would like more information, please contact one of the following team members:

Scott Zerbes, C.Tech., Project Manager
Environmental and Infrastructure Services Division
Norfolk County
185 Robinson Street, Suite 200,
Simcoe, Ontario, N3Y 5L6
Tel: 519-426-5870 ext. 8014

Bill Banks, P.Eng., EA Manager
Banks Groundwater Engineering
940 Watson Road South
RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Simcoe - Additional Water Supply

Municipal Class Environmental Assessment

Norfolk County

Public Information Centre #3

March 22, 2023 from 5:00pm to 7:00pm

Norfolk County Robinson Administration Building 2nd Floor
185 Robinson St, Simcoe, ON

Welcome!

The goals of this Public Information Centre (PIC) are to:

- Revisit the project and why it is being undertaken
- Provide an overview of the process this study has followed
- Summarize the results of completed studies
- Present recommendations
- Obtain your feedback and answer any questions you may have
- Outline next steps in the process

Comments received during this PIC will be used to confirm whether to move forward with our recommendations.

Background

- Groundwater resources are currently the only source of water supply for the Community of Simcoe.
- The Community of Simcoe withdraws water from seven (7) wells and an infiltration gallery/well system.
- Maximum daily water supply requirements for the community are expected to increase.
- In 2007, Norfolk County began a groundwater investigation to evaluate the development of a groundwater source that could meet this additional capacity requirement.
- Since then, Norfolk County has identified the Inter-Urban Water Supply Project as the best means of providing a reliable water supply that meets current and future demand. This project includes building a new watermain that connects Simcoe to the Townsend Water Supply System, which is being evaluated under a separate Municipal Class Environmental Assessment.
- Commissioning of the Simcoe-Townsend Water Supply System is scheduled for 2025, pending project progress, approvals and available funding.

Municipal Class EA Study Process

This study will meet the requirements for Schedule ‘B’ projects and will satisfy the first two phases of the Class EA process.

Phase 1:
Problem and Opportunity

- Review background planning and policy documents (e.g., Official Plan)
- Identify problems and opportunities

Phase 2:
Alternative Solutions

- Identify alternative solutions to the Problem/Opportunity
- Inventory the socio-economic, natural and cultural environments
- Evaluate feasible Alternative Solutions and recommend a Preferred Solution
- Consult public, Indigenous communities and agencies
- Select Preferred Solution

Problem/opportunity Statement

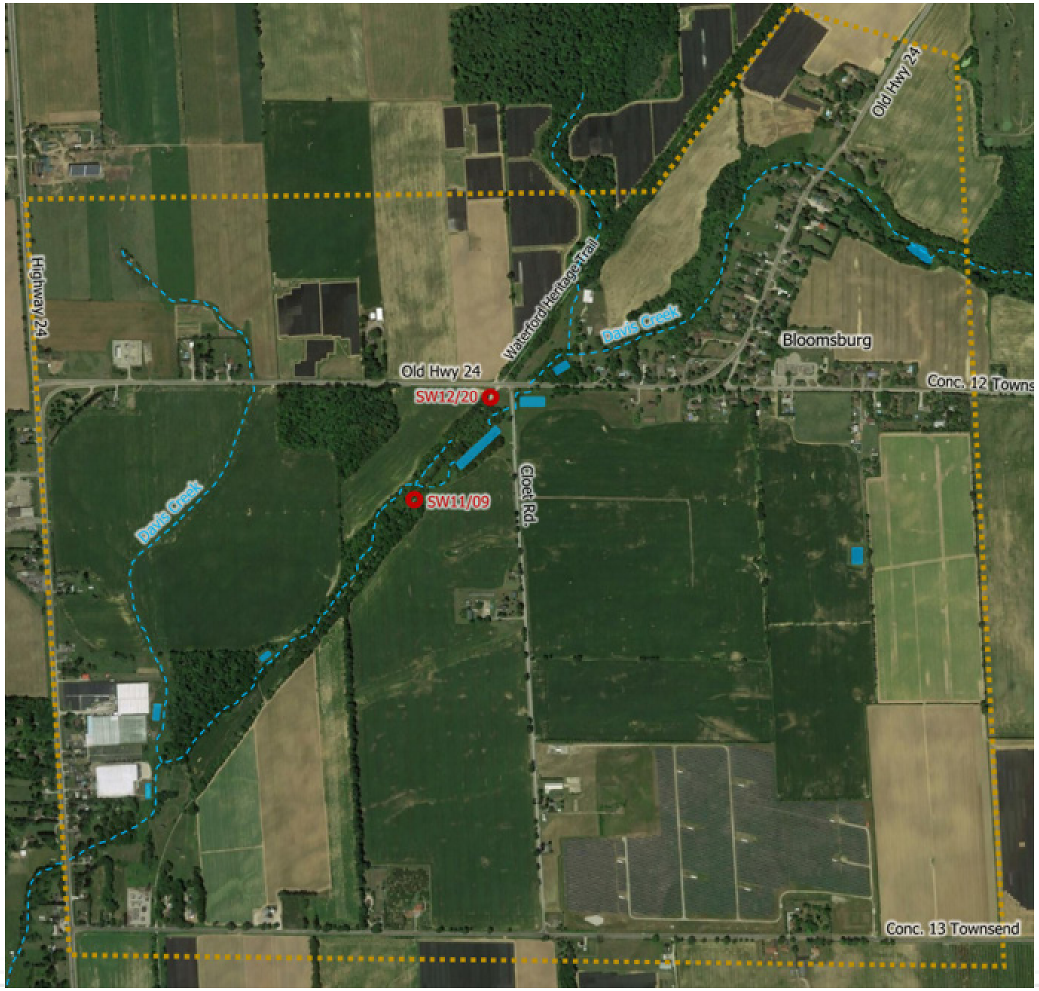
Norfolk County is taking a regional approach to water supply through the implementation of the Inter-Urban Water Supply System. However, in the interim, and until this inter-urban supply solution is operational, the County requires additional water supply for the Community of Simcoe.

This supply is needed to manage increasing demand from a growing population and to create resilience in Simcoe's water supply system until additional water supply is provided through the Inter-Urban Supply Projects. This additional supply will also provide resilience in the event of any temporary issues related to the operation of Inter-Urban Supply Projects.

Alternatives Considered

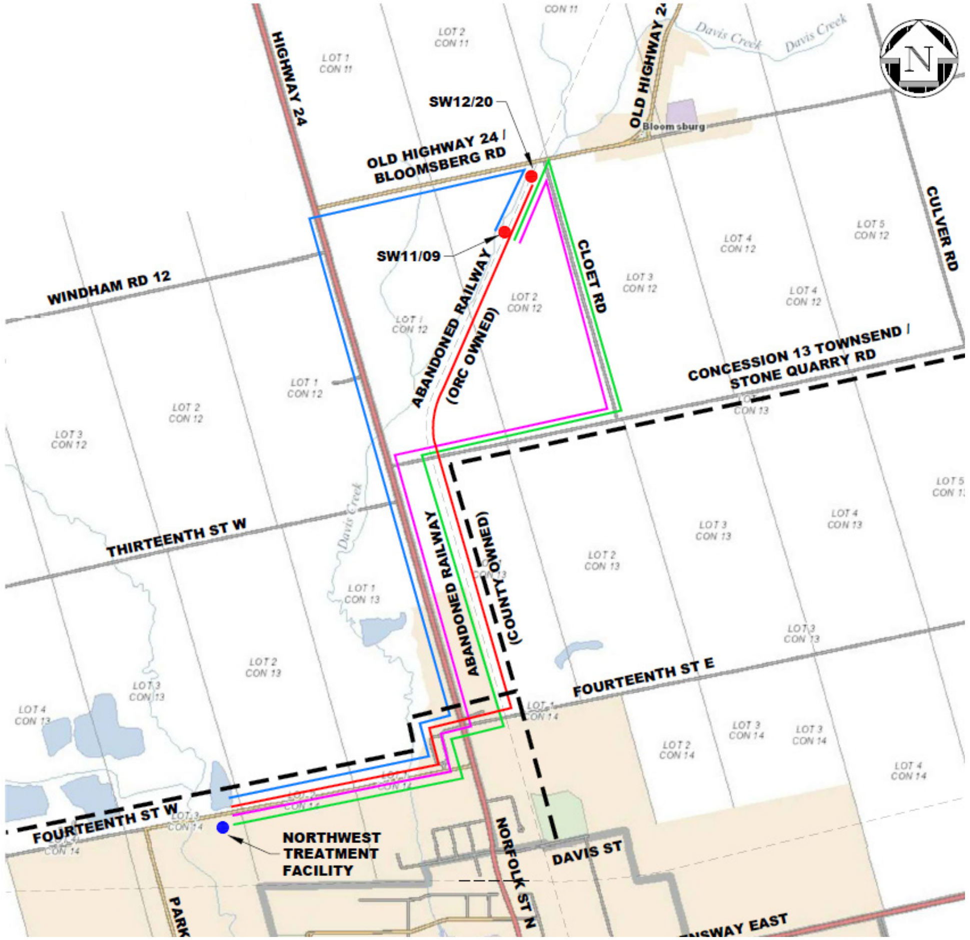
- **Do nothing:** No further action by Norfolk County to meet the interim water supply demand for the Community of Simcoe.
- **Reduce water demand:** Offset water demand through conservation initiatives.
- **New groundwater supply:** Locate and develop a new groundwater supply.
- **New Pipeline:** In addition to the planned Inter-Urban Supply Projects.

Identifying a new groundwater supply



- The search for a new groundwater source began in 2007 with a groundwater investigation, which was completed in 2010.
- Two well locations were identified, and test wells were constructed in 2009 and 2020.
- To date considerable groundwater testing has been completed, including monitoring of adjacent private wells and Davis Creek.
- Analysis of the monitoring program results confirms the aquifer performance test was completed without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies, and the local environment, including local wetlands and flow in Davis Creek.

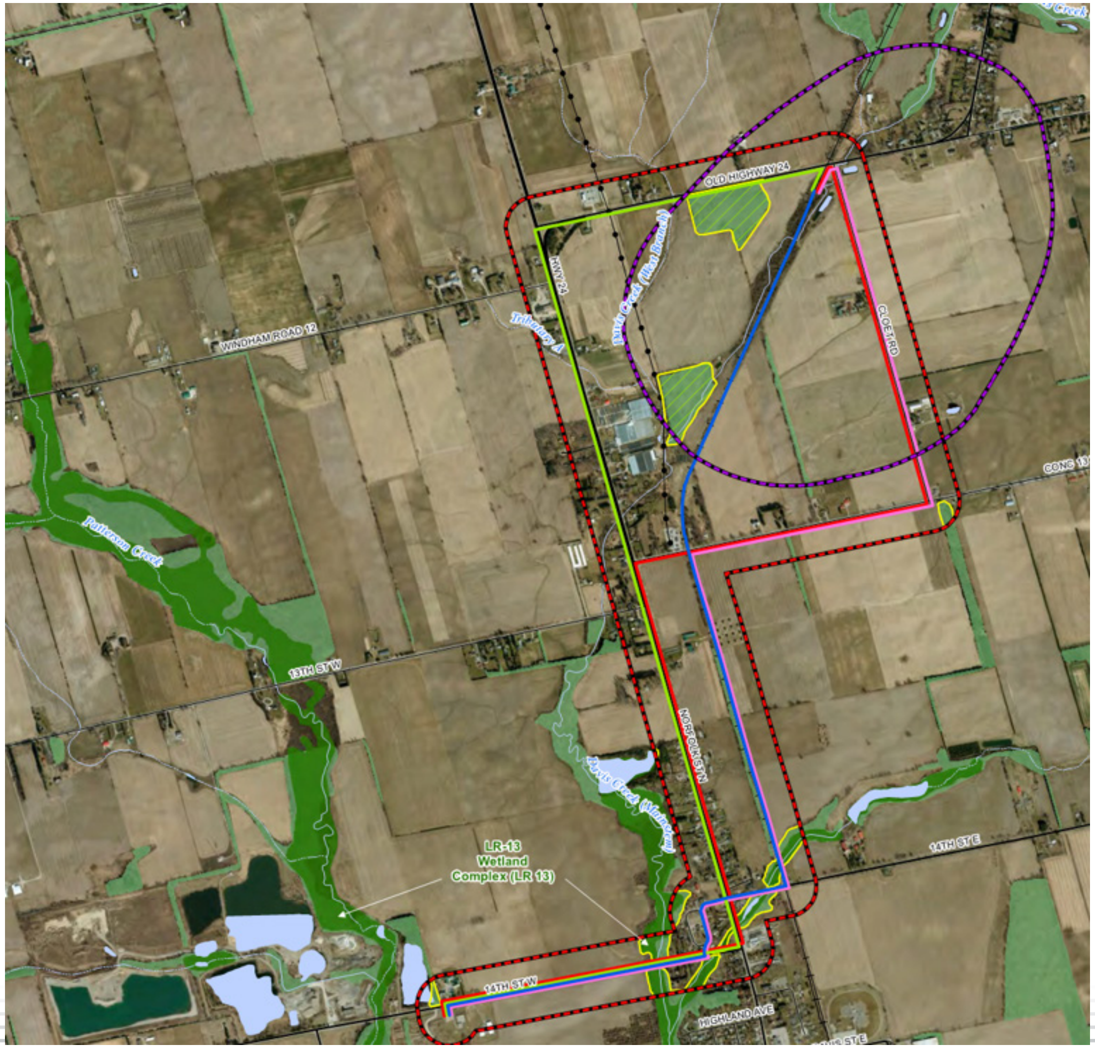
Potential Watermain Options



Legend

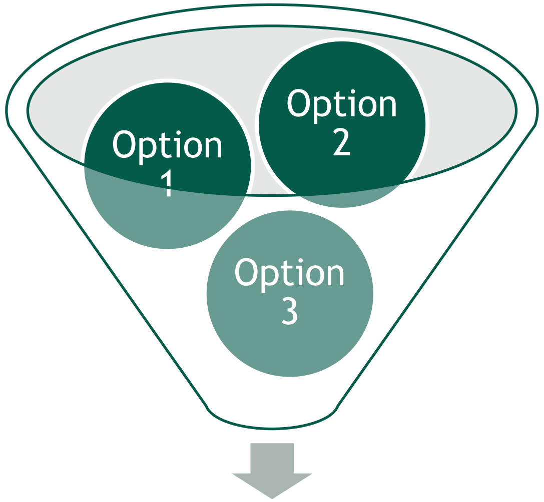
🔴	Potential well site
🔵	Water treatment plant
🟪	Potential watermain A
🟦	Potential watermain B
🟥	Potential watermain C
🟩	Potential watermain D
- - -	Abandoned Railway
▬ ▬ ▬	Proposed Simcoe-Townsend Transmission Main

Environmental Inventory



- Natural Resource Solutions Inc. conducted natural heritage surveys of the well areas, areas within the potential zone of influence of the wells (purple), and the four (4) watermain routes.
- The Study Area is dominated by agricultural fields, with associated roadways and residential lots.
- Butternut trees, which are listed as endangered, were documented along the rail trail.
- Pockets of significant woodland (yellow), exist within the study area.
- Areas along Davis Creek provide potential turtle wintering habitat

Preliminary Screening of Alternatives Inventory



Feasible alternatives to be further evaluated

☒ **Do-nothing:** Does not address water capacity issues and does not increase resilience in the water supply system.

☒ **Reduce demand:** The increased capacity needed until the Townsend-Simcoe project is operational cannot be met through conservation. Similarly, if that pipeline was ever taken offline, conservation would not provide adequate system resilience.

☑ **New groundwater supply:** Addresses capacity issues and increases system resilience.

☒ **New pipeline:** No feasible option for a pipeline that could be constructed before the planned Townsend-Simcoe pipeline.

Evaluation of Watermain Routes

The following table ranks the 4 watermain routes based on cost (1 = worst option, 4 = best)

Route	Opinion of Total Project Cost	Relative Ranking (1 = worst, 4 = best)
3A: Stone Quarry Road	$7,095,270	1
3B: Highway 24	$6,985,095	2
3C: Rail Trail	$5,259,020	4
3D: Rail Trail / Stone Quarry Road	$6,610,500	3

Approval Requirements/Land Ownership

The following table ranks the 4 watermain routes based on approval requirements and land ownership (1 = worst option, 4 = best)

Route	Approval Requirements/Land Ownership	Relative Ranking (1 = worst, 4 = best)
3A: Stone Quarry Road	• Majority of works on Norfolk County Road allowances and Highway 24 • Permission required for use of Highway 24 road allowance • Ministry of Transportation Ontario has indicated that “deep trunk watermain services are not permitted along our corridor” • Approval by MTO may not be possible	1
3B: Highway 24	• Permission required for use of Highway 24 road allowance • Ministry of Transportation Ontario has indicated that “deep trunk watermain services are not permitted along our corridor” • Approval by MTO may not be possible	1
3C: Rail Trail	• Majority of Road on Norfolk County Road allowances • Approval required by the Ontario Realty Corporation for the northern section of the rail trail • Crossing of Highway 24 should only require a simple approval	3
3D: Rail Trail / Stone Quarry Road	• All works on Norfolk County Road allowances or Norfolk County Trail • Crossing of Highway 24 should only require a simple approval	4

Accessibility

The following table ranks the 4 watermain routes based on accessibility for construction (1 = worst option, 4 = best)

Route	Approval Requirements/Land Ownership	Relative Ranking (1 = worst, 4 = best)
3A: Stone Quarry Road	• All on Norfolk County Road allowances and Highway 24 • Excellent access	4
3B: Highway 24	• Good access, subject to MTO approval/conditions	3
3C: Rail Trail	• Portion on County roads provides excellent access • Rail trail provides good access, however, the trail width results in some limitations • Access only via trail entrances • Potential snow removal difficulty if required	2
3D: Rail Trail / Stone Quarry Road	• Portion on County roads provides excellent access • Rail trail provides good access, however, the trail width results in some limitations • Access only via trail entrances • Potential snow removal difficulty if required • Shorter distance on rail trail compared to Route 3C.	2

Coordination with Simcoe-Townsend Watermain

The following table ranks the 4 watermain routes based on overlap with Simcoe-Townsend Watermain (1 = worst option, 4 = best)

Route	Overlapping Sections with the Simcoe to Townsend Watermain	Relative Ranking (1 = worst, 4 = best)
3A: Stone Quarry Road	• 14th Street from Treatment Facility to Glendale Crescent • Glendale Crescent to Norfolk Street • 13th Concession/Stone Quarry Road to Cloet Road	2
3B: Highway 24	• 14th Street from Treatment Facility to Glendale Crescent • Glendale Crescent to Rail Trail	1
3C: Rail Trail	• 14th Street from Treatment Facility to Glendale Crescent • Glendale Crescent to Rail Trail • Rail Trail to 13th Concession/Stone Quarry Road	3
3D: Rail Trail / Stone Quarry Road	• 14th Street from Treatment Facility to Glendale Crescent • Glendale Crescent to Rail Trail • Rail Trail to 13th Concession/Stone Quarry Road • 13th Concession/Stone Quarry Road to Cloet Road	4

Potential Environmental Effects

The following table ranks the 4 watermain routes based potential environmental effects (1 = worst option, 4 = best)

Route	Overlapping Sections with the Simcoe-Townsend Watermain	Relative Ranking (1 = worst, 4 = best)
3A: Stone Quarry Road	• Temporary traffic disruption during construction • Contains one (1) concession of four-lane Highway 24 where traffic would be disrupted during construction	1
3B: Highway 24	• Temporary traffic disruption during construction • Contains two (2) concession of four-lane Highway 24 where traffic would be disrupted during construction	2
3C: Rail Trail	• Minimizes traffic disruption by using the rail trail • Results in disruption to trail users during construction	4
3D: Rail Trail / Stone Quarry Road	• Moderate traffic disruption during construction • Results in disruption to trail users during construction	3

Evaluation of Watermain Routes - Overall

The following table ranks the 4 watermain routes by considering all evaluation criteria (1 = worst option, 4 = best)

Route	Project cost	Approval Requirements/Land Ownership	Accessibility for Construction and Maintenance	Coordination with Simcoe to Townsend Pipeline	Potential Environmental Impacts,	Total
3A: Stone Quarry Road	1	1	4	2	1	9
3B: Highway 24	2	1	3	1	2	9
3C: Rail Trail	4	3	2	3	4	16
3D: Rail Trail / Stone Quarry Road	3	4	2	4	3	16

Although the Rail Trail or Rail Trail/Stone Quarry Rd. alternative could be advanced as the preferred solution, Norfolk County would like to proceed with the Rail Trail Alternative.

Problems & Opportunities

The following problems and opportunities of the water supply system in Norfolk County were identified:

Problems

- Capacity for long-term growth
- Quality compliance
- Insufficient fire flow services
- Individual well systems
- High peak water demands (seasonal)
- Aging infrastructure
- Low water system pressure
- Concerns with existing backup of water system

Opportunities

- Provides capacity for growth to 2041 and beyond
- High quality water services
- Provides fire flow supply for growth to 2041 and beyond
- Provides opportunity for residents to connect to centralized municipal services
- Accommodates high peak water demands year-round
- Builds and renews infrastructure for 50+ years
- Provides reliable and consistent water pressure
- Provides backup capacity to water system
- Allows for future development and economic growth

Next Steps

Following the PIC, the project team will complete the next steps identified below:

- Finalize EA Report - March/April 2023
- Notice of Completion - April 2023
- Detailed design and tendering – to be determined
- Construction – to be determined

Comments received during this PIC will be used to confirm whether to move forward with our recommendations.

Thank you for participating!

Thank you for participating in the Public Information Centre for the Norfolk County Water Supply Municipal Class EA Study. Your feedback is valuable and appreciated.

Please provide comments by filling out the comment form or by contacting a member of the project team below by **March 29, 2023**:

Scott Zerbes, C.Tech.
Project Manager
Norfolk County
Phone: 519-426-5870 ext. 8014
Email: scott.zerbes@norfolkcounty.ca

Bill Banks, P.Eng.
Environmental Assessment Lead
Banks Groundwater Engineering
Phone: 519-829-4808
Email: bill.banks@banksgroundwater.ca

All information is collected in accordance with the Freedom of Information and Privacy Act.

Ministry of the Environment,
Conservation and Parks

Conservation and Source Protection Branch

14th Floor
40 St. Clair Ave. West
Toronto ON M4V 1M2

Ministère de l'Environnement, de la
Protection de la nature et des Parcs

Direction de la protection de la nature et des sources

14e étage
40, avenue St. Clair Ouest
Toronto (Ontario) M4V 1M2

Ontario

September 27, 2022

To: Janet Ivey, Source Protection Program Manager (A)
Lake Erie Source Protection Region

From: Angelune Des Lauriers, Program Analyst
Conservation and Source Protection Branch

Re: MECP Early Engagement Comments on Long Point Region proposed section 34 amendments for Bloomsburg, Norfolk County

Thank you for submitting the technical work supporting the delineation of wellhead protection areas (WHPAs) for two new wells in the community of Bloomsburg to be added to the Simcoe drinking water system in Norfolk County. We have reviewed this information as part of the early engagement stage of the process to amend the assessment report for the Long Point Source Protection Area under section 34 of the *Clean Water Act, 2006*.

The proposed amendment will incorporate two new wells (SW11/09 and SW12/20), with revised WHPA mapping, managed lands, livestock density, and impervious surfaces and identifying water quality activities, conditions, and issues that are or may be significant drinking water quality threats within the WHPAs.

Conservation and Source Protection Branch (CSPB) technical staff have reviewed the technical documents provided on September 6, 2021, and offer the following comments:

- The Martrix Solutions Inc. Consultant Reports, 2022 (reports) follow the 2021 Technical Rules (2021 TRs); therefore, the following issues should be addressed to align with the current TRs:
    1. WHPA-E delineation: given the wells' proximity to surface water bodies and hydrological characteristics of the region, please provide a rationale explaining whether or not a WHPA-E is needed. Note: the requirements for delineating WHPA-E were amended in the 2021 TRs, i.e., not solely depending on the GUDI designation of the well but rather on evidence of the hydraulic connection between the surface-water body and groundwater. Technical studies, including GUDI studies, may be used to demonstrate the connection.
    2. Impervious Surface Area (%IMP) calculations:
        a. The report used the previous %IMP thresholds under the 2013 and 2017 Technical Rules. These thresholds have been updated under the 2021 TRs. Please update the relevant sections of the reports (including maps) and the associated calculations of the %IMP to

   reflect the 2021 TRs and confirm the identified risk related to road salt application threats.
   b. The reports used the 1kmx1km grid for mapping the IMP%. This grid size is no longer required under the 2021 TRs; however, if it is chosen to identify risks related to road salt application threats, please explain that choice and include it in the documentation.

CSPB will continue to support source protection authority staff through pre-consultation for the Simcoe drinking water system. CSPB also notes that the documents provided are technical in support of an amendment to the assessment report. We look forward to reviewing the draft amendments to the assessment report and source protection plan during pre-consultation.

If you have any questions, please do not hesitate to reach out to your Liaison Officer or to me.

Angelune Des Lauriers
Program Analyst, Conservation and Source Protection Branch
angelune.deslauriers@ontario.ca (tel): 289-237-3062

Cc: Jennifer Moulton, A/Manager, Source Protection Section, CSPB
Wendy Lavender, Manager, Program Support Section, CSPB
Kathryn Baker, Hydrogeologist
George Jacoub, Hydrologist
Beth Forrest, Liaison Officer, CSPB

Ministry of the Environment,
Conservation and Parks

Environmental Assessment
Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.:   416 314-8001
Fax.:   416 314-8452

Ministère de l'Environnement,
de la Protection de la nature
et des Parcs

Direction des évaluations
environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. :   416 314-8001
Téléc. : 416 314-8452

June 15, 2023

Ian Callum
Senior Environmental Project Manager
N S. Burnett & Associates Limited
Email: ian.callum@sbaengineering.com

(Via Email Only)

Scott Zerbes
Project Manager
Norfolk County
Email: scott.zerbes@norfolkcounty.ca

Re: Simcoe Water Supply
Norfolk County
Municipal Class Environmental Assessment – Schedule B
Project Review Unit Comments – Draft Project File Report

Dear Ian Callum:

Thank you for providing the ministry with an opportunity to comment on the draft Project File Report (Report) for the above-noted Class Environmental Assessment (EA) project. Our understanding is that in order to meet future water supply demands for the planned growth within the County, Norfolk County (the proponent) has determined that the preferred alternative is a new groundwater water supply that would be located and developed to produce enough water until the Townsend-Simcoe connection is operational. Once connected with Townsend, the new well would continue to provide system resilience in the event of malfunctions with IUWSP pipelines or short-term shutdowns to allow for maintenance.

The Ministry of the Environment, Conservation and Parks (ministry) provides the following comments for your consideration.

Notices

- Please include copies of all the Notices and details of their publication in the Report. Please refer to the Section A.3.5 Public Notices of the Municipal Class EA parent document available online at https://municipalclassea.ca/manual/page25.html).

- Section 6: Notice of Completion of the Report does not reflect the changes made to the Environmental Assessment Act in July 2020, which scoped the grounds on which a s.16 order request (formerly referred to as a Part II order request) can be made to the Minister. Section 16(6) of the Environmental Assessment Act provides that a request for an order can be made only on the grounds that the order may prevent, mitigate, or remedy adverse impacts on existing Aboriginal and treaty rights of the Aboriginal peoples of Canada as recognized and affirmed in section 35 of the Constitution Act, 1982. Please update this section and ensure that the Notice of Completion contains current information.

  Further information can be found on link below:

  Class environmental assessments: Section 16 Order | ontario.ca

Planning and Policy

- A discussion of the Provincial Policy Statement (PPS), 2020, is missing from the Project File Report. As noted in Section C.1.1.1 of the Municipal Class EA document (https://municipalclassea.ca/manual/page45.html), the PPS is a key consideration for identifying land-use planning objectives and evaluating alternative solutions in Phases 2 of the Class EA process. The proponent should describe how the proposed project is consistent with these policies.

Evaluation of Alternatives

- It is recommended that the preferred alternative be highlighted in the report to provide more clarity (i.e., Highlight the preferred alternative for Table 8: Summary of Evaluation of Preferred Alternative Evaluation Scoring on Page 37).

- In order improve traceability of the decision-making process, Section 4.3.2.6 Selection of Preferred Alternative of the Report should be revised to include a brief summary of why Alternative 3C: Rail Trail was determined to be preferred over Alternative 3D: Rail Trail /

Stone Quarry Road considering that both alternatives were rated with identical overall scores in Table 8: Summary of Evaluation of Preferred Alternative Evaluation Scoring.

Climate Change

- Climate change considerations have not been documented in the Report. The document "Considering Climate Change in the Environmental Assessment Process" (Guide) (www.ontario.ca/page/considering-climate-change-environmental-assessment-process) is now a part of the EA program's Guides and Codes of Practice. The Guide sets out the ministry's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. The proponent should review this Guide in detail. The ministry expects proponents of Class EA projects to:
    - Consider the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation), as well as resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
    - Include a discrete section in the Report detailing how climate change was considered in the EA.

  How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

Agency Consultation

- All correspondence with review agency staff should be documented in the Report as per Section A.3.6 of the Municipal Class EA, 2015 document, "Review agency responses are to be documented in the Project File or the ESR." A.3.6 REVIEW AGENCIES (municipalclassea.ca).

Source Water Protection

The Simcoe Water Supply Municipal Class EA is located in the Long Point Source Protection Area and may therefore be subject to applicable policies of the approved **Long Point Region Source Protection Plan.**

Norfolk County is implementing its Inter-Urban Water Supply System (IUWSS) initiative, a regional approach to water supply, to increase the interconnection between its lower-tier municipalities, minimize overall costs of its water supply, and to improvie the resiliency of its water supply system. The IUWSS includes multiple projects including the Townsend-Simcoe Interconnection Pipeline, which is currently being assessed through a separate municipal class environmental assessment. However, in the interim and until the IUWSS is operational, the County requires additional water supply for the community of Simcoe. This additional supply is needed to manage increasing demand from a growing population and to create capacity in Simcoe's water supply system until additional water supply is provided through the IUWSS. The community of Simcoe currently obtains its water supply exclusively from groundwater through seven wells and an infiltration gallery/well system.

The preferred solution to increase the water supply for the community of Simcoe is through establishing two proposed groundwater wells, identified as SW11/09 and SW 12/20, located to the north and each of Simcoe. The raw water from the new wells is proposed to be transported by a watermain to the Nothwest Water Treatment Facility through a preferred route. Therefore, for the purposes of source protection, only the location of the proposed wells and the proposed preferred watermain route have been assessed.

The proposed location of the new groundwater wells and the preferred route for the watermain are described in the April 2023 Draft Class EA document as prepared by S. Burnett and Associates Limited and are shown in Figure 1 below. The approximate location of the SW12/20 well appears to intersect with SGRAs and with a HVA with a vulnerability score of 6. Meanwhile, the approximate location of the SW11/09 well appears to intersect with the SGRA only. The watermain, as per its preferred routing to connect the wells to the treatment facility, intersects with a WHPA-D with a vulnerability score of 6, HVA with a vulnerability score of 6, and the SGRA. Given that the proposed works (i.e., new wells and watermain) will not intersect with any high-scoring vulnerable areas, they are **not** significant drinking water threat activities.

In the Draft Simcoe Water Supply Class EA document, source water protection is discussed in section 5. This section acknowledges, albeit briefly, the need for the delineation of WHPAs around the new wells along with identifying significant drinking water threats that will be documented in the existing source protection plan through an amendment, under section 34 of the *Clean Water Act*, 2006. However, section 5 does not explicitly identify the Long Point Source Protection Area (SPA) as the applicable SPA within which the proposed works are situated, and it does not refer to the Long Point Source Protection Plan and its policies that may apply to the proposed works. Moreover, the report does not identify the vulnerable areas that intersect with the proposed works, including a WHPA-D with a vulnerability score of 6, the HVA with a vulnerability score of 6, and the SGRA. Furthermore, there is no map within the document that displays the proposed works along with the source protection vulnerable areas through which they intersect. There is an incorrect reference made to section 35 of the CWA which is a Miniser-initiated amendment to a source protection plan.

As a result of the review findings, as described above, we recommend that the proponent:

- Describe the vulnerable areas, including the WHPA-**D** with a vulnerability score of 6, the HVA with a vulnerability score of 6, and the SGRA, which intersect with the proposed works in the draft Simcoe Water Supply Class EA.
- Include mapping to show the proposed works and their intersection with the above mentioned source protection vulnerable areas.

- Provide a general summary of associated activities that may pose a risk to sources of drinking water, such as fuel storage, and ensure that the recommended mitigation measures noted under section 4.4 “Mitigation Measures for Preferred Solution” of the Class EA document are updated or revised as appropriate.
- Change the incorrect reference to section 35 of the CWA to section 34 which is a source protection authority initiated amendment to a source protection plan.

The EA proponent should also determine if any other types of drinking water systems could be affected during the construction or operation of the project that is not explicitly addressed in source protection plans, such as private systems – individual or clusters, and designated facilities within the meaning of O. Reg. 170/03 under the *Safe Drinking Water Act* – i.e., camps, schools, health care facilities, seasonal users, etc. The proponent should also consult with the local source protection authority if they have not already done so.

As above, this review for source protection has determined that the newly proposed water supply wells and watermain for the community of Simcoe are **not** significant drinking water threats and therefore no significant drinking water threat policies of the Long Point Region Source Protection Plan apply. However, given that the wells and the watermain are located in within HVAs, SGRAs with a vulnerability score of 6, and a WHPA-D with a vulnerability score of 6, they may still pose a moderate or low risk to sources of drinking water. This means moderate/low and select policies, if any, of the Long Point Region Source Protection Plan may apply (see below). In addition, within Highly Vulnerable Aquifers there may be other kinds of drinking water systems present that are not explicitly addressed by the source protection plan and the proponent should take these into consideration. EA projects should protect sensitive hydrologic features including current or future sources of drinking water not explicitly addressed in source protection plans, such as private systems – individual or clusters, and designated facilities within the meaning of O. Reg. 170/03 under the *Safe Drinking Water Act* – i.e., camps, schools, health care facilities, seasonal users, etc.

There are two policies, in particular, in the **Long Point Region Source Protection Plan** that the proponent should be aware of and consider before project development, as applicable.

- **NC-NB-1.15** as it relates to Norfolk County incorporating the location of WHPAs into their emergency response plans.
- **NC-NB-1.17** as it relates to Norfolk County working collaboratively with the Ministry of Environment, Conservation and Parks on document sharing and consultation on the issuance of prescribed instruments.

As a reminder, the proponent should consult with the local source protection authority(ies) if they have not already done so.

Figure 1. SPIA map showing the approximate locations of the two groundwater wells, SW 12/20 and SW 11/09, as well as the preferred route option for the watermain as indicated by the dashed blue line. The red pin highlights the WHPA-D scoring 6, the SGRA, and the HVA scoring 6

that the proposed watermain would intersect. The red dot on the map shows the current location of the existing water treatment facility.

Location Information

Zoom in to confirm your location and results

Latitude: **42.85463** Longitude: **-80.32211**
UTM Zone: **17**
Easting: **555384.07** Northing: **4744895.08**
Upper Tier Municipality: **N/A**
Lower Tier Municipality: **NORFOLK COUNTY**
Township Concession and Lot: **WINDHAM CON 14 LOT 2**
Assessment Parcel Address: **DAVIS ST W**
Assessment Roll #: **33104030250248000000**
MECP District: **Hamilton**
MECP Region: **West Central Region**

Source Protection Details for Location

Source Protection Area: **Long Point**
View Source Protection Plan
Wellhead Protection Area: **D** ; score is **6**
Wellhead Protection Area (WHPA-E): **No**
Intake Protection Zone: **No**
Issue Contributing Area: **No**
Significant Groundwater Recharge Area: **Yes** ; score is **N/A**
Highly Vulnerable Aquifer: **Yes** ; score is **6**
Event Based Area: **No**
Wellhead Protection Area Q1: **No**
Wellhead Protection Area Q2: **No**

Surface Water

- There are some potentials to impact the nearby surface water features for the proposed groundwater withdrawals. The ministry, therefore, recommends an appropriate surface water monitoring, contingency and mitigation plan be developed and submitted to the ministry during the long-term PTTW application for this water taking. The approved monitoring, contingency and mitigation plan will be the included in the Permit as one of the conditions of the approval.

- After a few years of monitoring, if no negative impacts on the nearby surface water features are noted, the Permit can be amended to remove the monitoring requirements.

Species at Risk

- It is the responsibility of the proponent to ensure that Species at Risk are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the site. If the proposed activities cannot avoid impacting protected species and their habitats, then the proponent will need to apply for an authorization under the Endangered Species Act (ESA). If the proponent believes that their proposed activities are going to have an impact or are uncertain about the impacts, they should contact SAROntario@ontario.ca to undergo a formal review under the ESA.

- There is a new regulation for Butternut in Ontario. Please refer to Ontario Regulation 830/21 (https://www.ontario.ca/laws/regulation/210830).

Excess Materials and Waste

- In December 2019, the ministry released a new regulation under the Environmental Protection Act, titled *On-Site and Excess Soil Management* (O. Reg. 406/19) to support improved management of excess construction soil. The regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit www.ontario.ca/page/handling-excess-soil. The Report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the ministry's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014). All waste generated during construction must be disposed of in accordance with ministry requirements.

Conclusion

- The ministry recommends that a conclusion be included to summarize important information, including the preferred alternative, how the alternative meets the problem, next steps, etc.

Thank you for circulating this Report for the ministry's consideration. Please document the receipt of this Project Review Unit Comments letter in the final report. We look forward to receiving a written response from Norfolk County to address our comments provided above.

Should you or any members of your project team have any questions regarding the material above, please contact me at joan.delvillarcuicas@ontario.ca.

Sincerely,

JoanDelVillar

Joan Del Villar Cuicas
Regional Environmental Planner
Project Review Unit, Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Park

Cc: Gavin Battarino, Project Review Unit Supervisor, MECP

Ian Callum

From:	Del Villar Cuicas, Joan (MECP) <Joan.DelVillarCuicas@ontario.ca>
Sent:	September 11, 2023 8:30 AM
To:	Ian Callum
Cc:	'bill.banks@banksgroundwater.ca'; Ryan Kyle; Scott Zerbes
Subject:	Draft Simcoe Water Supply Schedule ‘B’ Class Environmental Assessment Project File - FOR REVIEW

Good morning,

MECP Species at Risk unit has provided additional comments regarding the Draft Simcoe Water Supply Schedule B Class EA project file report. Please find comments below for your consideration:

- There are observations for American Badger (endangered, with species and regulated habitat protection) in the general area of the project. MECP recommends that the project area be surveyed for potential burrows that may be used by American Badger prior to the start of project activities to determine if there are ESA requirements for the project. While the Ministry does not have a specific protocol for American Badger, here are some general recommendations for surveying for the species, which begins with surveying for its habitat:
    - Conduct burrow surveys for the project location as well as within a 50 m range of adjacent lands if possible, focusing on a thorough coverage of woodlands, woodland edges, hedgerows, rail beds, roadsides, old fields, and edges of farm fields, etc. If open field transects are being completed, they should be no further than 20 m apart. Locations of any potential badger burrows as well as all groundhog / woodchuck burrows should be noted.
    - A minimum of two surveys throughout spring and summer to determine presence/absence of potential badger burrows is ideal.
    - Timing of day isn’t critical for when to complete surveys, as long as there is enough daylight to locate and assess burrows.
    - Generally, potential badger burrows are burrows that are 6 inches in diameter or greater. Badger burrows usually have large excavated mounds / sand piles near the entrance, lateral claw marks at the entrance, and potentially have a musky smell if the burrow has been used recently. In addition to the lateral claw marks, there may also be small indents / divots on both sides of the walls throughout the burrow (where the paw takes hold so the other paw can continue excavating). Also, if there are any nearby logs or branches, these should be checked for claw marks (instead of chew marks that a groundhog might make).
    - Data collected for each potential badger burrow should include at a minimum: UTM coordinates, observation dates, photographs (with a visible scale reference) of the entrance, inner walls, and nearby mounds.
    - Depending on the timing between surveys and proposed start date of the project, it is recommended to re-visit all potential badger burrows every few weeks or monthly to check for signs of use/occupancy.
- There are observations for Eastern Hog-nosed Snake (threatened, with species and general habitat protection) in the general area of the project. MECP recommends that potential impacts to Eastern Hog-nosed Snake and/or suitable habitat for this species be assessed. MECP also recommends that given the known occurrences in the Simcoe area, geotextile fencing with nylon mesh lining must not be used for any erosion/sediment control fencing due to the risk of injury/mortality of SAR snakes.
- SARB understands that MECP will be consulted when specific project details (e.g. detailed design, project timing) are available. An Information Gathering Form should be submitted to SAROntario@ontario.ca for review. Based on the information in the draft Environmental Study Report, the project may impact species at risk and/or protected habitat and may require authorization under the *Endangered Species Act, 2007*.

Regards,

Joan Del Villar Cuicas (she/her)
Regional Environmental Planner
Project Review Unit | Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Parks
Joan.delvillarcuicas@ontario.ca | Phone: 365-889-1180

From: Ian Callum <ian.callum@sbaengineering.com>
Sent: April 5, 2023 3:48 PM
To: EA Notices to WCRegion (MECP) <eanotification.wcregion@ontario.ca>
Cc: Bill Banks <bill.banks@banksgroundwater.ca>; Ryan Kyle <ryan.kyle@sbaengineering.com>; Scott Zerbes <Scott.Zerbes@norfolkcounty.ca>
Subject: Draft Simcoe Water Supply Schedule 'B' Class Environmental Assessment Project File - FOR REVIEW

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Good afternoon,

On behalf of Norfolk County, I am providing a link to access the Draft Simcoe Water Supply Schedule 'B' Class Environmental Assessment Project File and appendices. My understanding is that the Ministry will conduct a technical review of this report within 30 days of receipt of this report. After working with the Ministry to resolve any comments, our intent is to file a Notice of Completion for this project to initiate the 30-day Public, Agency, First Nations, and Métis review period.

If you require any additional information or clarification during your review, please feel free to contact me.

https://www.dropbox.com/sh/ypgwjlgff5n7va1/AAAD7LQVmRa3UQDw5my6xII9a?dl=0

Kind regards,

Ian

Ian Callum, M.Sc., PMP
Senior Environmental Project Manager

S. Burnett & Associates Limited
210 Broadway, Unit 203
Orangeville, ON L9W 5G4

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W: www.sbaengineering.com

S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

September 22, 2023

Project Review Unit | Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Parks

Attn: Joan Del Villar Cuicas, Regional Environmental Planner

Re: Norfolk County
Simcoe Water Supply Class EA – Addressing EA Review Comments
SBA File No: M21004

Dear Joan,

This letter includes a Comment Disposition Table that explains how Ministry of the Environment, Conservation and Parks comments from review of the Simcoe Water Supply Class EA were reflected in the updated report. This letter will be included with the revised report as part of the record of consultation.

#	Comment / Issue Identified	Resolution
1	Please include copies of all the Notices and details of their publication in the Report. Please refer to the Section A.3.5 Public Notices of the Municipal Class EA parent document available online at https://municipalclassea.ca/manual/page25.html).	References to all notices were added to the report and copies included in **Appendix A.**
2	Section 6: Notice of Completion of the Report does not reflect the changes made to the Environmental Assessment Act in July 2020, which scoped the grounds on which a s.16 order request (formerly referred to as a Part II order request) can be made to the Minister. Section 16(6) of the Environmental Assessment Act provides that a request for an order can be made only on the grounds that the order may prevent, mitigate, or remedy adverse impacts on existing Aboriginal and treaty rights of the Aboriginal peoples of Canada as recognized and affirmed in section 35 of the Constitution Act, 1982.	Section 6 of the report was revised to reflect changes made to the *EA Act*.

	Please update this section and ensure that the Notice of Completion contains current information	
3	A discussion of the Provincial Policy Statement (PPS), 2020, is missing from the Project File Report. As noted in Section C.1.1.1 of the Municipal Class EA document (https://municipalclassea.ca/manual/page45.html), the PPS is a key consideration for identifying land-use planning objectives and evaluating alternative solutions in Phases 2 of the Class EA process. The proponent should describe how the proposed project is consistent with these policies.	A new Section 2.3 Provincial Policy Statement, was added. Additionally, the preliminary screening of alternatives in Section 4.3.1 now considers the PPS.
4	It is recommended that the preferred alternative be highlighted in the report to provide more clarity (i.e., Highlight the preferred alternative for Table 8: Summary of Evaluation of Preferred Alternative Evaluation Scoring on Page 37).	The preferred alternative is now highlighted in Table 8.
5	In order improve traceability of the decision-making process, Section 4.3.2.6 Selection of Preferred Alternative of the Report should be revised to include a brief summary of why Alternative 3C: Rail Trail was determined to be preferred over Alternative 3D: Rail Trail /	The report is now clear that option 3C was selected in consideration of cost.
6	Climate change considerations have not been documented in the Report. The document "Considering Climate Change in the Environmental Assessment Process" (Guide) (www.ontario.ca/page/considering-climate-change-environmental-assessment-process) is now a part of the EA program's Guides and Codes of Practice. The Guide sets out the ministry's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. The proponent should review this Guide in detail. The ministry expects proponents of Class EA projects to:	A new section 4.3.2.6 Climate Change, was added.

	• Consider the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation), as well as resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation). • Include a discrete section in the Report detailing how climate change was considered in the EA. How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project’s level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.	
7	All correspondence with review agency staff should be documented in the Report as per Section A.3.6 of the Municipal Class EA, 2015 document, “Review agency responses are to be documented in the Project File or the ESR.” A.3.6 REVIEW AGENCIES (municipalclassea.ca).	Agency correspondence was added to Appendix A.
8	As a result of the review findings, as described above, we recommend that the proponent: Describe the vulnerable areas, including the WHPA-D with a vulnerability score of 6, the HVA with a vulnerability score of 6, and the SGRA, which intersect with the proposed works in the draft Simcoe Water Supply Class EA. Include mapping to show the proposed works and their intersection with the above mentioned source protection vulnerable areas. Provide a general summary of associated activities that may pose a risk to sources of drinking water, such as fuel storage, and ensure that the recommended mitigation measures noted under section 4.4 “Mitigation Measures for Preferred Solution” of the Class EA document are updated or revised as appropriate.	Section 5 Source Water Protection was revised to address these comments.

	Change the incorrect reference to section 35 of the CWA to section 34 which is a source protection authority initiated amendment to a source protection plan.	
9	The EA proponent should also determine if any other types of drinking water systems could be affected during the construction or operation of the project that is not explicitly addressed in source protection plans, such as private systems – individual or clusters, and designated facilities within the meaning of O. Reg. 170/03 under the Safe Drinking Water Act – i.e., camps, schools, health care facilities, seasonal users, etc. The proponent should also consult with the local source protection authority if they have not already done so.	Section 5 now documents consultation with Long Point Conservation Authority regarding source water protection. Private wells were monitored during the pumping test and as indicated in Section 4.1.3.2, the proposed pumping rate of 5,040 m3/day would not cause unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies, and the local environment, including local wetlands and flow in Davis Creek. All other potential impacts will be managed through the mitigation measures provided in Section 4.4.
10	There are two policies, in particular, in the Long Point Region Source Protection Plan that the proponent should be aware of and consider before project development, as applicable. • NC-NB-1.15 as it relates to Norfolk County incorporating the location of WHPAs into their emergency response plans. • NC-NB-1.17 as it relates to Norfolk County working collaboratively with the Ministry of Environment, Conservation and Parks on document sharing and consultation on the issuance of prescribed instruments.	Section 5.1.2 now includes the following statement: “the County will incorporate the location of the new WHPA-A into their emergency response plans to protect drinking water sources from potential spills along old Highway 24. “ The Conclusion Section now includes the following statement with regards to next steps: “Collaborate with MECP regarding the sharing of information and consultation on the issuance of prescribe instruments that relate to water quality, for example, nutrient management plans,”
11	As a reminder, the proponent should consult with the local source protection authority(ies) if they have not already done so.	Section 5 now documents consultation with Long Point Conservation Authority regarding source water protection, which is also included in Appendix A.
12	There are some potentials to impact the nearby surface water features for the proposed groundwater withdrawals. The ministry, therefore, recommends an appropriate surface water	Section 4.5 Monitoring, now includes the following: “However, to ensure that operation of the two production wells does not effect flow in Davis Creek, a

	monitoring, contingency and mitigation plan be developed and submitted to the ministry during the long-term PTTW application for this water taking. The approved monitoring, contingency and mitigation plan will be the included in the Permit as one of the conditions of the approval.	monitoring, contingency and mitigation plan will be developed and submitted to the MECP as part of the Permit to Take Water Application”.
13	After a few years of monitoring, if no negative impacts on the nearby surface water features are noted, the Permit can be amended to remove the monitoring requirements.	Noted, no further action required.
14	It is the responsibility of the proponent to ensure that Species at Risk are not killed, harmed, or harassed, and that their habitat is not damaged or destroyed through the proposed activities to be carried out on the site. If the proposed activities cannot avoid impacting protected species and their habitats, then the proponent will need to apply for an authorization under the Endangered Species Act (ESA). If the proponent believes that their proposed activities are going to have an impact or are uncertain about the impacts, they should contact SAROntario@ontario.ca to undergo a formal review under the ESA. There is a new regulation for Butternut in Ontario. Please refer to Ontario Regulation 830/21 (https://www.ontario.ca/laws/regulation/210830).	Noted, no further action required.
15	In December 2019, the ministry released a new regulation under the Environmental Protection Act, titled On-Site and Excess Soil Management (O. Reg. 406/19) to support improved management of excess construction soil. The regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit www.ontario.ca/page/handling-excess-soil. The Report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the ministry’s current guidance document titled “Management of Excess Soil – A Guide for Best Management Practices” (2014). All waste generated during construction must be disposed of in accordance with ministry requirements.	Section 4.4 Mitigation, now includes the following: “In addition to the proposed mitigation measures, all waste generated during construction will be disposed of in accordance with ministry requirements, including the *Environmental Protection Act* regulation *On-Site and Excess Soil Management (O. Reg. 406/19)* and the guidance document Management of Excess Soil – A Guide for Best Management Practices. ‘.

16	The ministry recommends that a conclusion be included to summarize important information, including the preferred alternative, how the alternative meets the problem, next steps, etc.	A new conclusion section has been added in Section 8.
17	MECP recommends that the project area be surveyed for potential burrows that may be used by American Badger prior to the start of project activities to determine if there are ESA requirements for the project.	Additional text added to Section 4.2.10 Species at Risk to reflect possible presence of American Badger. Pre-construction surveys added to Section 4.4 Mitigation Measures for referred Solution.
18	MECP recommends that potential impacts to Eastern Hog-nosed Snake and/or suitable habitat for this species be assessed. MECP also recommends that given the known occurrences in the Simcoe area, geotextile fencing with nylon mesh lining must not be used for any erosion/sediment control fencing due to the risk of injury/mortality of SAR snakes.	Additional text added to Section 4.2.10 Species at Risk to reflect possible presence of Hog-nosed Snake. Pre-construction surveys and construction mitigation measures added to Section 4.4 Mitigation Measures for referred Solution

If there is any aspect regarding how comments were addressed that could benefit from further discussion, I would be more than willing to do so on a call.

Yours truly,

Ian Callum
Senior Environmental Project Manager
S. Burnett & Associates Limited

Incl. Revised Simcoe Water Supply Class EA - DRAFT

M21004_ Norfolk EA_MECP Comments_V1_IRC_19Sep23

S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix B

Hydrogeological Report

Hydrogeological Report

2020 Well Construction, Aquifer Testing, and Monitoring Program

Community of Simcoe

Additional Water Supply Class Environmental Assessment

July 2021

Prepared for:

Norfolk County

Environmental and Infrastructure Services Division

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario NOB 2J0
519.829.4808 banksgroundwater.ca

Banks Groundwater Engineering Limited
940 Watson Road South, RR 1 Puslinch, Ontario N0B 2J0
519.829.4808 banksgroundwater.ca

27 July 2021

Mr. Scott Zerbes, Project Manager
Engineering, Environmental and Infrastructure Services Division
Corporation of Norfolk County
185 Robinson Street, Suite 200
Simcoe, Ontario, N3Y 5L6

Re: Hydrogeological Report
2020 Well Construction, Aquifer Testing, and Monitoring Program
Simcoe Water Supply Class Environmental Assessment
Norfolk County

Dear Mr. Zerbes,

On behalf of our project team, I am pleased to submit this Hydrogeological Report. In 2019, an updated work plan was jointly prepared by Banks Groundwater Engineering Limited (BGE) and Natural Resource Solutions Inc. (NRSI). The scope of work presented in this work plan has been completed and this report presents the results.

A second test production well has been constructed and an aquifer testing, and monitoring program was successfully completed. Analyses of the results support the conclusion that the sustainable yield for the aquifer at the locations of test production wells SW11/09 and SW12/20 is 3,500 L/min (5,040 m^3/day or 770 Igpm). The seven-day aquifer performance test at this total combined rate has confirmed this sustainable yield for the aquifer, without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies, and the local environment, including local wetlands and flow in Davis Creek.

I trust the information provided in this report meets your current requirements. Should you have any questions or comments, please contact me.

Respectfully submitted,
Banks Groundwater Engineering Limited

WDBanks

William D. Banks, P.Eng.
Principal Hydrogeologist
Bill.Banks@banksgroundwater.ca

Encl.

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1 Introduction and Background

Groundwater is the sole water supply source for the Community of Simcoe. The water supply for Simcoe is currently drawn from seven wells and an infiltration gallery/well system. Maximum daily water supply requirements for the community are increasing and additional sources are required to augment these existing limited sources. A search for additional sources began in 2008 with a groundwater investigation. The primary objective of this investigation was to evaluate the potential of developing new municipal wells capable of providing additional capacity.

Based on the outcome of the groundwater investigation, the Corporation of Norfolk County initiated a study to identify, evaluate, and document a recommended solution for new municipal water supply sources in the identified study area northeast of Simcoe, with consideration for environmental, cultural, social, natural, technical, and economic factors. This project is being completed as a Schedule "B" Municipal Class Environmental Assessment (Class EA) under Ontario's Environmental Assessment Act. This project was initiated in September 2010 and a Notice of Study Commencement was issued in November 2010.

Since completion of the initial investigation in 2010, subsequent testing and monitoring was completed on a test production well located northeast of Simcoe. Following review of a first draft of a report on the results of this program by Provincial and Conservation Authority Staff, the following report was completed:

> *Revised Draft Report, 2012 Monitoring and Aquifer Testing Program, Community of Simcoe Additional Water Supply Class Environmental Assessment. September 2015. Prepared for the Public Works & Environmental Services Department of Norfolk County, by Banks Groundwater Engineering Limited.*

A work plan was then prepared in 2016 on the basis of comments received to confirm a sustainable groundwater supply of is available from two test production wells, without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies and the local environment, including local wetlands and streamflow in Davis Creek. Provided the measured effects and projected future effects are acceptable, the next steps will be to complete the Municipal Class Environmental Assessment (EA) and apply for a Permit to Take Water (PTTW) for a new groundwater supply source for the Community of Simcoe in Norfolk County.

In 2019, an updated work plan was jointly prepared by Banks Groundwater Engineering Limited (BGE) and Natural Resource Solutions Inc. (NRSI). During initial preparation of the work plan in 2016, NRSI staff reviewed all comments received previously from agencies, with particular interest in those provided by staff from the Ministry of Natural Resources and Forestry (MNRF), and Long Point Region Conservation Authority (LPRCA), and the respective responses of our project team that are provided in the above-referenced report. The updated work plan reflected comments received following circulation of the 2016 version, as well as updates to information sources. The work plan was also prepared to be submitted to the Ministry of the Environment, Conservation and Parks (MOECP), in support of an Application for a Category 3 PTTW for the completion of the testing and monitoring program described herein.

The scope of work presented in the 2019 work plan has now been completed and this report presents the results. A second test production well has been constructed and a testing and monitoring program has been successfully completed. Analyses of the results support the conclusion that the sustainable yield for the aquifer at the locations of test production wells SW11/09 and SW12/20 is 3,500 L/minute (5,040 m^3/day or 770 Igpm). The seven-day aquifer performance test at this total combined rate has confirmed this sustainable yield for the aquifer, without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies, and the local environment, including local wetlands and flow in Davis Creek.

2 Characteristics of Site and Local Area

2.1 Land and Water Use

The local area surrounding the potential municipal wells site is predominantly agricultural and rural residential. The Community of Bloomsburg is located northeast of the site. The two test production wells, previous test wells, and some of the monitoring wells are situated on an abandoned rail line that has been converted to a public trail. These various land uses are shown in Figure 1 (Appendix A).

All residential, commercial, institutional (i.e. school), and agricultural land uses are serviced by private water wells and waste disposal systems. There are several local ponds that are, or have been, used for agricultural irrigation. A review of Permit to Take Water mapping on the MOECP website, indicated there were three active Permits associated with groundwater and surface water sources located within a radius of about 1.0 km of the test production wells. The Permit database (updated as of 30 November 2020) was reviewed to confirm the status of each Permit shown on the map. The permitted sources included one well and two ponds. One of the ponds is on-line, being directly connected to Davis Creek, while the other pond had been at one time. Each of these sources have been previously used for irrigation purposes, but it is understood not in recent years. There was no observed irrigation in 2019 and 2020 during the test production well construction and testing program, and the corn crops surrounding these sources would not typically be irrigated. The locations of these Permitted sources are shown in Figure 2. Water levels in each of these Permitted sources were monitored as part of the testing program described in Section 5.

2.2 Geology

The following is a brief summary of the bedrock and overburden geology that is relevant to this project. This summary is derived from detailed descriptions of the local and regional geology provided in several Ontario Geological Survey publications. An updated interpretation of the overburden (Quaternary) geology is available from the Long Point Tier 3 Water Budget and Local Area Risk Assessment (Matrix Solutions Inc., 2015). The Tier 3 work was completed over the period 2010 to 2015. The project included extensive drilling and core sampling of overburden deposits to the bedrock surface, providing additional information to support refinement of the regional geologic conceptual model. Prior to this drilling and sampling program, the regional geologic model relied on water well records from the Ontario Government database. The results of drilling, sampling, and monitoring well installation completed by our Project Team as part of the 2012 Monitoring and Aquifer Testing Program were also subsequently incorporated into the geologic model by Matrix. Therefore, this refined interpretation has been incorporated into the assessment of the local hydrogeology within the Simcoe Water Supply Municipal Class EA study area.

2.2.1 Bedrock Geology

Bedrock units underlying the study area consist mainly of carbonate (limestone and dolostone) rocks of Silurian to Devonian age. These units are part of the Michigan Basin marine sediments, deposited from approximately 480 to 300 million years ago. The rock units dip to the southwest at about 5 to 7 m/km, and are predominantly interbedded and layered limestone, dolostone and shale.

The uppermost bedrock formations in the local area include the Dundee Formation and the Detroit River Group. The rocks of the Dundee Formation are reported to be a grey to brown fossiliferous limestone. Within this region, the Detroit River Group consists of the Onondaga, Lucas, and Amherstburg Formations. The Onondaga Formation consists of cherty fossiliferous limestone. Overlying the Onondaga Formation are the crinoidal limestones and dolostones of the Amherstburg Formation. The Lucas Formation conformably overlies the Amherstburg Formation and consists of microcrystalline limestone. The local bedrock geology, as mapped by the Ontario Geological Survey, is shown in Figure 3.

2.2.2 Overburden Geology

The bedrock is overlain by a thick veneer of sediments deposited during the Quaternary Period. It has been previously reported that the sedimentary deposits in this region were deposited mainly during the late Wisconsinan glacial period (beginning 25,000 years before present). The Laurentide ice sheet repeatedly advanced and retreated through Ontario. The ice front advanced during cold periods (glacial stades) and retreated when the climate temporarily warmed (glacial interstades), leaving behind a complex sedimentological record. During the Late Wisconsinan, the Laurentide ice sheet thinned and formed a number of sublobes. Each of these sublobes deposited a series of distinct tills and associated landforms. Deposits within this region are predominately associated with the advance and retreat of ice lobes originating from the Lake Erie and Lake Ontario basins.

During the Port Huron Stade (about 13,000 to 13,500 years ago), the ice sheet deposited the Wentworth Till and the Paris and Galt Moraines. The Wentworth Till is the youngest till deposit in this area and is commonly buried beneath more recent glaciolacustrine deposits. Wentworth Till is described as a stony silt till that coarsens inland. The western flank of the buried Galt Moraine is apparent in the northeast part of the study area at Bloomsburg and to the north. Coarse-grained interstadial deposits also occur beneath the younger glaciolacustrine surficial deposits and the Wentworth Till.

Within the study area, surficial deposits have been mapped as predominantly medium-to coarse-textured glaciolacustrine deposits of the Norfolk Sand Plain. These deposits comprise fine to medium sand, are massive to laminated, and were deposited in the shallower parts of glacial lakes. Fine-textured glaciolacustrine deposits of the Haldimand Clay Plain occur at surface east of the study area and consist of fine-grained silts and clays, deposited in a deep glacial lake basin. The local Quaternary geology, as mapped by the Ontario Geological Survey, is shown in Figure 4.

2.3 Hydrogeology

2.3.1 Bedrock Aquifers

The occurrence and movement of groundwater in bedrock formations are governed by the rock type, structure and, in some cases, by the thickness and type of the overlying overburden. In sedimentary rocks such as those in the study area, groundwater occurs in the weathered rock, bedding planes and most commonly in the fractures, crevices, vugs, and other pore spaces characteristic of carbonaceous (dolostone/limestone) rocks.

Locally, most wells are completed in the overburden with few local bedrock wells that are typically completed in the upper 10 to 30 m of the bedrock. The required capacities for domestic wells are small, typically less than 65 m^3/day, so drilling usually ends when this yield is achieved. The depth of bedrock wells is therefore dependent on the thickness of overburden and the depth of rock drilled to obtain the required water supply. Drilling to greater depths is uncommon locally, as typically poorer water quality occurs in deeper bedrock formations in this area. A review of available water well records, on-file with the MOECP, indicated there are three bedrock water supply wells located about 0.9 km east-northeast of the test production wells (i.e. two domestic wells and an irrigation well located south of Bloomsburg Public School). Otherwise, there are no other recorded bedrock water supply wells located within 1.0 km of test well.

The well record for the bedrock irrigation well, located about 1.0 km east of the test production wells indicates it is 120 m deep, with top of bedrock occurring at about 39 m, and water was found at depths of 61 and 102 m. Although not in use in recent years, there is an active Permit to Take Water for this well. Water levels in this well were monitored for the aquifer testing program.

2.3.2 Overburden Aquifers

Overburden in the study area is highly variable in thickness and composition. Significant aquifers are found in areas of greater overburden thickness containing a higher percentage of sands and gravels. Two overburden aquifer types have been identified in this region, those being an unconfined upper overburden aquifer (e.g. Norfolk Sand Plain) and semi-confined (i.e. leaky) lower overburden aquifer sequences. The Tier 3 hydrogeological characterization has indicated in this area the glaciolacustrine sands and silts/clays were deposited on a fairly regional scale and represent local and regional aquifers and aquitards, respectively. The lower overburden aquifers, while not as continuous, were found to extend over much broader areas than had previously been interpreted, largely due to the previous lack of deeper wells. The Wentworth Till has been interpreted to be a semi-confining layer of varying thickness in the local area.

Most wells within the study area derive groundwater supplies from one of the overburden aquifers. Well depths are highly variable, which can be attributed to the local occurrence and characteristics of the overburden aquifers and the specific water supply requirements of the well owner. Water uses identified in this area include domestic, agricultural, institutional, and commercial. Municipal wells are located to the southwest (i.e. Simcoe's Northwest Well Field) and to the north (i.e. Waterford's Well Field).

Recognizing the variability of water well types and depths in the local area, groundwater level monitoring during the 2020 pumping test program included previous test wells and monitoring wells completed at various depths, private wells, and shallow piezometers. A detailed description of the monitoring methodology is presented in Section 5, which illustrates the spatial and depth range of groundwater monitoring. These monitoring locations are included in hydrogeological cross-sections to illustrate the interpreted overburden aquifers and semi-confining layer within the study area, as described in Section 7.

2.4 Surface Water

The local area around the potential municipal wells site is drained by Davis Creek, which is a tributary of the Lynn River. Two intermittent branches of Davis Creek originate north of Old Highway 24 (or Bloomsburg Road), as depicted in Figure 1. The locations of surface water resources shown in this figure are based on the 2004 MNR NRVIS data. Some modifications were made to illustrate the correct alignment of Davis Creek in the vicinity of the potential municipal wells site, based on site observations made by the Project Team.

The west branch of Davis Creek flows southerly, crossing Old Highway 24 approximately 500 m east of Highway 24. South of Old Highway 24, this tributary flows southwesterly for another 600 m, before continuing southerly for about 430 m where it merges with the east branch.

The east branch originates as two tributaries in areas north and east of Bloomsburg. These tributaries merge about 160 m northeast of the intersection of Old Highway 24 and Cloet Road. This is just north of an inactive irrigation pond. The east branch then flows southwesterly, crossing beneath Old Highway 24, approximately 1250 m east of Highway 24, on the east side of the intersection with Cloet Road (i.e. between an inactive irrigation pond [Pond 2] and Cloet Road). The east branch then flows southwesterly under Cloet Road into a large on-line pond located approximately 100 m south of Old Highway 24, between Cloet Road and the rail trail. The pond, which in Section 5.3 is referred to as Pond 1, is approximately 130 m long and 20 m wide. The east branch outlets from the pond at the southwest end, flowing southwesterly for about 100 m, and then westerly through a culvert under the rail trail (i.e. about 40 m northeast of test well SW11/09). The east branch continues to meander in a southwesterly direction, somewhat parallel to the rail trail, for about 640 m to where it converges with the west branch.

From the confluence of the west and east branches, Davis Creek flows southwesterly passing beneath Highway 24, approximately 1200 m south of the intersection with Old Highway 24. Another tributary of Davis Creek flows from the area north of 14th Street East and merges with the other tributaries within the northern part of Simcoe. The main branch of Davis Creek then flows southerly where it merges with Patterson Creek from the west. These two creeks combine with Kent Creek and form the headwaters of the Lynn River, which flows from about the geographic centre of Simcoe southeasterly to Port Dover where it ultimately discharges to Lake Erie.

3 Test Production Well Construction and Development

The construction and development of two test production wells (i.e. potential municipal production wells) has occurred in the project area in two phases. Following the successful testing of test production well SW11/09 in 2009 and 2012, it was recommended that an additional test production well be constructed to permit testing and assessment of higher aquifer potential in this area. Construction and development of this additional test production well, SW12/20, is described below. The locations of test production wells SW11/09 and SW12/20 are depicted in Figure 5.

3.1 Previous Test Production Well – SW11/09

Test production well SW11/09 was drilled and constructed in 2009 as part of the Norfolk County Simcoe / Waterford Groundwater Investigation. The well was tested during this investigation, and subsequently in 2012. The results and evaluation of the 2012 testing and monitoring program were documented in the previously-referenced report (BGE, 2015).

3.2 Additional Test Production Well – SW12/20

Following a tendering process by Norfolk County, the Simcoe NE Well Construction Project (Contract PW-E-19-45), was awarded in July 2019 to Aardvark Drilling Inc., of Guelph, Ontario.

3.2.1 Drilling and Construction – SW12/20

The initial step in well construction, as per the Contract Specifications, was the drilling of a pilot hole at the selected location of the planned test production well SW12/20. The primary purpose of the pilot hole was to drill and collect samples of the aquifer material (i.e. sand and gravel), to support the design of the well. The drilling and sampling were completed in August 2019. Selected samples of the aquifer material were then submitted to a laboratory for grain-size distribution analyses. A temporary PVC well casing was installed in the pilot hole, to permit geophysical logging to assist in the assessment of the aquifer material. The geophysical logging included natural gamma, electrical resistivity, and conductivity.

The results of the grain-size distribution analyses and geophysical logging indicated a suitable aquifer occurred in the interval of 13.7 to 27.4 m, below grade. The selected well screen interval was from 15.2 to 24.4 m, with a uniform slot size of 0.76 mm (0.030 inches). The well was then designed to comprise a nominal 305 mm diameter well casing, with a nominal 305 mm diameter, pipe-size, stainless steel, gravel-pack well screen, and a sump extending 4.0 m below the well screen. This design required the over-drilling of the pilot hole and the installation of a temporary steel well casing, with a nominal diameter of 457 mm. Following a review of the Contractor’s well design, it was recommended that all required components be ordered. Upon delivery of the well components to the site, well construction began in March 2020. Well construction was completed by the end of March 2020.

Prior to grouting the well casing, a well plumbness test and an alignment test were completed. This was to determine the well was constructed with casing set round, straight and plumb. To demonstrate the compliance with this requirement, the Contractor performed tests in accordance with ANSI/AWWA A100-06 Standard for Water Wells. As per this standard, it was demonstrated that the test pipe or dummy moved freely through the length of the casing and the well did not vary from plumb, in excess of 2/3 the smallest diameter of the part of the well being tested per 30 m (98 ft) of depth.

Upon completion of this stage, all construction materials and equipment, as well as contained cuttings, drilling fluids, and water, were removed from the site.

3.2.2 Well Development – SW12/20

Development of the test production well began in June 2020, following receipt of the required Permit to Take Water (PTTW) from the MOECP (refer to Appendix B). The goal of development for this project was to yield water that is pumped from the well having turbidity of less than five Nephelometric Turbidity Units (NTU) and a sand content of less than 5 mg/L, under cyclic operation, at a pumping rate of at least 1,820 L/minute (2,620 m^3/day or 400 Igpm).

Well development methods included mechanical surging and pumping, assisted by compressed air surging and lifting. A non-ionic, polymer dispersant (i.e. NuWell®) was injected into the well to remove sits and clays associated with the drilling fluids. Development by cyclic pumping using a submersible pump was also conducted later in the development process. Once it had been confirmed by multiple water samples with low turbidity and sand content, the well was considered developed and ready for stop-start testing.

Verification of turbidity and sand-free conditions was achieved by performing stop-start tests. This included pumping the well for five periods of 10 minutes, sequentially increasing the rate up to 1,820 L/minute (2,620 m^3/day or 400 Igpm), followed by 10 minute intervals of non-pumping. This testing was completed on 7 July 2020.

The following week, a video inspection of the well was performed by the Contractor. The purpose of the video inspection was to provide a video record of the well screen and casing immediately following construction to verify proper construction and installation of the well screen and for future reference. The process of installing and constructing the test production well must not alter the shape, size, configuration, or strength of the well casing, well screen, welds, or any other material used to construct the well.

4 Initial Short-Term Testing of Test Production Wells

To assess well efficiency and to select a pumping rate for each of the test production wells, that could be sustained for the duration of the aquifer performance test, step-drawdown tests were performed on each well as described below.

4.1 Step-Drawdown Testing – SW12/20

A test pump was installed in test well SW12/20, in preparation for step-drawdown testing on 8 July 2020. The step-drawdown test was performed to assess well performance factors and to select a pumping rate that could be sustained for the duration of the aquifer performance test. The well was tested at four rates stepped up from 634, to 1,234, to 1,817, to 2,417 L/minute (913, to 1,777, to 2,616, to 3,480 m^3/day), with each step including 60 minutes of pumping followed by 60 minutes of recovery. Pumping rates were measured by an inline electromagnetic meter and controlled by a gate valve. The water pumped from the well was carefully dispersed into the nearby wetland, at a sufficient distance to not affect water levels in the test well.

The results of the Mogg-type step-drawdown test are presented in Graph 1 (Appendix C1), as drawdown versus time since pumping started. The drawdown at 60 minutes for each step versus pumping rate is presented in Graph 2, which illustrates the interpreted efficiency of the well.

4.2 Step-Drawdown Testing – SW11/09

A test pump was installed in test well SW11/09, and step-drawdown testing was conducted on 23 September 2020, to assess well performance factors. The well was tested at three rates stepped up from 1,000, to 1,400, to 1,880 L/minute (1,440, to 2,016, to 2,707 m^3/day), with each step including 60 minutes of pumping followed by 60 minutes of recovery. Pumping rates were measured by an inline electromagnetic meter and controlled by a gate valve. The water pumped from the well was carefully dispersed into the nearby wetland, at a sufficient distance to not affect water levels in the test well.

The results of the Mogg-type step-drawdown test are presented in Graph 3 (Appendix C1), as drawdown versus time since pumping started. The drawdown at 60 minutes for each step versus pumping rate is presented in Graph 4, which illustrates the interpreted efficiency of the well.

Upon completion of the step tests, the data was analyzed to determine sustainable pumping rates for the aquifer performance test. The project team and the Contractor also began preparing for the monitoring program that would begin in advance of the start of pumping, as described in the following Section.

5 Monitoring Methodology

The various components of the monitoring program that were established prior to the start of the aquifer testing period are described in detail in the following sub-sections. Monitoring completed by the NRSI Biologists is presented in the accompanying Natural Environment Assessment Report, 2021.

5.1 Private Water Wells and Ponds

A well survey of the local area was conducted in 2019 to request information from well owners. This survey was intended to determine the types of wells in use (e.g. drilled, dug, sandpoint), water use, concerns related to available water quantity and water quality, among other attributes. Well owners were also asked if their well was accessible for inspection and possibly for water level measurements during the planned aquifer testing program. The survey also provided the opportunity to indicate if a pond and/or other surface water features were located on the property of the well owners. An uncompleted version of the well survey is included in Appendix D. There were 110 surveys issued to addresses within the survey area (as depicted on Figure 6). A total of 23 completed surveys were returned in the pre-addressed, postage paid, envelopes provided.

Following receipt of the 23 completed surveys, arrangements were made to meet with each of the 15 well and/or pond owners who had indicated their respective wells and/or ponds were currently accessible for water level monitoring. Each well was then inspected to determine accessibility (i.e. well cap/lid could be readily removed, and a water level measuring device could be safely lowered into the well). Of the 13 wells inspected, ten wells were found to be accessible, the remaining three were not readily accessible. After discussion with two owners, one of two accessible wells on adjacent properties was preferred for monitoring. The locations of the nine wells and the three ponds selected for water level monitoring are shown in Figure 6, and further information is provided in Sections 5.2 and 5.3.

5.2 Groundwater Monitoring Methodology

In advance of the planned aquifer testing, groundwater monitoring stations were established at various locations within and beyond the anticipated area of influence (i.e. the area where groundwater levels could be reasonably expected to respond to pumping of the test wells based on previous test results). Prior to, during, and following the aquifer testing, groundwater levels were measured and recorded in each monitoring station. Data loggers were installed in all stations and recorded groundwater levels at ten-minute intervals. Manual measurements were also taken and recorded throughout the monitoring period on a less frequent basis. The groundwater monitoring stations included the following:

- two test production wells
- four existing test wells and eleven existing monitoring wells
- nine private water wells
- nine shallow creek-bed piezometers
- two shallow wetland piezometers.

The locations of these groundwater monitoring stations are shown in Figure 7, which demonstrates the extensive spatial coverage of the local area. The well records for the test production wells, test wells, and private wells (where available), and logs of monitoring wells are presented in Appendix E. A brief description of each type of groundwater monitoring station follows and key attributes of all stations are summarized in Table 1 below.

5.2.1 Test Production Wells

The test production wells, SW11/09 and SW12/20, were completed in the deeper overburden aquifer. Construction details for these wells are provided in the well records and also well construction sketches in Appendix E.

5.2.2 Test and Monitoring Wells

The four existing test wells (i.e. labelled as SW1/08, SW7/08, SW9/08, and SW10/09) are the wells installed as part of the previous Simcoe/Waterford Groundwater Investigation completed in 2010.

The 11 existing monitoring wells were installed at various times for different purposes. Monitoring well MW1/09, located near test well SW11/09, was installed prior to the testing performed on test wells SW10/09 and SW11/09 in 2009. Monitoring well MW2/11 was installed in 2011, at a location near Old Highway 24 and Cloet Road, to provide for monitoring of groundwater levels in the same deeper aquifer that SW11/09 is completed (i.e. the aquifer that is expected to be the municipal supply source).

Two groups of three monitoring wells (i.e. labelled as LP-MW-2-10, and LP-MW-15-10) were installed in 2010, as part of the Long Point Tier 3 Water Budget and Local Area Risk Assessment. These monitors were installed at various depths and in some cases different water-bearing zones.

Prior to the 2012 testing of SW11/09, three additional monitoring wells were installed in response to input received from local residents following an April 2012 Public Information Centre (PIC). The first monitor (MW3/12) was installed at a location south of the test well site along the rail trail, a short distance north of the 13th Concession Rd. Our study team was advised that domestic wells in this area are shallow sandpoints and therefore could not be monitored during the testing period. This shallow monitor was completed in the overburden aquifer.

The second new monitor (MW4/12) was installed at a location adjacent to MW2/11, but completed in the uppermost part of the semi-confined aquifer at a mid-point between the test well and the Community of Bloomsburg. Due to the limited number of available and accessible domestic wells in Bloomsburg, a shallow water table monitor (MW5/12) was installed on a privately-owned property, at a north-central location within the Community.

5.2.3 Private Water Wells

As described above, nine private water wells were selected for monitoring of groundwater levels. The private wells are labelled PW1/20 through PW9/20, on Figures 6 and 7. The well records for all private wells, except one, are included in Appendix E. The well record for PW9/20 could not be located in the MOECP database and the well owner has also been unsuccessful in finding a record. The available well records indicate seven of the private wells were completed in an overburden aquifer and one was completed in the bedrock. The well without a record is presumed to also be completed in an overburden aquifer (i.e. it was not possible to measure the well depth).

5.2.4 Creek-Bed and Wetland Piezometers

As described in Section 2.4, Davis Creek flows through the local area and within about 40 m of both test production wells. To establish whether the test pumping had any measurable effects on the shallow groundwater regime beneath Davis Creek, small-diameter piezometers were installed at the edge of the creek at nine locations in late-September/early-October 2020. The piezometers were manually driven to depths averaging about 1.1 m below the streambed. The static groundwater levels relative to the creek-bed level at each piezometer, measured prior to the pumping test, are listed in Table 1. Upward hydraulic gradients were apparent in eight of the nine creek-bed piezometers.

Two piezometers (PZ4/20 and PZ8/20) were installed in wetlands located south of the test production wells, adjacent to the rail trail. Piezometer PZ4/20 was driven to a depth of 1.1 m below ground level. On the day of installation, the wetland soils were dry at surface and subsequent measurements determined the shallow groundwater level at this location to be below the piezometer, as it was dry the entire monitoring period. Piezometer PZ8/20 was located on the east side of the rail trail. It was also driven to a depth of 1.1 m below ground level. The wetland soils were damp on the day of installation and subsequent water level measurements confirmed a shallow groundwater level close to ground surface throughout the monitoring period.

Table 1: Groundwater Monitoring Locations Summary

Groundwater Monitoring Station	Monitor Type	Screened Interval (m bgl)	Overburden Aquifer Type (or Bedrock as noted)	Static Water Level (m bmp) (20 Oct 2020)
SW12/20	Pumped Test Well	15.2 - 24.4	Semi-Confined (Leaky)	2.95
SW11/09	Pumped Test Well	15.5 - 18.6	Semi-Confined (Leaky)	3.09
SW1/08	Monitored Test Well	38.7 - 41.1	Semi-Confined (Leaky)	4.22
SW7/08	Monitored Test Well	15.5 - 18.9	Semi-Confined (Leaky)	3.09
SW9/08	Monitored Test Well	9.4 - 12.8	Semi-Confined (Leaky)	4.87
SW10/09	Monitored Test Well	9.1 - 11.9	Semi-Confined (Leaky)	4.24
MW1/09	Monitoring Well	14.7 - 15.8	Semi-Confined (Leaky)	2.61
MW2/11	Monitoring Well	22.9 – 25.9	Semi-Confined (Leaky)	3.05
MW3/12	Monitoring Well	4.6 - 7.6	Semi-Confined (Leaky)	4.73
MW4/12	Monitoring Well	4.6 - 7.6	Semi-Confined (Leaky)	2.70
MW5/12	Monitoring Well	6.1 - 9.1	Unconfined	7.33
LP-MW-02-10S	Monitoring Well	3.0 - 6.1	Aquitard	6.96
LP-MW-02-10I	Monitoring Well	10.1 - 11.6	Semi-Confined (Leaky)	9.98
LP-MW-02-10D	Monitoring Well	19.1 - 20.6	Semi-Confined (Leaky)	9.90
LP-MW-15-10S	Monitoring Well	2.4 - 5.5	Unconfined	4.26
LP-MW-15-10I	Monitoring Well	13.4 - 14.9	Unconfined	4.29
LP-MW-15-10D	Monitoring Well	20.1 - 21.6	Semi-Confined (Leaky)	4.37
PW1/20	Private Water Well	15.2 - 16.5	Semi-Confined (Leaky)	3.73
PW2/20	Private Water Well	16.0 - 17.2	Semi-Confined (Leaky)	6.20
PW3/20	Private Water Well	14.5 - 18.5	Semi-Confined (Leaky)	10.74
PW4/20	Private Water Well	15.8 - 18.3	Semi-Confined (Leaky)	11.34
PW5/20	Private Water Well	13.7 - 15.2	Unconfined	9.87
PW6/20	Private Water Well	41.1 - 120	Bedrock Confined	15.17
PW7/20	Private Water Well	15.2 - 16.8	Unconfined	9.47
PW8/20	Private Water Well	9.4 - 10.7	Semi-Confined (Leaky)	4.70
PW9/20	Private Water Well	unknown	unknown	3.73
PZ1/20	Creek-bed Piezometer	0.3 - 0.6	Unconfined	1.63
PZ2/20	Creek-bed Piezometer	1.0 - 1.3	Unconfined	1.09
PZ3/20	Creek-bed Piezometer	1.0 - 1.3	Unconfined	0.97
PZ4/20	Wetland Piezometer	0.8 - 1.1	Unconfined	Dry
PZ5/20	Creek-bed Piezometer	0.8 - 1.1	Unconfined	1.00
PZ6/20	Creek-bed Piezometer	0.7 - 1.0	Unconfined	1.05
PZ7/20	Creek-bed Piezometer	0.9 - 1.2	Unconfined	1.02
PZ8/20	Wetland Piezometer	0.8 - 1.1	Unconfined	1.28
PZ9/20	Creek-bed Piezometer	0.8 - 1.1	Unconfined	1.12
PZ10/20	Creek-bed Piezometer	0.8 - 1.1	Unconfined	1.08
PZ11/20	Creek-bed Piezometer	0.8 - 1.1	Unconfined	1.13

5.3 Surface Water Monitoring Methodology

5.3.1 Creek Stage Monitoring

Davis Creek water levels (i.e. stage) were measured and recorded at three locations adjacent to creek-bed piezometers. These locations were labelled with the same station number as the adjacent piezometer, which were: DCS1/20, DCS3/20, and DCS11/20. The locations of these Davis Creek stage monitors are shown in Figure 8. These stations consisted of a 1.0 m length of nominal 40 mm diameter, ABS pipe, with multiple saw-cut slots over the bottom 0.5 m-interval, and bottom and top caps. Each were set on the creek-bed and fastened to the adjacent piezometer.

5.3.2 Irrigation Ponds

Water levels were also recorded with data loggers installed in three nearby ponds, depicted as Ponds 1, 2, and 3, in Figures 6 and 8. The study team was advised that Ponds 2 and 3 have not been used for irrigation purposes in recent years. It was also apparent from the crops planted adjacent to Pond 1 in 2019 and 2020 (i.e. corn), that irrigation was not required.

During the 2009 monitoring and testing of test well SW10/09, the Project Team was contacted by the owner of a shallow dugout pond, indicating that the water level in the pond appeared to decline during the testing of this well, but recovered shortly following a rainfall event after pumping ended. It was later determined that this pond was located within about 100 m of SW10/09 (refer to Figure 6), but it was not confirmed that the pumping of this well had affected this pond. There were no reported changes in the pond water level during the 2009 testing of SW11/09, which had been completed several days earlier. The pond is interpreted to be beyond the area of influence of SW11/09 and SW12/20. Also, despite the notifications distributed in 2019, no response was received from the owner of this pond granting access to monitor during the 2020 testing program.

5.4 Precipitation Monitoring Methodology

A rain gauge was installed at test production well SW12/20 to measure and record precipitation prior to, during, and following the aquifer testing period. This data was augmented by the precipitation recorded at the Delhi Climate Station, for the period leading up to the aquifer test and following the recovery period.

6 Aquifer Performance Test

To establish the long-term sustainable available supply from the semi-confined (i.e. leaky) overburden aquifer, an aquifer performance test (i.e. pumping test) was conducted by pumping the test production wells, SW11/09 and SW12/20, at a constant combined rate for a period of seven days. The details of the testing methodology and the testing results are presented in this Section. Analysis of the testing results is presented in Sections 7 through 9.

6.1 Testing Methodology

6.1.1 Permit to Take Water

Prior to performance of the aquifer test (i.e. pumping test), a Category 3 Permit to Take Water (PTTW) was obtained from the MOECP (i.e. Number 8647-BQAMC5). A copy of the PTTW, issued 15 June 2020, is included in Appendix B. A maximum pumping rate of 4,250 L/minute (6,120 m^3/day or 935 Igpm), for a period of up to seven days was authorized for the aquifer performance testing purposes. The notifications issued to the public in advance of the testing program are included in Appendix D.

6.1.2 Period and Rate of Pumping

The aquifer performance test began on 20 October 2020 at 10:00 a.m., at a combined pumping rate of 3,500 L/minute (5,040 m^3/day or 770 Igpm), with SW11/09 pumped at 1,365 L/minute (1,965 m^3/day or 300 Igpm), and SW12/20 pumped at 2,135 L/minute (3,075 m^3/day or470 Igpm). Pumping continued at this combined constant rate for an uninterrupted period of seven days. Pumping ceased at 10:00 a.m. on 27 October 2020.

6.1.3 Controlling, Measuring and Recording of Pumping Rates

Throughout the aquifer test, the pumping rates for each test production well were measured by an inline electromagnetic meter and controlled by a gate valve. Instantaneous pumping rates were recorded during the testing periods and total volumes pumped were recorded from the meter totalizer at the conclusion of each pumping period.

6.1.4 Discharge of Water from Test Production Wells

The water pumped from the test production wells was transmitted by flexible hoses and discharged using a control structure temporarily installed in Davis Creek at a location about 470 m southwest of the test production well SW11/09, and about 10 m downstream of the piezometer PZ5/20. This discharge location is shown in Figures 7 and 8.

6.1.5 Water Level Monitoring in Test Production Wells and Other Locations

Groundwater levels were manually monitored frequently in the test production wells, throughout the pumping period and during the recovery period. As noted above, groundwater and surface water levels were also measured and recorded every ten minutes with data loggers, installed in the test production wells and all monitored wells, piezometers, Davis Creek, and ponds. Barometric pressure was also recorded by an on-site data logger for subsequent compensation of water levels (i.e. pressure readings). Manual measurements of groundwater levels at all locations, taken at key times during the monitoring and testing program, were used to calibrate the respective data logger readings relative to measuring points (e.g. top of well casing).

The data loggers were installed at least two weeks prior to the start of the pumping period at almost all groundwater and surface water monitoring locations, and continued recording for up to two weeks after the pumping period. Most data loggers were then removed from the monitoring locations, with the exception of selected locations where longer-term water level monitoring is continuing.

6.1.6 Water Sample Collection from Test Production Wells

To assess the water quality of the groundwater withdrawn from the test production wells, relative to drinking water quality objectives, water samples were collected on three occasions during the pumping period. The first set of samples were collected two hours after pumping started on 20 October 2020, the second set after 72 hours of pumping, on 23 October, and the third set shortly before pumping ended on 27 October. All samples were collected in sample bottles provided by SGS Canada Inc.; the private accredited laboratory retained by Norfolk County for the analyses. After each set of samples was collected by a Project Team Member, they were stored in the provided coolers, and then delivered to Norfolk County Staff, following normal chain-of-custody procedures. The samples were then sent in the coolers to the laboratory by overnight courier.

6.1.7 Water Sample Collection from Private Wells

Prior to the start of the aquifer performance test, water samples were collected from eight of the nine private water supply wells. The eight wells sampled are currently used for domestic water supply purposes. The only well not sampled is a former irrigation supply well (i.e. PW6/20). The water samples were collected on 19 October 2020. The samples were placed in coolers and Norfolk County Staff sent them to the laboratory by overnight courier, again following normal chain-of-custody procedures. The samples were to be analyzed by SGS Canada Inc., for general chemical parameters, to provide a background (i.e. pre-pumping) assessment of water quality relative to some drinking water objectives.

The results of water quality analyses for these private wells have been shared with the respective well owners, and for privacy reasons are not included in this report. Where certain parameters exceeded drinking water objectives (mostly aesthetic), the results were highlighted and additional information from Health Canada was provided.

6.2 Precipitation Monitoring Results

The precipitation recorded by the on-site rain gauge, and the Delhi Climate Station, is presented in Graph 5 (Appendix C2). A summary of the total precipitation that fell prior to, during, and after the aquifer performance test period is as follows:

- Prior to the aquifer test from 6 to 19 October inclusive: 44.7 mm
- On-site during the aquifer test from 20 to 27 October inclusive: 21.0 mm
- Following the aquifer test from 28 October to 10 November inclusive: 8.1 mm

The effects of the recorded precipitation events on groundwater and surface water monitoring results, where observed, are described in the respective sub-sections below.

6.3 Groundwater Monitoring Results

The groundwater level data recorded manually and by data loggers was compiled for each monitoring station and plotted for analysis. Hydrographs of water levels measured below the top of well, or piezometer, for the monitoring period, are presented in Graphs 6 to 41 (Appendix C2). Interpretations of these results are described below relative to the respective types of groundwater monitoring stations.

6.3.1 Test Production Wells

The recorded water levels in the test production wells SW11/09 and SW12/20, are presented as hydrographs in Graphs 6 and 7, respectively. These graphs clearly show the following:

- static levels increasing by a minor amount from 6 October until before the aquifer test began on 20 October
- a minor fluctuation in water levels when the pumps were installed on 15 October, and briefly pumped on 16 October

- steadily lowering water levels through the testing period from 10:00 am on 20 October, to 10:00 am on 27 October
- a maximum observed drawdown just prior to the end of pumping of 4.19 m in SW11/09
- a maximum observed drawdown just prior to the end of pumping of 6.54 m in SW12/20
- recovering water levels from 27 October to 10 November, with full recovery occurring by the end of this period.

6.3.2 Test Wells and Monitoring Wells

Observations made relative to each of the four test wells and 11 monitoring wells are described below, beginning with those adjacent to the test production wells, and continuing with those located in a north-easterly direction, and one located to the west. The monitors located to the east and southeast of the test production wells are described next, followed by those to the southwest. Refer to Figure 7 for locations of these 15 groundwater monitoring stations.

SW7/08 The recorded water levels in SW7/08, the well closest to SW11/09 (i.e. distance of 3.8 m), are presented in Graph 8. The observed changes in water levels are similar to the adjacent test production well, but considerably less in magnitude. The maximum observed drawdown just prior to the end of pumping was 1.81 m.

MW1/09 The recorded water levels in MW1/09, the well next closest to SW11/09 (i.e. distance of 5.2 m), are presented in Graph 9. The observed changes in water levels are similar to the test production well, but considerably less in magnitude. The maximum observed drawdown just prior to the end of pumping was 1.72 m.

MW2/11 The recorded water levels in MW2/11, located about 290 m northeast of SW11/09, and just 11 m south of SW12/20, are presented in Graph 10. The observed changes in water levels illustrate the effects of pumping both test production wells, but are considerably less in magnitude. The maximum observed drawdown just prior to the end of pumping was 1.96 m.

MW4/12 The recorded water levels in MW4/12, located adjacent to MW2/11, are presented in Graph 11. The observed changes in water levels, in this shallow monitoring well, illustrate the effects of pumping both test production wells, but are considerably less in magnitude. The maximum observed drawdown just prior to the end of pumping was 1.10 m, which was less than the deeper MW2/11.

MW5/12 The recorded water levels in MW5/12, located about 730 m northeast of SW12/20, in the Community of Bloomsburg, are presented in Graph 12. The observed changes in water levels, in this shallow monitoring well, illustrate the potential effects of pumping both test production wells. The maximum observed drawdown just prior to the end of pumping is 0.11 m. This graph also illustrates how the static water level declined gradually from 5 October through to 12 November, which may account for part of the drawdown calculated.

SW1/08 The recorded water levels in SW1/08, located about 1,050 m west of SW12/20, are presented in Graph 13. There were no observed changes in water levels in this test well attributed to pumping of the test production wells.

LP-MW-02-10 The monitoring well nest LP-MW-02-10, located about 460 m southeast of SW11/09, includes three monitors completed at various depths in the overburden. The recorded water levels in each monitor are presented in Graphs 14, 15, and 16. The observed changes in water levels in each monitor illustrate minor effects in response to pumping the test well. The maximum observed drawdown just prior to the end of pumping was 0.01 m in the shallow monitor (completed in the underlying till aquitard), 0.47 m in the intermediate monitor, and 0.48 m in the deep monitor (completed in the pumped aquifer).

SW9/08 and SW10/09 Southwest of the test well along the rail trail about 1,000 m, there are two test wells that were monitored. The recorded water levels in SW9/08 are presented in Graph 17 and water levels for SW10/09 are presented in Graph 18. These graphs clearly illustrate that pumping of the test production wells had no effect on water levels in these wells. These graphs also illustrate the static water level increased several centimetres leading up to and during the test period. This increase in local groundwater levels is interpreted to be a response to the rainfall that occurred from 19 to 23 October. Soon after, the static water levels continued to decline gradually through to 10 November.

MW3/12 The recorded water levels in MW3/12, located about 1,120 m southwest of the test well along the rail trail, are presented in Graph 19. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow monitoring well. Similar to SW9/08 and SW10/09, this graph also illustrates the static water level increased several centimetres leading up to and during the test period. This increase in local groundwater levels is interpreted to be a response to the rainfall that occurred from 19 to 23 October. Soon after, the static water levels continued to decline gradually through to 10 November.

LP-MW-15-10 The monitoring well nest LP-MW-15-10, located about 1,600 m southwest of the test well along the rail trail, includes three monitors completed at various depths in the overburden. The recorded water levels in each monitor are presented in Graphs 20, 21, and 22. These graphs clearly illustrate that pumping of the test well had no effect on water levels in the shallow, intermediate, and deep monitoring wells. The graphs may also show minor influences following the various rainfall events that occurred during the monitoring period.

6.3.3 Private Water Wells

Observations made relative to each of the nine private wells included in the monitoring program are described below in numerical order, beginning with the six in the northern part of the local area, including four located within the Community of Bloomsburg.

PW1/20 The recorded water levels in domestic well PW1/20, located about 940 m west of test production well SW12/20, are presented in Graph 23. The observed changes in water levels during the test pumping period illustrate a minor response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was 0.08 m. Other changes in water levels are attributed to pumping of this domestic well for short intervals. It is also apparent from the graph there were increases in the static water level following the various rainfall events that occurred during the monitoring period.

PW2/20 The recorded water levels in domestic well PW2/20, located about 360 m northwest of test production well SW12/20, are presented in Graph 24. Approval to proceed with monitoring was received from the well owner on 14 October, and began on 16 October. The observed changes in water levels during the test pumping period illustrate a minor response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was 0.16 m. Other changes in water levels are attributed to pumping of this domestic well for short intervals. It is also apparent from the graph there were increases in the static water level following the various rainfall events that occurred during the monitoring period.

PW3/20 The recorded water levels in domestic well PW3/20, located in the Community of Bloomsburg about 530 m easterly along Old Highway 24 from test production well SW12/20, are presented in Graph 25. The observed changes in water levels during the test pumping period clearly illustrate a response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was 0.69 m. Other changes in water levels are attributed to pumping of this domestic well for short intervals. It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

PW4/20 The recorded water levels in domestic well PW4/20, located in the Community of Bloomsburg about 540 m easterly along Old Highway 24 from test production well SW12/20, are presented in Graph 26. The observed changes in water levels during the test pumping period clearly illustrate a response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was also 0.69 m. Other changes in water levels are attributed to pumping of this domestic well for short intervals. It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

PW5/20 The recorded water levels in domestic well PW5/20, located in the Community of Bloomsburg about 870 m east-northeast of test production well SW12/20, are presented in Graph 27. The observed changes in water levels during the test pumping period indicate a possible minor response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was about 0.02 m, although a downward trend of the static water level in this well over the monitoring period may be the cause of this apparent drawdown. Other changes in water levels are attributed to pumping of this domestic well for short intervals, which were significantly greater than the changes attributed to the pumping test. It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

PW6/20 The recorded water levels in a former irrigation well PW6/20, located south of the Community of Bloomsburg, about 1,020 m southeast of test production well SW12/20, are presented in Graph 28. It is interpreted that the observed changes in water levels in this deep bedrock well, during the monitoring period up to 25 October were not the result of the pumping test. The decline of about 0.6 m, observed from 26 to 31 October, may be an inconsequential delayed response to pumping the test production wells.

PW7/20 The recorded water levels in domestic well PW7/20, located about 1,460 m southeast of test production well SW11/09, are presented in Graph 29. This graph illustrates a downward trend of the static water level in this well over the monitoring period, and with this trend accounted for it is interpreted pumping of the test production wells had no effect on water levels in this water supply well. Other changes in water levels are attributed to pumping of this domestic well for short intervals, which were significantly greater than the changes in the static water level. It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

PW8/20 The recorded water levels in domestic well PW8/20, located about 1,200 m south-southwest of test production well SW12/20, are presented in Graph 30. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this water supply well. Similar to SW9/08 and SW10/09 located about 270 m to the north, this graph also illustrates the static water level increased several centimetres leading up to and during the test period. This increase in local groundwater levels is interpreted to be a response to the rainfall that occurred from 19 to 23 October. Soon after, the static water levels continued to decline gradually through to 12 November. Other changes in water levels are attributed to pumping of this domestic well for short intervals, which were significantly greater than the changes in the static water level.

PW9/20 The recorded water levels in domestic well PW9/20, located about 1,100 m southwest of test production well SW12/20, are presented in Graph 31. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this water supply well. Similar to other monitored wells, this graph also illustrates the static water level increased several centimetres leading up to and during the test period. This increase in local groundwater levels is interpreted to be a response to the rainfall that occurred from 19 to 23 October. Soon after, the static water levels continued to decline gradually through to 12 November. Other changes in water levels are attributed to pumping of this domestic well for short intervals, which were significantly greater than the changes in the static water level.

6.3.4 Creek-bed and Wetland Piezometers

Observations made relative to each of the shallow piezometers are described below, beginning with those located in the east branch of Davis Creek, northeast of the test production wells, followed by one to the northwest in the west branch, and then those located to the southwest. It should be noted that the range in water levels for the piezometer graphs (i.e. y-axis) is significantly less than the range for the test wells, monitoring wells, and private well graphs. The daily total precipitation recorded during the monitoring period is also illustrated in each graph for interpretation purposes.

Piezometers Located in Northern Section of the East Branch of Davis Creek

PZ1/20 The recorded water levels in PZ1/20, located about 70 m northeast of test production well SW12/20, are presented in Graph 32. The static water level increased steadily after the piezometer was installed on 5 October, through to 12 November. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow piezometer. On, or about, 14 October, the groundwater level in this piezometer rose to above the creek-bed and remained above until 12 November. It is interpreted that this local reach of Davis Creek was gaining (i.e. an upward hydraulic gradient) for this period of monitoring.

PZ2/20 The recorded water levels in PZ2/20, located about 45 m southeast of test production well SW12/20, are presented in Graph 33. This graph illustrates the static water level increased gradually after the piezometer was installed on 2 October, through to the start of the pumping test. The observed changes in water levels during the test period illustrate a minor decline, possibly in response to pumping of the test production wells. The maximum observed drawdown just prior to the end of pumping was 0.04 m. The water level in this piezometer was below the creek-bed during the entire monitoring period, indicating this local reach of Davis Creek was losing (i.e. the hydraulic gradient was downward). It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

PZ3/20 The recorded water levels in PZ3/20, the piezometer closest to test production well SW11/09, located about 40 m to the northeast, are presented in Graph 34. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow piezometer. On, or about, 15 October, the groundwater level in this piezometer rose to above the creek-bed and remained above until 12 November, with some short periods below. It is interpreted that this local reach of Davis Creek was gaining (i.e. an upward hydraulic gradient) for this period of monitoring. It is also apparent from the graph there were minor changes in the static water level following the various rainfall events that occurred during the monitoring period.

Piezometer Located in West Branch of Davis Creek

PZ6/20 The recorded water levels in PZ6/20, installed in the west tributary of Davis Creek at a location about 600 m west of the test production well SW12/20, are presented in Graph 35. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow piezometer. It is also noted the groundwater level in this piezometer was above the creek-bed throughout the monitoring period, indicating this local reach of Davis Creek was gaining.

Piezometers Located in Wetlands Adjacent to the East Branch of Davis Creek

PZ4/20 Piezometer PZ4/20 was installed in the wetland adjacent to the east branch of Davis Creek, located about 77 m southwest of SW11/09. There are no recorded water levels for this piezometer as it was dry during the entire monitoring period. Groundwater levels in this area must have been at a depth below the bottom of the piezometer (i.e. greater than 1.1 m below ground level).

PZ8/20 The recorded water levels in PZ8/20, installed in the wetland immediately east of the rail trail, located about 220 m southwest of SW11/09, are presented in Graph 36. This graph illustrates that pumping of the test production wells had no effect on water levels in this shallow wetland piezometer. Groundwater levels are interpreted to have increased following precipitation events during the first half of the monitoring period, rising to above ground surface on 22 October, and then gradually declining after the pumping period when there was little rainfall recorded.

Piezometers Located in Southern Section of the East Branch of Davis Creek

PZ7/20 The recorded water levels in PZ7/20, located in Davis Creek about 280 m southwest of SW11/09, are presented in Graph 37. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow piezometer. Groundwater levels are interpreted to have increased following precipitation events during the monitoring period, fluctuating above and below the creek-bed until about 14 October, then increasing above the creek-bed through to 10 November. At this location, the creek-bed consisted of well-sorted sand and gravel, which likely contributed to the response in water levels following rain events. During the period when the groundwater level in this piezometer was above the creek-bed, this local reach of Davis Creek was gaining.

PZ9/20 The recorded water levels in PZ9/20, located in Davis Creek about 380 m southwest of SW11/09, are presented in Graph 38. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in this shallow piezometer. Groundwater levels are interpreted to have increased on 14 October, following temporary removal of the data logger to download data and verify operation. This likely also removed some fine sediment within the piezometer, allowing the water level to rise and reflect the actual shallow groundwater level at this location, which was above the creek-bed. The water levels after 14 October show this local reach of Davis Creek was gaining. There were also minor fluctuations in the shallow groundwater levels following rainfall events.

PZ5/20 The recorded water levels in PZ5/20, located on the bank of Davis Creek about 460 m southwest of SW11/09, are presented in Graph 39. The static water level just before pumping began on 20 October was at 0.2 m above the creek-bed. From the start of pumping until early 25 October, the groundwater level remained relatively constant at 0.2 m above the creek-bed, then began to gradually decline until the end of pumping on 27 October. The observed changes in water levels during the last two days of the test pumping period appear to indicate a response. The maximum observed drawdown just prior to the end of pumping was 0.12 m, which was comparable to previous testing in 2012, despite the increased pumping rate in 2020. The shallow groundwater level at this location remained above the creek-bed through the monitoring period, confirming this local reach of Davis Creek was gaining.

The groundwater pumped from the test production wells was discharged into Davis Creek about 10 m south of PZ5/20, using a control structure to prevent any erosion of the creek-bed. This location was selected because of the upward hydraulic gradient, which prevented the discharged water from returning to a shallow overburden aquifer, and potentially affecting groundwater levels. The water levels in PZ5/20 clearly confirm the shallow groundwater levels did not show any increase caused by the discharged water. The location was also within the right-of-way of the rail trail, which allowed access to the creek before it meandered westerly away from the right-of-way onto private property.

PZ10/20 The recorded water levels in PZ10/20, located in Davis Creek about 510 m southwest of SW11/09, are presented in Graph 40. Groundwater levels at this location were above the creek-bed throughout the monitoring period, confirming this local reach of Davis Creek was gaining. It is apparent the water levels increased during the pumping period, in response to increased flow in the creek at this location, downstream of the point of discharge from the test production wells. At this location, the creek-bed consisted of well-sorted sand and gravel, which likely contributed to this response observed in water levels.

PZ11/20 The recorded water levels in PZ11/20, located in Davis Creek about 610 m southwest of SW11/09, are presented in Graph 41. Groundwater levels at this location were at or above the creek-bed throughout the monitoring period, confirming this local reach of Davis Creek was gaining. Unlike the levels in PZ10/20, it is apparent the water levels in PZ11/20 increased before and during the pumping period in response to precipitation events. Following the pumping period, the shallow groundwater level at this location reduced to about the creek-bed through to the end of monitoring on 10 November. There was limited precipitation during this period, which is interpreted to be the cause of the relatively stable groundwater levels in PZ11/20.

6.4 Surface Water Monitoring Results

The surface water level data recorded manually and by data loggers was compiled for each monitoring station and plotted for analysis. Hydrographs of Davis Creek water levels measured below the top of the staff gauge, for the monitoring period, are presented in Graphs 42, 43, and 44 (Appendix C2). Hydrographs of pond water levels measured as the height of water above the data logger, are presented in Graphs 45, 46, and 47 (Appendix C2). Interpretations of these results are described below relative to the respective types of surface water monitoring stations.

The results of complimentary monitoring of Davis Creek, conducted by our Project Team Biologists from NRSI, are presented in the accompanying Natural Environment Assessment Report, 2021. The interpreted results are included in Section 9.

6.4.1 Creek Stage

Water levels in the east branch of Davis Creek were recorded at three locations. These locations were each adjacent to creek-bed piezometers and were numbered relative to the respective piezometers. The locations of DCS1/20, DCS3/20, and DCS11/20 are shown in Figure 8.

DCS1/20 A water level hydrograph for the east branch of Davis Creek, at a location about 70 m northeast of test production well SW12/20, is presented in Graph 42. Water levels at this location were relatively consistent during the monitoring period, with short-term increases in stage following precipitation events. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in Davis Creek at this location.

DCS3/20 A water level hydrograph for the east branch of Davis Creek, at a location about 40 m to the northeast of test production well SW11/09, is presented in Graph 43. Water levels at this location were also relatively consistent during the monitoring period, with short-term increases in stage following precipitation events. This graph clearly illustrates that pumping of the test production wells had no effect on water levels in Davis Creek at this location.

DCS11/20 A water level hydrograph for the east branch of Davis Creek, at a location about 610 m southwest of SW11/09, is presented in Graph 44. Water levels at this location were relatively consistent before and after the pumping period. However, during the pumping period the water level rose in response to the water discharged upstream into Davis Creek. There were also short-term increases in stage following precipitation events throughout the monitoring period.

6.4.2 Irrigation Ponds

Water levels were recorded in three in-active irrigation ponds. The locations of Ponds 1, 2 and 3 are shown in Figure 8.

Pond 1 As noted previously, Pond 1 is an on-line pond, with Davis Creek flowing directly into the pond near the northeast end, about 70 m south of test production well SW12/20. The pond outlet is located near the southwest end, and Davis Creek continues to flow from this location in a southwesterly direction towards the rail trail. As shown in Graph 45, the water level in Pond 1 increased gradually from the start of monitoring on 29 September until about 3 November. The level declined during the following week, as flow in Davis Creek reduced, as observed at DCS1/20 (Graph 42). Graph 45 clearly illustrates that pumping of the test production wells had no effect on water levels in Pond 1.

Pond 2 The hydrograph for Pond 2, located about 75 m east of SW12/20, is presented in Graph 46. This graph illustrates a steady increase in water level from the start of monitoring on 29 September to 17 October, possibly the result of overland flow to the pond following precipitation events. This period is followed by a relatively constant water level until 3 November, although there are notable fluctuations that appear to occur following precipitation events. The level declined after 3 November. The water level in Pond 2 was not affected by the pumping of the test production wells.

Pond 3 The hydrograph for Pond 3, located about 980 m east-southeast of SW12/20, is presented in Graph 47. This graph illustrates a gentle increase in the water level from the start of monitoring on 29 September through to the end on 12 November. There are minor fluctuations that appear to occur following precipitation events. The water level in Pond 3 was clearly not affected by the pumping of the test production wells.

7 Hydrogeological Cross-Sections

A set of three hydrogeological cross-sections were previously prepared to illustrate the interpreted overburden aquifer and aquitard sequences, depths to bedrock, groundwater levels, relative locations, and depths of monitored wells, and the extent of the potential municipal supply aquifer. Most of the wells listed in Table 1 (Section 5.2) are included in one or more of the cross-sections, which also include other selected local private wells. The locations of the three cross-sections are shown in Figure 9. The cross-sections are presented in Appendix F. The hydrogeological interpretations presented in each cross-section have been derived from the results of the Long Point Tier 3 Water Budget and Local Area Risk Assessment, Physical Characterization Report (Matrix, 2013). The cross-sections are included here to assist in explaining the interpretation of the results of the monitoring and testing program presented in Sections 8 and 9.

Cross-Section AA' is located along Old Highway 24 from the current Highway 24 in the west to the Community of Bloomsburg in the east. This section includes a test well (SW1/08), two monitoring wells (MW2/11 and MW4/12), two creek-bed piezometers (PZ2/12/20 and PZ6/12/20), and four private wells that were either monitored during previous testing in 2009 and/or 2012, or during the 2020 testing. The logs or well records of all test wells, monitoring wells and private wells that were monitored are included in Appendix E. Other private well records have also been used to augment the stratigraphic interpretation along this cross-section. This section illustrates the uppermost Norfolk Sand Plain is continuous across most of this area, although very thin in the western end. Groundwater occurs within the uppermost sand deposit and is often a local source of water for residents, typically developed using sandpoint wells.

Underlying the surficial sand deposits is a relatively thick Wentworth Drift (Till) that extends across this section. It is interpreted (and supported by this cross-section) this till sequence across this area confines the underlying aquifer. All but one of the wells that were selected for this cross-section are completed in the semi-confined underlying aquifer, which occurs in the thick interstitial coarser-grained sediments. One bedrock well is shown on the eastern end of the section. This is the domestic bedrock well referred to in Section 2.3.1, that is located within about 0.9 km of the test well site. An interpreted discontinuous lower sequence of Wentworth Drift is shown in the western half of the section, which has been observed in other parts of the Tier 3 study area. Underlying the aquifer is a continuous till layer consisting of either Wentworth Drift and/or Port Stanley Drift, which the Tier 3 study interpreted to occur regionally. This till layer confines the underlying basal sand found in one well (SW1/08) locally, and also the underlying bedrock aquifer.

It is noted on this hydrogeological cross-section that an upward hydraulic gradient was observed in PZ6/12/20 (i.e. during the 2012 and 2020 monitoring and testing programs) at the western tributary of Davis Creek. An upward hydraulic gradient is also interpreted to occur across the uppermost Wentworth Drift in the central part of this section, as depicted by the potentiometric surface. Horizontal groundwater flow in this area is southeasterly, which is not apparent from this west-to-east cross-section.

Cross-Section BB' extends from northwest of the test well site (i.e. north of Old Highway 24), through the test production well site (i.e. SW11/09), and continues to the southeast to the Tier 3 monitoring well nest located adjacent to Cloet Road (i.e. LP-MW-02-10). The same interpreted sequence of overburden deposits is depicted along this cross-section, with the exception of the basal sand. Groundwater levels in the deeper aquifer are shown in the northwestern well (i.e. OW3/09, which is also PW2/20) and the test well site show an upward gradient across the till. However, a downward hydraulic gradient is interpreted from the monitoring well nest in the southeast. A south-to-southeasterly groundwater flow direction is interpreted from these groundwater levels.

Cross Section CC' crosses the two other cross-sections (i.e. AA' at Old Highway 24 and BB' at the SW11/09 test production well site) and extends from the north-central part of Bloomsburg, southwesterly along the rail trail to the southwestern part of the study area. This cross-section includes all of the groundwater monitoring stations established through the central part of the study area.

The Norfolk Sand Plain is shown to extend across the entire section, which is based on previous mapping by the Ontario Geological Survey. It overlies the buried Galt Moraine at the northern end (i.e. in Bloomsburg). The underlying Wentworth Drift occurs along this cross-section, extending from the Galt Moraine in the north, but potentially thinning in the southern end. As noted on the cross-section, it is possible that the Wentworth Till may be absent in the local area around MW3/12 and test wells SW9/08 and SW10/09. The underlying aquifer occurring in the coarse-grained interstitial sediments varies in thickness, but exceeds 10 m across this area. A southern discontinuous Wentworth Drift is interpreted from the records of the test wells and the monitoring well nest LP-MW-15-10. The underlying Wentworth / Port Stanley Drift is also interpreted to be continuous across this section, although no data was available for the northern-most part. This till sequence is again interpreted to confine the underlying bedrock aquifer, thus hydraulically separating the overburden aquifer from the bedrock aquifer.

The potentiometric surface of the deeper overburden aquifer indicates an upward gradient across the Wentworth Till in the central part of this section (i.e. from OW1/12 to south of SW11/09). The groundwater levels at the four southern well locations (i.e. SW9/08, SW10/09, MW3/12, and LP-MW-15-10) are interpreted to have been observed below the Wentworth Till in the area where it thins, and may be absent. This would indicate that the underlying aquifer varies from confined to semi-confined and possibly unconfined conditions locally. This interpretation is discussed further in Section 8. Horizontal groundwater flow direction is interpreted to be southerly from the groundwater levels depicted on this cross-section.

8 Sustainable Well and Aquifer Yield

The analysis that is presented in this Section demonstrates the safe perennial yield for the aquifer at the sites of SW11/09 and SW12/20, is 3,500 L/minute (5,040 m^3/day or 770 Igpm). This is based on the results of additional testing at this combined pumping rate, which had been recommended following the 2012 testing and monitoring program.

As described previously, the aquifer performance test began on 20 October 2020 at 10:00 a.m., at a combined pumping rate of 3,500 L/minute (5,040 m^3/day or 770 Igpm), with SW11/09 pumped at 1,365 L/minute (1,965 m^3/day or 300 Igpm), and SW12/20 pumped at 2,135 L/minute (3,075 m^3/day or 470 Igpm). Pumping continued at this combined constant rate for an uninterrupted period of seven days, ending at 10:00 a.m. on 27 October 2020.

The evaluation of well and aquifer parameters is an iterative process that includes consideration of the following factors:

- Well design and location
- Geology
- Response of other local wells during the test periods
- Response of the pumped wells and aquifer during the test periods.

Consideration of these factors has resulted in two key hydrogeological interpretations, and each will be described and/or referenced in the sections below:

- The test production wells are completed in a semi-confined (i.e. leaky) overburden aquifer
- A single impervious boundary exists in this semi-confined aquifer at some distance from the test production wells.

Plots of drawdown and recovery were prepared for the groundwater monitoring stations where the effects of pumping the test production wells were observed. These plots were analyzed to estimate aquifer characteristics and sustainable yields. The semi-logarithmic plots illustrate the drawdown (i.e. reduction in water level from static) from the start of the pumping period, and the recovery (i.e. increase in water level from the level at the end of pumping) following the pumping period. These semi-logarithmic plots are presented in Graphs 48 to 66 (Appendix C3). Interpretations of these results are described below. Also included in Appendix C4 are selected graphs from the 2012 aquifer test performed on test production well SW11/09 only. Analyses of these plots have been updated to reflect the interpreted semi-confined aquifer condition and are referenced to support the analysis of the 2020 aquifer performance test.

8.1 Test Production Wells

8.1.1 Seven-Day Aquifer Test Response

SW11/09 The plot of drawdown/recovery for test production well SW11/09, presented in Graph 48, indicates the following:

- the drawdown observed reflects the response of the aquifer to the combined pumping rate of the two test production wells
- a total drawdown of 4.19 m after pumping for 7 days, representing only 31 percent of the available drawdown (i.e. 13.54 m)
- almost full recovery of the aquifer during the 7 days following the pumping test period
- a steepening slope at two points (i.e. doubling of the slope Δs) during the pumping period is interpreted as the mutual interference between the two test production wells, and also evidence of a distant impervious boundary to the aquifer

- with an impervious boundary condition and/or mutual well interference (i.e. when more than one test well is pumped), the correct approach for determining aquifer transmissivity is to only consider the earlier time drawdown data (Driscoll, 1986). However, for semi-confined aquifers, the transmissivity must be calculated from adjacent observation well data (i.e. not the pumped well data), using the Hantush-Jacob method (1955) (also referred to as the Walton method), with the principle of superposition incorporated into the analysis for two wells pumping. This was accomplished using AquiferTest Pro V10.0 (Waterloo Hydrogeologic, 2020). Applying this approach and with the interpreted semi-confined aquifer condition, the aquifer transmissivity value is 4,470 m^2/day, calculated using data from the adjacent monitoring wells MW1/09 and SW7/08. The results from this program are presented in Appendix C5

SW12/20 The plot of drawdown/recovery for the test production well SW12/20, presented in Graph 49, indicates the following:

- the drawdown observed reflects the response of the aquifer to the combined pumping rate of the two test production wells
- a total drawdown of 6.54 m after pumping for 7 days, representing only 51 percent of the available drawdown (i.e. 12.88 m)
- almost full recovery of the aquifer during the 7 days following the pumping test period
- similar to SW11/90, a steepening slope at two points (i.e. doubling of the slope Δs) during the pumping period is interpreted as the mutual interference between the two test production wells, and also evidence of a distant impervious boundary to the aquifer
- as explained above for SW11/90, the earlier time drawdown data indicates an aquifer transmissivity value of 4,470 m^2/day, calculated with data from adjacent monitoring well MW2/11, using the Hantush-Jacob method (1955) (also referred to as the Walton method), with the principle of superposition incorporated into the analysis for two wells pumping. This was again accomplished using AquiferTest Pro V10.0 (Waterloo Hydrogeologic, 2020), and the results from this program are presented in Appendix C5.

8.1.2 Projected Long-Term Aquifer Response and Test Well Available Drawdown

If the observed drawdown trend (i.e. from the start of day 2 to the end of day 7) in the test production wells was extended for a duration of 20 years, with both wells pumping constantly at same rate of the aquifer performance test, the estimated drawdown in SW11/09 would be 6.7 m, and in SW12/20 would be 9.0 m. These estimates are illustrated in Graphs 50 and 51, respectively (Appendix C3). This estimation is based on an unrealistic condition, which is pumping constantly for 20 years, without any recharge to the aquifer. However, even under this condition the estimated drawdown represents 49 percent of the available drawdown in SW11/09, and 70 percent of the available drawdown in SW12/20, which for both wells is within the recommended operational limit of 80 percent. This is the only beneficial purpose in assessing a 20-year projected drawdown, as it is considered a safety factor applied to future operation of municipal wells when considering periods of drought.

The test production well schematics, included in Appendix E, illustrate the available drawdown in each well at the time of the aquifer test. With reference to each schematic, there would remain more than 6.8 m of available drawdown in SW11/09, and more than 3.8 m of available drawdown in SW12/20 at the projected 20-year duration. Therefore, if pump intakes are set at top of screen, there remains sufficient depth of water above as recommended.

8.2 Test Wells, Monitoring Wells, Private Wells, and Piezometers

Table 2 lists the observed maximum drawdown at all groundwater monitoring locations. Also noted are the locations where there was no drawdown (i.e. no effects from pumping the test production wells were observed). These maximum observed drawdown values are illustrated on a map of the local area in Figure 10.

Table 2: Observed Maximum Drawdown in Groundwater Monitoring Locations

Groundwater Monitoring Station	Maximum Observed Drawdown (m)	Groundwater Monitoring Station	Maximum Observed Drawdown (m)
SW12/20	6.54	PW2/20	0.16
SW11/09	4.19	PW3/20	0.69
SW1/08	0	PW4/20	0.69
SW7/08	1.81	PW5/20	0.02
SW9/08	0	PW6/20	0
SW10/09	0	PW7/20	0
MW1/09	1.72	PW8/20	0
MW2/11	1.96	PW9/20	0
MW3/12	0	PZ1/20	0
MW4/12	1.10	PZ2/20	0.04
MW5/12	0.11	PZ3/20	0
LP-MW-02-10S	0.01	PZ5/20	0.12
LP-MW-02-10I	0.47	PZ6/20	0
LP-MW-02-10D	0.48	PZ7/20	0
LP-MW-15-10S	0	PZ8/20	0
LP-MW-15-10I	0	PZ9/20	0
LP-MW-15-10D	0	PZ10/20	0
PW1/20	0.08	PZ11/20	0

The plots of drawdown/recovery are presented in Graphs 52 to 66 (Appendix C3). These graphs are for the monitored locations in Table 2, where drawdown was observed. Analysis of the plots are summarized as follows:

- the earlier time drawdown data for the monitoring wells SW7/08 and MW1/09, located near SW11/09, and completed in the same aquifer, indicate an aquifer transmissivity value of 4,470 m^2/day, calculated using the Hantush-Jacob method (1955) (also referred to as the Walton method), with the principle of superposition incorporated into the analysis for two wells pumping. This was accomplished using AquiferTest Pro V10.0 (Waterloo Hydrogeologic, 2020), and the results from this program are presented in Appendix C5
- the earlier time drawdown data for the monitoring wells MW2/11 and MW4/12, located near SW12/20, and completed in the same aquifer, also indicate an aquifer transmissivity value of 4,470 m^2/day, calculated using the Hantush-Jacob method (refer to Appendix C5)
- the earlier time drawdown data for monitoring wells LP-MW-02-10I and D, and also private wells PW1/20, PW2/20, PW3/20, and PW4/20, indicate potentially higher aquifer transmissivity values, which may possibly be due to a thicker aquifer in the areas west, northwest, northeast, and southeast of the test production wells
- a steepening slope at two points (i.e. doubling of the slope Δs) during the pumping period, for monitoring wells SW7/08, MW1/09, MW2/11, indicates the mutual interference between the two pumped wells, and also evidence of a distant impervious boundary to the aquifer
- a steepening slope later in the pumping period, for monitoring wells LP-MW-02-10I and D, and also private wells PW3/20 and PW4/20, is further evidence of a distant impervious boundary to the aquifer, which is interpreted from the data to be south of the test production wells

- a drawdown of 0.11 m in monitoring well MW5/12 by the end of the pumping period, indicates a minor reduction in shallow groundwater levels occurred in the unconfined aquifer northeast of the test production wells, supporting the interpretation that the pumped aquifer is semi-confined
- a relatively minor drawdown of 0.02 m in piezometer PZ2/20 by the end of the pumping period, indicates an increase in the downward hydraulic gradient at this location
- a relatively minor drawdown of 0.12 m in piezometer PZ-5/20 by the end of the pumping period, indicates a reduction in the upward hydraulic gradient at this location.

The extent of drawdown observed at the end of the pumping period is illustrated by a plot of drawdown versus distance in Graph 67 (Appendix C3). This graph illustrates there was no drawdown at a distance of about 1,000 m and greater, although the area of influence is interpreted from these data to be an irregular shape. An assessment of the area of influence and potential effects of municipal groundwater withdrawals on the local water resources is discussed further in Section 9.

The extent of drawdown in all monitored locations is also illustrated in Figure 10. The drawdown observed at the end of the seven-day pumping period is shown at each location. The monitored locations where there was no measurable response are listed in Table 2.

8.3 Sustainable Well and Aquifer Yield

To establish a sustainable yield (often referred to as safe perennial yield) for the well and aquifer at the locations of test production wells SW11/09 and SW12/20, the response of the wells and aquifer is estimated for a prolonged period of pumping. This would be achieved by extending the drawdown trends in the pumped well and monitored wells, exhibited during an aquifer performance test, for a period of 20 years on the semi-logarithmic plot. The maximum pumping rate of each respective well is also limited by the well dimensions and other factors (e.g. well screen openings). The sustainable yield for a municipal production well is the continuous pumping rate that would consume no more than 80 percent of the available drawdown in the well, if the well was pumped continuously for 20 years, with the conditions prevailing at the time of the test. This is a very conservative method of analysis because it does not account for any recharge to the supply aquifer over the 20-year period. The available drawdown is measured from the static water level to the top of the well screen.

The available drawdown in test production well SW11/09, at the time of testing, was 13.54 m and in SW12/20 it was 12.88 m. Up to 20 percent of the available drawdown is required as a safety factor for seasonal fluctuations and efficiency losses in the well. The effective available drawdown was therefore 10.83 m in SW11/09, and 10.30 m in SW12/20. Based on the responses of the wells during the separate step-testing, and during the aquifer performance test, the effective available drawdown, and the well dimensions, the sustainable yield is confirmed to be 1,820 L/minute (2,620 m^3/day or 400 Igpm) for SW11/09, and for SW12/20 it is confirmed to be 2,135 L/minute (3,075 m^3/day or 470 Igpm). Testing confirmed less than 80 percent of the available drawdown would be consumed at these respective rates. The safe perennial yield of SW11/09 is less because the 200 mm diameter of the well is a limiting factor. This is the maximum rate, with this amount of drawdown, for the largest pump that can be installed in SW11/09.

The sustainable yield for the aquifer at the locations of test production wells SW11/09 and SW12/20 is 3,500 L/minute (5,040 m^3/day or 770 Igpm). The seven-day aquifer performance test at this total combined rate was required to confirm this sustainable yield for the aquifer.

9 Assessment of the Effects of Potential Municipal Water Supply Production on Local Water Resources

Based on the interpretation of the results of the aquifer performance test completed on the test production wells SW11/09 and SW12/20, the effects of pumping at the sustainable aquifer yield can be discussed in terms of the effects on local water resources. As presented in the previous section, the sustainable yield of the aquifer has been confirmed to be 3,500 L/minute (5,040 m^3/day or 770 Igpm). The drawdown at each monitoring location is summarized in Table 2, in Section 8.2.

9.1 Area of Influence in Supply Aquifer

To assess the potential effects of municipal water supply production on local water resources, it is necessary to first consider the area of influence within the semi-confined overburden aquifer at the end of the seven-day pumping test. For those groundwater monitoring locations that are interpreted to be completed in the same aquifer as the test production wells (i.e. supply aquifer), the drawdown observed during the pumping test was determined from the individual hydrographs and drawdown graphs. The maximum observed drawdown values at these specific locations, sorted by distance from the closest test production well, are summarized in Table 3.

Table 3: Supply Aquifer Monitoring Locations – Maximum Observed Drawdown

Groundwater Monitoring Station	Monitor Type	Screened Interval (m bgl)	Distance from Closest Test Production Well (m)	Maximum Observed Drawdown (m)
SW12/20	Pumped Test Well	15.2 - 24.4	0	6.54
SW11/09	Pumped Test Well	15.5 - 18.6	0	4.19
SW7/08	Monitored Test Well	15.5 - 18.9	3.8	1.81
MW1/09	Monitoring Well	14.7 - 15.8	5.2	1.72
MW4/12	Monitoring Well	4.6 - 7.6	10	1.10
MW2/11	Monitoring Well	6.1 - 9.1	11	1.96
PW2/20	Private Water Well	16.0 - 17.2	360	0.16
LP-MW-02-10I	Monitoring Well	10.1 - 11.6	460	0.47
LP-MW-02-10D	Monitoring Well	19.1 - 20.6	460	0.48
PW3/20	Private Water Well	14.5 - 18.5	530	0.69
PW4/20	Private Water Well	15.8 - 18.3	540	0.69
PW5/20	Private Water Well	13.7 - 15.2	870	0.02
PW1/20	Private Water Well	15.2 - 16.5	940	0.08
SW9/08	Monitored Test Well	9.4 - 12.8	1,000	0
SW10/09	Monitored Test Well	9.1 - 11.9	1,000	0
MW3/12	Monitoring Well	4.6 - 7.6	1,120	0
PW8/20	Private Water Well	9.4 - 10.7	1,200	0
PW7/20	Private Water Well	15.2 - 16.8	1,460	0
LP-MW-15-10S	Monitoring Well	2.4 - 5.5	1,600	0
LP-MW-15-10I	Monitoring Well	13.4 - 14.9	1,600	0
LP-MW-15-10D	Monitoring Well	20.1 - 21.6	1,600	0

The maximum observed drawdown values in Table 3 have been interpreted to estimate the area of influence within the overburden supply aquifer at the end of the seven-day pumping test. The estimated area of influence is illustrated in Figure 11. This represents the extent of the area where drawdown occurred in the supply aquifer (i.e. the source of water for the test production wells). It is not drawdown in the water table aquifer that overlies the deeper supply aquifer, separated by a silty clay layer (i.e. aquitard) of varying thickness. This important principle must be appreciated in consideration of the potential for impacts on surface water features and is discussed further in Sections 9.3 and 9.4.

9.2 Effects on Groundwater Supplies

The area of influence shown in Figure 11 is depicted by three lines; Drawdown = 0 m, Drawdown = 0.5 m, and Drawdown = 1.0 m. These estimated lines are based on the drawdown values from Table 3 only. Outside, or beyond, the area defined by the line of Drawdown = 1.0 m, there would be no effect on a water supply derived from a well completed in the deeper supply aquifer. Currently, all local private wells completed in the supply aquifer are located outside, or beyond, the area defined by the line of Drawdown = 1.0 m. The maximum observed drawdown was less than 0.7 m in all of the private wells that were monitored before, during, and following the aquifer performance test.

As noted previously, most wells within the study area derive groundwater supplies from one of the overburden aquifers. Well depths are highly variable, which can be attributed to the local occurrence and characteristics of the overburden aquifers and the specific water supply requirements of the well owner. Water uses identified in this area include domestic, agricultural, institutional, and commercial. The water well surveys, conducted for this project in 2012 and 2019, determined the types of wells included shallow sandpoints, dug wells, and shallow and deeper drilled wells.

Locally, sandpoints, dug wells, and shallow drilled wells, completed in the upper water table aquifer, are more susceptible to interruption in water supply if water levels decline by 0.5 m, or greater. The effect on shallow groundwater levels would be less than observed in the underlying deeper supply aquifer during the testing program. For example, the water level in the shallow monitoring well MW5/12, located in the Community of Bloomsburg (refer to Figure 7), was interpreted to have a maximum drawdown of 0.11 m, by the end of the pumping test.

It was determined during the water well survey that the two closest private wells to the test production wells are located slightly more than 300 m southeast of SW11/09. Both wells are sandpoints and were therefore not accessible for monitoring. There were no reported effects on the water supplies, during the test period, at these two homes and farm located on Cloet Rd. For reference, the monitoring well nest LP-MW-02-10 is located about 160 m beyond these private wells. As noted previously, the shallow monitor in this nest, which is completed at a depth of 6.1 m in the underlying interbedded clay to sand, responded to the pumping test with an observed drawdown of 0.01 m. Therefore, it is estimated that drawdown in the shallow water table aquifer at the end of the pumping test at the two sandpoint supply wells may have been at most 0.2 m. This amount of drawdown would not normally be expected to interfere with these two sandpoint supply wells, but if interference did occur as a result of municipal pumping, Norfolk County would be obligated to provide a suitable replacement water supply, such as a deeper drilled well completed in the supply aquifer. The deeper monitors at LP-MW-02-10 are completed in the supply aquifer.

It is important to note there were no complaints received from local well owners either during, or following, the aquifer test period. On the basis of the test results, it can be concluded that water supplies were not affected by the performance of the aquifer test.

9.3 Effects on Local Ponds

The 2020 aquifer performance test had no measurable effect on the water levels in the three nearby ponds, including one of the on-line ponds (i.e. Pond 1), and two off-line ponds (i.e. Ponds 2 and 3). As noted previously, these ponds have not been used for irrigation purposes in recent years. The MOECP on-line database indicates the Permits to Take Water for Ponds 1 and 2 remain active. There are no other Permits for irrigation ponds within 1.0 km of the test production wells.

9.4 Effects on Davis Creek

9.4.1 Creek-bed Piezometers

The only two locations where drawdown was observed in the shallow water table aquifer adjacent to Davis Creek was at PZ2/20 and PZ5/20. The groundwater level in creek-bed piezometer PZ2/20 declined by an amount that is interpreted from the plot of drawdown in Graph 65 to be at most 0.04 m. The fluctuations in water levels at this location caused by changes in flow in Davis Creek were greater in magnitude. Therefore, this interpreted amount of drawdown in a reach of Davis Creek where the natural hydraulic gradient is downward, is considered negligible.

A relatively minor drawdown observed in piezometer PZ-5/20 by the end of the pumping period, indicates a reduction in the upward hydraulic gradient at this location. The static water level just before pumping began on 20 October was at 0.2 m above the creek-bed. From the start of pumping until early 25 October, the groundwater level remained relatively constant at 0.2 m above the creek-bed, then began to gradually decline until the end of pumping on 27 October. The observed changes in water levels during the last two days of the test pumping period appear to indicate a response. The maximum observed drawdown just prior to the end of pumping was 0.12 m, which was comparable to previous testing in 2012, despite the increased pumping rate in 2020. The shallow groundwater level at this location remained above the creek-bed through the monitoring period, confirming this local reach of Davis Creek was gaining. Based on these observations, it is apparent the semi-confining layer separating the water table aquifer and the pumped aquifer is thinner in the vicinity of this piezometer.

Following the recommendation from 2012 testing, additional piezometers were installed in 2020 to augment the monitoring of groundwater levels along Davis Creek. In all, seven other creek-bed piezometers did not exhibit any drawdown effects, confirming groundwater continued to discharge to Davis Creek. These responses indicate there is limited to no potential for reductions in groundwater discharge to the short reach of Davis Creek in the vicinity of the test production wells.

The aquifer test had no measurable effect on the flow in Davis Creek, other than the increase downstream of the location where the groundwater pumped from the test production wells was discharged. Long-term groundwater withdrawals at this site for municipal supply purposes are therefore not expected to have deleterious effects on Davis Creek, a local surface water feature that has historically been (and may continue to be) a source of water for irrigation.

9.4.2 Aquatic Habitat

The following conclusion is derived from the accompanying Natural Environment Assessment Report, 2021, completed by NRSI. Based on the aquatic habitat parameters gathered from the monitoring of the watercourse before, during, and after the aquifer performance test, there is no evidence to suggest that there were any negative short- or long-term environmental impacts from either the pumping or release of water back into the watercourse. This is supported by the depths and flows within the watercourse not decreasing during the testing, which would have suggested a significant connection between the aquifer and the surface waters. Additionally, there was no noted scouring, large changes in substrate, or decreases in shoreline vegetation associated with the release of the water within the monitored sites. Within the full study area there were no new areas of erosion or scouring found after the test's completion.

10 Groundwater Quality

As noted in Section 6, groundwater samples were collected on three occasions from the test production wells SW11/09 and SW12/20 during the seven-day aquifer performance test. The first set of samples were collected two hours after pumping started on 20 October 2020, the second set after 72 hours of pumping, on 23 October, and the third set shortly before pumping ended on 27 October. All samples were collected in sample bottles provided by SGS Canada Inc.; the private accredited laboratory retained by Norfolk County for the analyses. After each set of samples was collected by a Project Team Member, they were stored in the provided coolers, and then delivered to Norfolk County Staff, following normal chain-of-custody procedures. The samples were then sent in the coolers to the laboratory by overnight courier, for analysis of chemical parameters. The results of the analyses are presented in Appendix G.

The water quality data was evaluated with reference to the respective parameters listed in Schedules 1, 2, or 3 of the Ontario Drinking Water Quality Standards, or Table 4 of the Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines. The concentrations of the parameters analyzed were below the applicable ODWQS criteria, with the following exceptions:

- Iron exceeded the ODWQS of 0.3 mg/L, at concentrations ranging from 0.396 to 0.495 mg/L
- Total hardness (as $CaCO_3$) exceeded the ODWQS of 100 mg/L, at concentrations ranging from 207 to 271 mg/L
- One sample collected from SW12/20 at the start of pumping exceeded the exceeded the ODWQS for Aluminum of 0.100 mg/L, with what appears to be an anomalous concentration of 0.422 mg/L. Subsequent samples were considerably lower than 0.100 mg/L.

The ODWQS for iron is an aesthetic objective and the elevated level is typical of groundwater in this area of Ontario.

The ODWQS for hardness is an operational guideline for drinking water supplies and the elevated level is typical of groundwater in this area of Ontario.

The quality of the groundwater pumped from the test production wells, based on the analyses conducted, is suitable for the development of a municipal water supply. It is acknowledged that treatment of the raw water will be provided at the same level as other municipal groundwater supply sources in the Community of Simcoe.

11 Source Water Protection

The results of the aquifer testing and monitoring program presented in this report can be used to support a Source Protection Technical Study, as required for the completion of the Municipal Class EA. This study would delineate draft Wellhead Protection Areas (WHPAs) through the updating of an existing groundwater flow model, and complete vulnerability scoring and a threats assessment for the test production wells, following the procedures of the current Technical Rules for Assessment Reports, under the Clean Water Act, 2006.

12 Conclusions

1. A second test production well was constructed for the purpose of completing an aquifer testing and monitoring program, and to potentially be used as a municipal water supply well. The two test production wells at this project site are suitable for use as municipal supply wells.
2. The available drawdown in test production well SW11/09, at the time of testing, was 13.54 m and in SW12/20 it was 12.88 m. Up to 20 percent of the available drawdown is required as a safety factor for seasonal fluctuations and efficiency losses in the well. The effective available drawdown was therefore 10.83 m in SW11/09, and 10.30 m in SW12/20. Based on the responses of the wells during the separate step-testing, and during the aquifer performance test, the effective available drawdown, and the well dimensions, the sustainable yield is confirmed to be 1,820 L/minute (2,620 m^3/day or 400 Igpm) for SW11/09, and the sustainable yield for SW12/20 is confirmed to be 2,135 L/minute (3,075 m^3/day or 470 Igpm). Testing confirmed less than 80 percent of the available drawdown would be consumed at these respective rates. The safe perennial yield of SW11/09 is less because the 200 mm diameter of the well is a limiting factor. This is the maximum rate, with this amount of drawdown, for the largest pump that can be installed in SW11/09.
3. The sustainable yield for the aquifer at the locations of test production wells SW11/09 and SW12/20 is 3,500 L/minute (5,040 m^3/day or 770 Igpm). The seven-day aquifer performance test at this total combined rate was required to confirm this sustainable yield for the aquifer.
4. Analyses of the monitoring program results confirms the aquifer performance test was completed without causing unacceptable effects on existing groundwater supplies, permitted surface water irrigation supplies, and the local environment, including local wetlands and flow in Davis Creek.

13 Recommendations

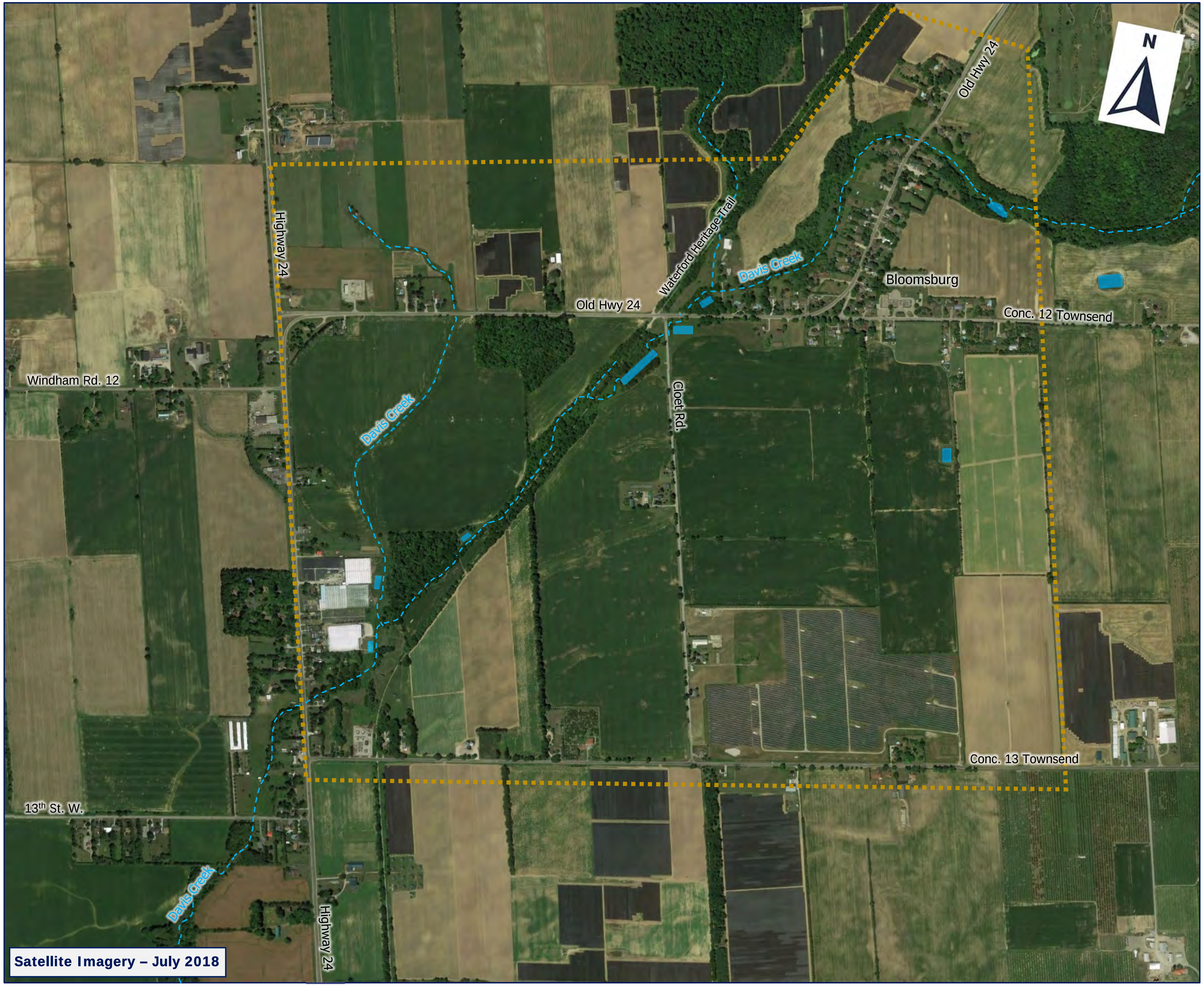
1. The results of the aquifer testing and monitoring program presented in this report should be used to support a Source Protection Technical Study, as required for the completion of the Municipal Class Environmental Assessment. This study would delineate draft Wellhead Protection Areas (WHPAs) through the updating of an existing groundwater flow model, and complete vulnerability scoring and a threats assessment for the test production wells, following the procedures of the current Technical Rules for Assessment Reports, under the Clean Water Act, 2006.
2. This report on the construction of a second test production well and the aquifer testing monitoring program, in combination with a Source Protection Technical Study Report (once completed), should be incorporated into a final Municipal Class Environmental Assessment Report, to be circulated for review and presented at a public forum.

Respectfully submitted,
Banks Groundwater Engineering Limited
WDBanks
William D. Banks, P.Eng.
Project Manager & Principal Hydrogeologist

REGISTERED PROFESSIONAL ENGINEER
27/07/21
W. D. BANKS
PROVINCE OF ONTARIO

Appendix A

Figures



Legend

- Approximate Study Area
- Davis Creek – Intermittent
- Ponds

Approximate Scale - Metres

200 100 0 200 400 600

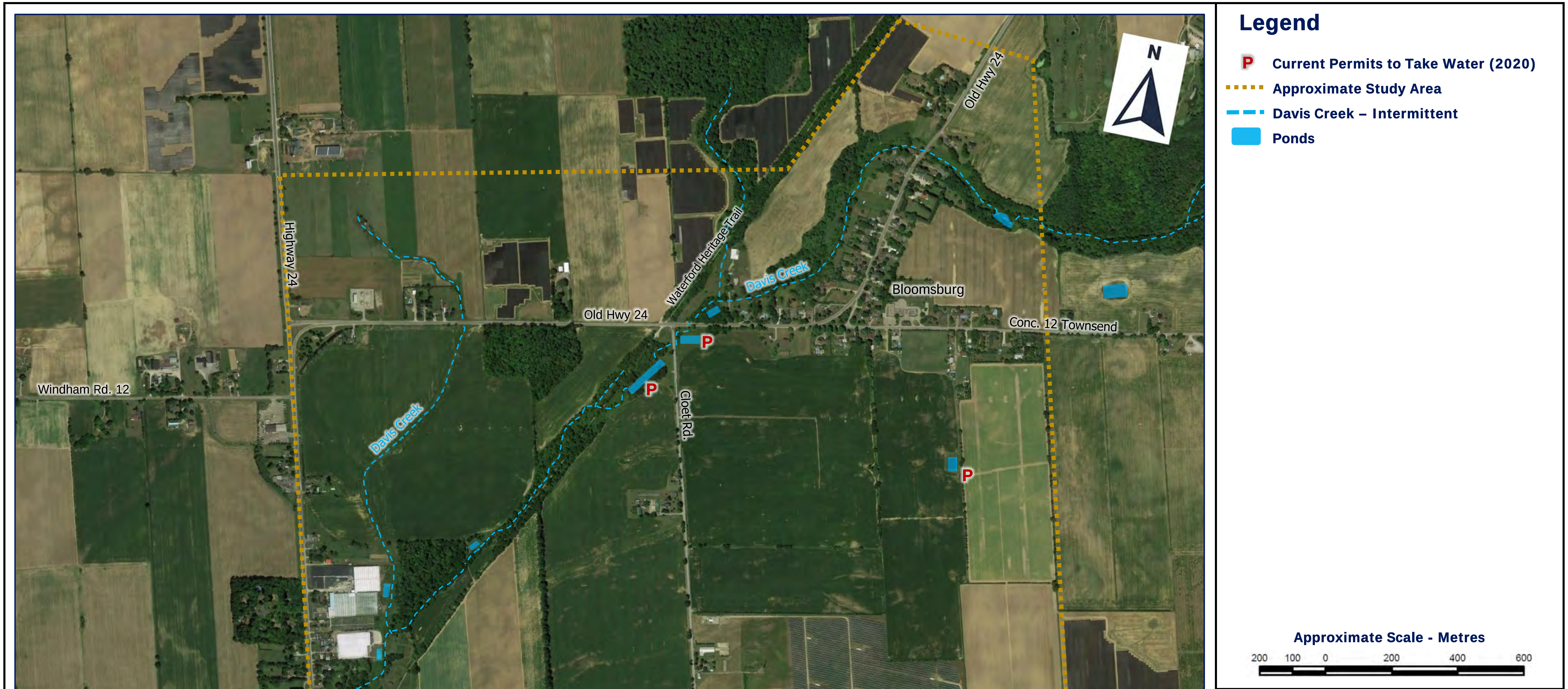
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Hydrogeological Study Area

Norfolk County

Figure 1



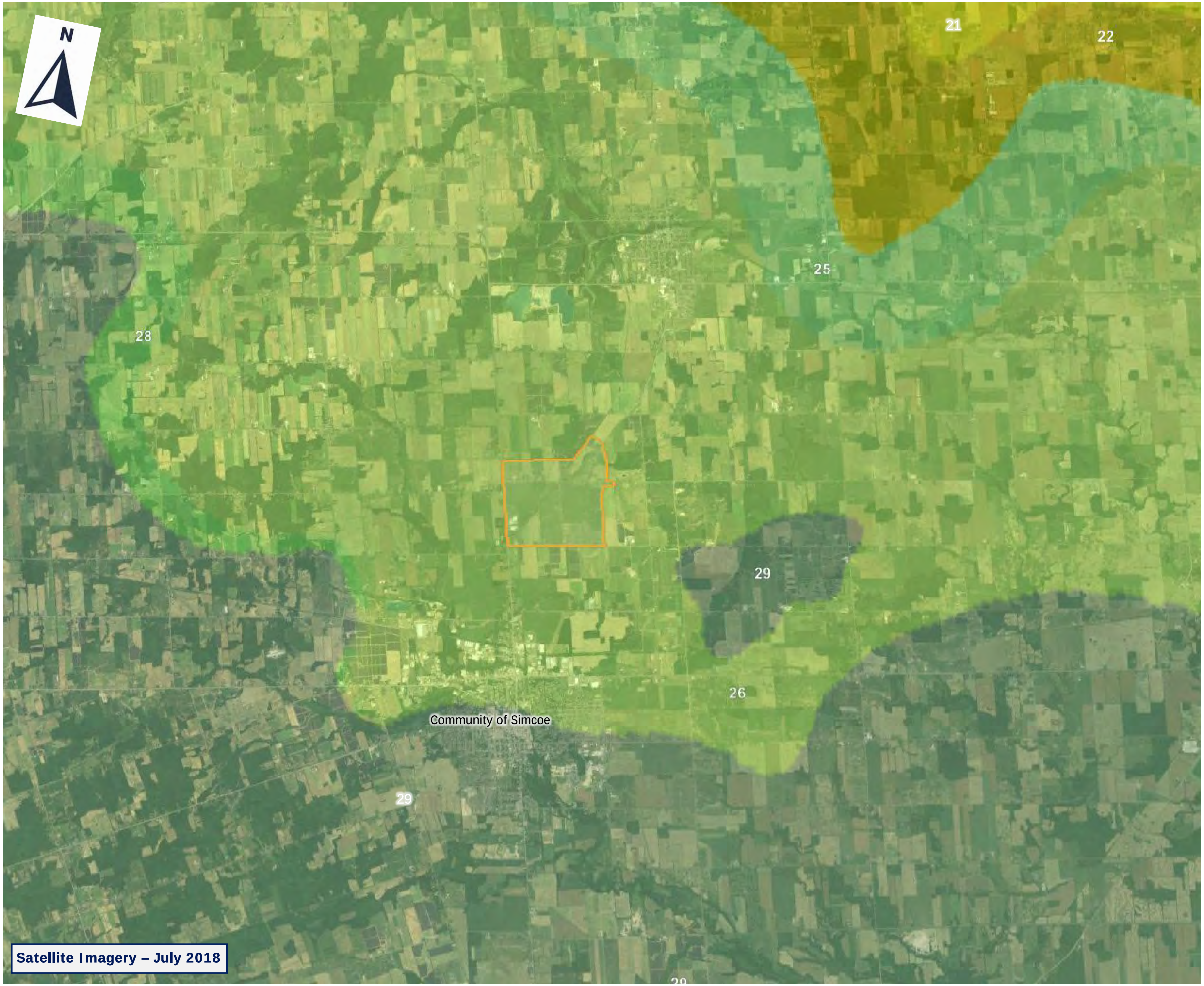
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Current Permits To Take Water

Norfolk COUNTY

Figure 2



Legend

🟧 Approximate Study Area

Bedrock Formations

- 🟨 21 Salina
- 🟧 22 Bertie
- 🟦 25 Bois Blanc
- 🟩 26 Onondaga
- 🟩 28 Lucas
- 🟫 29 Dundee

Source: Ontario Geological Survey

Not to Scale

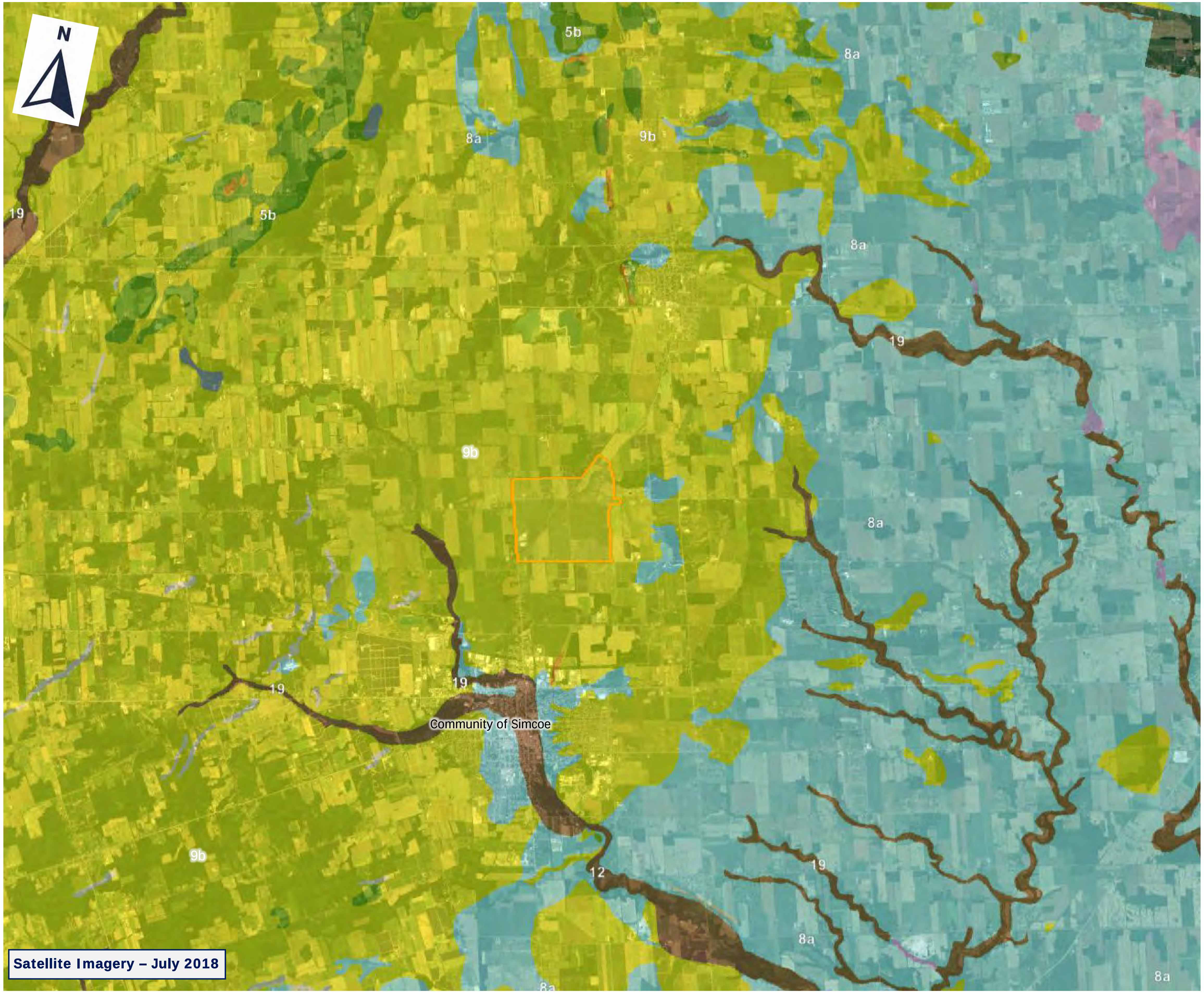
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Bedrock Geology

Norfolk County

Figure 3



Legend

— Approximate Study Area

Overburden Deposits

🟩 **5b Wentworth Till**
🟧 **6a Ice Contact Moraine**
🟦 **8a Haldimand Clay Plain**
🟨 **9b Norfolk Sand Plain**
🟫 **12 Older Alluvial**
🟫 **19 Modern Alluvial**

Source: Ontario Geological Survey

Not to Scale

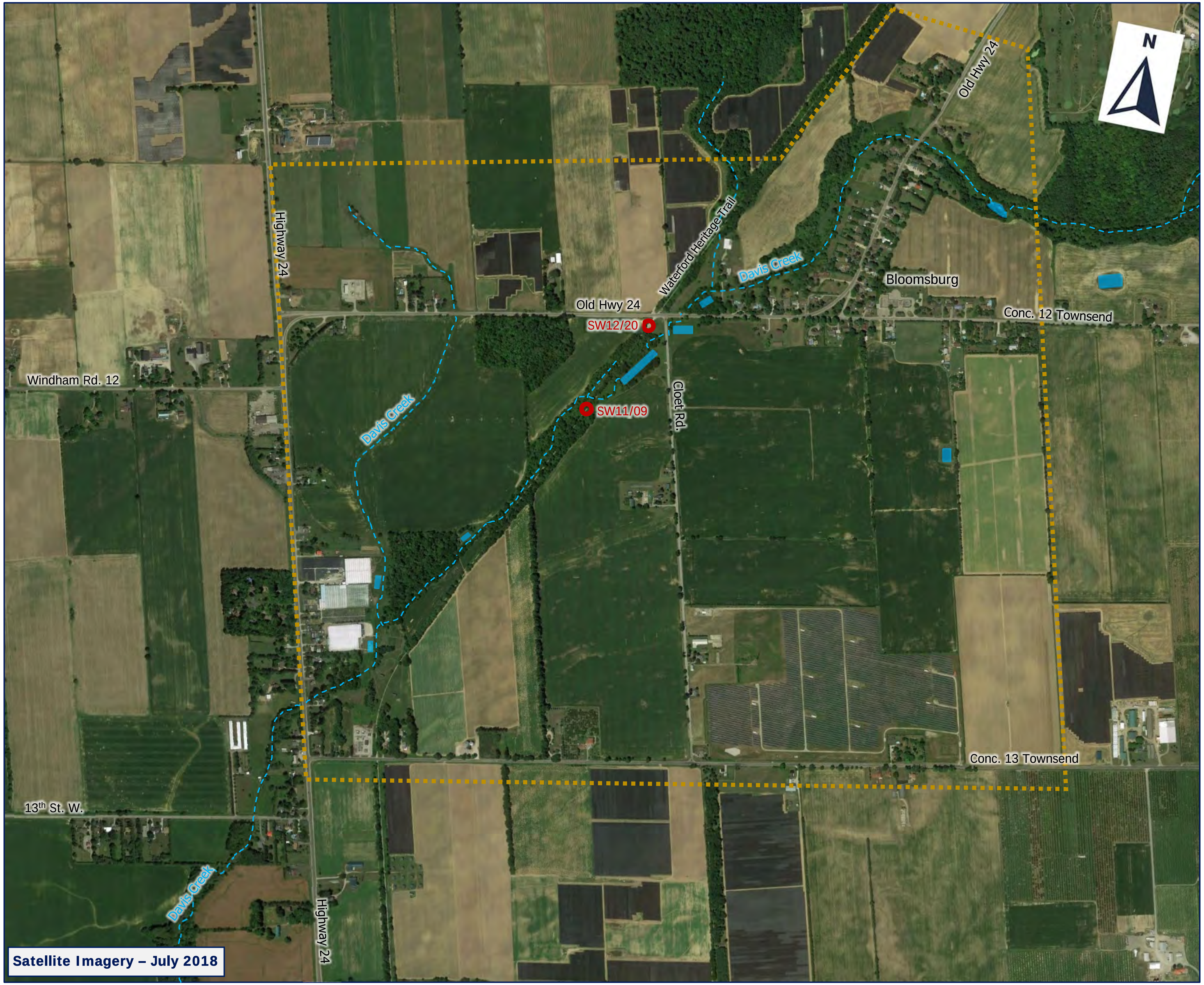
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Surficial Geology

Norfolk COUNTY

Figure 4



Legend

- ⋯⋯ **Approximate Study Area**
- ⦿ **Test Production Wells**
- ‒ ‒ **Davis Creek – Intermittent**
- ■ **Ponds**

Approximate Scale - Metres

200 100 0 200 400 600

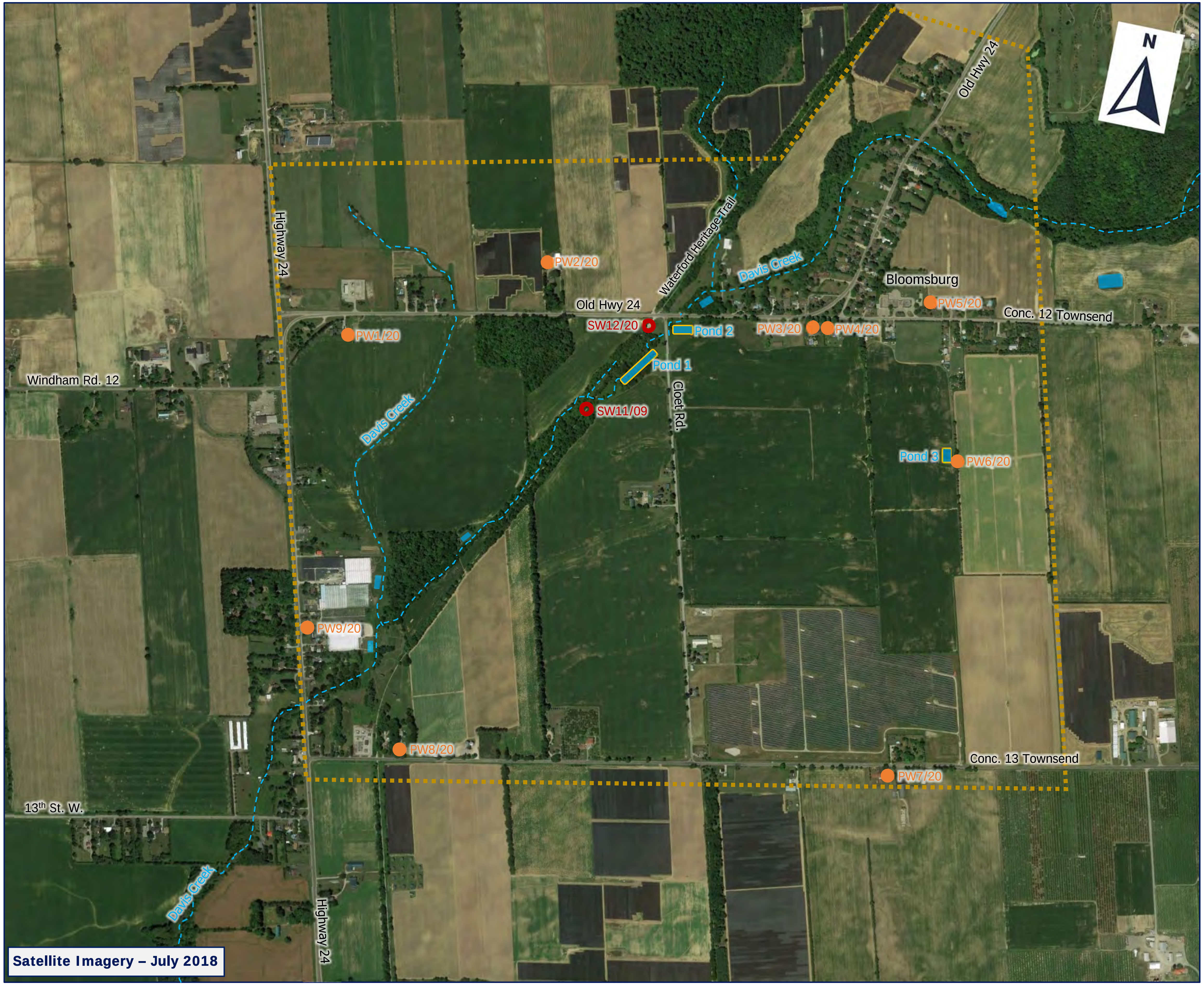
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Test Production Wells

Norfolk COUNTY

Figure 5



Legend

- ⋯ Approximate Survey Area
- ○ Test Production Wells
- ● Monitored Private Wells
- ▭ Monitored Irrigation Ponds (Inactive)
- - - Davis Creek – Intermittent
- ■ Other Ponds (Former Irrigation)

Approximate Scale - Metres

200 100 0 200 400 600

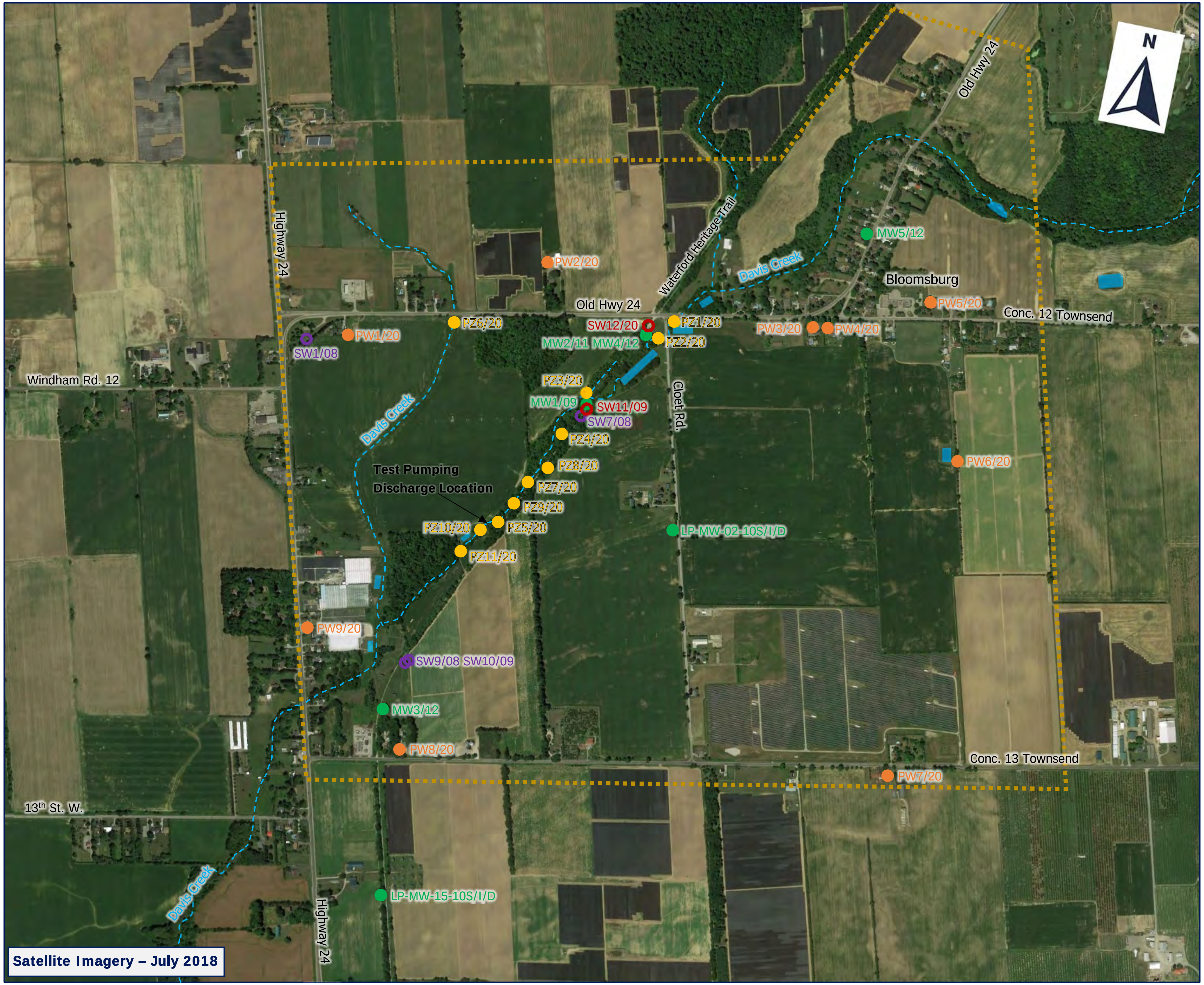
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Well & Pond Survey Area

Norfolk County

Figure 6



Legend

- ┅ Approximate Survey Area
- ○ Test Production Wells
- ○ Previous Test Wells
- ● Monitoring Wells
- ● Monitored Private Wells
- ● Creek-Bed & Wetland Piezometers
- ╌ Davis Creek – Intermittent
- ▬ Ponds (Former Irrigation)

Approximate Scale - Metres

200 100 0 200 400 600

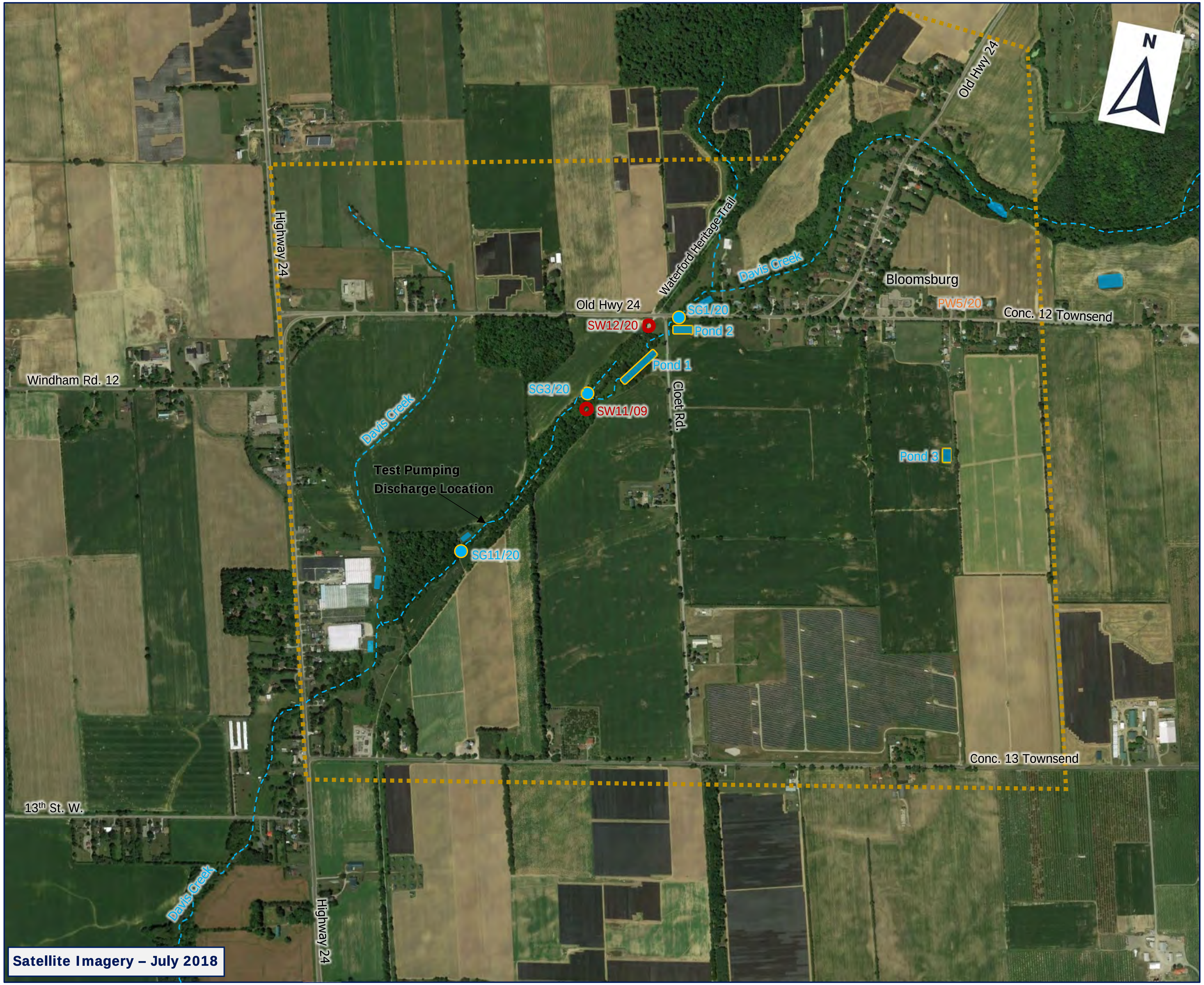
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Groundwater Monitoring Stations

Norfolk County

Figure 7



Legend

- ⋯ Approximate Survey Area
- ◉ Test Production Wells
- ● Monitored Davis Creek Stage
- ▭ Monitored Irrigation Ponds (Inactive)
- ‐ ‐ Davis Creek – Intermittent
- ■ Other Ponds (Former Irrigation)

Approximate Scale - Metres

200 100 0 200 400 600

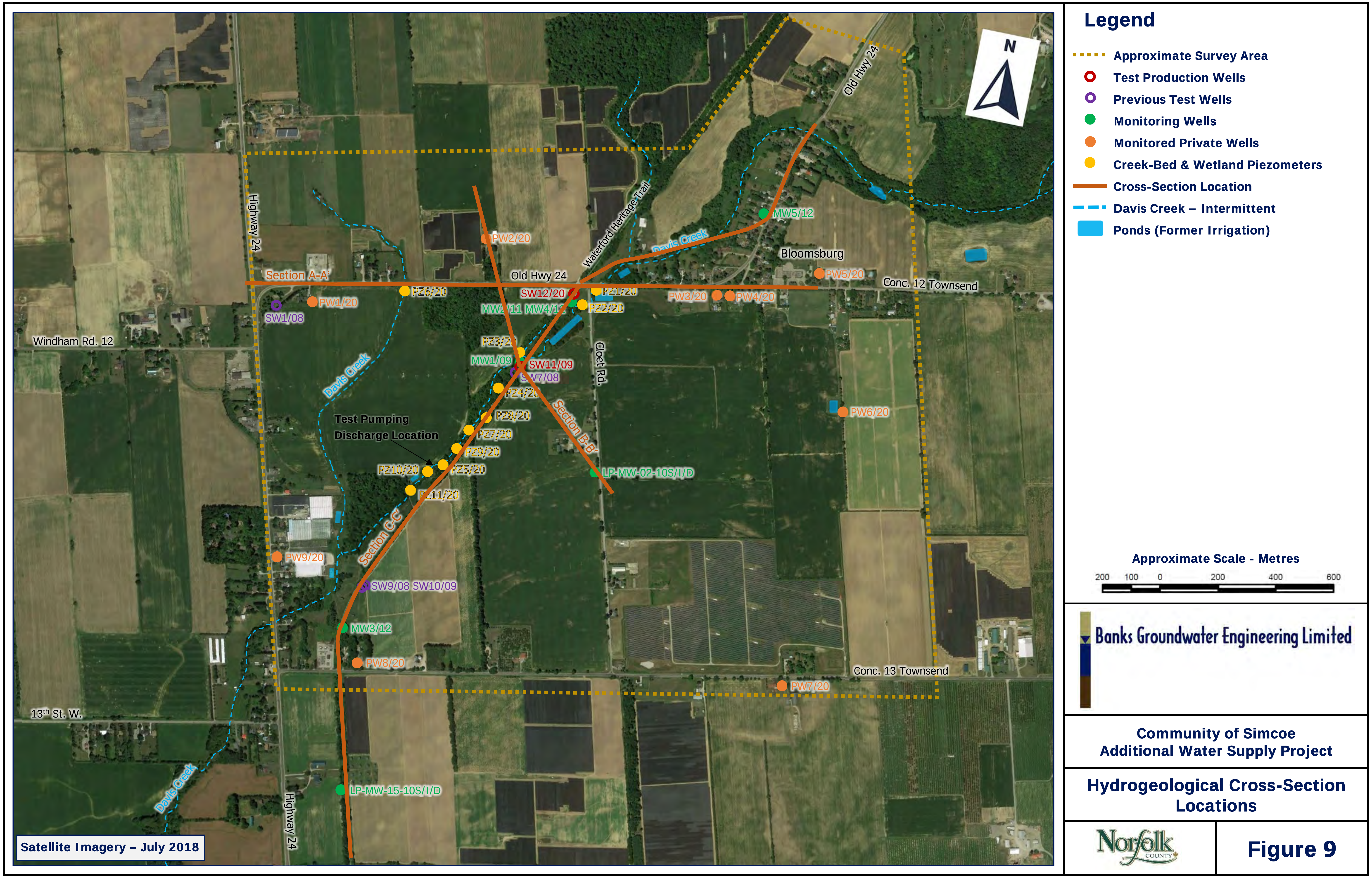
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Surface Water Monitoring Stations

Norfolk County

Figure 8



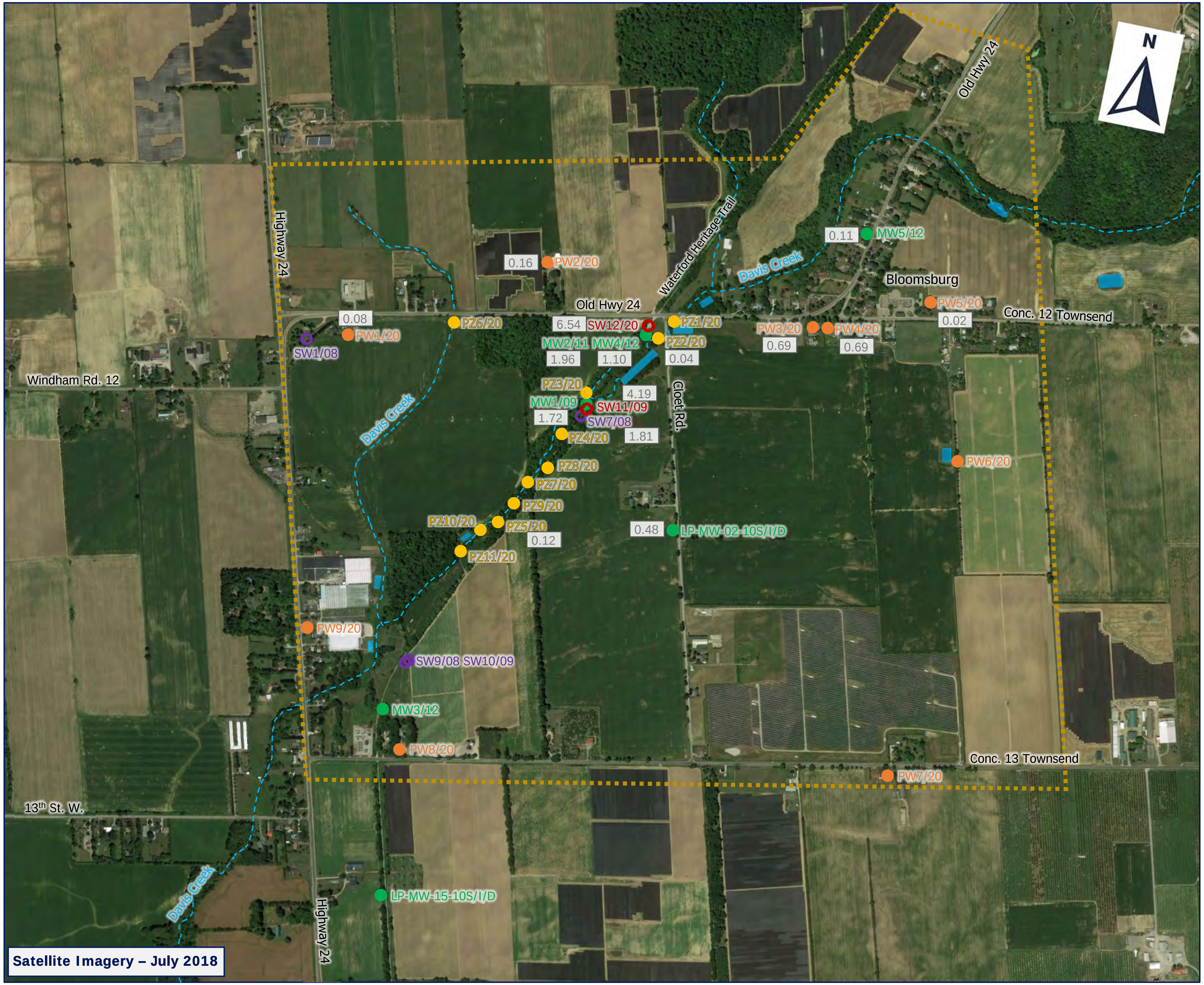
Banks Groundwater Engineering Limited

**Community of Simcoe
Additional Water Supply Project**

Hydrogeological Cross-Section Locations

Norfolk County

Figure 9



Legend

- ⋯ Approximate Survey Area
- ○ Test Production Wells
- ○ Previous Test Wells
- ● Monitoring Wells
- ● Monitored Private Wells
- ● Creek-Bed & Wetland Piezometers
- 6.54 Maximum Drawdown (m) (Only Where Observed, All Others = 0)
- – – Davis Creek – Intermittent
- ▬ Ponds (Former Irrigation)

Approximate Scale - Metres

200 100 0 200 400 600

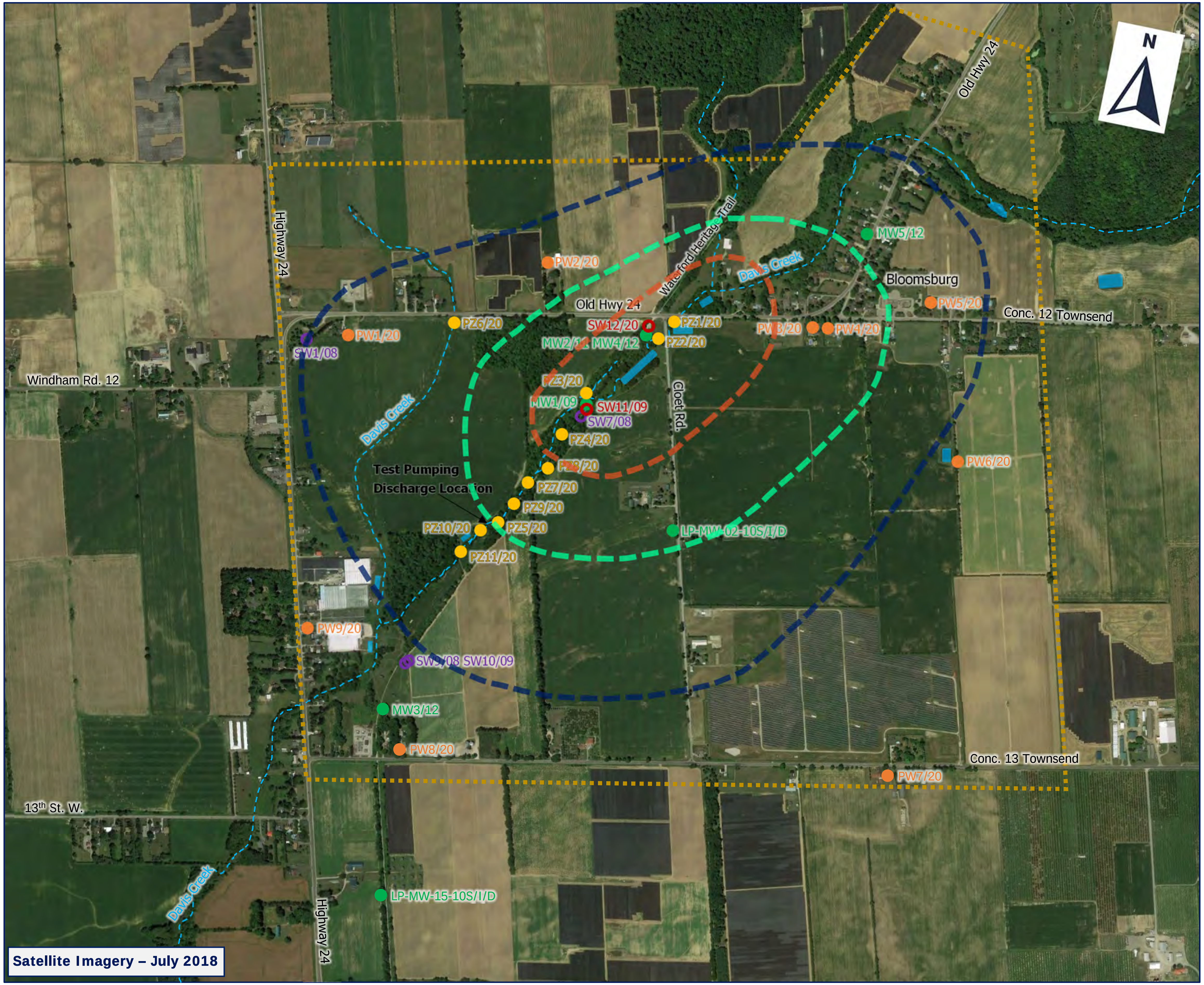
Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Drawdown at Seven Days

Norfolk County

Figure 10



Legend

- ····· Approximate Survey Area
- ○ Test Production Wells
- ○ Previous Test Wells
- ● Monitoring Wells
- ● Monitored Private Wells
- ● Creek-Bed & Wetland Piezometers
- ▬ ▬ Drawdown = 1.0 m (In Supply Aquifer)
- ▬ ▬ Drawdown = 0.5 m (In Supply Aquifer)
- ▬ ▬ Drawdown = 0.0 m (In Supply Aquifer)
- ‒ ‒ Davis Creek – Intermittent
- ▬ Ponds (Former Irrigation)

Approximate Scale - Metres

200 100 0 200 400 600

Banks Groundwater Engineering Limited

Community of Simcoe
Additional Water Supply Project

Interpreted Area of Influence
Pumping Rate = 3,500 L/min

Norfolk COUNTY

Figure 11

Appendix B

Permit to Take Water
2020 Aquifer Testing and Monitoring Program

Ministry of the Environment, Conservation and Parks
Environmental Assessment and Permissions Division
Brownfields and Permit to Take Water
Permit To Take Water Unit
12th Floor
119 King St W
Hamilton ON L8P 4Y7
Fax: (905) 521-7820
Tel: (905) 521-7394

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Direction des évaluations et des permissions environnementales
12e étage
119 rue King W
Hamilton ON L8P 4Y7
Télécopieur: (905) 521-7820
Tél:(905) 521-7394

Ontario

June 15, 2020

The Corporation of Norfolk County
183 Main St Delhi
Norfolk, Ontario
N4B 2M3

Dear Sir/Madam

RE: Lot: 2, Concession: 12
Geographic Township of Woodhouse
Norfolk

Permit Number 8647-BQAMC5

Please find attached a Permit to Take Water which authorizes the withdrawal of water in accordance with the application for this Permit to Take Water, dated March 10, 2020 and signed by Scott Zerbes.

This Permit expires on December 31, 2020. Authorized rates and amounts are indicated on Table A.

Section 9(3) of Ontario Regulation 387/04 (Water Taking and Transfer) requires all holders of a permit to report daily water taking amounts annually, in a manner and form approved by the Director (https://www.lrcsde.lrc.gov.on.ca/wtrs/). For the purpose of s. 9(3), such reports shall be submitted electronically to the Water Taking Reporting System (WTRS) electronic database or via hard copy, as described in the Technical Bulletin entitled "Permit to Take Water Program Monitoring and Reporting of Water Takings", dated November 2006, PIBs 6003e (http://www.ontla.on.ca/library/repository/mon/16000/269521.pdf**).**

If you have questions about reporting requirements, please call the WTRS Help Desk at 416-235-6322 (toll free: 1-877-344-2011) or by email, WTRSHelpdesk@ontario.ca. It is preferred that you submit your data directly and electronically to the WTRS. Where this is impracticable, please contact the WTRS Help Desk to arrange for written submission of your data.

Condition 1.4 specifically indicates that this Permit is not transferable to another party. Any queries regarding a change in owner/operator should be made to the Permit to Take Water Evaluator at the above address.

Take notice that in issuing this Permit, terms and conditions pertaining to the taking of water and to the results of the taking have been imposed. The terms and conditions have been designed to allow for the development of water resources, while providing reasonable protection to existing water uses and users.

Yours truly,

Gregory Meek
Supervisor (Acting), Permit To Take Water
Environmental Assessment and Permissions Branch

File Storage Number: AP28 NO NO

Ministry of the Environment, Conservation and Parks
Ministère de l'Environnement, de la Protection de la nature et des Parcs

PERMIT TO TAKE WATER

Pumping Test

NUMBER 8647-BQAMC5

Pursuant to Section 34.1 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

The Corporation of Norfolk County
183 Main St Delhi
Norfolk, Ontario
N4B 2M3

For the water taking from: Two Test Well: SW11/09, SW12/20

Located at: Lot 2, Concession 12, Geographic Township of Woodhouse
Norfolk

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment, Conservation and Parks.

(d) "District Office" means the Hamilton District Office.

(e) "Permit" means this Permit to Take Water No. 8647-BQAMC5 including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

(f) "Permit Holder" means The Corporation of Norfolk County.

(g) "OWRA " means the *Ontario Water Resources Act,* R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated March 10, 2020 and signed by Scott Zerbes C. Tech, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

2. General Conditions and Interpretation

2.1 Inspections
The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals
The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act*, and the *Environmental Protection Act*, and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information
The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action
The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability
The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts
Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 Expiry

This Permit expires on **December 31, 2020**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted
The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken:	Zone/ Easting/ Northing:
1	SW11/09	Well Drilled	Pumping Test	Miscellaneous	1,820	24	2,620,800	10	17 556500 4747861
2	SW12/20	Well Drilled	Pumping Test	Miscellaneous	2,430	24	3,499,200	30	17 556625 4748135
						Total Taking:	6,120,000		

3.2 Notwithstanding Table A, this Permit is valid for **one (1) non-recurring consecutive ten (10) day period** of water taking from Source Name SW11/09 and **one (1) non-recurring consecutive thirty (30) day period** of water taking from Source Name SW12/20 between the date of issuance and December 31, 2020.

3.3 Prior to taking of water under this Permit, the Permit Holder shall ensure that any and all applicable permits or authorizations are obtained from Federal and Provincial Agencies having legislative mandates in water resources management.

4. Monitoring

4.1 Notification to Well Owners
Prior to the commencement of water taking under the authorization of this Permit, the Permit Holder shall undertake a door to door well survey to confirm the location and completion details of all private domestic wells that are located within 500 m radius or anticipated zone of influence of the municipal test well, whichever is greater. At least 72 hours prior to beginning the pumping test, the Permit Holder shall provide written notification to the owners of the wells identified within the potential cone of influence. The notification shall include the expected date, time and duration of the pumping test, and a contact telephone number that may be used to report any interference with water supplies.

4.2 Measuring Water Depths
To establish baseline conditions, well depths and depths to water levels for identified representative wells in the area of the water taking shall be recorded by the Permit Holder. During the pumping test, water levels in the identified wells shall be recorded. The pumping test must be of sufficient duration to accurately predict the long term impacts of the proposed water taking. Water levels in the identified wells shall continue to be monitored beyond the water taking period until at least 85% recovery is achieved.

4.3 Under section 9 of O. Reg. 387/04, and as authorized by subsection 34(6) of the Ontario Water Resources Act, the Permit Holder shall, on each day water is taken under the authorization of this Permit, record the date, the volume of water taken on that date and the rate at which it was taken.

The daily volume of water taken shall be measured by a flow meter or calculated in accordance with the method described in the application for this Permit, or as otherwise accepted by the Director. A separate record shall be maintained for each source. The Permit Holder shall keep all records required by this condition current and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request. The Permit Holder, unless otherwise required by the Director, shall submit, on or before March 31st in every year, the records required by this condition to the ministry's Water Taking Reporting System.

4.4 Prior to the commencement of the pumping test and upon completion of a door to door survey required in Condition 4.1, the Permit Holder shall submit to the Director for concurrence a detailed groundwater and surface water monitoring plan. The monitoring plan shall identify groundwater and surface water monitoring locations, monitoring frequency and all other pertinent details relevant to the monitoring wells construction details and their relevance to the test pumping wells. The monitoring plan shall also identify discharge point/location accepting pumped water discharge and discussion on potential for artificial overburden aquifer recharge as a result of discharge water disposal on water level within the anticipated zone of influence of the pumping wells. In addition, the proposed monitoring plan include a provision of collecting groundwater samples from a subset of existing private wells for chemical quality testing (subject to owner's permission) to establish baseline groundwater quality conditions.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 Restoration of Water Supply

Where the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of doing so.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water*

Resources Act , Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, as amended, provides that the Notice requiring the hearing shall state:

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

a. The name of the appellant;
b. The address of the appellant;
c. The Permit to Take Water number;
d. The date of the Permit to Take Water;
e. The name of the Director;
f. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto ON
M5G 1E5
Fax: (416) 326-5370
Email: ERTTribunalsecretary@ontario.ca

AND

The Director, Section 34.1,
Ministry of the Environment, Conservation and Parks
Floor 1, 135 St Clair Ave W
Toronto, ON
M4V 1P5

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by Telephone at	by Fax at	by e-mail at
(416) 212-6349	(416) 326-5370	www.ert.gov.on.ca
Toll Free 1(866) 448-2248	Toll Free 1(844) 213-3474	

Dated at Toronto this 15th day of June, 2020.

G. Meek

Gregory Meek
Director, Section 34.1
Ontario Water Resources Act , R.S.O. 1990

Location: WTRS / WT DATA / Input WT Record WTRS-WT-008

Water Taking Data submitted successfully.

Confirmation:

Thank you for submitting your water taking data online.

Permit Number: 8647-BQAMC5
Permit Holder: THE CORPORATION OF NORFOLK COUNTY.
Received on:Feb 17, 2021 12:23 PM

This confirmation indicates that your data has been received by the Ministry,but should not be construed as acceptance of this data if it differs from that specified on the Permit Number, assigned to the Permit Holder stated above.

Return to Main Page

NORFOLK2 COUNTY2 | 2021/02/17
version: v4.5.0.21 (build#: 22)
Last modified: 2018/09/18

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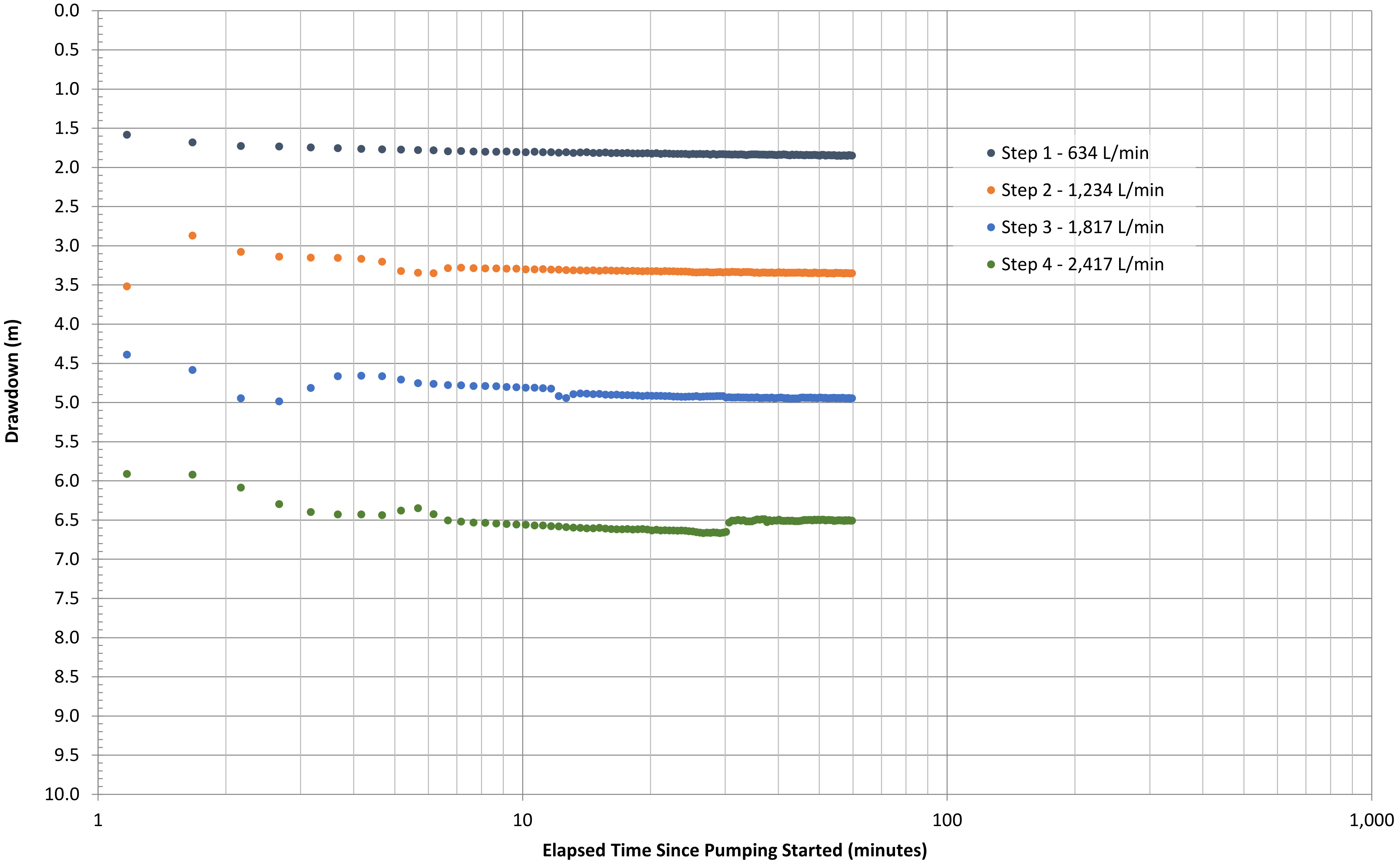
Appendix C

Monitoring and Aquifer Testing Program Graphs

Appendix C1

Step Testing Graphs
(Graphs 1 to 4)

Step-Drawdown Test - SW12/20 (8 July 2020)

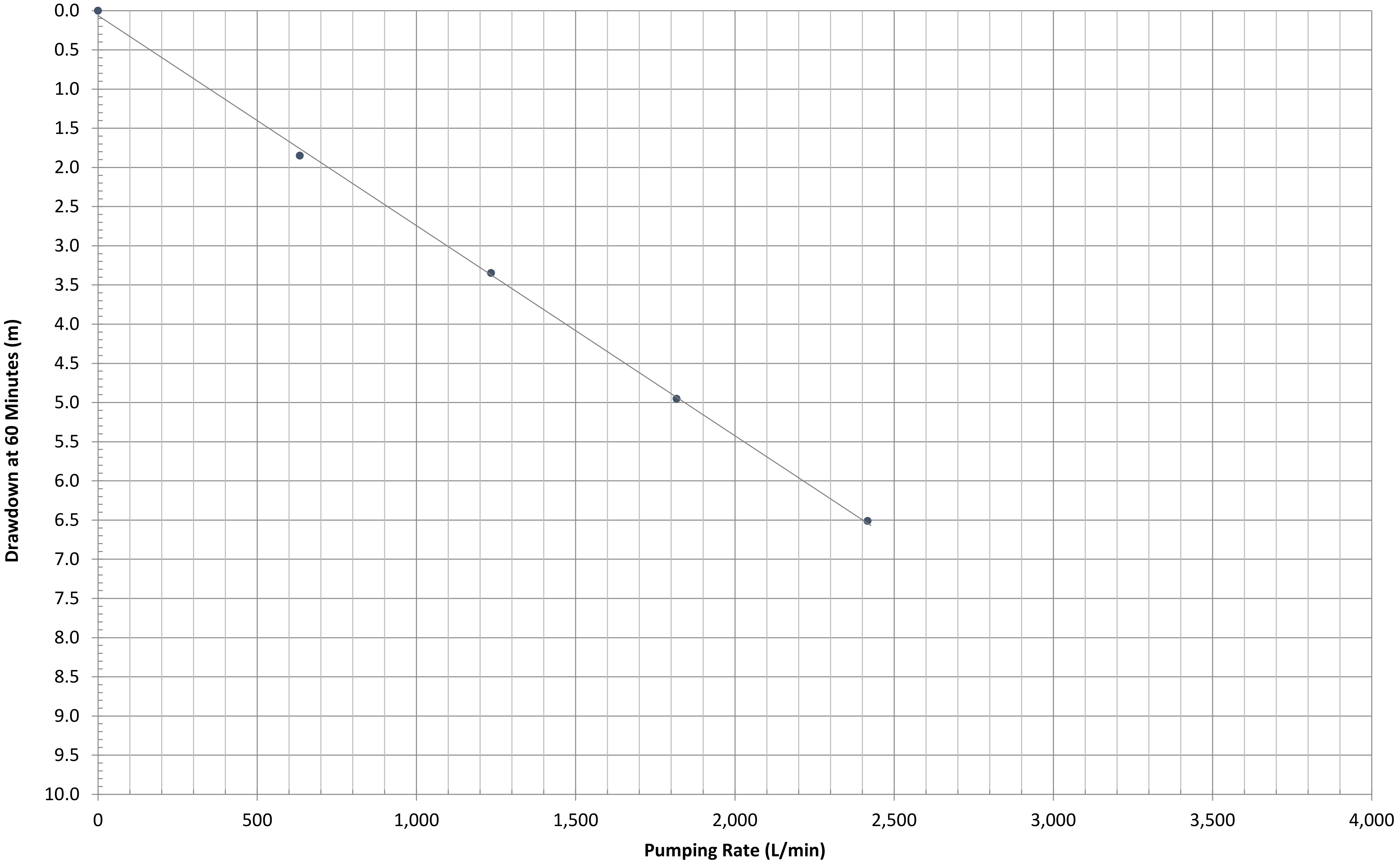


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 1

Step-Drawdown Test - SW12/20 (8 July 2020)

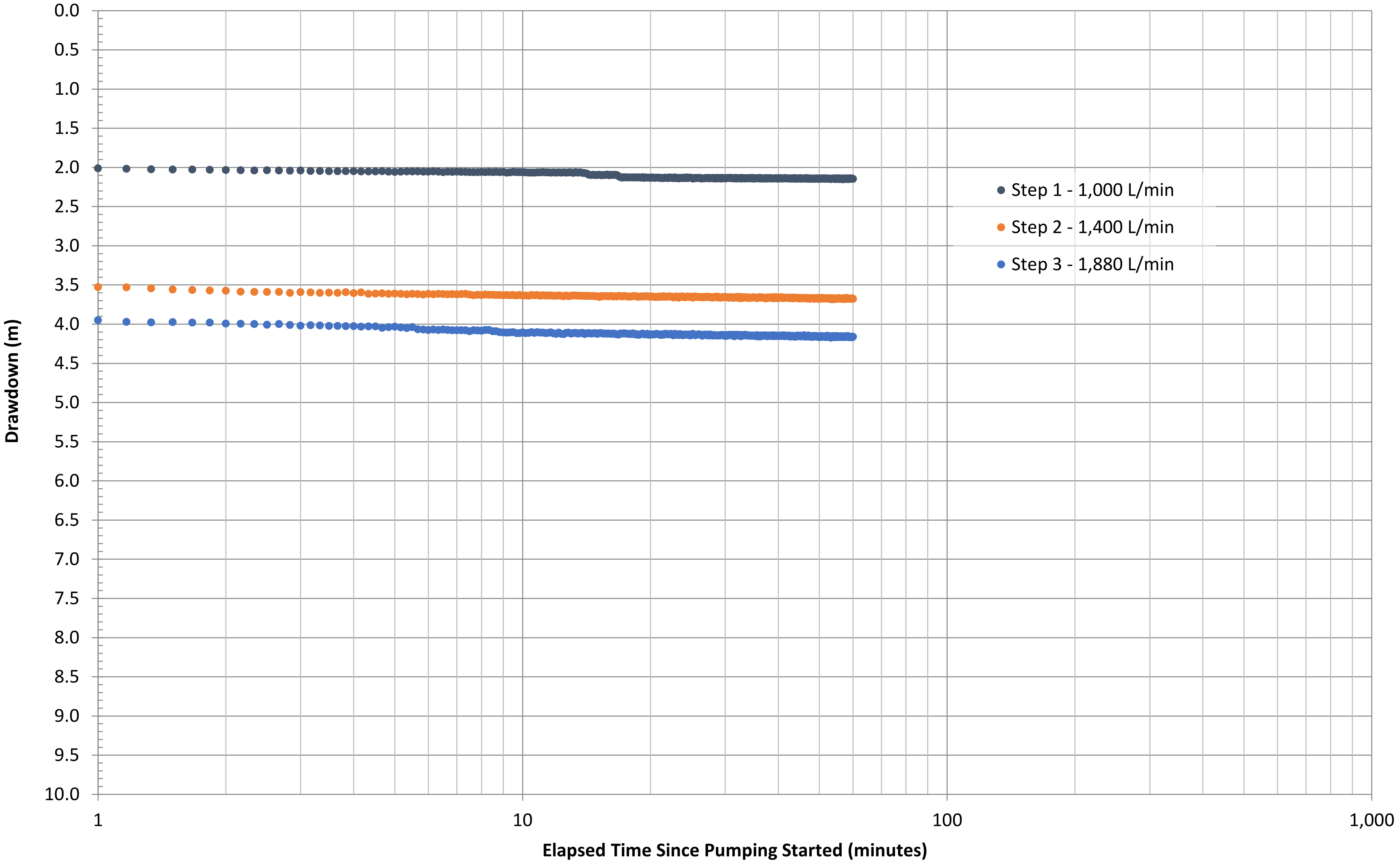


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 2

Step-Drawdown Test - SW11-09 (23 September 2020)

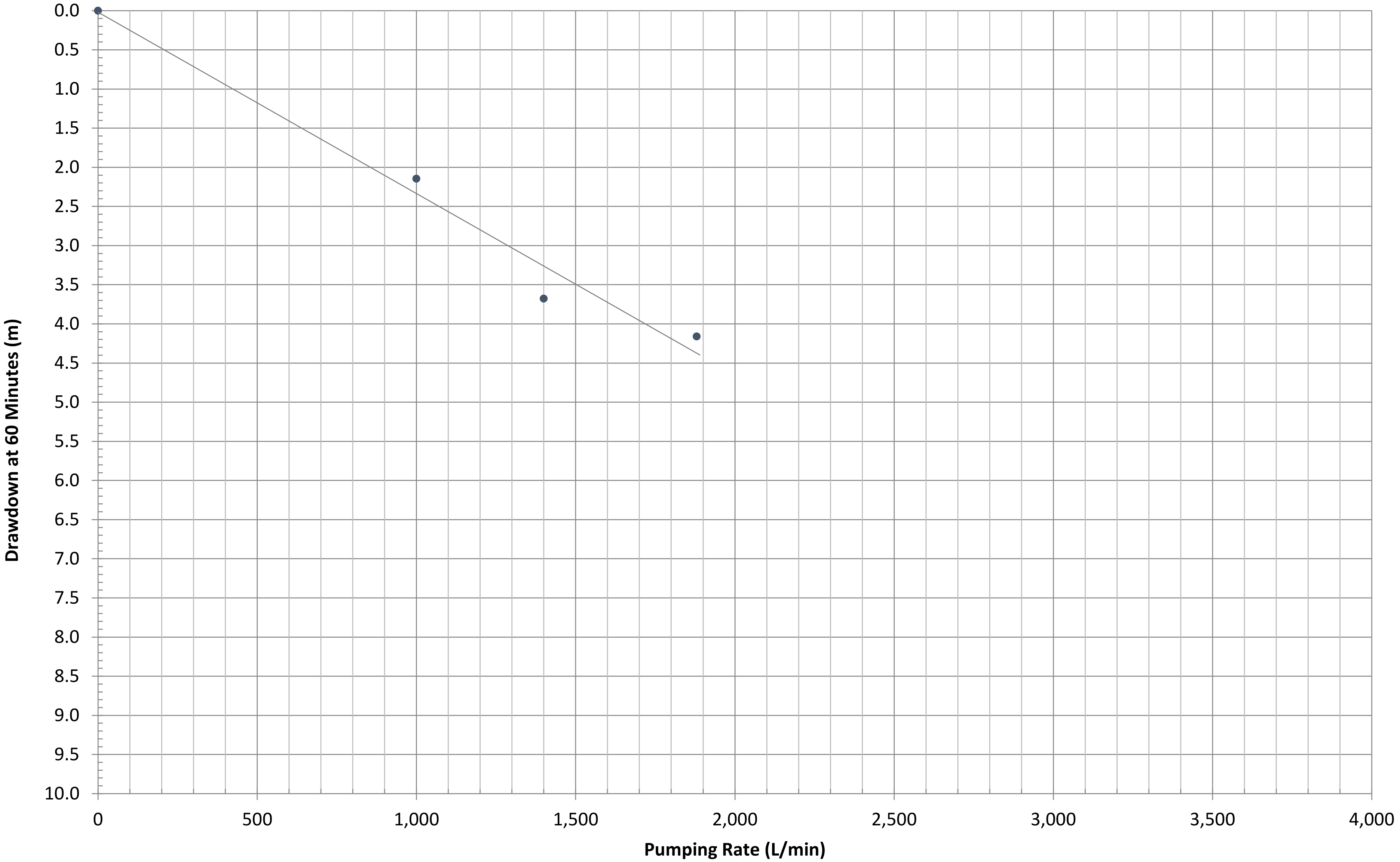


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 3

Step-Drawdown Test - SW11-09 (23 September 2020)



Banks Groundwater Engineering Limited

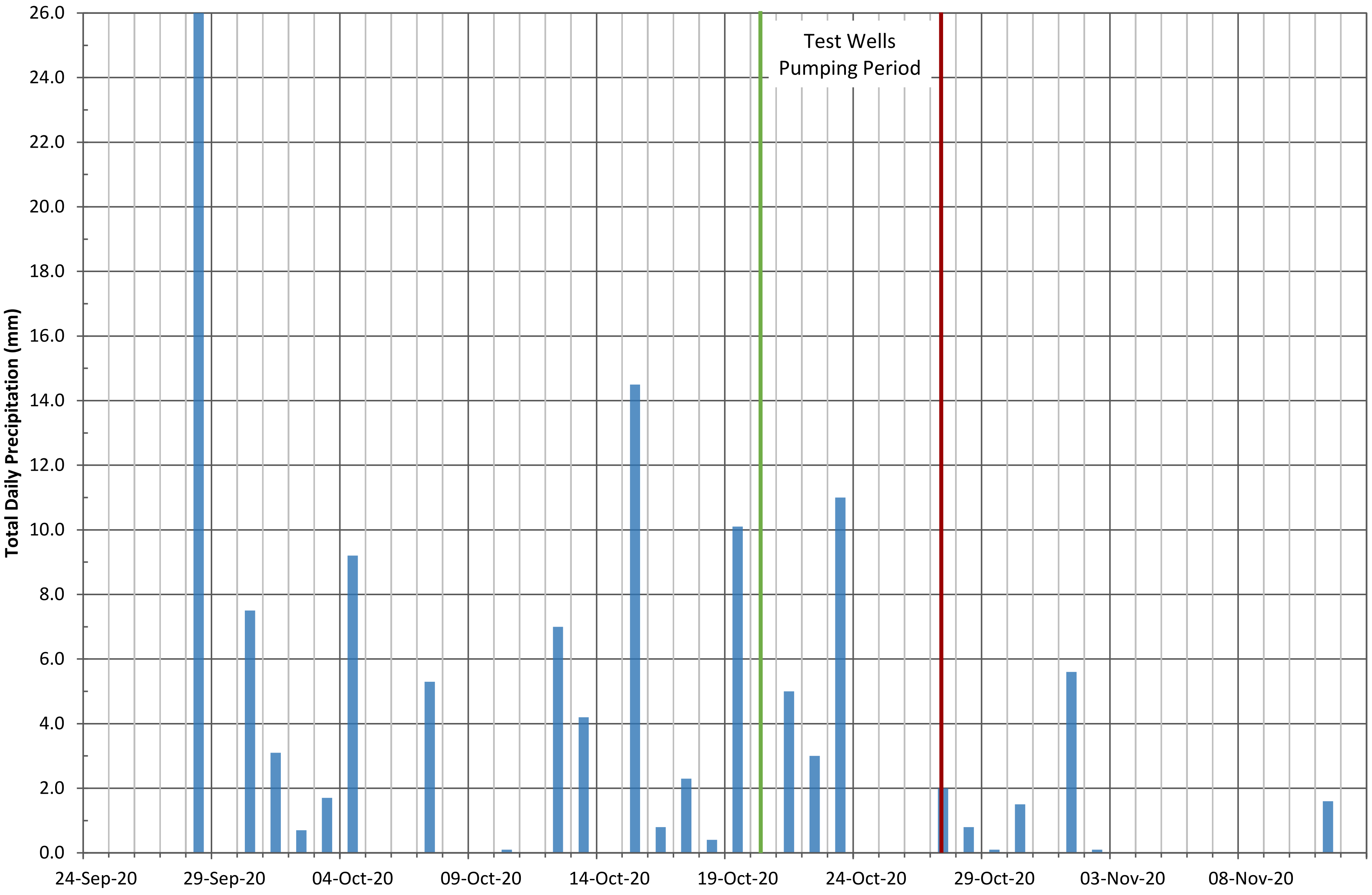
Community of Simcoe Water Supply Class Environmental Assessment

Graph 4

Appendix C2

Daily Precipitation and Hydrographs
(Graphs 5 to 47)

Total Daily Precipitation (mm)

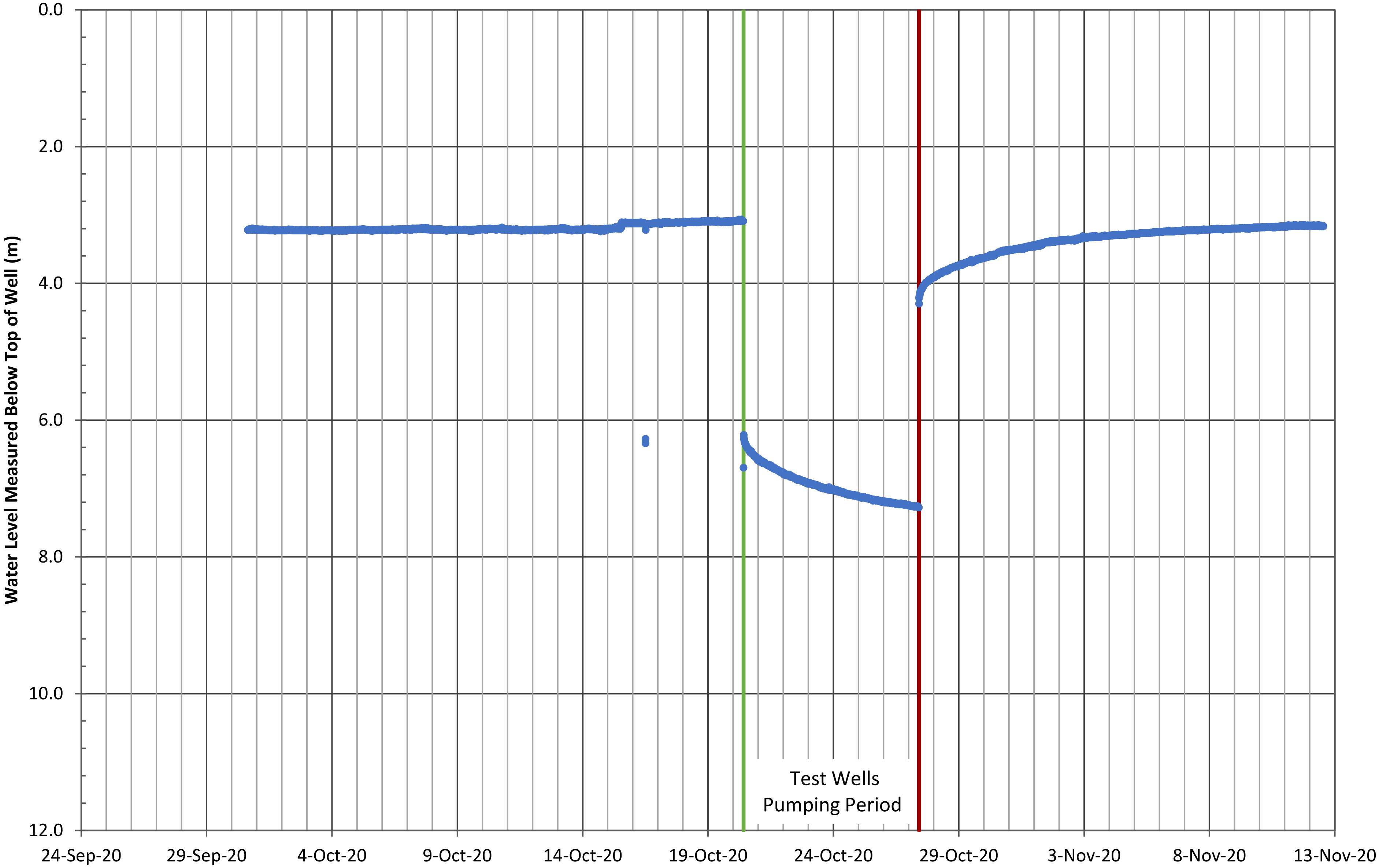


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 5

Hydrograph - Test Production Well SW11/09



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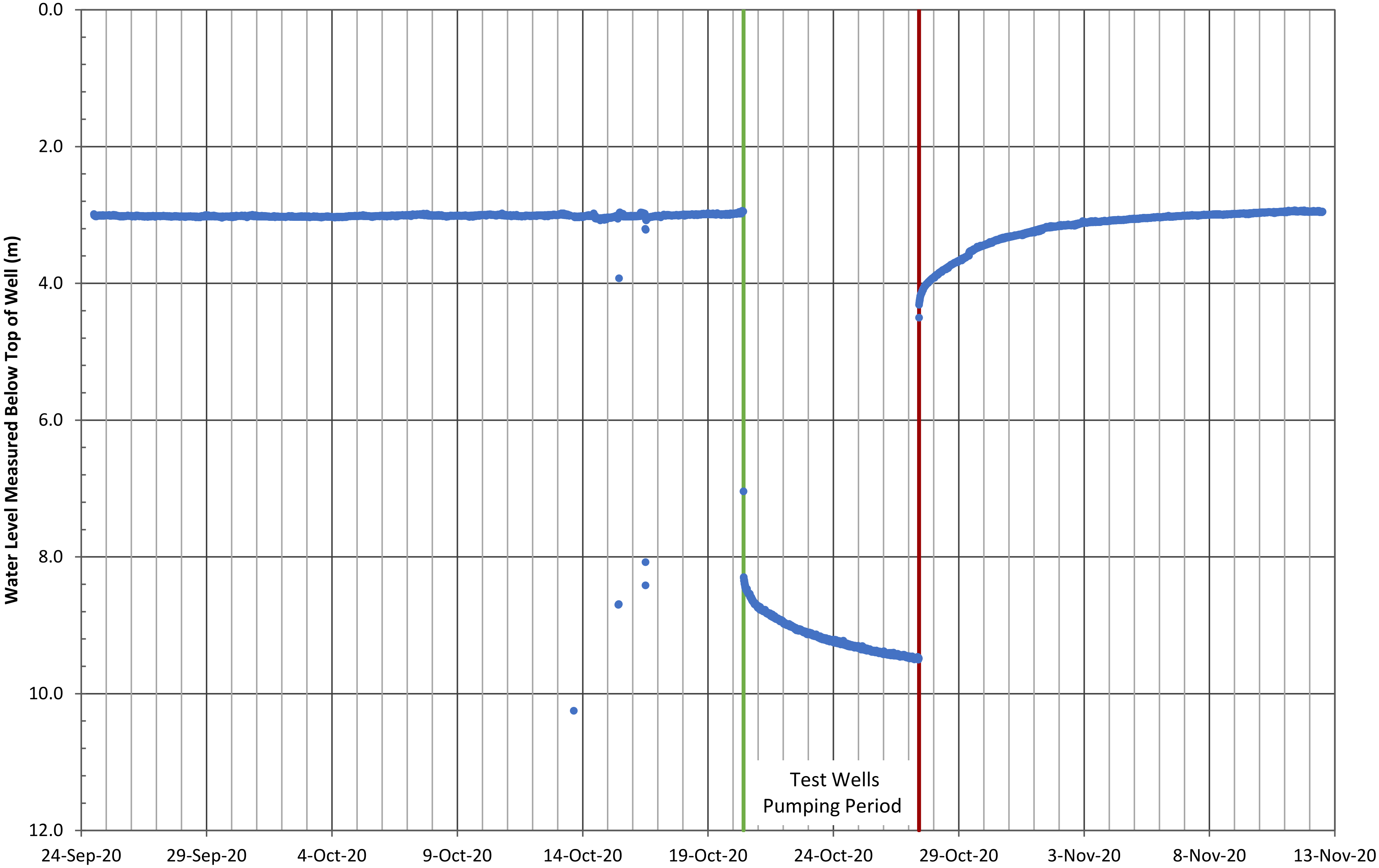
Graph 6

Hydrograph - Test Production Well SW12/20



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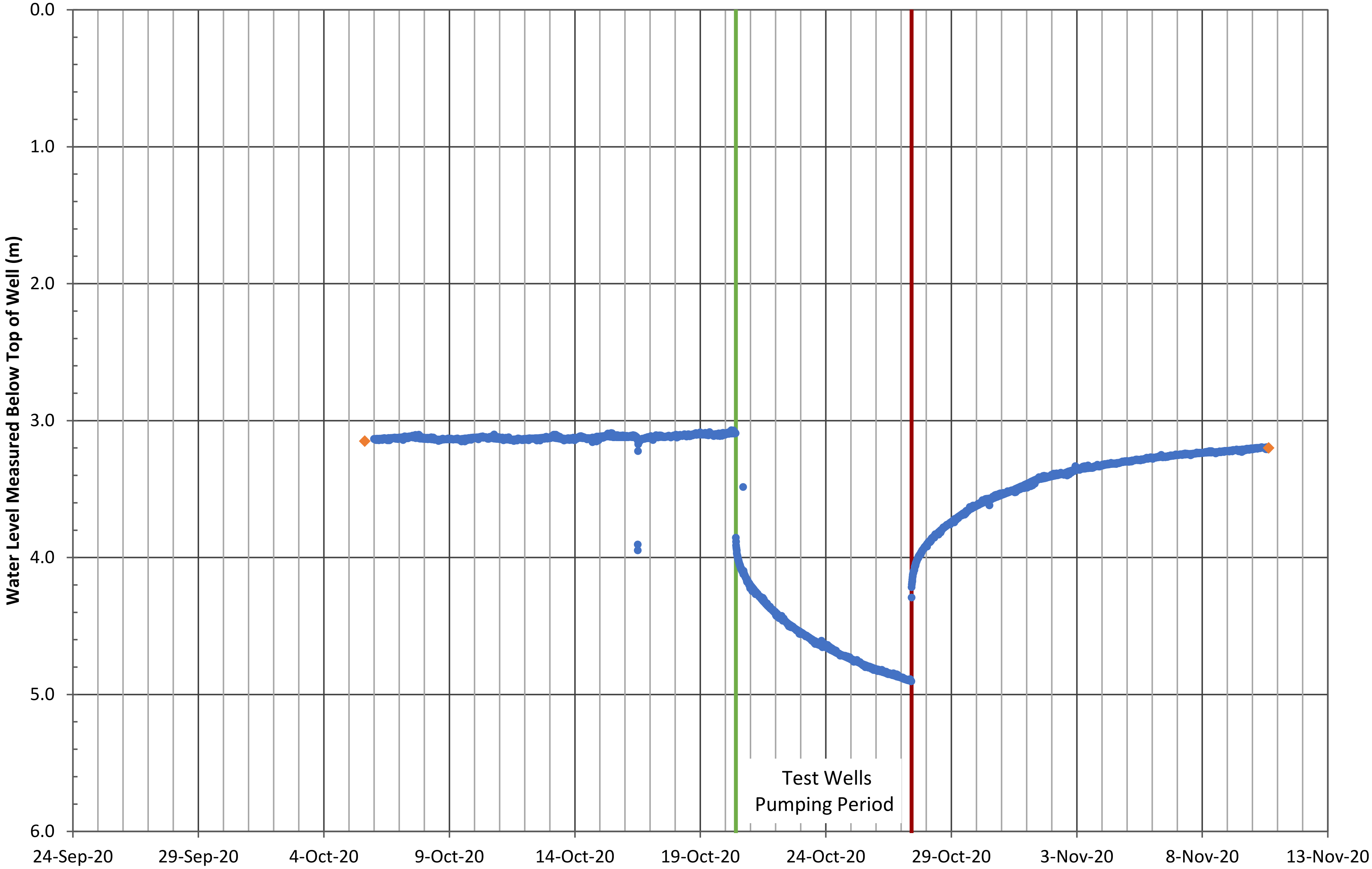
Graph 7

Hydrograph - Monitored Well SW7/08



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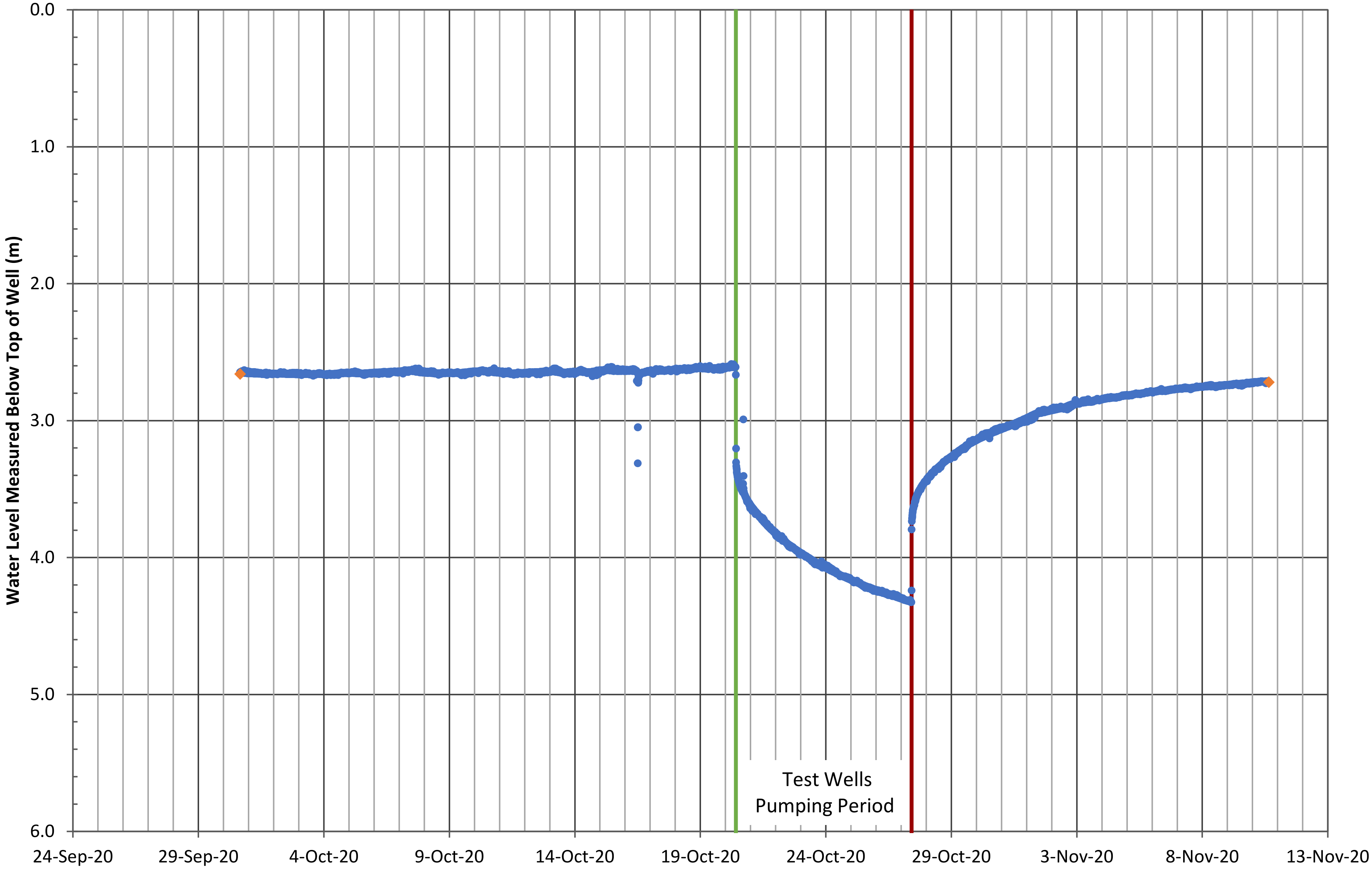
Graph 8

Hydrograph - Monitoring Well MW1/09



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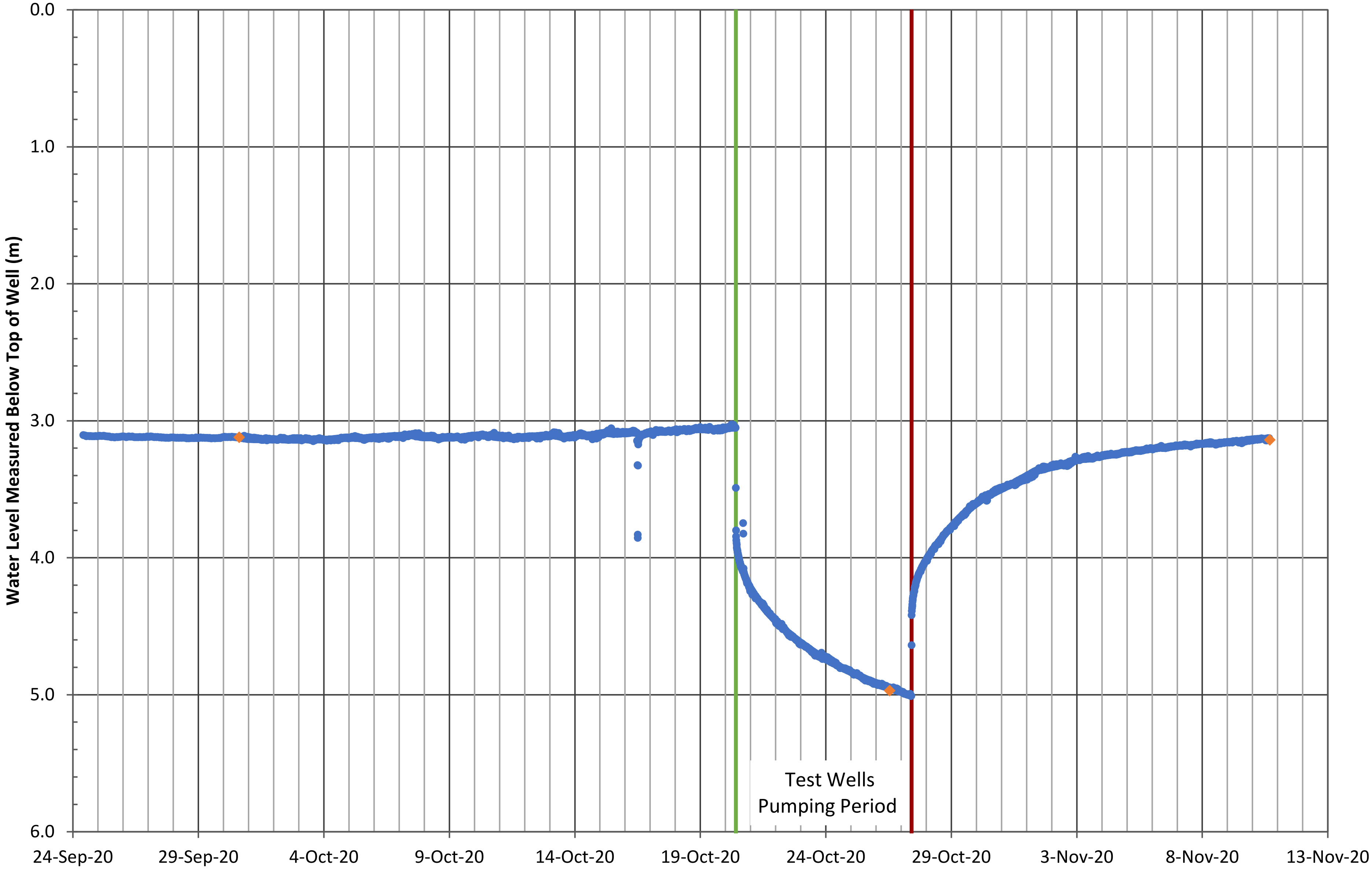
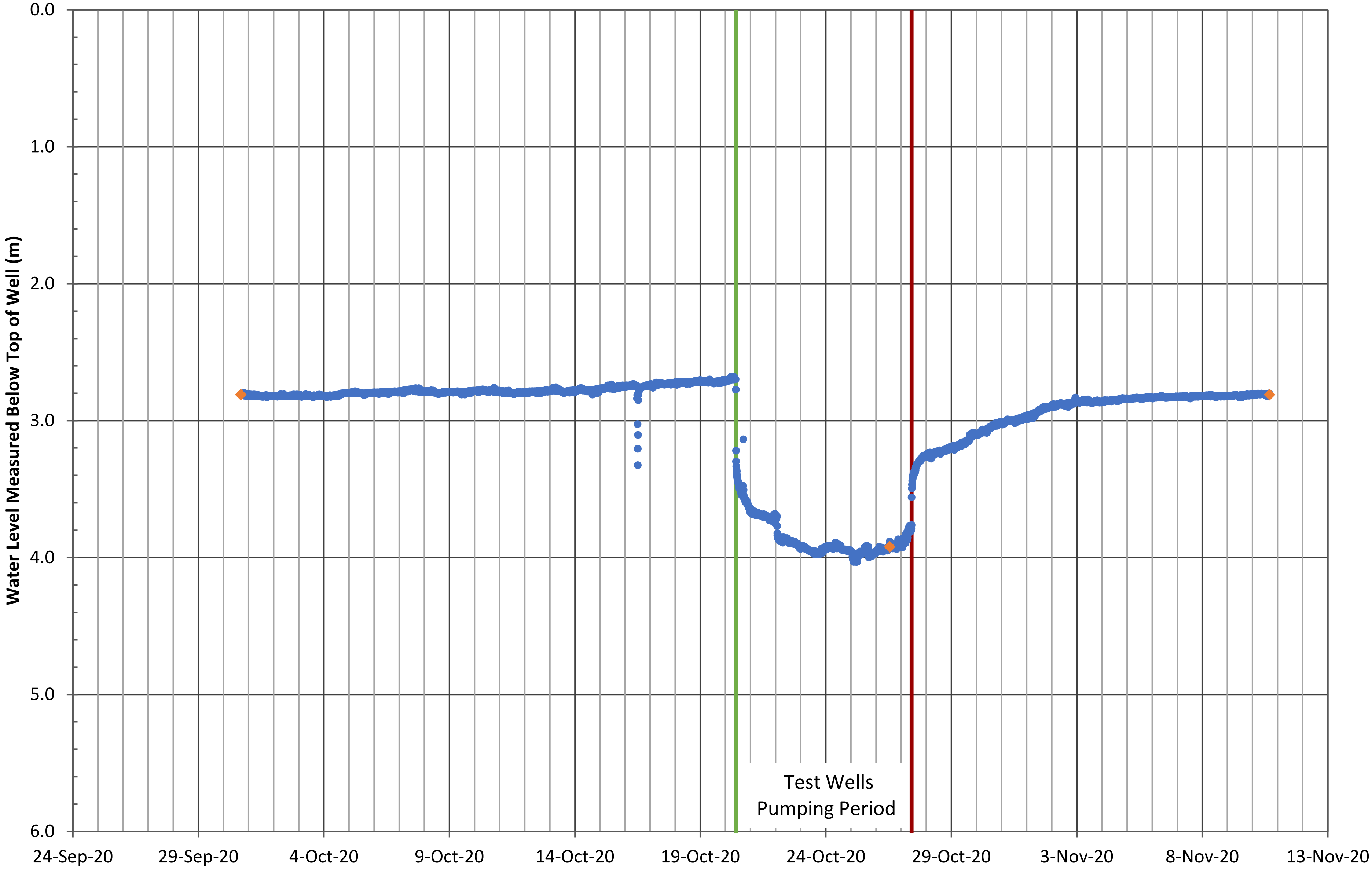
Graph 9

Hydrograph - Monitoring Well MW2/11



Hydrograph - Monitoring Well MW4/12



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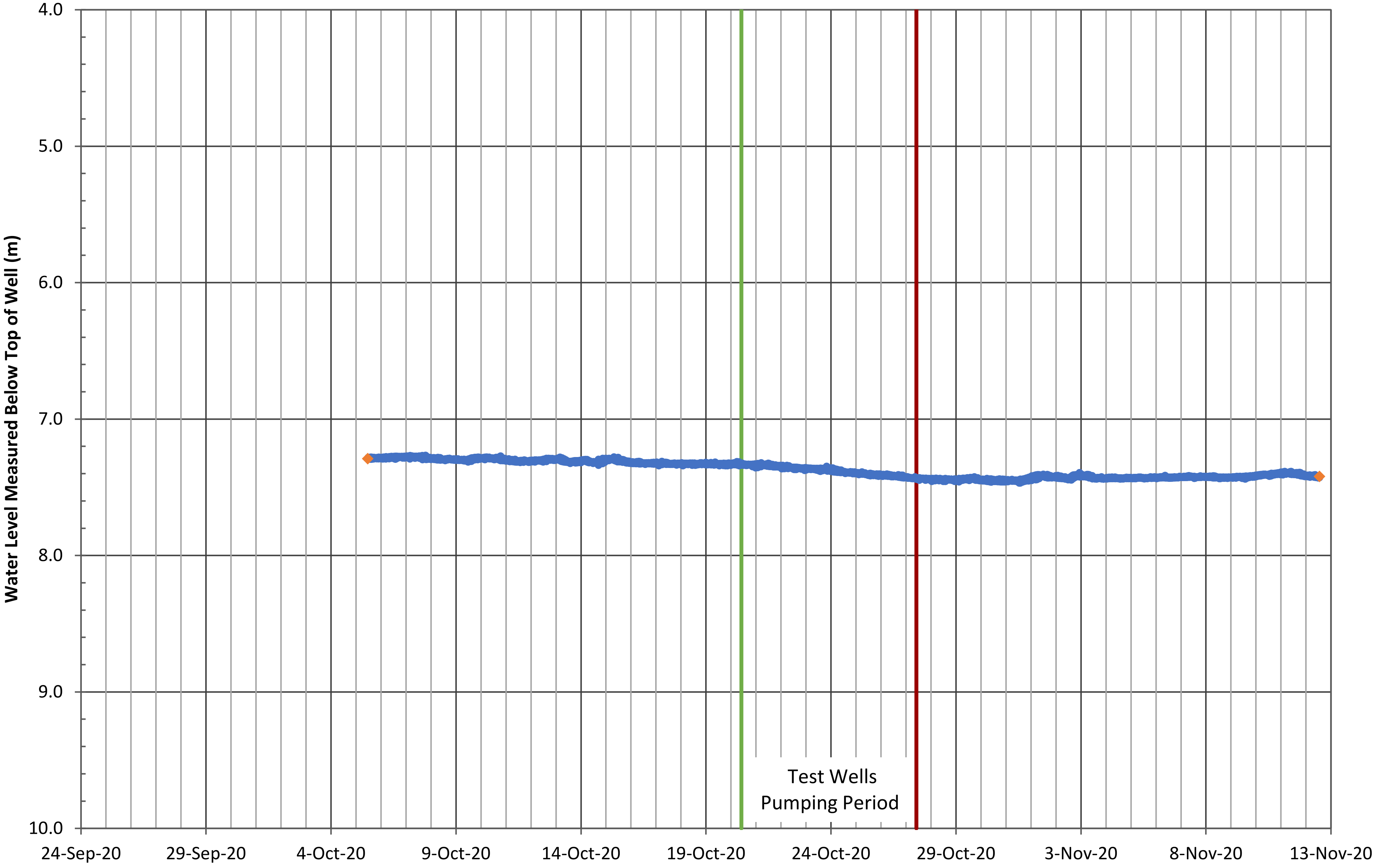
Graph 11

Hydrograph - Monitoring Well MW5/12



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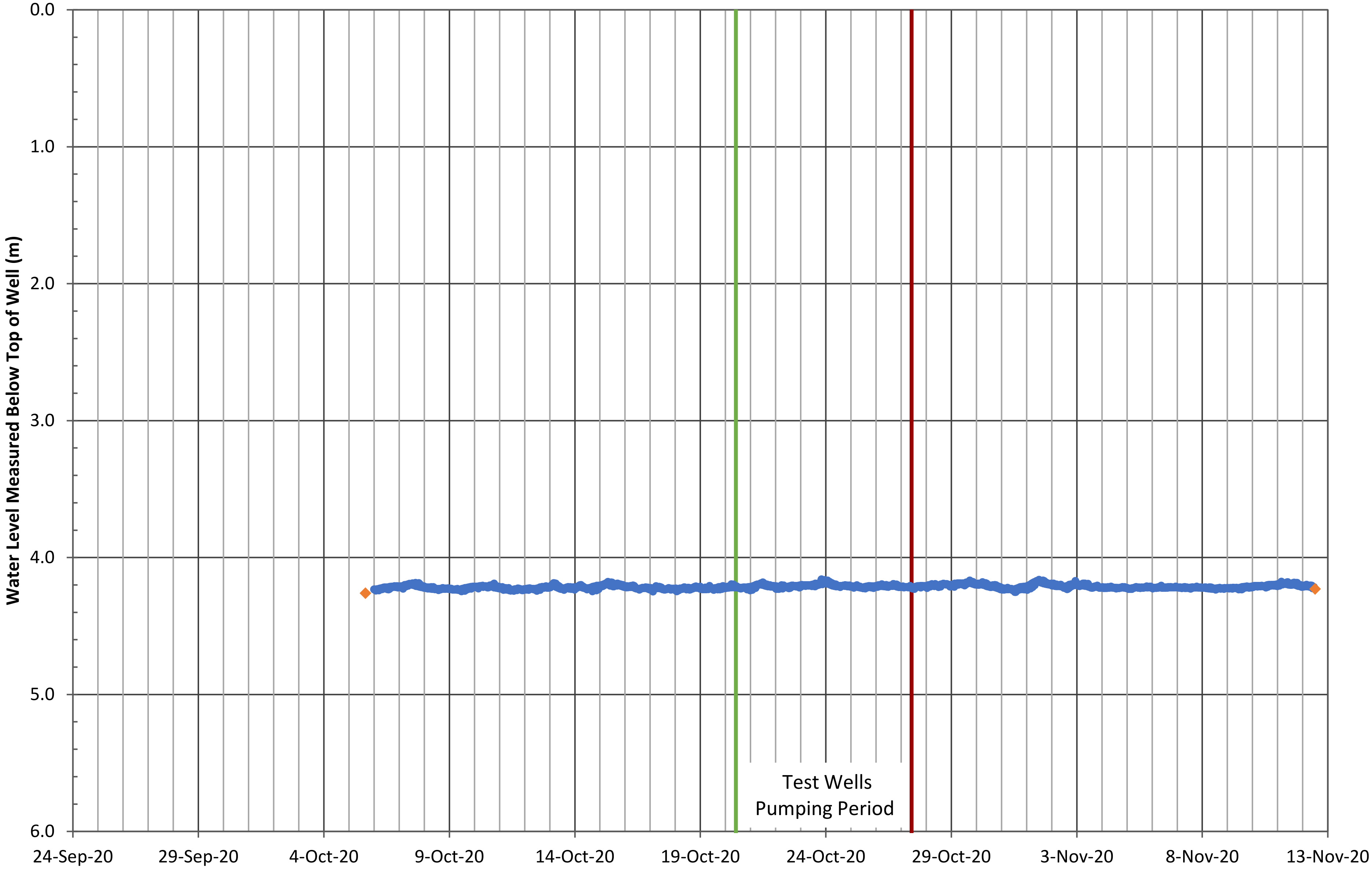
Graph 12

Hydrograph - Monitored Well SW1/08



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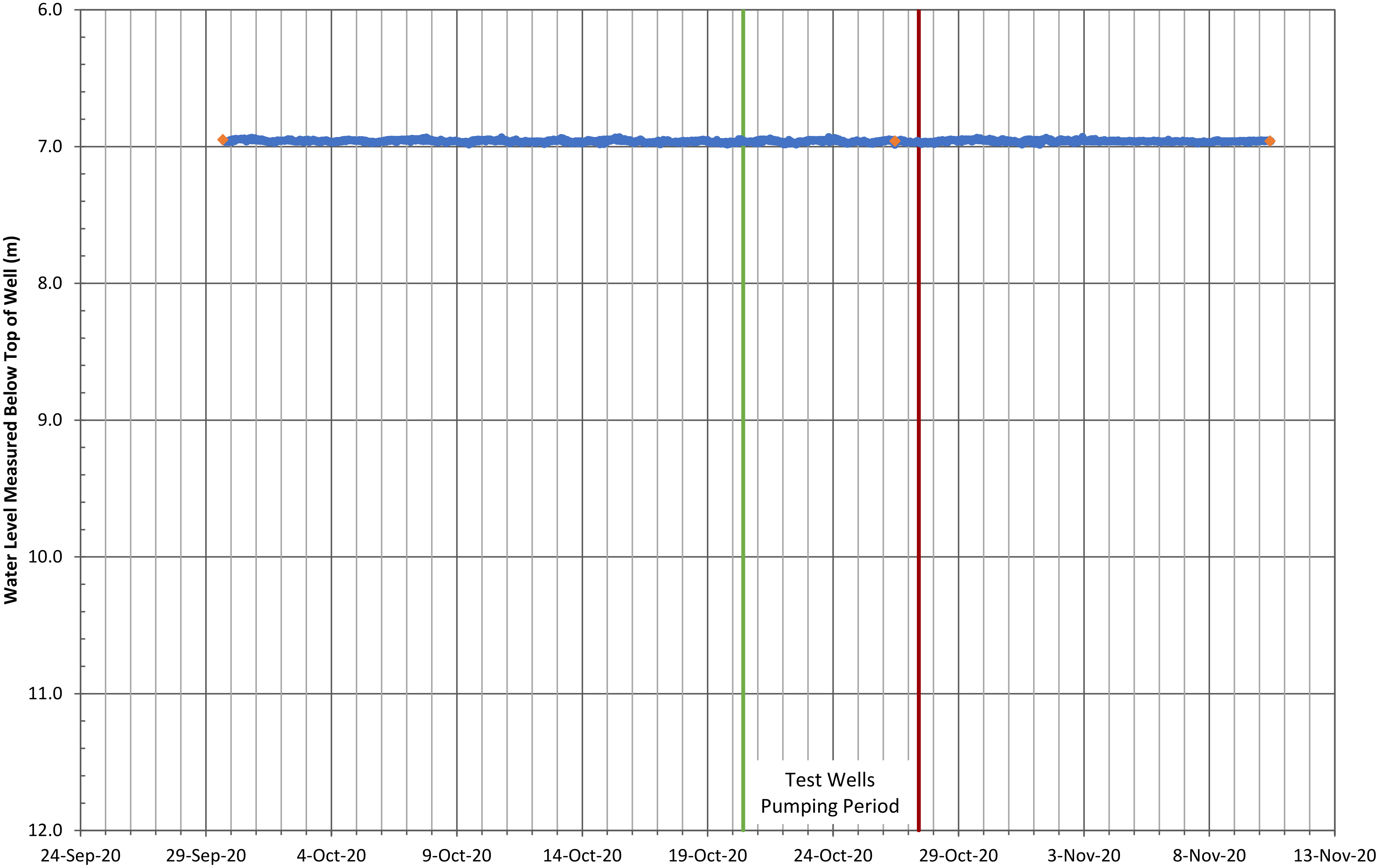
Graph 13

Hydrograph - Monitoring Well LP-MW-2-10-S



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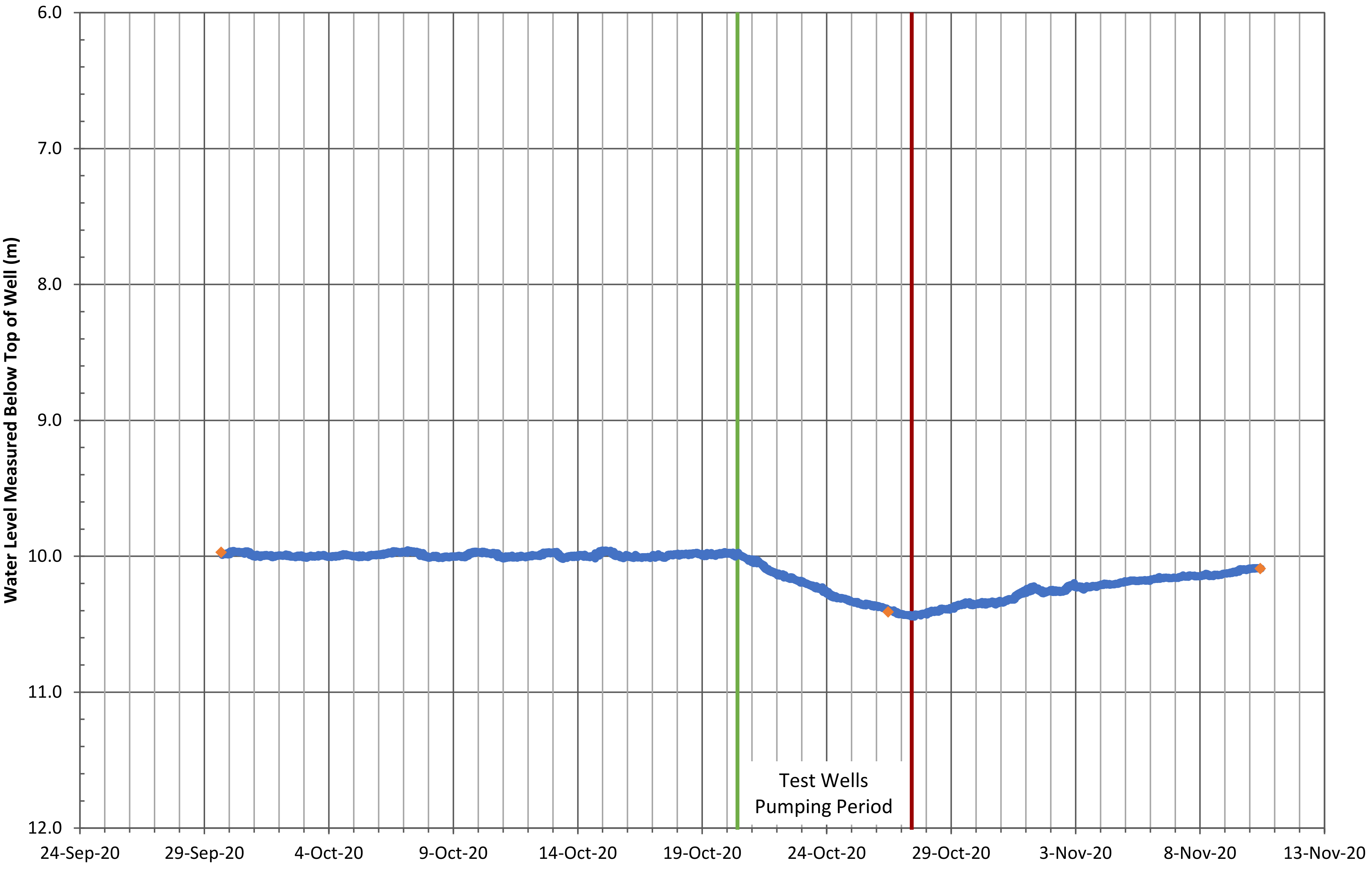
Graph 14

Hydrograph - Monitoring Well LP-MW-2-10-I



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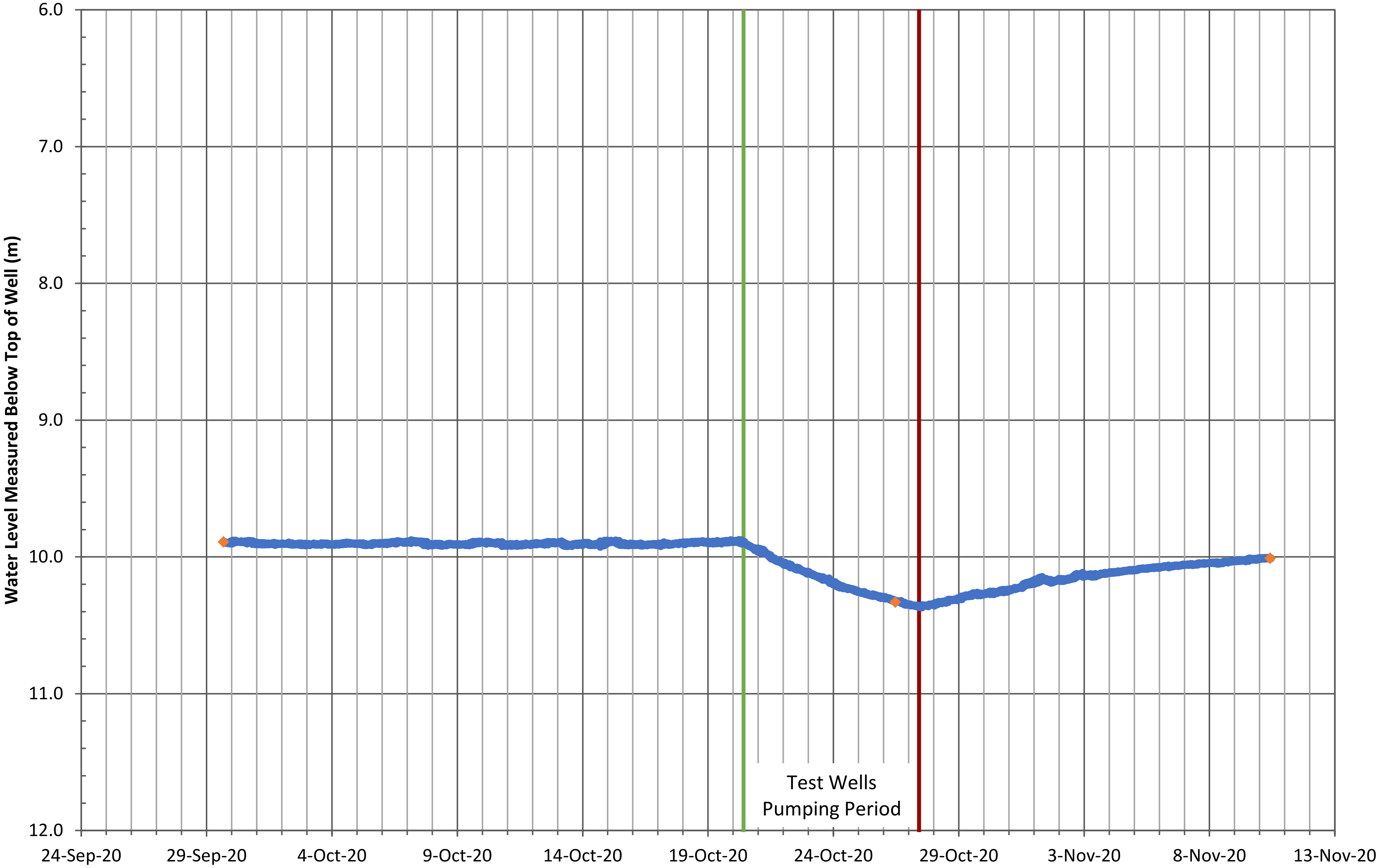
Graph 15

Hydrograph - Monitoring Well LP-MW-2-10-D



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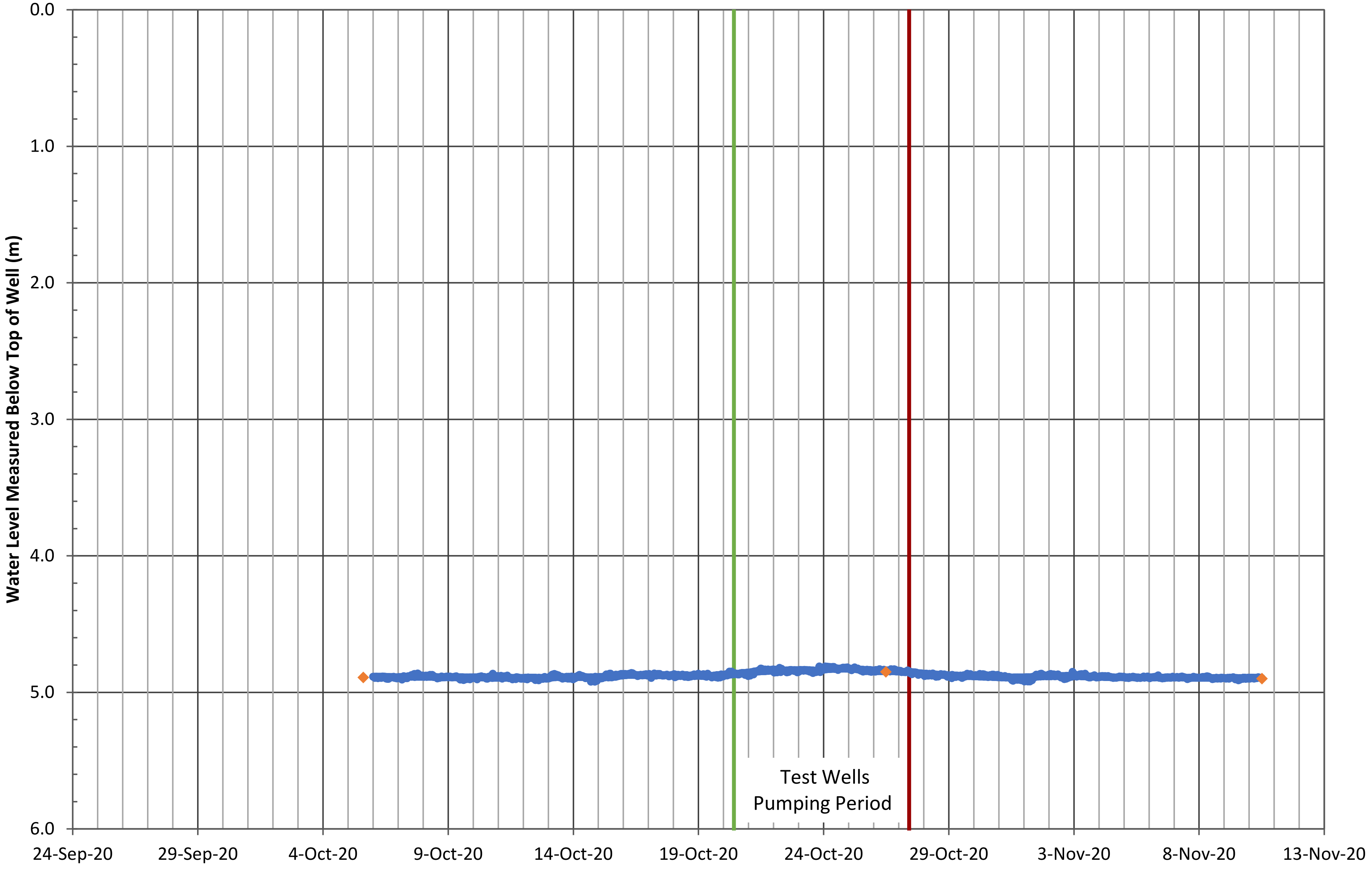
Graph 16

Hydrograph - Monitored Well SW9/08



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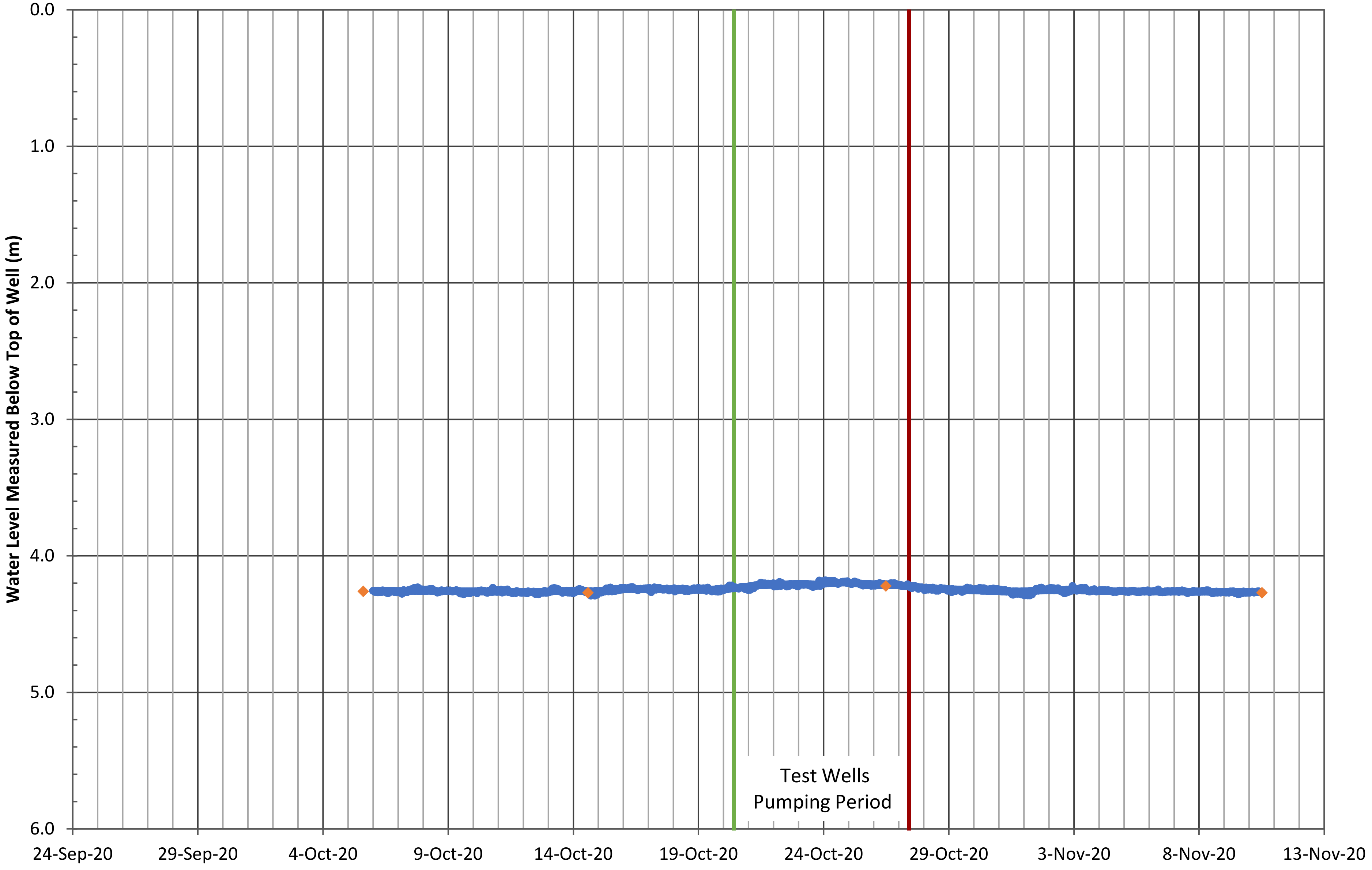
Graph 17

Hydrograph - Monitored Well SW10/09



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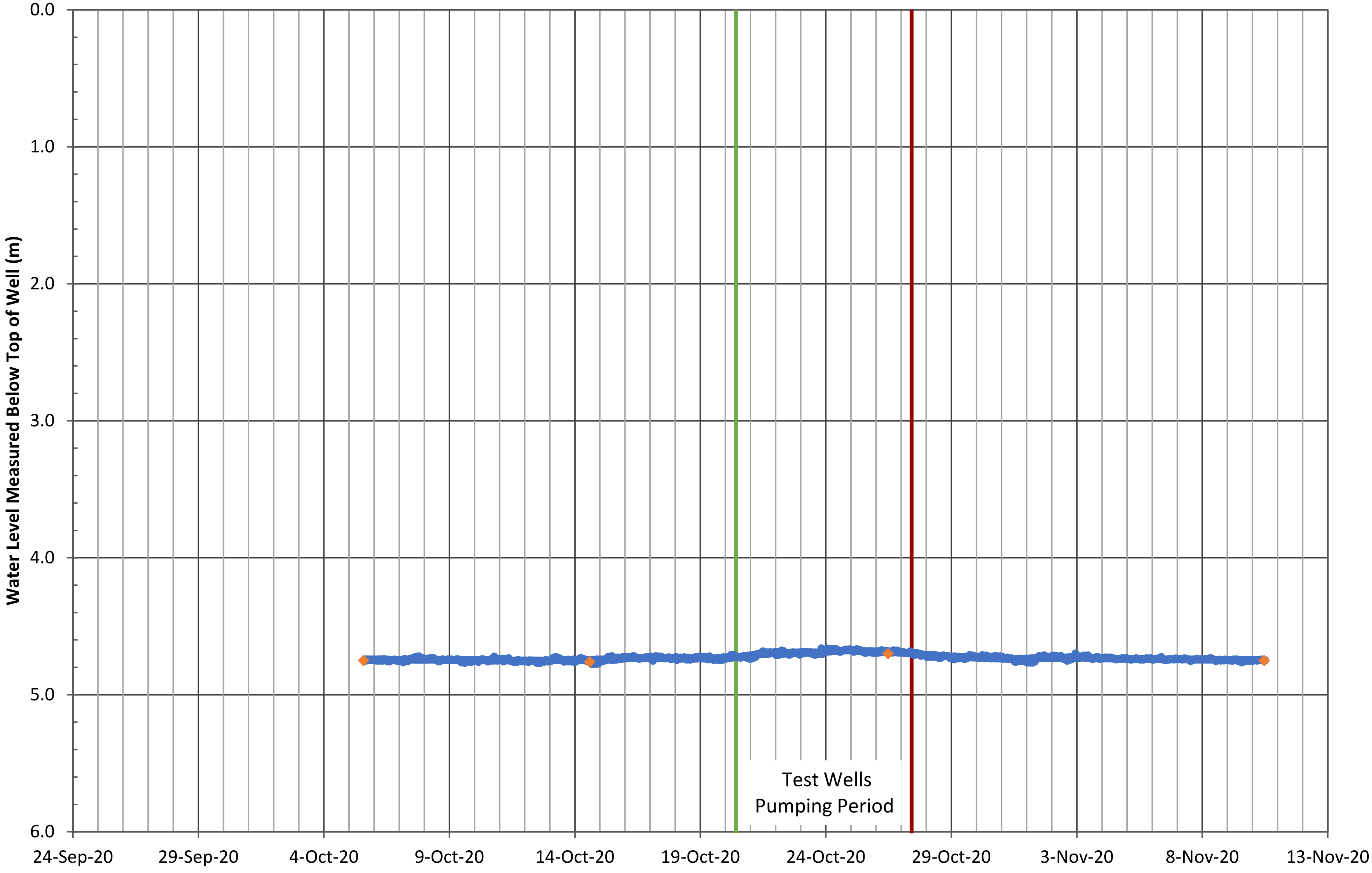
Graph 18

Hydrograph - Monitoring Well MW3/12



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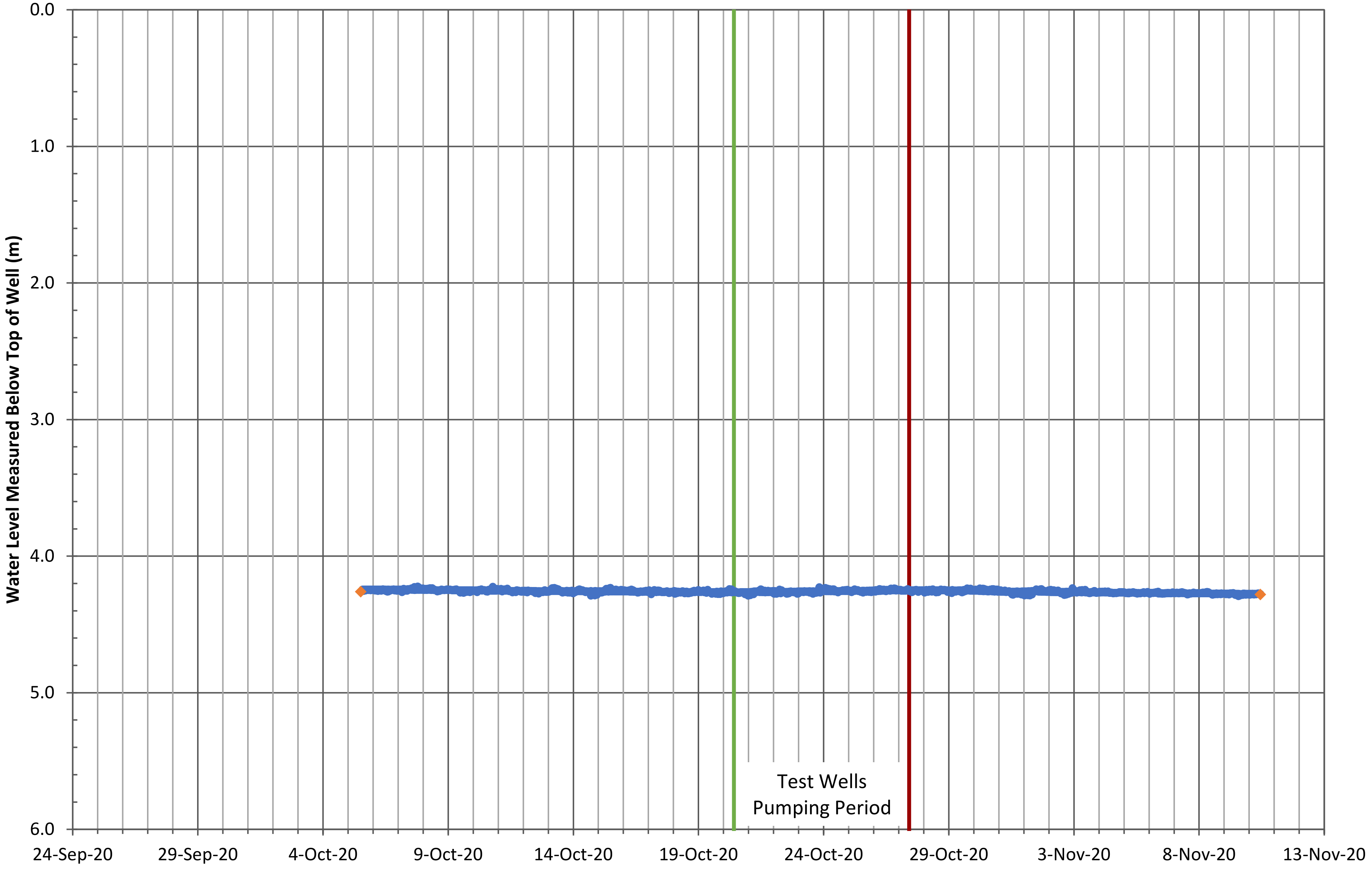
Graph 19

Hydrograph - Monitoring Well LP-MW-15-10-S



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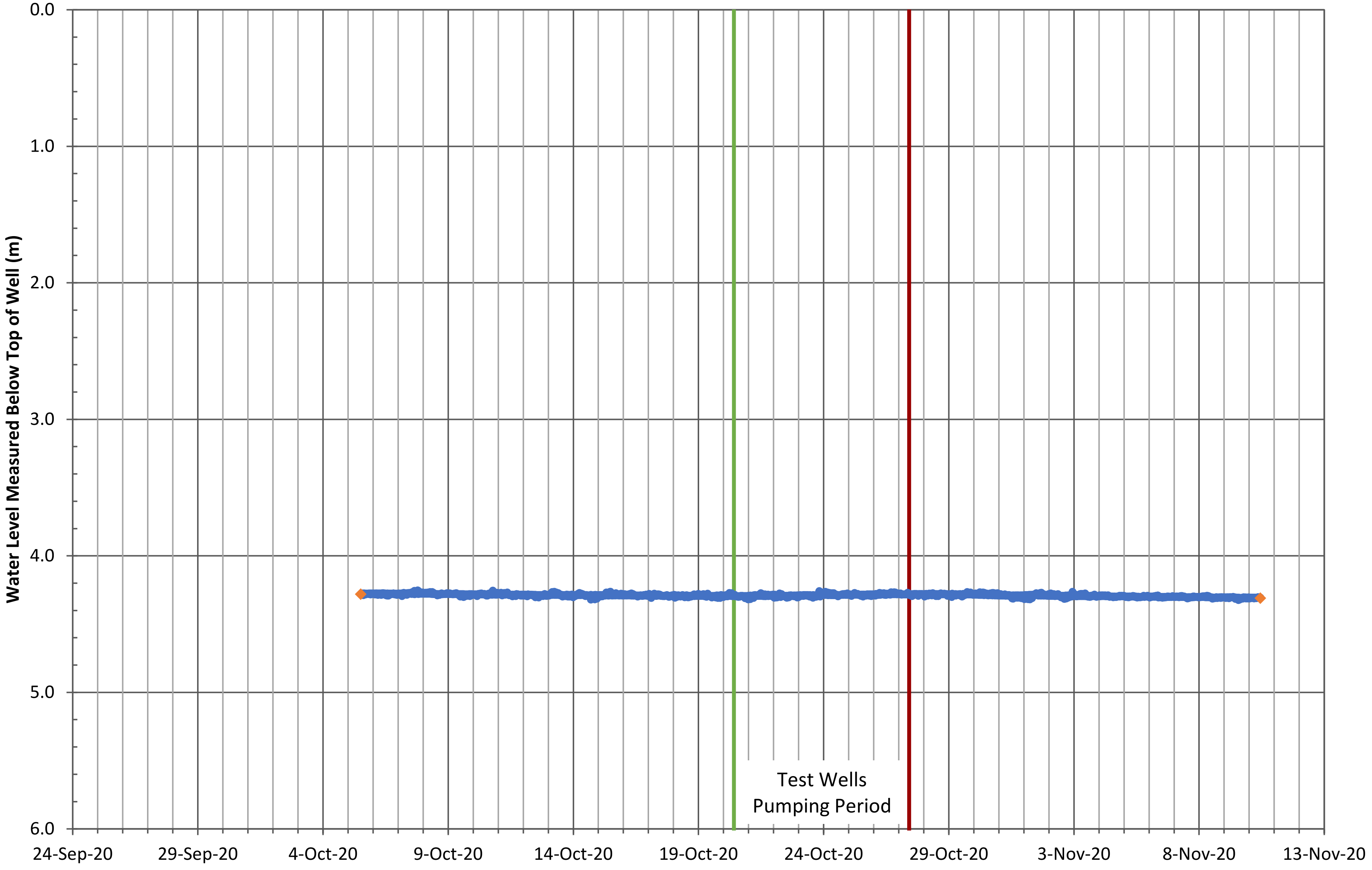
Graph 20

Hydrograph - Monitoring Well LP-MW-15-10-I



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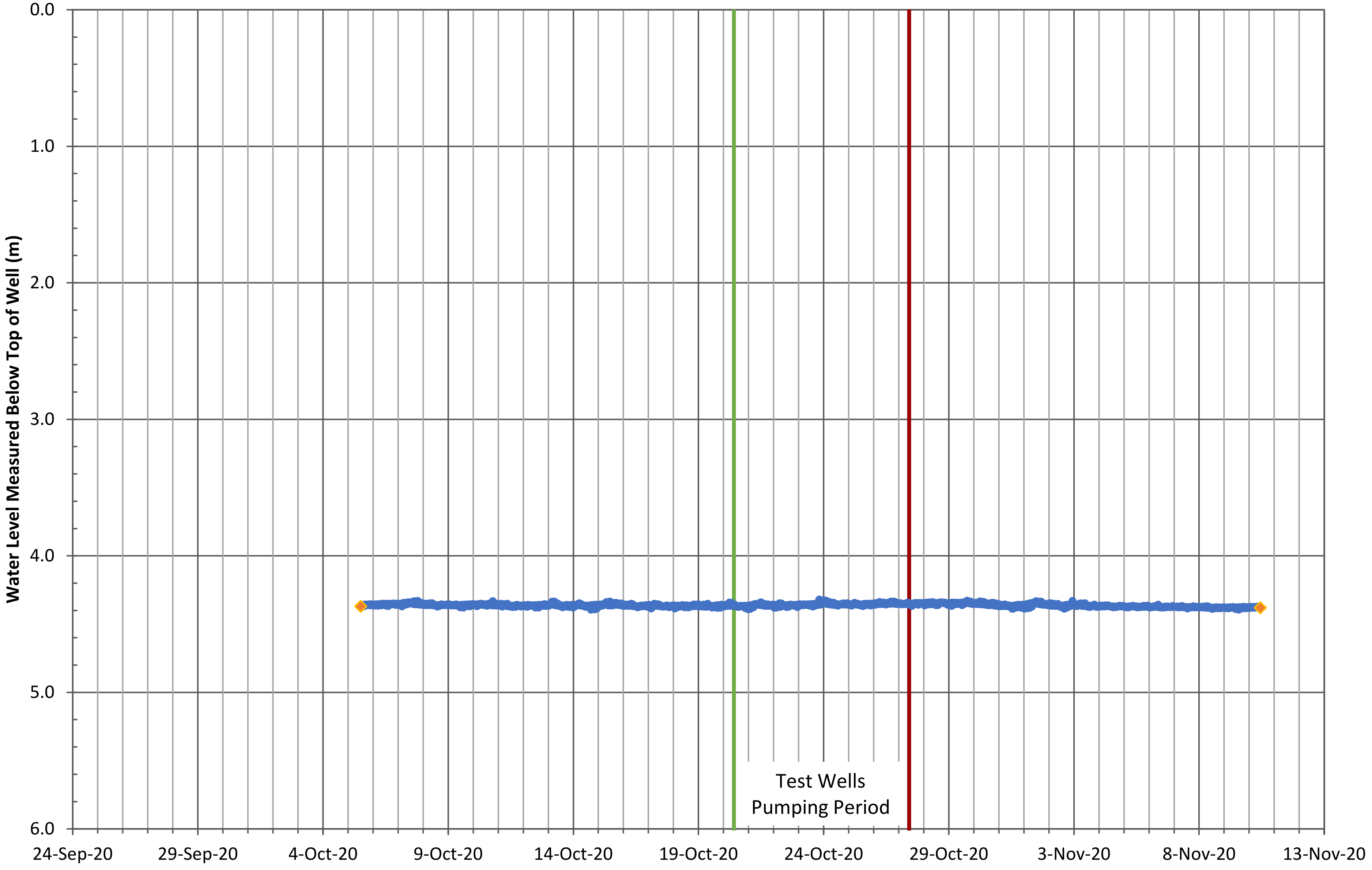
Graph 21

Hydrograph - Monitoring Well LP-MW-15-10-D



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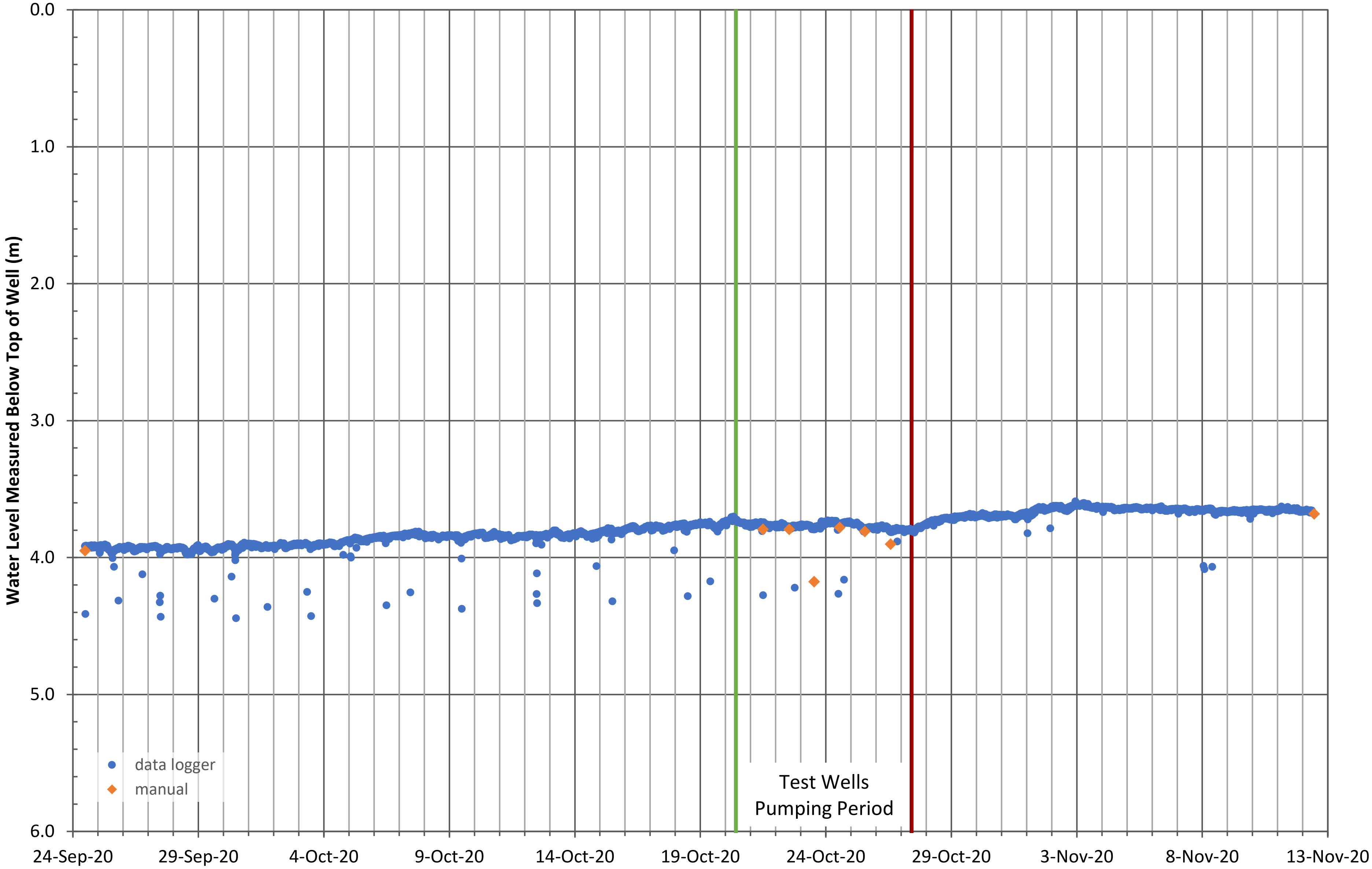
Graph 22

Hydrograph - Private Well PW1/20



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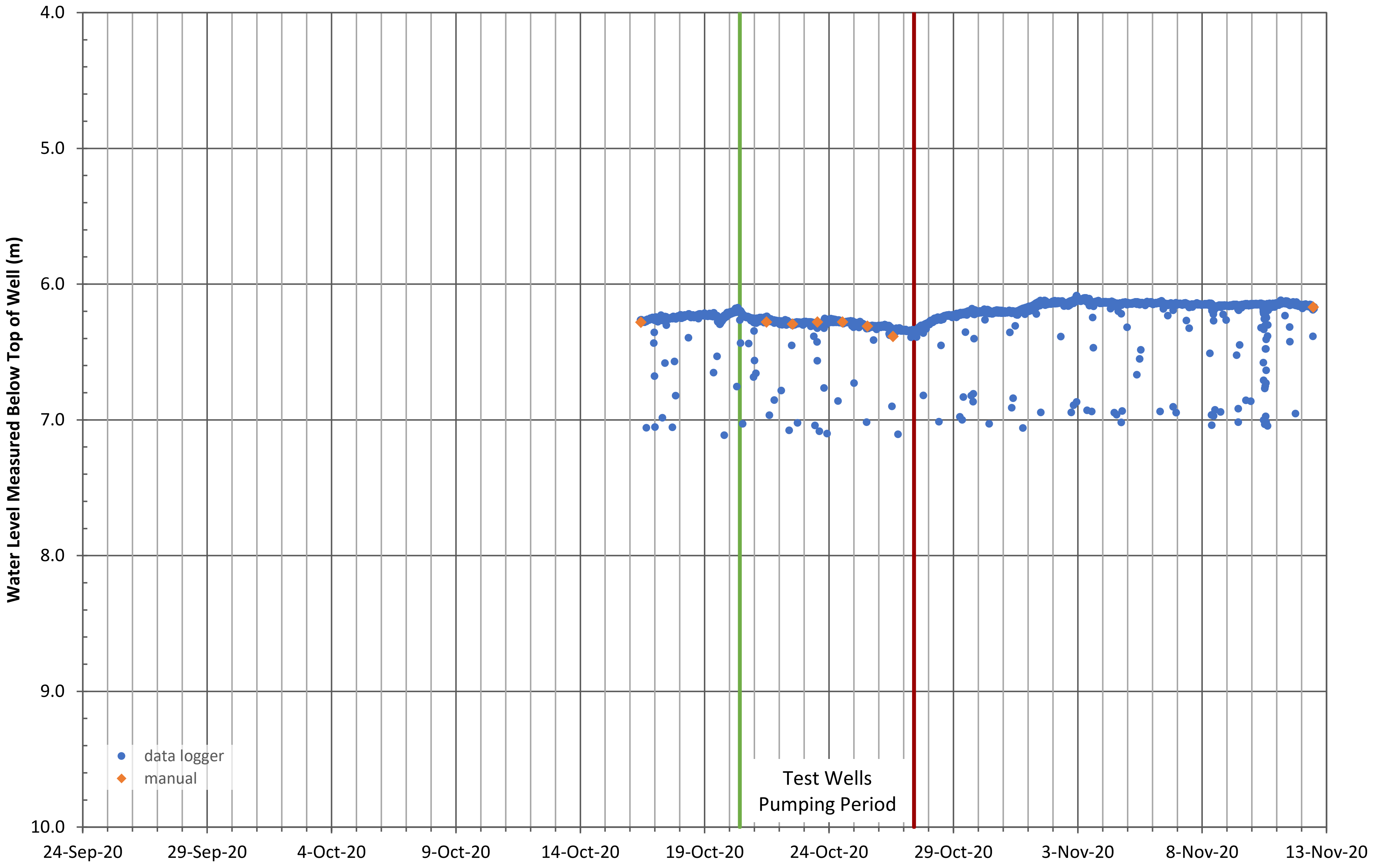
Graph 23

Hydrograph - Private Well PW2/20



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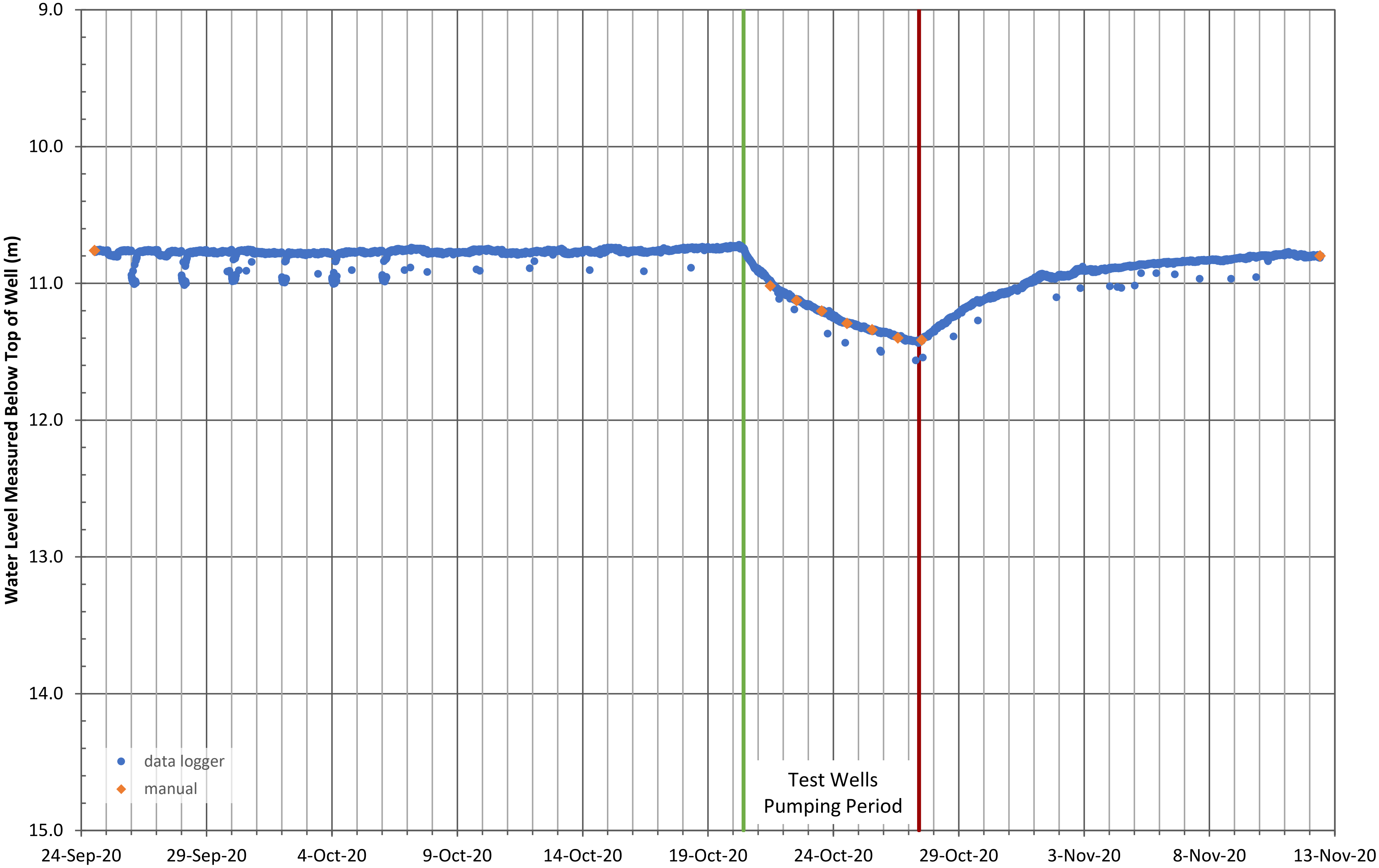
Graph 24

Hydrograph - Private Well PW3/20



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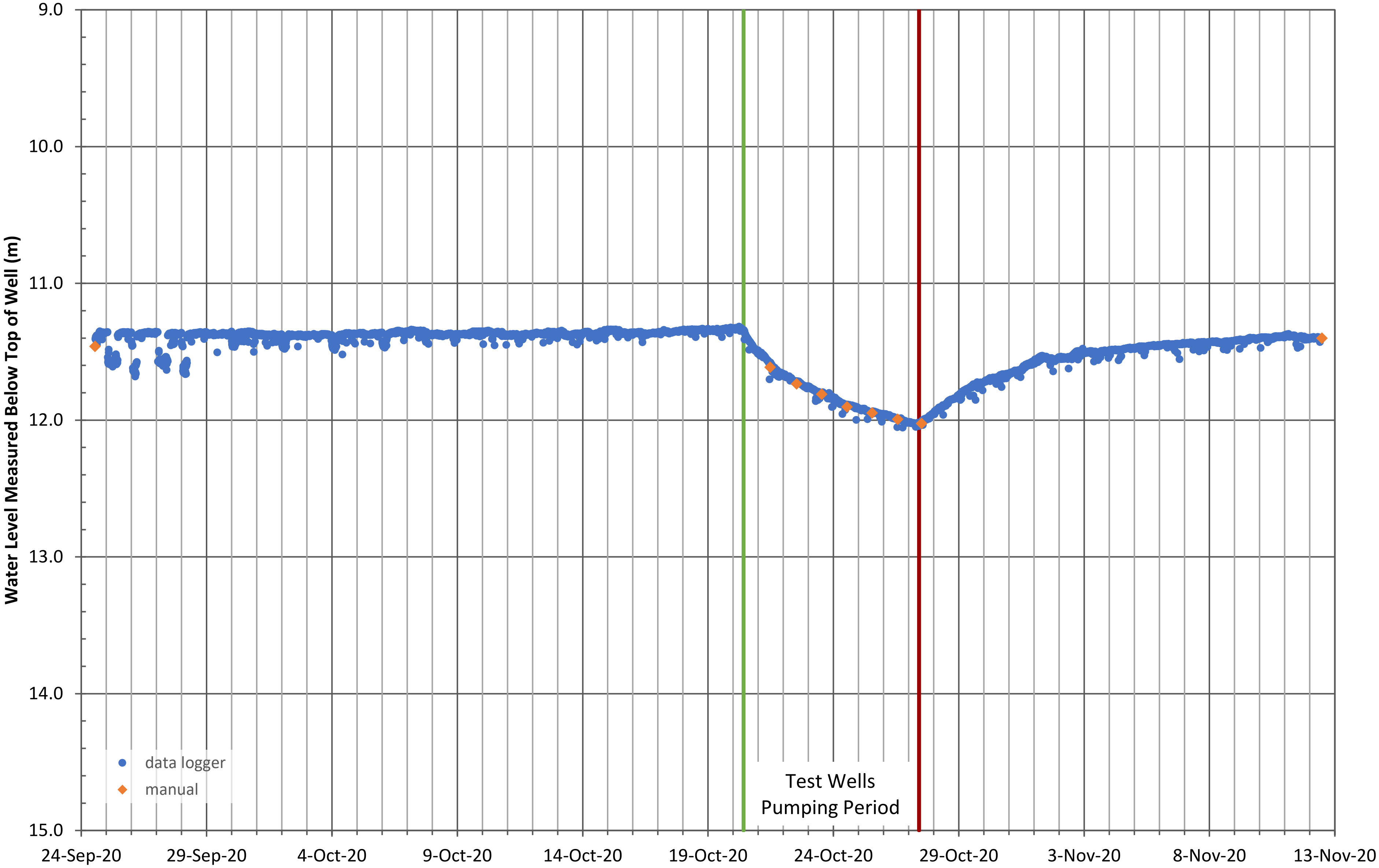
Graph 25

Hydrograph - Private Well PW4/20



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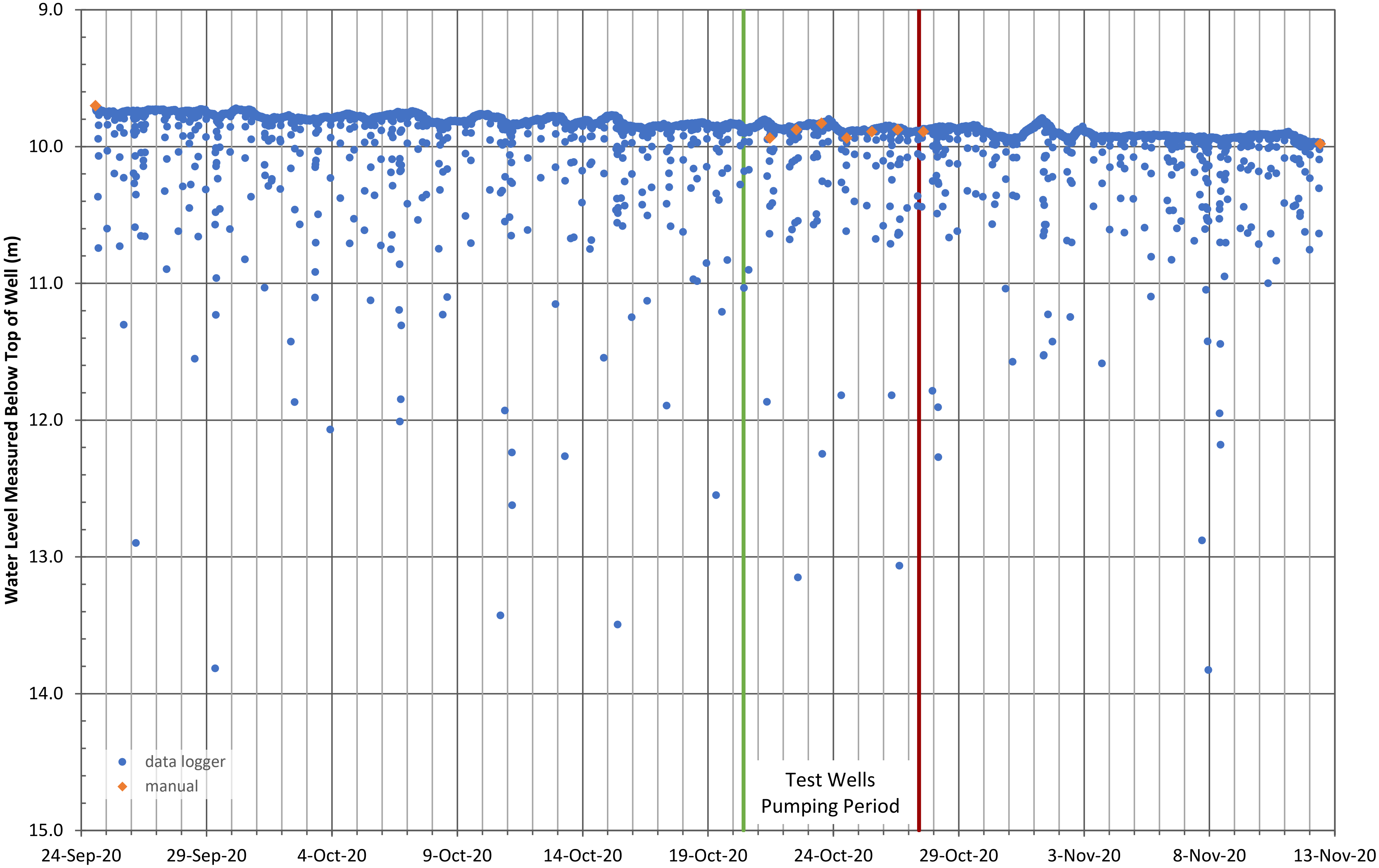
Graph 26

Hydrograph - Private Well PW5/20



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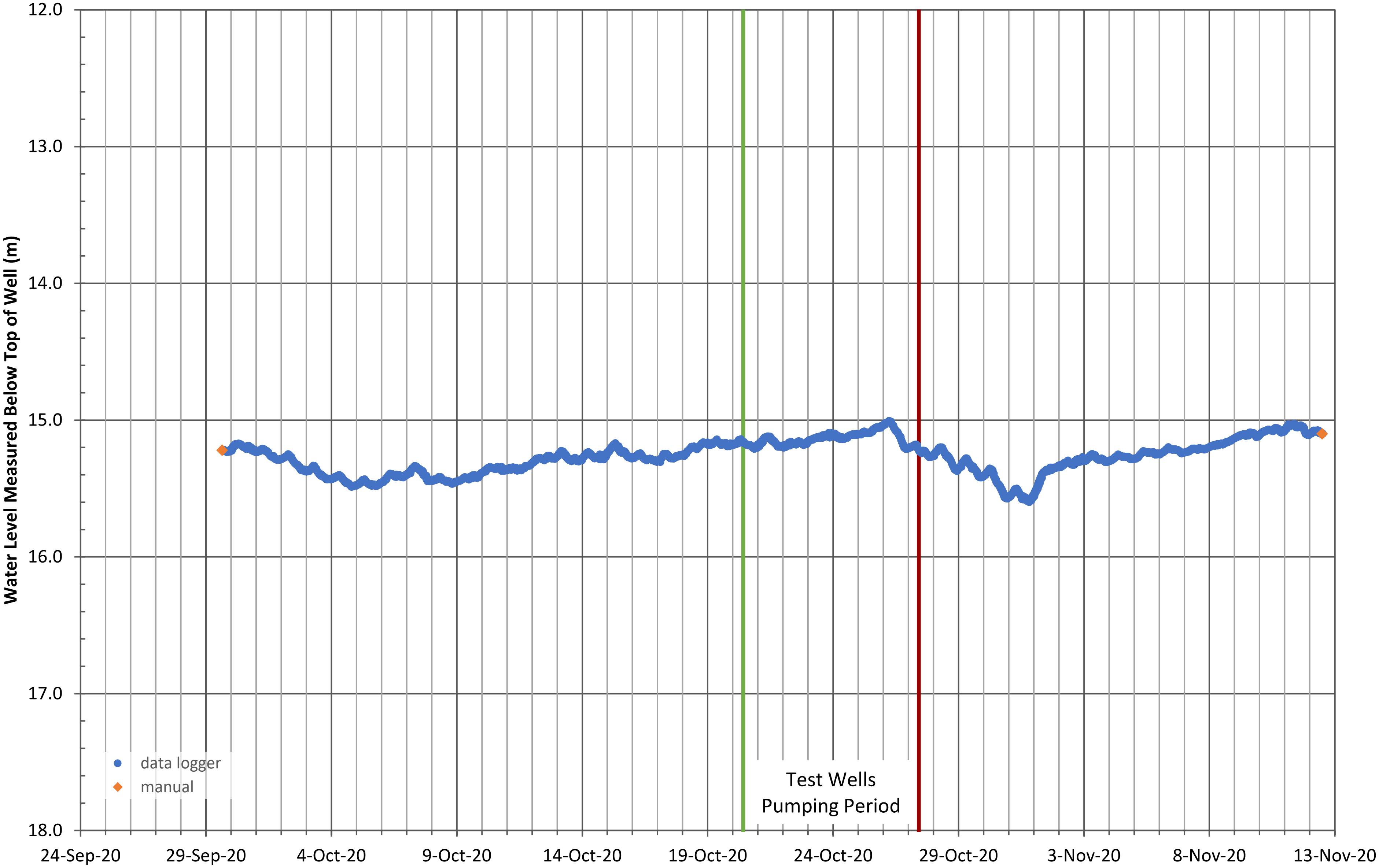
Graph 27

Hydrograph - Private Well PW6/20



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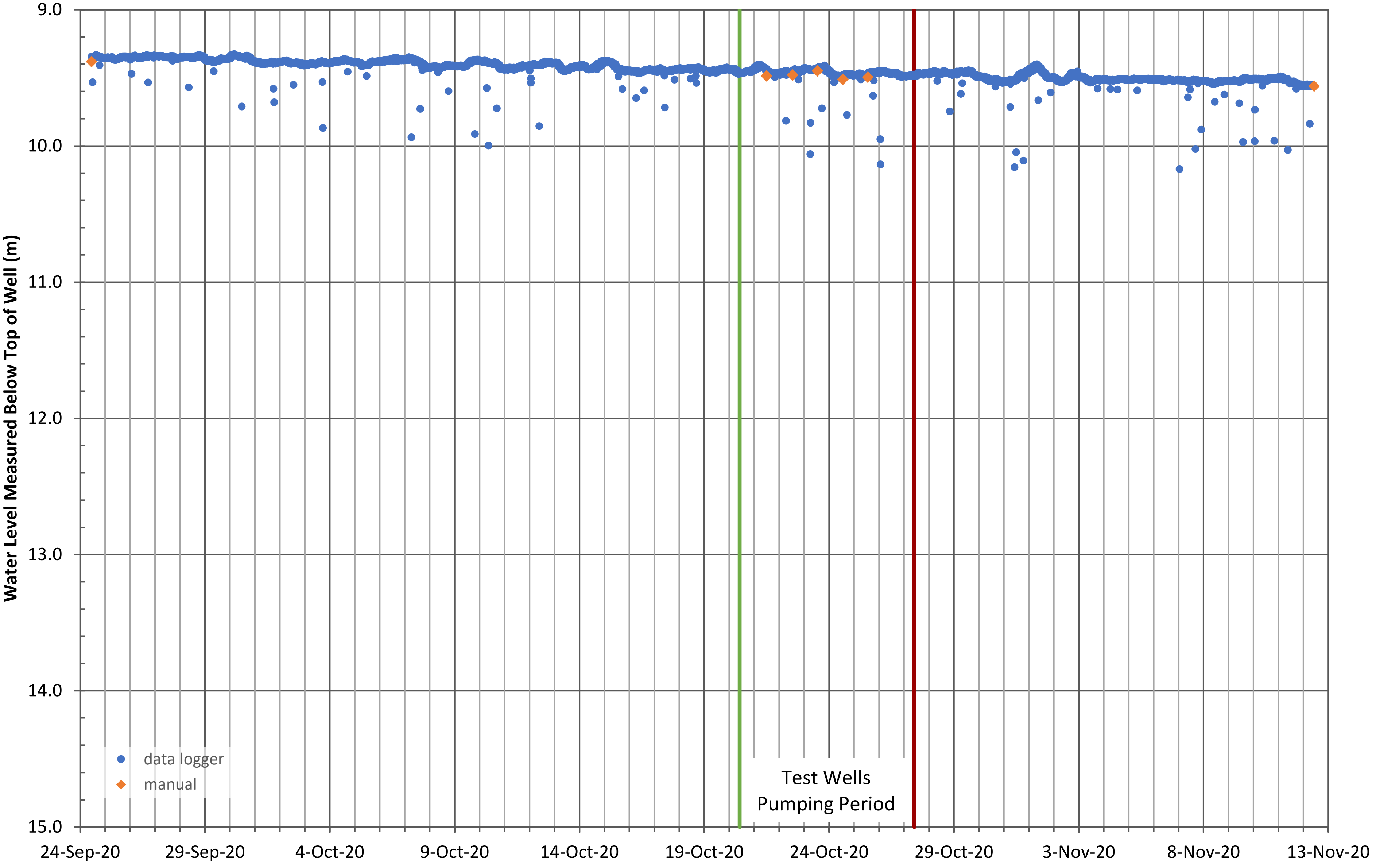
Graph 28

Hydrograph - Private Well PW7/20



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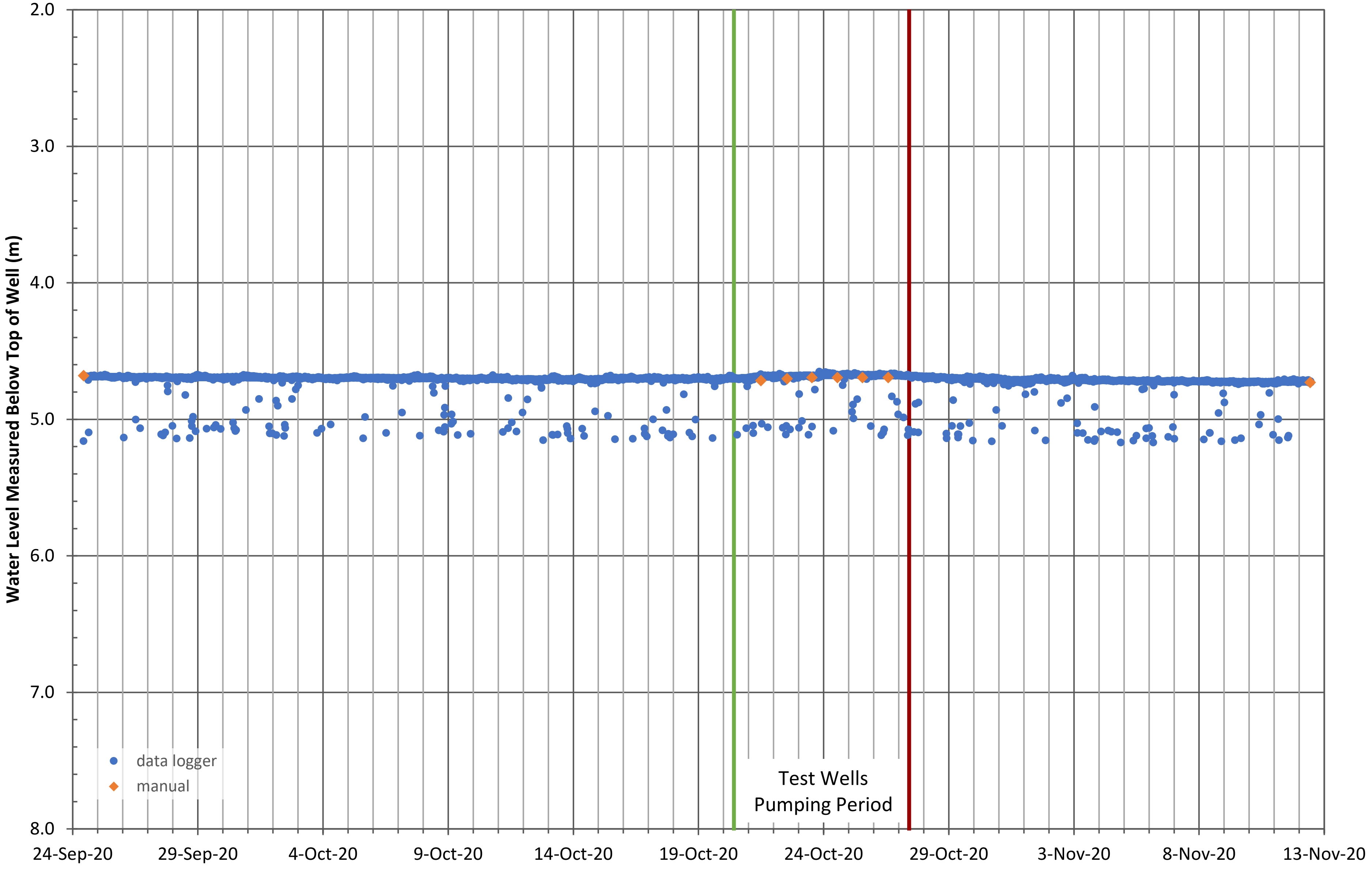
Graph 29

Hydrograph - Private Well PW8/20



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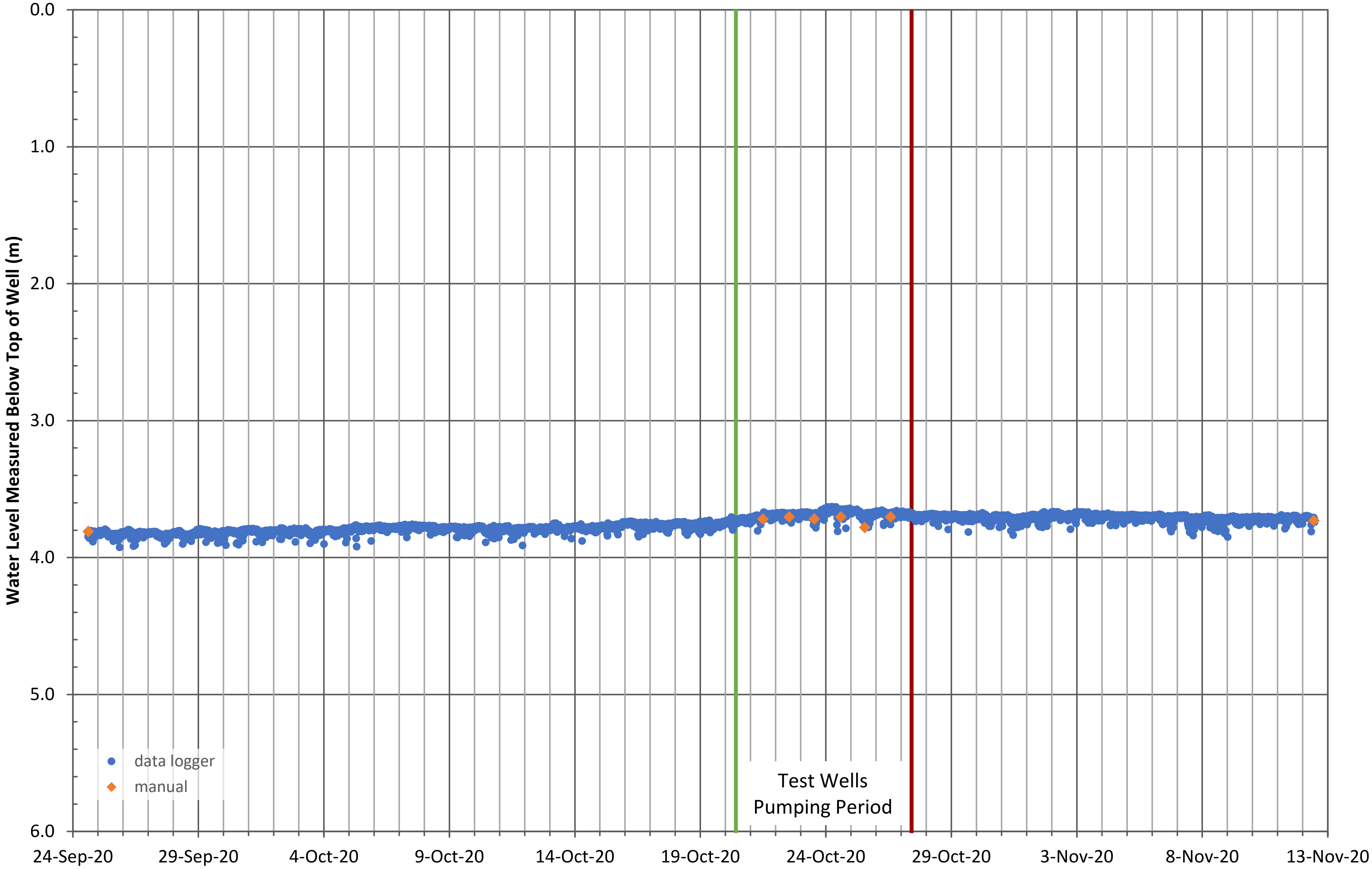
Graph 30

Hydrograph - Private Well PW9/20



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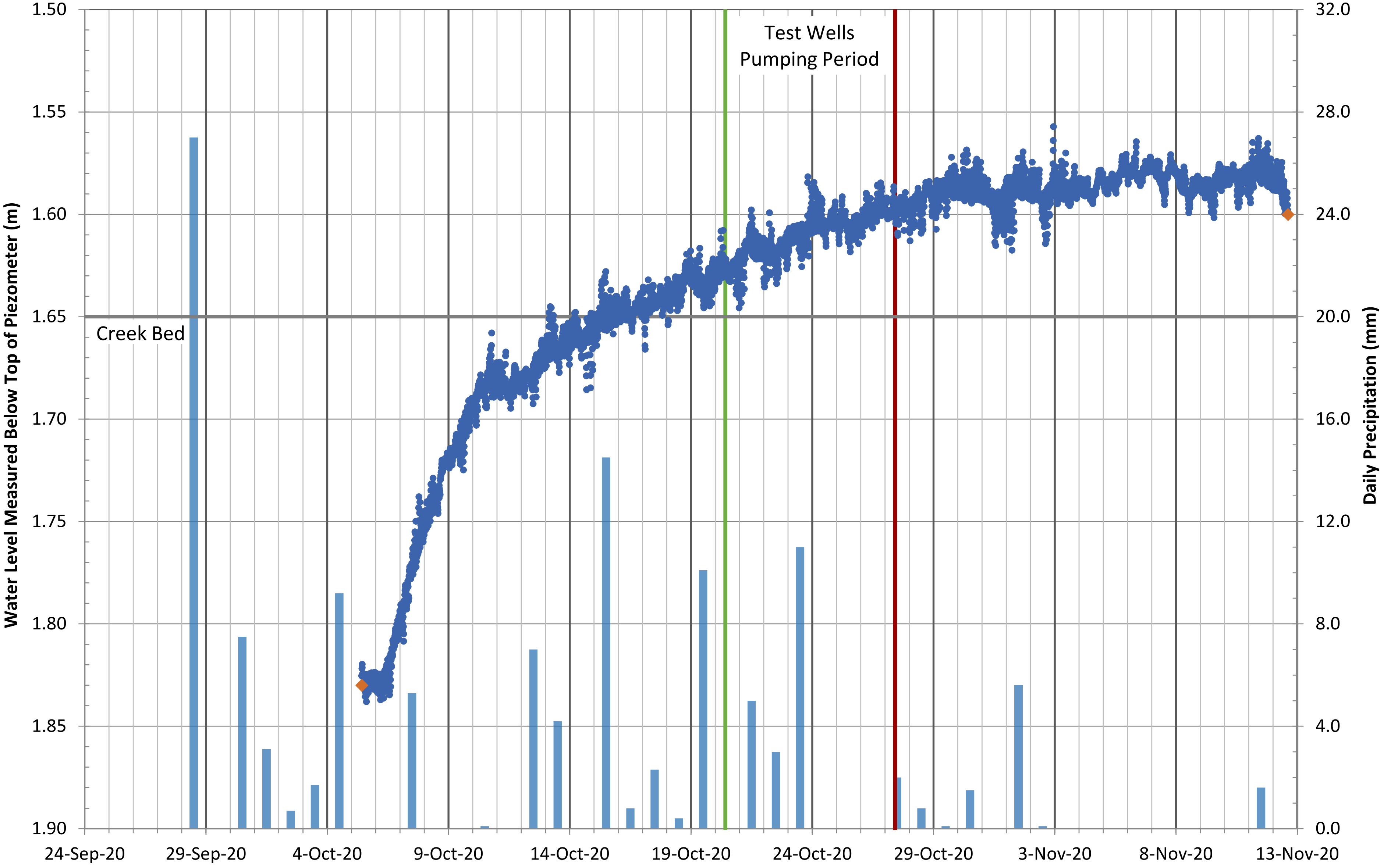
Graph 31

Hydrograph - Piezometer PZ1/20



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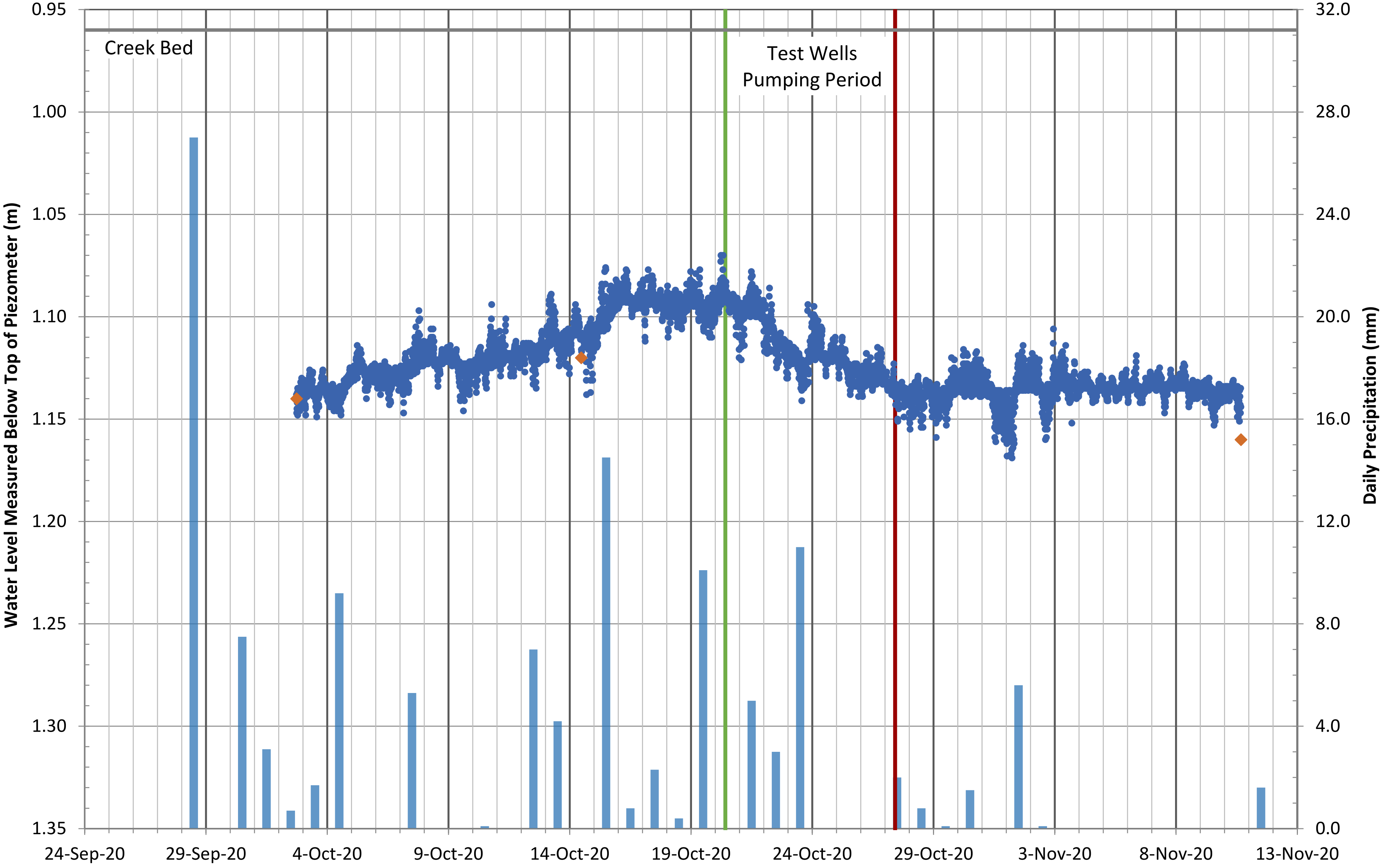
Graph 32

Hydrograph - Piezometer PZ2/20



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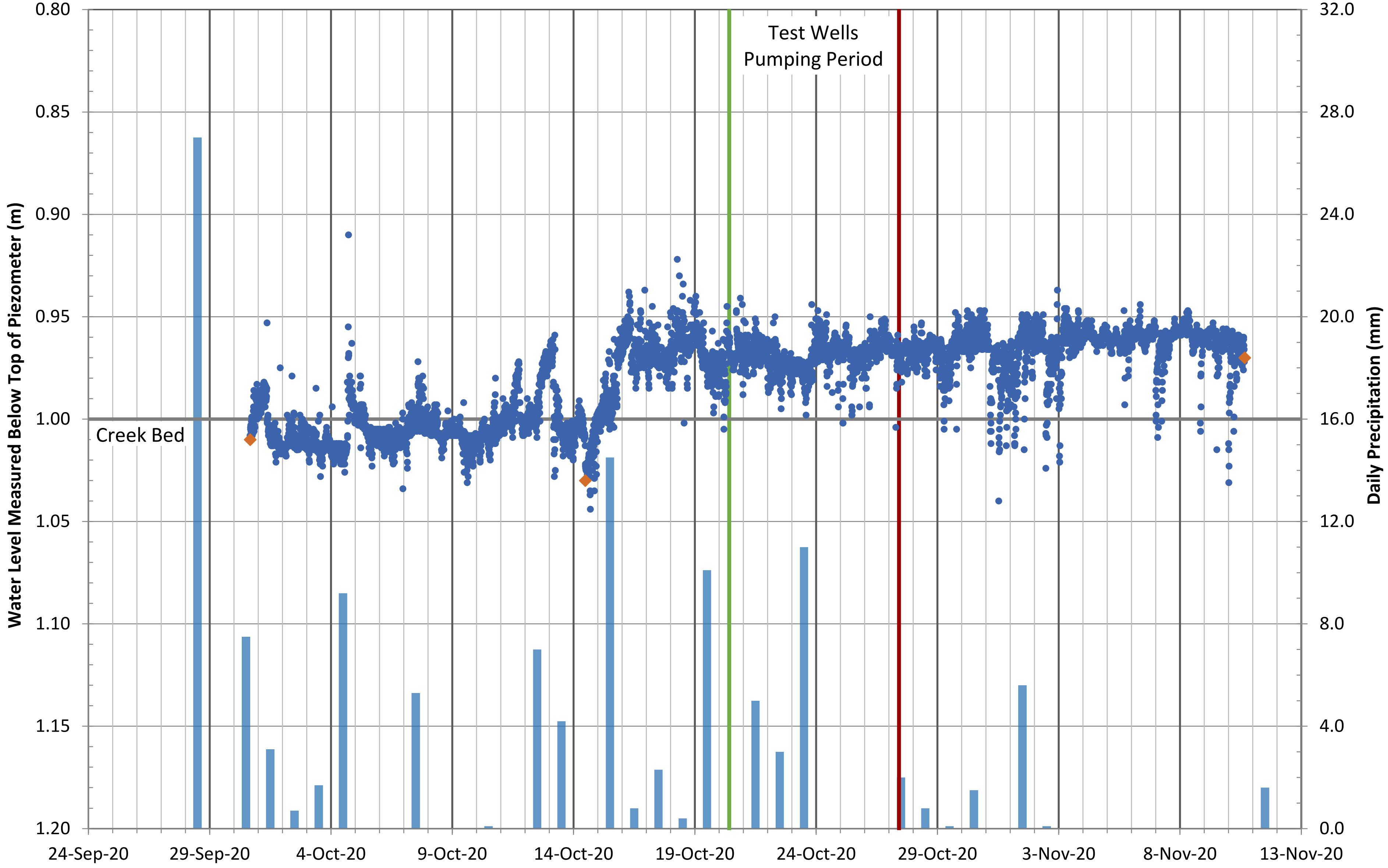
Graph 33

Hydrograph - Piezometer PZ3/20



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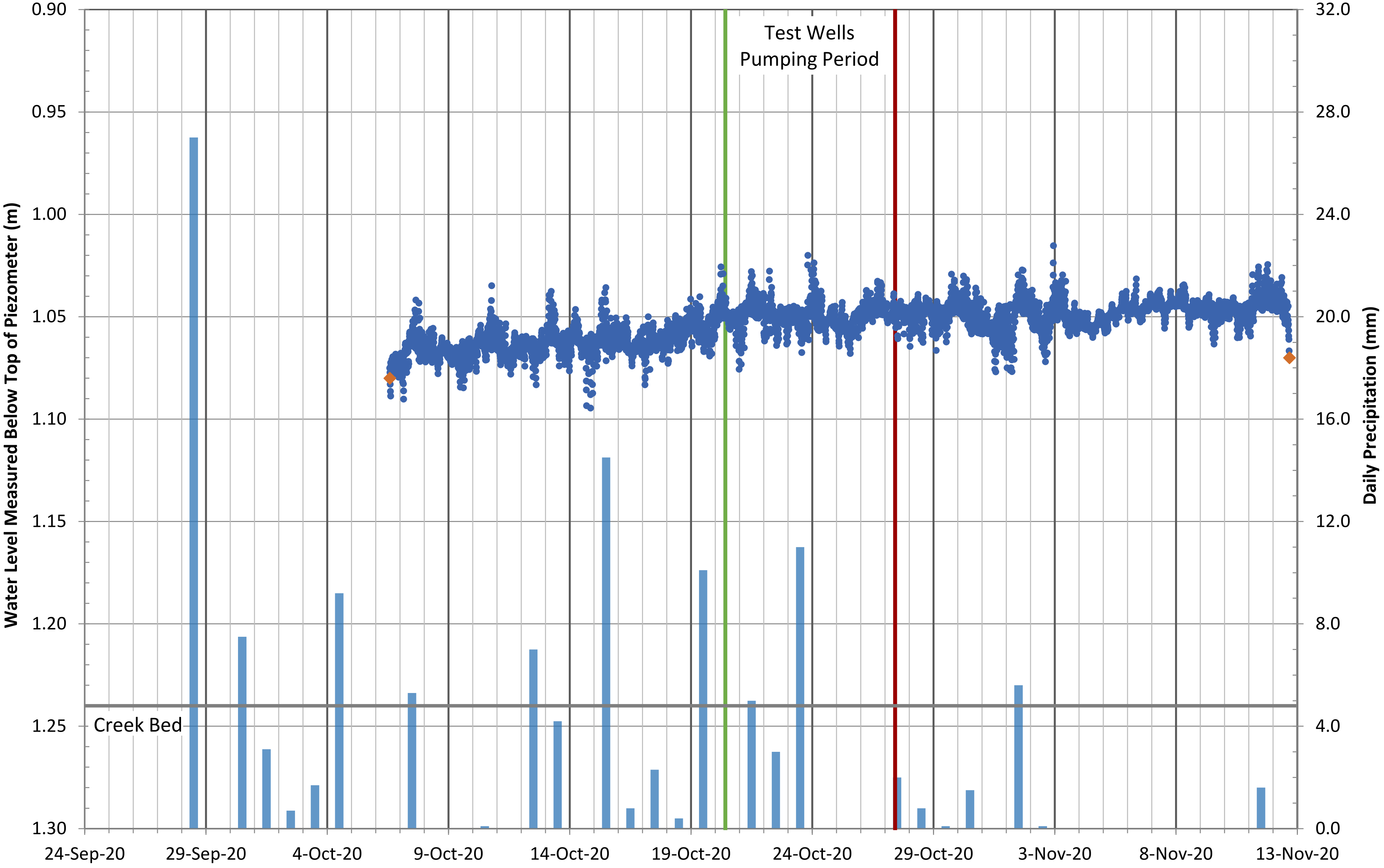
Graph 34

Hydrograph - Piezometer PZ6/20



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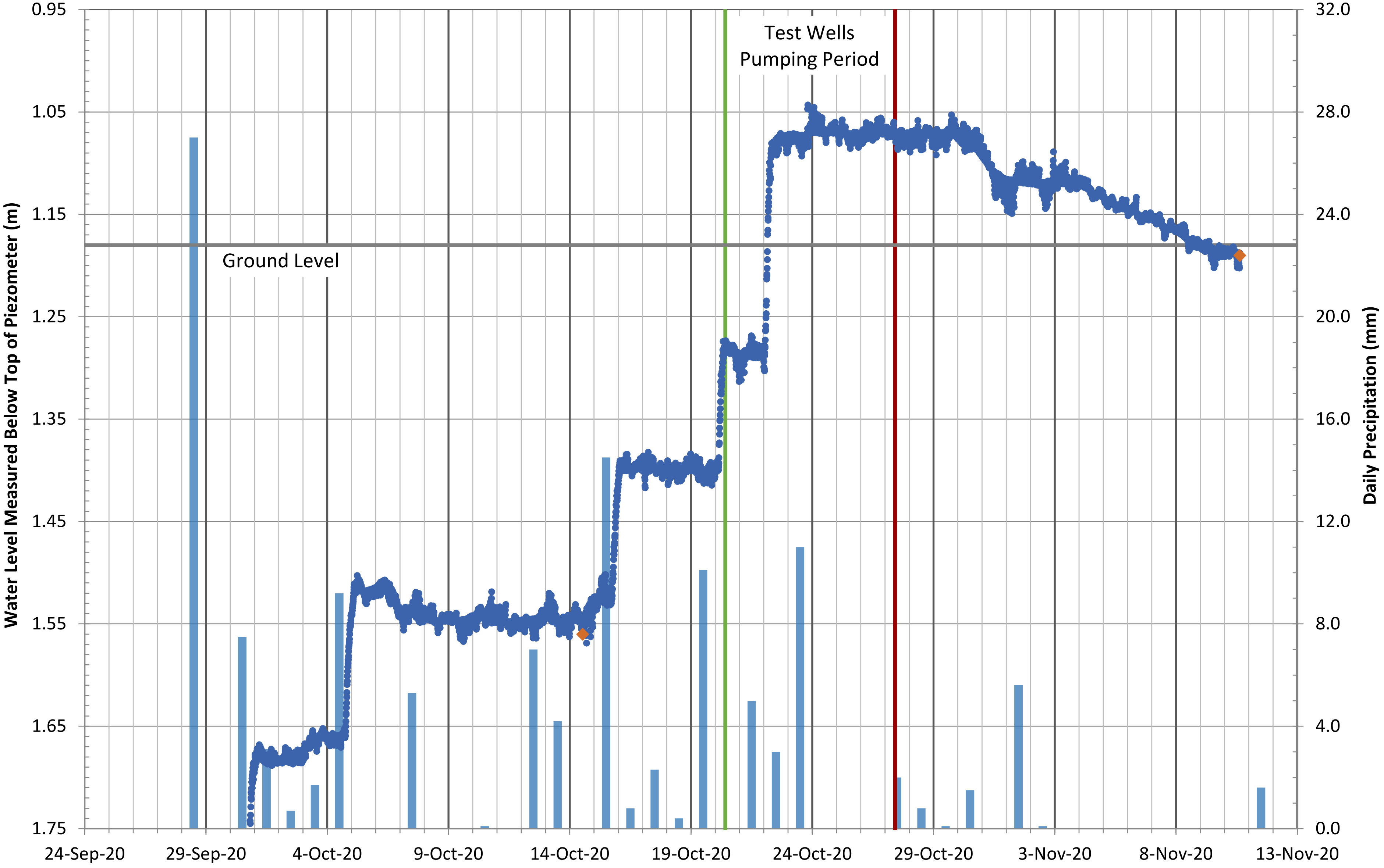
Graph 35

Hydrograph - Piezometer PZ8/20



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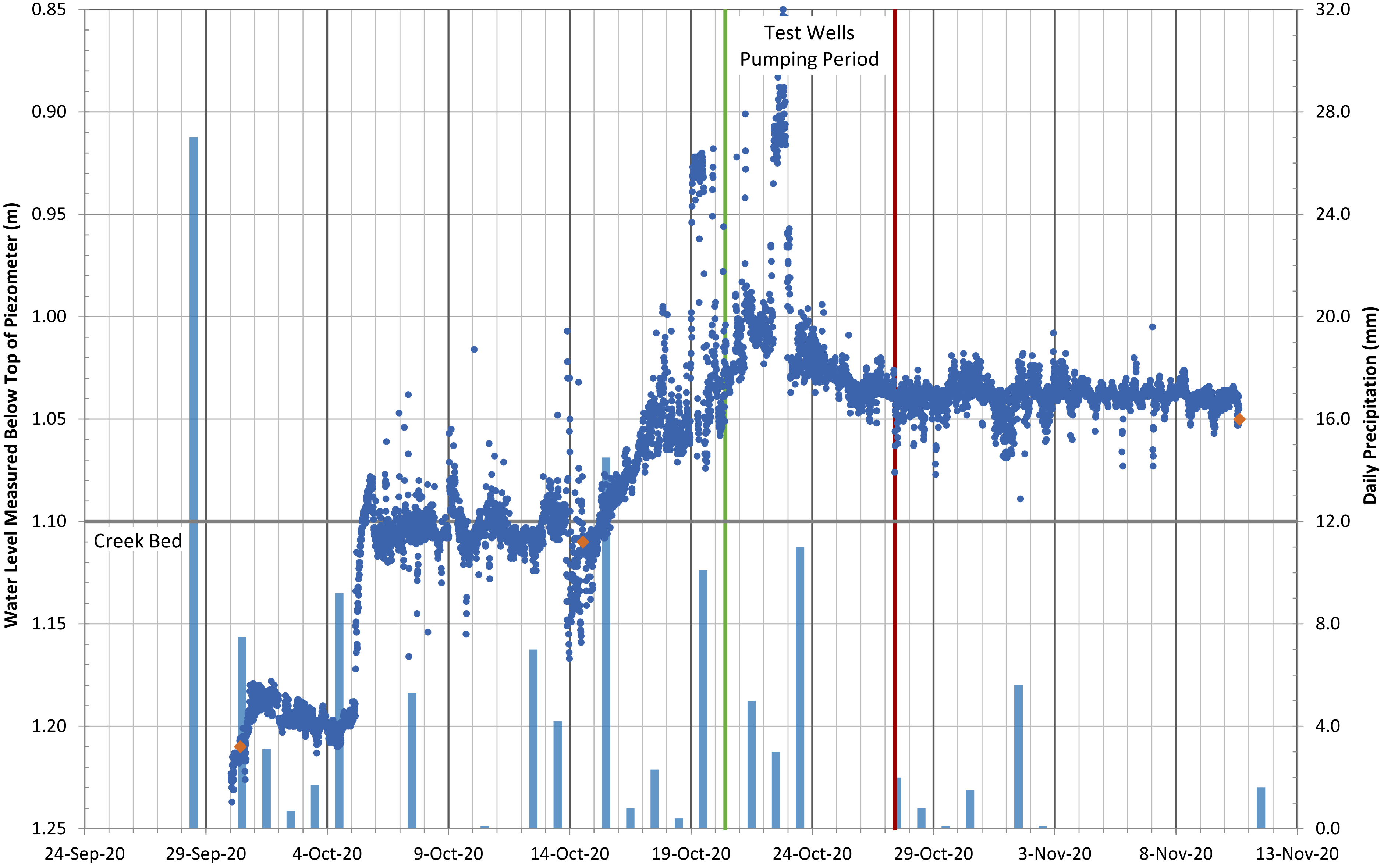
Graph 36

Hydrograph - Piezometer PZ7 / 20



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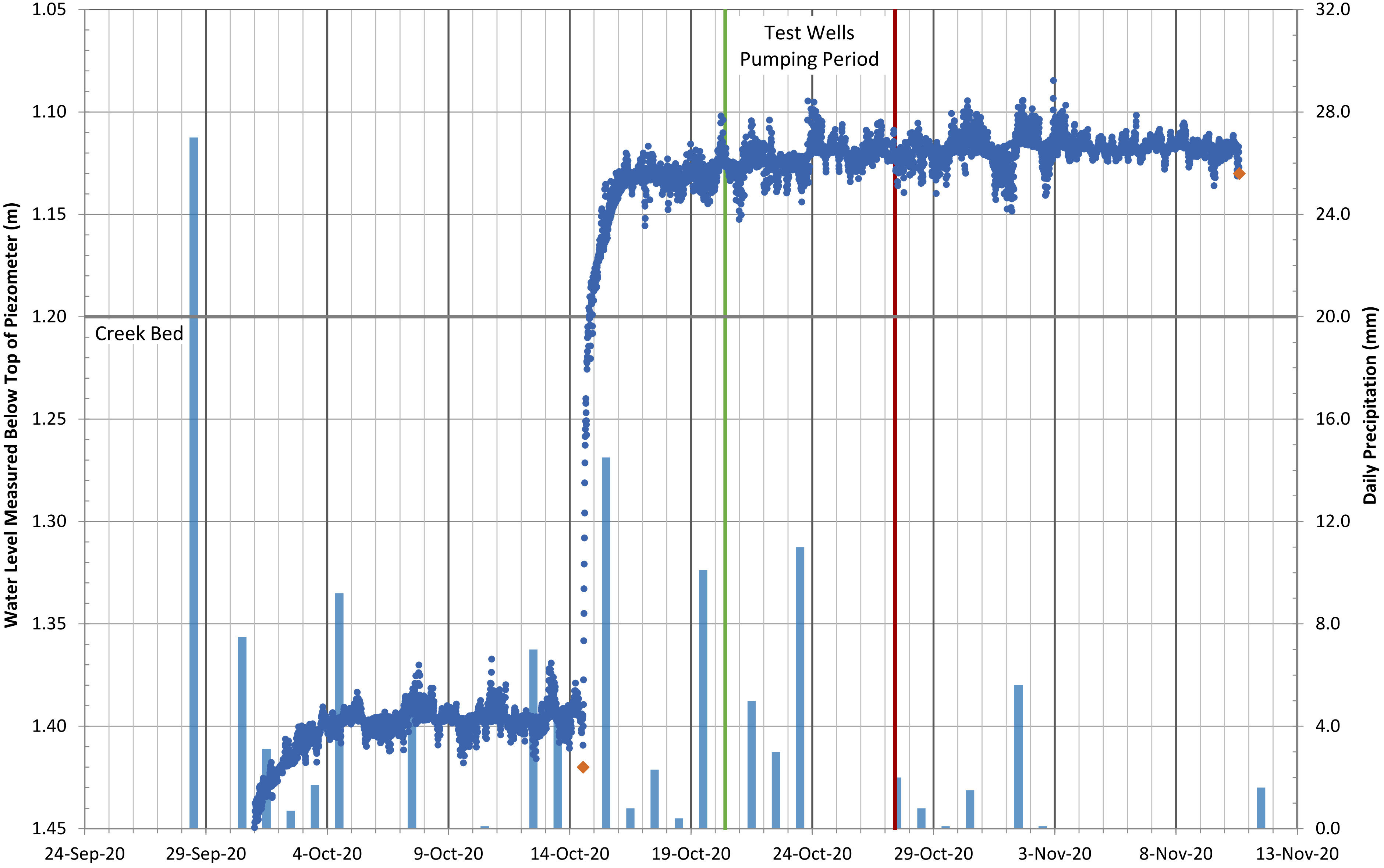
Graph 37

Hydrograph - Piezometer PZ9/20



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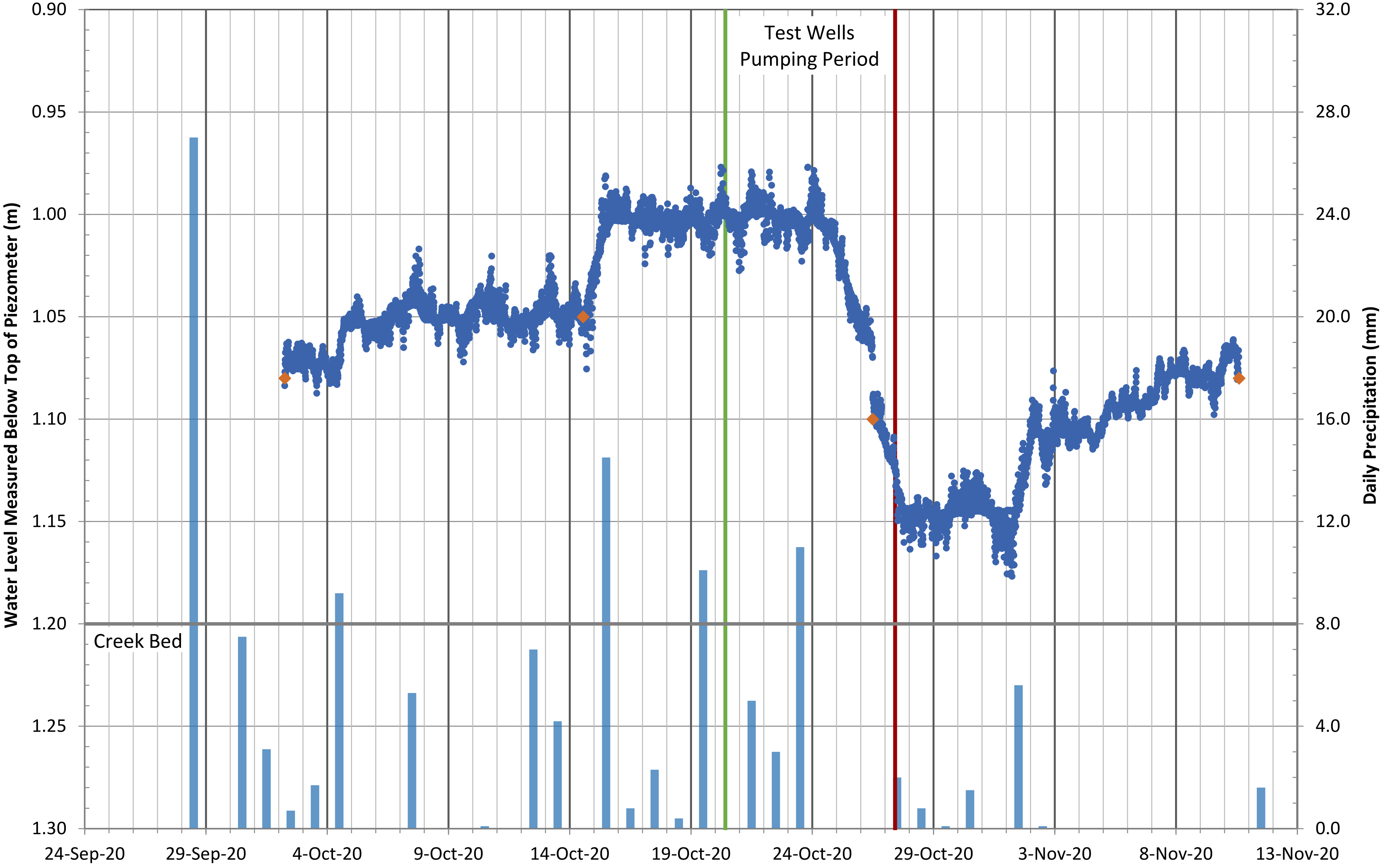
Graph 38

Hydrograph - Piezometer PZ5/20



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Graph 39

Hydrograph - Piezometer PZ10/20

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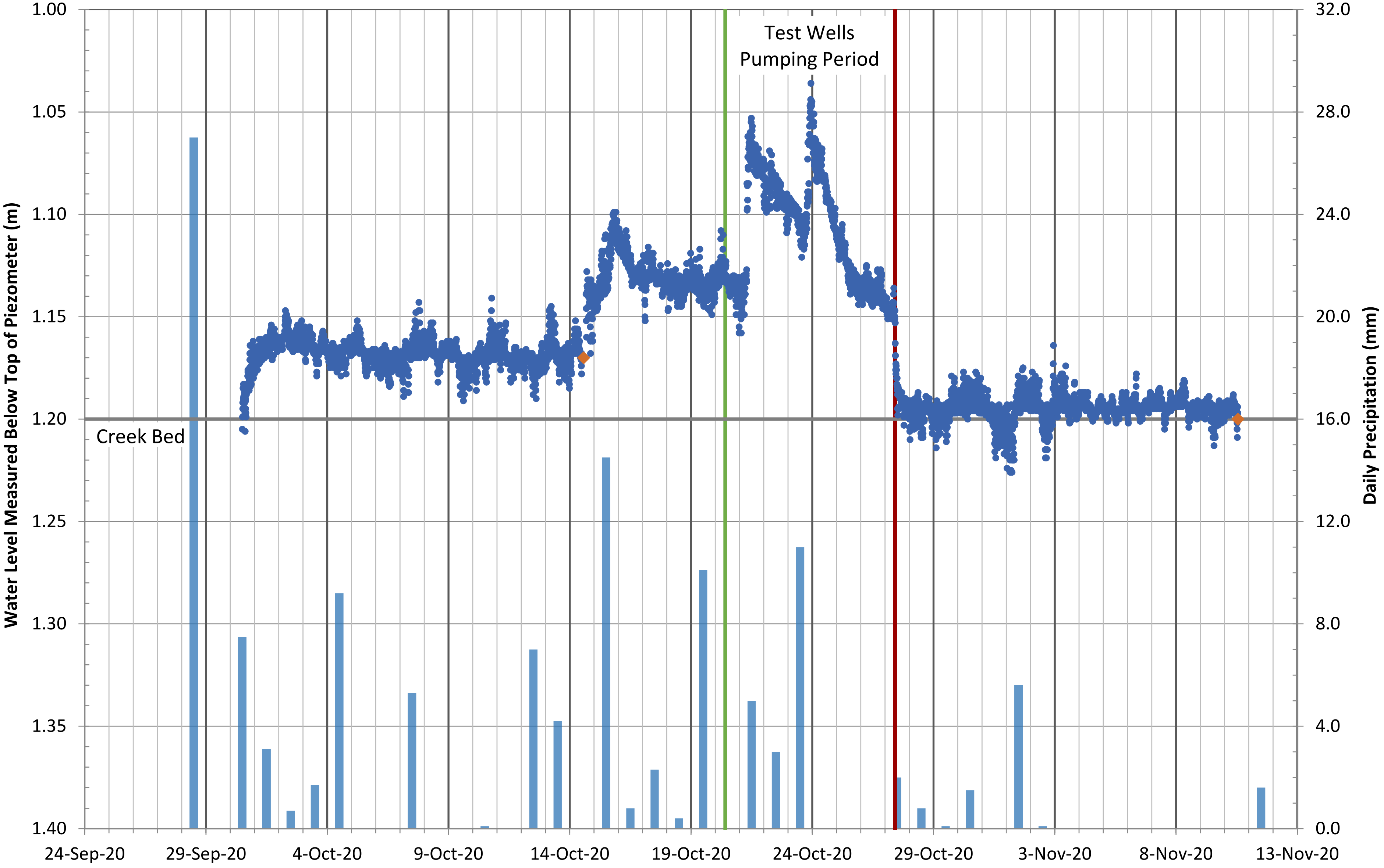
Graph 40

Hydrograph - Piezometer PZ11/20



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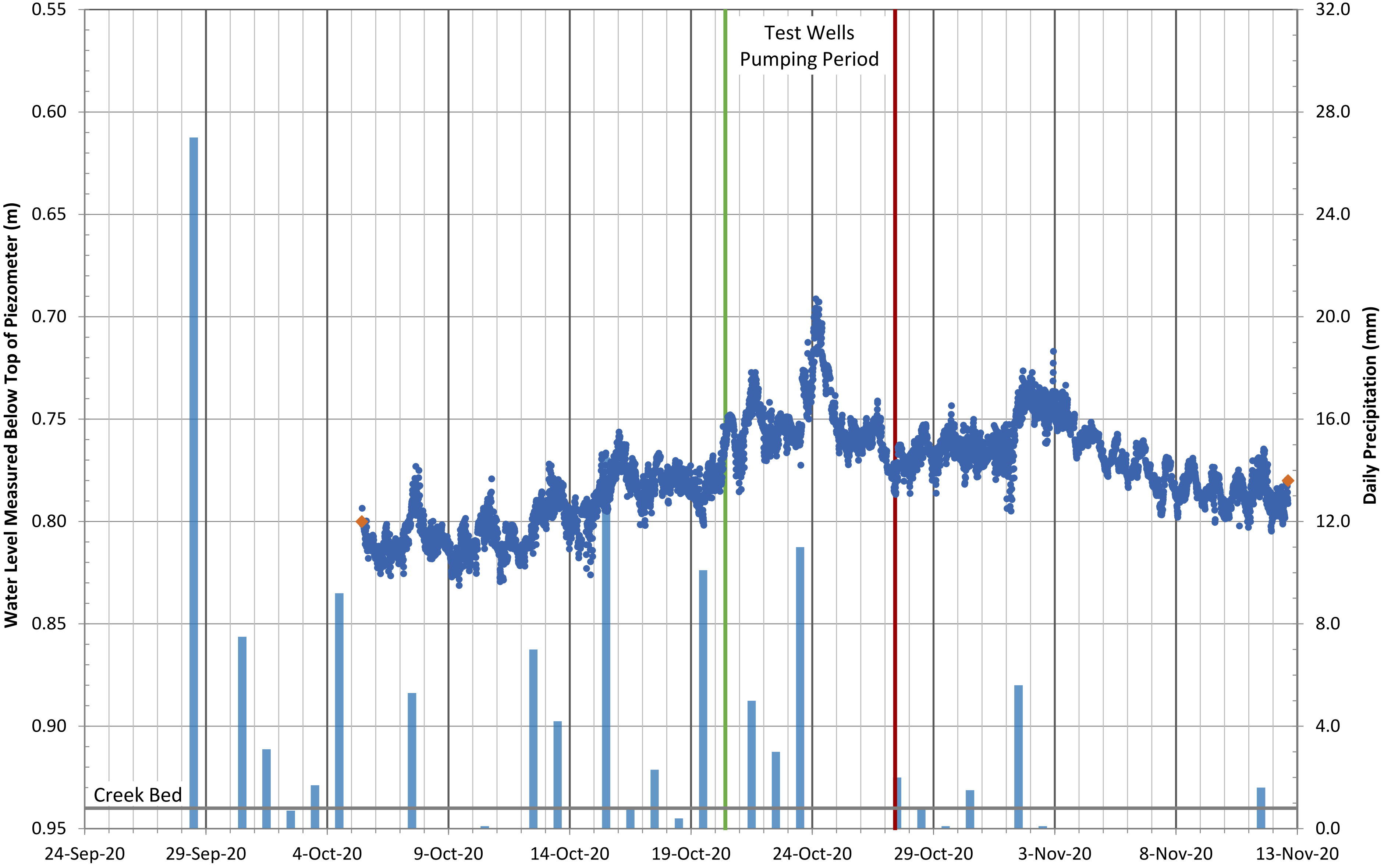
Graph 41

Hydrograph - Davis Creek SG1/20



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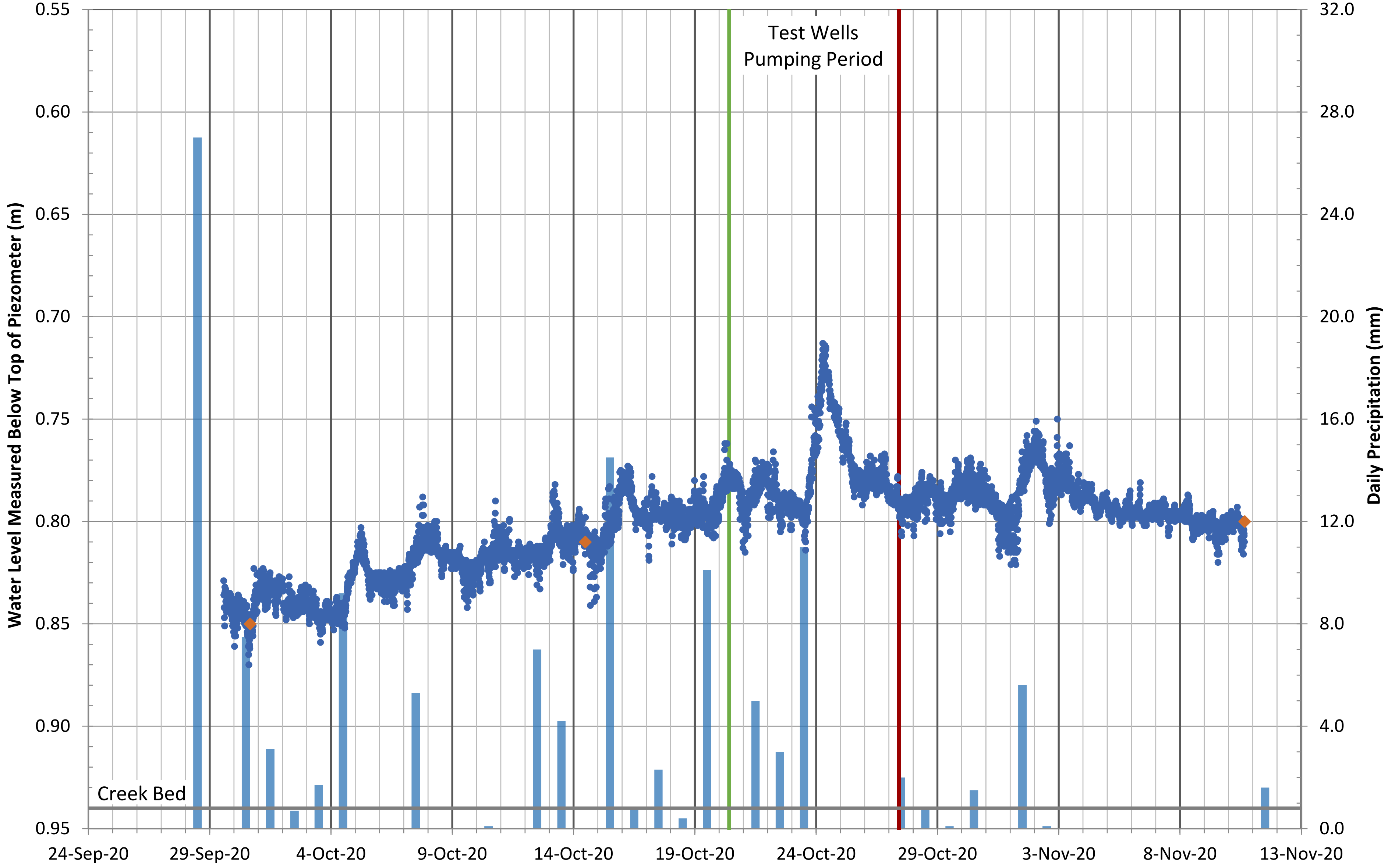
Graph 42

Hydrograph - Davis Creek SG3 / 20



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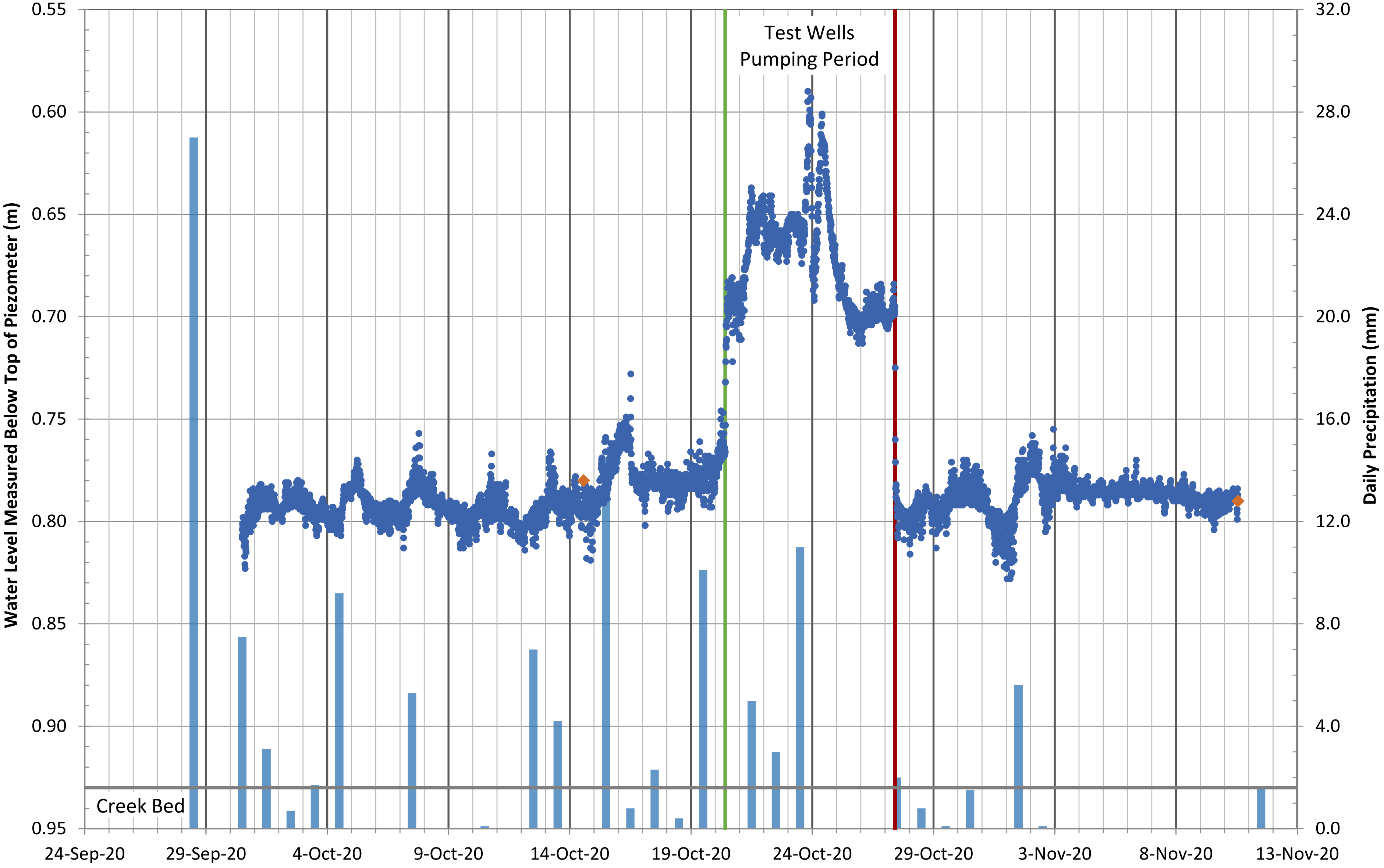
Graph 43

Hydrograph - Davis Creek SG11/20



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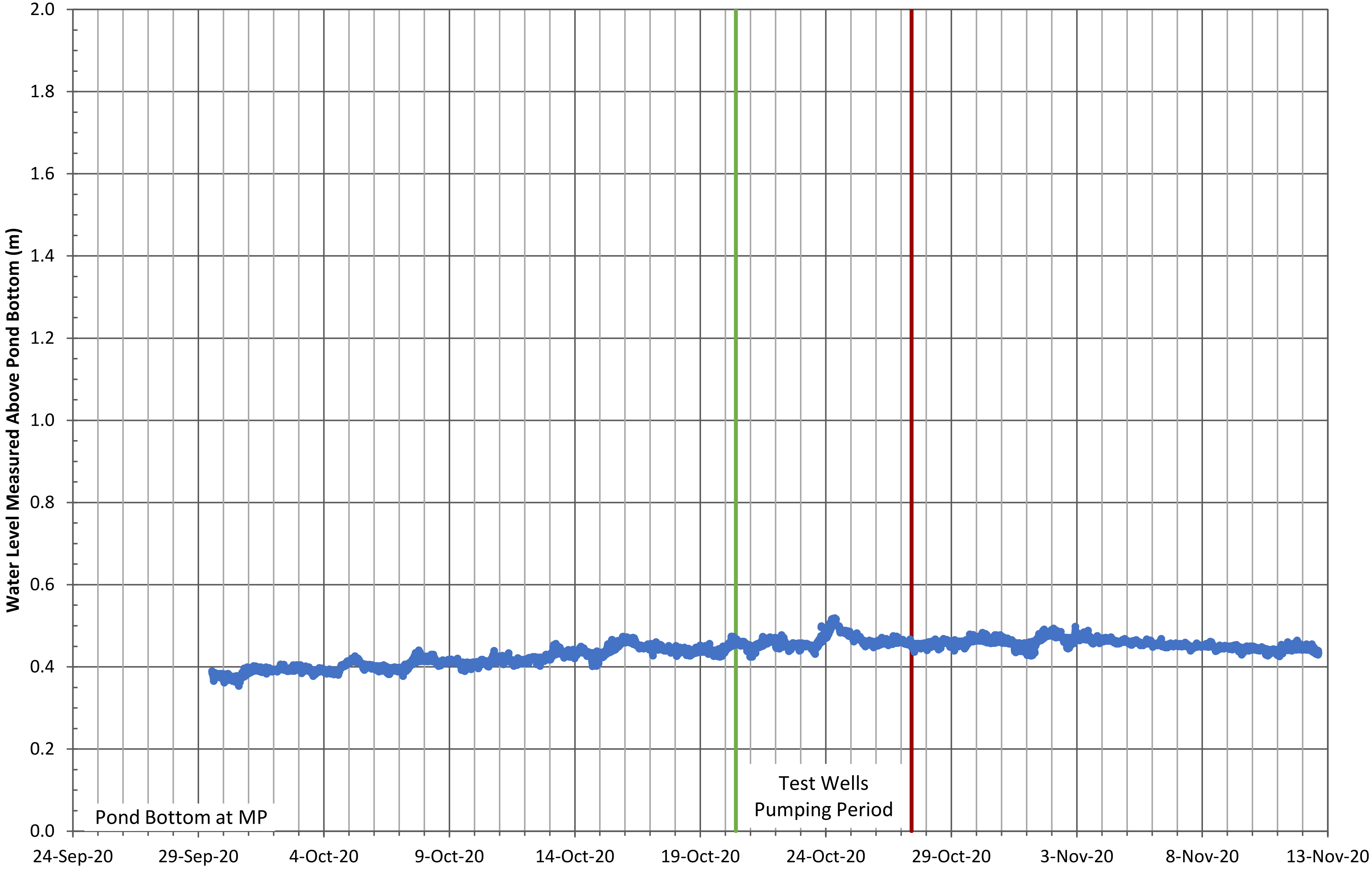
Graph 44

Hydrograph - Inactive Irrigation Pond No. 1 Cloet Road



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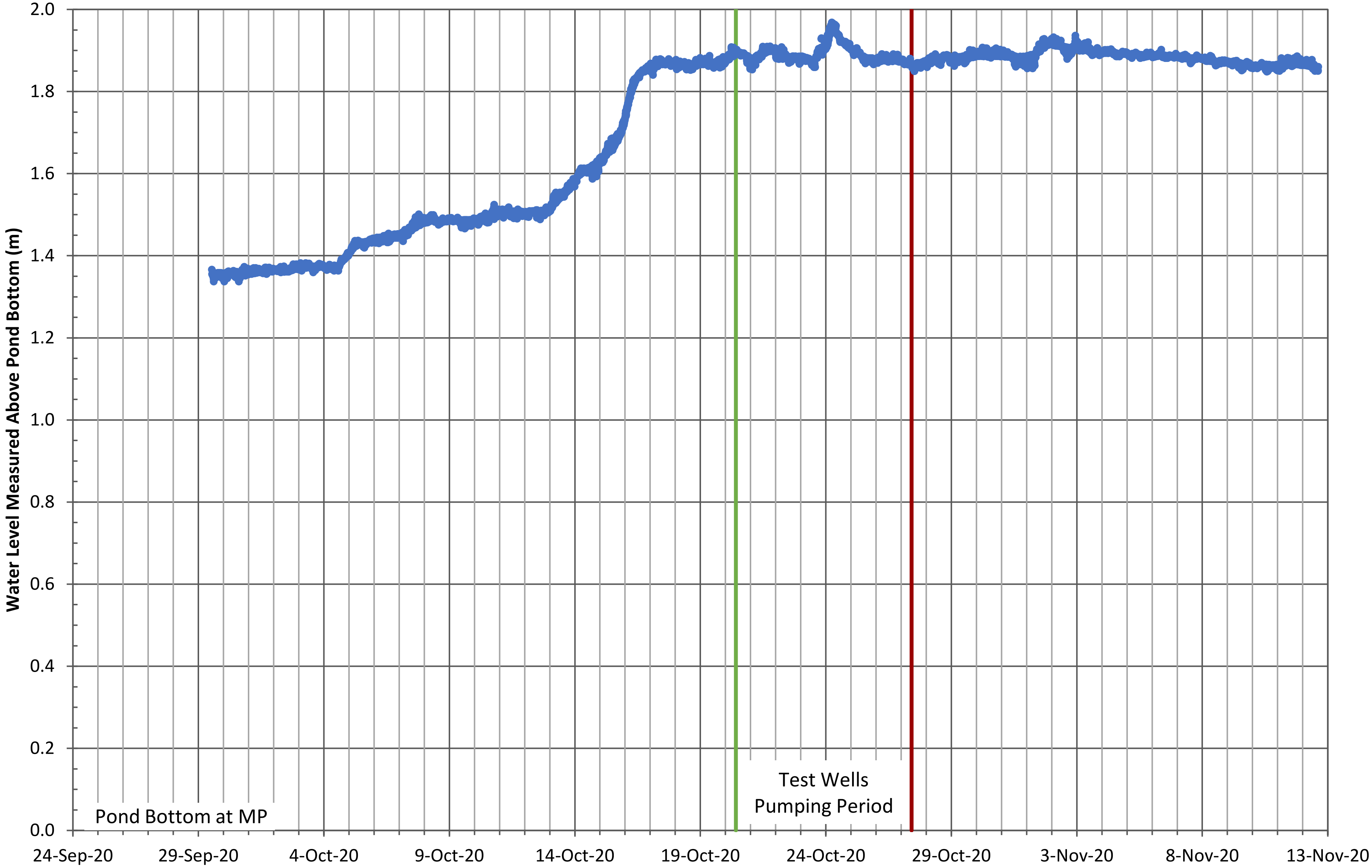
Graph 45

Hydrograph - Inactive Irrigation Pond No. 2 Old Highway 24/Cloet Road



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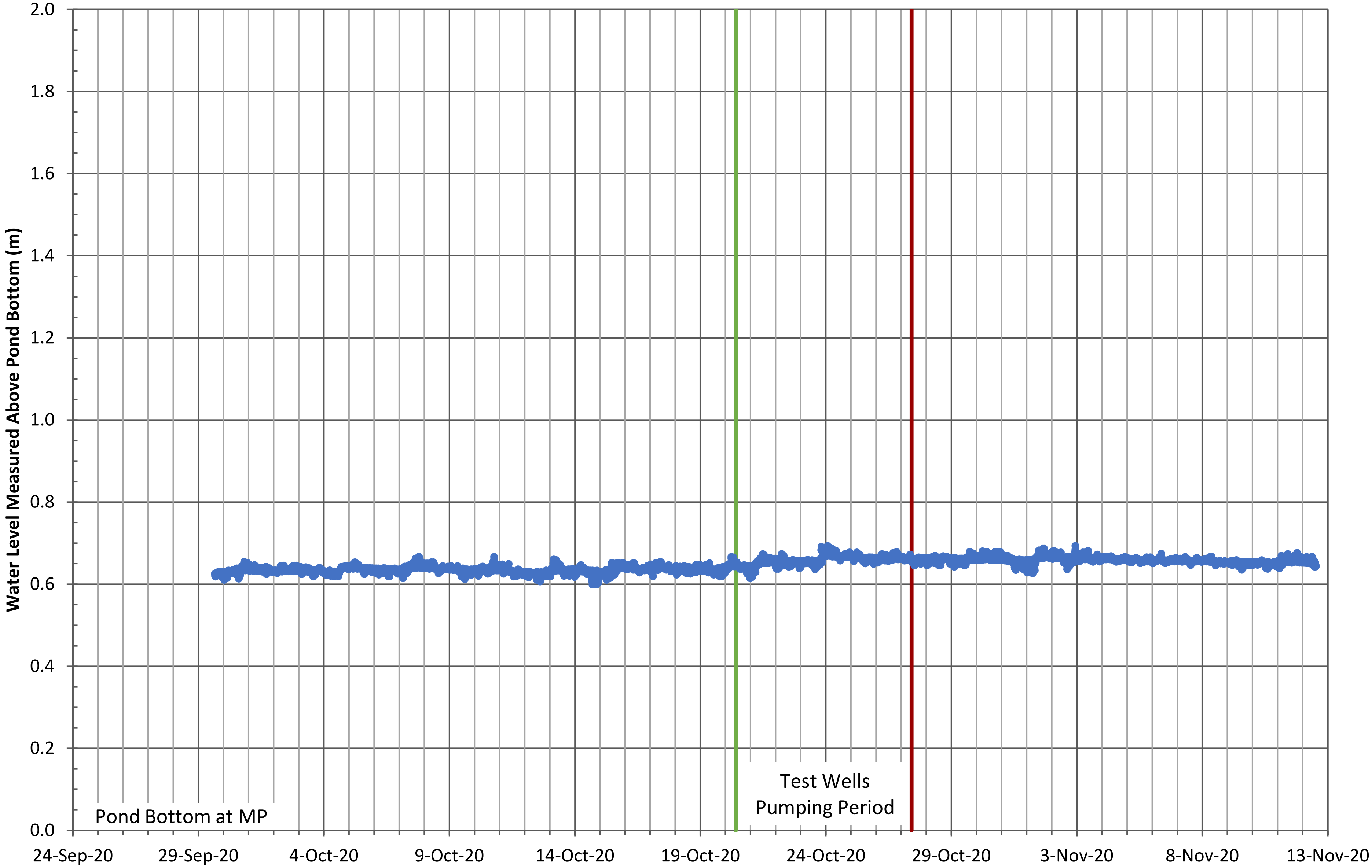
Graph 46

Hydrograph - Inactive Irrigation Pond No. 3 44 Concession 12



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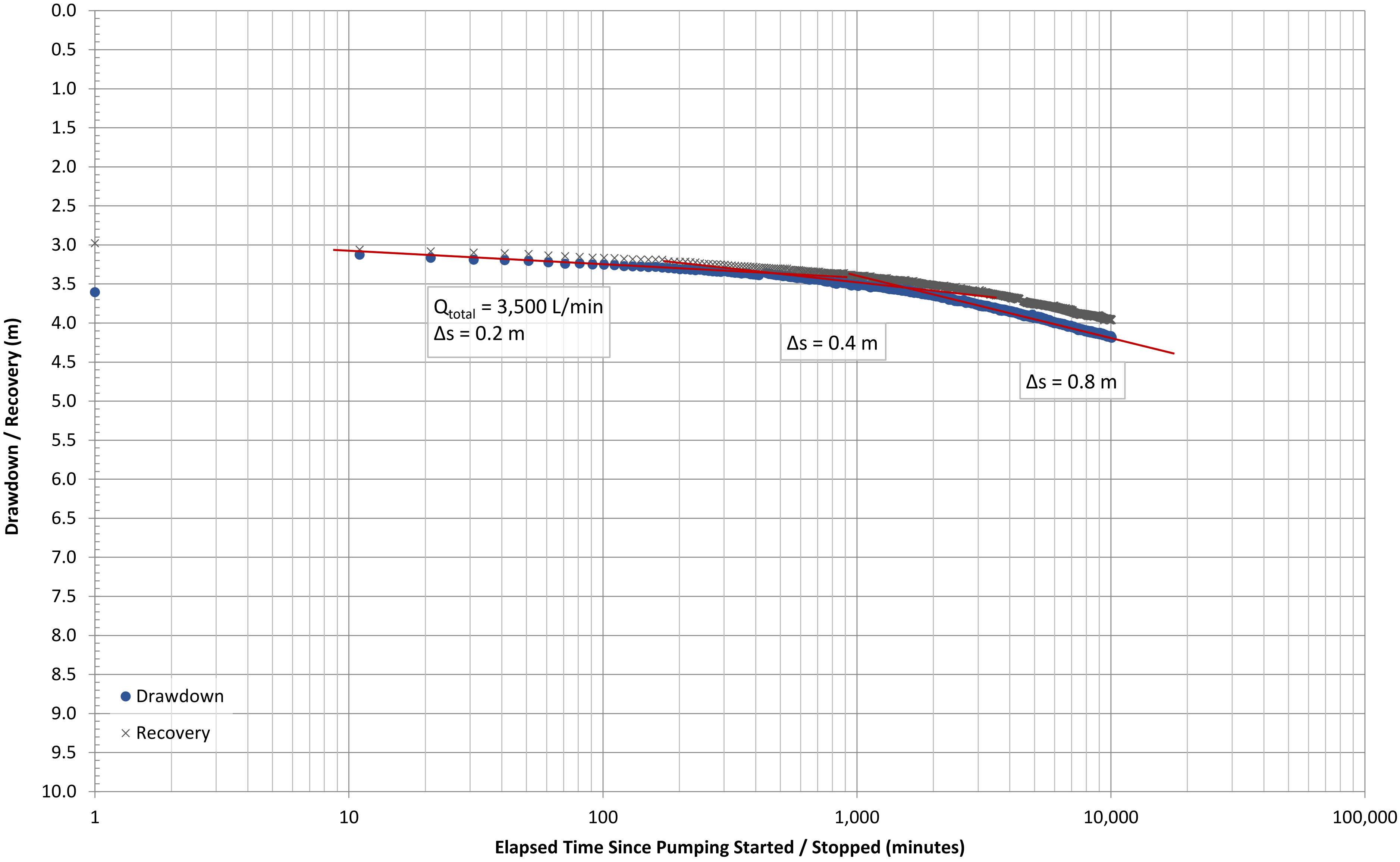
Graph 47

Appendix C3

Semi-Logarithmic Pumping Test Graphs 2020
(Graphs 48 to 67)

Aquifer Test - Test Production Well SW11/09



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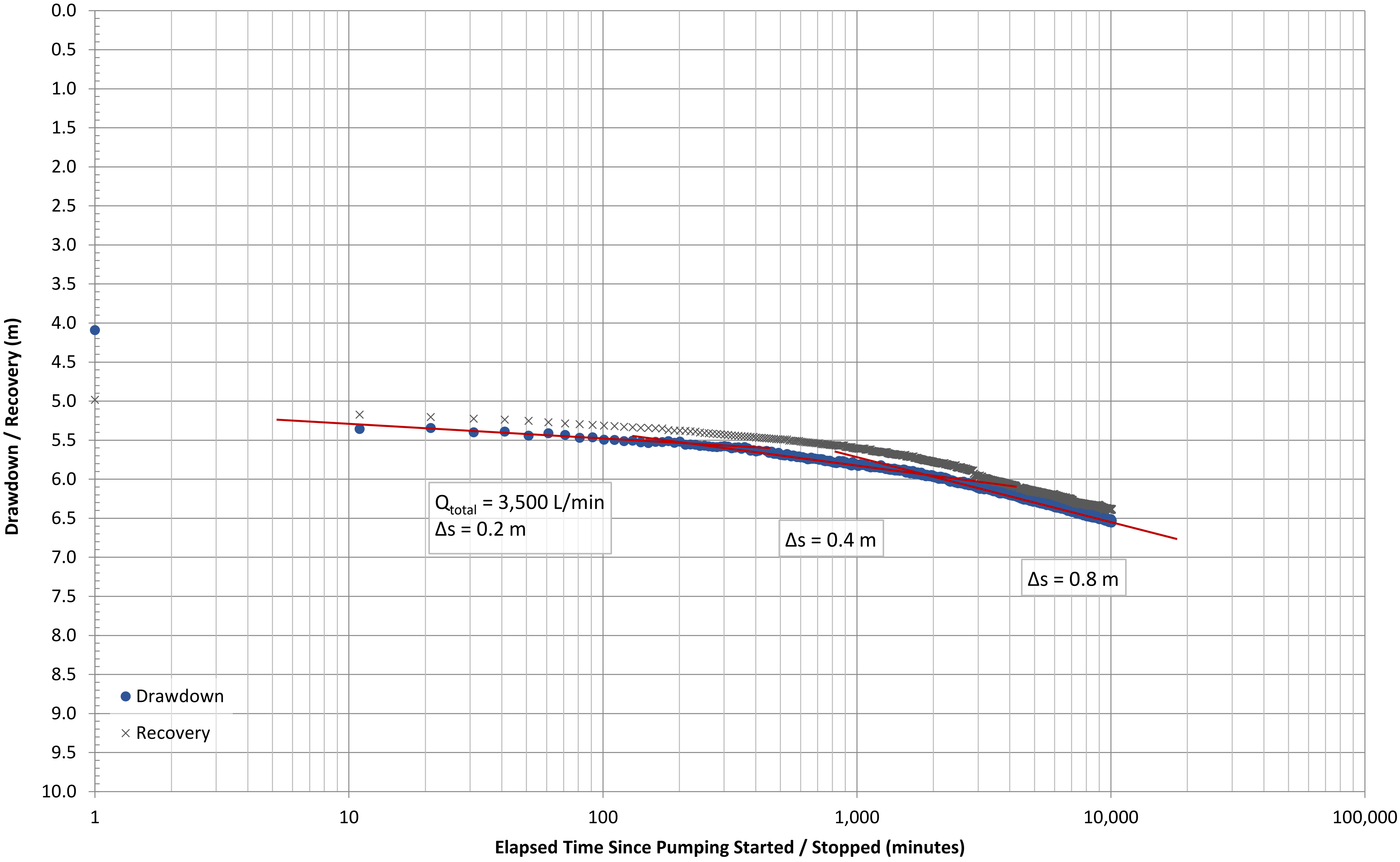
Graph 48

Aquifer Test - Test Production Well SW12/20



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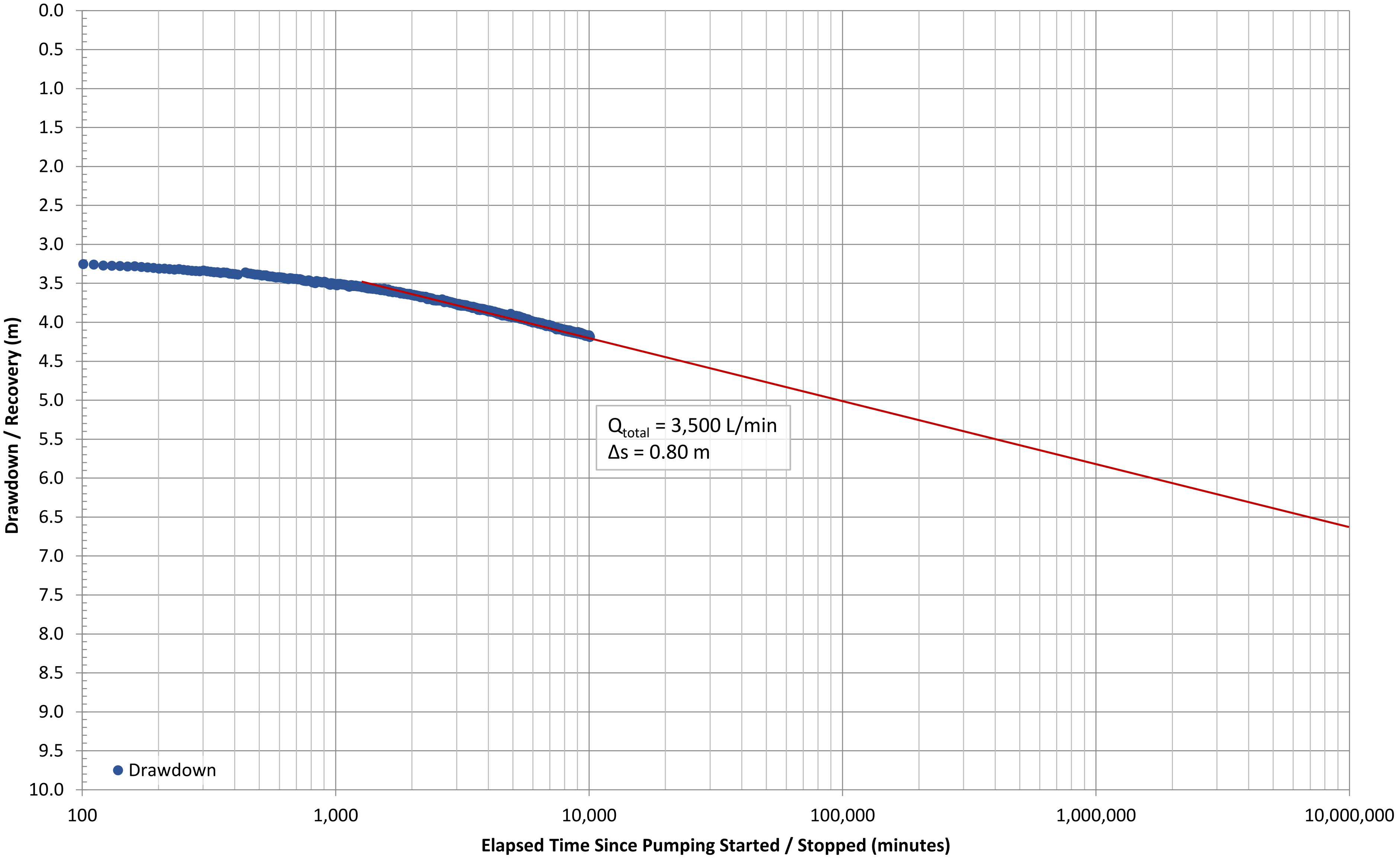
Graph 49

Aquifer Test - Test Production Well SW11/09



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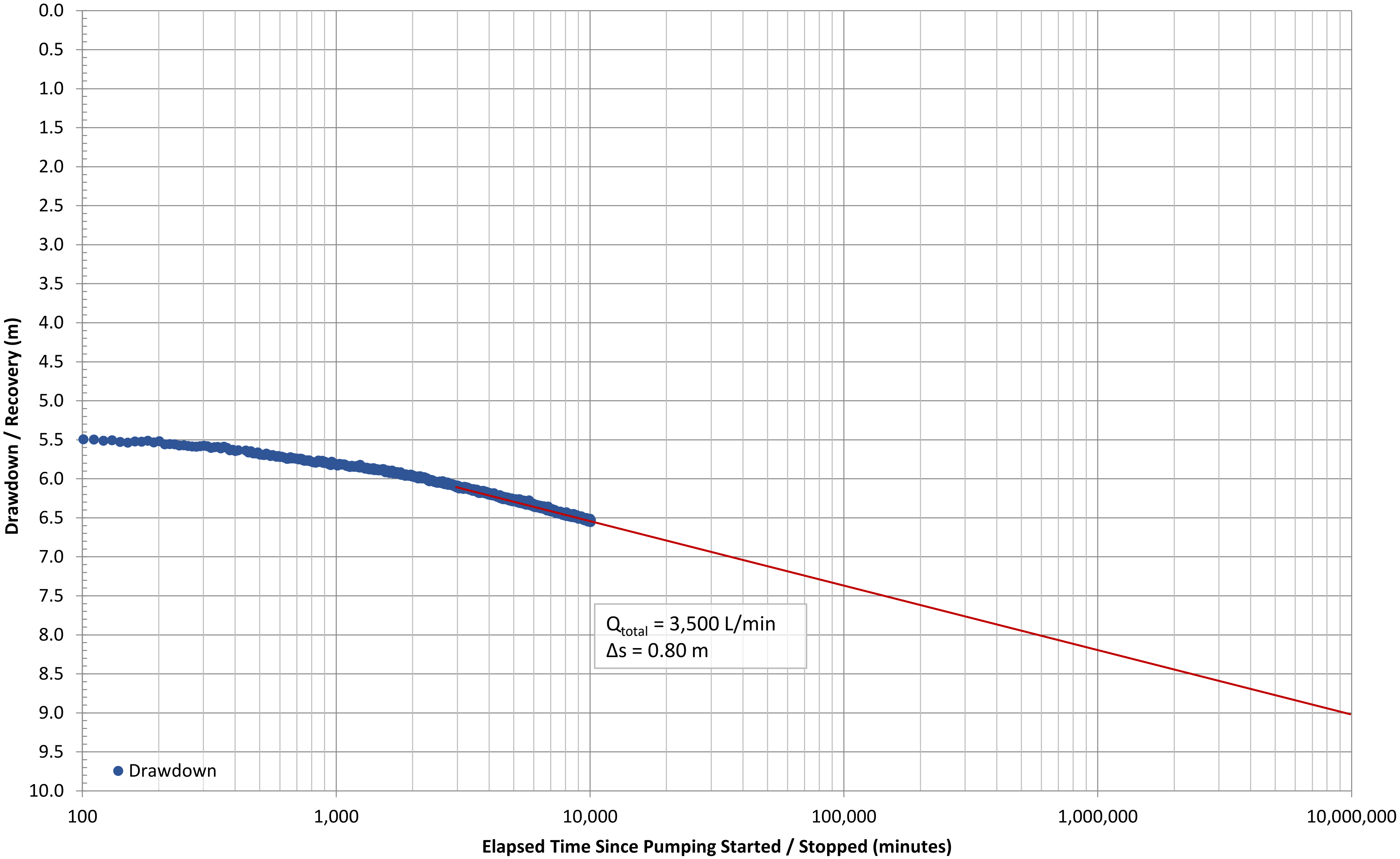
Graph 50

Aquifer Test - Test Production Well SW12/20



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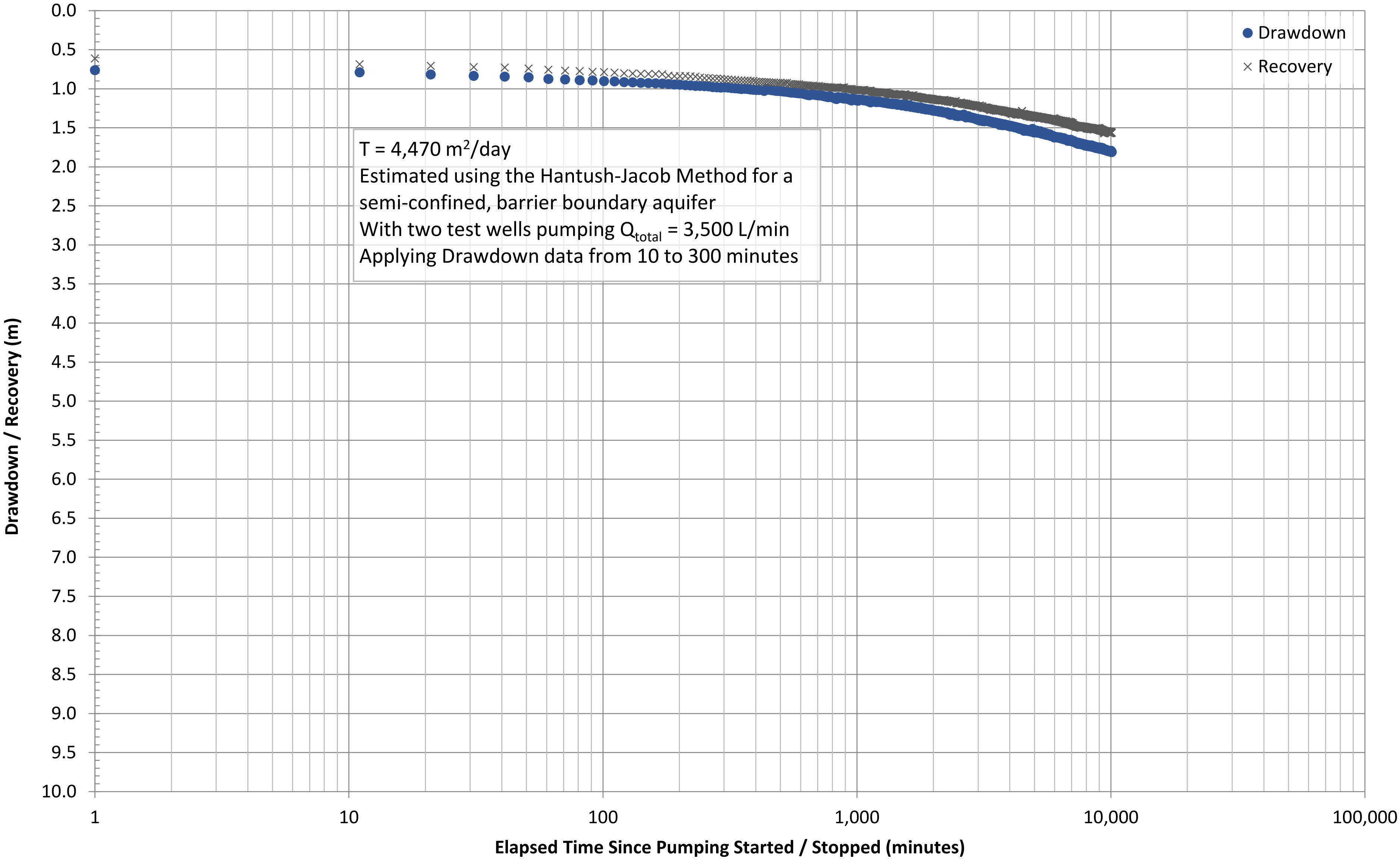
Graph 51

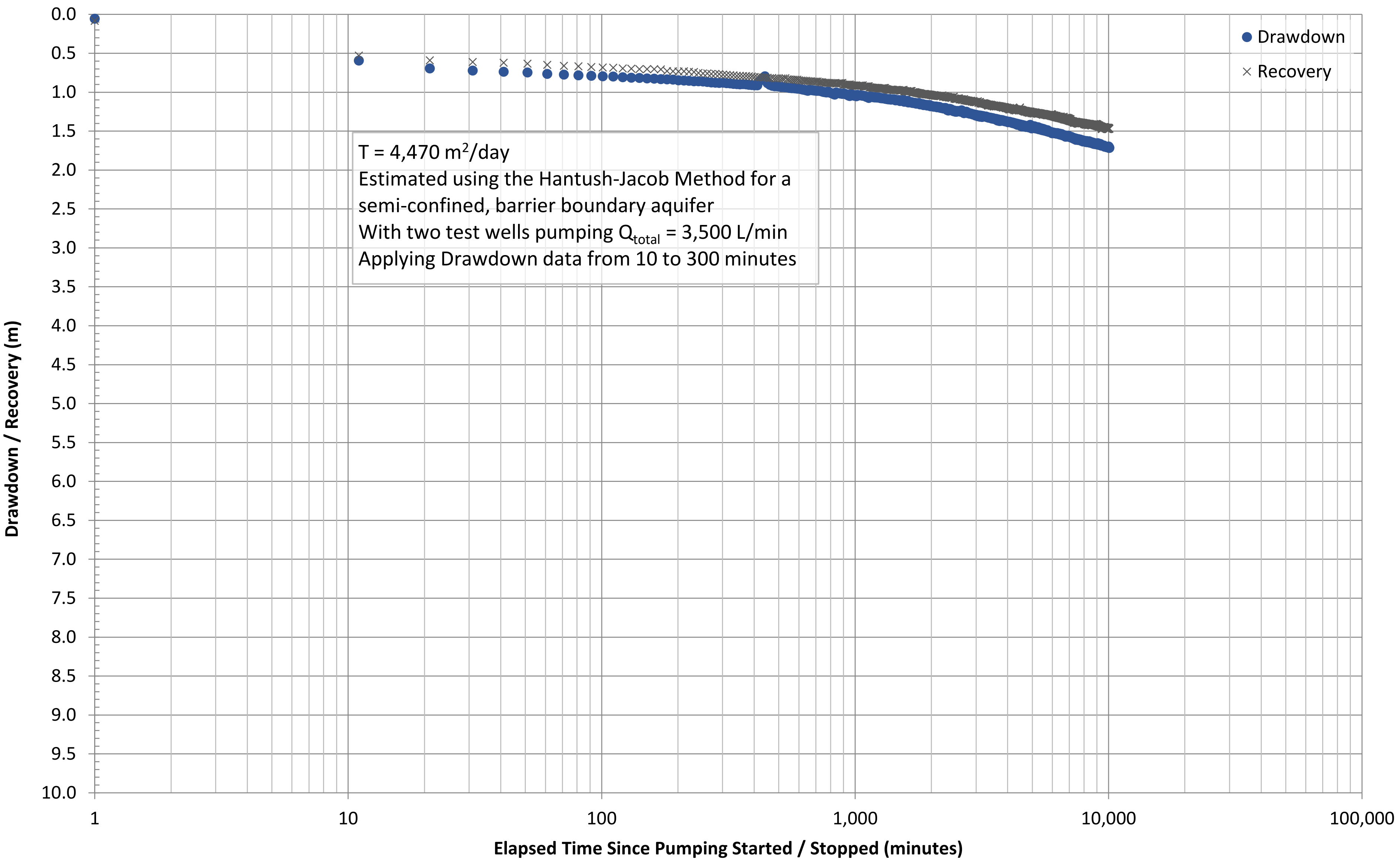
Aquifer Test - Monitored Well SW7/08



T = 4,470 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

Graph 52

Aquifer Test - Monitoring Well MW1/09



T = 4,470 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

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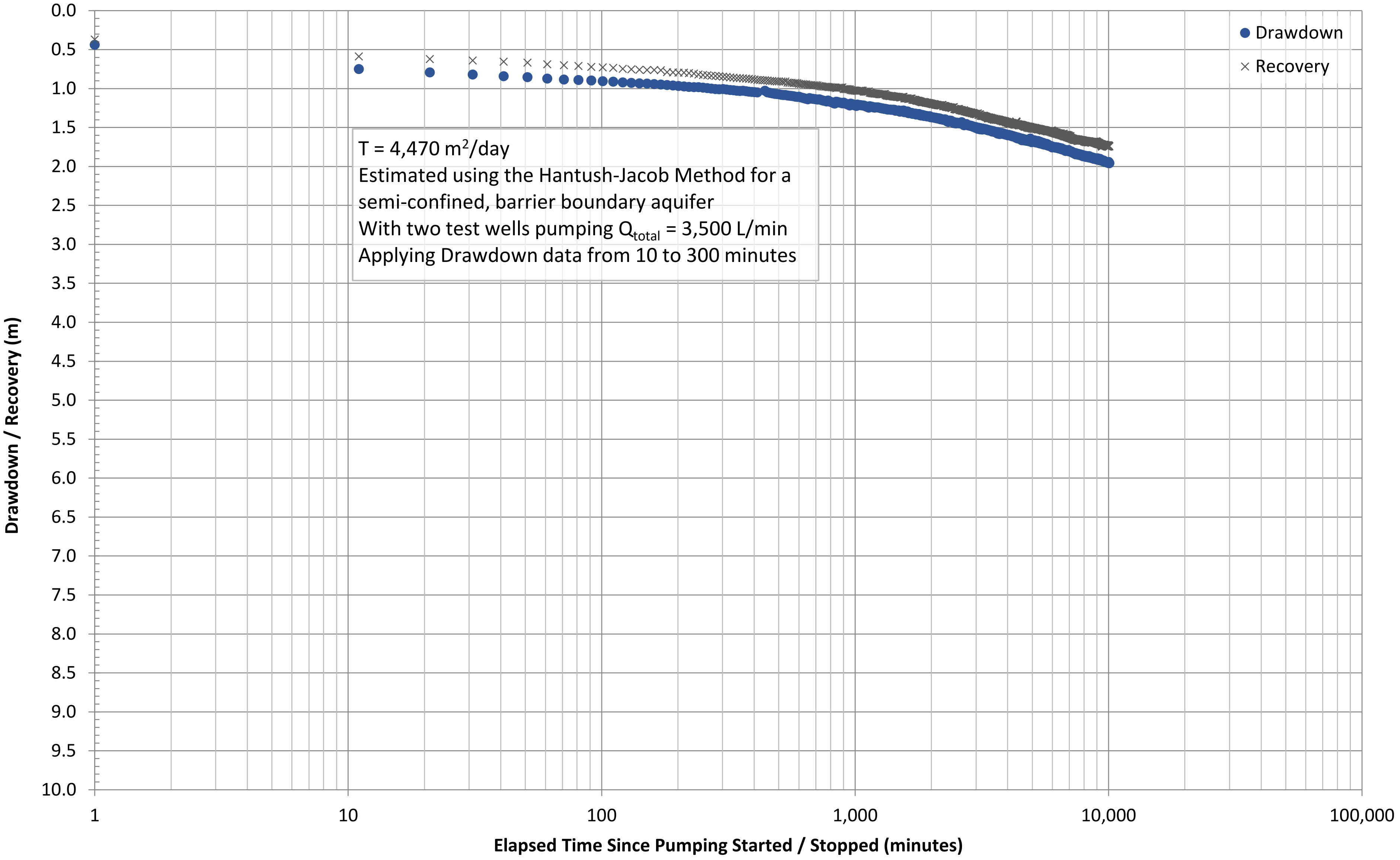
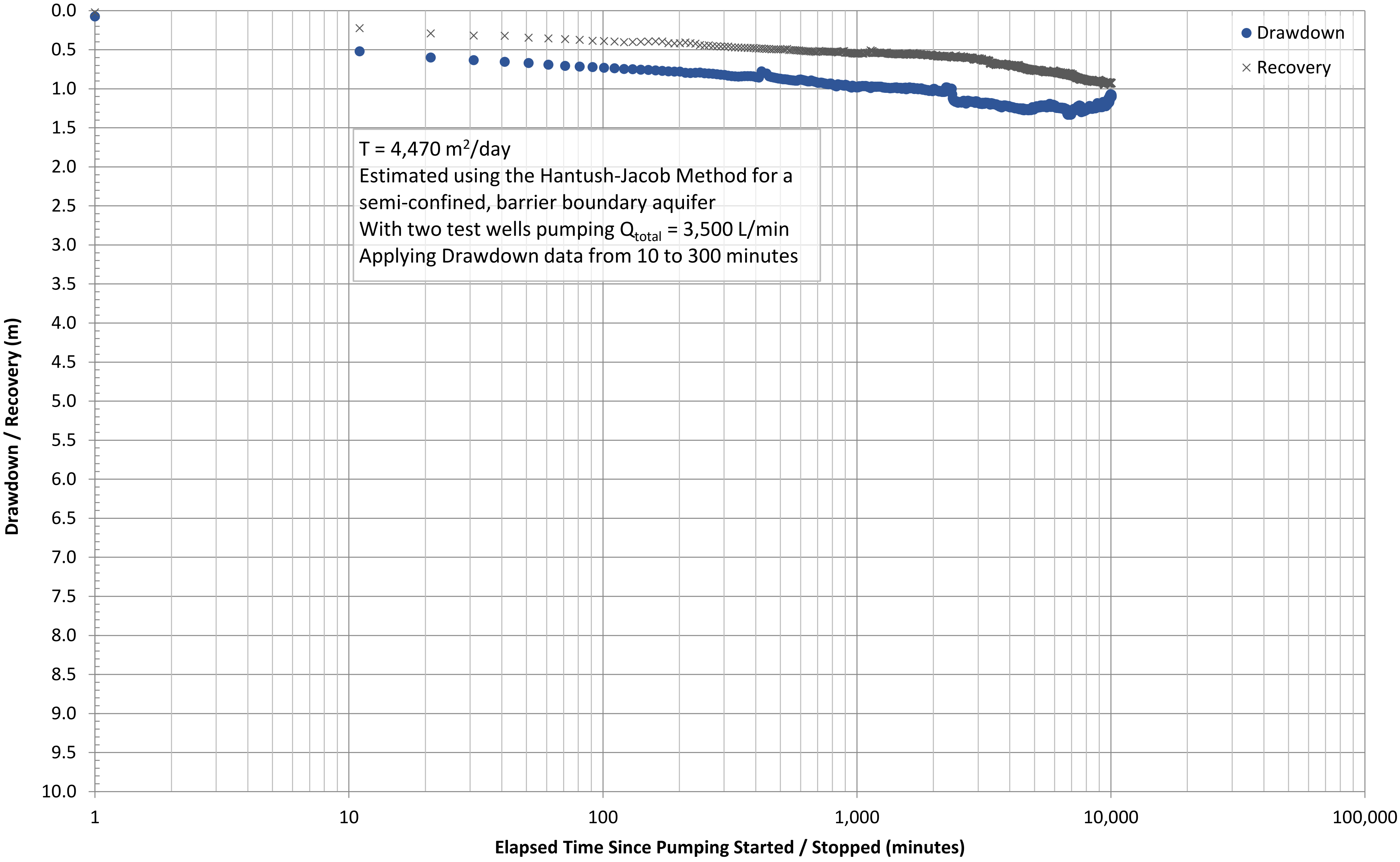
Graph 53

Aquifer Test - Monitoring Well MW2/11



T = 4,470 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

Aquifer Test - Monitoring Well MW4/12



T = 4,470 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

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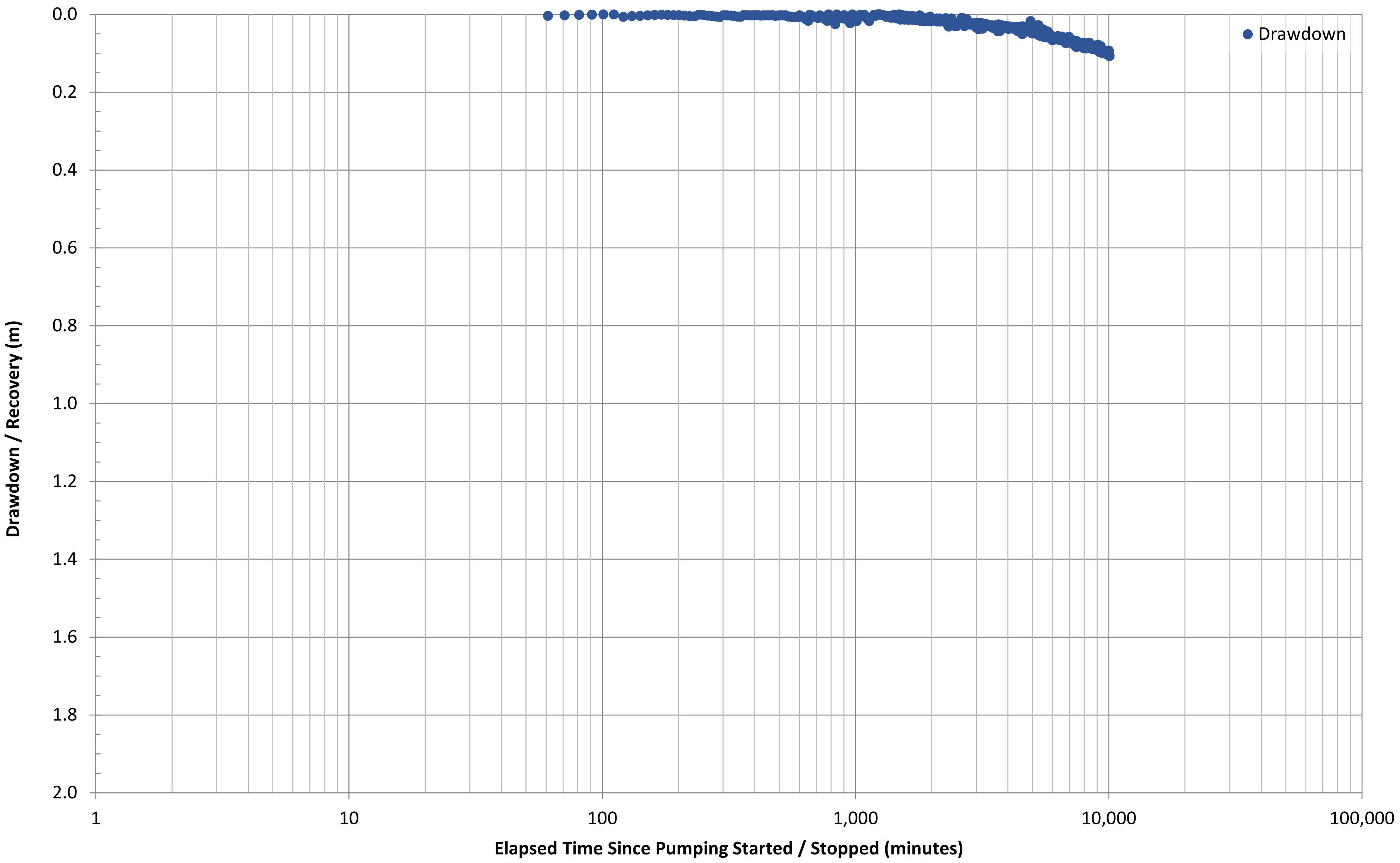
Graph 55

Aquifer Test - Monitoring Well MW5/12



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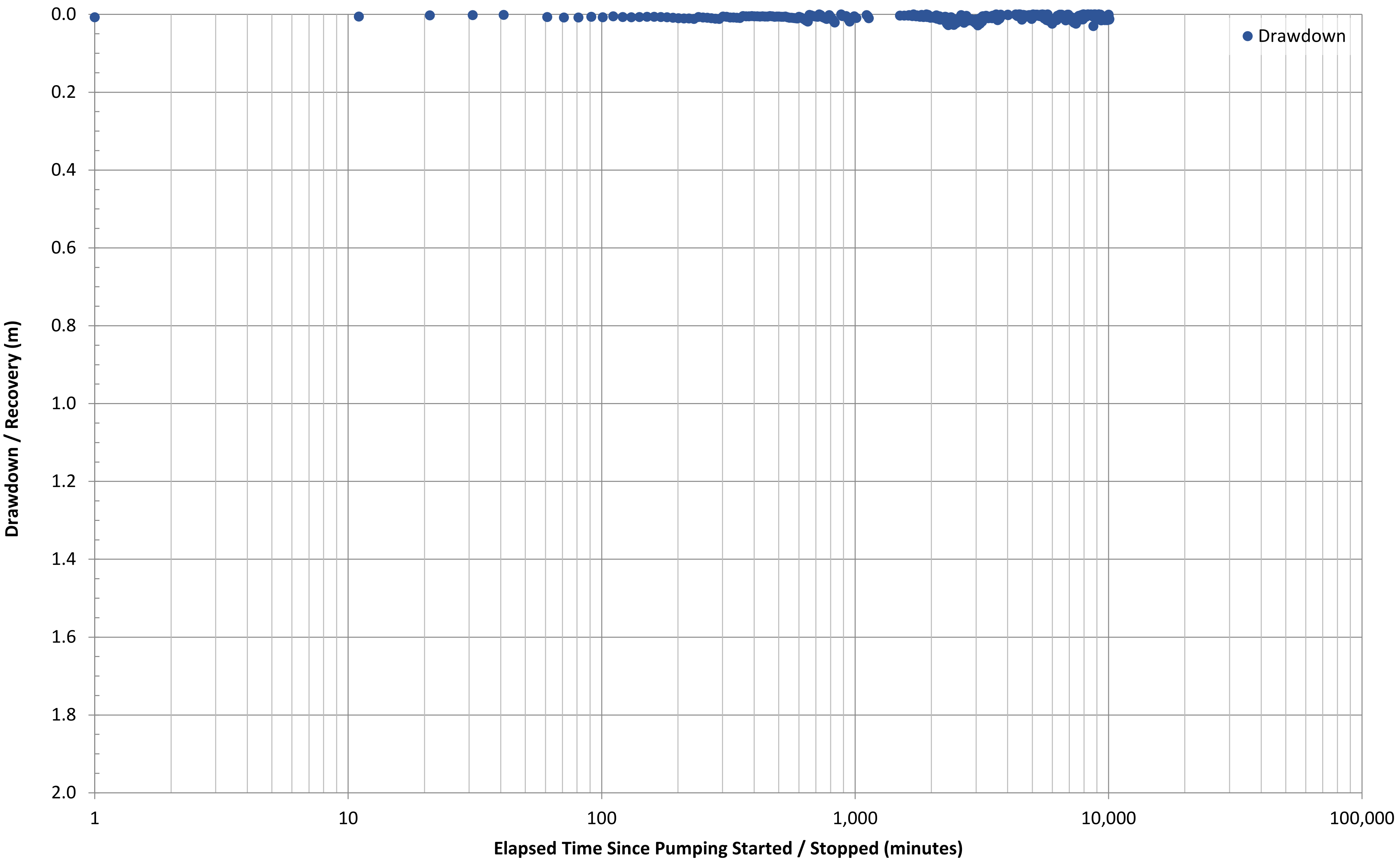
Graph 56

Aquifer Test - Monitoring Well LP-MW-2-10-S



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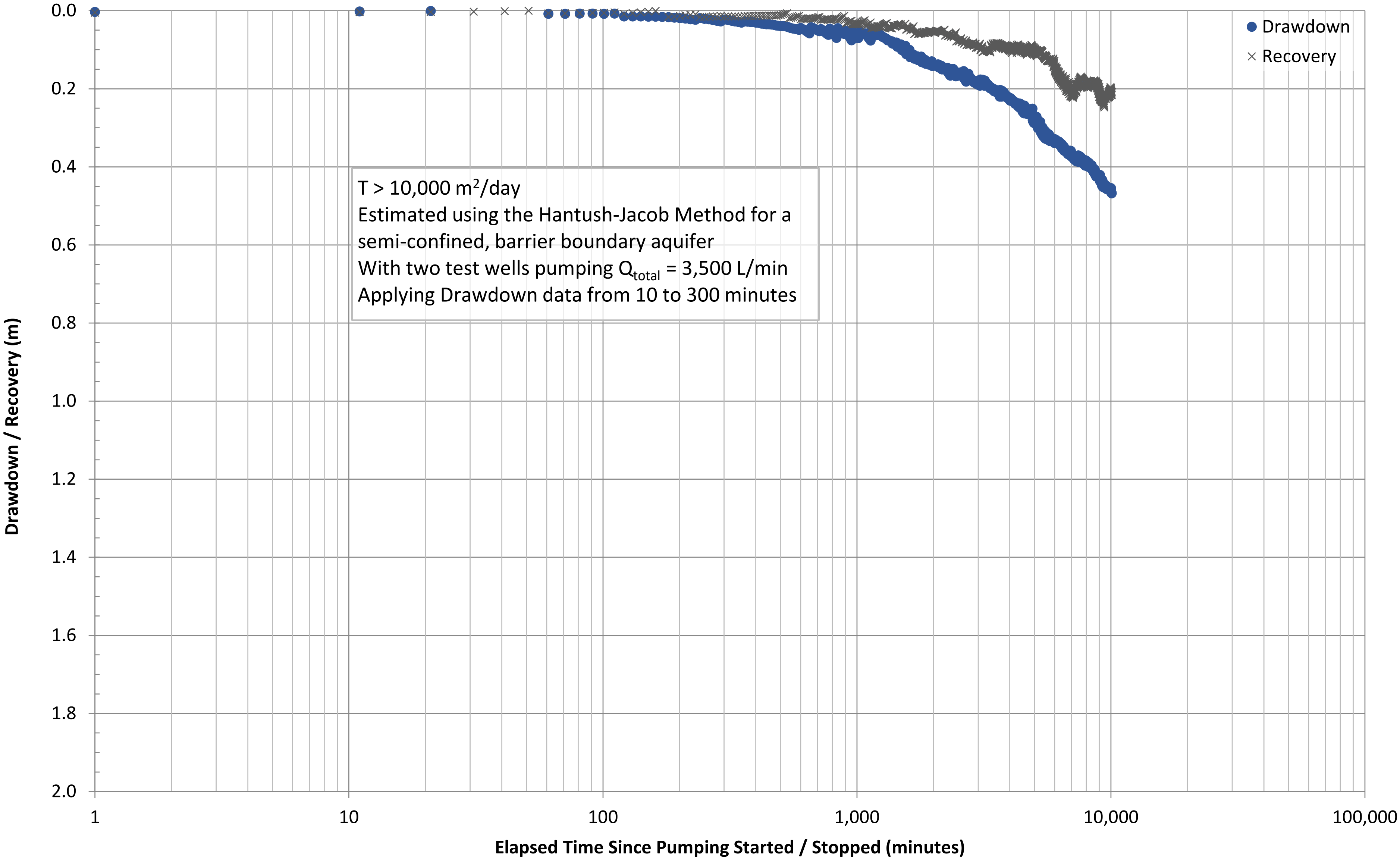
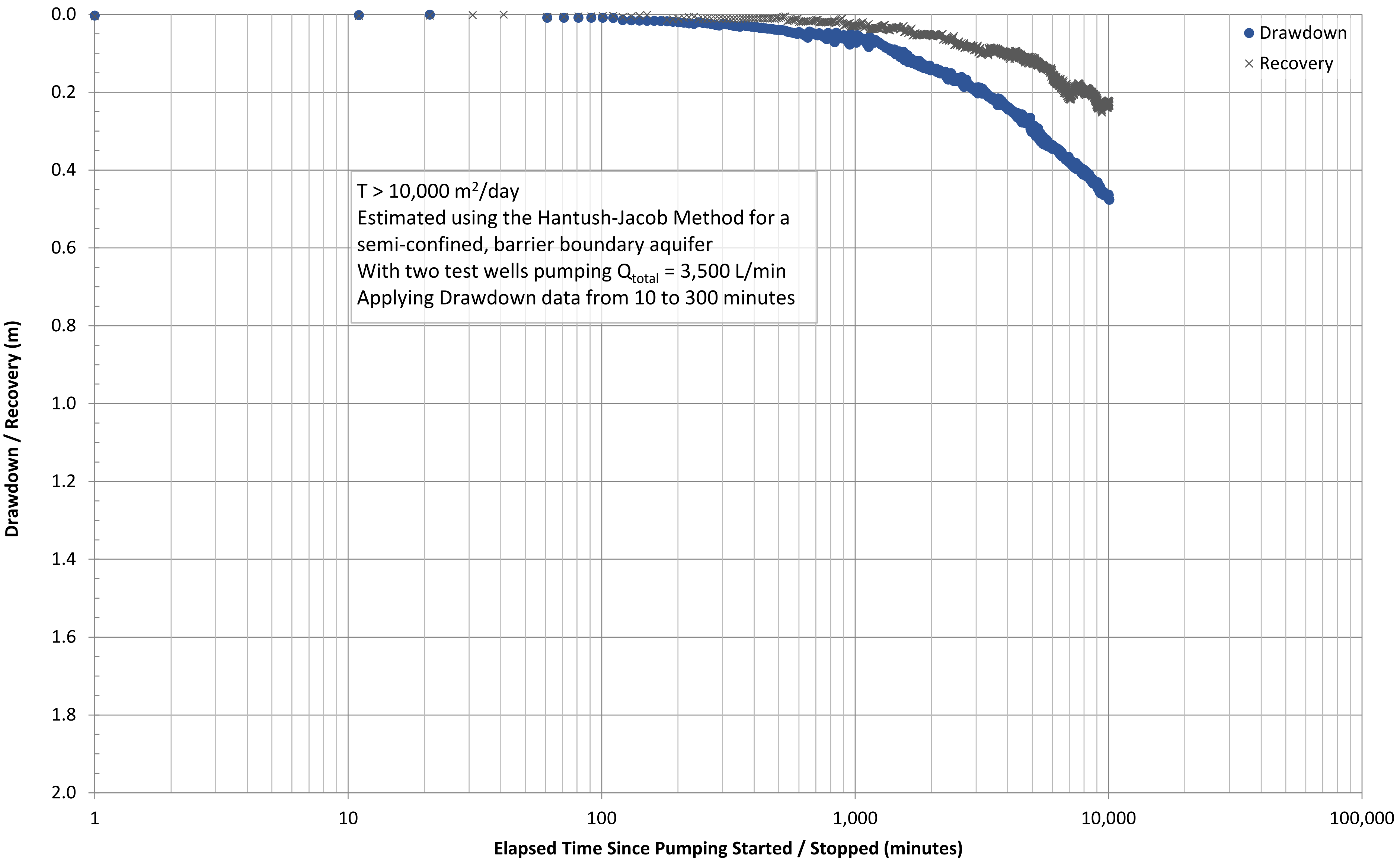
Graph 57

Aquifer Test - Monitoring Well LP-MW-2-10-I



T > 10,000 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

Aquifer Test - Monitoring Well LP-MW-2-10-D



T > 10,000 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With two test wells pumping Q_{total} = 3,500 L/min
Applying Drawdown data from 10 to 300 minutes

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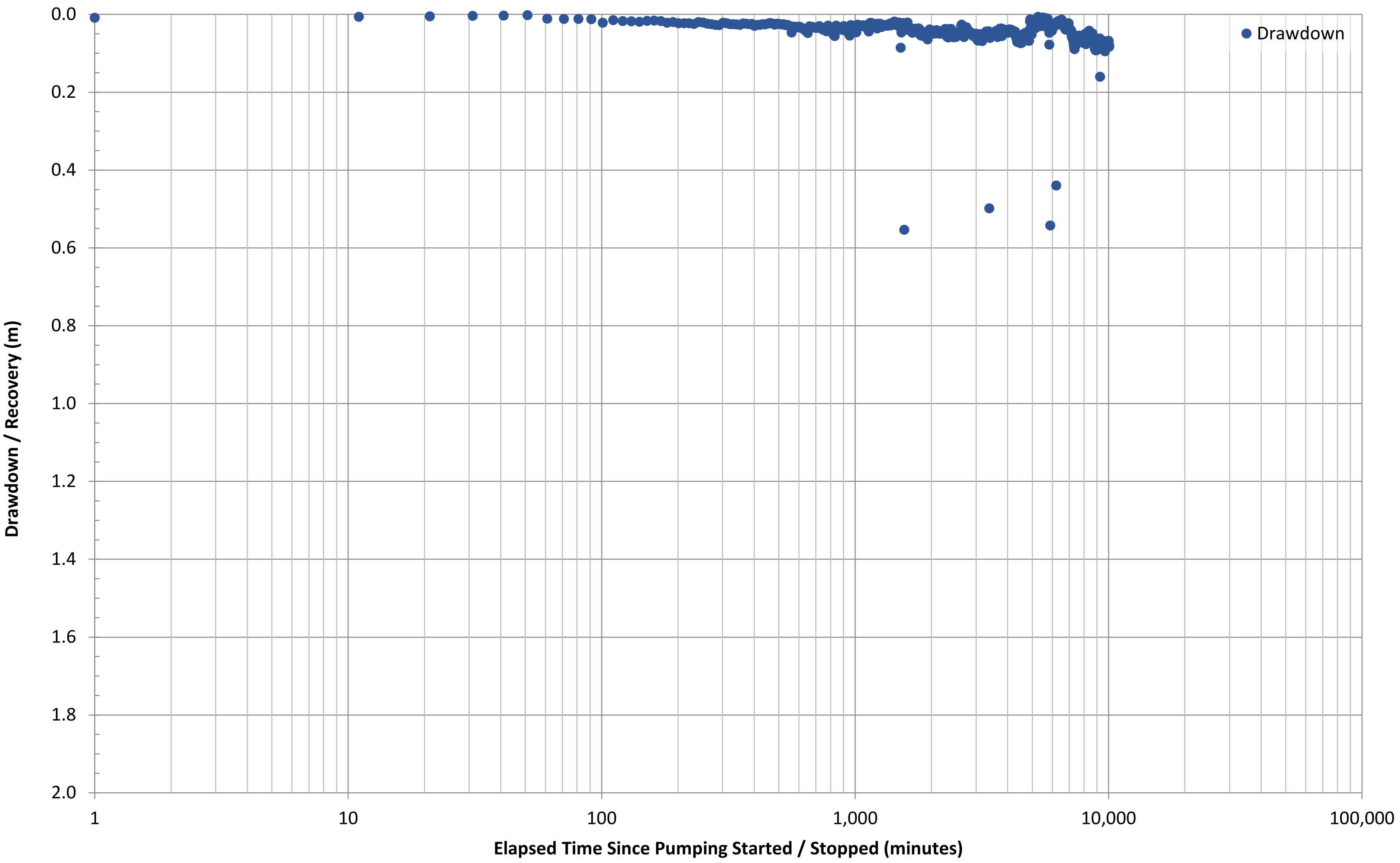
Aquifer Test - Private Well PW1/20



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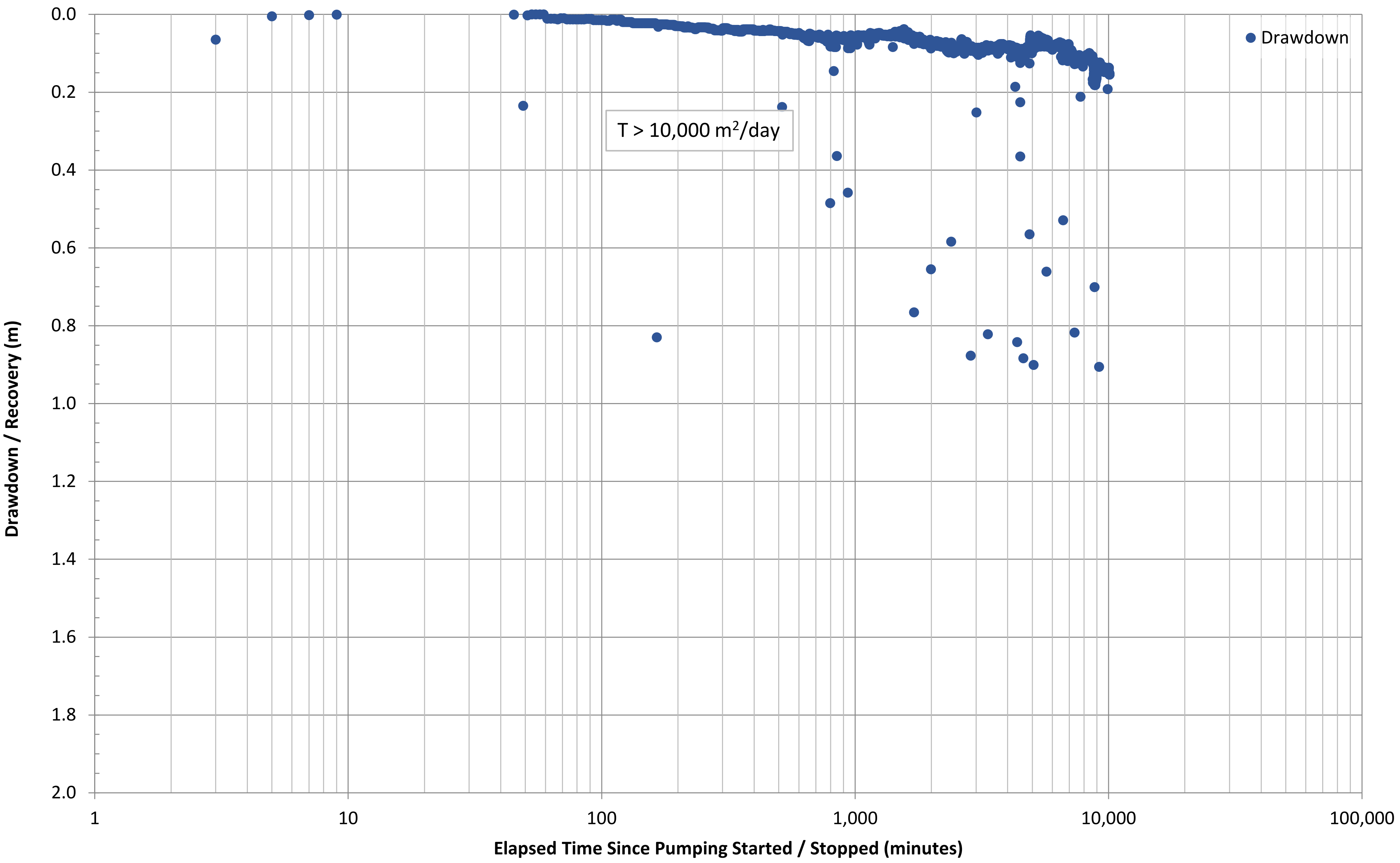
Graph 60

Aquifer Test - Private Well PW2/20

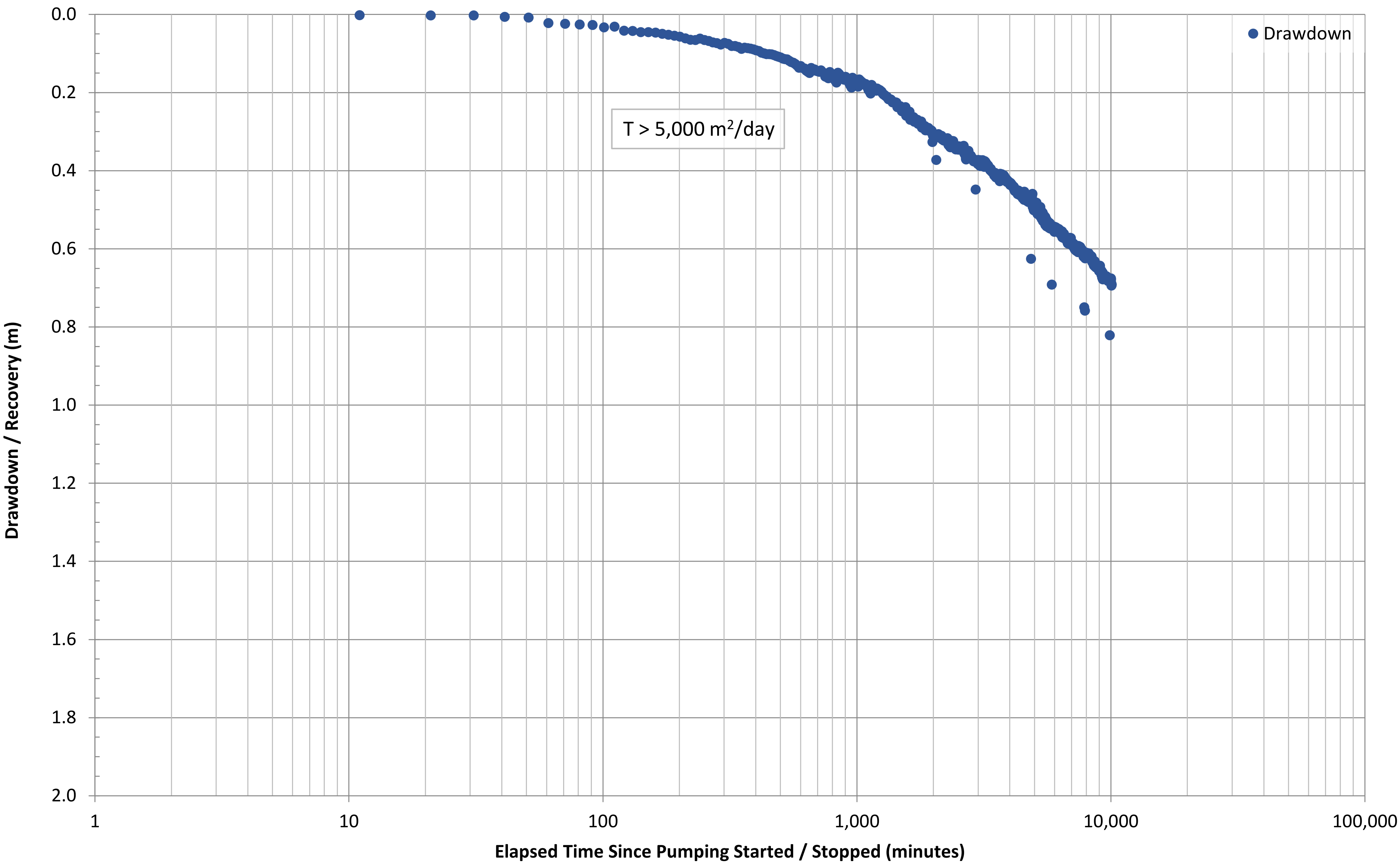


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 61

Aquifer Test - Private Well PW3/20

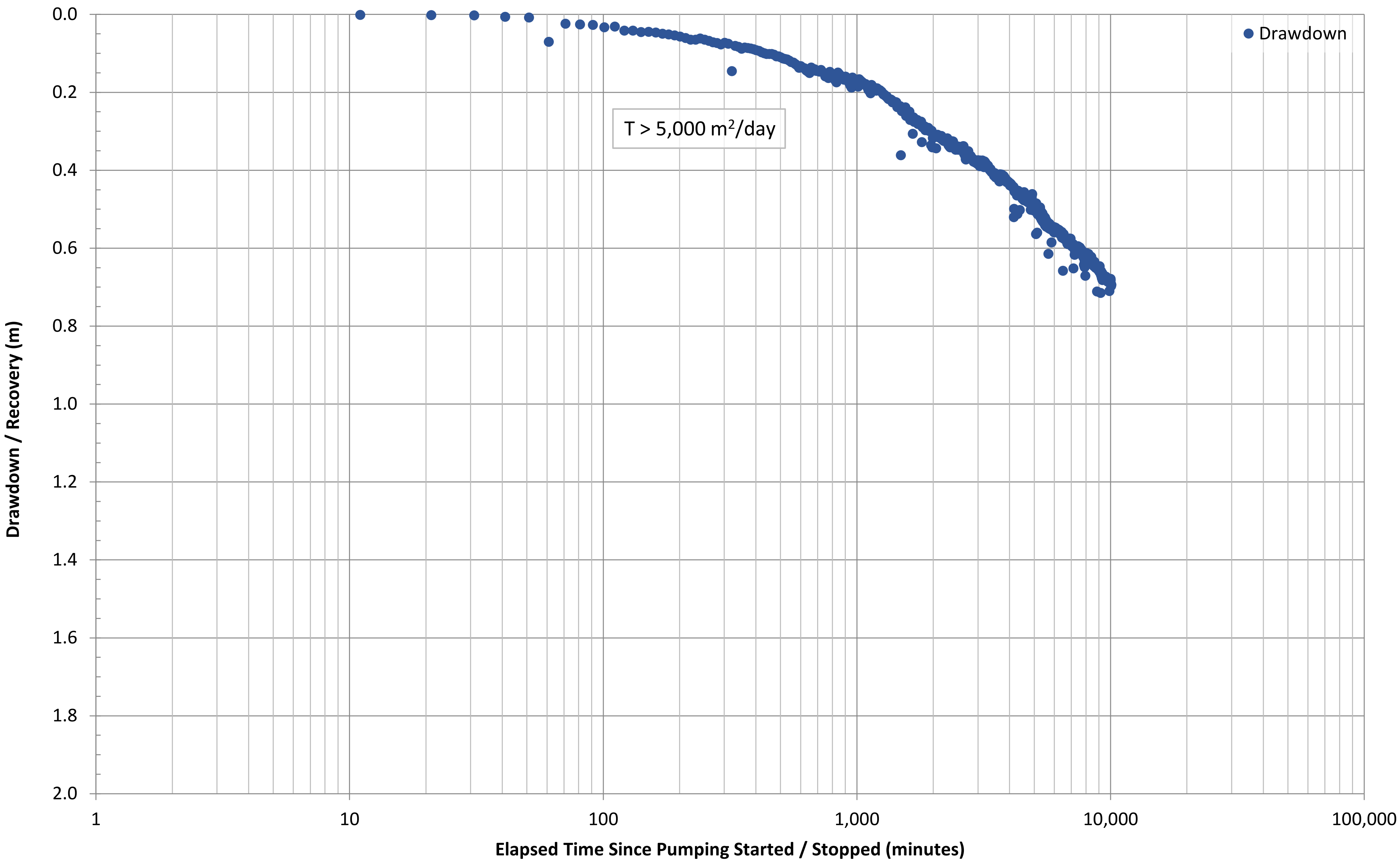


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 62

Aquifer Test - Private Well PW4/20

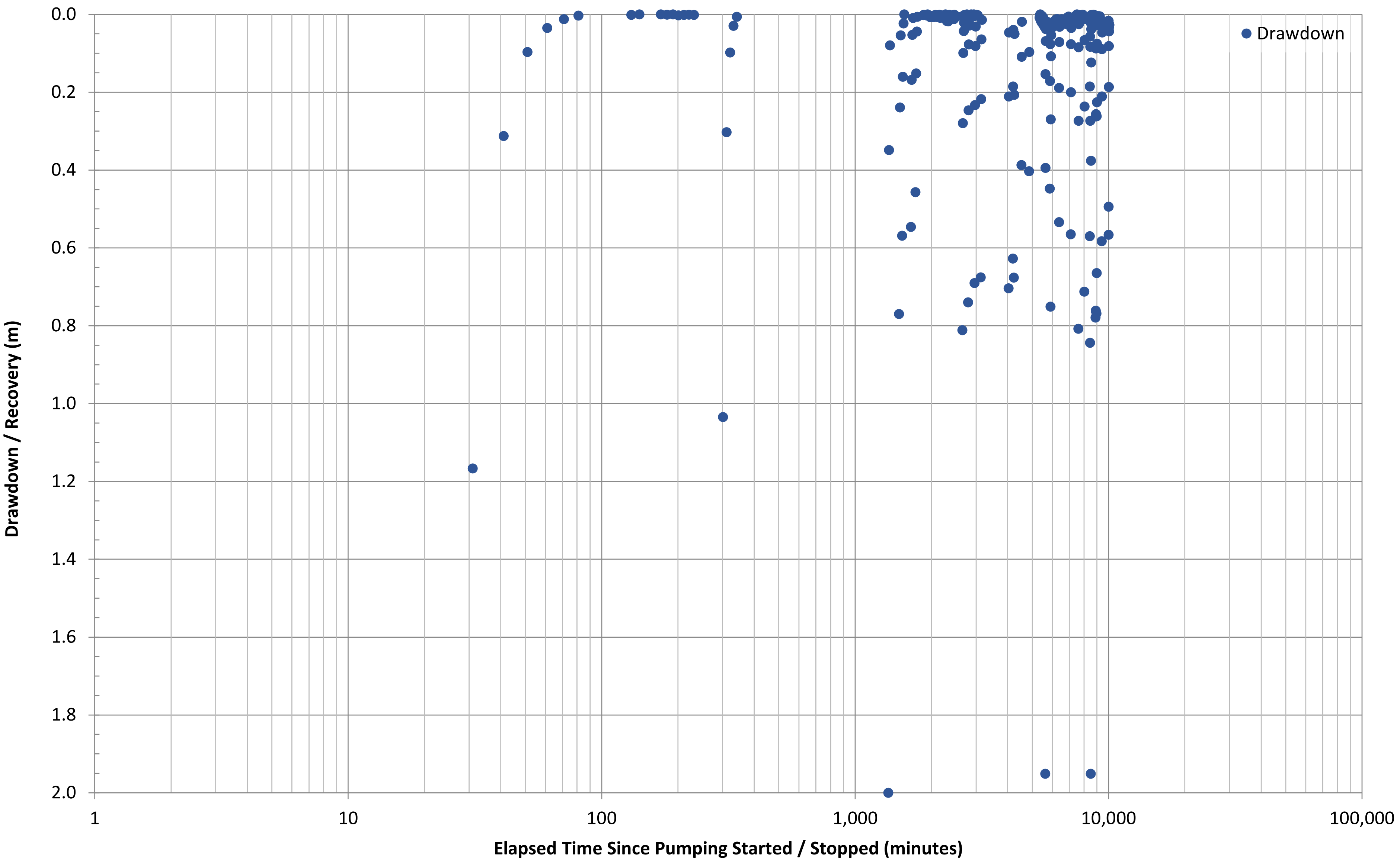


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 63

Aquifer Test - Private Well PW5/20

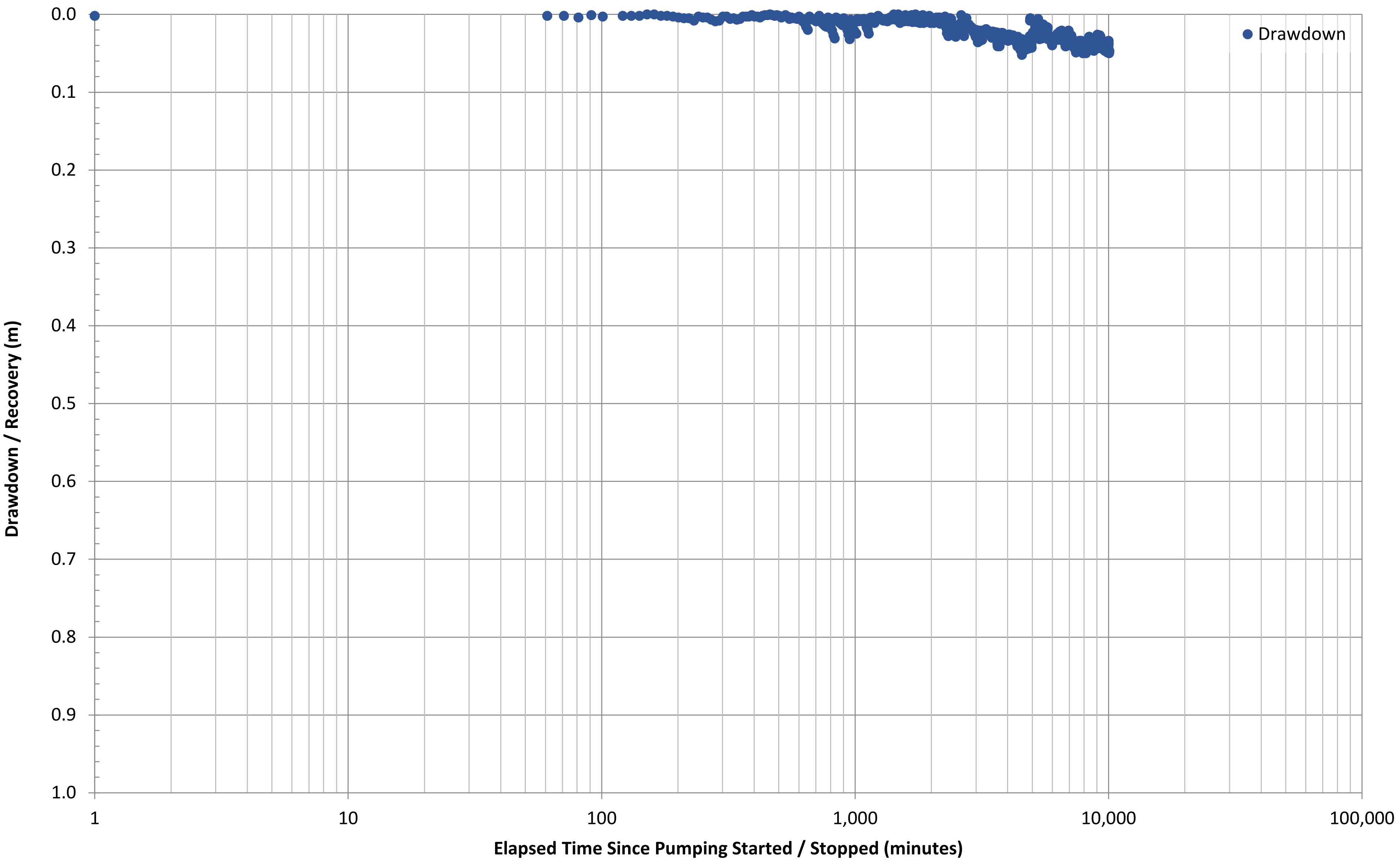


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

Graph 64

Aquifer Test - Piezometer PZ2/20

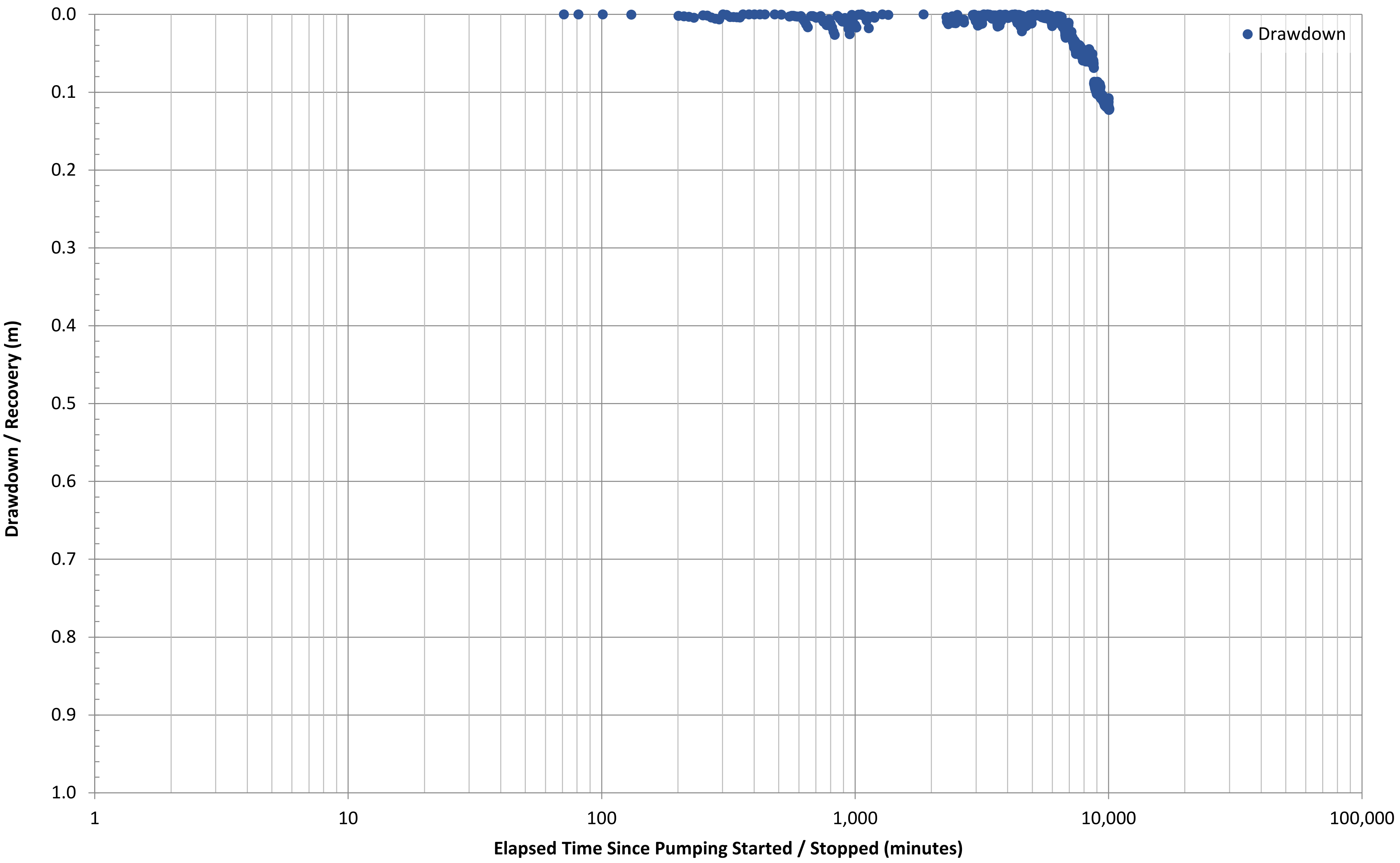


Banks Groundwater Engineering Limited

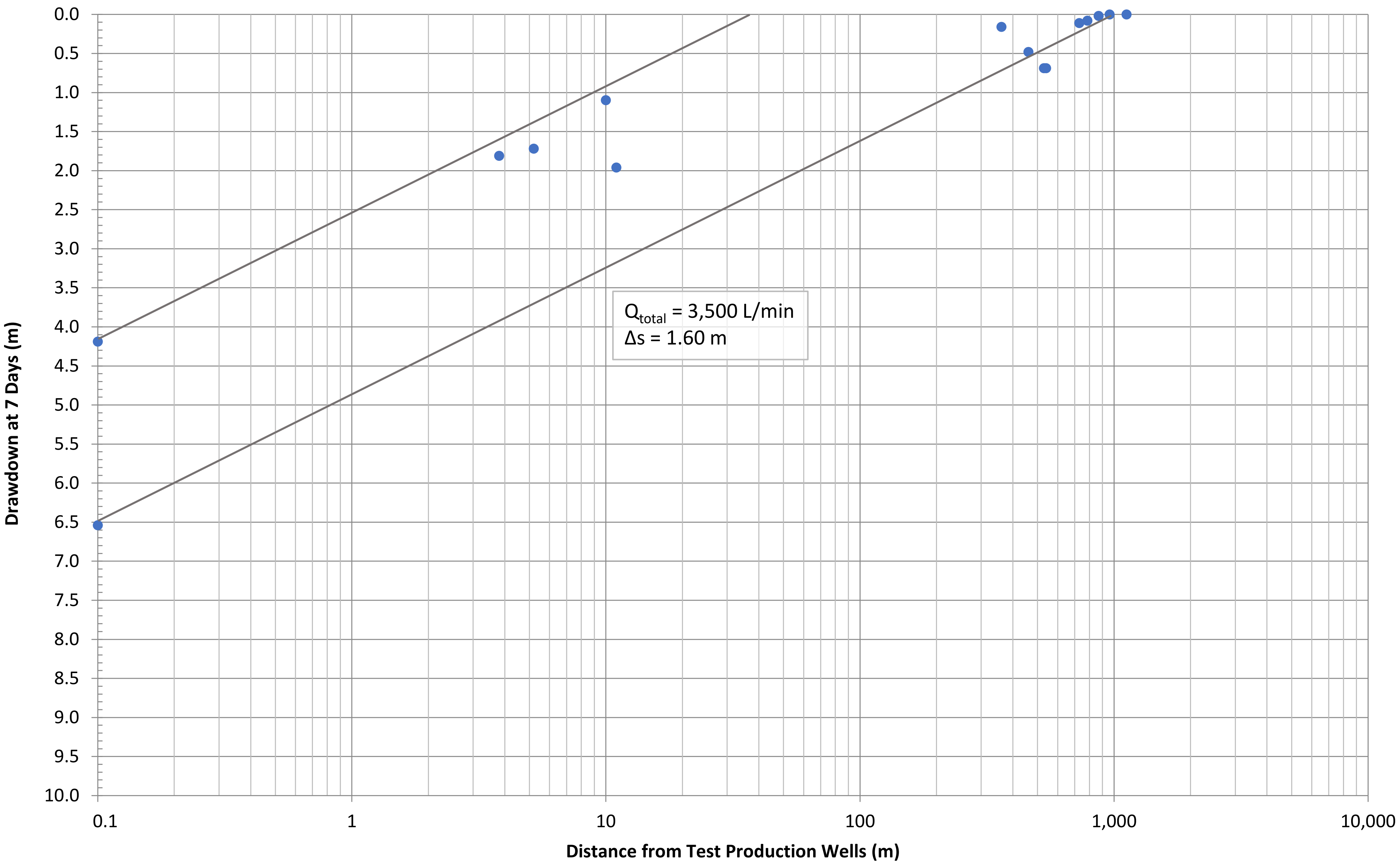
Community of Simcoe Water Supply Class Environmental Assessment

Graph 65

Aquifer Test - Piezometer PZ5/20



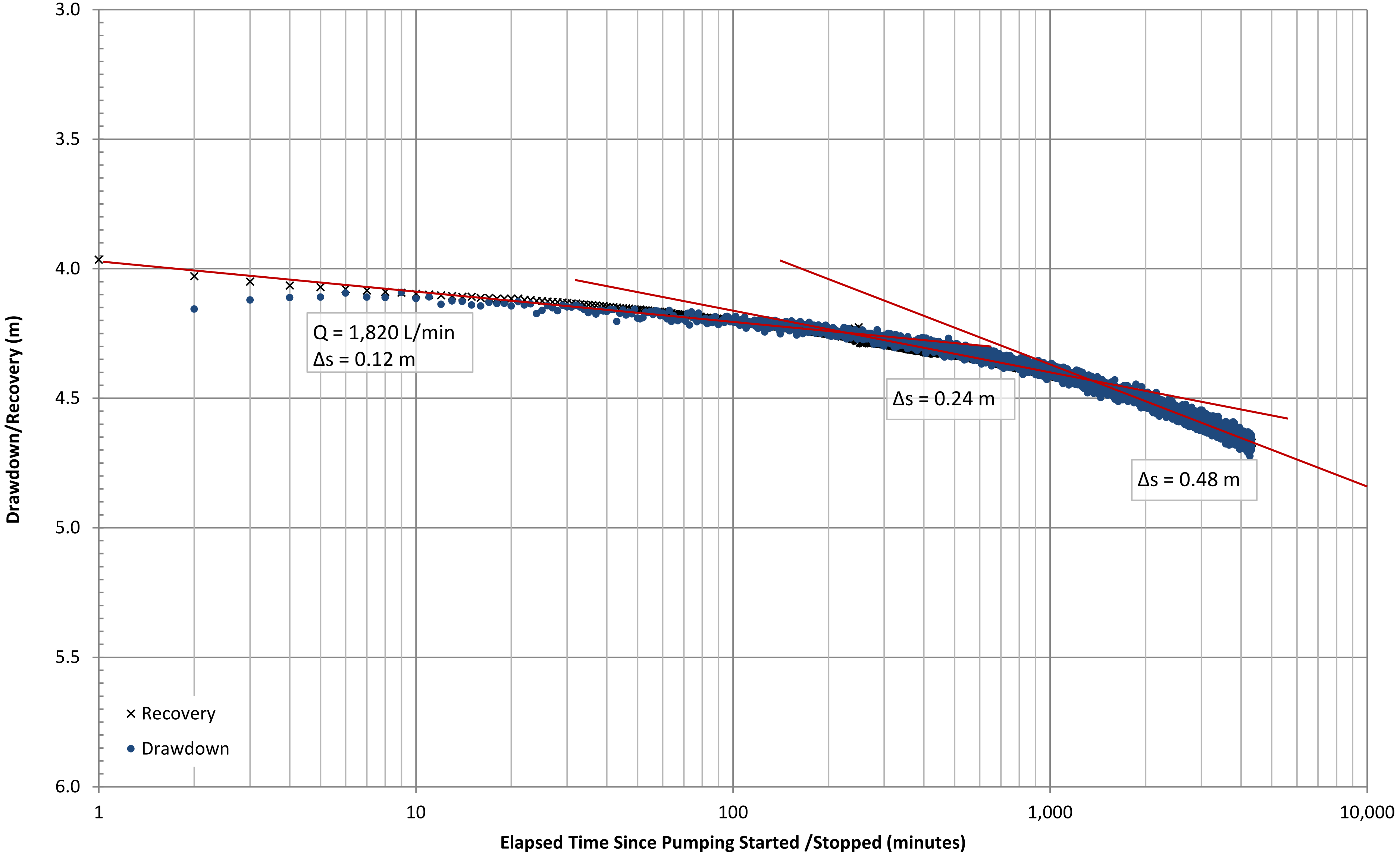
Aquifer Test - Pumped Test Wells SW11/09 and SW12/20



Appendix C4

Semi-Logarithmic Pumping Test Graphs 2012
(Graphs 68 to 70)

Aquifer Test - SW11/09 (29 May - 1 June 2012)

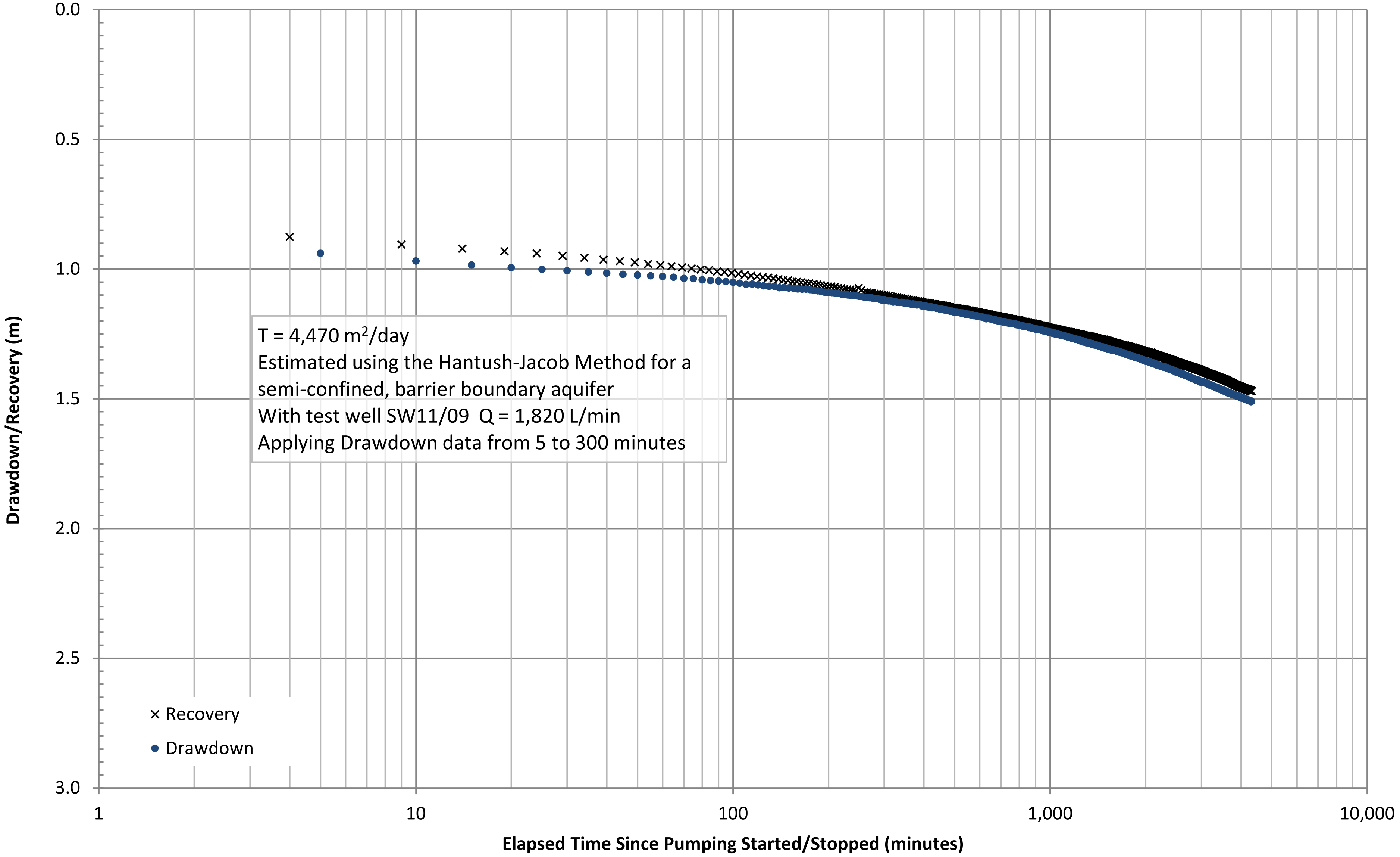


Banks Groundwater Engineering Limited

Community of Simcoe Water Supply Class Environmental Assessment

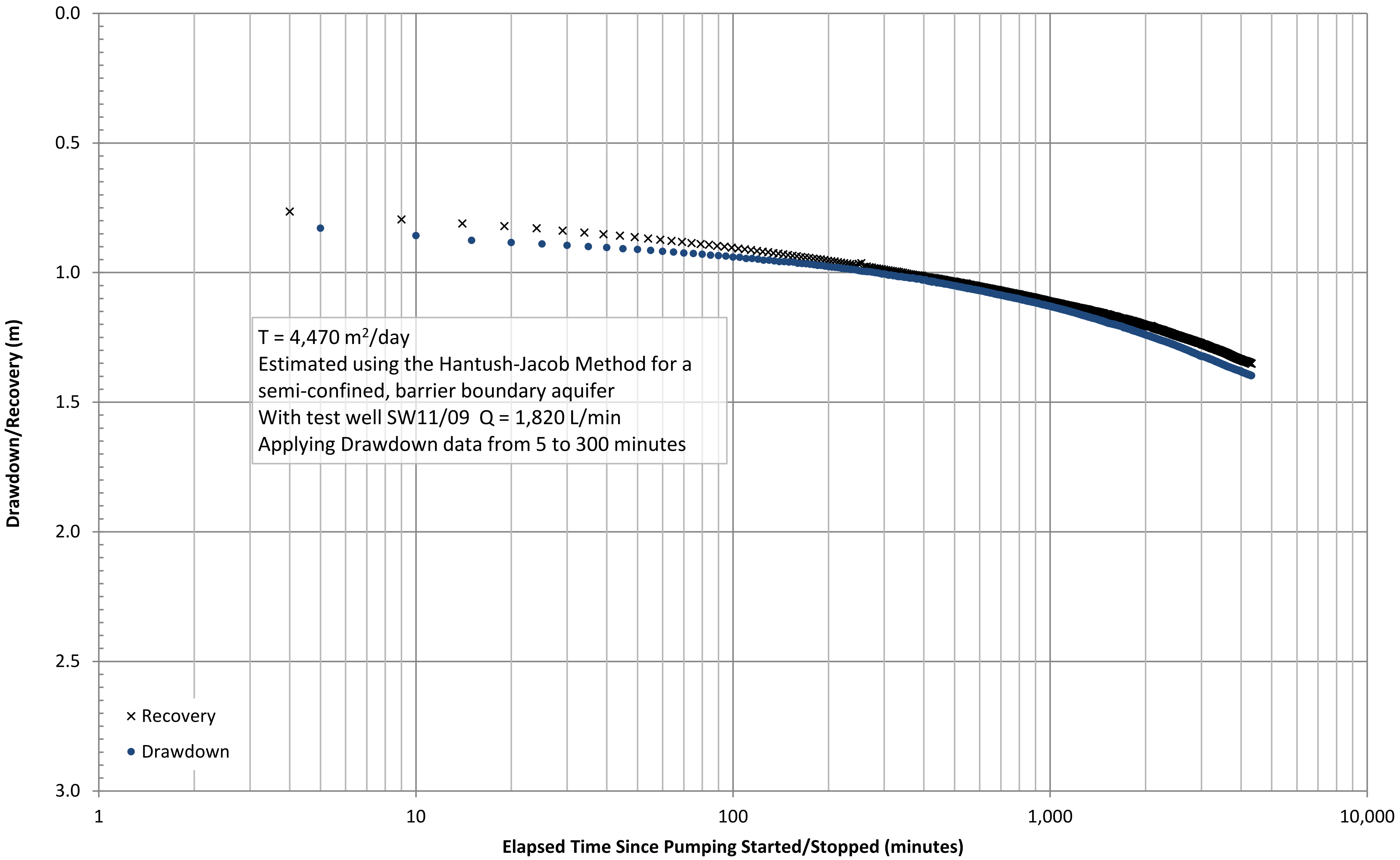
Graph 68

Aquifer Test - SW7/08 (29 May - 1 June 2012)



T = 4,470 m²/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With test well SW11/09 Q = 1,820 L/min
Applying Drawdown data from 5 to 300 minutes

Aquifer Test - MW1/09 (29 May - 1 June 2012)

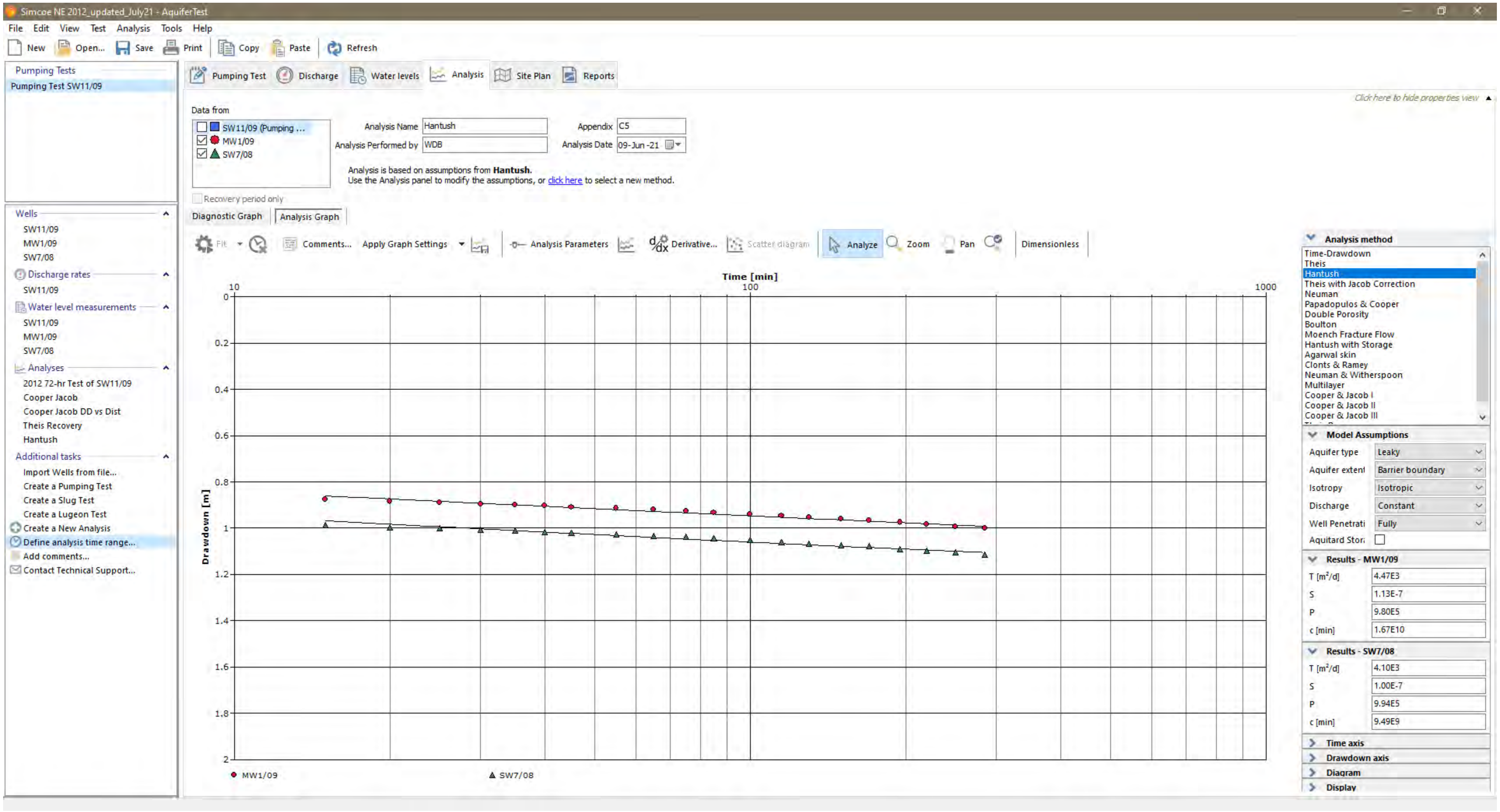


T = 4,470 m^2/day
Estimated using the Hantush-Jacob Method for a semi-confined, barrier boundary aquifer
With test well SW11/09 Q = 1,820 L/min
Applying Drawdown data from 5 to 300 minutes

Appendix C5

Pumping Test Analysis Results from AquiferTest Pro (2012 and 2020)

2012 Pumping Test on SW11/09



Data from

☐ 🟦 SW11/09 (Pumping ...
☑ ● MW1/09
☑ ▲ SW7/08

Analysis Name: Hantush

Analysis Performed by: WDB

Appendix: C5

Analysis Date: 09-Jun -21

Analysis is based on assumptions from **Hantush**.
Use the Analysis panel to modify the assumptions, or click here to select a new method.

☐ Recovery period only

Analysis method

- Time-Drawdown
- Theis
- Hantush
- Theis with Jacob Correction
- Neuman
- Papadopulos & Cooper
- Double Porosity
- Boulton
- Moench Fracture Flow
- Hantush with Storage
- Agarwal skin
- Clonts & Ramey
- Neuman & Witherspoon
- Multilayer
- Cooper & Jacob I
- Cooper & Jacob II
- Cooper & Jacob III

Model Assumptions

Aquifer type: Leaky
Aquifer extent: Barrier boundary
Isotropy: Isotropic
Discharge: Constant
Well Penetrati: Fully
Aquitard Stor: ☐

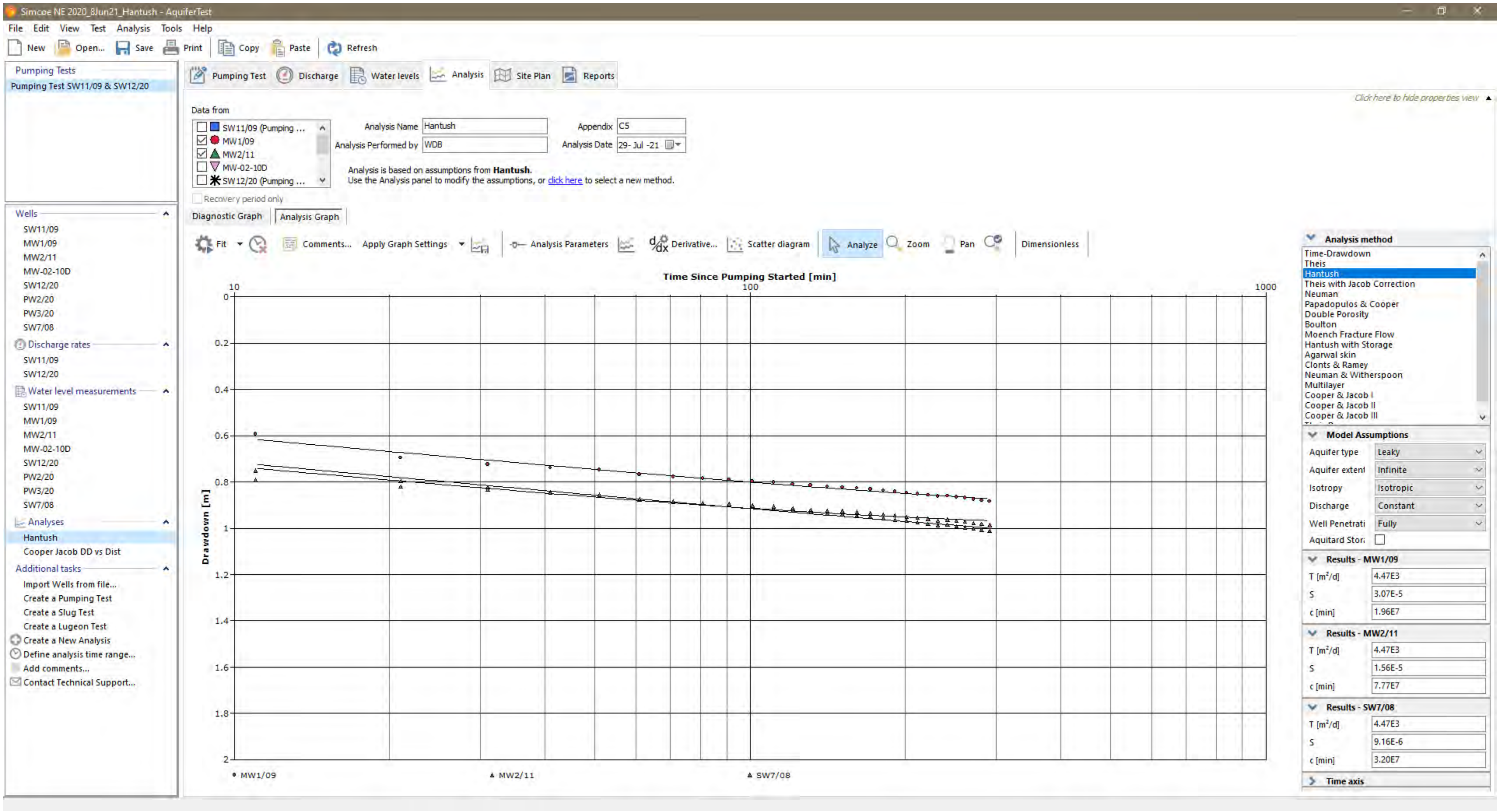
Results - MW1/09

T [m²/d]	4.47E3
S	1.13E-7
P	9.80E5
c [min]	1.67E10

Results - SW7/08

T [m²/d]	4.10E3
S	1.00E-7
P	9.94E5
c [min]	9.49E9

2020 Pumping Test on SW11/09 and SW12/20



Data from

☐ SW11/09 (Pumping ...
☑ MW1/09
☑ MW2/11
☐ MW-02-10D
☐ SW12/20 (Pumping ...

☐ Recovery period only

Analysis Name: Hantush
Analysis Performed by: WDB
Appendix: C5
Analysis Date: 29- Jul -21

Analysis is based on assumptions from **Hantush**.
Use the Analysis panel to modify the assumptions, or click here to select a new method.

Aquifer type: Leaky
Aquifer extent: Infinite
Isotropy: Isotropic
Discharge: Constant
Well Penetrati: Fully
Aquitard Stor: ☐

Results - MW1/09

T [m²/d]	4.47E3
S	3.07E-5
c [min]	1.96E7

Results - MW2/11

T [m²/d]	4.47E3
S	1.56E-5
c [min]	7.77E7

Results - SW7/08

T [m²/d]	4.47E3
S	9.16E-6
c [min]	3.20E7

Appendix D

Well Survey Form
and Public Notifications

Community of Simcoe Additional Water Supply
Municipal Class Environmental Assessment

Notice of Municipal Test Well Construction, Testing and Monitoring – Issued August 7, 2019

Previous Testing Results

In 2012 a testing and monitoring program was performed on an existing municipal test well, as part of a Municipal Class Environmental Assessment for a Community of Simcoe Additional Water Supply Source. The testing and monitoring were conducted to determine the effects of pumping the well on local private water wells, ponds, nearby Davis Creek and adjacent wetlands. The results confirmed water supplies from local private water wells were unaffected. Davis Creek flows and wetland water levels were also unaffected by the pumping test. These results were presented in a report, which has been reviewed by technical staff of Provincial Ministries and the Long Point Region Conservation Authority. From the comments and recommendations received, a work plan was developed to continue with the project to assess the sustainable capacity of the groundwater supply source for existing water supply wells and potential additional municipal wells.

Municipal Test Well Construction

The next step in this project will begin with the construction of a second municipal test well. Drilling operations are planned to begin during the week of August 19, 2019. The site of the planned second well and the existing municipal test well are located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted on the map on the other side of this page). Well drilling and construction will be completed in several stages. Following construction, the municipal test well will undergo short-duration periods of pumping over several working days. This procedure is referred to as well development. Once it is determined that the well is properly developed, it will be ready for a longer-term continuous pumping test of both wells.

Well Testing and Monitoring Program

Prior to longer-term testing of the municipal test wells, a monitoring program will be initiated. It is expected this program will include frequent measuring and recording of water levels in selected local operating private water wells, multiple local monitoring wells, the two test wells, irrigation ponds, Davis Creek, and wetlands. Water level monitoring will begin several days before pumping begins, and will continue during the pumping period, and for several days after the end of pumping. A pumping period of seven days is currently planned to occur this Fall. As with previous testing, a notice will be issued in advance to provide the expected start date and contact information should local well owners experience problems with their water supply during the test.

Water Well Survey

Enclosed with this notice is a Water Well Survey form. We kindly request that you complete this survey to the best of your knowledge and return it in the included stamped envelope to Norfolk County before September 6, 2019. Our Consultant will review the completed surveys and contact respondents that have indicated their well and/or pond is available for monitoring. We appreciate your cooperation and assistance with this program.

Public Involvement

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. Representatives from Norfolk County and the Project Consultant Team will be present at the PIC. A notice of the date and location of the PIC will be issued in advance (expected to be early 2020). If you have any questions or would like more information, please contact one of the following team members:

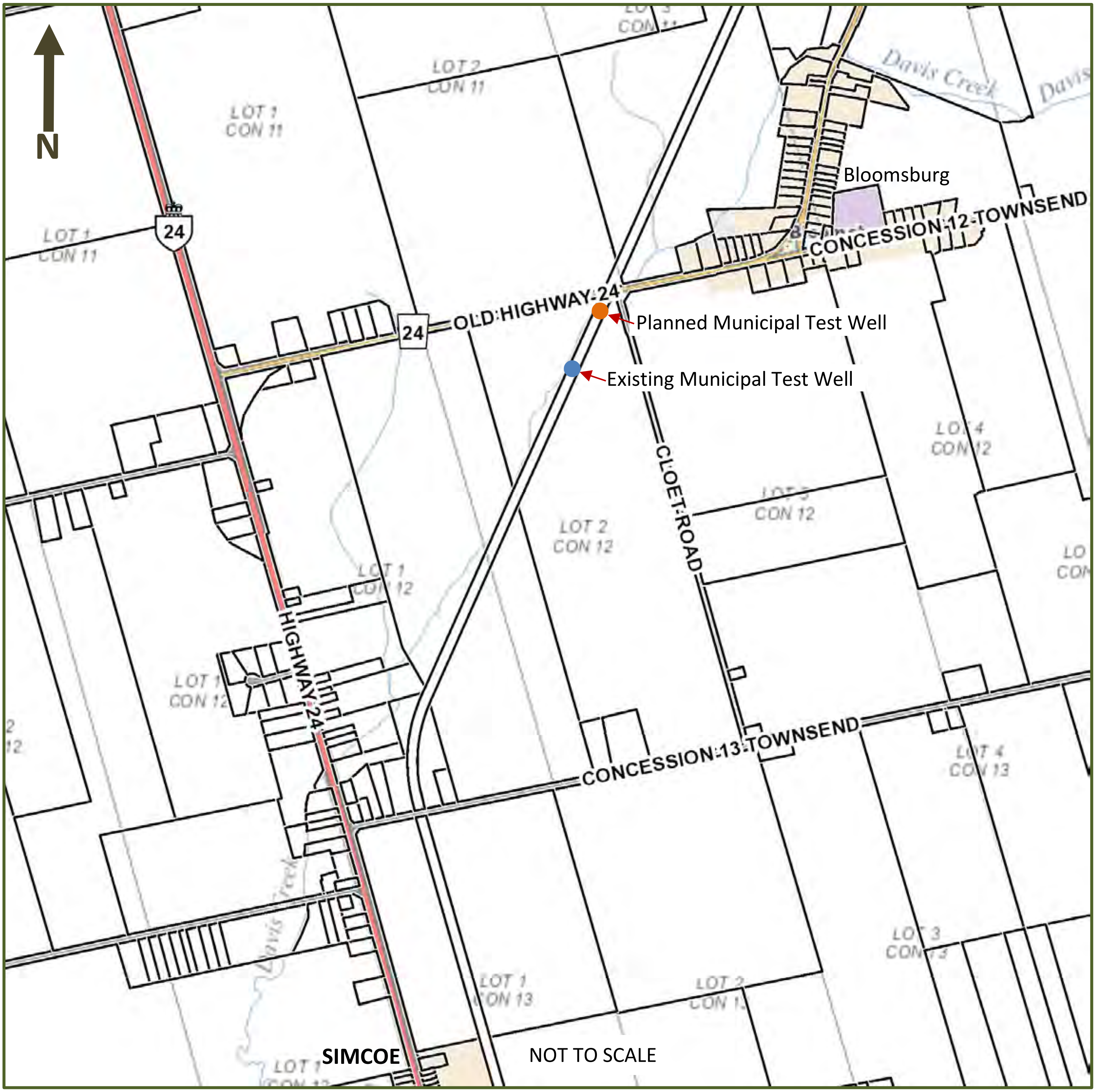
Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Scott Zerbes, C.Tech., Project Manager
Public Works, Corporation of Norfolk County
183 Main Street of Delhi, Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1614
Email: Scott.Zerbes@norfolkcounty.ca

Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

Site Map

Municipal Test Well Construction



August 7, 2019

Community of Simcoe Additional Water Supply Environmental Assessment
Water Well Survey

Please complete the following survey and return to us in the stamped envelope provided by September 6, 2019. This information will be retained by Norfolk County and their Consultant for the purposes of selecting suitable wells and ponds for measuring water levels and collecting water samples during the upcoming well testing and monitoring program.

Property Owner / Resident

Name: ____
Address: ____
Address: ____________________________________ Telephone: (____)____________________

Existing Well(s)

Number of well(s) on property: _______ Number of well(s) currently being used: ________
Well Construction Details: (check and complete as appropriate)
Well 1: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

Well 2: Drilled___ Bored___ Dug___ Sandpoint___ Unknown___
Well Depth: ____ feet Well Diameter: ____ inches
Year well constructed:_______ Name of Water Well Contractor:__________________________
Type of pump: Submersible___ Jet___ Age of pump:____ years
Is the top of the well easily accessible for measuring water levels? _____

If you have more than two water wells on your property, please provide additional information on other side of this page.

Current Uses of Existing Well(s) (check as many as applicable)
Household use____ Lawn and/or garden____ Watering of livestock and/or poultry____
Crop irrigation____ Commercial____ Fire protection____

Do you have an active Permit to Take Water for any of these uses? _____
If you have a Permit, for which use? ______________________________
Maximum permitted taking per day: ______________________________

Have you experienced any shortage of water supply from your well(s)? ____ If so, when? __________
Have you experienced any problems with the quality of water from your well(s)? ______
If so, when? ________________________________

When was the last time you sent a sample of the well water for bacteriological and/or chemical analysis?
____

Continued on other side

Permission to Access Well(s) for Monitoring Purposes

Would you be willing to provide access to your well(s) for the purpose of measuring water levels in the well before, during, and after the planned pumping of the Norfolk County test wells?_____________

If selected, would you be willing to provide access to your well(s) for the purpose of collecting water samples for submission to a private laboratory for general chemical analysis?___________________

Please note the laboratory results would be provided to you upon receipt.

Other Water Sources and Features

Please check any water sources and features that occur on your property (check as many as applicable)

Pond____ Creek____ Wetland____

Do you have an active Permit to Take Water for any of these sources? _____

If you have a Permit, for which use? ________________________________

Maximum permitted taking per day: ________________________________

Would you be willing to provide access to your other water source or feature for the purpose of measuring water levels before, during, and after the planned pumping of the Norfolk County test wells?_______

Contacting You

If you are willing to provide access for monitoring, please indicate the preferred time and/or day of week and a telephone number for a member of the Consultant Team to contact you:

____

____

Thank you for your assistance and cooperation.

Community of Simcoe Additional Water Supply Municipal Class Environmental Assessment

Notice of Well Testing and Monitoring

Issued: 9 October 2020

Previous Testing Results

As indicated in our previous notice to you, in 2012 a testing and monitoring program was performed on an existing municipal test well, as part of a Municipal Class Environmental Assessment for a Community of Simcoe Additional Water Supply Source. The testing and monitoring were conducted to determine the effects of pumping the well on local private water wells, ponds, nearby Davis Creek and adjacent wetlands. The results confirmed water supplies from local private water wells were unaffected. Davis Creek flows and wetland water levels were also unaffected by the pumping test. These results were presented in a report, which was reviewed by technical staff of Provincial Ministries and the Long Point Region Conservation Authority. From the comments and recommendations received, a work plan was developed to continue with the project to assess the sustainable capacity of the groundwater supply source for existing water supply wells and potential additional municipal wells.

Municipal Test Well Construction

The next step in this project was the construction of a second municipal test well. Drilling operations began in August 2019 at a site located along the Waterford Heritage Trail, east of Highway 24, between Old Highway 24 and Concession Road 13, Townsend (noted on the map on the other side of this page). After unforeseen delays this past year, well drilling and construction was completed during the spring and summer of 2020. Following construction, the municipal test well required short-duration periods of pumping over several working days. This procedure is referred to as well development. Once it was determined the well was properly developed, our project team began preparations for a longer-term continuous pumping test of both wells.

Well Testing and Monitoring Program

Prior to the longer-term testing of the municipal test wells, a monitoring program was established and initiated. This program includes frequent measuring and recording of water levels in selected local operating private water wells, multiple local monitoring wells, the two test wells, irrigation ponds, Davis Creek, and wetlands. The water level monitoring began recently, before pumping begins, and will continue during the pumping period, and for several days after the end of pumping.

The purpose of this notice is to advise you the pre-test monitoring recently started, and that pumping will begin during the week of 19 October 2020. Test pumping is planned to continue for a duration of seven days.

During the pumping period if you experience problems with your water supply, please contact Scott Zerbes at Norfolk County during the hours of 8:30 am to 4:30 pm (telephone: 519-582-2100 extension 1614), or Bill Banks at Banks Groundwater Engineering at any time (telephone: 1-519-829-4808). We appreciate your cooperation and assistance with this program.

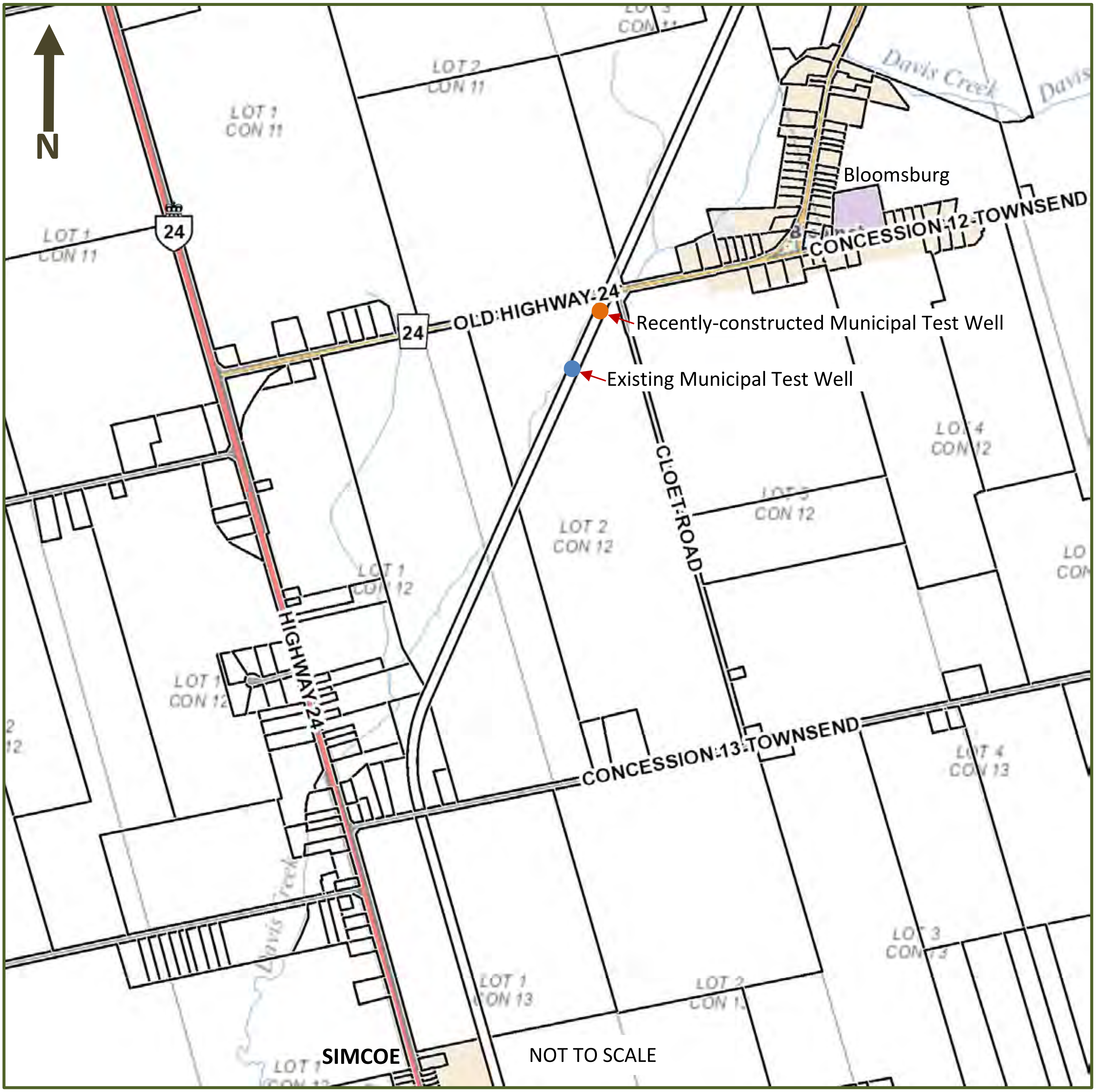
Public Involvement

Public involvement is an important part of the Municipal Class EA process. Residents and community organizations are encouraged to participate. A third Public Information Centre (PIC) will be held to present the results of the testing and monitoring program. The PIC will include a presentation, followed by a question and answer period. The timing of the PIC will be confirmed at a later date. If you have any questions or would like more information, please contact one of the following team members:

Bill Banks, P.Eng., Project Manager
Banks Groundwater Engineering Limited
940 Watson Road South, RR1 Puslinch, ON N0B 2J0
Tel: 519-829-4808
Email: Bill.Banks@banksgroundwater.ca

Scott Zerbes, C.Tech., Project Manager
Public Works, Corporation of Norfolk County
183 Main Street of Delhi, Delhi, ON N4B 2M3
Tel: 519-582-2100 ext. 1614
Email: Scott.Zerbes@norfolkcounty.ca

Site Map
Municipal Test Well Construction



Appendix E

Well Records and Monitoring Well Logs

Test Production Well Records and Schematics
SW12/20 and SW11/09

Banks Groundwater Engineering Limited

Ontario Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. (Place Sticker and/or Print Below)
A273182

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 2

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	Norfolk County		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
185 Robinson Street suite 200	Simcoe	ON	N3Y5L6	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Old Hwy 24 & Cloet Rd	Norfolk		

County/District/Municipality	City/Town/Village	Province	Postal Code
Norfolk Cty	Simcoe	**Ontario**	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556627	4748138		

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 (ft) From	Depth (ft) To
yellow/brown	silt, fine sand	Minor gravel	loose to medium	0	5
grey/brown	silt, minor sand	Minor, occasional clay	dense, saturated	5	22.5
brown	stones	medium to coarse sand	round-oval, flat-angular	22.5	42.5
Blue/grey	clay layer	some stones	medium dense	425	45
brown/black	stones	Med to coarse sand	saturated gravel	45	50
grey/black	sand	Med - coarse	gravel & stones, fewer	50	75
grey/black	sand	Med - coarse	more stones	75	80
brown/grey	sand	fine-med-coarse	some silt, gravel, stone	80	90
grey	clay	minor silt		90	93

Annular Space

Depth Set at (ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (ft³)
0	46	Cement Grout	54.8
46	50	Bentonite chips	9.52
50	80	gravel pack	35.73
80	93	Bentonite seal	15.48

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 (ft) 50

Pumping rate (GPM) 400

Duration of pumping 175 hrs + min

Final water level end of pumping (ft) 31

If flowing give rate (l/min/GPM)

Recommended pump depth (ft) 50

Recommended pump rate (l/min/GPM)

Well production (GPM) 400

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m)	Recovery Time (min)	Recovery Water Level (m)
Static Level	2.95		2.95
1	7.01	1	4.57
2	6.34	2	4.49
3	8.14	3	4.44
4	7.81	4	4.42
5	8.33	5	4.39
10	8.33	10	4.34
15	8.33	15	4.31
20	8.33	20	4.29
25	8.34	25	4.28
30	8.34	30	4.27
40	8.37	40	4.26
50	8.39	50	4.24
60	8.42	60	4.23

Method of Construction

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

Well Use

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

Construction Record - Casing

Inside Diameter (in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (in)	Depth (ft) From	To
12	steel	.250	+3.3	42
12	S.S 304	.250	42	50
12	Stainless (Sump)	.250	80	93

Construction Record - Screen

Outside Diameter (in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (ft) From	To
12	stainless	variable	50	80

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

Map of Well Location

Please provide a map below following instructions on the back.

See attached map

Water Details

Water found at Depth 9.7 (ft) ☐ Gas | Kind of Water: ☑ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (ft) From	To	Diameter (in)
0	93	18

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Aardvark Drilling Inc	7675

Business Address (Street Number/Name)	Municipality
25 Lewis Rd, Unit C	Guelph

Province	Postal Code	Business E-mail Address
ON	N1H1E9	info@aardvarkdrillinginc.com

Bus.Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5198269340	Richards, Adrian

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2554		20201029

Comments:

Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered Y Y Y Y M M D D

Date Work Completed 20201029

Ministry Use Only
Audit No. Z341404
Received

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37R-7922
33607062302
33607017059
OLD HIGHWAY 24
24
37R-4149
30.37 m
Total: 30.37 m
33607035000
33607035700
33607032000
33607019000
CLOET ROAD
1: 750
0.0
0
0.02
0.0 Kilometers

- A273182

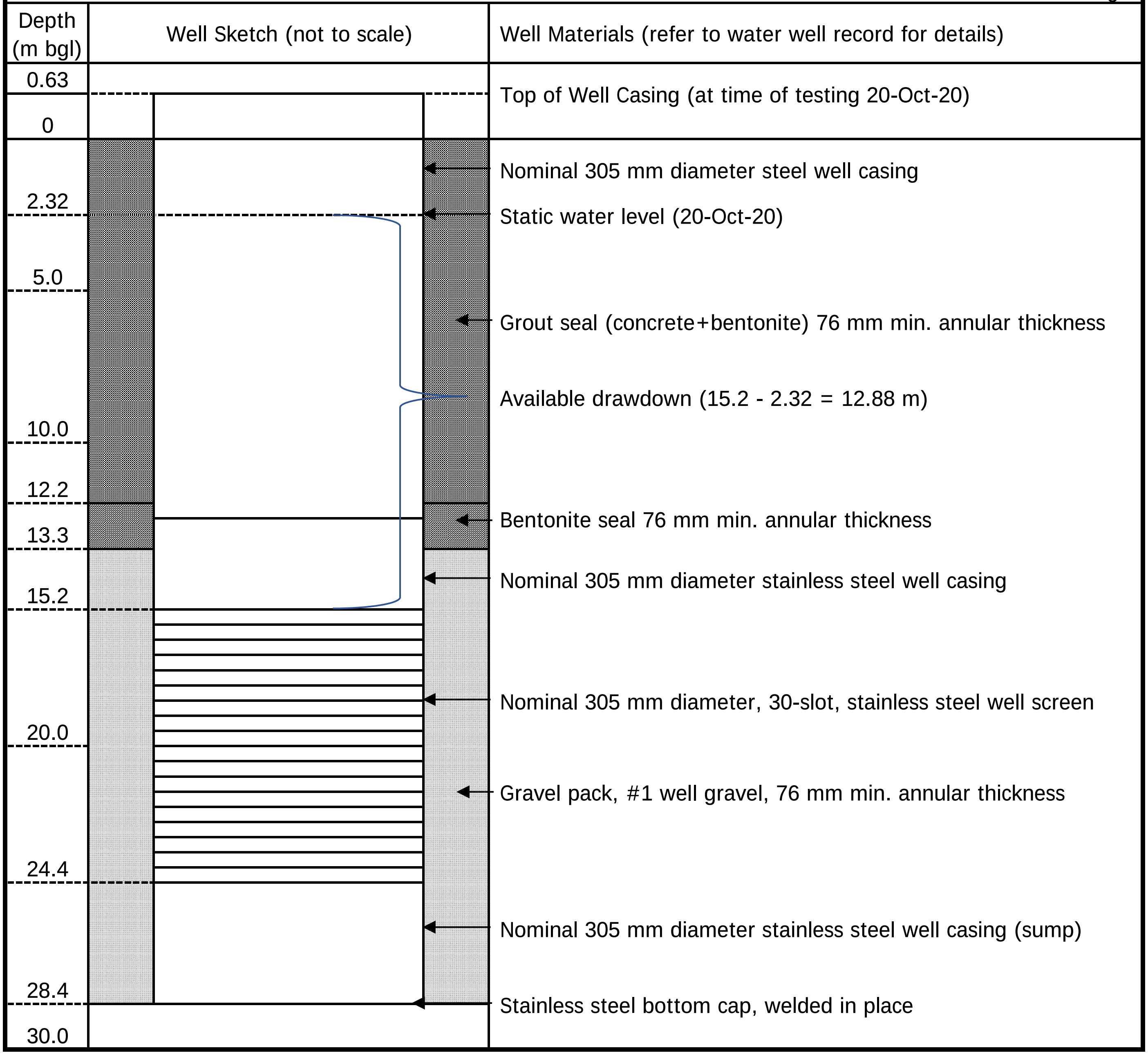
2/2

Well Construction Sketch

Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748138 Easting: 556627 (+/- 5m)

Project Well Number: **SW12/20**
Date Completed: 07-Jul-20
Drilling Method: Dual Rotary
Contractor: Aardvark Drilling



Ontario Ministry of the Environment

Measurements recorded in: ☒ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
A051656

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 2

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
Norfolk County			

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
183 West Main ST. Delhi	Haldimand-Nor.	ON		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	town of simcoe	2	12

County/District/Municipality	City/Town/Village	Province	Postal Code
Haldimand-Norfolk	nanticoke	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556500	4747861		

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
Brown	Top soil	gravel		0	1.82
Brown	clay	sand, silt		1.82	9.14
Brown	sand		fine	9.14	17.06
Brown	gravel	sand	course	17.06	18.74
Grey	clay			18.74	19.20

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	14.6	BEntonite Pellets	0.65

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): 15,4

Pumping rate (l/min / GPM): 2045,74

Duration of pumping: 72 hrs + 0 min

Final water level end of pumping (m/ft): 6,94

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

Recommended pump depth (m/ft): 15,4

Recommended pump rate (l/min / GPM): 2045.74

Well production (l/min / GPM): uk

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	2.17		2
1	6.17	1	2.76
2	6.33	2	2.71
3	6.44	3	2.67
4	6.45	4	2.67
5	6.48	5	2.68
10	6.50	10	2.66
15	6.50	15	2.65
20	6.51	20	2.63
25	6.52	25	2.62
30	6.53	30	2.61
40	6.56	40	2.60
50	6.57	50	2.60
60	6.57	60	2.60

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ 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
~~8xxx2~~	~~Sxxxx~~	~~0x6xx~~		
20.32	Steel	0.477	+.46	15.5

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
21.90	Steel		15.5	18.59

see attached for slot sizes

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

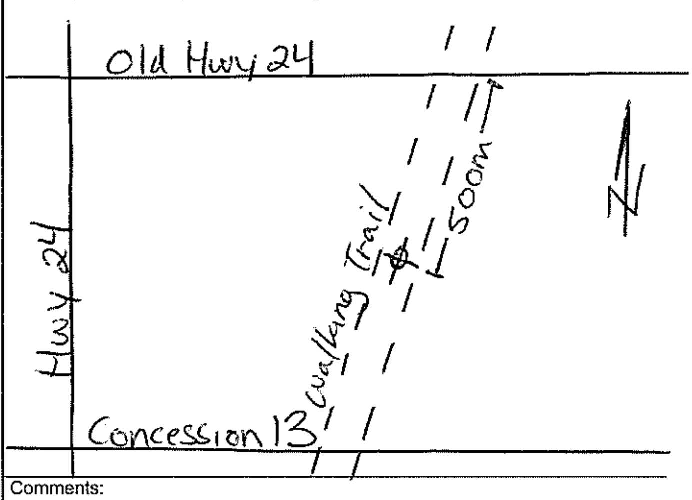
Water found at Depth 13.7 (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	18.59	31.75
18.59	19.20	15.24

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
SW-11 Simcoe

Well Contractor and Well Technician Information

Business Name of Well Contractor: Gerrits Drilling & Engineering Ltd.
Well Contractor's Licence No.: 3406

Business Address (Street Number/Name):
215154 10th Line, R.R. #1
Grand Valley, Ontario L0N 1G0

Municipality:

Province:
Postal Code:
Business E-mail Address:

Bus.Telephone No. *(inc. area code)*:
Name of Well Technician (Last Name, First Name): Gerrits Steve

Well Technician's Licence No.: 2964
Signature of Technician and/or Contractor:
Date Submitted: 2009 05 27

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered: 2009 05 27

Date Work Completed: 2009 05 16

Ministry Use Only
Audit No. Z 93660
MAR 04 2010
Received

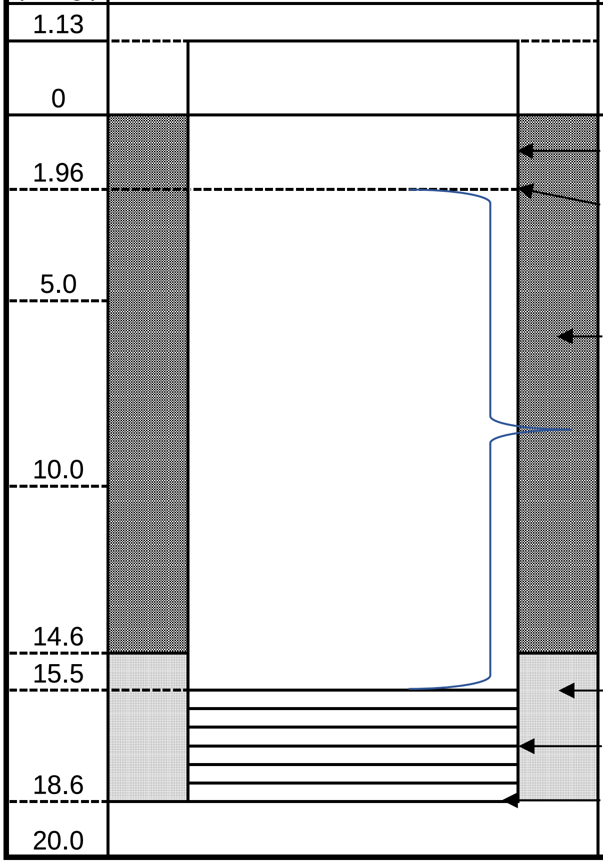
Well Construction Sketch

Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Rial Trail S. of Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4747861 Easting: 556500 (+/- 5m)

Project Well Number:	**SW11/09**
Date Completed:	16-May-09
Drilling Method:	Dual Rotary
Contractor:	Gerrits Drilling

Depth (m bgl) | Well Sketch (not to scale) | Well Materials (refer to water well record for details)



Top of Well Casing (at time of testing 20-Oct-20)

Nominal 203 mm diameter steel well casing

Static water level (20-Oct-20)

Grout seal (bentonite) 57 mm min. annular thickness

Available drawdown (15.5 - 1.96 = 13.54 m)

Gravel pack, 57 mm min. annular thickness

Nominal 203 mm diam., variable-slot, stainless steel well screen

Stainless steel bottom cap, welded in place

Previous Test Well Records
SW1/08, SW7/08, SW9/08, and SW10/09

Ontario Ministry of the Environment

Measurements recorded in: ☒ Metric ☐ Imperial

SW1

Well T int Below)
A 051736
A051736

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name / Last Name / Organization: The Corporation of Norfolk County
E-mail Address:
☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 183 Main Street
Municipality: Delhi
Province: ON
Postal Code:
Telephone No. *(inc. area code)*:

Well Location

Address of Well Location (Street Number/Name):
Township: Townsend
Lot: 1
Concession: 12
County/District/Municipality:
City/Town/Village:
Province: **Ontario**
Postal Code:
UTM Coordinates NAD 83 | Zone 17 | Easting 555597 | Northing 4747873
Municipal Plan and Sublot Number:
Other:

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	To
Black	Loam			0	0.91
Brown/Grey	Sand/Clay	Silt		0.91	15.54
Grey	Sand/Gravel		Medium to Coarse	15.54	17.37
Grey	Clay			17.37	28.65
Grey	Sand	Silt	Fine	28.65	33.99
Grey	Clay		Soft	33.99	37.64
	Gravel		Coarse	37.64	41.15
	Rock			41.15	41.45

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	6.4	Bentonite Slurry	0.21

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): 38.73
Pumping rate (l/min / GPM): 318.2
Duration of pumping: 8 hrs + 0 min
Final water level end of pumping (m/ft): 14.83
If flowing give rate (l/min / GPM):
Recommended pump depth (m/ft): unknown
Recommended pump rate (l/min / GPM): unknown
Well production (l/min / GPM): unknown
Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	4.27		
1	5.91	1	13.38
2	6.35	2	12.86
3	6.61	3	12.58
4	6.79	4	12.34
5	6.99	5	12.16
10	7.27	10	11.52
15	7.50	15	11.10
20	7.91	20	
25	8.20	25	
30	8.31	30	
40	8.68	40	
50	8.94	50	
60	9.21	60	

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ 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	To
15.24	Steel	0.477	+0.41	38.56

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

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
14.6	Steel	50	38.73	41.15

Map of Well Location

Please provide a map below following instructions on the back.

See Attached

Water Details

Water found at Depth 17.22 (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
Water found at Depth 28.65 (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
Water found at Depth 34.62 (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	6.4	25.4
6.4	41.45	15.71

Well Contractor and Well Technician Information

Business Name of Well Contractor:
Gerrits Drilling & Engineering Ltd.
215154 10th Line, R.R. #1
Grand Valley, Ontario L0N 1G0
Well Contractor's Licence No.: 3406
Business Address (Street Number/Name):
Municipality:
Province:
Postal Code:
Business E-mail Address:
Bus.Telephone No. *(inc. area code)*:
Name of Well Technician (Last Name, First Name): Theo Gerrits
Well Technician's Licence No.: 0080
Signature of Technician and/or Contractor:
Date Submitted: 20090206

Comments:

Well owner's information package delivered ☒ Yes ☐ No
Date Package Delivered: 20090206
Date Work Completed: 20090206

Ministry Use Only
Audit No. Z100535
MAR 04 2010
Received

Ontario Ministry of the Environment

SW7

Well Tag No. nd/or Print Below)
A 051715
A051715

Well Record

Regulation 903 Ontario Water Resources Act

Page ______ of ______

Measurements recorded in: ☒ Metric ☐ Imperial

Well Owner's Information

First Name: The Corporation	Last Name / Organization: of Norfolk County	E-mail Address:	☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 183 Main Street	Municipality: Delhi	Province: ON	Postal Code: N4B2M3
Telephone No. *(inc. area code)*:			

Well Location

Address of Well Location (Street Number/Name):	Township: Townsend	Lot: 3	Concession: 12
County/District/Municipality: Norfolk	City/Town/Village:	Province: **Ontario**	Postal Code:
UTM Coordinates: NAD 83, Zone 17, Easting 556501, Northing 4747864	Municipal Plan and Sublot Number:	Other:	

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	To
Brown	Sand			0	2.44
Grey	Clay			2.44	4.57
	Gravel		Coarse	4.57	10.21
	Sand	Gravel	Coarse	10.21	19.20
Grey	Clay		Soft	19.20	20.70
Grey	Clay	Silt	Soft	20.70	25.30
	Silt	Clay		25.50	30.78
Grey	Clay	Gravel Trace		30.78	33.53
	Limestone			33.53	33.99

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	6.4	Bentonite slurry	0.21

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ 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	To
15.24	Steel	0.477	+0.40	15.39

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* ______

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
14.6	Steel	See attached	15.54	18.97

Water Details

Water found at Depth 7.62 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______
Water found at Depth 16.76 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______
Water found at Depth ______ *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ______

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	6.4	25.4
6.4	33.99	15.71

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)*: 15.54

Pumping rate *(l/min / GPM)*: 368.2

Duration of pumping: 8 hrs + 6 min

Final water level end of pumping *(m/ft)*: 3.83

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

Recommended pump depth *(m/ft)*: 15.54

Recommended pump rate *(l/min / GPM)*: unknown

Well production *(l/min / GPM)*: unknown

Disinfected? ☒ Yes ☐ No

Draw Down Time *(min)*	Draw Down Water Level *(m/ft)*	Recovery Time *(min)*	Recovery Water Level *(m/ft)*
Static Level	2.87		
1	3.75	1	2.94
2	3.76	2	2.93
3	3.76	3	2.92
4	3.77	4	2.92
5	3.75	5	2.92
10	3.61	10	2.92
15	3.62	15	2.91
20	3.61	20	
25	3.62	25	
30	3.62	30	
40	3.62	40	
50	3.62	50	
60	3.62	60	

Map of Well Location

Please provide a map below following instructions on the back.

See Attached

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Gerrits Drilling & Engineering Ltd.**

Well Contractor's Licence No.: 5406

Business Address (Street Number/Name): 215154 10th Line, R.R. #1 Grand Valley, Ontario L0N 1G0

Municipality:

Province:

Postal Code:

Business E-mail Address:

Bus.Telephone No. *(inc. area code)*:

Name of Well Technician (Last Name, First Name): Theo Gerrits

Well Technician's Licence No.: 0080

Signature of Technician and/or Contractor: Ge Dr & Eng Ltd

Date Submitted: 20090206

Comments:

Well owner's information package delivered: ☒ Yes ☐ No

Date Package Delivered: 20094206

Date Work Completed: 20090206

Ministry Use Only

Audit No. Z 100537

MAR 04 2010
Received

Ontario Ministry of the Environment

SW9

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☑ Metric ☐ Imperial

Well (... Print Below) A 051662
A051662

Page ______ of ______

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
The Corporation	of Norfolk County		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
183 Main Street	Delhi	ON	N4B2M3	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	Townsend	2	12

County/District/Municipality	City/Town/Village	Province	Postal Code
Norfolk		**Ontario**	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556107	4746981		

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
Black	Loam			0	0,30
Red/Brown	Sandy Clay			0.30	2,44
	Gravel	Sand	Coarse	2.44	8,38
	Sand	Gravel	Medium	8.38	11.58
	Gravel	Sand		11,58	13.11
Grey	Clay			13,11	34.75
	Bedrock			34.75	35.05

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	6.4	Bentonite Slurry	0.21

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)* 9.44

Pumping rate *(l/min / GPM)* 318

Duration of pumping 8 hrs + 0 min

Final water level end of pumping *(m/ft)* 5.77

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

Recommended pump depth *(m/ft)* 9.44

Recommended pump rate *(l/min / GPM)* unknown

Well production *(l/min / GPM)* unknown

Disinfected? ☑ Yes ☐ No

Draw Down Time *(min)*	Draw Down Water Level *(m/ft)*	Recovery Time *(min)*	Recovery Water Level *(m/ft)*
Static Level	4.72		
1	5.63	1	4.84
2	5.66	2	4.82
3	5.68	3	4.82
4	5.69	4	4.82
5	5.69	5	4.82
10	5.69	10	4.82
15	5.70	15	4.81
20	5.70	20	
25	5.70	25	
30	5.70	30	
40	5.68	40	
50	5.68	50	
60	5.69	60	

Method of Construction

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

Well Use

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

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
15.24	Steel	0.477	+0.41	8.99

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	Depth *(m/ft)* To
14.6	Steel	see attached	9.44	12.80

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 11.6 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify ______
Water found at Depth ______ *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify ______
Water found at Depth ______ *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify ______

Hole Diameter

Depth *(m/ft)* From	Depth *(m/ft)* To	Diameter *(cm/in)*
0	6.4	25.4
6.4	35.05	15.71

Map of Well Location

Please provide a map below following instructions on the back.

See Attached

Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Gerrits Drilling & Engineering Ltd.**

Well Contractor's Licence No. 3406

Business Address (Street Number/Name):
215154 10th Line, R.R. #1
Grand Valley, Ontario L0N 1G0

Municipality:

Province: | Postal Code: | Business E-mail Address:

Bus.Telephone No. *(inc. area code)*:

Name of Well Technician (Last Name, First Name): Theo Gerrits

Well Technician's Licence No. 0080

Signature of Technician and/or Contractor: Drill & Eng Ltd

Date Submitted 20090206

Well owner's information package delivered ☑ Yes ☐ No

Date Package Delivered 20090206

Date Work Completed 20090206

Ministry Use Only

Audit No. Z100538

Received ... 04 2010

Ontario Ministry of the Environment

Measurements recorded in: ☒ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
A051655

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	
Norfolk County			☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
183 Main St. Delhi		ON		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	town of simcoe	~~xxx~~ 1	13

County/District/Municipality	City/Town/Village	Province	Postal Code
NOrfolk	city oif nanticoke	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556112	4746855		

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
Brown	Sand	Gravel	Course, dry	0	9.14
Brown	Sand ~~Gxx~~	Gravel	Course, water bearing	9.14	11.88
Grey	clay			11.88	12.80

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	7.62	Bentonite Pellets	0.26

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)*: 9,14

Pumping rate *(l/min / GPM)*: 1591,13

Duration of pumping: 72 hrs + 0 min

Final water level end of pumping *(m/ft)*: 8.32

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

Recommended pump depth *(m/ft)*: 9.14

Recommended pump rate *(l/min / GPM)*: 1591.13

Well production *(l/min / GPM)*: uk

Disinfected? ☒ Yes ☐ No

Draw Down Time *(min)*	Draw Down Water Level *(m/ft)*	Recovery Time *(min)*	Recovery Water Level *(m/ft)*
Static Level	4.44		
1		1	5.77
2	6.39	2	5.75
3	6.40	3	5.75
4	6.40	4	5.74
5	6.41	5	5,72
10	6.43	10	5,70
15	6.44	15	5.68
20	6.47	20	5,66
25	6.48	25	5.64
30	6.49	30	5,63
40	6.51	40	5.58
50	6.53	50	5.57
60	6.54	60	5.55

Method of Construction

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

Well Use

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

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
20.32	Steel	0.477	+.5	9.14

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

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
21.90	Steel	80	9.14	11.88

Water Details

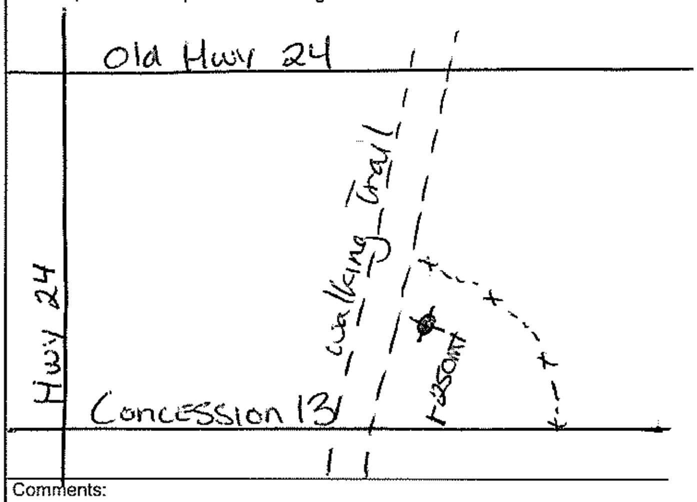
Water found at Depth 9.14 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	12.8	31.75

Map of Well Location

Please provide a map below following instructions on the back.



Comments: SW-10 Simcoe

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Gerrits Drilling & Engineering Ltd.**
Well Contractor's Licence No.: 3406
Business Address (Street Number/Name): **215154 10th Line, R.R. #1**
Grand Valley, Ontario L0N 1G0
Municipality:
Province:
Postal Code:
Business E-mail Address:
Bus.Telephone No. *(inc. area code)*:
Name of Well Technician (Last Name, First Name): Gerrits Steve
Well Technician's Licence No.: 2964
Signature of Technician and/or Contractor:
Date Submitted: 2009 05 27

Well owner's information package delivered: ☒ Yes ☐ No
Date Package Delivered: 20090527
Date Work Completed: 2009 05 21

Ministry Use Only
Audit No. Z 93663
MAR 04 2010
Received

Monitoring Well Records and Logs
MW1/09, MW2/11, MW3/12, MW4/12, MW5/12, LP-MW-02-10S/I/D, and LP-MW-15-10S/I/D

Banks Groundwater Engineering Limited

Ontario Ministry of the Environment

Measurements recorded in: ☒ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*

A051654

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 21

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
Norfolk County			

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
183 Main St. Delhi		ON		

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
	Town of Simcoe	2	12

County/District/Municipality	City/Town/Village	Province	Postal Code
Norfolk	Nanticoke	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556502	4747861		

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	To
Brown	Top soil	gravel		0	1.82
Grey	Clay	Sand		1.82	9.14
Brown	Sand		Fine	9,14	16.76

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	6.13	Bentonite Pellets	0.36

Method of Construction

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

Well Use

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

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
15.24	Steel	0.477	+.60	14.7

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
7.62	Steel	8	14.7	15.84

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)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Water found at Depth 14.3 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify*

Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	6.13	31.12
6.13	16.76	15.5

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)*

Pumping rate *(l/min / GPM)*

Duration of pumping ____ hrs + ____ min

Final water level end of pumping *(m/ft)*

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

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

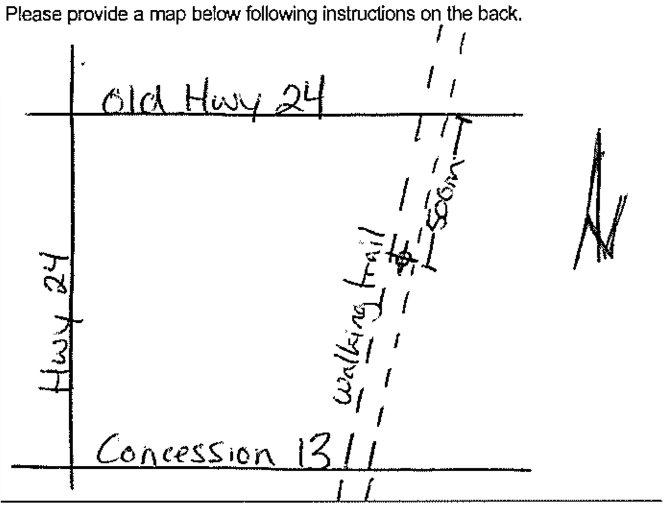
Well production *(l/min / GPM)*

Disinfected? ☒ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

SW-11 offset monitor

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Gerrits Drilling & Engineering Ltd.	3406

Business Address (Street Number/Name)	Municipality
215154 10th Line, R.R. #1 **Grand Valley, Ontario L0N 1G0**	

Province	Postal Code	Business E-mail Address

Bus.Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
	Gerrits Steve

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2964		2009 05 27

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2009 05 25	2009 05 25

Ministry Use Only

Audit No. Z 93661

Received MAR 04 2010

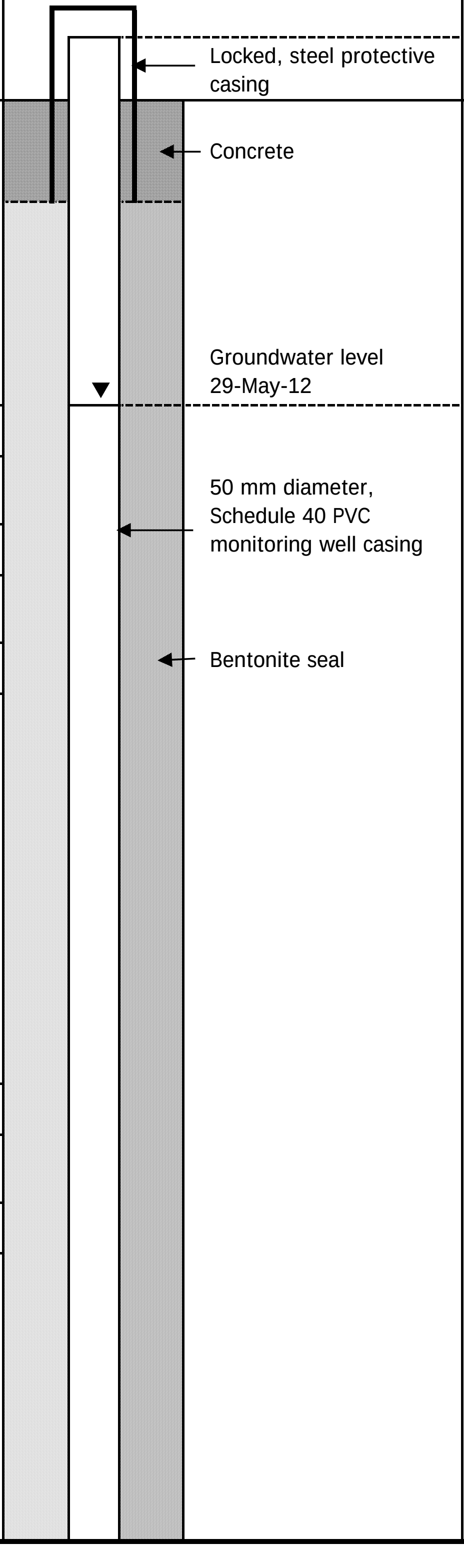
Borehole and Monitor Installation Log

Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748130 Easting: 556622 (+/- 5m)

Date Completed: 30-Jun-11
Drilling Method: PQ Coring
Oversight By: WDB

Monitor Number: MW2/11

Depth (m bgl)	Stratigraphic Description	Sampling		Monitor Installation Details	Elevation (m amsl)
0		Number	Type		
	Topsoil				
1					
	Silty fine sand, light brown, moist				
2		1	GS		
	Silty fine sand, light brown, moist	2	CS		
3	Silt with fine sand, light brown, moist				
	Clay, grey, moist	3	CS		
	Stones with darker brown silt, saturated				
4	Sandy silt, darker brown, saturated				
5	Silt with occasional thin clay layers, grey, saturated				
6		4	CS		
		5	CS		
7	Stones, small to medium, with medium to coarse sand, saturated				
8					

Borehole and Monitor Installation Log

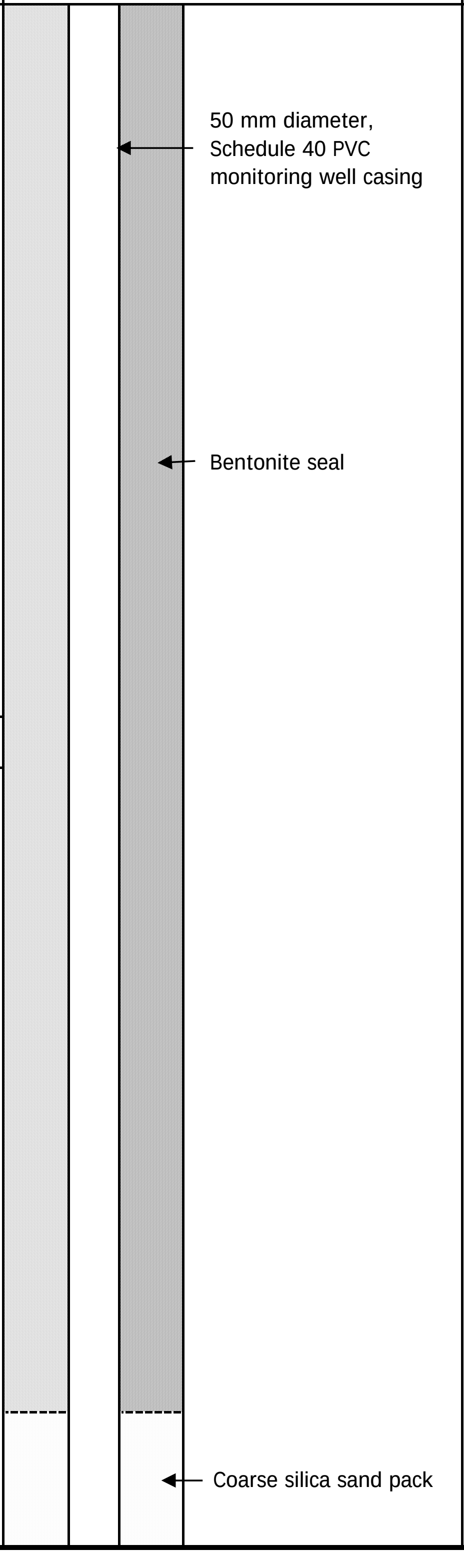
Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748130 Easting: 556622 (+/- 5m)

Date Completed: 30-Jun-11
Drilling Method: PQ Coring
Oversight By: WDB

Monitor Number: MW2/11

Depth (m bgl)	Stratigraphic Description	Sampling		Monitor Installation Details	Elevation (m amsl)
9					
10	Stones, small to medium, with medium to coarse sand, saturated				
11					
12					
13	Sand, medium to coarse, grey to black, with stones, saturated	6	CS		
14					
15	Sand, medium to coarse, grey to black, saturated				
16					
17	Sand, coarse, grey to black, with stones, saturated				



Borehole and Monitor Installation Log

Banks Groundwater Engineering Limited

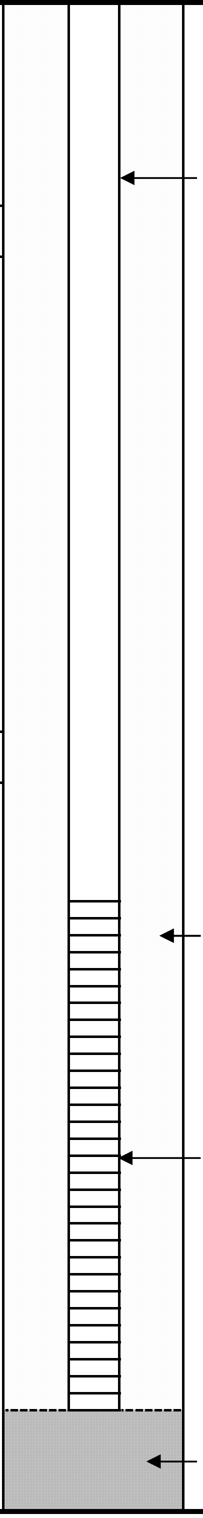
Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748130 Easting: 556622 (+/- 5m)

Date Completed: 30-Jun-11
Drilling Method: PQ Coring
Oversight By: WDB

Monitor Number: MW2/11

Depth (m bgl)	Stratigraphic Description	Sampling		Elevation (m amsl)
18				
		7	CS	
19				
20				
21				
22	Sand, fine to coarse, grey to black, with some silt and stones, saturated	8	CS	
23				
24				
25				
26				

Monitor Installation Details



50 mm diameter, Schedule 40 PVC monitoring well casing

Coarse silica sand pack

50 mm dia., Schedule 40 PVC, 10 slot well screen, 22.9 to 25.9m

Caved material from borehole

Borehole and Monitor Installation Log

Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748130 Easting: 556622 (+/- 5m)

Date Completed: 30-Jun-11
Drilling Method: PQ Coring
Oversight By: WDB

Monitor Number: MW2/11

Depth (m bgl)	Stratigraphic Description	Sampling		Monitor Installation Details		Elevation (m amsl)
27	Sand, fine to coarse, grey to black, with some silt and stones, saturated			▨	Caved material from borehole	
28	Sand, fine to coarse, grey to black, with thin clay layers and stones, saturated	9	CS	▨		
29	Clay, grey, with some sand and silt, saturated			▨		
30	Borehole terminated at 29.9 m					

Borehole and Monitor Installation Log

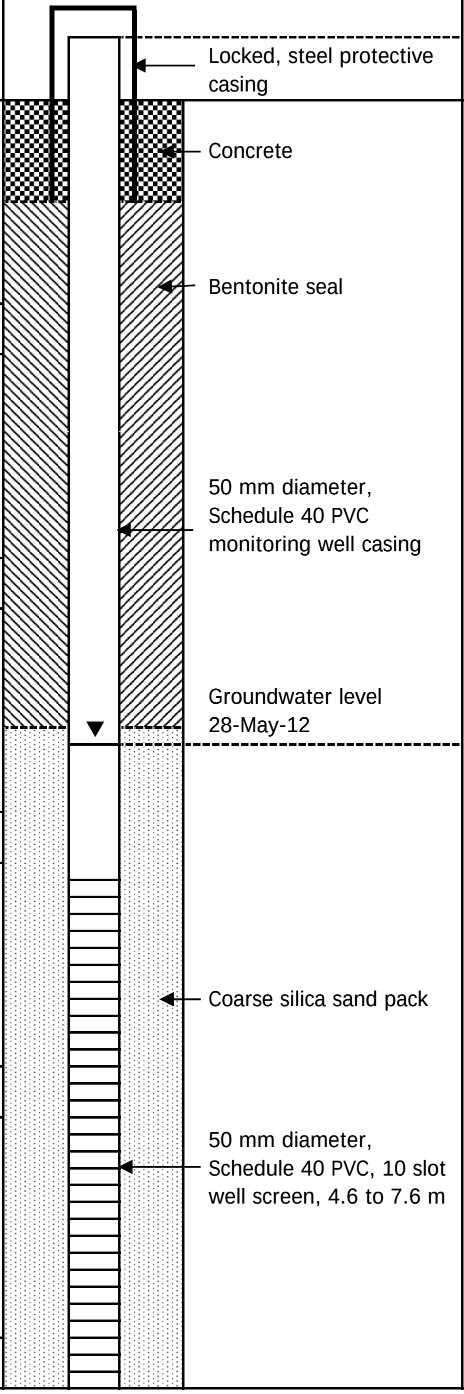
Banks Groundwater Engineering Limited

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4746823 Easting: 556070 (+/- 5m)

Date Completed: 22-May-12
Drilling Method: HS Auger
Oversight By: WDB

Monitor Number: MW3/12

Depth (m bgl)	Stratigraphic Description	Sampling		Monitor Installation Details	Elevation (m amsl)
0		Number	Type		
	Topsoil				
1	Silty fine sand, light brown, moist				
		1	GS		
2					
		2	GS		
3					
4					
		3	GS		
5	Sand and gravel, light brown, moist, becoming saturated at 3.6 m				
		4	GS		
6					
7					
		5	GS		
8	Borehole terminated at 7.6 m				



Borehole and Monitor Installation Log

Norfolk County - Simcoe Water Supply EA
Site: Old Hwy. 24 & Cloet Road
Norfolk, Ontario
Northing: 4748131 Easting: 556623 (+/- 5m)

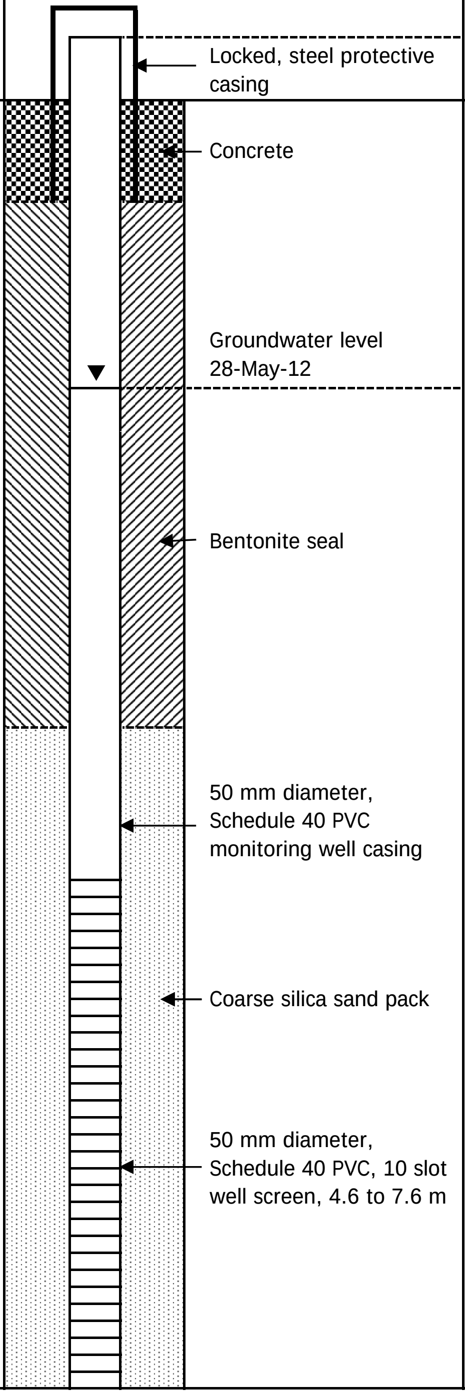
Date Completed: 22-May-12
Drilling Method: HS Auger
Oversight By: WDB

Banks Groundwater Engineering Limited

Monitor Number: MW4/12

Depth (m bgl)	Stratigraphic Description	Sampling Number	Sampling Type
0		Number	Type
	Topsoil	Refer to MW2/11	
1 2	Silty fine sand, light brown, moist		
	Silty fine sand, light brown, moist		
3	Silt with fine sand, light brown, moist		
	Clay, grey, moist		
	Stones with darker brown silt, saturated		
4	Sandy silt, darker brown, saturated		
5 6	Silt with occasional thin clay layers, grey, saturated		
7	Stones, small to medium, with medium to coarse sand, saturated		
8	Borehole terminated at 7.6 m		

Monitor Installation Details



Elevation (m amsl)

Borehole and Monitor Installation Log

Banks Groundwater Engineering Limited

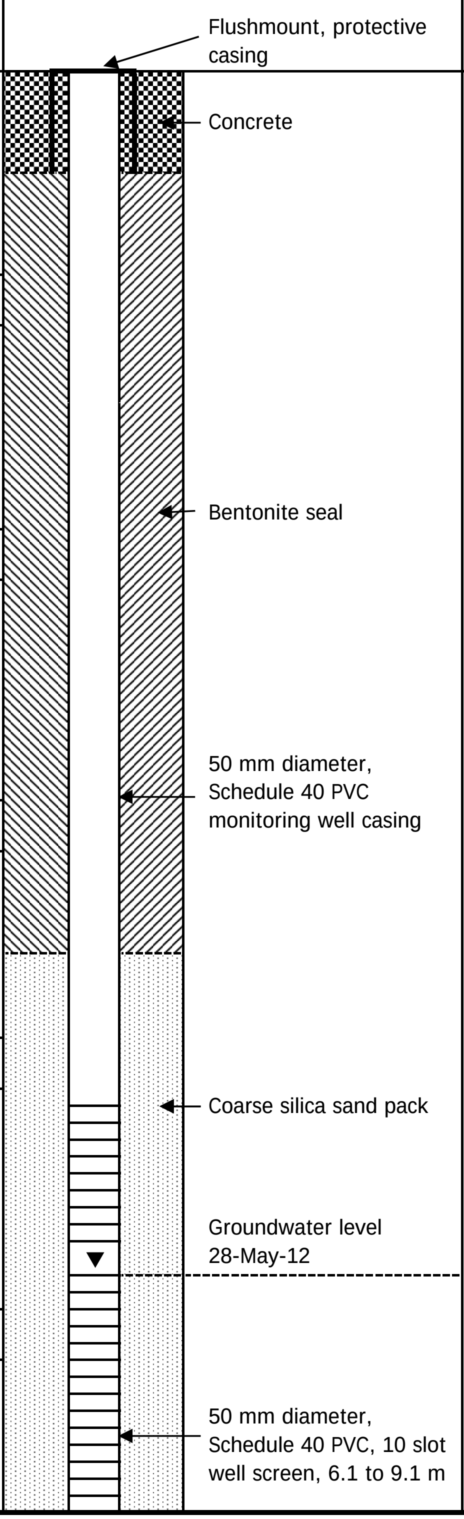
Norfolk County - Simcoe Water Supply EA
Site: 265 Old Hwy. 24
Norfolk, Ontario
Northing: 4748558 Easting: 557219 (+/- 5m)

Date Completed: 23-May-12
Drilling Method: HS Auger
Oversight By: WDB

Monitor Number: MW5/12

Depth (m bgl)	Stratigraphic Description	Sampling		Elevation (m amsl)
		Number	Type	
0				
	Topsoil			
1				
		1	GS	
2				
	Silty sand, yellow/brown, moist			
3		2	GS	
4				
		3	GS	
5				
6	Sand, fine to medium, moist, becoming saturated at 7 m	4	GS	
7				
		5	GS	
8	Sand, medium to coarse with gravel, saturated			

Monitor Installation Details

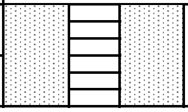


Borehole and Monitor Installation Log

Norfolk County - Simcoe Water Supply EA
Site: 265 Old Hwy. 24
Norfolk, Ontario
Northing: 4748558 Easting: 557219 (+/- 5m)

Date Completed: 23-May-12
Drilling Method: HS Auger
Oversight By: WDB

Monitor Number: MW5/12

Depth (m bgl)	Stratigraphic Description	Sampling		Monitor Installation Details	Elevation (m amsl)
9	Sand, medium to coarse with gravel, saturated	6	GS		
10	Borehole terminated at 9.1 m				

LP 10-12.

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A107507

10-0165-00.

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name / Last Name / Organization: The Corporation of Norfolk County.		E-mail Address:	☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 183 Main Street.	Municipality: Norfolk	Province: ON	Postal Code: N4B2M3
Telephone No. *(inc. area code)*: 5198522100.			

Well Location

Address of Well Location (Street Number/Name): Cloet Rd.	Township: ~~Simcoe~~ Norfolk.	Lot:	Concession:
County/District/Municipality: Norfolk.	City/Town/Village: Simcoe	Province: **Ontario**	Postal Code:
UTM Coordinates: NAD 83; Zone: 17; Easting: 556839; Northing: 4747559	Municipal Plan and Sublot Number:	Other:	

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
Brn	Silt	Sand	Moist	0'	22'

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0'	8'	Bentonite	

Method of Construction

☐ Cable Tool
☐ Rotary (Conventional)
☐ Rotary (Reverse)
☐ Boring
☐ Air percussion
☑ Other, *specify* H.S.A.
☐ Diamond
☐ Jetting
☐ Driving
☐ Digging

Well Use

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

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
2"	Plastic	Sch.80	0'	10'

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
2"	Plastic	10	10'	20'

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)* ☐ Gas — Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas — Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas — Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0'	22'	8"

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)*

Pumping rate *(l/min / GPM)*

Duration of pumping ____ hrs + ____ min

Final water level end of pumping *(m/ft)*

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

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

Well production *(l/min / GPM)*

Disinfected? ☐ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.

Please see attached map.

Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: Aardvark Drilling Inc.	Well Contractor's Licence No.: 7238
Business Address (Street Number/Name): 25 Lewis Road - Unit C	Municipality: Guelph
Province: ON	Postal Code: N1H1E9
Business E-mail Address:	
Bus. Telephone No. *(inc. area code)*: 5198269340	Name of Well Technician (Last Name, First Name): Smith, Kyle
Well Technician's Licence No.: 3591	Signature of Technician and/or Contractor:
Date Submitted (YYYYMMDD): 20101104	

Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: 20101007

Ministry Use Only

Audit No. z121804

Received NOV 12 2010

0506E (2007/12)

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Ministry's Copy

LP10-12

10-0165-00

Ontario Ministry of the Environment

Measurements recorded in: ☑ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* 4107506

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name / Last Name / Organization: The Corporation of Norfolk County.

E-mail Address:

☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name): 183 Main Street.

Municipality: Norfolk

Province: ON

Postal Code: N4B2m3

Telephone No. *(inc. area code)*: 5198522100

Well Location

Address of Well Location (Street Number/Name): Cloet Rd.

Township: ~~Simcoe~~ Norfolk

Lot:

Concession:

County/District/Municipality: Norfolk

City/Town/Village: Simcoe

Province: Ontario

Postal Code:

UTM Coordinates Zone 17 Easting 556839 Northing 4747559 NAD 83

Municipal Plan and Sublot Number:

Other:

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	To
Brn	Silt	sand	Moist	0'	~~33~~ 10
Brn	Sand	gravel	wet	~~33~~ 10	33'

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0'	31'	Bentonite	

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☐ Other, specify H.S.A.

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
2"	Plastic	Sch80	0'	33'

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
2"	Plastic	10	33'	38'

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)* ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Water found at Depth *(m/ft)* ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Water found at Depth *(m/ft)* ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0'	40'	8"

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)*

Pumping rate *(l/min / GPM)*

Duration of pumping ___ hrs + ___ min

Final water level end of pumping *(m/ft)*

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

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

Well production *(l/min / GPM)*

Disinfected? ☐ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.

See attached map.

Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: Aardvark Drilling Inc.

Well Contractor's Licence No.: 7238

Business Address (Street Number/Name): 25 Lewis Road-Unit C

Municipality: Guelph.

Province: ON

Postal Code: N1H1E9

Business E-mail Address:

Bus. Telephone No. *(inc. area code)*: 5198269340.

Name of Well Technician (Last Name, First Name): Smith, Kyle.

Well Technician's Licence No.: 35911

Signature of Technician and/or Contractor:

Date Submitted: 20101104

Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: 20101007

Ministry Use Only

Audit No. Z121803

Received NOV 12 2010

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Ministry's Copy

LP 10-12

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. A107505

A107505

10-0165-00

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
The Corporation	of Norfolk County		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
183 Main Street	Norfolk	ON	N4B2M3	5194852?100

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Cloet Rd	~~Simcoe~~ Norfolk		

County/District/Municipality	City/Town/Village	Province	Postal Code
Norfolk	Simcoe	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556839	4747559		

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
Brown	Top soil			0	1
	silt			1	30'
	Sand	Gravel		30'	70'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	4'	cement	
4'	47'	Grout	100 gallons
47'	58½	Bent chips	1 pail
58½	70'	silica sand	200 pounds

Method of Construction

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

Well Use

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

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
	Plastic	Sch 80	+3'	62½

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
2"	Plastic	10	62½	67½

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

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)

Pumping rate (l/min / GPM)

Duration of pumping
hrs + min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected?
☐ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.

Please see attached map

Water Details

Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Water found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	5'	8"
5'	70'	5½"

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
~~B~~ AardvarkDrilling Inc	7238

Business Address (Street Number/Name)	Municipality
25 Lewis Rd ~~Guelph~~ Unit	Guelph

Province	Postal Code	Business E-mail Address
Ont.	N1H1E9	

Bus.Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5198269340	Richards Adrian

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
2554		20101025

Comments:

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☐ No	YYYYMMDD	20100928

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Audit No. Z121802

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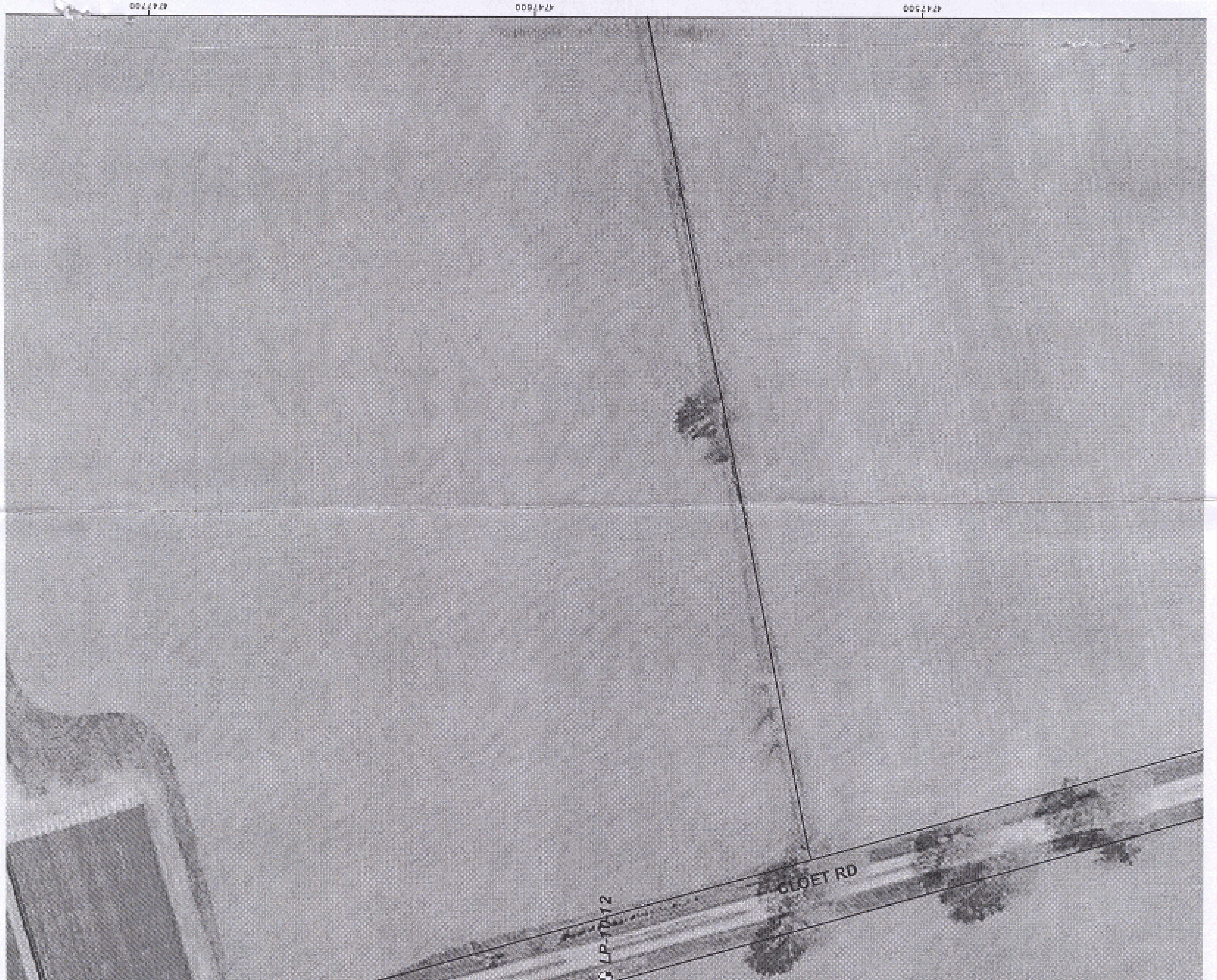

C-7238
Z121802

NOV 12 2010

LP 10-15

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* **A109959**

10-0165-00

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name / Last Name / Organization: The Corporation of Norfolk County.

E-mail Address:

☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name): 183 Main Street

Municipality: Norfolk

Province: ON

Postal Code: N4B2M3

Telephone No. *(inc. area code)*: 5195822100

Well Location

Address of Well Location (Street Number/Name): Norfolk Road North

Township: Norfolk

Lot:

Concession:

County/District/Municipality: NORFOLK

City/Town/Village: Simcoe.

Province: **Ontario**

Postal Code:

UTM Coordinates: NAD 8 3 Zone: 1 7 Easting: 556163 Northing: 4746207

Municipal Plan and Sublot Number:

Other:

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	To
~~SAND~~ BROWN	SAND			0	18'

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	6	BENTONITE	
6	18	SAND	

Method of Construction

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

Well Use

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

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
2	PLASTIC	SCHED80	0	8

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*

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
2	PLASTIC	10	8	18

Water Details

Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	18	8

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)*

Pumping rate *(l/min / GPM)*

Duration of pumping ____ hrs + ____ min

Final water level end of pumping *(m/ft)*

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

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

Well production *(l/min / GPM)*

Disinfected? ☐ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.

Please see attached map.

Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor: Aardvark Drilling Inc.

Well Contractor's Licence No.: 7 2 3 8

Business Address (Street Number/Name): 25 Lewis Road - Unit C

Municipality: Guelph

Province: ON

Postal Code: N1H1E9

Business E-mail Address:

Bus. Telephone No. *(inc. area code)*: 5198269340

Name of Well Technician (Last Name, First Name): England, M

Well Technician's Licence No.: 3 0 5 9

Signature of Technician and/or Contractor:

Date Submitted: 20101201

Well owner's information package delivered ☐ Yes ☐ No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: 20101123

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LP10-15

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. (Place Sticker and/or Print Below) **A109958**

10-0165-00.

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
The Corporation of Norfolk County			

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
183 Main Street	Norfolk	ON	N4B2M3	5194265870

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Norfolk Road North	Norfolk		

County/District/Municipality	City/Town/Village	Province	Postal Code
NORFOLK	Simcoe	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	556163	4746207		

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~~ BROWN	SAND			0	49

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	42	BENTONITE	
42	49	SAND	

Method of Construction

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

Well Use

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

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
2	PLASTIC	SCHED 80	0	44

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
2	PLASTIC	10	44	49

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) ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft) ☐ Gas Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	49	6

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)

Pumping rate (l/min / GPM)

Duration of pumping ___ hrs + ___ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

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

Map of Well Location

Please provide a map below following instructions on the back.

Please see attached map.

Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Aardvark Drilling Inc.	7238

Business Address (Street Number/Name)	Municipality
25 Lewis Road - Unit C	Guelph

Province	Postal Code	Business E-mail Address
ON	N1H1E9	

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5198269340	England M

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3059	M England	20101201

Well owner's information package delivered	Date Package Delivered
☐ Yes ☐ No	Y Y Y Y M M D D
	Date Work Completed 20101123

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Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A109957

10-0165-00 1910-15

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name / Last Name / Organization: The Corporation of Norfolk County		E-mail Address:	☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 183 Main Street	Municipality: Norfolk	Province: ON	Postal Code: N4B2M3
Telephone No. (inc. area code): 5195822100			

Well Location

Address of Well Location (Street Number/Name): Norfolk Road North	Township: Norfolk	Lot:	Concession:
County/District/Municipality: Norfolk County	City/Town/Village: Simcoe	Province: **Ontario**	Postal Code:
UTM Coordinates NAD 8 3 · Zone: 17 · Easting: 556163 · Northing: 4746207	Municipal Plan and Sublot Number:	Other:	

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	To
Brown	Sand		Dense	0'	12'
Brown	sand	Gravel	Loose	12'	60'
Brown	sand		medium / Loose	60'	70'10"

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0'	60'10	Bentonite Grout	
60'10'	63'10	Bentonite chips (3/8)	

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)*

Pumping rate *(l/min / GPM)*

Duration of pumping ____ hrs + ____ min

Final water level end of pumping *(m/ft)*

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

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

Well production *(l/min / GPM)*

Disinfected? ☐ Yes ☐ No

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

Method of Construction

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

Well Use

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

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
2	Plastic	Sch. 50	0	65'10"

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
2	Plastic	.10	65'10"	70'10"

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) ☐ Gas · Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ____
Water found at Depth ____ (m/ft) ☐ Gas · Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ____
Water found at Depth ____ (m/ft) ☐ Gas · Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ____

Hole Diameter

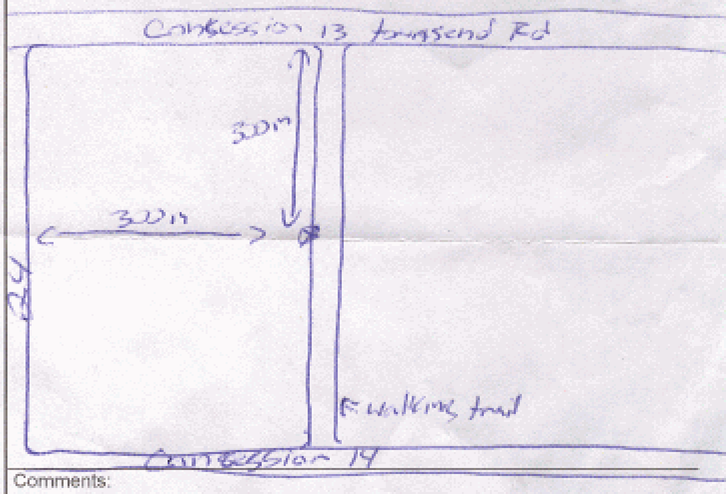
Depth (m/ft) From	To	Diameter (cm/in)
0	71'10"	5

Well Contractor and Well Technician Information

Business Name of Well Contractor: Aardvark Drilling Inc.	Well Contractor's Licence No.: 7238
Business Address (Street Number/Name): 25 Lewis Road - Unit C	Municipality: Guelph
Province: ON · Postal Code: N1H1E9	Business E-mail Address:
Bus. Telephone No. (inc. area code): 5198269340	Name of Well Technician (Last Name, First Name): England, M
Well Technician's Licence No.: 3059 · Signature of Technician and/or Contractor: Matt Eph	Date Submitted: 20101201

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well owner's information package delivered ☐ Yes ☐ No	Date Package Delivered: Y Y Y Y M M D D	
	Date Work Completed: 20101125	

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C-7238
2123582

DEC 17 2010

Well Records for Monitored Private Wells

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11

4406941

Municipality 44004   Con. CON 12

NORFOLK

County or District [redacted]

Township/Borough/City/Town/Village NANTICOKE (TOWNSEND)

Con block tract survey, etc. XII   Lot 1

Address R. R. 4 SIMCOE

Date completed 19 day 11 month 97 year

21   Northing   RC   Elevation   RC   Basin Code

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
BLACK	TOPSOIL			0	2
BROWN	CLAY			2	13
BLUE	CLAY	SILT		13	46
GREY	COARSE SAND			46	54

31

32

41 WATER RECORD

Water found at - feet	Kind of water
46	☑ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
5	☑ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.241	0	54
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic			
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic			

SCREEN

Sizes of opening (Slot No.) 14
Diameter 5 inches
Length 4 feet
Material and type S.S.
Depth at top of screen 50 feet

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	10	3/8 HOLE PLUG

71 PUMPING TEST

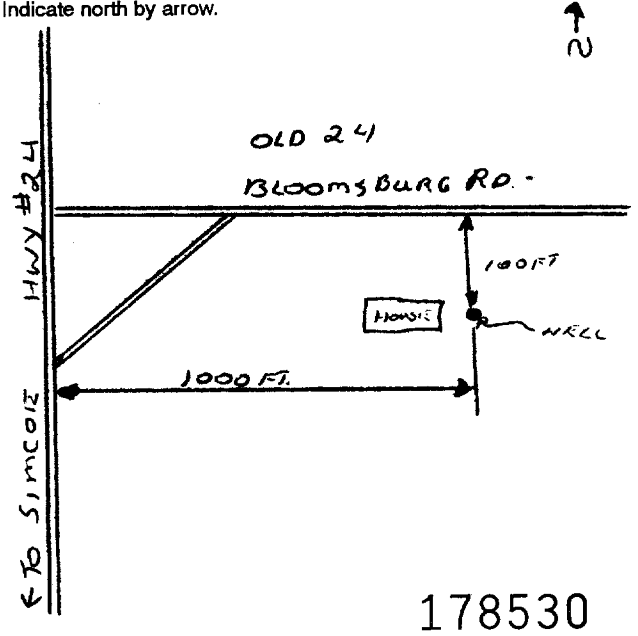
Pumping test method ☑ Pump ☐ Bailer
Pumping rate 12 GPM
Duration of pumping 1 Hours 00 Mins

Static level	Water level end of pumping	15 minutes	30 minutes	45 minutes	60 minutes
10 feet	15 feet	15 feet	15 feet	15 feet	15 feet

Water levels during ☐ Pumping ☐ Recovery
If flowing give rate GPM
Pump intake set at 50 feet
Water at end of test ☑ Clear ☐ Cloudy
Recommended pump type ☐ Shallow ☑ Deep
Recommended pump setting 50 feet
Recommended pump rate 12 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



178530

FINAL STATUS OF WELL

- ☑ Water supply
- ☐ Observation well
- ☐ Test hole
- ☐ Recharge well
- ☐ Abandoned, insufficient supply
- ☐ Abandoned, poor quality
- ☐ Abandoned (Other)
- ☐ Dewatering
- ☐ Unfinished
- ☐ Replacement well

WATER USE

- ☑ Domestic
- ☐ Stock
- ☐ Irrigation
- ☐ Industrial
- ☐ Commercial
- ☐ Municipal
- ☐ Public supply
- ☐ Cooling & air conditioning
- ☐ Not used
- ☐ Other

METHOD OF CONSTRUCTION

- ☑ Cable tool
- ☐ Rotary (conventional)
- ☐ Rotary (reverse)
- ☐ Rotary (air)
- ☐ Air percussion
- ☐ Boring
- ☐ Diamond
- ☐ Jetting
- ☐ Driving
- ☐ Digging
- ☐ Other

Name of Well Contractor TED VAN KESSEL WATERWELLS
Well Contractor's Licence No. 5201
Address 179 SHERMAN ST. SIMCOE
Name of Well Technician MARK VAN KESSEL
Well Technician's Licence No. T-0528
Signature of Technician/Contractor
Submission date day mo yr

MINISTRY USE ONLY
Data source
Contractor 5201
Date received DEC 24 1997
Date of inspection
Inspector
Remarks
CSS.S8

0506 (07/94) Front Form 9

2 - MINISTRY OF ENVIRONMENT & ENERGY COPY

Ontario Ministry of the Environment

Well Tag Num **A 025693**

A025693

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN ___ CON ___ LOT ___

Well Owner's Information and Location of Well Information

[redacted]

RR#/Street Number/Name: RR#3 (115)

City/Town/Village: Waterford

Site/Compartment/Block/Tract etc.:

GPS Reading NAD 83 Zone 17 Easting 556286 Northing 4748281

Unit Make/Model: Mag 2000

Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify ______

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
BLACK	TOPSOIL			0	.62
BROWN	SAND			.62	5.23
BROWN	SILT	CLAY		5.23	8.62
GRAY	SILT	CLAY		8.62	12.00
BLACK	CLAY			12.00	14.46
GREY	COARSE	SAND		14.46	17.23

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	5.23	24.13

Water Record

Water found at ___ Metres	Kind of Water
5.23 m	☒ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
14.46 m	☒ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
___ m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was ☒ Clear and sediment free ☐ Other, specify ______

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth Metres From	Depth Metres To
Casing				
12.70	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	1.48	0	16.00
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 12.70	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No. 14	16.00	17.23
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
S&B				
Pump intake set at - (metres) 16.92	Static Level	6.15		7.38
Pumping rate - (litres/min) 45	1	6.77	1	6.46
Duration of pumping 2 hrs + 00 min	2	7.38	2	6.15
Final water level end of pumping ______ metres	3	7.38	3	6.15
Recommended pump type. ☐ Shallow ☒ Deep	4		4	
Recommended pump depth. ______ metres	5		5	
Recommended pump rate. 45 (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record ☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	5.23	QUICK GROUT	.20

Method of Construction

☒ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☒ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: VanKessel Waterwells

Well Contractor's Licence No.: 7193

Business Address (street name, number, city etc.): Box 646 Simcoe, ON N3Y 4T2

Name of Well Technician (last name, first name): VAN KESSEL MARK

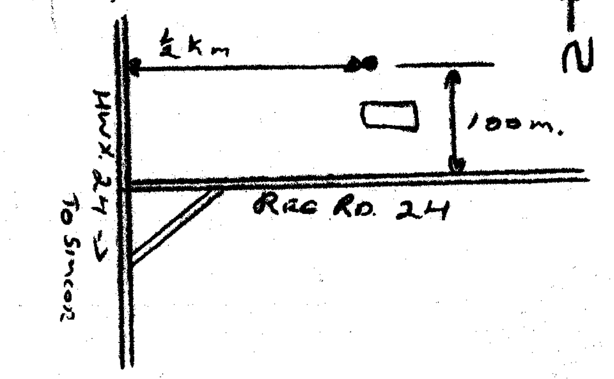
Well Technician's Licence No.: T-528

Signature of Technician/Contractor: X

Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 26233

Date Well Completed YYYY MM DD: 2005 07 05

Was the well owner's information package delivered? ☑ Yes ☐ No

Date Delivered YYYY MM DD: 2005 07 05

Ministry Use Only

Data Source

Contractor 7193

Date Received YYYY MM DD: JUL 28 2005

Date of Inspection YYYY MM DD

Remarks

Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐

Cette formule est disponible en français

Ontario Ministry of the Environment

Well Tag Number A 038129

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN ☐☐☐☐☐ CON ☐☐☐☐☐☐☐☐☐☐ LOT ☐☐☐

Well Owner's Information and Location of Well Information

[redacted]

RR#/Street Number/Name: RR# 3

City/Town/Village: Waterford.

Site/Compartment/Block/Tract etc.:

GPS Reading NAD 83 Zone 17 Easting 557100 Northing 4748287

Unit Make/Model: Mag2000

Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
BLACK	TOPSOIL			0	.62
BROWN	SAND			.62	2.77
BROWN	CLAY	SILT		2.77	6.77
BLUE	CLAY	SILT		6.77	14.46
BROWN	COARSE SAND			14.46	18.46

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	6.15	24.13

Water Record

Water found at ___ Metres / Kind of Water

14.46 m ☐ Gas ☒ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Other:

___ m ☐ Gas ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Other:

___ m ☐ Gas ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals ☐ Other:

After test of well yield, water was

☒ Clear and sediment free

☐ Other, specify

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth Metres From	Depth Metres To
Casing				
12.70	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.48	0	16.00
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 12.70	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No. 16	16.00	18.46
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method: SuB.

Pump intake set at - (metres) 16.00

Pumping rate - (litres/min) 45

Duration of pumping 1 hrs + 00 min

Final water level end of pumping 10.77 metres

Recommended pump type. ☐ Shallow ☒ Deep

Recommended pump depth. 16 metres

Recommended pump rate. 45 (litres/min)

If flowing give rate - (litres/min)

If pumping discontinued, give reason.

Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Static Level	10.46		10.77
1	10.77	1	10.46
2	10.77	2	10.46
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	6.15	QUICK GROUT	.25

Method of Construction

☒ Cable Tool ☐ Rotary (conventional) ☐ Rotary (reverse) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting ☐ Driving ☐ Digging ☐ Other

Water Use

☒ Domestic ☐ Stock ☐ Irrigation ☐ Industrial ☐ Commercial ☐ Municipal ☐ Public Supply ☐ Not used ☐ Cooling & air conditioning ☐ Other

Final Status of Well

☒ Water Supply ☐ Observation well ☐ Test Hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Unfinished ☐ Dewatering ☐ Replacement well ☐ Abandoned, (Other)

Well Contractor/Technician Information

Name of Well Contractor: VanKessel Waterwells

Well Contractor's Licence No.: 7193

Business Address (street name, number, city etc.): Box 646 Simcoe, ON

Name of Well Technician (last name, first name): VAN KESSEL MARK

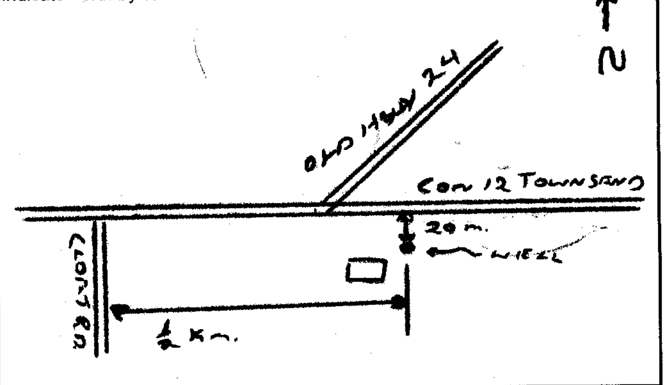
Well Technician's Licence No.: T-528

Signature of Technician/Contractor: X

Date Submitted YYYY MM DD

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 27021

Date Well Completed YYYY MM DD 2006 09 15

Was the well owner's information package delivered? ☐ Yes ☐ No

Date Delivered YYYY MM DD 2006 09 15

Ministry Use Only

Data Source RECEIVED

Contractor 7193

Date Received JAN 05 2007

Date of Inspection YYYY MM DD

Remarks

Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐ *Cette formule est disponible en français*

Ontario Ministry of the Environment

Well Tag No. *(Place Sticker and/or Print Below)*

A 098081

Well Record

Regulation 903 Ontario Water Resources Act

[redacted]

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
RR#3	townsend.	4	XII

(County)/District/Municipality	City/Town/Village	Province	Postal Code
NORFolk	Waterford	Ontario	N0E 1Y0

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	557113	5474825		

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	To
BLACK	TOPSOIL			0	2
BROWN	SAND			2	11
BROWN	CLAY	SAND		11	21
BLUE	CLAY	SILT		21	43
BROWN	COARSE SAND			43	60

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
0	20	QUICK GROUT	.27

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)* 55

Pumping rate *(l/min / GPM)* 25

Duration of pumping 1 hrs + 00 min

Final water level end of pumping *(m/ft)* 40

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

Recommended pump depth *(m/ft)* 55

Recommended pump rate *(l/min / GPM)* 20

Well production *(l/min / GPM)*

Disinfected? ☒ Yes ☐ No

Draw Down Time *(min)*	Water Level *(m/ft)*	Recovery Time *(min)*	Water Level *(m/ft)*
Static Level	34		40
1	37	1	37
2	40	2	34
3	40	3	34
4	40	4	34
5		5	
10	↓	10	↓
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Method of Construction

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

Well Use

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

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
5 5/8	STEEL	.188	0	52

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*

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To
5	S. STEEL	16	52	60

Water Details

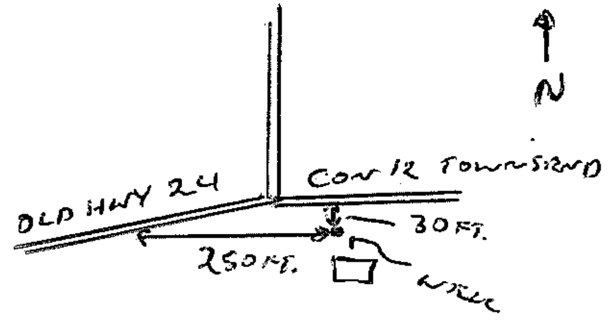
Water found at Depth 43 *(m/ft)* ☐ Gas | Kind of Water: ☒ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*
Water found at Depth *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	20	8 1/2
0	60	5 1/2

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: VanKessel Waterwells
Well Contractor's Licence No.: 7 1 1 9 3
Business Address (Street Number/Name): Box 646
Municipality: Simcoe
Province: ON
Postal Code: N3Y 4T2
Business E-mail Address:
Bus. Telephone No. *(inc. area code)*: 5[redacted]264152
Name of Well Technician (Last Name, First Name): VanKessel, Mark
Well Technician's Licence No.: T1528
Signature of Technician and/or Contractor:
Date Submitted: Y Y Y Y M M D D

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered: 2012 01 24

Date Work Completed: 2012 01 24

Ministry Use Only

Audit No. Z117233

JAN 31 2012

Received

The Ontario Water Resources Commission Act

WATER WELL RECORD

40-I 16f
3321

Water management in Ontario

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 4403796 | MUNICIP. 44004 | CON. CON 11

COUNTY OR DISTRICT: norfolk.
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Townsend.
CON., BLOCK, TRACT, SURVEY, ETC.: 11
LOT: 004 ~~4 S.P.~~

OWNER (SURNAME FIRST) 28-47: [redacted]
ADDRESS: Simcoe, Ont. Second ave. No-8 Ph- [redacted]
DATE COMPLETED 48-53: DAY 18 MO. 11 YR. 74

21 | ZONE 17 | EASTING 557680 | NORTHING 4748200 | RC. 4 | ELEVATION 0795 | RC. 4 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH – FEET FROM	DEPTH – FEET TO
sand	sand	loam		0	15
sand	sand			15	25
sand		quik sand		25	58

31 | 0015 28 | 0025 28 | 0058 2807

32

41 WATER RECORD

WATER FOUND AT – FEET	KIND OF WATER
0040	1 ☑ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH – FEET FROM	DEPTH – FEET TO
06 ~~4~~	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	188 ~~heavy~~	0 ~~23~~	0040 ~~46~~
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.): 006
DIAMETER: 06.000 INCHES
LENGTH: 05 FEET
MATERIAL AND TYPE: Stainless Steel
DEPTH TO TOP OF SCREEN: 0045 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT – FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☑ BAILER
~~PUMPING~~ Bailer RATE: 0003 ~~3/4~~ GPM.
DURATION OF PUMPING: 01 HOURS 00 MINS.
☑ STATIC LEVEL: 045 FEET
WATER LEVEL END OF PUMPING: 045 FEET
WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY
15 MINUTES: — FEET; 30 MINUTES: — FEET; 45 MINUTES: — FEET; 60 MINUTES: 045 FEET
IF FLOWING, GIVE RATE: GPM.
PUMP INTAKE SET AT: FEET
WATER AT END OF TEST: 1 ☐ CLEAR 2 ☑ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☑ DEEP
RECOMMENDED PUMP SETTING: 044 FEET
RECOMMENDED PUMPING RATE: 0002 GPM.
0060 GPM./FT. SPECIFIC CAPACITY

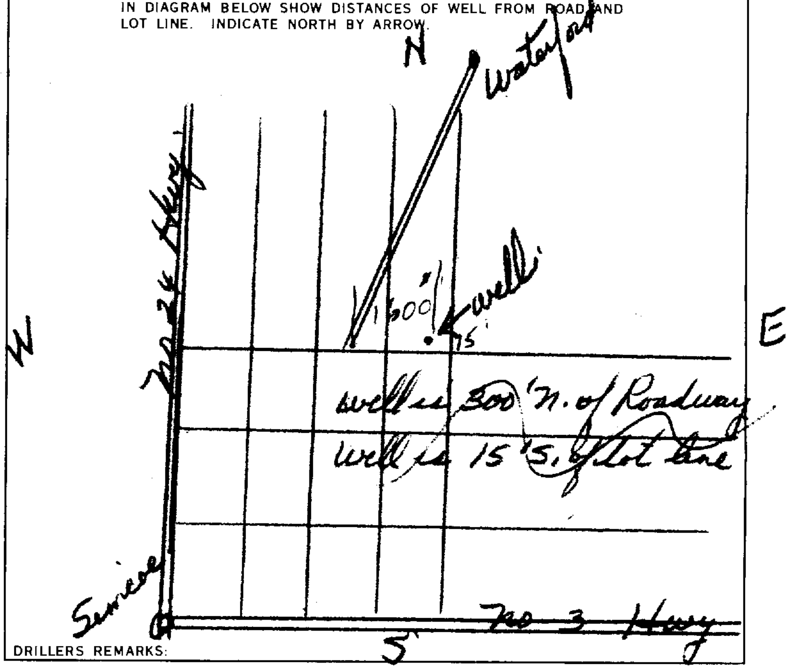
FINAL STATUS OF WELL 1
1 ☑ WATER SUPPLY
2 ☐ OBSERVATION WELL
3 ☐ TEST HOLE
4 ☐ RECHARGE WELL
5 ☐ ABANDONED, INSUFFICIENT SUPPLY
6 ☐ ABANDONED, POOR QUALITY
7 ☐ UNFINISHED

WATER USE 01
1 ☑ DOMESTIC
2 ☑ STOCK
3 ☐ IRRIGATION
4 ☐ INDUSTRIAL
☐ OTHER
5 ☐ COMMERCIAL
6 ☐ MUNICIPAL
7 ☐ PUBLIC SUPPLY
8 ☐ COOLING OR AIR CONDITIONING
9 ☐ NOT USED

METHOD OF DRILLING 1
1 ☑ CABLE TOOL
2 ☐ ROTARY (CONVENTIONAL)
3 ☐ ROTARY (REVERSE)
4 ☐ ROTARY (AIR)
5 ☐ AIR PERCUSSION
6 ☐ BORING
7 ☐ DIAMOND
8 ☐ JETTING
9 ☐ DRIVING

LOCATION OF WELL 574B

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

CONTRACTOR

NAME OF WELL CONTRACTOR: Elgin Stewart
LICENCE NUMBER: 4804
ADDRESS: Jarvis, Ont. R-3
NAME OF DRILLER OR BORER: Gerald Stewart
LICENCE NUMBER:
SIGNATURE OF CONTRACTOR: Elgin Stewart
SUBMISSION DATE: DAY 19 MO. 11 YR. 74

OFFICE USE ONLY

DATA SOURCE: 1
CONTRACTOR: 4804
DATE RECEIVED: 06/01/75
DATE OF INSPECTION:
INSPECTOR:
REMARKS: CSS.S8
P
WI

OWRC COPY

UTM 17 Z 557580 E
5 R 4747990 N
Elev. 5 ~~R~~ 778
Basin 23 |
10 4

93

ONTARIO

The Water-well Drillers Act, 1954
Department of Mines

44 № 1580

RECEIVED
JUL 9 1956
GEOLOGICAL BRANCH
DEPARTMENT of MINES

Water-Well Record

County or Territorial District NORFOLK Township, ~~Village, Town or City~~ TOWNSEND

[redacted] Village, Town or City)
Address
(day) (month) (year)

Pipe and Casing Record

Casing diameter(s) 8"
Length(s) 128'
Type of screen
Length of screen

Pumping Test

Static level 35'
Pumping rate 4000 GALS PER HR.
Pumping level 135'
Duration of test 36 HRS

Well Log

Water Record

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	No. of feet water rises	Kind of water (fresh, salty, or sulphur)
SAND	0'	28'			
WATER SAND	28'	38'	134'	99'	SULPHER
QUICKSAND	38'	75'			
PUTTY SAND	75'	120'			
HARD CLAY + GRAVEL	120'	128'			
ROCK LIGHT GRAY	128'	200'			

For what purpose(s) is the water to be used?
IRRAGATION
Is water clear or cloudy? CLEAR
Is well on upland, in valley, or on hillside? UPLAND

Drilling firm J. STEFAN
Address PRINCETON

Name of Driller C. LONGSTREET
Address MT. PLEASANT P.O.

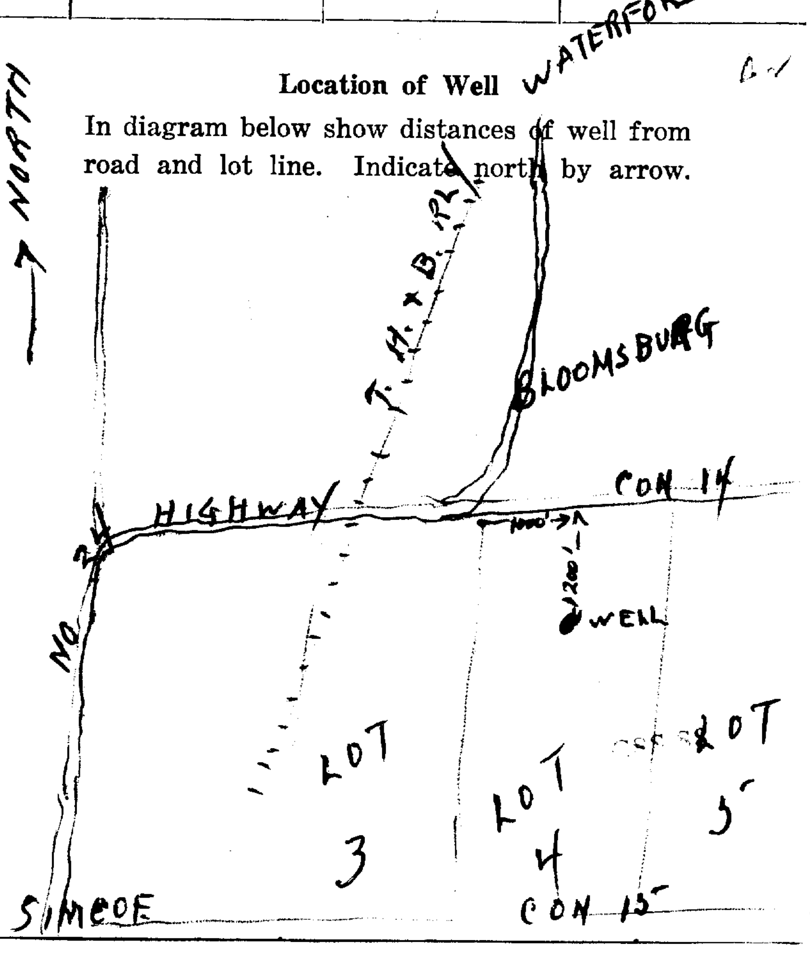
Licence Number 224

I certify that the foregoing statements of fact are true.

Date June 5/56 J. Stefan
Signature of Licensee

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 5

900 40 1/16 W

UTM ~~17~~ 17 | 557390 E

15 R | 4747250 N

Elev. 15 R | 10770

Basin 13 | 4

APL

94

GROUND WATER RECORD
44 № 1579
ONTARIO WATER RESOURCES COMMISSION

The Ontario Water Resources Commission Act, 1957

WATER WELL RECORD

County or District Norfolk Township, ~~Village, Town or City~~ Townsend

[redacted]te completed 15 (day) May (month) 1961 (year)

dress Waterford, R-3, Ont.

Casing and Screen Record	
Inside diameter of casing	6 5/8 8"
Total length of casing	135 122'
Type of screen	
Length of screen	
Depth to top of screen	
Diameter of finished hole	6 5/8

Pumping Test	
Static level	50'
Test-pumping rate	140 G.P.M.
Pumping level	290'
Duration of test pumping	16 hours
Water clear or cloudy at end of test	Clear
Recommended pumping rate	140 G.P.M.
with pumping level of	290'

Well Log / **Water Record**

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	No. of feet water rises	Kind of water (fresh, salty, sulphur)
~~unknown~~ previously drilled	0	200'	200	140	fresh?
Brown lime	200	250'			
Brown lime + shale	250	290			
Brown lime	290	365			
Brown lime, shale, Gypsum	365	385	385	335'	Mild sulphur
Brown lime	385	395			

For what purpose(s) is the water to be used? irrigation

Is well on upland, in valley, or on hillside? upland

Drilling Firm Elgin Stewart

Address Jarvis, Ont.

Licence Number 432

Name of Driller Elgin Stewart

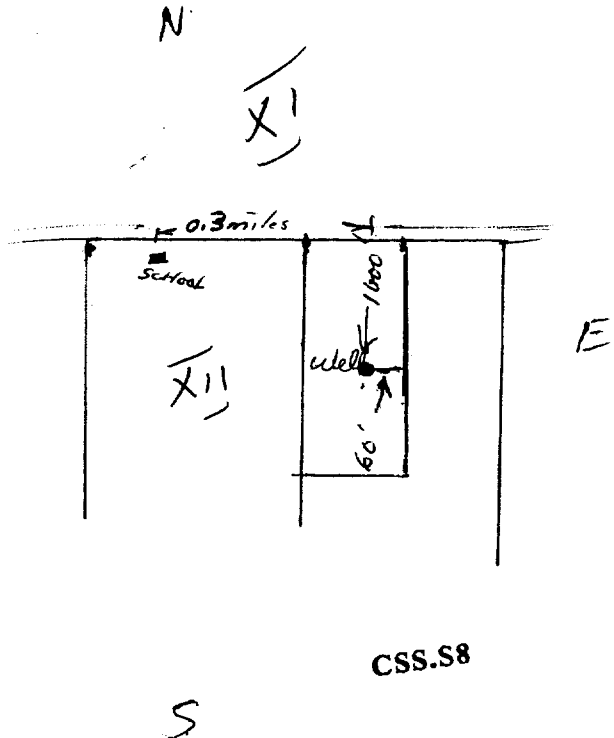
Address Jarvis

Date May 15/61

Elgin Stewart (Signature of Licensed Drilling Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Form 5

CSS.S8

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 **4407514** Municipality 44004 Con. CON 13

County or District [redacted]	Township/Borough/City/Town/Village NANTICOKE (TOWNSEND)	Con block tract survey, etc. XIII	Lot 3
	Address RR 4 SIMCOE		Date completed 3 day 01 month 2001 year

21 Northing RC Elevation RC Basin Code

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	To
BLACK	TOPSOIL			0	2
BROWN	SAND	GRAVEL		2	32
BROWN	MED. SAND			32	55

31

32

WATER RECORD

Water found at - feet	Kind of water	
32	☑ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals ☐ Gas

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	To
5	☑ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	188	0	55
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic			
	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter	Length
12	5 inches	5 feet

Material and type	Depth at top of screen
S.S.	50 feet

PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

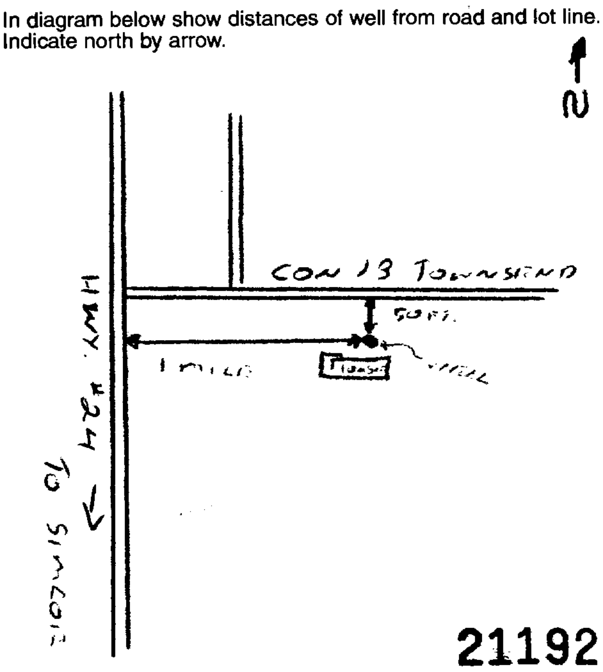
Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
0	10	3/8 HOLEPLUG

PUMPING TEST

Pumping test method ☑ Pump ☐ Bailer		Pumping rate 10 GPM		Duration of pumping 1 Hours 00 Mins	
Static level	Water level end of pumping	Water levels during ☑ Pumping ☐ Recovery			
		15 minutes	30 minutes	45 minutes	60 minutes
32 feet	35 feet	35 feet	35 feet	35 feet	35 feet
If flowing give rate GPM		Pump intake set at 50 feet		Water at end of test ☑ Clear ☐ Cloudy	
Recommended pump type ☐ Shallow ☑ Deep		Recommended pump setting 50 feet		Recommended pump rate 10 GPM	

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



211928

FINAL STATUS OF WELL

- ☑ Water supply
- ☐ Observation well
- ☐ Test hole
- ☐ Recharge well
- ☐ Abandoned, insufficient supply
- ☐ Abandoned, poor quality
- ☐ Abandoned (Other)
- ☐ Dewatering
- ☐ Unfinished
- ☐ Replacement well

WATER USE

- ☑ Domestic
- ☐ Stock
- ☐ Irrigation
- ☐ Industrial
- ☐ Commercial
- ☐ Municipal
- ☐ Public supply
- ☐ Cooling & air conditioning
- ☐ Not use
- ☐ Other

METHOD OF CONSTRUCTION

- ☑ Cable tool
- ☐ Rotary (conventional)
- ☐ Rotary (reverse)
- ☐ Rotary (air)
- ☐ Air percussion
- ☐ Boring
- ☐ Diamond
- ☐ Jetting
- ☐ Driving
- ☐ Digging
- ☐ Other

Name of Well Contractor T. VANKESSEL WATERWELLS	Well Contractor's Licence No. 5201
Address 179 SHERMAN ST. SIMCOE	
Name of Well Technician MARK VAN KESSEL	Well Technician's Licence No. T-0528
Signature of Technician/Contractor	Submission date day mo yr

MINISTRY USE ONLY

Data source	Contractor 5201	Date received MAR 0 1 2001
Date of inspection	Inspector	
Remarks		CSS.ES1

0506 (11/98) Front Form 9

2 - MINISTRY OF THE ENVIRONMENT COPY

Ontario Ministry of the Environment

Measurements recorded in: ☐ Metric ☑ Imperial

Well Tag No. (Pl... ...ller Print Below) **A 082949**

Well Record

Regulation 903 Ontario Water Resources Act

[redacted]

Address of Well Location (Street Number/Name): #43 13nth conc.

Township: Townsend

Lot: #3

Concession: #12

County/District/Municipality:

City/Town/Village:

Province: **Ontario**

Postal Code:

UTM Coordinates: NAD 8 3 | Zone 17 | Easting 556159 | Northing 4746721

Municipal Plan and Sublot Number:

Other:

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
black	top soil			0	2
brown	clay			2	25
grey	coarse sand		clean	25	35

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
0	20	bent slurry	1

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

Pumping rate (l/min / GPM): 15

Duration of pumping: 20 hrs + 0 min

Final water level end of pumping (m/ft): 18

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

Recommended pump depth (m/ft): 30

Recommended pump rate (l/min / GPM): 10

Well production (l/min / GPM): 20

Disinfected? ☑ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	15		18
1		1	
2		2	
3		3	
4		4	
5	18	5	15
10	18	10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60	18	60	15

Method of Construction

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

Well Use

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

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
5 5/8	Steel	.188	0	31

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

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To
4 1/2	S.S.	#18	31	35

Water Details

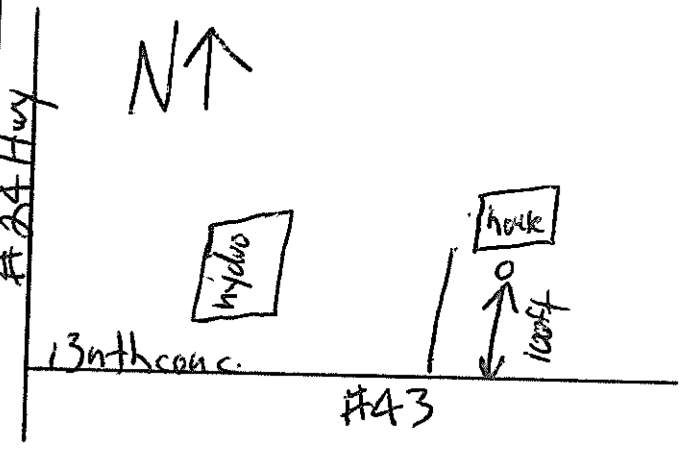
ter found at Depth 5 (m/ft) ☐ Gas | Kind of Water: ☑ Fresh ☐ Untested ☐ Other, specify
ter found at Depth 5 (m/ft) ☐ Gas | Kind of Water: ☑ Fresh ☐ Untested ☐ Other, specify
ter found at Depth (m/ft) ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	Depth (m/ft) To	Diameter (cm/in)
0	35	5 1/2

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

ness Name of Well Contractor: 1+M Pump Service

Well Contractor's Licence No.: 7049

ness Address (Street Number/Name): 1 Lamport Vittoria

Municipality:

ince: Ont.

Postal Code: N0E1W0

Business E-mail Address:

Telephone No. (inc. area code): 19942621163

Name of Well Technician (Last Name, First Name): Mcbuire Mik

Technician's Licence No.: 511

Signature of Technician and/or Contractor: M McGuire

Date Submitted: 20101228

Well owner's information package delivered: ☐ Yes ☐ No

Date Package Delivered: Y Y Y Y M M D D

Date Work Completed: 20101028

Ministry Use Only

Audit No. Z 095380

JAN 14 2011

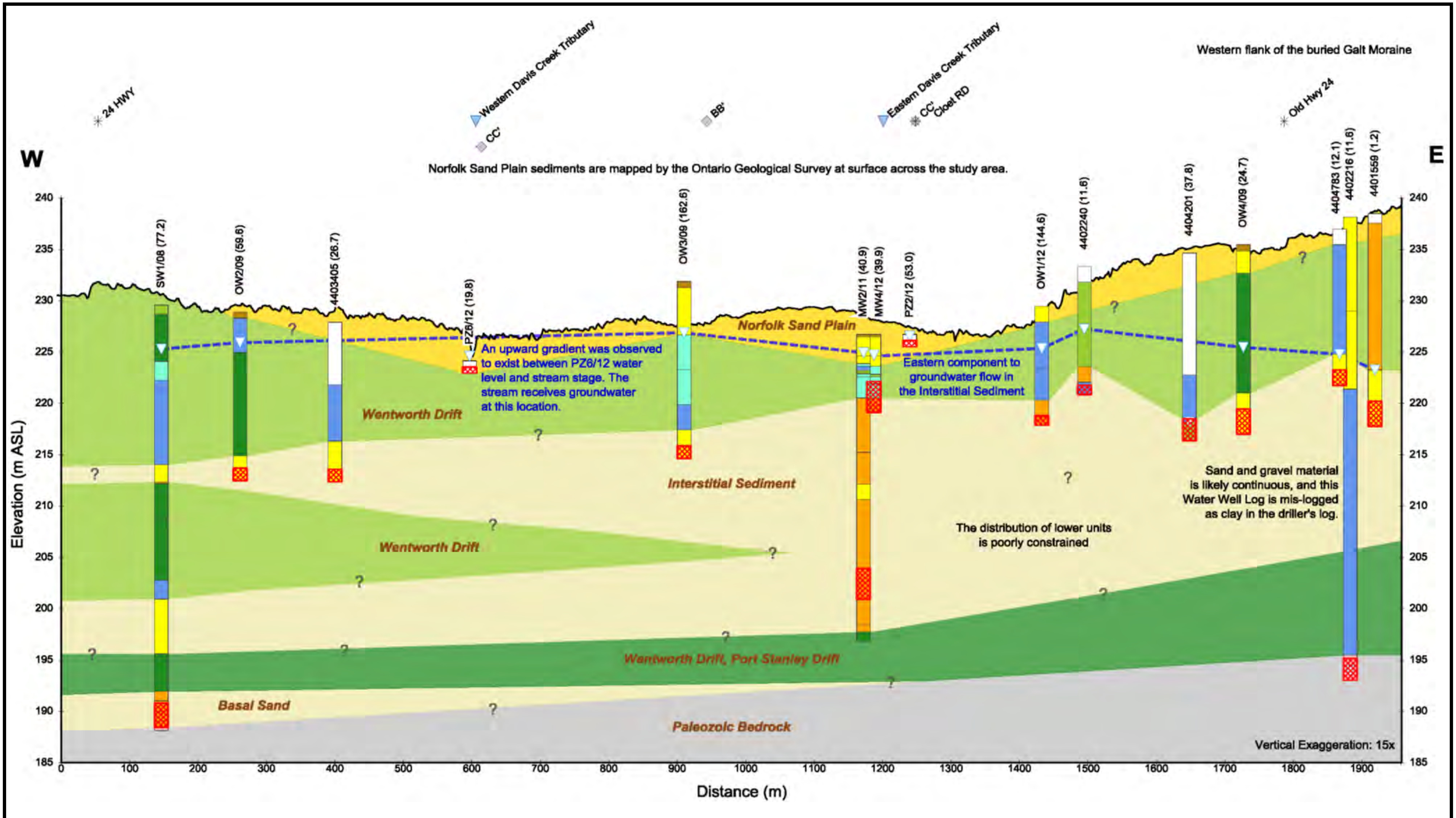
Received

(12/2007)

Ministry's Copy

Appendix F

Hydrogeological Cross-Sections



Base Mapping Intersection
- ▽ Drainage
- ◇ Profile
- ✳ Road

- — Ground Surface
- ▽ Static Water Level
- - - - Potentiometric surface, semi-confined aquifer
- ▨ Screened Interval

Borehole Lithology
- 🟦 Clay, silt clay
- 🟩 Fine-grained diamict (cl, si), Laminated glaciolacustrine clay, silt, and sand
- 🟩 Coarse-grained diamict (si, sa)
- 🟦 Silt, clayey silt, sandy silt
- 🟨 Sand, silty sand
- 🟧 Gravelly sand, gravel
- 🟥 Limestone, Rock
- 🟫 Fill, topsoil
- ☐ Unknown

Interpreted Units
- 🟨 Norfolk Sand Plain
- 🟩 Wentworth Drift
- 🟨 Interstitial Sediment
- 🟩 Wentworth Drift, Port Stanley Drift
- ⬜ Paleozoic Bedrock

Norfolk COUNTY

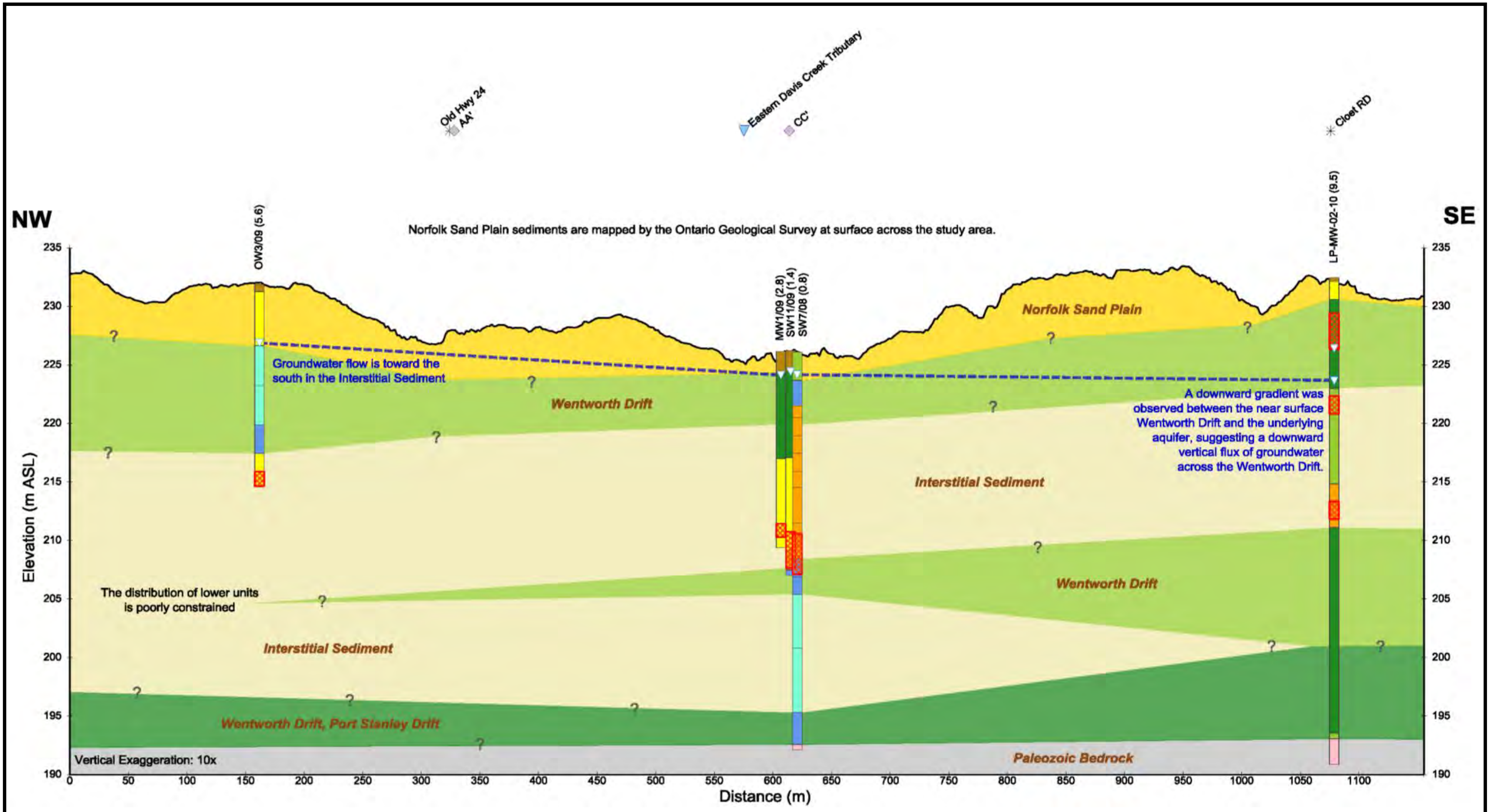
Community of Simcoe Additional Water Supply Project

Cross-Section AA'

Date:	Project:	Technical:	Reviewer:	Drawn:
June 30, 2015	BGE.59.101	L. Weaver	W. Banks	L. Weaver

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure F-1



Norfolk Sand Plain sediments are mapped by the Ontario Geological Survey at surface across the study area.

Groundwater flow is toward the south in the Interstitial Sediment

A downward gradient was observed between the near surface Wentworth Drift and the underlying aquifer, suggesting a downward vertical flux of groundwater across the Wentworth Drift.

The distribution of lower units is poorly constrained

Vertical Exaggeration: 10x

Base Mapping Intersection
- ▽ Drainage
- ◇ Profile
- ✳ Road
- — Ground Surface
- ▽ Static Water Level
- - - - Potentiometric surface, semi-confined aquifer
- ▨ Screened Interval

Borehole Lithology
- 🟦 Clay, silt clay
- 🟩 Fine-grained diamict (cl, si), Laminated glaciolacustrine clay, silt, and sand
- 🟩 Coarse-grained diamict (si, sa)
- 🟦 Silt, clayey silt, sandy silt
- 🟨 Sand, silty sand
- 🟧 Gravelly sand, gravel
- 🟥 Limestone, Rock
- 🟫 Fill, topsoil
- ☐ Unknown

Interpreted Units
- 🟨 Norfolk Sand Plain
- 🟩 Wentworth Drift
- ☐ Interstitial Sediment
- 🟩 Wentworth Drift, Port Stanley Drift
- ⬜ Paleozoic Bedrock

Norfolk COUNTY

Community of Simcoe Additional Water Supply Project

Cross-Section BB'

Date:	Project:	Technical:	Reviewer:	Drawn:
June 30, 2015	BGE.59.101	L. Weaver	W. Banks	L. Weaver

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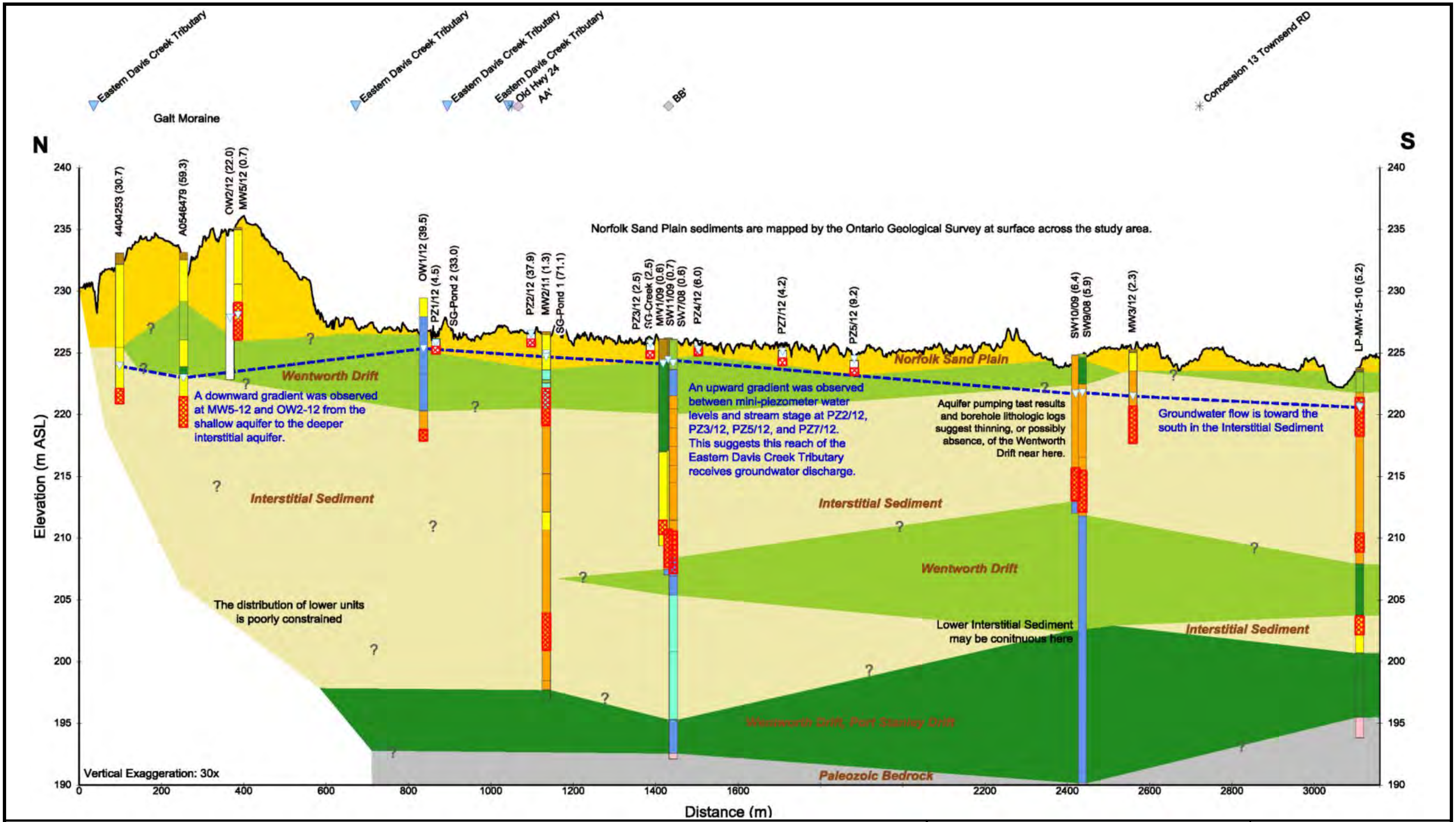
Figure F-2



Norfolk COUNTY

Community of Simcoe Additional Water Supply Project

Cross-Section CC'

Date:	Project:	Technical:	Reviewer:	Drawn:
June 30, 2015	BGE.59.101	L. Weaver	W. Banks	L. Weaver

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Figure
F-3

Appendix G

Groundwater Quality

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO#54858

09-November-2020

County of Norfolk (Non-Regulated)
Attn : Shaun Earls

183 Main Street
Delhi, ON
N4B 2M3, Canada

Phone: 519 582-2100 x1508
Fax:519-582-4571

Date Rec. : 21 October 2020
LR Report: **CA15330-OCT20**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**5: MAC**	**7: AO/OG**	**8: MDL**	**9: NR Test Well SW 11-09**	**10: NR Test Well SW12-20**
Sample Date & Time								20-Oct-20 12:10	20-Oct-20 12:00
Temperature Upon Receipt [°C]	---	---	--	--	--	---	---	11.0	11.0
pH [No unit]	23-Oct-20	07:48	23-Oct-20	16:18	---	6.5-8.5	0.05	8.14	8.16
Alkalinity [mg/L as CaCO3]	23-Oct-20	07:48	23-Oct-20	16:18	---	30-500	2	186	180
Carbonate [mg/L as CaCO3]	23-Oct-20	07:48	23-Oct-20	16:18	---	---	2	< 2	< 2
Bicarbonate [mg/L as CaCO3]	23-Oct-20	07:48	23-Oct-20	16:18	---	---	2	186	180
Conductivity [uS/cm]	23-Oct-20	07:48	23-Oct-20	16:18	---	---	2	447	414
Colour [TCU]	26-Oct-20	08:17	27-Oct-20	10:40	---	5	3	< 3	< 3
Total Suspended Solids [mg/L]	22-Oct-20	15:57	23-Oct-20	15:49	---	---	2	2	2
Total Dissolved Solids [mg/L]	22-Oct-20	14:16	27-Oct-20	11:32	---	500	30	280	269
Fluoride [mg/L]	22-Oct-20	14:08	23-Oct-20	12:42	1.5	---	0.06	0.55	0.47
Dissolved Organic Carbon [mg/L]	22-Oct-20	12:03	23-Oct-20	08:12	---	5	1	1	1
Total Organic Carbon [mg/L]	22-Oct-20	12:03	23-Oct-20	08:12	---	---	1	1	1
Ammonia+Ammonium (N) [mg/L]	22-Oct-20	17:31	23-Oct-20	14:54	---	---	0.04	0.11	0.08
Phosphorus (total reactive) [mg/L]	27-Oct-20	10:04	27-Oct-20	15:53	---	---	0.03	< 0.03	< 0.03
Chloride [mg/L]	05-Nov-20	20:58	06-Nov-20	16:02	---	250	0.04	5.8	6.0
Sulphate [mg/L]	05-Nov-20	20:58	06-Nov-20	16:02	---	500	0.04	50	47
Nitrite (as N) [mg/L]	24-Oct-20	12:20	27-Oct-20	12:55	1	---	0.003	0.003 <MDL	0.003 <MDL
Nitrate (as N) [mg/L]	24-Oct-20	12:20	27-Oct-20	12:55	10	---	0.006	0.006 <MDL	0.006 <MDL
Nitrate + Nitrite (as N) [mg/L]	24-Oct-20	12:20	27-Oct-20	12:55	---	---	0.006	0.006 <MDL	0.006 <MDL

OnLine LIMS

0002315010

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Test method information available upon request. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.
SGS Canada Inc. Environment-Health & Safety statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**5: MAC**	**7: AO/OG**	**8: MDL**	**9: NR Test Well SW 11-09**	**10: NR Test Well SW12-20**
Hardness [mg/L as CaCO3]	23-Oct-20	17:11	26-Oct-20	12:56	---	80-100	0.05	229	207
Silver [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.05	< 0.05	< 0.05
Antimony [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	6	---	0.09	< 0.09	< 0.09
Aluminum [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	100	1	3	422
Arsenic [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	10	---	0.2	< 0.2	0.3
Barium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	1000	---	0.02	198	150
Beryllium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.007	< 0.007	0.011
Boron [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	5000	---	2	48	71
Bismuth [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.007	< 0.007	< 0.007
Calcium [mg/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.01	63.5	57.4
Cadmium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	5	---	0.003	0.004	< 0.003
Cobalt [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.004	0.025	0.057
Chromium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	50	---	0.08	< 0.08	0.23
Copper [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	1000	0.2	12.9	2.8
Iron [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	300	7	477	411
Potassium [mg/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.009	0.828	0.786
Magnesium [mg/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.001	17.1	15.5
Manganese [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	50	0.01	14.0	21.6
Molybdenum [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.04	0.63	0.61
Sodium [mg/L]	23-Oct-20	17:11	26-Oct-20	12:54	20	200	0.01	7.89	6.49
Nickel [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.1	< 0.1	1.4
Lead [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	10	---	0.01	0.69	0.51
Phosphorus [mg/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.003	< 0.003	< 0.003
Selenium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	50	---	0.04	< 0.04	< 0.04
Silicon [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	20	9010	7020
Tin [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.06	0.15	< 0.06
Strontium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.02	1060	941
Titanium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.05	< 0.05	0.10
Thallium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.005	< 0.005	< 0.005
Uranium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	20	---	0.002	0.059	0.154
Vanadium [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	---	0.01	< 0.01	0.17
Zinc [ug/L]	23-Oct-20	17:11	26-Oct-20	12:54	---	5000	2	16	68

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SGS Canada Inc. Environment-Health & Safety statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
MDL - SGS Method Detection Limit
NR - Not regulated / reportable under applicable Provincial drinking water regulations as per client.

Dioxins/Furans - sub-contracted to Wellington laboratory.

PStark

Patti Stark
Project Specialist,
Environment, Health & Safety

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WELLINGTON LABORATORIES

345 Southgate Drive
Guelph ON N1G 3M5 CANADA
Tel: 519-822-2436
Fax: 519-822-2849

2020-280-LR	**CA 15330-OCT20**					
Table A: Dioxins and Furans: Water (ppq)						
			CA 15330-OCT20-9		CA 15330-OCT20-10	
	Lab Blank		Test Well		Test Well	
		# of	October 20/2020 at 12:10 pm	# of	October 20/2020 at 12:00 pm	# of
Furans:		pks		pks		pks
2378-TCDF	ND (1)		ND (1)		ND (1)	
Total TCDFs *	ND (1)		ND (1)		ND (1)	
12378-PeCDF	ND (1)		ND (1)		ND (1)	
23478-PeCDF	ND (1)		ND (1)		ND (1)	
Total PeCDFs *	ND (1)		ND (1)		ND (1)	
123478-HxCDF	ND (1)		ND (1)		ND (1)	
123678-HxCDF	ND (1)		ND (1)		ND (1)	
234678-HxCDF	ND (1)		ND (1)		ND (1)	
123789-HxCDF	ND (1)		ND (1)		ND (1)	
Total HxCDFs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDF	ND (1)		ND (1)		NDR (1)	
1234789-HpCDF	ND (1)		ND (1)		ND (1)	
Total HpCDFs *	ND (1)		ND (1)		ND (1)	
OCDF	ND (1)		ND (1)		ND (1)	
Dioxins:						
2378-TCDD	ND (1)		ND (1)		ND (1)	
Total TCDDs *	ND (1)		ND (1)		ND (1)	
12378-PeCDD	ND (1)		ND (1)		ND (1)	
Total PeCDDs *	ND (1)		ND (1)		ND (1)	
123478-HxCDD	ND (1)		ND (1)		ND (1)	
123678-HxCDD	ND (1)		ND (1)		ND (1)	
123789-HxCDD	ND (1)		ND (1)		ND (1)	
Total HxCDDs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDD	ND (1)		ND (1)		5.0	
Total HpCDDs *	ND (1)		ND (1)		11.0	2
OCDD	1	1	ND (1)		38.0	1
I-TEQ **	0.001 ppq		0 ppq		0.0880 ppq	
98 WHO TEQ (1/2 DL)**	1.69 ppq		1.69 ppq		1.74 ppq	
Approved By:	Dave Potter					
Signature:					November 12/2020 10:37 am	
					Date and Time	

Form: PCDD/PCDFs

Revision Number 1
Revision Date May 15/2012

2020-280-LR

Table A (cont.)

% Recovery of Surrogates:	Lab Blank	CA 15330-OCT20-9 Test Well October 20/2020 at 12:10 pm	CA 15330-OCT20-10 Test Well October 20/2020 at 12:00 pm
13C-2378-TCDF	92	79	100
13C-2378-TCDD	92	80	94
13C-12378-PeCDF	98	88	76
13C-23478-PeCDF	93	84	67
13C-12378-PeCDD	99	88	73
13C-123478-HxCDF	100	94	115
13C-123678-HxCDF	100	96	88
13C-234678-HxCDF	101	98	106
13C-123789-HxCDF	100	96	96
13C-123478-HxCDD	98	89	110
13C-123678-HxCDD	103	101	71
13C-1234678-HpCDF	104	103	105
13C-1234789-HpCDF	117	112	111
13C-1234678-HpCDD	108	100	100
13C-OCDD	107	106	110

ND - none detected (detection limits in brackets)
NDR - none detected based on peak ratio
NDS - none detected based on peak shape
DPE - diphenyl ether interference present
* Calculated as the sum of the individual named PCDDs/PCDFs and other detected unnamed PCDDs/PCDFs.
The summations do not include ND and NDR values.
** The reported TEQ is a calculated parameter.

Approved By: Dave Potter

Signature:

November 12/2020 10:37 am
Date and Time

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO#54858

10-November-2020

County of Norfolk (Non-Regulated)
Attn : Shaun Earls

183 Main Street
Delhi, ON
N4B 2M3, Canada

Phone: 519 582-2100 x1508
Fax:519-582-4571

Date Rec. : 24 October 2020
LR Report: **CA18850-OCT20**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MAC	6: Half MAC	7: AO/OG	8: MDL	9: NR Test Well SW11-09	10: NR Test Well SW12-20
Sample Date & Time									23-Oct-20 10:15	23-Oct-20 10:00
Temperature Upon Receipt [°C]	---	---	--	--	--	--	---	---	14.0	14.0
pH [No unit]	26-Oct-20	15:25	28-Oct-20	14:46	---	---	6.5-8.5	0.05	8.19	8.19
Alkalinity [mg/L as CaCO3]	26-Oct-20	15:25	28-Oct-20	14:46	---	---	30-500	2	190	197
Conductivity [uS/cm]	26-Oct-20	15:25	28-Oct-20	14:46	---	---	---	2	487	506
Carbonate [mg/L as CaCO3]	26-Oct-20	15:25	28-Oct-20	14:46	---	---	---	2	< 2	< 2
Bicarbonate [mg/L as CaCO3]	26-Oct-20	15:25	28-Oct-20	14:46	---	---	---	2	190	197
Colour [TCU]	26-Oct-20	08:17	27-Oct-20	10:44	---	---	5	3	< 3	< 3
Total Suspended Solids [mg/L]	26-Oct-20	13:13	28-Oct-20	14:10	---	---	---	2	< 2	2
Total Dissolved Solids [mg/L]	26-Oct-20	14:35	29-Oct-20	10:30	---	---	500	30	314	311
Fluoride [mg/L]	26-Oct-20	08:57	26-Oct-20	14:20	1.5	---	---	0.06	0.50	0.41
Dissolved Organic Carbon [mg/L]	26-Oct-20	16:54	28-Oct-20	12:59	---	---	5	1	1	1
Total Organic Carbon [mg/L]	26-Oct-20	16:54	28-Oct-20	12:59	---	---	---	1	2	< 1
Phosphorus (total reactive) [mg/L]	27-Oct-20	10:04	27-Oct-20	15:57	---	---	---	0.03	< 0.03	< 0.03
Ammonia+Ammonium (N) [mg/L]	26-Oct-20	18:14	27-Oct-20	13:03	---	---	---	0.04	0.12	0.08
Chloride [mg/L]	07-Nov-20	15:53	09-Nov-20	16:22	---	---	250	0.04	13	14
Sulphate [mg/L]	07-Nov-20	15:53	09-Nov-20	16:22	---	---	500	0.04	52	53
Nitrite (as N) [mg/L]	29-Oct-20	11:35	02-Nov-20	11:44	1	---	---	0.003	0.003 <MDL	0.009
Nitrate (as N) [mg/L]	29-Oct-20	11:35	02-Nov-20	11:44	10	---	---	0.006	0.006 <MDL	0.383
Nitrate + Nitrite (as N) [mg/L]	29-Oct-20	11:35	02-Nov-20	11:44	---	---	---	0.006	0.006 <MDL	0.392

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Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**5: MAC**	**6: Half MAC**	**7: AO/OG**	**8: MDL**	**9: NR Test Well SW11-09**	**10: NR Test Well SW12-20**
Hardness [mg/L as CaCO3]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	80-100	0.05	229	238
Silver [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.05	< 0.05	< 0.05
Antimony [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	6	3	---	0.09	0.10	< 0.09
Aluminum [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	100	1	18	25
Arsenic [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	10	5	---	0.2	< 0.2	0.2
Barium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	1000	500	---	0.02	218	156
Beryllium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.007	< 0.007	< 0.007
Boron [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	5000	2500	---	2	47	44
Bismuth [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.007	< 0.007	< 0.007
Calcium [mg/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.01	62.6	65.6
Cadmium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	5	2.5	---	0.003	< 0.003	< 0.003
Cobalt [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.004	0.011	0.048
Chromium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	50	25	---	0.08	0.11	0.09
Copper [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	1000	0.2	1.2	0.7
Iron [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	300	7	482	396
Potassium [mg/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.009	0.796	0.790
Magnesium [mg/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.001	17.7	18.1
Manganese [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	50	0.01	14.2	24.1
Molybdenum [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.04	0.28	0.45
Sodium [mg/L]	27-Oct-20	22:34	28-Oct-20	16:04	20	---	200	0.01	10.2	11.0
Nickel [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.1	0.2	0.4
Lead [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	10	5	---	0.01	0.06	0.23
Phosphorus [mg/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.003	< 0.003	< 0.003
Selenium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	50	25	---	0.04	< 0.04	< 0.04
Tin [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.06	< 0.06	< 0.06
Strontium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.02	1140	758
Titanium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.05	< 0.05	< 0.05
Thallium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.005	< 0.005	< 0.005
Uranium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	20	10	---	0.002	< 0.002	0.129
Vanadium [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	0.01	< 0.01	0.05
Zinc [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	5000	2	5	15
Silicon [ug/L]	27-Oct-20	22:34	28-Oct-20	16:04	---	---	---	20	8670	6890

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MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
MDL - SGS Method Detection Limit
NR - Not regulated / reportable under applicable Provincial drinking water regulations as per client.

Dioxins/Furans - sub-contracted to Wellington laboratory.

PStark

Patti Stark
Project Specialist,
Environment, Health & Safety

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2020-287-LR **CA 18850-OCT20**

Table A: Dioxins and Furans: Water (ppq)

	Lab Blank	# of pks	CA 18850-OCT20-9 Testwell October 23/2020 at 10:15 am	# of pks	CA 18850-OCT20-10 Testwell October 23/2020 at 10:00 am	# of pks
Furans:						
2378-TCDF	ND (1)		ND (1)		ND (1)	
Total TCDFs *	ND (1)		ND (1)		ND (1)	
12378-PeCDF	ND (1)		ND (1)		ND (1)	
23478-PeCDF	ND (1)		ND (1)		ND (1)	
Total PeCDFs *	ND (1)		ND (1)		ND (1)	
123478-HxCDF	ND (1)		ND (1)		ND (1)	
123678-HxCDF	ND (1)		ND (1)		ND (1)	
234678-HxCDF	ND (1)		ND (1)		ND (1)	
123789-HxCDF	ND (1)		ND (1)		ND (1)	
Total HxCDFs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDF	ND (1)		ND (1)		ND (1)	
1234789-HpCDF	ND (1)		ND (1)		ND (1)	
Total HpCDFs *	ND (1)		ND (1)		ND (1)	
OCDF	ND (1)		ND (1)		ND (1)	
Dioxins:						
2378-TCDD	ND (1)		ND (1)		ND (1)	
Total TCDDs *	ND (1)		ND (1)		ND (1)	
12378-PeCDD	ND (1)		ND (1)		ND (1)	
Total PeCDDs *	ND (1)		ND (1)		ND (1)	
123478-HxCDD	ND (1)		ND (1)		ND (1)	
123678-HxCDD	ND (1)		ND (1)		ND (1)	
123789-HxCDD	ND (1)		ND (1)		ND (1)	
Total HxCDDs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDD	ND (1)		ND (1)		ND (1)	
Total HpCDDs *	ND (1)		ND (1)		ND (1)	
OCDD	ND (1)		ND (1)		ND (1)	
I-TEQ **	0 ppq		0 ppq		0 ppq	
98 WHO TEQ (1/2 DL)**	1.69 ppq		1.69 ppq		1.69 ppq	

Approved By: Dave Potter

Signature: Dave Potter

November 25/2020 10:38 am
Date and Time

2020-287-LR

Table A (cont.)

	Lab Blank	CA 18850-OCT20-9 Testwell October 23/2020 at 10:15 am	CA 18850-OCT20-10 Testwell October 23/2020 at 10:00 am
% Recovery of Surrogates:			
13C-2378-TCDF	105	105	88
13C-2378-TCDD	102	105	90
13C-12378-PeCDF	96	100	89
13C-23478-PeCDF	91	94	87
13C-12378-PeCDD	95	101	93
13C-123478-HxCDF	98	105	92
13C-123678-HxCDF	96	106	90
13C-234678-HxCDF	105	108	93
13C-123789-HxCDF	112	107	92
13C-123478-HxCDD	96	104	93
13C-123678-HxCDD	107	120	94
13C-1234678-HpCDF	95	103	91
13C-1234789-HpCDF	105	117	97
13C-1234678-HpCDD	99	108	93
13C-OCDD	95	113	91

ND - none detected (detection limits in brackets)
NDR - none detected based on peak ratio
NDS - none detected based on peak shape
DPE - diphenyl ether interference present

* Calculated as the sum of the individual named PCDDs/PCDFs and other detected unnamed PCDDs/PCDFs.
The summations do not include ND and NDR values.

** The reported TEQ is a calculated parameter.

Approved By: Dave Potter

Signature: Dave Potter

November 25/2020 10:38 am
Date and Time

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Phone: 705-652-2000 FAX: 705-652-6365

Project : PO#54858

10-November-2020

County of Norfolk (Non-Regulated)
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Date Rec. : 28 October 2020
LR Report: **CA15462-OCT20**

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**5: MAC**	**7: AO/OG**	**8: MDL**	**9: NR Test Well SW11-09**	**10: NR Test Well SW12-20**
Sample Date & Time								27-Oct-20 09:45	27-Oct-20 09:30
Temperature Upon Receipt [°C]	---	---	--	--	--	---	---	8.0	8.0
Gross Alpha [Bq/L]	02-Nov-20	10:31	04-Nov-20	13:38	---	---	0.1	< 0.1	< 0.1
Gross Beta [Bq/L]	02-Nov-20	10:31	04-Nov-20	13:38	---	---	0.1	0.1	0.1
pH [No unit]	29-Oct-20	14:17	30-Oct-20	16:52	---	6.5-8.5	0.05	8.14	8.19
Alkalinity [mg/L as CaCO3]	29-Oct-20	14:17	30-Oct-20	16:52	---	30-500	2	179	207
Conductivity [uS/cm]	29-Oct-20	14:17	30-Oct-20	16:52	---	---	2	488	518
Bicarbonate [mg/L as CaCO3]	29-Oct-20	14:17	30-Oct-20	16:52	---	---	2	179	207
Carbonate [mg/L as CaCO3]	29-Oct-20	14:17	30-Oct-20	16:52	---	---	2	< 2	< 2
Colour [TCU]	29-Oct-20	14:56	30-Oct-20	10:00	---	5	3	< 3	< 3
Total Suspended Solids [mg/L]	28-Oct-20	15:16	29-Oct-20	15:50	---	---	2	< 2	2
Total Dissolved Solids [mg/L]	28-Oct-20	15:15	30-Oct-20	09:32	---	500	30	311	320
Fluoride [mg/L]	29-Oct-20	10:02	29-Oct-20	14:05	1.5	---	0.06	0.48	0.44
Dissolved Organic Carbon [mg/L]	04-Nov-20	06:41	04-Nov-20	14:33	---	5	1	1	1
Total Organic Carbon [mg/L]	04-Nov-20	06:41	04-Nov-20	14:33	---	---	1	< 1	< 1
Ammonia+Ammonium (N) [mg/L]	28-Oct-20	20:23	30-Oct-20	11:03	---	---	0.04	0.12	0.08
Phosphorus (total reactive) [mg/L]	30-Oct-20	10:07	02-Nov-20	13:05	---	---	0.03	< 0.03	< 0.03
Chloride [mg/L]	10-Nov-20	03:34	10-Nov-20	14:13	---	250	0.04	17	18
Sulphate [mg/L]	10-Nov-20	03:34	10-Nov-20	14:13	---	500	0.04	54	57
Nitrite (as N) [mg/L]	30-Oct-20	18:34	03-Nov-20	12:03	1	---	0.003	0.003 <MDL	0.004
Nitrate (as N) [mg/L]	30-Oct-20	18:34	03-Nov-20	12:03	10	---	0.006	0.006 <MDL	0.247
Nitrate + Nitrite (as N) [mg/L]	30-Oct-20	18:34	03-Nov-20	12:03	---	---	0.006	0.006 <MDL	0.251
Hardness [mg/L as CaCO3]	04-Nov-20	04:12	04-Nov-20	10:16	---	80-100	0.05	252	271
Silver [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.05	< 0.05	< 0.05
Antimony [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	6	---	0.09	< 0.09	< 0.09
Aluminum [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	100	1	7	16
Arsenic [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	10	---	0.2	< 0.2	0.3
Barium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	1000	---	0.02	230	156
Beryllium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.007	< 0.007	< 0.007
Boron [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	5000	---	2	51	41
Bismuth [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.007	< 0.007	< 0.007
Calcium [mg/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.01	68.3	76.2
Cadmium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	5	---	0.003	< 0.003	< 0.003
Cobalt [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.004	0.013	0.053
Chromium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	50	---	0.08	< 0.08	< 0.08
Copper [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	1000	0.2	2.3	0.2
Iron [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	300	7	495	415

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Project : PO#54858
LR Report : **CA15462-OCT20**

Analysis	**1: Analysis Start Date**	**2: Analysis Start Time**	**3: Analysis Completed Date**	**4: Analysis Completed Time**	**5: MAC**	**7: AO/OG**	**8: MDL**	**9: NR Test Well SW11-09**	**10: NR Test Well SW12-20**
Potassium [mg/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.009	0.830	0.854
Magnesium [mg/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.001	19.8	19.5
Manganese [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	50	0.01	14.8	27.8
Molybdenum [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.04	0.26	0.46
Sodium [mg/L]	04-Nov-20	04:12	04-Nov-20	10:16	20	200	0.01	12.3	11.9
Nickel [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.1	< 0.1	< 0.1
Lead [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	10	---	0.01	0.11	0.14
Phosphorus [mg/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.003	< 0.003	0.003
Selenium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	50	---	0.04	< 0.04	0.04
Silicon [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	20	8890	7560
Tin [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.06	< 0.06	0.06
Strontium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.02	1190	751
Titanium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.05	< 0.05	< 0.05
Thallium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.005	< 0.005	< 0.005
Uranium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	20	---	0.002	0.011	0.196
Vanadium [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	---	0.01	0.02	0.04
Zinc [ug/L]	04-Nov-20	04:12	04-Nov-20	10:16	---	5000	2	4	21

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
MDL - SGS Method Detection Limit
NR - Not regulated / reportable under applicable Provincial drinking water regulations as per client.

Dioxins/Furans - sub-contracted to Wellington laboratory.

Patti Stark
Project Specialist,
Environment, Health & Safety

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Tel: 519-822-2436
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2020-289-LR **CA 15462-OCT20**

Table A: Dioxins and Furans: Water (ppq)

	Lab Blank	# of pks	CA 15462-OCT20-9 Testwell October 27/2020 at 09:45 am	# of pks	CA 15462-OCT20-10 Testwell October 27/2020 at 09:30 am	# of pks
Furans:						
2378-TCDF	ND (1)		ND (1)		ND (1)	
Total TCDFs *	ND (1)		ND (1)		ND (1)	
12378-PeCDF	ND (1)		ND (1)		ND (1)	
23478-PeCDF	ND (1)		ND (1)		ND (1)	
Total PeCDFs *	ND (1)		ND (1)		ND (1)	
123478-HxCDF	ND (1)		ND (1)		ND (1)	
123678-HxCDF	ND (1)		ND (1)		ND (1)	
234678-HxCDF	ND (1)		ND (1)		ND (1)	
123789-HxCDF	ND (1)		ND (1)		ND (1)	
Total HxCDFs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDF	ND (1)		ND (1)		ND (1)	
1234789-HpCDF	ND (1)		ND (1)		ND (1)	
Total HpCDFs *	ND (1)		ND (1)		ND (1)	
OCDF	ND (1)		ND (1)		ND (1)	
Dioxins:						
2378-TCDD	ND (1)		ND (1)		ND (1)	
Total TCDDs *	ND (1)		ND (1)		ND (1)	
12378-PeCDD	ND (1)		ND (1)		ND (1)	
Total PeCDDs *	ND (1)		ND (1)		ND (1)	
123478-HxCDD	ND (1)		ND (1)		ND (1)	
123678-HxCDD	ND (1)		ND (1)		ND (1)	
123789-HxCDD	ND (1)		ND (1)		ND (1)	
Total HxCDDs *	ND (1)		ND (1)		ND (1)	
1234678-HpCDD	ND (1)		ND (1)		ND (1)	
Total HpCDDs *	ND (1)		ND (1)		ND (1)	
OCDD	ND (1)		ND (1)		ND (1)	
I-TEQ **	0 ppq		0 ppq		0 ppq	
98 WHO TEQ (1/2 DL)**	1.69 ppq		1.69 ppq		1.69 ppq	

Approved By: Dave Potter

Signature:

November 25/2020 10:54 am
Date and Time

2020-289-LR

Table A (cont.)

	Lab Blank	CA 15462-OCT20-9 Testwell October 27/2020 at 09:45 am	CA 15462-OCT20-10 Testwell October 27/2020 at 09:30 am
% Recovery of Surrogates:			
13C-2378-TCDF	105	92	91
13C-2378-TCDD	102	90	93
13C-12378-PeCDF	96	87	90
13C-23478-PeCDF	91	81	86
13C-12378-PeCDD	95	91	99
13C-123478-HxCDF	98	91	89
13C-123678-HxCDF	96	91	95
13C-234678-HxCDF	105	95	97
13C-123789-HxCDF	112	95	95
13C-123478-HxCDD	96	93	92
13C-123678-HxCDD	107	105	101
13C-1234678-HpCDF	95	92	96
13C-1234789-HpCDF	105	100	103
13C-1234678-HpCDD	99	97	98
13C-OCDD	95	100	98

ND - none detected (detection limits in brackets)
NDR - none detected based on peak ratio
NDS - none detected based on peak shape
DPE - diphenyl ether interference present
* Calculated as the sum of the individual named PCDDs/PCDFs and other detected unnamed PCDDs/PCDFs.
The summations do not include ND and NDR values.
** The reported TEQ is a calculated parameter.

Approved By: Dave Potter

Signature: Dave Potter

November 25/2020 10:54 am
Date and Time

Appendix C

Vallee Report

vallee
Consulting Engineers,
Architects & Planners

August 12, 2022

Banks Groundwater Engineering Limited
940 Watson Road South
RR 1 Puslinch ON N0B 2J0

Attention: **Mr. Bill Banks, P. Eng.**

Reference: **Watermain Route Evaluation election – Simcoe Water Supply Class EA**
Simcoe - Norfolk County
Our Project 10115

We understand that the community of Simcoe in Norfolk County requires additional potable water capacity, and that you are undertaking a Schedule "B" Class Environmental Assessment to determine the preferred solution and design for this problem. To date in the process, you have identified a new ground water well to be located north and east of Simcoe to be an attractive alternative.

G. Douglas Vallee Limited has been retained to evaluate alternatives for the transmission of raw ground water from that proposed well site to the existing treatment plant on 14th Street West in Simcoe. A draft report was prepared and submitted in 2011. Please accept this as our update to that report to reflect 2022 construction dollars and a general confirmation of the evaluation of the routes.

THE FOUR ROUTES

Four (4) routes have been considered. These routes are identified on the attached drawing, and are described as follows:

Route A: Stone Quarry Road

This route will commence at the existing treatment plant located on 14th Street West. The route travels as follows:

- Easterly along 14th Street West
- Turns northerly and follows Glenndale Cres to the intersection of Highway 24 (Norfolk Street) and 14th Street East.
- Turns northerly and follows Highway 24 to Stone Quarry Road.
- Turns easterly and follows Stone Quarry Road to Cloet Road,
- Turns northerly and follows Cloet Road to the well field.

Route B: Highway 24

This route will commence at the existing treatment plant located on 14th Street West. The route travels as follows:

- Easterly along 14th Street West
- Turns northerly and follows Glendale Cres to the intersection of Highway 24 (Norfolk Street) and 14th Street East.
- Turns northerly and follows Highway 24 to Regional Road 24 (Bloomsburg Road)
- Turns easterly and follows Bloomsburg Road to the proposed well field.

Route C: Rail Trail

This route will commence at the existing treatment plant located on 14th Street West. The route travels as follows:

- Easterly along 14th Street West
- Turns northerly and follows Glendale Cres to the intersection of Highway 24 (Norfolk Street) and 14th Street East.
- The route crosses Highway 24 and continues along 14th Street East to the Norfolk County Rail Trail.
- The route then follows the Rail Trail northerly to Stone Quarry Road.
- Crosses Stone Quarry Road and continues northerly on the Rail Trail to the proposed well field.

It is important to note that south of Stone Quarry Road the Rail Trail is owned by Norfolk County, however, north of Stone Quarry Road the Rail Trail is owned by the Ontario Realty Corporation.

Route D: Rail Trail / Stone Quarry Road

This route will commence at the existing treatment plant located on 14th Street West. The route travels as follows:

- Easterly along 14th Street West
- Turns northerly and follows Glendale Cres to the intersection of Highway 24 (Norfolk Street) and 14th Street East.
- Crosses Highway 24 and continues along 14th Street East to the Norfolk County Rail Trail.
- Then follows the Rail Trail northerly to Stone Quarry Road.
- Turns easterly and follows Stone Quarry Road to Cloet Road,
- Then follows Cloet Road northerly to the well field.

EVALUATION OF THE ROUTES

The four routes for this watermain have been evaluated considering the following issues:

1. Opinion of Total Project Cost
2. Approval requirements / land ownership
3. Accessibility for construction and maintenance
4. Coordination with Simcoe to Townsend Transmission Watermain
5. Environmental impacts

Opinion of Total Project Cost

Itemized opinions of total project cost have been prepared for each of the four routes. Those estimates are attached to this memo and include:

- Construction Cost
- Contingency of 15% of construction costs
- Engineering at 10% of construction costs
- HST at 13%

The opinions of total project cost are summarized as follows:

Route	Opinion of Total Project Cost	Relative Placing (1 = Worst, 4 = Best)
A: Stone Quarry Road	$7,095,270	1
B: Highway 24	$6,985,095	2
C: Rail Trail	$5,259,020	4
D: Rail Trail / Stone Quarry Road	$6,610,500	3

Routes A and B are considered to be the most expensive solutions given the high urban nature of this routes and predominantly following roadways. Restoration costs will be highest for these routes, and traffic control during construction will also be the most expensive. With Highway 24, the Ministry of Transportation owns a significant portion of this route, and their requirements for design, construction, testing, and procedures are anticipated to add significant cost to the project. These routes are the least preferred with respect to construction cost.

Route C: Rail Trail is considered to be the least expensive solution since the majority of the route is along a gravel walking trail requiring minimal restoration expense. Traffic control is minimized and construction access is good, making this the preferred route in this regard.

Routes A and D are similar with Route D having the advantage of avoiding the MTO lands.

The above assessment of relative construction cost has been completed based on the assumption that the watermain would be constructed by open cut. As an alternative construction method, trenchless technologies may also be possible. The advantage of trenchless technologies versus open cut is that the restoration costs can be reduced significantly. It is beyond the scope of this report to optimize the design of the watermain from the proposed new well to the treatment facility, however the following can be offered to show that the relative construction cost by trenchless methods would be of a similar relative placing as summarized above for open cut construction.

In general, the installation of a watermain by trenchless methods involves the excavation of entry and exit pits at periodic intervals along a route. The route is then drilled / bored / tunnelled from pit to pit and the pipe pulled through. The frequency of the pits and the distance between them depends on the pipe diameter and the nature of the native soil.

In general, for this project it is not unreasonable to assume that the frequency and distance between pits would be very similar regardless of which route of this report was being constructed. As long as the overall lengths do not differ such that the number of pits would not double or triple, the unit cost per length of route for the construction by trenchless methods would differ minimally from route to route. Therefore, the relative placing of the construction costs for trenchless construction along the routes of this report would be very similar to the relative placing of the overall lengths of each route. These lengths can be summarized, along with the relative placing, as follows:

Route	**Overall Length (m)**	**Relative Placing (1 = Worst, 4 = Best)**
A: Stone Quarry Road	6200	1
B: Highway 24	6100	2
C: Rail Trail	4900	4
D: Rail Trail / Stone Quarry Road	5950	3

The relative placing of the route lengths is similar to the relative placing of the Opinions of Total Project Cost.by open cut construction. It can therefore be extended that a similar relative placing of Opinions of Total Project Cost by trenchless technologies would be achieved. We do note that once the project progresses to implementation, the construction methods should be reviewed to optimize the overall design for constructability with the intention to control construction costs.

Approval Requirements / Land Ownership

The approval requirements for each route depend largely upon the ownership of the route and the owner's standards and requirements. We do note that historically the MTO has not allowed deep buried infrastructures withing their ROW. This was confirmed in 2011 for the purposes of this project and is understood to remain the position currently in place. The anticipated approval requirements are summarized in the following chart.

Route	**Approval Requirements / Land Ownership**	**Relative Placing (1 = Worst; 4 = Best)**
A: Stone Quarry Road	• Majority of works on Norfolk County Road allowances and Highway 24 connecting link • MTO Highway occupation on Highway 24 between 13th Street West and 13th Street East (Stone Quarry Road) • MTO has indicated that "deep trunk watermain services are not permitted along our corridor." • Approval by MTO may be impossible	1
B: Highway 24	• MTO has indicated that "deep trunk watermain services are not permitted along our corridor." • Approval by MTO may be impossible	1
C: Rail Trail	• Majority of route on Norfolk County Road allowances • Crossing of Highway 24 connecting link with simple approval anticipated • Northern section of rail trail on ORC lands and approval / permission from ORC required	3
D: Rail Trail / Stone Quarry Road	• All on Norfolk County Road allowances or Norfolk County owned trail. • Crossing of Highway 24 connecting link with simple approval anticipated • No MTO or ORC involvement	4

Accessibility for Construction and Maintenance

It is important that Norfolk County be able to easily access the entire route with heavy construction equipment for the purposes of constructing the watermain, and for subsequent maintenance work. Issues related to accessibility are summarized in the following chart.

Route	Accessibility	Relative Placing (1 = Worst; 4 = Best)
A: Stone Quarry Road	• All on Norfolk County Road allowances and Highway 24 • Excellent access	4
B: Highway 24	• Good access subject to MTO conditions	3
C: Rail Trail	• Portion on County roads provides excellent access. • Rail trail provides good access, however some limitation during construction due to lack of width of the trail. • Construction or maintenance equipment must enter from ends of trail at cross roads • Potential snow removal issue if emergency access is required during the winter months	2
D: Rail Trail / Stone Quarry Road	• Portion on County roads provides excellent access. • Rail trail provides good access, however some limitation during construction due to lack of width. Construction equipment must enter from ends of trail at cross roads • Potential snow removal issue if emergency access is required during the winter months • Shorter distance on rail trail compared to Route C	2

Coordination with Simcoe to Townsend Transmission Watermain

Norfolk County has recently awarded the design, inspection and contract administration project for a transmission watermain from Simcoe to Townsend. The proposed route of the Simcoe to Townsend Watermain is along 14th Street to Glendale Crescent to the Rail Trail to Concession 13 / Stone Quarry Road. This route overlaps significant lengths of all route options being evaluated by this letter report.

It is noted that the watermain from this report is intended to deliver raw water to the County's treatment facility on 14th Street. The Simcoe to Townsend Watermain will be deliver potable water to the Simcoe distribution system and therefore, the watermains can not be inter-connected. However, the mains can be constructed at the same time to make the installation in overlapping areas as efficient as possible and avoid two separate construction projects along the same routes.

The following table summarizes the overlapping sections for each of the proposed routes for the raw water watermain

Route	**Overlapping Sections with the Simcoe to Townsend Watermain**	**Relative Placing (1 = Worst; 4 = Best)**
A: Stone Quarry Road	• 14th Street from Treatment Facility to Glendale Crecent • Glendale Crescent to Norfolk Street • 13th Concession / Stone Quarry Road to Cloet Road	2
B: Highway 24	• 14th Street from Treatment Facility to Glendale Crecent • Glendale Crescent to Norfolk Street	1
C: Rail Trail	• 14th Street from Treatment Facility to Glendale Crecent • Glendale Crescent to Rail Trail • Rail Trail to 13th Concession / Stone Quarry Road	3
D: Rail Trail / Stone Quarry Road	• 14th Street from Treatment Facility to Glendale Crecent • Glendale Crescent to Rail Trail • Rail Trail to 13th Concession / Stone Quarry Road • 13th Concession / Stone Quarry Road to Cloet Road	4

Environmental Impacts

The assessment of environmental impacts includes consideration of the social, economic and natural environments.

The social environment in this area of Norfolk County is to be discussed in detail in the overall Project File Report and therefore this is not repeated here. The differential in social impacts between the considered routes is small. Construction along main highways (Highway 24) could result in inconvenience to the travelling public, while construction along a rail trail could inconvenience the hiking public. In any case, this inconvenience is anticipated to be small, and of short duration. Since a smaller number of people will be impacted by the rail trial route, its impact is expected to be less than construction along roadways.

The economic environment in this area of Norfolk County is also to be discussed in detail in the overall Project File Report and therefore is not repeated here. Clearly the lowest cost proposal will have the least economic impact on Norfolk County and its taxpayers, and therefore is a favoured alternative from this perspective.

The natural environment in this area of Norfolk County is also to be discussed in detail in the overall Project File Report and therefore is not repeated here. The subject rail trails have recently been constructed by Norfolk County, and therefore the required clearing of trees and vegetation is already complete. There is no significant impact in this regard. The placing of watermains on public roadways or rail trails is seen as having negligible environmental impact, and is in fact standard procedure within the Province of Ontario. There are no perceived natural environmental impacts that separate these routes alternatives.

Route	**Environmental Impact**	**Relative Placing (1 = Worst; 4 = Best)**
A: Stone Quarry Road	• Disruption of traffic on all portions of this route • Contains one concession of four lane Highway 24 with potential delay impacts for construction	1
B: Highway 24	• Disruption of traffic on all portions of this route • Contains two concessions of four lane Highway 24 with potential delay impacts for construction	2
C: Rail Trail	• Minimizes traffic disruptions • Provides disruption to hiking pedestrians while trial closed during construction • Eliminates work on four lane Highway 24	4
D: Rail Trail / Stone Quarry Road	• Moderate traffic disruptions • Provides disruption to hiking pedestrians while trial closed during construction • Eliminates work on four lane Highway 24	3

SUMMARY

Four routes for a watermain between the proposed well field and the existing treatment plant have been evaluated considering the following issues:

1. Construction cost
2. Approval requirements / land ownership
3. Accessibility for construction and maintenance
4. Coordination with Simcoe to Townsend Transmission Watermain
5. Environmental impacts

The results of this evaluation based on the sum of the relative placings for each issue, with the lowest relative placing representing the worst route and the highest relative placing representing the best route, are as follows:

Route	Opinion of Total Project Cost Placing	Approval Requirements / Land Ownership Placing	Accessibility for Construction and Maintenance Placing	Coordination with Simcoe to Townsend Watermain Placing	Environmental Impacts Placing	Sum of All Placings (Lowest = Worst; Highest = Best)
A: Stone Quarry Road	1	1	4	2	1	9
B: Highway 24	2	1	3	1	2	9
C: Rail Trail	4	3	2	3	4	16
D: Rail Trail / Stone Quarry Road	3	4	2	4	3	16

Based on this analysis, we recommend the following:

1. That **Route C: Rail Trail** be selected as the "preferred route and design" subject to Norfolk County securing a suitable agreement with the Ontario Realty Corporation for the use or purchase of the rail trail between Stone Quarry Road and Bloomsburg Road.

2. That **Route D: Rail Trail / Stone Quarry Road** be the alternative "preferred route and design" to be used in the event that Norfolk County is unable to reach a suitable agreement with the Ontario Realty Corporation for the use or purchase of the rail trail between Stone Quarry Road and Bloomsburg Road.

I trust that this report is clear and to your satisfaction. Should you have any questions or comments, please feel free to contact our office at any time.

Yours very truly,

T. Gregory Smith, P.Eng.
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planner
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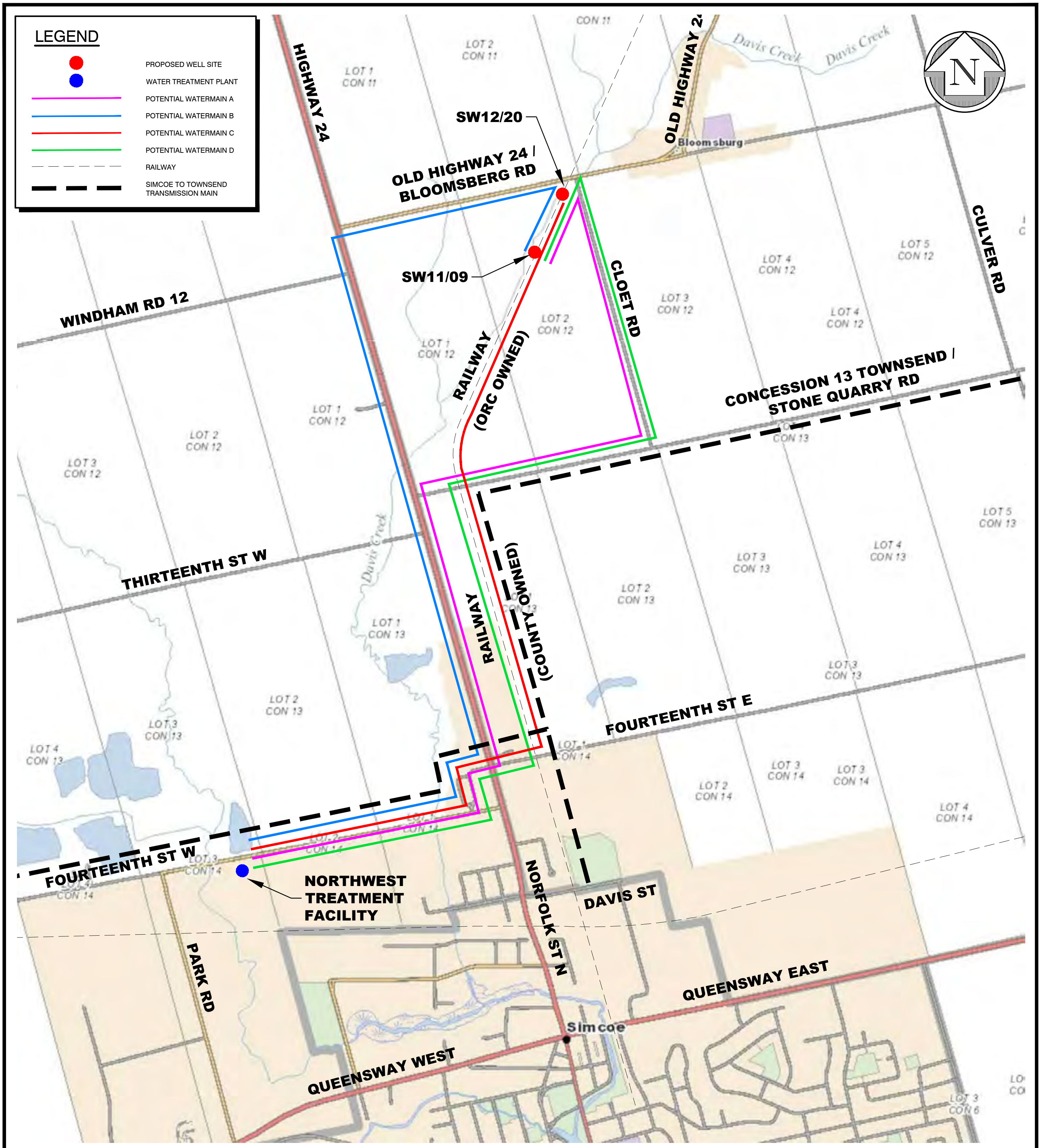

vallee

Consulting Engineers, Architects & Planners

G. DOUGLAS VALLEE LIMITED
2 TALBOT STREET NORTH
SIMCOE, ONTARIO N3Y 3W4
(519) 426-6270

Stamp

REV. No.	DATE	REVISION

Project Title : COMMUNITY OF SIMCOE WATER SUPPLY

Location : SIMCOE - NORFOLK COUNTY

Drawing Title : POTENTIAL MUNICIPAL WELL AND WATERMAIN OPTIONS

Designed by : NLB
Drawn By : NLB
Project No. 10-115

Checked by : TGS
Drawing Scale : 1: 25000
Drawing No. FIG1

Date Started : JUNE 16, 2022

DATE LAST PLOTTED : August 8, 2022

S. BURNETT
& ASSOCIATES LIMITED
ENGINEERING & ENVIRONMENTAL

Appendix D

Natural Environment Reports

Simcoe Water Supply Class EA

Natural Environment Assessment Report

Prepared for:

Banks Groundwater Engineering
940 Watson Road South, RR1
Puslinch, Ontario
N0B 2C0

Project No. 2250A | February 2021

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Simcoe Water Supply Class EA

Natural Environment Assessment Report

Project Team

Tara Brenton	Senior Biologist, Certified Arborist, Project Advisor
Ken Burrell	Terrestrial and Wetland Biologist, Project Manager
Josh Pickering	Terrestrial and Wetland Biologist
Kaitlin Filippov	GIS Specialist
Kayla Ellis	Terrestrial and Wetland Biologist, Certified Arborist
Lillian Knopf	Terrestrial and Wetland Biologist
Nick Allen	Aquatic Biologist
Nyssa Hardie	Ecohydrologist
Pat Deacon	Terrestrial and Wetland Biologist

Report submitted on February 12, 2021

Tara Brenton

Tara Brenton
Project Advisor
Senior Terrestrial and Wetland Biologist, Certified Arborist

Ken Burrell
Project Manager
Terrestrial and Wetland Biologist

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained by Banks Groundwater Engineering in April 2019 to complete a Natural Environment Assessment Report (NEAR) as part of the required Municipal Class Environmental Assessment (EA) to facilitate the approval for a new municipal groundwater supply source for the Community of Simcoe, Norfolk County, Ontario. The proposed project requires the completion and submission of a NEAR in accordance with the requirements of the Municipal Class Environmental Assessment (MEA 2015).

For the purposes of this report, the “study area” refers to the lands located southeast of Bloomsburg and northeast of the Community of Simcoe in Norfolk County, Ontario as shown on Map 1. The study area contains a portion of the hamlet of Bloomsburg, a stretch of the Waterford Heritage Trail, a highway (Old Highway 24), two secondary roads (Cloet Road and Concession 12 Townsend), Davis Creek, and several wetlands, forests, hedgerows as well as agricultural fields.

To-date considerable groundwater testing and biological work has been completed in support of the approval for a new municipal groundwater supply source for the Community of Simcoe, and is summarized in the *Revised Draft Report 2012 Monitoring and Aquifer Testing Program* (Banks Groundwater Engineering Limited 2015) and the *Community of Simcoe Additional Water Supply Class EA – Fisheries Update and Preliminary Fisheries Risk Self Assessment* (Golder 2015). As part of the current groundwater testing program, a 7-day aquifer testing program was completed at two test pumping discharge locations within the study area by Banks Groundwater Engineering Ltd. in 2020. It is anticipated that these two test production wells will become the municipal well-sites used to supply groundwater to the Community of Simcoe. The effects of this testing program on the biological community as assessed by NRSI are discussed in this report.

Existing natural features within the study area are limited to the wetland, forest, and thicket communities which are located near or adjacent to Davis Creek (Map 1). The Norfolk County Official Plan (OP, 2020) (Schedule C-1; and C-4) identifies the presence of two “Significant Woodland” features within the western portion of the study area. The watercourse feature present in the study area, identified as Davis Creek, falls within the regulation area of the Long Point Region Conservation Authority (LPRCA) and is subject to Ontario Regulation 178/06 (2013). The watercourse is classified as a tributary of the Lynn-Black Creek Watershed and is located outside any areas of Source Water Protection by the Norfolk County OP (2020)

(Schedule D-1; D-4; and D-5). Davis Creek receives drainage from the surrounding area northeast of Bloomsburg and continues to flow west across Highway 24 and into the Community of Simcoe. The study area is located within an area of "Significant Groundwater Recharge" (Norfolk County 2020) (Schedule D-7).

This report summarizes relevant background information on natural heritage features within the study area as well as the results of field surveys completed by NRSI biologists to accurately characterize the existing natural environment conditions. This detailed characterization is to inform an analysis of natural feature significance and sensitivity within the study area with consideration for applicable municipal, and provincial legislation and regulations.

1.1 Relevant Policies, Legislation, and Planning Studies

Natural heritage features within the study area were assessed for significance by evaluating them against relevant policies, legislation, and planning studies. Table 1 provides an overview of policies and an analysis of natural features within the study area. The specific implications of these policies are provided to the study team, while identifying areas to avoid and/or mitigate for.

Table 1. Relevant Policies, Legislation, and Planning Studies

Policy/Legislation	Description	Project Relevance
Provincial Policy Statement (PPS) (OMMAH 2014).	- Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as 'significant'. - The Natural Heritage Reference Manual (MNRF 2010) and the Significant Wildlife Habitat Technical Guide (OMNR 2000, OMNR 2015) were prepared by the MNRF to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	- Background review and field observations confirmed the presence of several significant natural features and Signification Wildlife Habitat (SWH) types in the study area. - Section 2.1.5 of the PPS states that development or site alteration shall not be permitted in SWH in Ecoregion 7E unless it has been demonstrated that there will be no negative impacts on the features or their ecological functions.
Endangered Species Act (ESA) (Government of Ontario 2019)	- The ESA prohibits killing, harming, harassing, or capturing SAR and protects their habitats from damage and destruction.	- Based on the background review and SAR/SCC screening, several candidate SAR and SCC were reported within the vicinity of the study area, and several species were observed within the study area during field investigations.
Migratory Birds Convention Act (Government of Canada 2019)	- The MBCA protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment and was assented in 1994. - Prohibits the disturbance, destruction, or taking of a nest or eggs of migratory birds. - The schedule of on-site work must consider MBCA timing windows, with the breeding bird season typically occurring between April 1 and August 31, however, this is a guideline, since the MBCA applies to nesting bird species at any time. - "Incidental take" is considered illegal, with the exception of a permit obtained by the Canadian Wildlife Service (CWS).	- The timing of construction activities, especially vegetation clearing and site grading, must have consideration for the MBCA.
Fish and Wildlife Conservation Act (Government of Canada 2019)	- The FWCA provides protection for certain bird species not protected under the MBCA (e.g., raptors), as well as furbearing mammals and their dens or habitual dwellings, aside from the Red Fox (*Vulpes vulpes*) and Striped Skunk (*Mephitis mephitis*).	- The timing of construction activities, especially vegetation clearing and site grading, must have consideration for bird nesting and den sites of furbearing mammals.
Norfolk County Official Plan (2020)	- Natural heritage objectives to be met regarding proposed development within or adjacent to identified natural heritage features outlined in Section 3.0 and Schedule "C" – Natural Heritage.	- Background review and field observations confirmed the presence of two 'Significant Woodland' features from the study area. - The study area is located within an area of 'Significant Groundwater Recharge', and

Policy/Legislation	Description	Project Relevance
	• In association with the LPRCA, watershed management objectives including Source Water and Aquifer Protection are to be implemented in areas identified in Schedule "D" – Water Resources.	contains Davis Creek, a permanent watercourse identified as a tributary of the Lynn-Black Creek Watershed.
Ontario Reg. 178/06: Long Point Region Conservation Authority (LPRCA): Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (2013)	• Regulation issued under *Conservation Authorities Act,* R.S.O. 1990. • Through this regulation, the LPRCA has the responsibility to regulate activities in natural and hazardous areas (i.e., areas in and near rivers, streams, floodplains, wetlands, and slopes).	• Davis Creek, a LPRCA regulated tributary of the Lynn-Black Creek Watershed is present in the study area.

2.0 Background Review and Significant Habitat Screening

2.1 Background Information Secondary Sources

A review of existing natural heritage information was completed to identify the presence of natural heritage features and species that are reported from or have potential to occur within the study area. Background information relevant to the study area was collected and reviewed from the following sources:

- Natural Heritage Information Centre (NHIC) Biodiversity Explorer (MNRF 2019a);
- Species at Risk in Ontario List (MNRF 2019b);
- Land Information Ontario (LIO) data base mapping;
- Long Point Region Conservation Authority mapping;
- Norfolk County Official Plan (2020);
- Fisheries and Oceans Canada (DFO) Species at Risk Mapping (DFO 2019);
- Species at Risk public registry (Government of Canada 2019);
- Atlas of the Mammals of Ontario (Dobbyn 1994);
- Ontario Reptile and Amphibian Atlas (ORAA) (Ontario Nature 2019);
- Ontario Breeding Bird Atlas (OBBA) (BSC et al. 2006);
- Ontario Odonata Atlas Database (OOAD 2019); and
- TEA Ontario Butterfly Atlas (Macnaughton et al. 2019).

2.2 Species at Risk and Significant Wildlife Habitat Screening

For the purposes of this report, Species at Risk (SAR) include species listed as ‘Threatened’ or ‘Endangered’ under the provincial *Endangered Species Act* (ESA 2007). In Ontario, provincial Species of Conservation Concern (SCC) include:

- Species designated under the ESA as ‘Special Concern’ within Ontario;
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre;
- Species that have a high percentage of their global population in Ontario, and
- Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the COSSARO. These species may be protected by the federal *Species at Risk* Act (SARA) if they are listed as Threatened or Endangered on Schedule 1 of the SARA.

Habitat for SCC is considered Significant Wildlife Habitat (SWH), which is afforded protection under the Provincial Policy Statement (OMMAH 2014) and municipal natural heritage protection policies.

Based on NRSI's examination of background sources and federally or provincially significant species with occurrence records in the study area vicinity (within 10km), an assessment of SAR and SCC suitable habitat presence within the study area was completed. Assessments of habitat suitability in the study area were made by cross-referencing each species' known habitat preferences or requirements (e.g., OMNR 2000) against habitats known to occur in the study area. This was completed to ensure that the potential presence of all significant species within the study area was adequately assessed to inform the Class EA. Based on this screening exercise, Candidate habitat for 5 SAR and 2 SCC was identified within the study area (Appendix I).

The Significant Wildlife Habitat Technical Guide (SWHTG) is a guideline document that outlines the types of habitats that the MNRF considers significant in Ontario, as well as criteria to identify these habitats (OMNR 2000, MNRF 2015). The SWHTG groups SWH into four broad categories: seasonal concentration areas, rare vegetation communities and specialized wildlife habitat, habitats of SCC, and animal movement corridors. This screening involved the comparison of MNRF criteria outlined for Ecoregion 7E, in which the study area is located, against habitats known to occur in the study area. Based on this screening exercise, four candidate SWH types were identified within the study area including:

- Bat Maternity Colonies;
- Turtle Wintering Area;
- Amphibian Breeding Habitat (Woodland); and
- Habitat for Special Concern and Rare Wildlife Species (Appendix II).

3.0 Field Methods

Terrestrial and aquatic field surveys were undertaken within the study area to characterize natural features and identify those that are significant and sensitive and that have potential to be adversely affected by the proposed undertaking. A total of seven site visits were completed in 2019, and four more were completed in 2020 as described below in Table 2.

3.1 Vegetation Community Mapping and Vascular Floral Inventory

Vegetation communities within the study area were described and mapped using the Ecological Land Classification (ELC) system for southern Ontario (Lee et al. 1998) on May 15, May 31, June 24, and August 22, 2019. A comprehensive three-season inventory of vascular flora was completed to inform the ELC vegetation community classification and associated revisions. ELC and vegetation inventory work was focused in the natural areas along Davis Creek and its forested riparian areas as shown on Map 2.

3.2 Breeding Bird Surveys

Two early morning breeding bird point count surveys were completed on June 14 and June 24, 2019 in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (BSC 2001). Surveys were completed between a half-hour before sunrise and 1000hrs and were timed to occur 10 days or more apart. Surveys were completed through comprehensive point counts and standard area searches of study area lands with a focus on Davis Creek and its forested riparian areas. Standard breeding evidence codes were recorded based on OBBA protocol (BSC 2001).

3.3 Reptile Area Search Surveys

Visual encounter surveys (VES) were completed on May 15 and June 14, 2019 to assess the presence of basking reptiles (snakes and turtles) in suitable habitat within the study area (i.e., Davis Creek, the forested riparian areas, and wetland features). The investigation included an assessment of habitat suitability for reptile species reported from the study area vicinity (Ontario Nature 2019).

Table 2. Field Survey Summary

Survey Type	Protocol	Date (2019)	Start and End Time (24 hrs)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud Cover (%)	Precipitation	Observers
Ecological Land Classification	Lee et. al (1998)	May 15	1000-1300	13	0	5	None	K. Ellis
		May 31	0620-0905	16	1	80	None	P. Deacon
		June 24	0950-1300	16	0	100	None	K. Burrell T. Brenton
		August 22	0700-1000	17	0	100	None	P. Deacon
Vascular Flora Inventory	Systematic search by ELC polygon	May 15	1000-1300	13	0	5	None	K. Ellis
		May 31	0620-0905	16	1	80	None	P. Deacon
		June 24	0950-1300	16	0	100	None	K. Burrell T. Brenton
		August 22	0700-1000	17	0	100	None	P. Deacon
Anuran Call Surveys	BSC (2009)	April 24	2045-2145	10	0	20	None	N. Allen K. Ellis
		May 15	2100-2145	13	0	5	None	L. Knopf M. Zago

Survey Type	Protocol	Date (2019)	Start and End Time (24 hrs)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud Cover (%)	Precipitation	Observers
		June 5	2130-2215	21	0	100	None	K. Ellis L. Knopf
Breeding Bird Surveys	OBBA (2001)	June 14	0645-0845	11	3	50	None	K. Burrell
		June 24	0640-0950	16	0	100	None	K. Burrell T. Brenton
Reptile Area Search Surveys	Systematic search within suitable habitat	May 15	1130-1600	16-19	2	40	None	N. Hardie
		June 14	0845-1000	11	3	50	None	K. Burrell
Fish Community Surveys	3-Pass Depletion Sampling	October 16, 2020	0800 - 1500	9	1	0	None	N. Allen S. Burgin E. Bannon
Aquatic Habitat Assessment	Ontario Stream Assessment Protocol	October 18, 19, 20, 2020	0800 - 1400	7-13	1-4	0-100	None	N. Allen S. Burgin M. Heyming S. Catry E. Bannon

3.4 Incidental Observations

During the field work program, all incidental observations of wildlife and vegetation species were documented on all field visits. This included direct observations of individuals, as well as signs of wildlife presence (i.e., tracks, scat, dens, nests, etc.).

3.5 Aquatic Field Surveys

During fall 2020 a series of site investigations were completed. Fish community sampling was conducted on October 16, 2020 to determine the fish assemblage and confirm the DFO's mapping for no SAR presence. On October 18 - 20, 2020 Davis Stream was assessed physically by methods outlined in the Ontario Stream Assessment Protocol (OSAP) Manual to determine substrates, bank stability, erosion, and overall form within the study area. This assessment was completed in coordination with the 7-day aquifer water testing within the study area. NRSI subsequently prepared a memo to Banks Groundwater Engineering (dated February 2021) to assess the groundwater test results and its impacts on Davis Creek (Appendix III).

4.0 Existing Conditions

4.1 Soils, Terrain and Drainage

The study area is located within the Norfolk Sandplain physiographic region, which slopes gradually from the northwest toward Lake Erie (Presant and Acton 1984). Overburden deposits within this region are predominantly classed as the Wentworth Till and the Paris and Galt Moraines associated with the most recent glacial retreat (13,000 – 13,500 years ago) of the Laurentide ice sheet (Barnett 1978, Banks Groundwater Engineering Ltd. 2015). Within the study area, soil deposits are dominated by lacustrine sands, containing sandy or loamy sediments (Presant and Acton 1984). Areas of gravelly sands of fluvial or till derivation and clay deposits make up smaller portions of the study area (Presant and Acton 1984). The combination of sandy wind-modified surfaces and flat topography within this physiographic region results in relatively high infiltration capacity and deep-cut riverine features within sands which range between 1m and 20m (Presant and Acton 1984).

The study area contains Davis Creek, which flows southwest and then southeast as a tributary to Lynn-Black Creek, which empties into Lake Erie at Port Dover. The majority of the study area is dominated by agricultural lands and natural features are limited to Davis Creek's riparian vegetation and wetlands, nearby isolated forests, and adjacent hedgerows.

4.2 Vegetation

The majority of the surrounding land is comprised of agricultural fields with associated roadways and rural residential lots. Vegetation communities are described in Table 3, below. Refer to Map 2 for the study area ELC communities and the surrounding land-uses.

4.2.1 Vascular Flora

A total of 168 species of vascular flora were inventoried within the study area. A complete list of inventoried species is provided in Appendix IV. Of the species observed, approximately 31% were non-native (MNRF 2019a).

In total, 6 provincially rare flora species are reported from the vicinity of the study area (within 1km) (Oldham 1993). Of the species reported, 3 provincially rare vegetation species were observed by NRSI within the study area, however, all were observed in a planted native garden feature, which are generally not afforded protection, including; Spiked Blazing Star (*Liatris spicata*), Gray-headed Coneflower (*Ratibida pinnata*), and Oswego-tea (*Monarda didyma*).

Table 3. Vegetation Communities Identified within the Study Area

ELC Ecosite Type	ELC Description	Environmental Characteristics
FOD9	Fresh – Moist Oak-Maple – Hickory Deciduous Forest Ecosite	Located in the northwest corner of the study area, this deciduous forest community is a remnant forest, typical of the area, pre-European settlement. Within the canopy and sub-canopy this community is dominated by Freeman's Maple (*Acer x freemanii*), Bitternut Hickory (*Caryua cordiformis*), and Sugar Maple (*Ace saccharum*). Understorey and groundcover vegetation is comprised of an extensive layer of Sugar Maple, Freeman's Maple, and Blue Beech (*Carpinus caroliniana*) saplings, along with White Trillium (*Trillium grandiflorum*), Sensitive Fern (*Onoclea sensibilis*), and May-Apple (*Podophyllum peltatum*).
HR	Hedgerow	Several deciduous hedgerows are present throughout the study area. Hedgerow composition varies, primarily with Sugar Maple, Bitternut Hickory, and Basswood (*Tilia americana*) being common throughout.
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type	This community is located in the western portion of the study area, adjacent to several drainage tributaries. Reed-canary Grass (*Phalaris arundinacea*) is the dominant vascular flora, along with mixed grasses and forbs.
SWD4	Mineral Deciduous Swamp Type	This community is present within the central portion of the study area, adjacent to the rail-trail. Within the canopy and sub-canopy layers, Freeman's Maple, Eastern Cottonwood (*Populus deltoides*), Manitoba Maple (*Acer negundo*), and Black Walnut (*Juglans nigra*) are dominant. Within the understorey, Red Panicled Dogwood (*Cornus foemina ssp. racemosa*) and Silky Dogwood (*Cornus amomum ssp. obliqua*) are abundant. Garlic Mustard (*Alliaria petiolata*), Skunk-cabbage (*Symplocarpus foetidus*), and Orchard Grass (*Dactylis glomerata*) are common.
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type	Primarily located adjacent to the rail-trail, this community consists of Freeman's Maple, Eastern Cottonwood, and Green Ash (*Fraxinus pennsylvanica*). Throughout the sub-canopy Black Walnut is also present commonly.

4.3 Wildlife

4.3.1 Birds

In total, 97 bird species have been reported from the vicinity of the study area (BSC et al. 2008). A total of 45 of these species were documented within the study area during field surveys, of which thirty-six species displayed evidence of possible, probable or confirmed breeding within the study area based on OBBA breeding evidence codes (BSC 2001). A complete list of bird observations is provided in Appendix IV.

A total of 11 SAR/SCC birds are reported from background review data (MNRF 2019). NRSI field surveys documented 1 SAR, and 1 SCC bird species from the study area; Barn Swallow (*Hirundo rustica*), and Eastern Wood-Pewee (*Contopus virens*), respectively.

Barn Swallow are regulated SAR listed as Threatened provincially and federally, affording individuals and their habitat protection under the ESA. This species is an aerial insectivore, requiring large open areas for foraging (Heagy et al. 2014). Individuals were observed during the breeding bird surveys foraging over agricultural fields from BMB-001, BMB-002, BMB-003, and BMB-004. Nesting habitat includes human-made structures such as barns, sheds, homes, and other structures with adequate coverage (Brown and Brown 2020). Suitable nesting habitat may be present within the study area; however, access did not allow suitable structures to be investigated.

Eastern Wood-Pewee are regulated SCC listed as Special Concern provincially and federally. The species is noted to be common throughout Ontario; however, it has experienced widespread declines. Single Eastern Wood-Pewee were observed singing during targeted breeding bird surveys at BMB-001 and BMB-005, indicating ‘Possible’ breeding evidence. Eastern Wood-Pewee is a forest bird often associated with deciduous or mixed intermediate forests with little understorey, clearings, and edges (OMNR 2000; COSEWIC 2012). Suitable breeding habitat is present within the study area where forest communities and riparian edges of Davis Creek provide appropriate habitat (Map 4).

4.3.2 Herpetofauna (Reptiles & Amphibians)

In total, 21 herpetofauna (reptile & amphibian) species have been reported from the vicinity of the study area based on background data (Ontario Nature 2019). Six of these species were documented within the study area during field surveys. A complete list of all herpetofauna species reported from the study area is provided in Appendix IV.

A total of 8 SAR/SCC herpetofauna species are reported from background review data (MNRF 2019; Ontario Nature 2019). A single SCC was documented by NRSI biologists – a Common Snapping Turtle (*Chelydra serpentina serpentina*) was observed incidentally on April 24, 2019. Snapping Turtles inhabit a wide range of habitats, including man-made ponds, streams and watercourses.

Anuran call surveys were conducted to identify the presence of breeding frog and toad species within the study area. Anurans were observed at stations ANR-001, -002, and -005 (Map 3). Full choruses of Spring Peeper (*Pseudacris crucifer*) were heard earlier in the spring at ANR-001 and 002, while lower numbers of American Toad (*Anaxyrus americanus*) were documented at these times too. Small numbers of Wood Frog (*Lithobates sylvaticus*) and Northern Green

Frog (*Lithobates clamitans melanota*) were observed at ANR-002. Table 4 presents the anuran call survey results.

Table 4. Anuran Call Survey Results

Survey		Call Abundance*			
		Spring Peeper	American Toad	Wood Frog	Northern Green Frog
Station	Date				
1	April 24	3	2(6)	-	-
	May 15	3	1(1)	-	-
	June 5	-	2(5)	-	-
2	April 24	2(7)	2(6)	1(2)	-
	May 15	1(5)	-	-	-
	June 5	-	-	-	1(1)
3	April 24	-	-	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-
4	April 24	-	-	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-
5	April 24	-	2(4)	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-

*Call abundance refers to the Marsh Monitoring Programs call codes (Bird Studies Canada 2009).

Temperature on survey dates: April 24 – 9-10°C; May 15 - 13°C; June 5 - 21°C.

4.3.3 Insects

In total, 26 Odonata (dragonfly & damselfly) species and 57 Lepidoptera (butterfly) species are reported from the vicinity of the study area, based on the Ontario Odonata Atlas Database (OOAD 2019), and the Ontario Butterfly Atlas (Macnaughton et al. 2019). No Odonata or butterfly species were observed during field visits conducted by NRSI biologists. A complete list of insect species reported from the study area is provided in Appendix IV.

4.3.4 Mammals

In total, 37 mammal species are reported from the vicinity of the study area, based on the Mammal Atlas of Ontario (Dobbyn 1994). Six mammal species were observed incidentally during field investigations in the study area by NRSI biologists including. A complete list of all mammal species reported from the study area is provided in Appendix IV.

Forest, treed wetland, and hedgerow communities located within the study area may provide suitable bat maternity colony habitat features. Further discussion regarding presence of suitable roosting habitat for SAR/SCC bats is provided in section 5.2.4 and Section 5.3.

4.4 Aquatic Habitat Assessment

4.4.1 Watercourse Structure

There is one distinct watercourse present within the subject property, Davis Creek. Due to its length within the study area, Davis Creek can be described in 4 parts: i) the upstream channel, ii) the inline former irrigation pond, iii) downstream channel, and the iv) channelized portion of Davis Creek (Map 3). The upstream channel is a northeast to southwest flowing 80m long stretch of watercourse (Map 2). It has an average width of 2.5m, an average depth of 20cm, with consistent flow year-round. This permanent watercourse originates upstream from an underground CSP culvert that carries flow underneath Cloet Road. This section of watercourse connects to a former inline irrigation pond at the end of its 80m run and contains silt and sand substrates, with strong tree canopy cover throughout most of the reach.

The second distinct section of Davis Creek is the irrigation pond located in the northeast portion of the study area (Map 3). The pond has an approximate size of 3000m^2, a depth of 0.9m and minimal flow and contains emergent, submergent, and floating vegetation throughout the waterbody as well as riparian vegetation surrounding the majority of the shoreline. The substrates are largely silt and muck with deep pockets >1m in depth.

The third defined section of Davis Creek is the meandering section after the former irrigation pond, before the well channelized and straightened final section (Map 3). Due to its meander, the full length is unknown but it travels 500m southwest from the pond. As it travels, it switches periodically between inundated wetland and a defined watercourse. While a defined watercourse, it has an average width of 0.6m and an average depth of 20cm, with sand and gravel substrates. The watercourse has a very strong meander, with cross-over points located approximately 4m apart suggesting susceptibility to erosion. There is complete riparian vegetation coverage and a high level of arboreal coverage throughout the entire section.

The fourth and final section of the watercourse is the channelized and straightened section that extends along the farmers’ fields in the south of the study area (Map 3). The watercourse extends for 400m and is very straight with little meander, however, there are several in-stream crossovers present. Section 4 is on average 14cm deep and 2.35m wide, with limited riparian vegetation, however, there is dense tree canopy cover. The substrate was largely silt and sand with some pockets of gravel. Aquatic vegetation was present periodically throughout this section of the watercourse with several large patches of Watercress (*Nasturtium officinale*) suggesting the presence of groundwater inputs (Map 4). Full results of the water test monitoring assessment are provided in Appendix III.

4.4.2 Fish Community

The fish community assessment was completed in three parts, all of which focused on the watercourse as the irrigation pond was unsafe for sampling due to sediment and depth concerns. The following table summarizes the catch within each section. The fish collected in all sections of the creek are indicative of coolwater fish communities, consistent with previous assessments (Banks Groundwater Engineering Ltd. 2015, Golder Associates 2015). This type of community is able to deal with seasonal fluctuation, but prefer consistent groundwater and surface water inputs. The Largemouth Bass (*Micropterus salmoides*) collected are suspected to come from one of the retention ponds immediately upstream of the sampling location, but outside of the study area. Largemouth Bass are non-native but likely historic and well-established at this time within Davis Creek. A complete list of all fish species reported from the study area is provided in Appendix IV. This fish community is consistent with previous assessments (e.g., Banks Groundwater Engineering Ltd. 2015, Golder Associates 2015).

Table 5. Fish Capture from Davis Creek

EMS-001 – 1650 seconds			
Species	Count	Max Size (cm)	Min Size (cm)
Creek Chub	16	7.3	3.3
Blacknose Dace	6	3.1	2.6
Mottled Sculpin	2	4.3	1.8
Largemouth Bass	2	3.1	3.0
White Sucker	1	4.5	-
EMS-002 – 1397 seconds			
Species	Count	Max Size	Min Size
Blacknose Dace	19	9.2	4.1
Creek Chub	5	13.7	9.8
Mottled Sculpin	2	10.2	4.4
EMS-003 – 2081 seconds			
Species	Count	Max Size	Min Size
Blacknose Dace	9	9.2	4.8
Mottled Sculpin	2	7.9	6.4
Blacknose Dace	2	5.2	5.2
Creek Chub	1	5.4	-

5.0 Natural Feature Significance and Sensitivity

Analysis of the significance of existing natural features was used to identify those features and habitats that are sensitive to disturbance based on the rarity or sensitivity of the feature or the functions/processes that contribute toward their significance. This assessment also considered the policies, legislation, and regulations that apply to the study area natural features which must be considered in the evaluation of the developed scenario. The following is a brief discussion of the results of this analysis with regards to background information and the presence of natural features within the study area.

5.1 Wetlands

Based on background information reviews, unevaluated wetlands are reported within the study area. However, NRSI determined the presence of several wetland features within the study area along the Davis Creek riparian area (Maps 2 and 4). The closest Provincially Significant Wetland (PSW) is to the southwest and is approximately 900m from the study area. Based on complexing rules under the Ontario Wetland Evaluation System (MNRF 2014), the unevaluated wetlands documented within the study area do not qualify as PSW.

5.2 Significant Woodlands

The Norfolk County Official Plan (2020) (Schedule C-1; and C-4) identifies the presence of 2 “Significant Woodland” features within the western portion of the study area (Map 4).

5.3 Significant Wildlife Habitats

Based on background information review, desktop analysis, and field studies, the study area contains 2 candidate and 2 confirmed SWH types as shown on Map 4:

- Bat Maternity Colonies (Candidate);
- Turtle Wintering Areas (Candidate);
- Amphibian Breeding Habitat (Woodland) (Confirmed), and
- Special Concern and Rare Wildlife Species (Eastern Wood-Pewee and Snapping Turtle) (Confirmed).

Further details are provided regarding each candidate and confirmed SWH type; refer to the Significant Wildlife Habitat screening exercise (Appendix II) for an analysis of all significant species assessed within the study area.

5.3.1 Seasonal Concentration Areas

Wildlife seasonal concentration areas are defined as areas where animals occur in relatively high densities for all, or portions, or their life cycle (OMNR 2000). These areas are generally relatively small in size, particularly when compared to areas used by these species during other times of the year.

Bat Maternity Colonies

Several species of SAR bats are known to roost in tree cavities, hollows, or under loose bark, as well as within buildings (MNR 2000). Based on habitat present within the study area, it is assumed that all deciduous forested habitats provide suitable habitats for SAR bats (see Map 4). More information is provided in Section 5.4.

Turtle Wintering Area

Several listed species are reported from the vicinity of the study area, based on the background review completed by NRSI. Field surveys documented the presence of a single Snapping Turtle within the SWD4 community. Suitable over-wintering aquatic habitat is present within the study area in the form of wetlands and ponds (see Map 4).

5.3.2 Specialized Habitat for Wildlife

Specialized habitats include those that support wildlife species with highly specific habitat requirements, areas with exceptionally high species diversity, and/or areas that provide habitat that greatly enhances a species' chance of survival (MNR 2000). The SWHTG indicates that most specialized habitats have not been formally identified or mapped by any agency (MNR 2000). Examples of specialized wildlife habitat include sites supporting area-sensitive species, old growth or mature forest stands, turtle nesting habitats, seeps/springs and cliffs.

Amphibian Breeding Habitat (Woodland)

Amphibian Breeding Habitat (Woodland) is confirmed within the study area. Suitable wetlands adjacent or in woodland habitat is present within the study area along Davis Creek. Targeted anuran call surveys conducted by NRSI identified the presence of American Toad, Spring Peeper, Wood Frog and Gray Treefrog. During anuran call counts in April, May and June, 2019 NRSI biologists observed >20 Spring Peeper and Wood Frog individuals from the SWD4 community located adjacent to and along Davis Creek.

5.3.3 Habitat for Species of Conservation Concern

Species of Conservation Concern are species with a provincial S-rank of S1 to S3, species listed as species of Special Concern provincially, or species listed as Endangered or Threatened nationally with no provincial designation (i.e., not protected by the Endangered Species Act (ESA)). Confirmed habitat for SCC may be considered Significant Wildlife Habitat (MNR 2000).

Special Concern and Rare Wildlife Habitat

Suitable habitat for SCC is present in the study area. Observed SCC include Eastern Wood-Pewee and Snapping Turtle. Eastern Wood-Pewee was observed during the breeding bird surveys on June 14 and 24, 2019. A single Snapping Turtle was observed incidentally within the SWD4 community on April 24, 2019.

Eastern Wood-Pewee

Eastern Wood-Pewee's were observed during NRSI field surveys at two monitoring stations: BMB-001 and BMB-005 (see Map 2). Eastern Wood-Pewee is a forest bird often associated with deciduous or mixed intermediate forests with little understorey, clearings, and edges (OMNR 2000; COSEWIC 2012). Suitable breeding habitat is present within the deciduous forested communities within the study area (see Map 4).

Snapping Turtle

A single Snapping Turtle was observed incidentally during a field visit on April 24, 2019 in the SWD4 community (see Map 2). Further, a landowner provided photo evidence of a Snapping Turtle along the railway line (B. Banks pers. comm. 2019), which was reviewed and confirmed by NRSI biologists from 2012. Suitable habitat is present within the wetland communities adjacent to Davis Creek (see Map 4).

5.4 Habitat of Endangered and Threatened Species

Based on field investigations a single SAR; Barn Swallow, was documented from within the study area. Additionally, 4 SAR Bat species have the potential to occur within the study area due to the presence of suitable treed habitat along Davis Creek and within isolated forests. Refer to the SAR/SCC screening exercise (Appendix I) for an analysis of all significant species assessed within the study area.

Barn Swallow

Barn Swallow was observed at BMB-001; 002; 003; and 004 during targeted breeding bird surveys conducted by NRSI biologists on June 14, and 24, 2019. The highest breeding evidence code recorded for Barn Swallow within the study area is 'Possible' which suggests suitable breeding habitat is present although no direct evidence such as nests or fledged young was observed. Individual Barn Swallows were observed foraging over fields and amongst natural areas within the study area. Barn Swallow nest almost exclusively in or on human structures where areas of open habitat are available for foraging and access to nesting materials (Heagy et al. 2014). Barn Swallow are reported to forage within 600m of their nest (Heagy et al. 2014) suggesting nests are likely within the study area in barns, out buildings and other appropriate human-made structures outside natural features.

SAR Bats

Several SAR bats are known to occur within southern Ontario and have the potential to occur within the study area, including the Eastern Small-footed Bat (*Myotis leibii*), the Little Brown Myotis (*Myotis lucifungus*), Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*). These species are listed as Endangered (SARO 2020).

5.5 Fish Habitat

The aquatic habitat within the study area consists of Davis Creek, a tributary of the Lynn-Black Creek Watershed that appears to maintain adjacent wetland communities within the study area. Davis Creek provides suitable fish habitat but the tributary does not provide habitat for SAR fish as reported by Fisheries and Oceans Canada (DFO 2020). Field investigations undertaken by NRSI in 2020 and historical studies (Banks Groundwater Engineering Ltd. 2015,Golder Associates 2015) support the findings of coolwater fish assemblages but no SAR or unique fish assemblages. These results are consistent with the Community of Simcoe Additional Water Supply Class EA – Fisheries Update and Preliminary Fisheries Risk Self Assessment (Golder Associates 2015) and *Revised Draft Report 2012 Monitoring and Aquifer Testing Program* (Banks Groundwater Engineering Ltd. 2015).

6.0 Impact Assessment and Mitigation Recommendations

6.1 Description of the Proposed Works

The County of Norfolk has initiated a Municipal Class EA to facilitate an approval for a new groundwater supply source for the Community of Simcoe, Norfolk County. As part of this undertaking, it is anticipated that the two test productions wells within the study area will become the municipal well-sites used to supply groundwater to the Community of Simcoe.

Servicing and alignment alternatives will be confirmed following the recommendations of this NEAR and the groundwater monitoring program undertaken by Banks Groundwater Engineering Ltd. As such, impacts and recommendations are provided briefly below and are expected to be updated following the confirmation of the groundwater source and the alignments meant to support it.

6.2 Approach to Impact Analysis

The impact analysis provided here is based on a high-level assessment of potential natural feature impacts based on a conceptual understanding of the proposed groundwater supply source and associated development within the identified study area. Uupdates to this impact analysis are anticipated once detailed designs have been identified. Characterization and identification of potentially significant areas and features are provided briefly to assist in the design process. The following is a description of the types of impacts discussed:

- Direct Impacts – associated with the disruption or displacement of natural features;
- Indirect Impacts – associated with changes in site conditions; and
- Induced impacts – associated with impacts after the development is completed.

6.3 Direct Impacts and Mitigation

As a general means to limit the extent of impacts to natural features, efforts should be made to control surface water runoff and sedimentation associated with the two test production wells.

6.3.1 Water Quantity and Quality

Direct water quality and quantity impacts should be considered during the detailed design stage regarding the potential to negatively impact the existing water quality and quantity within Davis Creek. Several significant features, including fish habitat, candidate turtle wintering areas and confirmed amphibian breeding (woodland) SWH, and species (Snapping Turtle) are present within the study area (see Map 4).

In order to maintain the water balance of Davis Creek and the wetland communities within the study area, surface water quantities reaching the wetland and creek should be maintained. However, it is important to note and understand that in the existing condition, agriculture, primarily through irrigation, heavily influences the study area and Davis Creek (Banks Groundwater Engineering Ltd. 2015). Based on the 7-day aquifer testing program completed in 2020 and the previous 72-hour aquifer testing program completed (e.g., Banks Groundwater Engineering Ltd. 2015), groundwater removal is not anticipated to negatively impact the form and function of Davis Creek, due to the amount of water being removed and the natural recharge rates of the surrounding landscapes.

6.4 Indirect Impacts and Mitigation

Indirect impacts associated with any infrastructure surrounding the development of the groundwater supply should have consideration for the natural environment. Any proposed infrastructure works should clearly demarcate the limits of the development, including vegetation cutting and grading boundaries, so as to prevent encroachment into the surrounding natural features. Silt fencing should be correctly applied to prohibit encroachment of machinery into natural areas, as well as hinder wildlife from entering construction sites.

6.4.1 Sediment and Erosion

If infrastructure associated with the development of the groundwater supply is required, a robust Erosion and Sediment Control (ESC) Plan is to be developed at the detailed design stage. ESC measures are recommended to be installed along the development limit and outside of the natural features, prior to any vegetation removal, rough grading or digging within the area. The following ESC measures are recommended:

- ESC fencing is to be installed prior to any vegetation removal, rough grading and construction to demarcate the development limit. Fencing is to be inspected for proper installation by the Contract Administrator or Environmental Monitor.
- Maintenance of machinery during construction should occur at a designated location away from natural areas on-site (30m from watercourse, 10m from woodland).
- No storage of equipment, materials or fill is to occur within the natural areas.
- All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any materials from leaving the site.

- Any areas of bare soil within the construction area are to be re-vegetated as soon as feasible to prevent erosion of soils and keep dust to a minimum (within 30 days of area being left inactive). An approved native seed mix comprised of species indigenous to the area is to be applied where bare soils are in proximity to any natural areas. Seed mixes are not to contain non-native, invasive species that are known to invade natural areas.
- Following completion of construction and site stabilization, all ESC measures and accumulated sediment are to be removed and disposed of properly.

6.4.2 Vegetation Removal and Wildlife and Their Habitats

Any undertaking associated with the groundwater supply or infrastructure development may require vegetation removal. Incidental take of wildlife is punishable under the Migratory Birds Convention Act (Government of Canada 1994), Fish and Wildlife Conservation Act, (Government of Canada 2019), and Endangered Species Act (ESA) (Government of Ontario 2019) regarding applicable species.

The removal of trees and other vegetation within the study area has the potential to disrupt nesting birds, fur-bearing mammals, and raptors not protected under the MBCA, as well as endangered species listed under the ESA (e.g., SAR bats). Specifically, impacts to breeding birds, fur-bearing mammals, raptors, and bats may be sustained through damage and destruction of nests, eggs and young, or avoidance of the area by breeding adults. The Migratory Birds Convention Act (MBCA, Government of Canada 1994) identifies a list of migratory bird species that are protected. It prohibits the destruction of nests, individuals and activities that would cause an adult bird to abandon a nest.

Any vegetation removal, if required, is to occur outside of the core nesting period for migratory birds, as established by the Canadian Wildlife Service (CWS 2012), and SAR bats, as established under the ESA. Vegetation clearing should therefore occur between November 1 and March 31, so as to limit disturbances to breeding activities of birds and bats and to avoid destruction of active nests. Every developer/consultant/contractor, etc. is legally obliged to carry out due diligence to protect migratory birds from harm during all construction projects.

Historically, the implementation policies of the MBCA provided for biologists to conduct nest searches when vegetation removals were to occur during the nesting period. These provisions were revoked in 2014. One exception is for when the removals are to occur in simple habitats which are characterized in the MBCA (e.g., bridge structures, isolated trees, vacant lot). Should vegetation removal in simple habitats be required to occur within the peak breeding window, nest surveys may be conducted by a qualified biologist just prior to the removal activity (less than 48 hours prior to) to ensure that nesting birds are not present. Should a nest be identified within vegetation to be removed, the vegetated area shall be protected with a buffer and there shall be no removal or construction activity within that area until sign-off is obtained from the qualified biologist that the nest is no longer active. Vegetated areas identified as having no nesting activity can be removed; however, removal is to occur within 48 hours of the nest search. If vegetation removal does not occur within this time frame, additional nest searches are to be conducted.

In the event a nest survey is conducted, a clearance letter is to be prepared by the qualified biologist that undertook the surveys and submitted to the County for their files in the event a record of due diligence is requested by CWS.

A tree that may provide roosting habitat for SAR bats cannot be removed during the active bat season, without prior permission from the Ministry of Environment, Conservation and Parks (MECP). If vegetation removal is proposed to occur within the bat active period (i.e., April 1 to October 30) a memorandum of understanding with the MECP should be undertaken documenting steps to abide by the ESA. This memorandum should outline the approach to the removal of isolated trees and follow guidelines outlined by the *Survey Protocol for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis and Tri-colored Bat* (MNRF 2017) and will require approval from the MECP prior to removal.

6.5 Induced Impacts

No induced impacts are anticipated from the development of the groundwater supply within the study area.

7.0 Conclusions

Natural Resource Solutions Inc. (NRSI) was retained by Banks Groundwater Engineering in April 2019 to complete a Natural Environment Assessment Report as part of the required Municipal Class Environmental Assessment to facilitate the approval for a new municipal groundwater supply source for the Community of Simcoe, Norfolk County, Ontario. The proposed project requires the completion and submission of a NEAR in accordance with the requirements of the Municipal Class Environmental Assessment (MEA 2015).

The study area contains a portion of the Davis Creek, wetlands, significant woodland, hedgerows, and agricultural fields. Existing natural features within the study area are limited to the wetland and forest communities which are located adjacent to Davis Creek.

Habitat for 7 regulated SAR is potentially present within the study area, along with 2 confirmed and 2 candidate SWH features. The majority of suitable habitat for these species is present, or potentially present, in close or direct proximity to natural areas adjacent to Davis Creek and the remaining woodland areas in the study area. Regard for the remaining natural areas should be a priority going forward.

Following receipt of development plans from the project team, an updated and comprehensive impact analysis will be provided, outlining key recommendations and mitigations. As such, the updated NEAR will include mitigation measures and recommendations specific to the undertaking.

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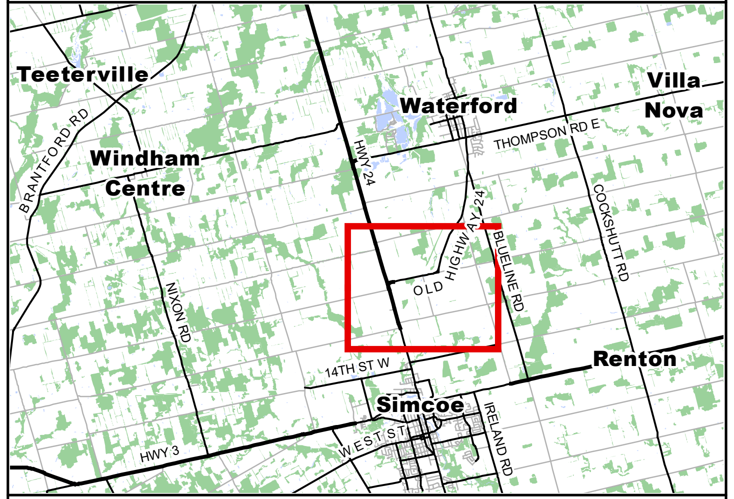
MAPS

Path: X:\2250A_SimcoeWaterSupplyClassEA\NRSI_2250A_Map1_StudyArea_ARA_16K_2021_02_04_MV.mxd

Map 1

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

ARA Data



Legend

- Study Area (1km)
- Study Area (Estimated Zone of Influence)
- Aquatic Resource Area (ARA) Survey Point
- ARA Line Segment
- Utility Line
- Highway
- Primary Road
- Secondary Road
- Railway
- Permanent
- Intermittent

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Project: 2250A
Date: February 4, 2021

NAD83 - UTM Zone 17
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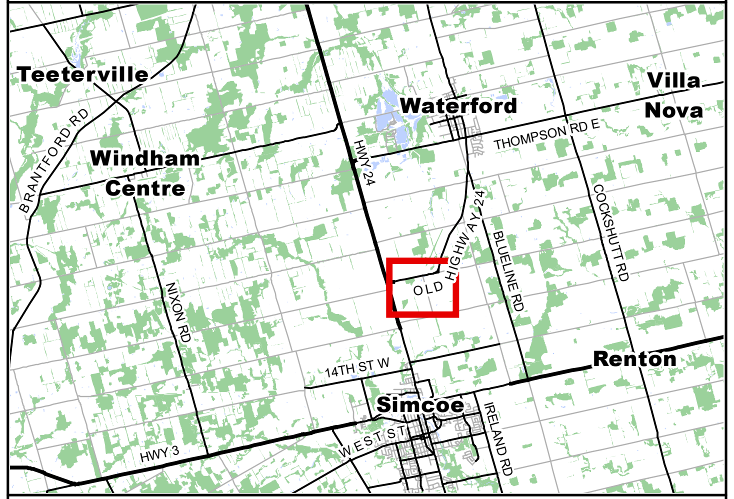
Map 2

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

Vegetation Communities



Legend

- 🟧 Study Area (Estimated Zone of Influence)
- —• Utility Line
- — Highway
- — Primary Road
- — Secondary Road
- —+— Railway
- ∼ Permanent Watercourse
- ∼ Intermittent Watercourse
- 🟨 Ecological Land Classification (ELC)

(CUW) Cultural Woodland
(FOD9) Fresh - Moist Oak-Maple - Hickory Deciduous Forest Ecosite
(HR) Hedgerow
(MAM2-2) Reed-canary Grass Mineral Meadow Marsh Type
(Res) Residential
(SWD3-3) Swamp Maple Mineral Deciduous Swamp Type
(SWD4) Mineral Deciduous Swamp Ecosite

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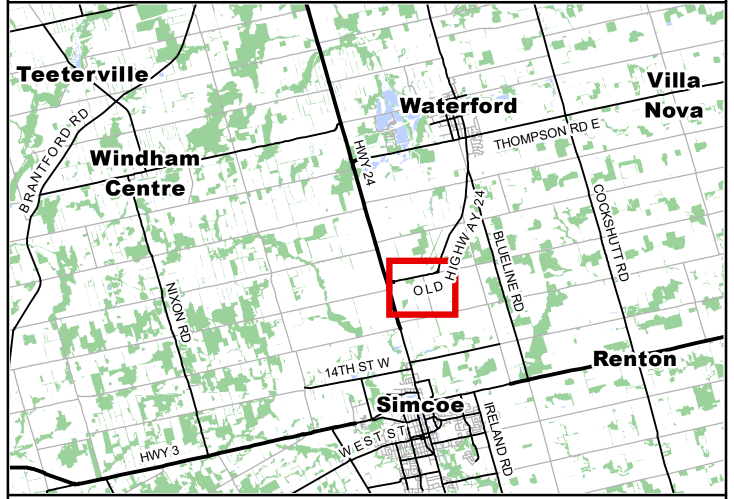
Map 3

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

Monitoring Stations



Legend

▭	Study Area (Estimated Zone of Influence)
Ⓑ	Bird Breeding Monitoring (BMB)
Ⓐ	Anuran Call Station (ANR)
╍	Fish Community Monitoring (EMS)
▭	Turtle Monitoring Areas
•—	Utility Line
━	Highway
—	Primary Road
—	Secondary Road
┼	Railway
∼	Permanent Watercourse
∼	Intermittent Watercourse

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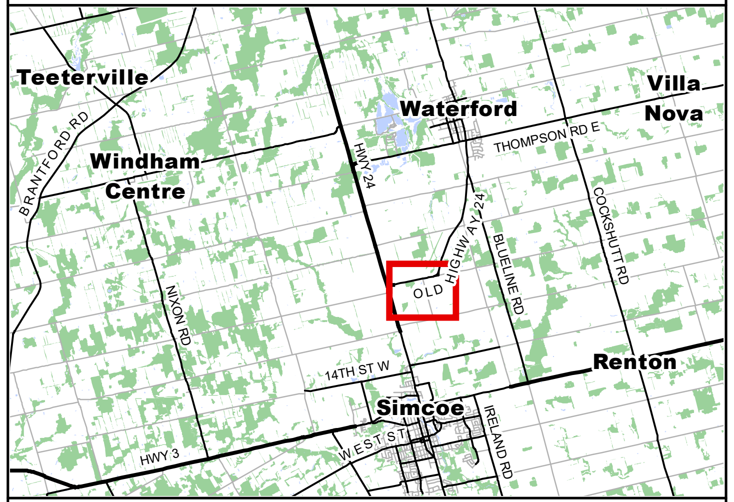
Map 4

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

Natural Heritage Features



Legend

☐ Study Area (Estimated Zone of Influence)

—● Utility Line

—+— Railway

━ Highway

— Primary Road

— Secondary Road

～ Permanent Watercourse

～ Intermittent Watercourse

● Watercress

☐ Wetland (NRSI Delineated)

☐ Significant Woodland (Norfolk County 2020)

🟩 **Significant Wildlife Habitat (SWH)**

(1) Bat Maternity Colonies SWH (Candidate)

(2) Special Concern and Rare Wildlife Species (Eastern Wood-Pewee) SWH (Confirmed)

(3) Amphibian Breeding Habitat (Woodland) SWH (Confirmed)

(4) Special Concern and Rare Wildlife Species (Snapping Turtle) SWH (Confirmed)

☐ Turtle Wintering Areas SWH (Candidate)

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Project: 2250A
Date: February 4, 2021

NAD83 - UTM Zone 17
Size: 11x17"
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APPENDIX I

Species at Risk / Species of Conservation Concern Screening Assessment

Project: 2250
Simcoe Water Supply Class EA
SAR-SCC Screening Table

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA[3]	Background Source	Observed by NRSI	Habitat Preference[4]	Suitable Habitats within Study Area?	Carried Forward to EA?	Rationale
Birds											
Colinus virginianus	Northern Bobwhite	S1	END	E	Schedule 1	BSC et al. 2008	No	Grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs; fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges	Yes	No	Suitable fence rows, woodland edges, and cropland habitat are present in the study area. Northern Bobwhite was not observed during breeding bird surveys or on any site visits by NRSI staff. Northern Bobwhite are also extremely rare in Ontario and are likely extirpated from regions they've previously occupied. Breeding bird surveys did not document the species within the study area.
Chaetura pelagica	Chimney Swift	S4B, S4N	THR	T	Schedule 1	BSC et al. 2008	No	Commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys; highly gregarious; feeds over open water	Yes	No	Potential suitable habitat exists in the study area in the form of chimneys, and hollow trees. However, breeding bird surveys did not document the species within the study area.
Caprimulgus vociferus	Eastern Whip-poor-will	S4B	THR	T	Schedule 1	BSC et al. 2008	No	Dry, open, deciduous woodlands of small to medium trees; oak or beech with lots of clearings and shaded leaflitter; wooded edges, forest clearings with little herbaceous growth; pine plantations; associated with >100 ha forests; may require 500 to 1000 ha to maintain population	No	No	Forests within the study area are < 100 ha and are therefore not suitable for supporting Eastern Whip-poor-will.
Chordeiles minor	Common Nighthawk	S4B	THR	SC	Schedule 1	BSC et al. 2008	No	Open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs	Yes	No	Suitable open ground, ploughed fields, and open woodlands are present in the study area. However, breeding bird species did not document the species within the study area.
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC		BSC et al. 2008	Yes	Open, deciduous, mixed or coniferous forest; predominated by oak with little understory; forest clearings, edges; farm woodlots, parks	Yes	Yes	Forested habitat is present within the study. Breeding bird surveys documented the presence of this species within the study area.
Riparia riparia	Bank Swallow	S4B	THR	T		BSC et al. 2008	No	Sand, clay or gravel river banks or steep riverbank cliffs; lakeshore bluffs of easily crumbled sand or gravel; gravel pits, road-cuts, grassland or cultivated fields that are close to water; nesting sites are limiting factor for species presence	No	No	No suitable habitat present within the study area. Breeding bird surveys did not document the presence of this species.

Project: 2250
Simcoe Water Supply Class EA
SAR-SCC Screening Table

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA[3]	Background Source	Observed by NRSI	Habitat Preference[4]	Suitable Habitats within Study Area?	Carried Forward to EA?	Rationale
Hirundo rustica	Barn Swallow	S4B	THR	T		BSC et al. 2008	Yes	Farmlands or rural areas; cliffs, caves, rock niches; buildings or other man-made structures for nesting; open country near body of water	Yes	Yes	Suitable habitat is present for nesting and foraging. Breeding bird surveys documented several foraging individuals throughout the study area.
Hylocichla mustelina	Wood Thrush	S4B	SC	T		BSC et al. 2008	No	Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges; must have some trees higher than 12 m	Yes	No	Suitable habitat is present (marginally) within the study area. However, breeding bird surveys did not document the presence of this species within the study area.
Setophaga citrina	Hooded Warbler	S3B	SC	NAR	Schedule 1	BSC et al. 2008	No	Favours mature, deciduous forest (Carolinian), particularly along stream bottoms, ravine edges and where saplings and shrubbery grow; nests above ground in small shrubs; feeds on or near ground	Yes	No	Suitable habitat is present (marginally) within the study area. However, breeding bird surveys did not document the presence of this species within the study area.
Ammodramus savannarum	Grasshopper Sparrow	S4B		SC		BSC et al. 2008	No	Well-drained grassland or prairie with low cover of grasses, taller weeds on sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities; perches for singing; requires tracts of grassland > 10 ha	No	No	Suitable habitat is not present within the study area. Breeding bird surveys did not document the presence of this species within the study area.
Dolichonyx oryzivorus	Bobolink		THR	T	No Schedule	BSC et al. 2008	No	Large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha	No	No	Suitable habitat is not present within the study area. Breeding bird surveys did not document the presence of this species within the study area.
Sturnella magna	Eastern Meadowlark		THR	T	No Schedule	BSC et al. 2008	No	Open, grassy meadows, farmland, pastures, hayfields or grasslands with elevated singing perches; cultivated land and weedy areas with trees; old orchards with adjacent, open grassy areas >10 ha in size	Yes	No	Suitable habitat is not present within the study area. Breeding bird surveys did not document the presence of this species within the study area.
Herpetofauna											
Graptemys geographica	Northern Map Turtle	S3	SC	SC	Schedule 1	Ontario Nature 2019	No	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water.	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys did not document the presence of this species within the study area.
Chelydra serpentina serpentina	Common Snapping Turtle	S3	SC	SC	Schedule 1	Ontario Nature 2019	No	Permanent or semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddybanks or bottoms. The species often uses soft soil or clean dry sand on south-facing slopes for nest sites and may nest at some distance from water.	Yes	Yes	Suitable habitat is present within the study area. A single individual was observed within the study area.

Project: 2250
Simcoe Water Supply Class EA
SAR-SCC Screening Table

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA[3]	Background Source	Observed by NRSI	Habitat Preference[4]	Suitable Habitats within Study Area?	Carried Forward to EA?	Rationale
Emydoidea blandingii	Blanding's Turtle (Great Lakes/St Lawrence population)	S3	THR	t	Schedule 1	Ontario Nature 2019	No	Shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs; not readily observed.	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys did not document the presence of this species within the study area.
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	Schedule 1	Ontario Nature 2019	No	Sandy upland fields, pastures, savannahs, sandy beaches; dry open oak-pine-maple forest with sandy soils; prefer forest areas > 5ha	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys did not document the presence of this species within the study area.
Lampropeltis taylori triangulum	Eastern Milksnake	S3	NAR	SC		Ontario Nature 2019	No	Farmlands, meadows, hardwood or aspen stands; pine forest with brushy or woody cover; river bottoms or bog woods; hides under logs, stones, or boards or in outbuildings; often uses communal nest sites	Yes	No	Suitable habitat is not present within the study area. Herpetofauna surveys did not document the presence of this species within the study area.
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake (Great Lakes population)	S3	SC	SC	Schedule 1	Ontario Nature 2019	No	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups	Yes	No	Suitable habitat is not present within the study area. Herpetofauna surveys did not document the presence of this species within the study area.
Mammals											
Myotis leibii	Eastern Small-footed Bat	S2S3	END			Dobbyn 1994	No	Roosts in caves, mine shafts, crevices or buildings that are in or near woodland; hibernates in cold dry caves or mines; maternity colonies in caves or buildings; hunts in forests	Yes	Yes	Suitable habitat is present within forested communities within the study area.
Myotis lucifungus	Little Brown Myotis	S5	END	E		Dobbyn 1994	No	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges	Yes	Yes	Suitable habitat is present within forested communities within the study area.
Myotis septentrionalis	Northern Myotis	S3?	END	E		Dobbyn 1994	No	Hibernates during winter in mines or caves; during summer males roost alone and females form maternity colonies of up to 60 adults; roosts in houses, man-made structures but prefers hollow trees or under loose bark; hunts within forest, below canopy	Yes	Yes	Suitable habitat is present within forested communities within the study area.

Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA[3]**	**Background Source**	**Observed by NRSI**	**Habitat Preference[4]**	**Suitable Habitats within Study Area?**	**Carried Forward to EA?**	**Rationale**
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	Schedule 1	Dobbyn 1994	No	Open woods near water; roosts in trees, cliff crevices, buildings or caves; hibernates in damp, draft-free, warm caves, mines or rock crevices	Yes	Yes	Suitable habitat is present within forested communities within the study area.
Taxidea taxus jacksoni	American Badger	S2	END	E	Schedule 1	Dobbyn 1994	No	Open grasslands and oak savannahs; dens in new hole or enlarged existing hole; sometimes makes food caches	No	No	No suitable habitat present within the study area. Field surveys did not document the presence of this species or suitable burrows and/or dens within the study area.
Insects											
Nasiaeschna pentacantha	Cyrano Darner	S3				NHIC 2019	No	Slow swampy streams; lake coves, pools, and ponds usually in forested landscapes	Yes	No	Suitable habitat is not present. Field surveys did not document the presence of this species within the study area.
Somatochlora tenebrosa	Clamp-tipped Emerald	S2S3				NHIC 2019	No	Shady forest waters, from trickles to streams, occasionally boggy and often partly dry	Yes	No	Suitable habitat is not present. Field surveys did not document the presence of this species within the study area.
Libellula semifasciata	Painted Skimmer	S2				NHIC 2019	No	Most commonly found by coastal plains; marshy ponds, and occasionally bogs or slow streams	Yes	No	Suitable habitat is not present. Field surveys did not document the presence of this species within the study area.
Danaus plexippus	Monarch	S4	SC	SC		Macnaughton et al. 2019	No	Open areas with milkweed species (*Asclepias spp.*).	Yes	No	Limited areas of the species host plant. Field surveys did not document the presence of this species within the study area.
Plants											
Phegopteris hexagonoptera	Broadbeech Fern	S3	SC	SC	Schedule 3	NHIC 2019	No	Rich, moist soil in mature deciduous forests.	No	No	Vascular flora surveys did not document the species within the study area.
Castanea dentata	American Chestnut	S2	END	E	Schedule 1	NHIC 2019	No	Moist to well drained forests on sand, occasionally heavy soils.	Yes	No	Vascular flora surveys did not document the species within the study area.
Carya glabra	Pignut Hickory	S3				NHIC 2019	No	Dry to dry-mesic deciduous forests and savannahs.	Yes	No	Vascular flora surveys did not document the species within the study area.
Liatris spicata	Spiked Blazing Star	S3	THR	T	Schedule 1	N/A	Yes	Prairies, savannahs and open sandy woods, occassionally adventive.	Yes	No	Vascular flora surveys documented several individuals within a cultivated garden. NRSI surveys did not document the presence of naturally occurring individuals.

Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA[3]**	**Background Source**	**Observed by NRSI**	**Habitat Preference[4]**	**Suitable Habitats within Study Area?**	**Carried Forward to EA?**	**Rationale**
Ratibida pinnata	Gray-headed Coneflower	S3				N/A	Yes	Prairies, open sandy woods.	Yes	No	Vascular flora surveys documented several individuals within a cultivated garden. NRSI surveys did not document the presence of naturally occurring individuals.
Monarda didyma	Oswego-tea	S3				N/A	Yes	Moist woods, swampy thickets, and roadsides.	Yes	No	Vascular flora surveys documented several individuals within a cultivated garden. NRSI surveys did not document the presence of naturally occurring individuals.
Hieracium gronovii	Gronovius' Hawkweed	S3?				NHIC, 2019	No	Habitats include moist to mesic sand prairies, sandy thickets, openings in rocky or sandy woodlands, savannas, bluffs, and edges of fields.	No	No	Vascular flora surveys did not document the species within the study area.
Lupinus perennis ssp. perennis	Wild Lupine	S3				NHIC, 2019	No	Dry, sandy oak savannahs and prairies; open forests and forest edges	Yes	No	Vascular flora surveys did not document the species within the study area.
Quercus prinoides	Dwarf Chinquapin Oak	S2				NHIC, 2019	No	Open, dry sandy places, savannahs	No	No	Vascular flora surveys did not document the species within the study area.
Phlox subulata ssp. subulata	Moss Phlox	S1?				NHIC, 2019	No	Open ,sandy woods, and sandy woods and lakeshores	No	No	Vascular flora surveys did not document the species within the study area.
Persicaria arifolium	Halberd-leaved Tearthumb	S3				NHIC, 2019	No	Wet mucky soil under alders at margin of peat bogs; wet, shades ground along streams, ponds, swamps and lakes; rich thickets and marshy boarders; wet depressions and seepage areas in mature hardwood forests	Yes	No	Vascular flora surveys did not document the species within the study area.
Enemion biternatum	False Rue-anemone	S2	THR	T	Schedule 1	NHIC, 2019	No	Floodplain woods and rich wooded slopes	No	No	Vascular flora surveys did not document the species within the study area.
Viola palmata	Early Blue Violet	S2S3				NHIC, 2019	No	Dry-mesic or sometimes wet-mesic sandly loam forests, disturbed forests and prairie-forest ecotones	Yes	No	Vascular flora surveys did not document the species within the study area.
Viola pedata	Bird's-foot Violet	S1	END	E	Schedule 1	NHIC, 2019	No	Open, dry oak and jack pine woods, sand barrens, dry prairies and dune forests	No	No	Vascular flora surveys did not document the species within the study area.

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Simcoe Water Supply Class EA
SAR-SCC Screening Table

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA[3]	Background Source	Observed by NRSI	Habitat Preference[4]	Suitable Habitats within Study Area?	Carried Forward to EA?	Rationale
Aplectrum hyemale	Putty-root	S2				NHIC, 2019	No	Moist deciduous forests	Yes	No	Vascular flora surveys did not document the species within the study area.
Corallorhiza odontorhiza	Autumn Coral-root	S2				NHIC, 2019	No	Open, oak-pine woods or occassionally in open, red pine or white pine plantations in sandy areas	No	No	Vascular flora surveys did not document the species within the study area.
Spiranthes ochroleuca	Yellow Nodding Ladies' Tresses	S2				NHIC, 2019	No	Sandy meadows, prairies and roadsides	Yes	No	Vascular flora surveys did not document the species within the study area.

[1]MNRF 2019a; [2]MECP 2019; [3]Government of Canada 2019; [4]OMNR 2000

Legend
SRank
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
S#? Rank Uncertain
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
SARA Schedule
Schedule 1 Officially Protected under SARA

APPENDIX II

Significant Wildlife Habitat Screening Assessment

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					
Rationale: Habitat important to migrating waterfowl	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Lake. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	Fields with sheet water during Spring (mid March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available[cxlviii] Information Sources • Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. • Reports and other information available from Conservation Authorities (CAs) • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Field Naturalist Clubs • Ducks Unlimited Canada • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • Any mixed species aggregations of 100[l] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat[cxlviii]. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	Suitable agricricultural habitat is present within the study area, however, does not contain spring sheet water during spring melt. **Not SWH**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					
Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district	Canada Goose Cackling Goose Snow Goose Green-winged Teal American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Blue-winged Teal Hooded Merganser Common Merganser Red-breasted Merganser Lesser Scaup Greater Scaup Common Goldeneye Bufflehead Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Canvasback Redhead Ruddy Duck Brant White-winged Scoter Black Scoter	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). Information Sources • Environment Canada • Naturalist clubs often are aware of staging/stopover areas • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100[l] or more of listed species for 7 days[l], results in >700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH[cxlix] • The combined area of the ELC ecosites and a 100m radius area is the SWH[cxlviii] • Wetland area and shorelines associated with sites identified within the SWHTG[cxlviii] Appendix K[cxlix] are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	Suitable aquatic habitat of sufficient size is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Shorebird Migratory Stopover Area					
Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird’s Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources • Western hemisphere shorebird reserve network • Canadian Wildlife Service (CWS) Ontario Shorebird Survey • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Center (NHIC) Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000[l] shorebird use days during spring or fall migration period (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (<24hrs) during spring migration, any site with >100[l] Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area[cxlviii] • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • SWHMIST[cxlix] Index #8 provides development effects and mitigation measures.	Suitable shoreline habitat is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources**[1]	**Defining Criteria**[1]	**Assessment Details**
Wildlife Habitat: Raptor Wintering Area					
Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class. Forest: FOD, FOM, FOC Upland: CUM, CUT, CUS, CUW Bald Eagle: Forest Community Series: FOD, FOM, FOC, SWD, SWM, or SWC, on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering (hawk/owl) sites need to be > 20ha[cxlviii, cxlix] with a combination of forest and upland[xvi, xvii, xviii, xix, xx, xxi]. Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags aviable for roosting[cxlix] Information Sources • OMNRF Districts • Natural clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from CAs • Results of Christmas Bird Counts	Studies confirm the use of these habitats by: • One or more Short-eared Owls, or, One or more Bald Eagles or; at least 10 individuals and two listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years)[cxlix] for a minimum of 20 days by the above number of birds[l]. • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Suitable combination of forest and upland habitat is present within the study area. However, listed species totals are not sufficient to signify confirmed Raptor Wintering Area SWH. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Bat Hibernacula					
Rationale: Bat hibernacula, are rare habitats in all Ontario landscapes.	Big Brown Bat Eastern Pipistrelle/Tri-colored Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. Active mine sites should not be considered The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts	• All sites with confirmed hibernating bats are SWH[í]. • The area includes 200m radius around the entrance of the hibernaculum[cxlviii, ccvii, í]. for the development types and 1000m for wind farms [ccv.] • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the[ccv]."Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv] • SWHMIST[cxlix] Index #1 provides development effects and mitigation measures.	Suitable cave, mine and karst habitat is not present within the study area. **Not SWH**
Wildlife Habitat: Bat Maternity Colonies					
Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	Maternity colonies can be found in tree cavities, vegetation and often in building [sxxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario[xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands[ccix, ccx] with >10/ha large diameter (>25cm dbh) wildlife trees[ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3[ccxiv] or class 1 or 2[ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred[ccx]. Information Sources • OMNRF for possible locations and contact for local experts • University Biology Departments with bat experts	Maternity Colonies with confirmed use by: • >10 Big Brown Bats[í] • >5 Adult Female Silver-haired Bats[í] • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies[í]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"[ccv]. • SWHMIST[cxlix] Index #12 provides development effects and mitigation measures.	Suitable treed habitat present throughout study area. Proposed works are not anticipated to affect the areas of potential bat maternity colony habitat. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Bat Migratory Stopover Area					
	Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.	Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migrations concentrate these species of bats at stopover areas. The location and characteristics of stopover habitats are generally unknown. <u>Information Sources</u> • OMNR for possible locations and contact for local experts • University of Waterloo, Biology Department	Long Point (42°35'N, 80°30'E to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration[ccxv]. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWHDSS[cxlix] Index #38 provides development effects and mitigation measures.	Criteria unavailable to assess significance of habitat within the study area. **Not SWH**
Wildlife Habitat: Turtle Wintering Area					
<u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle <u>Special Concern</u>: Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles: ELC Community Classes: SW, MA, OA and SA ELC Community Series: FEO and BOO Northern Map Turtle: Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen[cix, cx, cxi, cxviii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH <u>Information Sources</u> • EIS studies carried out by Conservation Authorities • Field naturalists clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant[l]. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[l]. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – Apr)[cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant[cix, cx, cxi, cxii]. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Several listed species are reported from the vicinity of the study area and Snapping Turtle was observed within the SWD4 community. Suitable aquatic habitat is present within the study area in the form of wetlands, ponds, and Davis Creek. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Reptile Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite in southern Ontario other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifying candidate SWH.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, lii, cxii]. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Information Sources • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from CAs • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[l]. • Note: If there are Special Concern Species present, then site is SWH • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (i.e. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH[l]. • SWHMIST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	This SWH type is difficult to assess for presence or absence due to the variability of site selection for hibernacula. However, only a single snake species (Eastern Gartersnake) was observed within the study area during targetted visual encounter surveys conducted by NRSI biologists in 2019. **Not SWH.**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)					
Rationale: Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. Information Sources • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]. • Bird Studies Canada: Nature Counts http://www.birdscanada.org/birdmon/ • Field Naturalist clubs	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nests[ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi]. • SWHMIST[cxlix] Index #4 provides development effects and mitigation measures.	Suitable eroding banks, steep slopes and sand piles are not present within the study area. **Not SWH**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)					
Rationale: Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas[ccv], colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other list species. • The habitat extends from the the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH[cc, ccvii]. • Confirmation of active colonies must be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells • SWHMIST[cxlix] Index #5 provides development effects and mitigation measures.	Suitable treed habitat is present within the study area, however no listed species were observed by NRSI biologists during targetted breeding bird surveys . **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Ground)					
Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1:50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources • Ontario Breeding Bird Atlas[ccv], rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[i]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[i]. • Presence of 5 or more pairs for Brewer's Blackbird[i]. • The edge of the colony and a minimum 150m radius area of the habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH[cc, ccvii]. • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #6 provides development effects and mitigation measures.	Suitable rocky island habitat is not present within the study area. **Not SWH**
Wildlife Habitat: Migratory Butterfly Stopover Areas					
Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter	Painted Lady Red Admiral Special Concern: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate sight for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10ha in size with a combination of field and forest habitat present, and will be located within 5km of Lake Ontario and Erie[cxlix]. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south [xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat [cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes [xxxvii, xxxviii, xxxix, xl, xli]. Information Sources • MNRF District Offices • Natural Heritage Information Centre (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association • Conservation Authorities	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)[xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day[xxxvii], significant variation can occur between years and multiple years of sampling should occur[xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD • MUD of >5000 or >3000 with the presence of Painted Ladies or White Admiral's is to be considered significant[i]. • SWHMIST[cxlix] Index #16 provides development effects and mitigation measures.	The study area not located within 5 km of Lake Ontario or Lake Erie. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Landbird Migratory Stopover Areas					
Rationale: Sites with a high diversity of species as well as high numbers are most significant	All migratory songbirds Canadian Wildlife Service Ontario website: http://www.on.ec.gc.ca/wildlife_e.html All migrant raptors species Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	Woodlots need to be >5 ha[Í] in size and within 5km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie or Ontario are more significant[cxlix]. • Sites have a variety of habitats: forest, grassland and wetland complexes[cxlix]. • The largest sites are more significant[cxlix] • Woodlots and forest fragments are important habitats to migrating birds[ccxviii], these features located along the shore and located within 5km of Lake Ontario and Lake Erie are Candidate SWH[cxlviii]. Information Sources • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates[Í]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (March/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #9 provides development effects and mitigation measures.	The study area not located within 5 km of Lake Ontario or Lake Erie. **Not SWH**
Wildlife Habitat: Deer Winter Congregation Areas					
Rationale: Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii]	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations (CUP) smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha[Í]. • Deer movement during winter in Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands[cxlviii]. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha[ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[Í]. Information Sources • MNRF District Offices • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF[cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF[Í]. • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques[ccxxiv], ground or road surveys, or a pellet count deer density survey[ccxxv]. • SWHMIST[cxlix] Index #2 provides development effects and mitigation measures.	Suitable habitat of appropriate size is not present in the study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	**Candidate SWH**			**Confirmed SWH**	**Study Area**
	ELC Ecosite Codes[1]	**Habitat Description**[1]	**Detailed Information and Sources**[1]	**Defining Criteria**[1]	**Assessment Details**
Cliff and Talus Slopes					
Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes[lxxviii] • SWHMIST[cxlix] Index #21 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Sand Barrens					
Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. They have little or no soil and the underlying rock protrudes through the surface. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	A sand barren area >0.5ha in size Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens[lxxviii] • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp)[l]. • SWHMIST[cxlix] Index #20 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	**Habitat Description[1]**	**Detailed Information and Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Alvar					
Rationale: Alvars are extremely rare habitats in Ecoregion 7E	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 **Five Alvar Indicator Species:** 1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum These indicator species are very specific to Alvars within Ecoregion 7E[cxlix]	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover[lxxviii].	An Alvar site > 0.5ha in size[lxxv]. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie[cxcix]. Information Sources • Alvars of Ontario (2000), Federation of Ontario Naturalists[lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars[ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Staff • Field Naturalist clubs • Conservation Authorities	Field studies identify four of the five **Alvar indicator species**[lxxv] at a candidate Alvar site is Significant • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses[lxxv]. • SWHMIST[cxlix] Index #17 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Old Growth Forest					
Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland area is >0.5ha Information Sources • OMNRF Forest Resource Inventory mapping • OMNRF Districts • Field naturalist clubs • Conservation Authorities • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments	Field Studies will determine: • If dominant trees species of the ecosite are >140 years old, then stand is Significant Wildlife Habitat[cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present) • Determine ELC Vegetation Type for forest area containing the old growth characteristics[lxxviii]. • SWHMIST[cxlix] Index #23 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l] Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location data available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present[l]. Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #18 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Centre (NHIC has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present[l]. Note: Prairie plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation Type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #19 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Other Rare Vegetation Communities					
Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG[cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M[cxlviii]. The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG[cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Waterfowl Nesting Area					
Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	A waterfowl nesting area extends: 120m[cxlix] from a wetland (>0.5ha) or a wetland (>0.5ha) with small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120m of each individual wetland where waterfowl nesting is known to occur[cxlix]. • Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. Information Sources • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from CAs	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[i], or, • Presence of 10 or more nesting pairs for listed species including Mallards[i]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120m[cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST[cxlix] Index #25 provides development effects and mitigation measures.	Suitable wetland habitat is present within the study area however, only a single mallard was observed incidentally within the study area with no evidence of breeding. **Not SWH**
Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern: Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands.	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources • Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario • MNRF values information (LIO/NRVIS) will list known nesting locations, Note: data from NRVIS is provided as a point format and does not include all the habitat. • Nature Counts, Ontario Nest Records Scheme data • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented • Reports and other information available from CAs • Field naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area[cxlviii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300m radius around the nest or the contiguous woodland stand is the SWH[ccvii], maintaining undisturbed shorelines with large trees within this area is important[cxlviii]. • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH[cvi, ccvii]. Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat[cvi]. • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for ≥3 years or suspected of not being used for >5 years before being considered not significant[ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #26 provides development effects and mitigation measures.	Suitable treed habitat is present within the study area however, no listed species were observed during targetted breeding bird surveys conducted by NRSI biologists. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Woodland Raptor Nesting Habitat					
Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM, SWD and CUP3	All natural or conifer plantation woodland/forest stands combined >30ha or with >4ha of interior habitat[lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. Interior habitat determined with a 200m buffer[cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada • Reports and other information available from CAs	Studies confirm: • Presence of 1 or more active nests from species list is considered significant[cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha of habitat is the SWH[ccvii].(the 28ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • Barred Owl – A 200m radius around the nest is the SWH[ccvii]. • Broad-winged Hawk and Coopers Hawk – A 100m radius around the nest is the SWH[ccvii]. • Sharp-Shinned Hawk – A 50m radius around the nest is the SWH[ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWHMIST[cxlix] Index #27 provides development effects and mitigation measures.	Forested habitat of suitable size is not present within the study area. **Not SWH**
Wildlife Habitat: Turtle Nesting Area					
Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m)[cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. Information Sources • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Center (NHIC) Field naturalist clubs	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[l] • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[l] • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH[cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat[cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observation studies observing the turtles nesting is a recommended method. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	A single Snapping Turtle was observed in 2019 (April 24), however, suitable habitat is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Seeps and Springs					
Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system[cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species[cxix, cxx, cxxi, cxxii, cxiii, cxiv]. <u>Information Sources</u> • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists and landowners • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped	Field Studies confirm: • Presence of a site with 2 or more[l] seeps/springs should be considered SWH. • The area of a ELC forest ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation of the habitat[cxlviii]. • SWHMIST[cxlix] Index #30 provides development effects and mitigation measures.	Suitable seeps/spring areas are not present within the study area. **Not SWH**
Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					
<u>Rationale:</u> These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m^2 (about 25m diameter) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size)[clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat[cxlviii]. <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations • Field naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the wetland area plus a 230m radius of woodland area[lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWHMIST[cxlix] Index #14 provides development effects and mitigation measures.	Suitable wetlands adjacent or in woodland habitat is present within the study area along Davis Creek. Targetted anuran call surveys conducted by NRSI identified the presence of >20 Spring Peeper and Wood Frog individuals from the SWD4 community located adjacent to and along Davis Creek. **Confirmed SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario Landscapes	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	• Wetlands >$500m^2$ (about 25m diameter)[ccvii] supporting high species diversity are significant: some small or ephemeral habitats may not be identified on MNR mapping and could be important amphibian breeding habitats[clxxxiv]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations • Reports and other information available from CAs	Studies confirm: • Presence of breeding population of 1or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 breeding individuals (adults and eggs masses)[lxxi, lxxiii] or 2 or more of the listed frog/toad species with Call Level of 3. or; Wetland with confirmed breeding Bullfrogs are significant[i]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys cviii to determine breeding/larval stages will be required during the spring (May March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHMIST[cxlix] Index #15 provides development effects and mitigation measures.	Suitable wetland habitat is present in the study area however, targetted anuran call surveys and field investigations conducted in 2019 by NRSI bioligists did not confirm suitable species counts or presence within applicable wetland communities. **Not SWH**
Wildlife Habitat: Woodland Area-Sensitive Bird Breeding Habitat					
Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker Special Concern: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs. old) forest stands or woodlots >30ha[cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200m from forest edge habitat[clxiv]. Information Sources • Local birder clubs • Canadian Wildlife Service (CWS) for the location of forest bird monitoring • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from CAs	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species[i]. • Note: any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH[i]. • Conduct field investigations in early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • SWHMIST[cxlix] Index #34 provides development effects and mitigation measures.	Suitable woodland habitat is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Gallinule American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites	• Nesting occurs in wetlands • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present[cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. Information Sources • OMNRF Districts and wetland evaluations • Field naturalist clubs • Natural Heritage Information Centre (NHIC) • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species[i]. • Note: any wetland with breeding of 1 or more Trumpeter Swans, Black Terns, Green Heron or Yellow Rail is SWH[i]. • Area of the ELC ecosite is the SWH • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #35 provides development effects and mitigation measures	Suitable wetland habitat is present within the study area. No listed species were observed during targetted breeding bird surveys conducted by NRSI in 2019. **Not SWH**
Wildlife Habitat: Open Country Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Special Concern: Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30ha[clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years)[i]. Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. Information Sources • Agricultural land classification maps Ministry of Agriculture • Local birder clubs • Ontario Breeding Bird Atlas[ccv] • EIS Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species[i]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #32 provides development effects and mitigation measures	Suitable grassland habitat is not present within the study area. Several listed species were reported with breeding evidence from the study area; Vesper Sparrow (Possible) and Savannah Sparrow (Probable) however significant habitat criteria have not been met. **Not SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat such as woodland area for some bird species.	Large natural field areas succeeding to shrub and thicket habitats >10ha[clxiv] in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years)[i]. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species[clxxiii]. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs • Ontario Breeding Bird Atlas[ccv] • Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species[i]. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat[i]. • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #33 provides development effects and mitigation measures.	Suitable natural field and succeeding shrub habitats of appropriate size are not present within the study area. Several listed species were reported with reeding evidence from the study area; Brown Thrasher (Possible), and Willow Flycatcher (Possible) however significant habitat criteria have not been met. **Not SWH**
Wildlife Habitat: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. [Ccii]	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish	Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites[cci]. • Area of ELC Ecosite or an ecoelement area of meadow marsh or swamp within the large ecosite area is the SWH • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult [cci] • SWHMIST[cxlix] Index #36 provides development effects and mitigation measures.	This SWH type is difficult to assess for presence or absence due to the inconsonspicuous nature of constructed burrows which can be found in various terrestrial sites. However, no burrows were observed by NRSI biologists during site investigations in 2019. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Special Concern and Rare Wildlife Species					
Rationale: These species are quite rare or have experienced significant population declines in Ontario	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites[lxxviii]. Information Sources • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists and element occurrences for these species. • NHIC Website: "Get Information" http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas[ccv] • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat neess to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	NRSI field surveys documented the presence of Eastern Wood-Pewee and Snapping Turtle within the study area. **Confirmed SWH**

Significant Wildlife Habitat Assessment Tables

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Blue-spotted Salamander Spotted Salamander Four-toed Salamander Gray Treefrog Northern Leopard Frog Pickerel Frog Western Chorus Frog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	Movement corridors between breeding habitat and summer habitat[clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi] Movement corridors must be considered when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[l]. Information Sources • MNRF District Office • Natural Heritage Information Centre NHIC • Reports and other information available from CAs • Field naturalist Clubs	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterwaycxlix or be up to 200m widecxlix of woodland habitat and with gaps <20m[cxlix] • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMIST[cxlix] Index #40 provides development effects and mitigation measures.	Suitable habitat features to support criterion are not present within the study area. Amphibian breeding habitat is absent from the study area and as such, movement corridors are also absent from the study area. **Not SWH**

APPENDIX III

Water Test Monitoring Results

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 11, 2021 Proj. 2250A

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Banks Groundwater Engineering
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Puslinch, ON N0B 2J0

RE: Simcoe Water Supply Class EA Natural Environmental Studies Aquifer Performance Test Results

Introduction

To-date, considerable groundwater testing and biological work has been completed in support of the approval for a new municipal groundwater supply source for the Community of Simcoe, and is summarized in the *Revised Draft Report 2012 Monitoring and Aquifer Testing Program* (Banks Groundwater Engineering Limited 2015) and the *Community of Simcoe Additional Water Supply Class EA – Fisheries Update and Preliminary Fisheries Risk Self Assessment* (Golder 2015). As part of the current groundwater testing program, a 7-day aquifer performance test was completed at 2 test well locations within the study area by Banks Groundwater Engineering Ltd. in 2020 to assess impacts to the groundwater supply source. NRSI was retained to complete the pumping test monitoring to verify that there were no significant impacts to the surface water or the aquatic environment.

The following summary outlines the aquatic biological surveys undertaken during this 7-day aquifer performance test, herein referred to as the pumping test, and the results of these assessments.

Methodology

NRSI biologists were on site on October 16, 2020 to establish three monitoring sites. The first objective was to determine whether or not the pumping test would impact the surface waters to determine if there was a connection between the aquifer and the surface waters. The second objective was to determine the existing conditions present within the watercourse and document any changes caused by the pumping testing. Three locations within the watercourse were selected to give the most complete picture. One of the sites was at the upper extent of the watercourse, one was downstream of the two production wells SW12\20 and SW11\09, and one was downstream of the test pumping discharge location (Map 1). The Ontario Stream Assessment Protocol (OSAP), which covers site selection, monitoring methodology and data management, was used to collect the watercourse baseline data.

The pumping test was scheduled to begin on October 20, 2020 at 1000hr. To establish a baseline prior to the start of the pumping test, water depth and flow monitoring measurements were taken on October 19 and again on October 20 prior to pumping test beginning. The entire watercourse within the study area was visually examined for locations with poor bank stability in addition to the depth and flow at the three monitoring sites (Map 1). Monitoring was conducted daily from October 19 to October 29 starting at 0800hr and ending between 1000hr and 1200hr depending on the number of staff present that day. The sites within the watercourse were monitored from downstream to upstream along pre-established transects marked with pink surveyor flags. At each sampling location, a water depth and hydraulic head were captured to determine if there was significant change in the water caused by the pumping test. Hydraulic head was used as a proxy for velocity as specified by the OSAP.

To determine if there was a change in substrate composition or bank stability additional metrics were recorded prior to the start of the pumping testing and then 1 day after the pumping test was completed. These metrics included percent substrate composition, bank slope, bank composition, bank vegetation, and undercutting as specified by the OSAP.

Depth and Flow Monitoring

In order to determine if there is a connection between the surface waters and the aquifer undergoing the pumping test, the depth and flows of the watercourse were monitored in several locations. This was completed in addition to Banks Groundwater Engineering's monitoring using installed piezometers and water level loggers throughout the system and surrounding area.

Site 1 – Upstream Extent

Site 1 was located at the upstream extent of the watercourse where land access had been granted. The site began upstream of the large irrigation pond to the east of test production well SW12\20 and extended north to just downstream of the culvert under Cloet Road. The site was 48m long with a minimum width of 2.1m; therefore, in accordance with OSAP, Site 1 included 12 transects equally spaced 4.35m apart. Figure 1 shows the average depth of water recorded at each transect throughout the monitoring period. Figure 2 shows the average hydraulic head between the 5 points of each transect and Figure 3 shows the average water depth across all transects and the rainfall that day, the columns in yellow are during the pumping test.

As shown on Figures 1, 2, and 3, there was little variation in the depths of the watercourse during the pumping test, with one exception on October 24. There was significant precipitation during the night of October 23, which led to the elevated depths and velocities documented on October 24. This pattern of elevated values on October 24 was consistent across all three sites. The depths were consistent between sampling events as flows within Site 1 are mitigated by the large ponds on either side of the watercourse. These ponds likely buffer the system from significant fluctuations that the smaller and less buffered systems experience downstream. The yellow bars represent measurements taken during the pumping test.

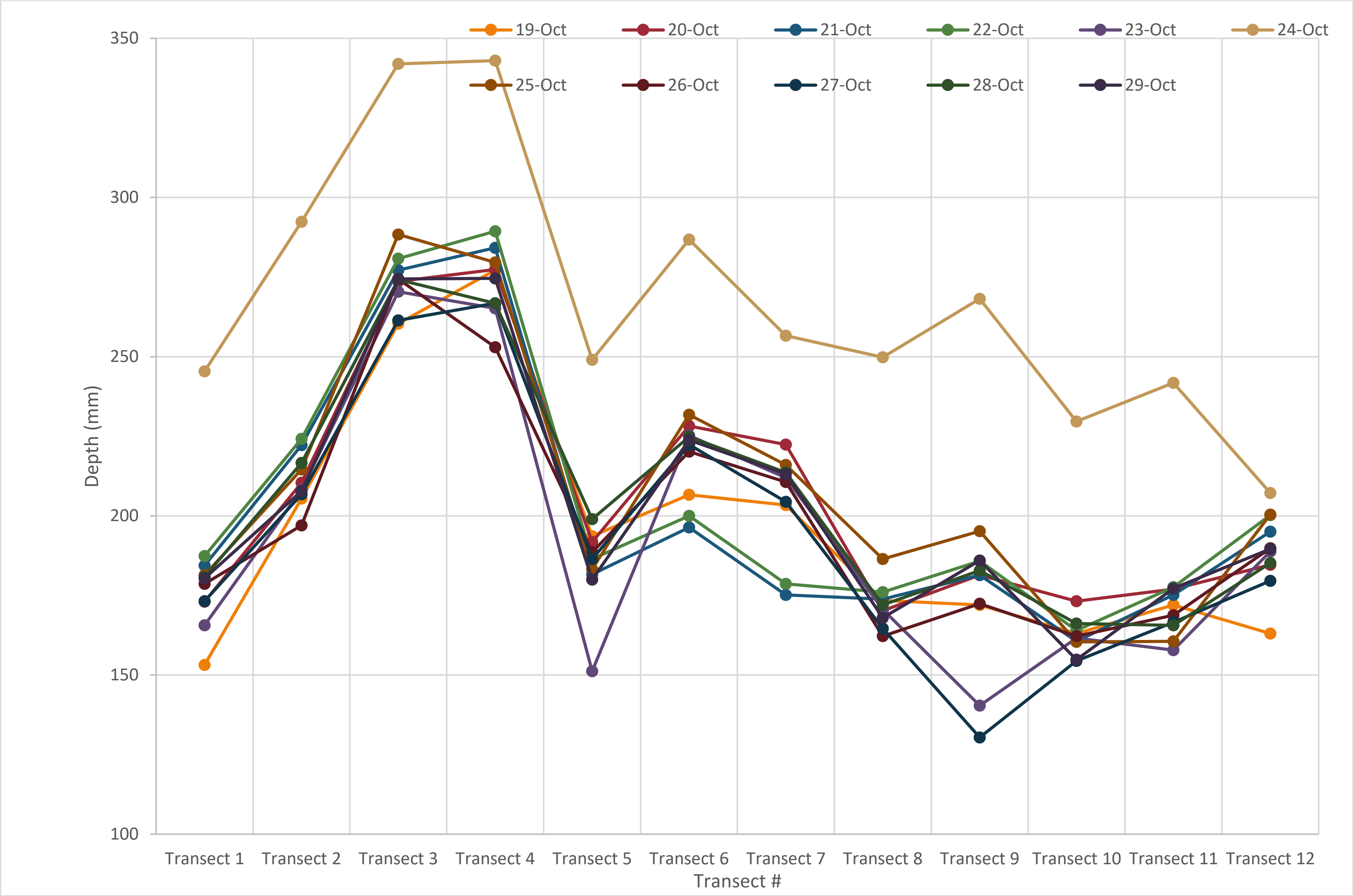


Figure 1. Site 1 Average Water Depth by Transect

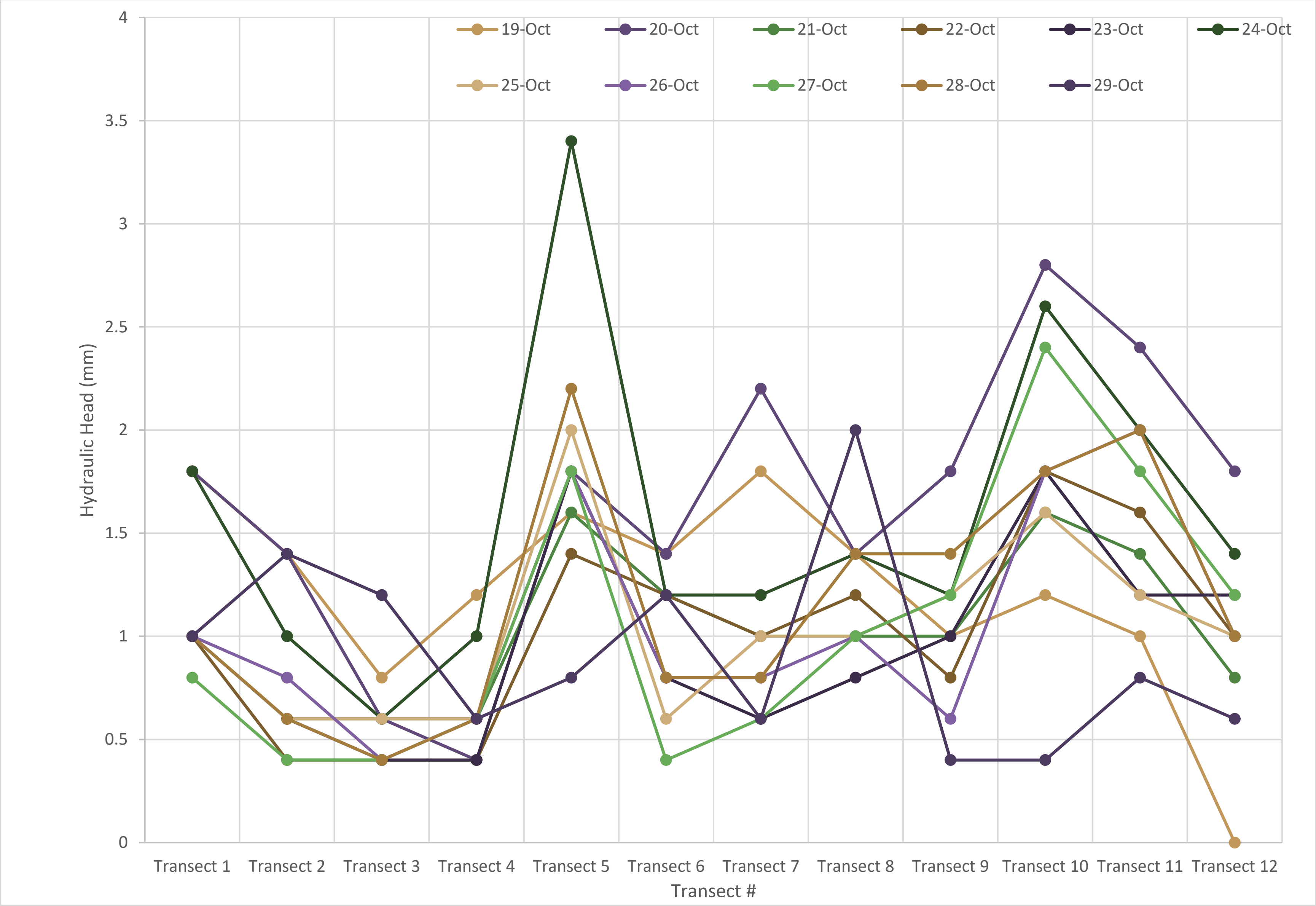


Figure 2. Site 1 Average Hydraulic Head by Transect

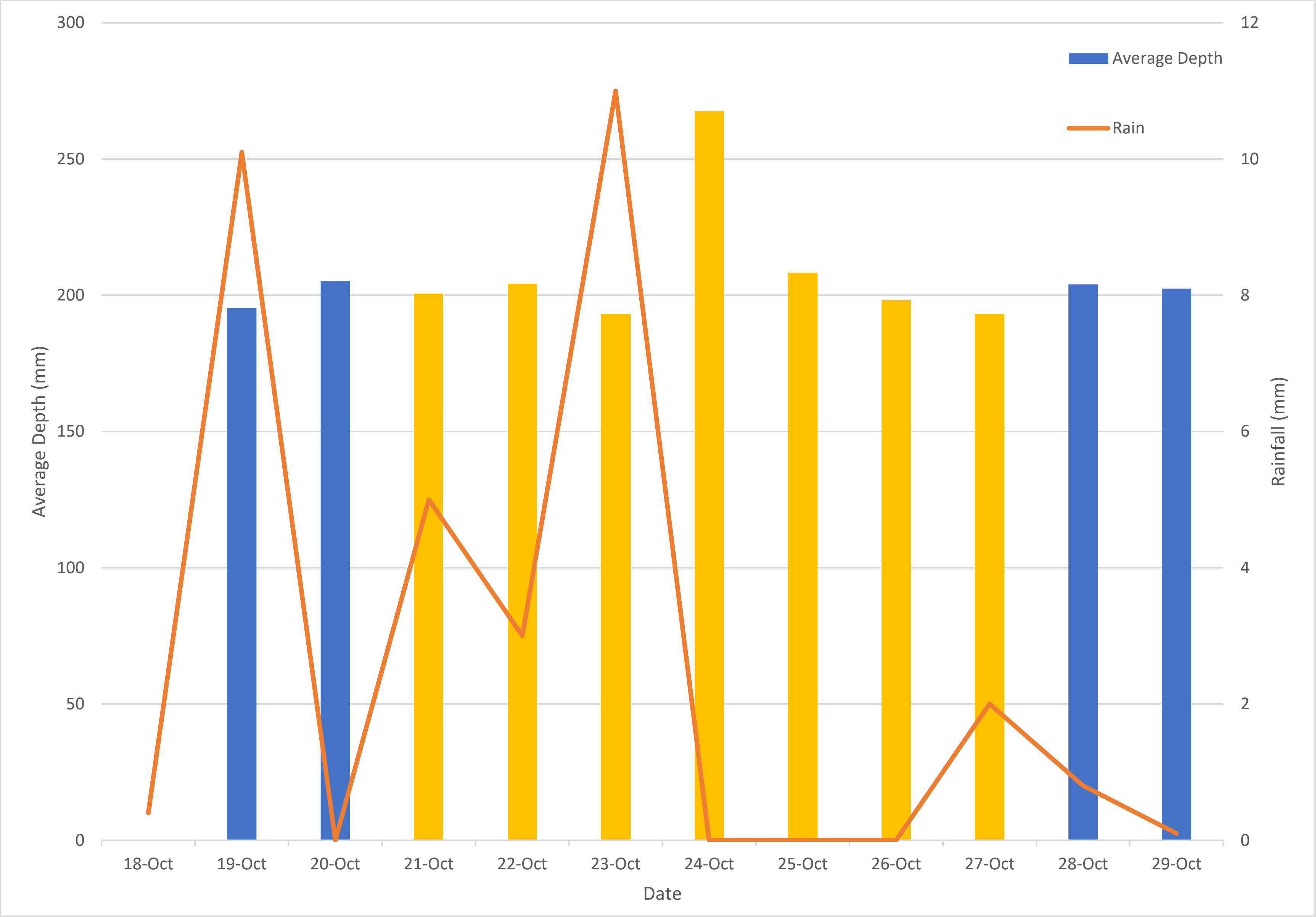


Figure 3. Site 1 Average Daily Depth and Rainfall

Site 2 – Downstream of Pumps

Site 2 was located downstream of both test production wells and upstream of the test pumping discharge location. This site was significantly narrower than Sites 1 and 3, with a minimum width of 1.0m and a total length of 42.2m. A total of 20 transects, with two points per transect, were established across the length of the site with 2.2m spacing between them. Figure 4 shows the average water depth of each transect over the course of the monitoring period. Figure 5 shows the average hydraulic head of each transect and Figure 6 shows the average water depth across all transects and the rainfall that day. The columns in yellow are during the pumping test.

As Figure 6 best exemplifies, Site 2 was temporarily impacted by the release of water from the test pumping discharge location downstream. Based on the depths by transect, this flooding significantly inundated the site up to Transect 11. Here the pre-pumping and during-pumping results began to realign, but the elevated depths continued to a lesser extent throughout the entire monitored area during the test. One post-hoc manipulation that can be done to attempt to minimize the obscuring effect of the increased depths is to remove Transects 1 through 10 as they saw the greatest increases.

After this manipulation, shown in Figure 7, the results are relatively consistent with higher overall depths during pumping with daily spikes associated with local rainfall. These higher depths during pumping after manipulation suggest we cannot properly control for the released water that temporarily elevated the depths within Site 2.

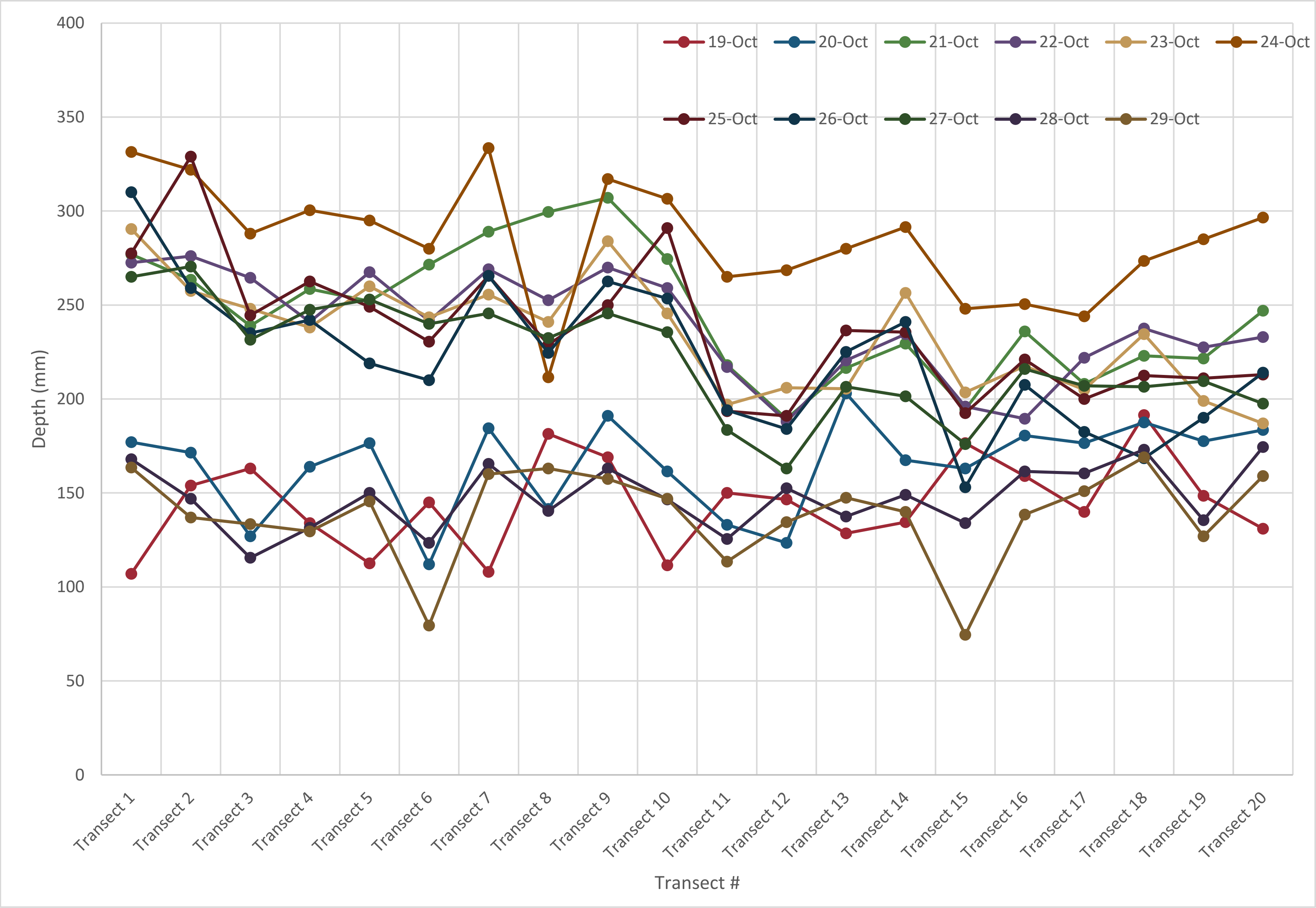


Figure 4. Site 2 Depths by Transect

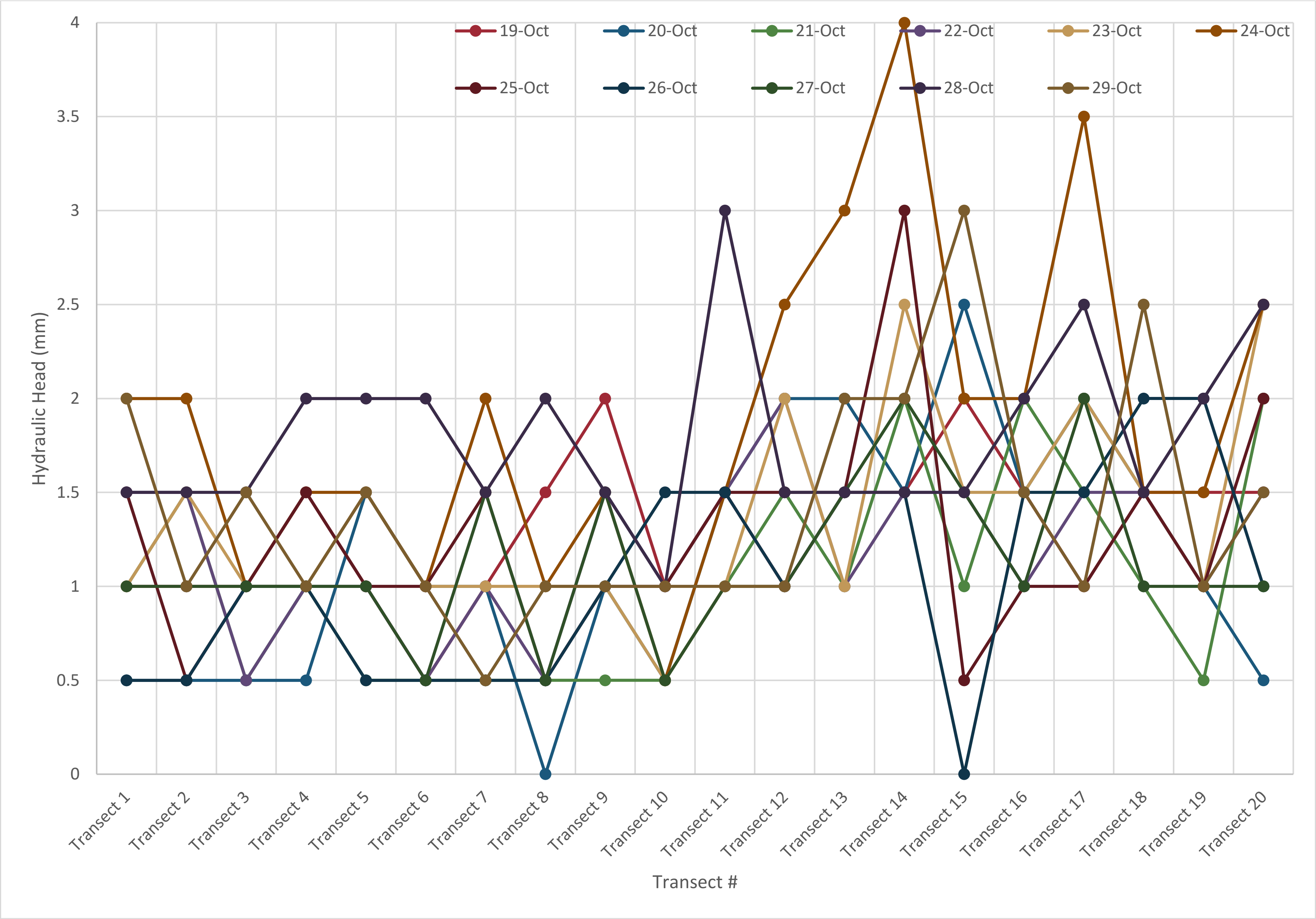


Figure 5. Site 2 Flows by Transect

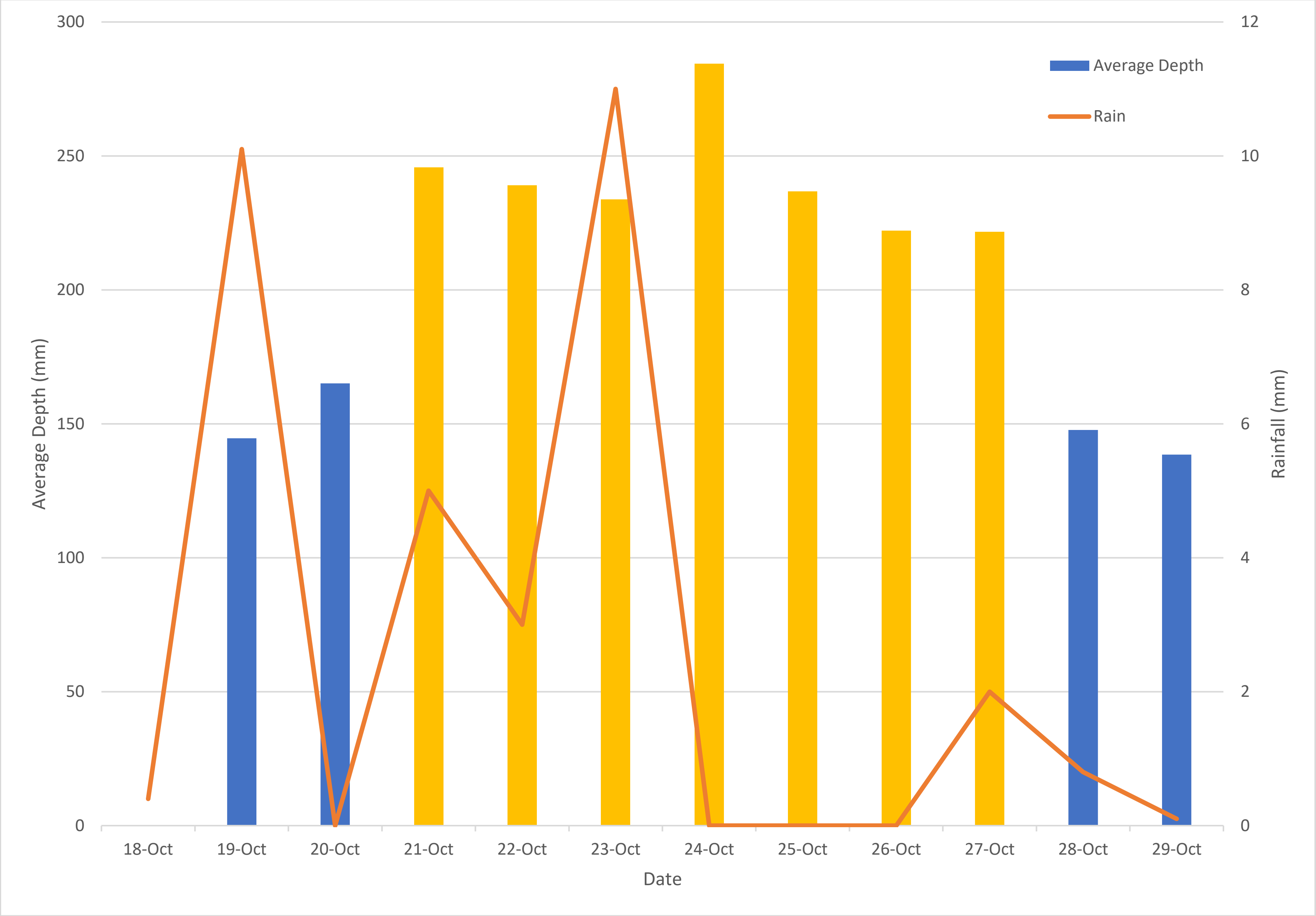


Figure 6. Site 2 Average Daily Depth and Rainfall

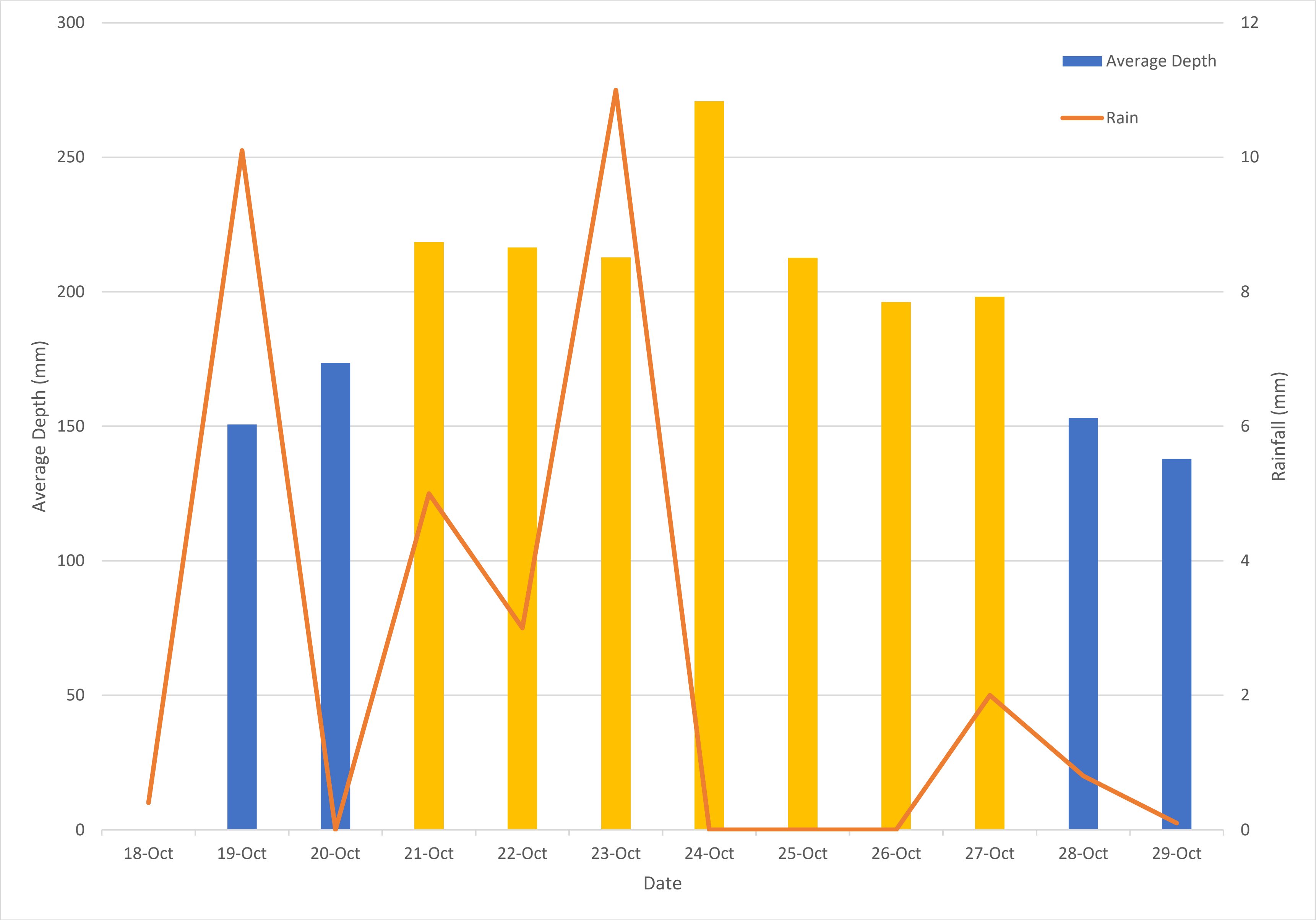


Figure 7. Site 2 Back Flooding Adjusted Average Daily Depth and Rainfall

Site 3 – Below the Test Pumping Discharge Location

A site below the test pumping discharge location was established to determine if the pumping test had any negative impacts on the existing creek. The site is significantly wider and, unlike Site 1 and 2, is located between two agricultural fields as opposed to forest and wetland. The site had a minimum width of 1.6m, a total length of 48.0m with 12 transects at 5 points per transect and each transect 4 meters apart. Figures 8, 9, and 10 show the water depths, flows, and average depth and rainfall respectively.

Site 3 was the most impacted, although temporarily, by the pumping testing since there was a significant increase in the quantity of water passing through the watercourse. The depths increased sharply once the testing began and remained high throughout the test. This was expected with the depths approximately doubling during the pumping test due to the large increase of water within the watercourse. The water level returned to normal after the testing was completed.

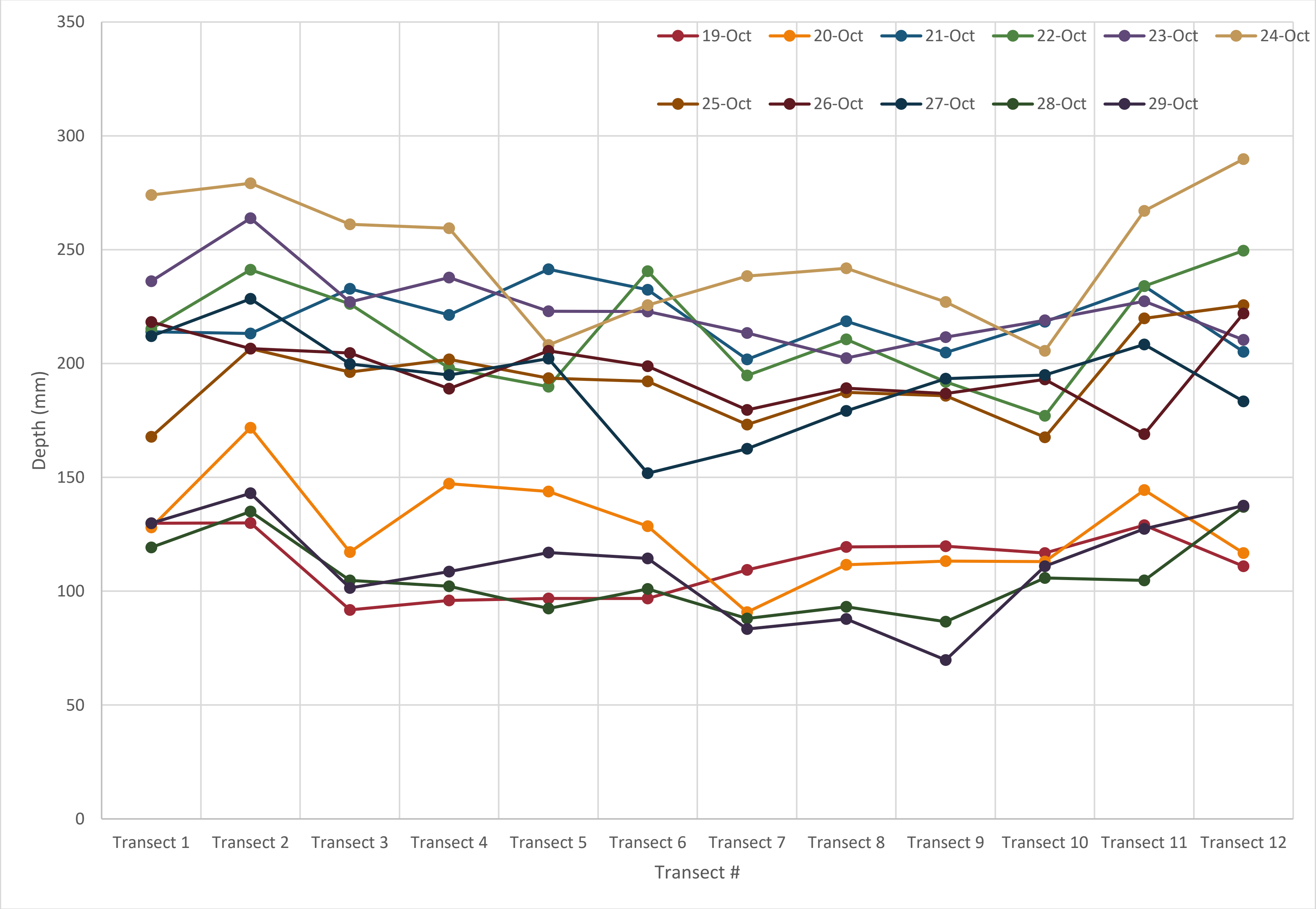


Figure 8. Site 3 Depths by Transect

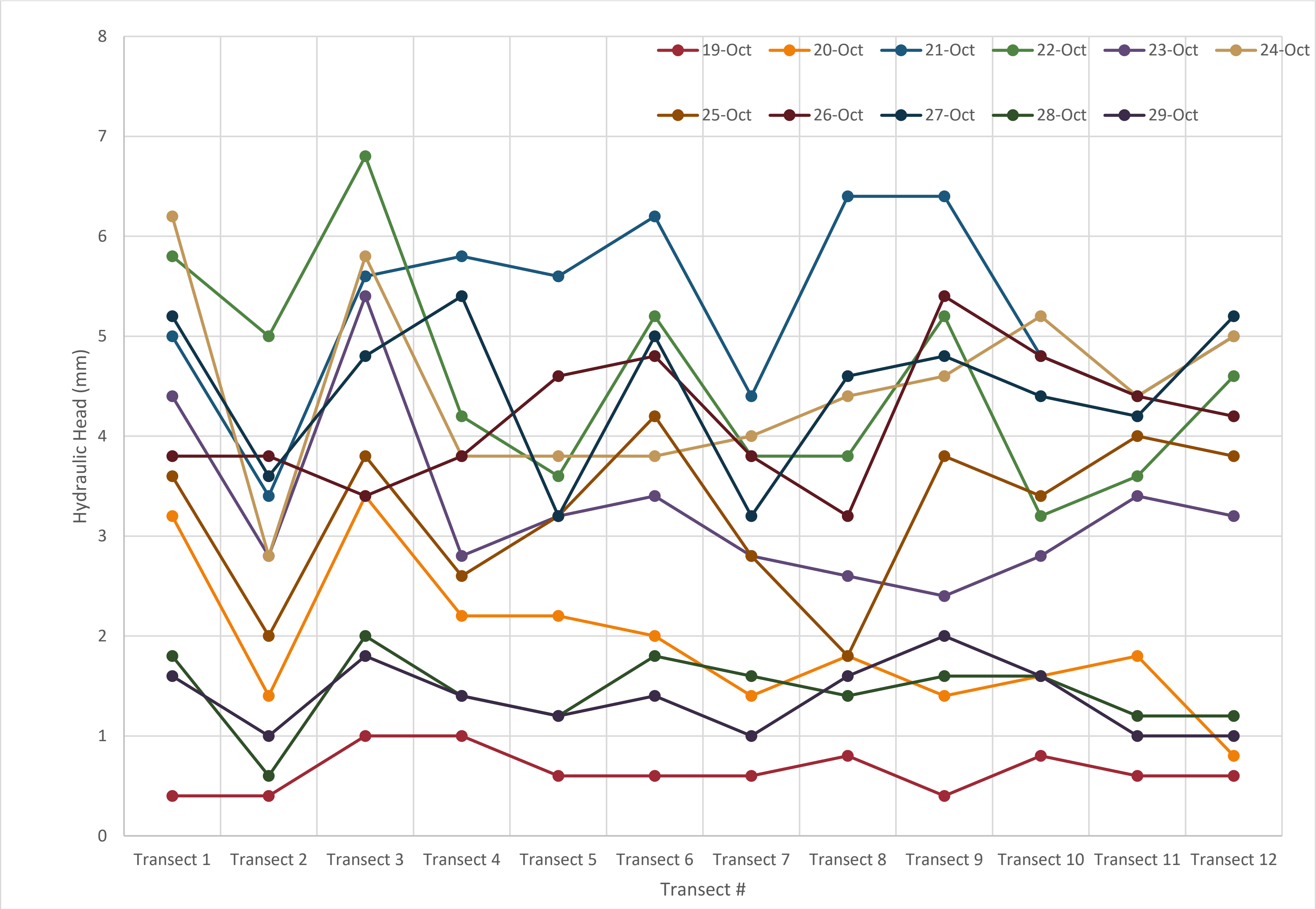


Figure 9. Site 3 Flows by Transect

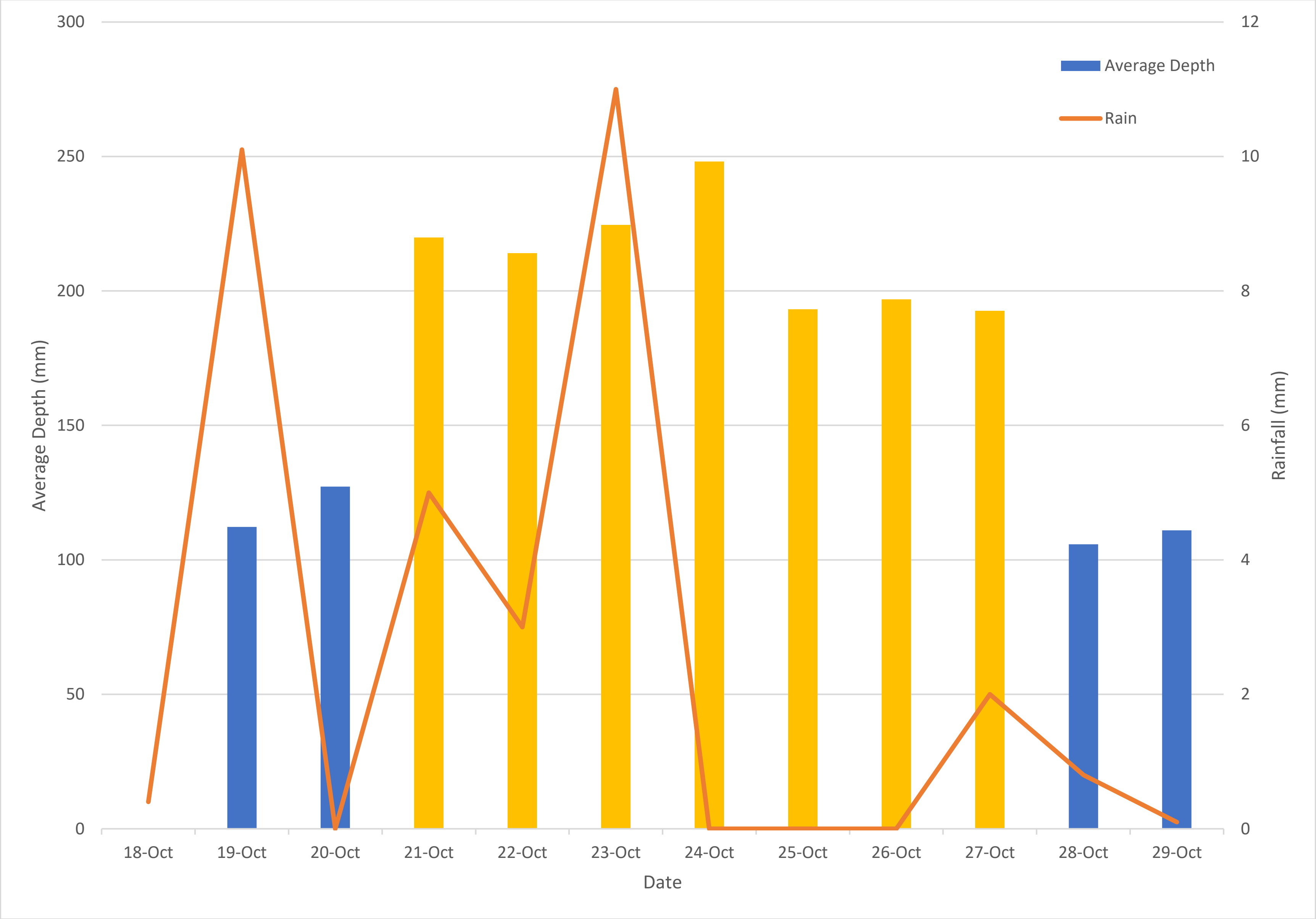


Figure 10. Site 3 Average Daily Depth and Rainfall

Water Quality Monitoring

To determine if there were any negative impacts associated with the pumping test water, two water quality parameters were monitored: Dissolved Oxygen (DO) and temperature. The data is represented below in Figures 11 and 12. The yellow points represent measurements collected during the pumping test.

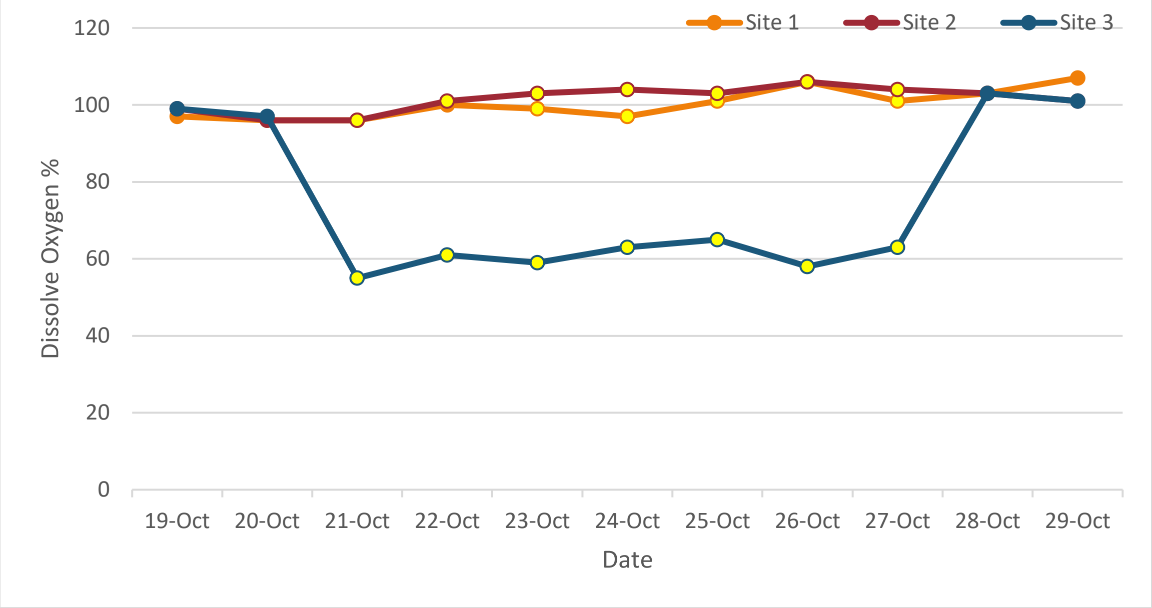


Figure 11. Dissolved Oxygen by Site

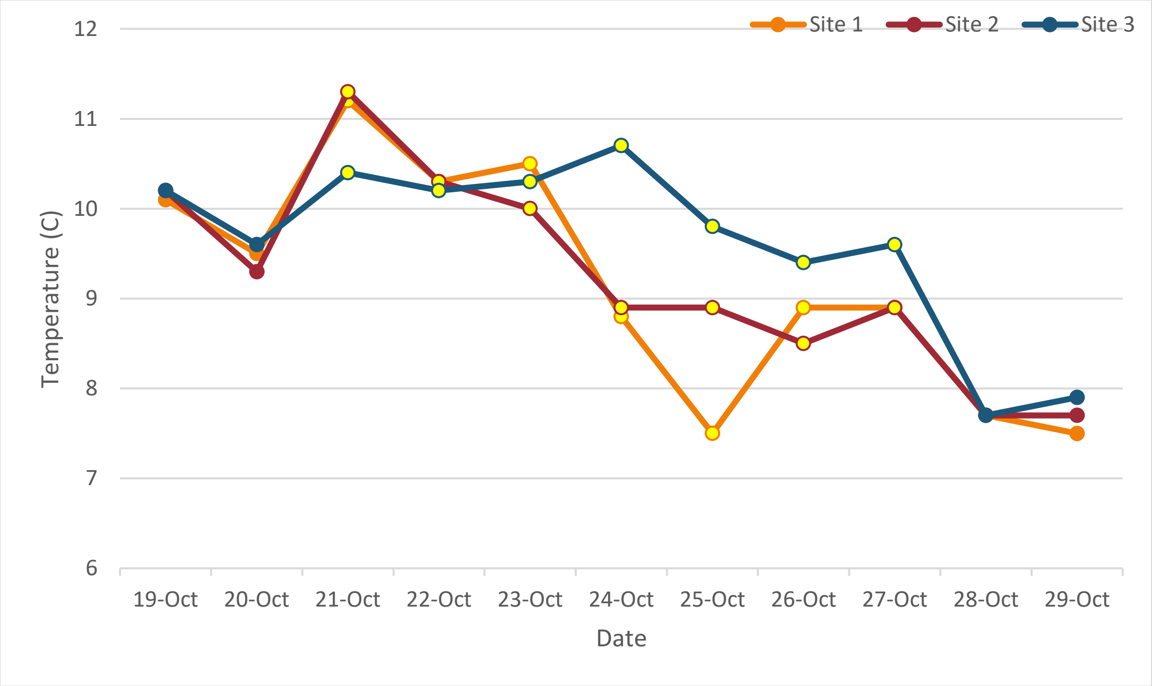


Figure 12. Water Temperature by Site

As shown on Figure 11, Site 3 was receiving a substantial quantity of water with low DO from the aquifer. This water lowered the DO content by approximately 30-40% relative to upstream of the test pumping discharge location. Fortunately, the DO decrease was not significant enough to pose mortality risks to the fish downstream since it was being oxygenated by the outlet manifold and mitigated by the already oxygenated water within the watercourse. Considering the coolwater fish community present, a decreased DO for 7 days would not be a cause for concern at the levels present during the pumping test. Point sampling was completed at the test pumping discharge location on October 21 and 26 and found that the water was at 35-40% DO when it was exiting the pump. There are no long-term concerns associated with changes in the DO.

Water coming out of the test pumping discharge was 9.3°C during both point samplings. Figure 12 shows that Site 3 did not fluctuate as rapidly likely due to the influx of water at a consistent temperature. There were no environmental concerns linked with temperature fluctuation. The fish community present within the watercourse would deal with seasonal fluctuations from the high teens to freezing each year.

Substrate Composition Monitoring

Prior to the pumping test, the substrates of Sites 1, 2, and 3 were assessed to determine their composition. The monitoring used a modified Wentworth classification of substrate types by size, as outlined in Table 1. After the completion of the pumping test, the substrates were re-examined for notable changes or signs of new erosion. This would be characterized by a change in average grain size by one category or higher as defined below. As of October 29, there were no detectable changes to Sites 1 and 2 in terms of substrate composition or erosion. Site 3 experienced a reduction in silt and sand quantities relative to gravel and pebble. The increases were expected as the increased velocity and volume of water present within the watercourse disturbed the overlying silt and sand while leaving the larger and heavier gravel and pebble in place. Based on the site conditions and fish community found during the broader environmental assessment conducted by NRSI (October 16, 2020) that is described under separate cover, the decrease in silt and sand may have a positive impact on the fish present within the watercourse. This is because the fish community present, *Rhinichthys atratulus* and *Semotilus atromaculatus* in particular, prefer larger substrates for habitat use.

The minimal aquatic vegetation present within Site 3 remained throughout the testing.

Table 1. Modified Wentworth Classification of Substrate Type by Size

Substrate Type	Particle Size Range (mm)	Sample Codes
Boulder	>256	5
Cobble	64 - 256	4
Pebble	16 - 63	3
Gravel	2 - 15	2
Sand	0.06 - 1	1
Silt and Clay	<0.059	0

*Modified Wenthworth classification reference: Cummins, K.W. 1962. An evaluation of some techniques for the collection and analysis of benthic samples with special emphasis on lotic waters. American Midland Naturalist 67:477-504

Conclusion

Based on the aquatic habitat parameters gathered from the monitoring of the watercourse before, during, and after the pumping test, there is no evidence to suggest that there are any negative short- or long-term environmental impacts from either the pumping or the discharge of the water back into the watercourse. This is supported by the depths and flows within the watercourse not decreasing during the pumping testing which would have suggested a significant connection between the aquifer and the surface waters. Additionally, there was no noted scouring, large changes in substrate, or decreases in shoreline vegetation associated with the discharge of water from the pumping test. Within the full study area there were no new areas of erosion or scouring found after the pumping test's completion.

References

Banks Groundwater Engineering Limited. 2015. 2012 Monitoring and Aquifer Testing Program, Community of Simcoe Additional Water Supply Class Environmental Assessment. Prepared for Norfolk County. 134pp.

Golder Associates. 2015. Community of Simcoe Additional Water Supply Class Environmental Assessment – Fisheries Update and Preliminary Fisheries Risk Self Assessment. 4pp.

Map 1
Study Area and Monitoring Sites

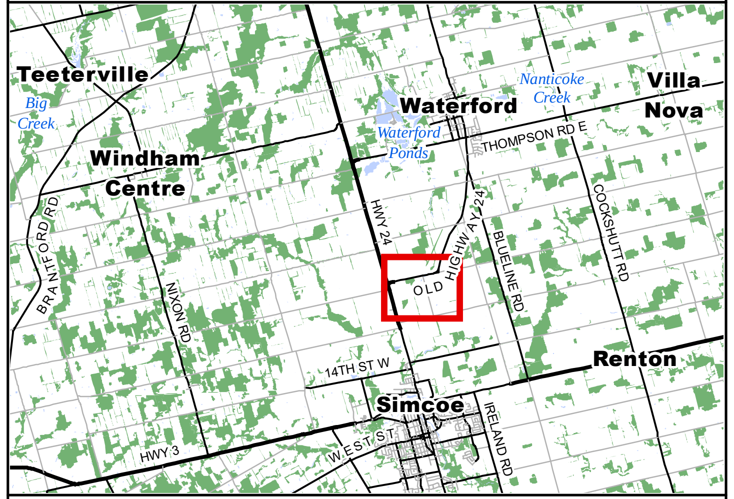
Map 1
Study Area and Monitoring Sites

Path: X:\2250A_SimcoeWaterSupplyClassEA\NRSI_2250A_Map1_PumpTestMonitoring_8K_2021_02_05_MV.mxd

Map 1

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

Pump Test Monitoring



Legend

- 🟧 Study Area (Estimated Zone of Influence)
- ● Watercress
- ● Pump
- ● Pump Release
- ▬ ▬ OSAP Monitoring Site
- •— Utility Line
- —+— Railway
- ━ Highway
- — Primary Road
- — Secondary Road
- ∼ Permanent Watercourse
- ∼ Intermittent Watercourse

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Aquatic, Terrestrial and Wetland Biologists

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Project: 2250A
Date: February 5, 2021

NAD83 - UTM Zone 17
Size: 11x17"
1:8,000

0 100 200 300 400 500 Metres

N

APPENDIX IV

Species Lists

Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRank[2]	SARO[3]	COSEWIC[3]	SARA Schedule[4]	Rare Plant Atlas[5]	Haldimand-Norfolk Status[6]	NHIC Data[7]	NRSI Observed					
											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site
Pteridophytes	**Ferns & Allies**																
Dryopteridaceae	**Wood Fern Family**																
Dryopteris carthusiana	Spinulose Wood Fern	5	-2		S5					C			X				X
Onoclea sensibilis	Sensitive Fern	4	-3		S5					C			X	X			X
Equisetaceae	**Horsetail Family**																
Equisetum arvense	Field Horsetail	0	0		S5					C			X	X			X
Thelypteridaceae	**Beech Fern Family**																
Thelypteris palustris var. pubescens	Marsh Fern	5	-4		S5									X			X
Gymnosperms	**Conifers**																
Cupressaceae	**Cypress Family**																
Juniperus virginiana	Eastern Red Cedar	4	3		S5								X				X
Pinaceae	**Pine Family**																
Pinus strobus	Eastern White Pine	4	3		S5					C				X			X
Dicotyledons	**Dicots**																
Aceraceae	**Maple Family**																
Acer negundo	Manitoba Maple	0	-2		S5					C		X	X		X		X
Acer platanoides	Norway Maple		5	-3	SE5							X		X			X
Acer saccharum ssp. saccharum	Sugar Maple	4	3		S5					C				X			X
Acer X freemanii	Freeman's Maple													X		X	X
Anacardiaceae	**Sumac or Cashew Family**																
Rhus hirta	Staghorn Sumac	1	5		S5					C			X	X	X		X
Toxicodendron rydbergii	Poison-ivy	0	0		S5					C		X	X	X			X
Apiaceae	**Carrot or Parsley Family**																
Aegopodium podagraria	Goutweed		0	-3	SE5							X					X
Cicuta maculata	Spotted Water-hemlock	6	-5		S5					C			X				X
Daucus carota	Wild Carrot		5	-2	SE5					IC		X	X				X
Apocynaceae	**Dogbane Family**																
Apocynum androsaemifolium ssp. androsaemifoli	Spreading Dogbane	3	5		S5							X					X
Apocynum cannabinum var. cannabinum	Indian Hemp		1		S5					C			X				X
Asclepiadaceae	**Milkweed Family**																
Asclepias incarnata ssp. incarnata	Swamp Milkweed	6	-5		S5								X				X
Asclepias syriaca	Common Milkweed	0	5		S5							X					X
Asteraceae	**Composite or Aster Family**																
Ambrosia artemisiifolia	Common Ragweed	0	3		S5					C		X					X
Arctium minus ssp. minus	Common Burdock		5	-2	SE5							X		X			X
Cirsium vulgare	Bull Thistle		4	-1	SE5					IC		X					X
Erigeron annuus	Daisy Fleabane	0	1		S5					U		X	X	X			X
Erigeron philadelphicus ssp. philadelphicus	Philadelphia Fleabane	1	-3		S5					C		X					X
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	3	-5		S5								X				X
Heliopsis helianthoides	Sweet Ox-eye	3	5		S5							X					X
Hieracium caespitosum ssp. caespitosum	Field Hawkweed		5	-2	SE5							X					X
Lactuca biennis	Biennial Lettuce	6	0		S5					U			X				X
Lactuca canadensis	Tall Lettuce	3	2		S5								X				X
Liatris spicata	Spiked Blazing Star	9	0		S3	THR	T	Schedule 1				Planted					X
Matricaria discoidea	Pineapple-weed				SE5							X					X
Ratibida pinnata	Gray-headed Coneflower	9	5		S3							X					X
Solidago altissima var. altissima	Tall Goldenrod	1	3		S5					C			X				X
Solidago canadensis	Canada Goldenrod	1	3		S5					C		X	X				X
Solidago flexicaulis	Zig-zag Goldenrod	6	3		S5					C				X			X
Symphyotrichum lanceolatum	Panicled Aster	3	-3		S5							X	X				X
Symphyotrichum oolentangiense	Azure Aster	9	5		S4							X					X
Symphyotrichum puniceum	Purple-stemmed Aster				S5					C			X				X
Symphyotrichum urophyllum	Arrow-leaved Aster	6	5		S4					C		X	X				X

Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRank[2]	SARO[3]	COSEWIC[3]	SARA Schedule[4]	Rare Plant Atlas[5]	Haldimand-Norfolk Status[6]	NHIC Data[7]	NRSI Observed					
											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site
Taraxacum officinale	Common Dandelion		3	-2	SE5					IC			X	X			X
Tussilago farfara	Coltsfoot		3	-2	SE5					IC				X	X		X
Balsaminaceae	**Touch-me-not Family**																
Impatiens capensis	Spotted Touch-me-not	4	-3		S5					C		X	X				X
Impatiens glandulifera	Glandular Touch-me-not		-3	-2	SE4							X					X
Berberidaceae	**Barberry Family**																
Podophyllum peltatum	May-apple	5	3		S5					C				X			X
Betulaceae	**Birch Family**																
Carpinus caroliniana ssp. virginiana	Blue Beech	6	0		S5					C				X			X
Boraginaceae	**Borage Family**																
Hackelia virginiana	Virginia Stickweed	5	1		S5					X		X					X
Brassicaceae	**Mustard Family**																
Alliaria petiolata	Garlic Mustard		0	-3	SE5					IC		X	X	X			X
Barbarea vulgaris	Yellow Rocket		0	-1	SE5					IC			X				X
Cardamine bulbosa	Bulbous Cress	8	-5		S4					U			X				X
Hesperis matronalis	Dame's Rocket		5	-3	SE5					IC		X					X
Campanulaceae	**Bellflower Family**																
Lobelia siphilitica	Great Lobelia	6	-4		S5								X				X
Caprifoliaceae	**Honeysuckle Family**																
Lonicera tatarica	Tartarian Honeysuckle		3	-3	SE5							X					X
Lonicera X bella	Bell's Honeysuckle		5	-3	SE2								X				X
Viburnum lentago	Nannyberry	4	-1		S5					C			X				X
Viburnum opulus	Guelder Rose		0	-1	SE4					IU			X				X
Caryophyllaceae	**Pink Family**																
Saponaria officinalis	Bouncing-bet		3	-3	SE5							X					X
Silene latifolia	Bladder Campion				SE5							X					X
Celastraceae	**Staff-tree Family**																
Euonymus obovata	Running Strawberry-bush	6	5		S5									X			X
Chenopodiaceae	**Goosefoot Family**																
Chenopodium album var. album	Lamb's-quarters		1	-1	SE5					IC		X					X
Cornaceae	**Dogwood Family**																
Cornus amomum ssp. obliqua	Silky Dogwood	5	-4		S5								X				X
Cornus foemina ssp. racemosa	Red Panicled Dogwood	2	-2		S5					U		X	X				X
Cucurbitaceae	**Gourd Family**																
Echinocystis lobata	Prickly Cucumber	3	-2		S5							X	X	X			X
Dipsacaceae	**Teasel Family**																
Dipsacus fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5										X		X
Euphorbiaceae	**Spurge Family**																
Acalypha virginica var. rhomboidea	Three-seeded Mercury	0	3		S5					C		X					X
Fabaceae	**Pea Family**																
Amphicarpaea bracteata	Hog Peanut	4	0		S5					C		X	X				X
Medicago lupulina	Black Medick		1	-1	SE5							X					X
Melilotus alba	White Sweet-clover		3	-3	SE5							X					X
Robinia pseudo-acacia	Black Locust		4	-3	SE5							X					X
Trifolium pratense	Red Clover		2	-2	SE5					IC		X	X				X
Fagaceae	**Beech Family**																
Fagus grandifolia	American Beech	6	3		S5					C				X			X
Quercus macrocarpa	Bur Oak	5	1		S5								X	X			X

Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRank[2]	SARO[3]	COSEWIC[3]	SARA Schedule[4]	Rare Plant Atlas[5]	Haldimand-Norfolk Status[6]	NHIC Data[7]	NRSI Observed					
											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site
Geraniaceae	**Geranium Family**																
Geranium maculatum	Spotted Crane's-bill	6	3		S5					C				X			X
Grossulariaceae	**Currant Family**																
Ribes americanum	Wild Black Currant	4	-3		S5					C			X				X
Juglandaceae	**Walnut Family**																
Carya cordiformis	Bitternut Hickory	6	0		S5					C			X	X			X
Carya ovata var. ovata	Shagbark Hickory	6	3		S5					C			X	X			X
Juglans nigra	Black Walnut	5	3		S4					C		X	X	X		X	X
Lamiaceae	**Mint Family**																
Glechoma hederacea	Creeping Charlie		5	-2	SE5					IC		X					X
Monarda didyma	Oswego-tea	8	3		S3				X	R		Planted					X
Monarda fistulosa	Wild Bergamot	6	3		S5					C		X					X
Pycnanthemum virginianum	Virginia Mountain-mint	8	-4		S4							X					X
Scutellaria lateriflora	Mad-dog Skullcap	5	-5		S5					C			X				X
Teucrium canadense ssp. canadense	Wood Germander	6	-2		S5?					U			X				X
Lauraceae	**Laurel Family**																
Sassafras albidum	Sassafras	6	3		S4							X					X
Lythraceae	**Loosestrife Family**																
Lythrum salicaria	Purple Loosestrife		-5	-3	SE5								X				X
Moraceae	**Mulberry Family**																
Morus alba	White Mulberry		0	-3	SE5							X	X				X
Oleaceae	**Olive Family**																
Fraxinus americana	White Ash	4	3		S5					C		X	X	X			X
Fraxinus pennsylvanica	Green Ash	3	-3		S5					C				X		X	X
Ligustrum vulgare	Common Privet		1	-2	SE5								X				X
Onagraceae	**Evening-primrose Family**																
Circaea lutetiana ssp. canadensis	Yellowish Enchanter's Nightshade	3	3		S5					C		X	X				X
Epilobium species	Willow-herb speices												X				X
Ludwigia palustris	Marsh Purslane	5	-5		S5								X				X
Oenothera perennis	Perennial Evening-primrose	6	0		S4S5							X					X
Oxalidaceae	**Wood Sorrel Family**																
Oxalis stricta	Upright Yellow Wood-sorrel	0	3		S5					C		X					X
Papaveraceae	**Poppy Family**																
Chelidonium majus	Celandine		5	-3	SE5								X				X
Sanguinaria canadensis	Bloodroot	5	4		S5					C				X			X
Plantaginaceae	**Plantain Family**																
Plantago lanceolata	Ribgrass		0	-1	SE5							X					X
Plantago major	Common Plantain		-1	-1	SE5					IC		X					X
Polygonaceae	**Smartweed Family**																
Persicaria virginiana	Virginia Knotweed	6	0		S4					C			X				X
Rumex crispus	Curly-leaf Dock		-1	-2	SE5					IC		X					X
Portulacaceae	**Purslane Family**																
Claytonia virginica	Virginia Spring Beauty	5	3		S5					C				X			X
Primulaceae	**Primrose Family**																
Lysimachia ciliata	Fringed Loosestrife	4	-3		S5								X				X
Ranunculaceae	**Buttercup Family**																
Anemone virginiana var. virginiana	Thimbleweed	4	5		S5					C		X					X
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	4	-3		S5					C			X				X

Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRank[2]	SARO[3]	COSEWIC[3]	SARA Schedule[4]	Rare Plant Atlas[5]	Haldimand-Norfolk Status[6]	NHIC Data[7]	NRSI Observed					
											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site
Thalictrum dioicum	Early Meadow-rue	5	2		S5					C				X			X
Thalictrum pubescens	Tall Meadow-rue	5	-2		S5					C			X				X
Rhamnaceae	**Buckthorn Family**																
Rhamnus cathartica	European Buckthorn		3	-3	SE5					IU		X	X				X
Rosaceae	**Rose Family**																
Fragaria vesca ssp. americana	Woodland Strawberry	4	4		S5					U			X				X
Fragaria virginiana	Wild Strawberry				S5					C		X		X			X
Prunus serotina	Black Cherry	3	3		S5					C		X	X	X			X
Prunus virginiana ssp. virginiana	Choke Cherry	2	1		S5					C			X				X
Rosa multiflora	Multiflora Rose		3	-3	SE4					IU		X	X				X
Rubus allegheniensis	Alleghany Blackberry	2	2		S5							X					X
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	0	-2		S5							X	X				X
Rubus occidentalis	Black Raspberry	2	5		S5					C		X					X
Rubiaceae	**Madder Family**																
Galium aparine	Cleavers	4	3		S5					C			X				X
Salicaceae	**Willow Family**																
Populus balsamifera ssp. balsamifera	Balsam Poplar	4	-3		S5								X				X
Populus deltoides ssp. deltoides	Eastern Cottonwood	4	-1		S5					C		X	X			X	X
Populus tremuloides	Trembling Aspen	2	0		S5							X	X				X
Salix species	Willow species														X	X	X
Salix amygdaloides	Peach-leaved Willow	6	-3		S5								X				X
Salix bebbiana	Long-beaked Willow	4	-4		S5										X		X
Salix discolor	Pussy Willow	3	-3		S5							X					X
Salix eriocephala	Heart-leaved Willow	4	-3		S5							X					X
Salix fragilis	Crack Willow		-1	-3	SE5					C			X				X
Salix nigra	Black Willow	6	-5		S4?					U			X				X
Scrophulariaceae	**Figwort Family**																
Chelone glabra	Turtlehead	7	-5		S5					C			X				X
Linaria vulgaris	Butter-and-eggs		5	-1	SE5							X					X
Verbascum thapsus	Common Mullein		5	-2	SE5					IC		X					X
Solanaceae	**Nightshade Family**																
Physalis heterophylla	Clammy Ground-cherry	3	5		S4							X					X
Solanum dulcamara	Bitter Nightshade		0	-2	SE5							X	X				X
Tiliaceae	**Linden Family**																
Tilia americana	American Basswood	4	3		S5					C			X	X			X
Ulmaceae	**Elm Family**																
Ulmus americana	White Elm	3	-2		S5					C		X	X				X
Urticaceae	**Nettle Family**																
Boehmeria cylindrica	False Nettle	4	-5		S5					C			X				X
Urtica dioica ssp. dioica	European Stinging Nettle		-1	-1	SE2								X				X
Urtica dioica ssp. gracilis	American Stinging Nettle	2	-1		S5							X					X
Verbenaceae	**Vervain Family**																
Verbena urticifolia	White Vervain	4	-1		S5					C			X				X
Violaceae	**Violet Family**																
Viola sororia	Woolly Blue Violet	4	1		S5					C			X				X
Vitaceae	**Grape Family**																
Parthenocissus vitacea	Woodbine	3	3		S5					C		X	X				X
Parthenocissus quinquefolia	Virginia-creeper	6	1		S4?					U				X			X
Vitis riparia	Riverbank Grape	0	-2		S5					C		X	X	X			X

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											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site
Monocotyledons	**Monocots**																
Alismataceae	**Water-plantain Family**																
Sagittaria latifolia	Broad-leaved Arrowhead	4	-5		S5								X				X
Araceae	**Arum Family**																
Arisaema triphyllum	Jack-in-the-pulpit	5	-2		S5					C			X				X
Symplocarpus foetidus	Skunk-cabbage	7	-5		S5					C			X				X
Cyperaceae	**Sedge Family**																
Carex aquatilis	Aquatic Sedge	7	-5		S5								X				X
Carex blanda	Woodland Sedge	3	0		S5					C			X				X
Carex retrorsa	Retrorse Sedge	5	-5		S5								X				X
Carex rosea	Stellate Sedge	5	5		S5					C		X					X
Carex stipata	Awl-fruited Sedge	3	-5		S5					C		X	X				X
Carex stricta	Tussock Sedge	4	-5		S5								X				X
Iridaceae	**Iris Family**																
Iris versicolor	Multi-coloured Blue-flag	5	-5		S5								X				X
Lemnaceae	**Duckweed Family**																
Lemna minor	Lesser Duckweed	2	-5		S5					C			X	X			X
Liliaceae	**Lily Family**																
Asparagus officinalis	Garden Asparagus		3	-1	SE5							X					X
Erythronium americanum ssp. americanum	Yellow Dog's-tooth Violet	5	5		S5					C				X			X
Maianthemum racemosum ssp. racemosum	False Solomon's Seal	4	3		S5					C			X				X
Trillium grandiflorum	White Trillium	5	5		S5					C				X			X
Poaceae	**Grass Family**																
Bromus inermis ssp. inermis	Awnless Brome		5	-3	SE5							X		X			X
Dactylis glomerata	Orchard Grass		3	-1	SE5					IC		X	X				X
Digitaria sanguinalis	Large Crabgrass		3	-1	SE5							X					X
Elymus virginicus var. virginicus	Virginia Wild Rye	5	-2		S5							X					X
Glyceria striata	Fowl Meadow Grass	3	-5		S5					C			X				X
Leersia oryzoides	Rice Cut Grass	3	-5		S5								X				X
Panicum capillare	Witch Grass	0	0		S5					C		X					X
Phalaris arundinacea	Reed Canary Grass	0	-4		S5					C		X	X		X		X
Poa palustris	Fowl Meadow Grass	5	-4		S5					C			X				X
Schizachyrium scoparium	Little Bluestem	7	3		S4							X					X
Setaria faberi	Giant Foxtail		2	-1	SE4							X					X
Setaria pumila	Yellow Foxtail		0	-1	SE5					IC		X					X
Setaria viridis	Green Foxtail			-1	SE5					IC		X					X
Typhaceae	**Cattail Family**																
Typha angustifolia	Narrow-leaved Cattail	3	-5		S5					IC			X				X
								Total	**1**	**101**	**0**	**85**	**93**	**39**	**7**	**5**	**168**

[1]Oldham et al. 1995; [2]MNRF 2019a; [3]MECP 2019; [4]Government of Canada 2019; [5]Oldham and Brinker 2009; [6]Oldham 2017; [7]MNRF 2019a

Legend
SRank
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
S#? Rank Uncertain
COSSARO
END Endangered
THR Threatened
SC Special Concern
COSEWIC
E Endangered
T Threatened
SC Special Concern

Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRank[2]	SARO[3]	COSEWIC[3]	SARA Schedule[4]	Rare Plant Atlas[5]	Haldimand-Norfolk Status[6]	NHIC Data[7]	NRSI Observed					
											17NH5647, 17NH5648, 17NH5747, 17NH5748	CUW	SWD4	FOD9	MAM2	SWD3-3	Entire Site

SARA Schedule
Schedule 1 Officially Protected under SARA

FLORISTIC SUMMARY & ASSESSMENT			
Species Diversity*			
Total Species:	**171**		
Native Species:	**121**	70.76%	
Exotic Species	**691**	404.09%	
Total Taxa in Region (List Region, Source)	10000		
% Regional Taxa Recorded	1.71%		
Regionally Significant Species	enter manually		
S1-S3 Species	enter manually		
S4 Species	400		
S5 Species	764		
Co-efficient of Conservatism and Floral Quality Index			
Co-efficient of Conservatism (CC) (average)		**6.91**	
CC 0 to 3	*lowest sensitivity*	163	134.71%
CC 4 to 6	*moderate sensitivity*	464	383.47%
CC 7 to 8	*high sensitivity*	462	381.82%
CC 9 to 10	*highest sensitivity*	520	429.75%
Floral Quality Index (FQI)		**76.03**	
Presence of Weedy & Invasive Species			
mean weediness		**-1.20**	
weediness = -1	*low potential invasiveness*	592	85.67%
weediness = -2	*moderate potential invasiveness*	62	8.97%
weediness = -3	*high potential invasiveness*	37	5.35%
Presence of Wetland Species			
average wetness value		**1.00**	
upland		867	507.02%
facultative upland		371	216.96%
facultative		312	182.46%
facultative wetland		321	187.72%
obligate wetland		439	256.73%

**NOTE: Species numbers only correct if all Exotics have a weediness index and all Natives have a Coefficient of Conservatism.*

Project: 2250
Simcoe Water Supply Class EA
Bird Species Reported From the Study Area

						OBBA[4]	NHIC Data[5]	NRSI Observed					
Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA Schedule[3]**	17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	**BMB-001**	**BMB-002**	**BMB-003**	**BMB-004**	**BMB-005**	**Entire Site**
Anatidae	**Ducks, Geese & Swans**												
Branta canadensis	Canada Goose	S5				CO							
Aix sponsa	Wood Duck	S5				CO							
Anas platyrhynchos	Mallard	S5				CO							X
Odontophoridae	**New World Quails**												
Colinus virginianus	Northern Bobwhite	S1	END	E	Schedule 1	PO							
Phasianidae	**Partridges, Grouse & Turkeys**												
Phasianus colchicus	Ring-necked Pheasant	SNA				PO							
Bonasa umbellus	Ruffed Grouse	S4				CO							
Meleagris gallopavo	Wild Turkey	S5				CO							X
Columbidae	**Pigeons & Doves**												
Columba livia	Rock Pigeon	SNA				CO							
Zenaida macroura	Mourning Dove	S5				CO		PO	PR	PR			PR
Cuculiformes	**Cuckoos & Anis**												
Coccyzus americanus	Yellow-billed Cuckoo	S4B				PR							
Coccyzus erythropthalmus	Black-billed Cuckoo	S5B				CO							
Caprimulgidae	**Goatsuckers**												
Chordeiles minor	Common Nighthawk	S4B	SC	SC	Schedule 1	PO							
Caprimulgus vociferus	Eastern Whip-poor-will	S4B	THR	T	Schedule 1	PR							
Apodidae	**Swifts**												
Chaetura pelagica	Chimney Swift	S4B, S4N	THR	T	Schedule 1	PR							
Trochilidae	**Hummingbirds**												
Archilochus colubris	Ruby-throated Hummingbird	S5B				CO							
Charadriidae	**Plovers**												
Charadrius vociferus	Killdeer	S5B, S5N				CO		PO	PO	PO			PO
Scolopacidae	**Waders**												
Scolopax minor	American Woodcock	S4B				PR							
Actitis macularia	Spotted Sandpiper	S5				CO							
Ardeidae	**Herons & Bitterns**												
Butorides virescens	Green Heron	S4B				PR							
Cathartidae	**Vultures**												
Cathartes aura	Turkey Vulture	S5B				PO							X
Accipitridae	**Hawks, Kites, Eagles & Allies**												
Circus cyaneus	Northern Harrier	S4B	NAR	NAR		PO							
Accipiter cooperii	Cooper's Hawk	S4	NAR	NAR		PR							
Buteo platypterus	Broad-winged Hawk	S5B				PR							
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR		PR							

Project: 2250
Simcoe Water Supply Class EA
Bird Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	OBBA[4]	NHIC Data[5]	NRSI Observed					
						17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	BMB-001	BMB-002	BMB-003	BMB-004	BMB-005	Entire Site
Strigidae	**Typical Owls**												
Megascops asio	Eastern Screech-Owl	S4	NAR	NAR		CO							
Bubo virgianus	Great Horned Owl	S4				PR							
Alcedinidae	**Kingfishers**												
Megaceryle alcyon	Belted Kingfisher	S4B				CO							X
Picidae	**Woodpeckers**												
Melanerpes carolinus	Red-bellied Woodpecker	S4				CO						X	X
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				PR							
Dryobates pubescens	Downy Woodpecker	S5				CO					PO	PO	PO
Dryobates villosus	Hairy Woodpecker	S5				CO							
Colaptes auratus	Northern Flicker	S4B				CO		PO	PO		PO		PO
Dryocopus pileatus	Pileated Woodpecker	S5				CO							
Falconidae	**Caracaras & Falcons**												
Falco sparverius	American Kestrel	S4				PO							
Falco columbarius	Merlin	S5B	NAR	NAR		PR							
Tyrannidae	**Tyrant Flycatchers**												
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC		PR		PO				PO	PO
Empidonax traillii	Willow Flycatcher	S5B				PR		PO					PO
Empidonax minimus	Least Flycatcher	S4B				PO							
Sayornis phoebe	Eastern Phoebe	S5B				CO							
Myiarchus crinitus	Great Crested Flycatcher	S4B				PR		PO		X		PO	PO
Tyrannus tyrannus	Eastern Kingbird	S4B				CO							
Vireonidae	**Vireos**												
Vireo gilvis	Warbling Vireo	S5B				PR			PR	PO		PO	PR
Vireo olivaceus	Red-eyed Vireo	S5B				CO		PO				PO	PO
Corvidae	**Crows & Jays**												
Cyanocitta cristata	Blue Jay	S5				CO		PO	PO	PO	PO	PO	PO
Corvus brachyrhynchos	American Crow	S5B				CO		PO	PO		PO	PO	PO
Alaudidae	**Larks**												
Eremophila alpestris	Horned Lark	S5B				PO		PO			PO		PO
Hirundinidae	**Swallows**												
Progne subis	Purple Martin	S4B				PO							
Tachycineta bicolor	Tree Swallow	S4B				CO							X
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B				CO							
Riparia riparia	Bank Swallow	S4B	THR	T		CO							
Hirundo rustica	Barn Swallow	S4B	THR	T		CO		PO	PO	PO	PO		PO
Paridae	**Chickadees & Titmice**												
Poecile atricapillus	Black-capped Chickadee	S5				CO				PO			PO

Project: 2250
Simcoe Water Supply Class EA
Bird Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	OBBA[4]	NHIC Data[5]	NRSI Observed					
						17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	BMB-001	BMB-002	BMB-003	BMB-004	BMB-005	Entire Site
Sittidae	**Nuthatches**												
Sitta canadensis	Red-breasted Nuthatch	S5				PR							
Sitta carolinensis	White-breasted Nuthatch	S5				CO		PO	PO				PO
Troglodytidae	**Wrens**												
Troglodytes aedon	House Wren	S5B				CO						PO	PO
Thryothorus ludovicianus	Carolina Wren	S4				CO							
Mussciciapidae	**Old world Flycatchers**												
Turdidae	**Thrushes**												
Sialia sialis	Eastern Bluebird	S5B	NAR	NAR		CO							
Catharus fuscescens	Veery	S4B				PR							
Hylocichla mustelina	Wood Thrush	S4B	SC	T		CO							
Turdus migratorius	American Robin	S5B				CO		PO	PO	PR	PR	PO	PR
Mimidae	**Mockingbirds, Thrashers & Allies**												
Dumetella carolinensis	Gray Catbird	S4B				CO			PO	PO			PO
Toxostoma rufum	Brown Thrasher	S4B				CO					PO		PO
Mimus polyglottos	Northern Mockingbird	S4				CO							
Sturnidae	**Starlings**												
Sturnus vulgaris	European Starling	SNA				CO		CO	PO	PO	CO		CO
Bombycillidae	**Waxwings**												
Bombycilla cedrorum	Cedar Waxwing	S5B				CO			PO	PO			PO
Passeridae	**Old World Sparrows**												
Passer domesticus	House Sparrow	SNA				CO		PO			PR		PR
Fringillidae	**Finches & Allies**												
Carpodacus mexicanus	House Finch	SNA				CO							
Carpodacus purpureus	Purple Finch	S4B				PO							
Spinus tristis	American Goldfinch	S5B				CO		PO	PO	PO	PO	PO	PO
Parulidae	**Wood Warblers**												
Seiurus aurocapillus	Ovenbird	S4B				CO							
Parkesia noveboracensis	Northern Waterthrush	S5B				PO							
Vermivora cyanoptera	Blue-winged Warbler	S4B				PR							
Geothylpis trichas	Common Yellowthroat	S5B				PR							X
Setophaga citrina	Hooded Warbler	S4B	NAR	NAR	Schedule 1	CO							
Setophaga ruticilla	American Redstart	S5B				PO						PO	PO
Setophaga petechia	Yellow Warbler	S5B				PR			PR	PR			PR
Setophaga pensylvanica	Chestnut-sided Warbler	S5B				PR							
Setophaga caerulescens	Black-throated Blue Warbler	S5B											X
Setophaga pinus	Pine Warbler	S5B				PR							
Emberizidae	**New World Sparrows & Allies**												
Pipilo erythrophthalmus	Eastern Towhee	S4B				CO							
Spizella passerina	Chipping Sparrow	S5B				CO					PR		PR
Spizella pusilla	Field Sparrow	S4B				PR							

Project: 2250
Simcoe Water Supply Class EA
Bird Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	OBBA[4]	NHIC Data[5]	NRSI Observed					
						17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	BMB-001	BMB-002	BMB-003	BMB-004	BMB-005	Entire Site
Pooecetes gramineus	Vesper Sparrow	S4B				PR				PO	PO	PO	PO
Passerculus sandwichensis	Savannah Sparrow	S4B				CO		PO			PR		PR
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC	SC		CO							
Melospiza melodia	Song Sparrow	S5B				CO		PR	PR	PR	PR	PR	PR
Melospiza georgiana	Swamp Sparrow	S5B				PR							X
Cardinalidae	**Cardinals, Grosbeaks & Allies**												
Piranga olivacea	Scarlet Tanager	S4B				PR							
Cardinalis cardinalis	Northern Cardinal	S5				CO			PR	PR	PO	PO	PR
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B				CO			PR	PO		PR	PR
Passerina cyanea	Indigo Bunting	S4B				CO		PO	PO			PR	PR
Icteridae	**Blackbirds**												
Dolichonyx oryzivorus	Bobolink	S4B	THR	T	No Schedule	PR							
Agelaius phoeniceus	Red-winged Blackbird	S4				CO		PR	PR	PR	PR	PO	PR
Sturnella magna	Eastern Meadowlark	S4B	THR	T	No Schedule	PR							
Quiscalus quiscula	Common Grackle	S5B				CO		CO	CO		PO	PO	CO
Molothrus ater	Brown-headed Cowbird	S4B				CO		PR	PO	PO	PO		PR
Icterus spurius	Orchard Oriole	S4B				PO							
Icterus galbula	Baltimore Oriole	S4B				CO			CO	PO	PO	CO	CO
					Total	**97**	**0**	**22**	**22**	**20**	**20**	**20**	**45**

[1]MNRF 2019a; [2]MECP 2019; [3]Government of Canada 2019; [4] BSC et al. 2008; [5]MNRF 2019b

Legend
SRank
S1 Critically Imperiled
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
SARA Schedule
Schedule 1 Officially Protected under SARA

Project: 2250
Simcoe Water Supply Class EA
Reptile and Amphibian Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	ORAA[4]	NHIC Data[5]	NRSI Observed
						17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	
Turtles								
Chelydra serpentina serpentina	Snapping Turtle	S3	SC	SC	Schedule 1	X		X
Chrysemys picta marginata	Midland Painted Turtle	S5		SC		X		
Emydoidea blandingii	Blanding's Turtle (*Great Lakes/St Lawrence population*)	S3	THR	T	Schedule 1	X		
Graptemys geographica	Northern Map Turtle	S3	SC	SC	Schedule 1	X		
Snakes								
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	Schedule 1	X		
Lampropeltis triangulum	Eastern Milksnake	S4	NAR	SC	Schedule 1	X		
Opheodrys vernalis	Smooth Greensnake	S4				X		
Sistrurus catenatus catenatus pop. 1	Massasauga (*Great Lakes/St. Lawrence population*)	S3	THR	T	Schedule 1	X		
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake	S3	SC	SC	Schedule 1	X		
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5				X		X
Salamanders								
Ambystoma laterale	Blue-spotted Salamander	S4				X		
Notophthalmus viridescens viridescens	Red-spotted Newt	S5				X		
Plethodon cinereus	Eastern Red-backed Salamander	S5				X		
Toads and Frogs								
Anaxyrus americanus	American Toad	S5				X		X
Hyla versicolor	Tetraploid Gray Treefrog	S5				X		
Pseudacris crucifer	Spring Peeper	S5				X		X
Lithobates catesbeiana	American Bullfrog	S4				X		
Lithobates clamitans melanota	Northern Green Frog	S5				X		X
Lithobates palustris	Pickerel Frog	S4	NAR	NAR		X		
Lithobates pipiens	Northern Leopard Frog	S5	NAR	NAR		X		
Lithobates sylvaticus	Wood Frog	S5				X		X
					Total	**21**	**0**	**6**

[1] MNRF 2019a; [2] MECP 2019; [3] Government of Canada 2019; [4] Ontario Nature 2019; [5] MNRF 2019b

Legend
SRank
S3 Vulnerable
S4 Apparently Secure
S5 Secure
COSSARO
THR Threatened
SC Special Concern
NAR Not at Risk
COSEWIC
T Threatened
SC Special Concern
NAR Not at Risk
SARA Schedule
Schedule 1 Officially Protected under SARA

Project: 2250
Simcoe Water Supply Class EA
Butterfly Species Reported From the Study Area

						TEA Atlas[4]	**NHIC Data[5]**	**NRSI Observed**
Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA Schedule[3]**	17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	
Hesperiidae	**Skippers**							
Ancyloxypha numitor	Least Skipper	S5				X		
Epargyreus clarus	Silver-spotted Skipper	S4				X		
Erynnis icelus	Dreamy Duskywing	S5				X		
Erynnis juvenalis	Juvenal’s Duskywing	S5				X		
Euphyes vestris	Dun Skipper	S5				X		
Hesperia leonardus	Leonard's Skipper	S4				X		
Hesperia sassacus	Indian Skipper	S4				X		
Pholisora catullus	Common Sootywing	S4				X		
Poanes hobomok	Hobomok Skipper	S5				X		
Polites mystic	Long Dash Skipper	S5				X		
Polites peckius	Peck’s Skipper	S5				X		
Polites themistocles	Tawny-edged Skipper	S5				X		
Thorybes bathyllus	Southern Cloudywing	S3				X		
Thorybes pylades	Northern Cloudywing	S5				X		
Wallengrenia egeremet	Northern Broken Dash	S5				X		
Papilionidae	**Swallowtails**							
Battus philenor	Pipevine Swallowtail	SNA				X		
Papilio cresphontes	Giant Swallowtail	S4				X		
Papilio glaucus	Eastern Tiger Swallowtail	S5				X		
Papilio polyxenes	Black Swallowtail	S5				X		
Papilio troilus	Spicebush Swallowtail	S4				X		
Pieridae	**Whites and Sulphurs**							
Colias eurytheme	Orange Sulphur	S5				X		
Colias philodice	Clouded Sulphur	S5				X		
Pieris rapae	Cabbage White	SNA				X		
Pontia protodice	Checkered White	SNA				X		
Lycaenidae	**Harvesters, Coppers, Hairstreaks, Blues**							
Callophrys henrici	Henry’s Elfin	S4				X		
Celastrina neglecta	Summer Azure	S5				X		
Cupido comyntas	Eastern Tailed Blue	S5				X		
Glaucopsyche lygdamus	Silvery Blue	S5				X		
Lycaena phlaeas	American Copper	S5				X		
Satyrium acadica	Acadian Hairstreak	S4				X		
Satyrium calanus	Banded Hairstreak	S4				X		
Satyrium caryaevorus	Hickory Hairstreak	S4				X		
Satyrium liparops	Striped Hairstreak	S5				X		
Nymphalidae	**Brush-footed Butterflies**							
Aglais milberti	Milbert’s Tortoiseshell	S5				X		
Boloria selene	Silver-bordered Fritillary	S5				X		
Cercyonis pegala	Common Wood-Nymph	S5				X		
Chlosyne harrisii	Harris’s Checkerspot	S4				X		
Chlosyne nycteis	Silvery Checkerspot	S5				X		
Coenonympha tullia	Common Ringlet	S5				X		
Danaus plexippus	Monarch	S2N, S4B	SC	E	Schedule 1	X		
Euphydryas phaeton	Baltimore Checkerspot	S4				X		

Project: 2250
Simcoe Water Supply Class EA
Butterfly Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	TEA Atlas[4]	NHIC Data[5]	NRSI Observed
						17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	
Lethe eurydice	Eyed Brown / Northern Eyed Brown	S5				X		
Limenitis archippus	Viceroy	S5				X		
Limenitis arthemis arthemis	White Admiral/Banded Purple	S5				X		
Limenitis arthemis astyanax	Red-spotted Purple	S5				X		
Megisto cymela	Little Wood-Satyr	S5				X		
Nymphalis antiopa	Mourning Cloak	S5				X		
Nymphalis l-album	Compton Tortoiseshell	S5				X		
Phyciodes cocyta	Northern Crescent	S5				X		
Phyciodes tharos	Pearl Crescent	S4				X		
Polygonia comma	Eastern Comma	S5				X		
Polygonia comma	Eastern Comma/Hop Merchant	S5				X		
Polygonia interrogationis	Question Mark	S5				X		
Speyeria aphrodite	Aphrodite Fritillary	S5				X		
Speyeria cybele	Great Spangled Fritillary	S5				X		
Vanessa atalanta	Red Admiral	S5				X		
Vanessa cardui	Painted Lady	S5				X		
					Total	**57**	**0**	**0**

[1]MNRF 2019a; [2]MECP 2019; [3]Government of Canada 2019; [4]Macnaughton et al. 2008; [5]MNRF 2019b

Legend
SRank
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO
SC Special Concern
COSEWIC
E Endangered
SARA Schedule
Schedule 1 Officially Protected under SARA

Project: 2250
Simcoe Water Supply Class EA
Dragonfly and Damselfly Species Reported From the Study Area

						Odonate Atlas[4]	NHIC Data[5]	
Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA Schedule[3]**	17NH54	17NH5647, 17NH5648, 17NH5747, 17NH5748	**NRSI Observed**
Calopterygidae	**Broadwinged Damselflies**							
Calopteryx maculata	Ebony Jewelwing	S5				X		
Lestidae	**Spreadwings**							
Lestes congener	Spotted Spreadwing	S5				X		
Lestes dryas	Emerald Spreadwing	S5				X		
Lestes rectangularis	Slender Spreadwing	S5				X		
Coenagrionidae	**Narrow-winged Damselflies**							
Argia fumipennis violacea	Violet Dancer	S5				X		
Ischnura verticalis	Eastern Forktail	S5				X		
Aeshnidae	**Darners**							
Aeshna umbrosa	Shadow Darner	S5				X		
Basiaeschna janata	Springtime Darner	S5				X		
Boyeria vinosa	Fawn Darner	S5				X		
Epiaeschna heros	Swamp Darner	S2S3				X		
Nasiaeschna pentacantha	Cyrano Darner	S3				X		
Gomphidae	**Clubtails**							
Arigomphus villosipes	Unicorn Clubtail	S2S3				X		
Cordulegasteridae	**Spiketails**							
Cordulegaster maculata	Twin-spotted Spiketail	S4				X		
Corduliidae	**Emeralds**							
Epitheca cynosura	Common Baskettail	S5				X		
Somatochlora tenebrosa	Clamp-tipped Emerald	S2S3				X		
Libellulidae	**Skimmers**							
Celithemis elisa	Calico Pennant	S5				X		
Celithemis eponina	Halloween Pennant	S4				X		
Leucorrhinia intacta	Dot-tailed Whiteface	S5				X		
Libellula luctuosa	Widow Skimmer	S5				X		
Libellula pulchella	Twelve-spotted Skimmer	S5				X		
Libellula quadrimaculata	Four-spotted Skimmer	S5				X		
Libellula semifasciata	Painted Skimmer	S2				X		
Plathemis lydia	Common Whitetail	S5				X		
Sympetrum obtrusum	White-faced Meadowhawk	S5				X		
Sympetrum rubicundulum	Ruby Meadowhawk	S5				X		
Tramea lacerata	Black Saddlebags	S4				X		
					Total	**26**	**0**	**0**

[1]MNRF 2019a; [2]MECP 2019; [3]Government of Canada 2019; [4]OOAD 2019; [5]MNRF 2019b

Legend	
SRank	
S2	Imperiled
S3	Vulnerable
S4	Apparently Secure
S5	Secure

Project: 2250
Simcoe Water Supply Class EA
Mammal Species Reported From the Study Area

Scientific Name	Common Name	SRank[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Ontario Mammal Atlas[4]	NHIC Data[5]	NRSI Observed
						NT	17NH5647, 17NH5648, 17NH5747, 17NH5748	
Didelphimorphia	**Opossums**							
Didelphis virginiana	Virginia Opossum	S4				X		
Insectivora	**Shrews and Moles**							
Blarina brevicauda	Northern Short-tailed Shrew	S5				X		
Condylura cristata	Star-nosed Mole	S5				X		
Parascalops breweri	Hairy-tailed Mole	S4				X		
Sorex cinereus	Masked Shrew	S5				X		
Sorex fumeus	Smoky Shrew	S5				X		
Chiroptera	**Bats**							
Eptesicus fuscus	Big Brown Bat	S4				X		
Lasionycteris noctivagans	Silver-haired Bat	S4				X		
Lasiurus borealis	Eastern Red Bat	S4				X		
Lasiurus cinereus	Hoary Bat	S4				X		
Myotis leibii	Eastern Small-footed Myotis	S2S3	END			X		
Myotis lucifugus	Little Brown Myotis	S4	END	E	Schedule 1	X		
Myotis septentrionalis	Northern Myotis	S3	END	E	Schedule 1	X		
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	Schedule 1	X		
Lagomorpha	**Rabbits and Hares**							
Lepus europaeus	European Hare	SNA				X		
Sylvilagus floridanus	Eastern Cottontail	S5				X		X
Rodentia	**Rodents**							
Castor canadensis	Beaver	S5				X		
Microtus pennsylvanicus	Meadow Vole	S5				X		
Mus musculus	House Mouse	SNA				X		
Napaeozapus insignis	Woodland Jumping Mouse	S5				X		
Ondatra zibethicus	Muskrat	S5				X		
Peromyscus leucopus	White-footed Mouse	S5				X		
Peromyscus maniculatus	Deer Mouse	S5				X		
Sciurus carolinensis	Eastern Gray Squirrel	S5				X		X
Synaptomys cooperi	Southern Bog Lemming	S4				X		
Tamiasciurus hudsonicus	Red Squirrel	S5				X		
Tamias striatus	Eastern Chipmunk	S5				X		X
Zapus hudsonius	Meadow Jumping Mouse	S5				X		
Carnivora	**Carnivores**							
Canis latrans	Coyote	S5				X		X
Mephitis mephitis	Striped Skunk	S5				X		
Mustela erminea	Ermine	S5				X		
Mustela frenata	Long-tailed Weasel	S4				X		
Mustela vison	American Mink	S4				X		
Procyon lotor	Northern Raccoon	S5				X		X
Taxidea taxus jacksoni	American Badger	S2	END	E	Schedule 1	X		

Project: 2250
Simcoe Water Supply Class EA
Mammal Species Reported From the Study Area

						Ontario Mammal Atlas[4]	**NHIC Data[5]**	
Scientific Name	**Common Name**	**SRank[1]**	**SARO[2]**	**COSEWIC[3]**	**SARA Schedule[3]**	NT	17NH5647, 17NH5648, 17NH5747, 17NH5748	**NRSI Observed**
Vulpes vulpes	Red Fox	S5				X		
Artiodactyla	**Deer and Bison**							
Odocoileus virginianus	White-tailed Deer	S5				X		X
					Total	**37**	**0**	**6**

[1]MNRF 2019a; [2]MECP 2019; [3]Government of Canada 2019; [4]Dobbyn 1994; [5]MNRF 2019b

Legend
SRank
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SNA Unranked
S#? Rank Uncertain
COSSARO
END Endangered
COSEWIC
E Endangered
SARA Schedule
Schedule 1 Officially Protected under SARA

Fish Species Reported from the Study Area - Simcoe Environmental Assessment (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	ARA Data	NRSI Observed
		MNRF 2020a	MNRF 2020a	Government of Canada 2020	Government of Canada 2020	Government of Canada 2020	Government of Ontario 2015	NRSI Results from 2020
Cyprinidae	**Carps**							
Cyprinus carpio[1]	Common Carp	SNA					X	
Leuciscidae	**Minnows**							
Chrosomus neogaeus	Finescale Dace	S5					X	
Hybognathus hankinsoni	Brassy Minnow	S5					X	
Luxilus cornutus	Common Shiner	S5					X	
Notemigonus crysoleucas	Golden Shiner	S5					X	
Notropis heterolepis	Blacknose Shiner	S5					X	
Pimephales notatus	Bluntnose Minnow	S5	NAR	NAR	NS	No schedule	X	
Pimephales promelas	Fathead Minnow	S5					X	
Rhinichthys cataractae	Longnose Dace	S5					X	X
Semotilus atromaculatus	Creek Chub	S5					X	X
Catostomidae	**Suckers**							
Catostomus commersonii	White Sucker	S5					X	X
Salmonidae	**Trouts and Salmons**							
Salvelinus fontinalis fontinalis	Brook Trout	S5					X	
Gasterosteidae	**Sticklebacks**							
Culaea inconstans	Brook Stickleback	S5					X	
Cottidae	**Sculpins**							
Cottus bairdii	Mottled Sculpin	S5					X	X
Centrarchidae	**Sunfishes and Basses**							
Ambloplites rupestris	Rock Bass	S5					X	
Lepomis gibbosus	Pumpkinseed	S5					X	
Micropterus salmoides	Largemouth Bass	S5					X	X
Pomoxis nigromaculatus	Black Crappie	S4					X	
Percidae	**Perches and Darters**							
Percina maculata	Blackside Darter	S4					X	
Total							**19**	**0**

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Final

Community of Simcoe Additional Water Supply Class EA

Natural Environment Assessment Report

Prepared for:

Norfolk County
Engineering, Environment and Infrastructure
Services Division
185 Robinson Street, Suite 200
Simcoe, Ontario
N3Y 5L6

Project No. 2250A | October 2022

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Community of Simcoe Additional Water Supply Class EA

Natural Environment Assessment Report

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained by Norfolk County as a subconsultant to Banks Groundwater Engineering (BGE) in April 2019 to complete a Natural Environment Assessment Report (NEAR) as part of the required Municipal Class Environmental Assessment (EA) to facilitate the approval for a new municipal groundwater supply source for the Community of Simcoe, Norfolk County, Ontario. The proposed project required the completion and submission of a NEAR in accordance with the requirements of the Municipal Class Environmental Assessment (MEA 2015). The community of Simcoe now requires additional potable water capacity and therefore has undertaken a Schedule “B” Class Environmental Assessment to determine the preferred solution and design for this problem. G. Douglas Vallee Limited evaluated alternatives for the transmission of raw groundwater from the proposed well site to the existing treatment plant on 14th Street West in Simcoe. In total, four potential watermain alignment options were evaluated, and one of these was determined to be the preferred alignment route.

The study area, as shown on Maps 1 through 4, includes the four potential watermain alignments and identifies the preferred alignment (Potential Watermain C). The extents of the study area include the lands within 120m from each of the potential alignments. The preferred alignment extends southwest and then south from Old Highway 24 along the trailway to 14th Street East where it turns west and follows Glendale Crescent to 14th Street West where it again turns west, tying in to the water treatment plant approximately 530m east of Park Road. Mapping also delineates the estimated zone of influence from test pumping that was identified in 2019 and utilized during the 2020 testing and ecological assessments.

To-date, considerable groundwater testing and biological work has been completed in support of the approval for a new municipal groundwater supply source for the Community of Simcoe (BGE 2015, BGE 2021, NRSI 2021). As part of the current groundwater testing program, a 7-day aquifer testing program was completed at two test pumping discharge locations within the study area by BGE in 2020. It is anticipated that these two test production wells will become the municipal well-sites used to supply groundwater to the Community of Simcoe. NRSI completed monitoring of ecological conditions concurrently with test pumping to assess the potential effects of the testing program on the ecological conditions within the east branch of Davis Creek, within the estimated zone of influence (Appendix I).

Existing natural features within the study area are limited to the wetland, forest, and thicket communities, which are generally associated with Davis Creek and other tributaries that flow to Davis Creek (Map 1). The Norfolk County Official Plan (OP, 2020) (Schedule C-1; and C-4) identifies the presence of two “Significant Woodland” features within the northern portion of the study area. L-13 Provincially Significant Wetland (PSW) complex is also present along the southern portion of the study area. The primary watercourse feature present in the study area, identified as Davis Creek, falls within the regulation area of the Long Point Region Conservation Authority (LPRCA) and is subject to Ontario Regulation 178/06 (2013). The watercourse is classified as a tributary of the Lynn-Black Creek Watershed and is located outside any areas of Source Water Protection by the Norfolk County OP (2020) (Schedule D-1; D-4; and D-5). The study area is located within an area of “Significant Groundwater Recharge” (Norfolk County 2020) (Schedule D-7).

This report summarizes relevant background information and field data collected for the study area, which includes part of the 2019 estimated zone of influence. In 2019 and 2020, NRSI conducted field surveys to characterize the existing natural environment conditions within the estimated zone of influence. In 2022, field surveys were focused on assessing the natural features along the preferred watermain alignment (Potential Watermain C) (Map 1). For the purposes of this environmental assessment, the natural features associated with the three other identified watermain alignment options have been characterized through a desktop-level assessment. The assessment of natural features included within this report informs an analysis of natural feature significance and sensitivity within the study area with consideration for applicable municipal, and provincial legislation and regulations.

1.1 Relevant Policies, Legislation and Planning Studies

Natural heritage features within the study area were assessed for significance by evaluating them against relevant policies, legislation, and planning studies. Table 1 provides an overview of policies and an analysis of natural features within the study area. The specific implications of these policies are provided to the study team, while identifying areas to avoid and/or mitigate.

Table 1. Relevant Policies, Legislation, and Planning Studies

Policy/Legislation	Description	Project Relevance
Provincial Policy Statement (PPS) (OMMAH 2020)	• Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as 'significant'. • The Natural Heritage Reference Manual (MNRF 2010) and the Significant Wildlife Habitat Technical Guide (OMNR 2000, OMNR 2015) were prepared by the MNRF to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	• Background review and field observations confirmed the presence of several significant natural features and Signification Wildlife Habitat (SWH) types in the study area. • Section 2.1.5 of the PPS states that development or site alteration shall not be permitted in SWH in Ecoregion 7E unless it has been demonstrated that there will be no negative impacts on the features or their ecological functions.
Endangered Species Act (ESA) (Government of Ontario 2019)	• The ESA prohibits killing, harming, harassing, or capturing SAR and protects their habitats from damage and destruction.	• Based on the background review and SAR/SCC screening, several candidate SAR and SCC were reported within the vicinity of the study areas, and several species were observed within the study areas during field investigations in both years.
Migratory Birds Convention Act (Government of Canada 2019)	• The MBCA protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment and was assented in 1994. • Prohibits the disturbance, destruction, or taking of a nest or eggs of migratory birds. • The schedule of on-site work must consider MBCA timing windows, with the breeding bird season typically occurring between April 1 and August 31, however, this is a guideline, since the MBCA applies to nesting bird species at any time. • "Incidental take" is considered illegal, with the exception of a permit obtained by the Canadian Wildlife Service (CWS).	• Species protected by the MBCA are known to occur and were observed within the study area during the 2019 and 2022 field surveys. • The timing of construction activities, especially vegetation clearing and site grading, must have consideration for the MBCA.
Fish and Wildlife Conservation Act (Government of Canada 2019)	• The FWCA provides protection for certain bird species not protected under the MBCA (e.g., raptors), as well as furbearing mammals and their dens or habitual dwellings, aside from the Red Fox (*Vulpes vulpes*) and Striped Skunk (*Mephitis mephitis*).	• The timing of construction activities, especially vegetation clearing and site grading, must have consideration for bird nesting and den sites of furbearing mammals.
Fisheries Act (Government of Canada, 1985)	• The purpose of the Act is to ensure the conservation and protection of fish and fish habitat.	• Davis Creek and several associated tributaries, which support a fish population and provide fish habitat, occur within the study area and cross the preferred alignment.

Policy/Legislation	Description	Project Relevance
Norfolk County Official Plan (2020)	• Natural heritage objectives to be met regarding proposed development within or adjacent to identified natural heritage features outlined in Section 3.0 and Schedule “C” – Natural Heritage. • In association with the LPRCA, watershed management objectives including Source Water and Aquifer Protection are to be implemented in areas identified in Schedule “D” – Water Resources.	• Background review and field observations confirmed the presence of two ‘Significant Woodland’ features from both study areas and a PSW complex from the 2022 study area. • The study areas are located within an area of ‘Significant Groundwater Recharge’, and contains Davis Creek, a permanent watercourse identified as a tributary of the Lynn-Black Creek Watershed.
Ontario Reg. 178/06: Long Point Region Conservation Authority (LPRCA): Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (2013)	• Regulation issued under *Conservation Authorities Act,* R.S.O. 1990. • Through this regulation, the LPRCA has the responsibility to regulate activities in natural and hazardous areas (i.e., areas in and near rivers, streams, floodplains, wetlands, and slopes).	• Davis Creek, a LPRCA regulated tributary of the Lynn-Black Creek Watershed is present in the study area.
Ontario Water Resources Act (Government of Ontario 1990)	• The Ontario Water Resource Act deals with the powers and obligations of the Ontario Clean Water Agency, as well as an assigned provincial officer, who monitors and investigates any potential problems with regards to water quality or supply. There are also extensive sections on Wells, Water Works, and Sewage works involving their operation, creation and other aspects.	• The project proposes to establish new wells and create a new watermain to provide additional capacity for the Community of Simcoe.

2.0 Background Review and Significant Habitat Screening

2.1 Background Information Secondary Sources

A review of existing natural heritage information was completed to identify the presence of natural heritage features and species that are reported from or have potential to occur within the study areas, with a focus on the natural features within and adjacent to the four potential watermain alignment options. Background information relevant to the study area was collected and reviewed from the following sources:

- Natural Heritage Information Centre (NHIC) Biodiversity Explorer (NDMNRF 2022);
- Species at Risk in Ontario List (MNRF 2019b);
- Land Information Ontario (LIO) data base mapping;
- Long Point Region Conservation Authority mapping;
- Norfolk County Official Plan (2020);
- Fisheries and Oceans Canada (DFO) Species at Risk Mapping (DFO 2022);
- Aquatic Resource Area (ARA) Data (LIO 2022)
- Species at Risk public registry (Government of Canada 2019);
- Atlas of the Mammals of Ontario (Dobbyn 1994);
- Ontario Reptile and Amphibian Atlas (ORAA) (Ontario Nature 2019);
- Ontario Breeding Bird Atlas (OBBA) (BSC et al. 2006);
- Ontario Odonata Atlas Database (OOAD 2022); and
- TEA Ontario Butterfly Atlas (Macnaughton et al. 2022).

2.2 Species at Risk and Significant Wildlife Habitat Screening

For the purposes of this report, Species at Risk (SAR) include species listed as ‘Threatened’ or ‘Endangered’ under the provincial *Endangered Species Act* (ESA 2007). In Ontario, provincial Species of Conservation Concern (SCC) include:

- Species designated under the ESA as ‘Special Concern’ within Ontario;
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre;
- Species that have a high percentage of their global population in Ontario, and
- Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the COSSARO. These species may be protected by the federal

Species at Risk Act (SARA) if they are listed as Threatened or Endangered on Schedule 1 of the SARA.

Habitat for SCC is considered Significant Wildlife Habitat (SWH), which is afforded protection under the Provincial Policy Statement (OMMAH 2020) and municipal natural heritage protection policies.

Based on NRSI's examination of background sources and federally or provincially significant species with occurrence records in the study area vicinity (within 10km), an assessment of SAR and SCC suitable habitat presence within the study areas were completed. Assessments of habitat suitability were made by cross-referencing each species' known habitat preferences or requirements (e.g., OMNR 2000) against habitats known to occur in the study areas. This was completed to ensure that the potential presence of all significant species within the study areas were adequately assessed to inform the Class EA. Based on this screening exercise, Candidate habitat for five SAR and two SCC was identified within the study area (Appendix II).

The Significant Wildlife Habitat Technical Guide (SWHTG) is a guideline document that outlines the types of habitats that the NDMNRF considers significant in Ontario, as well as criteria to identify these habitats (OMNR 2000, MNRF 2015). The SWHTG groups SWH into four broad categories: seasonal concentration areas, rare vegetation communities and specialized wildlife habitat, habitats of SCC, and animal movement corridors. This screening involved the comparison of NDMNRF criteria outlined for Ecoregion 7E, in which the study area is located, against habitats known to occur in the study area. Based on this screening exercise, seven candidate SWH types were identified for the study area (Appendix III) including:

- Bat Maternity Colonies;
- Turtle Wintering Area;
- Tallgrass Prairie;
- Turtle Nesting Area;
- Seeps and Springs;
- Amphibian Breeding Habitat (Woodland); and
- Habitat for Special Concern and Rare Wildlife Species.

3.0 Field Methods

Field surveys and desktop analyses were conducted to characterize and identify significant and sensitive natural features that have potential to be adversely affected by the proposed undertaking. In 2019 and 2020, terrestrial and aquatic field surveys were undertaken to characterize the natural environment within the estimated zone of influence. In 2022, field surveys and desktop analyses focused on assessing the natural environment within the extended study area, which included targeted field surveys along the preferred watermain alignment and desktop analysis for the three remaining alignment options where they deviated from the preferred route (Map 1). Field methods are described below and summarized in Table 2 for 2019, 2020, and 2022 data.

3.1 Vegetation Community Mapping and Vascular Flora Inventory

Vegetation communities within the study area were described and mapped using the Ecological Land Classification (ELC) system for southern Ontario (Lee et al. 1998). A comprehensive inventory of vascular flora was completed to inform the ELC vegetation community classification and associated revisions. In 2019, ELC and vegetation inventory work was focused in the natural areas along Davis Creek and its forested riparian areas as shown on Map 2. In 2022, ELC and vegetation inventory work also focused on these areas, along with the full extent of the preferred alignment options as shown on Map 2.

3.2 Breeding Bird Surveys

Early morning breeding bird point count surveys were conducted in both 2019 and 2022 in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Birds Canada et al. 2021). Surveys were completed between a half-hour before sunrise and 1000hrs and were timed to occur 10 days or more apart. Surveys included comprehensive point counts and standard area searches of study area lands with a focus on Davis Creek and its forested riparian areas in 2019 and natural areas along the preferred watermain alignment option in 2022 as shown on Map 3. Standard breeding evidence codes were recorded based on OBBA protocol (Birds Canada et al. 2021).

3.3 Reptile Area Search Surveys

Visual encounter surveys (VES) were completed in spring 2019 to assess the presence of basking reptiles (snakes and turtles) in suitable habitats within the study area (i.e., Davis Creek, former irrigation ponds, forested riparian areas, and wetland features). The investigation included an assessment of habitat suitability for reptile species reported from the study area vicinity (Ontario Nature 2019).

3.4 Anuran Call Surveys

Anuran call surveys were conducted in 2019 in accordance with the Marsh Monitoring Program (MMP) amphibian call survey protocol (BSC 2009) to identify the presence of species breeding within the study area. This involved 3-minute point counts during peak breeding periods in each of April, May, and June, to record species calling and their abundance. Point counts were located adjacent to Davis Creek (Map 3).

3.5 Aquatic Field Surveys

Aquatic field surveys were carried out for the project in 2020 and 2022. In 2020, fall surveys were conducted at three stations along Davis Creek (AHA/EMS-001 through AHA/EMS-003) to assess the aquatic habitat and fish community within the estimated zone of influence for test pumping. Fish community surveys were conducted on October 16, 2020 utilizing the methods described in Section 3: Module 1 of the Ontario Stream Assessment Protocol (OSAP 2017) for multiple pass depletion sampling. The aquatic habitat characterization was conducted between October 18 and 20, 2020 utilizing the methods described in Section 4: Module 2 of the Ontario Stream Assessment Protocol (OSAP 2017) to assess the creek for channel structure and flow conditions. The aquatic habitat assessment was completed in coordination with the seven-day aquifer test pumping.

In 2022, generalized aquatic habitat assessments were completed on July 14 at four additional stations (AHA-004 through AHA-007) to characterize the existing aquatic habitat conditions at locations where the preferred watermain alignment (Potential Watermain C) crossed a watercourse feature. This involved assessing the feature for potential as fish habitat, including wetted width, water depth, substrate composition, instream cover and habitat, and in situ water quality (e.g., water temperature, conductivity, total dissolved solids and pH). No fish sampling was conducted in 2022.

3.6 Incidental Wildlife Observations

During 2019, 2020 and 2022 field work programs, all incidental observations of wildlife and vegetation species were documented on all field visits. This included direct observations of individuals, as well as signs of wildlife presence (i.e., tracks, scat, dens, nests, etc.).

Table 2. Field Survey Summary

Survey Type	Protocol	Date	Start and End Time (24 hrs)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud Cover (%)	Precipitation
Ecological Land Classification	Lee et. al (1998)	May 15, 2019	1000 - 1300	13	0	5	None
		May 31, 2019	0620 - 0905	16	1	80	None
		June 24, 2019	0950 - 1300	16	0	100	None
		June 25, 2022	1300 - 2015	22	5	30	None
		August 22, 2019	0700 - 1000	17	0	100	None
Vascular Flora Inventory	Systematic search by ELC polygon	May 15, 2019	1000 - 1300	13	0	5	None
		May 31, 2019	0620 - 0905	16	1	80	None
		June 24, 2019	0950 - 1300	16	0	100	None
		June 25, 2022	1300 - 2015	22	5	30	None
		August 22, 2019	0700 - 1000	17	0	100	None
Anuran Call Surveys	BSC (2009)	April 24, 2019	2045 - 2145	10	0	20	None
		May 15, 2019	2100 - 2145	13	0	5	None
		June 5, 2019	2130 - 2215	21	0	100	None
Breeding Bird Surveys	Birds Canada et al. (2021)	June 10, 2022	0630 - 0830	9	1	0	None
		June 14, 2019	0645 - 0845	11	3	50	None
		June 24, 2019	0640 - 0950	16	0	100	None
		June 30, 2022	0630 - 0815	11	1	5	None
Reptile Area Search Surveys	Systematic search within suitable habitat	May 15, 2019	1130 - 1600	16 - 19	2	40	None
		June 14, 2019	0845 - 1000	11	3	50	None
Fish Community Surveys	3-Pass Depletion Sampling	October 16, 2020	0800 - 1500	9	1	0	None

Survey Type	Protocol	Date	Start and End Time (24 hrs)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud Cover (%)	Precipitation
Aquatic Habitat Assessment	Ontario Stream Assessment Protocol	October 18, 19, 20, 2020	0800 - 1400	7 - 13	1 - 4	0 - 100	None
Aquatic Habitat Assessment	N/A	July 14, 2022	1300 - 1500	26 (High of 27)	3	50	None

4.0 Existing Conditions

4.1 Soils, Terrain and Drainage

The study area is located within the Norfolk Sandplain physiographic region, which slopes gradually from the northwest toward Lake Erie (Presant and Acton 1984). Overburden deposits within this region are predominantly classed as the Wentworth Till and the Paris and Galt Moraines associated with the most recent glacial retreat (13,000 – 13,500 years ago) of the Laurentide ice sheet (Barnett 1978, BGE 2015, BGE 2021). Within the study area, surficial deposits have been mapped as predominantly medium-to coarse textured glaciolacustrine deposits of the Norfolk Sand Plain. These deposits comprise fine to medium sand. Coarse-grained interstadial deposits also occur beneath the younger glaciolacustrine surficial deposits and the Wentworth Till.

Within the study area, soil deposits are dominated by lacustrine sands, containing sandy or loamy sediments (Presant and Acton 1984). Areas of gravelly sands of fluvial or till derivation and clay deposits make up smaller portions of the study area (Presant and Acton 1984). The combination of sandy wind-modified surfaces and flat topography within this physiographic region results in relatively high infiltration capacity and deep-cut riverine features within sands which range between 1m and 20m (Presant and Acton 1984).

The study areas contain Davis Creek, which flows southwest and then southeast as a tributary to Lynn-Black Creek, which empties into Lake Erie at Port Dover. The majority of the study area is dominated by agricultural lands and natural features are limited to Davis Creek's riparian vegetation and wetlands, LR-13 Provincially Significant Wetland complex, nearby isolated forests, and adjacent hedgerows.

4.2 Vegetation

The surrounding landscape is comprised of active agricultural fields with associated roadways and rural residential lots. However, a large portion of Davis Creek within the study area flows through a narrow, naturally vegetated corridor. Vegetation communities are described in Table 3, below. Refer to Map 2 for the study area ELC communities and the surrounding land-uses.

4.2.1 Vascular Flora

In 2019, a total of 168 species of vascular flora were inventoried within the study area. In 2022, a total of 133 species were inventoried within the study area. A complete list of inventoried species is provided in Appendix IV. Of the species observed, approximately 31% were non-native in 2019 and approximately 36% were non-native in 2022 (MNRF 2019a).

In 2019, a total of six provincially rare flora species were reported from the vicinity of the study area (within 1km) (Oldham 1993). Of the species reported, three provincially rare vegetation species were observed by NRSI. However, all three species were observed in a planted native garden feature, which are generally not afforded protection. These species included Spiked Blazing Star (*Liatris spicata*), Gray-headed Coneflower (*Ratibida pinnata*), and Oswego-tea (*Monarda didyma*). In 2022, a total of two provincially rare flora species were reported from the vicinity of the study area (within 1km) (Oldham 1993). One of these species was observed by NRSI; Butternut (*Juglans cinerea*), which is discussed in further detail in Section 5.4.

Table 3. Vegetation Communities Identified within the Study Area

ELC Ecosite Type	ELC Description	Environmental Characteristics
CUW1	Cultural Woodland Ecosite	CUW1 1 – located between row crop. Soils are close to 50% sand, with some medium grains but most are very fine. The woodland canopy is dominated by Manitoba Maple (*Acer negundo*) with mainly Black Walnut (*Juglans nigra*) and Manitoba Maple in the subcanopy. CUW1 located further south between row crop. The canopy is abundant in Black Cherry (*Prunus serotina)* and the subcanopy is abundant in Staghorn Sumac (*Rhus typhina*). The east side of the trail has been left open for hydro corridor. The ecosite has prairie character with Smooth Oxeye (*Heliopsis helianthoides*).
FOD7-4	Fresh – Moist Black Walnut Lowland Deciduous Forest Type	Two FOD7-4 communities have been identified in the study area – one adjacent to Davis Creek near Woodland Drive, and another further south near Glendale Crescent. The community composition is the same in both natural creek corridors. Black Walnut is dominating the canopy and the subcanopy is mainly comprised of American Elm (*Ulmus americana*).
FOD8-1	Fresh – Moist Poplar Deciduous Forest	This community is located in the southwest corner of the study area. The canopy is mainly comproised of Eastern Cottonwood (*Populus deltoides*) and the subcanopy is dominated by Manitoba Maple. This community is highly impacted by invasive species.
FOD9	Fresh – Moist Oak-Maple – Hickory Deciduous Forest Ecosite	Located in the northwest corner of the study area, this deciduous forest community is a remnant forest, typical of the area, pre-European settlement. Within the canopy and sub-canopy this community is dominated by Freeman's Maple (*Acer x freemanii*), Bitternut Hickory (*Caryua cordiformis*), and Sugar Maple (*Ace saccharum*). Understorey and groundcover vegetation is comprised of an extensive layer of Sugar Maple, Freeman's Maple (*Acer x freemanii*), and Blue Beech (*Carpinus caroliniana*) saplings, along with White Trillium (*Trillium*

ELC Ecosite Type	ELC Description	Environmental Characteristics
		grandiflorum), Sensitive Fern (*Onoclea sensibilis*), and May-Apple (*Podophyllum peltatum*).
HR	Hedgerow	Several deciduous hedgerows are present throughout the study area. Hedgerow composition varies, primarily with Sugar Maple, Bitternut Hickory, and Basswood (*Tilia americana*) being common throughout.
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type	This community is located in the western portion of the study area, adjacent to several drainage tributaries. Reed-canary Grass (*Phalaris arundinacea*) is the dominant vascular flora, along with mixed grasses and forbs.
SWD4	Mineral Deciduous Swamp Type	This community is present within the central portion of the study area, adjacent to the rail-trail. Within the canopy and sub-canopy layers, Freeman's Maple, Eastern Cottonwood, Manitoba Maple, and Black Walnut are dominant. Red Panicled Dogwood (*Cornus foemina ssp. racemosa*) and Silky Dogwood (*Cornus amomum ssp. obliqua*) are abundant in the understorey. Garlic Mustard (*Alliaria petiolata*), Skunk-cabbage (*Symplocarpus foetidus*), and Orchard Grass (*Dactylis glomerata*) are common in the groundcover layer.
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type	Primarily located adjacent to the rail-trail, this community consists of Freeman's Maple, Eastern Cottonwood, and Green Ash (*Fraxinus pennsylvanica*). Throughout the sub-canopy Black Walnut is also commonly present.

4.3 Wildlife

4.3.1 Birds

In 2019 and 2022, 97 bird species were reported from the vicinity of the study area (BSC et al. 2008). In 2019, a total of 45 of these species were documented within the study area during field surveys, of which 36 species displayed evidence of possible, probable or confirmed breeding within the study area based on OBBA breeding evidence codes (Birds Canada et al. 2021). In 2022, a total of 39 species reported were documented within the study area during field surveys, all of which displayed evidence of possible, probable or confirmed breeding within the study area (Birds Canada et al. 2021). A complete list of bird observations from both years is provided in Appendix IV.

A total of 11 SAR/SCC birds were reported from background review data from both 2019 and 2022 (MNRF 2019; NDMNRF 2022). In 2019, NRSI field surveys documented one SAR, and one SCC bird species from the study area: Barn Swallow (*Hirundo rustica*), and Eastern Wood-Pewee (*Contopus virens*), respectively. In 2022, NRSI documented the same SAR and SCC, as well as one additional SAR: Chimney Swift (*Chaetura pelagica*).

Barn Swallow are regulated SAR listed as Threatened provincially and federally, affording individuals and their habitat protection under the ESA (2007). This species is an aerial insectivore, requiring large open areas for foraging (Heagy et al. 2014). In 2019, individuals were observed during the breeding bird surveys foraging over agricultural fields from BMB-001, BMB-002, BMB-003, and BMB-004. In 2022, an individual was observed at BMB-001 and another was observed foraging at BMB-006 during visit 1. During visit 2, one individual was observed at BMB-006. Another individual was observed incidentally during an ELC and summer vegetation inventory survey. Nesting habitat includes human-made structures such as barns, sheds, homes, and other structures with adequate coverage (Brown and Brown 2020). Suitable nesting habitat may be present within the study area; however, access did not allow suitable structures to be investigated.

Chimney Swift are regulated SAR listed as Threatened provincially and federally, affording individuals and their habitat protection under the ESA (2007). In 2022, one individual was observed at BMB-004. Chimney Swift is commonly found in urban areas near buildings. They will nest in chimneys, hollow trees, and crevices of rock cliffs (MECP 2020; OMNR 2000). Suitable breeding habitat may exist within the study area where chimneys and hollow trees are present.

Eastern Wood-Pewee are regulated SCC listed as Special Concern provincially and federally. The species is noted to be common throughout Ontario; however, it has experienced widespread declines. In 2019, Eastern Wood-Pewee was observed singing during targeted breeding bird surveys at BMB-001 and BMB-005, indicating ‘Possible’ breeding evidence. In 2022, one Eastern Wood-Pewee was observed singing at BMB-001. Eastern Wood-Pewee is a forest bird often associated with deciduous or mixed intermediate forests with little understorey, clearings, and edges (OMNR 2000; COSEWIC 2012). Suitable breeding habitat is present within the study area where forest communities and riparian edges of Davis Creek provide appropriate habitat (Map 4).

4.3.2 Herpetofauna (Reptiles & Amphibians)

In 2019, 21 herpetofauna (reptile & amphibian) species were reported from the vicinity of the study area based on background data (Ontario Nature 2019). Six of these species were documented within the study area during field surveys. In 2022, 24 herpetofauna species were reported from background data; one of which was incidentally observed within the study area during field surveys. A complete list of all herpetofauna species reported from the study area is provided in Appendix IV.

A total of eight SAR/SCC herpetofauna were reported from background review data in 2019 (MNRF 2019; Ontario Nature 2019) and a total of nine SAR/SCC were reported in 2022. A single SCC, Common Snapping Turtle (*Chelydra serpentina serpentina*), was documented by NRSI biologists incidentally on April 24, 2019. Snapping Turtles inhabit a wide range of habitats, including man-made ponds, streams and watercourses.

In 2019, anuran call surveys were conducted to identify the presence of breeding frog and toad species within the study area. Anurans were observed at stations ANR-001, -002, and -005 (Map 3). Full choruses of Spring Peeper (*Pseudacris crucifer*) were heard earlier in the spring at ANR-001 and 002, while lower numbers of American Toad (*Anaxyrus americanus*) were documented at these times too. Small numbers of Wood Frog (*Lithobates sylvaticus*) and Northern Green Frog (*Lithobates clamitans melanota*) were observed at ANR-002. Table 4 presents the anuran call survey results.

Table 4. Anuran Call Survey Results (2019)

Survey		Call Abundance*			
Station	Date	Spring Peeper	American Toad	Wood Frog	Northern Green Frog
1	April 24	3	2(6)	-	-
	May 15	3	1(1)	-	-
	June 5	-	2(5)	-	-
2	April 24	2(7)	2(6)	1(2)	-
	May 15	1(5)	-	-	-
	June 5	-	-	-	1(1)
3	April 24	-	-	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-
4	April 24	-	-	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-
5	April 24	-	2(4)	-	-
	May 15	-	-	-	-
	June 5	-	-	-	-

*Call abundance refers to the Marsh Monitoring Programs call codes (Bird Studies Canada 2009).

Air temperature on survey dates: April 24 - 9 to10°C; May 15 - 13°C; June 5 - 21°C.

4.3.3 Insects

In both 2019 and 2022, 26 Odonata (dragonfly & damselfly) species were reported from the vicinity of the study area, based on the Ontario Odonata Atlas Database (OOAD 2019). In 2019, 57 Lepidoptera (butterfly) species and in 2022, 29 species were reported from the vicinity of the study area, based on the Ontario Butterfly Atlas (MacNaughton et al. 2022). NRSI did not observe any Odonata species during field visits in either year. In 2019, NRSI did not observe any butterfly species. In 2022, NRSI observed two species, one of which is an SCC: Monarch (*Danaus plexippus*). A complete list of insect species reported from the study areas from both years is provided in Appendix IV.

4.3.4 Mammals

In 2019, 37 mammal species were reported from the vicinity of the study area, based on the Mammal Atlas of Ontario (Dobbyn 1994). Six mammal species were observed incidentally during field investigations in the study area by NRSI biologists. In 2022, 41 mammal species were reported from the vicinity of the study area, based on the Mammal Atlas of Ontario (Dobbyn 1994). Five mammal species were observed incidentally during field investigations in the study area by NRSI biologists. A complete list of all mammal species reported from the study areas from both years is provided in Appendix IV.

Forest, treed wetland, and hedgerow communities located within the study area may provide suitable bat maternity colony habitat features. Further discussion regarding presence of suitable roosting habitat for SAR/SCC bats is provided in Section 5.3.

4.4 Aquatic Habitat

4.4.1 Davis Creek

The primary watercourse within the study area is Davis Creek, which has been separated and described as the west branch, east branch, and mainstem. Additional tributaries also exist within the study, labeled as Tributary A and Tributary B. These features have been described below. Davis Creek and its tributaries cross the four potential watermain alignments at several locations, as shown on Map 3.

East Branch

The east branch of Davis Creek originates northeast of the study area near the community of Bloomsburg. The east branch enters the study area at its northeast corner near the intersection of Old Highway 24 and Cloet Road and flows southwest, parallel to the trailway before turning west and crossing under the trailway approximately 300m southwest from Cloet Road. The watercourse then turns southwest and flows generally parallel to the trailway along its north side for approximately 1.0km to its confluence with the west branch. The east branch exhibits both meandering and straightened forms that suggests historical channelization. The upper 300m stretch between Cloet Road and the trailway is largely straightened and includes direct connection to an online irrigation pond. North of the trailway the east branch transitions to a more meandering form for approximately 500m before transitioning back to a straightened channel for 350m. The lower portion of the east branch then meanders for another 100m before joins the east branch. Along its length the east branch flows through a narrow corridor of cultural woodland and deciduous swamp that ranges in total width between approximately 40 and 100m, restricted due to the presence of active agricultural lands along both sides. However, the extent of natural riparian cover depends on the location of the channel within the corridor, which is restricted to a minimum of approximately 5m in some locations. Generally, the natural corridor provides a relatively high quality of shading to the east branch due to the presence of mature deciduous forest and thick riparian shrub growth. The average width of the wetted channel ranges from approximately 0.5 to 2.5m with relatively shallow depths that ranged from 0.15 to 0.2m at the time of the assessments, however it is likely to experience areas of slightly lower and slightly greater depths. Substrates within the east branch appear to be dominated by sand, silt, and gravel.

Watercress (*Nasturtium officinale*) was observed at various locations along the east branch indicating the likely presence of groundwater inputs to the creek that help to support baseflow and maintain cool water temperatures. Davis Creek has been identified as a cool to coldwater feature (LPRCA, MNR, 2014), which is supported through in situ water temperature measurements that were taken on July 14, 2022. The water temperature was 19.3°C at 14:40 with an air temperature of 27°C, measured at the downstream (west) side of the trailway crossing. When graphed using the nomograph method developed by Chu et. al. (2009)

Several irrigation ponds exist along the east branch of Davis Creek within the study area. Two irrigation ponds occur at the northeast corner of the study area along its east side with one present to the east of Cloet Road and the second to the west. The pond east of Cloet Road is the smaller of the two (approximately 1,300m^2) and was historically connected to the east branch while the second pond (approximately 2,800m^2) remains online and connects to the east branch at its north and south ends. These ponds have been historically used for irrigation purposes but it is understood not in recent years BGE 2021). A third irrigation pond is also present along the north side of the east branch approximately 400m upstream from its confluence with the west branch. This pond measures approximately 500m^2 and there is the potential that this pond still connects to the east branch at times during the year, although this could not be confirmed.

West Branch

The west branch of Davis Creek originates within active agricultural lands north of the study area and crosses Old Highway 24 approximately 650m west of Cloet Road and the east branch crossing. The west branch flows south for approximately 1.0km to where it merges with the east branch. Within the study area the watercourse flows as a channelized feature through agricultural lands with a limited riparian corridor that appears to consist primarily of grasses with occasional trees and shrubs. The width of the corridor ranges from approximately 10 to 20m and appears to provide relatively poor shading to the channel. Several lane crossings are present along the west branch, which facilitate access to the adjacent agricultural lands. Based on aerial imagery, the channel widens at the downstream (south) sides of these crossings, suggesting the presence of undersized culverts and channel scouring.

Mainstem

The mainstem of Davis Creek diverges from the adjacent trailway approximately 120m south from the confluence of the east and west branches. The channel travels southwest and crosses Highway 24 approximately 170m north from Concession 13 where it exits the study area and then turns south. The mainstem then crosses the study area again at 14th Street West approximately 330m west from Norfolk Street North (Highway 24). Similar to the east branch, the mainstem flows primarily through an agricultural landscape within a narrow naturally vegetated corridor. South of the study area Davis Creek flows through a predominately developed landscape.

The mainstem was assessed at its crossing of 14th Street West (AHA-004). At this location the wetted width ranged from approximately 2.0 to 5.0m with a bankfull width up to approximately 7.0m. The creek flows through a relatively straight channel over a low to moderate gradient with substrates comprised of gravel, sand, and silt with some cobble. The channel was slightly incised and evidence of bank erosion and undercutting was noted. On July 14, 2022 the water temperature was 18.0°C at 13:00 with an air temperature of 27°C, which falls within the cool to coldwater thermal regime (Chu et. al. 2009). Watercress was observed in relatively low abundance at this location.

4.4.2 Tributaries

A desktop analysis of aerial imagery shows two additional tributaries that cross the study area and flow to Davis Creek; Tributary A and Tributary B.

Tributary A

Tributary A is a minor feature that originates northwest of the study area and flows southeast, crossing Highway 24 before flowing to the west branch of Davis Creek. This feature appears to be historically channelized and flows within a narrow riparian corridor across agricultural lands, which provides limited shading.

Tributary B

Tributary B originates east of the study area and flows through an agricultural landscape generally west and southwest, crossing the study area near its southeast corner. Within the study area the tributary crosses the trailway approximately 80m north of 14th Street East before crossing 14th Street East, Norfolk Street, and 14th Street West. The tributary merges with the mainstem of Davis Creek approximately 200m south of 14th Street West and outside the study area. Approximately 400m east of the trailway Tributary B flows through a large online pond.

Tributary B was assessed where it crosses the preferred alignment at the trailway (AHA-005) and along 14th Street East (AHA-006). Based on the presence of flow, defined channel form, and exposed sand and gravel substrates, the lower portion of Tributary B appears to be a permanent feature. Upstream from the trailway, the tributary flows through abundant riparian shrub growth (Dogwood spp.), which provides high quality shading. Iron staining and watercress were both observed at this location indicating the presence of groundwater input. Watercress was also observed in moderate abundance between the trailway and 14th Street East. At this location the riparian area is dominated by wetland species including Skunk Cabbage and mature deciduous trees and shrubs provide shading to the channel. The wetted width ranges from approximately 1.5 to 3.5m with a bankfull width up to approximately 5.0m. Water depths at the time of the survey ranged from 0.1 to 0.3m. Instream cover is present in the form of pools, riffles, woody debris, undercut banks, instream and overhanging vegetation.

Tributary B was confirmed as fish habitat based on the presence of several small-bodied and young-of-year fish species.

Water temperature was measured at the downstream side of the trailway culvert and was 20.5°C at 13:50 with an air temperature of 27°C, which falls within the coolwater thermal regime (Chu et. al. 2009).

4.5 Fish Community

A total of 21 fish species were identified as potentially occurring within or in the vicinity of the study area (Appendix IV) based on historical data. These include a variety of small and large-bodied species that exhibit warmwater, coolwater, and coldwater thermal preferences.

NRSI completed fish community sampling at three locations along the east branch of Davis Creek within the estimate zone of pumping influence on October 16, 2020 using a multi-pass depletion methodology. This sampling resulted in the capture of six species; Blacknose Dace (*Rhinichthys atratulus*), Brook Stickleback (*Culaea inconstans*), Creek Chub (*Semotilus atromaculatus*), Largemouth Bass (*Micropterus salmoides*), Mottled Sculpin (*Cottus bairdii*), and White Sucker (*Catostomus commersonii*). These species generally exhibit coolwater thermal preferences, which is consistent with earlier assessments of the east branch (BGE 2015, Golder Associates 2015). In addition to the coolwater species (e.g., Blacknose Dace, Brook Stickleback, Creek Chub and White Sucker) captured, one coldwater species (Mottled Sculpin) and one warmwater species (Largemouth Bass) were observed. The capture of Mottled Sculpin further supports the designation of Davis Creek as a coldwater watercourse. The capture of Largemouth Bass appears to be the result of a warmwater species moving to the creek from one of the online irrigation ponds that connect to Davis Creek. As evidenced by the capture of this species it is likely that warmwater species occasionally migrate to the creek from irrigation ponds when there is a suitable connection that would facilitate movement. Largemouth Bass prefer the warm, shallow areas of ponds, bays, and marshes (Eakins 2022), conditions which are found within the irrigation ponds but not within Davis Creek.

Historical fish community information identifies the presence of Brook Trout (*Salvelinus fontinalis*) within the mainstem of Davis Creek near the confluence of Davis Creek and Patterson Creek, located approximately 700m downstream from the study area (MNR 2014, LPRCA 2014, LIO 2022). Brook Trout are a coldwater species that occur in clean, well-oxygenated lakes, rivers and streams (Scott and Crossman 1998) and are sensitive to changes in conditions, specifically thermal changes. While Brook Trout have been identified near the lower reaches of the creek, there is no information to suggest that they occur within the upper reaches. However, conditions within the upper reaches must still be considered as important since they support a known Brook Trout population within the lower reaches.

5.0 Natural Feature Significance and Sensitivity

Analysis of the significance of existing natural features was used to identify those features and habitats that are sensitive to disturbance based on the rarity or sensitivity of the feature or the functions/processes that contribute toward their significance. This assessment also considered the policies, legislation, and regulations that apply to the study areas' natural features which must be considered in the evaluation of the developed scenario. The alternative watermain alignment options were analyzed through a desktop review of the surrounding existing natural features whereas a more detailed analysis was conducted for the preferred watermain alignment option. The following is a brief discussion of the results of this analysis with regards to background information and the presence of natural features within the study area.

5.1 Wetlands

Based on background information reviews, unevaluated wetlands are reported within the study area. However, NRSI determined the presence of several wetland features within the study area along the Davis Creek riparian area (Maps 2 and 4). Based on complexing rules under the Ontario Wetland Evaluation System (MNRF 2014), the unevaluated wetlands documented within the northern section of the study area do not qualify as Provincially Significant Wetland (PSW). The LR-13 PSW is within the southwest portion of the 2022 study area.

5.2 Significant Woodlands

The Norfolk County Official Plan (2020) (Schedule C-1; and C-4) identifies the presence of two "Significant Woodland" features within the western portion of the study area (Map 4). Development or site alteration in, or adjacent to, Significant Woodlands shall not be permitted unless it has been demonstrated that there will be no negative impacts on the Woodlands and the ecological functions that sustain them. Under the OP, a minimum setback of 10m from the Woodland dripline is required.

5.3 Significant Wildlife Habitats

Based on background information review, desktop analysis, and field studies, the study area contains four candidate and three confirmed SWH types as shown on Map 4:

- Bat Maternity Colonies (Candidate),
- Turtle Wintering Areas (Candidate),
- Tallgrass Prairie (Candidate),
- Amphibian Breeding Habitat (Woodland) (Confirmed),

- Turtle Nesting Area (Candidate),
- Seeps and Springs (Confirmed), and
- Special Concern and Rare Wildlife Species (Eastern Wood-Pewee, Monarch, and Snapping Turtle) (Confirmed).

Further details are provided regarding each candidate and confirmed SWH type; refer to the Significant Wildlife Habitat screening exercise (Appendix III) for an analysis of all significant species assessed within both study areas.

5.3.1 Seasonal Concentration Areas

Wildlife seasonal concentration areas are defined as areas where animals occur in relatively high densities for all, or portions, or their life cycle (OMNR 2000). These areas are generally relatively small, particularly when compared to areas used by these species during other times of the year.

Bat Maternity Colonies

Several species of SAR bats are known to roost in tree cavities, hollows, or under loose bark, as well as within buildings (MNR 2000). Based on habitat present within the study area, it is assumed that all deciduous forested habitats provide suitable roosting habitat for SAR bats (see Map 4). More information is provided in Section 5.4.

Turtle Wintering Area

Several listed species are reported from the vicinity of the study area, based on the background review completed by NRSI. Field surveys in 2019 documented the presence of a single Snapping Turtle within the SWD4 community. Suitable over-wintering aquatic habitat is present within the study area in the form of wetlands and ponds (see Map 4).

5.3.2 Rare vegetation Communities

Tallgrass Prairie

Tallgrass Prairie vegetation community is reported from the vicinity of the study area, based on the background review completed by NRSI (NDMNRF 2022). This community is not present along the preferred alignment based on 2022 ELC field surveys. It may exist along the other watermain alignment options, but it is unlikely as the area is relatively disturbed.

5.3.3 Specialized Habitat for Wildlife

Specialized habitats include those that support wildlife species with highly specific habitat requirements, areas with exceptionally high species diversity, and/or areas that provide habitat that greatly enhances a species' chance of survival (MNR 2000). The SWHTG indicates that most specialized habitats have not been formally identified or mapped by any agency (MNR 2000). Examples of specialized wildlife habitat include sites supporting area-sensitive species, old growth or mature forest stands, turtle nesting habitats, seeps/springs and cliffs.

Amphibian Breeding Habitat (Woodland)

Amphibian Breeding Habitat (Woodland) is confirmed within the study area. Suitable wetlands adjacent or in woodland habitat is present within the study area along Davis Creek. Targeted anuran call surveys conducted by NRSI identified the presence of American Toad, Spring Peeper, Wood Frog and Gray Treefrog. During anuran call counts in April, May and June, 2019 NRSI biologists observed >20 Spring Peeper and Wood Frog individuals from the SWD4 community located adjacent to and along Davis Creek.

Turtle Nesting Area

Ponds, wetlands, and Davis Creek, including its tributaries, are present within the study area. Agricultural land surrounding these areas may provide suitable habitat. Additional areas of exposed mineral soils may be present within the new portion of the study area, and may also provide suitable habitat. NRSI Biologists observed a Snapping Turtle during a site visit in 2019 but did not observe active nesting.

Seeps and Springs

Seeps/springs were observed by NRSI along Tributary B on July 14, 2022. This was observed east of the trailway crossing (Map 4). Further, the presence of watercress along the east branch of Davis Creek and the mainstem at 14th Street West suggests that additional seeps or springs may be present along the east branch as well.

5.3.4 Habitat for Species of Conservation Concern

Species of Conservation Concern are species with a provincial S-rank of S1 to S3, species listed as species of Special Concern provincially, or species listed as Endangered or Threatened nationally with no provincial designation (i.e., not protected by the Endangered Species Act (ESA)). Confirmed habitat for SCC may be considered SWH (MNR 2000).

Special Concern and Rare Wildlife Habitat

Suitable habitat for SCC is present in the study area. Observed SCC include Eastern Wood-Pewee, Monarch, and Snapping Turtle. Eastern Wood-Pewee was observed during breeding bird surveys on June 14 and 24, 2019 and June 10 and 30, 2022 and incidentally during an ELC and summer vegetation inventory survey on July 25, 2022. A single Monarch was observed during the summer ELC and vegetation inventory survey on July 25, 2022. A single Snapping Turtle was observed incidentally within the SWD4 community on April 24, 2019.

Eastern Wood-Pewee

Eastern Wood-Pewee's were observed during NRSI field surveys at two monitoring stations: BMB-001 and BMB-005 in 2019 and BMB-001 and BMB-006 in 2022 (see Map 3). Eastern Wood-Pewee is a forest bird often associated with deciduous or mixed intermediate forests with little understorey, clearings, and edges (OMNR 2000; COSEWIC 2012). Suitable breeding habitat is present within the deciduous forested communities within the study area (see Map 4).

Monarch

A single Monarch was observed incidentally during a field visit on July 25, 2022. Monarch is a widespread species associated with a variety of habitats, include roadsides, agricultural lands, and meadows. They require a variety of wildflowers for adults and milkweed for larvae (MECP 2020). Given that only a single adult Monarch was observed and there was no evidence of larvae on milkweed plants, suitable habitat is not considered present within the study area.

Snapping Turtle

A single Snapping Turtle was observed incidentally during a field visit on April 24, 2019 in the SWD4 community (see Map 2). Further, a landowner provided photo evidence of a Snapping Turtle along the railway line (B. Banks pers. comm. 2019), which was reviewed and confirmed by NRSI biologists from 2012. Suitable habitat is present within the wetland communities adjacent to Davis Creek (see Map 4).

5.4 Habitat of Endangered and Threatened Species

Based on field investigation, Barn Swallow was documented in 2019 and 2022 and Chimney Swift and Butternut were documented in 2022. Additionally, four SAR Bat species have the potential to occur within the study areas due to the presence of suitable treed habitat along Davis Creek and within isolated forests. Refer to the SAR/SCC screening exercise (Appendix II) for an analysis of all significant species assessed within the study area.

Barn Swallow

Barn Swallow was observed at BMB-001, 002, 003, and 004 during targeted breeding bird surveys conducted by NRSI biologists on June 14, and 24, 2019. The highest breeding evidence code recorded for Barn Swallow within the study area is ‘Possible’ which suggests suitable breeding habitat is present although no direct evidence such as nests or fledged young was observed. Individual Barn Swallows were observed foraging over fields and amongst natural areas within the study area. Barn Swallow nest almost exclusively in or on human structures where areas of open habitat are available for foraging and access to nesting materials (Heagy et al. 2014). Barn Swallow are reported to forage within 600m of their nest (Heagy et al. 2014) suggesting nests are likely within the study area in barns, out buildings and other appropriate human-made structures outside natural features.

Chimney Swift

A single Chimney Swift was observed at BMB-004 during targeted breeding bird surveys conducted by NRSI biologists on June 10, 2022. The breeding evidence code recorded for Chimney Swift within the study area is ‘Observed’, which does not indicate that suitable breeding habitat is present. Chimney Swift is commonly found in urban areas near buildings. They will nest in chimneys, hollow trees, and crevices of rock cliffs (MECP 2020; OMNR 2000).

SAR Bats

Several SAR bats are known to occur within southern Ontario and have the potential to occur within the study area, including the Eastern Small-footed Bat (*Myotis leibii*), the Little Brown Myotis (*Myotis lucifungus*), Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*). These species are listed as Endangered (SARO 2020).

Butternut

In 2022, mature Butternut trees were documented along and adjacent to the preferred watermain alignment route at seven distinct locations (Map 4). These observations range from a single Butternut to larger stands of multiple individuals. Butternut is listed as Endangered provincially (MECP 2022) and are, therefore, regulated, including individual trees and their habitat. Development within 25m of a Butternut main stem will require a Butternut Health Assessment to be completed by a qualified professional.

5.5 Fish Habitat

Historical data (BGE 2015, Golder Associates 2015, Jacques 2014, LIO 2022, McCloskey 2014, NRSI 2021) and field observations completed by NRSI in 2020 and 2022 confirm that the east branch and mainstem of Davis Creek provide suitable year-round habitat for a variety of fish species including cool and coldwater species. This supports comments made by the MNRF, which recommend that *any assessment of impacts on the Davis Creek fishery should be based upon the presence of cool to cold water fish community in a permanent stream* (McCloskey 2014, email communication). Warmwater species (e.g., Largemouth Bass, Pumpkinseed and Fathead Minnow) have also been identified within the east branch but it is expected that this is due to these species moving to the creek from online irrigation ponds, which provide water temperature and habitat conditions more suited to warmwater species.

A known population of Brook Trout exists near the lower extent of Davis Creek near the confluence with Patterson Creek. However, in its current state, the aquatic habitat within the study area is likely to limit the presence of a Brook Trout population due to degraded water quality, temperature and flow conditions resulting from adjacent agricultural practices, including online irrigation ponds. Still, conditions within the study area should be maintained or improved, if possible, particularly as they relate to water temperature and groundwater inputs, which are critical for maintaining habitat conditions for Brook Trout throughout the lower sections.

No fish data was available for the west branch of Davis Creek but due to its direct connection to the east branch and mainstem it is expected that this feature provides suitable fish habitat within the study area as well. Several lane crossings were noted along the west branch, which may inhibit upstream movement of fish. However, it should be expected that the west branch provides fish habitat up to and beyond the crossing of Old Highway 24.

Tributary A is likely to provide seasonal fish habitat during periods when water is flowing within the feature. However, it is expected that this watercourse does not provide adequate fish habitat during low-flow periods. Tributary B was confirmed as fish habitat based on field observations of Black-nose Dace, Brook Stickleback, and juvenile White Sucker in the vicinity of the trailway crossing, suggesting a coolwater fish assemblage. In situ water temperature measurements taken on July 14, 2022 supports the designation of this feature as a coolwater feature with a temperature of 20.5°C and air temperature of 27°C, taken at 13:40 (Chu et. al. 2009).

No aquatic SAR are known to occur within the watercourses that cross the study area based on a review of Fisheries and Oceans Canada SAR mapping (DFO 2022).

6.0 Impact Assessment and Mitigation Recommendations

6.1 Description of Proposed Works

The County of Norfolk initiated a Municipal Class EA in 2010 to facilitate an approval for a new groundwater supply source that would provide additional potable water capacity for the Community of Simcoe. As part of this undertaking aquifer testing was conducted by BGE in 2009 and then again in 2012 for test production well SW11/09. Following 2012 testing it was recommended that a well construction and testing program be implemented to confirm the safe perennial yield for the aquifer in the vicinity of the test well (BGE 2015). In 2020, a pumping test was completed at two test production wells, including test production well SW11/09, and an additional well (SW12/20), which was constructed in August, 2019 (BGE 2021). It was anticipated that the two test production wells within the study area would become the municipal well-sites used to supply groundwater to the Community of Simcoe.

Servicing and alignment alternatives were initially evaluated by G. Douglas Vallee Limited in 2011, with updates in 2022 to provide a general confirmation of the evaluation of the routes (Vallee, 2022). Four routes were evaluated under the assumption that the watermain would be constructed by open cut but with recommendations to consider trenchless technologies, if possible, which would reduce restoration costs. From an environmental perspective trenchless technology is generally a preferred method of installation, particularly at locations when the alignment crosses a watercourse, since disturbance to the natural environment is generally limited to the areas around entry and exit pits. For the preferred alternative (Proposed Alignment C), a large portion of the watermain would be installed along the trailway, which is elevated above Davis Creek and adjacent natural areas. An open cut methodology along the trailway may be suitable for areas where excavation would not interfere with groundwater or surface water resources (i.e., where all construction activity would be completed above these along the trailway). Impacts and recommendations are provided below, considering the various installation methods along the preferred alignment.

6.2 Approach to Impact Analysis

The impact analysis provided here is based on a high-level assessment of potential natural feature impacts based on a conceptual understanding of the proposed groundwater supply source and associated development within the identified study area. Updates to this preliminary impact analysis are anticipated once detailed designs and installation techniques have been further refined. Characterization and identification of potentially significant areas and features are provided briefly to assist in the design process for the preferred watermain alignment. The following is a description of the types of impacts discussed:

- Direct Impacts – associated with the disruption or displacement of natural features;
- Indirect Impacts – associated with changes in site conditions; and
- Induced impacts – associated with impacts after the development is completed.

6.3 Direct Impacts and Recommended Mitigation

As a general means to limit the extent of impacts to natural features, efforts should be made to delineate the construction areas utilizing heavy-duty Erosion and Sediment Control (ESC) fencing to control surface water runoff and prevent potential sedimentation to adjacent natural features associated with the installation of the preferred watermain.

Recommended mitigation measures for avoiding or minimizing direct impacts resulting from installation of the watermain along the preferred alignment are provided in Table 5.

6.3.1 Water Quantity and Quality

Direct water quality and quantity impacts should be considered during the detailed design stage regarding the potential to negatively impact the existing water quality and quantity within Davis Creek, its connecting tributaries, and the PSW complex. Several significant natural features and wildlife habitat types have been confirmed within the study area (Map 4) that are directly influenced by water quantity and/or quality. These include amphibian breeding (woodland) SWH, seeps and springs, and coolwater/coldwater fish habitat. Additionally, significant species including Snapping Turtle were observed within the study area and candidate turtle wintering area SWH has been noted.

In order to maintain the water balance of Davis Creek, the PSW, and the wetland communities within the study area that support the above noted significant natural features, surface water quantities reaching the wetlands and watercourses must be maintained. Current and historical agricultural practices (e.g., construction and use of online and adjacent irrigation ponds) have already heavily influenced and created stress on Davis Creek and other water-influenced natural features within the study area (BGE 2015) and it is important to prevent additional impacts to the water quality and quantity within the study area.

Based on the 7-day aquifer testing program completed in 2020 (BGE 2021) and the previous 72-hour aquifer testing program (e.g., BGE 2015) it was concluded that there is no evidence to suggest that there will be any negative short- or long-term effects on the form and function of Davis Creek and its tributaries or adjacent wetland features.

6.3.2 Vegetation Removal

Site preparation (e.g., staging areas and grading) and watermain installation (e.g., entry/exit pits or trenching) are likely to result in the removal of vegetation along the preferred alignment to some degree. Vegetation removal should be minimized to the extent possible by maintaining work limits along the trailway and within road Right-of ways (ROW).

Butternuts were observed at seven locations along the preferred alignment. As a result, there is the potential for direct or indirect impacts to Butternuts and/or their root systems. This will ultimately depend on the location of trenching and installation in relation to these trees. Where possible, installation of the watermain should be avoided where these potential direct impacts to Butternut exist. Butternut is listed as an endangered species on the SARO list and is therefore afforded protection under the ESA (2007) from being killed, harmed, or removed. In the event the preferred watermain alignment and installation techniques are within 25m of any Butternuts, the project may be eligible to follow the requirements set out in section 23.7 of the Ontario Regulation 242/08 under the ESA. As part of this process, a Butternut Health Assessment will need to be completed by a qualified professional. The BHA will assess the presence and extent of Butternut Canker and categorize the Butternuts as Category 1, 2, 3 or hybrid to inform protection measures and potential compensation requirements as per the ESA (2007).

- **Category 1** – Butternut that is affected by Butternut canker to such an advanced degree that retaining the tree would not support the protection or recovery of Butternut in the area in which the tree is located, and is considered ‘non-retainable’.
- **Category 2** – Butternut that is not affected by Butternut Canker, or is affected by the canker but the degree to which it is affected is not too advanced and retaining the tree could support protection or recovery. Category 2 trees are considered ‘retainable’ and compensation is required where the tree may be killed, harmed or taken.
- **Category 3** – Butternut that may be useful in determining sources of resistance to Butternut Canker and is considered ‘archivable’. Category 3 trees are not eligible to be killed, harmed or taken under section 23.7 of Ontario Regulation 242/08 and will likely require ESA authorization.

- **Hybrids** – Butternut hybrids are not protected under the ESA; however, their removal may be subject to municipal by-laws and other legislation.

6.3.3 Aquatic Habitat

The preferred watermain alignment directly crosses Davis Creek and Tributary B at several locations, which has the potential to cause direct impacts to the watercourses at those locations. The level of impact will largely depend on the installation technique utilized. An open cut technique will result in a larger direct impact than a trenchless technique since this technique would typically involve a dam and pump set up to dewater an area of watercourse to facilitate the open cut. This results in direct impacts to the bed and banks of the creek and has the potential to cause impacts to fish. Therefore, to reduce direct impacts to the watercourses within the study area it is recommended that a trenchless technology be utilized to the extent possible to eliminate direct impacts to channel bed and banks and associated fish habitat. With that said, if open cut installation along the trailway can be completed above the level of groundwater and surface water resources then these direct impacts may be eliminated.

6.3.4 Potential Impacts to Wildlife and Wildlife Habitats

Installation of the watermain may temporarily displace wildlife species that are currently using the natural areas immediately adjacent to the alignment area. Species that use the area along the preferred alignment are generally common and well-adapted to pedestrian and vehicle traffic, and are expected to return to the adjacent natural areas upon completion of the installation works.

6.4 Indirect Impacts and Recommended Mitigation

Indirect impacts associated with any infrastructure surrounding the installation of the preferred watermain should have consideration for the natural environment. Any proposed infrastructure works should clearly demarcate the limits of construction including vegetation cutting and grading boundaries so as to prevent encroachment into the surrounding natural features. Heavy-duty ESC fencing should be correctly installed along the limits of disturbance to prohibit encroachment of machinery into natural areas, as well as hinder wildlife from entering construction sites.

Recommended mitigation measures for avoiding or minimizing indirect impacts resulting from installation of the watermain along the preferred alignment are provided in Table 5.

6.4.1 Erosion and Sedimentation

The effects of sedimentation on aquatic life has been well documented (i.e. Newcombe and MacDonald 1991; Ward 1992; Waters 1995; Osterling *et al.* 2010). Sedimentation can negatively alter the aquatic habitat in any water body, and destabilize the existing erosion and sediment transport regimes of watercourses. It has the ability to reduce water clarity, absorb energy from sunlight, and increase turbidity. These effects can reduce the feeding success of sight-feeding fish and invertebrate species, reduce the reproductive success of aquatic species through the loss of nesting habitat and the smothering of eggs, inhibit plant photosynthesis, cause water temperatures to increase, impair respiratory functions, lower tolerance to disease and toxicants and increase physiological stress. Under prolonged conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result.

During construction, areas of bare soil may be exposed which have the potential to erode during rainfall events and impact adjacent natural features. In the event of a heavy rain, sediment laden runoff can enter adjacent natural areas by way of overland flow. In order to protect on-site and off-site natural features from potential impacts due to sediment, a ESC plan is to be developed and implemented prior to any construction activities on the site.

Based on the soil type and slopes on the site, the potential for erosion on the site is considered to be moderate. However, maintaining existing vegetation along slopes will help to prevent erosion and sedimentation.

6.4.2 Contaminant Spills

Contaminant spills are a concern due to the proximity of construction vehicles and machinery to water bodies and wetlands. Accidental spills during equipment re-fueling are one of the more frequent spills of concern.

A contaminant spill will result in the degradation of water quality within a water body or wetland. Changes in water quality may impose significant behavioral and physiological stress on wildlife species, including fish, herpetofauna and birds, resulting in impaired spawning/breeding, nesting, feeding or routine activities. Under conditions where water quality remains at levels unacceptable for aquatic and semi-aquatic life, death of organisms may result. In some cases, depending on contaminant physical and chemical properties, a spill has potential to result in immediate death of wildlife dependent upon the habitats impacted.

The degree of impact on the water quality and aquatic organisms is dependent on the quantity, chemical composition, and toxicity of the substance spilled, as well as, the spill response time, ability to contain the spill, and dilution capabilities of the receiving water body (flow volume and rate). Watercourses have the potential to carry hazardous materials for long distances and affect large areas of habitat. The degree to which this impact occurs is directly related to flow within the watercourse. Consequently, deleterious substances will travel a much greater distance in a water body that experiences relatively high flow rates compared to one with standing water. At the same time, higher flows tend to dilute the contaminant, resulting in lower contaminant concentrations.

Ultimately, a release of contaminant or 'spill' into a water body is considered a release of a 'deleterious substance' and is prohibited under the *Fisheries Act*, the *Environmental Protection Act* and *Ontario Water Resources Act*.

6.4.3 Vegetation Removal and Wildlife and Their Habitats

Direct damage and indirect disturbances can cause stresses on natural features that weaken their ecological integrity. In these states, natural features are more prone to establishment and proliferation of invasive, non-native species such as European Buckthorn. Proliferation of invasive, non-native species within natural communities decreases their ecological value by suppressing native species, diminishing biodiversity and reducing habitat suitability.

Increased disturbance caused by excessive noise, dust, vibrations, artificial night-time lighting, and proximity of human presence during construction may cause certain wildlife species to abandon or avoid the area for travel, nesting, roosting or foraging. However, these impacts are anticipated to be minimal, localized, and temporary, and it is expected that displaced wildlife species will return to the study area following construction.

Any undertaking associated with the groundwater supply or infrastructure construction may require vegetation removal. Incidental take of wildlife is punishable under the Migratory Birds Convention Act (Government of Canada 1994), Fish and Wildlife Conservation Act, (Government of Canada 2019), and Endangered Species Act (ESA) (Government of Ontario 2019) regarding applicable species.

The removal of trees and other vegetation within the study area has the potential to disrupt nesting birds, fur-bearing mammals, and raptors not protected under the MBCA, as well as endangered species listed under the ESA (e.g., SAR bats). Specifically, impacts to breeding birds, fur-bearing mammals, raptors, and bats may be sustained through damage and destruction of nests, eggs and young, or avoidance of the area by breeding adults. The Migratory Birds Convention Act (MBCA, Government of Canada 1994) identifies a list of migratory bird species that are protected. It prohibits the destruction of nests, individuals and activities that would cause an adult bird to abandon a nest. Every developer/consultant/contractor, etc. is legally obliged to carry out due diligence to protect migratory birds from harm during all construction projects.

Historically, the implementation policies of the MBCA provided for biologists to conduct nest searches when vegetation removals were to occur during the nesting period. These provisions were revoked in 2014. One exception is for when the removals are to occur in simple habitats which are characterized in the MBCA (e.g., bridge structures, isolated trees, vacant lot). Should vegetation removal in simple habitats be required to occur within the peak breeding window, nest surveys may be conducted by a qualified biologist just prior to the removal activity (less than 48 hours prior to) to ensure that nesting birds are not present. Should a nest be identified within vegetation to be removed, the vegetated area shall be protected with a buffer and there shall be no removal or construction activity within that area until sign-off is obtained from the qualified biologist that the nest is no longer active. Vegetated areas identified as having no nesting activity can be removed; however, removal is to occur within 48 hours of the nest search. If vegetation removal does not occur within this time frame, additional nest searches are to be conducted.

In the event a nest survey is conducted, a clearance letter is to be prepared by the qualified biologist that undertook the surveys and submitted to the County for their files in the event a record of due diligence is requested by CWS.

A tree that may provide roosting habitat for SAR bats cannot be removed during the active bat season, without prior permission from the Ministry of Environment, Conservation and Parks (MECP). If vegetation removal is proposed to occur within the bat active period (i.e., April 1 to October 30) a memorandum of understanding with the MECP should be undertaken documenting steps to abide by the ESA. This memorandum should outline the approach to the removal of isolated trees and follow guidelines outlined by the *Survey Protocol for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis and Tri-colored Bat* (MNRF 2017) and will require approval from the MECP prior to removal.

6.5 Induced Impacts

Induced impacts are described as those that are not directly related to the construction or operation of the proposed undertaking (watermain), but rather arise when the landscape is altered in a way that could facilitate impacts to the natural environment in the future. The preferred watermain alignment will be along an existing rail trail and along existing roadways, therefore, no induced impacts are anticipated.

Table 5. Recommended Mitigation Measures

Potential Impact	Recommended Mitigation Measure(s)
• Erosion and sedimentation	• Prepare and implement a comprehensive Erosion and Sediment Control (ESC) Plan. • Implement trenchless technology where appropriate (e.g., crossing watercourses). • Heavy-duty ESC fencing is to be installed prior to any vegetation removal, rough grading and construction to demarcate the limit of disturbance, including entry/exit pits. Fencing is to be inspected for proper installation by the Contract Administrator or Environmental Monitor and must be maintained for the duration of work until exposed soils stabilize. • Any areas of bare soil within the construction area are to be re-vegetated as soon as feasible to prevent erosion of soils and keep dust to a minimum (within 30 days of area being left inactive). An approved native seed mix comprised of species indigenous to the area is to be applied where bare soils are in proximity to any natural areas. Seed mixes are not to contain non-native, invasive species that are known to invade natural areas. • Minimize potential for soil compaction. • Control vehicle and machinery access routes, and keep away from water bodies and wetlands wherever possible to minimize potential disturbance to riparian and bank vegetation. • Avoid clearing, grubbing and grading activities during seasonally wet periods (i.e., spring). • Avoid work during high volume rain events (>20mm in 24hrs) or snow melts are observed, resuming once soils have stabilized • If deemed necessary through on-site monitoring, stabilize exposed soils/banks as soon as possible after construction disturbance (i.e., plantings, rock etc.). If insufficient time is available in the growing season to establish vegetative cover, an overwintering treatment such as biodegradable erosion control blankets, fiber matting etc. should be applied to contain the site over the winter period. • Work in dry conditions (i.e., low flow period) or isolate in-water work area (if necessary) with use of a water containment structure. • No storage of equipment, materials or fill is to occur within the natural areas.
• Contaminant spills and construction equipment	• Implement an LSRCA-approved Spill Response Plan. • Keep machinery clean and refuel a minimum of 30m away from any water body and wetlands. • Maintenance of machinery during construction should occur at a designated location away from natural areas on-site (30m from watercourse, 10m from woodland). • Fuel and other construction-related chemical must be stored securely away from water bodies and wetlands. • Any discharges to a water body must meet MOE Policy 2 standards (at or better water quality that than of the receiving water body). • Contract Administrator or Environmental Monitor to be on-site during any on-site directional drilling to monitor for fac-outs (where applicable).
• Temporary disruption of fish habitat (in-	• Restrict construction to coldwater timing window (October 1 to May 31 (Government of Ontario 2013)). • Work in the dry (i.e., low flow) or isolate work area with a water containment structure or by working in dry conditions using accepted methods to bypass flows such as damming.

Potential Impact	Recommended Mitigation Measure(s)
water work) – only if necessary	• Implement an LSRCA-approved dewatering program if in-water works are required. • Machinery should be operated in a manner that minimizes disturbance to the banks and bed of the watercourse. • When using a water containment structure, obtain qualified biologists to implement Fish Salvage Plan to remove and relocate any fish from the work area prior to dewatering. • Stabilize any exposed soils as soon as possible after construction disturbance with native plantings where adjacent to natural features.
• Damage to/removal of trees and vegetation	• Install protective fencing at or 1m beyond drip line of trees. • Delineate limits of work zones with heavy-duty ESC fencing. • Control vehicle access routes to avoid areas of trees and vegetation. • Staging areas should be located away from protected trees, wooded areas and associated root zones (i.e., 10-20m). • Complete a Butternut Health Assessment if construction activities are anticipated within 25m of any Butternuts too inform setbacks, protection measures and compensation/authorization requirements. • Delineate natural areas of vegetation to be retained (e.g., Butternut individuals and communities). • Limbs of any trees to be retained which are damaged during construction should be pruned using proper arboricultural techniques. • Any vegetation and tree removal should adhere to the applicable MBCA breeding bird timing windows to prevent the destruction of nesting birds. • Conduct nest searches within ‘simple’ habitats only where construction schedule will not allow for vegetation removal to be outside of MBCA timing window to confirm no nesting birds present prior to any removals. • Any vegetation removal, if required, is to occur outside of the core nesting period for migratory birds, as established by the Canadian Wildlife Service (CWS 2012), and SAR bats, as established under the ESA. Vegetation clearing should occur between November 1 and March 31.
• Wildlife and their habitats	• Restrict daily timing of construction activities to between 7:00am and 7:00pm. • Lighting equipment associated with construction activities to be turned off following cessation of daily construction activities, or turned away from natural features. • Moisten exposed soils / dry soil with water as needed during construction to reduce dust. • Any vegetation and tree removal should adhere to the applicable MBCA breeding bird timing windows to prevent the destruction of nesting birds. • Conduct nest searches within ‘simple’ habitats only where construction schedule will not allow for vegetation removal to be outside of MBCA timing window to confirm no nesting birds present prior to any removals.
• Debris entering a water body	• Construction debris should be stabilized (i.e., tarps) away from water bodies and wetlands. • Refuse and other material should be appropriately disposed of off-site. • Staging areas should be located away from water bodies and wetlands (i.e., 30m). • Drilling shafts should be located away from water bodies and wetlands (i.e., 30m).

7.0 Summary

Natural Resource Solutions Inc. (NRSI) was retained by Norfolk County as a subconsultant to BGE in April, 2019 to complete a Natural Environment Assessment Report as part of the required Municipal Class Environmental Assessment to facilitate the approval for a new municipal groundwater supply source for the Community of Simcoe in Norfolk County, Ontario. The proposed project required the completion and submission of a NEAR in accordance with the requirements of the Municipal Class Environmental Assessment (MEA 2015). The Community of Simcoe requires additional potable water capacity and therefore has undertaken a Schedule "B" Class Environmental Assessment to determine the preferred solution and design for this problem. Two new production wells have been constructed northeast of Simcoe and were tested in 2020 (BGE 2021). G. Douglas Vallee Limited evaluated alternatives for the transmission of raw groundwater from the well sites to the existing treatment plant on 14th Street West in Simcoe. Four potential watermain alignment options were evaluated, and one of these was determined to be the preferred alignment route.

The study areas contains a portion of the Davis Creek and associated tributaries, LR-13 PSW complex, wetlands, significant woodland, hedgerows, and agricultural fields. Existing natural features within the study area are limited to the wetland and forest communities which are located adjacent to Davis Creek.

Habitat for nine regulated SAR is potentially present within the study areas, along with three confirmed and four candidate SWH features. The majority of suitable habitat for these species is present, or potentially present, in close or direct proximity to natural areas adjacent to Davis Creek and the remaining woodland areas.

Existing natural features adjacent to the preferred and remaining three proposed watermain alignment were characterized and assessed for potential direct, indirect, and induced impacts. Recommendations have been provided to mitigate potential impacts.

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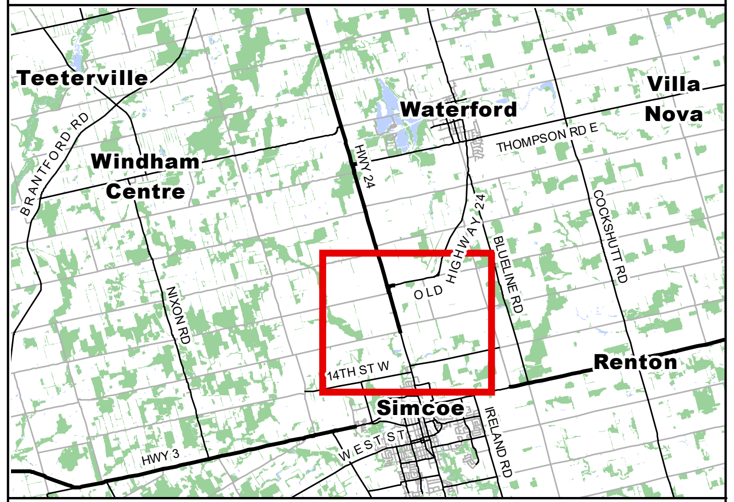
Maps

Path: X:\2250A_SimcoeWaterSupplyClassEA\NRSI_2250A_Map1_StudyArea_NaturalFeatures_18K_2022_09_29_KEF.mxd

Map 1

Simcoe County Additional Water Supply Class EA

Study Area and Natural Features



Legend

- ▭ Study Area (120m)
- ▭ Estimated Zone of Influence
- — Potential Watermain A
- — Potential Watermain B
- — Potential Watermain C (Preferred)
- — Potential Watermain D
- •— Utility Line
- — Highway
- — Primary Road
- — Secondary Road
- +— Railway
- ~ Permanent Watercourse
- ~ Intermittent Watercourse
- ▨ Water Body
- ▨ Provincially Significant Wetland (PSW)
- ▨ Wooded Area
- ▨ Significant Woodland (Norfolk County 2020)
- ▭ Natural Features within Study Area

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Project: 2250A
Date: September 29, 2022

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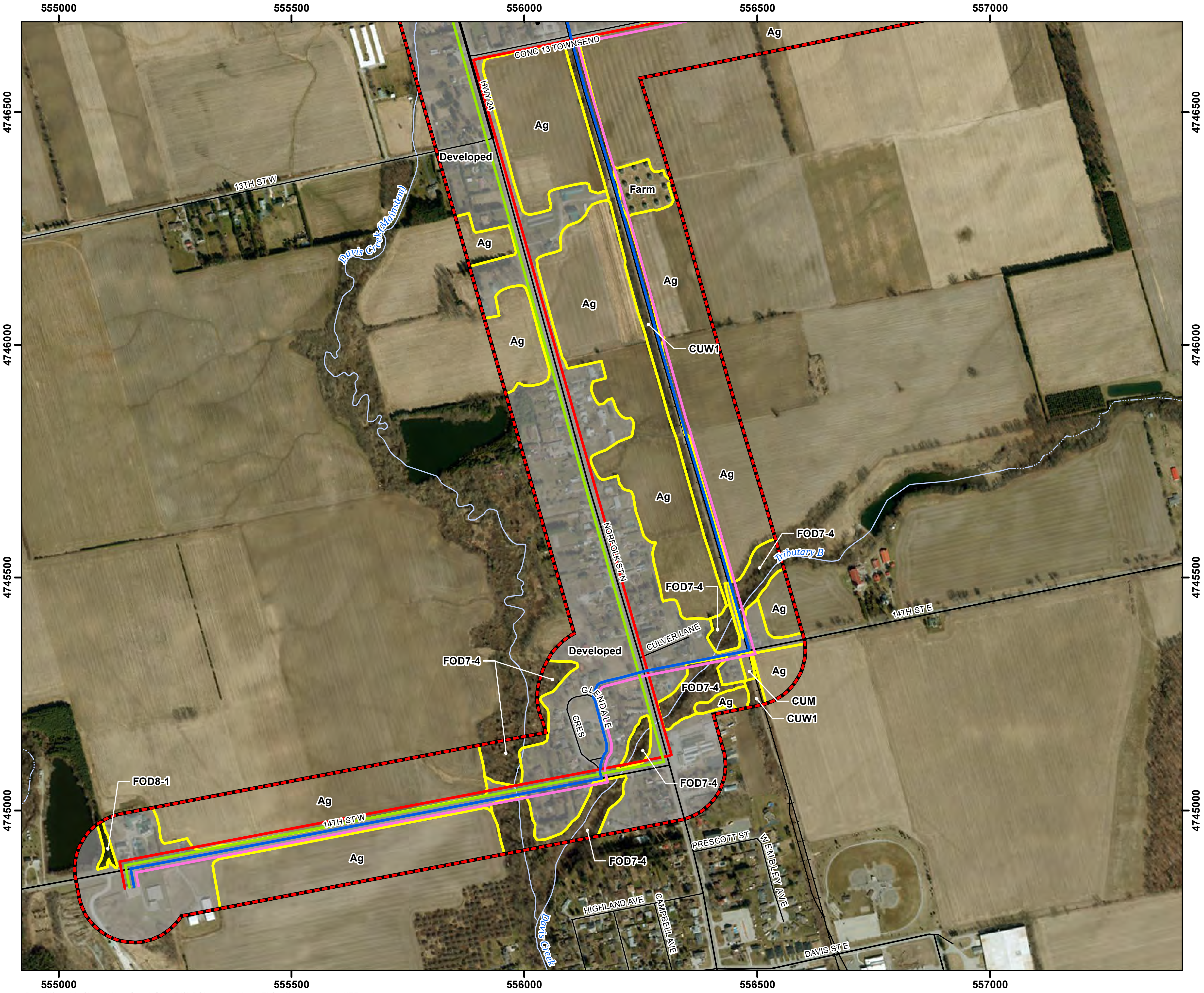
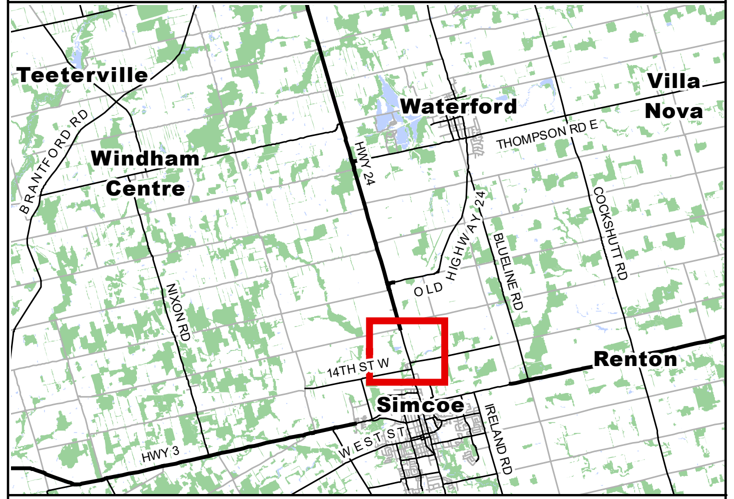
Map 2a

Simcoe County Additional Water Supply Class EA

Vegetation Communities





Legend

- 🟥 Study Area (2022)
- ▬ Potential Watermain A
- ▬ Potential Watermain B
- ▬ Potential Watermain C (Preferred)
- ▬ Potential Watermain D
- ☐ Ecological Land Classification (ELC)
- (Ag) Agriculture
- (CUM) Cultural Meadow
- (CUW1) Mineral Cultural Woodland Ecosite
- (FOD7-4) Fresh - Moist Black Walnut Lowland Deciduous Forest Type
- (FOD8-1) Fresh - Moist Poplar Deciduous Forest Type
- ▨ Developed / Unclassified
- •— Utility Line
- ▬ Highway
- — Primary Road
- — Secondary Road
- +— Railway
- ~ Permanent Watercourse
- ~ Intermittent Watercourse

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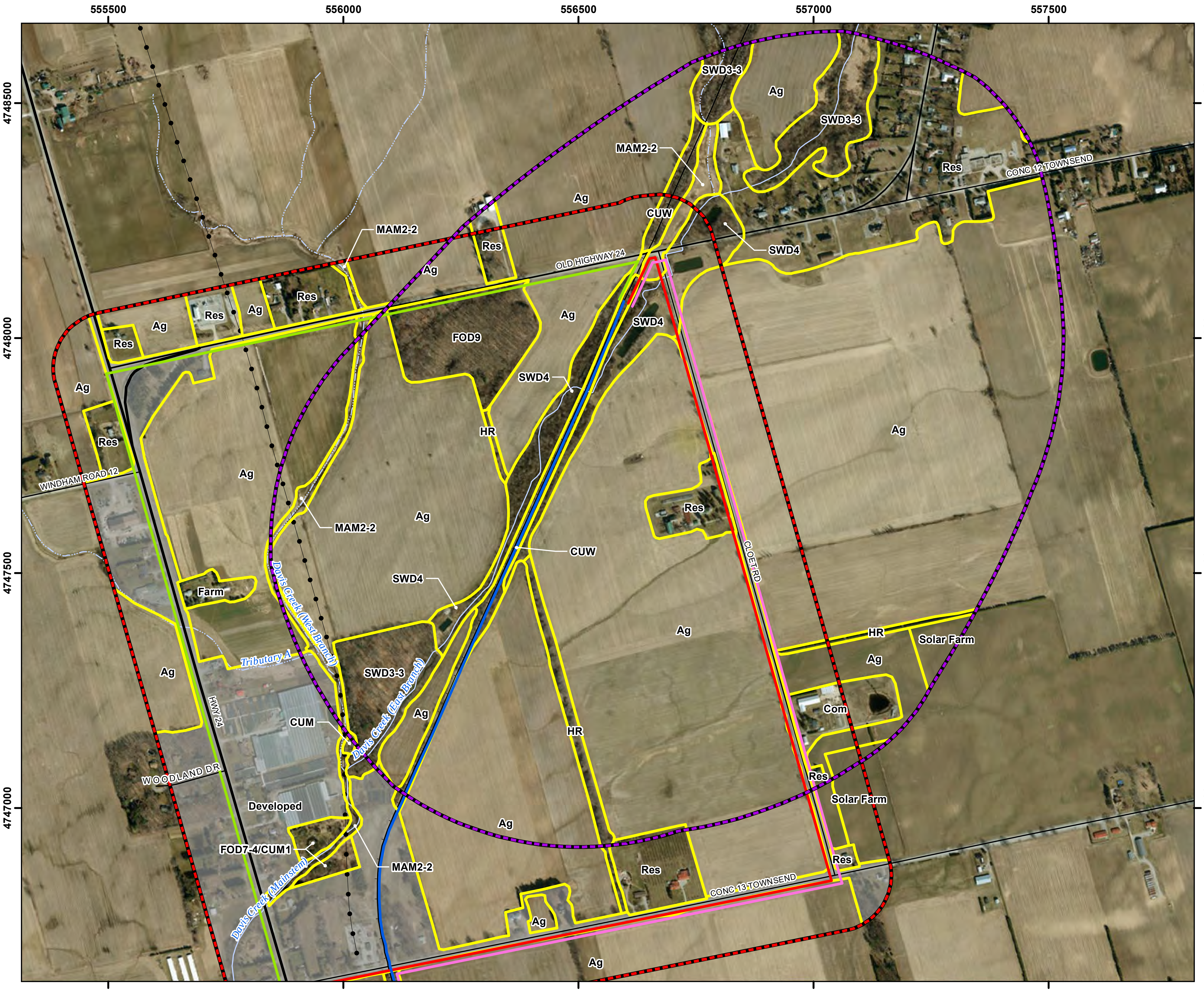
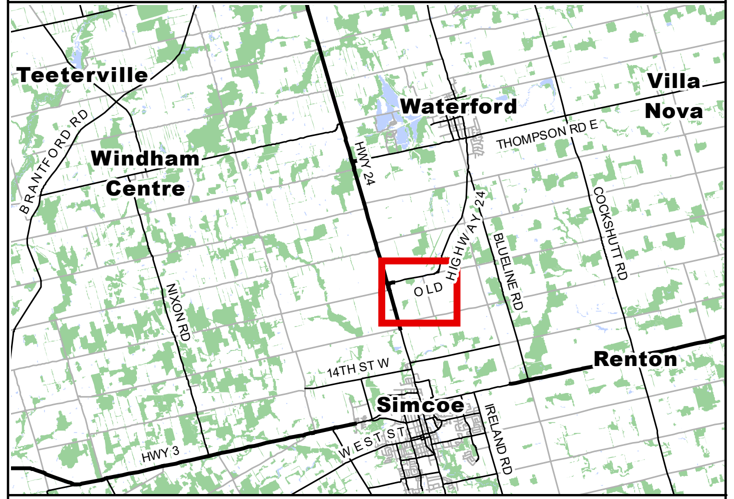
Map 2b

Simcoe County Additional Water Supply Class EA

Vegetation Communities





Legend

🟥	Study Area (2022)
🟪	Estimated Zone of Influence
—	Potential Watermain A
—	Potential Watermain B
—	Potential Watermain C (Preferred)
—	Potential Watermain D
🟨	Ecological Land Classification (ELC)

(Ag) Agriculture
(CUM) Cultural Meadow
(CUW) Cultural Woodland
(CUW1) Mineral Cultural Woodland Ecosite
(Com) Commercial
(FOD9) Fresh - Moist Oak-Maple - Hickory Deciduous Forest Ecosite
(HR) Hedgerow
(MAM2-2) Reed-canary Grass Mineral Meadow Marsh Type
(Res) Residential
(SWD3-3) Swamp Maple Mineral Deciduous Swamp Type
(SWD4) Mineral Deciduous Swamp Ecosite

▨	Developed / Unclassified
•—	Utility Line
—	Highway
—	Primary Road
—	Secondary Road
-+-	Railway
~	Permanent Watercourse
~	Intermittent Watercourse

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Date: September 29, 2022

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Size: 11x17"
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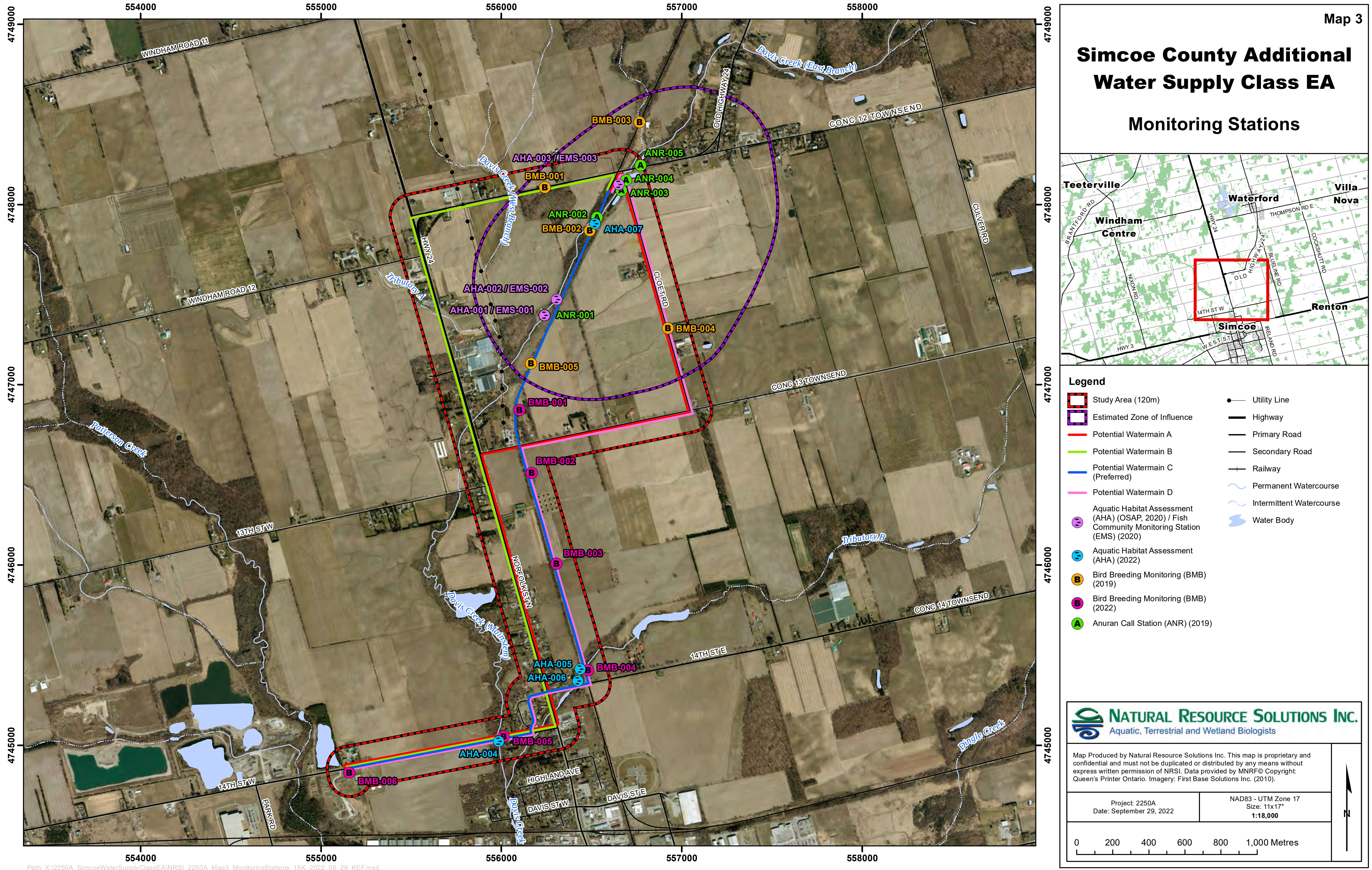
Map 3

Simcoe County Additional Water Supply Class EA

Monitoring Stations



Legend

- 🟥 Study Area (120m)
- 🟪 Estimated Zone of Influence
- ― Potential Watermain A
- ― Potential Watermain B
- ― Potential Watermain C (Preferred)
- ― Potential Watermain D
- ● Aquatic Habitat Assessment (AHA) (OSAP, 2020) / Fish Community Monitoring Station (EMS) (2020)
- ● Aquatic Habitat Assessment (AHA) (2022)
- B Bird Breeding Monitoring (BMB) (2019)
- B Bird Breeding Monitoring (BMB) (2022)
- A Anuran Call Station (ANR) (2019)
- ●― Utility Line
- ― Highway
- ― Primary Road
- ― Secondary Road
- ┼ Railway
- ∼ Permanent Watercourse
- ∼ Intermittent Watercourse
- ▨ Water Body

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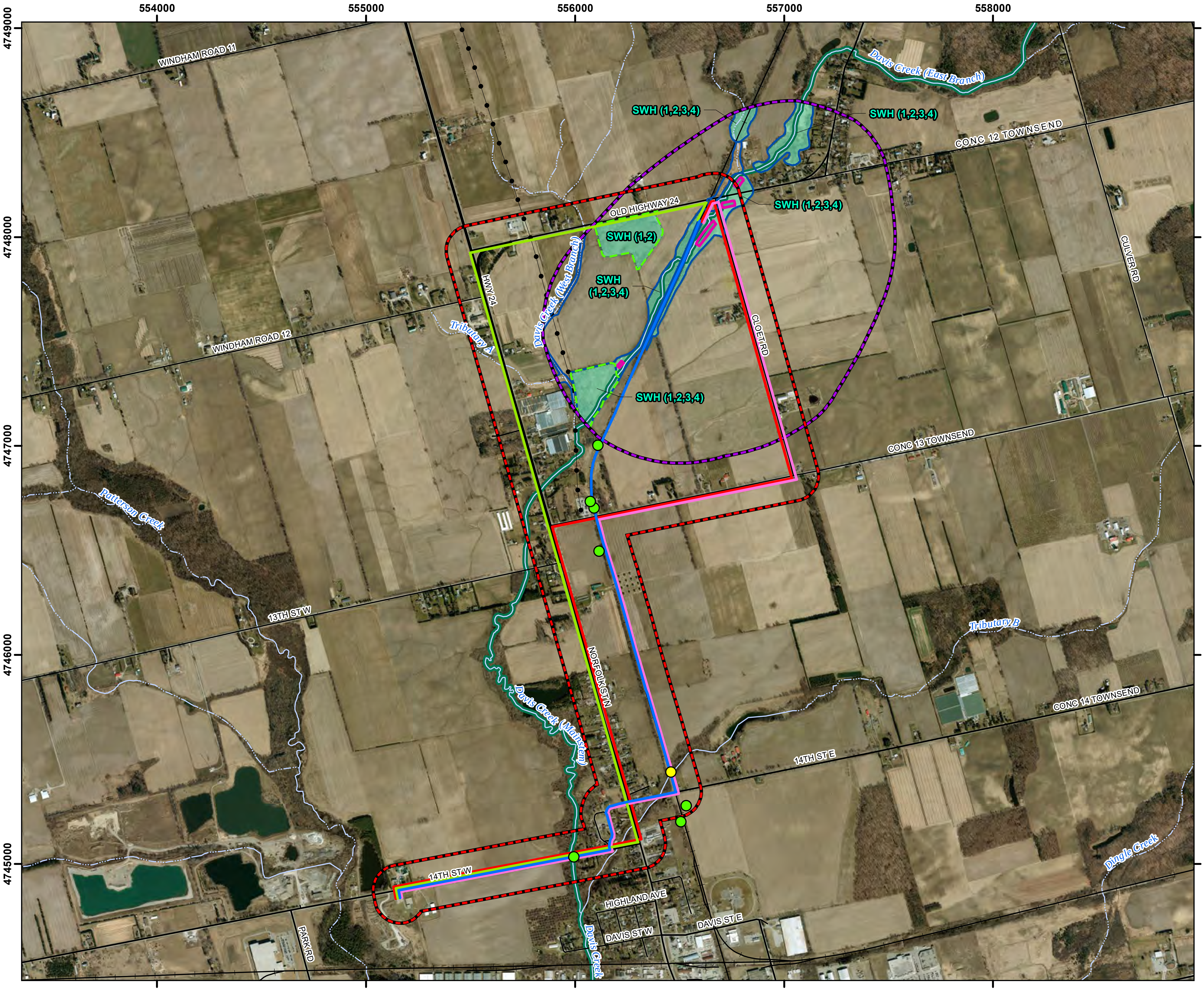
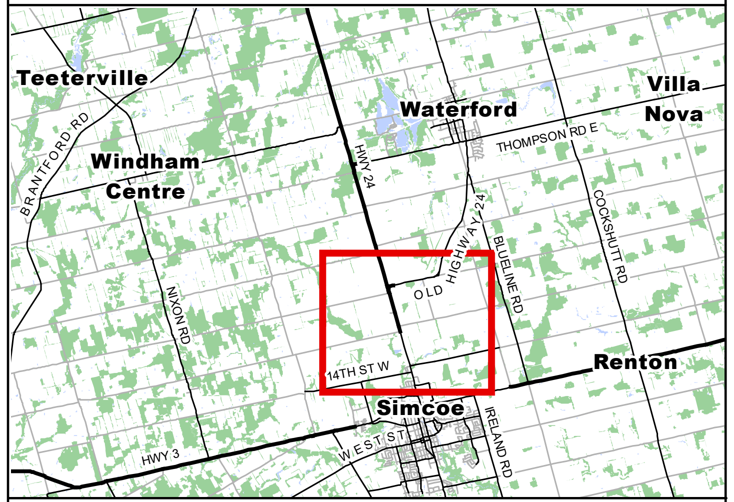


Map 4

Simcoe County Additional Water Supply Class EA

Natural Feature Constraints



Legend

▨	Study Area (120m) (2022)
▨	Estimated Zone of Influence
—	Potential Watermain A
—	Potential Watermain B
—	Potential Watermain C (Preferred)
—	Potential Watermain D
●—	Utility Line
—+—	Railway
—	Highway
—	Primary Road
—	Secondary Road
∼	Permanent Watercourse
∼	Intermittent Watercourse
∼	Coolwater/Coldwater
●	Butternut (2022)
☐	Wetland (NRSI Delineated)
☐	Significant Woodland (Norfolk County 2020)
🟩	**Significant Wildlife Habitat (SWH)**
	(1) Bat Maternity Colonies SWH (Candidate)
	(2) Special Concern and Rare Wildlife Species (Eastern Wood-Pewee) SWH (Confirmed)
	(3) Amphibian Breeding Habitat (Woodland) SWH (Confirmed)
	(4) Special Concern and Rare Wildlife Species (Snapping Turtle) SWH (Confirmed)
☐	Turtle Wintering Areas SWH (Candidate)
●	Seeps and Springs

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Date: September 29, 2022

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Appendix I
Pumping Test Monitoring Results

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

February 11, 2021 Proj. 2250A

Bill Banks
Banks Groundwater Engineering
940 Watson Road South
Puslinch, ON N0B 2J0

RE: Simcoe Water Supply Class EA Natural Environmental Studies Water Pump Test Monitoring Results

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Introduction

To-date, considerable groundwater testing and biological work has been completed in support of the approval for a new municipal groundwater supply source for the Community of Simcoe, and is summarized in the *Revised Draft Report 2012 Monitoring and Aquifer Testing Program* (Banks Groundwater Engineering Limited 2015) and the *Community of Simcoe Additional Water Supply Class EA – Fisheries Update and Preliminary Fisheries Risk Self Assessment* (Golder 2015). As part of the current groundwater testing program, a 7-day aquifer testing program was completed at 2 test pumping discharge locations within the study area by Banks Groundwater Engineering Ltd. in 2020 to assess impacts to the groundwater supply source. NRSI was retained to complete test monitoring to verify that there were no significant impacts to the surface water or the aquatic environment.

The following summary outlines the aquatic biological surveys undertaken during this 7-day aquifer testing program and the results of these assessments.

Methodology

NRSI biologists were on site on October 16, 2020 to establish three monitoring sites. The first objective was to determine whether or not the pump test would impact the surface waters to determine if there was a connection between the aquifer and the surface waters. The second objective was to determine the existing conditions present within the watercourse and document any changes caused by the pump testing. Three locations within the watercourse were selected to give the most complete picture. One of the sites was at the upper extent of the watercourse, one was downstream of the first pump, and one was downstream of the pump release location (Map 1). The Ontario Stream Assessment Protocol (OSAP), which covers site selection, monitoring methodology and data management, was used to collect the watercourse baseline data.

The 7-day aquifer pump test was scheduled to begin on October 20, 2020 at 1000hr. To establish a baseline prior to the start of the pump testing, water depth and flow monitoring measurements were taken on October 19 and again on October 20 prior to pumps being turned on. The entire watercourse within the study area was visually examined for locations with poor bank stability in addition to the depth and flow at the three monitoring sites (Map 1). Monitoring was conducted daily from October 19 to October 29 starting at 0800hr and ending between 1000hr and 1200hr depending on the number of staff present that day. The sites within the watercourse were monitored from downstream to upstream along pre-established transects marked with pink surveyor flags. At each sampling location, a water depth and hydraulic head were captured to determine if there was significant change in the water caused by the operation of the pump. Hydraulic head was used as a proxy for velocity as specified by the OSAP.

To determine if there was a change in substrate composition or bank stability additional metrics were recorded prior to the start of the pump testing and then 1 day after the pump test was completed. These metrics included percent substrate composition, bank slope, bank composition, bank vegetation, and undercutting as specified by the OSAP.

Depth and Flow Monitoring

In order to determine if there is a connection between the surface waters and the aquifer undergoing the pump test, the depth and flows of the watercourse were monitored in several locations. This was completed in addition to Banks Groundwater Engineering’s monitoring using installed piezometers and water level loggers throughout the system, surrounding area, and piezometers.

Site 1 – Upstream Extent

Site 1 was located at the upstream extent of the watercourse where land access had been granted. The site began upstream of the large irrigation pond to the east of the pump 1 and extended north to just downstream of the culvert under Cloet Road. The site was 48m long with a minimum width of 2.1m; therefore, in accordance with OSAP, Site 1 included 12 transects equally spaced 4.35m apart. Figure 1 shows the average depth of water recorded at each transect throughout the monitoring period. Figure 2 shows the average hydraulic head between the 5 points of each transect and Figure 3 shows the average water depth across all transects and the rainfall that day, the columns in yellow are during the pump test.

As shown on Figures 1, 2, and 3, there was little variation in the depths of the watercourse during the pump test, with one exception on October 24. There was significant precipitation during the night of October 23, which led to the elevated depths and velocities documented on October 24. This pattern of elevated values on October 24 was consistent across all three sites. The depths were consistent between sampling events as flows within Site 1 are mitigated by the large ponds on either side of the watercourse. These ponds likely buffer the system from significant fluctuations that the smaller and less buffered systems experience downstream. The yellow bars represent measurements taken during the 7-day aquifer pump test.

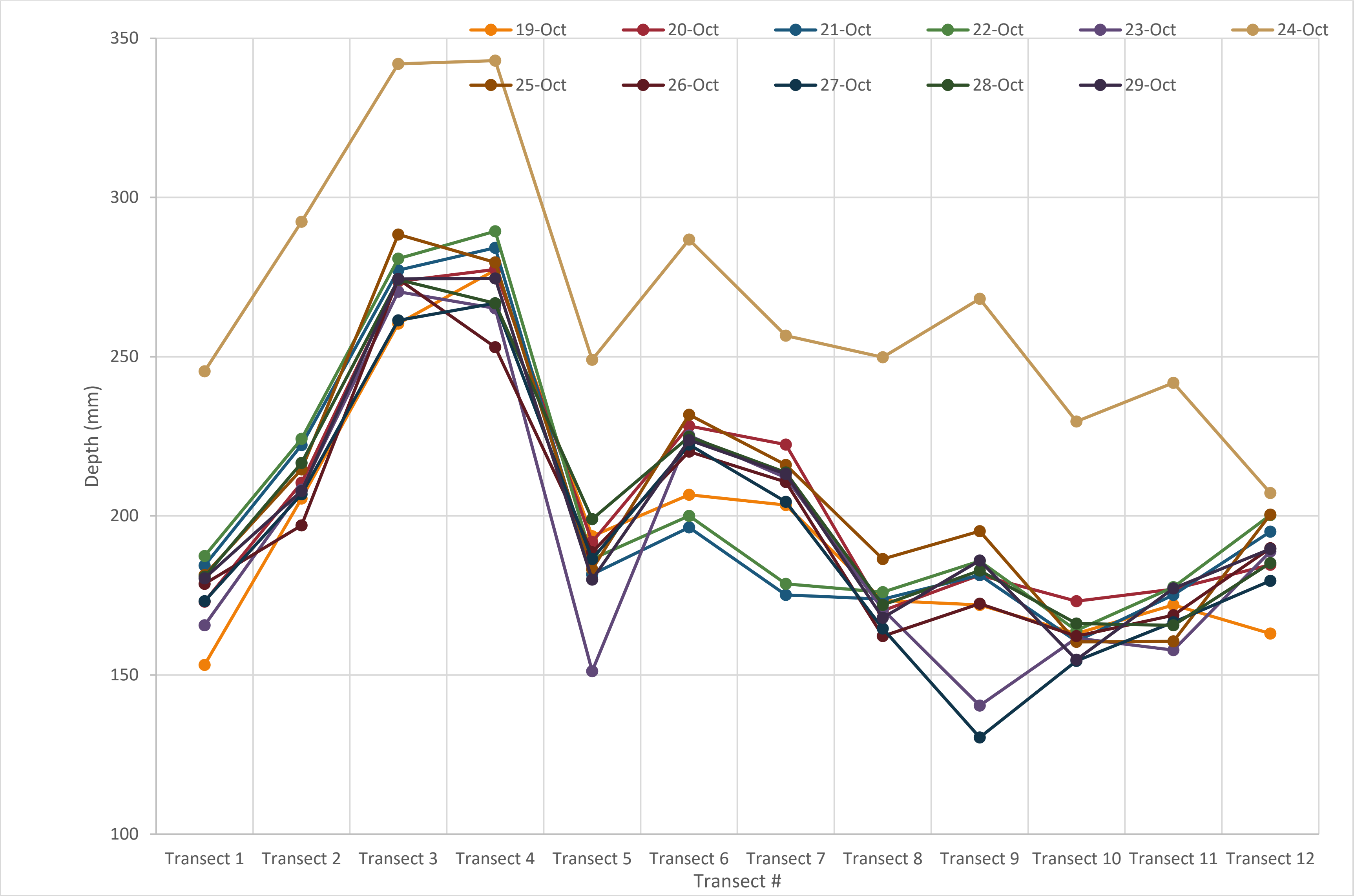

Figure 1. Site 1 Average Water Depth by Transect

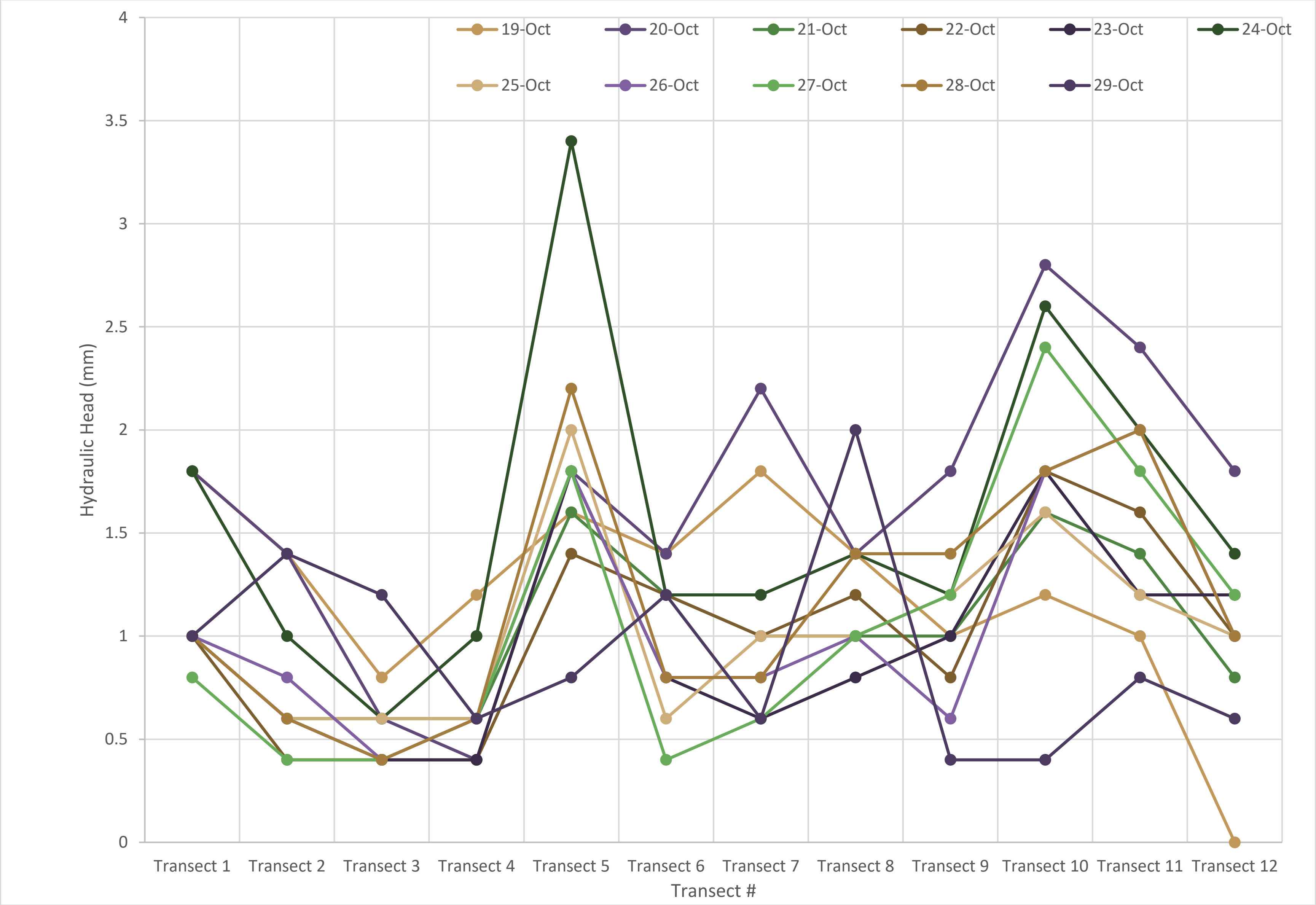

Figure 2. Site 1 Average Hydraulic Head by Transect

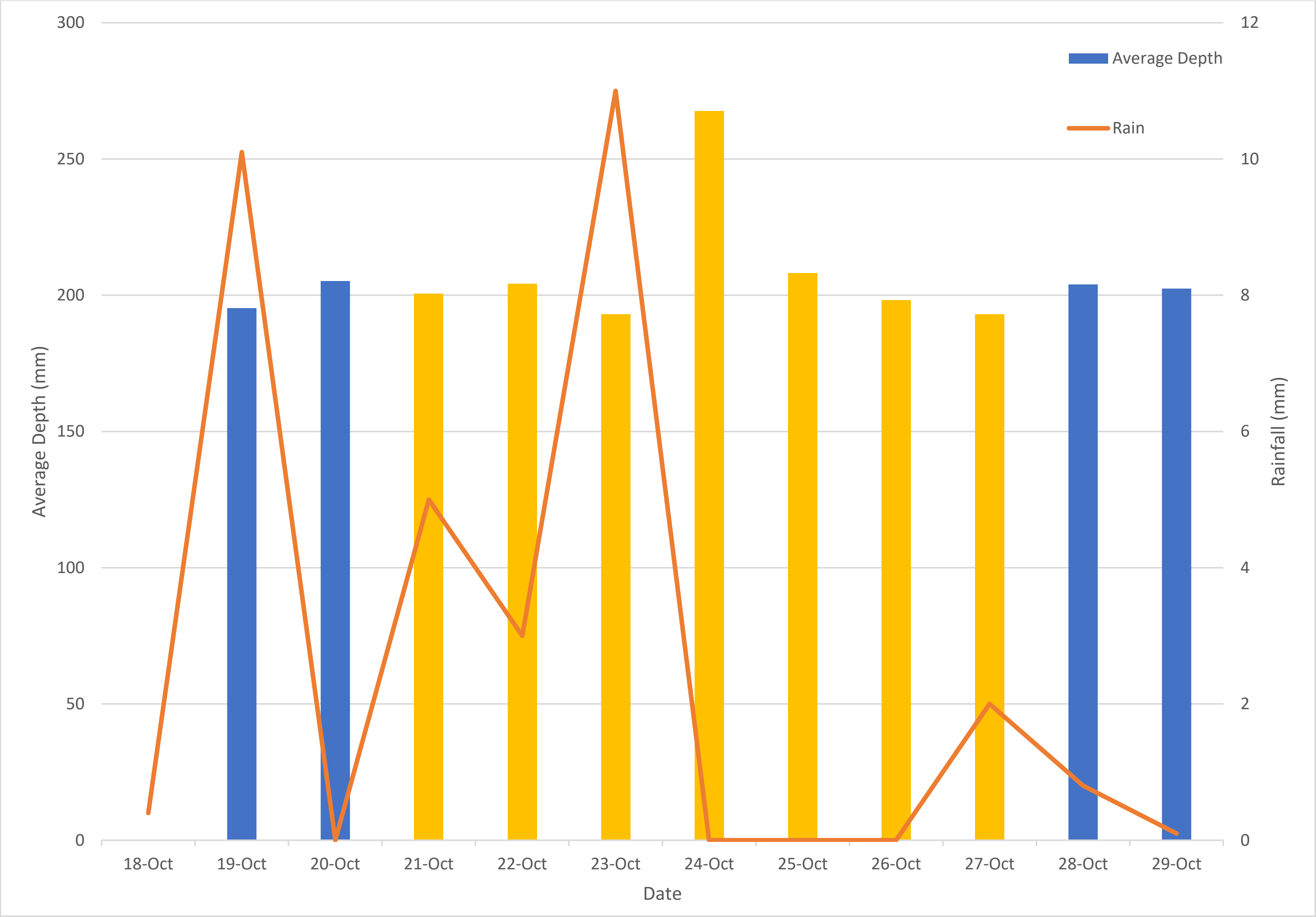

Figure 3. Site 1 Average Daily Depth and Rainfall

Site 2 – Downstream of Pumps

Site 2 was located downstream of both pumps and upstream of the pump release location. This site was significantly narrower than Sites 1 and 3, with a minimum width of 1.0m and a total length of 42.2m. A total of 20 transects, with two points per transect, were established across the length of the site with 2.2m spacing between them. Figure 4 shows the average water depth of each transect over the course of the monitoring period. Figure 5 shows the average hydraulic head of each transect and Figure 6 shows the average water depth across all transects and the rainfall that day. The columns in yellow are during the pump test.

As Figure 6 best exemplifies, Site 2 was temporarily impacted by the release of water from the groundwater pump test release point downstream. Based on the depths by transect, this flooding significantly inundated the site up to Transect 11. Here the pre-pumping and during-pumping results began to realign, but the elevated depths continued to a lesser extent throughout the entire monitored area during the test. One post-hoc manipulation that can be done to attempt to minimize the obscuring effect of the increased depths is to remove Transects 1 through 10 as they saw the greatest increases. These increases could hide a potential connection to the aquifer.

After this manipulation, shown in Figure 7, the results are relatively consistent with higher overall depths during pumping with daily spikes associated with local rainfall. These higher depths during pumping after manipulation suggest we cannot properly control for the released water that temporarily elevated the depths within Site 2.

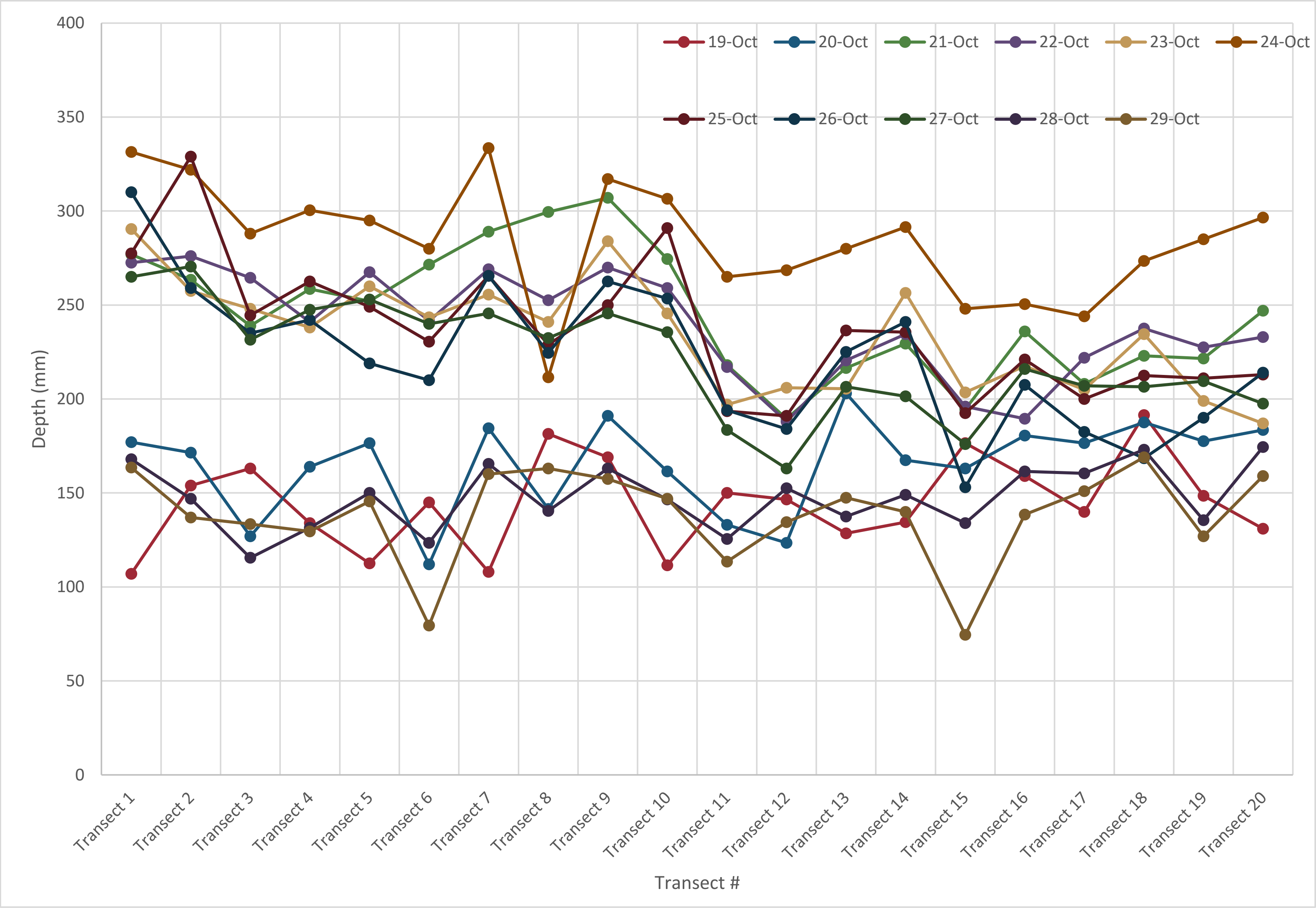

Figure 4. Site 2 Depths by Transect

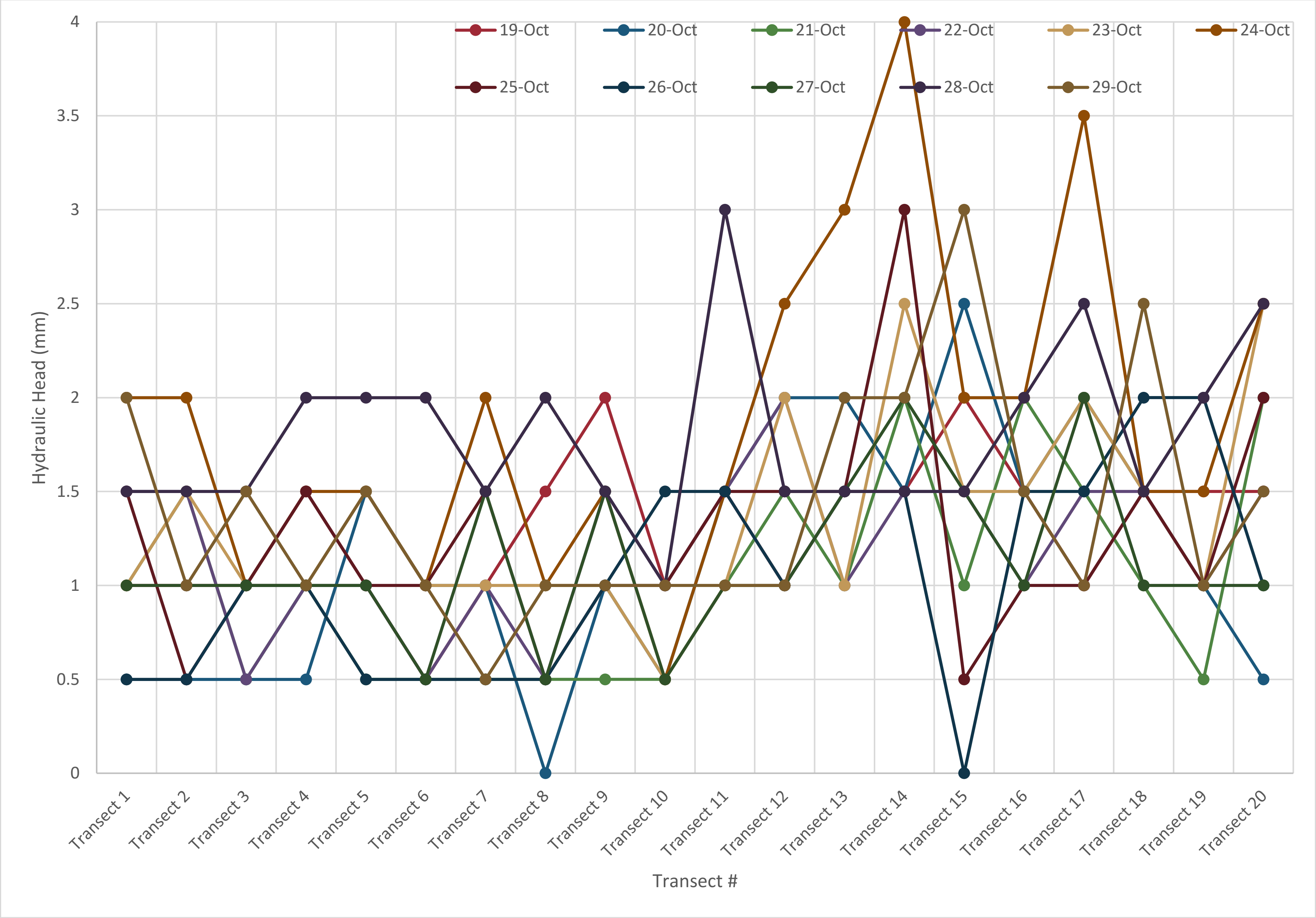

Figure 5. Site 2 Flows by Transect

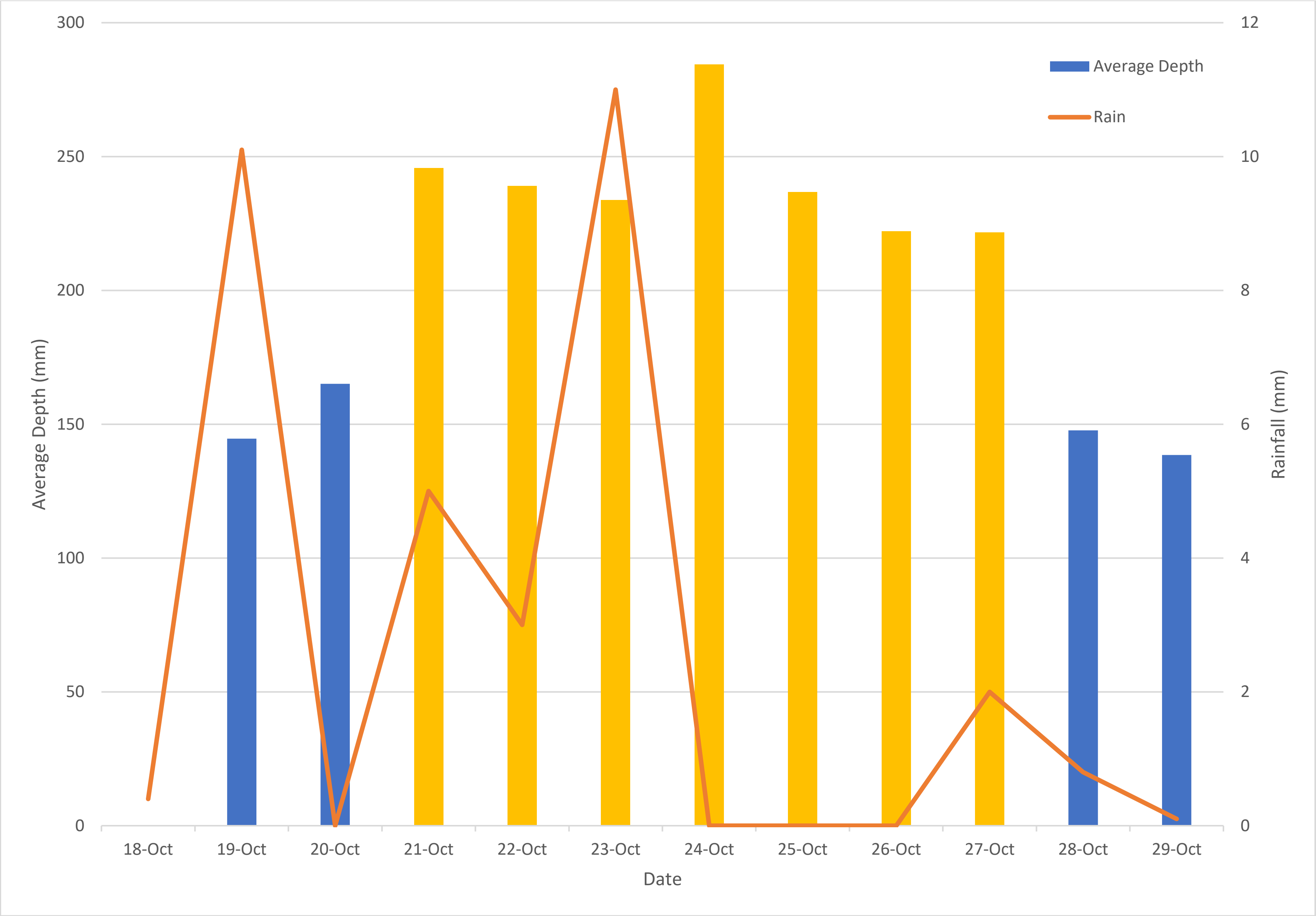

Figure 6. Site 2 Average Daily Depth and Rainfall

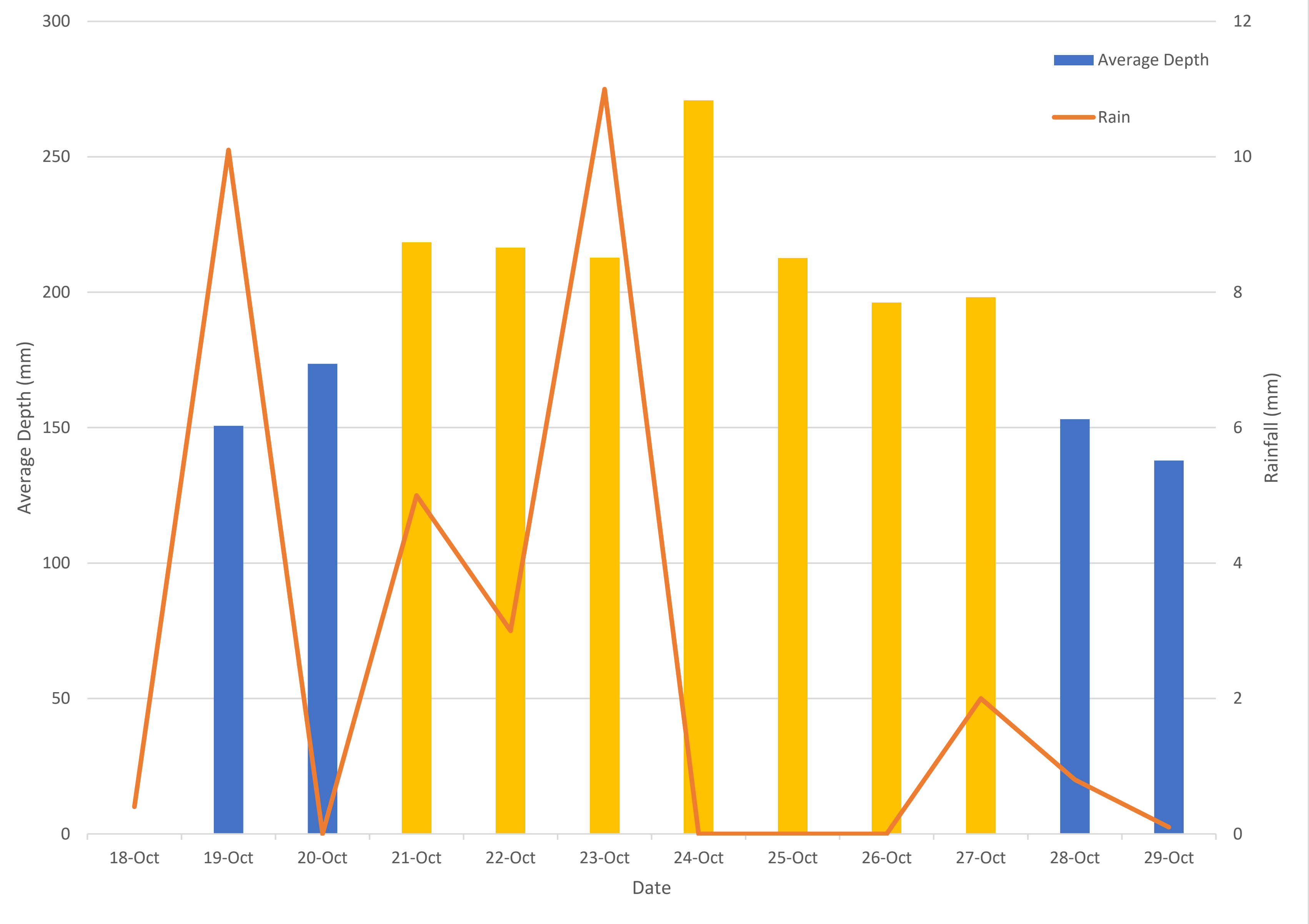

Figure 7. Site 2 Back Flooding Adjusted Average Daily Depth and Rainfall

Site 3 – Below the Pump Test Release

A site below the release point from the pump test was established to determine if the pump test had any negative impacts on the existing creek. The site is significantly wider and, unlike Site 1 and 2, is located between two agricultural fields as opposed to forest and wetland. The site had a minimum width of 1.6m, a total length of 48.0m with 12 transects at 5 points per transect and each transect 4 meters apart. Figures 8, 9, and 10 show the water depths, flows, and average depth and rainfall respectively.

Site 3 was the most impacted, although temporarily, by the pump testing since there was a significant increase in the quantity of water passing through the watercourse. The depths increased sharply once the testing began and remained high throughout the test. This was expected with the depths approximately doubling during the test duration due to the large increase of water within the watercourse. The water level returned to normal after the testing was completed.

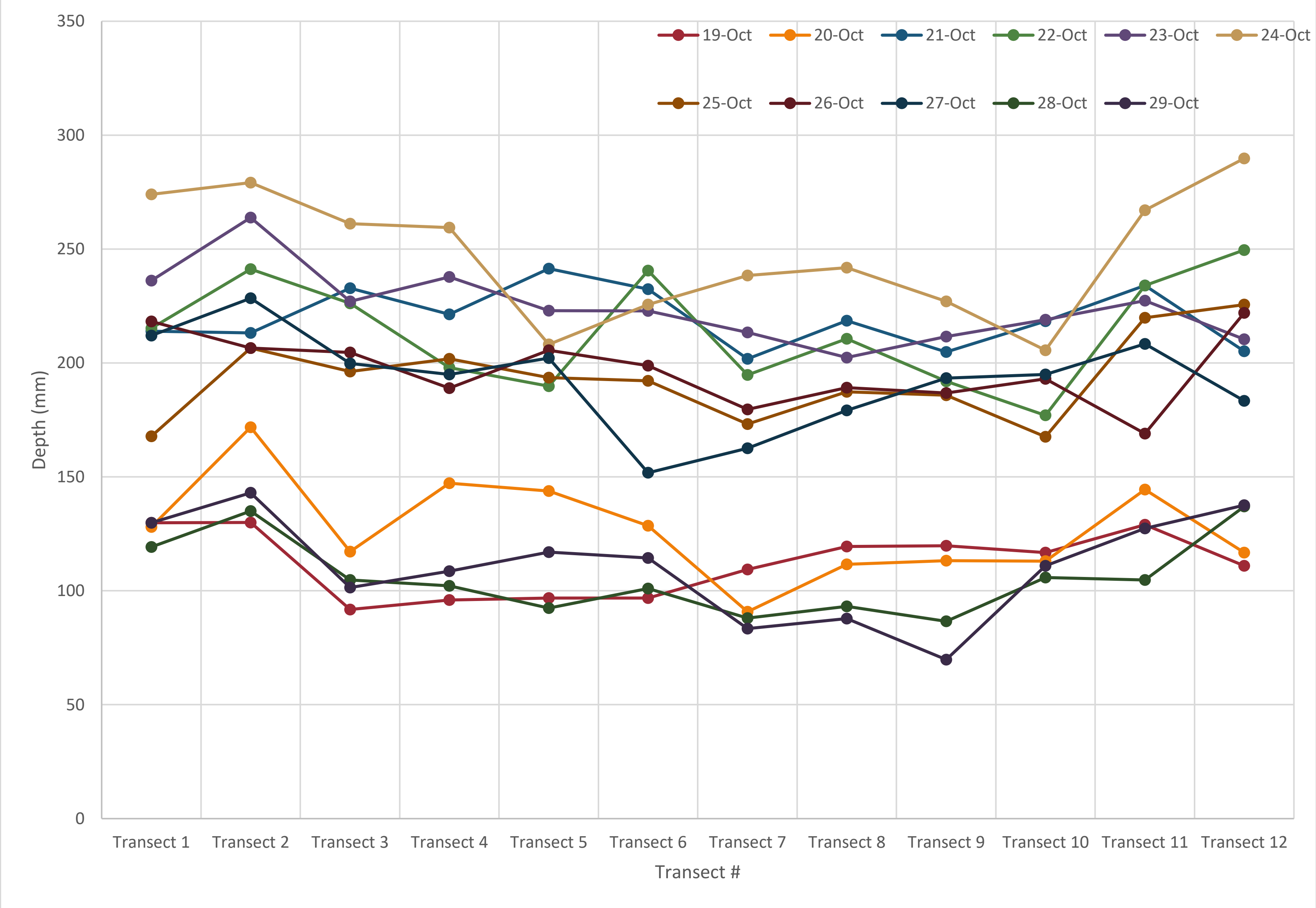

Figure 8. Site 3 Depths by Transect

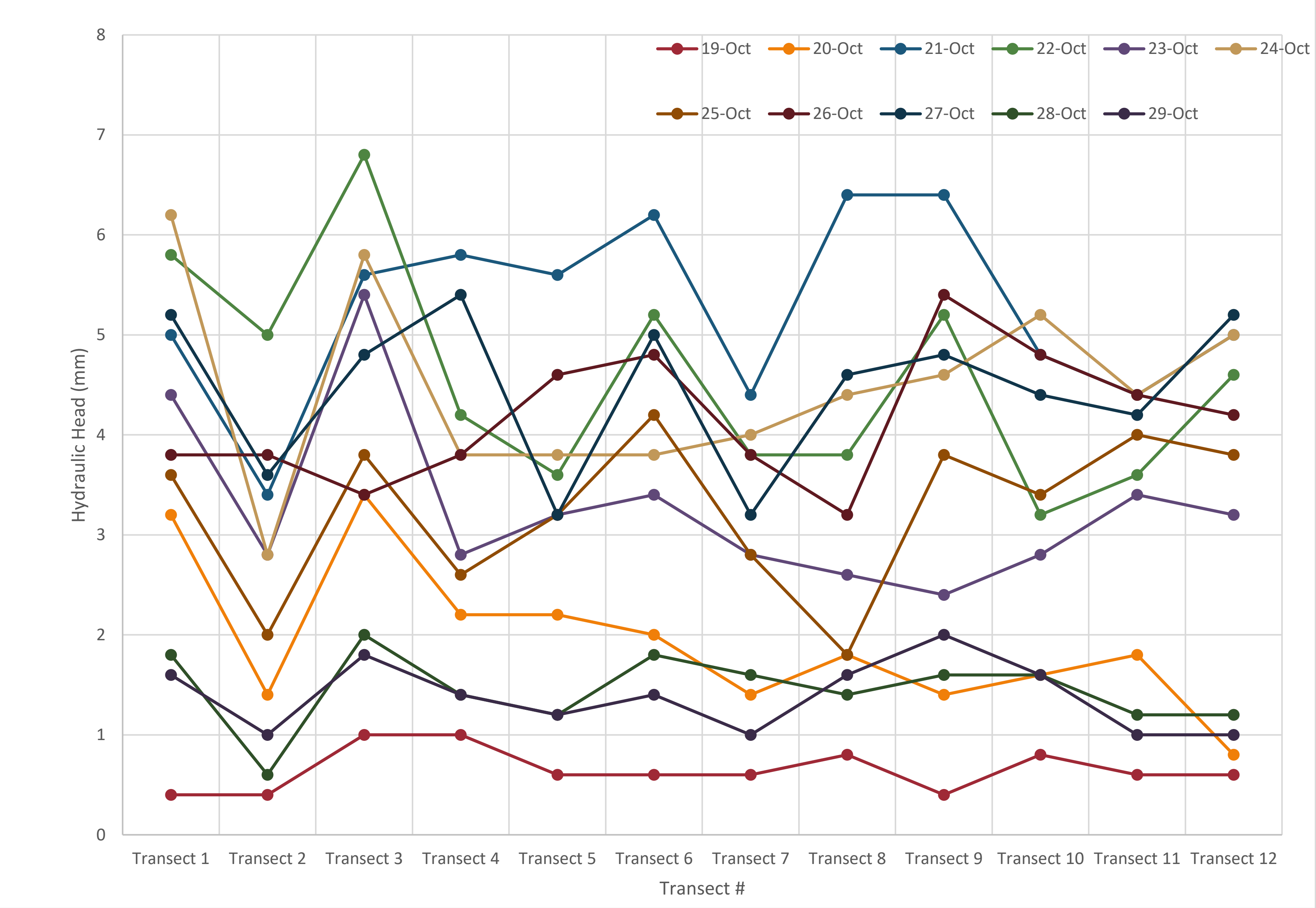

Figure 9. Site 3 Flows by Transect

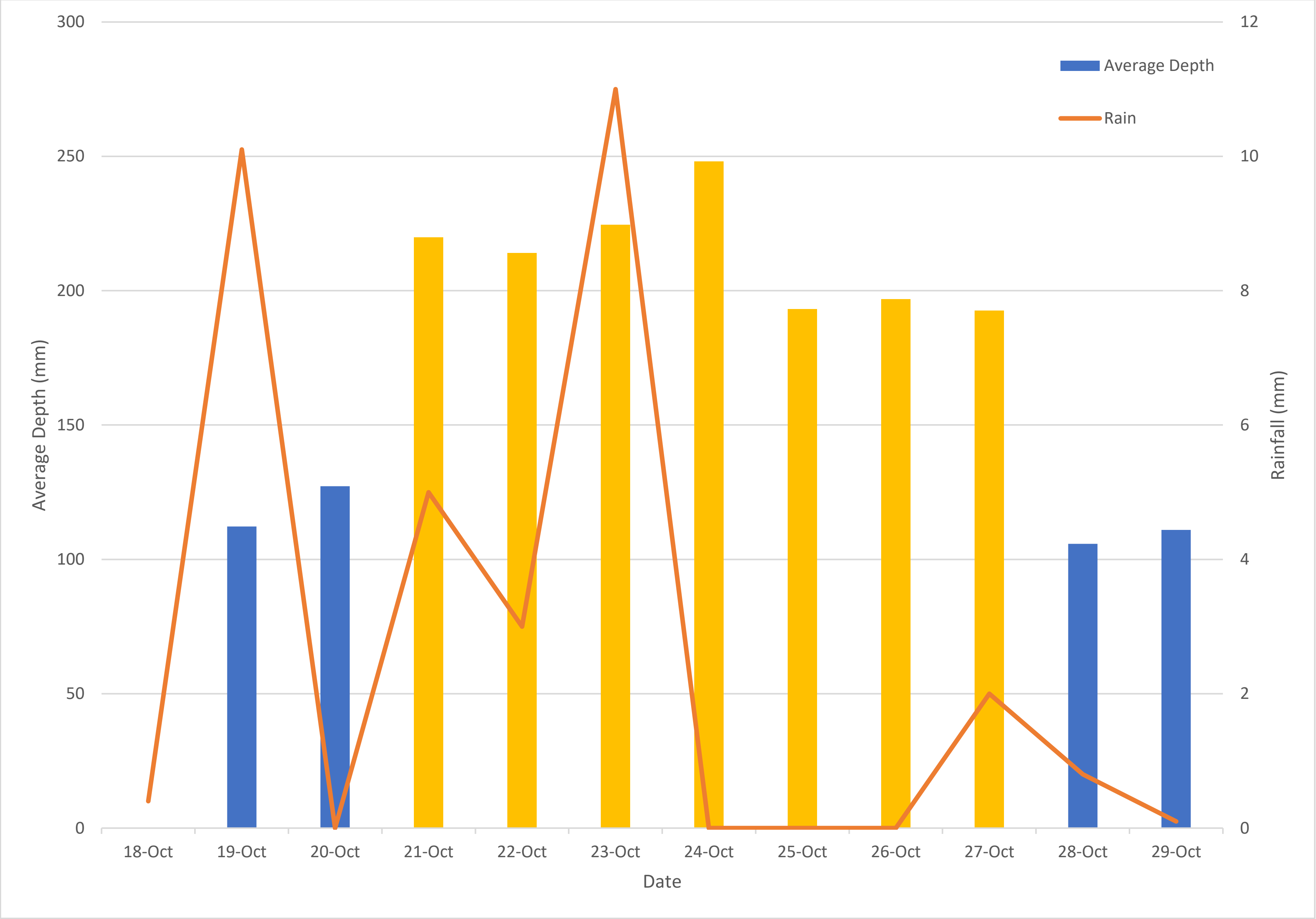

Figure 10. Site 3 Average Daily Depth and Rainfall

Water Quality Monitoring

To determine if there were any negative impacts associated with the release of the pump test water, two water quality parameters were monitored: Dissolved Oxygen (DO) and temperature. The data is represented below in Figures 11 and 12. The yellow points represent measurements collected during the pump testing.

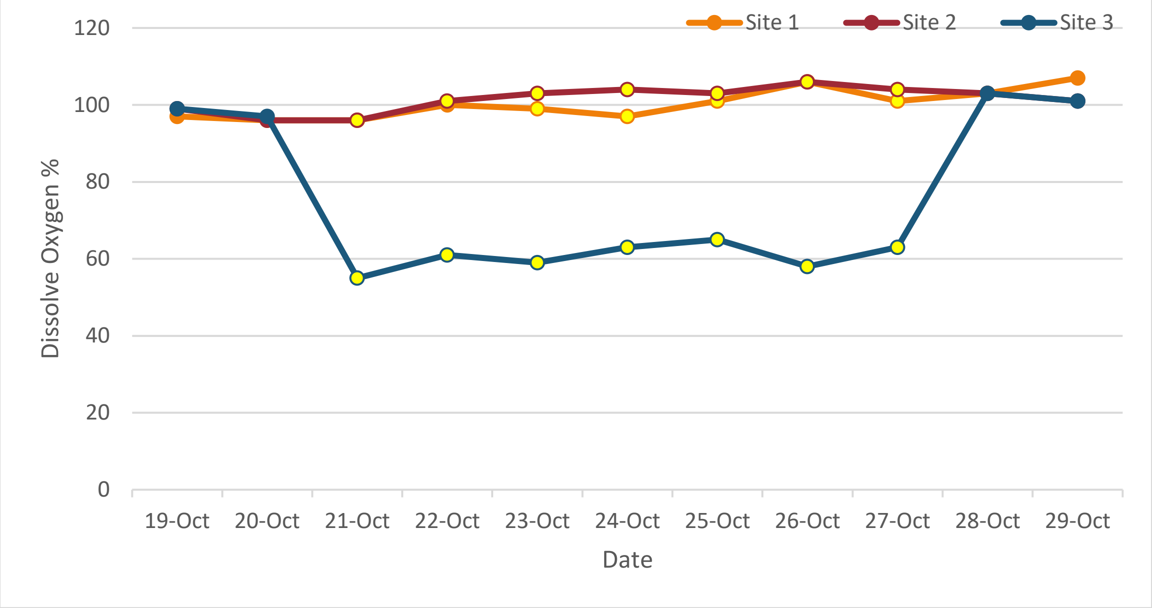

Figure 11. Dissolved Oxygen by Site

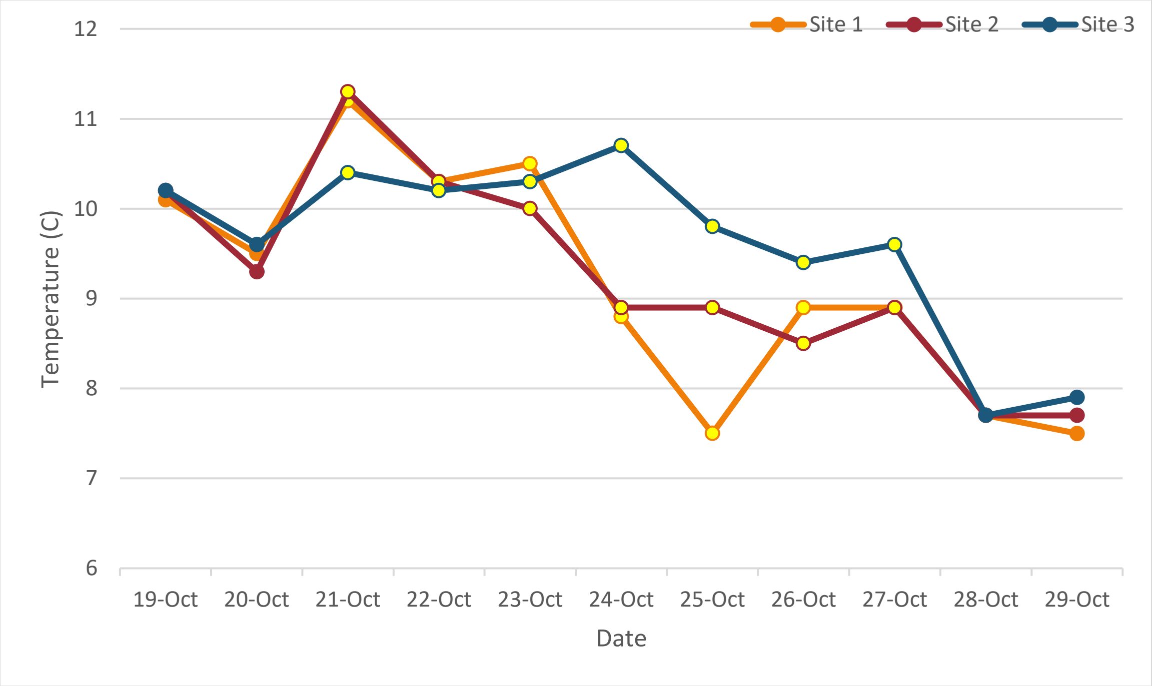

Figure 12. Water Temperature by Site

As shown on Figure 11, Site 3 was receiving a substantial quantity of water with low DO from the aquifer. This water lowered the DO content by approximately 30-40% relative to upstream of the pump test release. Fortunately, the DO decrease was not significant enough to pose mortality risks to the fish downstream since it was being oxygenated by the outlet manifold and mitigated by the already oxygenated water within the watercourse. Considering the coolwater fish community present, a decreased DO for 7 days would not be a cause for concern at the levels present during this pump test. Point sampling was completed at the outlet on October 21 and 26 and found that the water was at 35-40% DO when it was exiting the pump. There are no long-term concerns associated with changes in the DO.

Water coming out of the pump was 9.3°C during both point samplings. Figure 12 shows that Site 3 did not fluctuate as rapidly likely due to the influx of water at a consistent temperature. There were no environmental concerns linked with temperature fluctuation. The fish community present within the watercourse would deal with seasonal fluctuations from the high teens to freezing each year.

Substrate Composition Monitoring

Prior to the pump testing, the substrates of Sites 1, 2, and 3 were assessed to determine their composition. The monitoring used a modified Wentworth classification of substrate types by size, as outlined in Table 1. After the completion of the pump test, the substrates were re-examined for notable changes or signs of new erosion. This would be characterized by a change in average grain size by one category or higher as defined below. As of October 29, there were no detectable changes to Sites 1 and 2 in terms of substrate composition or erosion. Site 3 experienced a reduction in silt and sand quantities relative to gravel and pebble. The increases were expected as the increased velocity and volume of water present within the watercourse disturbed the overlying silt and sand while leaving the larger and heavier gravel and pebble in place. Based on the site conditions and fish community found during the broader environmental assessment conducted by NRSI (October 16, 2020) that is described under separate cover, the decrease in silt and sand may have a positive impact on the fish present within the watercourse. This is because the fish community present, *Rhinichthys atratulus* and *Semotilus atromaculatus* in particular, prefer larger substrates for habitat use.

The minimal aquatic vegetation present within Site 3 remained throughout the testing.

Table 1. Modified Wentworth Classification of Substrate Type by Size

Substrate Type	Particle Size Range (mm)	Sample Codes
Boulder	>256	5
Cobble	64 - 256	4
Pebble	16 - 63	3
Gravel	2 - 15	2
Sand	0.06 - 1	1
Silt and Clay	<0.059	0

*Modified Wenthworth classification reference: Cummins, K.W. 1962. An evaluation of some techniques for the collection and analysis of benthic samples with special emphasis on lotic waters. American Midland Naturalist 67:477-504

Conclusion

Based on the aquatic habitat parameters gathered from the monitoring of the watercourse before, during, and after the pump test, there is no evidence to suggest that there are any negative short- or long-term environmental impacts from either the pumping or release of water back into the watercourse. This is supported by the depths and flows within the watercourse not decreasing during the pump testing which would have suggested a significant connection between the aquifer and the surface waters. Additionally, there was no noted scouring, large changes in substrate, or decreases in shoreline vegetation associated with the release of the pump test water within the monitored sites. Within the full study area there were no new areas of erosion or scouring found after the pump test's completion.

References

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Golder Associates. 2015. Community of Simcoe Additional Water Supply Class Environmental Assessment – Fisheries Update and Preliminary Fisheries Risk Self Assessment. 4pp.

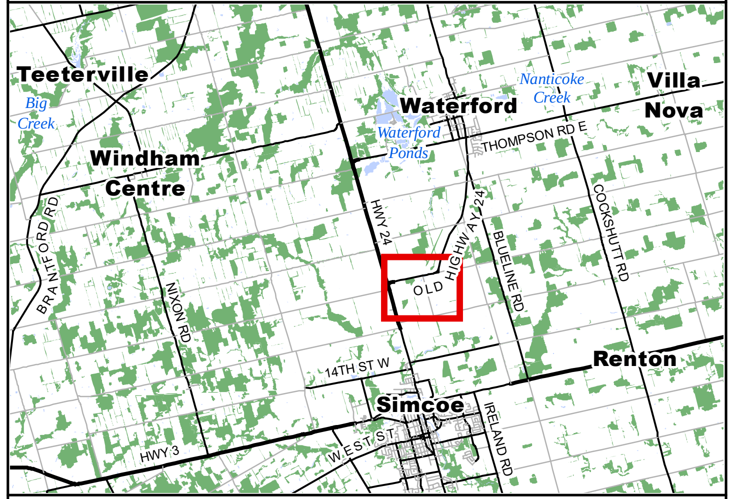
Map 1
Study Area and Monitoring Sites

Path: X:\2250A_SimcoeWaterSupplyClassEA\NRSI_2250A_Map1_PumpTestMonitoring_8K_2021_02_05_MV.mxd

Map 1

Simcoe Additional Water Supply Class EA and Pump Test Monitoring

Pump Test Monitoring



Legend

- ▭ Study Area (Estimated Zone of Influence)
- ● Watercress
- ● Pump
- ● Pump Release
- ▬ ▬ OSAP Monitoring Site
- ●— Utility Line
- —+— Railway
- ━ Highway
- — Primary Road
- — Secondary Road
- ～ Permanent Watercourse
- ～ Intermittent Watercourse

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Date: February 5, 2021

NAD83 - UTM Zone 17
Size: 11x17"
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Appendix II
SAR / SCC Screening Assessment Tables

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Observed by NRSI	Habitat Requirements	Suitable Habitats within Subject Property	Carried Forward to EIS?	Rationale
Birds												
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC	SC	SC	Schedule 1	BSC et al. 2008	No	Well-drained grassland or prairie with low cover of grasses, taller weeds or sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities. Requires perches for singing and tracts of grassland generally >5ha.[3,4]	No	No	Suitable habitat is not present within the study area. Breeding bird surveys did not document the presence of this species within the study area.
Antrostomus vociferus	Eastern Whip-poor-will	S4B	THR	T	T	Schedule 1	BSC et al. 2008	No	Areas with a mix of open and forested areas, such as open woodlands, savannas, pine plantations, woodland edges, or openings in more mature deciduous, coniferous and mixed forests. Forages in open areas and uses forested areas for roosting and nesting.[3,4]	No	No	Significant woodland habitat is present in the northern section of the study area. However, forests are < 100 ha and are therefore not suitable for supporting Eastern Whip-poor-will.
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1	BSC et al. 2008	Yes (2022)	Commonly found in urban areas near buildings; nests in chimneys, hollow trees,and crevices of rock cliffs. Feeds over open water.[3,4]	Yes	No	Potential suitable habitat exists in the study area in the form of chimneys, and hollow trees. Although NRSI Biologists observed this species during 2022 breeding bird surveys, no evidence of breeding was observed.
Chordeiles minor	Common Nighthawk	S4B	SC	SC	T	Schedule 1	BSC et al. 2008	No	Open ground; clearings in dense forests (including burns and logged areas); rock barrens; peat bogs; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs.[3,4]	Yes	No	Suitable open ground, ploughed fields, and open woodlands are present in the study area. However, breeding bird surveys did not document the species within the study area.
Colinus virginianus	Northern Bobwhite	S1?B	END	E	E	Schedule 1	BSC et al. 2008	No	Grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs; fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges.[3,4]	Yes	No	Suitable fence rows, woodland edges, and cropland habitat are present in the study area. Northern Bobwhite was not observed during breeding bird surveys or on any site visits by NRSI staff. Northern Bobwhite are also extremely rare in Ontario and are likely extirpated from regions they've previously occupied. Breeding bird surveys did not document the species within the study area.
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC	Schedule 1	BSC et al. 2008	Yes (2019 and 2022)	Mid-canopy layer of forest clearings and edges of deciduous and mixed forest. Abundant in intermediate-age mature forest stands with little understory vegetation.[3,4]	Yes	Yes	Forested area in the North of the subject property provides suitbale forest habitat for this species. Possible breeding evidence documented by NRSI Biologists during 2022 breeding bird surveys.
Dolichonyx oryzivorus	Bobolink	S4B	THR	T	T	Schedule 1	BSC et al. 2008	No	Large (>10 ha), open expansive grasslands, pastures, hayfields, meadows or fallow fields with dense ground cover. Occassionally nest in large (>50 ha) fields of winter wheat and rye in southwestern Ontario. [3,4]	No	No	Suitable habitat is not present within the study area. Breeding bird surveys did not document the presence of this species within the study area.
Hirundo rustica	Barn Swallow	S4B	THR	SC	T	Schedule 1	BSC et al. 2008	Yes (2019 and 2022)	Farmlands, rural areas and other open or semi-open areas near body of water. Nests almost exclusively on human-made structures such as open barns, buildings, bridges and culverts.[3,4]	Yes	Yes	Suitable habitat is present for nesting and foraging. Possible breeding evidence was observed by NRSI Biologists during 2022 breeding bird surveys.
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1	BSC et al. 2008	No	Carolinian and Great Lakes-St. Lawrence forest zones. Undisturbed moist mature deciduous or mixed forest with deciduous sapling growth. Near pond or swamp. Must have some trees higher than 12 m.[3,4]	Yes	No	Suitable habitat is present (marginally) within the study area. However, breeding bird surveys did not document the presence of this species within the study area.
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1	BSC et al. 2008	No	Nests in burrows in natural and human-made settings with vertical faces in silt and sand deposits. Ususally on banks of river and lakes, but also found in sand and gravel pits.[3,4]	No	No	No suitable habitat present within the study area. Breeding bird surveys did not document the presence of this species.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Observed by NRSI	Habitat Requirements	Suitable Habitats within Subject Property	Carried Forward to EIS?	Rationale
Sturnella magna	Eastern Meadowlark	S4B, S3N	THR	T	T	Schedule 1	BSC et al. 2008; NDMNRF 2022	No	Open pastures, hayfields, grasslands or grassy meadows with elevated singing perches (small trees, shrubs or fence posts). Also weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields or other open areas. Generally prefers larger tracts of habitat >10 ha, but will sometimes use smaller tracts.[3,4]	Yes	No	Pastures and grassland habitat are present within the subject property. However, breeding bird surveys did not document the presence of this species within the study area.
Herpetofauna												
Turtles												
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1	NDMNRF 20022; Ontario Nature 2019	Yes	Slow-flowing rivers and streams, lakes, and permanent or semi-permanent wetlands with soft substrates and vegetation. Key habitat requirements: open areas with structures for basking, open sand or gravel areas for nesting, shallow areas with soft substrates to bury in, soft banks or substrates for hibernation.[3]	Yes	Yes	Wetlands are located within the subject property. One Snapping Turtle was observed in the SWD4 community.
Emydoidea blandingii	Blanding's Turtle (Great Lakes / St. Lawrence population)	S3	THR	E	T	Schedule 1	Ontario Nature 2019	No	Eutrophic, shallow wetlands such as marshes, ponds, swamps, bogs, fens, or coastal wetlands, with soft, muddy substrates, abundant aquatic vegetation, and basking structures (logs, stumps, hummocks). Large overland movements occur between aquatic habitats and to open sandy or gravelly areas for nesting. Forest habitat is important for upland movements. Overwintering typically occurs in permanent wetlands.[7]	Yes	No	Wetland habitat is present within the subject property and may provide suitable habitat for this species. However, herpetofauna surveys in 2019 did not document the presence of this species within the study area.
Graptemys geographica	Northern Map Turtle	S3	SC	SC	SC	Schedule 1	NDMNRF 20022; Ontario Nature 2019	No	Large bodies of water such as rivers and lakes with soft bottoms, aquatic vegetation, abundant mollusc prey, and basking structures such as logs or rocks. Nesting occurs in open areas with soft substrates such as sand or gravel. Hibernate on the bottom of deep areas of lakes or deep, slow-moving sections of rivers.[3]	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys in 2019 did not document the presence of this species within the study area.
Snakes												
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1	Ontario Nature 2019	No	Open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates. Specializes in hunting and eating toads; occurs in habitats near or adjacent to wetland habitats where toads are present. Rocks, logs, stumps, etc. are used for shelter. Use snout to dig nests as well as to dig burrows for overwintering.[11]	Yes	No	Open habitats and wetlands are present within the subject property. Numerous American Toads were documented during the herpetofauna surveys conducted in 2019.
Pantherophis gloydi pop. 2	Eastern Foxsnake (Carolinian population)	S2	END	E	E	Schedule 1	Ontario Nature 2019	No	Open natural and semi-natural upland habitats, such as meadows, fields, restored prairies, and marshes and creeks. Root wads and logs provide cover and shelter. Nests in rotten logs, stumps, dune slopes, decaying piles of vegetation. Hibernates communally underground in animal burrows, or in old wells or foundations.[12]	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys in 2019 did not document the presence of this species within the study area.
Sistrurus catenatus pop. 1	Massasauga (Great Lakes/St. Lawrence population)	S3	THR	T	T	Schedule 1	Ontario Nature 2019	No	Bogs, marshes, shorelines, forests, forest edges, rocky-outcrops, and alvars. Require open areas to warm themselves in the sun. Foraging occurs in lowland habitats such as grasslands, wetlands, bogs and the shorelines of lakes and rivers. Massasaugas on the Bruce Peninsula hibernate in rocky fissures or cracks or rodent burrows in deciduous and conifer forests. In eastern Georgian Bay, Massaugas primarily hibernate in wetlands such as conifer shrub swamps, fens, or wetlands with sphagnum moss or	Yes	No	Wetland, forest, and open habitats are present within the subject property. Herpetofauna surveys conducted in 2019 did not document the presence of this species within the study area.
Thamnophis sauritus septentrionalis	Northern Ribbonsnake	S4	SC	SC	SC	Schedule 1	Ontario Nature 2019	No	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows, marshes, borders of ponds, lakes or streams.[3]	No	No	Suitable habitat is not present within the study area. Herpetofauna surveys in 2019 did not document the presence of this species within the study area.
Mammals												
Microtus pinetorum	Woodland Vole	S3?	SC	SC	SC	Schedule 1	Dobbyn 1994	No	Mature deciduous forest in the Carolinian region where there is a deep litter layer that allows it to burrow.[3,4]	Yes	No	Mature deciduous forest tracts present within subject property. Field surveys did not document the presence of this species or suitable burrows and/or dens within the study area.
Myotis leibii	Eastern Small-footed Myotis	S2S3	END				Dobbyn 1994	No	Roosts in caves, mine shafts, crevices or buildings that are in or near woodland. Hibernates in cold dry caves or mines. Maternity colonies in caves or buildings. Hunts in forests.[3,4]	Yes	Yes	Suitable habitat is present within the forested communities in the study ara.
Myotis lucifungus	Little Brown Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994	No	Uses caves, quarries, tunnels, hollow trees or buildings for roosting. Winters in humid caves. Maternity sites in dark warm areas such as attics and barns. Feeds primarily in wetlands and forest edges.[3,4]	Yes	Yes	Suitable habitat is present within the forested communities in the study ara.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Observed by NRSI	Habitat Requirements	Suitable Habitats within Subject Property	Carried Forward to EIS?	Rationale
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994	No	Roosts in houses and man-made structures but prefers hollow trees or under loose bark. Hibernates in mines or caves. Hunts within forest, below the canopy.[3,4]	Yes	Yes	Suitable habitat is present within the forested communities in the study ara.
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1	Dobbyn 1994	No	Roosts and maternity colonies in older forests and occassionally in barns or other sturctures. Forage over water and along streams in the forest. Hibernate in caves.[3,4]	Yes	Yes	Suitable habitat is present within the forested communities in the study area.
Taxidea taxus jacksoni	American Badger (Southwestern Ontario population)	S2	END	E	E	Schedule 1	Dobbyn 1994	No	Open grasslands, oak savannahs, sand barrens and farmland.[3,4]	No	No	Suitable habitat is not present within the study area. Field surveys did not document the presence of this species or suitable burrows and/or dens within the study area.
Urocyon cinereoargenteus	Gray Fox	S1	THR	T	T	Schedule 1	Dobbyn 1994	No	Deciduous forests, swamps and marshes, wooded farmland edge, old fields and thickets. Dens usually found in dense shrubs close to water but also rocky areas, hollow trees, and underground burrows dug by other animals.[3,4]	Yes	No	Deciduous forest tracts, wetland habitats, and a creek are present within the subject property.
Butterflies												
Danaus plexippus	Monarch	S2N, S4B	SC	END	SC	Schedule 1	MacNaughton et al. 2022	Yes (2022)	Adults found in a diversity of habitats with a variety of wildflowers. Caterpillars are confined to meadows and open areas where milkweeds grow (larval food plants).[3]	Yes	No	A variety of habitats and wildflowers are present within the subject property. Two milkweed species also observed. One adult Monarch incidentally observed during field surveys but larvae were not observed.
Plants												
Carya glabra	Pignut Hickory	S3	-	-	-	-	NDMNRF 2022	No	In upland, often sandy, forests, associated with oaks.[23]	No	No	NRSI biologists did not document the presence of Pignut Hickory during vegetation inventories.
Dichanthelium clandestinum	Deer-tongue Panicgrass	S2	-	-	-	-	N/A	Yes (2022)	Usually in moist and often sandy ground: floodplains and thickets on stream banks; aspen forests, borders, and clearings; marshy ground, ditches, etc.[23]	Yes	Yes	NRSI biologists documented the presence of Deer-tongue Panicgrass during 2022 vegetation inventories.
Gleditsia triacanthos	Honey-locust	S2?	-	-	-	-	N/A	Yes (2022)	River banks, shores, floodplains, and lowland woods.[23]	Yes	Yes	NRSI biologists docunmented the presence of Honey-locust during 2022 vegetation inventories.
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	NDMNRF 2022	Yes (2022)	Stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands.[23]	Yes	Yes	Hardwood stands and a stream/creek are present within subject property. Species observed by NRSI biologists during 2022 ELC.
Liatris spicata	Spiked Blazing Star	S2	THR	T	T	Schedule 1	N/A	Yes (2019)	Moist sandy plains and shores, marshy meadows, wet prairies, fens, tamarack swamps, mucky swales, marly shores, roadsides and fields. Rarely in drier oak or jack pine savannah.[23]	Yes	No	Vascular flora surveys documented several individuals within a cultivated garden. NRSI surveys did not document the presence of naturally occurring individuals.
Monarda didyma	Scarlet Beebalm	S3	-	-	-	-	N/A	Yes (2019)	In or near prairie remnants (including roadsides and fencerows), at margins of swamps, and in dry open ground. Most northern occurrences represent garden escapes or other waifs along roadsides or in rocky fields.[23]	Yes	No	Vascular flora surveys documented several Scarlet Beebalm within a cultivated garden. NRSI surveys did not document the presence of naturally occurring individuals.
Phegopteris hexagonoptera	Broadbeech Fern	S3	SC	SC	SC	Schedule 3	NDMNRF 2022	No	Rich, moist deciduous forests, often at bases of slopes, edges of seeps, and along sreams.[23]	Yes	No	A stream flows through the subject property. Deciduous forest tracts also present within subject property. However, species not observed during surveys.
Ratibida pinnata	Gray-headed Prairie Coneflower	S3	-	-	-	-	N/A	Yes (2019)	Prairies, woodland openings and borders, limestone outcrops.[24]	Yes	Yes	NRSI biologists documented the presence of Gray-headed Prairie Coneflowe during 2019 vegetation inventories.

Appendix III
Significant Wildlife Habitat Screening Assessment Tables

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					
Rationale: Habitat important to migrating waterfowl	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Lake. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	Fields with sheet water during Spring (mid March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available[cxlviii] Information Sources • Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. • Reports and other information available from Conservation Authorities (CAs) • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Field Naturalist Clubs • Ducks Unlimited Canada • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • Any mixed species aggregations of 100[l] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat[cxlviii]. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	Suitable agricricultural habitat is present within the new portion of the study area however aggregations of listed species were not observed by NRSI Biologists during 2019 or 2022 breeding bird surveys.. **Not SWH**
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					
Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district	Canada Goose Cackling Goose Snow Goose Green-winged Teal American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Blue-winged Teal Hooded Merganser Common Merganser Red-breasted Merganser Lesser Scaup Greater Scaup Common Goldeneye Bufflehead Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Canvasback Redhead Ruddy Duck Brant White-winged Scoter Black Scoter	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). Information Sources • Environment Canada • Naturalist clubs often are aware of staging/stopover areas • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100[l] or more of listed species for 7 days[l], results in >700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH[cxlix] • The combined area of the ELC ecosites and a 100m radius area is the SWH[cxlviii] • Wetland area and shorelines associated with sites identified within the SWHTG[cxlviii] Appendix K[cxlix] are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWHMIST[cxlix] Index #7 provides development effects and mitigation measures.	There are three ponds within the subject property; South of Old Highway 24, East of Highway 24, West of Cloet Road. These ponds may provide suitbale stopover and staging habitat however aggregations of listed species were not observed by NRSI Biologists during 2019 and 2022 breeding bird surveys. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Shorebird Migratory Stopover Area					
Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources • Western hemisphere shorebird reserve network • Canadian Wildlife Service (CWS) Ontario Shorebird Survey • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Center (NHIC) Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000[l] shorebird use days during spring or fall migration period (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (<24hrs) during spring migration, any site with >100[l] Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area[cxlviii] • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #8 provides development effects and mitigation measures.	Suitable shoreline habitat is not present within the study area. **Not SWH**
Wildlife Habitat: Raptor Wintering Area					
Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class. Forest: FOD, FOM, FOC Upland: CUM, CUT, CUS, CUW Bald Eagle: Forest Community Series: FOD, FOM, FOC, SWD, SWM, or SWC, on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering (hawk/owl) sites need to be > 20ha[cxlviii, cxlix] with a combination of forest and upland[xvi, xvii, xviii, xix, xx, xxi]. Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags aviable for roosting[cxlix] Information Sources • OMNRF Districts • Natural clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from CAs • Results of Christmas Bird Counts	Studies confirm the use of these habitats by: • One or more Short-eared Owls, or, One or more Bald Eagles or; at least 10 individuals and two listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years)[cxlix] for a minimum of 20 days by the above number of birds[l]. • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Suitable combination of forest and upland habitat is present within the study area. However, adequate species and numbers of individuals to meet criteria were not observed by NRSI Biologists during 2022 breeding bird surveys. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Bat Hibernacula					
Rationale: Bat hibernacula, are rare habitats in all Ontario landscapes.	Big Brown Bat Eastern Pipistrelle/Tri-colored Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. Active mine sites should not be considered The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts	• All sites with confirmed hibernating bats are SWH[l]. • The area includes 200m radius around the entrance of the hibernaculum[cxlviii, ccvii, l]. for the development types and 1000m for wind farms [ccv.] • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the[ccv]."Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv] • SWHMIST[cxlix] Index #1 provides development effects and mitigation measures.	Suitable cave, mine and karst habitat is not present within the study area. **Not SWH**
Wildlife Habitat: Bat Maternity Colonies					
Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	Maternity colonies can be found in tree cavities, vegetation and often in building [sxxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario[xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands[ccix, ccx] with >10/ha large diameter (>25cm dbh) wildlife trees[ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3[ccxiv] or class 1 or 2[ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred[ccx]. Information Sources • OMNRF for possible locations and contact for local experts • University Biology Departments with bat experts	Maternity Colonies with confirmed use by: • >10 Big Brown Bats[l] • >5 Adult Female Silver-haired Bats[l] • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies[l]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"[ccv]. • SWHMIST[cxlix] Index #12 provides development effects and mitigation measures.	Suitable treed habitat present throughout study area. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Bat Migratory Stopover Area					
	Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.	Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migrations concentrate these species of bats at stopover areas. The location and characteristics of stopover habitats are generally unknown. Information Sources • OMNR for possible locations and contact for local experts • University of Waterloo, Biology Department	Long Point (42°35'N, 80°30'E to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration[ccxv]. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWHDSS[cxlix] Index #38 provides development effects and mitigation measures.	Criteria unavailable to assess significance of habitat within the study area. **Not SWH**
Wildlife Habitat: Turtle Wintering Area					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles: ELC Community Classes: SW, MA, OA and SA ELC Community Series: FEO and BOO Northern Map Turtle: Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen[cix, cx, cxi, cxviii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH Information Sources • EIS studies carried out by Conservation Authorities • Field naturalists clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant[l]. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[l]. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – Apr)[cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant[cix, cx, cxi, cxii]. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Several listed species are reported from the vicinity of the study area and Snapping Turtle was observed by NRSI Biologists within the SWD4 community. Suitable aquatic habitat is present within the study area in the form of wetlands, ponds, and Davis Creek. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Reptile Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite in southern Ontario other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifying candidate SWH.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, lii, cxii]. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Information Sources • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from CAs • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[l]. • Note: If there are Special Concern Species present, then site is SWH • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (i.e. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH[l]. • SWHMIST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	This SWH type is difficult to assess for presence or absence due to the variability of site selection for hibernacula. However, only a single snake species (Eastern Gartersnake) was observed within the study area during targetted visual encounter surveys conducted by NRSI biologists in 2019. **Not SWH**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)					
Rationale: Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed/permitted Mineral Aggregate Operation. Information Sources • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]. • Bird Studies Canada: Nature Counts http://www.birdscanada.org/birdmon/ • Field Naturalist clubs	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50m radius habitat area from the peripheral nests[ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi]. • SWHMIST[cxlix] Index #4 provides development effects and mitigation measures.	Suitable eroding banks, steep slopes and sand piles are not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)					
Rationale: Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas[ccv], colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other list species. • The habitat extends from the the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH[cc, ccvii]. • Confirmation of active colonies must be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells • SWHMIST[cxlix] Index #5 provides development effects and mitigation measures.	Suitable treed habitat is present within the study area. However, no probable, possible, or confirmed breeding evidence was observed by NRSI Biologists during 2019 and 2022 breeding bird surveys. **Not SWH**
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Ground)					
Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1:50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources • Ontario Breeding Bird Atlas[ccv], rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[l]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[l]. • Presence of 5 or more pairs for Brewer's Blackbird[l]. • The edge of the colony and a minimum 150m radius area of the habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH[cc, ccvii]. • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #6 provides development effects and mitigation measures.	Suitable rocky island habitat is not present within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Migratory Butterfly Stopover Areas					
Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter	Painted Lady Red Admiral Special Concern: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate sight for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10ha in size with a combination of field and forest habitat present, and will be located within 5km of Lake Ontario and Erie[cxlix]. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south [xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat [cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes [xxxvii, xxxviii, xxxix, xl, xli]. Information Sources • MNRF District Offices • Natural Heritage Information Centre (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association • Conservation Authorities	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)[xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day[xxxvii], significant variation can occur between years and multiple years of sampling should occur[xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD • MUD of >5000 or >3000 with the presence of Painted Ladies or White Admiral's is to be considered significant[l]. • SWHMIST[cxlix] Index #16 provides development effects and mitigation measures.	The study area not located within 5 km of Lake Ontario or Lake Erie. **Not SWH**
Wildlife Habitat: Landbird Migratory Stopover Areas					
Rationale: Sites with a high diversity of species as well as high numbers are most significant	All migratory songbirds Canadian Wildlife Service Ontario website: http://www.on.ec.gc.ca/wildlife_e.html All migrant raptors species Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	Woodlots need to be >5 ha[l] in size and within 5km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie or Ontario are more significant[cxlix]. • Sites have a variety of habitats: forest, grassland and wetland complexes[cxlix]. • The largest sites are more significant[cxlix] • Woodlots and forest fragments are important habitats to migrating birds[ccxviii], these features located along the shore and located within 5km of Lake Ontario and Lake Erie are Candidate SWH[cxlviii]. Information Sources • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates[l]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (March/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #9 provides development effects and mitigation measures.	The study area not located within 5 km of Lake Ontario or Lake Erie. **Not SWH**
Wildlife Habitat: Deer Winter Congregation Areas					
Rationale: Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii]	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations (CUP) smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha[l]. • Deer movement during winter in Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands[cxlviii]. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha[ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[l]. Information Sources • MNRF District Offices • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF[cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF[l]. • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques[ccxxiv], ground or road surveys, or a pellet count deer density survey[ccxxv]. • SWHMIST[cxlix] Index #2 provides development effects and mitigation measures.	Suitable habitat of appropriate size is not present in the study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	**Candidate SWH**			**Confirmed SWH**	**Study Area**
	ELC Ecosite Codes[1]	**Habitat Description**[1]	**Detailed Information and Sources**[1]	**Defining Criteria**[1]	**Assessment Details**
Cliff and Talus Slopes					
Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes[lxxviii] • SWHMIST[cxlix] Index #21 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Sand Barrens					
Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. They have little or no soil and the underlying rock protrudes through the surface. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	A sand barren area >0.5ha in size Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens[lxxviii] • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp)[l]. • SWHMIST[cxlix] Index #20 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Alvar					
Rationale: Alvars are extremely rare habitats in Ecoregion 7E	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 **Five Alvar Indicator Species:** 1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum These indicator species are very specific to Alvars within Ecoregion 7E[cxlix]	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover[lxxviii].	An Alvar site > 0.5ha in size[lxxv]. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie[cxcix]. Information Sources • Alvars of Ontario (2000), Federation of Ontario Naturalists[lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars[ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Staff • Field Naturalist clubs • Conservation Authorities	Field studies identify four of the five **Alvar indicator species**[lxxv] at a candidate Alvar site is Significant • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses[lxxv]. • SWHMIST[cxlix] Index #17 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Old Growth Forest					
Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland area is >0.5ha Information Sources • OMNRF Forest Resource Inventory mapping • OMNRF Districts • Field naturalist clubs • Conservation Authorities • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments	Field Studies will determine: • If dominant trees species of the ecosite are >140 years old, then stand is Significant Wildlife Habitat[cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present) • Determine ELC Vegetation Type for forest area containing the old growth characteristics[lxxviii]. • SWHMIST[cxlix] Index #23 provides development effects and mitigation measures.	FOD7-4 vegetation community is present within the study area however it is not dominated by tree species >140 yeaars old. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l] Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location data available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present[l]. Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #18 provides development effects and mitigation measures.	This vegetation community is not present within the study area. **Not SWH**
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Centre (NHIC has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present[l]. Note: Prairie plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation Type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #19 provides development effects and mitigation measures.	This vegetation community may be present within the study area. **Candidate SWH**
Other Rare Vegetation Communities					
Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG[cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M[cxlviii]. The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG[cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	ELC surveys did not detect any provincially rarae vegetation communities. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Waterfowl Nesting Area					
Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	A waterfowl nesting area extends: 120m[cxlix] from a wetland (>0.5ha) or a wetland (>0.5ha) with small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120m of each individual wetland where waterfowl nesting is known to occur[cxlix]. • Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. Information Sources • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from CAs	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[l], or, • Presence of 10 or more nesting pairs for listed species including Mallards[l]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120m[cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST[cxlix] Index #25 provides development effects and mitigation measures.	Suitable wetland habitat is present within the study area however no listed species were observed by NRSI Biologists during 2022 breeding bird surveys. **Not SWH**
Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern: Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands.	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources • Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario • MNRF values information (LIO/NRVIS) will list known nesting locations, Note: data from NRVIS is provided as a point format and does not include all the habitat. • Nature Counts, Ontario Nest Records Scheme data • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented • Reports and other information available from CAs • Field naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area[cxlviii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300m radius around the nest or the contiguous woodland stand is the SWH[ccvii], maintaining undisturbed shorelines with large trees within this area is important[cxlviii]. • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH[cvi, ccvii]. Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat[cvi]. • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for ≥3 years or suspected of not being used for >5 years before being considered not significant[ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #26 provides development effects and mitigation measures.	Suitable treed habitat is present within the study area however, no listed species were observed by NRSI Biologists during 2022 breeding bird surveys. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Woodland Raptor Nesting Habitat					
Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM, SWD and CUP3	All natural or conifer plantation woodland/forest stands combined >30ha or with >4ha of interior habitat[lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. Interior habitat determined with a 200m buffer[cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources • OMNRF Districts • Check the Ontario Breeding Bird Atlas[ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada • Reports and other information available from CAs	Studies confirm: • Presence of 1 or more active nests from species list is considered significant[cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha of habitat is the SWH[ccvii].(the 28ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • Barred Owl – A 200m radius around the nest is the SWH[ccvii]. • Broad-winged Hawk and Coopers Hawk – A 100m radius around the nest is the SWH[ccvii]. • Sharp-Shinned Hawk – A 50m radius around the nest is the SWH[ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWHMIST[cxlix] Index #27 provides development effects and mitigation measures.	Forested habitat of suitable size is not present within the study area. **Not SWH**
Wildlife Habitat: Turtle Nesting Area					
Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle Special Concern: Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m)[cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. Information Sources • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Center (NHIC) Field naturalist clubs	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[l] • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[l] • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH[cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat[cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observation studies observing the turtles nesting is a recommended method. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	Ponds, wetlands, and Davis Creek are present within the new portion of the subject property. Agricultural land surrounding these areas may provide suitable habitat. Additional areas of exposed mineral soils may be present within the new portion of the study area, and may also provide suitable habitat. NRSI Biologists observed a Snapping Turtle during a site visit in 2019. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Seeps and Springs					
Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system[cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species[cxix, cxx, cxxi, cxxii, cxiii, cxiv]. <u>Information Sources</u> • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists and landowners • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped	Field Studies confirm: • Presence of a site with 2 or more[l] seeps/springs should be considered SWH. • The area of a ELC forest ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation of the habitat[cxlviii]. • SWHMIST[cxlix] Index #30 provides development effects and mitigation measures.	The Natural Heritage: Make a Map webiste and ARA data shows headwater areas of Davis Creek that flow into the North-East of the study area. Sattelite imgery shows the West branch as being forested. Groundwater was observed flowing to Tributary B east of the trailway. **Confirmed SWH**
Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					
<u>Rationale:</u> These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m^2 (about 25m diameter) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size)[clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat[cxlviii]. <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations • Field naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the wetland area plus a 230m radius of woodland area[lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWHMIST[cxlix] Index #14 provides development effects and mitigation measures.	Suitable wetlands adjacent or within woodland habitat is present within the study area along Davis Creek. Targetted anuran call surveys conducted by NRSI identified the presence of >20 Spring Peeper and Wood Frog individuals from the SWD4 community located adjacent to and along Davis Creek. **Confirmed SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario Landscapes	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	• Wetlands >500m^2 (about 25m diameter)[ccvii] supporting high species diversity are significant: some small or ephemeral habitats may not be identified on MNR mapping and could be important amphibian breeding habitats[clxxxiv]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations • Reports and other information available from CAs	Studies confirm: • Presence of breeding population of 1or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 breeding individuals (adults and eggs masses)[lxxi, lxxiii] or 2 or more of the listed frog/toad species with Call Level of 3. or; Wetland with confirmed breeding Bullfrogs are significant[l]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys cviii to determine breeding/larval stages will be required during the spring (May March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHMIST[cxlix] Index #15 provides development effects and mitigation measures.	Suitable wetland habitat is present in the study area however, targetted anuran call surveys and field investigations conducted in 2019 by NRSI biologists did not confirm suitable species counts or presence within applicable wetland communities. **Not SWH**
Wildlife Habitat: Woodland Area-Sensitive Bird Breeding Habitat					
Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker Special Concern: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs. old) forest stands or woodlots >30ha[cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200m from forest edge habitat[clxiv]. Information Sources • Local birder clubs • Canadian Wildlife Service (CWS) for the location of forest bird monitoring • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from CAs	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species[l]. • Note: any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH[l]. • Conduct field investigations in early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”[ccxi] • SWHMIST[cxlix] Index #34 provides development effects and mitigation measures.	Suitable woodland habitat is not present within the study area. Additionally, no confirmed breeding evidence of the listed species was observed by NRSI Biologists during 2022 breeding bird surveys. **Not SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Gallinule American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites	• Nesting occurs in wetlands • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present[cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. Information Sources • OMNRF Districts and wetland evaluations • Field naturalist clubs • Natural Heritage Information Centre (NHIC) • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species[l]. • Note: any wetland with breeding of 1 or more Trumpeter Swans, Black Terns, Green Heron or Yellow Rail is SWH[l]. • Area of the ELC ecosite is the SWH • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #35 provides development effects and mitigation measures	Suitable wetland habitat is present within the study area. However, no listed species were observed by NRSI biologists during 2022 breeding bird surveys. **Not SWH**
Wildlife Habitat: Open Country Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Special Concern: Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30ha[clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years)[l]. Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. Information Sources • Agricultural land classification maps Ministry of Agriculture • Local birder clubs • Ontario Breeding Bird Atlas[ccv] • EIS Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species[l]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #32 provides development effects and mitigation measures	Suitable grassland habitat is not present within the study area. Possible breeding evidence for Savannah Sparrow was observed by NRSI biologists during 2022 breeding bird surveys. However, additonal listed species were not observed and significant habitat criteria have not been met. **Not SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat such as woodland area for some bird species.	Large natural field areas succeeding to shrub and thicket habitats >10ha[clxiv] in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years)[l]. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species[clxxiii]. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources • Agricultural land classification maps, Ministry of Agriculture. • Local bird clubs • Ontario Breeding Bird Atlas[ccv] • Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species[l]. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat[l]. • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #33 provides development effects and mitigation measures.	Suitable natural field and succeeding shrub habitats of appropriate size are present within the study area. Only Brown Thrasher and Willow Flycatcher were observed by NRSI Biologists during 2022 breeding bird surveys however no confirmed breeding evidence was documented. **Not SWH**
Wildlife Habitat: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. [Ccii]	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish	Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites[cci]. • Area of ELC Ecosite or an ecoelement area of meadow marsh or swamp within the large ecosite area is the SWH • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult [cci] • SWHMIST[cxlix] Index #36 provides development effects and mitigation measures.	This SWH type is difficult to assess for presence or absence due to the inconsonspicuous nature of constructed burrows which can be found in various terrestrial sites. However, no burrows were observed by NRSI biologists during site investigations in 2019 or 2022. **Not SWH**
Wildlife Habitat: Special Concern and Rare Wildlife Species					
Rationale: These species are quite rare or have experienced significant population declines in Ontario	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites[lxxviii]. Information Sources • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists and element occurrences for these species. • NHIC Website: "Get Information" http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas[ccv] • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat neess to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	NRSI field surveys documented the presence of Butternut, Chimney Swift, Eastern Wood-Pewee, Barn Swallow and Snapping Turtle within the study area. **Confirmed SWH**

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 7E.

	Wildlife Species[1]	**Candidate SWH**		**Confirmed SWH**	**Study Area**
		ELC Ecosite Codes[1]	**Habitat Criteria and Information Sources[1]**	**Defining Criteria[1]**	**Assessment Details**
Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Blue-spotted Salamander Spotted Salamander Four-toed Salamander Gray Treefrog Northern Leopard Frog Pickerel Frog Western Chorus Frog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	Movement corridors between breeding habitat and summer habitat[clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi] Movement corridors must be considered when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[l]. Information Sources • MNRF District Office • Natural Heritage Information Centre NHIC • Reports and other information available from CAs • Field naturalist Clubs	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterwaycxlix or be up to 200m widecxlix of woodland habitat and with gaps <20m[cxlix] • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMIST[cxlix] Index #40 provides development effects and mitigation measures.	Suitable habitat features to support criterion are not present within the study area. Amphibian breeding habitat is absent from the study area and as such, movement corridors are also absent from the study area. **Not SWH**

Appendix IV
Species Lists

Plant Species Reported from the Study Area - Simcoe Water Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	NHIC Data*	NRSI Observed	ELC 2019 CUW	ELC 2019 SWD4	ELC 2019 FOD9	ELC 2019 MAM2	ELC 2019 SWD3-3	ELC 2022 CUW1 (North)	ELC 2022 FOD7-4 (1)	ELC 2022 CUW1 (South)	ELC 2022 FOD7-4 (2)	ELC 2022 FOD8-1
		NDMNRF 2021	MECP 2022	Government of Canada 2021	Government of Canada 2021	Government of Canada 2021	NDMNRF 2022	NRSI Results from 2019, 2022	2019	2019	2019	2019	2019	2022	2022	2022	2022	2022
Pteridophytes	**Ferns & Allies**																	
Dryopteridaceae	**Wood Fern Family**																	
Dryopteris carthusiana	Spinulose Wood Fern	S5						X		X								
Matteuccia struthiopteris	Ostrich Fern	S5						X									X	
Onoclea sensibilis	Sensitive Fern	S5						X		X	X							
Equisetaceae	**Horsetail Family**																	
Equisetum arvense	Field Horsetail	S5						X		X	X			X		X		
Thelypteridaceae	**Beech Fern Family**																	
Phegopteris hexagonoptera	Broad Beech Fern	S3		SC	SC	Schedule 3	X											
Thelypteris palustris	Marsh Fern	S5						X			X							
Gymnosperms	**Conifers**																	
Cupressaceae	**Cypress Family**																	
Juniperus virginiana	Eastern Red Cedar	S5						X		X					X			X
Thuja occidentalis	Eastern White Cedar	S5						X								X		
Pinaceae	**Pine Family**																	
Picea glauca	White Spruce	S5						X							X			
Pinus strobus	Eastern White Pine	S5						X			X						X	X
Pinus sylvestris	Scots Pine	SE5						X							X			X
Dicotyledons	**Dicots**																	
Aceraceae	**Maple Family**																	
Acer negundo	Manitoba Maple	S5						X	X	X		X		X	X	X	X	X
Acer platanoides	Norway Maple	SE5						X	X		X						X	
Acer saccharum	Sugar Maple	S5						X			X							
Acer x freemanii	Freeman's Maple	SNA						X			X		X			X		
Anacardiaceae	**Sumac or Cashew Family**																	
Rhus typhina	Staghorn Sumac	S5						X		X	X	X		X	X	X		X
Toxicodendron radicans	Poison Ivy	S5						X	X	X	X							
Toxicodendron radicans var. rydbergii	Western Poison Ivy	S5						X						X				
Apiaceae	**Carrot or Parsley Family**																	
Aegopodium podagraria	Goutweed	SE5						X	X									
Cicuta maculata	Spotted Water-hemlock	S5						X		X								
Daucus carota	Wild Carrot	SE5						X	X	X				X	X	X		X
Apocynaceae	**Dogbane Family**																	
Apocynum androsaemifolium	Spreading Dogbane	S5						X	X									
Apocynum cannabinum	Hemp Dogbane	S5						X						X				
Apocynum cannabinum var. cannabinum	Hemp Dogbane	S5						X		X								
Asclepiadaceae	**Milkweed Family**																	
Asclepias incarnata ssp. incarnata	Swamp Milkweed	S5						X		X								
Asclepias syriaca	Common Milkweed	S5						X	X							X		
Asteraceae	**Composite or Aster Family**																	
Achillea millefolium	Common Yarrow	SE5?						X								X		
Ambrosia artemisiifolia	Common Ragweed	S5						X	X					X		X		
Ambrosia trifida	Great Ragweed	S5						X						X			X	
Arctium lappa	Great Burdock	SE5						X								X		
Arctium minus	Common Burdock	SE5						X	X		X				X			
Artemisia absinthium	Absinthe Wormwood	SE5?						X								X		
Cichorium intybus	Chicory	SE5						X								X		
Cirsium arvense	Creeping Thistle	SE5						X								X		
Cirsium vulgare	Bull Thistle	SE5						X	X					X	X	X	X	
Erigeron annuus	Annual Fleabane	S5						X						X	X		X	
Erigeron hyssopifolius	Daisy Fleabane	S5						X	X	X	X					X		
Erigeron philadelphicus var. philadelphicu	Philadelphia Fleabane	S5						X	X									
Eutrochium maculatum	Spotted Joe Pye Weed	S5						X		X	X							
Heliopsis helianthoides	False Sunflower	S4S5						X	X							X		
Lactuca biennis	Tall Blue Lettuce	S5						X		X				X		X		
Lactuca canadensis	Canada Lettuce	S5						X		X								
Liatris spicata	Dense Blazing-star	S2	THR	T	T	Schedule 1		X	Planted									
Matricaria discoidea	Pineappleweed	SE5						X	X									
Pilosella caespitosa	Meadow Hawkweed	SE5						X	X									
Ratibida pinnata	Gray-headed Prairie Coneflower	S3						X	X									
Rudbeckia hirta	Black-eyed Susan	S5						X								X		
Solidago altissima var. altissima	Eastern Tall Goldenrod	S5						X		X								
Solidago canadensis	Canada Goldenrod	S5						X	X	X								
Solidago flexicaulis	Zigzag Goldenrod	S5						X			X							
Solidago nemoralis	Gray-stemmed Goldenrod	S5						X								X		
Sonchus arvensis	Field Sow-thistle	SE5						X						X	X	X		
Symphyotrichum lanceolatum	Panicled Aster	S5						X	X	X				X	X	X		
Symphyotrichum novae-angliae	New England Aster	S5						X						X	X	X		
Symphyotrichum oolentangiense	Sky-blue Aster	S4						X	X									
Symphyotrichum pilosum	Old Field Aster	S5						X								X		
Symphyotrichum puniceum	Swamp Aster	S5						X		X								
Symphyotrichum urophyllum	Arrow-leaved Aster	S4						X	X	X						X	X	
Taraxacum officinale	Common Dandelion	SE5						X		X	X			X				
Tussilago farfara	Colt's-foot	SE5						X			X	X						

Bird Species Reported from the Study Area - Simcoe Water Supply EA (Project #2250A)

Scientific Name	**Common Name**	**SRANK**	**SARO**	**COSEWIC**	**SARA**	**SARA Schedule**	**2019 NRSI Incidental Observations**	**2022 NRSI Incidental Observations**	**OBBA***	**NHIC Data****	**NRSI Observed: Highest Level of Breeding Evidence**	**BMB-001 (2019)**	**BMB-002 (2019)**	**BMB-003 (2019)**	**BMB-004 (2019)**	**BMB-005 (2019)**	**BMB-001 (2022)**	**BMB-002 (2022)**	**BMB-003 (2022)**	**BMB-004 (2022)**	**BMB-005 (2022)**	**BMB-006 (2022)**
		NDMNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Citation	Citation	BSC et al. 2006	NDMNRF 2022	NRSI Results from 2019, 2022											
Anatidae	**Ducks, Geese & Swans**																					
Aix sponsa	Wood Duck	S5B,S3N							CO													
Anas platyrhynchos	Mallard	S5							CO													
Branta canadensis	Canada Goose	S5							CO													
Odontophoridae	**New World Quails**																					
Colinus virginianus	Northern Bobwhite	S1?	END	E	E	Schedule 1			PO													
Phasianidae	**Partridges, Grouse & Turkeys**																					
Bonasa umbellus	Ruffed Grouse	S5							CO													
Meleagris gallopavo	Wild Turkey	S5					OB		CO													
Phasianus colchicus	Ring-necked Pheasant	SNA							PO													
Columbidae	**Pigeons & Doves**																					
Columba livia	Rock Pigeon	SNA							CO													
Zenaida macroura	Mourning Dove	S5					PR	OB	CO		**PR**	PO	PO	PR	PO		PO	PO		PO	PR	PR
Cuculiformes	**Cuckoos & Anis**																					
Coccyzus erythropthalmus	Black-billed Cuckoo	S4S5B							CO													
Coccyzus sp.	Black/Yellow-billed Cuckoo	NP							PR													
Caprimulgidae	**Goatsuckers**																					
Antrostomus vociferus	Eastern Whip-poor-will	S4B	THR	T	T	Schedule 1			PR													
Chordeiles minor	Common Nighthawk	S4B	SC	SC	T	Schedule 1			PO													
Apodidae	**Swifts**																					
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1			PR		**OB**									OB		
Trochilidae	**Hummingbirds**																					
Archilochus colubris	Ruby-throated Hummingbird	S5B							CO													
Charadriidae	**Plovers & Lapwings**																					
Charadrius vociferus	Killdeer	S4B					OB	OB	CO		**PO**	PO	PO	PO				PO				
Scolopacidae	**Sandpipers & Allies**																					
Actitis macularia	Spotted Sandpiper	S5B							CO													
Scolopax minor	American Woodcock	S4B							PR													
Ardeidae	**Herons & Bitterns**																					
Ardea herodias	Great Blue Heron	S4									**OB**									OB		
Butorides virescens	Green Heron	S4B							PR													
Cathartidae	**Vultures**																					
Cathartes aura	Turkey Vulture	S5B,S3N					OB	OB	PO		**PO**						PO					
Accipitridae	**Hawks, Kites, Eagles & Allies**																					
Accipiter cooperii	Cooper's Hawk	S4	NAR	NAR	NS	No schedule			PR													
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR	NS	No schedule			PR													
Buteo platypterus	Broad-winged Hawk	S5B							PR													
Circus hudsonius	Northern Harrier	S5B,S4N	NAR	NAR	NS	No schedule			PO													
Strigidae	**Typical Owls**																					
Bubo virginianus	Great Horned Owl	S4							PR													
Megascops asio	Eastern Screech-Owl	S4	NAR	NAR	NS	No schedule			CO													
Alcedinidae	**Kingfishers**																					
Megaceryle alcyon	Belted Kingfisher	S5B,S4N					OB		CO													
Picidae	**Woodpeckers**																					
Colaptes auratus	Northern Flicker	S5					OB	OB	CO		**PO**	PO	PO		PO		PO					
Dryobates pubescens	Downy Woodpecker	S5					OB		CO		**PR**					PR	PO			PO		PO
Dryobates villosus	Hairy Woodpecker	S5							CO													
Dryocopus pileatus	Pileated Woodpecker	S5							CO													
Melanerpes carolinus	Red-bellied Woodpecker	S5					OB		CO		**PO**										PO	
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B,S3N							PR													
Falconidae	**Caracaras & Falcons**																					
Falco columbarius	Merlin	S5	NAR	NAR	NS	No schedule			PR													
Falco sparverius	American Kestrel	S4							PO													
Tyrannidae	**Tyrant Flycatchers**																					
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC	SC	Schedule 1	PO		PR		**PO**	PO				PO	PO					
Empidonax minimus	Least Flycatcher	S5B							PO													
Empidonax traillii	Willow Flycatcher	S4B							PR		**PO**	PO										
Myiarchus crinitus	Great Crested Flycatcher	S5B					OB		PR		**PO**	PO	PO			PO						
Sayornis phoebe	Eastern Phoebe	S5B							CO													
Tyrannus tyrannus	Eastern Kingbird	S4B						OB	CO		**PO**						PO					
Vireonidae	**Vireos**																					
Vireo gilvus	Warbling Vireo	S5B							PR		**PO**		PO	PO		PO				PO		
Vireo olivaceus	Red-eyed Vireo	S5B							CO		**PO**	PO				PO	PO					
Corvidae	**Crows & Jays**																					
Corvus brachyrhynchos	American Crow	S5					OB	OB	CO		**PR**		PR		PO	PO		PO	OB		PO	
Cyanocitta cristata	Blue Jay	S5					OB	OB	CO		**PR**	PR	PR	PO	PO	PO	PR	PO		PR	PO	PO
Alaudidae	**Larks**																					
Eremophila alpestris	Horned Lark	S4					OB	PO	PO		**PO**	PO			PO							
Hirundinidae	**Swallows**																					
Hirundo rustica	Barn Swallow	S4B	THR	SC	T	Schedule 1	OB	OB	CO		**PO**	PO		PO	PO		OB					PR
Progne subis	Purple Martin	S3B							PO													
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1			CO													
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B							CO													
Tachycineta bicolor	Tree Swallow	S4S5B					PR		CO													
Paridae	**Chickadees & Titmice**																					
Poecile atricapillus	Black-capped Chickadee	S5					OB		CO		**PO**			PO			PO	PO	PO		PO	
Sittidae	**Nuthatches**																					
Sitta canadensis	Red-breasted Nuthatch	S5							PR													
Sitta carolinensis	White-breasted Nuthatch	S5							CO		**PO**	PO	PO								PO	
Troglodytidae	**Wrens**																					
Thryothorus ludovicianus	Carolina Wren	S4							CO		**PR**									PR	PR	
Troglodytes aedon	House Wren	S5B						PO	CO		**PR**					PO	PO	PR	PR	PR	PR	PO
Turdidae	**Thrushes**																					
Catharus fuscescens	Veery	S5B							PR													
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1			CO													
Sialia sialis	Eastern Bluebird	S5B,S4N	NAR	NAR	NS	No schedule			CO													

Turdus migratorius	American Robin	S5					OB	OB	CO		**CO**	PO	PR	PR	PR	PR	CO	PR	PR	PO	PR	PR
Mimidae	**Mockingbirds, Thrashers & Allies**																					
Dumetella carolinensis	Gray Catbird	S5B,S3N					OB	PO	CO		**PR**		PO	PO			PO	PR	PR	PR	PO	PO
Mimus polyglottos	Northern Mockingbird	S4							CO													
Toxostoma rufum	Brown Thrasher	S4B							CO		**PO**				PO							
Sturnidae	**Starlings**																					
Sturnus vulgaris	European Starling	SNA						OB	CO		**CO**	CO		PR	CO		PO	PO	PO	OB		CO
Bombycillidae	**Waxwings**																					
Bombycilla cedrorum	Cedar Waxwing	S5						OB	CO		**PO**			PO					PO		PO	
Passeridae	**Old World Sparrows**																					
Passer domesticus	House Sparrow	SNA							CO		**PR**	PO			PR		PR			PO		PO
Fringillidae	**Finches & Allies**																					
Haemorhous mexicanus	House Finch	SNA							CO													PO
Haemorhous purpureus	Purple Finch	S5							PO													
Spinus tristis	American Goldfinch	S5						OB	CO		**PR**	PO	PO	PR	PO	PO		PO		PO		PR
Emberizidae	**New World Sparrows & Allies**																					
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC	SC	SC	Schedule 1			CO													
Melospiza georgiana	Swamp Sparrow	S5B,S4N							PR													
Melospiza melodia	Song Sparrow	S5						OB	CO		**PR**	PR	PR	PR	PR	PR	PO	PR	PR	PR	PR	PR
Passerculus sandwichensis	Savannah Sparrow	S5B,S3N							CO		**PR**	PO			PR		PO					
Pipilo erythrophthalmus	Eastern Towhee	S4B,S3N							CO													
Pooecetes gramineus	Vesper Sparrow	S4B					OB		PR		**PO**			PO	PO	PO						
Spizella passerina	Chipping Sparrow	S5B,S3N							CO		**PR**				PR							
Spizella pusilla	Field Sparrow	S4B,S3N							PR													
Icteridae	**Troupials & Allies**																					
Agelaius phoeniceus	Red-winged Blackbird	S5					PR		CO		**PR**	PR		PR	PR	PR	PR	PO		PR	PO	PR
Dolichonyx oryzivorus	Bobolink	S4B	THR	SC	T	Schedule 1			PR													
Icterus galbula	Baltimore Oriole	S4B					OB		CO		**CO**		CO	PO	PO	CO		PO	PR	PR	PO	
Icterus spurius	Orchard Oriole	S4B							PO													
Molothrus ater	Brown-headed Cowbird	S5							CO		**PR**	PR	PR	PO	PO		PO	PR	PR	PO		PR
Quiscalus quiscula	Common Grackle	S5							CO		**CO**	CO	PO		PO	PR	PR	PO		PO	PO	PO
Sturnella magna	Eastern Meadowlark	S4B,S3N	THR	T	T	Schedule 1			PR													
Parulidae	**Wood Warblers**																					
Geothlypis trichas	Common Yellowthroat	S5B,S3N					OB		PR		**PO**										PO	
Parkesia noveboracensis	Northern Waterthrush	S5B							PO													
Seiurus aurocapilla	Ovenbird	S5B							CO													
Setophaga caerulescens	Black-throated Blue Warbler	S5B					OB															
Setophaga citrina	Hooded Warbler	S4B	NAR	NAR	NS	No schedule			CO													
Setophaga pensylvanica	Chestnut-sided Warbler	S5B							PR		**PO**								PO	PO	PO	
Setophaga petechia	Yellow Warbler	S5B					OB		PR		**PR**		PO	PR			PO				PO	PO
Setophaga pinus	Pine Warbler	S5B,S3N							PR													
Setophaga ruticilla	American Redstart	S5B					OB		PO		**PO**					PO						
Vermivora cyanoptera	Blue-winged Warbler	S4B							PR													
Cardinalidae	**Cardinals, Grosbeaks & Allies**																					
Cardinalis cardinalis	Northern Cardinal	S5					OB	PO	CO		**PR**		PR	PR	PO	PO	PR	PR	PR	PO	PR	PO
Passerina cyanea	Indigo Bunting	S5B							CO		**PR**	PO	PO			PR		PO	PO		PO	
Pheucticus ludovicianus	Rose-breasted Grosbeak	S5B					OB	PO	CO		**PR**		PR	PO		PR						
Piranga olivacea	Scarlet Tanager	S5B							PR													
Total							**27**	**18**	**97**	**0**	**44**	**21**	**19**	**19**	**20**	**19**	**22**	**17**	**13**	**20**	**20**	**17**

*OBBA Atlas Square: 17NH54

**NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

References

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Balsaminaceae	**Touch-me-not Family**																	
Impatiens capensis	Spotted Jewelweed	S5						X	X	X								
Impatiens glandulifera	Purple Jewelweed	SE4						X	X									
Berberidaceae	**Barberry Family**																	
Podophyllum peltatum	May-apple	S5						X			X							
Betulaceae	**Birch Family**																	
Carpinus caroliniana ssp. virginiana	Blue-beech	S5						X			X							
Bignoniaceae	**Bignonia Family**																	
Catalpa speciosa	Northern Catalpa	SE1						X								X	X	
Boraginaceae	**Borage Family**																	
Hackelia virginiana	Virginia Stickseed	S5						X	X					X				
Brassicaceae	**Mustard Family**																	
Alliaria petiolata	Garlic Mustard	SE5						X	X	X	X			X	X	X	X	
Barbarea vulgaris	Bitter Wintercress	SE5						X		X								
Berteroa incana	Hoary False-alyssum	SNA						X								X		
Cardamine bulbosa	Bulbous Bittercress	S4						X		X								
Hesperis matronalis	Dame's Rocket	SE5						X	X									
Campanulaceae	**Bellflower Family**																	
Lobelia siphilitica	Great Blue Lobelia	S5						X		X								
Caprifoliaceae	**Honeysuckle Family**																	
Lonicera maackii	Amur Honeysuckle	SE2						X									X	
Lonicera morrowii	Morrow's Honeysuckle	SE3						X								X		
Lonicera tatarica	Tatarian Honeysuckle	SE5						X	X							X		
Lonicera x bella	*(Lonicera morrowii X Lonicera tatarica)*	SNA						X		X						X	X	
Viburnum lentago	Nannyberry	S5						X		X								
Viburnum opulus	Cranberry Viburnum	S5						X		X						X		
Caryophyllaceae	**Pink Family**																	
Saponaria officinalis	Bouncing-bet	SE5						X	X									X
Silene latifolia	White Campion	SE5						X	X									
Celastraceae	**Staff-tree Family**																	
Celastrus orbiculatus	Oriental Bittersweet	SE2						X								X	X	X
Euonymus obovatus	Running Strawberry Bush	S4						X			X							
Chenopodiaceae	**Goosefoot Family**																	
Chenopodium album	White Goosefoot	SE5						X	X									
Clusiaceae	**St. John's-wort Family**																	
Hypericum perforatum	Common St. John's-wort	SE5						X								X		X
Cornaceae	**Dogwood Family**																	
Cornus obliqua	Pale Dogwood	S5						X		X								
Cornus racemosa	Gray Dogwood	S5						X	X	X				X				
Cornus sericea	Red-osier Dogwood	S5						X									X	
Cucurbitaceae	**Gourd Family**																	
Echinocystis lobata	Wild Mock-cucumber	S5						X	X	X	X			X		X		
Dipsacaceae	**Teasel Family**																	
Dipsacus fullonum	Common Teasel	SE5						X				X			X	X		
Elaeagnaceae	**Oleaster Family**																	
Elaeagnus angustifolia	Russian Olive	SE3						X							X			
Euphorbiaceae	**Spurge Family**																	
Acalypha rhomboidea	Common Three-seeded Mercury	S5						X	X									
Fabaceae	**Pea Family**																	
Amphicarpaea bracteata	American Hog-peanut	S5						X	X	X								
Apios americana	American Groundnut	S5						X									X	
Desmodium canadense	Showy Tick-trefoil	S4						X								X		
Gleditsia triacanthos	Honey-locust	S2?						X								X		
Lotus corniculatus	Garden Bird's-foot Trefoil	SE5						X								X		
Medicago lupulina	Black Medic	SE5						X	X					X		X		
Melilotus albus	White Sweet-clover	SE5						X	X							X		
Robinia pseudoacacia	Black Locust	SE5						X	X									
Trifolium pratense	Red Clover	SE5						X	X	X						X		
Trifolium repens	White Clover	SE5						X								X		
Fagaceae	**Beech Family**																	
Fagus grandifolia	American Beech	S4						X			X							
Quercus macrocarpa	Bur Oak	S5						X		X	X							
Quercus rubra	Northern Red Oak	S5						X								X	X	
Geraniaceae	**Geranium Family**																	
Geranium maculatum	Spotted Geranium	S5						X			X							
Grossulariaceae	**Currant Family**																	
Ribes americanum	Wild Black Currant	S5						X		X				X				
Ribes rubrum	Northern Red Currant	SE5						X						X				
Juglandaceae	**Walnut Family**																	
Carya cordiformis	Bitternut Hickory	S5						X		X	X							
Carya glabra	Pignut Hickory	S3					x											
Carya ovata var. ovata	Shagbark Hickory	S5						X		X	X							
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	x	X						X	X	X	X	
Juglans nigra	Black Walnut	S4?						X	X	X	X		X	X	X	X	X	
Lamiaceae	**Mint Family**																	
Glechoma hederacea	Ground Ivy	SE5						X	X							X		
Monarda didyma	Scarlet Beebalm	S3						X	Planted									
Monarda fistulosa	Wild Bergamot	S5						X	X							X		
Nepeta cataria	Catnip	SE5						X								X	X	
Prunella vulgaris	Self-heal	S5						X								X		

Pycnanthemum virginianum	Virginia Mountain-mint	S4						X	X									
Scutellaria lateriflora	Mad Dog Skullcap	S5						X		X								
Teucrium canadense var. canadense	Canada Germander	SU						X		X								
Lauraceae	**Laurel Family**																	
Sassafras albidum	Sassafras	S4						X	X							X		
Lythraceae	**Loosestrife Family**																	
Lythrum salicaria	Purple Loosestrife	SE5						X		X								
Magnoliaceae	**Magnolia Family**																	
Liriodendron tulipifera	Tulip Tree	S4						X								X		
Moraceae	**Mulberry Family**																	
Morus alba	White Mulberry	SE5						X	X	X					X	X		
Oleaceae	**Olive Family**																	
Fraxinus americana	White Ash	S4						X	X	X	X							
Fraxinus nigra	Black Ash	S4		T	NS	No schedule	x											
Fraxinus pennsylvanica	Green Ash	S4						X			X		X	X			X	X
Ligustrum vulgare	European Privet	SE5						X		X								
Onagraceae	**Evening-primrose Family**																	
Circaea canadensis	Broad-leaved Enchanter's Nightshade	S5						X						X				
Circaea canadensis ssp. canadensis	Canada Enchanter's Nightshade	S5						X	X	X								
Ludwigia palustris	Marsh Seedbox	S5						X		X								
Oenothera parviflora	Small-flowered Evening-primrose	S5						X								X		
Oenothera perennis	Perennial Evening-primrose	S5						X	X									
Oxalidaceae	**Wood Sorrel Family**																	
Oxalis stricta	Upright Yellow Wood-sorrel	SE5						X	X							X		
Papaveraceae	**Poppy Family**																	
Chelidonium majus	Greater Celandine	SE5						X		X								
Sanguinaria canadensis	Bloodroot	S5						X			X							
Phytolaccaceae	**Pokeweed Family**																	
Phytolacca americana	Common Pokeweed	S4						X						X	X	X		
Plantaginaceae	**Plantain Family**																	
Plantago lanceolata	English Plantain	SE5						X	X					X		X		X
Plantago major	Common Plantain	SE5						X	X					X				
Plantago rugelii	Rugel's Plantain	S5						X								X		
Platanaceae	**Plane-tree Family**																	
Platanus occidentalis	Sycamore	S4						X									X	
Polygonaceae	**Smartweed Family**																	
Fallopia dumetorum	Hedge Bindweed	SEH						X								X		
Persicaria virginiana	Virginia Smartweed	S4						X		X								
Rumex crispus	Curly Dock	SE5						X	X					X		X		
Portulacaceae	**Purslane Family**																	
Claytonia virginica	Narrow-leaved Spring Beauty	S5						X			X							
Primulaceae	**Primrose Family**																	
Lysimachia ciliata	Fringed Loosestrife	S5						X		X								
Ranunculaceae	**Buttercup Family**																	
Anemone virginiana	Tall Anemone	S5						X								X	X	
Anemone virginiana var. virginiana	Tall Anemone	S5?						X	X									
Ficaria verna	Fig-root Buttercup	SE1						X									X	
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	S5						X		X								
Thalictrum dioicum	Early Meadow-rue	S5						X			X							
Thalictrum pubescens	Tall Meadow-rue	S5						X		X								
Rhamnaceae	**Buckthorn Family**																	
Rhamnus cathartica	Common Buckthorn	SE5						X	X	X				X		X		X
Rosaceae	**Rose Family**																	
Fragaria vesca ssp. americana	American Woodland Strawberry	S5						X		X								
Fragaria virginiana	Wild Strawberry	S5						X	X		X			X				
Geum canadense	White Avens	S5						X						X				
Malus pumila	Common Apple	SE4						X								X		
Prunus serotina	Black Cherry	S5						X	X	X	X			X		X		
Prunus virginiana	Choke Cherry	S5						X								X		
Prunus virginiana var. virginiana	Choke Cherry	S5						X		X								
Rosa multiflora	Multiflora Rose	SE5						X	X	X				X		X		
Rubus allegheniensis	Allegheny Blackberry	S5						X	X					X		X		
Rubus idaeus	Common Red Raspberry	S5						X						X				
Rubus idaeus ssp. strigosus	Wild Red Raspberry	S5						X	X	X								
Rubus occidentalis	Black Raspberry	S5						X	X					X		X	X	
Spiraea alba	White Meadowsweet	S5						X								X		
Rubiaceae	**Madder Family**																	
Galium aparine	Cleavers	S5						X		X								
Salicaceae	**Willow Family**																	
Populus balsamifera	Balsam Poplar	S5						X		X								
Populus deltoides	Eastern Cottonwood	S5						X							X	X		X
Populus deltoides ssp. deltoides	Eastern Cottonwood	S5						X	X	X			X					
Populus tremuloides	Trembling Aspen	S5						X	X	X					X			X
Salix alba	White Willow	SE4						X							X		X	X
Salix amygdaloides	Peach-leaved Willow	S5						X		X								
Salix bebbiana	Bebb's Willow	S5						X				X						
Salix discolor	Pussy Willow	S5						X	X									
Salix eriocephala	Heart-leaved Willow	S5						X	X									
Salix euxina	Crack Willow	SE						X		X							X	X
Salix nigra	Black Willow	S4						X		X							X	

Scrophulariaceae	**Figwort Family**																	
Chelone glabra	White Turtlehead	S5						X		X								
Linaria vulgaris	Butter-and-eggs	SE5						X	X									
Verbascum thapsus	Common Mullein	SE5						X	X					X	X			
Solanaceae	**Nightshade Family**																	
Physalis heterophylla	Clammy Ground-cherry	S4						X	X									
Solanum dulcamara	Bittersweet Nightshade	SE5						X	X	X				X		X		
Tiliaceae	**Linden Family**																	
Tilia americana	American Basswood	S5						X		X	X					X	X	
Ulmaceae	**Elm Family**																	
Ulmus americana	American Elm	S5						X	X	X						X	X	
Ulmus pumila	Siberian Elm	SE3						X							X	X		
Urticaceae	**Nettle Family**																	
Boehmeria cylindrica	False Nettle	S5						X		X								
Laportea canadensis	Wood Nettle	S5						X									X	
Urtica dioica	Stinging Nettle	SE2						X						X		X		
Urtica dioica ssp. dioica	European Stinging Nettle	SE2						X		X								
Urtica gracilis	Slender Stinging Nettle	S5						X	X									
Verbenaceae	**Vervain Family**																	
Verbena urticifolia	White Vervain	S5						X		X					X	X		
Violaceae	**Violet Family**																	
Viola sororia	Woolly Blue Violet	S5						X		X								
Vitaceae	**Grape Family**																	
Parthenocissus quinquefolia	Virginia Creeper	S4?						X			X						X	
Parthenocissus vitacea	Thicket Creeper	S5						X	X	X				X		X	X	X
Vitis riparia	Riverbank Grape	S5						X	X	X	X			X	X	X	X	X
Monocotyledons	**Monocots**																	
Alismataceae	**Water-plantain Family**																	
Sagittaria latifolia	Broad-leaved Arrowhead	S5						X		X								
Araceae	**Arum Family**																	
Arisaema triphyllum	Jack-in-the-pulpit	S5						X		X								
Symplocarpus foetidus	Skunk Cabbage	S5						X		X							X	
Cyperaceae	**Sedge Family**																	
Carex aquatilis	Water Sedge	S5						X		X								
Carex blanda	Woodland Sedge	S5						X		X								
Carex cephaloidea	Thin-leaved Sedge	S4						X						X				
Carex molesta	Troublesome Sedge	S4S5						X								X		
Carex retrorsa	Retrorse Sedge	S5						X		X								
Carex rosea	Rosy Sedge	S5						X	X									
Carex stipata	Awl-fruited Sedge	S5						X	X	X								
Carex stricta	Tussock Sedge	S5						X		X								
Iridaceae	**Iris Family**																	
Iris versicolor	Harlequin Blue Flag	S5						X		X								
Lemnaceae	**Duckweed Family**																	
Lemna minor	Lesser Duckweed	S5						X		X	X							
Liliaceae	**Lily Family**																	
Allium canadense	Canada Garlic	S5						X								X		
Asparagus officinalis	Garden Asparagus	SE5						X	X									
Erythronium americanum ssp. americanur	Yellow Trout-lily	S5						X			X							
Maianthemum racemosum	Large False Solomon's Seal	S5						X		X						X		
Trillium grandiflorum	White Trillium	S5						X			X							
Poaceae	**Grass Family**																	
Agrostis gigantea	Redtop	SE5						X								X		
Bromus hordeaceus	Soft Brome	SE2?						X						X				
Bromus inermis	Smooth Brome	SE5						X	X		X			X		X		
Bromus japonicus	Japanese Brome	SE4						X						X				
Dactylis glomerata	Orchard Grass	SE5						X	X	X				X	X	X		
Dichanthelium clandestinum	Deer-tongue Panicgrass	S2						X								X		
Digitaria sanguinalis	Hairy Crabgrass	SE5						X	X									
Elymus repens	Creeping Wildrye	SE5						X						X		X		
Elymus riparius	Eastern Riverbank Wildrye	S4						X								X		
Elymus virginicus	Virginia Wildrye	S5						X						X		X		
Elymus virginicus var. virginicus	Virginia Wildrye	S5						X	X									
Glyceria striata	Fowl Mannagrass	S5						X		X								
Leersia oryzoides	Rice Cutgrass	S5						X		X								
Lolium pratense	Meadow Fescue	SE5						X								X		
Panicum capillare	Common Panicgrass	S5						X	X									
Panicum virgatum	Old Switch Panicgrass	S4						X								X		
Phalaris arundinacea	Reed Canary Grass	S5						X	X	X		X		X	X	X	X	
Phleum pratense	Common Timothy	SE5						X								X		
Poa compressa	Canada Bluegrass	SE5						X						X				
Poa palustris	Fowl Bluegrass	S5						X		X								
Poa pratensis	Kentucky Bluegrass	S5						X								X		X
Schizachyrium scoparium	Little Bluestem	S4						X	X									
Setaria faberi	Giant Foxtail	SE4						X	X									
Setaria pumila	Yellow Foxtail	SE5						X	X									
Setaria viridis	Green Foxtail	SE5						X	X									
Typhaceae	**Cattail Family**																	
Typha angustifolia	Narrow-leaved Cattail	SE5						x										
TOTAL							**4**	**238**	**85**	**92**	**40**	**6**	**4**	**55**	**29**	**93**	**38**	**21**

*NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

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Reptile and Amphibian Species Reported from the Study Area - Simcoe Water Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	ORAA*	NHIC Data**	NRSI Observed	Anuran Call Survey	Turtle Basking Survey	Incidental Observations
		NDMNRF 2021	MECP 2022	Government of Canada 2021	Government of Canada 2021	Government of Canada 2021	Ontario Nature 2019	NDMNRF 2022	NRSI Results from XXXX			
Turtles												
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1	X	X	X			
Chrysemys picta marginata	Midland Painted Turtle	S4		SC	SC	Schedule 1	X					
Emydoidea blandingii	Blanding's Turtle (Great Lakes / St. Lawrer	S3	THR	E	E	Schedule 1	X					
Graptemys geographica	Northern Map Turtle	S3	SC	SC	SC	Schedule 1	X	X				
Snakes												
Pantherophis gloydi pop. 2	Eastern Foxsnake (Carolinian population)	S2	END	E	E	Schedule 1	X					
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1	X					
Lampropeltis triangulum	Milksnake	S4	NAR	SC	SC	Schedule 1	X					
Opheodrys vernalis	Smooth Greensnake	S4					X					
Sistrurus catenatus pop. 1	Massasauga (Great Lakes / St. Lawrence	S3	THR	T	T	Schedule 1	X					
Storeria dekayi	Dekay's Brownsnake	S5	NAR	NAR	NS	No schedule	X					
Storeria occipitomaculata	Red-bellied Snake	S5					X					
Thamnophis sauritus septentrionalis	Northern Ribbonsnake	S4	SC	SC	SC	Schedule 1	X					
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5					X		X			
Salamanders												
Ambystoma laterale	Blue-spotted Salamander	S4					X					
Notophthalmus viridescens viridescens	Red-spotted Newt	S5					X					
Plethodon cinereus	Eastern Red-backed Salamander	S5					X					
Frogs and Toads												
Anaxyrus americanus	American Toad	S5					X		X	X		
Hyla versicolor	Gray Treefrog	S5					X					
Pseudacris crucifer	Spring Peeper	S5					X		X	X		
Lithobates catesbeianus	American Bullfrog	S4					X					
Lithobates clamitans	Green Frog	S5					X		X	X		X
Lithobates palustris	Pickerel Frog	S4	NAR	NAR	NS	No schedule	X					
Lithobates pipiens	Northern Leopard Frog	S5	NAR	NAR	NS	No schedule	X					
Lithobates sylvaticus	Wood Frog	S5					X		X	X		
Total							**24**	**2**	**6**	**4**	**0**	**1**

*ORAA Atlas Square: 17NH54

**NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

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Butterfly Species Reported from the Study Area - Simcoe Water Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Ontario Butterfly Atlas*	NHIC Data**	NRSI Observed
		NDMNRF 2021	MECP 2022	Government of Canada 2021	Government of Canada 2021	Government of Canada 2021	Macnaughton et al. 2022	NDMNRF 2022	NRSI Results from 2019-2022
Hesperiidae	**Skippers**								
Ancyloxypha numitor	Least Skipper	S5					X		
Epargyreus clarus	Silver-spotted Skipper	S4					X		
Erynnis icelus	Dreamy Duskywing	S5					X		
Erynnis juvenalis	Juvenal's Duskywing	S5					X		
Euphyes vestris	Dun Skipper	S5					X		
Hesperia leonardus	Leonard's Skipper	S4					X		
Hesperia sassacus	Indian Skipper	S4					X		
Pholisora catullus	Common Sootywing	S4					X		
Poanes hobomok	Hobomok Skipper	S5					X		
Polites mystic	Long Dash Skipper	S5					X		
Polites peckius	Peck's Skipper	S5					X		
Polites themistocles	Tawny-edged Skipper	S5					X		
Thorybes bathyllus	Southern Cloudywing	S3					X		
Thorybes pylades	Northern Cloudywing	S5					X		
Wallengrenia egeremet	Northern Broken Dash	S5					X		
Papilionidae	**Swallowtails**								
Battus philenor	Pipevine Swallowtail	SNA					X		
Papilio cresphontes	Giant Swallowtail	S4					X		
Papilio glaucus	Eastern Tiger Swallowtail	S5					X		X
Papilio polyxenes	Black Swallowtail	S5					X		
Papilio troilus	Spicebush Swallowtail	S4					X		
Pieridae	**Whites and Sulphurs**								
Colias eurytheme	Orange Sulphur	S5					X		
Colias philodice	Clouded Sulphur	S5					X		
Pieris rapae	Cabbage White	SNA					X		
Pontia protodice	Checkered White	SNA							
Lycaenidae	**Harvesters, Coppers, Hairstreaks, Blues**								
Callophrys henrici	Henry's Elfin	S4					X		
Celastrina sp.	Azure species	SNA					X		
Cupido comyntas	Eastern Tailed Blue	S5					X		
Glaucopsyche lygdamus	Silvery Blue	S5					X		
Lycaena phlaeas	American Copper	S5					X		
Satyrium acadica	Acadian Hairstreak	S4					X		
Satyrium calanus	Banded Hairstreak	S4					X		
Satyrium caryaevorus	Hickory Hairstreak	S4					X		
Satyrium edwardsii	Edwards' Hairstreak	S4					X		
Satyrium liparops	Striped Hairstreak	S5					X		
Nymphalidae	**Brush-footed Butterflies**								
Aglais milberti	Milbert's Tortoiseshell	S5					X		
Boloria selene	Silver-bordered Fritillary	S5					X		
Cercyonis pegala	Common Wood-Nymph	S5					X		
Chlosyne harrisii	Harris's Checkerspot	S4					X		
Chlosyne nycteis	Silvery Checkerspot	S5					X		
Coenonympha tullia	Common Ringlet	S5					X		
Danaus plexippus	Monarch	S2N,S4B	SC	E	SC	Schedule 1	X		X
Euphydryas phaeton	Baltimore Checkerspot	S4					X		
Lethe anthedon	Northern Pearly-Eye	S5					X		
Lethe eurydice	Eyed Brown	S5					X		
Limenitis archippus	Viceroy	S5					X		
Limenitis arthemis arthemis	White Admiral	S5					X		
Limenitis arthemis astyanax	Red-spotted Purple	S5					X		
Megisto cymela	Little Wood-Satyr	S5					X		
Nymphalis antiopa	Mourning Cloak	S5					X		
Nymphalis l-album	Compton Tortoiseshell	S5					X		
Phyciodes cocyta	Northern Crescent	S5					X		
Phyciodes tharos	Pearl Crescent	S4					X		
Polygonia comma	Eastern Comma	S5					X		
Polygonia interrogationis	Question Mark	S5					X		
Polygonia progne	Gray Comma	S5					X		
Speyeria aphrodite	Aphrodite Fritillary	S5					X		
Speyeria cybele	Great Spangled Fritillary	S5					X		
Vanessa atalanta	Red Admiral	S5B					X		
Vanessa cardui	Painted Lady	S5B					X		
Total							**58**	**0**	**2**

*TEA Atlas Square: 17NH54
**NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

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Odonate Species Reported from the Study Area - Simcoe Watery Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Odonate Atlas*	NHIC Data**	NRSI Observed
		NDMNRF 2021	MECP 2022	Government of Canada 2021	Government of Canada 2021	Government of Canada 2021	OOAD 2022	NDMNRF 2022	NRSI Results from 2019-2022
Calopterygidae	**Broadwinged Damselflies**								
Calopteryx maculata	Ebony Jewelwing	S5					X		
Lestidae	**Spreadwings**								
Lestes congener	Spotted Spreadwing	S5					X		
Lestes dryas	Emerald Spreadwing	S5					X		
Lestes rectangularis	Slender Spreadwing	S5					X		
Coenagrionidae	**Narrow-winged Damselflies**								
Argia fumipennis violacea	Violet Dancer	S5					X		
Ischnura verticalis	Eastern Forktail	S5					X		
Aeshnidae	**Darners**								
Aeshna umbrosa	Shadow Darner	S5					X		
Basiaeschna janata	Springtime Darner	S5					X		
Boyeria vinosa	Fawn Darner	S5					X		
Epiaeschna heros	Swamp Darner	S3S4					X		
Nasiaeschna pentacantha	Cyrano Darner	S4					X		
Gomphidae	**Clubtails**								
Arigomphus villosipes	Unicorn Clubtail	S3					X		
Cordulegasteridae	**Spiketails**								
Cordulegaster maculata	Twin-spotted Spiketail	S4					X		
Corduliidae	**Emeralds**								
Epitheca cynosura	Common Baskettail	S5					X		
Somatochlora tenebrosa	Clamp-tipped Emerald	S3					X		
Libellulidae	**Skimmers**								
Celithemis elisa	Calico Pennant	S5					X		
Celithemis eponina	Halloween Pennant	S4					X		
Leucorrhinia intacta	Dot-tailed Whiteface	S5					X		
Libellula luctuosa	Widow Skimmer	S5					X		
Libellula pulchella	Twelve-spotted Skimmer	S5					X		
Libellula quadrimaculata	Four-spotted Skimmer	S5					X		
Libellula semifasciata	Painted Skimmer	S3					X		
Plathemis lydia	Common Whitetail	S5					X		
Sympetrum obtrusum	White-faced Meadowhawk	S5					X		
Sympetrum rubicundulum	Ruby Meadowhawk	S5					X		
Tramea lacerata	Black Saddlebags	S4					X		
Total							**26**	**0**	**0**

**Odonate Atlas Square Numbers: 17NH54*

***NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544*

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Mammal Species Reported from the Study Area - Simcoe Water Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Ontario Mammal Atlas	NHIC Data**	NRSI Observed
		NDMNRF 2021	MECP 2022	Government of Canada 2021	Government of Canada 2021	Government of Canada 2021	Dobbyn 1994	NDMNRF 2022	NRSI Results from 2019-2022
Didelphimorphia	**Opossums**								
Didelphis virginiana	Virginia Opossum	S4					X		
Eulipotyphla	**Shrews, Moles, Hedgehogs, and Allies**								
Blarina brevicauda	Northern Short-tailed Shrew	S5					X		
Condylura cristata	Star-nosed Mole	S5					X		
Parascalops breweri	Hairy-tailed Mole	S4					X		
Sorex cinereus	Masked Shrew	S5					X		
Sorex fumeus	Smoky Shrew	S5					X		
Chiroptera	**Bats**								
Eptesicus fuscus	Big Brown Bat	S4					X		
Lasionycteris noctivagans	Silver-haired Bat	S4					X		
Lasiurus borealis	Eastern Red Bat	S4					X		
Lasiurus cinereus	Hoary Bat	S4					X		
Myotis leibii	Eastern Small-footed Myotis	S2S3	END				X		
Myotis lucifugus	Little Brown Myotis	S3	END	E	E	Schedule 1	X		
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1	X		
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1	X		
Lagomorpha	**Rabbits and Hares**								
Lepus europaeus	European Hare	SNA					X		
Sylvilagus floridanus	Eastern Cottontail	S5					X		X
Rodentia	**Rodents**								
Castor canadensis	Beaver	S5					X		
Glaucomys volans	Southern Flying Squirrel (Great Lakes Pla	S4	NAR	NAR	NS	No schedule	X		
Marmota monax	Woodchuck	S5					X		
Microtus pennsylvanicus	Meadow Vole	S5					X		
Microtus pinetorum	Woodland Vole	S3?	SC	SC	SC	Schedule 1	X		
Mus musculus	House Mouse	SNA					X		
Napaeozapus insignis	Woodland Jumping Mouse	S5					X		
Ondatra zibethicus	Muskrat	S5					X		
Peromyscus leucopus	White-footed Mouse	S5					X		
Peromyscus maniculatus	Deer Mouse	S5					X		
Rattus norvegicus	Norway Rat	SNA					X		
Sciurus carolinensis	Eastern Gray Squirrel	S5					X		X
Tamias striatus	Eastern Chipmunk	S5					X		X
Tamiasciurus hudsonicus	Red Squirrel	S5					X		X
Zapus hudsonius	Meadow Jumping Mouse	S5					X		
Canidae	**Canines**								
Canis latrans	Coyote	S5					X		X
Urocyon cinereoargenteus	Gray Fox	S1	THR	T	T	Schedule 1	X		
Vulpes vulpes	Red Fox	S5					X		
Mephitidae	**Skunks and Stink Badgers**								
Mephitis mephitis	Striped Skunk	S5					X		
Mustelidae	**Weasels and Allies**								
Mustela erminea	Ermine	S5					X		
Mustela frenata	Long-tailed Weasel	S4					X		
Neovison vison	American Mink	S4					X		X
Taxidea taxus jacksoni	American Badger (Southwestern Ontario	S1	END	E	E	Schedule 1	X	X	
Procyonidae	**Raccoons and Allies**								
Procyon lotor	Northern Raccoon	S5					X		X
Artiodactyla	**Deer and Bison**								
Odocoileus virginianus	White-tailed Deer	S5					X		X
Total							**41**	**1**	**8**

*Mammal Atlas Square Numbers: NT54

**NHIC Atlas Squares: 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

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Fish Species Reported from the Study Area - Project NameSimcoe Water Supply EA (Project #2250A)

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Fisheries and Oceans SAR Data	Aquatic Resource Area Data	NHIC Data*	NRSI Observed
		NDMNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	DFO 2022	Government of Ontario 2022	NDMNRF 2022	NRSI Results from 2020
Cyprinidae	**Carps**									
Cyprinus carpio	Common Carp	SNA						x		
Leuciscidae	**Minnows**									
Chrosomus neogaeus	Finescale Dace	S5						x		
Hybognathus hankinsoni	Brassy Minnow	S5						x		
Luxilus cornutus	Common Shiner	S5						x		
Margariscus nachtriebi	Northern Pearl Dace	S5						x		
Notemigonus crysoleucas	Golden Shiner	S5						x		
Pimephales notatus	Bluntnose Minnow	S5	NAR	NAR	NS	No schedule		x		
Pimephales promelas	Fathead Minnow	S5						x		
Rhinichthys atratulus	Blacknose Dace	SNR						x		x
Rhinichthys cataractae	Longnose Dace	S5						x		
Semotilus atromaculatus	Creek Chub	S5						x		x
Catostomidae	**Suckers**									
Catostomus commersonii	White Sucker	S5						x		x
Umbridae	**Mudminnows**									
Umbra limi	Central Mudminnow	S5						x		
Salmonidae	**Trouts and Salmons**									
Salvelinus fontinalis fontinalis	Brook Trout	S5						x		
Gasterosteidae	**Sticklebacks**									
Culaea inconstans	Brook Stickleback	S5						x		x
Cottidae	**Sculpins**									
Cottus bairdii	Mottled Sculpin	S5						x		x
Centrarchidae	**Sunfishes and Basses**									
Ambloplites rupestris	Rock Bass	S5						x		
Lepomis gibbosus	Pumpkinseed	S5						x		
Micropterus salmoides	Largemouth Bass	S5						x		x
Pomoxis nigromaculatus	Black Crappie	S4						x		
Percidae	**Perches and Darters**									
Etheostoma caeruleum	Rainbow Darter	S4						x		
Percina maculata	Blackside Darter	S4						x		
Total							**0**	**22**	**0**	**6**

*NHIC Atlas Square(s): 17NH5748, 5648, 5647, 5547, 5646, 5645, 5545, 5544

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ENGINEERING & ENVIRONMENTAL

Appendix E

Archaeological Reports

Stage 1 Archaeological Assessment Norfolk Well Connection Route (Lots 1-2, Concessions 13-14, Geographical Township of Windham, and Lot 1, Concessions 13-14, Geographical Township of Townsend, County of Norfolk), Norfolk County

Original Report

Prepared for:

Norfolk County
50 Colborne Street South
N3Y 4H3 Simcoe Ontario

Archaeological Licence: P380 (Cooper)
PIF P380-0091-2022
Archaeological Services Inc. File: 22EA-126

15 July 2022

ASI Providing Archaeological & Cultural Heritage Services
528 Bathurst Street Toronto, ONTARIO M5S 2P9
416-966-1069 F 416-966-9723 asiheritage.ca

Executive Summary

Archaeological Services Inc. was contracted by Norfolk County to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Norfolk Well Connection Route project in Norfolk County. This project involves a well connection route. Stage 1 scope involves a corridor following Concession 13 to Fourteenth Street East, westerly on Fourteenth Street East and along Glendale Crescent to Fourteenth Street West and then westerly along Fourteenth Street West to the water reservoir at 154 Fourteenth Street West.

The Stage 1 background study determined two previously registered archaeological sites are located within one kilometre of the Study Area, neither of which are located within 50 metres of the Study Area. The background research and property inspection determined that parts of the Study Area exhibit archaeological potential and will require archaeological assessment.

The following recommendations are made:

1) Parts of the Study Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five metre intervals. Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Project Personnel

- **Senior Project Manager**: Lisa Merritt, MSc. (P094) Partner, Director, Environmental Assessment Division
- **Division Coordinator**: Katrina Thach, BA Hons. (R1225), Associate Archaeologist, Division Coordinator, Environmental Assessment Division
- **Project Administrator**: Catherine Kitchen, BA, Archaeologist, Project Administrator, Environmental Assessment Division
- **Project Director**: Martin S. Cooper, MA (P380), Senior Archaeologist, Senior Manager Northern Ontario Projects
- **Project Manager**: Eliza Brandy, MA (R1109), Associate Archaeologist, Project Manager, Environmental Assessment Division
- **Field Director**: Martin S. Cooper
- **Report Preparation**: Danielle Bella, BA Hons., Archaeologist, Technical Writer, Environmental Assessment Division
- **Graphics**: Robin Latour, MPhil, PDip, Associate Archaeologist, Geomatics Specialist, Operations Division; Jonas Fernandez, MSc (R281), Lead Archaeologist, Manager - Geomatics, Operations Division; Peter Bikoulis, PhD, Archaeologist, GIS Technician, Operation Division
- **Report Review**: Lisa Merritt; Eliza Brandy

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1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by Norfolk County to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Norfolk Well Connection Route project in Norfolk County. This project involves a well connection route as part of the same Norfolk Railway Lands project ASI carried out an assessment for under PIF P1066-0258-2021.

The Stage 1 scope involves former railway lands which currently form part of the Norfolk Sunrise Trail following Concession 13 to Fourteenth Street East. The Study Area includes the Fourteenth Street East, Glendale Crescent and Fourteenth Street West rights-of-way, following Fourteenth Street East westerly along Glendale Crescent to Fourteenth Street West and westerly along Fourteenth Street West to the water reservoir at 154 Fourteenth Street West (Figure 1).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (Ontario Heritage Act, R.S.O. c. O.18, 1990, as amended in 2019) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI 2011).

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act, RSO* (Environmental Assessment Act, R.S.O., 1990 as amended 2020) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the Municipal Engineers' Association document *Municipal Class Environmental Assessment* (Municipal Class Environmental Assessment, 2000, as amended 2015).

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment and property inspection was granted by Norfolk County on June 1, 2022.

1.1.1 Treaties

The Study Area is within Treaty 3, the Between the Lakes Purchase. Following the 1764 Niagara Peace Treaty and the follow-up treaties with Pontiac, the English colonial government considered the Mississaugas to be their allies since they had accepted the Covenant Chain. The English administrators followed the terms of the Royal Proclamation and insured that no settlements were made in the hunting grounds that had been reserved for their use (Johnston, 1964; Lytwyn, 2005). In 1784, under the terms of the "Between the Lakes Purchase" signed by Sir Frederick Haldimand and the Mississaugas, the Crown acquired over one million acres of land in-part spanning westward from near modern day Niagara-on-the-Lake along the south shore of Lake Ontario to modern day Burlington (Aboriginal Affairs and Northern Development Canada, 2016).

1.2 Historical Context

1.2.1 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years before present (B.P.) (Ferris, 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 B.P., the environment had progressively warmed (Edwards & Fritz, 1988) and populations now occupied less extensive territories (Ellis & Deller, 1990).

Between approximately 10,000-5,500 B.P., the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 B.P.; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 B.P. and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 B.P., populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 B.P. and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 B.P., evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). By 1,500 B.P. there is macro botanical evidence for maize in southern Ontario, and it is thought that maize only supplemented people's diet. There is earlier phytolithic evidence for maize in central New York State by 2,300 B.P. - it is likely that once similar analyses are conducted on Ontario ceramic vessels of the same period, the same evidence will be found (Birch & Williamson, 2013, pp. 13–15). As is evident in detailed Anishinaabek ethnographies, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From the beginning of the Late Woodland period at approximately 1,000 B.P., lifeways became more similar to that described in early historical documents. Between approximately 1000-1300 Common Era (C.E.), the communal site is replaced by the village focused on horticulture. Seasonal disintegration of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson, 1990, p. 317). By 1300-1450 C.E., this episodic community disintegration was no longer practised and populations now communally occupied sites throughout the year (Dodd et al., 1990, p. 343). From 1450-1649 C.E. this process continued with the coalescence of these small villages into larger communities (Birch & Williamson, 2013). Through this process, the socio-political organization of the First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed.

By 1600 C.E., the Huron-Wendat communities within Simcoe County had formed the Confederation of Nations encountered by the first European explorers and missionaries. Samuel de Champlain in 1615 reported that a group of Iroquoian-speaking people situated between the Haudenosaunee and the Huron-Wendat were at peace and remained “la nation neutre”. Like the Huron-Wendat, Petun, and Haudenosaunee, the Neutral or Attawandaron people were settled village agriculturalists. In the 1640s, the Attawandaron and the Huron-Wendat (and their Algonquian allies such as the Nippissing and Odawa) were decimated by epidemics and ultimately dispersed by the Haudenosaunee. Shortly afterwards, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. By the 1690s however, the Anishinaabeg were the only communities with a permanent presence in southern Ontario. From the beginning of the eighteenth century to the assertion of British sovereignty in 1763, there was no interruption to Anishinaabeg control and use of southern Ontario.

1.2.2 Post-Contact Settlement

Historically, the Study Area is located in the Geographical Windham Township, County of Norfolk in Lots 1-2 & Concessions 13-14, and in the Geographical Townsend Township, County of Norfolk in Lot 1 & Concessions 13-14.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006).

Windham Township

Windham is bound by Townships Burford to the north (Brant County), Townsend to the east, Charlotteville to the south, and by Norwich and Middleton to the west. The Illustrated Historical Atlas of the County of Norfolk (Page & Co., 1877) shows early settlers largely concentrated in the vicinity of the community of Colborne. The township is well settled and has good land for lumbering and cultivation, including grains, fruits, corn, and potatoes (Smith, 1846).

Town of Simcoe

The Town of Simcoe is 38 kilometres south of Brantford, on the Lynn River. The town was visited by Sir John Graves Simcoe, first lieutenant-governor of Upper Canada, in 1795. Sir John Graves Simcoe made the stop on his journal to establish Fort Norfolk on Fort Erie. Governor Simcoe granted land to potential settlers. Aaron Culver was granted land with provision that he was to build mills. By 1812, a settlement had formed surrounding the saw and grist mills Culver built. The mills were burnt during the War of 1812. Captain Bird, a prominent merchant in the settlement, was deeded some land by Culver. The town was called Birdtown for a while.

Aaron Culver divided his land into village lots between 1819 and 1823, proposing the village be named in remember of the late lieutenant-governor

Simcoe. While Simcoe was chosen, a group of businessmen in the north end favoured Wellington, and a park there commemorates the name. The Simcoe Post Office opened in 1829 with Duncan Campbell as postmaster. In 1836 a courthouse and jail were constructed. Simcoe became the seat of the newly created Talbot District in 1837, and in 1851 Simcoe was incorporated as a village and became a seat of Norfolk County.

A branch of the Great Western Railway was completed from Glencoe through Simcoe to Fort Erie in 1872. A line from Woodstock to Port Dover was built in 1875. These lines cause an increase in Simcoe's population. Simcoe was incorporated as a town in 1878. Dr. John Wilson was the first mayor of Simcoe.

In addition to saw and grist mills, Simcoe's early industries included Cable's Carriage Works and the "alligator tug" tugboat. The alligator tug was created by John West of West, Peachy and Sons and was able to operate on both water and land using cables and winches. The alligator tug was an asset to the lumbering industry. During the Depression, the flue-cured tobacco industry was a saving factor for Simcoe, as was fruit production. These industries drew people to the area. A large tin can manufacturing plant was established around 1930.

Presbyterian minister Reverend Jabez Culver held services in his own log home until a frame church was erected to its south in 1820. This was replaced by a brick church in 1868, known as the Windham Memorial Chapel of the New Connection Methodist Church. A church named the Old Windham Church, which stands present-day, was completed in 1962. The Methodist Church was built in 1840. The three churches united to form the Methodist Church of Canada. The Old Mud Church was constructed in 1843 of clay and straw bricks by the Congregationalists of Simcoe, and destroyed by a fire in 1876. Saint Andrew's Church of Scotland, constructed in 1847, and the Canadian Presbyterian Church, built in 1868, were united in 1876. The united congregation bult St. Paul's Presbyterian Church in 1886. Trinity Anglican Church was originally completed in 1850, and then renovated in 1882. Central School, constructed in 1858, was a Union School offering education to all students of Simcoe until a high school was erected in 1893-4. The South Ward Public School was erected in 1917, and the North Ward School in 1928.

In 1974, Simcoe became part of the Regional Municipality of Haldimand-Norfolk and the town was enlarged to include part of the Townships of Charlotteville, Townsend, Windham, and Woodhouse.

Colborne

Colborne, now a part of the Town of Simcoe, was first settled in 1798. The village was also known as Coulburn (The Church Historian's Press, 2022).

Townsend Township

Townsend Township in Norfolk County is located on the north shore of Lake Erie and has some of the most fertile lands in Ontario. It was settled in the 1790s in the aftermath of the American Revolutionary War (Phelps, 1972). Lieutenant-Governor John Graves Simcoe issued a proclamation on February 7, 1792 to invite prospective settlers with promise of free land grants and United Empire Loyalists and newly-arrived British immigrants fleeing America responded to the call (Mutrie, n.d.). The township, originally named Exeter Township, was renamed by Lieutenant-Governor John Graves Simcoe on August 7, 1794 to Townsend. This was to honour the British Secretary of State, Lord Thomas Townsend (also spelled Townshend). Some of the early settlers to Townsend Township include the Fairchilds, Cooleys, Omsteads, and Collvers (Mutrie, n.d.).

Lake Erie and Northern Railway

Construction of the Lake Erie and Northern Railway began in May 1913. The Canadian Pacific Railway took over the rail line in 1914 and completed its construction in 1916. The Lake Erie and Northern Railway was a more direct connection to the Canadian Pacific Railway for industry, farmers, and passengers between Brantford and Galt. The Lake Erie and Northern Railway and the Grand River Railway were merged under the new organization of the Canadian Pacific Electric Lines, formed in 1931 by the Canadian Pacific Railway. Passenger service was offered until 1955, and freight transportation occurred until the line was converted to diesel in 1961 (Canada-Rail, n.d.).

Norfolk Sunrise Trail

The Norfolk Sunrise Trail is a short 3.8-kilometre multi-use trail between Victoria Street in Simcoe and Concession 13 Townsend, connecting the Lynn Valley Trail to the south and the Waterford Heritage Trail to the north. The Norfolk Sunrise Trail follows the old rail line of the Lake Erie and Northern Railway. During the 1980s, the rails of the Lake Erie and Northern Railway were removed in sections. The Norfolk Sunrise Trail was constructed in 2009 by the Rotary Club of Norfolk Sunrise as a six-foot wide trail. The section between Fourteenth Concession and Argyle Street was upgraded and widened to eight feet in 2013. The trail can be accessed at Concession 13 Townsend, Fourteenth Street East, Davis Street, Queensway East, McCall Street, Wilson Street, and Argyle Street. (Pathways for People, n.d.; Rotary Club of Norfolk Sunrise, 2021).

1.2.3 Map Review

The 1856 *Tremaine's Map of Norfolk County* (Tremaine, 1856), 1877 *Illustrated Historical Atlas of Norfolk County* (Page & Co., 1877), 1909 Topographic Map Simcoe Sheet (Department of Militia and Defence, 1909), 1939 Topographic Map Simcoe Sheet (Department of National Defence, 1939) and 1996 National Topographic System Simcoe Sheet (Natural Resources Canada, 1996) were examined to determine the presence of historic features within the Study Area during the nineteenth and twentieth centuries (Figures 2-6).

The 1856 map (Figure 2) indicates Fourteenth Street West, Fourteenth Street East, Concession 13 Townsend, and Norfolk Street North are historically surveyed roads. Parts of Lot 1, Concession 13 in the Township of Windham off Norfolk Street North were divided into multiple smaller parcels. A brewery is indicated in the southeast corner of Norfolk Street North at Fourteenth Street East. Davis Creek intersects the Study Area at Fourteenth Street West. A tributary of Davis Creek intersects at two points, at Fourteenth Street East and north of Fourteenth Street East.

The 1877 map (Figure 3) shows the settlement of Colborne at the northeast corner of Norfolk Street North at Fourteenth Street East. Two structures and one orchard are immediately adjacent to the Study Area.

The 1909 map (Figure 4) shows three places where water is carried under the roads, and one structure within the Study Area. Four structures are adjacent.

The 1996 map (Figure 5) shows the subdivision of Glendale Crescent and the Old Windham United Church. The Canadian Pacific Railway is within the Study Area between Concession 13 Townsend and Fourteenth Street East. A series of small buildings are shown in a grid pattern adjacent the rail on its east side, closer to Concession 13 Townsend. An orchard is south of Fourteenth Street West.

1.2.4 Aerial and Orthoimagery Review

Historical aerial imagery from 1954 (Hunting Survey Corporation Limited, 1954) and 1964 (Norfolk County, n.d.) were reviewed.

The 1954 imagery (Figure 6) shows the Lake Erie and Northern Electric Railway cutting through agricultural fields east of Norfolk Street North. Davis Creek branches in two south of the Study Area. The western branch intersects the Study Area at Fourteenth Street West. The eastern branch is a straight diagonal branch intersecting the Study Area at Fourteenth Street East and Lake Erie and Northern Electric Railway.

The 1964 imagery (Figure 7) shows a series of 15 small buildings in a grid pattern east of the rail corridor, south of Concession 13 Townsend. Several structures are adjacent west of the rail corridor from Norfolk Street North.

A review of available Google satellite imagery since 2003 shows:

- Earth moving activities at the water treatment plant at 154 Fourteenth Street West in 2006 (Image 19)
- Earth moving activities for the construction of a structure north of Glendale Crescent in 2018 (Image 20)

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Study Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MHSTCI through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

1.3.1 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Study Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 B.P. (Karrow & Warner, 1990, fig. 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G*,* Section 1.3.1).

The Study Area is located within the sand plains of the Norfolk Sand Plain physiographic region of southern Ontario (Chapman & Putnam, 1984). The Norfolk Sand Plain physiographic region is a wedge-shaped feature that extends from the Lake Erie shoreline and tapers northward to a point in Brantford on the Grand River (Chapman & Putnam, 1984). The region encompasses an area of 3,134 square kilometres and consists of sands and silts that were deposited as a delta in glacial Lakes Whittlesey and Warren. A massive discharge of meltwater from the Grand River area entered the lakes between the ice front and the moraines to the northwest, building the delta from west to east as the glacier withdrew, thus covering most of the area west of the Galt Moraine with sand. In the vicinity of the subject property, glaciolactustrine deep water sediments belonging to mainly glacial Lake Warren and younger deposits and consisting of stratified to varved silt and clay, minor sand, are overlain by veneer of sand (Zone 10) (Cowan 1972: Map 2240).

Figure 8 depicts surficial geology for the Study Area. The surficial geology mapping demonstrates that the Study Area is underlain by coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and clay (Ontario Geological Survey, 2010).

Soils in the Study Area consist of (Figure 9):

- Walsher brunisolic grey brown luvisol, well draining
- Brant brunisolic grey brown luvisol, well draining
- Wattford Wattford, well draining
- Fox brunisolic grey brown luvisol, rapid to well draining
- Tuscola gleyed brunisolic grey brown luvisol, imperfect draining
- Alluvium floodplain deposits, variable drainage
- Urban land, variable drainage

The Study Area is intersected by two channelized branches of Davis Creek at Fourteenth Street West (Road 40), Fourteenth Street East, and at the Norfolk Sunrise Trail. The western branch intersecting Fourteenth Street West is the main branch, and the eastern branch splitting of to intersect Fourteenth Street East and the Norfolk Sunrise Trail is a tributary of Davis Creek. Davis Creek is within the Long Point Region watershed. The Long Point Region watershed covers 2,800 square kilometres including most of Norfolk County, and parts of Brant, Elgin, Haldimand, and Oxford counties (Long Point Region Conservation Authority, 2018).

1.3.2 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database maintained by the MHSTCI. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Study Area under review is located in Borden block *AfHb.*

According to the Ontario Archaeological Sites Database, two previously registered archaeological sites are located within one kilometre of the Study Area (MHTSCI 2022). Neither site is located within 50 metres of the Study Area. A summary of the sites is provided below in Table 1.

Table 1: Registered Sites within One Kilometre of the Study Area

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AfHb-1	Cayuga Quarry	Pre-Contact Indigenous	Unknown	Bellamy 1970; Parker 2004

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AfHb-134	David Kotchan	Pre-Contact Indigenous	Unknown	Northeastern Archaeological Associates Limited 1999

1.3.3 Previous Archaeological Assessments

ASI reviewed previous archaeological assessments that detail fieldwork within 50 metres of the Study Area. Only those specific archaeological assessments of direct relevance to the present undertaking other will be included here:

(ASI, 2022) Stage 1 Archaeological Assessment Norfolk Railway Lands (Lots 1-2, Concession 12, Former Townsend Township, County of Norfolk) Norfolk County, Ontario. P1066-0258-2021.

The project area is within 50 metres north of the current Study Area, along the Waterford Heritage Trail. The trail was determined to be disturbed from the construction of the rail line in the 1930s and its subsequent removal in the 1980s, and the construction of a raised granular surface (including the associated slope) for the Waterford Heritage Trail in 2010. The southern entrance was determined to be disturbed due to the late-twentieth century construction of the Hydro One transformer station. Lands beyond the disturbed trail were recommended to require Stage archaeological assessment.

(Parker Archaeological Consulting, 2004) Archaeological Assessment (Stage 1-2): Proposed Northwest Water Treatment Facility, Town of Simcoe, County of Norfolk. P043-017.

The project area is west of the current Study Area, and on the south side of Fourteenth Street West (Road 40) at the Northwest Water Treatment Facility. Test pit survey was conducted at five metre intervals. One positive test pit yielded a single precontact Indigenous ceramic sherd. The report concluded the sherd to be associated with the archaeological site AfHb-1 on the north of Fourteenth Street West (Road 40), registered by Roger Bellamy in 1970. The lawn area where the sherd was encountered was recommended to be protected from any future topsoil disturbances.

2.0 Property Inspection

2.1 Field Methods

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted under the field direction of Martin S. Cooper (P380) of ASI, on June 30, 2022, in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Study Area. It was a systematic visual inspection from publicly accessible lands/public right-of-ways only and did not include excavation or collection of archaeological resources. Fieldwork was conducted when weather conditions were deemed clear with good visibility (partly cloudy with seasonal temperatures), per S & G Section 1.2., Standard 2. Field photography is presented in Section 7.0 (Image 1 to Image 18), and field observations are overlaid onto the existing conditions of the Study Area in Section 8.0 (Figure 10 to Figure 13).

2.2 Current Land Use and Field Conditions

The Study Area follows part of the current Norfolk Sunrise Trail and former railway lands south from Concession 13 Townsend to Fourteenth Street East. The Norfolk Sunrise Trail within the Study Area is a narrow granular surface trail surrounded by trees and agricultural fields (Image 2 to Image 8). The grid of 15 small structures east of the trail seen on the 1964 aerial imagery and the 1996 topographic map are repurposed tobacco kilns (Image 4). The eastern branch of Davis Creek cuts through the Study Area north of Fourteenth Street East at the trail and at the road (Image 9 to Image 10).

Where Davis Creek intersects Fourteenth Street East, there is a steep drop, and the road has metal guardrails. West of the guardrails, this area is residential in nature. Fourteenth Street East is a two-way road which lacks curbs until it meets with Norfolk Road North (Image 11). From Fourteenth Street East the Study Area continues westerly into Glendale Crescent and south along the eastern curve of the crescent to Fourteenth Street West. Glendale Crescent is a two-way road which lacks curbs (Image 12 to Image 13). The crescent creates an oval surrounding the Old Windham Church, which was completed in 1962. Residential properties bound the crescents outer limits. A new house was constructed at 30 Glendale Crescent in 2018.

The Study Area continues west on Fourteenth Street West to the water reservoir at 154 Fourteenth Street West. Fourteenth Street West is a two-way road which lacks curbs. The eastern portion is lined by residential properties. A box concrete culvert allows the western branch of Davis Creek to flow under Fourteenth Street West. The section of road has wooden posts and metal wire fencing at the top of a slope which drops down to the creek. Fourteenth Street West passed through agricultural fields until the westmost portion of the Study Area which has residential housing, farms, and the existing water reservoir.

The Study Area along the Norfolk Sunrise Trail and part of Fourteenth Street West is 30 metres wide. The Study Area along Fourteenth Street East, Glendale Crescent, and parts of Fourteenth Street West is 20 metres wide. The Study Area along the remainder of Fourteenth Street West is 25 metres wide. The Study Area follows the rights-of-way of Fourteenth Street East, Glendale Crescent, and Fourteenth Street West.

3.0 Analysis of Archaeological Potential

The S & G*,* Section 1.3.1, lists criteria that are indicative of archaeological potential. The Study Area meets the following criteria indicative of archaeological potential:

- Previously identified archaeological sites (See Table 1);
- Water sources: primary, secondary, or past water source (Davis Creek);
- Well-drained soils (Walsher, Brant, Wattford, and Fox);
- Proximity to early settlements (Colborne, Simcoe); and
- Early historic transportation routes (Fourteenth Street West/East, Concession 13 Townsend, Norfolk Street North)

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register was consulted and no property within the Study Area is Listed or Designated under the *Ontario Heritage Act*:

The property inspection determined that parts of the Study Area exhibit archaeological potential. These areas will require Stage 2 archaeological assessment prior to any construction activities or other proposed impacts. According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (Image 2 to Image 10, Image 14, Image 15, Image 17, Image 18; Figure 11 to Figure 13: areas highlighted in green).

Part of the Study Area has been subjected to deep soil disturbance events due to the construction of Fourteenth Street West, Fourteenth Street East, and Glendale Crescent right-of-ways, the construction of late twentieth century and early twenty-first century residential development of Glendale Crescent, the construction of the Dennis Creek concrete culvert under Fourteenth Street West, and the construction of the Lake Erie and Northern Electric Railway by 1954 and subsequent removal in the 1980s. According to the S & G Section 1.3.2 these areas do not retain archaeological potential (Image 1 to Image 9, Image 11 to Image 18; Figure 11 to Figure 13: areas highlighted in yellow) and do not require further survey.

3.1 Conclusions

The Stage 1 background study determined two previously registered archaeological sites are located within one kilometre of the Study Area, neither of which are located within 50 metres of the Study Area. The background research and property inspection determined that parts of the Study Area exhibit archaeological potential and will require archaeological assessment (Figure 11 to Figure 13: areas highlighted in green).

4.0 Recommendations

The following recommendations are made:

1) Parts of the Study Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at five metre intervals (Figure 11 to Figure 13: areas highlighted in green). Stage 2 is required prior to any proposed construction activities on these lands;

2) The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3) Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Archaeology Programs Unit of the Ministry of Heritage, Sport, Tourism and Culture Industries should be immediately notified.

The above recommendations are subject to Ministry approval and it is an offence to alter any archaeological site without Ministry of Heritage, Sport, Tourism and Culture Industries concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MHSTCI approval has been received.

5.0 Legislation Compliance Advice

ASI advises compliance with the following legislation:

- This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, RSO 2005, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological field work on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) *of the Ontario Heritage Act*.

- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.
- Archaeological sites recommended for further archaeological field work or protection remain subject to Section 48(1) of the *Ontario Heritage Act* and may not be altered, nor may artifacts be removed from them, except by a person holding an archaeological license.

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7.0 Images

7.1 Field Photography

Image 1 Area is disturbed, no potential

Image 2 Areas beyond disturbed trail require Stage 2 survey

Image 3 Areas beyond disturbed trail require Stage 2 survey

Image 4 Areas beyond disturbed trail require Stage 2 survey

Image 5 Areas beyond disturbed trail require Stage 2 survey

Image 6 Areas beyond disturbed trail require Stage 2 survey

Image 7 Areas beyond disturbed trail require Stage 2 survey

Image 8 Areas beyond disturbed trail require Stage 2 survey

Image 9 Area is disturbed,no potential

Image 10 Banks of Davis Creek require Stage 2 survey

Image 11 Areas beyond disturbed right-of-ways require Stage 2 survey

Image 12 Area is disturbed by the late twentieth and early twenty-first century development of Glendale Crescent

Image 13 Area is disturbed by the late twentieth century development of Glendale Crescent

Image 14 Areas beyond disturbed right-of-ways require Stage 2 survey

Image 15 Areas beyond disturbed right-of-ways require Stage 2 survey

Image 16 Creek has been disturbed by construction of the concrete culvert carrying creek under Fourteenth Street West

Image 17 Areas beyond disturbed right-of-ways require Stage 2 survey

Image 18 Areas beyond disturbed right-of-ways require Stage 2 survey

7.2 Historical Imagery

Image 19 154 Fourteenth Street West in 2006 (Google Earth Pro, 2022)

Image 20 Glendale Crescent in 2018 (Google Earth Pro, 2022)

8.0 Maps

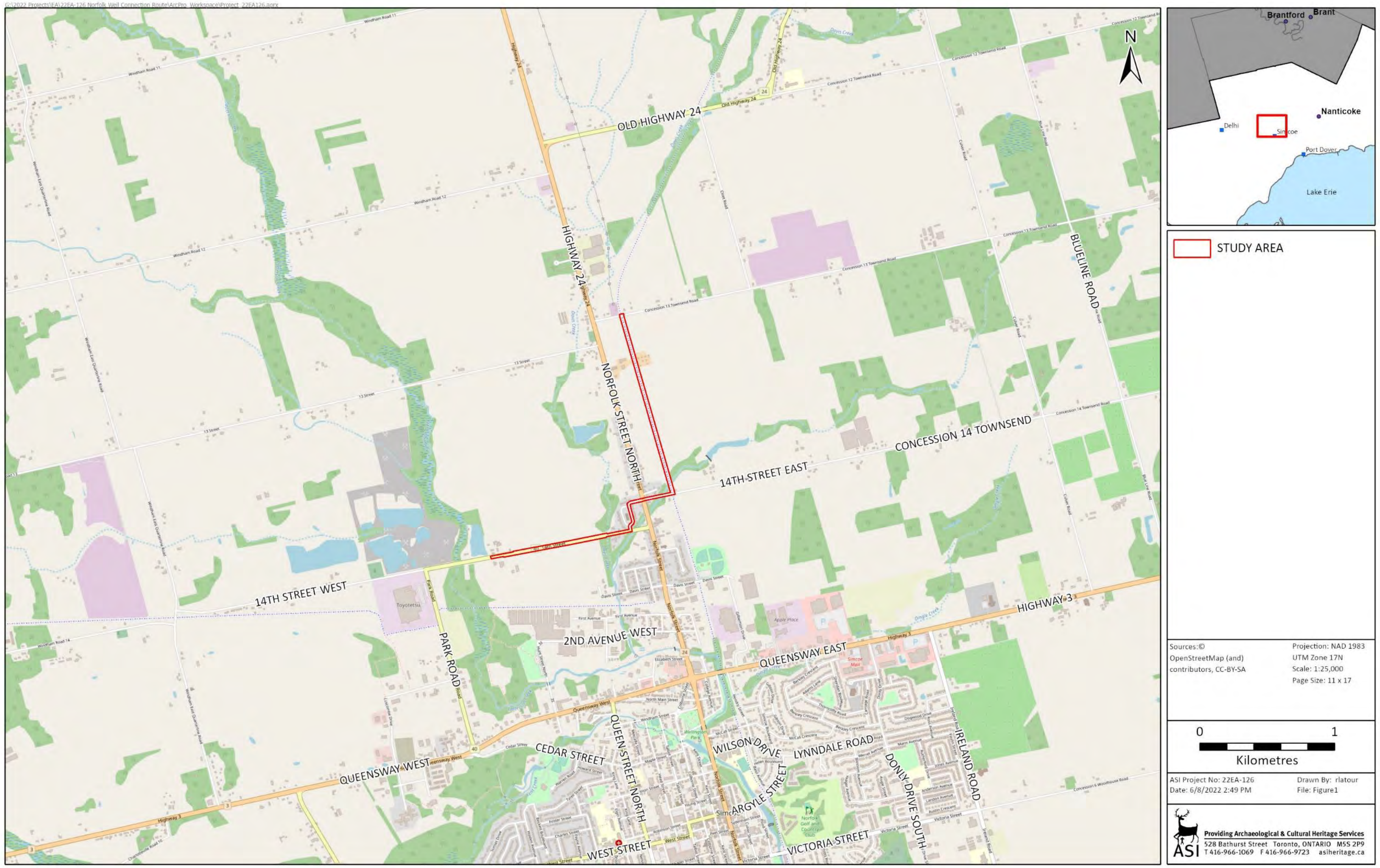

Figure 1 Norfolk Well Connection Route Study Area

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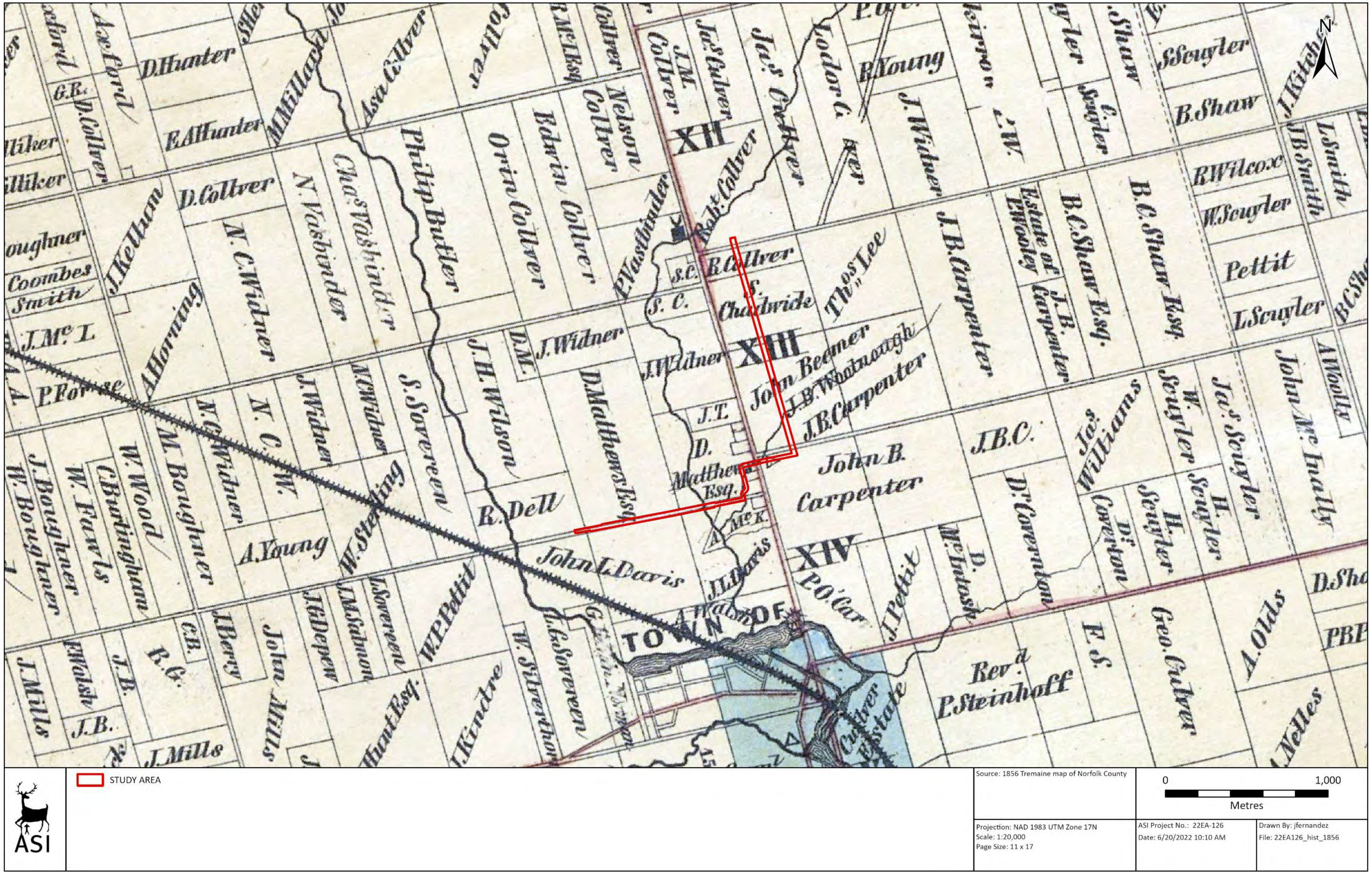
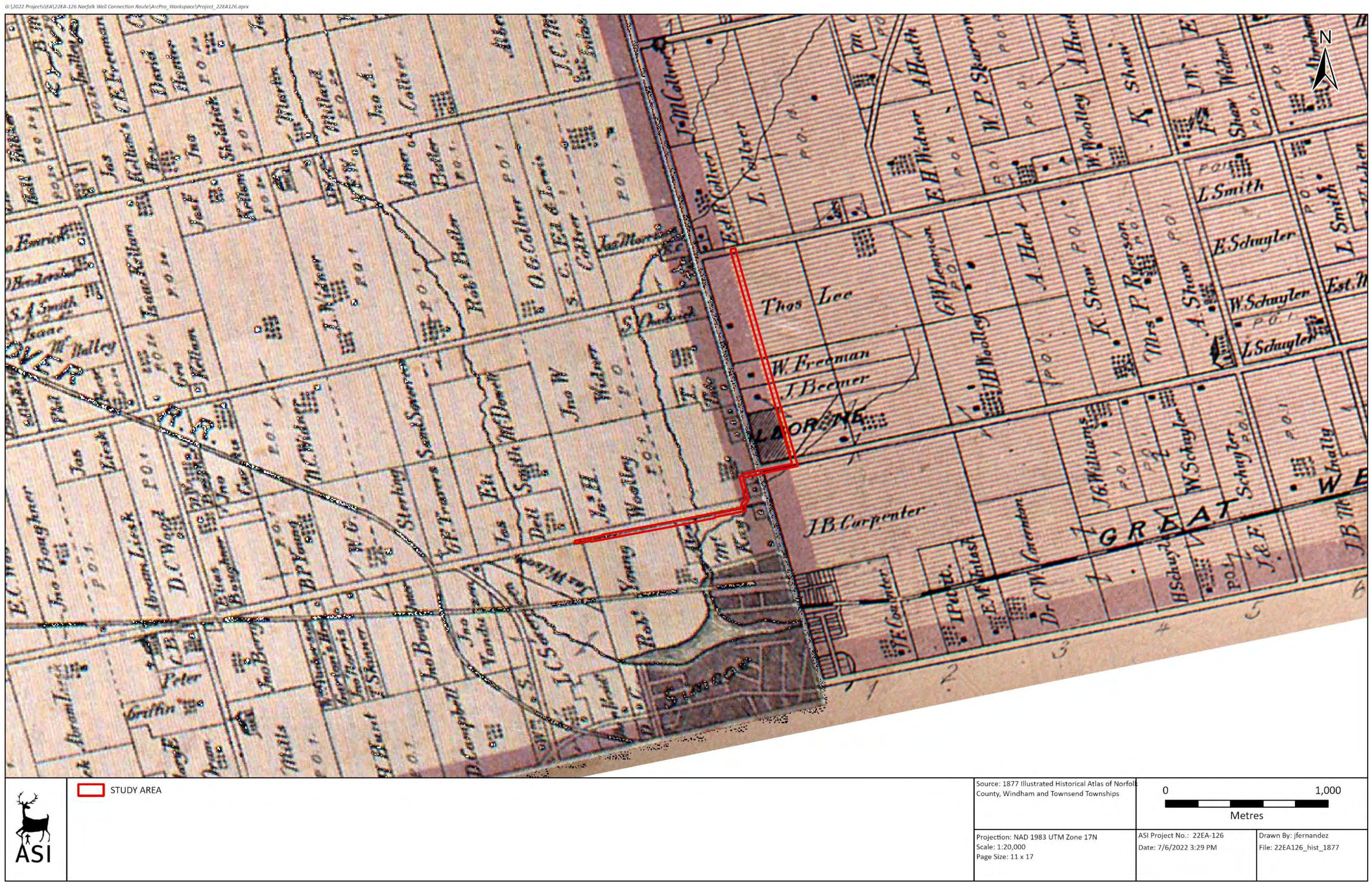


Source: 1856 Tremaine map of Norfolk County

Figure 2 Study Area (Approximate Location) Overlaid on the 1856 Tremaine's Map of Norfolk County



Source: 1877 Illustrated Historical Atlas of Norfolk County, Windham and Townsend Townships

Projection: NAD 1983 UTM Zone 17N
Scale: 1:20,000
Page Size: 11 x 17

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Date: 7/6/2022 3:29 PM

Drawn By: jfernandez
File: 22EA126_hist_1877

Figure 3 Study Area (Approximate Location) Overlaid on the 1877 Illustrated Historical Atlas of Norfolk County

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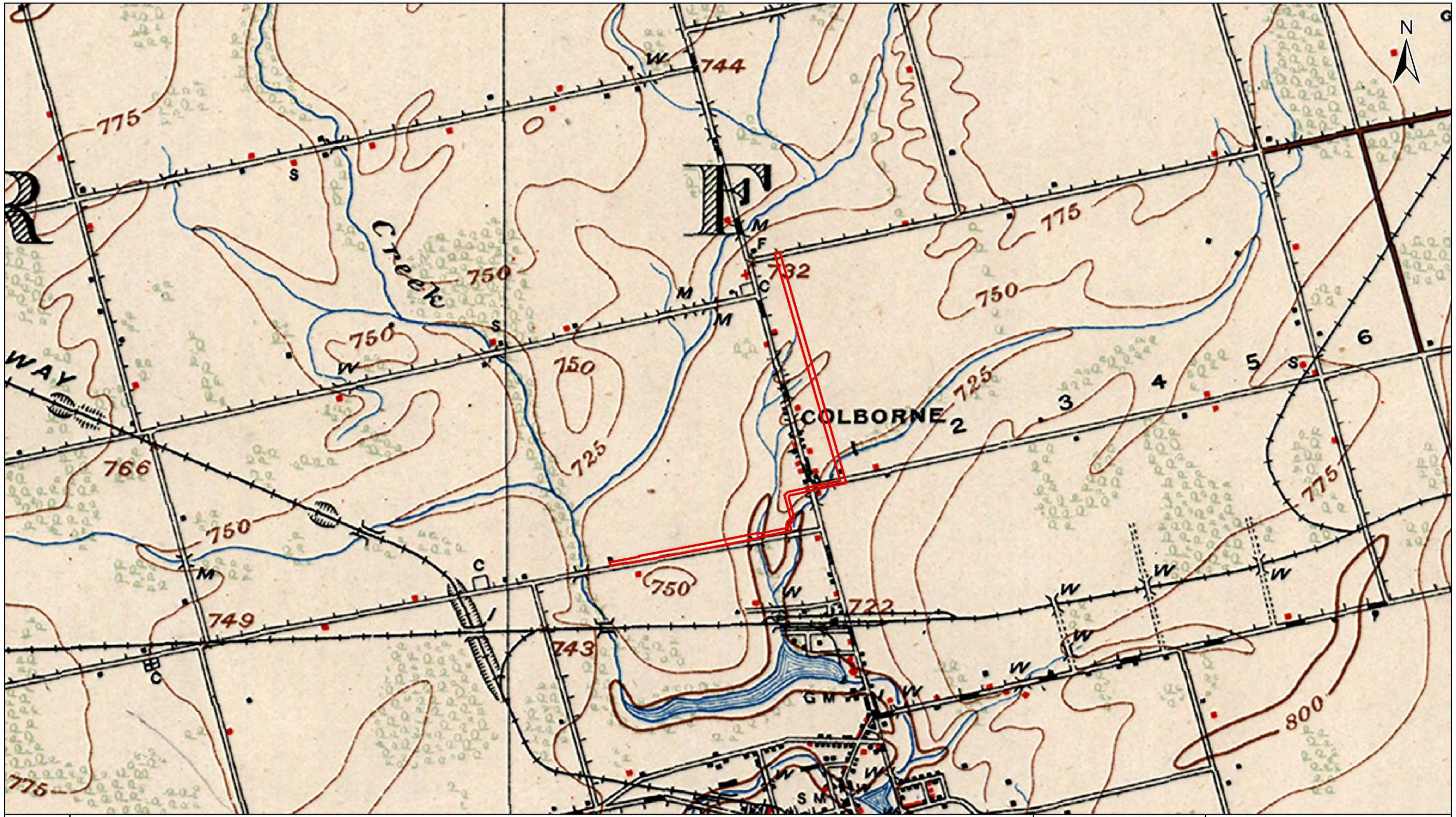

🟥 STUDY AREA

Source: 1909 DMD Topographic map, Simcoe Sheet

0 1,000
Metres

Projection: NAD 1983 UTM Zone 17N
Scale: 1:20,000
Page Size: 11 x 17

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Figure 4 Study Area (Approximate Location) Overlaid on the 1909 Topographic Map Simcoe Sheet

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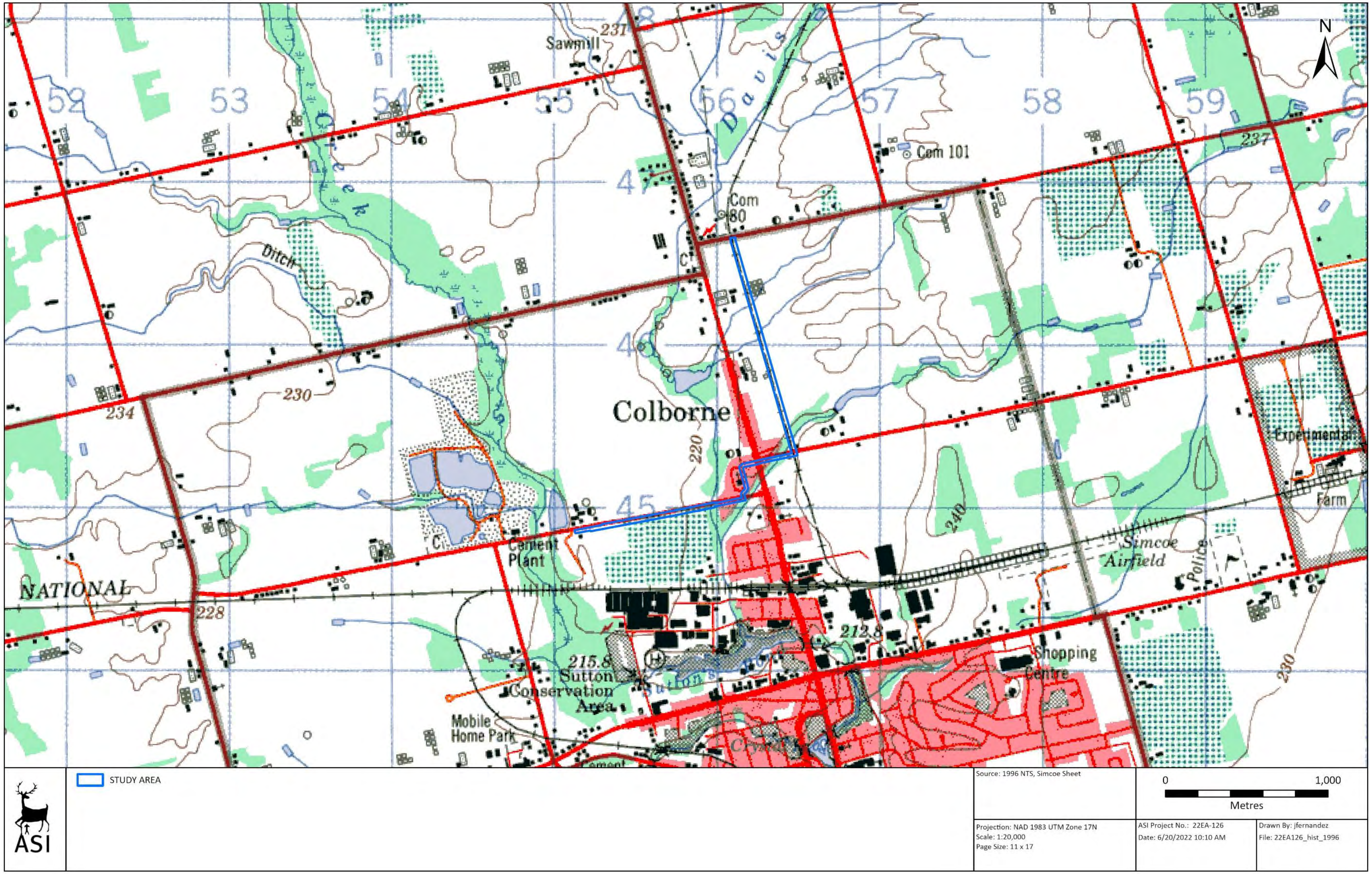

Source: 1996 NTS, Simcoe Sheet

Projection: NAD 1983 UTM Zone 17N
Scale: 1:20,000
Page Size: 11 x 17

ASI Project No.: 22EA-126
Date: 6/20/2022 10:10 AM

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File: 22EA126_hist_1996

Figure 5 Study Area (Approximate Location) Overlaid on the 1996 National Topographic System Simcoe Sheet

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Source: 1954 Aerial Survey of Ontario

Projection: NAD 1983 UTM Zone 17N
Scale: 1:20,000
Page Size: 11 x 17

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Date: 6/20/2022 10:10 AM

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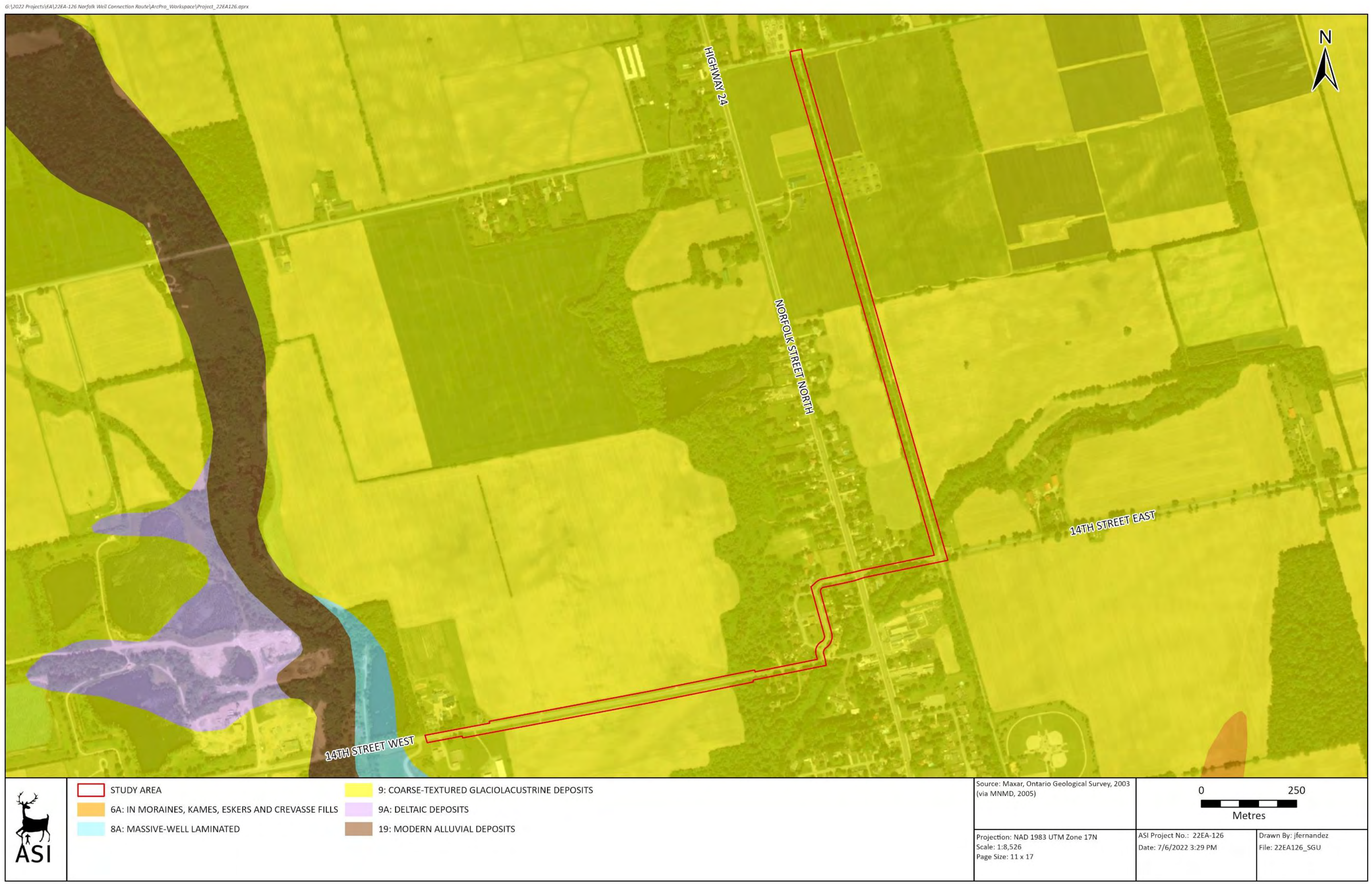
File: 22EA126_hist_1954

Figure 6 Study Area (Approximate Location) Overlaid on the 1954 Aerial Photography

Figure 7 Study Area (Approximate Location) Overlaid on the 1964 Aerial Photography



Source: Maxar, Ontario Geological Survey, 2003 (via MNMD, 2005)

Projection: NAD 1983 UTM Zone 17N
Scale: 1:8,526
Page Size: 11 x 17

ASI Project No.: 22EA-126
Date: 7/6/2022 3:29 PM

Drawn By: jfernandez
File: 22EA126_SGU

Figure 8 Study Area – Surficial Geology

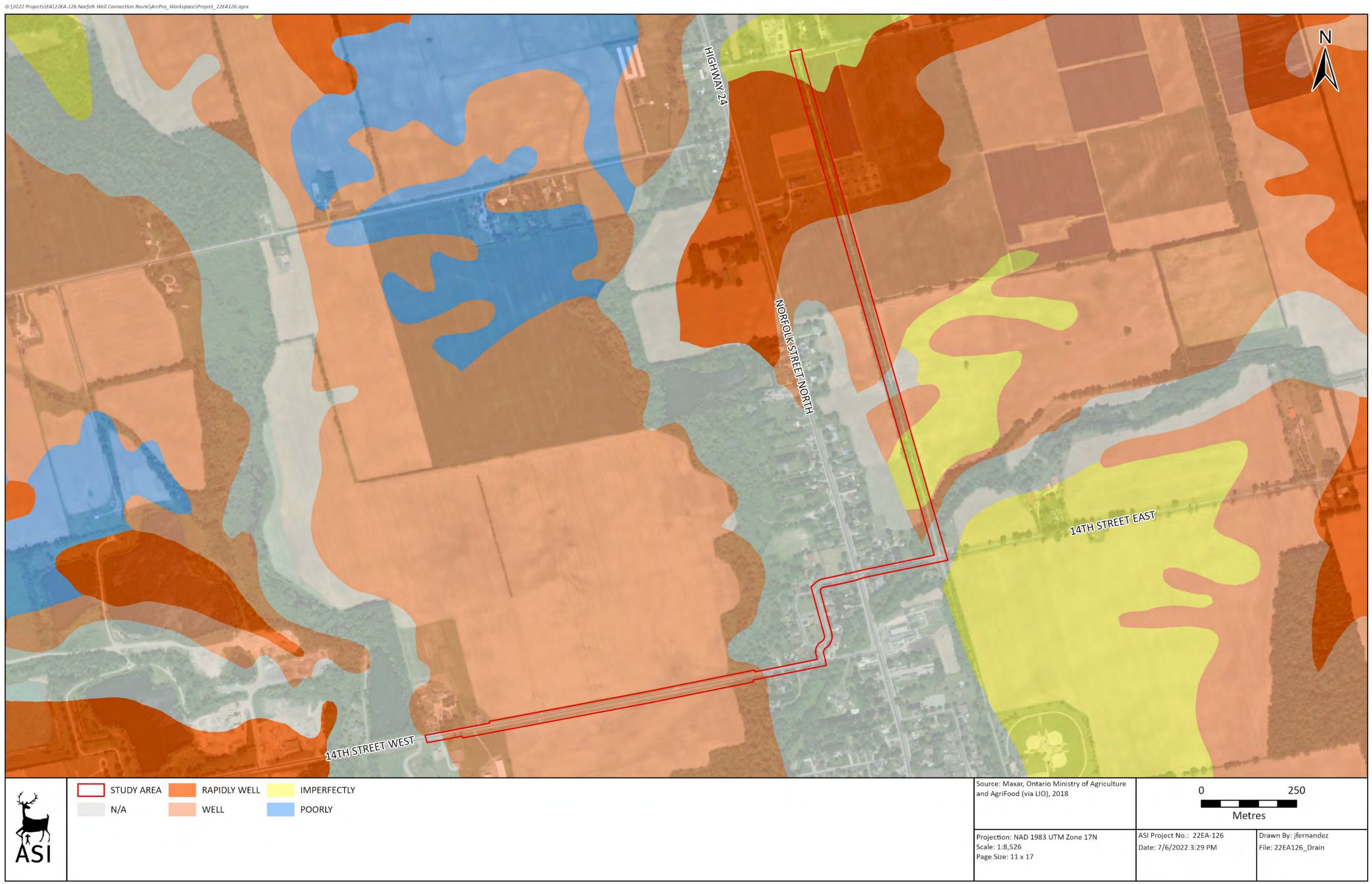


Figure 9 Study Area – Soil Drainage

Source: Maxar

Figure 10 Norfolk Well Connection Route – Results of Stage 1 (Key Map)

Figure 11 Norfolk Well Connection Route – Results of Stage 1 (Sheet 1)

Figure 12 Norfolk Well Connection Route – Results of Stage 1 (Sheet 2)

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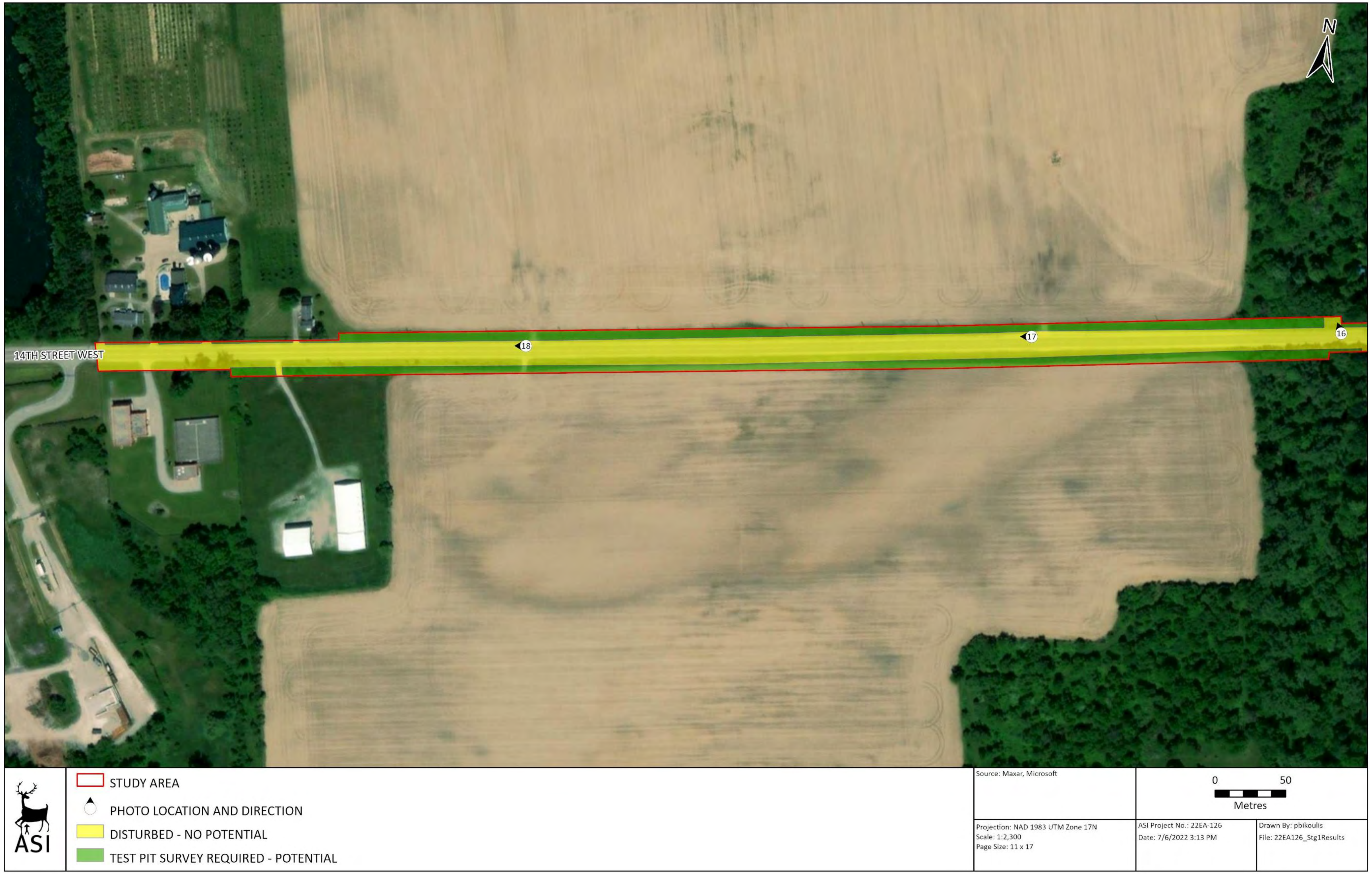

Source: Maxar, Microsoft

Projection: NAD 1983 UTM Zone 17N
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Date: 7/6/2022 3:13 PM

Drawn By: pbikoulis
File: 22EA126_Stg1Results

Figure 13 Norfolk Well Connection Route – Results of Stage 1 (Sheet 3)

Ministry of Heritage, Sport, Tourism, and Culture Industries

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May 3, 2022

Jessica Lytle (P1066)
ASI Archaeological and Cultural Heritage Services
200 - 2321 Fairview Burlington ON L7R 2E3

RE: Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "Stage 1 Archaeological Assessment Norfolk Railway Lands (Lots 1-2, Concession 12, Former Townsend Township, County of Norfolk) Norfolk County, Ontario", Dated Feb 22, 2022, Filed with MHSTCI Toronto Office on N/A, MHSTCI Project Information Form Number P1066-0258-2021, MHSTCI File Number 0015524

Dear Ms. Lytle:

The above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18, has been entered into the Ontario Public Register of Archaeological Reports without technical review.[1]

Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require further information, please do not hesitate to send your inquiry to Archaeology@Ontario.ca

cc. Archaeology Licensing Officer
Scott Zerbes,Norfolk County
Miranda Brunton,City of Hamilton

[1] *In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.*

Stage 1 Archaeological Assessment
Norfolk Railway Lands
(Lots 1-2, Concession 12, Former Townsend Township, County of Norfolk)
Norfolk County, Ontario

Original Report

Prepared for:

The Corporation of Norfolk County

60 Colborne Street South

Simcoe, Ontario, N3Y 4H3

Archaeological Licence: P1066 (Lytle)

PIF P1066-0258-2021

Archaeological Services Inc. File: 21EA-011

22 February 2022

ASI
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Executive Summary

Archaeological Services Inc. (ASI) was contracted by Norfolk County to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Former Norfolk Railway Lands Purchase in Norfolk County. This project involves former railway lands that currently form part of the Waterford Heritage Trail.

Stage 1 scope involves the portion of former railway lands which run east of Highway 24, west of Cloet Road and are bounded by Concession 13 Townsend and Old Highway 24 to the south and north.

The Stage 1 background study determined three archaeological sites are located within one kilometre of the Study Area, none of which are within 50 metres. The property inspection determined parts of the Study Area retain archaeological potential and will require Stage 2 Survey.

The following recommendations are made:

1 Parts of the Study Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit/pedestrian survey at five metre intervals, where appropriate. Stage 2 is required prior to any proposed construction activities on these lands;

2 The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3 Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

Project Personnel

- **Senior Project Manager**: Lisa Merritt, MSc. (P094) Partner, Director, Environmental Assessment Division
- **Project Coordinator**: Katrina Thach, Hon. BA (R1225), Associate Archaeologist, Project Coordinator, Environmental Assessment Division
- **Project Director**: Jessica Lytle, MSc (P1066), Lead Archaeologist, Project Manager, Environmental Assessment Division
- **Project Manager**: Johanna Kelly, MSc (P1017), Associate Bioarchaeologist, Project Manager, Environmental Assessment Division
- **Field Director**: Doug Todd (R055), Associate Archaeologist, Analyst - Laboratory and Fieldwork Services, Operations Division
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- **Graphics**: Andrew Clish, BES (P046), Senior Archaeologist, Senior Field Director, Laboratory and Fieldwork Services, Operations Division; Carolyn Nettleton, BA, Archaeologist, GIS Technician, Operation Division; Adam Burwell, MSc, Archaeologists, Geomatics Specialist, Operations Division
- **Report Reviewer**: Johanna Kelly; Lisa Merritt

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1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by Norfolk County to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Former Norfolk Railway Lands Purchase in Norfolk County. This project involves former railway lands, owned by Infrastructure Ontario that currently form part of the Waterford Heritage Trail.

Stage 1 scope involves the portion of former railway lands which run east of Highway 24, west of Cloet Road and are bounded by Concession 13 Townsend and Old Highway 24 to the south and north (Figure 1).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (Ontario Heritage Act, R.S.O. c. O.18, 1990, as amended in 2019) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Heritage, Sport, Tourism and Culture Industries (M.H.S.T.C.I., 2011).

1.1 Development Context

This project has been triggered by Infrastructure Ontario's internal due diligence process as per the *S&Gs for the Conservation of Provincial Heritage Properties*, the Provincial Policy Statement and in accordance with Ontario Regulations 9/06 and 10/06.

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment and property inspection was granted by Norfolk County on September 27, 2021.

1.1.1 Treaties and Traditional Territories

The Study Area is within Treaty 3, the Between the Lakes Purchase. Following the 1764 Niagara Peace Treaty and the follow-up treaties with Pontiac, the English colonial government considered the Mississaugas to be their allies since they had accepted the Covenant Chain. The English administrators followed the terms of the Royal Proclamation and insured that no settlements were made in the hunting grounds that had been reserved for their use (Johnston, 1964; Lytwyn, 2005). In 1784, under the terms of the "Between the Lakes Purchase" signed by Sir Frederick Haldimand and the Mississaugas, the Crown acquired over one million acres of land in-part spanning westward from near modern day Niagara-on-the-Lake along the south shore of Lake Ontario to modern day Burlington (Aboriginal Affairs and Northern Development Canada, 2016).

1.2 Historical Context

1.2.1 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years before present (B.P.) (Ferris, 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 B.P., the environment had progressively warmed (Edwards & Fritz, 1988) and populations now occupied less extensive territories (Ellis & Deller, 1990).

Between approximately 10,000-5,500 B.P., the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 B.P.; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 B.P. and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 B.P., populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 B.P. and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 B.P., evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). By 1,500 B.P. there is macro botanical evidence for maize in southern Ontario, and it is thought that maize only supplemented people's diet. There is earlier phytolithic evidence for maize in central New York State by 2,300 B.P. - it is likely that once similar analyses are conducted on Ontario ceramic vessels of the same period, the same evidence will be found (Birch & Williamson, 2013, pp. 13–15). As is evident in detailed Anishinaabek ethnographies, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From the beginning of the Late Woodland period at approximately 1,000 B.P., lifeways became more similar to that described in early historical documents. Between approximately 1000-1300 Common Era (C.E.), the communal site is replaced by the village focused on horticulture. Seasonal disintegration of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson, 1990, p. 317). By 1300-1450 C.E., this episodic community disintegration was no longer practised and populations now communally occupied sites throughout the year (Dodd et al., 1990, p. 343). From 1450-1649 C.E. this process continued with the coalescence of these small villages into larger communities (Birch & Williamson, 2013). Through this process, the socio-political organization of the First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed.

By 1600 C.E., the Huron-Wendat communities within Simcoe County had formed the Confederation of Nations encountered by the first European explorers and missionaries. Samuel de Champlain in 1615 reported that a group of Iroquoian-speaking people situated between the Haudenosaunee and the Huron-Wendat were at peace and remained “la nation neutre”. Like the Huron-Wendat, Petun, and Haudenosaunee, the Neutral or Attawandaron people were settled village agriculturalists. In the 1640s, the Attawandaron and the Huron-Wendat (and their Algonquian allies such as the Nippissing and Odawa) were decimated by epidemics and ultimately dispersed by the Haudenosaunee. Shortly afterwards, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. By the 1690s however, the Anishinaabeg were the only communities with a permanent presence in southern Ontario. From the beginning of the eighteenth century to the assertion of British sovereignty in 1763, there was no interruption to Anishinaabeg control and use of southern Ontario.

1.2.2 Post-Contact Settlement

Historically, the Study Area is located in the Former Townsend Township, County of Norfolk in Lots 1-2 & Concession 12.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006).

Townsend Township

Townsend Township in Norfolk County is located on the north shore of Lake Erie and has some of the most fertile lands in Ontario. It was settled in the 1790s in the aftermath of the American Revolutionary War (Phelps, 1972). Lieutenant-Governor John Graves Simcoe issued a proclamation on February 7, 1792 to invite prospective settlers with promise of free land grants and United Empire Loyalists and newly-arrived British immigrants fleeing America responded to the call (Mutrie, n.d.). The township, originally named Exeter Township, was renamed by Lieutenant-Governor John Graves Simcoe on August 7, 1794 to Townsend. This was to honour the British Secretary of State, Lord Thomas Townsend (also spelled Townshend). Some of the early settlers to Townsend Township include the Fairchilds, Cooleys, Omsteads, and Collvers (Mutrie, n.d.).

Bloomsburg

Bloomsburg was named after the Town of Bloomsburg in Pennsylvania, the hometown of William Kitchen and the Schylers, early settlers in the community. A post office was opened in 1853 and the community was part of Townsend Township in Norfolk County until part of the township, including Bloomsburg, was annexed by the City of Nanticoke in 1974 in the newly created Regional Municipality of Haldimand-Norfolk (now Norfolk County) (Mika & Mika, 1977).

Waterford Heritage Trail

The Waterford Heritage Trail is a multi-season trail 19-kilometre-long trail following the old rail line of the Lake Erie and Northern Railway, and features asphalt and granular surfaces (Waterford Heritage Trails and Shadow Lake Park, n.d.-b). Construction of the Lake Erie and Northern Railway began in May 1913. The Canadian Pacific Railway took over the rail line in 1914 and completed its construction in 1916. The Lake Erie and Northern Railway was a more direct connection to the Canadian Pacific Railway for industry, farmers, and passengers between Brantford and Galt. The Lake Erie and Northern Railway and the Grand River Railway were merged under the new organization of the Canadian Pacific Electric Lines, formed in 1931 by the Canadian Pacific Railway. Passenger service was offered until 1955, and freight transportation occurred until the line was converted to diesel in 1961 (*Lake Erie and Northern Railway*, n.d.).

During the 1980s, the rails of the Lake Erie and Northern Railway were removed in sections. In 2000, a Waterford group was sought to form a trail using the old Lake Erie and Northern Railway from Waterford to Simcoe. Construction of the trail began in 2004 (Waterford Heritage Trails and Shadow Lake Park, n.d.-a).

1.2.3 Map Review

The 1856 *Tremaine's Map of Norfolk County* (Tremaine, 1856), 1877 *Illustrated Historical Atlas of Norfolk County* (Page & Co., 1877), 1909 Topographic Map Simcoe Sheet (Department of Militia and Defence, 1909), 1939 Topographic Map Simcoe Sheet (Department of National Defence, 1939) and 1996 National Topographic System Simcoe Sheet (Natural Resources Canada, 1996) were examined to determine the presence of historic features within the Study Area during the nineteenth and twentieth centuries (Figures 2-6).

The 1856 and 1877 maps show that Concession 13 Townsend, Old Highway 24, and Highway 24 were historically surveyed road allowances. The Study Area is within agricultural land. A creek is shown running parallel and intersecting the Study Area. The 1877 map shows the community of Bloomburg to the northeast.

The 1909 map depicts Old Highway 24 and Concession 13 Townsend and having telegraph or telephone lines. A branch is shown to divert from the creek, and both the branch and main section of creek intersect the Study Area. Cloet Road, to the east of the Study Area, is depicted. By 1939, the Lake Erie and Northern Electric Railway is illustrated within the Study Area. Old Highway 24 and Highway 24 are shown as wide paved roads.

The 1996 map labels the creek as Davis Creek. North of Concession 13 Townsend, one structure is shown adjacent the Study Area to the east, and an electric facility is shown to the west.

1.2.4 Aerial and Orthoimagery Review

Historical aerial imagery from 1954 (Hunting Survey Corporation Limited, 1954) indicates the Study Area is within agricultural fields and follows the Lake Erie and Northern Electric Railway right of way.

A review of available Google satellite imagery since 2003 shows construction of a granular surface for the Waterford Heritage Trail in 2010 (Images 11-12).

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Study Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the M.H.S.T.C.I. through “Ontario’s Past Portal”; published and unpublished documentary sources; and the files of ASI.

1.3.1 Current Land Use and Field Conditions

The Study Area is located along part of the current Waterford Heritage Trail and former railway lands. The Study Area runs east of Highway 24, west of Cloet Road and is bounded by Concession 13 Townsend and Old Highway 24 to the south and north.

The Waterford Heritage Trail includes a granular surface trail surrounded by trees and agricultural fields. A channelized and culverted section of Davis Creek flows alongside the former rail lands and passed underneath it via a culvert at the north end of the Study Area. A house and shed are adjacent the trail to the east on the northern side of Concession 13 Townsend, while a transformer station is located west of the trail.

1.3.2 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Study Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 BP (Karrow & Warner, 1990, p. Figure 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G*,* Section 1.3.1).

The Study Area is located within the sand plains of the Norfolk Sand Plain physiographic region of southern Ontario (Chapman & Putnam, 1984). The

Norfolk Sand Plain physiographic region is a wedge-shaped feature that extends from the Lake Erie shoreline and tapers northward to a point in Brantford on the Grand River (Chapman & Putnam, 1984). The region encompasses an area of 3,134 square kilometres and consists of sands and silts that were deposited as a delta in glacial Lakes Whittlesey and Warren. A massive discharge of meltwater from the Grand River area entered the lakes between the ice front and the moraines to the northwest, building the delta from west to east as the glacier withdrew, thus covering most of the area west of the Galt Moraine with sand. In the vicinity of the subject property, glaciolactustrine deep water sediments belonging to mainly glacial Lake Warren and younger deposits and consisting of stratified to varved silt and clay, minor sand, are overlain by veneer of sand (Zone 10) (Cowan 1972: Map 2240).

Figure 8 depicts surficial geology for the Study Area. The surficial geology mapping demonstrates that the Study Area is underlain by coarse-textured glaciolacustrine deposits of sand, gravel, minor silt and clay (Ontario Geological Survey, 2010).

Soils in the Study Area consist of Wattford, which is well draining; Colwood with poor drainage; Tuscola with imperfect drainage; and Alluvium with variable drainage (Figure 9).

The Study Area is intersected by a channelized section of Davis Creek at two points. Davis Creek is within the Long Point Region watershed. The Long Point Region watershed covers 2,800 square kilometres including most of Norfolk County, and parts of Brant, Elgin, Haldimand, and Oxford counties (Long Point Region Conservation Authority, 2018).

1.3.3 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (O.A.S.D.) maintained by the M.H.S.T.C.I. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Study Area under review is located in Borden block *AfHb.*

According to the O.A.S.D., three previously registered archaeological sites are located within one kilometre of the Study Area, none of which are located within 50 metres (M.H.S.T.C.I., 2022). A summary of the sites is provided below in Table 1.

Table 1: Registered Sites within One Kilometre of the Study Area

Borden number	Site Name	Temporal/ Cultural Affiliation	Site type	Researcher
AfHb-133	Robert Lee	Pre-Contact Indigenous	Unknown	Northeastern Archaeological Associates Limited 1999
AfHb-134	David Kotchan	Pre-Contact Indigenous	Unknown	Northeastern Archaeological Associates Limited 1999
AfHb-153	Not applicable	Euro-Canadian	Farmstead	The Archaeologists Inc. 2014

1.3.4 Previous Archaeological Assessments

According to the background research, no previous report details fieldwork within 50 metres of the Study Area.

2.0 Field Methods

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted under the field direction of Doug Todd (R055) of ASI, on November 16, 2021, in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Study Area. It was a systematic visual inspection from publicly accessible lands/public right-of-ways only and did not include excavation or collection of archaeological resources. Fieldwork was conducted when weather conditions were deemed clear with good visibility (overcast and 15 degrees Celsius), per S & G Section 1.2., Standard 2. Field observations are compiled onto the existing conditions of the Study Area in Section 8.0 (Figure 10) and associated photographic plates are presented in Section 7.0 (Images 1-10).

3.0 Analysis and Conclusions

The historical and archaeological contexts have been analyzed to help determine the archaeological potential of the Study Area. Results of the analysis of the Study Area property inspection and background research are presented in Section 3.1.

3.1 Analysis of Archaeological Potential

The S & G*,* Section 1.3.1, lists criteria that are indicative of archaeological potential. The Study Area meets the following criteria indicative of archaeological potential:

- Previously identified archaeological sites (See Table 1);
- Water sources: primary, secondary, or past water source (Davis Creek);
- Early historic transportation routes (Old Highway 24, Highway 24, Concession 13 Townsend);
- Proximity to early settlements (Bloomsburg); and
- Well-drained soils (Wattford).

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register was consulted and no property within the Study Area is Listed or Designated under the Ontario Heritage Act:

These criteria are indicative of potential for the identification of archaeological resources, depending on soil conditions and the degree to which soils have been subject to deep disturbance.

The property inspection determined that parts of the Study Area exhibit archaeological potential. These areas will require Stage 2 archaeological assessment prior to any construction activities. According to the S & G Section 2.1.1, pedestrian survey is required in actively or recently cultivated fields (Images 7-8; Figure 10: areas highlighted in orange). According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (Images 1-6, 9; Figure 10: areas highlighted in green).

The remainder of the Study Area has been subjected to deep and extensive soil disturbance events including: the late-twentieth century construction of the Hydro One transformer station; the construction of the rail line in the 1930s and its subsequent removal in the 1980s; the channelization of Davis Creek to flow via culvert below the rail bed; and the construction of a raised granular surface (including the associated slope) for the Waterford Heritage Trail in 2010. According to the S & G Section 1.3.2 these areas do not retain archaeological potential (Images 1-4, 6-10; Figure 10: areas highlighted in yellow) and do not require further survey.

3.2 Conclusions

The Stage 1 background study determined three archaeological sites are located within one kilometre of the Study Area, none of which are within 50 metres. The property inspection determined parts of the Study Area retain archaeological potential and will require Stage 2 Survey (Images 1-9; Figure 10: areas highlighted in orange and green).

4.0 Recommendations

The following recommendations are made:

1 Parts of the Study Area exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit/pedestrian survey at five metre intervals, where appropriate (Images 1-9; Figure 10: areas highlighted in orange and green). Stage 2 is required prior to any proposed construction activities on these lands;

2 The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

3 Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the Ministry of Heritage, Sport, Tourism and Culture Industries should be immediately notified.

The above recommendations are subject to Ministry approval and it is an offence to alter any archaeological site without Ministry of Heritage, Sport, Tourism and Culture Industries concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of M.H.S.T.C.I. approval has been received.

5.0 Legislation Compliance Advice

ASI advises compliance with the following legislation:

- This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, RSO 2005, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological field work on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the Ontario Heritage Act.

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act.

- The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the

Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.

- Archaeological sites recommended for further archaeological field work or protection remain subject to Section 48(1) of the Ontario Heritage Act and may not be altered, nor may artifacts be removed from them, except by a person holding an archaeological license.

6.0 Bibliography and Sources

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7.0 Images

7.1 Field Photography

Image 1 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed and parking area require Stage 2 survey

Image 2 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 3 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 4 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 5 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 6 Waterford Heritage Trail; Grassed areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 7 Waterford Heritage Trail; Area beyond disturbed trail/former rail bed requires Stage 2 survey

Image 8 Waterford Heritage Trail; Areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 9 Waterford Heritage Trail; Grassed areas beyond disturbed trail/former rail bed require Stage 2 survey

Image 10 Waterford Heritage Trail; Area is disturbed, no potential

7.2 Historical Imagery

Image 11: Aerial image in 2003 of the Study Area (Google Earth Pro, 2021)

Image 12: Aerial image in 2010 of the Waterford Heritage Trail (Google Earth Pro, 2021)

8.0 Maps

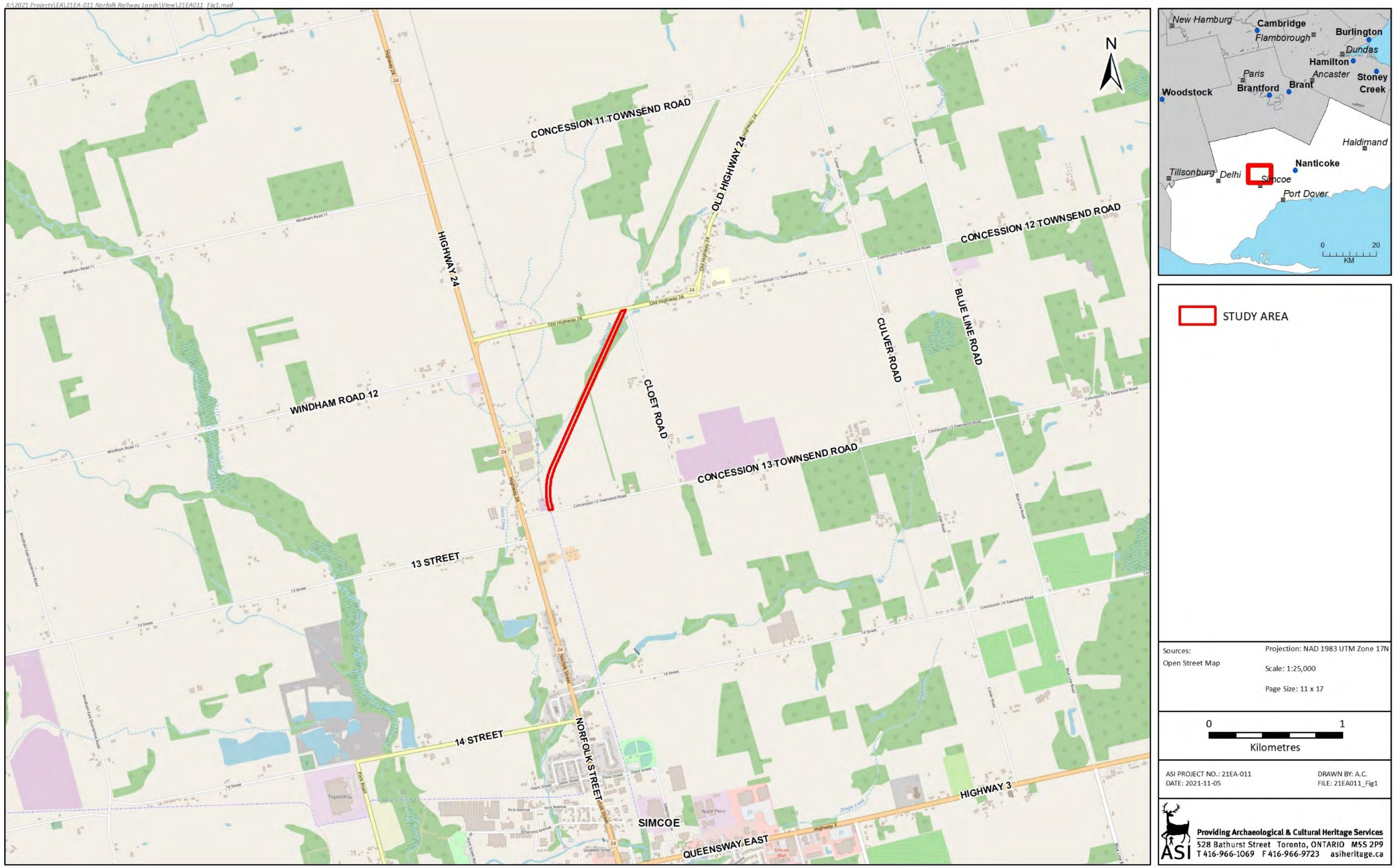

Figure 1 Norfolk Railway Lands Study Area

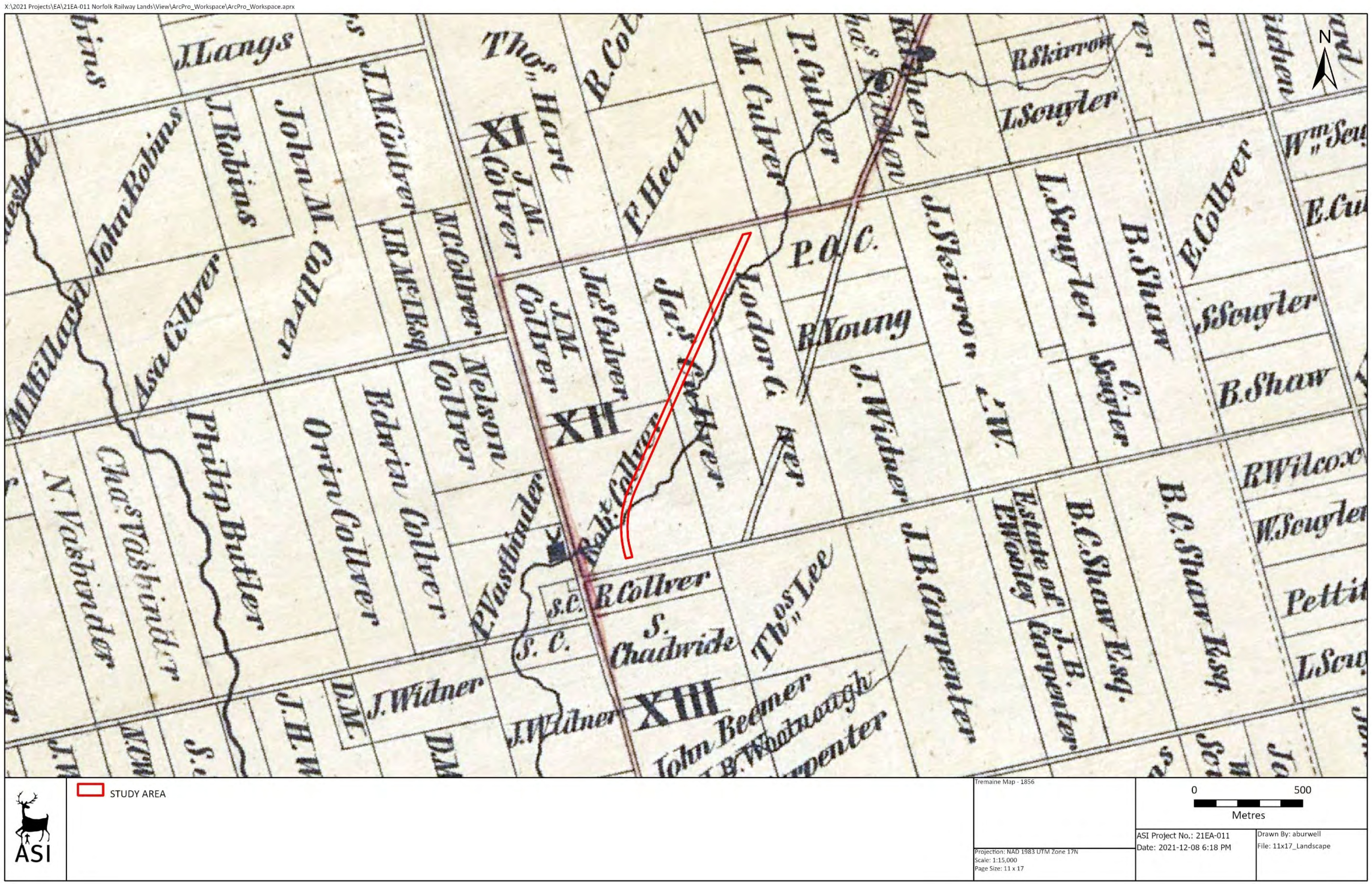

Figure 2 The Study Area (Approximate Location) Overlaid on the 1856 Tremaine's Map of Norfolk County

Figure 3 The Study Area (Approximate Location) Overlaid on the 1877 Illustrated Historical Atlas of Norfolk County

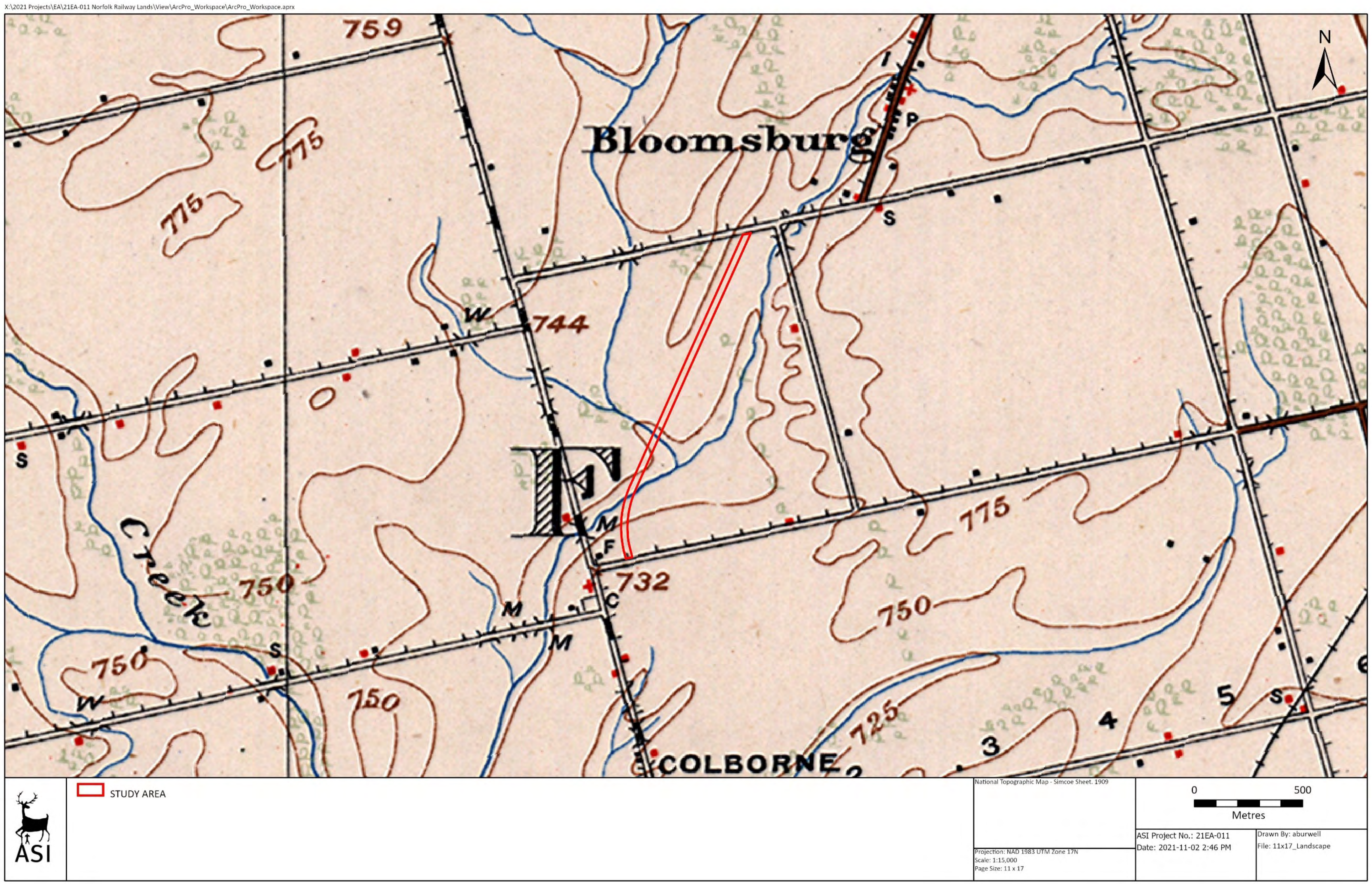

Figure 4 The Study Area (Approximate Location) Overlaid on the 1909 Topographic Map Simcoe Sheet

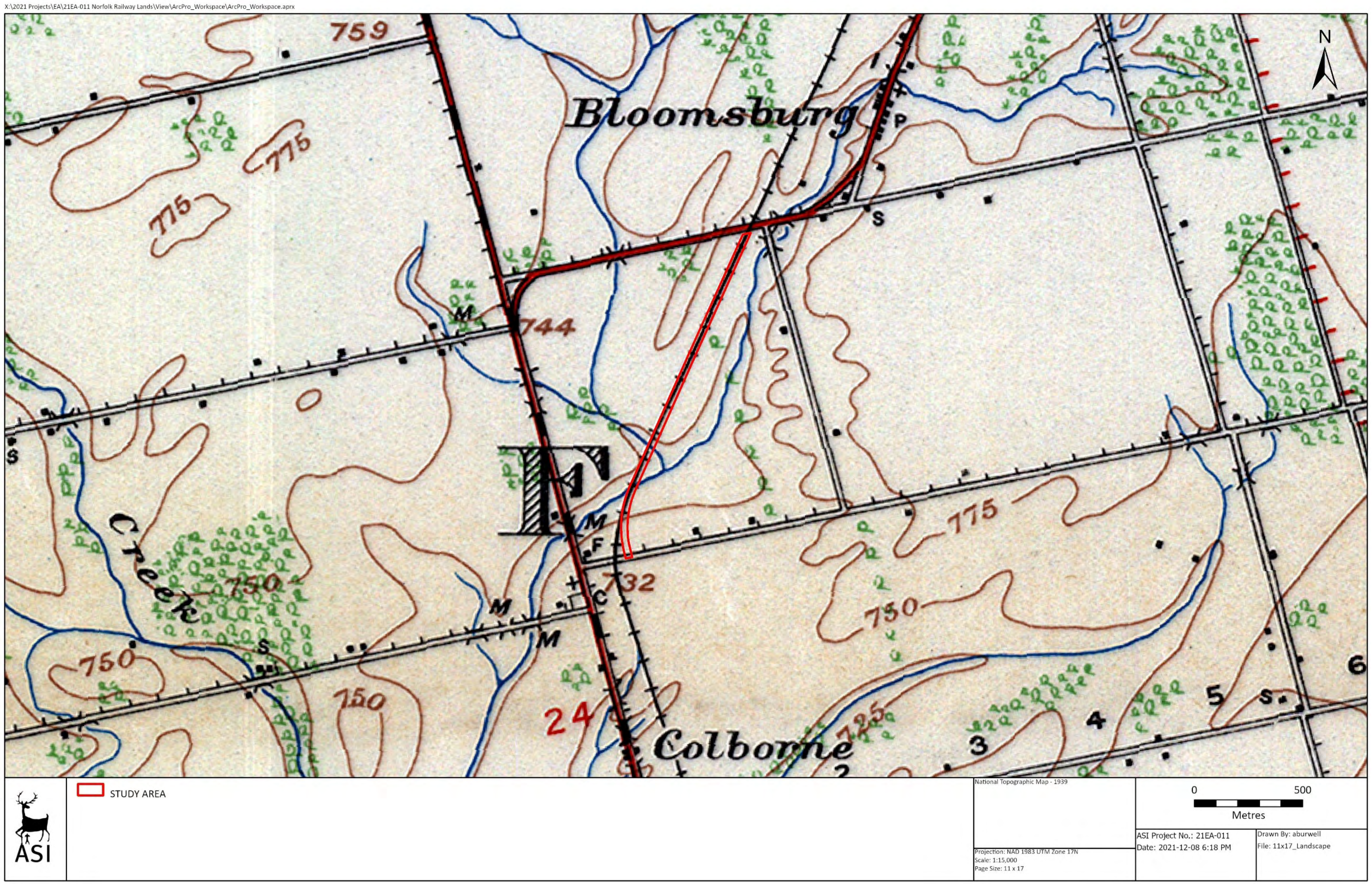

Figure 5 The Study Area (Approximate Location) Overlaid on the 1939 Topographic Map Simcoe Sheet

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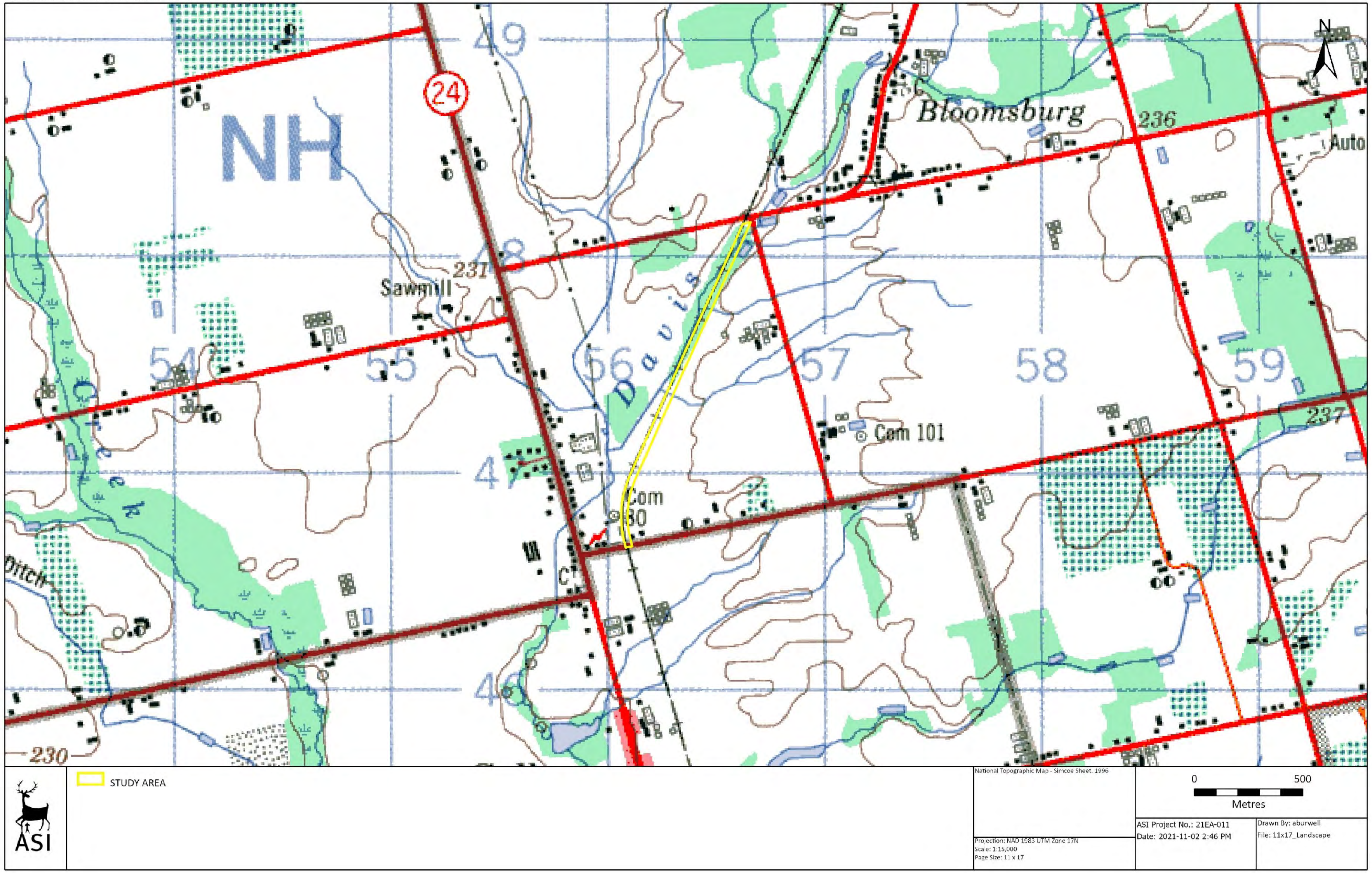

National Topographic Map - Simcoe Sheet. 1996

Projection: NAD 1983 UTM Zone 17N
Scale: 1:15,000
Page Size: 11 x 17

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File: 11x17_Landscape

Figure 6 The Study Area (Approximate Location) Overlaid on the 1996 National Topographic System Simcoe Sheet

Figure 7 The Study Area (Approximate Location) Overlaid on the 1954 Aerial Photography

Figure 8 Study Area – Surficial Geology

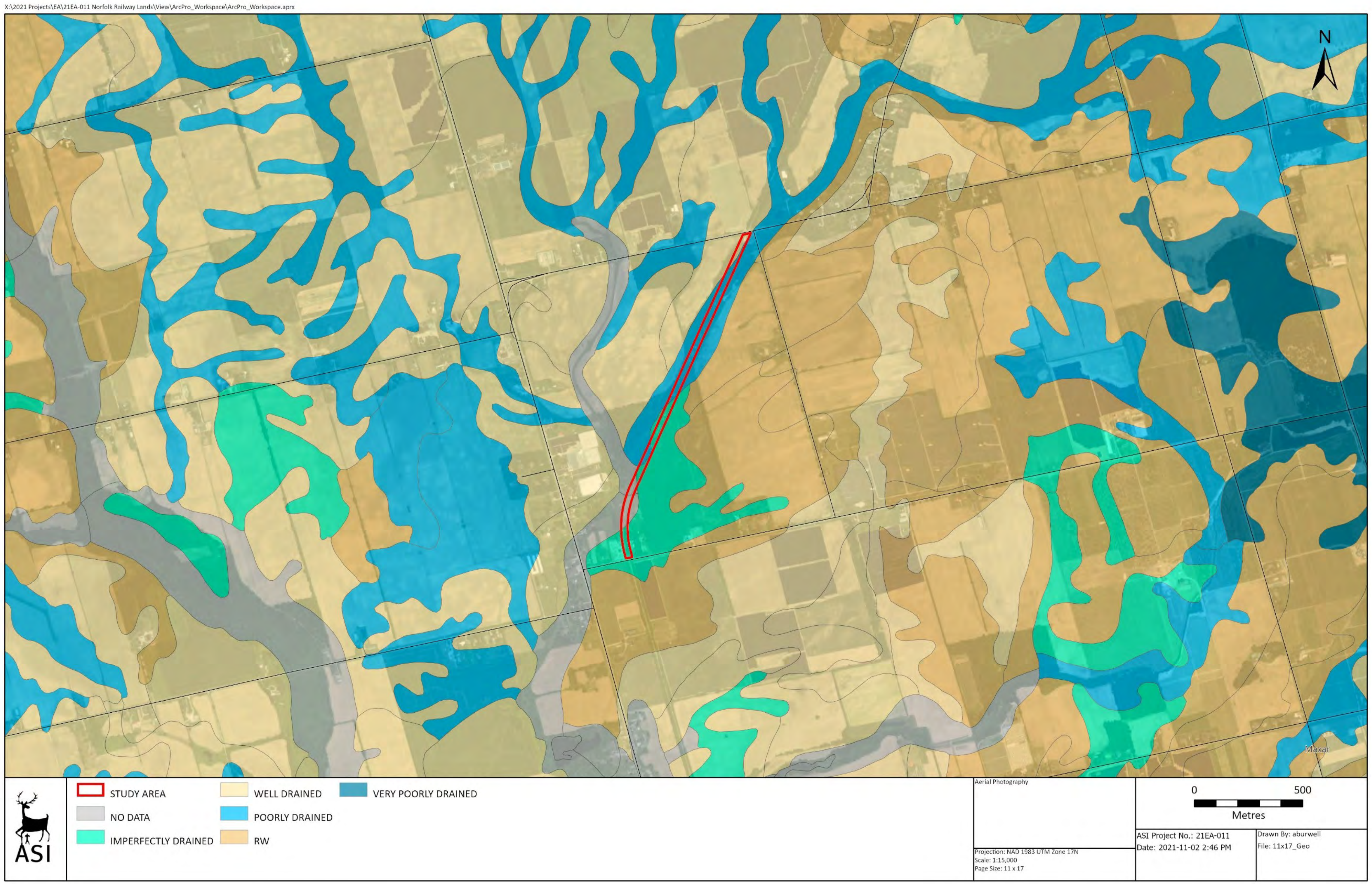

Figure 9 Study Area – Soil Drainage

Figure 10 Norfolk Railway Lands Study Area – Results of Stage 1