REPORT

Safarik Pit

Maximum Predicted Water Table Report

Submitted to:

CBM Aggregates, a Division of St. Marys Cement Inc. (Canada)
55 Industrial Street
Toronto, ON M4G 3W9

Submitted by:

WSP Canada Inc.
55 King Street Suite 700 St. Catharines, ON
L2R 3H5

905-687-1771

CA-GLD-21476582-2000

October 2, 2025

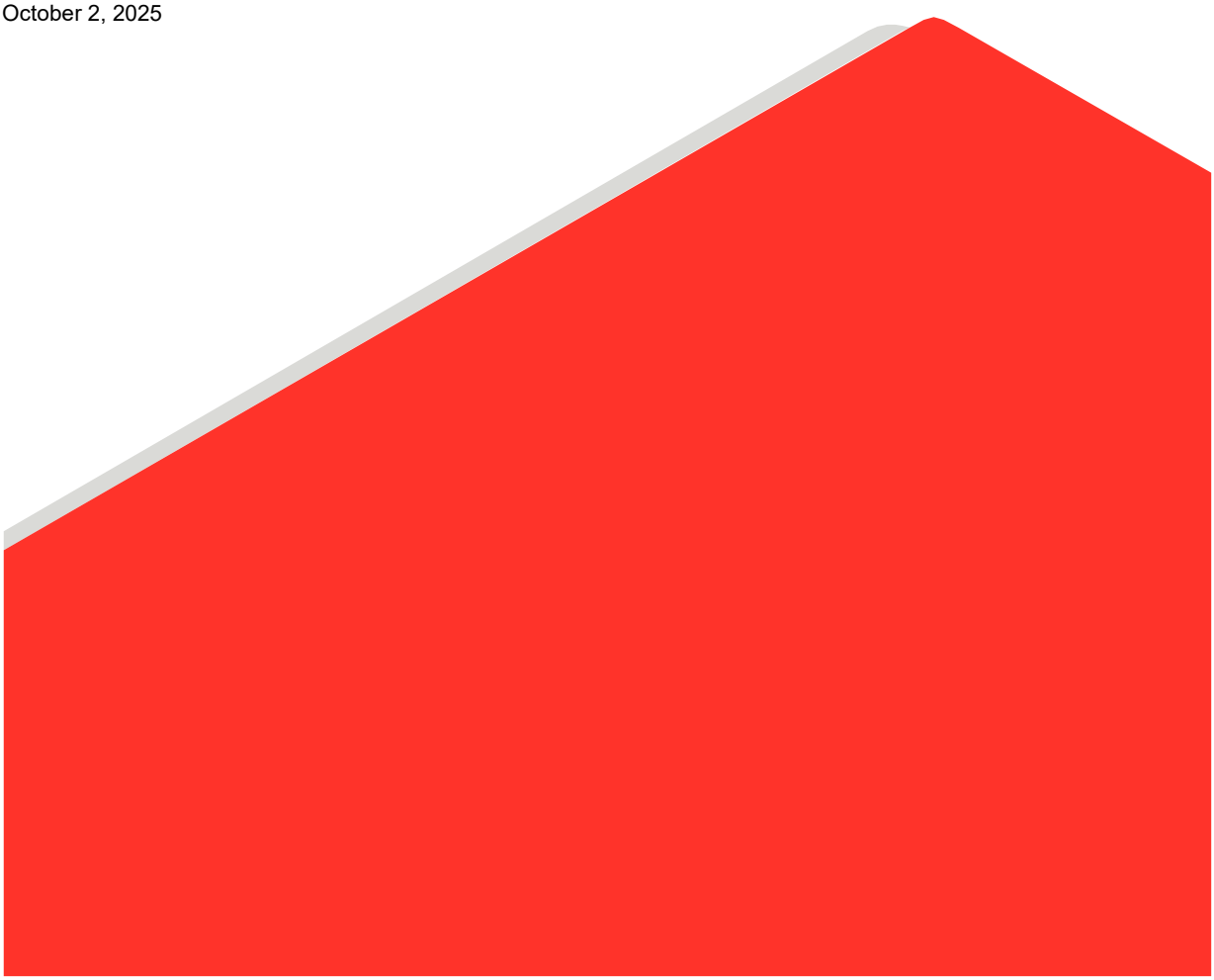


Table of Contents

1.0 INTRODUCTION

1.1 Background

The proposed Safarik Pit property is located at 4275 7th Concession in the Township of Puslinch, Wellington County, Ontario (the Site), as shown in the Location Map, **Figure 1**. The Site is ±28 hectares (ha) in size and is located to the east/southeast of the existing CBM Neubauer and McNally Pits. The Site is bisected by an overhead 230 kV electrical transmission corridor with access to the eastern portion of the Site permitted below the power lines.

The proposed pit will be developed below the natural groundwater table. Extraction below the natural water table will occur by dragline, and, therefore, dewatering will not be required. CBM is required to obtain a Class A Licence (Pit Below Water) for the Site under the Aggregate Resources Act (ARA).

WSP Canada Inc. (WSP) was retained by CBM to provide hydrogeological services, including the completion of this ARA Maximum Predicted Water Table report to meet the study requirements for the proposed pit licence application.

1.2 Evaluation Requirements

In the Aggregate Resources of Ontario Provincial Standards (Ministry of Natural Resources and Forestry (MNRF), August 2020), Part 2.1 outlines the following requirements for the Maximum Predicted Water Table Report for a Class A pit below groundwater:

> *A report must be prepared that details how the maximum predicted water table is identified in metres above sea level, relative to the proposed depth of excavation at the site.*
>
> *The maximum predicted water table shall be determined by monitoring the ground water table at the site for a minimum of one (1) year to account for seasonal variations and influences due to precipitation, unless alternative information already exists (e.g. previous hydrogeological study, existing well data) to support a determination of the maximum predicted water table by a qualified person.*
>
> *An alternative method may be used for sites determining the maximum water table in Precambrian rocks of the Canadian Shield where it is difficult to determine the elevation of the water table. In such cases, the maximum predicted water table may be assumed at an elevation (metres above sea level) that is a minimum of 2.5 metres below the deepest sump or pond on the site, provided a qualified person develops and oversees a drilling and monitoring program to determine if the ground water table would be intercepted at the assumed maximum predicted water table.*
>
> *The number of drill holes and seasonal monitoring frequency shall be determined by a qualified person based on site conditions.*

This report addresses the requirements of the Maximum Predicted Water Table report for the proposed pit.

1.3 Statement of Qualifications

This Maximum Predicted Water Table Report was completed by a project team at WSP Canada Inc. Curriculum vitae are provided in **Appendix A**.

1.4 Study Methodology

1.4.1 Drilling Programs

Boreholes were advanced during two separate drilling programs at the Site. The locations of boreholes completed as part of this undertaking are shown in the Site Plan, **Figure 2**.

2020

Prior to the current study, Golder Associates Ltd. (now WSP) advanced nine (9) boreholes as part of an initial resource assessment for the Site. The boreholes were designated BH20-01 (SAF) through BH20-09 (SAF). Monitoring wells were not installed during the 2020 drilling program.

2021

In December 2021, WSP advanced eight (8) additional boreholes across the Site. Four of the boreholes were sealed upon completion and were designated BH21-01 (SAF) through BH21-04 (SAF). The remaining four boreholes were completed as monitoring wells, designated MW21-01 (SAF) through MW21-04 (SAF). During drilling of MW21-03, a shallow perched groundwater condition was encountered and a second monitoring well which screened the shallow perched interval was installed. A deeper well was also installed adjacent to the shallow well. The shallow and deep wells are referred to as MW21-03-S (SAF) and MW21-03-D (SAF), respectively. Therefore, a total of five (5) monitoring wells were installed on Site. Monitoring well construction details are summarized in **Table B-1, Appendix B**.

1.4.2 Groundwater Monitoring

The baseline groundwater monitoring program completed for this study consisted of the following:

- Continuous groundwater level and temperature monitoring using dataloggers installed at the five (5) monitoring wells installed on the Site in 2021. The well locations are shown on the Site Plan, **Figure 2**. Loggers were programmed to collect data every hour. One barologger was installed to compensate for atmospheric pressure changes over time.
- Periodic manual water level measurements at each monitoring well were made over the course of the baseline monitoring period, generally occurring on a quarterly basis. The manual measurements were used to confirm the datalogger water levels. The manual water levels were measured with an electric contact gauge. The datalogger and manual water level measurements are depicted in the hydrographs included in **Appendix B**.

2.0 BASELINE GROUNDWATER ELEVATION DATA

2.1.1 Perched Condition at MW21-03-S (SAF)

As previously noted, saturated soil was encountered above the ‘Upper Till’ at MW21-03-S (SAF). A shallow monitoring well was installed to screen this perched layer. At MW21-03-S (SAF), the groundwater elevations ranged from 318.3 to 321.3 mASL, which is from 0.1 to 3.1 m below ground surface. Based on groundwater elevations from deeper well MW21-03-D (SAF), the perched groundwater level is located at minimum 9.8 m above the local water table. Shallow saturated conditions were not observed at the other borehole locations during drilling.

As shown in **Figure B-1** (Appendix B), the perched groundwater level fluctuated with peak levels approaching the ground surface during the spring (March 2022, May 2023 and April/May 2024). Between July 10 and July 16, 2024, the water level at MW21-03-S (SAF) increased by approximately 1 m, which corresponded with a total of 145 mm of rainfall recorded at the Kitchener/Waterloo climatological station during the same period. A discernable response to these significant precipitation events was not observed at the deeper wells installed within the water table (**Figure B-2**).

2.1.2 Regional Water Table

Regional groundwater modelling undertaken for the Guelph / Eramosa Tier 3 Study suggest that regional groundwater flow in the vicinity of the Site is generally to the west-southwest with groundwater elevations in the ± 300-320 mASL range (Matrix, 2017).

Based on the groundwater level data collected from the on-Site monitoring wells screened within the deeper sand and gravel deposits as part of this study, the following groundwater levels were observed:

- At MW21-01 (SAF), located in the western corner of the Site, groundwater elevations ranged from 305.9 to 307.0 mASL, or between 9.9 and 11.1 m below grade.
- At MW21-02 (SAF), located near the eastern corner of the Site, groundwater elevations ranged from 306.9 to 307.8 mASL, or between 20.2 to 21.1 m below grade.
- At MW21-03-D (SAF), located in the northern corner of the Site, groundwater elevations ranged from 307.0 to 308.5 mASL, which is between 12.9 and 14.4 m below grade.
- At MW21-04 (SAF), located in the eastern corner of the Site, groundwater elevations ranged from 306.5 to 308.1 mASL, or between 19.8 and 21.4 m below grade.

The water table elevation exhibited a seasonal fluctuation, with seasonal peak water levels observed in May 2022, June 2023 and August 2024, which is consistent with precipitation patterns during the study period. Seasonal low water levels were observed in February 2023 and January 2024. The pattern and magnitude of seasonal fluctuation was similar at MW21-01 (SAF), MW21-03-D (SAF) and MW21-04 (SAF), however the magnitude of fluctuations at MW21-02 (SAF) were slightly muted. The muted response at MW21-02 (SAF) results in the water level at MW21-02 (SAF) being higher than those at MW21-04 (SAF) during some periods, and lower than those at MW21-04 (SAF) during others. During the study period, the water level at MW21-04 (SAF) was higher than at MW21-02 (SAF) from March 2022 through August 2022, from May 2023 through October 2023 and from March 2024 through December 2024. The highest water table elevations were consistently observed at MW21-03-D (SAF) and the lowest water table elevations were consistently observed at MW21-01 (SAF).

The maximum water table elevations observed during the study occurred in August 2024. The maximum water table elevations recorded at the wells on August 9, 2024 are shown on **Figure 3.** The elevations ranged from 306.99 mASL at MW21-01 (SAF) to 308.52 mASL at MW21-03-D (SAF). Based on the groundwater elevations measured on-Site, groundwater flow across the Site is west-southwest, consistent with the Tier 3 Study noted above (Matrix, 2017).

3.0 SUMMARY OF FINDINGS

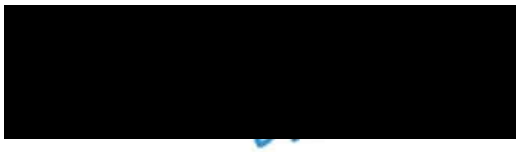
The following is a summary of the key findings of the Maximum Predicted Water Table Report undertaken to meet the study requirements for the Class A License (Pit Below Water) application.

- The proposed pit will be developed below the natural groundwater table. The maximum depth of extraction below the water table is to an elevation of 295 metres above sea level (mASL).
- The maximum water table at the Site ranges from 306.99 mASL at MW21-01 (SAF) to 308.52 mASL at MW21-03-D (SAF). Groundwater flows across the Site in a west-southwest direction.

Signature Page

WSP Canada Inc.

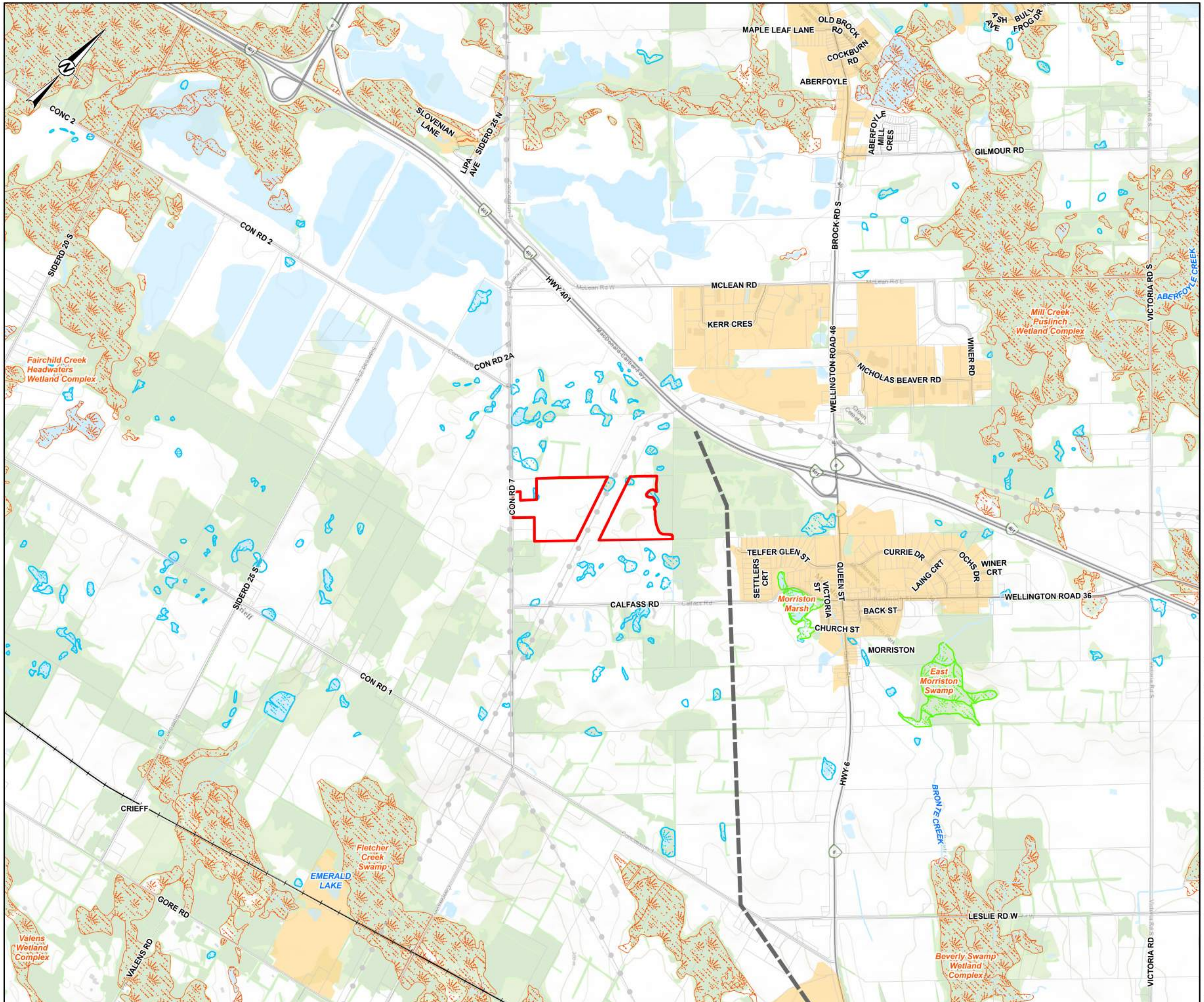
Leigh Davis, M.A.Sc., P.Eng.
Project Engineer / Hydrogeologist



Kevin Fitzpatrick, P.Eng. (Geological)
Senior Project Engineer

https://wsponline.sharepoint.com/sites/gld-148930/project files/6 deliverables/ph 2000 - hydrogeology/final october 2025/safarik pit - max water table report_final.docx

Figures



KEY MAP

SCALE 1:500,000

LEGEND

- LICENCE BOUNDARY
- ROADWAY
- WATERCOURSE
- RAILWAY
- UTILITY CORRIDOR
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- UNEVALUATED WETLAND
- EVALUATED WETLAND (NO SIGNIFICANCE)
- PROVINCIALLY SIGNIFICANT WETLAND (PSW)
- WATERBODY
- WOODED AREA
- BUILT-UP

0 250 500 1,000

1:25,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. IMAGERY CREDITS: WORLD TOPOGRAPHIC MAP: CITY OF HAMILTON, TOWN OF MILTON, PROVINCE OF ONTARIO, ONTARIO MNR, ESRI CANADA, ESRI, HERE, GARMIN, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCAN
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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

TITLE

LOCATION MAP

CONSULTANT

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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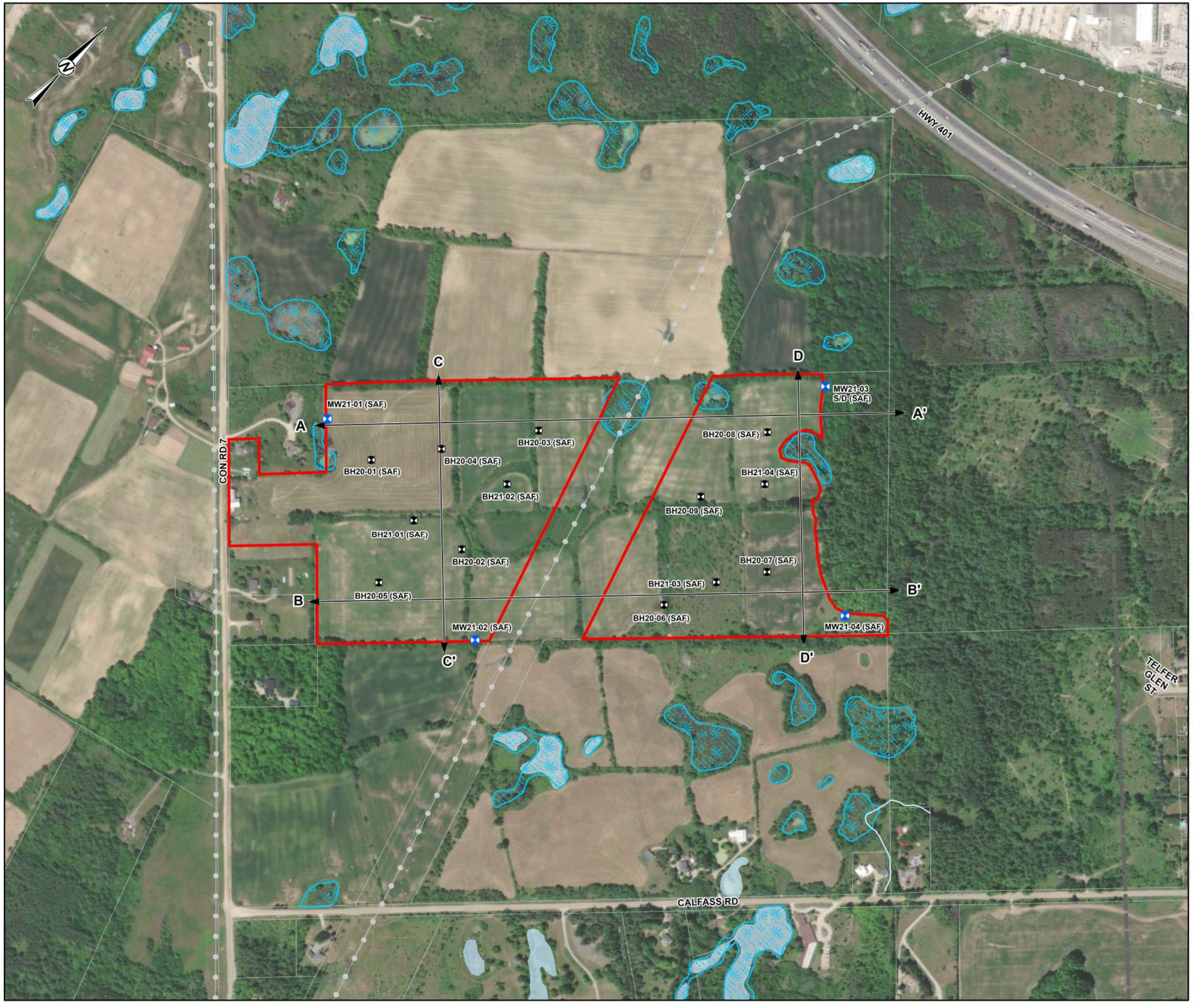

KEY MAP

SCALE 1:300,000

LEGEND

- BOREHOLE LOCATION AND DESIGNATION
- MONITORING WELL LOCATION AND DESIGNATION
- LICENCE BOUNDARY
- WATERCOURSE
- UTILITY CORRIDOR
- CROSS-SECTION LINES
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- UNEVALUATED WETLAND
- WATERBODY

0 75 150 300

1:6,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
SAFARIK PIT

TITLE
SITE PLAN

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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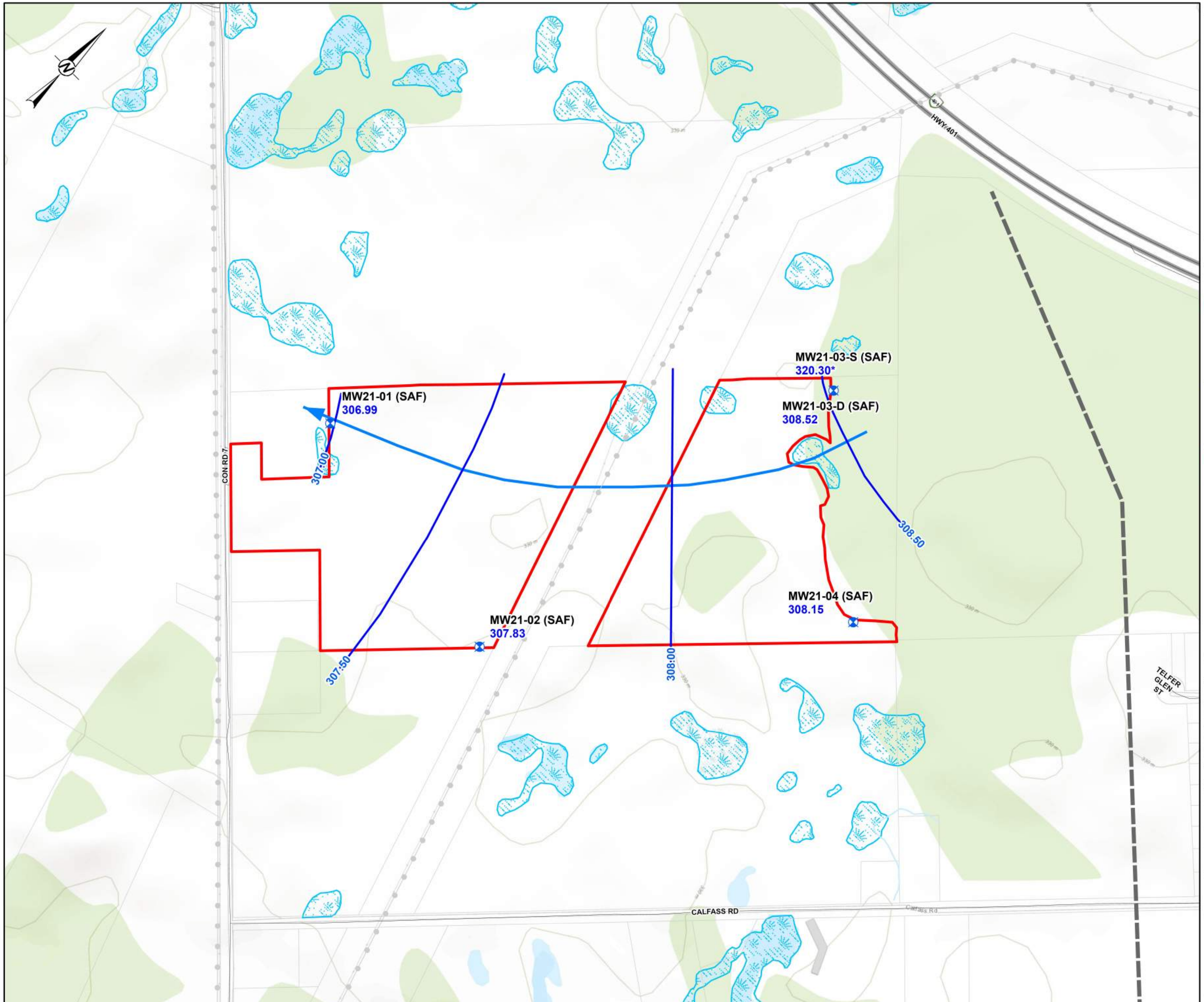

KEY MAP

SCALE 1:300,000

LEGEND

- MONITORING WELL LOCATION AND DESIGNATION
- LICENCE BOUNDARY
- ROADWAY
- WATERCOURSE
- UTILITY CORRIDOR
- INTERPOLATED WATER TABLE CONTOUR (masl)
- INFERRED DIRECTION OF GROUNDWATER FLOW
- APPROXIMATE LOCATION OF FUTURE MORRISTON BYPASS
- PROPERTY PARCELS
- UNEVALUATED WETLAND
- WATERBODY (APPROX. ELEVATION NOTED IN mASL)

308.15 WATER TABLE ELEVATION (MASL), AUGUST 9, 2024

* PERCHED CONDITION INFERRED AT MW21-03-S (SAF)

0 75 150 300

1:6,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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3. LICENSE BOUNDARY PROVIDED BY MHBC MARCH 2025
4. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT

SAFARIK PIT

TITLE

MAXIMUM WATER TABLE ELEVATION

CONSULTANT

wsp

YYYY-MM-DD	2025-07-15
DESIGNED	----
PREPARED	SO/LS
REVIEWED	RW
APPROVED	LD

PROJECT NO.	CONTROL	REV.	FIGURE
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APPENDIX A

Curriculum Vitae

J. LEIGH DAVIS, M.A.Sc., P.Eng.

Lead Professional, Environmental Engineering

Areas of practice

Groundwater Resources

Groundwater Modelling

Aggregate Resources

Waste Management

PROFILE

Mr. Leigh Davis is a licensed Project Engineer with WSP, specializing in hydrogeology. His 17 years of experience in the environmental consulting industry include peer review, project management and engineering support for hydrogeological studies and compliance reporting, numerical groundwater flow and transport model construction and calibration, coordination and analysis of in-situ testing, GIS / CAD design and analysis and field sampling (including low-flow methods).

Leigh holds a Bachelor of Applied Science in Environmental Engineering, as well as a Master of Applied Science in Civil Engineering, covering topics including hydrology, hydrogeology, contaminant transport mechanisms, groundwater modelling and landfill design. Leigh's Master's thesis was *Investigation of Seismic Excitation as a Method for Flow Enhancement in Porous Media.* He has a working knowledge of relevant software including ArcGIS, Microsoft Office (including Access), USGS MODFLOW (including various pre/post processing software), AutoCAD and HELP 3.

EDUCATION

Master of Applied Science, Honours Civil Engineering, University of Waterloo	2008
Bachelor of Applied Science, Honours Environmental Engineering (Co-op), University of Waterloo	2006

PROFESSIONAL DEVELOPMENT

Advanced Python Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2024
Introduction to Python Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2022
MODFLOW Solvers, Speed, Convergence and Robustness, GSI Environmental	2018
Introduction to Fortran Programming for MODFLOW Modelers, Environmental Simulations Inc. (ESI)	2018
Calibration and Uncertainty Analysis for Environmental Models, S.S. Papadopulos & Associates Inc.	2017
8-Hour Health & Safety Refresher Training Course (HAZWOPER)	2015
Surface Miner Common Core Training	2013
Estimating Rates of Groundwater Recharge, International Association of Hydrogeologists (IAH)	2012
Reactive Transport Modelling with PHT3D, International Groundwater Modeling Centre (IGWMC)	2011
The New MODFLOW Course: Theory and Hands-On Applications, National Groundwater Association (NGWA)	2009
Critical Thinking in Aquifer Test Interpretation, S.S.Papadopulos & Associates Inc.	2009

24-Hour Occupational Health & Safety Training Course (HAZWOPER)	2009

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario	PEO
Halton Region Environmental and Ecological Advisory Committee (Volunteer, 2011 – 2014)	EEAC

CAREER

Lead Professional, Environmental Engineering, WSP	2024 – Present
Project Engineer, Earth & Environment, WSP	2014 – 2024
Project Manager, Environment, GENIVAR (now named WSP)	2009 – 2013
Project Manager, Jagger Hims Limited (GENIVAR Acquisition)	2008 – 2009
Technical Project Assistant, Jagger Hims Limited	2005 – 2006
Engineer Assistant, St. Michael's Hospital, Toronto, ON	2004

PROFESSIONAL EXPERIENCE

Groundwater Resources

- Water Resources Monitoring Review and Strategy Development, Hamilton, ON (2021-2022): Comprehensive review of field data collection techniques, data management processes, existing monitoring network configuration and continuous improvement strategies for ongoing monitoring completed by the Source Protection Planning group in relation to the municipal supply wells. Client: City of Hamilton.
- Hydrogeological Study, St. Anns, ON (2019): Development of a hydrogeological conceptual model and water supply assessment for proposed site re-development. Client: Silverdale Gun Club / IBI Group.
- Open Space Design Development, Nova Scotia (2012-2014): Analysis of step test and pumping test data to estimate private supply well capacity as part of subdivision development applications at various sites throughout Nova Scotia. Client: Confidential.
- Earthfresh Potato Processing Facility, Hydrogeological Study, Flamborough, ON (2011): Design of drilling program and analysis of in-situ testing data. Client: Earthfresh Inc. / IBI Group.
- Viva Next H3 Project, Construction Dewatering PTTW Application, Markham, ON (2011): Hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: Kiewit-EllisDon / The Miller Group.
- 3091 Appleby Line, Hydrogeological Study, Burlington, ON (2011): Design of drilling program, field groundwater sampling, data analysis, figure and report preparation for a hydrogeological study of a dense non-aqueous phase liquid (DNAPL) contaminated site. Client: 1345059 Ontario Ltd.
- Greenwich Street Sewage Pumping Station, Construction Dewatering PTTW Application, Brantford, ON (2011): Hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: City of Brantford.

- Dominion Road Sewage Pumping Station, Construction Dewatering PTTW Application, Fort Erie, ON (2011): In-situ testing, hydrogeological analysis and report preparation for construction dewatering Permit to Take Water application. Client: R.V. Anderson & Associates / Niagara Region.
- Microbial Contaminant Control Plan, Halton Region, Peel Region, ON (2005, 2006): Threat inventory preparation; CAD figure preparation; field reconnaissance for development of microbial contaminant control plans for groundwater supply systems. Client: Regional Municipality of Halton, Peel Region.
- Garden City Municipal Golf Club, Evaluation of Alternative Irrigation Sources, St. Catharines, ON (2006): Report preparation, CAD figure preparation to assess the ability of a local pond to supply irrigation water requirements. Client: Urban & Environmental Management Inc.

Groundwater Modelling

- Various contaminated and landfill sites, ON (2020-ongoing): Development and use of a 2-D Domenico-Schwartz contaminant transport model to evaluate potential off-site impacts at various sites across Ontario.
- Proposed Pit, Puslinch, ON (2022-ongoing): Level 2 Hydrogeological Study to meet the requirements for a proposed Category 1 Class 'A' below water pit licence application at a greenfield site. Construction and calibration of a numerical groundwater flow model to predict impacts of proposed pit on local groundwater users and sensitive features, including groundwater temperature impacts. Client: Confidential.
- Fifteen Mile Stream Gold Project, NS (2022): Construct and calibrate a numerical groundwater flow model to assess potential impacts from a proposed open pit gold mine. Client: Atlantic Mining NS Corp.
- Essex-Windsor Regional Landfill Site, Windsor, ON (2022): Predictive modeling of annual leachate production using a 2-D Visual HELP model to simulate existing and future cell construction. Client: Essex-Windsor Solid Waste Authority.
- Duntroon Quarry, Collingwood, ON (2021): Review and re-calibration of the existing numerical groundwater model as part of the quarry's Adaptive Management Plan (AMP) 5-Year Comprehensive Review. Import and reconstruction of the model to utilize MODFLOW-USG capabilities. Client: Walker Aggregates Inc.
- Peer Review of Proposed Cumberland Quarry, County of Simcoe, ON (2018): Peer review of a Level 1 & Level 2 Hydrogeological Study report and numerical groundwater model in support of a Category 2 Class 'A' below water quarry application for a greenfield site. Client: Walker Aggregates Inc.
- Peer Review of Crane Mountain Landfill Groundwater Flow Model, NB (2018): Peer review of a numerical groundwater flow model used to predict landfill impacts on a drinking water aquifer in a complex bedrock setting. Client: Fundy Regional Service Commission, NB.
- Wellhead Protection Area Delineation, Pugwash, NS (2017): Construct and calibrate a numerical groundwater flow model to delineate the wellhead protection area for a municipal supply system. Client: Municipality of the County of Cumberland, NS.
- Hydrogeological Investigation / Numerical Groundwater Flow and Transport Modelling for Phosphate Mine, Kapuskasing, ON (2009-2014): Field work including drilling supervision, monitoring well installation, in-situ hydraulic conductivity tests / analysis and groundwater sampling (including low-flow sampling). Review of existing site data to construct and calibrate a groundwater flow model to be used for simulation of tailings pond leachate transport in the sub-surface in support of the

mine closure plan. Hydrogeological report and figure preparation in support of a revised mine closure plan. Client: Agrium Inc.

- Groundwater Capacity Assessment, Omemee, ON (2014): Use of an existing regional numerical groundwater model to identify potential groundwater supply well locations within the community as part of a Class EA. Client: City of Kawartha Lakes.
- Detailed Water Budget Analysis, South Lake Scugog Watershed, Durham Region, ON (2011): Use of an existing regional numerical groundwater model to calculate the groundwater components of the water budget. Client: Kawartha Lakes Conservation Authority.
- Contaminant Transport Modelling for a Thermal In-Situ Heavy Oil Processing Facility, near Cold Lake, AB (2010): Review of site data to construct and calibrate a groundwater flow model to simulate chloride transport from a process water retention pond, and evaluate remediation alternatives. Client: Canadian Natural Resources Limited.
- Numerical Groundwater Modelling, Legault Subdivision Water Supply, St. Albert, ON (2010): Construct and calibrate a numerical groundwater flow model to predict the steady-state drawdown due to proposed subdivision private water supply wells, and assess the impact on nearby existing private wells. Client: The Thomson Rosemount Group, Inc.
- Wilmot Creek Watershed Tier 2 Water Budget Analysis, Durham Region, ON (2010): Calibration of an existing regional groundwater flow model within the watershed of interest to determine the water budget components. Client: Ganaraska Region Conservation Authority.
- Hydrogeologic Study, Township of Melancthon, ON (2009-2010): Calibration of numerical groundwater flow model for existing site conditions and quarry scenario assessment. Client: The Highland Companies.
- Contaminant Transport Modelling for a Former Oil Battery Site, Calmar, AB (2009): Review of site data to construct and calibrate a groundwater flow model to simulate chloride transport and fate in the sub-surface. Client: Canadian Natural Resources Limited / Wiebe Environmental Services.
- Thermal Plume Migration Analysis, Mill Creek Aggregate Pit, Guelph, ON (2009): Use a recalibrated groundwater flow model to determine heat transfer into groundwater system from proposed final pit lake configuration, as well as assess impact on nearby cold-water fish habitat. Client: Dufferin Aggregates.
- Groundwater Vulnerability Assessment, City of Kawartha Lakes, ON (2007-2009): Regional groundwater model development; capture zone modelling; GIS figure preparation; technical memo/report preparation to develop a groundwater threat inventory database for 15 municipal well systems. Client: The City of Kawartha Lakes / Trent Conservation Coalition.

Aggregate Resources

- Norfolk Quarry, Port Dover, ON (2022-ongoing): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry extension of existing quarry. Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Client: MHBC Planning.
- Haliburton, ON (2019): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry application. Pumping test analysis and hydrogeological conceptual model development. Client: Confidential.
- Law Quarry, Wainfleet, ON (2017-ongoing): Level 2 Hydrogeological Study in support of Category 2 Class ‘A’ below water quarry extension of existing quarry.

Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Construction and calibration of a numerical groundwater flow model to predict impacts of quarry extension on local groundwater users and sensitive features. Client: Waterford Sand and Gravel Limited / MHBC Planning.

- Proposed Uppers Quarry, Thorold, ON (2016-ongoing): Level 2 Hydrogeological Study in support of a proposed Category 2 Class 'A' below water quarry at a greenfield site. Field support, pumping test coordination and analysis, report and figure preparation and liaison with regulatory agencies. Construction and calibration of a numerical groundwater flow model to predict impacts of quarry development on local groundwater users and sensitive features. Client: Walker Aggregates Inc. / MHBC Planning.
- Walker Aggregates Inc.
  - Walker Brothers Quarry, Niagara Falls, ON (2012-ongoing): Preparation of annual compliance monitoring report for an active quarry located adjacent to one active and two closed landfill sites. Data management and QA / QC using a custom Access database. Monitoring data from all four sites are considered when characterizing and assessing the hydrogeologic setting.
  - Duntroon Quarry Expansion, Collingwood, ON (2019-ongoing): Hydrogeological study to meet the requirements of proposed quarry deepening. Preparation of Adaptive Management Plan (AMP) annual compliance monitoring report for an active quarry located adjacent to the Niagara Escarpment. Data management and QA / QC using a custom Access database.
  - Sutherland Quarry, Owen Sound, ON (2023-ongoing): Hydrogeological investigation to mitigate quarry drawdown impacts, including design and construction of a grout curtain wall.
  - Vineland Quarry, Interference Complaint Study, Vineland, ON (2011): Evaluation of sub-watershed hydrologic data and outflow characteristics of quarry pond to determine the cause of downstream channel erosion.
- Pioneer Construction Ltd.
  - City Pit, Sault Ste. Marie, ON (2016-2020): Level 2 Hydrogeological Study in support of Category 2 Class 'A' pit / quarry licence extension for below water table extraction. Data collation, report and figure preparation and liaison with regulatory agencies.
  - Palmer Pit, Sault Ste. Marie, ON (2015-2016): Level 2 Hydrogeological Study in support of Category 2 Class 'A' pit / quarry licence extension for below water table extraction. Field support, data collation, report and figure preparation and liaison with regulatory agencies.
- Erin Pit, Erin, ON (2015-2017): Level 1 Hydrogeological Study in support of pit licence extension for above water table extraction. Field support, pumping test coordination and analysis, data collation, report and figure preparation and liaison with regulatory agencies. Client: Halton Crushed Stone Inc. / MHBC Planning.
- Identify Potential New Sand and Gravel Pit, Haldimand and Norfolk Counties, ON (2015): GIS and ARIP mapping used to assess potential new sand and gravel pit locations. Client: Confidential.
- Jigs Hollow Pit, Waterloo, ON (2014-2020): Level 2 Hydrogeological Study in support of pit licence application. Field support, pumping test coordination and analysis, data collation, report and figure preparation and liaison with regulatory agencies. Client: Preston Sand and Gravel / IBI Group.

- Vinemount Quarry, Stoney Creek, ON (2013-2018): Level 2 Hydrogeological Study in support of Category 2 Class 'A' quarry licence extension. Field support, data collation, report and figure preparation and liaison with regulatory agencies. Client: Waterford Sand and Gravel Limited / IBI Group.
- Aggregate Resource Assessment, Windsor, ON (2012): Review of borehole information and local geology to quantify remaining high-quality aggregates at two quarries near Windsor. Client: Confidential.
- Aggregate Resource Assessment, Greater Toronto Area, ON (2008): Development of aggregate resource database and GIS figure preparation to determine high quality aggregate resources in the Greater Toronto Area. Client: Confidential.

Waste Management

- Proposed South Landfill Phase 2, Niagara Falls, ON (2024-ongoing): Hydrogeological study to meet the Terms of Reference for an Environmental Assessment (EA) for a proposed landfill extension, including borehole advancement, geophysics and hydraulic testing, groundwater elevation and quality monitoring and calibration of a numerical groundwater flow model.
- Region of Halton - various closed Landfill Sites, (2021-ongoing): Peer reviewer and engineering support for annual compliance monitoring reports for several closed landfill sites within the Queenston shale plain physiographic region of Southern Ontario.
- Regional Municipality of Niagara
  - Bridge Street and Quarry Road Landfill Sites and Quarry Road Constructed Wetland, Annual Monitoring Programs (2013, 2014 and 2018-ongoing): Peer reviewer, project manager and engineering support for annual compliance monitoring programs at landfills in complex fractured bedrock settings. Responsibilities include: manage field staff; liaise with client, subcontractors and laboratories; cost / budget control, collate, QA / QC, analyze and interpret technical data for leachate, groundwater, surface water and sediment samples. Evaluate and assess the condition of the monitoring well network at the Site, develop a work / cost program and implement maintenance and repair program. Performance evaluation of containment systems and perimeter leachate collection systems. Provide routine status updates to client and prepare annual report for submission to the MECP. Additional site-specific studies include:
    - Updated Water Well Survey (2020) to identify potential downgradient groundwater users used as input for a risk-management strategy.
    - Groundwater Monitoring Network Optimization (2020) to reduce redundancy in the groundwater monitoring program using statistical analyses and an evaluation of leachate indicator parameter trends.
    - Paleo-karst Investigation (2013) to characterize paleo-karst hydrogeology and geochemistry, including the use of low-flow groundwater sampling techniques.
    - Chloride Isotope (2011) and Tritium, Oxygen and Hydrogen Isotope (2010) sampling and statistical analyses to determine the source of elevated chloride concentrations.
  - Line 5 Landfill, Niagara-on-the-Lake, ON (2013-ongoing): Project manager for annual compliance monitoring program at a closed landfill in an overburden setting. Management of field staff; liaisons with client and laboratories; cost / budget control, collation, QA / QC, analysis and interpretation of technical data for leachate, groundwater, and surface water samples; routine status updates to client; and preparation of annual compliance monitoring report. Preparation of a

revised environmental monitoring program, which included assessment of site conceptual model, potential contaminant pathways and sensitive receptors. Additional site-specific studies include:

  - Revised Groundwater Trigger Mechanism Plan (2020) including a statistical analysis of background geochemistry to develop suitable trigger levels at property boundary wells.
  - Stormwater Management Pond Trigger Mechanism Plan (2015) including a statistical analysis of historical chemical results to determine appropriate trigger parameters and levels for operation of the stormwater management pond.
  - Revised Environmental Monitoring Program (2014) to reduce redundancy in the monitoring program and revise monitor screen intervals to more effectively evaluation the leachate collection system performance.

- Nitrate Isotope (2017) and Chloride Isotope (2014) Sampling and Assessment, Centre Street Landfill Site, Fonthill, ON (2017): Statistical analyses of isotope results to determine the source of elevated nitrate and chloride concentrations.
- Mountain Road In-situ Hydraulic Conductivity Tests, Niagara Falls, ON (2005): In-situ hydraulic conductivity tests; slug test analysis; report preparation.
- Landfill Monitoring Programs, Niagara Falls, Grimsby, Pelham, Niagara-on-the-Lake, Fort Erie, ON (2005-2014): Field sampling for groundwater and surface water as part of annual monitoring programs at Mountain Road, Park Road, Niagara Road 12, Line 5, Station Road, Centre Street, Quarry Road and Bridge Street Landfills.

- Region of Waterloo - Closed Woolwich Landfill Site, Woolwich, ON (2015-ongoing): Peer reviewer, project manager and engineering support for annual compliance monitoring and hydrogeological impact assessment at a small rural closed landfill situated in a thick silt, sand and gravel setting. A 1,1-dichloroethane (DCA) plume is present downgradient of the site, and an area wide study was completed to identify potential contributing sources to the 1,1-DCA plume. A hydrogeological conceptual model was developed for the site area and work program to delineate the plume was established.
- Walker Environmental Group - East, South, and West Landfill Sites, City of Niagara Falls, ON (2012-ongoing): Preparation of annual compliance monitoring reports for one operating and two closed landfill sites located within one continuous footprint. Data management and QA/QC using a custom Access database. An adjacent active quarry is also monitored and monitoring data from all four sites are considered when characterizing and assessing the hydrogeologic setting.
- Township of North Kawartha – various closed Landfill Sites (2022-2024): Peer reviewer for annual compliance monitoring reports for several closed landfill sites within the Precambrian shield bedrock setting of Central Ontario.
- County of Oxford
  - Landfill Monitoring Programs, Norwich, Salford, ON (2012-2014): Preparation of annual monitoring report data tables, figures and text at Holbrook (closed) and Oxford County (operational) landfills.
  - Well Network Assessment, Norwich, ON (2013): Completion of a well network assessment at Holbrook (closed) landfill to identify monitoring program deficiencies and recommend remedial measures.

- City of Brantford - Mohawk Street Landfill, Brantford, ON (2009-2018): Data collation, technical analysis, and reporting as part of the annual monitoring program. Field sampling for groundwater and surface water at a large operating landfill.
- Tembec Kapuskasing Operations - Private Landfill Monitoring Programs, Kapuskasing, ON (2012-2013): Preparation of annual monitoring report data tables, figures and text for two private landfill sites.
- Potential Landfill Constraint Mapping, Eastern Ontario (2006): Constraint mapping for potential landfill sites; GIS figure preparation. Client: Confidential.

Geotechnical Engineering

- OPG Pump Generating Station Dyke Monitoring Program, Niagara Falls, ON (2012-2013): Field and technical support for the abandonment of 111 pressure relief wells and piezometers and 4 additional tunnel well nests around the PGS Dyke, including 3 Waterloo System multi-level wells. Wells were located adjacent to the Niagara Escarpment and the Buried St. Davids Gorge. Additional work included rehabilitation of 48 wells; and preparation of documentation and figures. Client: Ontario Power Generation Inc.
- Sir Adam Beck Tunnel 3, Groundwater Monitoring Program, Niagara Falls, ON (2010-2013): Installation and operation of double-valve pumps (DVPs) for low-flow groundwater sampling to monitor the effect of dewatering for tunnel construction on local groundwater resources. Client: Strabag.
- Abitibi Thorold Mill, Cogeneration Plant, Geotechnical Drilling Program, Thorold, ON (2006): Drill rig supervision; borehole logging and soil sampling as part of a geotechnical investigation of soils for a planned co-generation plant. Client: Abitibi-Consolidated.
- Whirlpool Rapids Bridge Monitoring Program, Niagara Falls, ON (2005): Groundwater sampling and erosion monitoring at a contaminated site within the Niagara River Gorge. Client: Niagara Falls Bridge Commission.

Environmental Site Assessments and Site Remediation

- Designated Substance Survey, Brantford, ON (2013): Development of an Access database for survey results and automated reporting of asbestos material location and condition. Client: City of Brantford.

KEVIN J. FITZPATRICK, P.Eng.

Senior Project Engineer, Environment

AREAS OF PRACTICE

Hydrogeology

Aggregate Resources

Geology & Geotechnical Engineering

Environmental Assessments & Remediation

Waste Management

PROFILE

Mr. Kevin Fitzpatrick, P. Eng. (Geological) is a Senior Project Engineer with more than 20 years of experience in geology, hydrogeology, geotechnical engineering, and water resources. His work experience encompasses project management, field investigations, analysis, interpretation, and peer review for numerous projects requiring his earth science expertise.

Mr. Fitzpatrick has developed his technical and project management expertise through his management of geological, hydrogeologic and geotechnical investigations related to groundwater quality and quantity compliance issues, aggregate resources, waste management, environmental remediation, dewatering, and civil construction. He has been a guest lecturer for geotechnical engineering course at Niagara College since 2012.

EDUCATION

B.A.Sc. Geological Engineering, University of Waterloo, ON	1993

PROFESSIONAL DEVELOPMENT

WHMIS	2013
Critical Thinking in Aquifer Test Interpretation, Christopher Neville, S.S. Papadopulos & Associates	2009
40-hour Health & Safety Training Course for Hazardous Waste Operations, OSHA, and update courses, Surface Miner Common Core Training	2005
Waterloo In-situ Groundwater Remediation Course, Toronto, ON	2000

PROFESSIONAL ASSOCIATIONS

Professional Engineers Ontario	1996
Ontario Stone, Sand and Gravel Association, Rehabilitation Committee	OSSGA
Aggregate Resource Prospecting and Evaluation Specialty, Ontario Ministry of Transportation, Registry Appraisal and Qualifications System	RAQS
Niagara College Programs Advisory Committee for Construction/ Civil Engineering Programs	2013

CAREER

Senior Project Engineer, Environment, WSP	2014 - Present
Senior Project Engineer, Environment, GENIVAR (now named WSP)	2009 - 2013
Project Engineer, Jagger Hims Limited (GENIVAR Acquisition)	1993 - 2009

PROFESSIONAL EXPERIENCE

Hydrogeology

- Assessments, Permit to Take Water Applications and Hydrogeologic Monitoring Reports (ongoing): Completed numerous studies as project manager in support of OWRA applications and Certificate of Approval for Discharge studies throughout Ontario, including in Lincoln, Waterford, Mosport, Thorold, Hamilton, Niagara Falls, Coboconk, Markham, Port Colborne, Port Dover, Wainfleet and Hagersville. The studies supported quarry applications, civil construction dewatering and industrial applications. Client: Various.
- Dewatering Assessment, Fort Erie, ON (2012): Hydrogeologic study for a pumping station within a productive, corrosive bedrock aquifer. Client: Region of Niagara.
- Hydrogeologic Assessment, Flamborough, ON (2011): Hydrogeologic assessment for a large food processing facility. Work included geotechnical design and wastewater compliance issues. Client: Earthfresh Foods Inc.
- Water Well Interference, Niagara-on-the-Lake, ON (2011): Completed a salt water intrusion contaminant assessment as part of a Ministry of Environment director's order. Design of a sulphate-resistant decommissioning program to prevent future cross-contamination. Client: Aviva Canada.
- Groundwater Interference Study, Dunnville, ON (2010): Intermittent issues at residential wells located adjacent to a dolostone and limestone quarry were evaluated for quality and quantity. The hydrogeology was complicated by the high transmissivities of the aquifer and the proximity of the Grand River and Lake Erie. Client: Dunnville Rock Products.
- Lookout Point Golf Club, Pelham, ON (2008-ongoing): Conducted a multi-year groundwater and surface water investigation that led to construction of a high capacity deep well in the Fonthill Kame for golf course irrigation. Other consultants had installed deep wells at the site; however, yields were very poor. High hydrogen sulphide concentrations and a cold-water fishery were also a concern. A thorough re-evaluation of the local hydrogeology was completed and detailed long-term pump tests were performed to satisfy Niagara Escarpment Commission and MOE concerns. Monitoring of the various system components was designed to improve data quality and lower operating costs. Client: Lookout Point Golf and Country Club.
- Groundwater Salt Impact Assessment, Lincoln, ON (ongoing): Hydrogeologic monitoring at a winter sand storage facility. The facility is located above the Niagara Escarpment on fractured bedrock upgradient of several groundwater springs. A best management plan was produced for the facility. Client: Town of Lincoln.
- Hydrogeologic Study, Port Colborne, ON (2009): Hydrogeologic study to support residential development plan. A developer needed to assess a productive shallow bedrock aquifer as part of a plan of subdivision. Client: Lester Shoaltz Limited.
- Hydrogeologic Monitoring, Caledonia, ON (2009): Hydrogeologic monitoring at a golf course in support of a Permit to Take Water. Electronic groundwater monitoring was installed to provide high quality data. Client: Numbered Ontario Company.
- Niagara Tunnel Project, Niagara Falls, ON (2008): Completed detailed core logging on deep groundwater monitors. Cores represented a complete section of Niagara Escarpment bedrock from the Guelph Formation to the Queenston Formation. Client: Strabag.
- Alternative Irrigation Sources, St. Catharines, ON (2007): Conducted hydrogeologic evaluation of a groundwater irrigation source for a golf course. The site was utilizing

a municipal supply for irrigation. Multiple low-yielding wells of poor quality complicated the assessment. Client: Urban & Environmental Management.

- Hydrogeologic Assessment, Massey, ON (2006): Hydrogeologic assessment of proposed Greenfield quarry. The site is a traprock escarpment and is located at a watershed divide. Impact assessments, a monitoring program and a closure plan were completed. Client: Pioneer Construction.

Aggregate Resources

- Completed detailed resource assessments, approvals and licensing for many major aggregate producers including Ontario Ministry of Transportation, CBM Canada, Dufferin Aggregates, Lafarge Canada, Walker Industries, Capital Materials Inc., Chefero Sand, Pioneer Construction, Waterford Sand and Gravel, Nelson Aggregates, Dimension Stone Ltd. and for several private clients.
- Conducted geologic studies in unconsolidated deposits. These sites include the Oak Ridges Moraine, Paris and Galt Moraines, and sites in Ayr, Caledon, Cambridge, London, Stratford, Brantford, North Dumfries, Orangeville, Norwood, Ommemee, and more than 60 sites in Northern Ontario.
- Conducted numerous detailed bedrock resource evaluations (dolostone, limestone, shale, granite, traprock) and licenses at sites throughout Ontario, including the Niagara Escarpment, Lake Erie shoreline, Guelph, Shelburne, Hamilton, Georgian Bay, Carden, Hudson Bay lowlands, Manitoulin Island, and Northern Ontario. Northern Ontario aggregate experience has included work within the Grenville, Southern and Superior Province locations.
- Proposed Shale Quarry Assessment, Brampton, ON (2010): Completed a resource assessment of a property zoned for a shale quarry in support of redevelopment. Client: Osmington Inc.
- Proposed Dolostone Quarry, Wainfleet, ON (2009): Peer review and witness statements at a proposed quarry for an Ontario municipal board hearing. Client: Sullivan Mahoney LLP.
- Clay Borrow Pit, Thorold, ON (2007): Completed aggregate wayside pit permit for clay borrow for 400-series highway embankments. Client: Hardrock Group.

Geology and Geotechnical Engineering

- Slope Stability Studies, Excavations and Retaining Wall Inspections (ongoing): Conducted over 60 studies in support of development approval for private clients, public agencies and consultants.
- Rock Mechanics Work (ongoing): Conducted rock wall stability assessments in Lincoln, Woodstock, Orillia, Ottawa, and Quebec for various clients in support of open excavations.
- Post-construction Investigations (ongoing): Conducted forensic examinations of failed structures and roadways related to subsurface conditions in Burlington, Niagara-on-the-Lake and Lake Simcoe for various private and professional clients.
- Foundation Inspections (ongoing): Inspections of footings for bridges, buildings, marine facilities and retaining walls for public, private and institutional clients.
- Road Construction Investigations (ongoing): Geotechnical studies completed in support of road reconstruction for municipal government agencies including project management for material inspections (concrete, asphalt and compaction testing).

- Septic System Investigations and Sewage Lagoon Assessments, various locations in Niagara Region (ongoing): Conducted geotechnical investigations for new municipal sewage lagoons, and investigations for large septic systems. Client: Niagara Region.
- Dewatering Investigation, Hamilton (2019): Dewatering investigation for earth retaining structure at a proposed waste water treatment plant. Client: Canada Centre for Inland Waters.
- Pipeline Work, Geotechnical Investigations for pipeline works across CN Rail/Welland Canal/Niagara Escarpment. (2018): Client: Walker Industries.
- Retaining Pond Design, North Dumfries ON (2017): Geotechnical work for liner installation. Client: Preston Sand and Gravel; Walker Industries
- Jerseyville Road Facility, Jerseyville, ON (2017): Water supply, geotechnical investigation and wastewater servicing peer review and project management. Client: The Green Organic Dutchman.
- Boat Ramp Investigation, Fort Erie, ON (2017): Below water geotechnical investigation within the Niagara River. Client: Niagara Parks Commission.
- Binbrook Dam Safety Review, Binbrook, ON (2016): Earth dam testing and inspection. Client: Niagara Peninsula Conservation Authority.
- East Rail Maintenance Yard, Whitby, ON (2016): Construction dewatering issues for a rail siding. Client: Bird/Kiewit Joint Venture.
- Glanbrook Landfill Collector System Evaluation, Hamilton, ON (2015): Subsurface geotechnical assessment of a failed sewer. CCTV work. Client: City of Hamilton.
- Hydrogeologic Study, Flamborough, ON (2011): Proposed Earthfresh potato processing facility hydrogeologic study. Client: Earthfresh.
- Facility Relocation and reservoir installation, Dunnville, ON (2011). Client: Intercounty Concrete.
- VivaNext, Highway 7, Markham, ON (2011): Permit to take Water for three concrete box culvert stream crossings. Client: Brennan Paving and Construction.
- Hotel Dieu Hospital, St. Catharines, ON (2004, 2010): Conducted a preliminary geotechnical investigation for a proposed general hospital on an existing site; and subsequently, geotechnical considerations for site after use. Client: Niagara Health System.
- Rail Siding Hopper, Niagara Falls, ON (2012): Conducted a geotechnical investigation for an unloading facility. Client: Redpath Sugar.
- Niagara Health System
  - Hotel Dieu Hospital, St. Catharines, ON (2004, 2010): Conducted a preliminary geotechnical investigation for a proposed general hospital on an existing site; and subsequently, geotechnical considerations for site after use. Clients: Niagara Health System and Mountainview Homes.
  - Port Colborne General Hospital (2006): Geotechnical investigation at the Port Colborne Hospital Site.
  - St. Catharines General Hospital (2005): Preliminary geotechnical investigation on a proposed greenfield general hospital site.
- Commercial Construction of an Automobile Dealership, St. Catharines, ON (2008): Geotechnical studies for construction of an automobile dealership on thick fill soils. Client: Confidential.

- Hamilton Public Housing, Stone Church Road, Burlington, ON (2005): Geotechnical Drilling Program at failed former public housing building. Client: Morrison Hershfield.
- Rolling Meadows Subdivision, St. Catharines, ON (2005): Geotechnical investigation and report at a large proposed subdivision. Client: Numbered Ontario Company.
- Arcelor Mittal, East Chicago Steel Works, Gary, IN, USA (2002): Slag granulation dewatering assessment. Provided expert testimony for a construction dewatering investigation around a sheet pile wall cofferdam. This work was in support of a dispute before the American Arbitration Association. Client: Lafarge Canada Inc.
- Caisson and Pile Inspections, St. Catharines/Thorold, ON (2002, 1999): Supervised and inspected caisson installations. Geotechnical investigation of a pile-supported outbuilding at a hospital. Clients: Walker Industries Holdings Limited; Polymax Construction.

Environmental Assessment and Remediation

- Environmental Reporting (ongoing): Numerous soil, groundwater and surface water environmental reports completed for private and public clients. Reviewed and authored numerous Phase I and Phase II Environmental Site Assessments.
- Former Public Works Yard, Lincoln, ON (ongoing): Design, operation and optimization of a pump and treat groundwater remediation system in a fractured bedrock environment. The system has operated successfully for over 15 years. Client: Town of Lincoln.
- Truck Marshalling Yard, Burlington, ON (2011): Conducted a hydrogeologic investigation at a DNALP-impacted site. Client: DML Environmental.
- Former Dry Cleaning Site, Hamilton, ON (2009): Conducted a DNAPL investigation in shallow fractured bedrock, complicated by the presence of shale. This work corrected a previous consultant's study. Client: Confidential.
- Reported PCB-impacted Automobile Dealership Property, St. Catharines, ON (2009): Groundwater assessment program at a commercial property as part of a dispute resolution. Client: Confidential.
- Pesticide-Impacted Farm Building, St. Catharines, ON (2008): Soil assessment and remediation due to pesticide and fuel oil impacts at a former farm. Client: Confidential.
- Commercial Property Assessment, Canarctic Drive, North York, ON (2005): Soil and groundwater assessment at a former manufacturing facility prior to purchase. Client: Confidential.
- Flint Road Phase II ESA, Downsview ON (2004): The absence of groundwater and soil contamination was confirmed prior to sale of a commercial property. Client: Torkin Manes Cohen Arbus LLP.
- Fuel-impacted Soil and Groundwater, Orwell Road, Mississauga, ON (2004): Conducted a soil remediation program at a leaky underground storage tank site. Work included installation of a dewatering and treatment system for soil excavation below the water table. Client: Confidential.
- Fuel Oil Tank at a Housing Complex, Dunnville, ON (2002): Underground storage tank soil and groundwater investigation. Construction activities uncovered a UST. The tank had leaked into soil and sewer utilities. Sampling was completed and remedial options presented. Client: Hydro Vac Inc.

- Vineland Quarry Asphalt Plant, Lincoln, ON (2002): Conducted an analysis of scrubber sediment for disposal options. Client: Rankin Construction.
- Former Plating Facility, Mississauga, Ontario (2001): Environmental Assessment and remediation of soil, groundwater and installation of a remedial pumping system at a chrome and copper plating facility. Client: Chambers of Canada.
- Former General Abrasives Site, Niagara Falls, ON (2001): Extensive soil and groundwater sampling and contaminant delineation program at a large (40 ha) former industrial facility. Client: R. Ste. Pierre Excavation.
- Effluent-impacted Water Course, Beamsville, ON (2000): Investigation of a complaint led to an MOE order being rescinded regarding a leaking surface water underground storage tank. Client: Desousa Wines.

Waste Management

- Involved in numerous hydrogeologic monitoring programs at private and public landfills throughout Southern Ontario, including Niagara, Hamilton, Region of Waterloo, Simcoe County, City of North Bay, Region of Halton and in Lambton County.
- Unlicensed Landfill, Grimsby, ON (2008-ongoing): Preliminary and ongoing monitoring of a 30,000 tonne unlicensed landfill within a former quarry. Work includes a hydrogeological evaluation of the site, waste delineation and impact analysis; calculations of contaminating lifespan of the waste and financial assurance. The project involves extensive liaison with the Ministry of Environment on behalf of the client. Client: Confidential.
- Park Road Landfill, Grimsby, ON (2009, 2011): Bedrock core logging for new open-hole groundwater monitors. Interpretation of downhole geophysical logs to further define bedrock stratigraphy and fractures/flow zones. Client: Niagara Region.
- Bridge Street Landfill, Fort Erie, ON (2004, 2007, 2010): Geotechnical studies in support of L.C.S. construction. Analysis of instability of waste slopes for regarding purposes. Bedrock core logging for groundwater monitors installed through the Onondaga Escarpment. Completed leachate seep analysis and review of remedial measures, and toe drain installation. Client: Niagara Region.
- Line 5 Landfill, Niagara-on-the-Lake, ON (1994, 2004): Conducted geotechnical evaluation of base of new landfill cell to support landfill operations. Hazardous material sampling and analysis of sealed drums left at landfill site. Client: Niagara Region, Town of Niagara-on-the-Lake.
- West Quarry Landfill, Leachate Management Program, Thorold, ON (1999, 2003): Field supervision of installation of large-diameter caisson wells for controlling leachate in waste. Consultations for construction of residential compost facility on waste. Client: Niagara Waste Systems Limited.
- Glanbrook Landfill Site, Artesian Conditions Assessment, Glanbrook, ON (2000): Conducted an evaluation of deep groundwater upwellings associated with a former gas well on the landfill site. Client: Regional Municipality of Hamilton Wentworth.
- Centre Street Landfill, Pelham, ON (1998): Landfill compliance monitoring reporting as part of the site's Certificate of Approval. This landfill is located above deep unsaturated sands. Client: Town of Pelham.

PUBLICATIONS AND PRESENTATIONS

Publications

- Fitzpatrick, K and Campbell, J. 2012. Lake Erie to Lake Ontario, Spills, Mills and Landfills and GW/GS Glacial Geology; International Association of Hydrogeologists, 39th IAH Congress, September 16-21, 2012, Niagara Falls, ON, unpublished technical tour book.

APPENDIX B

Monitor Construction Details and Water Level Data

Table B-1: Monitoring Well Construction Details
Safarik Pit

Well ID	UTM		Top of Pipe Elevation (mASL)	Ground Surface Elevation (mASL)	Stick-up (m)	Measured Depth (mbTOP)	Screened Interval (mbgs)	Screened Interval (mASL)
MW21-01 (SAF)	4810093.943	569526.217	317.82	316.95	0.76	16.01	12.0 - 15.2	305.0 - 301.8
MW21-02 (SAF)	4810014.468	569931.985	328.63	327.98	0.65	22.38	18.4 - 21.6	309.6 - 306.4
MW21-03-D (SAF)	4810679.784	570037.809	322.39	321.42	0.95	25.22	21.2 - 24.4	300.2 - 297.0
MW21-03-S (SAF)	4810677.934	570039.545	322.33	321.38	0.97	6.51	2.3 - 5.5	319.1 - 315.9
MW21-04 (SAF)	4810448.223	570309.851	328.82	327.87	0.88	25.26	21.2 - 24.4	306.7 - 303.5

Table B-2: Manual Groundwater Level Elevations
Safarik Pit

Well ID:	MW21-01 (SAF)		MW21-02 (SAF)		MW21-03-D (SAF)		MW21-03-S (SAF)		MW21-04 (SAF)	
Top of Pipe Elevation (mASL):	317.82		328.63		322.39		322.33		328.82	
Date of Water Level Measurement	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)	(mbtop)	(mASL)
15-Dec-21 (after well install)	11.61	306.21	19.94	308.70	14.97	307.43	2.90	319.43	21.83	306.99
22-Dec-21 (during logger install)	11.61	306.21	21.67	306.97	14.95	307.44	2.86	319.48	21.82	307.00
28-Mar-22	11.16	306.67	21.07	307.56	14.44	307.95	1.07	321.26	21.27	307.55
16-Jun-22	10.97	306.85	20.88	307.75	14.20	308.19	2.02	320.31	20.91	307.91
23-Aug-22	11.36	306.47	21.20	307.44	14.67	307.72	3.20	319.13	21.40	307.42
08-Dec-22	11.83	305.99	21.63	307.00	15.31	307.09	3.93	318.40	22.07	306.75
24-Mar-23	11.81	306.01	21.76	306.87	15.27	307.12	2.95	319.38	22.19	306.63
22-Jun-23	11.24	306.58	21.05	307.58	14.44	307.95	2.03	320.30	21.22	307.60
12-Sep-23	11.23	306.59	21.07	307.56	14.44	307.95	2.50	319.83	21.20	307.62
15-Dec-23	11.53	306.29	21.35	307.28	14.85	307.54	2.84	319.50	21.65	307.18
26-Mar-24	11.24	306.58	21.14	307.49	14.54	307.85	1.63	320.70	21.35	307.47
10-Jun-24	11.00	306.82	20.90	307.73	14.22	308.17	1.84	320.49	20.95	307.87
20-Sep-24	10.93	306.89	20.84	307.79	14.04	308.35	2.61	319.72	20.79	308.03
03-Dec-24	11.27	306.55	21.16	307.47	14.53	307.86	3.07	319.27	21.32	307.50
19-Mar-25	11.43	306.39	21.41	307.22	14.83	307.56	2.19	320.14	21.73	307.09

Figure B-1: Groundwater Hydrograph - Perched MW21-03-S (SAF)
Safarik Pit

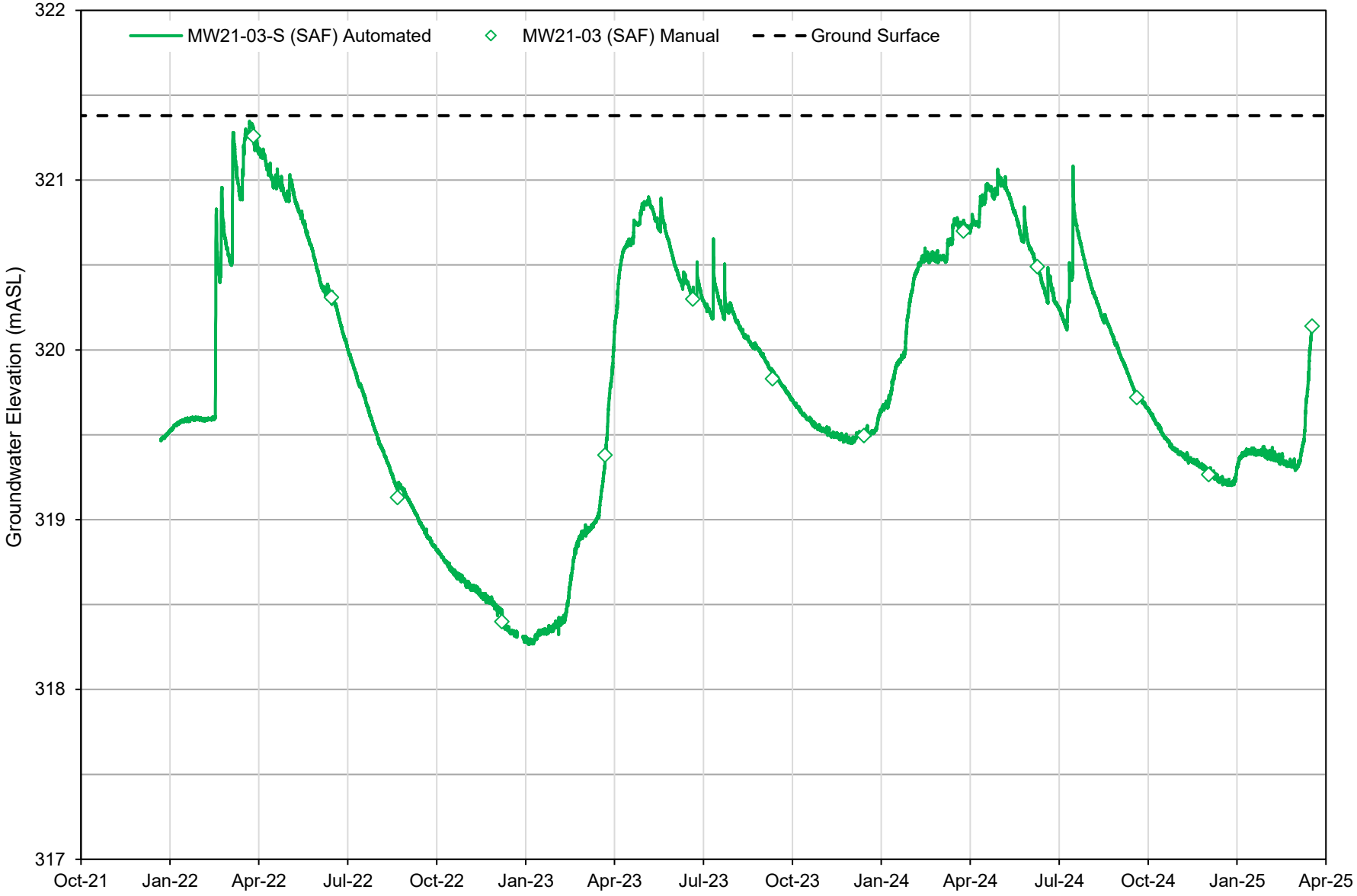
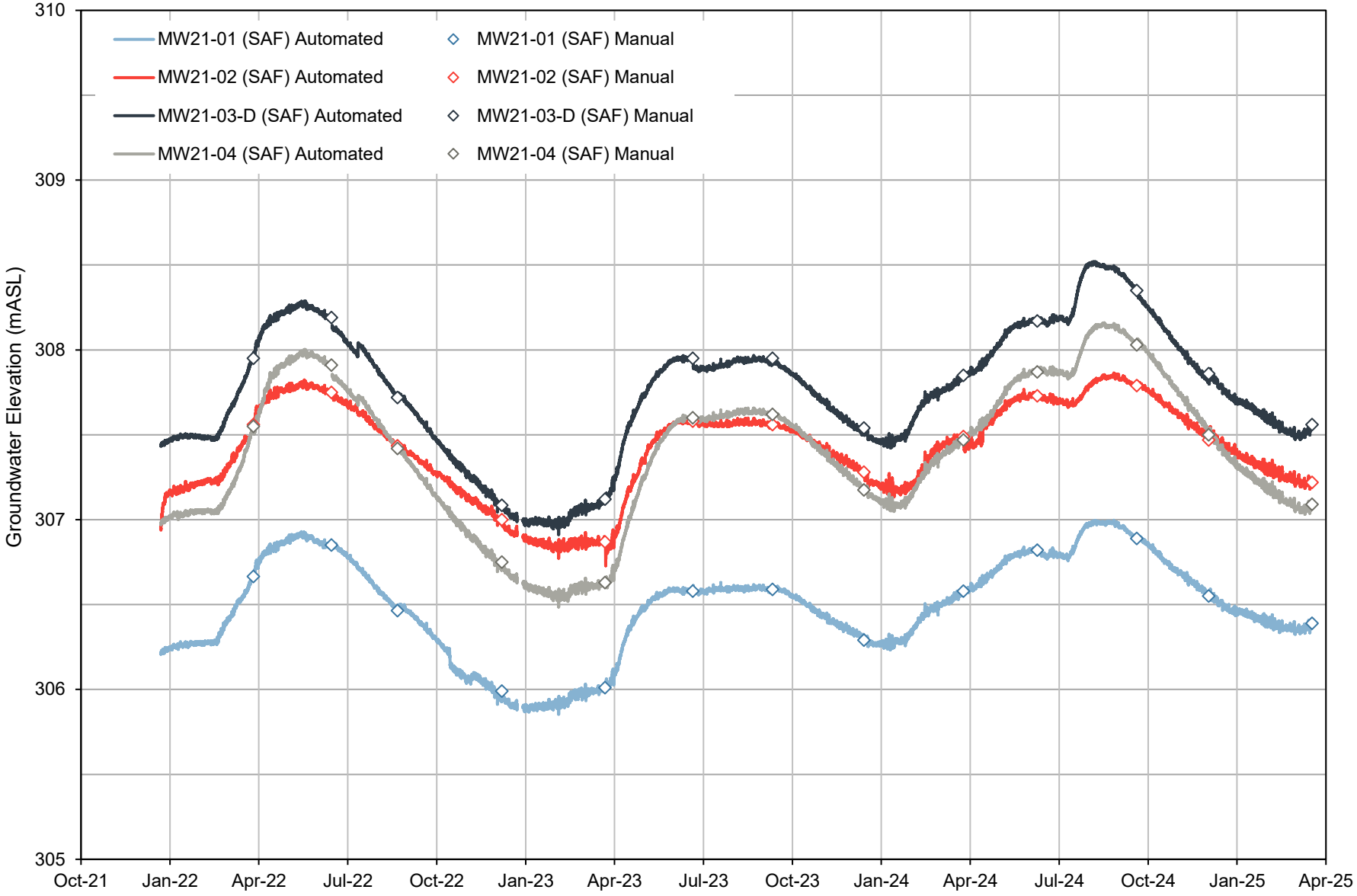


Figure B-2: Groundwater Hydrograph Safarik Pit



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