



MORWICK  
**G360**  
GROUNDWATER RESEARCH INSTITUTE

# 2<sup>nd</sup> Annual Morwick G360 Report 2024

FALL 2024



UNIVERSITY  
of GUELPH

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# A MESSAGE OF THANKS

Dear Ted,

Our groundbreaking event in November 2023 feels like a natural beginning for this report. The excitement sparked on that day has persisted, even as phase one of the Morwick Groundwater Research Centre nears completion.

The new Centre has already inspired more outreach events to engage with youth, undergraduate students, graduate students, and professionals. We have initiated new projects, working with new partners while our current collaborations feed off the enthusiasm and enhanced visibility promised by the new facilities that we celebrated on that day in November.

This unique Centre will intensify our ability to attract and retain some of the best students, faculty, and researchers. Additionally, it will foster deeper community awareness and engagement with the City of Guelph's groundwater quality and preservation programs.

We are equally excited about the sustained promise of our global reach and impact. In March, for example, we welcomed visiting researchers and students from Brazil, Chile, and Turkey and hosted a professional workshop that attracted 52 attendees from 7 different countries. We are proud that our research is protecting Canadians and helping citizens around the world.

The Morwick G360 Groundwater Research Centre will become an international hub where we will host workshops, short courses, large-scale meetings, and other outreach events. This promises continued growth and expanded connections within the local community, across Canada, and around the globe.

I hope that you enjoy this summary, that demonstrates the remarkable impacts that flow from your goodwill.

Sincerely and with gratitude,

**Beth Parker**

Director, Morwick G360 Groundwater Research Institute



# A MEMORABLE GROUNDBREAKING CEREMONY

On Thursday, November 9, 2023, we celebrated the promise of next level excellence with a ceremonial groundbreaking at 360 College Avenue E. Our new Morwick Groundwater Research Centre (MGRC) heralds a bigger, brighter future for groundwater quality and preservation.

Set in motion by your \$10M contribution, the new groundwater research hub rises from the foundation of our previous facility, thereby minimizing the structure's environmental footprint – we also like the metaphor of building the new facility upon our team's strong foundation of teaching, learning, research, and collaboration.

Visionaries understand the risks associated with research and discovery – you embraced those risks with your leadership gift and initiated our next level of progress toward a better future while motivating others to follow in your steps. As a result, we are seeing significant new contributions as well as multiple new conversations for support. Thank you.





# UPDATE ON RESEARCH CENTRE

When the new facility is complete, it will feature several unique teaching and research tools:

- A classroom that will serve as an educational space – for teaching, conferences, workshops, and community engagement.
- A two-story transparent groundwater well will be a key feature and teaching tool to show students the underground intricacies of monitoring and conventional wells.
- A rock wall representing the Silurian Dolostone Aquifer which is the sole drinking water source that we rely on in the City of Guelph.
- A rock core library for use as a hands-on teaching tool.

**The first phase of construction – the classroom – is set to be complete in November 2024.**

Your leadership has ignited a renewed energy – as we move forward, students and faculty feel the optimism created by the expanded possibilities of Morwick G360. We will engage the community with workshops and short courses for professionals, we will increase attraction and retention of graduate students with quality, hands-on education, and we will be sustained as a global hub for groundwater research.

# MAJOR RESEARCH PROJECTS

## 01 **Characterizing the Buried Bedrock Valley and Groundwater Flow Systems in Elora, ON.**

**Morwick G360 Team:** Isabella Bowman (MAsc Student), Jesse Brown (PhD Candidate), Dr. Peeter Pehme (P.Geo, Collaborator), Dr. Colby Steelman (PI), Dr. Emmanuelle Arnaud (PI), Dr. Beth Parker (PI)

**Research Site, Elora, ON:** new data being collected to gain further understanding of a buried bedrock valley and the associated overburden on bedrock groundwater flow systems.

**Sponsors, Partners & Collaborators:** NSERC CRSNG; Centre Wellington; Geological Survey, Canada.

## 02 **Groundwater as a Source and Pathway for Road Salt Contamination of Surface Water in the Great Lakes Basin.**

**Morwick G360 Team:** Dr. Jana Levison (PI), Dr. Jim Roy (ECCC), Ceilidh Mackie (PhD candidate), Rachel Lackey (MAsc candidate), Valerie Risch (MAsc student), Martina Di Iulio (BEng student)

**Research Site, Western Lake Ontario Basin:** data being collected over a two-year sampling program to increase the understanding of the contribution of chloride in groundwater to surface waters in the western Lake Ontario basin.

In April 2023, Rachel Lackey successfully defended her MAsc thesis, 'Geochemical determination of anthropogenic sources of elevated chloride in groundwater and surface water across various land uses of an urbanizing watershed' (Lackey et al. 2024, in prep.)

**Sponsors, Partners & Collaborators:** Ministry of the Environment; Conservation and Parks; Environment and Climate Change Canada; Credit Valley Conservation; Halton Region.

## 03 **Co-Developing Private Water Well Best Management Practice, Awareness & Education Materials through Community Engagement.**

**Morwick G360 Team:** Dr. Sheri Longboat (PI), Dr. Jana Levison, Dr. Heather Murphy, Dr Hugh Simpson (Project Coordinator)

**Research sites:** across Ontario, communities represented by farm, rural, and First Nations community-based organizations (CBOs), including technical knowledge holders in government, public health, and the water well industry.

Innovative collaborations between multiple communities, researchers, and community contributors to co-develop and implement a research design for gathering, analyzing, and sharing knowledge that address diverse rural community beliefs, concerns, needs, and values. Meant to update the 2023 Water Wells Best Management Practice book; and to investigate the use of collaborative, engaged community-based research to develop Knowledge Translation and Transfer (KTT) programs and materials that enhance sharing innovation with diverse rural communities.

**Sponsors & Partners:** Wilfred Laurier University; University of Guelph; Morwick G360; Ontario Agri-Food Innovation Alliance; The Groundwater Project (funded through KTT Research award from the Ontario Agri-Food Innovations Research program).

04

## **Novel Continuous Hydraulic Head Monitoring in Waterloo MLSs using Fiber Optic Sensors: Static and Dynamic Modelling in Support of Corrective Measures Studies.**

**Morwick G360 Team:** Dr. Beth Parker (PI), Dr. Jessica Meyer (PI, U of Iowa), Jessica Bulova (Senior Project Manager), Laura Weaver (Research Associate), Dr. Ken Walton (Research Scientist), Teresa Pilato (Modelling Specialist).

**Research site:** Waterloo, ON.

Collaboration with Hydrite Chemical Co. and **Matrix Solutions (Montrose Environmental)** to bring state-of-the-art methods to the site study by installing fiber optic transducers into MLSs, thereby developing three-dimensional dissolved phase plumes for suites of contaminants; advancing numerical contaminant transport/fate modelling.

**Sponsors, Partners & Collaborators:** Hydrite Chemical Co.; Matrix Solutions Inc.; University of Iowa.

05

## **Unveiling the Complexity: Hydrogeological Characterization to Decode Interactions and Reaction Mechanisms of Nitrogenated and Chlorinated Aromatic Compounds at a Contaminated Site in Brazil.**

**Morwick G360 Team:** Rosialine Roedel (PhD Candidate), Dr. Beth Parker (PI), Dr. Carlos Maldaner (Research Hydrogeologist)

**Research site:** Industrial Area, Brazil.

To refine the site conceptual model by characterizing the off-site of an industrial area that houses a complex mixture of contaminants, potentially posing a risk to groundwater receptors. Finding will offer valuable insights that inform decisions on mitigation and monitoring. This is pioneering research regarding contaminated sites in tropical climates.

**Sponsors, Partners & Collaborators:** Funding and site support provided by Corteva Agriscience do Brazil LTDA. Roedel, R. is supervised by Beth Parker.

06

## **Dipole and Push-Pull Tracer Testing to Characterize a Toluene- Contaminated Fractured Dolostone Aquifer and Inform Remediation.**

**Morwick G360 Team:** Felix Nyarko (PhD Candidate), Calvin Veenkamp (MAsc Student), Steven Chapman (P.Eng, Research Hydrogeologist), Dr. Beth Parker (PI), Dr. Ferdinando Manna (PI), Dr. Neil Thomson (PI), Dr. Kari Dunfield (PI), Kamini Khosla (Staff Scientist), Joseph Payne (PDF)

**Research site:** This Alice Street project site is a former industrial facility in Guelph, ON.

Activities nearly 30 years ago resulted in toluene contamination of the underlying fractured dolostone aquifer. Ongoing investigations and remedial activities have been conducted at the site for over a decade. In 2023, three tracer tests were conducted to characterize the fracture network connectivity and the transport of injected solutes. The resulting data will help inform the design and evaluate the success of a planned remedial program.

**Sponsors, Partners & Collaborators:** the research is part of a larger, multi-objective project, funded by BP and Econmetrix with matching NSERC Alliance grant and field support from Econmetrix, AECOM, and Vertex Environmental.

## 07 Discrete Fracture Network-Matrix (DFN-M) Investigations of a Creosote Contaminated Site Overlying Marlstone on the Island of Gotland, Sweden.

**Morwick G360 Team:** Zachary Walker (MSc Student), Steven Chapman (P.Eng, Research Hydrogeologist), Dr. Peeter Pehme (P.Geo, Collaborator), Dr. Beth Parker (PI)

**Research site:** Island of Gotland, off the east coast of Sweden.

Applying the Discrete Fracture Network-Matrix (DFN-M) field approach to a creosote contaminated site involving marlstone bedrock on the island of Gotland, off the east coast of Sweden. The site is a former sawmill.

**Sponsors, Partners & Collaborators:** SGU Geological Survey of Sweden; Wescon Miljökonsult; Relement.

## 08 Underground Inflows at Mines in the Yukon: Case Studies and Guidance.

**Morwick G360 Team:** Qian Yi Li (MASc Student), Baris Ozmen (IAESTE Student), Dr. Jonathan Kennel (Research Scientist), Dr. Ferdinando Manna (PI), Dr. Beth Parker (PI)

**Research Sites:** Four quartz mine sites in Wolverine, Minto, Bermingham, Flame & Moth, in Yukon.

In recognition of the critical importance of obtaining a better understanding of groundwater flow through fractured rock, the Yukon Ministry of the Environment sought MG360 team expertise and guidance related to characterizing fractured rock aquifers and predicting, monitoring, or managing underground flows at four mine sites. We conducted an independent, scientific review of characterization plans at the four sites where unexpected underground inflows were observed.

**Sponsors, Partners & Collaborators:** Yukon.

## 09 Sulfolane and Diisopropylamine: Two Emerging Co-Contaminants.

**Morwick G360 Team:** Dr. Erica Pensini (PI), Bibiana Bartokova (MASc Student), Dr. Beth Parker (PI), Jennie Hansson (PhD Student), Steven Chapman (P.Eng, Research Hydrogeologist), Dr. Ryan Prosser (PI), Amanda Reside (PhD Student), Tadeusz Gorecki (PI), Merrik Kobarfard (MSc Student)

**Research site:** Guelph, ON.

Sulfolane is an emerging contaminant, released into the environment via accidental spills and improper handling. In groundwater, it can be found alongside other pollutants, including hydrocarbons and amines (e.g.: diisopropylamine, DIPA). The co-presence of sulfolane and DIPA is due to the fact that they are both used to sweeten sour gas.

The Pensini Lab has been investigating the effect of groundwater chemistry on the mixing behaviour of sulfolane in groundwater and on its partitioning between water and non-aqueous phase pollutants (e.g.: hydrocarbons). The Prosser Lab is focused on studying the ecosystem impacts due to contamination, specifically Amanda Reside is assessing risk of sulfolane to amphibians. The Parker Field Research Team has implemented Core<sup>^</sup>DFN field sampling, preservation and extraction methods for the suite of contaminants and hydrochemical conditions at the selected field site tailored to the fractured rock and aquifer conditions using lab methods advanced by Dr. Tadeusz Gorecki and his student Merrik Kobarfard. The field methods used in cored holes resulted in G360 multi-level monitoring devices installed for temporal monitoring of the dynamic groundwater flow system. Jennie Hansson's PhD thesis involves analysis of plume discharge at a first order stream. Using novel monitoring well designs for the surface and groundwater interface.





## 10 **Baseline Groundwater Monitoring in the Transboundary Liard Basin (NWT), for Source Water Protection.**

**Morwick G360 Team:** Qian Yi Li (MSc Student), Somayeh Asadi Shekafti (PhD Student), Amanda Pierce (Research Hydrogeologist), Dr. Colby Steelman (PI), Dr. Jonathan Munn (Collaborator), Dr. Beth Parker (PI)

**Research site:** Transboundary Liard Basin in the Northwest Territories.

The team conducted a successful drilling campaign during May to July 2024. Six new boreholes were drilled across three locations at the Fort Liard research site. The drilling was conducted to gain new and future geologic, hydrogeological, hydrochemical, and geophysical datasets to provide a complete framework of the groundwater system in and around Fort Liard to aid Government of NWT in the protection of fresh groundwater sources in Canada's North.

**Sponsors, Partners & Collaborators:** Government of NWT; Acho Dene Koe; NSERC CRSNG; University of Calgary; McMaster University; Westbay Instruments; RST; Foundex Explorations Ltd.

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## Monitoring the Vadose Zone: Bedrock Vapour Extraction at the SSFL.

**Morwick G360 Team:** Dr. Ferdinando Manna (PI), Dr. Jonathan Kennel (Research Scientist), Amanda Pierce (Research Hydrogeologist), Dr. Beth Parker (PI)

**Research site:** Santa Susana Field Laboratory (SSFL), Simi Hills, Ventura County, California.

Six new coreholes were drilled at the SSFL for the purpose of monitoring a Bedrock Vapour Extraction (BE) pilot student. Five of the new wells used FLUTE™ multilevel systems for sampling gas in the vadose zone and one hole has a Westbay system installed.

**Sponsors, Partners & Collaborators:** Boeing; FLUTE™, Jacobs, Westbay Instruments, NSERC CRSNG.

12

## Understanding Mechanisms of Recharge through Fractured Sandstone at the SSFL.

**Morwick G360 Team:** Dr. Ferdinando Manna (PI), Dr. Jonathan Kennel (Research Scientist), Dr. Beth Parker (PI)

**Research site:** Santa Susana Field Laboratory (SSFL), Simi Hills, Ventura County, California.

The team used cross-correlation to quantify the relationship between precipitation and water levels for 16 wells at the Santa Susana Field Laboratory (SSFL). Many of the wells required a threshold amount of precipitation during the rainy season before a response could be detected – this was likely related to the water deficit that occurs during the previous 7 month dry season.

**Sponsors, Partners & Collaborators:** Boeing; NSERC CRSNG.

13

## The Challenges with Amendment Delivery in Fractured Rock: Using DFM Simulation to Quantify Amendment Reach

**Morwick G360 Team:** Dr. Ken Walton (Research Scientist), Teresa Pilato (Staff Scientist), Dr. Beth Parker (PI)

Contaminant remediation in fractured porous rock is difficult due to complexities of fracture network connectivity and aperture variability, making the movement of water and contaminants unpredictable and uneven.

Common remediation efforts rely on the ability to deliver some type of amendment to enhance existing biological activity or deliver reactive solids or solutes to sequester or degrade contaminants in situ. Unfortunately, there is no guarantee that an amendment delivery pathway will reach its intended extent due to channelized flow. Furthermore, the most accessible parts are the fractures (with apertures that are typically 10s to a few 100 microns) which contain only a fraction of the contaminant mass – the majority of mass that lives within low permeability rock matrix blocks between the fractures (as in, only accessible through diffusion).

Creating a series of 3d DFM simulations can illustrate the use of DFM modelling in quantifying the reach of an amendment in a targeted treatment zone.

**Sponsors, Partners & Collaborators:** Boeing; Consortium.

## 14 **Doody Family Chair for Women in Engineering.**

**Morwick G360 Team:** Dr. Jana Levison (PI), Jean Hein (Outreach Manager, CEPS)

Equity, Diversity, and Inclusion (EDI) in STEM is an important consideration at University of Guelph and by extension, Morwick G360.

Solutions to challenging problems benefit from people having a multitude of perspectives. Thanks to a transformative \$1M gift from retired engineers, Brian and Diana Doody, Dr. Jana Levison (the inaugural Doody Family Chair for Women in Engineering) is boosting engagement with youth and increasing enrollment – and retention – of women in UofG engineering programs.

Greater detail on the above-mentioned research can be found in the MG360 Newsletter:

<https://g360group.org/wp-content/uploads/2024/05/G360-Newsletter-2023-vf.pdf>

## 15 **Assessing and managing the risk associated with a major bedrock quarry in Guelph, Ontario.**

**Morwick G360 Team:** Dr. Jonathan Munn (PI), Dr. Beth Parker (PI), Dr. Jana Levison (PI), Hamidreza Dannak (PhD Student), Tobiloba Onipe (MAsc Student)

**Research Site, City of Guelph:** Historical bedrock excavation at the Dolime Quarry in Guelph has breached the aquitard layer that protects the main supply aquifer for the City of Guelph. To better understand and mitigate this risk, 8 new boreholes have been drilled around and within the Quarry, 6 of which have telemetry equipped multilevel monitoring wells to monitor the influence of pumping from the supply wells and quarry. Additionally, a LiDAR based drone survey has been collected in the quarry to learn about the fracture network that serves as the primary flow pathway through the aquifer. These datasets and study outcomes will guide the City's management of the quarry and nearby supply well pumping to provide continued safe drinking water for the people in Guelph.

**Sponsors, Partners & Collaborators:** The City of Guelph, Solinst Canada Ltd., Aardvark Drilling Inc., AECOM, WSP.

## 16 **Application of passive sampling for the monitoring of microbiological contaminants in aquatic systems**

**Morwick G360 Team:** Ilya Law (MSc Student), Dr. Heather Murphy (PI), Dr. Beth Parker (Collaborator).

Traditional methods for monitoring pathogens in environmental waters have numerous drawbacks. Few studies that monitored bacteria in any water source using membrane filters as passive samplers. Therefore, to fill this data gap, we assessed the efficacy of passive sampling compared to composite sampling for the monitoring of E. coli onto membrane passive samplers over time. We observed similar rates for E. coli detections on passive samplers compared to composite samples in surface water and wastewater.

**Sponsors, Partners & Collaborators:** NSERC Discovery, Guelph Institute for Environmental Research, WHAM Lab

# YOUTH AND COMMUNITY OUTREACH

Global challenges to safe and sustainable water sources serve to intensify our mission to train the next generations of groundwater science professionals. Additionally, pending retirements highlight an upcoming shortage of experts in the field, as well as an insufficient number of young Canadians entering the profession.

Engaging our community with specific attention to young students is an integral part of our strategy to increase enrollment in our College of Engineering and Physical Sciences and MG360 programs.

## **The following events were part of our 2023-2024 outreach:**

- Hosted Distinguished Lecturers such as the 2023 and 2024 Darcy Lecturer, and 2024 Birdsall Dreiss Lecturer
- Waterloo Wellington's Children's Groundwater Event (Virtual) – June 2023 and 2024
- The Royal Agricultural Winter Fair – November 2023 and 2024
- Visit to local elementary school, Sacred Heart Catholic School, Grade 8 – December 2023
- Visit to local high school, GCVI, Grade 12 – March 2024
- BattleSTEM – engaging youth in STEM-based learning experiences offered by U of G. – approximately 950 students and 50 teachers from more than 30 high schools across Ontario gathered for the annual BattleSTEM competition. Attendees had opportunity to participate in nearly 40 events and workshops, learning about diverse disciplines across science, technology, engineering, arts, and mathematics - May 2023 and 2024
- College Royal – March 2023 and 2024
- City of Guelph Public Works Week Open House – May 2024
- Groundwater U Lecture Series and Field Tour – a groundwater workshop series and tour of Santa Susana Field Laboratory (SSFL) to build an understanding of groundwater at SSFL. This site is a former rocket engine testing and nuclear research facility, 30 miles northwest of downtown Los Angeles, California. April 2024
- House of Commons Testimony, Freshwater Panel – Dr. Parker addressed the House of Commons Standing Committee on Environment and Sustainable Development. 'The pending global water crisis coincides with various challenges such as climate change, increasing demands for food and energy production, natural resource extraction and water and soil quality degradation,' says Parker. 'Groundwater is central to these challenges and therefore is an important part of the solution.'

We remain committed to training the next generation of groundwater science professionals, ensuring that we have the expertise to address our critical, world water quality issues.



# **SYMPOSIA, WORKSHOPS AND SHORT COURSES**

## **2024**

**Inaugural Hydrogeophysical Workshop**

March 7, 2024

**The University Consortium for Field  
Focused Groundwater Research**

May 22-24, 2024

**The University Consortium  
Fall Focus Meeting**

November 13-15, 2024

## **Planned for 2025**

**The Physical Hydrogeology Workshop**

March 6, 2025

**The Inaugural Science Policy Workshop**

May 12-14, 2025

**The University Consortium for Field  
Focused Groundwater Research**

June 3-5, 2025

**The University Consortium  
Fall Focus Meeting**

TBD

# GUEST LECTURES AND KNOWLEDGE MOBILIZATION

## Birdsall-Dreiss Distinguished Lecture, Geological Society of America Dr. Ben Rostron – February 16, 2024

Lecture on carbon storage: "Geology and hydrogeology at AQUISTORE: Canada's first CO2 storage project associated with a commercial-scale coal-fired power plant"

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## Darcy Lecture, National Ground Water Association Dr. Matt Becker – March 5, 2024

Lecture on "How Groundwater Impacts the People and Ecosystems of the South Pacific Islands"

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## World Water Day Water for Peace March 22, 2024

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## Art Corey Lecture Dr. Beth Parker – April 2, 2024 Colorado State University

Lecture titled "Building Diffusion into Hydrogeologic Conceptual Site Models with Field Evidence."



# VISITING STUDENTS AND RESEARCHERS

As we complete the MG360 facility, we expect that our visibility and profile will be enhanced, and our visiting researcher and student roster will expand.

**Carlos Marques** joined Morwick G360 as a visiting international PhD student with Dr. Parker in the summer of 2023. Carlos has gained experience participating in field activities and research projects conducted by CEPAS-USP (Groundwater Research Center of the University of São Paulo). He looks forward to advancing his knowledge in groundwater management and urban contamination with the Morwick G360 Groundwater Research Institute.

**Baris Cecil Ozmen** joined Morwick G360 as a visiting IASTE student with Dr. Parker in the summer of 2023. She completed her BSc in Mining Engineering at the Istanbul Technical University. She has had the opportunity to complete various internships in the underground mines and open pit mines in Turkey.

**Matias Taucare Matías** was a visiting researcher with us in February 2024. He is a Chilean geologist, holds a PhD in geology from Universidad de Chile after completing his undergraduate studies at Universidad Católica del Norte. His research focuses on developing hydrogeological conceptual models to understand the impact of geomorphological, structural, and anthropic factors on recharge process, particularly in mountainous areas. Proficient in diverse techniques, including structural geology, hydraulic tests, groundwater monitoring, and geophysics, his expertise lies in hydrogeochemistry, isotopy, and compositional data analysis. Matias currently teaches at Universidad de Chile's Geology Department while working on the WEF-Nexus Chile research project as a postdoctoral researcher.

# CO-OP STUDENTS

**Matthew Erdelsky** joined Morwick G360 as a co-op student this past summer (2024) with Dr. Parker, from the University of Waterloo where he is currently completing his undergraduate degree in Environmental Science with a specialization in Water Science. He assisted in the Northwest Territories field work and various other Morwick G360 projects.

**Anisha Karkera** joined Morwick G360 as a co-op student this summer (2024) with Dr. Parker, from the University of Waterloo, where she is currently completing her undergraduate degree with honours in Earth Sciences, and a Hydrogeology Specialization. She assisted in the Northwest Territories field work and various other Morwick G360 projects.

**Muskaan Kapadia** is an undergraduate student at the University of Waterloo. She studies Earth Science, specializing in Geophysics. She has been working at the Morwick G360 Groundwater Research Institute for four months as a co-op student technician. Muskaan has had previous work experience in geophysics and geotechnical engineering. She looks forward to gaining knowledge and experience in groundwater with the Morwick G360 team.

**Emma Nicholls** is currently pursuing her Bachelor of Environmental Engineering at University of Guelph. She has completed co-op terms working for environmental consulting firms and the Ministry of Agriculture Food and Rural Affairs. Emma is excited to further develop her knowledge of groundwater resources while she completes an 8-month co-op, working at MG360.



# CURRENT AND RECENTLY GRADUATED STUDENTS

MG360 hosts an impressive, international cohort of graduate students who bring a variety of skill sets and research perspectives into our comprehensive program.



## PhD Students

### Hamidreza Dannak

#### PhD Student, School of Engineering

Hamidreza Dannak, PhD Student, School of Engineering is an alumnus of the prestigious Erasmus Mundus Joint master's degree, GroundwatCH programme 2021 in Hydrogeology between IHE Delft Institute for Water Education, Delft, the Netherlands, Technical University of Dresden, Germany, and Institute Superior Technico, Lisbon, Portugal.

Hamidreza has worked on hydrogeological site characterization to improve a conceptual site model of a 'Natura 2000' site in the southern part of the Netherlands, North Brabant province. He worked with a company called Evides to improve local spatial resolution of hydrogeological models of REGIS II and GeoTOP. Hamidreza has also completed an internship with Waternet Company, Amsterdam's main water supplier, where he worked on fresh-brackish interface delineation.

Interested in using advanced and high-resolution geophysical tools for improving groundwater flow system understanding, Hamidreza is excited to learn at MG360.

'Groundwater flow system is alive and dynamic and always excites me with the way it responds to externally imposed pressures. By doing my PhD with MG360, I hope I can improve our insight on its static and dynamic characteristics.' Hamidreza Dannak, PhD candidate.

### Jennie Hansson

#### PhD Student, School of Engineering

Jennie Hansson, PhD Student, School of Engineering has an MSc in Environmental Science, specializing in Ecotoxicology from the University of Lund, Sweden. Jennie's focus has been understanding fate, transport, uptake, and accumulation of pollutants in the environment. As an ecotoxicologist, Jennie's expertise revolves around the study of responses at different biological levels, to determine the impact on the ecosystem.

Outside of academia, Jennie has primarily worked as an environmental consultant for contaminated sites. This involved a variety of fieldwork projects including groundwater and soil risk assessment and involvement with the marine monitoring team.

As she completes her PhD, Jennie looks forward to advancing her knowledge in complex real site issues in groundwater-surface water interaction and the potential impact of contaminated groundwater discharges to flora and fauna.

'For me, this is the ultimate way to combine two different practices to further understand and help solve the challenges we encounter by the extensive use of chemicals in our society.' Jennie Hansson, PhD candidate.

## **Rosialine Roedel**

### **PhD Candidate, School of Engineering**

Rosialine Roedel, PhD Candidate, School of Engineering is an environmental engineer with 15+ years of experience in environmental site characterization and groundwater related projects. Her MSc thesis focused on improving criteria for groundwater use permitting. She also coordinated the water resource management and monitoring programs for the Camacari Industrial Complex in Brazil. This included the evaluation of aquifer over-exploitation, the application of numerical models to guide management decisions, and how to gain useful insights from the massive environmental dataset collected to date. She has recently begun her PhD and her role as research assistant with the Morwick G360 team.

## **Somayeh Asadi Shekafti**

### **PhD Student, School of Engineering**

Somayeh Asadi Shekafti, PhD Student, School of Engineering has a bachelor's degree in Geology from Iran. Her first master's in applied Geophysics was completed in 2012 from the University of Science Malaysia where she worked on aeromagnetic data to detect buried underground structures such as faults. After graduation, Somayeh returned to Iran to work. In 2020, she started her second master's in Geophysics for Natural Risks and Resources at the University of Padova, Italy. She worked on seismic risk issues in Canada during the last year of her degree, when she won the exchange student program fund for 2 semesters at the University of British Columbia.

## **Felix Nyarko**

### **PhD Candidate, School of Engineering**

Felix Nyarko, PhD Candidate, School of Engineering has earned degrees in geological engineering (BSc, KNUST-Ghana, 2015) and groundwater (MSc, Institute for Water Education, IHE Delft, the Netherlands, 2019). In 2018, he was a research intern on the Phosphorous II project at the Institute of Hydrology, University of Freiburg, Germany. Felix has also worked as a mine geologist and a soil contamination analyst. He specializes in subsurface characterization using geophysical techniques and groundwater contaminant transport using hydrological tracers.

Currently, Felix's research focuses on field-based characterization of contaminant transport in porous aquifers with emphasis on understanding the spatial hydraulic connectivity at discrete depths.

## **Mansour Salek**

### **PhD Candidate, School of Engineering**

Mansour Salek, PhD Candidate, School of Engineering recently completed his Master of Engineering in Water Resources, specializing in groundwater vulnerability analysis from University of Guelph. He is pursuing a PhD in Water Resources Engineering with a focus on non-point contamination transport in bedrock aquifers.

## Master's Students

### Isabella Bowman

MASc Student, School of Engineering

Isabella Bowman, MASc Student, School of Engineering completed her BSc in Honours Earth Sciences with a Hydrogeology Specialization from the University of Waterloo. She has studied the geochemical evolution of water quality in the Waterloo moraine, she worked in the Heavy Metal Isotope Geochemistry Laboratory at the University of Waterloo, and she was part of the Water Efficiency team in the Region of Waterloo. Isabella will be investigating hydrogeologic properties and characteristics of the Elora buried bedrock valley using downhole hydraulic testing and dynamic monitoring techniques.

### Qian Yi (Cindy) Li

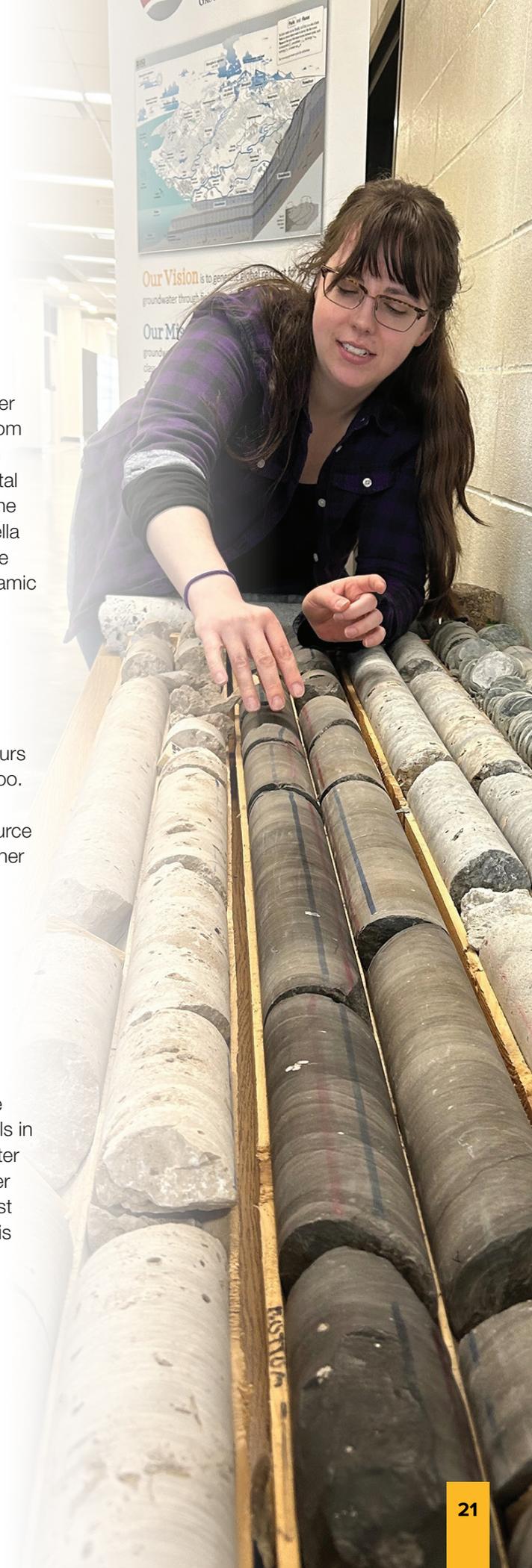
MASc Student, School of Engineering

Qian Yi (Cindy) Li, MASc Student, School of Engineering has an Honours BSc in Earth and Environmental Science from the University of Waterloo. She has gained experience through her co-op terms in groundwater remediation research, environmental management in the mineral resource industry, and Indigenous outreach. Cindy looks forward to advancing her expertise in groundwater remediation and protection at MG360.

### Calvin Veenkamp

MASc Student, School of Engineering

Calvin Veenkamp, MASc Student, School of Engineering is a BASc from the University of Waterloo Honours Environmental Engineering program, specializing in pollution treatment and control. He has completed co-op terms in a wide variety of fields including automotive manufacturing; geotechnical consulting; research on invasive sea snails in the Netherlands; environmental management at a cement factory; water taking permitting for the Ontario government (PTTW); and groundwater monitoring and remediation. His co-op experiences sparked an interest in groundwater remediation, and Calvin is excited to further develop his knowledge and field experience at Morwick G360.



## Zachary Walker

MASc Student, School of Engineering

Zachary Walker, MASc Student, School of Engineering completed his Honours BSc in Earth/Environmental Systems and Human Geography at University of Toronto, where he participated in field work and research that focused on glacial geomorphology and sediment transport mechanisms along the Oak Ridges Moraine. This initiated an interest in groundwater remediation and aquifer characterization, which in turn lead him to become an MASc candidate at Morwick G360. He hopes to learn novel techniques and methods in contaminant hydrogeology research.

## Tobiloba Onipe

MASc Student, School of Engineering

Tobiloba Onipe MASc Student, School of Engineering, completed his BSc in Geology at Ekiti State University, Nigeria and obtained an honours degree in Hydrology and Water Resources (Hydrology specialization) from the University of Venda, South Africa. His previous research focused on source mapping and geochemical characterization of naturally occurring fluoride in groundwater. Tobiloba gained experience with Morwick G360 this past summer as a co-op student and has started his MASc with the institute in September of 2024.



## Post Doctoral Fellows

### Sophie Erfurth

#### Postdoctoral Fellow

Sophie Erfurth, Postdoctoral Fellow conducts research at the intersection of groundwater resource use and irrigation agriculture. She investigates the impacts of predicted changes in groundwater availability on smallholder farming communities, associated local livelihoods, and global food security. With a BSc in Geography from University College London, UK, Sophie also has an MEM in Water Resources Management from Duke University, USA.

Using transdisciplinary tools, including Agent-Based Modelling (ABM) and Qualitative Comparative Analysis (QCA), her PhD research at the University of Oxford, UK sought to unpack social-ecological drivers of decision-making in groundwater management within the context of fragile political systems.

Prior to her doctoral studies, Sophie served as a policy officer at the German Federal Ministry for Economic Cooperation and Development (BMZ). Within the framework of the BMZ graduate programme, she worked as a hydrogeologist for Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Additionally, Sophie worked for the German Federal Institute for Geosciences and Natural Resources (BGR) in Tunisia, providing technical support on groundwater management for the governments of Morocco, Algeria, and Tunisia.

### Nataly Aranda Camacho

#### Postdoctoral Fellow

Nataly Aranda is a Ph.D. in Geophysics from the University of Sao Paulo. During her doctorate project, she applied seismic and electric methods to assess and monitor some physical and mechanical properties of a sanitary landfill in Brazil. Nataly worked for three years as a Professor at Ikiam University in Ecuador, teaching physics and geophysics courses and doing research in the Earth and Water Science Department. As a Postdoctoral Research Fellow with the Morwick G360 group, Nataly will be working on analyzing geophysical data.

## Recently Graduated Students

Our graduate cohorts move on to secure important careers that address global sustainability goals within multi-disciplinary roles. The graduates listed below are ambassadors of our program who demonstrate the integrity of the MG360 profile and embody the strong leadership that tests current norms while directing us toward a sustainable future.

### Cameron Myshok

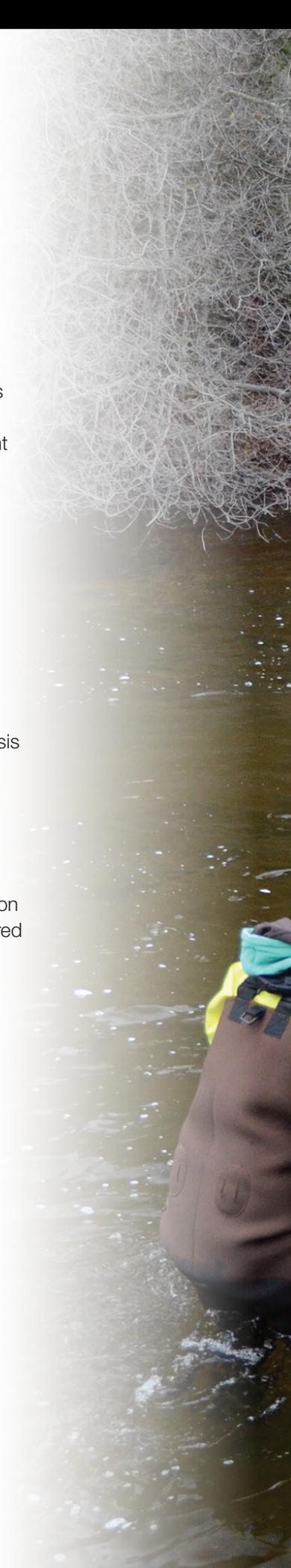
Cameron Myshok works with Geosyntec consultants. Cameron's thesis was on TCE Plume Evolution in a Fractured Dolostone Aquifer with Time-Varying Hydraulic Conditions: DFM Modeling Informed by High-Resolution Field Data (September, 2024).

### Laleh Shalikarian

Laleh Shalikarian is working with Morwick G360 after the completion of her MEng degree. Her thesis was on the topic of A Multiple Method Approach to Estimating Fracture Parameters in a Silurian Dolostone Aquifer (September, 2024).

### Michelle Leahey

Michelle Leahey works for the Government of British Columbia. Her thesis was based on 'Evaluation of Groundwater Flow Features and Flow Rates Through a DNAP-impacted Source Zone in Fractured Sedimentary Rock Using A-DTS' (January, 2024).





CURRENT AND RECENTLY GRADUATED STUDENTS

# AWARDS

## NSERC Synergy Award

On November 1st, Dr. Beth Parker, with her collaborators from the City of Guelph, Matrix Solutions and WSP Canada received the **NSERC Synergy Award for Innovation**. The prize celebrates our impactful and collaborative relationship working toward advancing and enhancing the City of Guelph's groundwater monitoring network. The main goal of this multi-faceted collaboration has been aimed at utilizing state-of-the-science methods to manage risks to the City's water supply, ultimately safeguarding the community's access to clean and safe water from now, until well into the future.

Bedrock aquifers are the sole suppliers of Guelph's water supply. To better understand the bedrock aquifer's complexity, Beth and her team have transformed Guelph into its own field laboratory.

This collaboration has led to the development of innovative and industry-led tools and methods for measuring contamination concentrations and flow rates underground.

Our research has provided crucial data, such as numerical models and 3D monitoring networks across the city. This data is necessary for making informed decisions regarding urban planning and sustainable governance to protect the quality and sustainability of Guelph's water supply.

Dr. Parker received a \$200,000 grant from NSERC to continue the advancement of this vital research. Each partner – WSP, Matrix, and the City of Guelph – will receive \$50,000 to further advance the research.

Collaborations are critical to the success and advancement of the high-quality research we produce. We are grateful for the opportunities to work together, and for the trail blazing advancements that these collaborations have produced over the years.

For more detail, a CEPS article about this successful collaboration and subsequent NSERC award can be found at this link: <https://news.uoguelph.ca/2023/11/u-of-g-collaboration-recognized-nationally-for-advances-in-groundwater-protection/>



## Research Leadership Chair Award

The Research Leadership Chair program was established in 2017 to celebrate mid-to-late-career researchers who have made substantive contributions to their field and have received national and international recognition for their research. The awards are based upon nominations by the faculty members' college.

For 2024, Dr. Beth Parker and Dr. Animesh Dutta from the School of Engineering are two of the twelve distinguished faculty named Research Leadership Chairs (RLC). Notably, both Dr. Parker and Dr. Dutta are focused on actionable research related to sustainability.

Dr. Parker is specifically recognized for her substantial, pioneering efforts in groundwater research. Her work to understand how water moves underground and how contaminants behave in groundwater, specifically in fractured rock, are key components for safeguarding our water supply.

Working to create sustainable groundwater resources across Canada and around the world, Dr. Parker's trailblazing discoveries in the field of groundwater research are impactful and internationally recognized. Also recognized with the RLC award are Dr. Parker's years as an educator and mentor, developing leaders for a sustainable future.

More about the two U of G School of Engineering RLC awards can be found at this link:

<https://www.uoguelph.ca/ceps/news/2024/02/two-newly-appointed-research-leadership-chairs-ceps>

## Student Awards

**Graduate Tuition Scholarship: Calvin Veenkamp and Cindy Li** – each year, the University of Guelph provides Graduate Tuition Scholarships (GTS) to graduate students across campus. The awards are based on academic excellence and this year, two of the School of Engineering master's students earned the Scholarships.

**Weston Family Awards in Northern Research: Cindy Li** – provides funding to graduate students in Canada who are pursuing natural science research in Northern Canada. This year, master's student Cindy Li received the generous award for her research in the Northwest Territories.

**NSERC Canada Graduate Scholarship: Cindy Li** – provided by the Natural Sciences and Engineering Research Council of Canada, this award is reserved for high-caliber scholars. Cindy Li was this year's recipient.

**Ontario Graduate Scholarship: Calvin Veenkamp** – received this award from the province of Ontario, based on merit.

# THANK YOU.

Your recognition of our work and your remarkable contribution to our new facilities will elevate everything that we do at the Morwick G360 Groundwater Research Centre. You are enabling a raised profile to attract the best students and collaborating scientists as well as a facility that can accommodate meaningful workshops and international conferences. We remain committed to continued success in novel groundwater research to sustain quality and protection of our precious resource. As we continue to mentor exceptional cohorts, we are focused on developing leaders who will carry the responsibilities of our future, the endless impacts of your vision, and the goodwill of your philanthropy. From the entire team of teachers, researchers, partners, and students, thank you for your leadership.

