

Introducing the Watershed and Ecosystems Living Lab (WELL):
A multidisciplinary outdoor lab to support river restoration teaching
and research

Elli Papangelakis

8th Natural Channels Conference

June 8, 2026

McMaster University, Hamilton, Ontario

Introduction

- Environmental sciences, geosciences, biology, and water resources engineering inherently involve **outdoor** applications.
- Opportunities for outdoor teaching enhances student learning and proves students with applied skills.
- Off-campus fieldtrips are logistically challenging, require additional paperwork, and often require students to pay extra fees.
- Just like we have indoor teaching labs on campus, why not have **outdoor** teaching labs on campus?

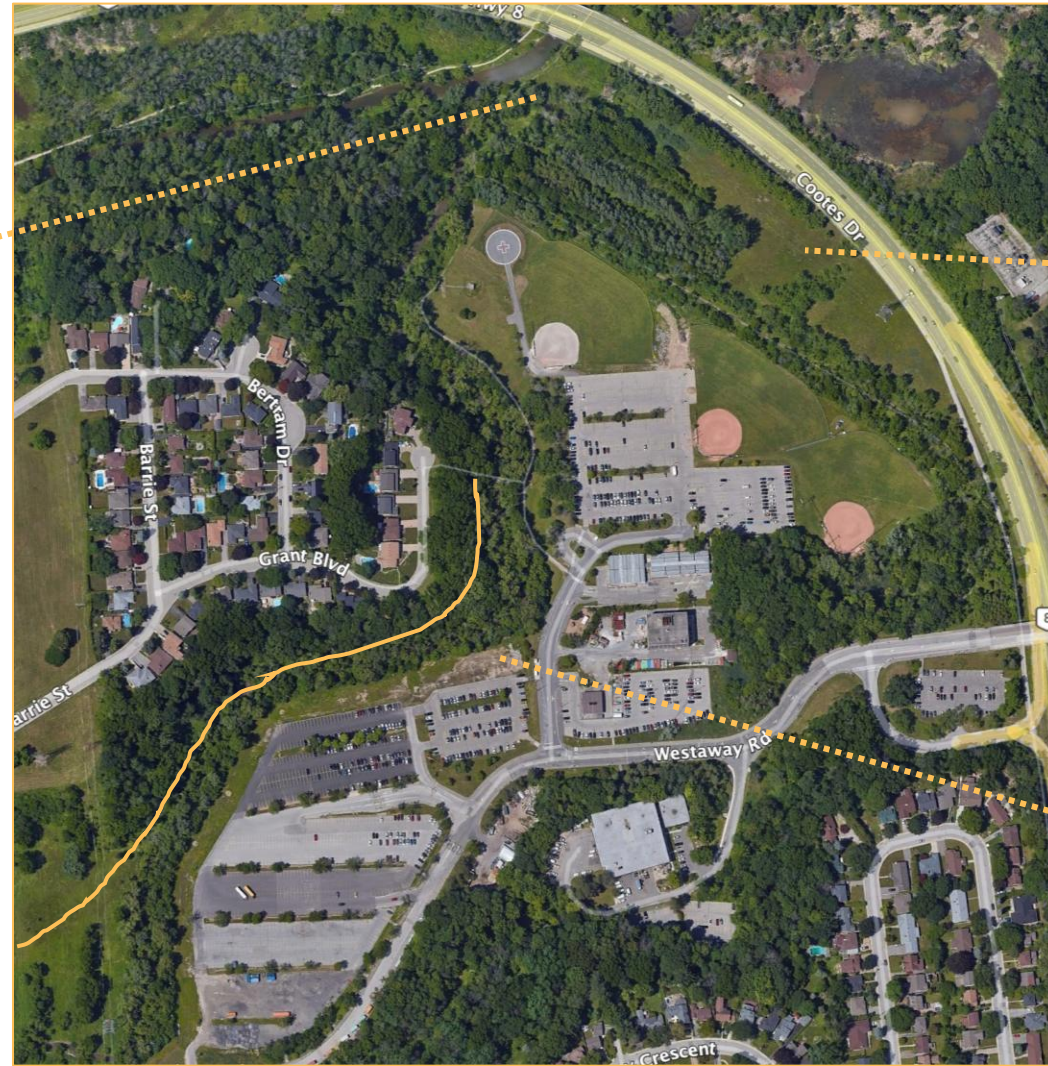


West Campus, McMaster University



West Campus, McMaster University

Wetland restoration
2026



Vernal pools
2023-2026



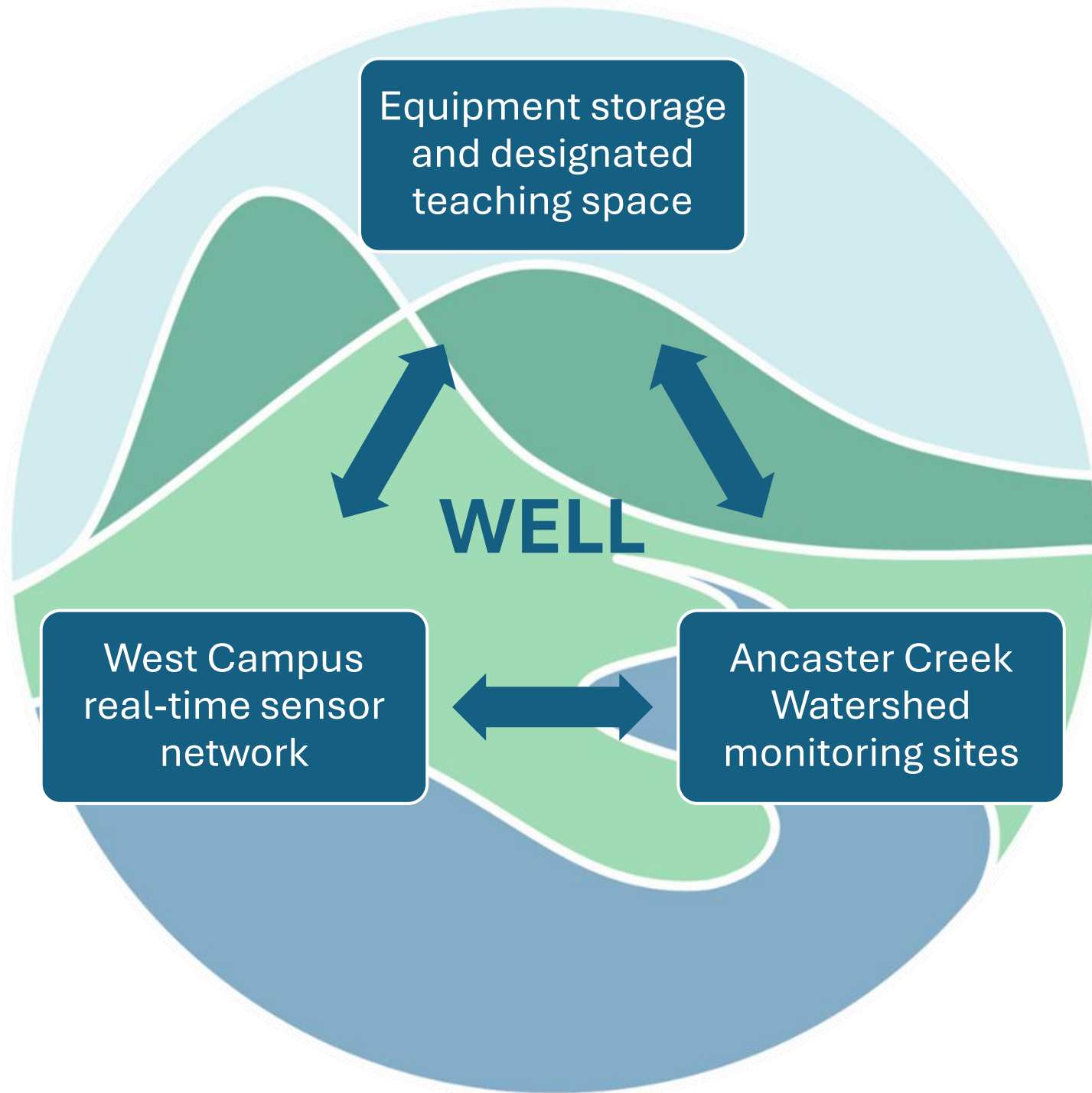
River restoration
2028?



Riparian buffer











2014-2016












The Team Behind WELL

Academic Leads

 <p>Dr. Elli Papangelakis Director ☐ (905) 525-9140 x12345 ☐ papangee@mcmaster.ca More Information</p>	 <p>Dr. James Michael Waddington Scientific Advisory Committee Member ☐ jmw@mcmaster.ca More Information</p>	 <p>Dr. Sean Carey Scientific Advisory Committee Member ☐ careysk@mcmaster.ca More Information</p>	 <p>Dr. Altaf Arain Scientific Advisory Committee Member ☐ arianm@mcmaster.ca More Information</p>
 <p>Dr. Alemu Gonsamo Scientific Advisory Committee Member ☐ gonsamo@mcmaster.ca More Information</p>	 <p>Dr. Paulin Coulibaly Scientific Advisory Committee Member ☐ couliba@mcmaster.ca More Information</p>	 <p>Dr. Chow-Fraser Collaborator ☐ (905) 525-9140 x27338 ☐ chowfras@mcmaster.ca More Information</p>	 <p>Dr. Matthew Giamou Collaborator ☐ (905) 525-9140 x67890 ☐ glamoum@mcmaster.ca More Information</p>
 <p>Dr. Kidd Collaborator ☐ (905) 525-9140 23550 ☐ karenkidd@mcmaster.ca More Information</p>	 <p>Lukhsaan Elankumaran Website Developer ☐ elankuml@mcmaster.ca More Information</p>		

Nature @ McMaster

 <p>Wayne Terryberry Coordinator, Outdoor Recreation and Natural Lands ☐ (905) 525-9140 x26384 ☐ terryber@mcmaster.ca</p>	 <p>Noah Stegman Coordinator, Natural Lands Restoration & Conservation ☐ stegman@mcmaster.ca</p>	 <p>Renee Twyford Restoration & Stewardship Coordinator ☐ twyfordr@mcmaster.ca</p>	 <p>Jonathan Scholtens Restoration & Stewardship Coordinator</p>
 <p>Laila Somani Restoration & Stewardship Intern</p>	 <p>Vamika Sharma Restoration & Stewardship Intern</p>	 <p>Nina Nakamura Restoration & Stewardship Intern</p>	

Student Volunteers!

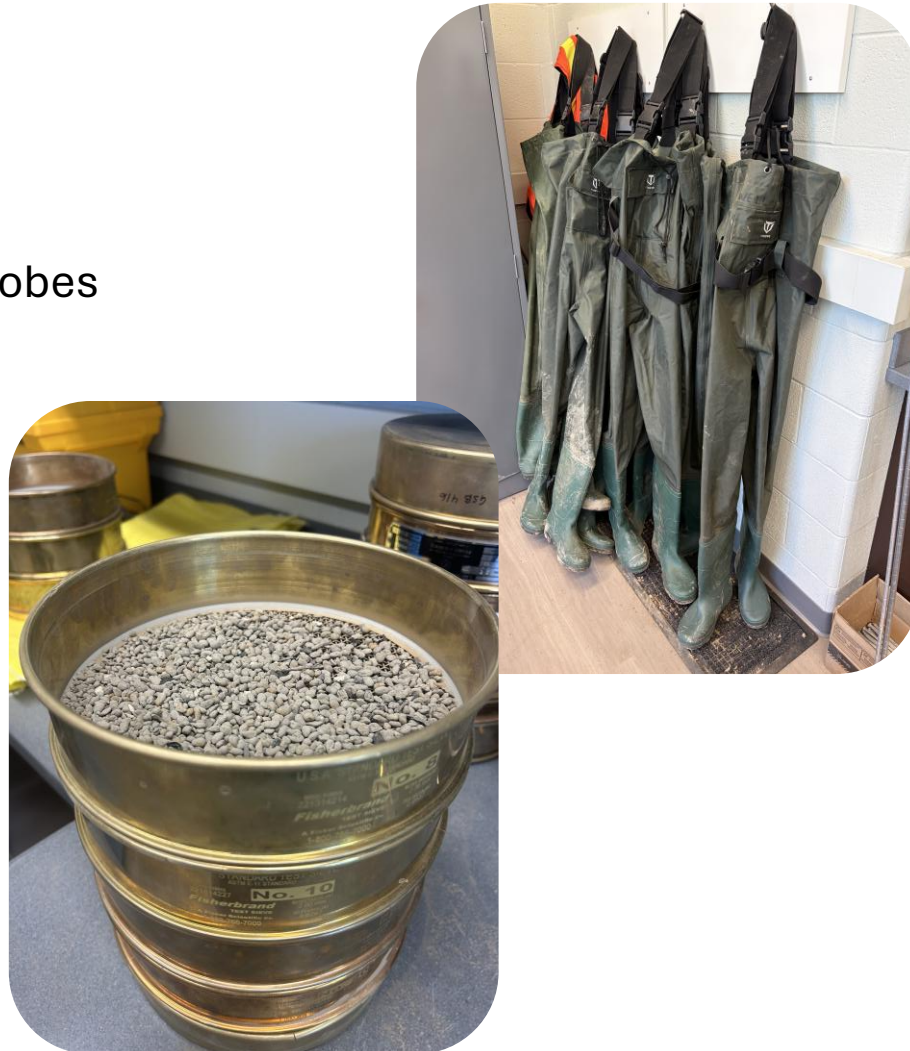


(and especially Andras Szeitz)

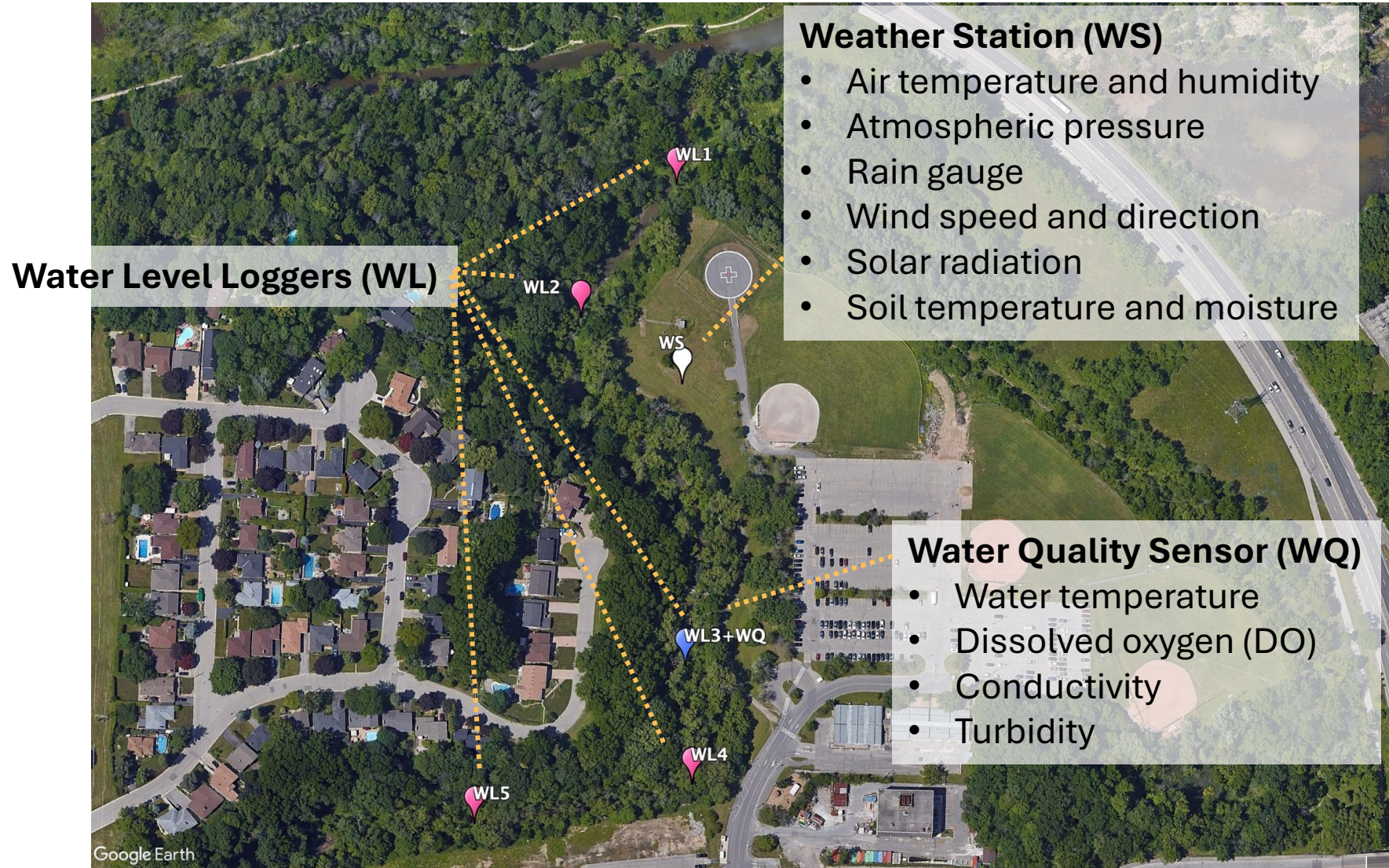
1. Equipment and designated teaching space

WELL Equipment

- Waders/boots
- Rain gauges
- Densitometers
- Flow meters
- Conductivity probes
- Sieves
- ...etc.

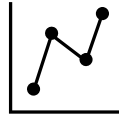


2. West Campus real-time sensor network



WELL Data Dashboard

Sensors Logging every 10 Minutes



Data remotely sent to online database



Online dashboard updated in real-time



Dashboard

West Campus Ancaster Watershed

Filters

- Water Loggers
 - Water Surface Elevation
 - Water Temperature
 - All Loggers
- Weather Station
 - Air Temperature
 - Pressure
 - Dew Point
 - Gust Speed
 - Wind Direction
 - Wind Speed
 - Rainfall
 - Relative Humidity
 - Solar Radiation
 - Soil Temperature
 - Water Content
- Water Quality >

Start Date
May 26th, 2026

End Date
May 27th, 2026

Download Data

Latest Data

Water Logger Metrics

Logger 1
Surface Elevation **39.61 m**

Weather Metrics

Air Temperature **14.51**

Map

Graphs

Water Loggers

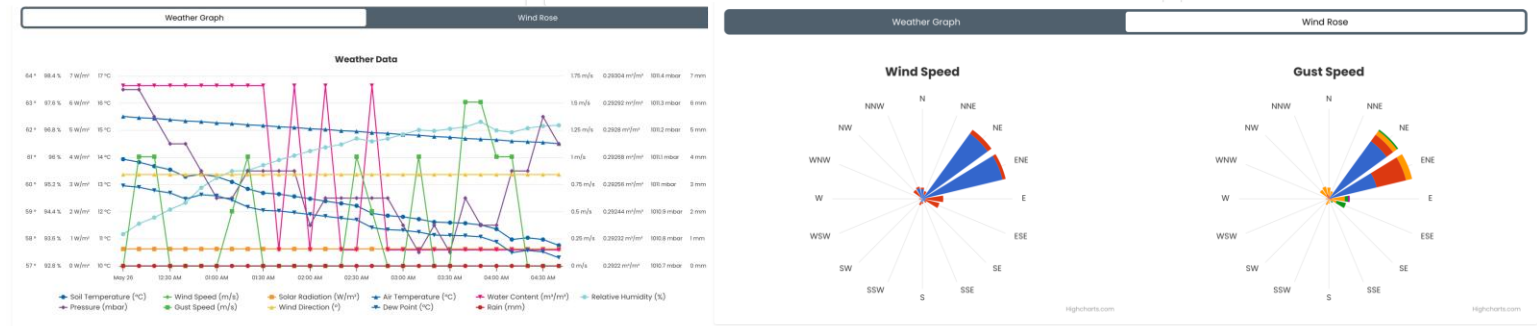
Logger 1 Data

Logger 2 Data

Logger 3 Data

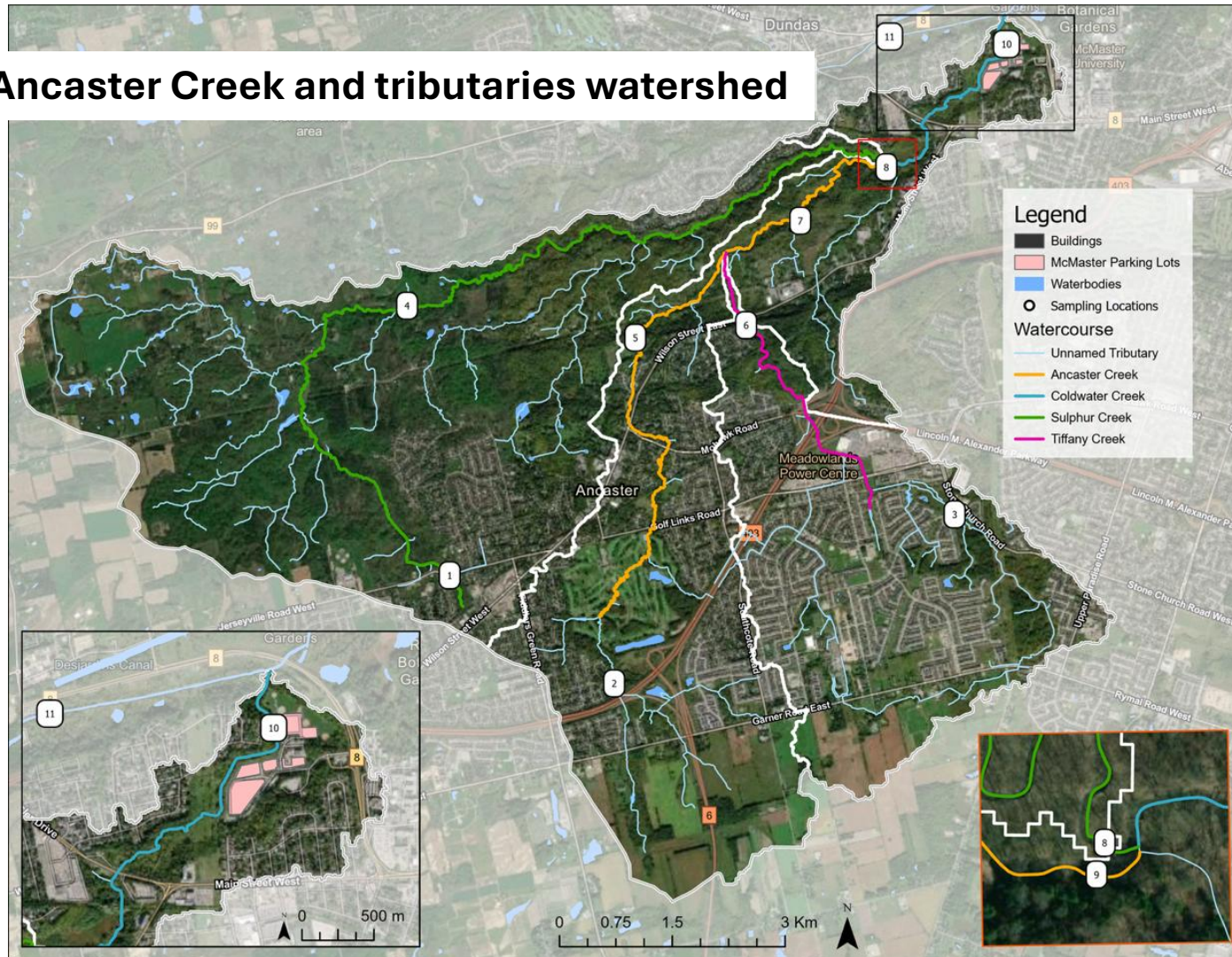
Logger 4 Data

Logger 5 Data



3. Ancaster Creek Watershed Monitoring Sites

Ancaster Creek and tributaries watershed



Water Quality (bi-weekly)

- Water chemistry
- Nutrients
- E. coli

Ecology (seasonally)

- Fish
- Benthic invertebrates

Geomorphology (yearly)

- Channel dimensions
- Channel slope
- Substrate

Teaching Opportunities Through WELL

Course-based Activities

- Undergraduate courses in Earth & Environmental Science
- Undergraduate courses in Engineering
- Graduate courses in Earth & Environmental Science

Experiential Learning

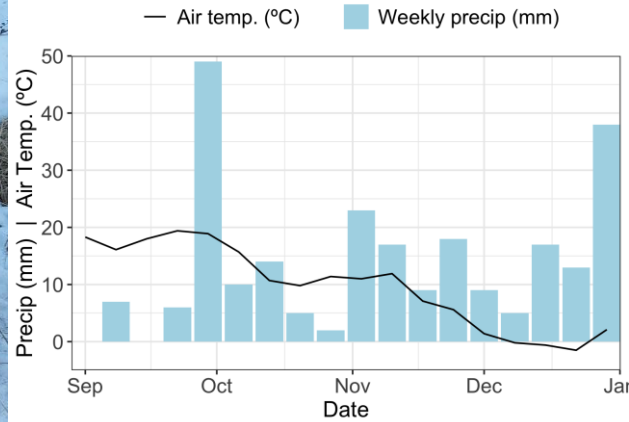
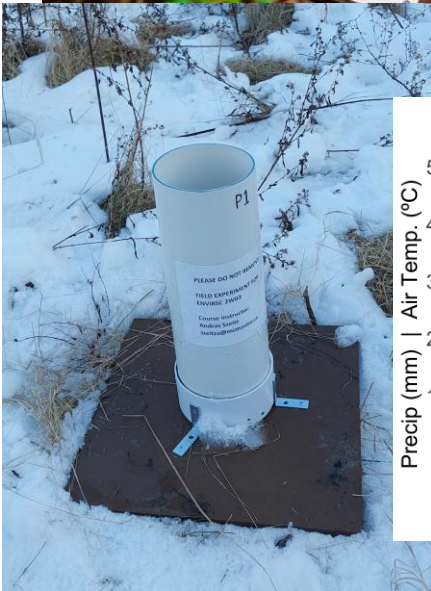
“A structured learning opportunity to apply academic knowledge in a hands-on environment with a focus on developing skills and knowledge, fostering reflection and the development of self, and preparing students to make a difference in the world.”

Student Research Opportunities

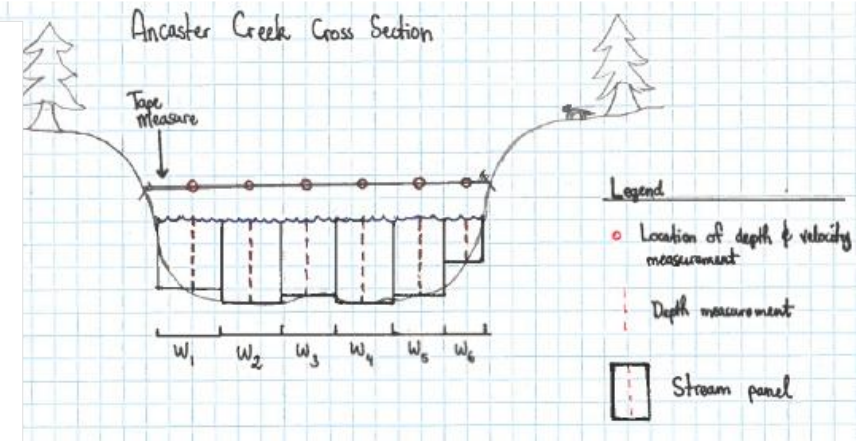
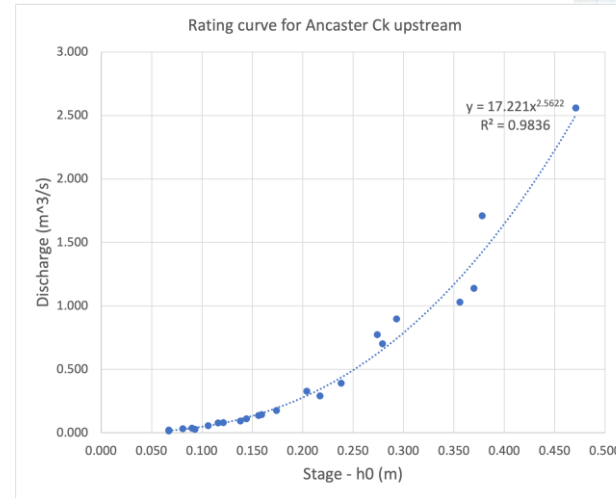
- Geomorphology
- Ecology
- Engineering

Course-based Learning Activities: Undergraduate Hydrology Labs

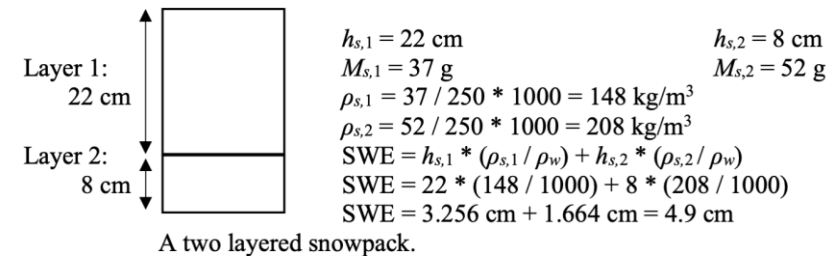
Precipitation and interception



Stream gauging and rating curves



Snow pack measurements



Course-based Learning Activities: Graduate Fluvial Labs

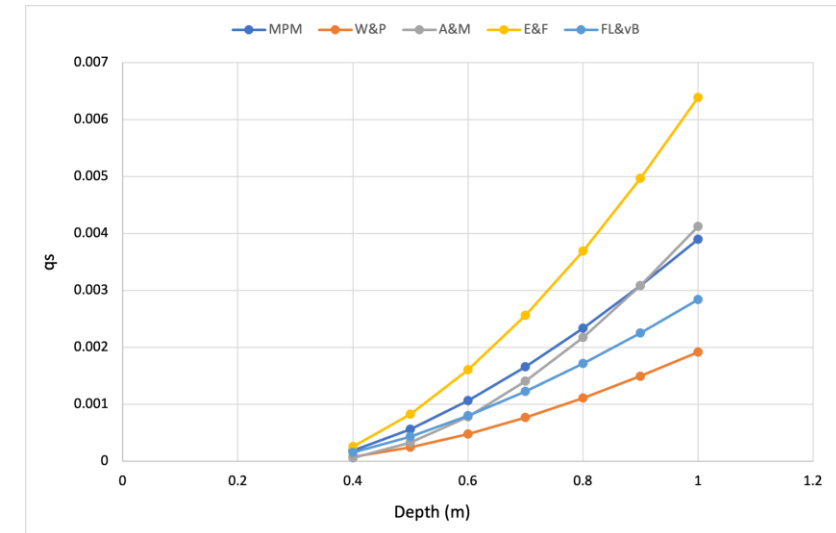
Geomorphic surveys



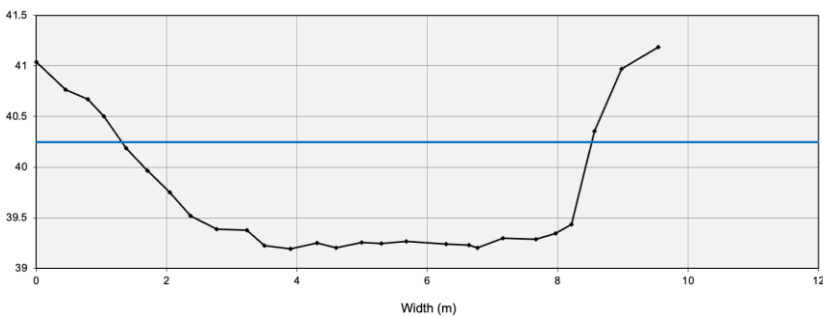
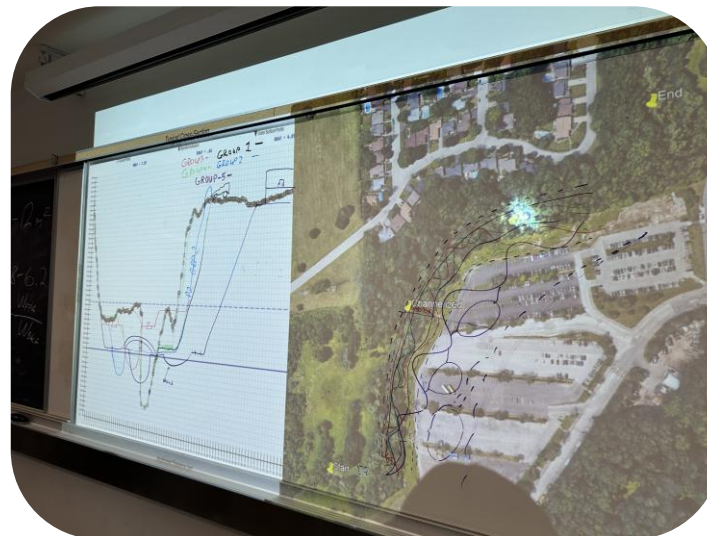
Grain size analysis



Sediment transport rates



Restoration Design



Experiential Learning



Teaching Beyond Geoscience

Biology

Benthic sampling



Water quality sampling and processing

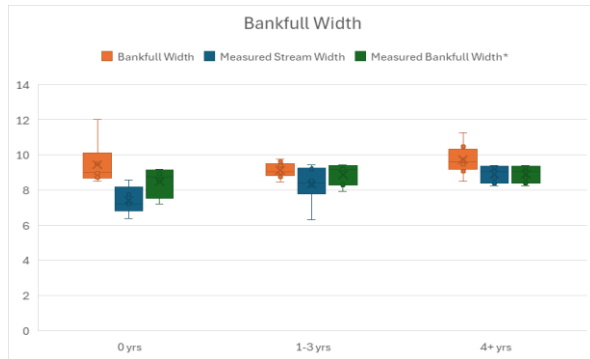
Computing & Software Dashboard development



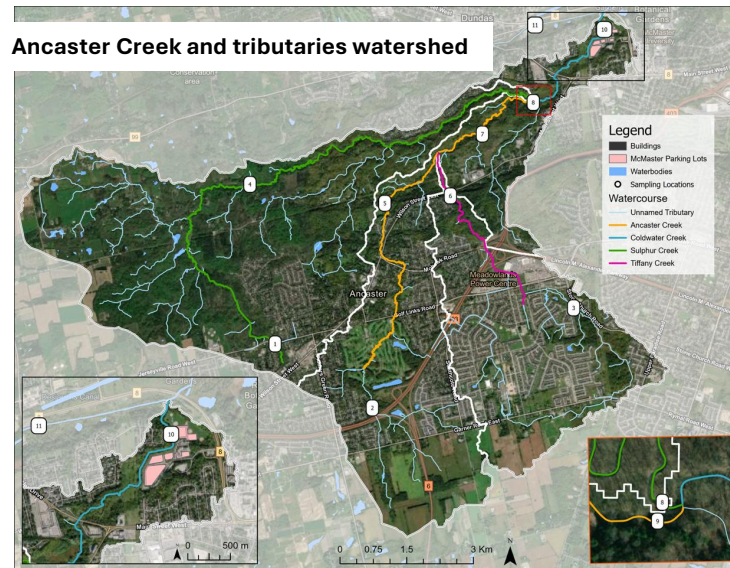
- Signal processing for environmental applications
- Interpolation
- Prediction and regression
- Bayesian nonparametric modelling

Student Research Opportunities

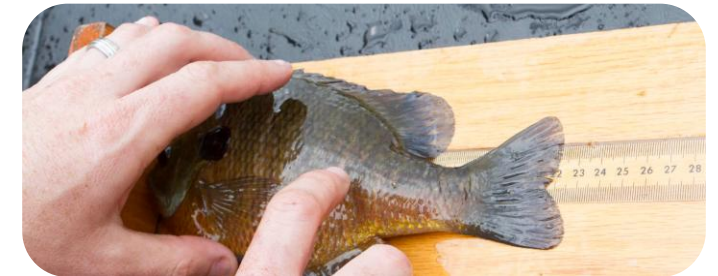
Operator bias in geomorphic assessment techniques
(N. Carson)



Integrated watershed monitoring
(T. Wiley)



Pre- and post- restoration habitat assessment
(in collaboration with DFO)



The WELL-Explorer (WELL-E) Project

An interdisciplinary research project run by graduate and undergraduate students

Environmental Science

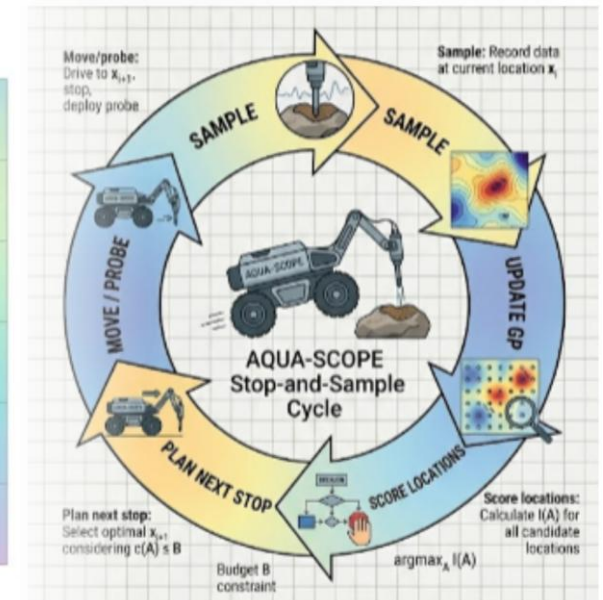
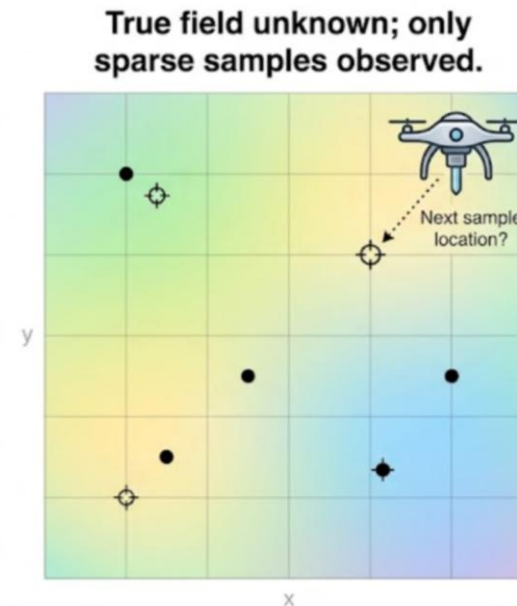
- Spatial and temporal variations in soil moisture
- Vernal pool hydrology monitoring

Biology

- Vernal pool ecology
- Amphibian populations and lifecycle tracking
- Vegetation monitoring

Engineering (robotics)

- Localization and mapping of outdoor environments
- Motion and sample planning using Gaussian processes



Thank you!

Learn more about WELL at: <https://well.mcmaster.ca>

Learn more about West Campus at: <https://nature.mcmaster.ca>



Watershed & Ecosystems
Living Lab



SCIENCE



Contact:
Elli Papangelakis
WELL Director
papangee@mcmaster.ca

Thank you to the donors that have funded WELL and our partners:
The Ratford Trust
Patrick J McNally Charitable Foundation
Hamilton Conservation Authority
Ducks Unlimited

Student Volunteers:
Andras Szeitz
Thomas Nucci
Calvin Newbery
Olive Thomas
Connor Lashley
Ella Wright
Mimi Guillerez
Oliver Li