

## Global Water Futures 2021 Operations Team Meeting – Project Reporting Template

Instructions: All GWF projects are asked to provide a summary update on their activities and accomplishments in preparation for the upcoming Operations Team meeting. **Please submit these by email to [chris.debeer@usask.ca](mailto:chris.debeer@usask.ca) by no later than December 2.** These will be used to help guide discussions and breakout synthesis activities and will be made generally accessible on our website in advance of the meeting.

<b>Project Name:</b>	<b><i>Co-Creation of Indigenous Water Quality Tools</i></b> <i>(Phase 2: Aquatic Assessment and Restoration Strategy)</i> See: <a href="https://www.ohneganos.com/research">https://www.ohneganos.com/research</a> for more information!
<b><u>Our major accomplishments to date are:</u></b>	
<p><b>Co-Principal Investigator:</b> Dawn Martin-Hill</p> <ul style="list-style-type: none"><li>• With support &amp; contributions from the team, led two book chapters entitled “Striving Towards Reconciliation through the Co-Creation of Water Research” and “Haudenosaunee Women’s Water Law: Reclaiming the Sacred” to be published in an upcoming volume titled “Indigenous Water and Drought Management in a Changing World” edited by Miguel Sioui (Assistant Professor, Wilfrid Laurier University)</li><li>• Developed a mechanism for community partners that have supported the project to receive a tangible acknowledgement through Certificates of Completion (with support from partners at McMaster University CCE).</li><li>• Organize an Indigenous Futurisms Science Symposium science contest for Indigenous youth – see: <a href="https://www.ohneganos.com/ifss-2021">https://www.ohneganos.com/ifss-2021</a></li><li>• Produced a knowledge mobilization/community engagement video podcast – <i>Ohneganos: Let’s Talk Water</i> - that proved to be a safe and effective mechanism for communicating during COVID-19. Over 25 episodes were aired live via <a href="#">social media</a>. Most researchers on CCIWQT presented and discussed over the course of the series.</li><li>• Completed Phase 1 of the development of the Virtual Reality knowledge mobilization/research dissemination &amp; experiential learning platform. Demos on <a href="#">YouTube</a>.</li><li>• Formalized partnership with Digital Democracy to being developing Indigenous map. Kicked off Indigenous mapping project via hosting a Haldimand Tract Research Sharing Workshop.</li></ul> <p><b>Co-Principal Investigator:</b> Charles de Lannoy</p> <ul style="list-style-type: none"><li>• Installing our first two water quality sensor modules in the McKenzie creek for preliminary testing in collaboration with Six Nations</li><li>• Coordinated a youth engagement in Six Nations to discuss sensors and water quality together with the STEAM academy</li><li>• Completed water collection on the reserve from wells and cisterns</li><li>• Initiated ethics review of wastewater treatment assessment on reserve</li></ul>	

**Co-Investigator:** Altaf Arain

- Simulated future McKenzie Creek sub-watershed streamflow and hydrological processes under Representative Concentrations Pathways (RCP) 4.5 and 8.5 waring conditions
- Led a [peer reviewed research article](#) on changes to climatic conditions and extreme climate trends for the Six Nations of the Grand River reserve area (past and future).

**Co-Investigator:** Nancy Doubleday

- Building mutual trust through shared research planning and execution
- Developing conceptual models for implementation of research, policy, and governance for secure water futures
- Articulating intergenerational collaboration as a community value, e.g., inclusion of youth, elders, roles of women, related community health values.
- Sharing understandings - from and for - research design

**Co-Investigator:** Christina Moffat

- Completion of pilot water use and health survey in 2019; analysis completed in 2020/2021
- Dissemination of results with Haudenosaunee Confederacy, Six Nations Health Services, and Six Nations Band Council
- [Published peer-reviewed journal article](#) on co-creation of community health knowledge through boundary work and the use of boundary objects, *Using Boundary Objects to Co-Create Community Health and Water Knowledge with Community-Based Medical Anthropology and Indigenous Knowledge*.
- Integration of water use survey results with household tap water contamination results for picture of who may be more at risk of contamination of household water (*manuscript submitted for publication*)
- Identified water insecurity prevalence through pilot survey as a feasible metric to assess community demographics and understand who is most at risk/susceptible to water insecurity, and what factors inform this
- Interviews with 25 community members on their water security and its impact on health; identified particular challenges relating to accessing water in community, accessing water for traditional practices including food and medicines; women (and particularly mothers) at a heightened risk for water insecurity, mental health struggles related to water, and stress of not being able to teach/practice water-related traditions to family

**Co-Investigators:** Karen Kidd and Mark Servos

- Collected preliminary samples from McKenzie Creek on Six Nations for e-DNA analyses of fish and amphibian species
- Meetings with hunters at Six Nations to discuss and coordinate turtle and fish sampling for contaminants analyses

**Co-Investigator:** Zoe Li

- Discussed with Digital Democracy (re: Terrastories) and the Grand River Conservation Authority for potential integration of databases and opportunities for collaboration.
- Reviewed the Nunaliit system for potential integration of databases.
- Finalized the system diagram and tech stack for database development and hired a research assistant to start building the database using sample data.
- Created a data catalog template to start collecting project data to be included in the database.

**Co-Investigators:** Emil Sekerinski

- Deployment of water quality sensors at Six Nations (together with Charles de Lannoy)
- Using machine learning for prediction of river chloride (together with Zoe Li)
- Simplification, re-development, and initial deployment of turtle sensors

**Our current activities are:**

**Co-Principal Investigator:** Dawn Martin-Hill

- Developing post-secondary accreditation initiatives/mechanisms that recognizing knowledge and participation of community members.
- Plan and develop additional Seasons of Ohneganos: Let's Talk Water.
- Initiating Phase 2 of the Virtual Reality platform that focuses on 'future' tied to results from climate change study (see below).
- Further developing the Indigenous map via a citizen science and grassroots 'Train the Trainer' methodology leveraging free and open-access tools - data collection software (Mapeo) and mapping platform (Terrastories).

**Co-Principal Investigator:** Charles de Lannoy

- Improving sensor network so that data can be reliably collected
- Developing anti-fouling coatings on DO probes
- Completing water quality analysis

**Co-Investigator:** Altaf Arain

- Drafting research paper on changes to McKenzie Creek streamflow under climate change
- Developing study on changes to McKenzie Creek streamflow under different water use scenarios
- Developing study on impacts of climate change on McKenzie Creek water quality

**Co-Investigator:** Nancy Doubleday

- Identification of emerging legal regimes and institutional norms for water governance relevant to Canada
- Reconciling data sources and sets

- Accommodation of external factors affecting context, trust and relationship building across the team

**Co-Investigator:** Christina Moffat

- Finalizing the integrated water and food survey with Six Nations Health services, preparing for co-analysis with hair sampling for 2022
- Finalizing protocols for human hair sampling for mercury with collaborators; targeting individuals who have previously had their water tested, including mothers, hunters
- Ethics submission for surveying and hair analysis by late 2021

**Co-Investigators:** Karen Kidd and Mark Servos

- Metabarcoding is ongoing of eDNA water samples for preliminary information on biodiversity
- Meetings between Six Nations community members and researchers at McMaster and Waterloo to identify sample priorities and coordinate sample collections for 2022

**Co-Investigator:** Zoe Li

- Preparing ethics applications for the database.
- Continuing building the database.

**Co-Investigators:** Emil Sekerinski

- Addressing reliability issues of water quality and turtle sensors
- Extending the software functionality of water quality and turtle sensors

**The main accomplishments expected by the end of the project are:**

**Co-Principal Investigator:** Dawn Martin-Hill

- Develop a massive open online course focused on co-creation and reconciliation.
- Formalize accreditation mechanisms, post-secondary pathways, and develop a TEK/STEM diploma program at McMaster University.
- Further developing and investing in the Ohneganos: Let's Talk Water video podcast so that it becomes a community-led and self-sustaining knowledge mobilization platform.
- Fully complete the Virtual Reality experience and complete the installment/distribution to ensure it reaches the widest audience possible.
- Complete the first iteration of the development of the Indigenous map and distribute/present the map to the public in Six Nations to begin developing a community of support.

**Co-Principal Investigator:** Charles de Lannoy

- Installation and continuous data collection from 4 sensor modules along the McKenzie Creek
- Youth engagement across all parts of the sensor installation

- Antifouling coating developed for DO probe
- Wastewater treatment performance assessment of systems (lagoon, peatmoss systems)

**Co-Investigator:** Altaf Arain

- Having completed a study of the impact of climate change on McKenzie Creek streamflow and hydrological processes within the McKenzie Creek sub-watershed
- Having completed a study of the effect of different water usages on the streamflow of the McKenzie Creek
- Having completed a study of climate change on water quality within the McKenzie Creek

**Co-Investigator:** Nancy Doubleday

- Robust understanding of collaborative research processes as seen by all participants
- Functional models for water governance across scales and regions in Canada
- Elaboration of interfaces of human needs and ecosystem capacities in water and sanitation planning and management, from local to regional scales
- Well-articulated strategy for co-creation that is transferable to other regions as contribution to reconciliation

**Co-Investigator:** Christina Moffat

- Further detail on water security + water uses, access, and perspectives for wider segment of the Six Nations community
- Detail on the food-water security relationships through survey (e.g., how water is being used in relation to food, particularly how traditional food access and medicine gathering may be impacted by contaminations and how these challenges impact mothers, hunters, youth in particular
- Hair sampling for mercury completed for a small sample of individuals who have had their water test positive for mercury contamination, focus on mothers and hunters to see particular human health risks for those identified as more vulnerable by collaborators

**Co-Investigators:** Karen Kidd and Mark Servos

- More collections of e-DNA in summer, 2022 for fish and amphibian biodiversity assessments and ground-truthing with electrofishing surveys
- Collections and analyses of fish and snapping turtles from Six Nations for contaminants

**Co-Investigators:** Zoe Li

- A data portal/website for all Co-Creation project data (database and web app), with restricted & public access.

**Co-Investigators:** Emil Sekerinski

- Open-sourced low-cost hardware & software setup for remote water quality and turtle sensing using state-of-the-art mesh and database technology

Here is a key visual from the project (figure, photo, table, graph, etc.)



Figure 1: Host and guests from Ohneganos: Let's Talk Water.

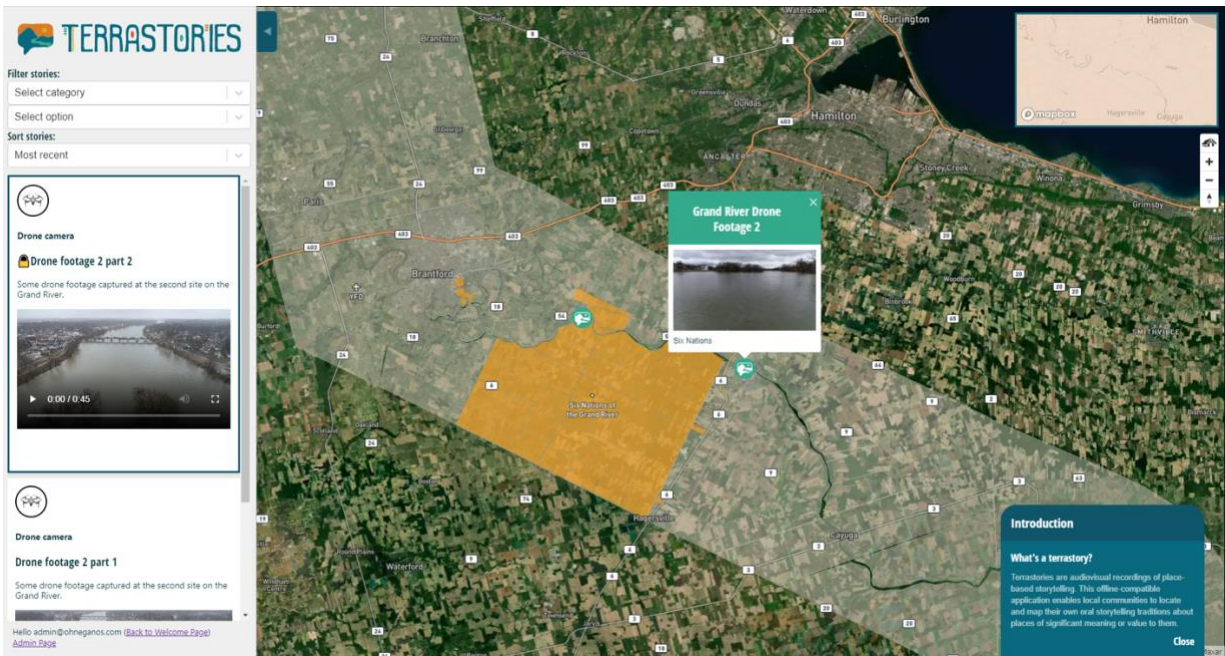


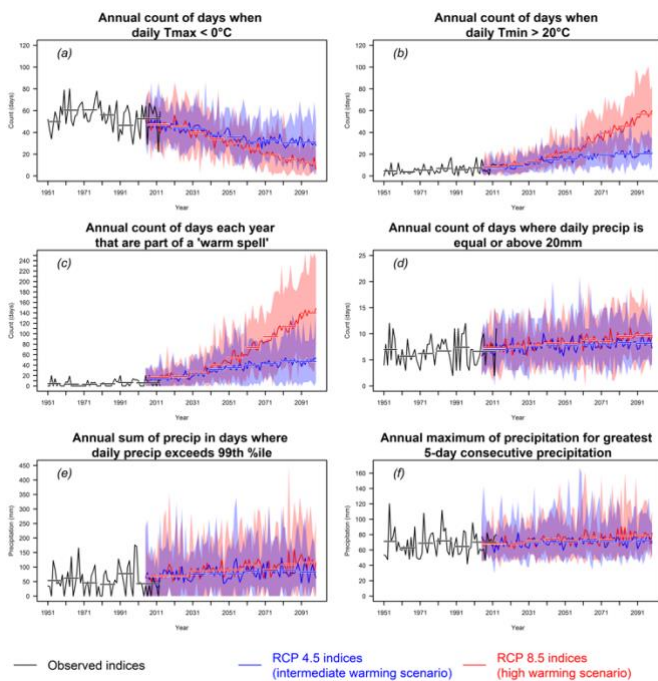
Figure 2: Digital Indigenous map being developing using [Terrastories](#).



**Figure 3:** Installing sensors in McKenzie Creek.

**Figure 3 Description**

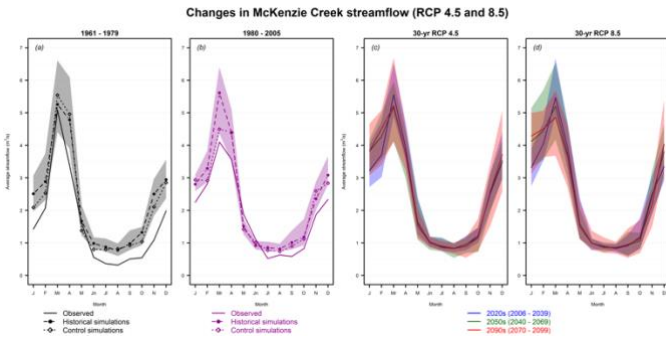
Co-PI Charles de Lannoy (right) and students from McMaster University and the Six Nations Polytechnic STEAM Academy installing sensor devices in the McKenzie Creek.



**Figure 4:** Changes in climate extremes in Six Nations.

**Figure 2 Description**

Sub-figures (a, b, and c) illustrate the warming conditions occurring in the region, specifically warming in conditions (a) and summer (b and c) conditions. Sub-figures (d, e, and f) illustrate the increase in precipitation related extremes, specifically the number of very wet days (d), and the intensity of rainfall events (e and f).



**Figure 5:** Changes in McKenzie Creek streamflow.

**Figure 5 Description**

Sub-figures (a and b) illustrate changes in average observed streamflow (solid lines), simulated streamflow using observed data (diamond points), and GCM historical data (solid black dots) between two time periods. Sub-figures (c and d) illustrate changes in future streamflow between 30-year periods under RCP 4.5 and 8.5 conditions; increase in winter streamflow, decrease in spring streamflow, and little change in summer and fall streamflow within simulated data.

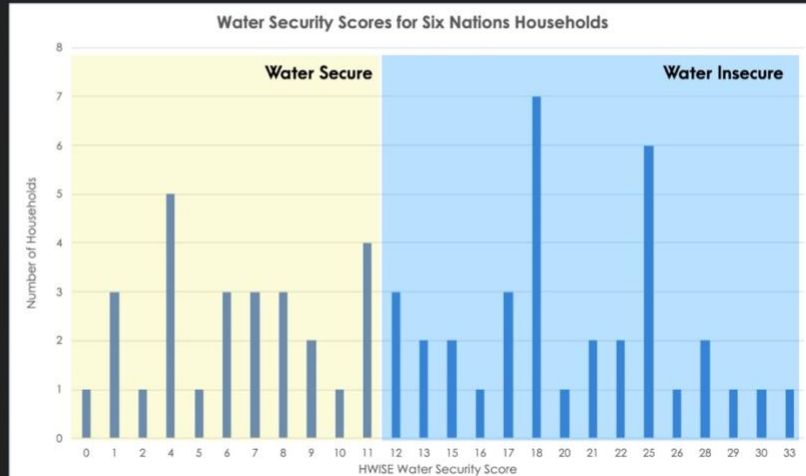
# WATER SECURITY RESULTS

**Average Water Security Rating = 14.5**

**60% of households (40/66) were water insecure based on the HWISE scale rating (over 12).**

**35% of households said in the last four weeks, they worried sometimes that they would not have enough water for all of household needs**

**38% of households said in the last four weeks, sometimes there had been no useable or drinkable water whatsoever at home**



**Figure 4:** Water security results from health and water use survey.