Workshop on Hydrogeology in Yukon

(WHY 2020)

February 19 – 20, 2020

Summary Report

Yukon

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Acknowledgments:

Stewardship of groundwater is a collective responsibility. Thank you to everyone for your attendance and interest in this event, and your continued work, research and collaboration on hydrogeology.

A special thank you to:

- Kwanlin Dün First Nation and Ta'an Kwach'an Council for hosting us on their traditional territory
- Kwanlin Dün First Nation for hosting us at their beautiful facility
- Government of Yukon, Organizational Development Branch, as well as John Miller, for workshop planning support
- Carola Scheu for notetaking during this event
- International Association of Hydrogeologists - Canadian National Chapter for sponsoring in part the meals and refreshments during the event
- SLR Consulting for sponsoring in part the evening social event
- Those that travelled from out of territory to attend, share and/or present

We appreciate the passion and engagement of all attendees in making this event a success.

Hydrogeology in the North – Yukon context

Groundwater is a critical resource in Yukon. Nearly all Yukoners depend on groundwater as a potable water supply and groundwater serves key ecosystem functions in the territory such as maintaining baseflows, modulating temperatures, influencing water quality and providing refugia for fish and other aquatic life.

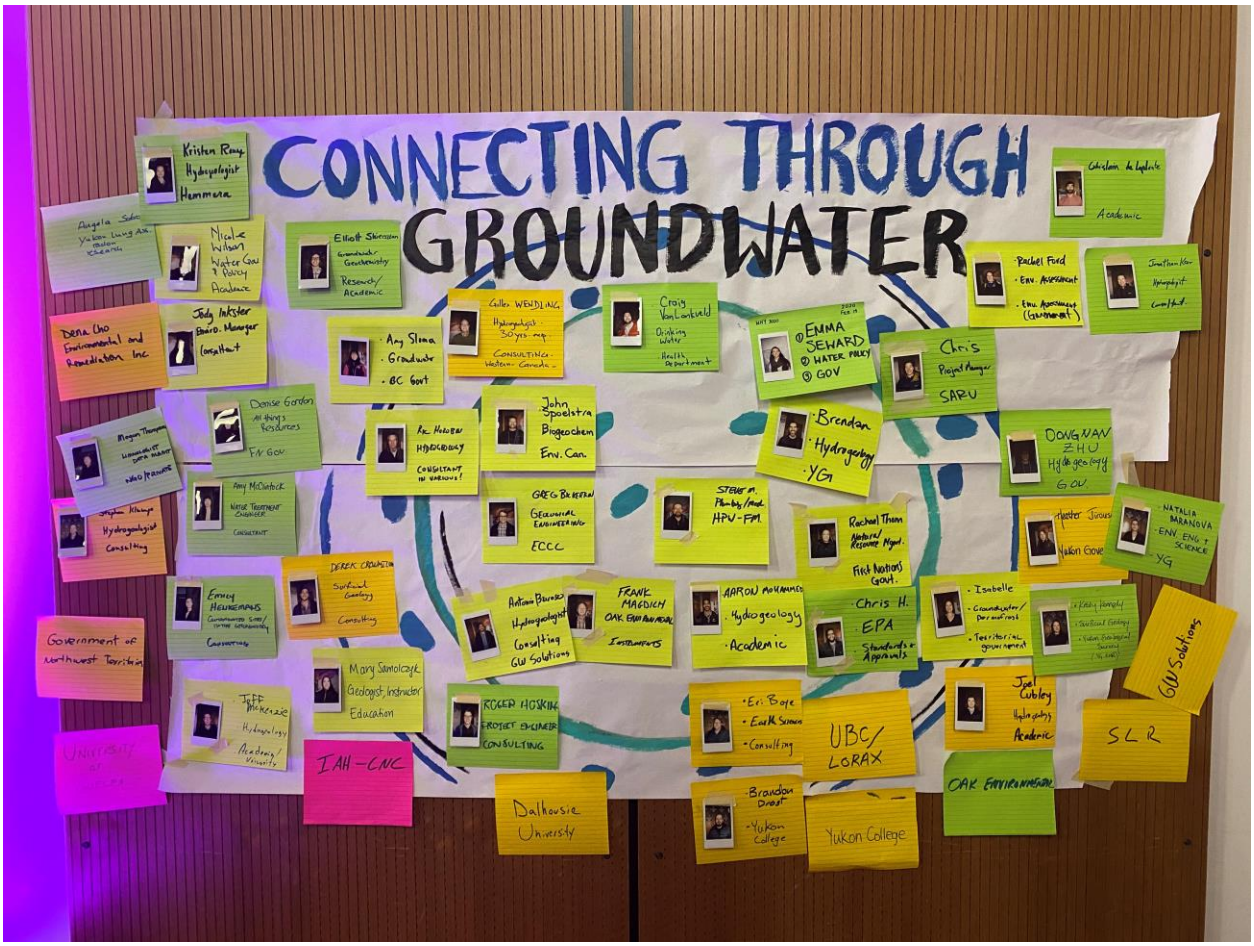
The Government of Yukon (YG) works together with partners to ensure clean water for the environment and for people. Within that, the Water Resources Branch's (WRB) focuses on issuing forecasts, providing expertise, and disseminating data and information in order to support understanding related to Yukon's water resources. WRB is committed to advancing their Groundwater Program by supporting foundational activities, strengthening guidance and working towards comprehensive regulation. In recent years, the WRB has:

- Added two new positions:
    - Senior Scientist – Groundwater, and
    - Water Resources Technologist – Groundwater
- Expanded the **Yukon Observation Well Network** from 8 to 52 wells
- Launched the Yukon Water Well Registry: click **HERE** to access
- Reviewed, from a hydrogeological perspective, projects with the potential to impact groundwater resources that are undergoing environmental and socio-economic assessment and licensing processes.
- Initiated and chaired an inter-departmental working group on groundwater
- Undertaken or supported on targeted groundwater research projects

Yukon is a relatively small jurisdiction. Effective groundwater stewardship can only be achieved through collaborations within and between governments (First Nations, federal, territorial, municipal), non-governmental organizations, environmental consultants, drillers, proponents, academia, and other partners.

The Workshop on Hydrogeology in Yukon 2020 (WHY 2020) was the first event of its kind in Yukon. It had three main objectives:

The workshop spanned the course of two days, and focused on Hydrogeology in the North, with some discussions focusing specifically on Yukon. Day 1 was hosted at Kwanlin Dün Cultural Centre, and had a broader audience of more than 50 groundwater practitioners, hydrogeologists, and governments. Day 2 provided an informal opportunity for 24 researchers, hydrogeologists, and government employees to share information about ongoing work and potential research interests in the North. Attendees came from within the territory, neighbouring jurisdictions, and academic institutions from across Canada. Names and contact information of attendees can be found in Appendix B. Workshop content was shaped by feedback from the November 2019 Yukon Water Forum, pre-workshop surveys and WRB's groundwater team. The agenda for both days is included in Appendix A. The summary in the pages below contains key takeaways and content from Day 1. Content shared during D Day 1 and Day 2 will be shared through Secure File Transfer.

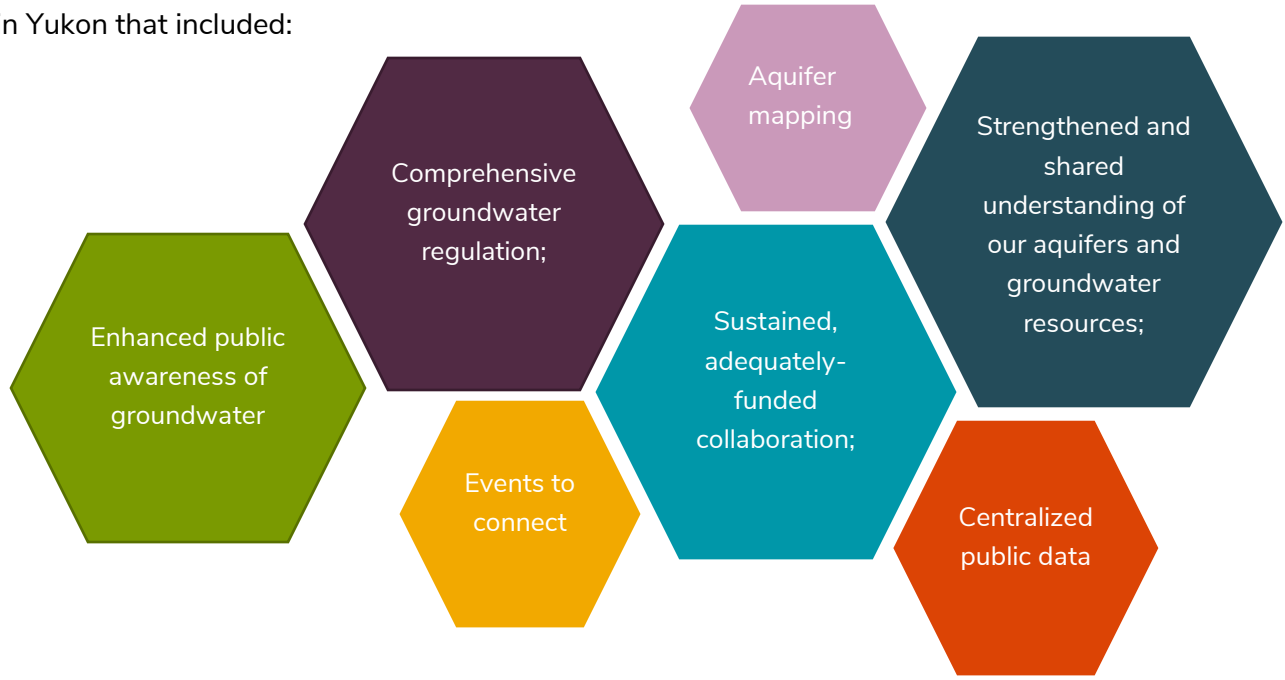


Workshop attendees were encouraged to take a Polaroid picture, and write a description of who they are upon arriving.

Key Takeaways

YG's groundwater program is relatively new. In the past five years, the program has evolved and expanded; however, more development is envisioned to better understand Yukon's hydrogeology and to advance how groundwater is managed and protected in the territory and across the North.

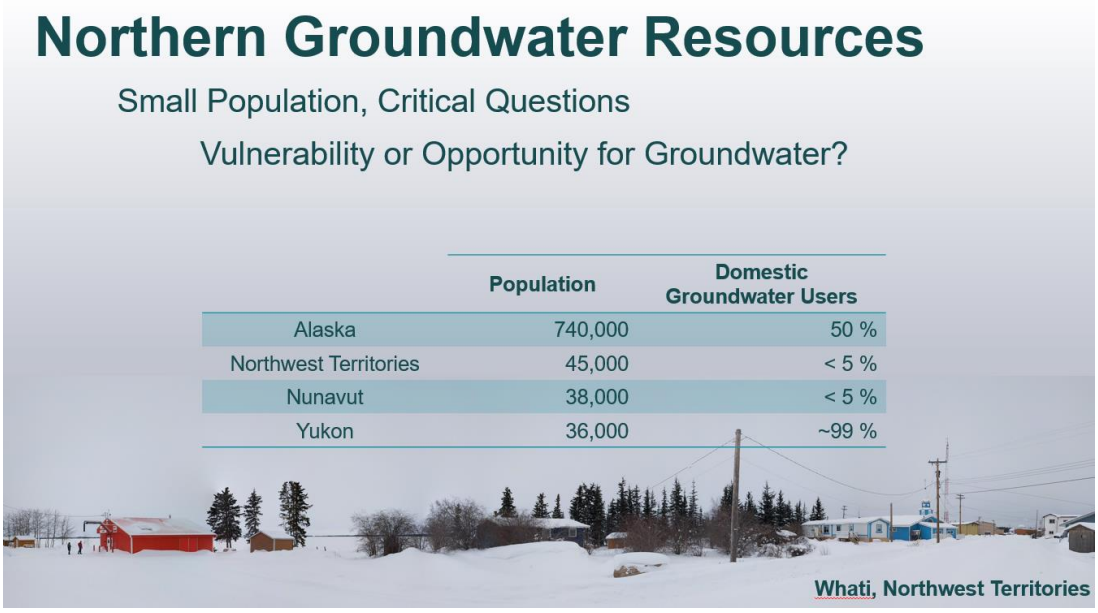
Workshop participants clearly expressed a shared vision for effective groundwater stewardship in Yukon that included:



Workshop Summary

Hydrogeology in the North: Dr. Jeff McKenzie, McGill University

Dr. Jeff McKenzie (McGill University) provided an overview of what makes hydrogeology in cold regions unique. Using the term "cryohydrogeology" (the study of groundwater in cold regions), McKenzie noted that the warming of the Arctic, and the resulting thawing of permafrost, is shifting groundwater dynamics, including connectivity and flow. Currently, work is being undertaken to test the hypothesis that cryohydrogeology is a catalyst of Northern environmental change. Mackenzie also highlighted challenges in undertaking groundwater stewardship in the North. Key barriers included lack of research and investigation, need for more data due to factors like permafrost distribution, and challenges associated with modelling.



During his presentation, McKenzie highlighted Yukon's reliance on groundwater.

Panel Discussion: Opportunities and challenges in Hydrogeology in Yukon

Four hydrogeologists with experience working in the North were invited to share insights and experiences.

- Dr. Emily Henkemans is a Hydrogeologist/Geochemist with Golder Associates Ltd. Emily has extensive academic experience and has been working in Yukon for the past four years.
- Dr. Ric Horobin is a Principal Hydrogeologist with SLR. Ric has extensive experience in the United Kingdom and moved to Yukon this year.
- Jonathan Kerr is a Senior Hydrogeologist with Morrison Hershfield. Jonathan has been working in Yukon for nearly twenty years.
- John Miller is the Manager in the Compliance Monitoring and Inspection Branch in YG. John was formerly the Yukon Government's first Senior Scientist - Groundwater. He has been working in Yukon for nearly twenty years.

The following issues were identified as key characteristics and/or challenges of working on hydrogeology in a Northern climate:

Opportunities:

- As there is a small amount of experts, there is often a need to take a generalist approach
- Huge opportunity to incorporate FN traditional knowledge into research initiatives

Challenges:

- Lack of public awareness, especially considering almost all Yukoners rely on groundwater for their drinking water

- Lack of regulations, for example there is limited groundwater legislation or and no Source Water Protection Act
- Operational challenges related to cold climate and remoteness
- Lack of access to data

When asked what they wished for the future, panelists stated they would like:

- More borehole information
- More groundwater community gatherings like WHY 2020
- More awareness/education of for Yukoners in order to better protect and understand groundwater
- A Groundwater Protection Regulation, similar to BC. There is no need to reinvent the wheel
- Enforcement tools
- More information in the urban areas – sites in the downtown area of Whitehorse are siloed
- Mining project proponents to install more wells to enhance understanding of what is happening on a site
- YG's WRB to have another Groundwater Technician and an increased budget

Debrief and Discussion: Groundwater Stewardship in the Territory

Attendees were asked to divide into one of four groups – industry, academia, YG and other governments.

First, individuals were asked to reflect on gaps and obstacles to reaching groundwater stewardship in the North. Participants were encouraged to think at an individual, institutional and collective level, before partnering-up and discussing with others. From there, partners discussed with their broader groups.

After that, participants were asked to undertake the same process, but this time, to discuss strengths and opportunities.

Takeaways

All sectors – key takeaways:

- Obstacles: Lack of regulation and lack of data
- Opportunities: Increased education of the general public to raise awareness among groundwater users, opportunity to partner and collaborate with First Nations.

Industry – key takeaways:

- Opportunities: partnering with First Nations.

Academia – key takeaways:

- Opportunities: Previously, there has been little groundwater research occurring in the North, so there are a lot of research opportunities, ability to explore new approaches, and to incorporate traditional knowledge into research projects.

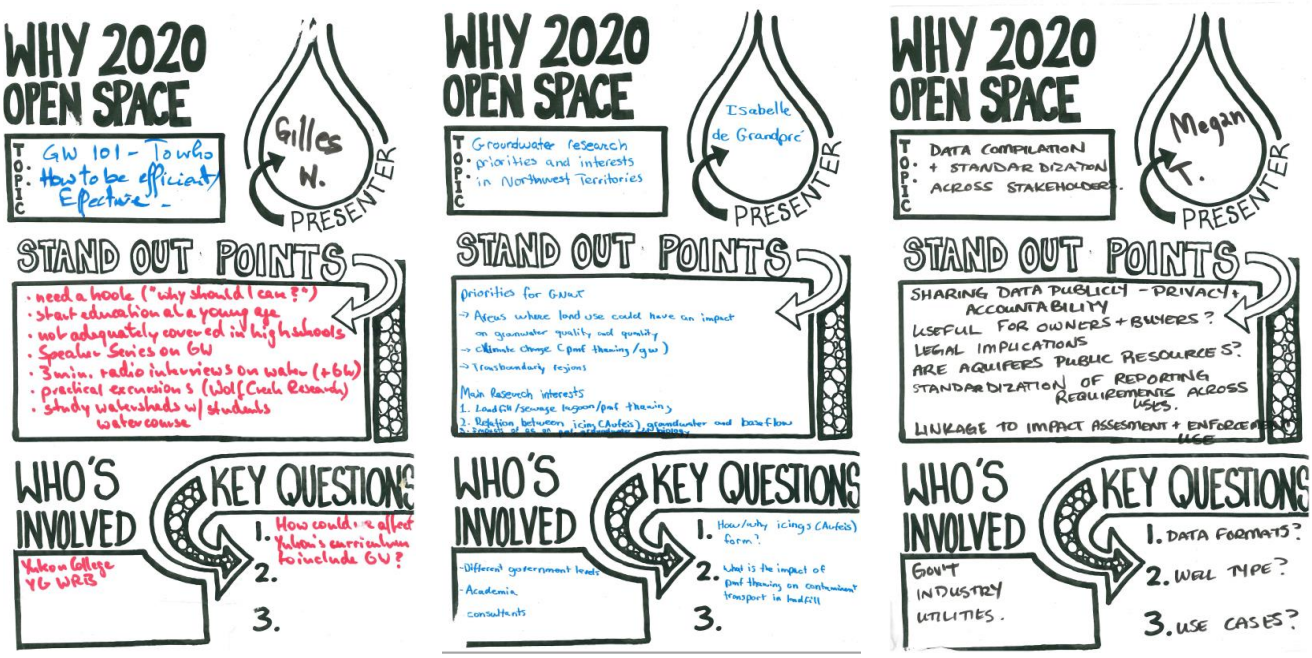
Non-YG-government – key takeaways

- Opportunities: There is relatively little groundwater work occurring in the North, most of which is new, so there are a lot of research opportunities, ability to explore new approaches, and to opportunity incorporate traditional knowledge into research projects.

Open Space

Participants were invited to assist in shaping the workshop agenda by proposing topics of interest, and hosting discussion groups through an Open Space format. The Open Space activity is governed by the "law of two feet": attendees can attend whichever session they are interested in, and can leave if they are not learning or contributing. The following nine topics each had 15 – 20 minute discussions and reported back on key points, who should be involved, and remaining key questions.

Topic	Host(s)
• Transport of radon gas in groundwater	Angela Sabo
• Groundwater 101: To Who? (How to be effective/efficient)	Gilles Wendling
• Groundwater governance (Regulation, Policy, etc.)	Nicole Wilson
• Groundwater research interest in NWT	Isabelle de-Grandpre
• Data compilation and standardization across stakeholders	Megan Thompson
• Interaction of groundwater and surface water	Dongnan Zhu
• Funding sources for monitoring wells/boreholes	Arcadio Rodriguez
• Groundwater Modeling – Best Practices	Jeff McKenzie
• Connection to the Land: FN Traditional Knowledge – Dealing with Emotions	Ric Horobin and Gilles Wendling



Notes taken during the Open Space session

Government of Yukon Groundwater Program: current program, and looking forward

Brendan Mulligan, Dongnan Zhu and Emma Seward presented on YG's groundwater program. An overview was provided of the many organizations and team's within YG that have responsibilities related to groundwater. This was followed by a demonstration of the recently launched Yukon Water Well Registry (which can be accessed **HERE)** as well as an updated version of a water well drilling form. Of note, there is currently no comprehensive groundwater legislation that relates specifically to the management of groundwater. YG's groundwater program is made of three key pillars, the Yukon Observational Well Network, the Yukon Water Well Registry, and the new initiative of aquifer mapping. These core pillars link to the contribution of groundwater related technical advice for environmental assessment processes, licenses and other projects as well as to targeted research projects.

Hydrogeology and Government: A Case Study from British Columbia

Amy Sloma, Government of British Columbia, presented on British Columbia's (BC) *Water Sustainability Act*. The legislation, which was released in 2016, addresses three main areas: Water Use, Management of Water Use, and Protection of the Resource. Various aspects of the legislation address management of groundwater resources, including required submission of

well logs, site scale groundwater issues, and well protection areas, among several other activities. In addition to regulatory updates, BC has conducted aquifer mapping in several areas.

Discussion on long-term goals, and how to get there:

To close the day, participants were asked to reflect on the following questions:

- What would an ideal future state of GW stewardship look like in the North?
- What would be its defining characteristics?
- What would be happening on a regular basis?

Attendees were then directed to discuss their thoughts with a partner, as needed, and then add their desired vision, along with how to get there, on sticky notes. This was then added to a large chart. A detailed breakdown of responses is included in Appendix C.

Overall Vision

Many attendees had a similar vision for how they hoped groundwater stewardship would look in the future. Common themes were:

- The quality of groundwater in the north is sustained in a naturally pure and high quality state.
- High standards of stewardship required by all users – in reasonable time (now)
- Responsible and sustainable use of groundwater and land use that impacts groundwater
- A stakeholder roundtable for every watershed in the Yukon and Canada
- Government branches will be one of the best hydrogeological resources in the territory

Desired Components

All comments revolved around the following components:

- Data
- Research
- Awareness and education
- Legislation

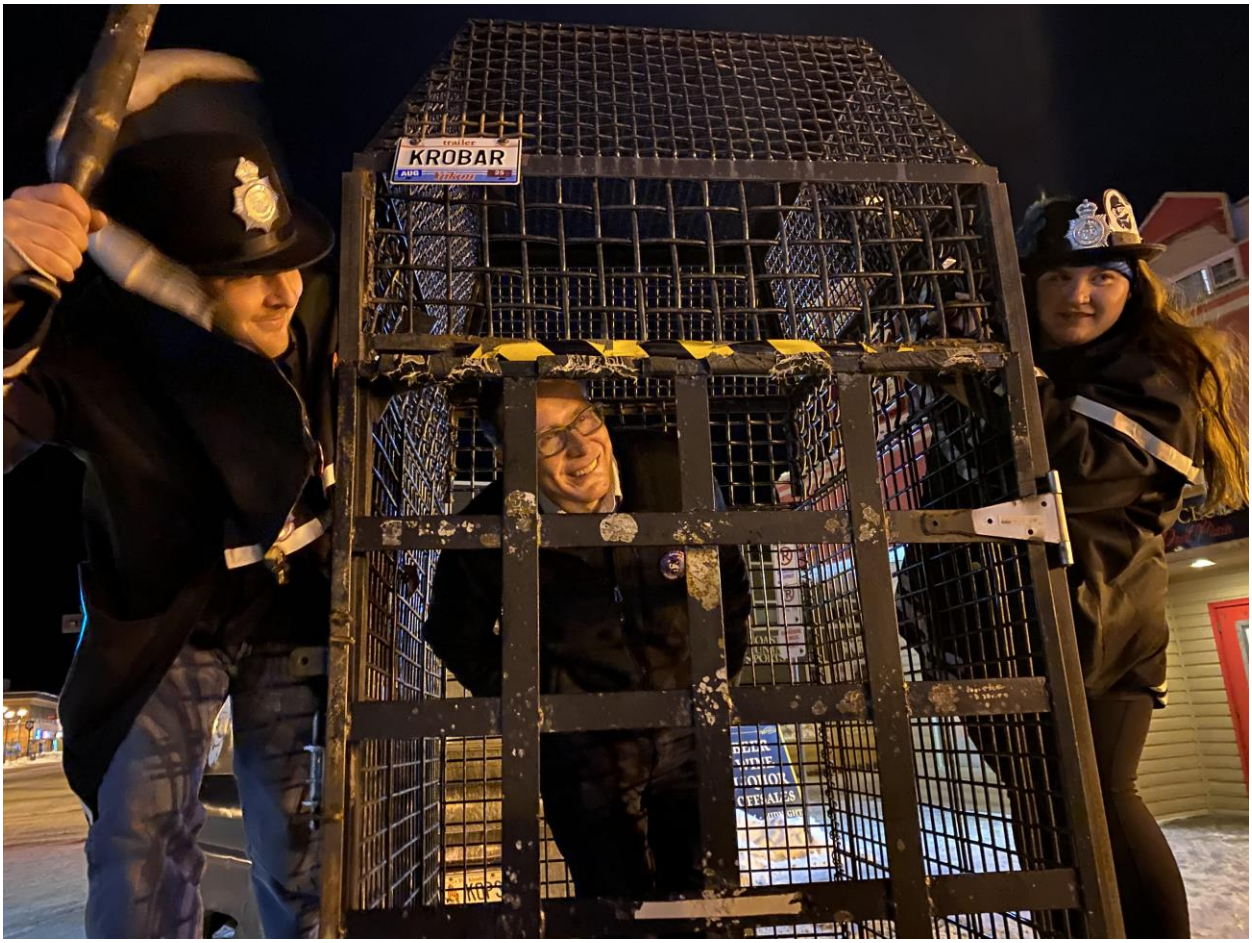
How to get there

There were several suggestions on how best to reach a desired state. Common themes included:

- A culture of sharing and collaboration
- Accessible, easy to use, centralized databases
- Increased and consistent budget and capacity
- Prioritization of groundwater by government
- Targeted training and awareness building
- Increased capacity of funding, expertise, research capabilities and laboratory facilities.
- Increased collaboration among stakeholder groups

- Regular meetings of groundwater practitioners
- Awareness building through public lectures, school visits, radio ads and other methods
- Community based training and monitoring
- Management board submission of a comprehensive groundwater regulation

Thanks for attending the first WHY!



After the event Dr. Jeff McKenzie was "arrested" by The Keystone Kops (Yukon Sourdough Rendezvous' "police" force). He was later released on good behaviour.

Appendix A – Agenda (with hyperlinks to presentations)

Agenda

February 19, 2020

Day 1: Kwanlin Dün Cultural Centre, Multi-purpose Room	
TIME	**CONTENT**
8:45 am	**Doors open and refreshments** • Connecting through Groundwater
9:00 am	**Welcome and Introductions** • Opening remarks • Roundtable introductions • Overview of agenda, workshop objectives and reporting back on survey results
9:30 am	**Hydrogeology in the North** • Jeff McKenzie, McGill University
	10:15 am BREAK
10:30 am	**Panel Discussion: Opportunities and challenges in Hydrogeology in Yukon** • Featuring: John Miller - Government of Yukon, Emily Henkemans - Golder Associates, Ric Horobin - SLR Consulting, Jonathan Kerr - Morrison Hershfield
11:15 am	**Debrief and Discussion: Groundwater Stewardship in the Territory** • Roundtable discussion on obstacles, gaps, strengths, and opportunities
	12:00 pm CATERED LUNCH
1:00 pm	**Open Space Discussion: How to Achieve Groundwater Stewardship in the North**
1:45 pm	**Debrief and Discussion: Who's involved**
2:00 pm	**Government of Yukon Groundwater Program: current program, and looking forward** • Brendan Mulligan, Dongnan Zhu, Norbert Botca, Emma Seward
	2:30 pm BREAK
2:45 pm	**Hydrogeology and Government: A Case Study from British Columbia** • Amy Sloma, Government of British Columbia
3:30 pm	**Discussion on long-term goals, and how to get there:** • Envisioning the direction of groundwater work in Yukon • Innovation and moving forward
4:30 pm	**Closing**

Evening Networking Event	
7:00 pm – 9:00 pm	**Join us at North of Ordinary Experience Centre for post-workshop discussion, snacks and refreshments** *Sponsored in part by SLR Consulting

Day 2: 419 Range Road	
TIME	**CONTENT**
8:45 am	**Doors open and refreshments**
9:00 am	**Welcome** • Review of day one • Introduction of day two theme: Building partnerships between academics and government for mutual benefit
9:30 am	**The Role of Government: Current and Future Research Partnerships** • Linking Government of Yukon work to research partnerships • Evidence based-decision making • Partnering with communities and other governments
10:15 pm	**Leveraging Research Partnerships in British Columbia** • How to select and strengthen research partnerships
	10:30 am BREAK
10:45 am	**Research Highlights: Groundwater Research in Yukon** • Jeff McKenzie, Nicole Wilson, John Spoelstra, Greg Bickerton, Ghislain De Laplante, Mary Samolcyzk
	12:00 pm CATERED LUNCH
1:00 pm	**Research Highlights: Groundwater Research in Northwest Territories** • Isabelle de-Grandpre, Beth Parker, Amanda Pierce, Megan Thompson
2:00 pm	**Research Highlights: Groundwater Research in Nunavut** • Barret Kurylyk
2:15 pm	**Research Highlights: Groundwater Research in Alaska** • Virtual Presentation from Kevin Petrone
2:30 pm	**Debrief and Discussion: Key Takeaways + Moving Forward**
	2:45 pm BREAK
3:00 pm	**Discussion Rounds: Building Effective Partnerships** • Translating discussions into actions
4:50 pm	**Closing**

Appendix B – Participants contact list

Name	Organization	Contact
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Appendix C – Desired Future State

Desired State	How to get there…
Component: Data	
• All historic records in registry, centralized groundwater database for the territory with a lot of data in it. • All developed aquifers mapped, aquifers are understood in 3-D in the context of aquitards • Comprehensive understanding of permafrost, groundwater quality (geochemistry, isotope, contamination) in the most populated areas of Yukon and in select remote areas to assist in groundwater usage and climate change assessments • Heavily regulated, transparent data which is public information, maintained by the territorial government • Interface where new data automatically feeds into the revision of those models, as for mineral exploration programs with new drill holes • Not static products! • One-stop database that holds all aquifers, wells (monitor/productive/dry) results and studies, and is sustainably funded for updates and maintenance • Coupled surface water and groundwater catchment-scale models for “important” aquifers • All privately and commercially held boreholes and MW (municipal water?) logs would be available to the public. • Community well logs and water quality available to public	• Sharing attitude towards sharing data/reports (consultants/industry) • Ease of access to data • Easy to use database • One owner and controller of the data which should be the government • More wells, more reporting • Aquifer mapping • Budget • Regular budget • Funding and partnership to map aquifers • Prioritize groundwater at government level
Component: Comprehensive legislation (that includes factors such as well drilling, abandonment, reporting, source water protection, and several other factors).	
• Mandatory submission of well records • Require permits to be issued to drill wells • after the well is drilled permit required to close	• Structured training • Informal engagement • Design wells that avoid cross-connections

Desired State	How to get there...
• submit well drilling logs, water quality data, pump test results • Have a regulated groundwater industry • Regulations for drillers and small public drinking water systems enforced • Regulatory framework implemented in stages • Make source water protection (and associated legislation) a priority!	• Use high resolution characterization methods and multiple tools/measurements • Commit more resources to 3-D monitoring infrastructure and measurements over time • Government support for regulation and data compilation • Comprehensive Groundwater Regulation • Management Board Submission
Component: Research	
• Groundwater Study – identifying vulnerability and values across Yukon to inform regulatory framework (G2G w FNs) • Cold regions specific groundwater knowledge and best practices	• In-territory research capability including laboratory facilities
Component: Education / Cooperation	
• Awareness of groundwater as an important resource – public/general awareness • Collaborative approach to managing this resource, collaboration among stakeholders (Gov, FN, Industry, University) • A well-informed public with respect to groundwater • More training opportunities in the North • Build local technical capacities • More monitoring perhaps using community volunteers • Steadily growing database	• Collaborative and reciprocal cooperation between YG branches, Government to Government and with First Nations • Collaboration with Academia and Industry • Regular practitioner meetings to keep informed on the latest groundwater information – networking opportunities • Communication and inclusion between /among stakeholders • Public support to implement Regulations. • Public education (include high schools) • Education for all hydrogeologists and groundwater scientists on updated characterization methods • Community-based groundwater monitoring