

Situating place-based, community-engaged watershed research at Xwulqw'selu Sta'lo'

Authors

Tom Gleeson ^{1,2}

Ella Martindale ³

Jennifer Shepherd ¹

David Serrano ¹

Kristina Disney ²

Q'utxulenukhw Tim Kulchyski ⁴

Tyrone Elliott// Tuwuxuwul't-hw ⁵

e campbell ⁶

¹ Department of Civil Engineering, University of Victoria

² School of Earth and Ocean Sciences, University of Victoria

³ Ontario Institute for Studies in Education, University of Toronto

⁴ Cowichan Tribes

⁵ Kwamutsun + Snuneymuxw' Mustimuhw

⁶ Illustrate Legal and Indigenous Law Research Unit, University of Victoria

Corresponding author: Tom Gleeson (tgleeson@uvic.ca)

Keywords: watershed science; community engagement; watershed co-governance planning; decolonization; project planning; community science; Cowichan Tribes; Xwulqw'selu Sta'lo'

Abstract:

Xwulqw'selu Sta'lo' is a culturally significant and salmon-bearing river facing significant challenges which Cowichan Tribes and the British Columbia Provincial Government are addressing with a first-of-its-kind watershed plan. Our research is deeply situated at Xwulqw'selu Sta'lo' and is grounded in interdisciplinary academic spheres of place-based research, water monitoring and modeling, co-governance and systems theory. Our project is an example of developing a deliberate, robust and responsive community science project designed to engage community, impact decision making and respectfully work together in place, on the land. We describe developing and initiating our project and share a visual representation of how we structure our project as 'woven statements'. The five statements give our research project team a shared understanding and motivation and help us plan and make decisions. The statements can be visualized as vertical warps interwoven with research projects, goals and partnerships as horizontal wefts. The warps and wefts mutually support each other since weaving gains strength where warp and weft meet, connect and overlap. Key lessons include the importance of taking responsibility for positionality, knowledge and relationships; the value of intention-setting that reflects the context and the priorities of partners and community; and that projects can flourish if structured around the good present in community.

1. Introduction: Where and why?

The place

Xwulqw'selu Sta'lo' (Koksilah River) is a culturally significant salmon-bearing river with interconnected challenges related to low flows and floods, critical fish habitat, ecosystem resiliency, food security, rural livelihoods, Indigenous cultural resources and water availability on so-called eastern Vancouver Island, British Columbia (BC), Canada in traditional and unceded Quw'utsun territory. On Quw'utsun tumuhw (land), Xwulqw'selu Sta'lo' is an important part of Quw'utsun Mustimuhw (peoples) origin stories, flowing from the top of Hwsalu'utsum (Koksilah Ridge) where the first ancestor fell from the sky. The lower Xwulqw'selu watershed, where water use has increased significantly, is primarily rural and agricultural, while the upper watershed, where land use has changed significantly, is primarily privately held forestry lands.

Quw'utsun Mustimuhw have consistent relationships with Xwulqw'selu Sta'lo' and its relations – including salmon, cedar, and other place-based kin. There are ongoing caretaking relationships with specific places on the sta'lo', as well as efforts to implement and support traditional stewardship practices. Our project, Xwulqw'selu Connections, is committed to honoring and supporting Xwulqw'selu Sta'lo' and its relations first and foremost.

Project background

Driven by challenges related to Xwulqw'selu Sta'lo', Cowichan Tribes and provincial government partners have done extensive work together since February 2020 to gain a holistic understanding of issues in the watershed and community priorities, and to build a collaborative government-to-government relationship to develop a water sustainability plan — the first of its kind in the Province of British Columbia (Cowichan Tribes and Province of British Columbia, 2021b, 2023). Around this time, we piloted a possible stream monitoring idea with key people from each government and community members. The pilot highlighted the need to better understand the hydrology of the whole watershed including the role of groundwater, land use and water use.

With support from and in dialogue with the collaborative government-to-government table, we worked with the two governments and two non-governmental organizations in the watershed to shape the research goals, methodology and partnerships. The research project goals crystallized as 1) improving our understanding of current and future low flows in Xwulqw'selu Sta'lo' through community engaged monitoring and modeling; 2) encouraging deeper community engagement with water science and Indigenous knowledge and watershed governance; and 3) clarifying the role and value of community science in improving water governance and shared management between Indigenous and settler governments. To meet these goals, five interconnected projects, described below, are being or will be conducted by the project team (Box 1) engaged with rightsholders, partners, collaborators and community members.

Box 1. Team background: The interdisciplinary research goals of this community science project necessitated a team with different backgrounds, skills and positionalities. People are a central foundation of this project, so each coauthor is introduced here in their own words. The roles of all the coauthors are described in the main text and summarized in the author contribution statement below. The authors who have been most involved in the development of the project and ideas are the 'research project team' (Ella, Jennifer, Kristina, David and Tom).

Ella: I am Quw'utsun Mustimuhw. As a community researcher with Xwulqw'selu Connections, I seek to bring in land-based knowledge practices to foreground our practice, our theory, and ways of documenting and communicating our findings. I have a social science background with a focus on Indigenous Studies. I am a PhD student at OISE in Social Justice Education, currently engaged in land-based education practices and Indigenous research methodologies in the context of Indigenous sovereignty and land return movements.

Q'utxulenukhw Tim: I am a Biologist and Member of Cowichan Tribes who grew up on the banks of Xwulqw'selu Sta'lo'. I have worked with a variety of clients assessing upland, freshwater, and marine ecosystems for 25 years. My work often involves examining the impacts of development on cultural values. I have travelled extensively, studying the interaction between resource issues and cultural heritage. Over the past several years I was involved in a major Hul'q'umi'num' language revitalization initiative, and I have been a member of the Cowichan Watershed Board since its inception in 2010.

Tuwuxuwul't-hw, english name Tyrone Elliott (They/He): I am a Kwamutsun Mustimuhw (a person of Kwamutsun). I am an artist, a Cedar weaver, a decolonial facilitator, a mentor to youth, and a lifelong learner. I take pride in learning my culture and about the lands I am in relation to. At different times in my life, I have held the roles of Environmental Health technician (FNHA), Arts and Culture Facilitator (SD61), Facilitator of Respectful Onsite Initiative (BCIB, CDHRP) as well as my current role of Indigenous consultation Facilitator (Ministry of Citizen Services, Province of BC). The role I identify closest with, however, is the role of Kwamutsun Mustimuhw - a person belonging to Kwamutsun, and more broadly, Quw'utsun' and Snuneymuxw' Mustimuhw.

Kristina: I am a settler whose family came to the prairies 150 years ago and I am grateful to know and to carry with me the names and stories of those who came before me. I am an extrovert, a problem solver and a storyteller. I grew up farming in a rural community in southern Saskatchewan and I was raised on the land within a community that took care of one another. I have rebuilt more of those strong community ties in the places I have called home since. I bring to the project all that I've learned from the many places and people who shaped me and therefore shaped how I see the sta'lo'. I am working to create a means for the Xwulqw'selu and other communities to improve stewardship of groundwater.

Jennifer: I am a descendant of Scottish ancestors and British farmers who profited from buying, selling, and renting land. I grew up in the Don River Watershed, which is one of the most urbanized watersheds in Canada. Education and travel experiences in developed and developing countries have shaped who I am and my life practice of tending relationships with curiosity, courage, and compassion. I weave creative, social and healing arts into my place-based work with Xwulqw'selu Connections while facilitating connections in community.

David: My background and social location involve hydrological modelling and youth education in Latin America. My previous research in UNESCO IHE (Delft, Netherlands) analyzed protection against floods

in a city designed with a green rainwater infrastructure, then I lectured in the Department of Civil Engineering of my hometown university. In Colombia, it is challenging to integrate stakeholders (academia, government, private sector) in hydrologic research because each sector protects their own interests strongly, and bureaucratic barriers slow down the data acquisition and research in general. Getting involved in Canadian research, like Xwulqw'selu Connections, allows me to see a successful strategy of cooperation, where all actors are involved, and community science can support the data collection and health in a First Nations Territory.

e: I am a settler of Scottish (Norse), English, German, and French ancestry living as an uninvited guest on MÁLEXEŁ and Quw'utsun territories. My ancestors arrived between the 1620-1940s in Kanehsatà:ke territory, Haida Gwaii, Treaty 6 territory, the territories of the Haudenosaunee and Anishinaabek, and lək'wəŋən and WSÁNEĆ territories. I grew up by Zhooniya Zaagiigan (Lake Simcoe) and Chi'Nibiish (Lake Ontario), in Michi Saagiig territory, so-called Mission Creek in syilx territory, and Showe'luqun (Shawnigan Lake) in Quw'utsun and MÁLEXEŁ territories. I work part-time as an artist and lawyer at my own law firm and art studio, and I am also grateful to be a Senior Researcher and Legal Designer at the Indigenous Law Research Unit at UVic.

Tom: I have a mixed European settler background (German, Irish and Ukrainian) and grew up in Iroquois territory near the Six Nations of the Grand River and live and work on Songhees, Esquimalt and WSÁNEĆ Territories. My academic background in geoscience and engineering combined with my abiding passion to do something useful for people and the planet have driven my research, teaching and service in groundwater science and sustainability. I was called to this specific, community-based project by the chance to contribute to a unique and evolving co-governance model between Indigenous and settler governments.

Objectives

Writing this article supports us in naming, situating and reflecting on what we are learning mid-way through our project. We invite readers to engage and learn with us. A key differentiator and novelty of our work in the literature of community-based water science is how we are deeply grounded in place and linked to an evolving co-governance structure. The term *deeply grounded* implicates our intention to keep returning specifically to Xwulqw'selu Sta'lo' physically, spiritually and intellectually, as an active part of the project and work.

The article is a methodological contribution from a specific place and team, rather than a theoretical/conceptual contribution. Our research project team comes to this work as Indigenous and settler researchers and community members with diverse backgrounds engaged in the Xwulqw'selu watershed. We work to counteract biases of disproportionately high numbers of settlers on the research project team and settler leadership of the project through partnerships, community engagements and efforts to engage Quw'utsun Knowledge Holders, community members and artists. A lesson that some of the settlers on the team have started to learn is the importance of taking responsibility for positionality, knowledge and relationships. The importance of taking responsibility has shaped many of our decisions about how we developed the project (such as clarifying our own intentions in Section 3) and even how to write this manuscript (such as clarifying our backgrounds and social locations in Box 1). We do not imply or suggest other teams from different places could or should use our methods, steps or approaches directly like a step-by-step recipe for their project. We offer these approaches as a possible list of ingredients that make up a specific and intentional recipe that is shaped by the project

relationships to the Xwuqlw'selu Sta'lo'. These ingredients include engaging with partners, connecting with land and place, team building, clarifying purpose, and building our own way to represent our research project, and developing both a logic model and a communications strategy.

This article draws on different literatures and approaches across disciplines rather than delving into discipline-specific details, arguments and approaches. Since our research project team and the research itself is interdisciplinary, it is important to clarify what we mean by some specific terms. 'Community science' refers to transdisciplinary science including social and public health science that is conducted in partnership with communities and is intended to address community challenges while contributing to scientific theory and methodology (following the aims and scope of this journal). By 'community' we mean Indigenous or settler peoples who live at or near Xwulqw'selu Sta'lo'.

Grounding our research in the broader literatures

We purposefully started this article by introducing the place, project, team and objectives to emphasize their importance to our place-based research process and outcomes. Our research is also grounded in broader academic spheres of place-based research, community science, co-governance, systems theory and water science. We seek to bring in, foreground and, where appropriate, engage insights and approaches from Indigenous academics and practitioners while acknowledging that the research project team is disproportionately settlers (Box 1) being careful of and responsible to Indigenous Knowledge (see Section 2). We are motivated and inspired by anti-colonial practices in community-based research and science (Liboiron, 2021). We turn toward the work of Indigenous scholars who critically engage with land and more-than-human relations in legal and scientific research areas (Liboiron, 2021; Todd, 2017) to take practical measures in our work with Xwulqw'selu Sta'lo', to assist us in accounting for Indigenous ways of knowing in our processes and outputs, and to continue and strengthen our dialogue with Cowichan Tribes and Quw'utsun Mustimuhw in good relation to our project.

Water-related issues disproportionately impact Indigenous peoples in so-called Canada (Waldron, 2020) driven in part by an overreliance on methods of Western science and management, ignoring the vast place-based wisdom of Indigenous knowledge systems and relational practices regarding water (Castleden et al., 2017). Castleden et al. (2017) argue for the importance of relationality and reconciliation in addition to the four 'Rs' of research involving Indigenous peoples: respect, relevance, reciprocity, and responsibility (Kirkness & Barnhardt, 1991). We endeavor to move beyond just following strategic directions to supporting Indigenous research in Canada (Canada Research Coordinating Committee, 2020) by respectfully working together in place, on the land with Indigenous knowledge (Reid et al., 2021), Indigenous data governance (Carroll et al., 2021; Jennings et al., 2023; Rowe et al., 2020), and designing the research to be consistent with calls to action for natural scientists working towards reconciliation (Wong et al., 2020).

Community science facilitates a better representation of local experiences and priorities, collects immense amounts of raw information, provides educational opportunities, and increases scientific knowledge (Buytaert et al., 2014; Callaghan et al., 2019). However, community science can have limitations in data collection, in its impact on decision making and how projects are developed. Community water science data collection often contains gaps, redundancies and biases (Callaghan et al., 2019) but the quality in community data collection has rapidly improved with the advances of accessible technology. Unfortunately, decision-makers are often wary and mistrustful of using the community data, due to perceptions of data robustness or lack of alignment with governmental data systems which contributes to community water science being poorly integrated into water resource decision-

making (Buytaert et al., 2014). Community water science protocols in this project ensure robust data collection methods (Strobl et al., 2020) that flexibly fits into daily life and are aligned with the shared priorities of two governments — important innovations in community science. Community water science often focuses on water quality in lakes and rivers (Allen et al., 2018); however, the focus of this research is on groundwater-surface water interactions in small streams. This project is novel and innovative in that watershed co-governance reform has not often explicitly incorporated community science. Some community science projects develop in an ad hoc way, driven by funding opportunities, a strong champion or an engaged group. We developed our project using insights about partnerships and design thinking and clarifying engagement in community-based research and public participation (Dale, 2013; Gray et al., 2010; IAP2 International Federation, 2018; Lipmanowicz & McCandless, 2013; Magruder Watkins & Mohr, 2001; Scharmer, 2018; Strategyzer AG, 2024; Tremblay, 2017). Recently, Dominguez Guzmán et al. (2023) argue for the importance of practices in the transformations to groundwater sustainability including situating (particularising existing groundwater knowledge in the specific contexts and networks in which it arose or is arising), caring (emotionally and practically engaging to restore, sustain, or protect groundwater) and tinkering (engaging groundwater in patched together and always in-the-making ways). We intend this article to situate our research, and hope to strengthen our practices of caring and tinkering.

This research includes hydrologic monitoring and modeling of the spatial and temporal distribution of groundwater contributions to low flows in small headwater streams. Groundwater-surface water interaction is a well-established sub-field of hydrology (Fleckenstein et al., 2010; Kalbus et al., 2006; Lewandowski et al., 2020), but the groundwater contributions to small, headwater streams remain challenging to quantify (Hammond et al., 2020). Little is known about how and where groundwater-surface water interactions occur in Canada and many other places (Larocque & Broda, 2016), even though low flows derived from groundwater are critical for maintaining aquatic ecosystems in many rivers (Gleeson et al., 2022). We advance and apply innovative methods for quantifying groundwater contributions (Kampf et al., 2018) by combining sensors with community science as a viable, robust means of data collection that uses emerging technologies.

2. Connections to Cowichan Tribes / Quw'utsun Tumuhw

The river and its connections

Quw'utsun Relations: The Xwulqw'selu Sta'lo' watershed is deeply connected to Quw'utsun tumuhw through stories, places, and longstanding Hul'q'umi'num' legal traditions tied to specific landscapes (Morales, 2016). Specific Hul'q'umi'num' laws are embedded in landscapes, informing Quw'utsun Mustimuhw relationships to land over time (Morales, 2016). The relations in the Xwulqw'selu Sta'lo' watershed stem from stories about Hwsalu'utsum (Koksilah Ridge), including the origin story about Stutsun, the first ancestor to fall from the sky. The importance of this story informs Quw'utsun Mustimuhw relationships to xpey' (cedar) and stseelhtun (salmon), both of whom the Xwulqw'selu Connections project has engaged during the research process. In order to be in good relation to the watershed, the research project team has considered the importance of bathing springs within the watershed; and considers how Hul'q'umi'num' language informs those who engage with the river. These are two of many unquantifiable considerations that the research project team must engage consistently to be in good relation to the watershed over time.

Quw'utsun Mustimuhw interactions on Xwuqlw'selu Sta'lo' are shaped by longstanding relations with other-than-human beings like xpey' (cedar) and stseelhtun (salmon). Xpey' and stseelhtun have each

offered specific priorities for the Xwulqw'selu Connections project alongside other research, policy, and restoration efforts on the watershed. Some of our team members joined a Quw'utsun Elders-led workshop in 2023 meant to uplift and change the course of the relation with xpey' (cedar) in response to climate change and the challenge of keeping xpey' thriving on Quw'utsun tumuhw (Quw'utsun' Cultural Connections Society, 2024; Ronson, 2022). Stseelhtun are ancient teachers for Quw'utsun Mustimuhw and consistently teach about the health of the river, as well as engage people in their personal and familial connections to fishing practices and land restoration and maintenance within the watershed. Jennifer has been part of a team planning a Stth'Ihnamut sqw'ulum (First Salmon Ceremony) with community members on the river, and she is co-leading a community arts installation project to express and honour our collective love of the natural world and our place in it, including fish and water kin. Quw'utsun Mustimuhw have deep knowledge that lies within relational connections to kin such as stseelhtun and xpey'; the Xwulqw'selu watershed is formed by these relational connections, and Quw'utsun ways of being are tied directly to the obligation to continue to connect our relations via waterways (Morales, 2016; Whetung, 2019).

Cowichan Tribes

Cowichan Tribes is the existing and unextinguished Indigenous rightsholder in Xwulqw'selu Sta'lo' and the single largest First Nation in British Columbia, Canada, with almost 5,000 members. Their core Traditional Territory is approximately 375,000 hectares (900,000 acres) and stretches to Goldstream River in the south, San Juan ridge in the west, Nanaimo in the north and the Fraser River in the east. Cowichan Tribes are governed by a Chief and 12 Councilors, within the framework of the Indian Act, which ratified Land Code in 2019 as part of a journey to self-governance. Xwulqw'selu Sta'lo' is in unceded, traditional territory of the Coast Salish peoples, including Quw'utsun' (Cowichan) Tribes, Malahat Nation, Halalt First Nation, Ts'uubaa-asatz (Lake Cowichan) First Nation, Lyackson First Nation, Stz'uminus First Nation, Penelakut Tribe, and T'sou-ke First Nation (Barroso & Wainwright, 2020).

Cowichan Tribes' vision for success and for a healthy Xwulqw'selu Watershed includes, but is not limited to (Cowichan Tribes and Province of British Columbia, 2023):

- its members feeling safe using the Xwulqw'selu Watershed for cultural and other purposes during all seasons;
- increased summer water levels, and decreased winter flows and impacts from flooding;
- improved water quality;
- a return to healthy and abundant stseelhtun (salmon) populations;
- its members' connection to the Xwulqw'selu Watershed area based on continual and improved access and use of a biodiverse watershed;
- addressing climate change impacts;
- supporting the habitat for the many species that were historically able to use the Xwulqw'selu Watershed in their life cycles;
- the restoration of ecological balance within the Xwulqw'selu Watershed; and
- recognition, priority protection, and restoration of culturally important species, including Xpey' (Western redcedar) and Tth'qw'ulhp (Sitka spruce).

Cowichan Tribes considers the Xwulqw'selu Connections project as a way of strengthening ties of Cowichan members to their territory, improving understanding of low summer water levels, and supporting the shift towards water co-governance. Engaging with Cowichan Tribes was of utmost

importance for developing the project's Memorandum of Understanding and relationship to the Watershed Sustainability Planning process, described below.

As part of the project's ongoing relationship with Cowichan Tribes, Ella and Tom regularly meet with the Quw'utsun Tumuhw Committee and Natural Resources Committee to share general updates and findings, ask questions, and answer any questions the committee might have for us. In April 2022, we met with the Quw'utsun Tumuhw Committee and received feedback on the project so far. We asked a question about using the Hul'q'umi'num' language in project documents, including in the title of the project, which up until this point had been 'Koksilah Connections', using the anglicized version of the Hul'q'umi'num' name for the river and the area. The committee agreed that Hul'q'umi'num' can and should be used within the project. In this way, we started naming the project with the Hul'q'umi'num' spelling: Xwulqw'selu Connections. Additionally, team members are taking Hul'q'umi'num' language lessons to continue to grow our relations.

In this same meeting with Quw'utsun Tumuhw Committee, we also enquired about appropriate ways to work with Indigenous knowledge. Tom mentioned an interest in Two-Eyed Seeing (Etuaptmumk in Mi'kmaw) (Reid et al., 2021). Chief Xtli'li ye' Lydia Hwitsum suggested not to bring other ways of pairing western and Indigenous knowledge from other Indigenous peoples such as Two-Eyed Seeing to Quw'utsun territory, but instead be guided by Quw'utsun snuw'uyulh (teachings). Although this question provided a starting point for discussion around Quw'utsun research methods and principles guiding research in Quw'utsun territory, in reflection, it was inappropriate because it was extractive (in extracting Two-Eyed seeing from its Mi'kmaq context without proper processes and guidance for that process) as well as pan-Indigenous (in assuming Mi'kmaq methodologies could be applied to Quw'utsun legal processes). A better question could have been 'what Quw'utsun methods, teachings, or processes are important to those doing work in the watershed?'

3. Developing our project

Rightsholders, partners, collaborators and community

A crucial foundation of this community science project was building transparent, mutually understood relationships with partners and collaborators including the rightsholder, Cowichan Tribes, described above. The research project team recognized early on that our relationship with each organization is unique because of organizational type (government, non-governmental, private), the socioeconomic landscape (including the ongoing legacy of colonialism) as well as respective goals, needs, requests, offerings, commitments and communication needs of our research project. Additionally, the funding only allowed for partnership with government or non-governmental organizations which led to formal partnerships on the research project with Cowichan Tribes (Section 2), the Province of British Columbia, the Cowichan Watershed Board and the Koksilah Working Group of the Cowichan Station Area Association (Figure 1).

The Province of British Columbia is committed to implementing B.C.'s 2019 *Declaration of the Rights of Indigenous Peoples Act* (DRIPA) and 2016 *Water Sustainability Act* (WSA) which includes provisions for Water Sustainability Plans described below. The initial project partner Ministry of Forests, Lands, Natural Resource Operations and Rural Development (renamed Ministry of Forests in April 2022) is the provincial agency of British Columbia that supports the forest sector, takes action to keep forests healthy, and protects communities in the face of climate change and extreme weather events. The

Ministry of Water, Land and Resource Stewardship (WLRs) was formed in April 2022, after the start of the project. This new ministry is accountable for integrated land and natural resource management, including objective setting for land and marine environments, effectively managing cumulative effects, and advancing reconciliation with Indigenous peoples, environmental sustainability, and economic growth. We have engaged with both ministries in the watershed planning process as described more below.

The Cowichan Watershed Board (CWB) is a local governance model created in 2010 to provide leadership for sustainable water management in the Quw'utsun (Cowichan) and Xwulqw'selu (Koksilah) watersheds, ancestral home of the Quw'utsun First Nation. The CWB is co-chaired by Cowichan Tribes and the Cowichan Valley Regional District (CVRD) and represents a unique partnership between First Nations and local government (Hunter et al., 2014). Through this model, Cowichan Tribes and the CVRD work together to advance whole-of-watershed health, demonstrating a commitment to moving down the path of reconciliation.

The Koksilah Working Group (KWG) is comprised of community volunteers who address concerns about the impacts of land use and climate change on local water and environment. The KWG was established in 2015 as part of the Cowichan Station Area Association. Formed in 2008, the Cowichan Station Area Association is a charitable organization that brings neighbors together to promote livability and sustain the natural environment and historic and cultural values of the Cowichan Station area (Pritchard et al., 2019). The KWG plays a role in monitoring the local environment and engaging with citizens on issues of education, management, and decision making.

Ten members of the KWG stepped forward to participate in streamflow monitoring in 2021, the first field season of Kristina's community-engaged monitoring work. Seven of these volunteers have continued to participate in one, two, or three of the subsequent monitoring seasons. Drawing on the generative power of word-of-mouth communications and strong community ties, we encouraged streamflow monitors to share their experiences and learning with neighbors, friends, and other community contacts. Several folks were inspired to join the monitoring team as a direct result of these conversations. KWG members have also volunteered to speak with the public at local gatherings and festivals alongside members of our project team. In 2022, there were 31 volunteers monitoring across eight teams, and in 2023, 45 volunteers participated in 9 Stream Teams. In 2024, 44 volunteers participated in 11 Stream Teams and two special local assignments. Most volunteers live in the Xwulqw'selu Sta'lo watershed; however, some volunteers travelled from nearby watersheds to gain skills and knowledge to apply in their local watershed. The volunteer commitment includes a welcome BBQ, an evening orientation session, a 2–3-hour monitoring route every other week from July through September, and a closing celebration. Volunteers were also invited to participate in a mid-summer picnic to learn from each other's experiences across sub-watersheds within Xwulqw'selu.

In addition to the formal partners, the project team has built relationships with numerous other collaborators and related organizations and initiatives. Important local stakeholders, advisors and implementers ensure cross-sectoral local engagement across regional government (Cowichan Valley Regional District), agriculture (BC Ministry of Agriculture) and forestry. Mosaic Forest Management, the forest planning, operations and product sales company that owns private forestry lands in the upper watershed, shows its commitment to this project by providing access to the upper watershed, providing staff time and resources to aid in fieldwork, helping define appropriate monitoring locations and

methodologies and potentially sharing data. Additionally, Jennifer plays a valuable role in supporting coordination of the informal Koksilah Low Flow Working Group, an important communications tool between agencies and organizations working on these issues to collaboratively work with water users to navigate periods of low flow. Finally, we engage local and community-based media, such as the Discourse, to raise awareness of our project and outcomes (Mehta, 2022, 2023, 2024; Shen, 2024).

Provincial and national implementers will maximize the impact of the project. The POLIS Water Sustainability Project is important as an advisor, and for disseminating project outcomes to a broad, national audience. Watersheds BC, with its partner BC Freshwater Legacy Initiative, is interested in supporting the methods and outcomes of this project and sharing project results by supporting peer learning opportunities, storytelling and housing shared knowledge to ensure that the project has broad accessibility to the freshwater community. The BC Ministry of Environment and Climate Change Strategy and other community-based groups are interested in implementing similar community-engaged hydrologic monitoring in other watersheds across the province. Foundry Spatial Ltd. is interested in incorporating community science data into their Water Tools in British Columbia that are used by decision-makers across the province. Throughout the project, BC Water Leaders (an informal group of non-governmental water leaders) will disseminate methods and results to water leaders in non-governmental organizations and the provincial government. Finally, a capstone workshop co-organized by the International Association of Hydrogeologists – Canadian National Chapter and Global Institute for Water Security (U. of Saskatchewan) will raise awareness of project methods and results to hydrogeologists and water policy makers across Canada.

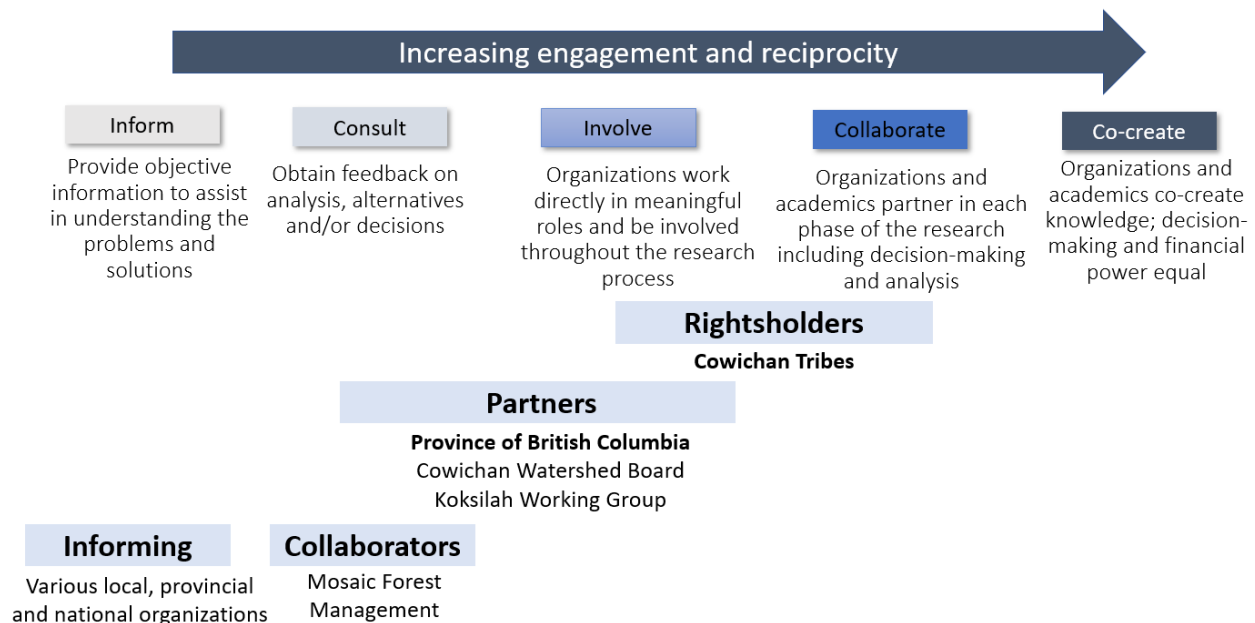


Figure 1. Organizations engaging with our research arranged along spectrum of increasing engagement and reciprocity.

Watershed Planning Process

A central motivation of the community science project team is supporting Cowichan Tribes and the Province of British Columbia who have been collaboratively engaged in Xwulqw'selu Watershed Planning (XWP) described in the Xwulqw'selu Watershed Planning Agreement S-xats-thut tst – We Agree (Cowichan Tribes and Province of British Columbia, 2023). The XWP is a significant opportunity to innovate and reform watershed management, realize co-governance and express Quw'utsun laws and knowledge alongside the provincial *Water Sustainability Act*. Chief Xtli'li ye' Lydia Hwitsum has described how the XWP will help Cowichan Tribes plan for the future, while restoring and rebuilding the watershed to a healthier condition. Quw'utsun Mustimuhw have always held, and continue to hold, that responsibility to care for the land and water (Cowichan Tribes and Province of British Columbia, 2021b). Additionally, the XWP is consistent with B.C.'s commitments to implement the United Nations *Declaration on the Rights of Indigenous Peoples* and the *Declaration of the Rights of Indigenous Peoples Act*. Initial work by the Province of B.C. was led by Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) but after change in ministry structures, the Ministry of Water, Land and Resource Stewardship (WLRS) was given the mandate to continue watershed planning. Overall, the planning will address significant, interlinked concerns in the watershed related to water availability, low flows, critical fish habitat, Indigenous cultural resources, local area planning, and other identified issues. A significant differentiator of this project with much community science is the formal partnership with a co-governance structure that is evolving in real time during the project — the two governments are partners on this project. An important intention is to be both collaborative and independent from the XWP so that our outcomes will be considered robust by all parties and community. Our interactions with and contributions to the XWP are described more below.

During the XWP scoping, an external engagement project in 2020 conducted interviews and a public online questionnaire that led to the following recommendations from diverse community members: focus on the whole watershed; be data-driven; encourage listening and learning across differences; and explore the application of values (Cowichan Tribes and Province of British Columbia, 2020). These recommendations also guided the initiation of our research elevating the importance of examining the whole watershed, being data-driven, and encouraging listening and learning across difference at our partner and community events. A concurrent but separate hydrologic study recommended streamflow monitoring of the tributary drainages, determining the relative importance of water uses within smaller sub-areas, and developing robust hydrologic models all of which we also included in our research goals (Cowichan Tribes and Province of British Columbia, 2021a).

Memorandum of understanding to guide research

Before initiating the project, we developed a memorandum of understanding that clarified support for the research goals and methods (Supplementary Information). The agreement described shared goals of meaningful relationships and opportunities for community members to experience and participate in science, knowledge sharing and co-production, incorporating Quw'utsun place names as permitted and appropriate, and ongoing learning about Indigenous history and rights. The memorandum of understanding and the research proposal were written to be consistent with relevant calls to action for natural scientists working towards reconciliation (Wong et al., 2020) which were inspired by the 94 calls to action from the Truth and Reconciliation Commission of Canada (Truth and Reconciliation Commission of Canada, 2015) and existing guidelines on ethical conduct for research involving humans,

cultural resources, and data ownership. Calls to action about animal subjects, publishing systems, funding system and the overall post-secondary systems are not directly relevant to the project.

Table 1. Relevant calls to action from Wong et al. (2020) for natural scientists working towards reconciliation and activities in the project

Call to Action	Planned activities when initiating the project	Current or previous activities
We call on natural scientists to understand the socio-political landscape around their research sites.	Research project team will work closely with partners who are deeply involved in the socio-political landscape of the research site through biannual partner progress meetings and other ad hoc meetings.	Research project team has biannual partner progress meetings and other ad hoc meetings and is contributing to Xwulqw'selu Watershed Planning process.
We call on natural scientists to recognize that generating knowledge about the land is a goal shared with Indigenous peoples and to seek meaningful relationships and possible collaboration for better outcomes for all involved	Research project team recognizes that generating knowledge about the land is a goal of Cowichan Tribes. Meaningful relationships and collaborations for all involved have been at the heart of developing the project.	The MOU and this manuscript affirm that generating knowledge about the land is a goal shared by Cowichan Tribes. We consistently aim to have meaningful relationships and collaborations.
We call on natural scientists to enable knowledge sharing and knowledge co-production	All knowledge produced in this project will be openly shared and knowledge co-production will be facilitated by the community researchers and knowledge holder participation.	All knowledge created in project is owned by Cowichan Tribes and openly shared. Knowledge co-production has been challenging due to authority holder lack of capacity but we consistently foster and support knowledge holder participation.
We call upon natural scientists to provide meaningful opportunities for Indigenous community members, particularly youth, to experience and participate in science.	Indigenous community members will have meaningful opportunities to experience and participate as monitors and knowledge holders.	Quw'utsun community members have meaningful opportunities to experience and participate as monitors and knowledge holders, especially through personal connections to the research project team.
To decolonize the landscape, we call on natural scientists to incorporate Indigenous place names as permitted.	Where appropriate to be shared, we will incorporate Quw'utsun place names in culturally relevant training for monitoring as well as any research products and outcomes.	We are seeking approval from Cowichan Tribes to use Quw'utsun place names in research products and outcomes.

We call upon natural scientists and their students to take a course on Indigenous history and rights.	All graduate students will complete Indigenous Cultural Acumen Training at University of Victoria (or similar training).	All settlers have completed Indigenous Cultural Acumen Training at University of Victoria and/or The Journey of our Generation with Cowichan Cultural Connections.
-------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------

Importantly, the memorandum centers Indigenous data sovereignty (Carroll et al., 2021; Jennings et al., 2023; Rowe et al., 2020) by defining Indigenous knowledge from Cowichan Tribes’ perspective, and the intention to share data openly and respectfully, excluding Indigenous Knowledge. Indigenous Knowledge in the memorandum means Indigenous cultural expressions of the First Nation, and knowledge of lifeways and systems; Indigenous knowledge was excluded to ensure it remains controlled by the First Nation. Data collection, storage, and sharing use the First Nations principles of ownership, control, access, and possession (OCAP) of data, which will be open source where acceptable and possible following Findability, Accessibility, Interoperability and Reuse (FAIR) principles (Carroll et al., 2021; Jennings et al., 2023; Rowe et al., 2020). In keeping with OCAP principles, all data derived from this project are owned by Cowichan Tribes and will be openly shared based on the expressed interest of Cowichan Tribes to benefit the evolving co-governance structure. University of Victoria is the custodian of the data during the project. The memorandum was signed by three project partners (Cowichan Tribes, Cowichan Watershed Board and the Cowichan Station Area Association). The province was not able to sign the memorandum due to limitations as a statutory decision maker but wrote a letter of support for the research project and the shared goals and understandings expressed in the memorandum. The Memorandum of Understanding and letter of support are shared publicly on our project website to ensure openness and transparency with community and collaborators, as well as in the Supplementary Information.

4. Initiating our project

Before describing our external processes with partners and community and our internal research project team processes, it is important to clarify how the specific research goals, projects and approaches (introduced in section 1) and different disciplines and team member backgrounds (Box 1) manifest in the project. Hydrologic monitoring and modeling are related to research goal 1 focused on groundwater-surface water connections and rooted in hydrologic science and community science approaches, and generally physical science and engineering backgrounds (Figure 2). Hydrologic monitoring and modeling are each the focus of graduate dissertations and will be introduced in detail in future articles (REF to Kristina and David conference abstracts once posted). Community research work is related to research goal 2 focused on watershed and people connections and rooted in diverse practices and literatures including Indigenous methodologies, place-based research, living systems, and theories of change. We outline below the internal and external processes led by the community researchers. Finally, legal and policy analysis related to research goal 3 around water science and water decision making will begin later in the project so it is not discussed here.

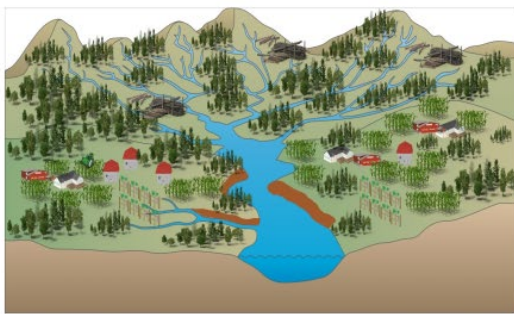
a) community monitoring



b) partner meetings in the watershed



c) hydrologic modeling



d) celebrating with community



Figure 2. Different projects and approaches in the research project

External processes with partners and community

We are consistently growing relationships and engaging with partners and community (described above). With partners, we built transparency and mutual understanding of the uniqueness of each relationship by working with each partner to clarify the partnership (Lachapelle, 2020). Specifically we clarified partnership goals (what value do you want to create?), needs (what do you need?), requests (how can we help you meet that need?), offers (what can you offer to the project?), partner commitment (what do you commit to?), project commitments (what do we commit to?) and communications (how would you like to communicate?). Then we shared this understanding with all the partners at workshops. We used this understanding to visualize the relational differences with a spectrum of engagement and reciprocity based on spectrums of community-based research (Tremblay, 2017) and IAP2 Spectrum of Public Participation) (IAP2 International Federation, 2018). We have used this spectrum of engagement and reciprocity (Figure 1) to discuss and clarify the depth of engagement with partners generally and on specific projects. One reflection is that we could have more consistently engaged partners on their goals, needs, requests, and offers especially with staff turnover in partner organizations. In planning various partner meetings and community events, we have struggled with how to balance how much energy and time to focus on the XWP process or community members, as well as how to include Mosaic Forest Management staff who are not formal partners but are important collaborators who have sometimes contentious relationships with some partners and community members. In general, our strategy has been to organize separate partner and community events and

include all relevant organizations to continue to try to improve relations across the watershed. Another strategy to deepen social and place-based relationships has been to consistently organize events in the watershed in person, and whenever possible, outside in the presence of the sta'lo with offerings of food.

We have continuously engaged with the evolving watershed planning process through a new provincial ministry, significant staff turnover and limited capacity in both governments. We contribute to the XWP formally and informally: Kristina sits on the Collaborative Community Advisory Table established to represent a diverse range of watershed interests; Tom contributes technical advice; and Jennifer supports communications and engagement in the process informally. We have also built relationships with Compass Resources Management, which is a company focused on environmental planning and policy, structured decision making, and risk analysis. Their staff are executive director and facilitators of the Government-to-Government planning and shared decision-making process for the Xwulqw'selu Watershed. At times of staff turnover and while the new ministry was being established, we struggled with maintaining meaningful collaborative relationship with partners; our strategy was to keep showing up, asking how to connect and seeking relationships through both formal and informal channels. At other times the pace of the research was faster than the planning process; our strategy was to do our best to ensure that the research we were doing could be useful to the planning process.

Internal research project team processes

The team of five researchers has spent the first two years of the five-year project engaging in co-learning together as a team comprised of multiple disciplines (Box 1) determined to foster an interdisciplinary meeting space. We intentionally invested time learning about each other's unique personal and academic backgrounds, the knowledge we each hold, and the skills we each offer to the project. We met for over 1.5 hours every week, mostly remotely on video-chat given the pandemic and where people were living, and we met in person where possible. This co-learning process resulted in a collaborative team meeting space, where team members feel comfortable challenging each other's ideas and offering consistent feedback. We invest in building personal and working relationships so that the team meeting space is one of holistic support for each other's academic goals and our well-being. The time spent co-learning amongst the research project team members resulted in team consensus and a common ground for our specific research goals. In this way, our processes are interdependent, and we rely on each other. We have found this process rewarding on multiple fronts: in working between multiple academic disciplines; in engaging each other in our community research activities, by honoring each other's roles; and in centering Xwulqw'selu Sta'lo'. While we met less frequently in 2023-2024, our relationships remain strong.

The community researchers Ella and Jennifer led a series of internal processes using tools from place-based learning and design thinking and we iteratively developed a logic model (a graphical representation of the chain of causes and effects leading to an outcome of interest (W.K. Kellogg Foundation, 2004)). Our logic model included actors (who is involved) → activities (what activities the program undertakes) → outputs (what is produced through those activities) → outcomes/impacts (the changes or benefits that result from the program). Throughout these activities we called our desired outcomes 'social impact goals' which was our internal shorthand for what we think is important, meaningful and potentially impactful to us, to our partners, to the community, and to the sta'lo'. We kept digging deeper, asking 'why' questions and reflecting on what is possible given our backgrounds, social locations, skills and capacity. We word smithed, debated and discussed until we had five statements that we reached consensus on. It is important to note that this whole process involved the

research project team after the project had started with clear research goals and a memorandum of understanding (Sections 1 and 3) and represents the deeper intentions or purpose to our research that we developed together. These are key statements that affirm how we do our work together as a research project team in place. Our research framework for doing work together is bound by the following statements:

- Quw'utsun Mustimuhw are present on Quw'utsun lands and waters and Quw'utsun rights and laws are upheld by all
- Authority holders, residents and community organizations deeply understand the watershed science of the whole watershed
- Community-based monitoring and modeling inform water and land decisions about the Xwulqw'selu Sta'lo
- Authority holders, residents and community organizations have capacity to steward the watershed into the future
- We share our practices and outcomes

These statements were developed as 'social impact goals' but after reflection we realized that these are not anymore 'social' than our research goals, nor are they necessarily specific future 'goals'. Instead, we engage these statements as both presently true and as something to strive towards. These statements are our diverse values and intentions, that we express in language that resonates with the research project team rather being a thematically or linguistically consistent list. We struggled with what to call them, trying 'foundations', 'common ground' or simply 'statements', and we eventually realized these interwoven and mutually reinforcing statements are the basis of our ethical and practical research intentions that holds and supports our work.

Weaving

Internally, we began discussing our statements as a basket, inspired by Jennifer's practices of learning weaving with and among community, including an introductory cedar basket workshop with Hwiemtun (Fred Roland), a community weaving initiative Jennifer co-led to weave gift baskets for elders and supporters of the Quw'ushin'tul Ancestors Walk, and carving with Tlith'kawi (Rupert Scow) who is Kwakwaka'wakw from Gilford Island. Tyrone Elliott// Tuwuxuwul't-hw who is Quw'utsun Mustimuhw provided direction and teachings so that the basket is culturally grounded in place-based knowledge. Tyrone Elliot // Tuwu'xu'wul-thw' and e campbell collaborated on two illustrations of the weaving process (Figure 3) as well as a finished basket. A second Memorandum of Understanding was developed to clarify the role and scope of this collaboration and protect the inherent rights of Indigenous communities, including the ownership, control, access, and possession of their data, information, and Intellectual Property, including Indigenous Knowledge (see Supplementary Information). The research project team is very grateful for the work of creating both of these images, which helped clarify that sharing the finished basket felt premature to all coauthors since we are still mid-project and could risk misuse or appropriation. For these reasons, the image of the finished basket is not shared herein. Here we focus on describing how weaving (and baskets as an important example of weaving) relate to our research process and project.

Weaving baskets and blankets are important Coast Salish cultural practices, and weaving has been used recently in other academic frameworks. For example, blanket weaving is the framework for the recent University of Victoria Indigenous plan with the weaving warps being the laws and philosophy guiding the

plan and the wefts being the priority areas of the plan (University of Victoria, 2023). More broadly, weaving is emerging as an important way of expressing decolonial practices of Western-trained scientists collaborating with Indigenous peoples and knowledge (Sidik, 2022) that Johnson et al. (Johnson et al., 2023) emphasize should not be a “one-size-fits-all” mindset, but instead should emphasize relationship building, continuous engagement, and ethical practices.

Q’utxulenukhw Tim Kulchyski has described weaving as bringing together everything: ecology, culture, and language into a useful and practical tool. This is consistent with Niles (2021) suggesting that basket weaving is a place-based cultural practice with deep social, ecological, seasonal and aesthetic connections that persist especially in gathering cultures over millennia. Practically, the principal function of baskets is to contain or separate other things, but baskets can also be thought of as a model and code passed between generations, expressing a people’s understandings of how to *live here* — often basket-based landscapes where the ecology is curated for baskets (Niles, 2021). Warps are woven at angles to one another in a pattern to form the base of the basket. At the edge of the base, the warps are bent (or upset) at 90 degrees and journey up the sides of the basket (Jensen, 1991; Siler, 1988). The wefts flow over and under the warps and serve to hold the warps upright. A basket needs both warp and weft to create structure. The basket weaver manipulates the warp and weft with care and intention, paying attention to how, where, and how closely the materials touch one another. The basket weaver learns from the materials; as they weave, they listen for what the basket calls to become. The choices they make as they weave in relationship with their intended purpose and with the materials — xpey’ (cedar) and other natural fibers — determine the basket’s strength, porosity, potential, and aesthetic qualities.

Figure 3 visualizes Xwulqw’selu weaving process. Importantly, this image was developed together, in place, with Xwulqw’selu Sta’lo’ as well as at SELEKTEL (Goldstream river) and TI’ulpalus (Cowichan Bay). The process is informed by Coast Salish and decolonial weaving practices (Sidik, 2022) and is our specific and place-based approach (note that, in sharing this approach we are not implying it should be applied elsewhere as a “one-size-fits-all” method (Johnson et al., 2023)). In recognition of our place-based praxis, Tyrone Elliott// Tuwuxuwul’t-hw underscored the importance of the sinew, in their design for the basket, as being threaded through the basket and holding it together. The sinew represents the “snuw’uy’ulh tuna tumuhw” (teachings of the land). Importantly, Tyrone Elliott// Tuwuxuwul’t-hw reinforces the “snuw’uy’ulh tuna tumuhw” (teachings of the land) and its presence in the basket are the dyes in the individual warps or stakes. These warps are each dyed by the land: the red dye coming from arbutus/alder, the dark blue dye coming from dark blue clay, the turquoise dye coming from turquoise clays, and the black coming from copper-rich swampy areas (cedar would be buried within them to dye them black), the yellow coming from Oregon grape. These dyes are reflective of how it takes an entire watershed to create this basket, in turn highlighting the nature of our work and the whole-of-watershed approach we use. The five statements that guide our work form the basket warp.

These five statements can be visualized as the vertical, colored warps (Figure 3). The horizontal weft are our research partnerships, goals, and projects. These three elements are twined rather than plaited around the basket. The twining here is the wrapping of multiple cedar strips together, representing the multiplicity of partners, goals, and projects. These three twined pieces are supporting one another and threaded into the plaiting of the design through a rhombus shape designed by Tyrone Elliott// Tuwuxuwul’t-hw that functions to each of these elements, as well as center Quw’utsun mustimuhw, laws, and rights in our work. They also connect, through the sides, and upwards, into the eventual

mobilization of our work through the handle of the basket, which is also twined to represent the multiplicity of ways the work is taken up in the world.

Weaving is a culturally significant practice outside our project that we were inspired by, and it is important to clarify that the research project team developed the statements and the initial idea of the weaving graphic, but that the graphic and the meaning embedded within it was developed by Tyrone Elliott// Tuwuxuwul't-hw and e campbell, and the final graphic was discussed by all coauthors. We did not formally co-develop or collaborate on the basket and statements (warp or stakes) with our research partners or community. Instead, we see this as our own internal work to do to be in alignment and to ensure we are respecting our responsibilities. We shared the woven statements and Figure 3 with rightsholders, partners and community members.

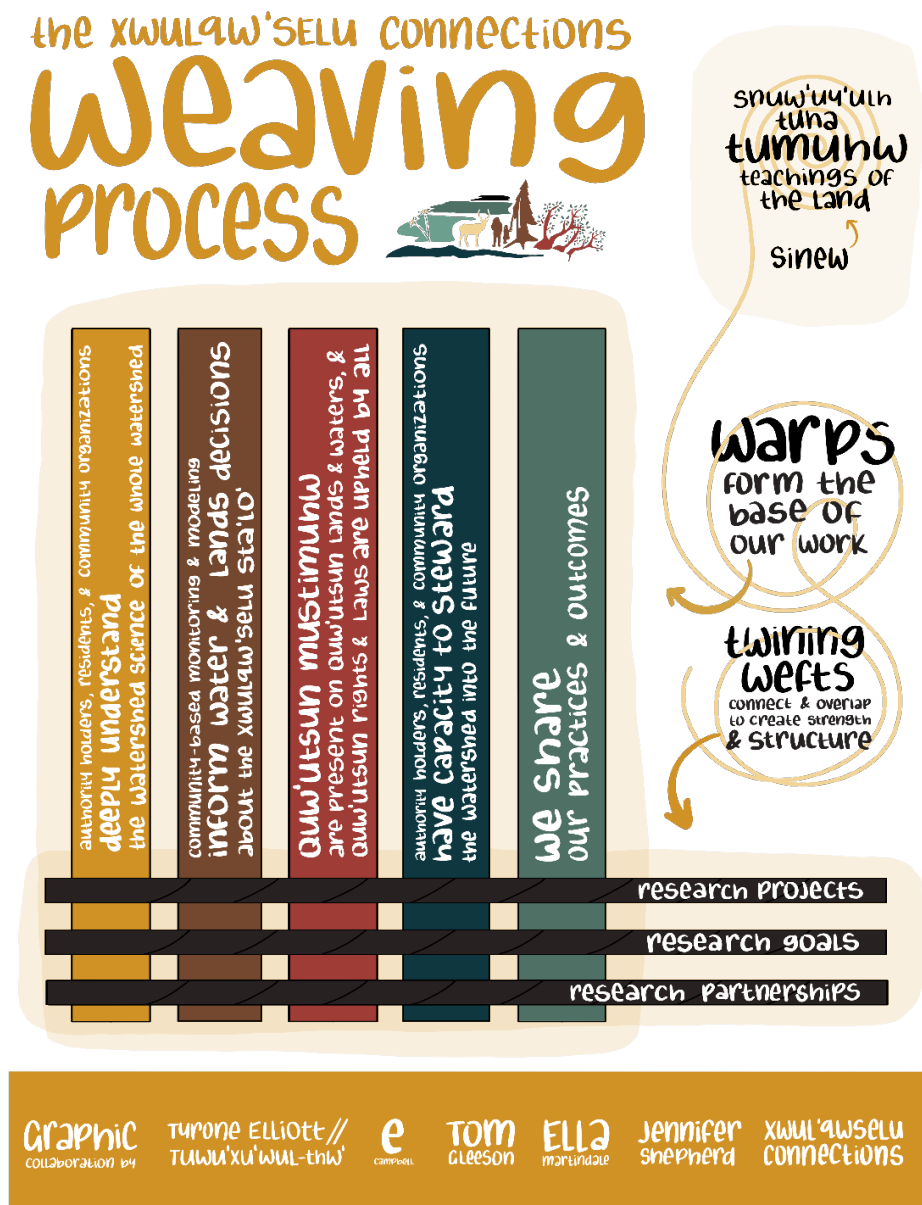


Figure 3. Woven statements

5. Working with the woven statements

We have held the 'woven statements' in relationship to other aspects of our project and our interdisciplinary knowledges. We have looked at the woven statements from different angles by constructively critiquing their usefulness in relation to different actors in the project and by clarifying if this is a research framework. By looking at the woven statements, we do not mean to pull them apart, since weaving gains strength at the intersections of where each of the elements meet, connect and overlap one another; each element (and the choice of material) is an integral part of what makes a basket a basket. Precisely how the elements come together form the design overall, the weaving pattern, and the finishing details.

Our woven statements are structured around the good work around the Xwuqlw'selu Sta'lo' already and continuously present in community. They have been useful in multiple ways over the year and a half since we came to consensus about the statements. First and foremost, the statements have given us a shared understanding and motivation that ties us to each other, partners and community and to the sta'lo'. The woven statements have been integral for planning and execution of the overall project. As described above, the woven statements (Section 4) were developed along with a logic model that allowed us to visually represent the chain of causes and effects leading to our desired outcomes (Figure S1). Even more tangibly, in medium-term planning (4-12 months) we consider how both individual and group activities are consistent with the woven statements. When we communicate about our project, the statements help us to clarify and refine our message for every audience (see image from communication strategy in Figure S2). Finally, as new opportunities arise to collaborate, grow relationships or contribute to community organizations or events, we consistently ask ourselves 'does this align with the statements?' In this way the woven statements also serve practical purposes as a planning aid and a decision-making criterion. A lesson that emerged for the research project team is the value of intention-setting that reflects the context and the priorities of partners and community.

An important consideration that we have debated internally is if these statements could be used to evaluate our research project (especially given that the statements were initially developed as 'social impact goals'). Instead of simplistically or reductively using the statements directly for project evaluation, we consider that the statements are most importantly about taking responsibility for the knowledge we hold in relation to the project, Xwulqw'selu Connections, and Xwulqw'selu Sta'lo'. Although the woven statements align with research partners and community, a possible limitation is not co-developing or collaborating on the basket and statements with our research partners or community. Future research can explore if or how the woven statements contribute to project evaluation as well as how well the woven statements align with the perspectives and priorities of each of the different actors in the project.

To more deeply consider the statements, we discussed one statement in significant detail at a research project team retreat. We focused on the statement 'authority holders, residents and community organizations deeply understand the watershed science of the whole watershed' since this statement relates to the ongoing community monitoring data and project. We realized we had to carefully consider our own biases and backgrounds as well as those of our partners and community. The statement could imply a unidirectional communication where western-trained scientists decide what's important to share with limited asking of what people need or want to know rather than many-directional engagement. This problem is partly rooted in colonial and dominant attitudes, practices and biases

valuing western science in our society and governance (Castleden et al., 2017). A subtle example of this is using 'the' in the statement which implies a singular, reductive knowledge of the watershed instead of emphasizing diverse and place-based knowledges. Furthermore, we realized we need to emphasize that all learning and knowing is socially mediated and relational in that we understand concepts better if we understand our relationship to them. This underscored the importance of accessibility and inclusion, of bringing everyone along and bringing them up to speed, while acknowledging the biases of our background and approach.

In our co-learning exercises, we discussed numerous research frameworks. We have also discussed whether the woven statements or basket represent a place-based research framework. We appreciate the importance and value of community-based and/or anti-colonial research frameworks that might be defined as a structured approach that emphasizes the inclusion and prioritization of indigenous knowledge, voices, and methodologies (Kovach, 2009). But we do not suggest that the woven statements or basket that emerged for the purposes of this project is a holistic research framework. The definition and purpose of a 'framework' significantly varies across disciplines (Partelow, 2023) but one can follow the general Cambridge Dictionary definition of framework as 'a supporting structure around which something can be built; a system of rules, ideas, or beliefs that is used to plan or decide something'. This definition emphasizes the normative or inherently subjective nature of framework development (Binder et al., 2013) and is important to acknowledge the insufficiency of language and the irony of using a definition from a colonial institution. We do not aim to use a place-based integration framework that integrates social and natural science (Kliskey et al., 2017). Nor do we follow the acontextual definition of framework in social-ecological systems research that is used for prescriptive inquiry and causal explanations (Partelow, 2023). We attempted to use one such acontextual framework, the Social Ecological Systems Framework (Ostrom, 2009) but concluded that this may de-emphasize or exclude specific Indigenous or place-based knowledge (see Supplementary Information for more discussion).

As we move forward, our ongoing and future work includes deeper internal reflections on our learning:

- What learnings have been important and how so?
- What have we noticed or learned by writing this narrative?
- Where do we source our inspiration from now?
- What are the new or refreshed or sustaining questions that guide our collective co-learning process in relationship with place and each other?
- Are there learnings that we choose to share here?
- Are there learnings that are emerging now that we can both express and listen to our shared narrative, from the perspective of basket weavers?

6. Conclusions

We have developed a deliberate, robust and flexible community science project grounded in place-based, ethical and practical research intentions. For now, we conclude by returning to our objective, of sharing a narrative of how we have wholistically developed a place-based community science project to reflect on our learnings early, throughout and near the end of the project. Key lessons include the importance of taking responsibility for positionality, knowledge and relationships; the value of intention-setting that reflects the context, the priorities of partners and community and the good work around the

Xwuqlw'selu Sta'lo' already and continuously present in community. Written at the approximately half-way point of the five-year research project, writing the article served as an important process of reflection on our learnings early and throughout the project and is an excellent foundation for reflection later in the project. We draw on, are inspired by, and hope to influence broad academic spheres of place-based research, community science, co-governance, and water science.

Acknowledgements: We deeply appreciate the engagement of rightsholders, partners, collaborators and community that enrich and make this project and our learning possible. This article was improved by useful comments from partners include Eduardo Sousa (Cowichan Tribes), Jill Thompson (Cowichan Watershed Board), Alison Nicholson (Koksilah Working Group), Jessica Doyle (Province of British Columbia), Natasha Overduin (Compass Resource Management) as well academic colleagues Kristian Dubrawski and Mark Johnson. This article has been approved to be submitted to peer review by Cowichan Tribes (consistent with our MOU). This project is funded by a five-year NSERC Alliance Type 2 grant.

Author Contributions: TG and EM conceived of this article, led discussions about it and wrote the majority of the text. TG, EM, JS, KD and DS have been involved in conversations initiating and developing the project. QTK has been an advisor and supporter of this project from the first day of the pilot. TE//T and ec collaborated to illustrate the weaving, assisted in drafting certain portions of this paper concerning the weaving and the process of visually depicting it and its constituent parts. All coauthors have reviewed, edited and made suggestions to the article.

Data Availability Statement: This article does not use data but does clarify that future articles in this project will follow FAIR Data Policy and Open Science practices as well as Indigenous data governance principles.

Human Studies and Subjects: This article does not use human studies or subjects.

References

- Allen, K., Curran, D., & Colwell, R. (2018). *Community-based water monitoring and decision making* (p. 39). Environmental Law Centre, University of Victoria.
- Barroso, S., & Wainwright, M. (2020). *Water Use and Management Options in the Koksilah River Watershed: Preliminary analysis and recommendations for future work* (Water Science Series, WSS2020-02). Victoria, BC: Province of British Columbia.
- Binder, C., Hinkel, J., Bots, P., & Pahl-Wostl, C. (2013). Comparison of Frameworks for Analyzing Social-ecological Systems. *Ecology and Society*, 18(4). <https://doi.org/10.5751/ES-05551-180426>

- Buytaert, W., Zulkafli, Z., Grainger, S., Acosta, L., Alemie, T. C., Bastiaensen, J., et al. (2014). Citizen science in hydrology and water resources: opportunities for knowledge generation, ecosystem service management, and sustainable development. *Frontiers in Earth Science*, 2, 26.
- Callaghan, C. T., Rowley, J. J., Cornwell, W. K., Poore, A. G., & Major, R. E. (2019). Improving big citizen science data: Moving beyond haphazard sampling. *PLoS Biology*, 17(6), e3000357.
- Canada Research Coordinating Committee. (2020). *Setting new directions to support Indigenous research and research training in Canada 2019 - 2022* (report on plans and priorities). Retrieved from <https://www.canada.ca/en/research-coordinating-committee/priorities/indigenous-research/strategic-plan-2019-2022.html>
- Carroll, S. R., Herczog, E., Hudson, M., Russell, K., & Stall, S. (2021). Operationalizing the CARE and FAIR Principles for Indigenous data futures. *Scientific Data*, 8(1), 108.
<https://doi.org/10.1038/s41597-021-00892-0>
- Castleden, H., Hart, C., Cunsolo, A., Harper, S., & Martin, D. (2017). Reconciliation and relationality in water research and management in Canada: Implementing indigenous ontologies, epistemologies, and methodologies. *Water Policy and Governance in Canada*, 69–95.
- Cowichan Tribes and Province of British Columbia. (2020). *External Engagement Summary Report - Koksilah Watershed Engagement*. Retrieved from https://www.koksilahwater.ca/_files/ugd/deeaf5_4a8f286da90f44579edec21d201cfb72.pdf
- Cowichan Tribes and Province of British Columbia. (2021a). *Koksilah Watershed Hydrologic Analysis* (p. 105). Retrieved from https://www.koksilahwater.ca/_files/ugd/deeaf5_bbd2e2d8581645108f2fcdf5a2d3e3d2.pdf
- Cowichan Tribes and Province of British Columbia. (2021b). *XWULQW'SELU (Koksilah) Water Sustainability Plan Scoping Project*. Retrieved from <https://www.koksilahwater.ca/resources>

- Cowichan Tribes and Province of British Columbia. (2023). *Xwulqw'selu Watershed Planning Agreement S-xats-thut tst – We Agree*. Retrieved from https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/consulting-with-first-nations/agreements/2023-05-12_xwulqwselu_watershed_planning_agreement_-_cowichan_tribes.pdf
- Dale, J. (2013). Who Wins With Deliberative Dialogue? Retrieved from <https://oneworldinc.ca/who-wins-with-deliberative-dialogue/>
- Dominguez Guzmán, C., Zwarteveen, M., & Kuper, M. (2023). Transformation as practice: Learning from everyday dealings with groundwater. Retrieved from <https://www.water-alternatives.org/index.php/alldoc/articles/vol16/v16issue1/697-a16-1-14/file>
- Fleckenstein, J. H., Krause, S., Hannah, D. M., & Boano, F. (2010). Groundwater-surface water interactions: New methods and models to improve understanding of processes and dynamics. *Advances in Water Resources*, 33(11), 1291–1295. <https://doi.org/10.1016/j.advwatres.2010.09.011>
- Gleeson, T., Huggins, X., Connor, R., Arrojo-Agudo, P., & Vázquez-Suñé, E. (2022). Groundwater and ecosystems (Chapter 6). In *Groundwater: Making the invisible visible* (pp. 89–100). Paris: UNESCO. Retrieved from <https://digital.csic.es/bitstream/10261/309302/1/380721eng.pdf>
- Gray, D., Brown, S., & Macanufo, J. (2010). *Gamestorming: A playbook for innovators, rulebreakers, and changemakers*. O'Reilly Media, Inc.
- Hammond, J. C., Zimmer, M., Shanafield, M., Kaiser, K., Godsey, S. E., Mims, M. C., et al. (2020). Spatial patterns and drivers of non-perennial flow regimes in the contiguous US. *Geophysical Research Letters*, 2020GL090794.
- Huggins, X., Gleeson, T., Castilla-Rho, J., Holley, C., Re, V., & Famiglietti, J. S. (2023). Groundwater connections and sustainability in social-ecological systems. *Groundwater*.

- Hunter, R., Brandes, O. M., Moore, M.-L., & Brandes. (2014). The Cowichan Watershed Board: An Evolution of Collaborative Watershed Governance. Retrieved March 13, 2024, from <https://poliswaterproject.org/polis-research-publication/cowichan-watershed-board-evolution-collaborative-watershed-governance/>
- IAP2 International Federation. (2018). IAP2 Spectrum of Public Participation. Retrieved from <https://www.iap2.org/page/pillars#>
- Jennings, L., Anderson, T., Martinez, A., Sterling, R., Chavez, D. D., Garba, I., et al. (2023). Applying the 'CARE Principles for Indigenous Data Governance' to ecology and biodiversity research. *Nature Ecology & Evolution*, 7(10), 1547–1551. <https://doi.org/10.1038/s41559-023-02161-2>
- Jensen, E. J. (1991). *Baskets from nature's bounty*. Interweave Press. Retrieved from <https://cir.nii.ac.jp/crid/1130282269786064768>
- Johnson, L. R., Wilcox, A. A. E., Alexander, S. M., Bowles, E., Castleden, H., Henri, D. A., et al. (2023). Weaving Indigenous and Western ways of knowing in ecotoxicology and wildlife health: a review of Canadian studies. *Environmental Reviews*, 31(3), 452–470. <https://doi.org/10.1139/er-2022-0087>
- Kalbus, E., Reinstorf, F., & Schirmer, M. (2006). Measuring methods for groundwater- surface water interactions: a review. *Hydrology and Earth System Sciences*, 10(6), 873–887.
- Kampf, S., Strobl, B., Hammond, J., Anenberg, A., Etter, S., Martin, C., et al. (2018). Testing the waters: Mobile apps for crowdsourced streamflow data. *Eos*, 99(8), 30–34.
- Kirkness, V. J., & Barnhardt, R. (1991). First Nations and higher education: The four R's—Respect, relevance, reciprocity, responsibility. *Journal of American Indian Education*, 1–15.
- Kliskey, A., Alessa, L., Wandersee, S., Williams, P., Trammell, J., Powell, J., et al. (2017). A science of integration: frameworks, processes, and products in a place-based, integrative study. *Sustainability Science*, 12, 293–303.

- Kovach, M. (2009). *Indigenous methodologies: Characteristics, conversations, and contexts*. Toronto: University of Toronto Press.
- Lachapelle, M. (2020, February). *Is this really the best partner for us? Presentation*. Intersection 19 Strategic Enterprise Design Conference in Lisbon. Retrieved from <https://www.youtube.com/watch?v=aHpnu9WAebY>
- Larocque, M., & Broda, S. (2016). Groundwater–surface water interactions in Canada. *Canadian Water Resources Journal / Revue Canadienne Des Ressources Hydriques*, 41(4), 451–454. <https://doi.org/10.1080/07011784.2016.1176537>
- Lewandowski, J., Meinikmann, K., & Krause, S. (2020). Groundwater–surface water interactions: Recent advances and interdisciplinary challenges. *Water*, 12(1), 296.
- Liboiron, M. (2021). *Pollution is colonialism*. Duke University Press.
- Lipmanowicz, H., & McCandless, K. (2013). *The surprising power of liberating structures: Simple rules to unleash a culture of innovation*. Liberating Structures Press Seattle, WA.
- Magruder Watkins, J., & Mohr, B. J. (2001). *Appreciative inquiry: Change at the speed of imagination*. Wiley.
- Mehta, S. (2022, August 12). Learnings from the Xwulqw'selu Sta'lo' (Koksilah River). Retrieved March 13, 2024, from <https://thediscourse.ca/cowichan-valley/xwulqwselu-connections-koksilah-river-water>
- Mehta, S. (2023, February 2). Five ways the community can support Cowichan watersheds. Retrieved March 13, 2024, from <https://thediscourse.ca/cowichan-valley/five-ways-to-support-cowichan-watersheds>
- Mehta, S. (2024, April 19). Community project honours 84,000 fish that died in Cowichan River. Retrieved September 20, 2024, from <https://thediscourse.ca/cowichan-valley/community-project-honours-84000-fish-that-died-in-cowichan-river>

- Morales, S. (2016). Stl'ul Nup: Legal Landscapes of the Hul'qumi'num Mustimuhw. *Windsor Yearbook of Access to Justice*, 33(1), 103–124.
- Niles, D. (2021). Le monde dans un panier: Esthétique, écologie et culture matérielle. *Techniques & Culture*, 76, 172–180.
- Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, 325(5939), 419–422. <https://doi.org/10.1126/science.1172133>
- Partelow, S. (2018). A review of the social-ecological systems framework: applications, methods, modifications, and challenges. *Ecology and Society*, 23(4). <https://doi.org/10.5751/ES-10594-230436>
- Partelow, S. (2023). What is a framework? Understanding their purpose, value, development and use. *Journal of Environmental Studies and Sciences*, 13(3), 510–519. <https://doi.org/10.1007/s13412-023-00833-w>
- Pritchard, H., Doyle-Yamaguchi, E., Carver, M., & Luttmer, C. (2019). *An Ecosystem-Based Assessment of the Koksilah Watershed Phase 1 Report: Watershed Character and Condition*. (p. 81). Cowichan Station area Association. Retrieved from <https://sites.google.com/a/cowichanstation.org/koksilah-watershed-working-group/kwg-reports/watershed-report-1>
- Quw'utsun' Cultural Connections Society. (2024). Projects. Retrieved March 13, 2024, from <https://www.journeyoffourgeneration.ca/projects>
- Reid, A. J., Eckert, L. E., Lane, J.-F., Young, N., Hinch, S. G., Darimont, C. T., et al. (2021). “Two-Eyed Seeing”: An Indigenous framework to transform fisheries research and management. *Fish and Fisheries*, 22(2), 243–261.

- Ronson, J. (2022, April 22). Quw'utsun Elders lead cedar planting ceremony at Bright Angel Park. Retrieved March 13, 2024, from <https://thediscourse.ca/cowichan-valley/elders-lead-cedar-planting-ceremony>
- Rowe, R. K., Bull, J. R., & Walker, J. D. (2020). Indigenous self-determination and data governance in the Canadian policy context. In *Indigenous Data Sovereignty and Policy* (pp. 81–98). Routledge.
- Scharmer, O. (2018). *The essentials of Theory U: Core principles and applications*. Berrett-Koehler Publishers.
- Shen, N. (2024, May 8). Drought signs raise fears of another fish die-off in B.C. rivers. *CBC News*. Retrieved from <https://www.cbc.ca/news/canada/british-columbia/drought-risk-fish-die-off-1.7197525>
- Sidik, S. M. (2022). Weaving Indigenous knowledge into the scientific method. *Nature*, *601*(7892), 285–287. <https://doi.org/10.1038/d41586-022-00029-2>
- Siler, L. (1988). *The Basket Book: Over 30 Magnificent Baskets to Make and Enjoy*. Sterling Publishing Company, Inc.
- Strategyzer AG. (2024). Business Model Canvas and Value Proposition Canvas. Retrieved May 15, 2024, from <https://www.strategyzer.com/library>
- Strobl, B., Etter, S., van Meerveld, I., & Seibert, J. (2020). Accuracy of crowdsourced streamflow and stream level class estimates. *Hydrological Sciences Journal*, *65*(5), 823–841.
- Todd, Z. (2017). Fish, kin and hope: Tending to water violations in Amiskwaciwâskahikan and Treaty Six Territory. *Afterall: A Journal of Art, Context and Enquiry*, *43*(1), 102–107.
- Tremblay, C. (2017). Impact Assessment. Community-engaged Research (CER) at the University of Victoria, 2009-2015. Retrieved from <http://dspace.library.uvic.ca/handle/1828/8166>
- Truth and Reconciliation Commission of Canada. (2015). *Truth and Reconciliation Commission of Canada: Calls to Action* (p. 20). Winnipeg. Retrieved from <https://nctr.ca/records/reports/>

- University of Victoria. (2023). *X^wk^wənəŋ istəl | WŁENENISTEL | Helping to move each other forward, UVic's Indigenous Plan 2023*. Retrieved from <https://www.uvic.ca/services/indigenous/plans/index.php>
- de Vos, A., Biggs, R., & Preiser, R. (2019). Methods for understanding social-ecological systems: a review of place-based studies. *Ecology and Society, 24*(4).
- Waldron, I. (2020). Environmental racism in Canada. *The Canadian Commission for UNESCO's IdeaLab*.
- Whetung, M. (2019). (En) gendering shoreline law: Nishnaabeg relational politics along the Trent Severn Waterway. *Global Environmental Politics, 19*(3), 16–32.
- W.K. Kellogg Foundation. (2004). *Logic Model Development Guide*.
- Wong, C., Ballegooyen, K., Ignace, L., Johnson, M. J., & Swanson, H. (2020). Towards reconciliation: 10 Calls to Action to natural scientists working in Canada. *FACETS, 5*(1), 769–783.

SUPPLEMENTARY INFORMATION

Logic model

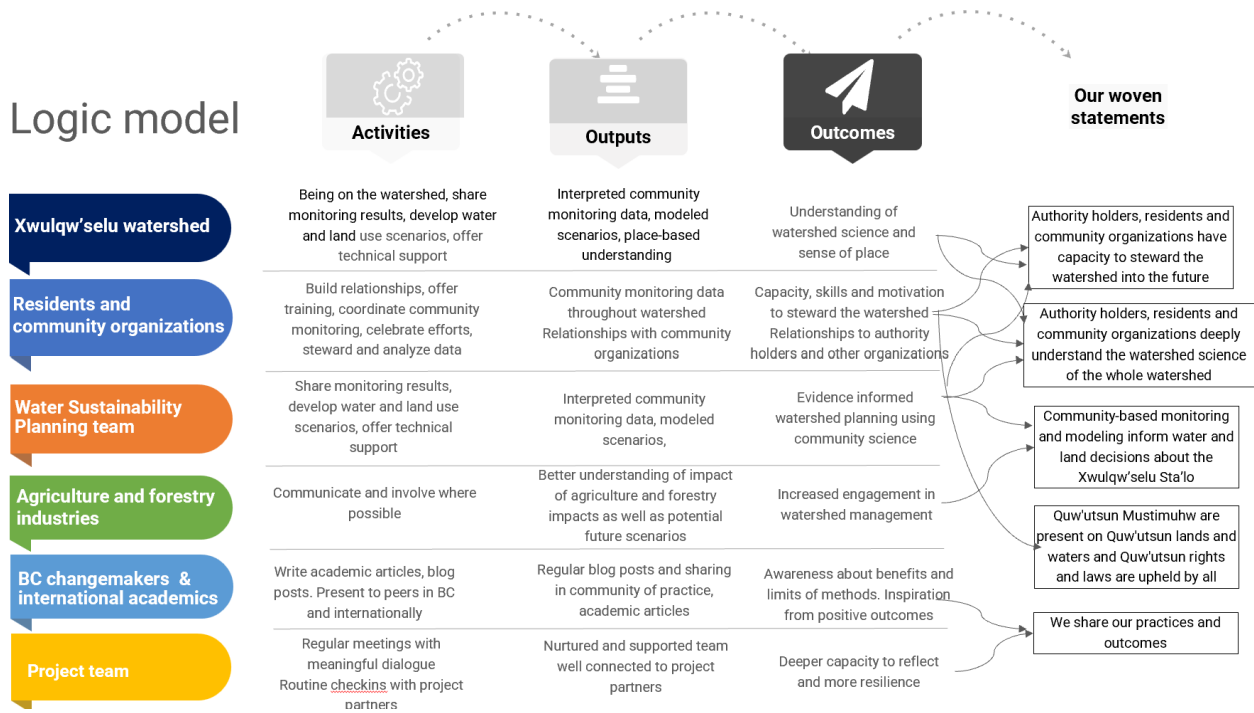


Figure S1. A logic model and communications strategy to ensure our activities, outputs and outcomes are consistent with the statements

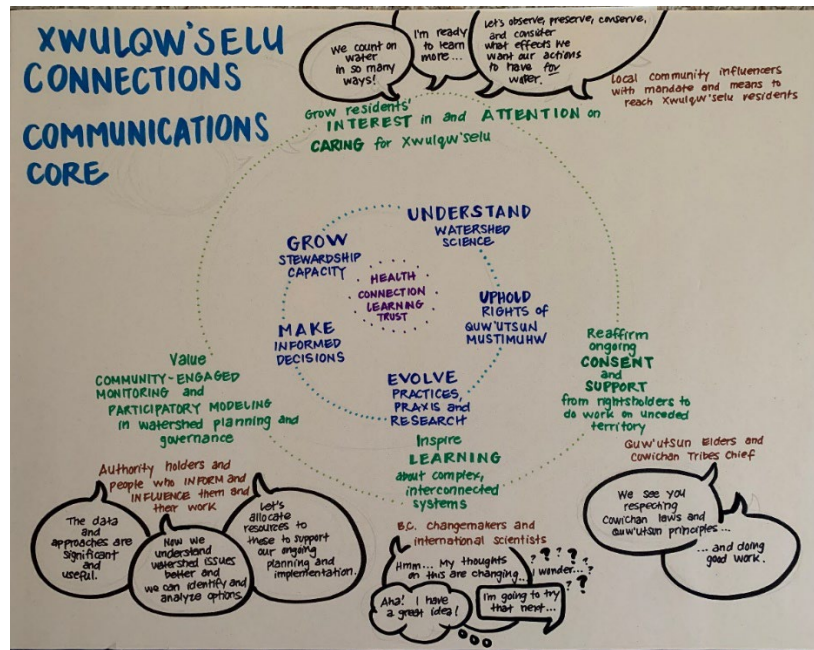
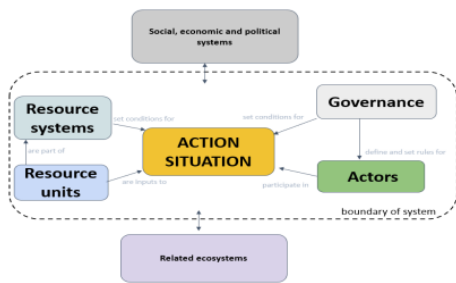


Figure S2. A communications strategy to ensure our communications are consistent with the statements

a) social ecological systems framework



b) applying SES framework to research project context

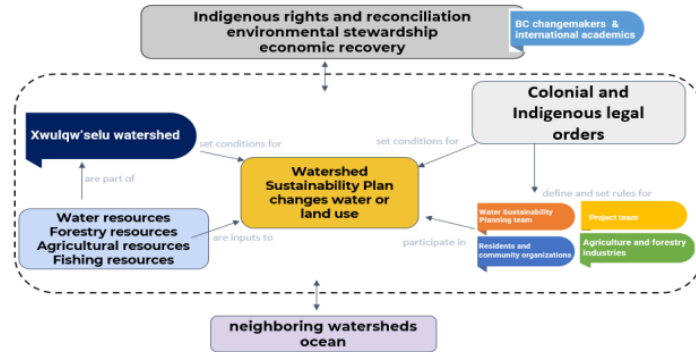


Figure S3. Considering the project through the Social-Ecological Systems Framework

Herein we describe an additional framework of social-ecological systems research that is dominated by place-based research (de Vos et al., 2019) to highlight the relationship to and limitation of frameworks not derived internally. Although social-ecological systems are pluralistic, integrative and interdisciplinary, the origin and focus of this research domain is western social and physical science with limited or non-existent relationship with Indigenous knowledge or methods, and certainly no specific relationship to Quw'utsun tumuhw. The Social-Ecological Systems Framework (Ostrom, 2009) was developed by studying common-pool resource and public goods governance using an interdisciplinary mix between public policy, behavioral and institutional economics (Partelow, 2018). Recently, the social ecological systems framework has been used as a mental model describing groundwater connected systems that importantly conceptualize groundwater's integral relationships with social, economic, ecological, and Earth systems (Huggins et al., 2023). As a groundwater hydrologist interested in sustainability, and deeply involved in the groundwater connected systems framing (Huggins et al., 2023), Tom was interested in considering if or how the social-ecological systems framework could be useful or applied to the Xwulqw'selu Watershed Sustainability Planning process (Figure 4e and 4f). Overall, Xwulqw'selu Sta'lo' and XWP can be mapped to the social-ecological system framework (action situations, resource systems, resource units, governance, actors, related ecosystems, and social, economic and political systems), suggesting this framework could be useful for considering the XWP within the broader social-ecological systems and sustainability literature, but it is important to note how this may de-emphasize or exclude specific Indigenous or place-based knowledge.

Memorandum of Understanding (about project overall)
Between
University of Victoria
And
Cowichan Tribes
And
Cowichan Watershed Board
And
Cowichan Station Area Association

Each of individually a “Party” and together the “Parties”

This Memorandum of Understanding (“MOU”) dated May 25, 2021, is made between the Parties, each wishing to establish a cooperative relationship in the interests of furthering the proposed ‘Koksilah Connections’ research project.

WHEREAS:

- A. the Parties are committed partners on the ‘Koksilah Connections’ research project which has been submitted for funding by a NSERC Alliance grant entitled “Koksilah Connections: community-engaged stream monitoring and groundwater modeling for water sustainability planning” submitted by Tom Gleeson from the University of Victoria (hereinafter the “Project”); and
- B. the Parties intend to work together on the Project in a good way and in the spirit of reconciliation towards the shared goal of improved water management in the Koksilah watershed;

NOW THEREFORE, the Parties agree to and set forth the following:

BACKGROUND, OBJECTIVES AND DEFINITIONS

1.1 Background

If the NSERC application is unsuccessful, the intention of the Parties is to proceed with the Project by applying for other funding and/or using a smaller funding envelope available to Tom Gleeson from University of Victoria.

1.2 Shared Objectives and Principles

- 1.2.1 The Parties acknowledge that the Project is community-focused and includes water monitoring, water modeling and water governance research and community engagement.
- 1.2.2 The Parties agree that generating knowledge about these topics is a goal shared by all Parties, as well as seeking meaningful relationships and collaboration for better outcomes for all involved.
- 1.2.3 The Project researchers are committed to enabling knowledge sharing and co-production, providing meaningful opportunities for community members to

experience and participate in science, incorporating Indigenous place names as permitted and appropriate, and ongoing learning about Indigenous history and rights.

1.2.4 Since the Project is community-focused and meant to support future co-governance of water, this MOU focuses on:

- Indigenous Knowledge;
- sharing and using data respectfully and openly; and
- clarifying intellectual property and publishing.

1.3 Definitions

1.3.1 “Indigenous Knowledge” in this MOU means Indigenous cultural expressions of the First Nation, and knowledge of lifeways and systems, whether embodied in tangible or intangible form, whether transmitted from ancient to contemporary times from generation to generation or otherwise received, and including:

- i) The manifestations of Cowichan Tribes’ sciences, technologies and culture (including environmental knowledge, use of natural resources, land use and occupation, systems of land tenure and self management);
- ii) Governance and laws;
- iii) Spiritual knowledge;
- iv) Protocols (including values and ethics governing human use and behaviour, as well as site-specific protocols);
- v) Immoveable cultural property (including sacred and historically significant sites and burial grounds);
- vi) Culturally significant areas (which may include archaeological sites which are not public);
- vii) Special ecological places;
- viii) Knowledge of fauna and flora, seeds, medicines, water, soils, weather, solar and lunar effects, processes and cycles;
- ix) Abundance and habitat information (including historic trends and base line information);
- x) Oral traditions, literatures, and visual performing arts (including songs, dances, music, stories, ceremonies, symbols and designs); and
- xi) Culturally significant practices and locations, that may be confidential and are generally not made public unless aggregated so as to protect identity of informants, specific sites, locations, species etc., and approved through internal processes;

In whatever form or media such knowledge is provided, including all discussions, analyses, compilations, studies, reports or other materials in a variety of media containing or generating from, in whole or in part, Cowichan Tribes.

1.3.2 “Sensitive Locations” are locations in the Koksilah watershed deemed by Cowichan

Tribes as containing sensitive cultural features or attributes.

- 1.3.3 “Data Steward” in this MOU means the Party responsible for coordination and implementation of data production, storage and distribution within the Project to be consistent with the understandings of this MOU. University of Victoria will be the Data Steward for the Project.
- 1.3.4 “Project Data” in this MOU means the water monitoring, water modeling and watergovernance data collected by the Project.
- 1.3.5 “Project Outputs” in this MOU means any Project Data or derived analysis or understanding that is shared informally or formally beyond the Parties. Project Outputs could include informal media such as community meetings, blog posts, newsletters, emails to the broader community, as well as more formal media such as project reports, thesis and academic manuscripts.

INDIGENOUS KNOWLEDGE

- 2.1 All Indigenous Knowledge shared by Cowichan Tribes with other Parties, even if communicated verbally, shall remain the sole property of Cowichan Tribes;
- 2.2 All Indigenous Knowledge communicated to other Parties, even if communicated verbally, shall remain confidential and shall not be shared with, or otherwise distributed to, any staff, students, or personnel of academic institutions or government agencies at any level, nor with private individuals, not-for-profit agencies, or any other third party without the express written consent of Cowichan Tribes. However, communication of Indigenous Knowledge amongst the Project research team is permitted for Project purposes.
- 2.3 Parties receiving Indigenous Knowledge shall ensure that all communications with Cowichan Tribes with respect to confidentiality and data sharing matters, as described above, shall be determined through an iterative process.
- 2.4 For clarity, this MOU, the Project proposal to NSERC, and any other formal agreements or applications pertaining to the Project do not form part of the Indigenous Knowledge.

SHARING AND USING DATA RESPECTFULLY AND OPENLY

- 3.1 Excluding Indigenous Knowledge, the intention of the Project is to share data respectfully and openly.
- 3.2 The Parties intend to develop a shared understanding of data collection, storage, and sharing using the First Nations principles of ownership, control, access, and possession ([OCAP](#)) of data, which will be open source where acceptable and possible following Findability, Accessibility, Interoperability and Reuse ([FAIR](#)) principles.

- 3.3 OCAP principles suggest that all data derived from this Project will be owned by Cowichan Tribes and openly shared to benefit the evolving co-governance structure, and multiple parties as much as possible. Strategies for sharing data respectfully and openly include:
- 3.3.1 Parties co-design monitoring and modeling strategies and locations to ensure that monitoring and modeling does not occur in sensitive locations.
 - 3.3.2 Monitoring data is collected by Cowichan Tribes members and by other Vancouver Island community members
 - 3.3.3 Control over data access, use, and storage lies within the authority of Cowichan Tribes.
 - 3.3.4 On behalf of Cowichan Tribes, University of Victoria is acting as Data Steward. Though in possession of the data, University of Victoria hosts the data as prescribed by Cowichan Tribes and claims no authority, ownership nor rights to the data. University of Victoria will take reasonable security measures to protect data, including all steps that it takes to protect its own sensitive research data.
 - 3.3.5 The Parties will regularly review and assess data collection, storage, and use for this Project to ensure ongoing consent of data use for Project purposes.
- 3.4 All Parties support an open, community-focused approach for the Project and agree to open dissemination of the research results in academic formats (academic publications and theses) as well as community-focused formats (blog posts, stories, reports to community meetings etc.).

INTELLECTUAL PROPERTY AND PUBLISHING

- 4.1 For the Project, the Parties plan to use various third-party open-source tools, including the “Stream Tracker app” for monitoring and possibly “streamdepletr” (software for water modeling) or other software for modeling.
- 4.2 Any Party can use Project Outputs in a timely way, likely under a Creative Commons license.
- 4.3 It is the intent of the Parties to openly and expeditiously publish and present accounts of the Project, including Project Outputs and Project Data. The process set out below shall be followed for all formal Project Outputs relating to the Project:
- 4.3.1 At least 30 days prior to the publication or release of a Project Output, the Project Output will be made available to Cowichan Tribes for review and comment.
 - 4.3.2 The formal Project Output will only be submitted or released after written approval from Cowichan Tribes.
 - 4.3.3 The Parties agree that there can be no delay for the defense of a student’s thesis.
- 4.4 The process set out in section 4.3 does not apply for informal media such as community meetings, blog posts, newsletters, emails but every effort will be taken to ensure that

ProjectOutputs shared through informal media is consistent with this MOU and the interests of all Parties.

- 4.5 Unless otherwise requested in writing, each Party's contribution to the Project shall beacknowledged in any Project Outputs.

ADDITIONAL TERMS

- 5.1 This MOU shall remain in place for the duration of the Project if approved by NSERC.
- 5.2 The Parties acknowledge and agree that if NSERC funding is granted, this MOU is subject to the terms and conditions of the NSERC Alliance program ("NSERC Terms"). Should any section of this MOU contravene or be incompatible with the NSERC Terms, the Parties will work together to modify this MOU so that it is in compliance with the NSERC Terms.
- 5.3 No amendment of the terms of this MOU will be effective unless made in writing and signed by each Party's authorized signatory.
- 5.4 Except in promoting the Project among each Party's staff, students, faculty, or other personnel,no Party may use the name of any other Party in any form of advertising or publicity without express written consent. The Parties will seek permission from one another by submitting the proposed use well in advance of any deadline.

Memorandum of Understanding (about graphics)
Dated for reference 28 June 2024

BETWEEN:

UNIVERSITY OF VICTORIA, a corporation continued under the *University Act* of British Columbia, 3800 Finnerty Road, Victoria, British Columbia, V8P 5C2 (“UVic”)

AND

Tuwu'xu'wul-thw' Tyrone Elliott (he/they), a sole proprietor located at... (“Tyrone Elliott”)

AND

Ellen Campbell (they/them), a sole proprietor located at ... (“Ellen Campbell”)

(Collectively the "Parties")

BACKGROUND FACTS

- A. Tyrone Elliott and Ellen Campbell intend to work together to co-author a basket-as-watershed research graphic (the "Graphic"). The Graphic will be informed by a weaving design (the "Design") shared by Tyrone Elliott. The Graphic will include an illustration done in collaboration between Tyrone Elliott and Ellen Campbell (the "Illustration"). Tyrone Elliott, Ellen Campbell, and Xwulqw'selu Connections will collaborate on the calligraphy and wording to be added to the design to create the Graphic.
- B. Xwulqw'selu Connections (a project at UVic) wishes to license the Graphic for the purposes of academic publications.
- C. Xwulqw'selu Connection wishes to license the Graphic for use for educational purposes in presentations, media, and on their websites.
- D. The Parties acknowledge and agree to the inherent rights of Indigenous communities, including the ownership, control, access, and possession of their data, information, and Intellectual Property, including Indigenous Knowledge.
- E. The Parties wish to enter into this MOU to define their respective roles, responsibilities, obligations and interests with respect to the Activities. This MOU is consistent with the Memorandum of Understanding Between University of Victoria, Cowichan Tribes, Cowichan Watershed Board and Cowichan Station Area Association dated May 25, 2021 which described their cooperative relationships for the Xwulqw'selu Connections research project. Section 2.1 and 2.2 of this previous MOU do not apply herein since the basket design is shared by Tyrone Elliott rather than Cowichan Tribes.

IN CONSIDERATION OF THE MUTUAL PROMISES SET OUT IN THIS MOU, THE PARTIES AGREE AS FOLLOWS:

1. Scope of Work

- 1.1. Tyrone Elliott and Ellen Campbell agree to
 - 1.1.1. Meet to determine the appropriateness of incorporating a basket design in the central idea of having a basket describing key elements of watershed research. (1 hour)
 - 1.1.2. Identify the Design to be used for the purpose of this project in a good way. (1 hour)
 - 1.1.3. Provide guidance on the direction of the digitization and incorporation of text. (1 hour)
 - 1.1.4. Validate the final image together. (1 hour)
 - 1.1.5. Meet with Xwulqw'selu Connections, about the image. (1 hour)
- 1.2. Ellen Campbell agrees to:
 - 1.2.1. Preliminary meeting with Jennifer Shepherd to discuss the basket image (1 hour)
 - 1.2.2. Meet with Jennifer Shepherd to discuss the project. (1 hour)
 - 1.2.3. Meet with Tom Gleeson to discuss the project. (1 hour)
 - 1.2.4. Make a Draft Graphic (3 hours)
 - 1.2.5. Modify and negotiate the terms of the contract (2 hours)
 - 1.2.6. Illustrate and Finalize the Graphic (7 hours)
 - 1.2.7. Make any appropriate final edits or changes (1 hour)

2. Use of the Design

- 2.1. Tyrone Elliott warrants that they have the necessary permissions for the adaptation and incorporation of the Design into the Illustration and the Graphic.
- 2.2. Tyrone Elliott agrees to give Ellen Campbell
 - 2.2.1. limited non-exclusive and specific license to, over the course of 4-6 weeks after the signing of this contract, to incorporate the Design into a co-authored Illustration, and into the Graphic, with the oversight of Tyrone Elliott, by
 - 2.2.1.1. Digitizing, recolouring, modifying, cropping, and adapting the Design;
 - 2.2.1.2. Add elements to the Design as appropriate to represent a basket-as-watershed Illustration and Graphic.
 - 2.2.1.3. Add text and calligraphy to the image to demonstrate key elements of the basket-as-watershed analogy with Tyrone Elliott's oversight.
- 2.3. In respect of the creation and use of the Design and Graphic
 - 2.3.1. Tyrone Elliott will provide guidance with respect to the treatment of the Design within the Graphic and in its publication.
 - 2.3.1.1. This will include a paragraph accompanying the basket image that explains elements of the image, and the intention around the design and weaving of the basket.
 - 2.3.1.2. This will also include a note that the Design and Illustration are the intellectual property of Tyrone Elliot, and that consent must be sought from him to use the image.
 - 2.3.2. Xwulqw'selu Connections, Jennifer Shepherd, Tom Gleeson, and Ellen Campbell do not have right to use or adapt the Design and Graphic beyond the scope of what is considered in this agreement without further consultation with Tyrone Elliott.

3. License of the Graphic

- 3.1. Tyrone Elliott and Ellen Campbell agree to give the parties limited non-exclusive and specific licensing of the Graphic to,
 - 3.1.1. include the Graphic in their upcoming academic publications;
 - 3.1.2. use the Graphic in their presentations demonstrating the watershed research-as-basket;
 - 3.1.3. use the Graphic on their websites or by other electronic means (such as social media);
 - 3.1.4. use the Graphic in their printed informational or promotional materials.
- 3.2. The parties licensing rights are those solely those contained in this MOU.
- 3.3. UVic, Xwulqw'selu Connections, Jennifer Shepherd, Ellen Campbell, and Tom Gleeson do not have rights to grant any permission to third parties to use the image without the permission of Tyrone Elliott.
- 3.4. The parties will communicate that the Graphic is not to be reproduced without permission of the Authors, and permission is only being granted for these instances of academic publishing, to the publishers using academic publications using the graphic.
- 3.5. Any other use of the Design or the Graphic by other non-governmental organizations, organizations, businesses, publications, or entities can only be permitted in writing and in advance by Tyrone Elliott. This includes any other uses by UVic outside of the Xwulqw'selu Connections team.
- 3.6. No commercial usage of the Illustration or Graphic by UVic, Xwulqw'selu Connections, Tom Gleeson, Jennifer Shepherd, or Ella Martindale is allowed.

4. Crediting

- 4.1. All uses of the Illustration must be credited to Tyrone Elliott and Ellen Campbell.
- 4.2. All uses of the Graphic must be credited to Tyrone Elliott, Ellen Campbell, Tom Gleeson, Jennifer Shepherd, and Ella Martindale.
- 4.3. The Graphic is to be used only for educational purposes.

5. Intellectual Property

- 5.1. Tyrone Elliott retains full and sole ownership and copyright of the Design and all the rights and privileges associated. For clarity, neither Xwulqw'selu Connections, UVic, Ellen Campbell, Jennifer Shepherd, nor Tom Gleeson have intellectual property rights to the Design.

- 5.2. Tyrone Elliott retains full and sole ownership and copyright of the Illustration. They are able to use the Illustration for any purposes (including commercial).
- 5.3. All preparation materials, visuals, and sketches, including all electronic files made and used solely by Ellen Campbell during the Project remain the property of Ellen Campbell.
- 5.4. Ellen Campbell reserves the right to use the intellectual property they create solely during this Project for future work.
- 5.5. For clarity, if any of the Parties uses Indigenous Intellectual Property in the creation of the Graphic, the Parties agree to obtain permission and consent from the appropriate individual or individuals, and compensate them in a form satisfactory to both Parties.

6. Limitation of Warranties; Liability and Insurance

- 6.1. UVic will hold harmless and indemnify Tyrone Elliott and Ellen Campbell from and against any and all claims or judgments, including all associated legal fees, expenses, and disbursements actually incurred, on a solicitor and own client basis, from or arising out of the use by UVic, or anyone for whom UVic is in law responsible or any of their successors or assigns, of Tyrone Elliott or Ellen Campbell's intellectual property, or jointly owned intellectual property, including, without limitation, any damages of any kind or nature whatsoever (including but not limited to direct, indirect, special, incidental, punitive or consequential), losses of any kind or nature (including without limitation loss of revenues, profits, savings, business, data or records) or costs arising in any manner whatsoever (including arising from or incidental to any product liability or other lawsuit, claim, demand or other action brought), directly or indirectly, from or out of any use whatsoever of their individual intellectual property or jointly owned intellectual property.

7. Force Majeure

- 7.1. No failure or omission by either Party in the performance of any obligation of this MOU shall be deemed a breach of this MOU or create any liability if the same is due to a reason or circumstance beyond the reasonable control of such Party, including, without limitation, changes to applicable laws or government regulations, fire, storm, flood, earthquake, accident, war, rebellion, insurrection, riot, invasion, labour dispute, labour shortage, third party non-performance, or failure or malfunction of computer or telecommunications hardware, equipment or software, provided that the other Party is notified and that such failure or omission is cured as soon as it is practicable after the occurrence of the event of force majeure. Provided that in no event shall lack of money, financing, or credit be or be deemed to be an event of force majeure beyond the reasonable control of a Party.

8. Notices

- 8.1. All notices, documents, video, animations, statements, reports, and other writings required under this MOU will be sufficient if given in writing and delivered in person, by registered mail, or by electronic transmission, to the addresses set out below or as may be changed from time to time by either Party upon written notice to the other Party. Notices under this MOU will be

deemed to have been duly given upon delivery if delivered in person or by registered mail, and on the day following transmission if given by email.

9. Independent Parties

9.1. The Parties expressly agree that Tyrone Elliott and Ellen Campbell are independent contractors from each other and UVic, and the MOU will in no way create a partnership between the Parties, whether at common law or in accordance with any applicable statute, nor have the Parties granted to each other any right or authority to assume or create any obligation of responsibility, express or implied, on behalf of or in the name of the other, or to bind the other in any manner whatsoever.

10. Amendment

10.1. Any amendments, changes, or modifications to this MOU must be in writing and signed by both Parties.

11. Surviving Terms

11.1. All terms of this MOU which by their nature have continuing effect shall survive the termination or expiration of this MOU. The obligations set out in section 3 (Confidentiality) shall survive termination or expiration of this MOU for a period of five (5) years.

12. General

12.1. This MOU is the entire agreement between the Parties with respect to its subject matter.

12.2. These terms may be severable and the invalidity, illegality, or unenforceability in whole or in part of any provision does not affect the validity of other provisions.

12.3. This MOU may be signed in separate counterparts, which may be transmitted by electronic mail or facsimile, and each of which when so executed and delivered shall be an original, but all such counterparts shall together constitute one instrument.

12.4. The headings and section numbers in this MOU are included for convenience of reference only and shall not affect its interpretation or meaning.

12.5. While Ellen Campbell is a lawyer, the work that Ellen Campbell is doing under this MOU is not being performed under their role as a lawyer.