PRAIRIE WATER ANNUAL PARTNERS' MEETING 2022

Summary report of the 17th February meeting

Prairie Water is funded by Global Water Futures

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Executive Summary

This executive summary provides a brief report of discussions and learning points from the Annual Partner's Meeting in February 2022.

Exploring Prairie Water's knowledge mobilization network.

- Knowledge transfer from Prairie Water to users happens directly with partners and indirectly through partners.
- Direct knowledge transfer with users is an opportunity to test and refine data and products at local scales
- Bi-directional knowledge transfer activities such as pilot studies and research project collaborations are effective for refining data and products for users
- Indirect transfer through intermediaries is an opportunity to reach larger audiences.
- Collaboration and/or co-development of education programs, education materials and guidance with "association" type partners are effective ways of transferring knowledge to larger audiences
- Weaknesses in Prairie Water's knowledge mobilization network include a lack of connection with senior government decision-makers, municipal government associations, and Indigenous communities

Mobilizing Prairie Water and other new knowledge in water management decisions.

- Incomplete and fragmented data, loss of government and academic extension activities, existing decision-making processes, and relationships between institutions influence the availability of knowledge for decision-making.
- Misconceptions, different priorities, and incomplete information contributes to conflict and mistrust between different user groups. Some sources of knowledge may be considered less trustworthy
- Knowledge can be used to play the 'blame game', assigning responsibility for solving problems to specific user groups, rather than taking collective responsibility
- External factors such as market forces and politics can constrain the choices available to water users, and require decisions to be made urgently with incomplete information.

Key messages for Prairie Water going forward.

- We need to be aware of our knowledge mobilization network and take advantage of its strengths.
- We need to be aware of the gaps and weaknesses in our knowledge mobilization network and keep trying to address these.
- We need to avoid presenting information in ways that appear to assign blame or responsibility. Our goal is to understand water resources on the prairie to help decision-makers manage them effectively into an uncertain future. Our goal is not to make any judgement on past water resource management.

1. Introduction

The theme of this year's APM was "Collaborations and partnerships for successful water outcomes". For the research team, our focus was to engage in discussions to better understand how we can accelerate the movement of research findings, data, and other products into the hands of you, our partners. More specifically, we wanted to find out more about how Prairie Water research outputs have been used to date, what the most effective ways to communicate these outputs with the widest audience have been, and what some of the challenges and opportunities to getting new knowledge into water management decision-making are.

1.1 Format of this report

This report provides a summary and analysis of some of what we heard during the APM panel session and discussions, and what we have learned from engagement with many of you over the years of the project. We have been able to conceptualize the network through which Prairie Water outputs are and could be disseminated (Section 2). Key themes influencing the uptake of knowledge have also identified from our discussions (Section 3). Awareness of these themes and this network will help us be strategic in how we approach knowledge mobilization for the remainder of the Prairie Water project and beyond.

The appendices contain the research progress report sections from the primer document provided for the APM.

We are cognizant that our analysis is heavily contextualized in the agriculture industry. This is a result of several factors. At the APM, our panel discussion included a producer, and a government specialist involved in agricultural and rural water management. More generally, Prairie Water, as a research project, is primarily focused on understanding how prairie hydrology and ecosystems function, and, given this focus, farmland represents the majority of the land in the study area. We are acutely aware that urban centres and other industries have roles and responsibilities in managing our shared water. However, agricultural land-use is perhaps the most complex and least understood part of our interaction with the water environment. As such, it is important to us to work collaboratively with our partners and others to develop solutions to these water challenges. Indeed, comments from attendees of the APM show that many people view farmers as custodians of the land, who make decisions under significant pressure with limited information. This is also the view we take as Prairie Water researchers, where we want to acknowledge those pressures and help fill the information gaps to help producers care for the land that supports them and us.

2. Knowledge Mobilization Network

One of the management team's goals for this year's APM was to explore the effectiveness of Prairie Water's Knowledge Mobilization activities to date. From discussions at the meeting and interactions with partners, we have gained some insight into how partners use knowledge, and what the best methods are for sharing knowledge.

From what we heard in the breakout sessions and panel session, and from broader engagement activities, we have conceptualised Prairie Water's 'Knowledge Mobilization network'. This network comprises different 'user group types', different 'interactions with knowledge', and numerous 'Knowledge Mobilization Approaches'. It is through these components that Prairie Water's knowledge is mobilized. Each part of the network is described below.

2.1 User group types

In Prairie Water's network of partners, there are at least 6 different 'types' of knowledge user (Table 1). Each of these group's function at different geographical and jurisdictional scales.

Table 1 - Prairie Water Knowledge User Types

User	Example	Scale
Academic Researchers	Prairie Water Researchers, GWF Researchers	Research dependent
Public interest groups	Environmental Societies	Multiple
Watershed groups	NSRBC, BRBC	Local, Sub-Basin, Sub-Watershed
NGOs	DUC	Local, Regional, National
Associations	APAS, ARBI, SAW, MAW, SARM, SUMA, etc.	Regional/Provincial
Government, & Community Leadership	WSA, Gov. Ministries, Municipal Administrations, Indigenous Leaders, Government Researchers	Indigenous Community, Municipal, Provincial, National
Individuals & 'Influencers'	Influential individuals in various positions, Citizen Scientists	Multiple

The scales at which these users operate is important in the distribution of knowledge beyond the immediate Prairie Water network. As a relatively small group the Academic Researchers have limited capacity to engage with stakeholders beyond this immediate network. However, each user group has their own existing communications network through which a large and diverse set of stakeholders can be engaged. For example, provincial government partners interact with other provincial government ministries and departments, municipal governments, and industry, and municipality associations are linked to the many individual municipal governments across the Prairies.

2.2 Interaction with knowledge

We also identified three key ways in which partners interact with the knowledge being produced from the Prairie Water Project; Knowledge User, Knowledge Intermediary, Knowledge Producer (Table 2).

Table 2 - User Knowledge interactions

Use	Example
Knowledge User	Data and modelling used for infrastructure design and other water management decisions. Information used for Watershed Strategy development.
Knowledge Intermediary	Information used to develop education programs, for awareness videos, for specialised workshops, for tool development, for guidance & best practice development
Knowledge Producer	Research team, Government specialists, Indigenous Communities

Each of the 6 user types we identified in section 2.1 can, and often do to a greater or lesser extent, interact with knowledge in all three of these ways. “Knowledge users” directly apply or adapt Prairie Water outputs in their own work. “Knowledge intermediaries” take Prairie Water outputs and translate and communicate them to knowledge users within their networks. “Knowledge producers” generate knowledge that contributes to Prairie Water outputs.

2.3 Knowledge Mobilization Approaches

Knowledge mobilization is an important aspect of what many of Prairie Water partners do. We identified the common approaches taken to mobilize Prairie Water knowledge to intermediaries and users (Table 3).

Table 3 - Approaches used to transfer Prairie Water knowledge to users

Knowledge transfer approaches	Examples
Workshops	PHyDAP introductory workshop. Contribution to IISD Water Retention on the Prairies workshop.
Education programs	Contribution to WSA AgH2Onwards
Education materials & Guidance	Contribution to WSA Community Drought Risk Planning
Summary reports	APM summary reports, Workshop summary reports
Videos	"Resilience is Who We Are" Prairie Water promotional video. "Source Waters: The Rivers the Shape Us," with the Red Deer Watershed Alliance. "What is a Virtual Watershed" Prairie Water video.
Traditional media	Articles in the Western Producer, The Conversation, Star Phoenix. Interviews on CBC radio.
Social media	Prairie Water Twitter account.
Committee participation	Prairie Water Advisory Committee, Representation on WSA Committees.
Academic manuscripts	Prairie Water researchers have published over 40 manuscripts since project inception.
Annual meetings	APM, attendance and participation in SAW, ARBI, and other Partner's annual meetings.
Pilot projects and collaborative research	Development and implementation with watershed groups, WSA, Mistawasis Nehiyawak, Redberry Lake Biosphere Reserve and others
Presentations, Webinars	Webinars delivered to CWRA, Saskatchewan Environmental Society, federal and provincial government departments, Saskatchewan Association of Watersheds, and others.

Using these approaches, Prairie Water partners share knowledge with users within their communications network. For example, workshops run by watershed groups are used to transfer new technical knowledge to users in their membership, often with targeted groups such as municipal governments or producers. Provincial government partners share new knowledge by integrating it into education programs and guidance for different audiences within their communications network.

It is clear getting Prairie Water outputs into users' hands effectively requires knowledge flowing both ways between users, intermediaries, and producers. For example, Individual meetings and pilot projects with knowledge users are an effective way for us to share our knowledge with users, learn how they want to use that knowledge, and find the most appropriate formats for us to provide that knowledge. We can then collaborate at more strategic levels, such as watershed associations, municipality associations and other similar organisations to refine what we learn from pilot studies and tailor tools and resources for larger audiences.

Each of the knowledge mobilization approaches available are valuable in different ways. It is important, therefore, that we consider what we want to achieve in terms of mobilizing knowledge so we can choose the most appropriate approach. For example, workshops delivered by research scientists are useful for introducing new information and tools to users and intermediaries, and to help the research scientists package these outputs in a way that works for users. Partnerships on pilot projects allow end users how to apply research outputs to their work activities in more detail and allow research scientists to further refine how research products are packaged. Summary reports provide a useful short description of research findings and increased accessibility of technical information that is of interest to users and intermediaries. And academic manuscripts are effective for demonstrating scientific rigour and sharing the more technical side of our work with those who need that information.

2.4 Prairie Water's Knowledge Mobilization Network

We can visualize the three components of Prairie Water's Knowledge Mobilization network in several ways. Knowledge moves from Prairie Water to end-users both directly and through intermediaries (Fig. 1). We can also see that when partners interact with knowledge as intermediaries, they significantly extend the reach of Prairie Water research outputs (Fig. 2). Through this conceptualisation of our knowledge mobilization network, we can identify opportunities and gaps in the way we communicate (Fig. 3).

Figure 1 – Prairie Water Knowledge Mobilization Network, Direct and Indirect

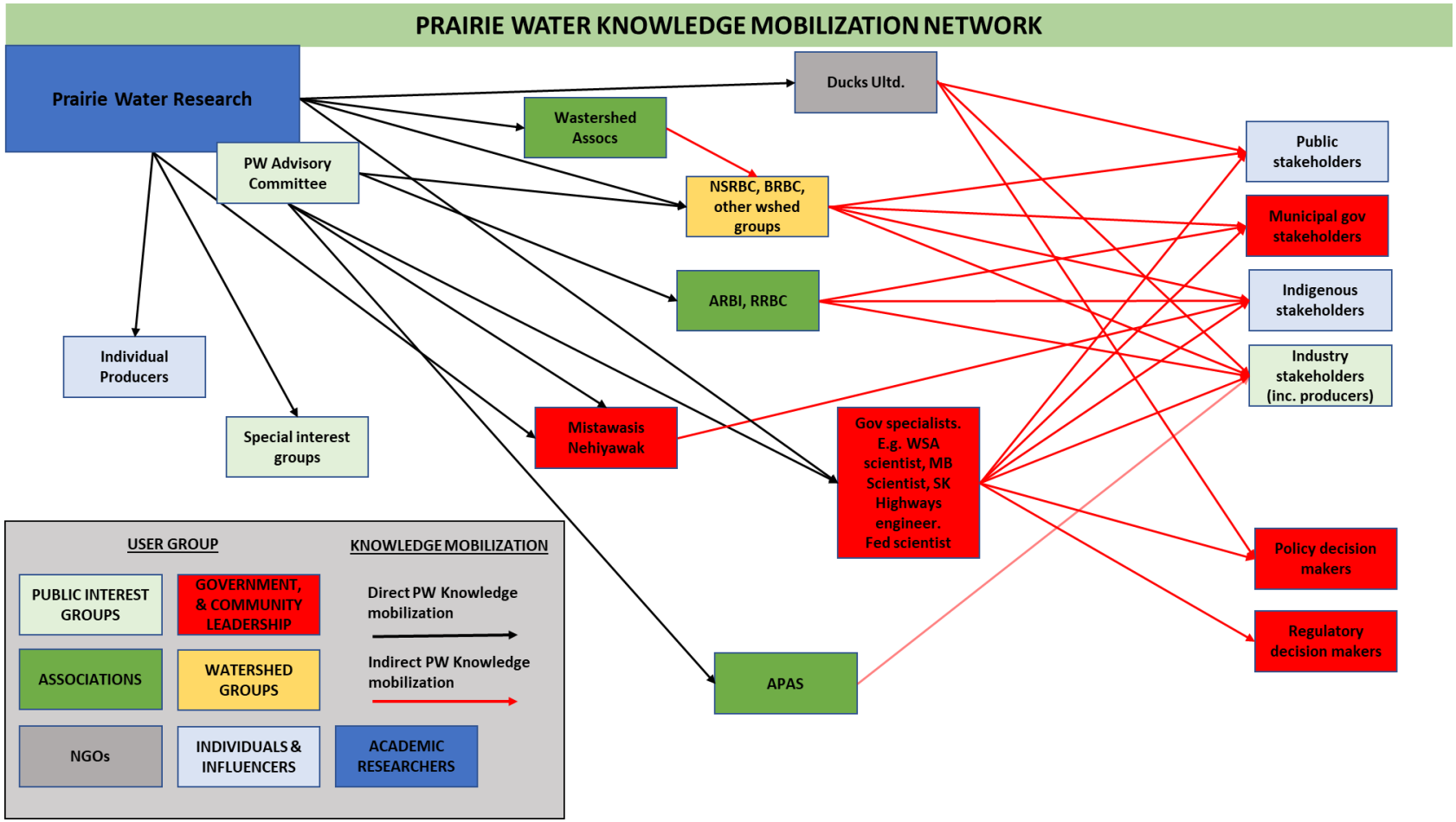


Figure 2a –Prairie Water direct knowledge mobilization approaches

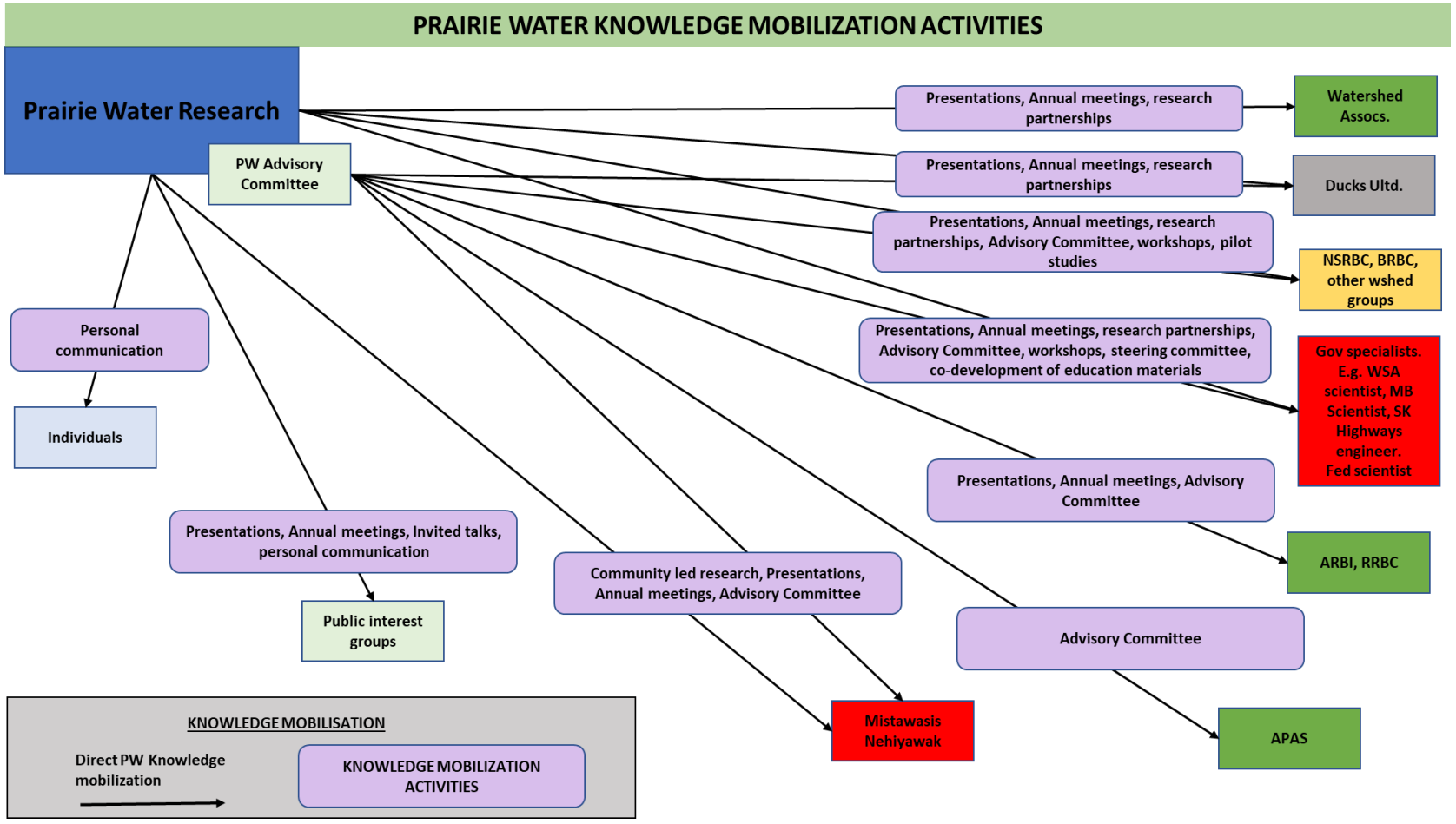
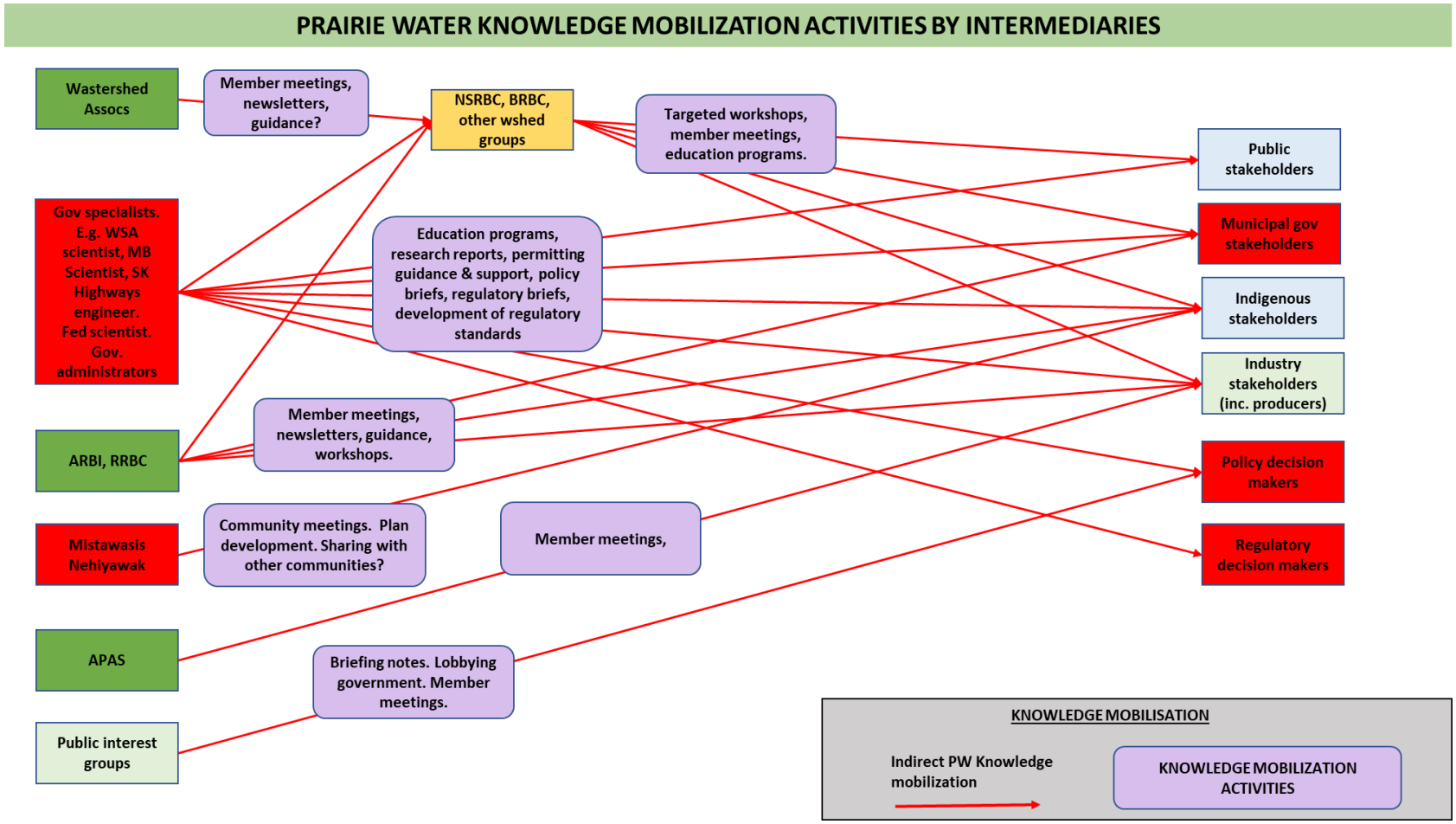


Figure 2b –Prairie Water knowledge mobilization through intermediaries



2.5 Knowledge Mobilization Network – Opportunities and Gaps

From reviewing discussions from the APM and current and past engagement with partners, we have identified several opportunities and gaps in our knowledge mobilization network (Fig. 3). These opportunities and gaps are being used to focus our knowledge mobilization strategy over the final stages of the Prairie Water project.

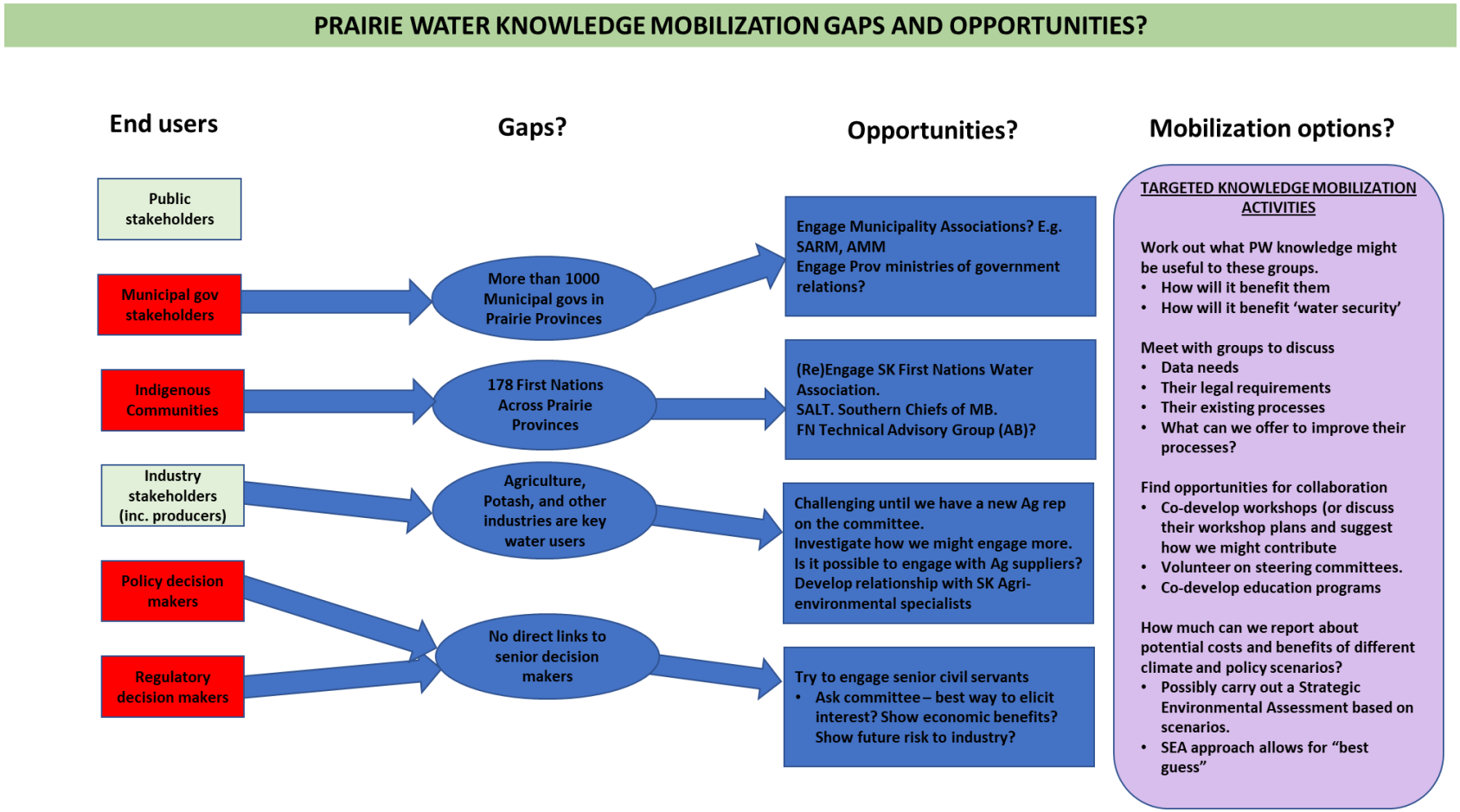
Over the past 5 years, the Prairie Water project has developed a substantial network of partners. This has helped overcome some of the challenges that being a relatively small research team presents for knowledge mobilization. Working with partners to integrate Prairie Water outputs with their existing knowledge mobilization networks and activities presents a significant opportunity for achieving the project's fundamental goal of getting the latest scientific knowledge into the hands of decision-makers. The "Associations" user group, for example, potentially presents a route to engaging several distinct stakeholder groups. Watershed Associations, Producer's Associations, Municipality Associations, and others represent large groups of stakeholders. Collaborating at this strategic level would provide an effective means of reaching more of these decision-makers than would otherwise be possible for the research team.

Engagement with "Associations" users is currently a gap in our knowledge mobilization network. Partially this is a factor of the stage of development of Prairie Water's research outputs. We need to understand more about how different users are likely to apply these outputs, and how we can package them for those purposes. Once we have a clearer understanding of practical applications of the research outputs, we will then have tangible results to share and discuss with "Associations" users. Towards this goal, we are in the process of developing and implementing pilot projects with individual watershed groups. Once we can demonstrate the benefits of Prairie Water's outputs in these projects, we will then have the opportunity work with Watershed and other associations to mobilize this knowledge to their memberships.

We need to address our limited engagement with Indigenous Communities and Municipal Governments. With 178 First Nations and over 1000 municipalities across the Prairie Provinces, this represents a key gap in our knowledge mobilization network. Although we have a steadfast partnership with Mistawasis Nehiyawak, and engagement with representatives from the Saskatchewan Aboriginal Land Technicians, our engagement with Indigenous communities and interest groups beyond this is limited. We need to nurture our existing relationships and explore opportunities to collaborate with other Indigenous organisations such as the Saskatchewan First Nations Water Association. We have the potential to reach significantly more Municipal Governments by connecting with Municipality Associations like SARM, SUMA, and AMM.

Another significant gap is that Prairie Water is in engaging senior leaders and key decision-makers in provincial government. We have very productive partnerships with government specialists, allowing us to share and co-create knowledge. We have collaborated on specific initiatives through the WSA's BRACE and AgH2Onwards programs. However, so far, we

Figure 3 - Opportunities and gaps.



have been unable to engage people who are able to influence institutional changes in water and land management strategy and policy. This institutional level change is something we believe is urgently required to facilitate greater resilience to climate and land-use change across the prairie ecozone.

Discussions at the APM identified other potential opportunities in our Knowledge Mobilization network. Several attendees noted that producers often receive technical advice from specialist with agricultural services suppliers, such as irrigation or fertilizer companies. Agronomists are also trusted by producers for advice on farm management. Engaging with these industry specific stakeholders may provide an opportunity for mobilizing knowledge through already trusted intermediaries.

3. Challenges to Knowledge Mobilization in decision-making – what we heard

Three clear themes relating to the challenges for knowledge mobilization and decision-making emerged from the panel and breakout sessions at the APM (Table 2). These can be termed 'Knowledge Governance', 'Perceptions, Values and Behaviours', and 'Economic and other external factors'. Along with these challenges, there also exists strengths in current institutional structures and relationships between partners. These strengths contribute to opportunities that Prairie Water, our Partners and other decision-makers might be able to exploit to improve the transfer of knowledge into water management practices. However, there are also associated risks.

Table 2 – Themes relating to operationalizing new knowledge in decision-making

Theme	Description
Knowledge Governance	Institutional knowledge resources, activities, processes and relationships that influence the availability of information and tools for decision-making
Perceptions, Behaviours and Values	Perspectives and priorities, ingrained and reactionary responses to conditions, values placed on water, land, and livelihood.
Economics & other externalities	Non-water related factors that influence and constrain water management decisions. Including market forces, changing climate, changing government priorities

3.1 Knowledge Governance

Institutional activities and processes, and relationships between different water user groups influence the information available for making water management decisions. These activities, processes and relationships can be considered part of a framework for how we create, use, and share knowledge. From the experiences shared by partners at the APM, we can see challenges and strengths that exist currently with respect to how we govern knowledge.

A prominent topic that came up was the gradual loss of extension activities by government and academia over the past 50–100 years. The Prairie Farm Rehabilitation Act (PFRA) created a direct link between agricultural experts and producers. Regional offices engaged with producers and mobilized state-of-the-art knowledge to modernise farm operations and increase resilience to environmental and economic forces. However, this program was wound down and those extension activities lost. To an extent this gap in extension has been filled by the private sector, with agricultural suppliers and other supporting industries providing expert advice to clients. However, this advice is understandably often narrowly focussed on individual agricultural operations such as fertiliser, irrigation, and mechanical equipment.

Expert advice is also available from professional consultant agronomists who generally work at the farm scale. The knowledge of these experts is essential to farmers in making decisions, but this knowledge comes in silos and is generally applied at local scales. A key benefit of public sector and academic expertise is that it has a greater capacity to integrate knowledge across silos and generate a more systemic understanding of how land and water decisions relate to resilience. But without the capacity for extension, getting that more systemic knowledge and understanding into the hands of decision-makers will remain challenging.

From discussions, it was also evident that some parts of government are moving towards more extension. The Government of Saskatchewan have created a group of Agri-Environmental Specialists who provide advice and guidance to producers on best practices, and the latest understanding and developments in agricultural science and technology. At the federal level, research is being carried out in clusters that are guided by industry experts from different agricultural sectors, generating knowledge that is better contextualised in producers' needs. Within academia, projects like Prairie Water and Agricultural Water Futures recognise the need to engage with key water user groups to co-develop knowledge and co-produce solutions.

Another challenge prominent in discussions about knowledge governance was the lack of tools to support water resource and land-use decision-making. The lack of tools was seen as a challenge for policy development. Although tools are available, they often are not designed in the context and complexities of prairie geography, and there is a dearth of prairie specific data to apply. The lack of an inventory and effective classification of prairie wetlands is seen as a key challenge in developing a fair and effective wetland policy.

There are strengths and opportunities in the current knowledge governance environment too. Prairie Water research is producing prairie specific tools and data. To overcome the obstacle that the loss of academic and public sector extension activities has created, Prairie Water recognised at the outset that its research needs to be engaged with the intended end-users. The relationships and connections we have built with and between partners are providing opportunities to co-develop tools and data products that meet user needs. Our partners have the capacity to reach wider audiences and are therefore important in mobilizing the knowledge we are co-producing. The new Agri-Environmental Specialist program from the Government of Saskatchewan is a welcome opportunity to build closer links between scientists, the provincial government and producers. Another potential opportunity to improve knowledge governance and mobilization is collaboration with private sector specialists, as the federal government is doing. As well as having valuable specialized knowledge and an in-depth understanding of farm operations industry consultants and agronomists have existing and trusting relationships with their clients.

3.2 Perceptions, Behaviours and Values

A second theme apparent in discussions at the APM was that the perceptions, behaviours, and values of different groups have an influence on decision-making and the type of knowledge that is trusted. Incomplete or out of date scientific knowledge can lead to misconceptions about the costs and benefits of different ecosystem services. Decisions made based on this incomplete information can often be counter-productive to effective water, soil, and agricultural management.

Partners at the APM talked about a lack empathy between water-users with different needs and pressures. This lack of empathy, to a degree, results from a lack of awareness of the pressures and priorities of different user groups and contributes to polarization and the tendency to engage in a 'blame game' over water management issues. As a result, there can be resistance to, or lack of trust in new information or recommendations from a perceived 'opponent'. For example, there is a clear urban/rural divide. Rural industries and communities are often blamed for water quality and quantity issues and perceived by urbanites as showing little concern for the environment. However, the reality is that rural water users have a different relationship with water than their urban counterparts. Rural homes may be reliant on groundwater for their everyday needs, and do not typically benefit from the extensive water management infrastructure available in urban centres. Rural businesses have pressures to manage business needs as well as environmental impact with incomplete information. This historic divide between urban and rural users can lead to a lack of trust in science emanating from Universities and Governments which are primarily urban institutions.

We also heard from partners about inertia in some land and water management practices. There was a belief that some water and land management actions are taken because they have always been done that way. One participant at the APM talked about the draining of wetlands on farmland in the spring, and that this may be less of a decision than an adherence to a process that has been effective in the past. To seed, surface water needs to be removed. Given the time pressures on producers, removing water from the land early in the season can become a matter of procedure. Producers currently may not have the time and resources to assess the costs and benefits of changing this and other procedures in any given year.

3.3 Economics and other externalities

External factors create pressures on water users that influence the choices they have and the decisions they make. Again, the examples we heard primarily relate to agriculture. For example, market forces play a significant role in year-to-year farm management decisions. The prevailing crop prices and cost of materials can dictate the types of crops planted and how intensely the land is farmed. The design of farm equipment can also force the choices producers have for managing surface water. The drive to improve operational efficiency has created demand for larger machinery which cannot easily work around small and irregular shaped objects. But producers have little option than to invest in the equipment that is available to them to maintain their competitiveness. These economic factors can combine with seasonal climate and can pressure

farmers into making decisions that preserve short-term productivity with unknown long-term impacts.

The difficulty in quantifying and comparing the costs and benefits associated with protection, retention and restoration was seen as a challenge in managing wetlands fairly. The two extremes to this discussion are; “If society benefits from wetlands, why should I be the only one to pay for them?”, and; “Why should we pay people to not harm the environment?”. Both arguments are reasonable, but not constructive. From a landowner’s perspective, it is easy to quantify the value or cost of draining or retaining a wetland in terms of productivity in the short-term. We are only just starting to understand how wetlands contribute to the resilience of agricultural land to changes in climate. There is clear evidence to show that wetlands mitigate the worst effects of drought and flood. However, without a clearer idea of the long-term impacts, landowners make pressing decisions based on the information they have available. So far, we have no effective way of quantifying these longer-term financial benefits in a way that supports decision-making at the local level. Similarly, we do not have an effective way of quantifying the value of ecosystem services to broader society. Until we have a way of assessing the costs and benefits of keeping wetlands on the landscape, it is unfair to assign costs and responsibilities to any one group. One of the tools that Prairie Water is developing seeks to fill this knowledge gap by looking at the economics of wetland management for agricultural land.

4. Summary and next steps for Prairie Water knowledge mobilization

We have learned a lot from what we heard at the APM and from our experiences collaborating and interacting with Prairie Water's partners. Being aware of the strengths and limitations of our knowledge mobilization network, and aware of some of the challenges that partners have when it comes to integrating and applying new knowledge will be essential as we increasingly seek to move our research into practice.

Close collaboration with partners at the point of use is essential to understand how data products and tools are likely to be used. It is also clear we also need to work closely with partners who act as intermediaries so we can make these data, products, and tools accessible to a wider audience. We will look for opportunities to collaborate on or contribute to the workshops and education programs of our partners, where appropriate. We will also seek to address gaps in our knowledge mobilization network by re-engaging with Indigenous partners and finding ways to connect with senior government decision-makers and politicians.

It is important that we remain aware of the social complexities of the prairies as we share our key findings and continue to develop products and tools. As we heard during the panel session *"Just because you are right, doesn't fix the problem"*. There is significant and justifiable sensitivity around water management in the prairies. When sharing knowledge, we need to be cognisant of the risk of appearing to apportion blame or responsibility. Improving water resource management for all needs to be a joint venture, so by acknowledging the social context, we can reduce the risk of alienating groups of water users.

In the months since the APM, we have been applying what we have learned to guide our knowledge mobilization actions. These actions include;

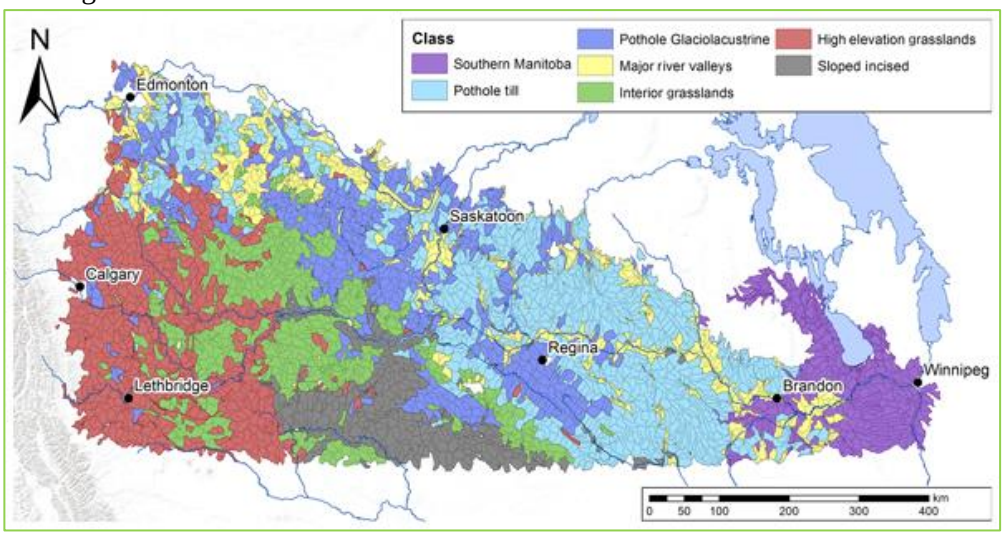
- Pilot projects testing prairie specific hydrological modelling data for water management infrastructure design, with the goal of demonstrating value to provincial governments, municipal government associations, and watershed associations
- Developing a workshop to demonstrate a tool for evaluating the economic impact of wetland drainage on agricultural land
- Working with Prairie habitat Joint Venture (PHJV) on a series of webinars for the Fall
- Developing a series of podcast that complement the PHJV webinars but reach a different audience
- Working with our Advisory Committee to develop posters and infographics that communicate Prairie Water's key findings to a broad audience
- Writing briefing notes aimed at raising awareness of the potential threat wetland drainage presents to economic, environmental, and social policy goals
- Developing a web-based dashboard that can be used to visualise many aspects of the knowledge generated by Prairie Water, focusing on those we anticipate being of most interest to water resource management

Appendix - Project status reports

A.1 Overall progress of Prairie Water

We are now entering the final two years of the Prairie Water project. Our activities increasingly reflect our move towards integration and application of the knowledge produced during the project's early stages. Synthesizing what our teams have learned and applying this to key operational issues experienced by our partners remains a focus. We have started exploring opportunities with partners to understand how we can craft and share our research outputs in useful, and usable ways. Highlights of our project level progress at present include:

- Biophysical classification of small Prairie watersheds (article), serving as a foundation for modelling



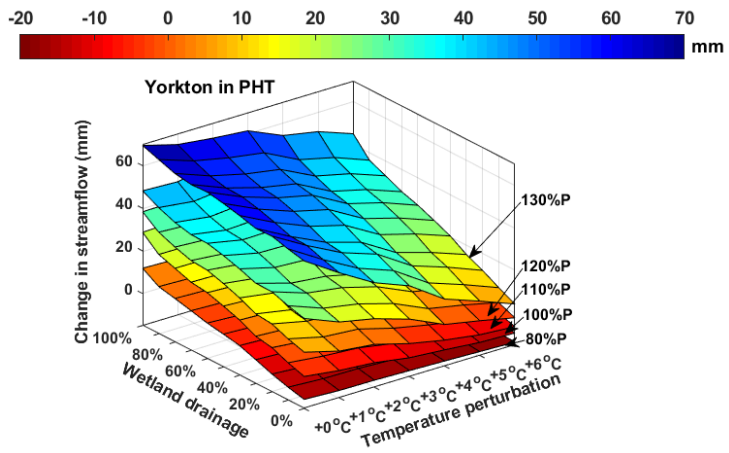
Prairie watershed classification, Wolfe et al., 2019

- A virtual watershed framework for modelling surface hydrology across the region (manuscript), and integrated modelling of watershed response to scenarios
- Partner engagement through workshops to design and drive pilot applications of our decision-support outputs (e.g. workshop report and workshop presentations)
- Synthesis of the state of western science on expected impacts of wetland drainage in the Canadian Prairies (article)
- Collaborations with multiple artists who have created work capturing Prairie Water research, including pieces installed at the National Hydrology Research Centre, and shared through GWF's Virtual Water Gallery
- Developed tool for economic assessment of wetland conservation costs
- Supporting emerging requests for information to support agricultural water management and drought preparedness planning
- Growing connections to network of Prairie stakeholder and rightsholders

A.2 Team A progress – Water Availability

The Water Availability team has made significant progress in several areas. Groundwater hydrology studies in Alberta have shown the importance of topographic depressions for groundwater recharge. This is significant as we have also found that groundwater in the prairies is not well connected to surface hydrology. The prairie basin classification system has allowed us to assess potential impacts of drainage and climate change on streamflow regimes, improves on existing hydrological modelling techniques, and can support better hydraulic design. Studies of historic and existing oil wells are shedding light on their risk to groundwater. These studies highlight that current groundwater monitoring and investigations are not adequate to assess the risk of contamination by the oil and gas industry. Our research outputs and activities include:

- Applying watershed classification system to create a classification-based virtual modelling framework (article)
- Applying this framework to assess the impacts of wetland drainage and climate change on streamflow regimes in the Prairie Pothole Region
- Completed a preliminary assessment of groundwater resources in the Prairies that suggests much of our groundwater is thousands of years old and not well connected to the surface and near-surface hydrologic cycle



Modelled impact of climate & drainage on streamflow - Zhihua He, 2022

- Estimated the contribution of topographic depressions (potholes) to groundwater recharge over Alberta Prairies (Manitoba Cooperator and Western Producer)
- We are extending the groundwater recharge model estimates to Saskatchewan
- Conducted a proximity analysis of spills from the oil industry and groundwater users in Saskatchewan; most spills occur within a 1 km of a water well
- Completed an analysis of abandoned oil wells revealing that older wells may pose a risk due to changes in abandonment standards over time (article)
- Found that shallow injection wells operated by the oil industry in south-east and west-central Saskatchewan may pose a risk to overlying groundwater supplies (article)

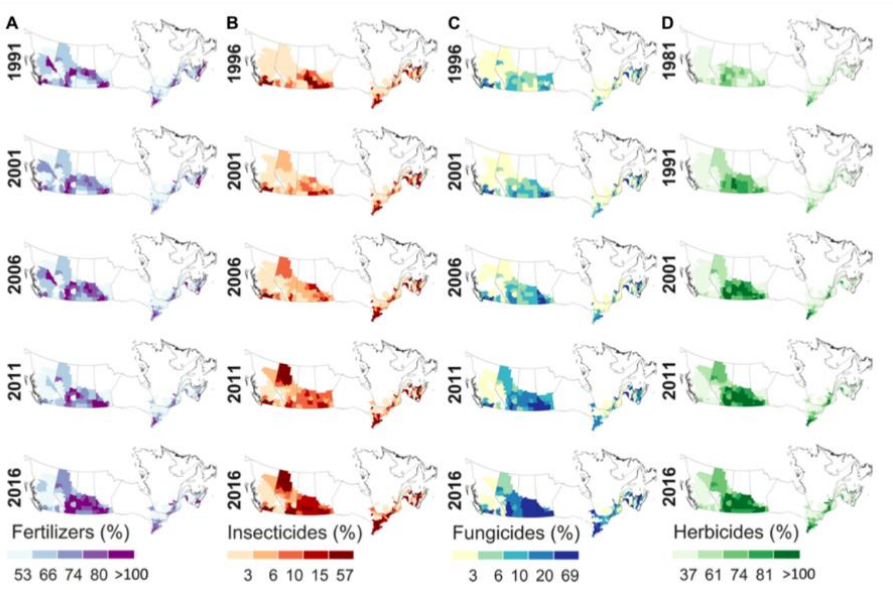
A.3 Team B progress – Aquatic Ecosystem Health

To date, our work on wetlands and aquatic ecosystem health has brought us a long way towards our initial goals. Many of these efforts are summarized below, and some new work (e.g. on pothole salinity) is now beginning. In the remaining stages of the project, we will work to connect the virtual modelling scenarios of surface hydrology with emerging information on aquatic ecosystems. This will allow us to explore how anticipated changes in hydrology associated with climate change can affect, for example, aquatic ecosystem services. This will include refining and advancing our integrated modelling work completed to date, working closely with the other teams, and including these outputs as part of a data visualization tool.

- In Alberta, climate changes that yield progressively warmer, wetter conditions are benefiting some bird groups, while riparian vegetation can buffer negative impacts of climate and water quality gradients on macroinvertebrate biodiversity (article)

- Analysis of changing agrochemical use in Canada over 35 years highlights increases in fertilizers (21%), fungicides (412%), herbicides (58%), and insecticides (52%) applied in the Prairie Region (article)

- Created an index for robust estimation of potential Prairie wetland pesticide exposure, highlighting areas vulnerable to contamination (article)



Distribution of agrochemicals calculated as percent of cropland treated with fertilizers (A), insecticides (B), fungicides (C), and herbicides (D) (Malaj et al. 2020).

- Found that simplified agricultural landscapes containing proportionately more cropland have increased in the last 20 years and are a strong predictor of rising pesticide use in the Prairies and Central regions of Canada (article)

- Spatial analysis through wetland survey suggests potential links between land use and P levels in pothole ponds (thesis)

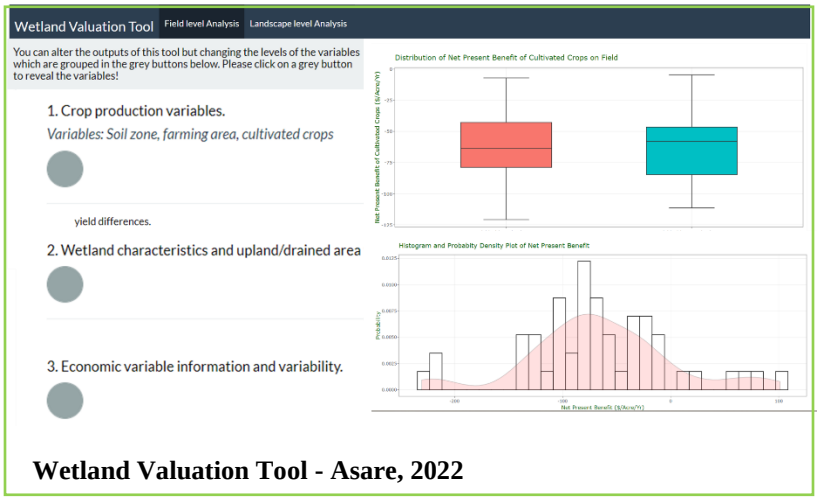
- Nitrogen process rate measurements suggest pothole ponds have more limited capacity to remove nitrogen than previously thought, but are sites of extremely rapid nitrogen cycling

- Integrated modelling to link hydrological, biogeochemical and biodiversity impacts associated with pothole wetland drainage for Pothole Till watersheds highlights complex effects of drainage, including impacts on multiple ecosystem services

A.4 Team C Progress – Water Management Practices and Governance

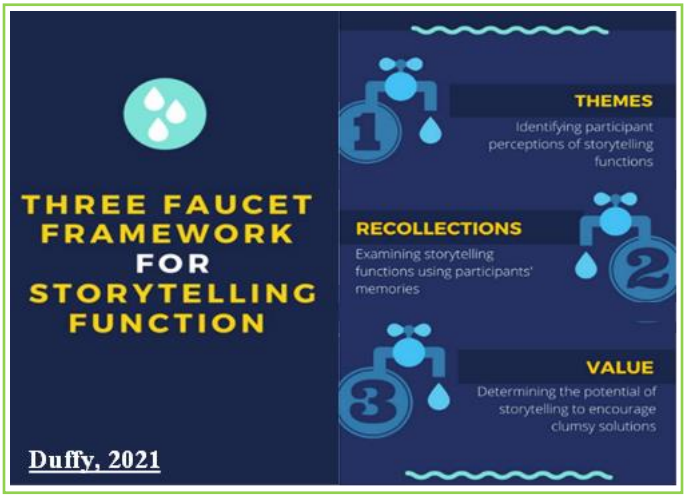
The Water Management Practices and Governance team has been making steady progress toward the projects' goals. To better understand decisions involving water resources on the prairies, we have been developing participatory models, conducting economic analyses, implementing large-scale surveys, coordinating experimental decision labs, and conducting interviews. We are currently working on integrating our analyses with the other teams. Some specific highlights of our work include:

- Developed wetland conservation cost curves for an Alberta watershed to understand the spatial differences in wetland conservation costs and how these costs are associated with wetland classes (article)
- Preliminary working version of a wetland conservation costs assessment webtool that allows users to input their own field or landscape level data.
- Surveyed 450 producers across the three Prairie Provinces in 2021 to better understand land-use decisions involving wetlands and preferences for conservation policy options.



Wetland Valuation Tool - Asare, 2022

- Examined how participatory modelling and mapping can enhance social learning for disaster risk reduction in Indigenous communities (thesis)
- Developed Three Faucet Framework to demonstrate how stories, especially those told in informal settings, impact source water protection planning and implementation (thesis)
- Preliminary analysis shows that experimental decision labs highlight different preferences for information selection among individuals and groups, but they do not appear to have significantly influenced individual or group choices about adaptation options.



- Systematic review of relevant policy documents for water security on the Prairies is ongoing.