CLIMATE CHANGE ADAPTATION PROGRAM

Knowledge Transfer for Adoption of Water Management Best Practices

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Knowledge Transfer for Adoption of Water Management Best Practices

Project Report

Bulkley-Nechako & Fraser-Fort George — Knowledge Transfer for Adoption of Water Management Best Practices

Prepared by ***Industrial Forestry Service Ltd***
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Disclaimer

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- ***Kenna Jonkman***, Regional District of Fraser-Fort George
- ***Jon Solecki***, Skeena Regional Cattlemen's Association
- ***Megan D'Arcy***, Smithers Farmers' Institute
- ***John Stevenson*** and ***Karen Tabe***, BC Ministry of Agriculture, Food and Fisheries
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The Bulkley-Nechako & Fraser-Fort George Agricultural Adaptation Working Group included representatives from:

- BC Ministry of Agriculture, Food and Fisheries
- Bulkley Valley Cattlemen's Association
- Climate & Agriculture Initiative BC
- District C Farmers' Institute
- Nechako Valley Cattlemen
- Prince George Cattlemen's Association
- Regional District of Bulkley-Nechako
- Regional District of Fraser-Fort George
- Skeena Regional Cattlemen's Association
- Smithers Farmers' Institute
- University of Northern BC

The cover photo is provided by Serena Black.

Funding for this project has been provided in part by the Regional District of Bulkley-Nechako and the Regional District of Fraser-Fort George, and in part by the governments of Canada and British Columbia under the Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Funding is administered by the Investment Agriculture Foundation of BC and the BC Agricultural Research & Development Corporation.

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Project Summary

Climate change projections across Highway 16 include warmer and drier summer conditions, and shifting precipitation patterns that include more extreme rain events. As such, ranchers and farmers will be in need of improved water management practices, including both infrastructure-related solutions and farm practice-related solutions that utilize existing water as efficiently as possible.

The *Knowledge Transfer for Adoption of Water Management Best Practices* project was established by the Climate & Agriculture Initiative BC (CAI) to address a need brought forward by producers in the region during the consultation for the *Bulkley-Nechako & Fraser-Fort George Adaptation Strategies plan*[1] completed in 2019.

The objectives of the project were to:

- Provide producers with information they need to better manage water on their farms/ranches and to make informed decisions about changing infrastructure or practices to adapt.
- Deliver applicable knowledge transfer activities in a decentralized way and in a highly accessible format (e.g. workshops, webinars).
- Document existing water management knowledge and resources to create a regional source of information for on-going distribution.

The project included additional consultation with stakeholders throughout the region to help identify priorities for each sub-region, including the Bulkley Valley, Lakes District, Nechako Valley, Fraser-Fort George and Robson Valley. An in-depth review of available resources related to water management was conducted simultaneous to the consultation process.

Proposed knowledge transfer activities were developed and presented to the Project Oversight Committee, and two topics were chosen for a series of workshops: 1) Keyline Design and 2) Strategies for Dryland Farms. The project delivery method was altered mid-project in response to the COVID-19 pandemic and restrictions on gathering for in-person events. Therefore, the series of three in-person workshops on Keyline Design was delivered in February-March 2020 prior to the COVID-19 restrictions. A follow-up webinar on the keyline design topic was then coordinated in June 2020 to increase the accessibility of the content. The workshop series for Strategies for Dryland Farms was changed into a series of four webinars delivered in September-October 2020.

There are continued needs for knowledge transfer related to water management best practices that were not addressed through this project. Recommendations for next steps were developed based on information collected through the stakeholder consultation, literature review, and on feedback provided from participants during the workshops and webinars.

[1] https://www.bcagclimateaction.ca/regional/rap/bnffg/

Water Management Resources: Summary of Resources for Agriculture in BC

The initial step of the project was to conduct an in-depth review of available water management resources throughout the province (and beyond, when applicable). A background document was compiled as part of the process to identify topics to be addressed through knowledge transfer activities. It was determined that publishing the document would allow producers to access a substantial list of more than 80 resources related to on-farm water management.

The document was reviewed by BC Ministry of Agriculture, Food and Fisheries staff to ensure the resources were relevant and applicable and not misleading to producers who would access the information. The document should be considered a dynamic, non-exhaustive list which could be built upon as new resources are developed or discovered. It is published on the CAI website.

Stakeholder Consultation

Building from the topics identified through consultation conducted during the development of the *Bulkley-Nechako & Fraser-Fort George Adaptation Strategies plan*, semi-structured interviews were conducted with stakeholders in each sub-region to help identify topics for the knowledge transfer events to be delivered.

Initial topics identified included:

- Livestock watering systems (e.g. low tech, new innovations and best practices)
- How to establish new irrigation infrastructure, irrigation/production economics
- Efficient irrigation, irrigation scheduling
- Small-scale irrigation systems (e.g. market gardening systems, drip irrigation systems)
- Improving soil water retention, soil moisture monitoring
- Rainwater capture
- Combining irrigation systems with wildfire protection
- Crop protection technology (blocking wind, reducing evapotranspiration)
- Whole farm design
- Using fodder instead of hay for cattle feed
- Drought tolerant crops/native species
- Agroforestry and/or silvopasture

A list of stakeholders provided by CAI was used to reach out to producers and industry specialists across both the Regional District of Bulkley-Nechako and the Regional District of Fraser-Fort George. A total of 17 semi-structured interviews were conducted over two weeks (Robson Valley: 1; Fraser-Fort George: 5; Nechako Valley: 5; Lakes District: 2; Bulkley Valley: 4). The Question Guide used for the consultation is provided in Appendix 1.

Consultation Results

Prince George and McBride

Prince George and McBride stakeholders were keen to have resources focused on considerations of whole farm design systems, specifically to assist with drainage and water storage issues that are becoming more evident with the increasing effects of climate change. Producers expressed that flooding and drainage during shoulder seasons are particularly challenging for crop production and livestock

management, and that ideally the topic of drainage would also address opportunities for water storage for irrigation later in the season.

Nechako Valley and Lakes District

Within the Nechako Valley and the Lakes District, two main themes emerged from consultation: (1) focus on new technologies to improve existing water infrastructure (e.g. improving irrigation efficiencies of systems already installed, and/or livestock watering systems); and (2) addressing water management on the dryland farms where irrigation may not be feasible.

Bulkley Valley

The Bulkley Valley had a recent On-Farm Water Management Workshop (2016), providing information on the Water Sustainability Act and Farm Irrigation Systems. Stakeholders in the region expressed that there may be some producers keen to have further discussion on this topic, but that more producers may benefit from a workshop looking at alternative strategies for on-farm water management.

Cross-Regional Topics

Finally, two additional themes arose across the whole Bulkley-Nechako and Fraser-Fort George region: (1) the need for clarification of water storage regulations and (2) the need for discussion specific to the potential of irrigation to increase productivity and stability in crop yield.

Knowledge Transfer Event Summary

Consultation with producers confirmed that there is a diverse set of needs and topics throughout the region (i.e. different topics would be relevant in different communities). Therefore, it was recommended that two separate agendas be developed to help address this diversity, and that different content be presented in the relevant communities.

The Project Oversight Committee chose the topics of Keyline Design (to address the whole-farm design need that was identified) and Strategies for Dryland Farms. Three forms of knowledge transfer were then completed in 2020: (1) three in-person workshops on Keyline Design, (2) a follow-up webinar on Keyline Design, and (3) a series of four webinars based on Strategies for Dryland Farms. An overview of water storage regulations was incorporated at each event in the workshop series, and was included as one of the four webinars developed for Strategies for Dryland Farms.

Water Management Best Practices Workshop: Keyline Design

A one-day workshop was hosted in Smithers, Prince George and McBride (February 27, 29 and March 1, 2020 respectively) to provide an introduction to water storage regulations and keyline design concepts as a water management tool. The workshop included a brief introduction to the objectives of the project and the *Bulkley-Nechako & Fraser-Fort George Adaptation Strategies plan*, an overview of water storage regulations from the Water Authorization Officer and Dam Safety Officer (Ministry of Forests, Lands, Natural Resources and Rural Development), and an introduction to the concepts of keyline design and keyline geometry by Javan Bernakevitch (All Points Design) (workshop agenda provided in Appendix 2). A total of 54 producers attended the workshop (20 in Smithers, 25 in Prince George and 9 in McBride).

1-on-1 Consultations

There was an opportunity for 1-on-1 consultations with Javan Bernakevitch after each workshop. A total of seven consultations were conducted (three in Smithers, three in Prince George and one in McBride).

Producers participating in consultations were sent a list of questions (developed by All Points Design), and IFS helped develop maps of their properties and related materials required for the consultations. Each session ran between 30-40 minutes. Producers were provided with physical and digital copies of the materials developed.

The 1-on-1 consultations were well received by those that took advantage of this opportunity. A couple of workshop participants indicated either that they were unclear about what these 1-on-1 consultations entailed and so did not sign up, or that it was not until after an introduction to the concept that they were able to decide whether a consultation would be relevant.

Feedback

A survey was developed to collect feedback from participants on the quality of the workshop and suggestions for future topics (Appendix 3). A total of 30 surveys were completed and responses were compiled by location in order to distinguish regionally relevant results (Table 1).

Table 1. Summary of Survey Responses from Keyline Workshop; a total of 30 surveys were completed.

	Smithers			*Prince George*			*McBride*	
	Uncertain	*Agree Somewhat*	*Strongly Agree*	*Uncertain*	*Agree Somewhat*	*Strongly Agree*	*Agree Somewhat*	*Strongly Agree*
The information presented was relevant to my needs	--	50%	50%	--	54%	46%	37%	63%
Facilitators demonstrated a solid knowledge of workshop content	--	30%	70%	--	12%	88%	--	100%
Increased my understanding of next steps to move forward with implementation of management practices on my property	30%	40%	30%	10%	50%	40%	37%	63%
Overall satisfied with the workshop	--	50%	50%	--	27%	73%	13%	87%

Content Capture

The keyline presentations (morning and afternoon) were recorded during the Prince George workshop. The recordings were intended to be used to develop a webinar that would be hosted online. Audio and video recording were of sufficient quality to utilize for a webinar; however, it was determined that a live webinar of the same topic would be more engaging and be of higher value. Feedback from the workshops was incorporated into webinar content development to ensure the materials were contextually relevant and applicable on the ground.

Keyline Design Webinar

The Keyline Design Webinar was delivered on June 3, 2020, and was hosted through Zoom; 90 people registered, of which a total of 37 attended the live webinar. The webinar was recorded and made available on the Climate & Agriculture Initiative and the Regional District of Bulkley-Nechako websites.

Tayler Krawcyzk (Hatchet & Seed) delivered the webinar and discussed:

- Overview of keyline design
- How keyline design is being applied to different production models
- Overview of 3-Year monitoring program in the Capital Region
- Applicability to Northern BC
- Using the GIS service to work with farm topography
- Q&A session

The webinar was advertised to producers who participated in the earlier workshops, and through the mailing lists of project partners. A Facebook event was created and a paid promotion of the event was done for the Bulkley-Nechako, Fraser-Fort George and Robson Valley areas. Of the live participants, 30% were producers, 16% were government, and 19% were researchers or industry consultants (35% had unknown association). At least 35% of attendees were located within the target region (RDBN and RDFFG).

Feedback

Participants were asked to complete a survey (Appendix 4) on Google Forms immediately after the webinar, to gather participant feedback and demographic information. This survey and delivery method was used for all of the webinar activities throughout this project. Thirteen participants (35%) completed the survey. Overall, participants who completed the survey indicated that they were extremely satisfied with the webinar (Table 2).

Table 2. Survey results from the keyline design webinar.

	Neutral	Agree	Strongly Agree
The information was relevant to my needs	31%	62%	7%
Presenter demonstrated solid knowledge of the workshop content	--	54%	46%
Increased understanding of the next steps needed to take to implement keyline management practices on my property	24%	38%	38%

Participants indicated that the most valuable aspects of the webinar were the overview of keyline principles and sub-soiling concepts, especially when applied through a case study. The Q&A session and information on where to find maps were also outlined as valuable. Feedback outlined the need to address economic components of keyline design in the future, as well as how the concept could be used to deal with too much water (i.e. managing extreme precipitation and excess water, in addition to drought conditions).

Other topics included drainage plans, potential impacts of natural resource activities (e.g. mining and forests) on water cycles and on the landscape, and systems to utilize stored water on market gardens.

An additional comment indicated that it would be valuable to provide a ranking of the webinar to indicate the depth of information to be provided (e.g. introductory, intermediate and advanced) to help guide participants. It was suggested that offering intermediate and advanced sessions could allow for more focused, specific information to be shared and would help address specific knowledge gaps.

Dryland Webinar Series

The *Water Management Best Practices Webinar Series: Strategies for Dryland Farms* consisted of 4 webinars that were delivered on September 29, October 6, October 13, and October 20, 2020. The webinars were hosted through the Zoom platform; a total of 235 people registered for the webinars and a total of 136 attended the webinars live. The webinars were recorded and are viewable on the CAI and the Regional District of Bulkley-Nechako websites.

The webinars covered the following topics:

1. Agriculture & Water Cycle, Agroforestry for Water Conservation, *with Dr. George Powell, PAg, PhD (Ag For Insight)*
2. Building Soil Carbon and Soil Tilth for Water Conservation, *with Dr. George Powell, PAg, PhD (Ag For Insight)*
3. Forage Crop & Variety Selection for Dryland Farms, *with Mike Witt, PAg, CCA (Witt Precision Ag)*
4. Water Authorizations & Dam Safety Overview*, with Ed Bryson (Dam Safety Officer, FLNRORD) & Rebecca Collier (Water Authorizations, FLNRORD)*

The webinar series was advertised to producers who had signed up for previous workshops coordinated through this project, and through the mailing lists of project partners. Facebook events for each webinar were developed and advertised through paid promotion.

Agriculture & Water Cycle, Agroforestry for Water Conservation

Demographic information was collected from the 53 registrants. Of the 22 webinar participants, 32% were producers, 18% were government, and 32% were researchers or industry consultants (18% identified as 'other'). At least 45% of attendees were located within the target region (RDBN and RDFFG).

Feedback

Five participants located in BC (23%) completed the survey (Appendix 4), which was prompted immediately after the webinar ended. Overall, participants who completed the survey indicated that they were extremely satisfied with the webinar (Table 3).

Table 3. Survey results from the *Agriculture & Water Cycle, Agroforestry for Water Conservation* webinar participants located in BC.

	Agree	Strongly Agree
The information presented was relevant to my needs.	20%	80%
The presenter demonstrated solid knowledge of the workshop content.	--	100%
I have increased my understanding of the steps I need to improve water management practices on my property.	25%	75%

Participants indicated that the whole webinar was valuable, particularly how it enabled participants to understand the concept of slowing water down using agroforestry. Participants were interested in learning more about how agroforestry systems would impact wildfire events, and how the changes of elevation and wind patterns can be used.

Building Soil Carbon and Soil Tilth for Water Conservation

Demographic information was collected from the 141 registrants. Of the 69 webinar participants, 30% were producers, 14% were government, and 19% were researchers or industry consultants (30% identified as 'other'). At least 19% of live attendees were located within the target regions.

Feedback

Participants were asked to complete a survey (Appendix 4) to gather participant feedback on the webinar. Eight of the participants that were located in BC (12%) completed the survey. Overall, participants who completed the survey indicated that they were extremely satisfied with the webinar (Table 4).

Table 4. Survey results from the *Building Soil Carbon and Soil Tilth for Water Conservation* webinar participants located in BC.

	Neutral	Agree	Strongly Agree
The information presented was relevant to my needs.	--	25%	75%
The presenter demonstrated solid knowledge of the workshop content.	--	43%	57%
I have increased my understanding of the steps I need to improve water management practices on my property.	12.5%	37.5%	50%

Participants indicated that the most valuable aspects of the webinar were the regionally relevant review of tilth, the discussion that focused on organic matter, both the impact of different types of organic matter (different C:N ratio content) and its relation to nutrient cycling and water holding capacity. Participants indicated that a few examples of successes and failures when trying to improve soils, and further information on no-till practices and cover cropping, would be of interest.

Forage Crop & Variety Selection for Dryland Farms

Demographic information was collected from the 129 registrants. Of the 43 webinar participants, 21% were producers, 21% were government, and 38% were researchers or industry consultants (21% identified as 'other'). At least 19% of live attendees were located within the target regions.

Feedback

Participants were asked to complete a survey (Appendix 4) to gather participant feedback on the webinar. Four of the participants that were located in BC (9%) completed the survey. Overall, participants who completed the survey indicated that they were satisfied with the webinar (Table 5).

Table 5. Survey results from the *Forage Crop & Variety Selection for Dryland Farms* webinar participants located in BC.

	Neutral	Agree	Strongly Agree
The information presented was relevant to my needs.	50%	--	50%
The presenter demonstrated solid knowledge of the workshop content.	--	25%	75%
I have increased my understanding of the steps I need to improve water management practices on my property.	50%	25%	25%

Participants indicated that the most valuable aspect of the webinar was the discussion of individual forage species and their characteristics (including variations in rooting structure), and the comparison of how species perform in different environmental conditions.

Water Authorizations & Dam Safety Overview

Demographic information was collected from the 132 registrants. Of the 47 webinar participants, 28% were producers, 28% were government, and 19% were researchers or industry consultants (28% identified as 'other'). At least 15% of live attendees were located within the target regions.

Feedback

Participants were asked to complete a survey (Appendix 4) to gather participant feedback on the webinar. Nine of the participants that were located in BC (19%) completed the survey. Overall, participants who completed the survey indicated that they were extremely satisfied with the webinar (Table 6).

Table 6. Survey results from the *Water Authorizations & Dam Safety Overview* webinar participants located in BC.

	Neutral	Agree	Strongly Agree
The information presented was relevant to my needs.	--	44%	56%
The presenter demonstrated solid knowledge of the workshop content.	--	22%	78%
I have increased my understanding of the steps I need to improve water management practices on my property.	22%	33%	45%

Participants indicated that the most valuable aspects of the webinar were the information provided on groundwater use, water diversions and withdrawal, regulation structure, and where to find more resources. Participants were interested to hear more about the use of vegetation around dams, best practices for water withdrawal/diversion, and strategies to manage excessive water with heavy clay soils.

Recommendations and Next Steps

Recommendations for next steps for knowledge transfer of water management best practices incorporate information collected through the stakeholder consultation, literature review of available resources and on feedback provided from participants during the workshops and webinars. Potential presenters for the following topics have been complied (Appendix 5).

Keyline Design

The series of one-day workshops delivered across the region provided an introduction into keyline design concepts as a water management tool. Producers indicated that more technical information is needed in order to apply this concept to their operations.

The Keyline Design webinar had positive feedback, with the most valuable aspects noted as providing a great basic introduction on principles of keyline, having the concepts outlined in a regional-specific case study, and the opportunity to have a detailed Q&A session with the presenter.

The next steps for this topic could include:

- **Technical Workshops** - A multi-day, more in-depth workshop bundled with more 1-on-1 consultation sessions could be developed where producers can work on developing a keyline plan for their farms with support from an expert.

- **Technical Webinar Series** – A follow-up webinar series could focus on more technical aspects of keyline design such as: the types of vegetation/crops that could be used within a keyline system, irrigation methods, water storage, flat land solutions, funding options available for implementation, economic feasibility and discussions of other permaculture topics, such as holistic management. Producers indicated that it would be useful to rate future webinars as

"beginner", "intermediate" or "advanced", to help content and discussions to proceed in more depth.

Strategies for Dryland Farms

Agriculture & Water Cycle, Agroforestry for Water Conservation

Agroforestry implementation is a concept that may require more 1-on-1 time to provide producers with the knowledge and confidence to move forward as it can vary by operation and landscape.

The next steps for this topic could include:

- **Field Day** – A field day could explore regional examples where agroforestry has been implemented, that would provide context and an opportunity to ask more in-depth questions. Alternatively, a live **case-study** could be developed where a producer who is interested in incorporating agroforestry receives prior consultation on the topic, and an event is then coordinated where producers are walked through the process of designing a system within a specific context.

- **Fact Sheets** – The Ministry of Agriculture, Food and Fisheries is in the process of developing a series of factsheets on Agroforestry and Silvopasture. Once published, requesting a series of presentations from the Ministry of Agriculture, Food and Fisheries on the new information and resources available could prove valuable.

- **Related topics** – A related topic that requires more information is effective riparian management. There may be regional projects underway that are focused on enhancing riparian areas that could be incorporated in a field-tour or series of presentations to show producers the benefits of increasing riparian habitat on their property.

- **Webinar** – A follow-up webinar could be developed that examines the relationship between wildfire, water cycle, and agroforestry – a topic that was suggested in the survey feedback.

Building Soil Carbon and Soil Tilth for Water Conservation

The importance of soil health has been a topic that has been increasingly discussed across the region in recent years and producers appreciated the content on organic matter, tilth, and water holding capacity. Related topics participants were interested included managing saturated soils, successful no-till strategies to conserve water, and cover cropping in short season climates.

The next step for this topic could include:

- **Presentation/Workshop** – A follow-up presentation or workshop could address how management practices (including no-till and minimal till practices, cover cropping, bale grazing, etc.) could be implemented to improve soil quality.
- **Field Day/Case Study** – Finding local examples of how producers in the region have been working towards improving soil health and bringing in regional soil experts to explain the processes and address challenges and benefits.

Some of these topics are in the process of being addressed in an introductory manner by programming delivered by the BC Forage Council; therefore, there is an opportunity to partner on delivering content on these topics in the near future.

Forage Crop & Variety Selection for Dryland Farms

Producers indicated that the information on individual species and their characteristics was beneficial to their understanding on appropriate crops for dryland conditions. The presentation helped outline the need for more regional information on species and cultivar performance.

The next step for this topic includes:

- **Background Survey/Review** – A project that would engage producer associations throughout the region to collect data on past studies or trials conducted in order to develop a regionally-specific review of forage species/variety performance would be beneficial (including a summary of new varieties and/or cultivars to be trialed in the region). The project could include a producer survey to outline current species being used for dryland sites.

- **Workshop/Webinar** – A series of workshops and/or webinars outlining how to conduct small, on-farm demonstration variety trials, and how to analyze trial results for the specific farm could be beneficial. Relevant tools (e.g. Peace Forage Seeding Tool, Forage U-Pick) and resources (e.g. BC Rangeland Seeding Manual, Alberta Forage Manual) that could be used to help identify potentially suitable species could be demonstrated at these events. Previous work on this topic has been completed through a CAI Farm Adaptation Innovator Program, *Demonstrating Innovative Forage Production Practices to Increase Climate Change Adaptation.*[2]

Other Topics Identified During Stakeholder Consultation

The *Knowledge Transfer for Adoption of Water Management Best Practices* project was able to address a variety of subjects on water management; however, not all topics identified during stakeholder consultation were addressed during this project.

Water Management with Whole Farm Design

Many producers do not have plans for managing on-farm water conditions such as drainage, water storage, and irrigation. Whole farm design was a reoccurring theme during consultation as a knowledge transfer need. While Keyline Design is one option to consider for whole-farm water management, information on other strategies is needed.

In recent years, producers in Prince George and McBride areas faced challenges with standing water on their hay fields and pasture, which caused problems in both harvesting forage crops and seasonal pasturing of livestock. Exploring drainage systems that could improve the accessibility of the fields and potential ways to capture and store excess water for later use when water is less abundant, is pertinent to producers' on-farm water management practices.

[2] FAIP Project Report: https://www.bcagclimateaction.ca/faip-project/fi03/

The next step for this topic includes:

- **Webinar/Workshop** – A series of presentations that discuss drainage options and water storage with a strong emphasis on proven systems that work in northern climates would be beneficial. It will be relevant to continue to coordinate with government representatives to ensure that information is provided on any relevant regulations and compliance requirements.

- **On-Site Visits** – Farms or ranches that are experiencing challenges with drainage or water storage systems could be visited. Pre-visit work with experts could be undertaken and then potential solutions could be discussed through a live case study approach. This would also allow interactive sessions with experts and other producers that have similar challenges.

Irrigation Systems

Large-scale irrigation systems are not as prevalent throughout the Bulkley-Nechako and Fraser-Fort George as in other regions in BC. During consultation, producers expressed the need to coordinate discussion that details how irrigation can increase productivity and stability in crop yield, including sharing case studies showing the return on investment (ROI) of investing in irrigation systems. Specific topics identified included how irrigation and/or drainage water can provide higher value crops and support transition to advanced cropping systems (e.g. two cuts instead of one cut in forage crops). Related topics that need to be addressed include outlining the variation in water demand for different crops, timing of irrigation to match crop demand, and systems for soil moisture monitoring.

All regions were interested in learning more about irrigation systems and practices. Prince George and McBride would benefit from an introduction into irrigation infrastructure and how to design systems, while the Nechako Valley, Lakes District and the Bulkley Valley would benefit from a more in-depth look at improving irrigation efficiencies.

The next steps for this topic could include:

- **Presentations and/or Field Days** – A series of presentations, or field days, highlighting local producers that are using irrigation effectively and touring different existing irrigations systems in the region. Pre-work would need to be conducted to collect relevant data to be shared (e.g. costs, water usage and allocation, etc.).

- **Webinar** – It may be beneficial to coordinate with Ministry of Agriculture, Food and Fisheries to host a webinar that addresses access to water (specifically water licenses, when information is available) and the water tools provided by the BC government which help producers navigate water regulations and make informed irrigation decisions such as the Agriculture Irrigation Scheduling Calculator and the BC Agriculture Water Calculator.

Livestock Watering Systems

Producers were interested in more information on innovative water systems, such as how to pump water long distances in pastures. There are remaining uncertainties regarding legislation around

livestock watering, but the topic was outside of the scope of this project. There are existing knowledge transfer materials that are focused on various livestock water systems, including solar or nose pumps. Other topics that could be addressed include: setting up livestock watering when changing grazing systems (e.g. rotational grazing); moving livestock off water ways and protecting riparian areas; and creating new water access in under-utilized portions of pastures.

The next steps for this topic could include:

- **Webinar** – Development of webinars highlighting existing systems that have been implemented, including benefits, challenges and associated costs. If work on this topic were to proceed, more discussion with local cattlemen's associations is recommended to ensure the content developed will answer specific producer questions.

- **Field Day** – Host field days showcasing local producers that are using livestock watering systems effectively and touring different existing systems in the region. There may be an opportunity to explore new gravity-fed water pumps being tested by the College of New Caledonia that could provide additional content and information on the topic.

Preferred Forms of Knowledge Transfer

There are various forms of knowledge transfer, and choosing the best approach to sharing information will influence whether or not the information is adopted and applied on the ground. Below are a few discussion points that should be considered for future events, based on feedback and consultation through this project.

- **Presentations/Webinars** – Webinars and static presentations are effective to share general information and introduce concepts. Still, the presentations should incorporate regional context into the examples provided related to the topic, to ensure producers understand the potential applicability to their operation. Coordinators and presenters should work with a producer to develop a case study in the region that would provide a relevant example to the audience. This format proved useful during the Keyline webinar when Taylor Krawcyzk was able to work through a theoretical application of the keyline process on a local farm which showed regional applicability. When webinars are conducted, they should be coordinated in a way that increases producer engagement, as much as possible (e.g. increase opportunities for back-and-forth information sharing, using polls and breakout rooms if relevant).

- **In-person Events (e.g. field days and workshops)** – In-person events are always the first choice for producers to receive information. The majority of the feedback received from participants suggested the need for more technical, regionally-applicable field days or workshops. It is also beneficial to try and visit as many communities as possible; while prudent to coordinate activities in a central location, there are benefits to going to the producers directly (e.g. coordinating meetings in Grassy Plains, rather than in Burns Lake). This reduces barriers to participation, and builds trust within the community.

- **1-on-1 Consultation Sessions** – Following the keyline workshop, individual consultation sessions were successful in helping individual producers consider taking the next steps towards implementation. Providing more opportunities for individual producers to have direct access to presenters in this format would enable producers to gain the confidence needed to assess how to apply complex concepts to their operation.

- **Extension Resources** – Relevant resources should be provided to participants following knowledge transfer events. If there are relevant fact sheets, webinars, reports, etc., on a topic being discussed, participants should be provided access to hard copies (if in-person), or electronic copies (for virtual events). The Water Management Practices Literature Review can be used to help identify relevant resources in the future.

Opportunities for Building New Regional Information

CAI's *Regional Adaptation Program* has delivered a variety of past and active projects in other regions focused on water management, which may be relevant to producers in the Bulkley-Nechako and Fraser-Fort George regions. Table 7 outlines a few examples of these projects.

Table 7. Examples of CAI projects that are regionally demonstrating and/or evaluating water management practices for adaptation.

Project Title	*Region*	*Description*
Livestock Surface Water Pilot & Demonstration[3]	Cariboo	This project is coordinating the installation of water developments at three pilot sites and conducting baseline rangeland health assessments to facilitate the monitoring and sharing of pilot outcomes.
Tools & Resources for On-Farm Water Conservation[4]	Kootenay & Boundary	This project is developing a series of practical water management informational resources for producers. Some resources will transfer existing knowledge about irrigation efficiency and soil moisture preservation. Additional resources will evolve out of demonstration projects with local producers that collect and share farm-level data to quantify the costs and benefits of various water management practices.
Best Practices for On-Farm Management of Runoff, Drainage & Erosion[5]	Peace	This project consulted with local producers to document the current practices and state of knowledge regarding managing for runoff, drainage and erosion. Best practices were identified for various soils, conditions and production systems as well as broader approaches for improving understanding of landscape-level issues, such as regional erosion risk mapping.
Improving On-farm Drainage Management[6]	Delta	Following a scan and research needs assessment project, a two year applied research project was undertaken. The project trialed various drainage management practices on a field with known drainage and salinity issues. Data was also collected from farms across Delta to assess efficacy of tile drains, pumps and drain tile cleaning.
Adaptive drainage management[7]	Fraser Valley	An initial project in the Fraser Valley assessed current drainage issues, practices and priorities. A second project focused on sharing precipitation projections to assess current approaches and identifying collaborative strategies for adaptive management.

[3] https://www.climateagriculturebc.ca/regional-adaptation/cariboo/
[4] https://www.climateagriculturebc.ca/regional-adaptation/kootenay-boundary/
[5] https://www.climateagriculturebc.ca/regional-adaptation/peace/
[6] https://www.climateagriculturebc.ca/regional-adaptation/delta/
[7] https://www.climateagriculturebc.ca/regional-adaptation/fraser-valley/

Appendix 1: Questions Guide for Consultation

Themes/Topics

1. What is the main water issue that producers have in your region? (e.g. Irrigation, Livestock Water Systems, Water Drainage)

   It is expected that there will be lots of follow-up questions based on this first question, therefore is left open ended.

   a. What is the main on-farm limitation/restraint for producers to be able to address the issue in your region?

   b. How could these sessions help address that barrier?

2. What type of information do you think producers would benefit the most from, on these issues?

3. What type(s) of crops are being grown under irrigation by most producers in your region?

Resources (**POC members have likely already answered the questions below**)

1. What regional resources are available that you are aware of, to help producers with these challenges?

2. Have there been any information/extension events on this topic in your region in the last few years?
   a. If so, what was the focus of that event?

3. Are there any speakers/experts that you can think of that could help address any of the outlined topics?

4. What would you like to see incorporated in future extension/outreach activities on the topic of water management?

Disclaimer Regarding Water Storage:

We respect that a major challenge for producers exists around water storage infrastructure. Due to the uncertainties around the livestock watering regulations and water licencing availability, this topic will be difficult to provide applicable information and resources on. If it would prove useful, it could be possible to include a speaker to provide a brief overview of the regulations and procedures associated to water storage, though it would not be the main focus of the Knowledge Transfer Event Series.

Appendix 2: Keyline Workshop Agenda

Water Management Best Practices: Keyline Design

Workshop Agenda

Prince George, February 29th 2020

9:00 a.m.	**Registration and Coffee**
9:30 a.m.	Project Introduction & Regional Climate Change Overview *Serena Black*
10:00 a.m.	Water Storage - Regulation Overview: What you can (and can't) do *Ed Bryson, Dam Safety Officer* *Rebecca Collier, Water Authorizations*
10:30 a.m.	Keyline Design: Part One *Javan K. Bernakevitch*
12:00 p.m.	**Lunch**
12:30 p.m.	Keyline Design: Part Two *Javan K. Bernakevitch*
1:30 p.m.	Individual Consultation Sessions & Open Networking

Funding for this project has been provided in part by the Regional District of Bulkley-Nechako, the Regional District of Fraser-Fort George and in part by the governments of Canada and British Columbia under the Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Funding is administered by the Investment Agriculture Foundation of BC and the BC Agricultural Research & Development Corporation. This project is part of the Regional Adaptation Program delivered by the BC Agriculture & Food Climate Action Initiative.

Appendix 3: Keyline Workshop - Producer Survey Template

1. Please rate your level of satisfaction with the following:

	Extremely Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Extremely Satisfied
Registration Procedures	☐	☐	☐	☐	☐
Keynote Presentations	☐	☐	☐	☐	☐
Individual Consultation	☐	☐	☐	☐	☐
Workshop Venue	☐	☐	☐	☐	☐
Meals	☐	☐	☐	☐	☐
Workshop Overall	☐	☐	☐	☐	☐

2. The information presented was relevant to my needs.

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

3. The facilitators demonstrated a solid knowledge of the workshop content.

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

4. I have an increased understanding of the next steps I need to take to move forward with implementation of management practices on my property.

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

5. Overall, I am very satisfied with the workshop.

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

6. **Which aspects of the conference were most valuable?** ***Why?***

_____

_____

7. Will the conference materials be useful for your farm business?

Yes	No
☐	☐

8. **What needs do you have that were not addressed in the conference?**

_____

_____

_____

9. **What was the most useful session for your farm business?**

_____

_____

_____

10. **What presenters/speakers would you like to see in the future?**

_____

_____

_____

11. **Addition comments?**

_____

_____

_____

Appendix 4: Webinar Participant Surveys

1. **What region do you live in?**

Bulkley-Nechako	Fraser-Fort George	Cariboo-Chilcotin	Thompson-Nicola	Other
☐	☐	☐	☐	☐

2. **Which category of participant best describes you?**

Producer	Government Representative	Researcher	Consultant	Other
☐	☐	☐	☐	☐

3. **The information presented was relevant to my needs.**

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

4. **The presenter demonstrated a solid knowledge of the workshop content.**

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

5. **I have an increased understanding of the next steps I need to take to move forward with implementation of management practices on my property.**

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

6. **Overall, I am very satisfied with the workshop.**

Disagree Strongly	Disagree Somewhat	Uncertain	Agree Somewhat	Agree Strongly
☐	☐	☐	☐	☐

7. **Which aspects of the conference were most valuable?** ***Why?***

_____

_____

8. **What needs do you have that were not addressed in the webinar?**

_____

_____

9. **Are there other topics related to water management that you would like to see addressed in the future?**

   _____

   _____

10. **Are there any specific presenters/speakers would you like to see in the future?**

    _____

    _____

11. **Addition comments?**

    _____

12. **If you would like to hear about other projects/activities related to agriculture and climate change adaptation for the Bulkley-Nechako and Fraser-Fort George Regions, please provide an e-mail address here.**

    _____

Appendix 5: Potential Presenters

Name	*Company*	*Topics of Expertise*	*Location*
EFP Advisors	BC ARDCorp	Riparian Management; Nutrient Management, Irrigation Projects	BC
Lisa Zabek	BC Ministry of Agriculture, Food and Fisheries: Interior Agroforestry Specialist	Agroforestry	BC
Wayne Salewski	Chair of Nechako Environment and Water Stewardship Society (NEWSS)	Agroforestry- Riparian Management	BC
Dr. Lauch Fraser	Thompson Rivers University	Agroforestry	BC
Mike Pritcher	BC Ministry of FLNRORD: Forest Protection Officer	Agroforestry	BC
Allen Dobb	Allen Dobb Consulting	Agroforestry	BC
Norm Dueck	Heartland Soil and Crop Solutions Inc.	Soil Health	BC
Josh Andrews	BC Ministry of Agriculture, Food and Fisheries: Nutrient Management Agrologist	Soil Health	BC
Sandra Burton	Agriculture Consultant	Soil Health	BC
Dr. Bill McGill	University of Northern BC	Soil Health	BC
Dr. Mike Rutherford	University of Northern BC	Soil Health	BC
Julie Robinson	Forage Friendly Enterprises Ltd.	Forage Species	BC
Jeremy Birky	Glendale Agra	Forage Species Selection and Nutrient Management	BC
Stephanie Tam	BC Ministry of Agriculture, Food and Fisheries: Water Management Engineer	Drainage	BC
Geoff Hughes-Games	McTavish Resource & Management Consultants	Drainage	BC
Andrew Peterson	BC Ministry of Agriculture, Food and Fisheries: Water Management Specialist	Irrigation, Drainage	BC

Presenters Suggested by Participants

Name	*Company*	*Topics of Expertise*	*Location*
Tayler Krawcyzk	Hatchet & Seed	Keyline	BC
Steve Kenyon	Greener Pastures Ranching	Livestock Watering	AB
Curtis Stone	The Urban Farmer	Urban Farming	BC
Jon Sitka	Menoken Farm	Soil Health and Natural Resource Conservation	North Dakota, USA
Joel Salatin	Polyface Farms	Landscape Design and Water Systems	Virginia, USA
Peter Johnson	Real Agriculture	Plant Agrologist	ON
Gabe Brown	Brown's Ranch	Regenerative Agriculture and Soil Health	North Dakota, USA
Dr. George Powell	Ag For Insight	Nutrient Management, Agroforestry	BC
Greg Patterson	A&L Laboratories, CEO	Nutrient Management	ON
Greg Moline	High Brix Manufacturing, Brix 'n Berries	Nutrient Management	AB
Emil Gulbranson	Agri-Green Enterprises	AG Maximizer Hay Dryer	BC
Chris or Dick Ford	Highlands Irrigation	Irrigation Design and Infrastructure	BC