Regional District of Bulkley-Nechako Agriculture Water Assessment & Community Irrigation Study for the Vanderhoof Area

By Upland Agricultural Consulting Ltd.
with support from Sound Water Advise Consulting
2025

Acknowledgements

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Acronyms

ALR	Agricultural Land Reserve
BMPs	Beneficial Management Practices
EFP	Environmental Farm Plan
Ha	Hectares
JWA	Joint Works Agreement
MOU	Memorandum of Understanding
NEWSS	Nechako Environment and Water Stewardship Society
QEP	Qualified Environmental Professional
RDBN	Regional District of Bulkley-Nechako
STMP	Summer Temperature Management Program
WLRS	BC Ministry of Water, Lands and Resource Stewardship
WUC	Water Users’ Community

1.0 Context and Background

The availability of water to meet agricultural and food security needs, both now and into the future, has become a growing concern for producers in the Regional District of Bulkley-Nechako (RDBN). For example, during the 2023 drought there was approximately an 80% drop in hay production and around triple the typical number of cattle were sent to market early due to lack of feed. The reduction in crop yields, often leads to trickle-down effects through the agri-food system, particularly since Vanderhoof forage producers supply feedstock to producers throughout other parts of BC, including dairy producers in the Fraser Valley. For the local forage sector to thrive, a safe and reliable source of water for irrigation must be secured. Producers in the RDBN have expressed an interest in learning how *community irrigation systems* (see text box) may be a way to access water to increase the amount of agricultural land under irrigation.

> **What is a community irrigation system?**
>
> Broadly, a community irrigation system is when two or more producers share a water source and infrastructure to deliver water to their individual properties, reducing overall costs. Typically, each producer obtains their own water licence, and they sign a written agreement to share the cost of building and maintaining common infrastructure such as a pump house, pumping equipment, and pipelines. Each system is unique, depending on the number of farms involved, the equipment required, the water source, and other factors. Community irrigation systems may be a tool for producers to reduce crop failure risk during drought by improving access to irrigation water. The term 'community irrigation system' is not formally defined in regulation.

This project assessed the feasibility of community irrigation systems for the Vanderhoof area. These collaborative systems are of particular interest because they can help multiple producers share the overhead and the costs incurred to design and build irrigation systems. This producer guide outlines how to collect data and make decisions about the suitability of community irrigation systems, with methods that can be applied across the region.

To investigate the feasibility of community irrigation systems, the following steps were undertaken:

- Collecting existing data on local surface water and groundwater, documenting gaps, and consulting local knowledge-keepers and provincial experts.
- Identifying hypothetical sites within the study area that may be suitable for community irrigation infrastructure.
- Engaging irrigation experts to estimate potential water volumes needed and to design irrigation system examples.
- Exploring water access options and key factors affecting site selection.
- Considering system scale, governance needs, and administration requirements such as water licensing.

The information in this guide is tailored to the Vanderhoof area, therefore producers in other regions may need to adjust the process to account for local differences.

Figure 1. Centre pivot irrigation in Vanderhoof region.

2.0 Geographic Context

The main area of focus for this community irrigation feasibility study is the Vanderhoof region and included Prairiedale and Braeside on the north side of Highway 16, as well as the Tachick Lake area on the south side of Highway 16. This area provided the lens through which water data was collected and the producer community was engaged.

Figure 2. Study area in red, Agricultural Land Reserve (ALR) in darker shaded green.

3.0 Irrigation and Water Sources Overview

The area of Vanderhoof receives an average of 488 mm of precipitation (rain and snow) annually, and 200 mm falls during the May to September growing season, but this can vary greatly from year to year.[12] In recent years, local producers have indicated that prolonged drought has been severely impacting the local water supply and the ability to harvest at least one cut of forage crop without irrigation. Historically, the region had excellent capability for forage production without irrigation (i.e., dryland production), with less than 10% of land under irrigation.[3] Future precipitation modelling indicates that summers will continue to become drier over the next few decades.[4] The Regional Adaptation Strategies for Bulkley-Nechako and Fraser-Fort George report indicated potential agricultural impacts including an increase in water demand and decrease in water supply, increase in need for water storage, and increase in costs associated with water supply and water distribution infrastructure.[5] Without water and/or the ability to irrigate crops, it is anticipated that forage crop yields will continue to be impacted by seasonal precipitation constraints during the summer months, which can result in producers needing to buy supplemental feed for their cattle. For those with irrigation systems, water use usually peaks at the end of May to support the first cut of forage crops, and again in mid-late July for a second cut.

Benefits and Challenges of Irrigation

All water users require a **water licence** under the provincial *Water Sustainability Act*. Water licences allow licensees to divert, store and/or use specific quantities of water for specific uses, including irrigation. A water licence is attached to a specific parcel ID, therefore in a community irrigation system each parcel is required to have an individual licence.

Irrigating crops in the Vanderhoof region can offer agronomic and economic advantages, especially in the face of increasingly variable precipitation. Consistent and targeted irrigation dramatically boosts forage yields, with the potential to double biomass production compared to rainfed systems, and can enable two harvests per season for most forage crops in the Vanderhoof area.[6] This not only results in increases to the overall number of harvest cuts (and therefore tonnage per acre) but also supports a more reliable and high-quality feed supply. Enhanced moisture availability improves the nutritional profile of forage crops, raising protein content and digestibility, while also allowing for better timing of harvests to maintain feed quality. Additionally, sufficient and timely irrigation supports robust plant growth, making crops less susceptible to pests and diseases. Water-stressed plants, by contrast, are often weakened and thus more vulnerable.

Irrigation also helps farmers manage drought risk and stabilize yields across drier years or shifting weather patterns. A consistent forage supply strengthens the economic viability of livestock operations by reducing the need for costly feed imports and providing greater control over production inputs. By maximizing productivity within a limited growing window, irrigation ensures that each hectare is used more efficiently. Moreover, irrigated perennial forages help maintain soil cover, reduce erosion, and build long-term soil health, while also offering the potential for diversified cropping systems that improve overall farm resilience.

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[1] BC Agriculture & Food Climate Action Initiative. 2019. Regional Adaptation Strategies: Bulkley-Nechako & Fraser-Fort George.
[2] R.Kline. N.d. Potential Agricultural Irrigation Water Demands on the Nechako River.
[3] BC Ministry of Agriculture. 2013. Agricultural Land Use Inventory.
[4] BC Agriculture & Food Climate Action Initiative. 2019. Regional Adaptation Strategies: Bulkley-Nechako & Fraser-Fort George.
[5] Ibid.
[6] Kerr Wood Leidal. 2016. Evaluation of Irrigation Potential in the BC Peace Region. BC Agriculture & Food Climate Action Initiative.

However, irrigating large acreages around Vanderhoof presents several logistical, environmental, and economic challenges. The region's gently rolling topography and variable soil types can complicate uniform water availability and distribution. Water licensing and access pose additional hurdles, as producers must navigate the *Water Sustainability Act* and associated water licensing requirements to secure reliable sources— typically from nearby rivers, streams or lakes. Infrastructure development is capital-intensive, with costs related to pumps, pipes, power supply, and maintenance often exceeding what smaller or medium-scale forage operations can afford without grants and other financial incentives. Furthermore, energy costs for pumping water across large acreages can be high. Finally, producers must carefully manage irrigation scheduling to prevent overwatering, nutrient leaching, or compaction in finer soils, which can negatively impact forage quality and stand longevity.

Characteristics of Irrigation Systems

There are three main types of forage irrigation systems used in the Vanderhoof area: wheel line, centre pivot, and travelling gun.[7]

- Wheel lines are mobile systems that allow a sprinkler pipeline to be rolled across and between fields. They are moved manually or with a small motor. They cost less than centre pivot systems and are suitable for smaller blocks of fields; however, they can be labour intensive and prone to uneven application on slopes.

Figure 3. Wheel line irrigation system (Source: Country Life in BC).[8]

- Centre pivot systems, common for large fields, rotate around a central pivot, irrigating in a circular pattern. The system is best suited for relatively flat or gently rolling land and it can be automated and adapted for fertigation. Irrigation on a scale larger than a half section (320 acres) is generally

[7] B.C. Ministry of Agriculture. 2014. B.C. Sprinkler Irrigation Manual, Chapter 3.

[8] Water Licence Angst: Experts sound alarm with time ticking on well registration. 2021. Country Life in BC.

expected to favour centre pivot systems due to the labour, water and energy savings.[9] These are efficient systems that require minimal labour; however, they are costly and require a reliable power source. They are not easy to move from one field to another.

Figure 4. Centre pivot irrigation system (Source: Agrivi).[10]

- Travelling guns are more versatile on varied property shapes and on hillier inclines. The downside is that substantially more pressure demand is required than wheel lines or centre pivots, which increases energy and maintenance costs. Centre pivots are also more water efficient as their application efficacy range is 65-85% while travelling guns are 55-70%.[11]

Figure 5. Travelling gun irrigation system (Source: University of Missouri Extension).[12]

[9] Kerr Wood Leidal Associates Ltd. 2016. Evaluation of Irrigation Potential in the BC Peace Region.
[10] Center Pivot Irrigation: From Dust Bowl to Modern Era Methods. Accessed August 2025. Agrivi.
[11] Application efficiency is an indication of the percentage of water applied by the irrigation system that is actually available to the crop. Lower efficiencies mean more water is lost during the application process to evaporation, wind drift or runoff and is not available to the crop. From B.C. Ministry of Agriculture, Food and Fisheries. 2005. Irrigation Management Guide, Chapter 6.
[12] University of Missouri Extension. 2023. Forage Crop Irrigation Systems and Economics.

Community Irrigation Systems

A community irrigation system exists when where two or more producers with water licences for their respective parcels have entered into an agreement (either informally or through a Joint Works Agreement[13]) to share the cost of conveying water from a supply source to their farmland. Once the water arrives at their parcels, they use their own irrigation infrastructure to irrigate their fields. Community irrigation systems can also be larger, for example six or more producers sharing a water source and irrigation infrastructure under a Water Users' Community framework (more information about Water Users' Community and Joint Works Agreements are described in Section 5.0 and 6.0). Across BC, several community irrigation systems are in operation.

3.1 Irrigation Water Sources

In the Vanderhoof area, some producers already have irrigation water licences in place. These may be sourced from groundwater (e.g., aquifers) or surface water (e.g., rivers, lakes, or streams). In consideration of a future community irrigation system, each of these sources was assessed for potential suitability. Table 1 provides information uncovered during this research. This information was obtained using iMap BC/Freshwater Atlas data and discussions with BC Ministry of Water, Lands and Resource Stewardship (WLRS) staff.[14] The presence or absence of water allocation notations were identified for each water source in Table 1 (next page). Water allocation notations are a water management tool used by the province that indicates a potential lack of water availability on a source.[15] There are five categories of water allocation notations and to determine if the water source of interest has a notation, producers can use iMap or a list periodically updated on the government website. As part of the WLRS water licencing approval process, the province consults with Indigenous communities of interest to receive input regarding the suitability of a water source for new uses.

[13] BC Ministry of Water, Lands and Resource Stewardship. 2016. Joint Works Agreement.
[14] iMap BC, Water Allocation Notations, Freshwater Atlas data, FountCounter BC contacts
[15] BC Ministry of Water, Lands and Resource Stewardship. 2021. What is a water allocation notation?

Table 1. Potential water sources for irrigation in the Vanderhoof region.

Water Source	Comments	Suitability
Nechako River	• The Nechako River does not have any WLRS water allocation notations associated with it. • The Nechako River summer flows are influenced by the [Summer Temperature Management Program (STMP)](), which is a provincial requirement for Rio Tinto to fulfil every year. The aim of the STMP is to cool the temperature of the Nechako River to less than 20°C at Finmore to help salmon survival and spawning. As part of the STMP, spillway discharge is increased between July 15 and August 20. The discharge fluctuates between 14.2 m^3/s and 453.1 m^3/s in response to weather forecasts.	High
Tributaries of the Nechako River	• Some tributaries of the Nechako River, such as Murray Creek, East Murray Creek, parts of Goldie Creek and several others have a “fully recorded” water allocation notation – meaning it is unlikely that future water licences would be approved in these watercourses due to low flows. (However, it’s always best to check with FrontCounter BC about water allocation notations on a preferred source of water). • Several others such as Knight Creek and Stoney Creek are noted as having “possible water shortage” water allocation notation – meaning they are nearing a fully recorded state. • Dozens of smaller tributaries near the Nechako do not have any water allocation notations on them. These sources may be possible for withdrawal for irrigation depending on volume and discretion from the WLRS water authorization staff.	Moderate
Ponds and Dugouts	• On-farm ponds or smaller lakes may be an option for irrigation sourcing. If the water source is suspected of being connected to groundwater or other watercourses (which can be confirmed by a Qualified Environmental Professional) then producers would be required to obtain water licences to draw water from that pond/lake. • Dugouts for livestock watering may or may not be connected to groundwater systems but generally do not hold sufficient water volume for irrigation purposes.	Moderate
Groundwater	• There is a general lack of data about the volume of water available in aquifers. • A notation on Aquifer 242, which underlies agricultural land around Vanderhoof, indicates the potential lack of water availability. • The volume of water required for forage irrigation is likely not possible to be supplied via groundwater.	Low
Tachick Lake, Nulki Lake, Sinkut Lake	• Consideration for new water licences in this area will need to include cultural considerations and environmental needs and would need to be undertaken in consultation with Saik’uz First Nation. • The larger lakes south of Vanderhoof have numerous existing water licences and water allocation notations associated with them. Tachick Lake and Sinkut Lake both have the water allocation of “Office Reserve” which is established as a temporary notation that preserves unrecorded water in a stream or an aquifer pending negotiations or decisions. Nulki Lake was a water allocation notation of “Possible Water Shortage” and “Office Reserve.”	Low

4.0 Designing a Community Irrigation System

Community irrigation systems require detailed planning to define their structure, water sources, and operational methods. This requires the expertise of an engineer and/or Qualified Environmental Professional (QEP) to design the system. Cost-share funding may be available through the Environmental Farm Plan/Beneficial Management Practices program for producers wishing to investigate the possibility of a shared irrigation system.[16]

An example of a potential community irrigation system is outlined below using the Nechako River as a hypothetical water supply source. The example provides a framework for the steps that would need to be followed to secure water allocation and infrastructure for two or more landowners. An additional example of two producers sharing a pond as a water source is provided in Appendix A. These are intended as examples only and should not be used as a design template.

The Nechako River example considers the following:

- **System design and water source:** The design envisions a community irrigation system drawing from the Nechako River and requires participating farms to have existing water licences. The system would connect properties along a shared pipeline route, reaching nine individual parcels. It would have the ability to pump water to irrigate approximately 518 ha (1,280 acres), representing irrigation on about 2/3 of farmland located across a total of three sections (768 ha).

- **Water delivery options and pressure requirements:** Three water delivery options are possible in this situation:
    - **Option A:** Delivering up to 10 psi of pressure in the pipes and requiring booster pumps at each property, with a reservoir midpoint in the system.
    - **Option B:** Delivering up to 10 psi of pressure in the pipes and requiring booster pumps at each property, with a reservoir at the top of the system. This option would use ditches (which would need to exist already or be developed) to move the water to the properties and demands less pumping power.
    - **Option C:** Delivering a minimum of 60 psi of pressure in the pipes, suitable for centre pivot or wheel line irrigation without additional pumps. This option requires a continuous piped system to each parcel, with a reservoir at the top of the system.

Figure 6 (next page) provides a schematic of Options A, B, and C, where producers are sourcing irrigation water from the Nechako River and sharing pumphouse and pipeline infrastructure to move water through pipes, up elevation to a reservoir and then to the cultivated parcels for irrigation. Nine (9) parcels were selected along the water main pipe path to calculate theoretical water demand supplied by the community irrigation system. Additional producers could connect to the system anywhere along the pipeline after obtaining a water licence.

[16] See the follow details for cost-sharing of [Engineering or Technical Design or Assessment - Water/Riparian](#).

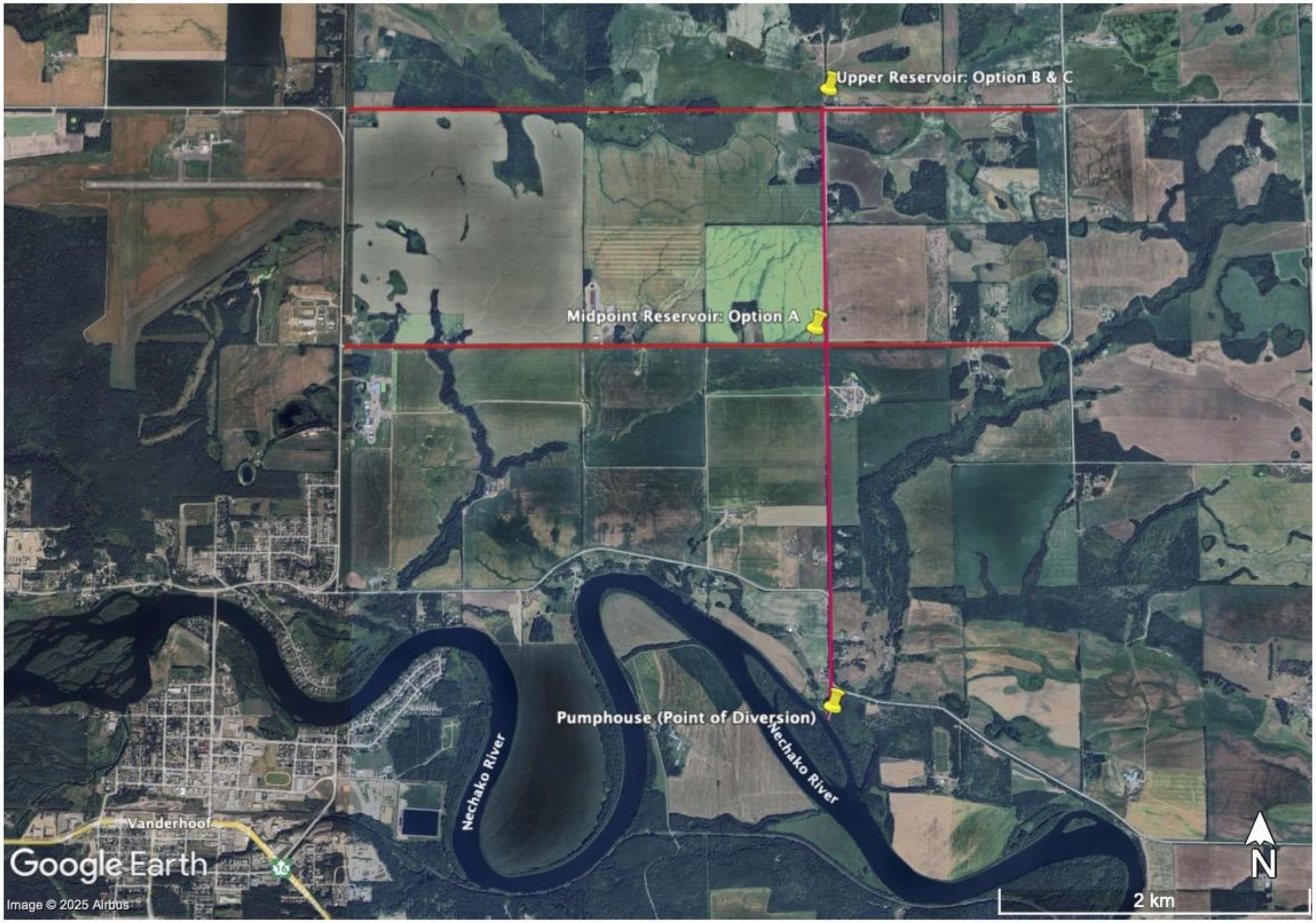

Figure 6. Shared community irrigation system design example. Yellow point of diversion indicates pumphouse location, red indicate water mains.

The BC Agriculture Water Calculator was used to estimate total water demand for the 1,280 acres of forage production using a sandy loam soil type (Figure 7). The model assumed that irrigation would occur between June 10th and September 10th for a total water demand of 1,409,520 m^3. Figure 8 (next page) provides a design sketch of the irrigation system, which includes details of the pressure reducing stations, connections to individual parcels and other features. Note that the conceptual design is for illustration purposes only, and an tailored design would be required for an actual community irrigation system.

Irrigation

Climate ID: 14821775

Peak Evapotranspiration (ET): 4.9 mm/day

Peak Flow Rate: 6,270 US gpm

Field 1

Irrigated Area: 1,280 acres

Crop: Forage

Soil: Sandy Loam

Irrigation Type: Wheelline

Irrigation season: Jun. 10 - Sep. 18 (101 days)

Annual crop irrigation water demand: 1,409,520 m3

Annual crop irrigation water demand (all fields combined): 1,409,520 m3

Crop irrigation water demand by month (all fields combined):

January	-
February	-
March	-
April	-
May	-
June	134,630 m3
July	580,420 m3
August	531,260 m3
September	163,220 m3
October	-
November	-
December	-

Summary

Total annual water demand: 1,409,520 m3

Figure 7. Estimated water demand for 1,280 acres of forage production in the Vanderhoof area (source: BC Agriculture Water Calculator).

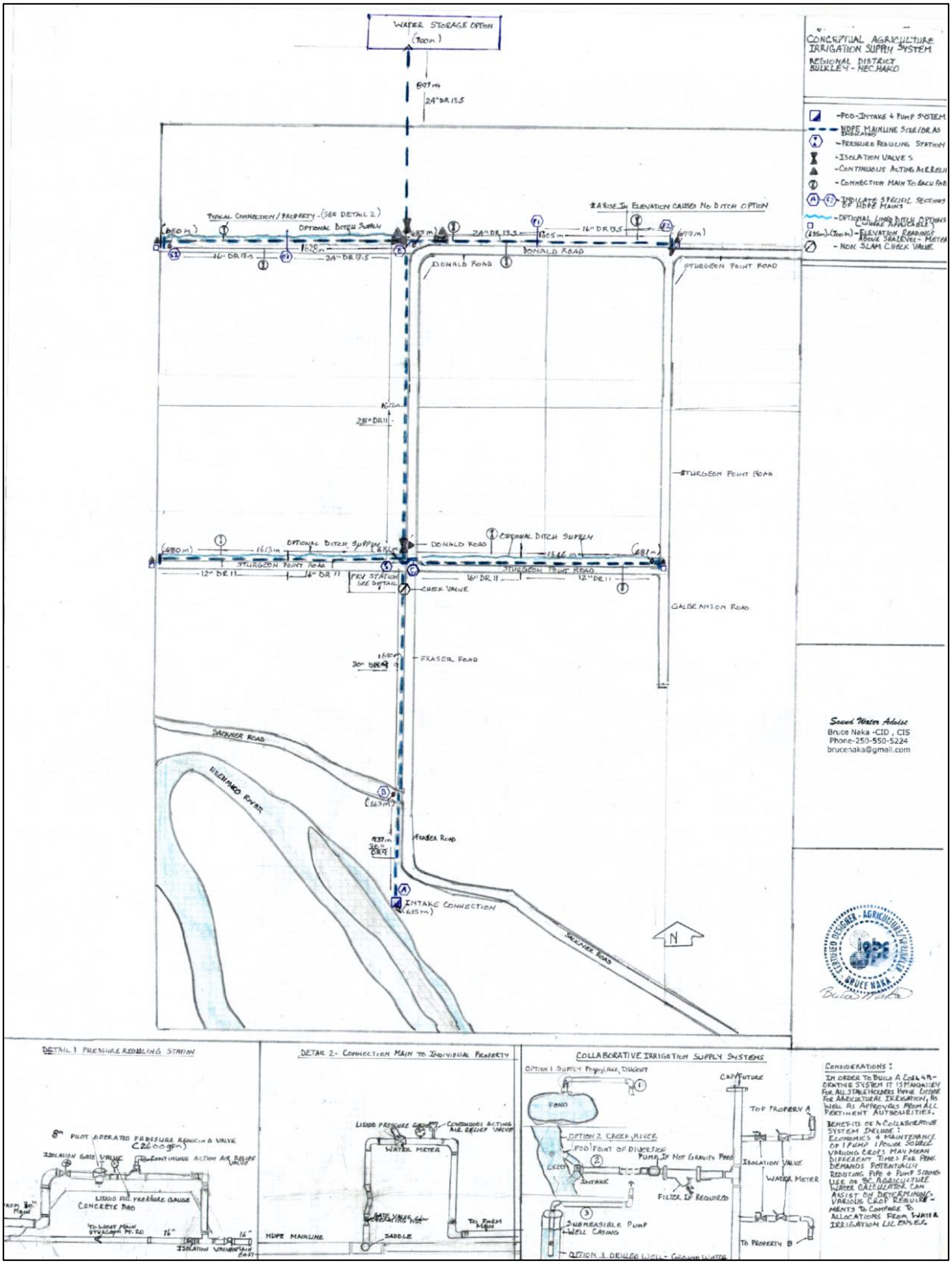

Figure 8. Conceptual design sketch of the system – for example purposes only.

Table 2 provides details on costing for some components of the system under Option A, which has low pressure (up to 10 psi) moving from a pump station (Figure 9) through pipes and a reservoir midpoint in the system. The equipment costs are estimated at $2.3 million, which does not include construction of the reservoir and other aspects of the system, as listed in Table 2. Therefore, the full cost is likely closer to $3 million; however, additional quotes and details of the system would be required to get an accurate final cost estimate. These costs also do not include the on-farm irrigation equipment (e.g., wheel line or centre pivot, and additional pumps – Figure 10). There are also fees associated with applying for a water licence, which vary depending on the annual volume licences, and annual water rental fees. Full details of the pump calculations, cost estimates, and other considerations are provided in Appendix B.

Based on the water demand of 1,409,520 m^3 a year for the Nechako River community irrigation system, the water rental fees are estimated at $1,200 per year using the provincial government water rent estimator.[17] An initial water licence application fee may also be required which can cost up to $1,000.

Table 2. Estimated costs of main equipment for a Nechako River community irrigation system: Option A (source: Sound Water Advise).

Item	Option A - Equipment Costs
Water Pipes & Fittings	$1,747,000
Pumphouse Station and Equipment	$263,000
Reservoir Pumps	$291,233
Total	**$2,301,233**
Not included in the cost estimate are: • complete mainline system, concept ideas, and engineering plans • all electrical materials • all controls system components • excavation, fusion and installation of mainline including all fittings and valves • building of reservoir • supply and building of the wet wells • supply and building of reservoir pump station • site survey • pumps and connections at the farm level or on-farm irrigation equipment	

The costs of piping for Options B and C were also calculated and are estimated at $2,253,070 and $2,584,172 respectively.

[17] Calculated using the Water Rent Estimator tool.

Figure 9. Example of a pump house that would be located at the main water diversion point, e.g. the Nechako River.

Figure 10. Example of pump and connection to main water pipeline that would be located at the farm parcel level.

5.0 Licensing and Approvals Considerations

All water users require a water licence under the provincial *Water Sustainability Act*. Water licences allow licensees to divert, store and/or use specific quantities of water for specific uses, including irrigation. A water licence is attached to a specific parcel ID, therefore in a community irrigation system each parcel is required to have a licence.

A community irrigation system may or may not require additional licensing under the *Water Sustainability Act*. The location and design specifics of the irrigation system will determine which licences and approvals may be required. Community irrigation systems must also comply with any relevant local, provincial and federal legislation. Table 3 below provides an overview of what legislation may need to be consulted under certain circumstances (this is not an exhaustive list, therefore at the time of design/construction a QEP and a discussion with FrontCounter BC staff should occur to understand what permits and licences are required).

Table 3. Legislation to consider for community irrigation systems in the RDBN.

Irrigation System Component	Legislation to Consider
Constructing water intake on a stream/river (e.g. pumphouse, intake pipe)	• Provincial *Water Sustainability Act* – Water Licence • Federal *Fisheries Act* (for example, ensure that intake is screened to prevent the passage of fish into the intake) • Local Government Land Use Bylaws and/or Development Permit Areas
Constructing water pipelines to parcels	• Permit over Crown Land or Crown Land Tenue Application if pipeline is crossing Crown Land • A use permit from the BC Ministry of Transportation and Transit if pipeline is crossing under roads/highways • Local Government Land Use Bylaws and/or Development Permit Areas
Constructing water intake on a pond	• Provincial *Water Sustainability Act* – Water Licence for ponds connected to groundwater and/or filled via surface water

Groundwater and Dugouts

For groundwater licences, numerous resources exist to assist producers with applying for a licence, which can be found on the Government Website, including licencing guidance for livestock watering and dugouts sourced from groundwater.

5.1 Example: Nechako River Community Irrigation System Licencing Considerations

For the conceptual community irrigation system described in the previous section, with the Nechako River as the water source, all farmers would require a water licence for each parcel they intend to irrigate. Initially producers should check to see if an existing water licence exists for the parcels. This can be done by inputting the Parcel Identifier number (PID) into the Water Licence Search Tool; if there is a licence, the details of the licence will be displayed. If there is no existing water licence, or if it needs to be modified (for example, if the source or volume of the water has changed), an application for a new or revised water licence is required.

Water Licence

The following list provides an idea of what information is required when applying for a surface water licence. There are several guidance resources available on the Government Website. The list below is not comprehensive, refer to the application portal, guidance document and checklist for all required information:

- The name and location of the stream from which water may be taken or stored.
- The purpose(s) for which the water may be used (i.e., “Irrigation purpose” which means the use of water on cultivated land or hay meadows to nourish crops or on pasture to nourish forage).
- The area of land that will be irrigated. Estimate crop irrigation needs using the BC Agriculture Water Calculator. The calculator estimates irrigation water for a specific location, soil type, crop type, and type of irrigation system.
- The maximum quantity of water that may be stored.
- The time of year during which the water may be used.
- The property where the water is to be used and to which the licence is attached.
- A description of the project or water use scheme (*the appurtenancy*).
- Legal land description and land tenure for all lands on which you propose to construct works (legal description, PID, or description if the land is not surveyed).
- The applicant's title to or interest in the appurtenancy and the name of the owner(s) of any land not owned by the applicant.
- Authorization to construct works to divert and convey the water from the stream to the place of use.
- A detailed description of the proposed works (e.g., diversion structures, pumps, pipelines, irrigation system, reservoir).

Joint Works Agreement

For a community irrigation system, it is recommended (however, not required for a water licence) to complete a Joint Works Agreement (JWA). A JWA is an agreement that describes how responsibilities and costs will be divided among multiple parties when sharing water lines and other water works. It is recommended that a lawyer prepare the JWA document.

The JWA should contain at least the following information or related provisions:

1. Name(s) of all water source(s) involved in the joint works arrangement.
2. Name and address of all applicants/authorization holders to be parties to the agreement.
3. Description of all the joint works to be covered by the agreement.
4. A detailed drawing showing the appurtenancy (i.e., water use scheme/project) for any authorization for each applicant or authorization holder that is party to the agreement and all the works that are to be jointly constructed or used.
5. For each party to the agreement, a clear and complete description of responsibilities for the

of joint works or compensation or payment among the users of joint works.

construction, operation, maintenance, removal, replacement, deactivation or decommissioning of joint works or compensation or payment among the users of joint works.

6. Provisions that ensure the agreement is binding on all future owners of the joint works and on the land, mine or undertaking to which subject authorizations are attached or applicants for such authorizations.
7. Provisions that consider the abandonment of authorization rights by one or more of the parties.
8. Provisions that consider responsibilities for response to regulatory actions, including proceedings for abandonment or suspension or cancellation of authorization rights.
9. Provisions that consider ongoing responsibilities for joint works following abandonment, suspension, termination or cancellation of authorization rights.
10. Provisions that consider the rights and obligations of authorization holders, including on transfer of the appurtenant land, mine or undertaking to which authorizations are attached.
11. Provisions that define a dispute resolution procedure among all parties to the agreement.
12. Provisions that define a process for one or more parties to withdraw from the agreement.
13. Provisions that define a process for the admission of new parties to the agreement.

Notification of Instream Work

If producers involved in a JWA already hold water licences, the conditions may specify what types of infrastructure can be built to deliver water to their parcels. If a pump house or other works are not included, the licence may need to be amended, or a notification of instream work may be required. In addition, the Nechako River may be considered a sensitive waterbody because of the Nechako white sturgeon, which could mean extra permitting requirements.

Figure 11. Existing pumphouse on the Nechako River used to convey water to agricultural properties at a higher elevation.

6.0 Organizational Structure, Governance and Financial Considerations

All community irrigation systems, whether serving a few farms or a larger agricultural area, need to consider how to ensure their long-term sustainability. Success requires attention to how the structure of the system is organized, managed, and financed. This includes clear roles for administration, decision-making, and accountability. In many cases, treating a community irrigation system as a business, partnership, or cooperative, rather than just water infrastructure, provides the stability needed for reliable operation.

This section introduces different ways community irrigation systems can be structured. It highlights the strengths and limitations of each option and explains how sound governance underpins effective management. With the right framework in place, community irrigation systems are better equipped to share costs fairly, resolve disputes, and ensure a dependable supply of water for all members.

In all of these structures, a JWA is recommended. A JWA allows for sharing the responsibilities and costs of building and maintaining a water distribution system common to two or more licensees. The JWA template recommended for water licencing sets out governance considerations. Ideally, legal advice is sought to draft the JWA and to understand the best option for organizational and governance structure.

6.1 Organizational Structure

The following section provides an overview of some possible organizational structures for community irrigation systems and Table 4 provides a full summary.

Private Ownership

Systems can be privately owned and operated as sole proprietorships, societies, partnerships, corporations, or co-operatives and can be unincorporated or incorporated.

Unincorporated

An unincorporated structure is typically when two or more producers informally share irrigation infrastructure for irrigation needs as a partnership. This structure tends to have fewer operating restrictions and simpler decision-making processes, but raising funds for repairs or upgrades can be extremely challenging. In an unincorporated general partnership, producers are responsible for all debts and obligations related to the system. This means that all partners share liability, meaning that if the irrigation system causes any debt or damage, such as a pipeline failure, flooding, injury, or unpaid repair bills, any single partner can be sued for the entire amount, and creditors can pursue a partner's personal assets. Financial planning and regular maintenance are key activities for system owners/decision makers. Funding is often limited to investments by producers into the system. There are three types of partnerships (general, limited and limited liability) under the *Partnership Act* that producers should consider when entering into a partnership.[18]

Incorporated

An incorporated privately owned system involves creating a legal entity that owns the system and is separate from the owners/users. There are several options in BC for incorporating a private community

[18] Government of BC. 2024. Sole Proprietors and Partnerships.

irrigation system, including establishing a Water Users' Community (WUC), creating a corporation, registering a society, or establishing a co-operative association.[19]

Benefits of incorporation include:[20]

- Increased stability of the organization, which enhances its ability to raise funds (e.g., establish rates and borrow money from a lender).
- Limited liability of owners/members.
- Continuity of system operations should the membership change (e.g., people buying and selling parcels connected to the system) or if the system exchanges hands.
- The water supply system, as opposed to individual members/owners, can own property, apply for easements and rights of way, open bank accounts and enter into contracts. This eases processes if membership changes or the system exchanges hands.
- Can enforce payment through legal proceedings, or water can be turned off to users that do not pay.
- Clear and enforceable conflict-resolution procedures can be built directly into the incorporation documents, providing a structured way to resolve disputes among users.

Challenges include:

- More administratively challenging to establish compared to an unincorporated system.
- More users may make it more challenging to make decisions about the system administration and finances.

Water Users' Community (WUC)

When six or more people share or are connected to water delivery works then a WUC is recommended. A WUC is a co-operative governance model incorporated under Part 3 of the *Water Users' Communities Act*. This requires a Certificate of Incorporation from the Comptroller of Water Rights. Each member must hold a water licence and agree to share a water works system. A WUC may acquire, hold and control property and water licences and may also acquire, construct, hold, maintain, improve, replace and operate works. A WUC allows members the right to bundle their water licences (each member retains "ownership" over their individual water rights) and collectively divert, store, and deliver water.[21]

Several steps are required to create and maintain a WUC including establishing a Memorandum of Agreement between licensees, assigning a 'manager', completing an Assessment Roll, hosting general meetings, and issuing financial statements. The manager of the WUC prepares an assessment roll for the purpose of collecting funds for operational costs. This statement includes the manager's estimate of the monies needed and the amount payable by each member. The amount payable is proportional to the member's interest in the water users' community.

More information is on the Provincial Government website. There are several WUCs throughout the province that have been established between a group of producers to supply water for irrigation.[22]

[19] In B.C., partnerships can remain unincorporated (general partnerships under the *Partnership Act*), or they can be incorporated by forming a corporation, society, or co-operative.

[20] BC Ministry of Health. 2024. Small Water System Guidebook.

[21] Small Water System Guidebook. 2024. BC Ministry of Health.

[22] Upper Pass Creek WUC, Larch Hill WUC and many others.

Corporation, society, or a co-operative association

These legal business structures are administered under various pieces of legislation (i.e., *Business Corporations Act*, *Societies Act* and *Cooperative Association Act*) and they are not exclusive to water supply systems. Incorporating under any of these business structures not only provides the benefits discussed at the beginning of this section but also provides the advantage of having legislation with a basic structure for governance built into it. The choice of legal structure should be heavily dependent on the system of ownership (e.g., collective or individual ownership) that would work best for your system. For example, a small water system that is owned by a sole proprietorship would probably want to incorporate as a business, whereas a system owned by a group of users may want to investigate becoming a society or co-operative association. The Corporate Registry offers information about registering partnerships and incorporating corporations, societies and co-operatives associations.

Public Water Supply Systems

A public water supply system can be operated by an incorporated improvement district or by a local government (regional district or municipality).

- **Improvement districts** (including irrigation districts and waterworks districts) are responsible for providing local services for residents within a defined area. Provincial government oversight is provided through the *Local Government Act* and the Ministry of Housing and Municipal Affairs. Improvement districts vary in size, from small subdivisions to larger communities. They are usually in rural areas within the boundaries of a regional district. The provincial government has indicated it is no longer approving the creation of improvement districts.
- **Local Governments** such as municipalities or regional districts, have the legal ability to offer services such as irrigation water (as an Agricultural Water Service area). However, due to the high costs associated and challenges with administration most local governments do not offer irrigation water services or are retiring from acting as irrigation districts. There are a few examples in the province of legacy systems still provided by a local government (e.g., City of Delta); however, this is an exception.

Figure 12. Agricultural fields and the Nechako River near Vanderhoof (source: I. Smith).

Table 4. Summary table of organizational structures for community irrigation systems.

Structure	Key Features	Pros	Cons	Best-fit Scenarios	Succession Planning Considerations	Complexity of Setup/ Admin
Unincorporated (partnership)	Agreement between two or more producers; not a separate legal entity.	• Simple setup and decision-making • Few administrative requirements	• Owners fully liable • Harder to raise funds • Limited to fees or owner investment	Small systems with few farms; when participants know/trust each other	Dependent on individual owners; transfer can be difficult if the owner retires or passes away; continuity risk is high.	Low
Incorporated Entities (Corporation / Society / Co-operative)	A separate legal entity (*Business Corporations Act*, *Societies Act*, or *Cooperative Association Act*).	• Limited liability • Greater stability and fundraising capacity • Can borrow, own property, contracts • Built-in governance frameworks	• More administrative work to establish and maintain and more annual financial overhead • Decision-making harder with more members	Corporation: best for systems with few farmers but needing capital Society/Co-op: best for groups of farms seeking collective decision making	Strong succession pathway: entity continues regardless of individual retirements; transfer of shares/ memberships manageable.	Medium–High
Water Users' Community (WUC)	A co-operative governance model under the *Water Users' Communities Act*; requires at least six licensees. Members share a waterworks system but keep their own water licences.	• Pooling of resources • Costs spread across many users • Clear financial processes • Continuity through land transfers • Limited liability	• Requires agreement, manager, regular meetings, and financial statements • Some administrative overhead	Best for >5 farms sharing water, when members want collective decision-making and stable cost-sharing	Strong succession pathway: membership tied to land parcels; when land sells, new owners step in automatically.	Medium
Public Systems (Improvement District / Local Government)	Managed by local government or improvement district.	• Oversight by government • Long-term stability (legacy cases)	• High costs • Province no longer approves new improvement districts	Rare; mostly legacy systems; possible in certain regional districts	Succession not an issue, but very limited applicability for new systems.	High

6.2 Governance Considerations

Governance refers to the rules and processes that guide decision-making and hold water users accountable. Every irrigation system faces decisions that go beyond day-to-day operations. These include financial planning, managing infrastructure and equipment, communicating with members, and overseeing system maintenance. Common examples are planning for new investments, securing loans, upgrading infrastructure, and acquiring or replacing assets. The Joint Works Agreement template lays out the requirements for much of the governance components that should be considered for success of the system, in particular if the organizational structure is an unincorporated partnership. If a WUC is the preferred organizational structure then specific governance documents and forms are available through the province of BC.

A governance structure should include the following information:[23]

- Defining responsibilities.
    - Identifying who oversees the system: Is it an individual or a group of people?
    - How big decisions are made: What types of decisions are voted on? Who gets to vote? How does the voting process work?
- Ensuring that key individuals have the skills to perform those responsibilities.
- Ensuring that material, financial, and human resources are adequate.
- Allocating resources effectively.
- A system for tracking expenditures and revenues.
- Communicating on relevant bylaws, guidelines, policies, standards and operating procedures.
- Enforcing compliance with all applicable legislation, including establishing accountability and consequences.

Successful governance structures have certain key elements in common:

- All users contribute to shaping the governance structure, which includes clear provisions for succession and the transfer of financial and operational responsibilities when ownership changes occur.
- The policies, decision-making processes, and roles and responsibilities are identified up front.
- There are clearly defined principles that must be considered when making decisions.
- All decisions in the day-to-day operations (i.e., management of operations) of the water supply system, including finances, asset management, communications and mechanical operations, are made in accordance with the governance framework.

6.3 Financial Considerations

Sound financial management is essential for the success of a community irrigation system. Financial considerations depend on the organizational structure and the number of users involved.

- Joint Works Agreement (JWA): If a JWA is established, a lawyer should help prepare a clear and complete description of each party's responsibilities for construction, operation, maintenance, replacement, deactivation or decommissioning of joint works, as well as protocols for compensation or payments among users.

[23] BC Ministry of Health. 2024. Small Water System Guidebook.

- Water Users' Community (WUC): If a WUC is established, specific protocols apply.[24] For example, when funds are required for operations, maintenance, or debt payments, the manager prepares an assessment roll outlining each member's contribution. Members pay proportionally, according to their water licence allocation.[25]
- For any organizational structure cost-sharing models could be considered: Users may decide that contributions to capital costs (e.g., system establishment) and maintenance should be proportional to each producer's water use.

Overall, producers should establish clear protocols for:

- Paying for initial system establishment;
- Covering maintenance and ongoing system costs; and
- Determining costs when new producers wish to join the system (if capacity allows, given the pumping infrastructure).

There may be some funding sources available for design, and cost-sharing for new or existing systems through various provincial and federal programs, such as the EFP/BMP Water Infrastructure Funding.

6.4 Example: Nechako River Community Irrigation System Organizational Structure

For the conceptual Nechako River Community Irrigation System example, it is assumed that there are less than six producers involved in the system, so a WUC would not be an appropriate organizational structure. Three options therefore exist for the producers which are outlined in Table 5 (next page). Overall, if the producers want minimal paperwork and have very high trust then an unincorporated partnership could work, but liability and succession risks are significant. If fairness proportional to water licence allocation is most important then a corporation is the strongest option. If equal say matters most, regardless of water licence allocation then a co-operative association is best.

Governance

In any of the three organizational structure options, establishing a JWA is highly recommended. If a corporation or co-operative is established, then additional bylaws and governance documents are required.

The agreement should, at a minimum:

- Describe how responsibilities and costs are divided for construction, operation, maintenance, and replacement.
- Ensure legal clarity on ownership of pumps, pipelines, easements, etc.
- Establish dispute resolution and rules for admitting/replacing members if one farmer sells their parcel(s).

Governance documents should specify:

- Voting rules (equal or weighted by water volume).
- Succession/transfer provisions: clear process when land changes hands.
- Protocols for expansion if additional farmers want to connect in the future.

[24] Government of BC. N.D. Conducting the Business of a Water Users' Community.
[25] Government of BC. N.D. Water Users' Community Assessment Roll.

Table 5. Organizational structure considerations for the community irrigation system.

Aspect	Unincorporated Partnership	Corporation	Co-operative Association
Legal Basis	*Partnership Act* (general partnership, unless register as LP/LLP). Not a separate legal entity.	*Business Corporations Act*. Separate legal entity.	*Co-operative Association Act*. Separate legal entity.
Ownership Model	Informal: farmers jointly own infrastructure. No shares, no separate entity.	Farmers own shares in the company (proportional to water use, land, or investment).	Farmers are members, each with one vote regardless of land size/water use.
Decision-Making	Decisions must be unanimous or per informal agreement. Can be prone to disputes.	Voting tied to shares; larger water users/landowners can have more influence.	One member, one vote governance; decisions equal among members.
Financial Contributions	Each farmer contributes directly (cash or in-kind). Costs divided by informal agreement (e.g., by acres, water use).	Contributions proportional to shares. Can raise funds more easily (loans, equity).	Membership fees + proportional user charges (outlined in bylaws or JWA define allocation).
Liability	Unlimited: each partner is personally liable for debts and obligations of the system.	Limited liability: only up to the value of shares.	Limited liability: only up to membership share.
Continuity & Succession Note: in all cases water licences do not change with land ownership. They are attached to a parcel.	Weak: if one farmer sells or exits, agreement must be renegotiated.	Strong: entity continues; shares can be transferred or sold.	Strong: entity continues; membership tied to water use, but voting remains equal.
Administration	Very simple: no incorporation filings. Only a written partnership agreement.	Moderate: annual returns, share registry, record-keeping.	Moderate: annual meetings, co-op filings, bylaws compliance.
Best Fit Scenario	High trust, modest infrastructure costs, desire for minimal admin.	When land/water use differs significantly; fairness requires proportional costs/votes.	When farmers want equal say regardless of farm size/water use.

Financial Structure

The following financial structure could be considered for the system, particularly if the water system is incorporated.

- Cost-sharing model:
    - Capital and operating costs are divided proportionally to licensed water volumes or irrigated acreage.
    - Farmers pay into a pooled fund managed by the incorporated entity.
- Funding sources:
    - Producer contributions (initial equity investment).
    - Potential provincial/federal programs (e.g., EFP/BMP Water Infrastructure Funding).
    - Bank financing, backed by incorporated entity's assets and rate structure.
- Reserves (if possible):
    - Establish a replacement/maintenance reserve fund to cover future pump and pipeline upgrades.

7.0 Beneficial Management Practices

Effective irrigation supports crop productivity and plays a key role in conserving water and protecting local watersheds. Adopting beneficial management practices (BMPs) for irrigation and watercourse stewardship helps optimize water use, reduce costs, reduces overall risk, and safeguards environmental values at the farm and watershed scales.

Irrigation BMPs

Key BMPs related to irrigation of crops include the following:

- **Match water application to crop needs**: Use BC irrigation use calculator; soil moisture monitoring tools, evapotranspiration data, and crop growth stages to guide irrigation timing and volume.
- **Improve system efficiency**: Regularly maintain and upgrade irrigation equipment (e.g., nozzles, pumps, pivots, or wheel lines) to minimize leaks, uneven distribution, and energy waste.
- **Irrigate during low-evaporation periods**: Apply water in the evening, at night, or early morning to reduce evaporative losses.
- **Adopt advanced technologies**: Consider variable-rate irrigation, pressure regulators, or automated scheduling systems where feasible to improve precision and reduce over-application.
- **Plan for soil health**: Maintain soil organic matter and avoid compaction to improve infiltration and water-holding capacity.

Environmental Farm Plan & Beneficial Management Practices Programs

The Environmental Farm Plan (EFP) Program is a free program that provides eligible producers with access to consultants (known as EFP Advisors) to assist in the completion of Environmental Farm Plans. An EFP is an on-farm, agri-environmental risk assessment. Its purpose is to identify potential environmental and climate risks within a farmer and rancher's operations and educate them about how these risks can be mitigated. The process supports producers to identify opportunities for funding through the Beneficial Management Practices program.

Resources

There are numerous resources available to assist in understanding more about efficient irrigation systems and implementing irrigation BMPs

- BC Ministry of Agriculture and Food: Irrigation webpage and guidance materials
- EFP/BMP Water Infrastructure Funding
- BC irrigation use calculator

Watercourse Stewardship Beneficial Management Practices (BMPs)s

Benefits of watercourse stewardship include improved water quantity and quality and improved livestock health. Key BMPs related to stewardship of watercourses on the farm include the following:

- **Reduce the speed of water flow in the watercourse**: Introducing beaver dam analogues, large woody debris, and rocks to slow the flow of water and hold more of it in place for longer periods of time can help to reduce the speed of water flow and subsequently reduce erosion (note: it is essential to work with a QEP when doing work in and about stream as an Approval through the Water Sustainability Regulation is required).
- **Protect riparian areas**: Maintain buffer zones of vegetation along streams, wetlands, and ditches to filter runoff and provide important wildlife and fish habitat. Exclusion fencing for livestock with limited access to water courses helps reduce bank erosion, protects the streambank vegetation,

and protects water quality. This may include off-stream watering or alternative watering tools for livestock.
- **Manage nutrients carefully**: Calibrate manure spreaders to ensure even spread and time of fertilizer or manure applications to avoid runoff during irrigation or rainfall events.
- **Reduce water withdrawals during critical periods**: Avoid over-extraction during low-flow conditions.

Resources

There are numerous resources available to assist in understanding more about how to improve riparian areas and implementing watercourse stewardship BMPs.

- BC Ministry of Agriculture and Food: Riparian areas webpage and guidance documents.
- Investment Agriculture Foundation of BC: EFP/BMP Riparian & Grazing Funding
- Nechako Environment and Water Stewardship Society (NEWSS): Potential funding opportunities to rehabilitate watercourses on-farm.
- BC Cattlemen's Association: Farmland-Riparian Interface Stewardship Program.

Figure 13. Beaver damn analogues project in the RDBN, NEWSS.[26]

[26] Nechako Environment and Water Stewardship Society. 2024. Restoration on East Murray Creek.

8.0 Overall Summary of Process and Considerations

Determining whether a community irrigation system is suitable involves moving through a series of steps that build on each other. The process ensures that producers make informed decisions about feasibility, legal requirements, organizational models, and long-term management.

Step 1 – Early Planning and Feasibility

- **Preliminary discussions**: Meet with potential partners to explore willingness, governance preferences, and cost-sharing approaches.
- **Water availability**: Confirm licences or potential availability with WLRS. Use tools like iMap BC and the Water Licence Search Tool to check for Water Allocation Notations.
- **Check land status**: Confirm whether proposed infrastructure will cross Crown land or roads.
- **Funding**: Identify cost-share opportunities such as the EFP/BMP program to help with capital infrastructure costs. Complete an individual or group EFP if needed.
- **Technical input**: Engage a QEP to design the system (note: this can be funded by the EFP/BMP program). Depending on the complexity, an engineer may also have to be hired.

Step 2 – Licensing and Approvals

- **Water licence:** If necessary, apply for new or amended licences under the *Water Sustainability Act* to reflect the shared system and ensure each parcel is properly licensed.
- **Additional approvals**: Secure any permits needed for fish screens, road crossings, or Crown land tenure. Early engagement with FrontCounter BC is recommended.
- **Consultation requirements**: The Province will lead First Nations consultation as part of the water licensing application process. A review by Fisheries and Oceans Canada (e.g., *Fisheries Act*) may apply.

Step 3 – System Design and Organizational Setup

- **Design details**: Work with an engineer or QEP to finalize intake, pumps, pipelines, and delivery pressure to meet farm needs.
- **Choose an organizational structure**: Decide whether an unincorporated partnership, corporation, or co-operative association is most appropriate (Section 6.0 which outlines pros/cons).
- **Draft governance agreements**: Prepare a Joint Works Agreement or bylaws to clearly outline roles, responsibilities, voting, dispute resolution, and succession planning.
- **Source funding or loans**: Based on estimated costs, apply for funding or obtain loans.

Step 4 – Construction and Compliance

- **Timing**: Build intake and conveyance works within approved dates to protect fish habitat.
- **Infrastructure**: Install pumps, pipelines, ditches, and on-farm connections.
- **Compliance**: Meet licence and permitting conditions.

Step 5 – Long-Term Operations and Maintenance

- **Financial management**: Pay annual water fees and maintain fair cost-sharing arrangements.
- **System upkeep**: Inspect infrastructure regularly; keep records of maintenance and expenditures.
- **Governance**: Review agreements periodically, update as membership changes, and ensure roles and responsibilities remain clear.
- **Succession**: Plan for smooth transfer of responsibilities when farms are sold or if new producers wish to join the system.

Appendix A. Community Irrigation System: Ponds

In this additional conceptual example, two or more farms would have water licences to a pond on one producer's property. Power would need to be brought in to operate pumps, and mainline infrastructure would need to be developed to deliver water from the pond to the fields. In such a circumstance, each farm would typically have to pay for irrigation system infrastructure on an individual basis. However, considerable cost savings for each farm could be introduced by collaborating and bringing power for only one pump to supply both farms and sharing a waterline to each property line.

In order for such a system to work it would be necessary to have the support from WLRS to ensure that the water licences are properly assigned, and to have a valid legal agreement between farms. Based on the BC Agriculture Water Calculator, 160 acres of irrigated forage would require just over 100,000 m^3 of water annually for two cuts.

Irrigation

Climate ID: 14821780

Peak Evapotranspiration (ET): 4.9 mm/day

Peak Flow Rate: 780 US gpm

Field 1

Irrigated Area: 160 acres

Crop: Forage

Soil: Silty Clay

Irrigation Type: Wheelline

Irrigation season: May. 14 - Aug. 15 (94 days)

Annual crop irrigation water demand: 105,810 m3

Annual crop irrigation water demand (all fields combined): 105,810 m3

Crop irrigation water demand by month (all fields combined):

January	-
February	-
March	-
April	-
May	9,510 m3
June	17,910 m3
July	54,430 m3
August	23,970 m3
September	-
October	-
November	-
December	-

Summary

Total annual water demand: 105,810 m3

Figure 14. Estimated water demand for 160 acres of forage using wheel line irrigation (source: BC Agriculture Water Calculator).

Appendix B. Additional Details for Nechako River Community Irrigation System

Pump Calculations for 60 psi and 10 psi

Vanderhoof Conceptual Agriculture Irrigation Supply System
Total Demand Sizing Worksheet

Total of 2 Sections of Land or 1280 Acres
Allocation of flow is 5 gpm/acre or 6400 Gpm.
Supply Derived from sum of all individual surface Licenses from Nechako River

Total Friction Loss of pipe supply line

Section of Pipe	**Distance feet**	**HDPE Pipe Size,Class Ve s**	**ID"**	**Flow**	**Velocity Fps**	**Loss Hd.Ft.**	**Elevation**
A-C	9433	30" DR 9	22.93	6400 gpm	4.97	28.4	60m 197ft.
C-D	5256	28" DR11	22.6	6400 gpm	5.12	17	4m 14ft.
D-F1	6562	24" DR 13.5	20.23	3840 gpm	3.8	14.1	7m 23 ft
F1-F2	6562	16" DR 13.5	13.49	1920 gpm	4.3	28	7m 23 ft
Totals	**27813**					**87.5**	**78m 257 ft.**

Total Dynamic Head-1 (TDH-1)	**(Feet)**		
Elevation Lift from Pump to Surface		**15**	
Friction Loss Pump to end Mainline		**87.5**	
Rise Elevation Total		**257**	
Pressure supplied to property line at last connection	60 psi	**138.6**	
Fitting/ Valve Loss		**15.11**	
Misc. Loss		**15**	
Total	**TDH-1**	**528.21**	**or 228.71 psi**

Total Dynamic Head-2 (TDH-2)(Feet)
TDH-2 shall only supply 10psi (23.10 feet) to property line
60 psi (TDH-1) - 10 psi (TDH-2)= 50psi or 115.50 head feet
> 515.87-115.50 = 400.37

Total -	**TDH-2**	**412.82**	**or 178.71 psi**

Horse Power Requirement

TDH-1	528.21 x 6400				
	3960 x .80% % =	1067 Hp or	**1100 Hp**	**Pump 80%**	**Efficiency**
		1219.53 or	**1220 Hp**	**Pump 70%**	**Efficiency**
TDH-2	412.82 x 6400				
	3960 x .80% =	833.98 Hp or **835 Hp**		**Pump 80% Efficiency**	
		953.12 Hp or **960 Hp**		**Pump 70% Efficiency**	

Details of system equipment and considerations for Option A

DELTA WATERTEC

YOUR TRUSTED PARTNER IN IRRIGATION SOLUTIONS

Bukley Nechako Regional District
Vanderhoof Irrigation District

Concept:

- River pump station located at the marked "point-of-diversion" location
  - Cornell centrifugal redi-prime pumps
  - Approximately 150ft head pressure at pump gives 35ft at reservoir location
  - 8H-RP. 150hp gives multiples of 3000gpm @ 150ft @ 1800rpm. 86% eff. 12.5ft NPSHr.
  - 12" River Screen per pump with 12" aluminum suction pipe and small section of rubber suction hose to suit installation site
  - Pumps discharging into common discharge header
- Mainline to reservoir
  - DR21 HDPE (2,300ft) from pump header to the main roadway
  - DR26 HDPE (7,500ft) from corner of main roadway to reservoir location
  - Discharge into reservoir with approximately 35ft of head pressure (head dependent on reservoir construction and final elevation
- Reservoir
  - Concrete poured-in-place construction
  - Square or rectangular with raft slab and column supported roof
  - Suggested construction would be reservoir fully underground
  - Wet well pump intake on one side of reservoir with space for X number of vertical turbines
  - Size of reservoir to be determined based on final acres served, inlet and outlet flow rates, and ability to buffer anticipated flow surges (discharge exceeding inlet flow)
- Turbines
  - Jockey pump
    - Goulds 10hp 85GS100
    - 100gpm @ 280ft
    - Minimum flow rate 40gpm
    - Mounted in flow sleeve
  - Mid-range pump
    - Integrity 9IDMH 5-stg
    - 570gpm @ 270ft
    - 50hp
    - Min flow 86gpm. 79.5% efficiency
  - Main pumps – multiples to achieve desired system flow rate
    - Integrity 14IML 3-stg
    - 2200gpm @ 270ft
    - 200hp
    - Min flow 440gpm. 86% efficiency
- 270ft of head pressure at reservoir location give approximately 20psi at North East corner of system
- Alternate idea would be to have a below-grade pump room and use Cornell centrifugal pumps with flooded suction off bottom of the reservoir. Efficient and lower capital cost than turbines, and easier to service. But would be installed below grade.
  - Cornell 6HH. 2000gpm @ 270ft. 81% efficiency

23160 72 Ave Langley, BC, V2Y 2K2
Langley, Chilliwack, Williams Lake, BC | Lynden, WA
604-882-7405
watertecna.com

- Various options available for jockey pumps

Thoughts:

- Confirm that PD is in the most accessible and efficient location
- Choose suitable reservoir location
  - Available land
  - Distance to 3ph power
  - Keep within 180 vertical feet from main pump station for most efficient piping choices
- Turbines or centrifugal pumps
- Where are the actual properties to be served by the irrigation district and is there thoughts to expand now or in the future, and what facility needs to be incorporated to allow expansion
- If a minimum of 20psi is provided at each point of connection, what power sources are available (1ph or 3ph) and what are the pumping limitation for each property/POC.
  - Example: 200A 1PH 240V service can handle a maximum of 38hp. 850gpm @ 60psi can supply 170ac @ 5gpm @ 80psi at pump location.

Buckley Nechako Regional District
Proposed Vanderhoof Irrigation District
Based on Lower Reservoir **(Option A)**

Quote Number:
Date: 9/20/25
Prepared By:

Item #	Description	Qty	Unit Price	Extended Price
1	Cornell Pump Station - 6000 gpm @ 160ft TDH	1	$142,000.00	$142,000.00
2	Rotation River Screen System x 40ft	1	$42,000.00	$42,000.00
3	Fabricated Inlet Header - 24" c/w all valves/airvents	1	$79,000.00	$79,000.00
4	30" HDPE Mainline - SDR 21	2300	$85.23	$196,029.00
5	30" HDPE Mainline - SDR 26	7500	$70.23	$526,725.00
6	30" HDPE misc fittings	1	$20,985.00	$20,985.00
7	28" HDPE SDR 17	5260	$87.57	$460,618.20
8	24" HDPE SDR 21	6560	$52.55	$344,728.00
9	16" HDPE SDR 21	6560	$24.15	$158,424.00
10	MiscFittings for 28" , 24" & 16	1	$39,500.00	$39,500.00
	Reservoir Pumps			
11	60 Hp - 650 gpm @ 240ft - 16ft length - Turbine Pump	1	$40,251.00	$40,251.00
12	100 Hp - 1300gpm @ 240ft - 16ft length - Turbine Pump	1	$47,500.00	$47,500.00
13	150 Hp - 2000 gpm @ 240ft - 16ft length - Turbine Pump	2	$58,741.00	$117,482.00
14	Fabricated Reservior Header - 24" c/w All Valves / Airvents	1	$86,000.00	$86,000.00

Subtotal: **$2,301,242.20**

Piping Comparison Options

Option A (10 psi to property line, lower reservoir)		Price/ft	Total
2300'	30" DR21	85.23	196,029
7500'	30" DR26	70.23	526,723
5260'	28"DR17	87.57	460,618
6560'	24"DR21	52.55	344,728
6560'	16"DR21	24.15	158,424
			1,686,522

Option B (10 psi to property line, upper reservoir)		Price/ft	Total
2300'	30"DR11	166	381,800
3750'	30" DR13.5	132	495,000
3750'	30" DR17	110	412,500
5260'	28" DR17	87.57	460,618
6560'	24"DR21	52.55	344,728
6560'	16"DR21	24.15	158,424
			2,253,070

Option C (60 psi to property line, upper reservoir)		Price/ft	Total
2300'	30" DR11	166	381,800
7500'	30" DR11	141	1,057,500
5260'	28" DR11	122	641,720
6560'	24" DR21	52.55	344,728
6560'	16"DR21	24.15	158,424
			2,584,172

Appendix C. Summary of Communication

Table 6 presents a summary of the communication that took place (in alphabetical order) throughout the course of this project in order to inform the report.

In addition, there were 14 farmers and ranchers who provided invaluable input to this project. Outreach included emails, phone calls, and in-person information meeting, and farm tours.

Table 6. Summary of communication efforts to support an informed project approach.

Organization	Role(s)	Forms of Communication
BC Ministry of Agriculture and Food	Regional Agrologist Water Resources Specialist	Email Virtual (Zoom) In-person
BC Ministry of Water Land and Resource Stewardship	Groundwater Hydrologist Licensed Authorizations Officer – Omineca Region Senior Licensed Authorization Specialist Senior Regional Specialist, Water and Dike Safety	Email Virtual (Zoom)
Nechako Environment and Water Stewardship Society	Executive Director	Email Phone Virtual (Zoom) In-person
Regional District of Bulkley Nechako	Agriculture Coordinator Electoral Area Director Emergency Services Manager	Email Phone Virtual (Zoom) In-person
Rio Tinto	Director – Energy and Watershed Partnerships Superintendent, Power Operations – Watershed	Email Virtual (Zoom)
Saik'uz First Nation	Lands Manager	Email Phone