ATTACHMENT B

APPENDICES

MACKENZIE RIVER BASIN (LIARD) BILATERAL WATER MANAGEMENT AGREEMENT

Between the

Government of Yukon

And the

Government of the Northwest Territories

2019-07-24

Draft

ATTACHMENT B

List of Appendices

ATTACHMENT B

Appendix A – Risk Informed Management

A1. Overview

Risk Informed Management (RIM) is an approach that guides the identification and implementation of management actions and that is informed by an understanding of the risks to and uses of a transboundary water body. It applies to all Transboundary Waters, including both surface and Groundwater.

The goals of the RIM approach are to:

- Support the achievement of the principles of the Master Agreement;
- Facilitate joint learning, and proactive and adaptive actions; and
- Apply human and financial resources in an efficient and effective manner.

Key principles include:

- The nature and intensity of Bilateral Water Management is commensurate with the nature and intensity of the risks to and uses of Transboundary Waters;
- Bilateral Water Management is based on a mutual understanding of the Ecological Integrity of the Aquatic Ecosystem; and
- Bilateral Water Management builds on the Jurisdictional Water Management actions of each Party as required to achieve the commitments of the Agreement.

The RIM approach will be implemented in a manner consistent with these goals and principles.

The RIM approach is one of several tools for collectively meeting the Master Agreement principles. It complements the oversight provided by the Board as well as each Party's Jurisdictional Water Management practices.

The specific RIM Commitments are documented in section 4.3 of the Agreement. This appendix provides an overview of the approach, which will guide the implementation of this Agreement.

Additional details that guide the implementation of this approach for surface water quantity, surface water quality, Groundwater and biological components are outlined in respective appendices to this Agreement and related supplementary bilateral specific RIM documents. Further details regarding the RIM approach will be developed by the Bilateral Management Committee (BMC) over time.

A2. Classifying Transboundary Waters

Operationally, the RIM approach involves assigning Transboundary Waters to one of four classes (Figure 1), defining Bilateral Water Management actions commensurate with the class, and establishing a structured and transparent process for Bilateral Water Management.

Classifications will be applied to Transboundary Waters at the border. The classification will consider development and use in the contributing basin as well as downstream needs. Bilateral Water Management actions may be directed at those contributing water bodies, but the classification is applied at the border. Criteria for classifying Transboundary Waters will be based on the type and

magnitude of development along with other quantitative and qualitative factors. Classification will consider both existing and projected development, based on a detailed five-year development forecast, as well as consider the longer-term (ten- year) outlook. Assignment of a transboundary water body to a particular class will be a joint decision by the Parties and will include consideration of Indigenous peoples' traditional uses in whose territory the classified Transboundary Waters are located.

Figure 1: Risk Informed Management Approach

The nature and intensity of Bilateral Management and Jurisdictional Water Management increase from Class 1 to Class 3 (varying levels of learning, Transboundary Objective-setting, monitoring, etc.).

Class 4 occurs when Transboundary Objectives are not met, indicating that the Ecological Integrity of the Aquatic Ecosystem may not be being maintained.

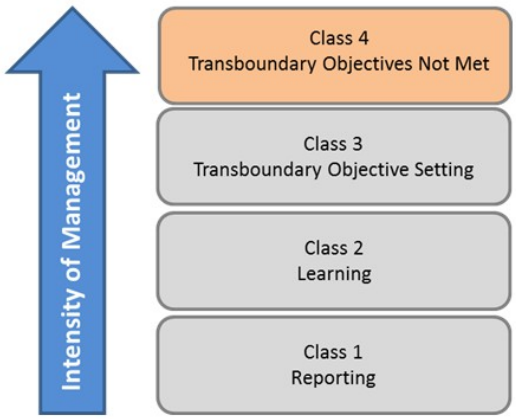

Table 1 provides a high-level summary of the four classes, including key commitments at each class, and some considerations for classification. To improve the transparency and consistency of classification, the appendices of each Bilateral Water Management Agreement may contain more specific criteria and representative conditions that correspond to each class. However, the Parties recognize the need to retain flexibility in the future, as it will be impossible to identify every possible consideration.

In general, as described in Table 1, water bodies with no or very low development/use are class 1. At class 1, it is expected that the Jurisdictional Water Management practices of each Party will be sufficient to meet transboundary commitments. Other than reporting, no Bilateral Water Management actions are required in this class. As warranted by increased development/use and other factors, Transboundary Waters will be moved to higher classes, where Bilateral Water Management actions are identified to complement Jurisdictional Water Management practices.

Some level of current or planned development/use is necessary for a water body to move from class 1 to class 2, but there is no single threshold of development/use that causes a water body to move to class 2 or
3. To move from a class 1 to 2 or from class 2 to 3, the level of development/use is considered along with other factors to classify water bodies using a risk-informed approach. Other factors beyond development levels that may influence the assignment of a water body to class 2 or class 3 include, but are not limited to:

- Natural or other anthropogenic stressors or vulnerabilities;
- Sensitive water or ecosystem uses (e.g., traditional uses, drinking waters, heritage sites or parks);
- Use conflicts or controversy;
- Water quality and quantity conditions or trends; and

- Aquatic Ecosystem (e.g., biological, human health or traditional use) conditions or trends.

In other words, a water body that is stressed or vulnerable (e.g., low winter flows, etc.), supports sensitive uses (e.g., traditional use, drinking water, etc.), experiences water use conflicts (e.g., conflicts among users or public controversy about water or ecosystem conditions), and/or demonstrates negative conditions or trends in water quality, water quantity or Aquatic Ecosystem Indicators, may be moved up in class at a lower level of development/use than a water body that does not.

The intensity of Bilateral Water Management will increase as required to support continued achievement of RIM goals and Transboundary Objectives. At class 2, a Learning Plan tailored to the needs of the water body will be developed. Learning Plans will be developed using an integrated approach, and will address relevant water quality, water quantity, Groundwater and biological considerations.

As part of the Learning Plan, Triggers may be established to support learning, to prepare for setting and assessing the achievement of Transboundary Objectives, and to proactively address any negative trends. Triggers are defined in the Agreement as specific conditions defined by the Parties that will require a Jurisdictional and/or Bilateral Water Management response. More specifically, in the context of RIM, a Trigger is a pre-defined early warning of change in typical or extreme conditions that results in confirmation of the change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary, for example, if there are degrading conditions, and Triggers can be set for class 2 and 3 Transboundary Waters. At class 2, Triggers may be established as part of the Learning Plans to initiate various kinds of management oversight or action (e.g., set a Transboundary Objective).

At class 3, Transboundary Objectives will be established based on detailed, site-specific analysis. Transboundary Objectives establish conditions that the responsible Party or Parties commit to meet. If the BMC determines that Transboundary Objectives are not met, the water body will be designated class 4, at which point the responsible Party or Parties will identify and implement action as in section 4.3 j) through of the Agreement, with the goal of returning the water body to class 3. The factors that will guide an assessment under 4.3 k) will be determined at the BMC.

Table 1. Transboundary Classes

Class	Key Commitments	Classification Considerations
1 Reporting	Ensure that each Party's Jurisdictional Water Management practices meet transboundary commitments and that its policy/regulatory processes include e a provision to check for transboundary impacts. Report on Developments and Activities and share available information on Aquatic Ecosystems. No additional Bilateral Water Management actions are required.	Examples of Transboundary Waters in this class include those characterized by no or very little existing and projected development.
2 Learning	Initiate a Learning Plan (e.g., issue scoping, monitoring, data analysis, investigations into potential effect pathways) to improve our understanding of the requirements for protecting the Ecological Integrity of the Aquatic Ecosystem. A Learning Plan will include the compilation and review of existing data and information and, if necessary, the collection of additional baseline data. The Learning Plan will form the basis for the setting of Transboundary Objectives, should they be required. As part of the Learning Plan, Triggers may be established to initiate various kinds of management oversight or action.	Examples of Transboundary Waters in this class include water bodies with a moderate level of existing and/or projected development. Water bodies that are stressed or vulnerable (e.g., low winter base flows), support sensitive uses (e.g., traditional uses, drinking water supply, etc.), experience a high degree of conflict or controversy, and/or demonstrate negative conditions or trends may be moved to class 2 at a lower level of development/use than other water bodies.
3 Objective Setting	Set objectives or firm conditions that the responsible Party or Parties will meet. Initiate intensive Bilateral Water Management to address specific issues. Conduct site-specific analyses where needed to assess the needs for protecting the Ecological Integrity of the Aquatic Ecosystem and to establish Triggers and Transboundary Objectives. Establish joint and/or jurisdictional monitoring programs and investigations. A jurisdiction may prepare action plans to outline how they will ensure that Transboundary Objectives are met.	Examples of Transboundary Waters in this class include water bodies with either high levels of development, or a combination of moderate development with natural vulnerabilities, sensitive uses, use conflicts or controversy and/or negative conditions or trends. As indicated above, some water bodies may move to class 3 at lower levels of development/use than other water bodies.

4 Objectives not met	Initiate immediate action in support of meeting the Transboundary Objective, and report progress on an agreed schedule. Additional action can follow to consider alternative ways to address the situation, such as adjusting a Transboundary Objective. The terms in section 4.3 j) through n) of the Agreement apply.	The intent of the RIM approach is to prevent any water body from moving to this class. Water bodies in this class have failed to meet Transboundary Objectives and the Ecological Integrity of the Aquatic Ecosystem may not be being maintained. The responsible Party or Parties must undertake Jurisdictional Water Management action in support of meeting Transboundary Objectives. The responsible Party will consult the other Party, but retain the right to select which actions are implemented in its jurisdiction. Either Party may request the consideration of alternative ways to address the situation. The Parties will establish an agreed timeframe to implement Jurisdictional Water Management action.

A3. Bilateral Water Management Actions

Bilateral Water Management actions that could apply at the different classes or under different conditions are documented in the appendices or will be developed by the BMC. The intent is to provide sufficient documentation to ensure that action occurs when warranted, while giving the Parties flexibility to choose which actions are most appropriate given the actual conditions and priorities and updated information and knowledge.

Key guidelines for the selection of Bilateral Water Management actions include:

- Bilateral Water Management actions will be designed and implemented at a level of detail and rigor commensurate with the assigned class. Water bodies in class 1 would require less management actions than other classes (e.g., class 1 water bodies would report on Development and Activities and share available information on Aquatic Ecosystems). Class 2 water bodies would require more detailed management actions (e.g., initiation of Learning Plans, which would include monitoring, review of existing data and information, and potentially establishing Triggers). Class 3 water bodies require more intensive management actions (e.g., setting Transboundary Objectives and monitoring to ensure the objectives are being met);
- The Parties will jointly decide on Bilateral Water Management actions;
- There may be both Jurisdictional Water Management actions (actions undertaken by one Party) and/or Bilateral Water Management actions (actions undertaken collaboratively by both Parties);
- There will be both mandatory and optional actions; appendices to the Agreement may define Triggers that require action to be taken, along with an illustrative set of sample actions, while leaving the choice of which specific action to the discretion of the Bilateral Management Committee;
- A diversity of sources of relevant available knowledge, including scientific, local and traditional knowledge, and information from the general public may be considered;
- Bilateral Water Management actions will be designed in recognition of data availability constraints, opportunities and needs (e.g., Transboundary Waters with limited data availability may be subject to different actions than water bodies with more sufficient data).

A4. Annual Transboundary Meeting

The RIM approach includes a mandatory annual meeting of the Parties to discuss transboundary issues. At this meeting the Parties will:

- Share information about the condition of, and trends, in the Ecological Integrity of the Aquatic Ecosystem, including but not limited to hydrological, meteorological, and ecological science, traditional knowledge and input from the general public of either Party;
- Share updated information about current and future Developments and Activities that could affect the Ecological Integrity of the Aquatic Ecosystem of the other Party; and
- Share information about relevant activities, policies and programs (e.g., conservation programs, policy changes that could affect transboundary water management, etc.).

ATTACHMENT B

Based on updated information, the Parties will:

- Jointly determine the classification for Transboundary Waters and update the relevant appendices to this Agreement;
- Jointly develop and/or update Learning Plans, tracking metrics, Triggers, Transboundary Objectives, monitoring and other studies or investigations as required, and update the relevant appendices;
- Review the effectiveness of Bilateral Water Management and Jurisdictional Water Management actions and identify additional or revised actions; and
- Identify any other issues that need to be addressed.

Appendix B – List of Transboundary Waters

A list of Transboundary Waters relevant to this Agreement is provided in Table 2. For this Agreement, Transboundary Waters refers to those within the Liard River sub-basin (see Figure 2). This list does not include Transboundary Groundwater which is described in Appendix F. Transboundary Waters were identified using 1:50,000 National Topographical System (NTS) map available from Natural Resources Canada. The Transboundary Waters included on the map have been included on the list. If development or water use occurs on Transboundary Waters that are not listed in Table 2, the water body will be added at the direction of the BMC. All Transboundary Waters with current or projected (1-5 years) development or use must be listed.

Table 2. List of YT-NWT Liard River sub-basin Transboundary Waters

No.	Water Body Crossing the diagonal boundary	Flow Direction	Latitude North, Longitude West	Area (km²)
1	Stream1 tributary to Liard River	YT to NWT	60.044, -123.917	24.4
2	Stream2 tributary to Liard River	YT to NWT	60.036, -123.896	1.55
3	Stream3 tributary to Liard River	YT to NWT	60.021, -123.861	9.22
4	Stream4 tributary to Liard River	YT to NWT	60.013, -123.839	11.3

Note: Table 2 is sorted north to south by latitude and west to east by longitude. The approximate area in the upstream jurisdiction that contributes water to the boundary crossing may be provided. N/A indicates the drainage area upstream of the boundary crossing has yet to be determined.

ATTACHMENT B

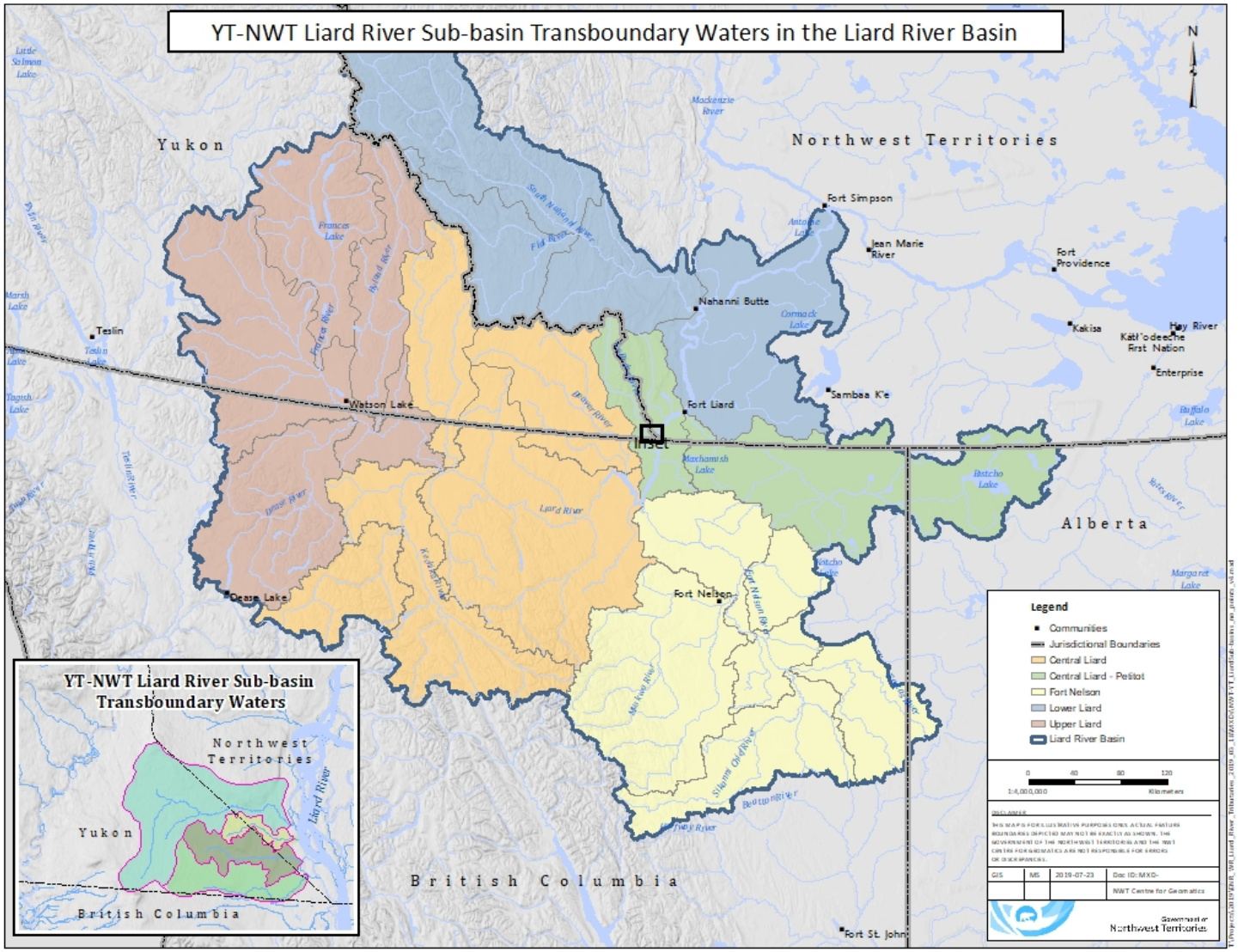

Figure 2. Yukon-NWT Liard River Sub-basin Transboundary Waters.

Appendix C – Use of Traditional and Local Knowledge

The Master Agreement acknowledges the need to consider traditional knowledge in cooperative water management decisions within the Basin. Traditional knowledge and local knowledge are not capitalized in this Agreement or appendices because they are not currently defined herein. Traditional and local knowledge will be defined as per the practices in section C1 below. Traditional and local knowledge are of critical importance to many Indigenous and/or local communities. When peer reviewed by knowledge holders, traditional knowledge and local knowledge contribute to a greater understanding and more comprehensive analysis of the environment. Traditional knowledge has been considered as evidence under Canadian law.

The following practices will guide the meaningful inclusion of traditional and local knowledge under the RIM approach in Bilateral Water Management (as per the Agreement and appendices). This guidance is adapted from the Board's Traditional Knowledge & Strengthening Partnerships Committee and other published sources. The Parties see this appendix as a living document that will be informed by the future work of numerous parties, including the Parties, the Board, Indigenous governments and organizations, and academics.

C1. Practices for the Use of Traditional and Local Knowledge in Bilateral Water Management

1. Acknowledge the value of traditional and local knowledge and the importance of traditional use;
2. Engage in dialogue and collaborative pursuits to better understand the basis, scope, and meanings of traditional and local knowledge and traditional use;
3. Identify the conclusions reached by the Parties regarding traditional and local knowledge;
4. Identify and implement ways to synthesize and blend traditional and local knowledge, western science and other forms of knowledge in decision-making under the RIM approach in Bilateral Water Management;
5. Establish and apply agreed definitions of traditional and local knowledge and traditional use with knowledge holders.
6. When requested by knowledge holders, ensure that the Parties protect sensitive traditional and local knowledge within the limits of a Party's applicable legislation, including;
   (a) Ensuring knowledge holders provide their informed consent for the use of their traditional and local knowledge;
   (b) Where consent is not given, respecting knowledge holders ownership and control of their traditional and local knowledge;
7. Where they exist, adhere to Party and Indigenous community guidelines, policies or protocols regarding the collection and use of traditional and local knowledge, including:
   (a) Culturally appropriate methods of engaging with traditional and local knowledge holders when gathering knowledge;
   (b) Culturally appropriate methods of presenting traditional and local knowledge;
   (c) Culturally appropriate methods of presenting western science information related to Bilateral Water Management;
   (d) Providing reasonable benefits (e.g., cost reimbursement for participation) when working with traditional and local knowledge holders;
   (e) Following formal research licensing guidelines.

C2. Framework

The BMC will develop a framework toward meaningful inclusion of traditional and local knowledge in decision making related to Bilateral Water Management. In addition, the framework will include how Indigenous governments and organizations will be involved in monitoring and research within their territory.

Appendix D – Surface Water Quantity

D1. Surface Water Quantity Classification

All Transboundary Waters listed in Table 2 of Appendix B are classified as class 1 for surface water quantity. Classification was based on known water uses and available water. Classification of Transboundary Waters will be reviewed at least annually by the BMC.

The BMC will work to develop a reproducible approach to classification of Transboundary Waters that meets both Parties' interests for water quantity, and that includes consideration of traditional uses. The BMC will begin this work by reviewing relevant risk assessment and other water management tools (e.g., BC Oil & Gas Commission's North East Water Tool: Flow Risk Management Framework for North East).

Factors to be considered in the development of a reproducible approach to classification of Transboundary Waters for surface water quantity include, but are not limited to, the sensitivity of fish species and aquatic habitats, the seasonal flow fluctuations (e.g., winter and summer low flows and spring-summer floods), statistical probabilities of extreme flow rates (e.g., flood and drought risks), the average recorded flow rate (e.g., mean monthly flows), stream size (e.g., as a function of long term mean annual discharge), the annual totals of allocated withdrawals and, when required, the estimation of consumption and return flows.

In accordance with the RIM approach, monitoring will be initiated if and when required.

D2. Learning Plans

A Learning Plan (Appendix H1) is required for class 2 Transboundary Waters. The Learning Plan provides additional information to confirm or alter the assigned classification and contribute to baseline information for Transboundary Waters.

As part of the Learning Plan, ratios of allocated withdrawals (or of actual consumption) to stream flow will be tracked on an instantaneous, daily, weekly, monthly or annual basis in support of the future development of Triggers and Transboundary Water Quantity Objectives, as required. Tracking metrics in water quantity conditions will include the tracking of stream flow and amount of water allocated for various uses. Learning Plans should help to understand baseline water quantity and reflect the seasonal site-specific characteristics of each water body. This information will be used to aid with evaluation of whether a Transboundary Water should change RIM classification.

D3. Approach to Setting Transboundary Water Quantity Triggers

As described in Appendix A, a Trigger is a pre-defined early warning of change that results in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary, for example, if there are degrading conditions. For water quantity, the Parties have defined a Trigger as a percentage of the Available Water (e.g., <50%) that, if exceeded, results in Jurisdictional and/or

Bilateral Water Management that will be determined by the BMC.

Triggers may be set for class 2 Transboundary Waters and will be set for class 3 Transboundary Waters according to the RIM approach. The BMC will determine the best monitoring location to calculate the amount of Available Water being passed from the upstream jurisdiction to the downstream jurisdiction, taking into consideration both the upstream and the downstream watersheds as part of its assessment.

D4. Approach to Setting Transboundary Water Quantity Objectives

Available Water will be shared as per section 6.1 c) of the Agreement and the sharing will be formalized into a Transboundary Water Quantity Objective if the relevant Transboundary Water reaches class 3.

The setting of Transboundary Water Quantity Objectives requires site-specific knowledge of stream flow and Available Water. Long-term continuous monitoring of stream flow is important to characterize hydrology of a water body and to estimate Available Water. This will allow for more site-specific information to be considered when evaluating maintenance of the Ecological Integrity of the Aquatic Ecosystem.

For class 3 Transboundary Waters, the BMC will set Transboundary Water Quantity Objectives and identify, based on the best available scientific information and/or a desktop or other office-based method and/or an instream flow needs study, the amount of water needed to maintain the Ecological Integrity of the Aquatic Ecosystem and hence, the Available Water.

When setting Transboundary Water Quantity Objectives for class 3 Transboundary Waters, the amount of Available Water passing from the upstream jurisdiction will be calculated at a location determined by the BMC. The BMC will take a watershed approach in determining the location of monitoring stations.

D5. Water Quantity Objectives for Class 3 Water Bodies

At time of signing, no Transboundary Waters were designated as class 3, therefore, no Transboundary Water Quantity Objectives were set.

Transboundary Water Quantity Objectives will be set so that the determined sum of the needs for maintaining the Ecological Integrity of the Aquatic Ecosystem protects the most sensitive use/user of the water body which includes:

- Drinking water sources;
- Traditional uses;
- Aquatic life;
- Wildlife; and
- Recreation and aesthetics.

Transboundary Water Quantity Objectives will be set by the BMC as required using an agreed upon desktop methodology or instream flow needs study.

D6. Water Quantity Conditions and Actions

Table 4 outlines some of the required responses to certain water quantity conditions that may arise in Transboundary Waters. This list was not exhaustive at the time of signing and will be amended through the BMC.

Table 4. Water Quantity Conditions and Associated Actions[1]

Water Quantity Condition	Required Response	Sample Actions / Comments
• Development and/or water use occurs in a Transboundary Water not listed in Appendix B	• The Transboundary Water will be added to the list in Appendix B. • The Transboundary Water is classified.	• Licences and other authorized withdrawals are tracked.
• Transboundary Water is designated as a class 2	• Learning Plan is developed and implemented. • Tracking metrics are determined. • Triggers may be developed. • Amounts of withdrawals and return flows are estimated.	• Compile baseline data and assess need for new information. • Track ratios of licences and other authorized withdrawals to stream flow. • Improve understanding of Aquatic Ecosystem. • Prepare for the setting of Transboundary Water Quantity Objectives, if required.
• A drought (or flood) event occurs in any classified Transboundary Water	• Notify other jurisdiction of event and identify any actions that will be taken immediately or if event persists.	• If required, assess impact to water quality, Groundwater and biological components of the Aquatic Ecosystem. • Determine whether a Trigger or Transboundary Water Quantity Objective (if applicable) has been reached. • Suspend uses as required to maintain Aquatic Ecosystem health • During hydrological drought conditions, after all reasonable conservation measures have been implemented and where inflows continue to decline, BMC will seek an appropriate balance among basic human needs (i.e. water for drinking, food preparation, and sanitation; water for animals or poultry that are kept for household use or as pets; and water for fire protection) and other ecosystem needs.

[1] This table includes examples of conditions and potential responses/actions. Further detail on the type of actions that will be taken will be developed by the BMC.

Water Quantity Condition	Required Response	Sample Actions / Comments
• Transboundary Water is designated as a class 3	• Track actual withdrawals. • Develop Triggers and set Transboundary Water Quantity Objectives based on an agreed desktop or other office-based method or an instream flow needs study.	• Assess need to conduct instream flow needs study.
• Total allocated water (licences and other authorized withdrawals) in upstream jurisdiction exceeds Trigger	• The BMC will seek confirmation of actual withdrawals and estimated return flows.	• Refine estimate of return flows.
• Actual water consumption exceeds Trigger (approaches Transboundary Water Quantity Objective)	• If Transboundary Water Quantity Objectives have not been set using an instream flow needs study, revise Trigger and/or Transboundary Water Quantity Objectives based on a refined desktop or other office-based method or proceed with the determination of the Available Water through an instream flow needs study.	• Jurisdictional Water Management
• Actual water consumption exceeds Transboundary Water Quantity Objective	• Clauses in sections 4.3 j) through n) of the Agreement apply. • Transboundary Water may be designated a class 4	• Class 4 Jurisdictional Water Management actions, if designated.

Appendix E – Surface Water Quality

E1. Surface Water Quality Classification

All Transboundary Waters listed in Table 2 of Appendix B are classified as class 1 for surface water quality. This classification was agreed based on a discussion of preliminary criteria by each Party. Classification of Transboundary Waters will be reviewed at least annually by the BMC.

The Parties agree that a reproducible approach for classification of Transboundary Waters is warranted. The BMC will work to develop a reproducible approach that meets both Parties' interests, and that includes consideration of traditional uses. The BMC will begin this work by reviewing the existing draft *Water Quality Ranking System to Classify Transboundary Water Bodies* provided by BC and the draft *Receiving Water Classification System for the NWT* provided by the NWT. Other relevant approaches will also be considered.

In accordance with the RIM approach, water quality monitoring will be initiated if and when required.

E2. Learning Plans

A Learning Plan is required for class 2 Transboundary Waters (see Appendix H1). The Learning Plan provides additional information to confirm the assigned classification and contribute to baseline information for Transboundary Waters.

The Learning Plan will include a screening level risk assessment which may incorporate a monitoring strategy, dependent upon the availability of information, and the level of risk to ecological (which includes biological/human) receptors. A key objective of the Learning Plan will be to evaluate the current and projected level of risk posed to water quality, quantity, biology and the Aquatic Ecosystem. This will involve the review of all available relevant watershed information (e.g., land and water use, ongoing and proposed resource development, existing water quality, quantity, biological Indicators data, and traditional use values) and the preparation of a conceptual model that describes the:

- Point and non-point source discharges;
- Parameters of concern and their environmental fate and transport pathways; and
- Human, biological and ecological receptors.

Tracking metrics will be developed for class 2 Transboundary Waters to enhance learning. Tracking metrics are for information, assessment and learning purposes. Tracking metrics will be developed using valid methods to help understand baseline water quality, identify changes in water quality conditions, assess the risk of development, and enable the BMC to identify potential provincial/territorial water quality issues. Tracking metrics will also help to identify any new or emerging parameters of concern as well as aid with the evaluation of whether a water body should change RIM classification. If a parameter that is not of concern based on the risk assessment begins to trend, the cause will be investigated and it will be determined if the status of the parameter should be changed to a parameter of concern.

Tracking metrics will be developed by the BMC to reflect the seasonal site-specific characteristics of each water body. The Learning Plan and the information gathered from tracking metrics will be useful to support the development of Triggers and Transboundary Water Quality Objectives (Appendix E3 and E5), as required (see Appendix H1).

E3. Approach to Setting Water Quality Triggers

As described in Appendix A, a Trigger is a pre-defined early warning of change in typical or extreme conditions that results in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary (e.g. to address degrading conditions). For water quality, Triggers may be set for the parameters of concern and human, biological, and ecological indicators at class 2 but will be set at class 3. The methodology for developing Triggers will be discussed as part of the Learning Plan by the BMC. Traditional knowledge and traditional use will be included in the derivation of Triggers.

Triggers will be set for the water quality parameters that have been identified through a Learning Plan.

Table 6. Definitions, examples and potential management actions for Triggers that will be set for water quality parameters of concern as identified through the Learning Plan[2].

	Definition	Examples	Potential Management Actions
Trigger 1	Trigger 1 is a pre- defined early warning of potential changes in typical conditions which results in Jurisdictional and/or Bilateral Water Management to confirm that change. Multiple Triggers can be set to invoke additional actions if conditions decline.	Exceedance of a water quality concentration based on background conditions (e.g. 30-day average concentration). Shift in central tendency (e.g., 50th percentile) and/or some other percentile (e.g. 75th). A statistically significant degrading trend in water quality. A change in the dissolved/total ratio. A pre-defined degree of change in land or water use.	Trigger 1 can be used either alone or in conjunction with Trigger 2. Jointly review water quality monitoring data/changes. Confirm the change is real. Jointly investigate cause and risk (i.e. land use change). Investigate other media (hydrometric, sediment and/or biota), as appropriate, to provide supporting evidence.
Trigger 2	Trigger 2 is a second warning indication that extreme conditions are changing which results in Jurisdictional and/or Bilateral Water Management.	A second pre-defined early warning to provide additional information to confirm changes in conditions. For water quality or biological parameters this would be defined statistically (e.g. upper limit of background: 90th percentile or upper prediction limits: 95UPL).	Trigger 2 can be used either alone or in conjunction with Trigger 1. Continue investigation using an ecosystem approach using all available evidence (i.e. weight of evidence approach). Adjust monitoring design (e.g., increase frequency, parameters, and/or sites) as necessary. Compare to upstream, downstream and/or regional sites. Discuss the need to change to class 3.

[2] This table includes examples of conditions and potential responses/actions. Further detail on the type of actions that will be taken will be developed by the BMC.

E4. Water Quality Triggers

To be determined after signing at the appropriate time as per RIM.

E5. Approach to Setting Transboundary Water Quality Objectives

This section describes the general approach to setting Water Quality Objectives.

For class 3 Transboundary Waters, Transboundary Water Quality Objectives will be set for the water quality parameters of concern that have been identified as part of the Learning Plan.

Transboundary Water Quality Objectives will be set to protect the most sensitive use/user of the water body which includes:

- Drinking water sources;
- Traditional uses;
- Aquatic life;
- Wildlife;
- Agriculture (irrigation and livestock watering);
- Recreation and aesthetics; and
- Industrial water supplies including food processing.

In setting Transboundary Water Quality Objectives, the Parties will:

- Consider a range of relevant methods;
- Select methods that are credible and transparent;
- Utilize relevant science and traditional and local knowledge;
- Ensure that methods and resulting Transboundary Water Quality Objectives are based on a weight- of-evidence approach (including science and traditional knowledge);
- Use best available data and information, and improve / adapt over time;
- Consider the ecological significance of trends in water quality and quantity;
- Design Transboundary Water Quality Objectives to protect all uses, including traditional uses;
- For the protection of aquatic life, design Transboundary Water Quality Objectives to protect the most sensitive species at all life stages;
- Consider the potential for synergistic and cumulative effects from multiple sources and parameters;
- Recognize each Party's right to use water and equitably share the assimilative capacity;
- Recognize the terms of land claims agreements, which the Parties have reviewed and understood; and
- Meaningfully engage other interested third parties and bring their input to the BMC.

The Parties agree that the approach to develop and implement Transboundary Water Quality Objectives requires further discussion and resources (Table 7). This will be discussed at the BMC, within 3 years of the Agreement being signed, unless land development significantly increases within this time period, and the BMC agrees to engage on development of methodology sooner.

Table 7. Definitions, examples and potential management actions for Transboundary Water Quality Objectives that will be set for water quality parameters of concern identified as part of the Learning Plan.

	Definition	Examples	Potential Management Actions
Objective	A Transboundary Water Quality Objective is a conservative value that is protective of all uses of the water body, including the most sensitive use. Exceedance of Transboundary Water Quality Objectives may represent unacceptable change and result in Jurisdictional and/or Bilateral Water Management to stop trend and/or exceedance(s).	A defined numerical value, agreed to by both Parties through the BMC;	Relevant jurisdiction takes necessary Jurisdictional Water Management action to stop trend and/or exceedance(s).
		A narrative statement describing the biological characteristics of the ecosystem e.g., fish abundance.	Exceedance of a Transboundary Water Quality Objective may move the water body from a class 3 to a class 4.

E6. Toxic, Bioaccumulative and Persistent Substances

As per Section 7d) of the Agreement, the Parties are committed to pollution prevention and sustainable development to meet the objective of the virtual elimination for substances that are human-made, toxic, bioaccumulative and persistent[3]. Virtual elimination refers to reducing, in the medium to long-term, the concentration of designated substances to levels below or at the limits of measurable concentrations.

If and when warranted, and as part of the Learning Plan, the BMC will assess the risks associated with these substances and determine monitoring efforts commensurate with that level of risk according to RIM.

It is recognized that future anthropogenic activities in the basin might pose a risk of releasing these

[3] The substances subject to virtual elimination were designated by the Federal Departments of Health[(A)]) and Environment and Climate Change[(B)] as well as the Stockholm Convention,[(C)] of which Canada is a signatory. At the time of signing, the current list included: Aldrin, Chlordane, Dieldrin, Endosulfan, Endrin, Heptachlor, Hexachlorobenzene, Hexachlorobutadiene, Hexachlorcyclohexane (HCH; alpha, beta, gamma), Mirex, DDD, DDE, DDT, Toxaphene, PCBs, Pentachlorobenzene, Dioxins and Furans, Chlordecone, Heptabromodiphenyl ether (Hepta-BDE), Hexabromobiphenyl (HBB), Hexabromobiphenyl ether (Hexa BDE), Octachlorostyrene, Pentabromodiphenyl ether (Penta-BDE), Perfluorooctane sulfonate and Tetrabromodiphenyl ether (Tetra-BDE). The Parties will periodically review and update the list accordingly.

(A) Health Canada; Pest Management Policy: virtual elimination of Track 1 substances (1999) (https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/policies-guidelines/regulatory-directive/1999/strategy-implementing-toxic-substances-management-policy-dir99-03.html)

(B) Environment and Climate Change Canada: virtual elimination list (2009) (https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/substances-list/virtual-elimination-list/updated-february-4-2009.html)

(C) Stockholm Convention: chemicals targeted for virtual elimination (2004) (http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx)

substances in the basin. The Parties will promote the use of safer chemical substances by supporting technologies that reduce or eliminate the use and release of substances that have been deemed toxic, bioaccumulative and persistent.

Appendix F – Groundwater

F1. Classification of Transboundary Groundwater

Hydrogeological information to delineate Transboundary Groundwater in the NWT-YT border region is scarce and most of the aquifers in this area are not defined or mapped. As an interim approach, surface watershed boundaries for the NWT-YT Liard sub-Basin Transboundary Waters listed in Table 2 are to be used as a surrogate for delineating Transboundary Groundwater. This surrogate is referred to as a groundwater area (Figure 23, which will be used until more information is available and aquifers are mapped.

Groundwater areas provide an area-based framework for data collection and synthesis and identification of key information gaps. It was assumed that topographic slope reflects shallow Groundwater flow directions and that surface sub-basins generally reflect Groundwater flow patterns within the smaller discrete sub-watershed units in order to facilitate management and investigations of Groundwater.

However, it is presumed and acknowledged that the aquifers and/or aquifer systems underlying the NWT-YT Liard sub-Basin Transboundary Waters extend beyond the surrogate groundwater area. Therefore, because of the proximity of the Liard sub-Basin groundwater areas in the BC-NWT and BC-YT Agreements, information on these groundwater areas will be shared between the NWT and YT for the BMC to consider: a) if the extent of the NWT-YT groundwater area should be revised; and/or b) if the RIM class of the NWT-YT groundwater area (Table 9) should be revised. Currently, the groundwater area is classified as class 1 based on Groundwater quality and quantity.

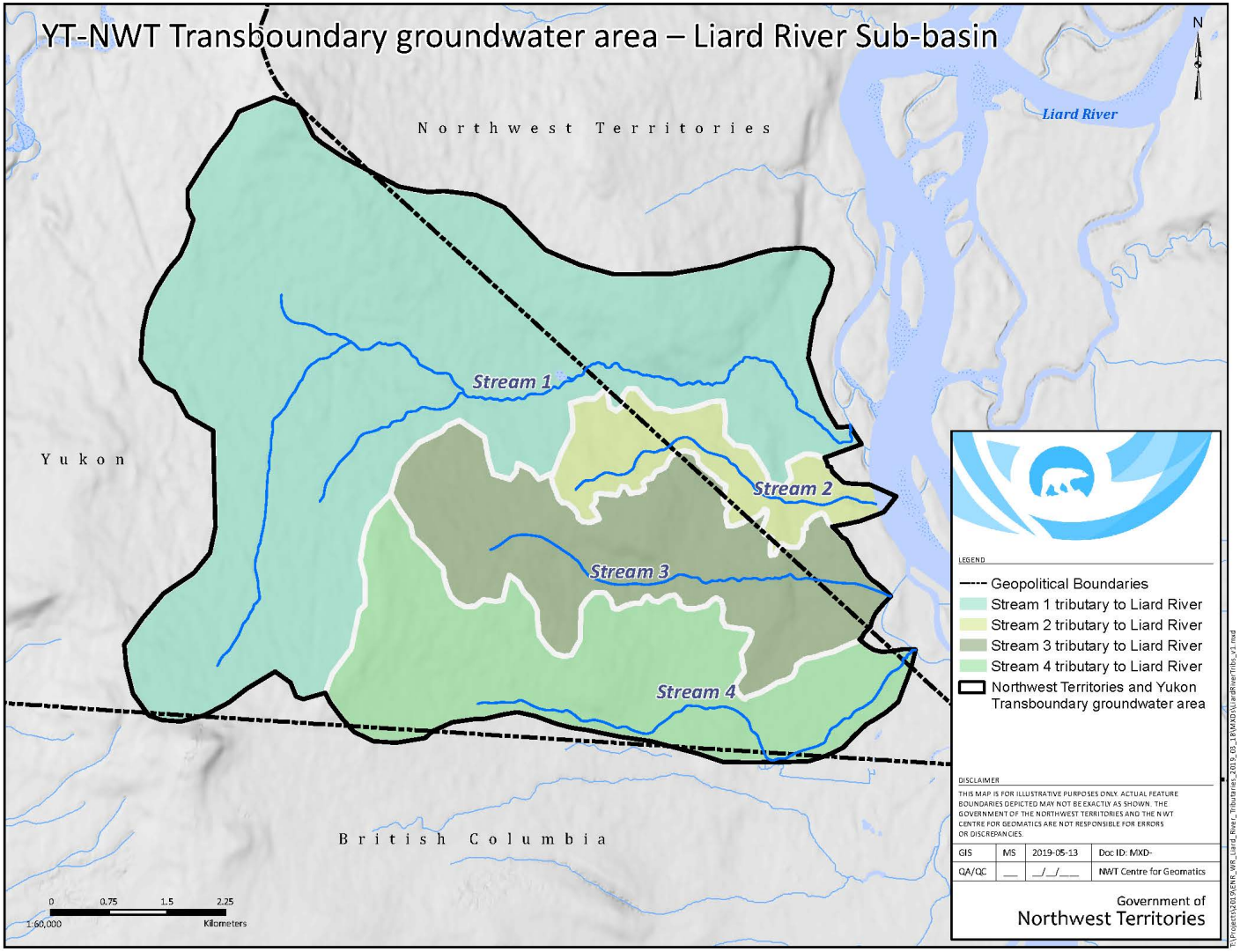

Figure 3. YT-NWT Transboundary Groundwater Area – Liard River Sub-basin

Table 9. Classification of Transboundary Groundwater Areas

Groundwater area	RIM Class - Quality	RIM Class - Quantity	Rationale/Comments
NWT-YT Liard Sub-Basin Transboundary Waters	1	1	**Groundwater Quality:** Information on the intrinsic vulnerability and risk from development are insufficient; however, no oil and gas wells exist within this area. Therefore, the Parties agree to classify a groundwater unit as a class 1. **Groundwater Quantity:** Available information such as well density and knowledge of water use indicate a low demand; therefore, the Parties agree to classify the groundwater unit as a class 1.

The BMC will work to develop a reproducible approach for classification of Transboundary Groundwater that meets both Parties' interests. The BMC will begin this work by reviewing relevant risk assessment tools (e.g., *The British Columbia, Yukon and Northwest Territories Trans-boundary Groundwater Area Classification Scheme*, a modified version of the BC Aquifer Classification System, produced by British Columbia). The method will improve over time as more data are collected.

Factors to be considered in the development of a reproducible approach to classification of Transboundary Groundwater include, but are not limited to, Groundwater quality, Groundwater quantity, domestic well density, community wells, irrigation and other large production wells, water source wells, surficial geology, hydrogeologic and subsurface geology data, land use (including assessment of risk from hydraulic fracturing and deep water injection, etc.).

F2. Learning Plans

Learning Plans are initiated for class 2 Transboundary Groundwater, where there is some concern that current conditions or predicted conditions resulting from a proposed land use will pose a risk to Groundwater quality and/or quantity and associated aquatic resources. Learning Plans provide additional information needed to confirm or alter the assigned classification and contribute to the baseline information for a Transboundary Groundwater.

A Learning Plan will provide a screening level risk assessment which may include an assessment and monitoring strategy, dependent upon the availability of information, and the level of risk to receptors. A key objective of the Learning Plan will be to evaluate the current level of risk posed to Groundwater quantity and/or quality and the Aquatic Ecosystem. This will involve the review of available relevant information (e.g., land use, ongoing and proposed resource development, water quality, biological Indicators data where applicable, etc.) and the preparation of a conceptual model that describes the:

- Sources of point and non-point discharges and substances of concern;
- Environmental fate and transport pathways for these substances; and
- Human, biological and ecological receptors (including traditional use values where appropriate).

As part of the Learning Plan, surficial and subsurface geological mapping to outline the physical structure and extent of the different rock and soil units that cover the Transboundary Groundwater may be conducted. This could include an assessment of local surficial and bedrock geology, including stratigraphy, depth, thickness, composition, water-bearing potential and lateral continuity.

As part of the Learning Plan, tracking metrics will be developed to help understand baseline Groundwater quality and quantity. These tracking metrics will be used to aid with evaluation of whether a water body should change RIM classification.

F3. Triggers and Objectives

The Parties will work towards preventing, better understanding and, potentially, resolving Transboundary Groundwater issues.

Triggers, Transboundary Groundwater Objectives and Jurisdictional or Bilateral Water Management actions will be determined at the BMC after signing. A Trigger is a pre-defined early warning of change that results in confirmation of the change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary, for example, if there are degrading conditions. A Transboundary Groundwater Objective identifies a change in conditions that, if exceeded, results in Bilateral Water Management. Methods to develop Transboundary Groundwater Objectives for both quantity and quality will be discussed at the BMC. Transboundary Groundwater Objectives will be set for class 3 Groundwater areas in accordance with the RIM approach. Transboundary Groundwater Objectives for quantity will be based on the equitable sharing of the sustainable yield of Transboundary Groundwater.

Conditions that could be used to assess if a Transboundary Groundwater should be reclassified are included, but not limited to, the quantity and quality sections below. These will be further developed by the BMC.

F3.1 Quantity

- Temporal (and statistically significant) change in Groundwater level, at an established monitoring location, in a Transboundary Groundwater;
- Impact to sensitive water body or wetland as demonstrated by water level changes;
- Decrease in base flow at a hydrometric station;
- Decreasing well supplies due to overall Groundwater level decline;
- Accuracy of modeled versus measured conditions in established monitoring wells; and
- Change in Developments and Activities.

F3.2 Quality

- A significant trend in Groundwater quality indicating a general degradation in quality;
- Occurrence of specific contaminants at levels above background at monitoring stations;
- Groundwater quality results indicating that health-related maximum acceptable concentration(s) have been exceeded or treatment limits for aesthetic parameters have been exceeded; and

ATTACHMENT B

- Change in Developments and Activities.

Appendix G – Biological

G1. Classification

The Parties agreed not to classify water bodies based on the biological component at this time. Biological considerations have been integrated into the Learning Plans for class 2 Transboundary Waters. The need for separate classification based on the biological component for Class 2 Transboundary Waters will be re-assessed by the BMC.

The Parties agree that biological monitoring is not dependent on a change in water quality and/or water quantity and will be considered separately for the following reasons:

- Considering that biota are sensitive Indicators, biological monitoring can be used as an early warning that a change in the environment is occurring, which allows for an adaptive response;
- Biota can be affected by factors other than the quality or quantity of water such as cumulative effects, climate change, and loss of habitat or habitat degradation which can affect access, cover, substrate and food;
- The presence of exotic species cannot be detected through water quality or quantity monitoring; and
- Contaminants can cause harm to aquatic life or pose a health hazard, such as to people eating fish well before contaminant concentrations in water indicate there is a problem.

G2. Learning Plans

The biological component is incorporated into section H1 of Appendix H: Surface Water Learning Plan. Class 2 Transboundary Waters must have Learning Plans that include a biological component.

As part of the Learning Plan, biological Indicators will be discussed at the BMC. A biological Indicator is a species, community or biological process used to provide qualitative and/or quantitative information on the state of the Ecological Integrity of the Aquatic Ecosystem and how it changes over time.

G3. Biological Monitoring and Indicators

Biological Indicators are used to track the status/conditions of living organisms in order to inform Bilateral Water Management, primarily the setting of Transboundary Objectives. Monitoring biological Indicators (e.g. plants, invertebrates, fish) provides complementary information to physical and chemical monitoring programs to assess ecosystem health with respect to the cumulative effects of multiple substances, water withdrawals, climate change and habitat alteration. It can also provide an early warning of change or stress in the aquatic environment. The early warning allows for a proactive and adaptive response to ensure the protection of all uses and to ensure the protection of the health of aquatic organisms, wildlife and humans. In determining appropriate biological Indicators and developing biological monitoring programs, the Parties will apply the following guidelines:

- Biological Indicators will be identified through the use of conceptual models developed for a

water body as part of a Learning Plan;

- The selection of biological Indicators and intensity of monitoring will be guided by site-specific needs and commensurate with the nature and intensity of the risks;
- Biological Indicators apply to all components (i.e., water quality, quantity and Groundwater) and will be used to track conditions and/or monitor Transboundary Objectives for other components where appropriate;
- Biological Indicators will employ the use of statistical methods to identify when Triggers are moving outside of natural variability and/or reference sites; the management framework described in Appendix E3 will apply to biological Indicators identified through the Learning Plan and/or adopted as Transboundary Biological Objectives; and
- Methods that will be explored by the BMC for the monitoring of biological Indicators may include, but are not limited to:
    - Comparison to historical tissue metal concentrations, nutrients and organic compounds and guidelines for large or small bodied fish and benthic invertebrates;
    - Presence/absence of fish compared to historical accounts for large and small bodied fish;
    - Hepatosomatic Index (HSI) and Gonadosomatic Index (GSI), weight at age, condition of fish for large bodied fish;
    - Critical effects size; and
    - Benthic invertebrate bio-monitoring (e.g., CABIN protocol, BACI design).

Tracking metrics will be developed as part of the Learning Plan.

Triggers will be identified through Learning Plans. A Trigger is a pre-defined early warning of change in typical or extreme conditions that result in confirmation of change and Jurisdictional and/or Bilateral Water Management to address the change/trend. Multiple Triggers can be set to invoke additional actions as necessary, for example, if there are degrading conditions.

G4. Transboundary Biological Objectives

Transboundary Biological Objectives may be established for class 3 water bodies in the future as deemed necessary and appropriate by the BMC. Transboundary Biological Objectives would have specific associated management actions. The development of Transboundary Biological Objectives will be informed by biological monitoring programs, with different associated management actions. There are many international examples of the use of Biological Objectives. These would be reviewed by the BMC as needed.

Appendix H - Learning Plans

H1. Surface Water and Groundwater Learning Plan

This appendix provides a draft Surface Water and Groundwater Learning Plan table of contents for typical class 2 Transboundary Waters. This table of contents is not exhaustive. The BMC will jointly decide where to place effort on a case-by-case basis. The Surface Water and Groundwater Learning Plans will be developed in conjunction with other components to ensure an overall ecosystem approach. Traditional knowledge and use information will be considered in every aspect of the Learning Plan.

1.0 Watershed Profile
- 1.1 Introduction
  - 1.1.1 Climate
  - 1.1.2 Topography
  - 1.1.3 Geomorphology and soils
  - 1.1.4 Geology
  - 1.1.5 Permafrost characteristics (ground temperature, ground ice content, and active layer thickness) and distribution
  - 1.1.6 Aquifer delineation and groundwater flow direction
  - 1.1.7 Vegetation
  - 1.1.8 History
- 1.2 Current and proposed Developments and Activities (agriculture, forestry, urban and rural population distribution, infrastructure, resource extraction, and industries)
- 1.3 Recent and projected climate change (temperature and precipitation)

2.0 Water Uses
- 2.1 Water licences, water wells inventory and other authorized water withdrawals
- 2.2 Traditional/cultural use
- 2.3 Aquatic ecosystem and wildlife
- 2.4 Tourism and recreation
- 2.5 Community water supplies
- 2.6 Navigation (including barge traffic)
- 2.7 Other designated uses

3.0 Influences on Water Resources
- 3.1 Water licences and other authorized water withdrawals and return flows
- 3.2 Point source discharges
- 3.3 Fisheries (commercial and recreational)
- 3.4 Non-point source loadings
- 3.5 Air emissions (local and long-range transport of atmospheric pollutants)
- 3.6 Climate change
- 3.7 Cumulative effects
- 3.8 Future developments
- 3.9 Other (e.g., wildfires)

ATTACHMENT B

4.0 Ambient Environmental Conditions
- 4.1 Existing traditional knowledge related to aquatic ecological health
- 4.2 Existing water quality conditions (including comparison to water quality guidelines and/or objectives)
- 4.3 Existing sediment quality conditions (including comparison to water quality guidelines and/or objectives)
- 4.4 Hydrology
  - 4.4.1 Regional and basin-wide water quantity
    - 4.4.1.1 Trends in total annual and seasonal flows
  - 4.4.2 Frequency and severity of floods and droughts
    - 4.4.2.1 Trends in flood and drought conditions
  - 4.4.3 Flow and water quality
  - 4.4.4 Flow and biology
  - 4.4.5 Groundwater and surface water interactions
- 4.5 Hydrogeology
  - 4.5.1 Summary of existing data for groundwater quantity and quality
  - 4.5.2 Environmental fate and pathway analysis for variables of concern (identify land and resource use activities and their risks, vulnerable aquifers, etc.)
  - 4.5.3 Knowledge Gap Analysis for Groundwater Quality and Quantity
- 4.6 Aquatic Ecosystem Structure
  - 4.6.1 Aquatic plants
  - 4.6.2 Zooplanktons
  - 4.6.3 Benthic invertebrates
  - 4.6.4 Fish (diversity, abundance, distribution, health, habitat conditions)
  - 4.6.5 Wildlife

5.0 Conceptual Model
- 5.1 Point source waste discharges
- 5.2 Non-point sources of pollution
- 5.3 Parameters of concern
  - 5.3.1 Environmental fate and pathway analysis
  - 5.3.2 Bioaccumulation/biomagnification risk
- 5.4 Receptors
  - 5.4.1 Analysis and rationale for human receptors
  - 5.4.2 Analysis and rationale for biological receptors
  - 5.4.3 Analysis and rationale for ecological receptors
- 5.5 Biological Indicators
  - 5.5.1 Analysis and rationale for biological Indicators

6.0 Receptor Risk Assessment
- 6.1 Risks to water uses
- 6.2 Risks to Aquatic Ecosystem structure and components
- 6.3 Human health
- 6.4 Potential for cumulative effects affecting water quantity or quality
- 6.5 Risks related to climate change

ATTACHMENT B

7.0 Knowledge Gaps

8.0 Monitoring Requirements
- 8.1 Monitoring approaches, procedures, methodology
- 8.2 Monitoring Sites
  - 8.2.1 Water Quality Monitoring Schedule
  - 8.2.2 Biological Indicators Monitoring Schedule
  - 8.2.3 Hydrometric Monitoring
  - 8.2.4 Groundwater Monitoring
  - 8.2.5 Data analysis and reporting
    - 8.2.5.1 Triggers

Appendix I – Monitoring

This appendix describes the commitments of the Parties, subject to sections 1.4 and 13.2 of the Agreement, for both direct Agreement implementation monitoring as well as broader regional and Basin-level monitoring as defined in section 10.2 of the Agreement.

I1. Summary of Commitments

Long-term monitoring is critical to understanding whether significant changes are taking place in the natural environment. Long-term datasets reveal important patterns, which allow trends, cycles, and rare events to be identified. This is particularly important for complex, large systems where signals may be subtle and slow to emerge. Long-term datasets are essential to test hypotheses that may have been overlooked at the time the monitoring was started. With increasing variability in hydrological regimes associated with increasing climatic variability, long-term monitoring is critically important.

Transboundary monitoring includes:

- Stations at which monitoring for Transboundary Objectives will occur;
- Stations that support transboundary management as well as broader regional and Basin-level monitoring network.

As part of the Learning Plans for class 2 Transboundary Waters, the Parties will assess monitoring needs and priorities as well as appropriate locations for monitoring Transboundary Waters with regard to surface water quantity and quality, Groundwater quantity and quality, and biology. They may consider the addition of monitoring for air or human dimensions in the future. In the meantime, the Parties will continue to encourage and support the long-term monitoring conducted by Environment Canada and Mackenzie River Basin jurisdictions (Table 10).

The identification of monitoring stations that may be monitored over the long-term for the Agreement will be based on a scientific and traditional knowledge assessment. Any stations established as per the RIM approach will also form part of the regional and Basin-level monitoring. Monitoring stations in unclassified and class 1 water bodies may be included to provide comparisons to background or reference conditions. In addition, how Indigenous governments and organizations will be involved in monitoring and research within their territory will be discussed.

Table 10 lists the present status of Transboundary Water Quality and Hydrometric Stations in the Liard River basin. The number and location of stations may vary based on available funding and jurisdictional priorities. Parties will communicate any changes to monitoring programs at the BMC.

I2. Joint Monitoring Arrangements

Table 10 lists the present status of hydrometric stations and water quality monitoring sites monitored within the Liard River basin. Some of these stations are or may be monitored through existing hydrometric and water quality agreements in place between the Yukon, the Northwest Territories and the Government of Canada - Department of Environment and Climate Change (ECCC) and other applicable programs.

The applicable agreements include:

- Canada-Yukon Memorandum of Agreement on the Hydrometric Monitoring Program for the Yukon;
- Canada-Yukon Water Quality & Ecosystem Monitoring and Reporting Agreement; and
- Canada-NWT Hydrometric Agreement.

I3. Water Quantity

For this Agreement, surface water quantity is monitored to ensure equitable sharing of Available Water between Parties and to maintain the Ecological Integrity of the Aquatic Ecosystem. To accomplish this, surface water quantity should be monitored on a regional, Basin-wide level and tracked with water withdrawals and return flows, water quality and the biological components in the Aquatic Ecosystem.

There are currently 26 active water quantity stations in the Liard River basin that record and report data in real time (Figure 4; Table 10). Monitoring on the Transboundary Waters will be initiated if and when required as per the RIM approach.

If snow stations are established, they will be added to this Appendix by the BMC after the time of signing.

I4. Water Quality

The primary goals of monitoring Transboundary Waters are to track changes in water quality over time, determine anthropogenic and natural drivers for changes in water quality, and ultimately ensure that water quality is protected for all water uses. While monitoring can help ensure the upstream jurisdiction does not cause unreasonable harm to the Ecological Integrity of the Aquatic Ecosystem in the downstream jurisdiction, monitoring should also be used to demonstrate that the downstream jurisdiction is not causing unreasonable harm as some aquatic resources (e.g., fish) may occur in both jurisdictions.

There are currently 18 active water quality monitoring sites in the Liard River basin (Figure 4; Table 10). Monitoring on the Transboundary Waters will be initiated if and when required as per the RIM approach.

Table 10. Current (2019) Status of Water Quality and Hydrometric Monitoring Stations in the Liard River basin.

				Water Quality Monitoring Sites				Hydrometric Stations		
Site/Station Name	**Lat**	**Long**	**Jur**	**Site #**	**Funder**	**Freq**	**Period of Record**	**Station #**	**Funder**	**Period of Record**
Beaver River below Whitefish River	60.131	-124.889	YT	BEVR-001	YT	3-4X/yr	2014-2018	YT10BD001	FED-YT	1997-1993; 2014-present
Big Creek at km 1084.8 Alaska Highway	60.158	-129.703	YT	--	--	--	--	YT10AA005	FED	1978-present
Birch River at Highway No. 7	61.333	-122.094	NWT	--	--	--	--	NT10ED003	FED	1974-present
Blackstone River at Highway No. 7	61.06	-122.865	NWT	--	--	--	--	NT10ED007	FED	1991-present
Contact Creek- Upper	60.0409	-127.6961	YT	--	--	--	--	YT30BE002	YT	2009-present
Cosh Creek	60.0098	-127.8237	YT	--	--	--	--	YT30BE003	YT	2009-2016
Cottonwood River above Bass Creek	59.118	-129.825	BC	--	--	--	--	BC10AC005	FED	1964-present
Flat River at the Park Boundary	61.3815	-126.6349	NWT	NW10EA0008	Parks	3x/year	1988-present	--	--	--
Flat River near the Mouth	61.53	-125.411	NWT	NW10EA0004	ECCC/Parks	3x/year	1972-present	NW10EA003	ECCC/Parks	1972-present
Fontas River near the Mouth	58.271	-121.464	BC	--	--	--	--	BC10CA001	FED	1988-present
Fortune Creek upstream of Petitot River	59.972	-122.421	BC	E290869	BC	4X/yr	2012-present	--	--	--
Frances Lake at Kilometre 171.4 Robert Campbell Highway	61.3944	-129.6278	YT	--	--	--	--	YT10AB002	FED	1975-1994
Frances River near Watson Lake	60.474	-129.119	YT	--	--	--	--	YT10AB001	FED	2011-present
Hyland River at km 108.5 Nahanni Range Road	61.487	-128.242	YT	--	--	--	--	YT10AD002	FED	2015-present
King Creek at Kilometre 20.9 Nahanni Range Road	60.9472	-128.9278	YT	--	--	--	--	YT10AB003	FED	1975-1988
LaBiche River at Yukon-BC Boundary	60.0059	-124.1083	YT	-	-	-	-	YT10DB001	FED-YT	2015-present
LaBiche Station d/s of Kotaneelee Gas Plant	60.0779	-124.036	YT	LBCH-002	YT	3-4X/year	2014-present	-	--	--

ATTACHMENT B

				Water Quality Monitoring Sites				Hydrometric Stations		
Site/Station Name	**Lat**	**Long**	**Jur**	**Site #**	**Funder**	**Freq**	**Period of Record**	**Station #**	**Funder**	**Period of Record**
LaBiche Station near of Kotaneelee Gas Plant	60.148	-124.063	YT	LBCH-001	YT	3-4X/year	2014-present	-	--	--
Liard River above Kotaneelee River	60.154	-123.743	NWT	n/a	NT	2-3X/yr	1992-present	--	--	--
Liard River at Fort Liard	64.243	-123.479	NWT	NW10ED0001	Fed	4-6X/yr	1960-present	NW10ED001	FED	1960-present
Liard River at Lower Crossing	59.413	-126.094	BC	BC10BE0005	Fed	--	1984-1994	BC10BE005	FED	1974-present
Liard River at Upper Crossing	60.047	-128.902	YT	YT10AA0001	Fed-YT	12X/yr	1991-present	YT10AA001	FED-YT	1972-present
Liard River below Scurvy Creek	60.811	-130.521	YT	--	--	--	--	YT10AA006	FED	2016-present
Liard River near the Mouth	61.743	-121.228	NWT	NW10ED0002	Fed	4-6X/yr	1960-present	NW10ED002	FED	1960-present
Petitot River below Highway No.77	59.989	-122.96	BC	BC10DA0002	Fed-BC	4X/yr	2011-present	BC10DA001	BC	1992-1996
Petitot River Downstream of Tsea River	59.644	-121.35	BC	EZ90871	BC	4X/yr	2012-present	--	--	--
Prairie Creek above Prairie Creek Mine	61.6008	-124.8345	NWT	NW10EC0020	Parks	3X/year	2003-present	--	--	--
Prairie Creek at Old Park Boundary	61.3414	-124.4119	NWT	NW10EC0019	ECCC	3X/year	2001-present	--	--	--
Prairie Creek at the New Park Boundary	61.5219	-124.7126	NWT	NW10EC0021	Parks	3X/year	2010-present	--	--	--
Prairie Creek below Prairie Creek Mine	61.556	-124.811	NWT	NW10EC0006	Parks	3X/year	2003-present	NW10EC003	Parks	2003-present
Prairie Creek near the Mouth	61.2844	-124.4456	NWT	NW10EC0014	Parks	3X/year	1988-present	--	--	--
Rancheria River near the Mouth	60.204	-129.55	YT	--	--	--	--	YT10DB001	FED	2011-present
Raspberry Creek near the Mouth	58.892	-123.319	BC	--	--	--	--	BC10CD003	FED	1979-present
Smith River near the Mouth	59.553	-126.481	BC	--	--	--	--	BC10BE013	FED	1983-present
South Nahanni River above Nahanni Butte	61.0414	-123.3894	NWT	NW10EC0017	ECCC	3x/year	1988-present	--	--	--
South Nahanni River at Virginia Falls	61.6361	-125.7969	NWT	NW10EB0016	ECCC	3x/year	1996-present	NW10EB001	ECCC	1996-present
Teeter Creek near the mouth	59.454	-126.228	BC	--	--	--	--	BC10BE009	FED	1979-

ATTACHMENT B

				Water Quality Monitoring Sites				Hydrometric Stations		
Site/Station Name	**Lat**	**Long**	**Jur**	**Site #**	**Funder**	**Freq**	**Period of Record**	**Station #**	**Funder**	**Period of Record**
										present
Tetcela R at Canadian Zinc Road	61.473	-123.724	NWT	--	--	--	--	NT10GD002	FED	2018-present
Toad River above Nonda Creek	58.855	-125.383	BC	--	--	--	--	BC10BE004	FED	1961-present
Tom Creek	60.2897	-129.0231	YT	--	--	--	--	YT30AA003	YT	1999-present
Tom Creek at Kilometre 34.9 Robert Campbell Highway	60.2906	-129.0206	YT	--	--	--	--	YT10AA002	FED	1974-1993
Tributary of Beaver River @ YT/BC border	60.0019	-124.3995	YT	BEVR-t-001	YT	n/a	2016-2018	--	--	--
Tributary of Labiche River d/s gas plant area	60.0406	-124.0949	YT	LBCH-t-002	YT	n/a	2016-2018	--	--	--
Tributary of Labiche River u/s gas plant area	60.1561	-124.2113	YT	LBCH-t-001	YT	n/a	2016-2018	--	--	--
Trout River at km 783.7 Alaska Highway	59.336	-125.94	BC	--	--	--	--	BC10BE007	FED	1970-present

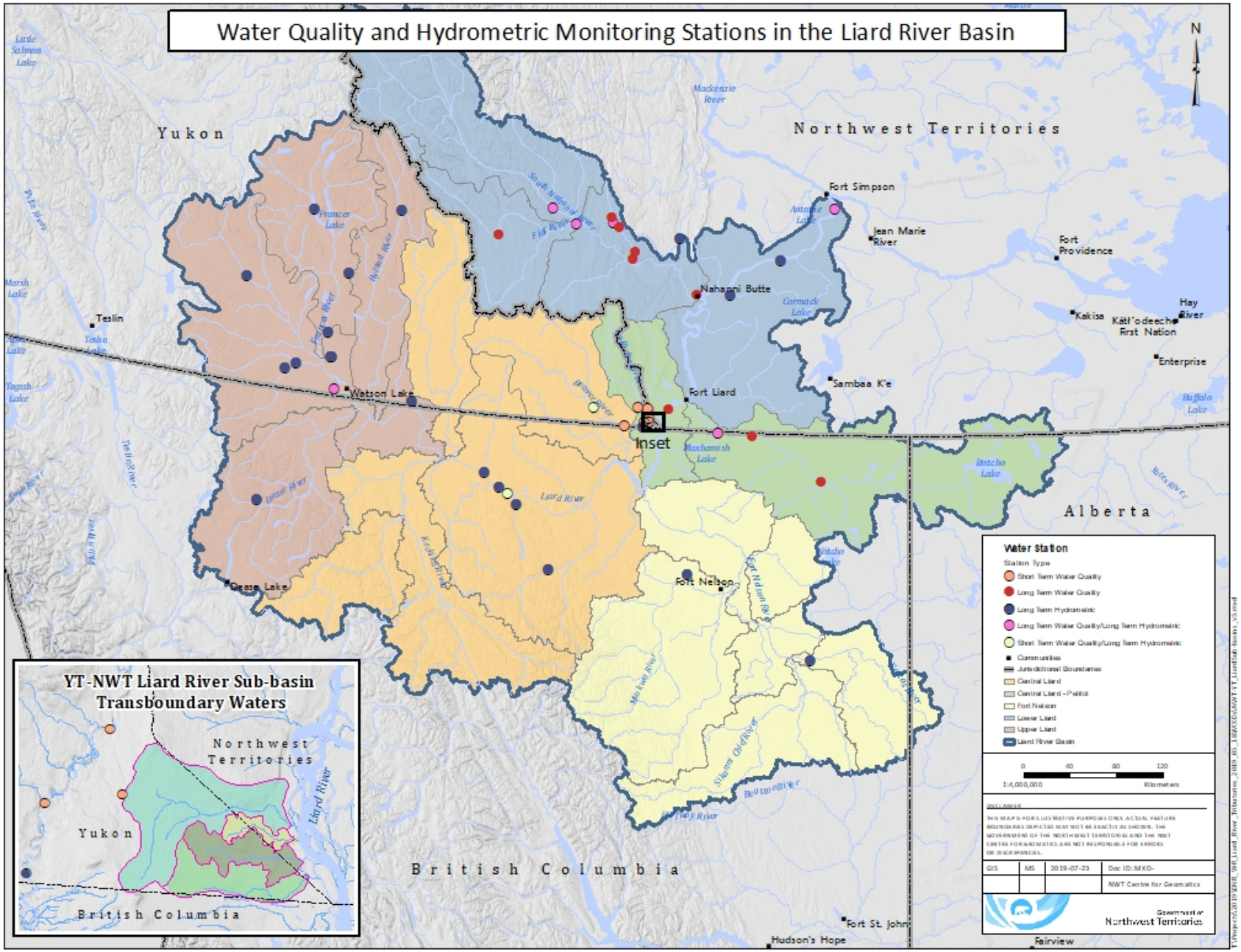

Figure 4. Transboundary Water Quality and Hydrometric Monitoring Stations in the Liard River basin.

I5. Groundwater

Groundwater is monitored to track changes in groundwater quantity and quality and to characterize and delineate aquifers. Groundwater monitoring currently exists at 19 sites in the Liard River basin, with a total of 63 wells (Table 11). These wells are relatively shallow, installed for site-specific purposes; deeper wells would be installed as needed as per RIM. In accordance with the RIM approach, groundwater monitoring would be established as agreed by the BMC if and when required.

Table 11. Current (2019) Status of Groundwater Monitoring Stations in the Liard River Basin.

SITE INFORMATION	NO. OF WELLS	DATE INSTALLED	EASTING	NORTHING	UTM ZONE	LAT	LONG	JUR	OWNER	INSTALLATION DEPTH (MBGS[4])
Fort Simpson Air Tanker Base	12	2012 (3); 2014 (9)	6849090	593270	10V	61.7634	-121.2328	NT	ENR, GNWT	5 - 5.5
Fort Simpson Helibase Storage Area	11	2012 (5); 2014 (6)	6856774	588362	10V	61.8335	-121.3220	NT	ENR, GNWT	3 - 6.1
Fort Simpson Helibase Landing Area	10	2012 (4); 2014 (6)	6856603	588632	10V	61.8319	-121.3169	NT	ENR, GNWT	4.2 - 6.5
Fort Liard Sewage Lagoon and Solid Waste Facility	7	2017	6670118	485476	10V	60.1677	-123.2617	NT	MACA, GNWT	5.5 - 9.1
Fort Simpson Active Solid Waste Facility	5	2017	6859385	583288	10V	61.8581	-121.4171	NT	MACA, GNWT	4.6 - 6.1
Fort Simpson Inactive Solid Waste Facility	5	2017	6855534	588465	10V	61.8224	-121.3206	NT	MACA, GNWT	4.6 - 7.6
Nahanni Butte - community water well supply 1	1	1996	6766053	479296	10V	61.0288	-123.3831	NT	Nahanni Butte Dene Band	41.5

[4] Metres Below Ground Surface

ATTACHMENT B

SITE INFORMATION	NO. OF WELLS	DATE INSTALLED	EASTING	NORTHING	UTM ZONE	LAT	LONG	JUR	OWNER	INSTALLATION DEPTH (MBGS[4])
Nahanni Butte - community water well supply 2	1	1996	6766076	479292	10V	61.0290	-123.3832	NT	Nahanni Butte Dene Band	33.5
Fort Liard - community water well supply 1	1	1989	6677893	473240	10V	60.2369	-123.4832	NT	Hamlet of Fort Liard	18 (top of screen)
Fort Liard - community water well supply 2	1	1989	6677870	473234	10V	60.2367	-123.4833	NT	Hamlet of Fort Liard	15 (top of screen)
Kotaneelee Gas Plant Well	1	2015*	6664889	441306	10V	60.1168	-124.0560	YT	YG	5.4 - 6.4
Watson Lake Well	4	1963	6658980	516875	9V	60.0676	-128.6968	YT	YG – Environmental Health Services	11.7 – 12.7
Watson Lake Campground Well - 1	1	2015*	6661751	511040	9V	60.0927	-128.8015	YT	YG	unknown
Watson Lake Campground Well – 2	1	2015*	6662148	510263	9V	60.0963	-128.8155	YT	YG	unknown
Watson Lake Campground Well - 3	1	2016*	6662092	510173	9V	60.0958	-128.8171	YT	YG	18.9 – 19.9
Big Creek Campground Well	1	2015*	6669348	460852	9V	60.1592	-129.7053	YT	YG	unknown
Nahanni Range Road Campground Well	1	2015*	6793104	538804	9V	61.2702	-128.2764	YT	YG	17.8 – 18.8
Simpson Lake Campground Well-1	1	2015*	6726905	487465	9V	60.6776	-129.2294	YT	YG	unknown

ATTACHMENT B

SITE INFORMATION	NO. OF WELLS	DATE INSTALLED	EASTING	NORTHING	UTM ZONE	LAT	LONG	JUR	OWNER	INSTALLATION DEPTH (MBGS[4])
Simpson Lake Campground Well-2	1	2015*	6726938	487389	9V	60.6779	-129.2308	YT	YG	21.25 – 22.25

* Date of installation unavailable. Denotes year monitoring began.

I6. Biology

Ecosystem health and diversity is evaluated by monitoring biological Indicators, hence the importance of incorporating these in this Agreement and regional and Basin-level monitoring programs.

Some biological monitoring has taken place in the Liard Basin as described below. Additional biological monitoring may have occurred in the region. Further research on past and current monitoring will be done by the BMC.

Benthic Invertebrates

Benthic macroinvertebrate monitoring was undertaken by British Columbia's Ministry of Environment and Climate Change Strategy (ENV) and ECCC in the Central Liard River Basin in Northeastern British Columbia (NEBC) between 2010 and 2017 as part of the Canadian Aquatic Biomonitoring Network (CABIN) program. The purpose of the monitoring was to develop a bioassessment model to assess potential impacts of unconventional oil and gas development and other activities on aquatic ecosystem health within the region. As part of this monitoring, 85 CABIN samples were collected by ENV and ECCC in the Liard, Petitot, and Fort Nelson watersheds, which included data for water quality, habitat, and benthic invertebrate communities. These data were used to update the NEBC CABIN model in 2018, which is currently available on ECCC's CABIN website to support aquatic ecosystem assessment. Further monitoring is planned by ENV and ECCC in 2019 in collaboration with Indigenous groups in the B.C. portion of the Liard Basin to help maintain the NEBC CABIN model.

Fish

In 1998, the Liard River Environmental Quality Monitoring Program (EQMP) was developed and measured the baseline condition of the aquatic ecosystem to compare with future samples (Taylor et al, 1998[4]). The program provided baseline data on contaminant levels in Liard River fish, water and suspended sediment to ensure that any present hazards were known and to support Transboundary Water negotiations. The program gave special attention to contaminants likely to result from metal mining and oil and gas development.

The Yukon Government conducts a variety of different types of fish monitoring in the Liard basin. Lake surveys of fish populations and angler harvest studies are done on a rotational basis across Yukon's lakes including lakes within the Liard Basin.

Biomonitoring Indicators and Locations

The Parties acknowledge the importance of monitoring biological components and agree that it will be considered when developing a monitoring program at the regional and Basin-wide level.

Approach for the Inclusion of Biological Monitoring

The approach for the inclusion of biological monitoring will be determined at the BMC after signing of this Agreement as described in the Learning Plan. The Parties agree, for a variety of reasons, as listed in Appendix G, that biological monitoring can be developed independently from a water quality and/or quantity monitoring program.

Appendix J – Costs to Administer and Implement the Agreement

Section 13.2 of this Agreement states:

The Parties agree that the costs to administer and implement this Agreement (as described in Appendix J) are subject to each Party's appropriation and allocation of resources, and the 3-5-year work plan approved under section 13.1.2 f) of this Agreement.

Although it is impossible to identify every cost that may arise, the Parties provide this partial list to clarify the nature of costs that may be required to administer and implement this Agreement.

For the purpose of this Agreement, costs are anticipated to fall under three categories: administration, bilateral implementation, and jurisdictional implementation. Tasks under this Agreement may be completed by a Party with either in-kind effort or direct resourcing (allocated from within a Party) or externally sub-contracted services, and may involve both capital and operating costs. The following is provided for illustration of anticipated costs.

1. Administration of Agreement [costs to be borne by each jurisdiction separately]

Each Party is responsible for payment of its:

- Participation on the BMC and its technical committees (e.g., staff time, travel, meeting costs, etc.);
- Documentation and reporting with respect to this Agreement;
- Participation on any related committees as might be convened by the BMC or the Board (e.g., staff time, travel, meeting costs, etc.) under BMC direction;
- Share of costs for administration of any committees convened by the BMC or the Board.

2. Bilateral Implementation of Agreement

The Parties agree to share bilateral implementation costs equally (50/50), with modifications on a case- by-case basis.

As required by this Agreement or as determined by the BMC, in accordance with section 13.2 of the Agreement, costs will be shared as required for the following:

- Monitoring: Capital and operating costs associated with the maintenance of existing or purchase, installation and operation of new monitoring and gauging stations related to:
    - developing and implementing Learning Plans;
    - setting, monitoring and revising (as required) Transboundary Objectives;
    - other monitoring or research as directed by the BMC or agreed by the BMC based on recommendations from a technical committee of the Board;
- Learning Plans: Costs associated with preparation, development and implementation of Learning Plans (e.g., studies, monitoring, fieldwork, research, analysis);
- Board: Resources allocated as a Party's share to support any technical committee of the Board;
- Research: Costs associated with research as directed by the BMC or agreed by the BMC based on recommendations from a technical committee of the Board.

3. Jurisdictional Implementation of Agreement [costs to be borne by each jurisdiction separately]:

Each Party is responsible for the cost of implementing its Jurisdictional Water Management commitments under this Agreement, including costs associated with:

- Consultation;
- Coordination with other jurisdictions (upstream and downstream);
- Information sharing, notification and consultation (i.e., sections 5 and 12 of this Agreement);
- Ongoing assessment of Triggers;
- Meeting Transboundary Objectives:
    - Regulatory actions or changes;
    - Policy or planning actions or changes;
    - Additional monitoring or studies;
    - Mitigation, enhancement, and/or other conciliative measures as prescribed in sections 4.3 k) and m) of this Agreement.