APPENDICES

MACKENZIE RIVER BASIN (Peel and Mackenzie Delta) BILATERAL WATER MANAGEMENT AGREEMENT

Between the

Government of Yukon

And the

Government of the Northwest Territories

List of Appendices

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.

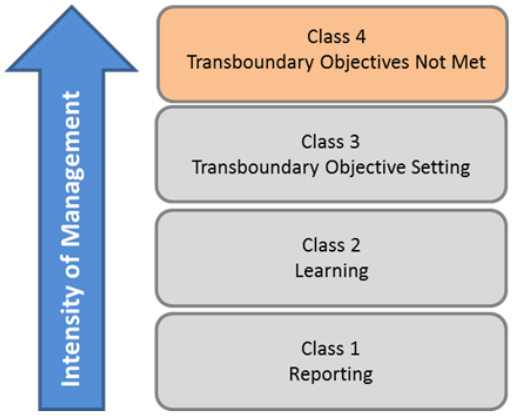

Table 1 provides a high-level summary of the four classes, including key commitments at each class, and some considerations for classification. To improve the transparency and consistency of classification, the appendices of each Bilateral Water Management Agreement may contain more specific criteria 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 n) 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/or 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/or 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 Indigenous 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, Indigenous knowledge and input from the general public of either Party;
- Share updated information about current and future Developments and/or 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.).

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, 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 Peel River and Mackenzie Delta sub-basins. This list does not include Transboundary Groundwater which is described in Appendix F. Most of the water bodies were identified using 1:250,000 National Topographical System (NTS) maps while some water bodies were identified using 1:50,000 NTS maps available from Natural Resources Canada. All major Transboundary Waters are included on the list. The list is not exhaustive; all small Transboundary Waters may not be included. 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 Transboundary Waters

a) Crossing in the north-to-south portion of the border – Mackenzie Delta sub-basin

No.	Water Body Crossing at 136.45° W Longitude	Flow Direction	Latitude North	Area (km²)
1	Ministicoog Channel	NWT to YT	68.865	N/A
2	Moose Channel	NWT to YT	68.776	N/A
3	Tributary to Eagle Creek	NWT to YT	68.554	N/A
4	Tributary to Big Fish River	YT to NWT	68.525	N/A
5	Big Fish River	YT to NWT	68.502	N/A
6	Little Fish Creek	YT to NWT	68.228	N/A
7	Almstrom Creek	YT to NWT	68.1275	N/A
8	Manuel Creek	YT to NWT	67.962	N/A
9	Fish Creek	YT to NWT	67.939	N/A
10	Rat River	YT to NWT	67.885	N/A
11	Rat River tributary	YT to NWT	67.725	N/A

b) Crossing in the west-to-east portion of the border – Peel River sub-basin

No.	Water Body Crossing at 67° N Latitude	Flow Direction	Longitude West	Area (km²)
12	Vittrekwa River tributary1	NWT to YT	-136.022	N/A
13	Vittrekwa River tributary2	NWT to YT	-136.000	N/A
14	Vittrekwa River tributary3	NWT to YT	-135.931	N/A
15	Vittrekwa River tributary4	NWT to YT	-135.861	N/A
16	Vittrekwa River tributary5	NWT to YT	-135.666	N/A
17	Vittrekwa River	YT to NWT	-135.601	N/A
18	Old Robert Creek tributary1	YT to NWT	-135.373	N/A

No.	Water Body Crossing at 67° N Latitude	Flow Direction	Longitude West	Area (km²)
19	Old Robert Creek	NWT to YT	-135.311	N/A
20	Old Robert Creek tributary2	NWT to YT	-135.284	N/A
21	Peel River	YT to NWT	-134.983	>70,000
22	Tributary Lake to Peel River	YT to NWT	-134.943	N/A
23	Three Cabin Creek, tributary to Peel River	YT to NWT	-134.779	N/A
24	Geh Kaii Creek, tributary to Peel River	YT to NWT	-134.646	N/A
25	Satah River	YT to NWT	-134.475	N/A
26	Satah River tributary1	NWT to YT	-134.345	N/A
27	Satah River tributary2	NWT to YT	-134.209	N/A
28	Tributary Lake to Satah River	YT to NWT	-134.118	N/A

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.

Appendix C – Use of Indigenous and Local Knowledge

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

The following practices will guide the meaningful inclusion of Indigenous 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 Indigenous and Local Knowledge in Bilateral Water Management

1. Acknowledge the value of Indigenous 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 Indigenous and local knowledge and traditional use;
3. Identify the conclusions reached by the Parties regarding Indigenous and local knowledge;
4. Identify and implement ways to synthesize and blend Indigenous 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 Indigenous and local knowledge and traditional use with knowledge holders.
6. When requested by knowledge holders, ensure that the Parties protect sensitive Indigenous 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 Indigenous and local knowledge;
   (b) Where consent is not given, respecting knowledge holders ownership and control of their Indigenous and local knowledge;
7. Where they exist, adhere to Party and Indigenous community guidelines, policies or protocols regarding the collection and use of Indigenous and local knowledge, including:
   (a) Culturally appropriate methods of engaging with Indigenous and local knowledge holders when gathering knowledge;
   (b) Culturally appropriate methods of presenting Indigenous 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 Indigenous and local knowledge holders;
   (e) Following formal research licensing guidelines.

C2. Framework

The BMC will develop a framework toward meaningful inclusion of Indigenous 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 except for the Peel River which is classified as Class 2. Rationale for the class 2 designation is included in Table 3. Classification of Transboundary Waters will be reviewed at least annually by the BMC.

Table 3. Water body classification according to RIM

Water Body	RIM Class	Rationale/Comments
Peel River	2	Potential for development, high traditional use, existing statistically significant trends in seasonal flow.
Mackenzie Delta (North Slope)	1	No development currently.

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., desktop tools for comparison of withdrawals/consumption to available water, flow statistics and/or flow needs).

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.

The Parties have agreed to continue supporting the existing hydrometric station on the Peel River above Fort McPherson for at least the period of the Learning Plan (Appendix I).

D2. Learning Plans

A Learning Plan (Appendix H) 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, climate change effects, 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. Learning Plans should help to understand baseline water quantity and reflect the seasonal site-specific characteristics of each water body, including changes associated with climate warming

effects on permafrost degradation and snow-melt/river-ice/lake-ice dynamics. 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 will be set for class 2 Transboundary Waters where information is available and will be set for class 3 Transboundary Waters according to the RIM approach.

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.

D5. Water Quantity Objectives for Class 3 Water Bodies

At the 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 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. · 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

Transboundary Waters are listed in Appendix B. All Transboundary Waters were classified as 1, except for the Peel River which was classified as a Class 2. Rationale for the class 2 designation is included in Table 5. Classification of Transboundary Waters will be reviewed at least annually by the BMC.

Table 5. Water body classification according to RIM

Water Body	RIM Class	Rationale/Comments
Peel River	2	Potential for development, high traditional use, existing statistically significant trends in water quality.
Mackenzie Delta (North Slope)	1	No development currently.

Ongoing monitoring of water quality in Transboundary Waters is essential for refining the approach used to assess risk to surface water quality. The Parties have agreed to continue surface water quality monitoring for at least the period of the Learning Plan on the Peel River as per Appendix I.

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.

E2. Learning Plans

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

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.

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, for example, if there are degrading conditions. Triggers may include water quality parameters as well as human, biological and ecological indicators. For water quality, Triggers will be set for class 2 Transboundary Waters where information is available and will be set for class 3 Transboundary Waters according to the RIM approach.

The Parties agree that their intent is to manage water quality within the range of natural variability. Triggers are an aid to this. The methodology for developing Triggers will be discussed as part of the Learning Plan by the BMC. Triggers will reflect the site-specific characteristics of each water body. Where possible, seasonal site-specific ambient water quality data will be used. The Triggers will be derived with consideration of Indigenous knowledge, traditional use and the natural variability (including seasonality) of the water body. Triggers will be established based on existing scientific literature (Table 6) and will be developed for a broad range of parameters to facilitate learning. Triggers are intended to enhance our understanding of baseline conditions, changes in water quality and enable the BMC to identify potential water quality concerns.

Table 6. Definitions, examples and potential management actions for Triggers that will be set for water quality parameters [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 (e.g., land use change). · Investigate other media (hydrometric, sediment and/or biota), as appropriate, to provide supporting evidence.

[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.

	Definition	Examples	Potential Management Actions
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.

E4. Water Quality Triggers

At the time of signing, the Parties agreed to use the 50th and 90th percentiles calculated from the historical Peel River dataset, as interim water quality triggers to assess water quality conditions in the Peel River.

The Parties have defined interim triggers for the conventional parameters monitored in the Peel River including physical parameters, major ions, nutrients and metals.

- Trigger 1 is defined as exceedance of the 50th percentile value beyond what is statistically expected (potential changes in typical conditions)
- Trigger 2 is defined as exceedance of the 90th percentile value beyond what is statistically expected (potential changes in extreme conditions)

When these values are exceeded at a frequency beyond what is statistically expected, the actions in Table 6 will be initiated. Trigger 1 and 2 may be considered separately and/or together in order to improve understanding and identify appropriate action.

The Parties expect that mutual learning will occur through implementation and that they may modify the approach based on implementation experience.

The BMC will review all total, dissolved and methyl mercury data collected from the Peel River to determine appropriate interim triggers for mercury.

Within the first three years of signing, the Parties will work towards the development of triggers for organic substances including hydrocarbons, pesticides and herbicides.

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 to protect all uses including:

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

It is understood that Water Quality Objectives, when they are set, may be beyond the range of natural variability, while still being suitably precautionary (per section 7 of the Agreement).

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 Indigenous and local knowledge;
- Ensure that methods and resulting Transboundary Water Quality Objectives are based on a weight-of-evidence approach (including science and Indigenous 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 that NWT and Yukon have obligations under 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 three 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 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; - A narrative statement describing the biological characteristics of the ecosystem, e.g., fish abundance.	- Relevant jurisdiction takes necessary Jurisdictional Water Management action to stop trend and/or exceedance(s). - 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. 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. To meet this commitment, the Parties agree as follows:

a) The BMC will maintain and periodically update a list of toxic, bioaccumulative and persistent substances that are subject to this commitment. A number of organizations and delegations including but not limited to those listed below have identified several human-made substances that have been slated for virtual elimination.

- Health Canada (Pest Management Regulatory Agency's Strategy for Implementing the Toxic Management Substances Policy)
- Environment Canada (Environment Canada's Risk Management Program: Toxic Substances Management Policy)
- Stockholm Convention (Persistent Organic Pollutants requiring control, Canada is a signatory)

The BMC will consider these and other relevant lists in developing and updating a list of substances subject to Section 7d) of the Agreement.

b) The current list of toxic, bioaccumulative and persistent substances subject to Section 7d) of the Agreement is provided in Table 8, along with location and status of existing monitoring. The toxic, bioaccumulative and persistent substances marked with a "✓" currently form part of the Peel River

Water Quality Monitoring Program. Monitoring will continue, unless a risk assessment demonstrates that a change is warranted. Substances may move from “monitored” to “not monitored” status upon agreement at the BMC. Substances that are not currently monitored are marked with an “X” in Table 8. Should an unmonitored substance be detected by another party, the information will be evaluated by the BMC to determine if the substance should be monitored in the transboundary water body. Monitoring of these substances will be prioritized commensurate with the level of risk.

The BMC will assess the risks associated with the substances in Table 8 as part of Learning Plans and determine monitoring efforts commensurate with that level of risk. If any of these substances are detected in Transboundary Waters and have the potential to alter the Ecological Integrity of the Aquatic Ecosystem, the Party will identify and implement appropriate courses of action, including continued prioritised monitoring of that substance. Monitoring priorities and management will be discussed at the BMC. It is recognized that, in some cases, it will take time to identify and implement alternative courses of action. 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.

c) The transboundary monitoring results of these substances will be shared with the Government of Canada’s Chemicals Management Plan (CMP) Stakeholder Advisory Council (Health Canada) to raise awareness about the presence and absence of these substances in Canada’s North and, within reason, help to understand potential sources. The CMP describes the Government of Canada’s existing monitoring commitments (such as the Great Lakes Water Quality Agreement, Stockholm Convention on Persistent Organic Pollutants) as well as being responsive to newer emerging contaminants of concern.

Table 8: Substances that have been listed as persistent, bioaccumulative and toxic in accordance with E6 (a).

Substances Subject to VE	Monitored in Water at Peel River above Fort McPherson	Organization(s) that has targeted substance for VE
Aldrin	✓	SC[1], HC[2]
Chlordane	✓	SC, HC
Dieldrin	✓	SC, HC
Endosulfan	✓	SC
Endrin	✓	SC, HC
Heptachlor	✓	SC, HC
Hexachlorobenzene	✓	SC, HC
Hexachlorobutadiene	✓	SC, ECCC[3]
Hexachlorcyclohexane (HCH; alpha, beta, gamma)	✓	SC
Mirex	✓	SC, HC
DDD, DDE, DDT	✓	SC, HC
Toxaphene	✓	SC, HC
PCBs	✓	SC, HC
Pentachlorobenzene	✓	SC
Dioxins and Furans	X	SC, HC
Chlordecone	X	SC
Heptabromodiphenyl ether (Hepta-BDE)	X	SC
Hexabromobiphenyl (HBB)	X	SC
Hexabromobiphenyl ether (Hexa BDE)	X	SC
Octachlorostyrene	✓	SC
Pentabromodiphenyl ether (Penta-BDE)	X	SC
Perfluorooctane sulfonate	✓	SC, ECCC
Tetrabromodiphenyl ether (Tetra-BDE)	X	SC

[1] **Stockholm Convention: chemicals targeted for virtual elimination (2004) (http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx)**
[2] **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)
[3] **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)**

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 Mackenzie Delta sub-Basin and Peel River sub-Basin Transboundary Waters listed in Table 2 are to be used as surrogates for delineating Transboundary Groundwater. These surrogates are referred to as groundwater areas, 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.

The Mackenzie Delta and Peel River sub-Basins were defined as transboundary groundwater areas relevant to this agreement (Figure 2). Currently, the Peel sub-Basin groundwater area is classified as class 2; and the Mackenzie Delta sub-Basin is classified as class 1. The Parties will reassess the classification annually or as more information becomes available.

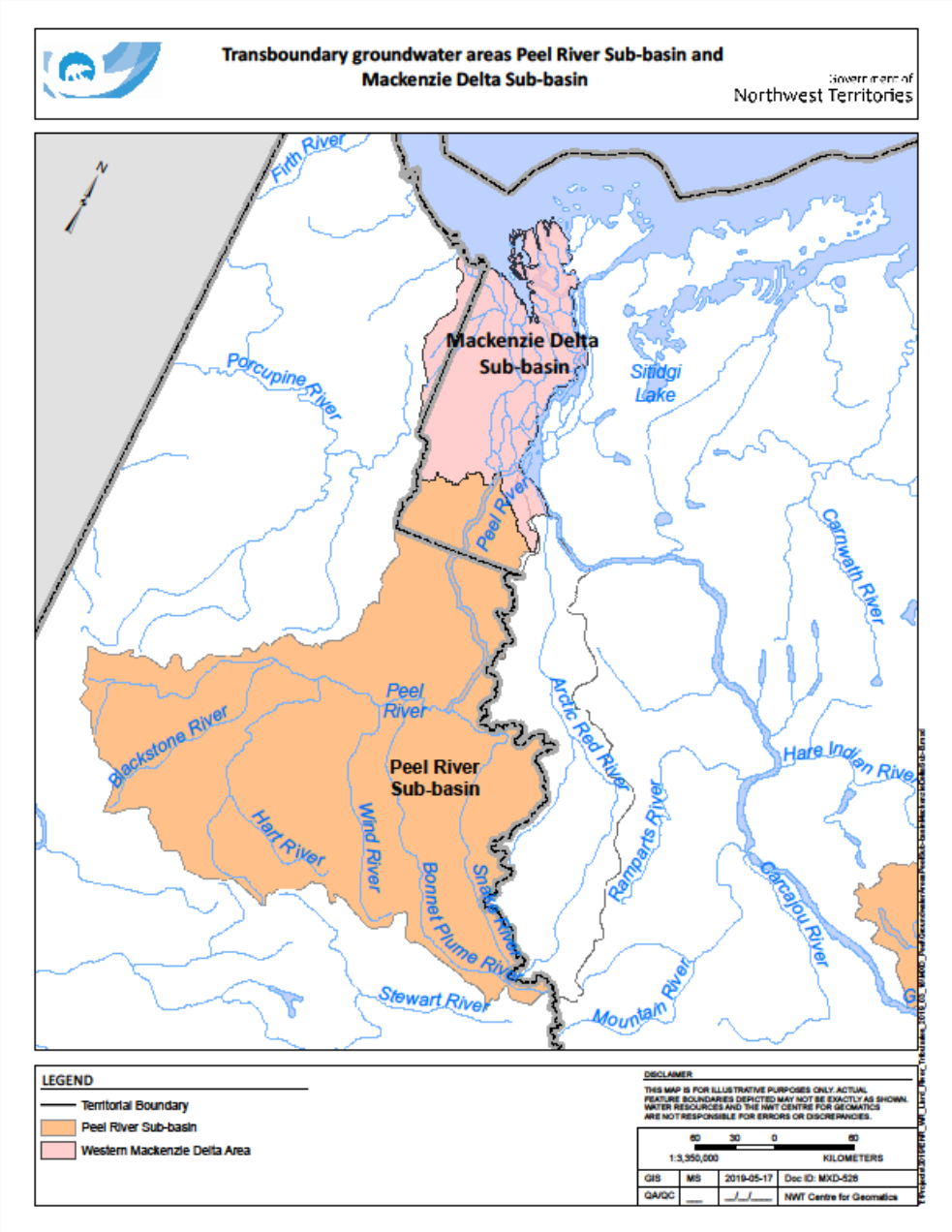

Figure 2. Transboundary groundwater areas for the Peel river Sub-basin and the Mackenzie Delta Sub-basin

Table 9. Classification of Transboundary Groundwater Areas

Groundwater Area	RIM Class	Rationale/Comments
Peel Sub-basin	2	Potentially high impacts of permafrost thawing on groundwater quality and storage, potential for development, high traditional use, existing statistically significant trends in surface water quality and seasonal flow.
Mackenzie Delta Sub-basin (North Slope)	1	No development currently.

In this appendix, use of the term Transboundary Groundwater refers to aquifers when they have been mapped or surrogate Groundwater areas when aquifers have not yet been mapped.

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 proposed *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, permafrost characteristics and distribution, 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 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, and 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, lateral continuity and permafrost characterization (active layer thickness, permafrost depth, ice content, cryostratigraphy) and distribution.

As part of the Learning Plan, gathering of data about quality and quantity of Transboundary Groundwater will improve understanding of baseline Groundwater quality and quantity, and aid with evaluation of whether a water body should change RIM classification.

The Learning Plan is further described in Appendix H.

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/or 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
- Change in Developments and/or 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).

As part of the Learning Plan, Triggers will be identified. 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. Indigenous knowledge and traditional 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
  - 1.1.9 Indigenous values
- 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)

4.0 Ambient Environmental Conditions
- 4.1 Existing Indigenous 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

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; and
- Stations that support transboundary water management as well as broader regional and Basin-level monitoring network.

The Parties have agreed to continue to support long-term surface water quantity and quality monitoring in the Basin while the Learning Plan for the Peel River is completed. Current and past water quantity stations and quality sites are listed in Table 10. The *Peel River above Fort McPherson* is a priority station where water quality and quantity triggers and objectives will be assessed. For that station, the Parties agree to continue to support the monitoring, including working with delegate agencies as required. All other stations are considered important stations for the long-term, Basin-level monitoring. The Parties will continue to support those monitoring stations, including working with delegate agencies as required at least for the period while the Learning Plans are completed. The Parties will encourage and support the continued surface water monitoring conducted in the Basin by Environment and Climate Change Canada. Existing and historic water quality and hydrometric monitoring stations are listed in Table 10.

The Parties will not make changes to monitoring at any of the stations in Table 10 without discussing with the other Party to this Agreement for the period while the Learning Plans are completed.
As part of the Learning Plan for class 2 Transboundary Waters, the Parties will review existing monitoring locations and programs (parameters, frequency, etc.) and 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. The identification of long-term monitoring stations for the Agreement will be based on a scientific and Indigenous and local knowledge assessment. 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.

I2. Joint Monitoring Arrangements

Table 10 lists the present hydrometric stations and water quality monitoring sites monitored by NWT and YT. 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).

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 (anticipated 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 six active long-term water quantity stations in the Peel River basin (Table 10; Figure 3). The station, *Peel River above Fort McPherson* (10MC002), is a priority station where water quantity triggers and objectives will be assessed. All other stations will be included in the long-term regional and Basin-level monitoring program. The Parties have agreed to continue to support long-term surface water quantity monitoring in the Basin while the Learning Plan for the Peel River is completed.

Snow stations 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 two active long-term water quality sites in the Peel River basin: *Peel River above Fort McPherson* and *Ogilvie River above Engineer Creek* (Figure 3; Table 10). The Pe*el River above Fort McPherson* (10MC0002) is co-located with a water quantity (hydrometric) station and is considered a priority site where water quality triggers and objectives will be assessed. The Parties have agreed to continue to support the long-term water quality monitoring in the Basin while the Learning Plan for the Peel River is completed. Information collected from current and past water quality monitoring will be used to inform the Learning Plan and may be recommended as part of the Agreement or a Basin-level monitoring program.

Table 10. Current (2021) Status of Transboundary Water Quality and Hydrometric Monitoring Stations in the Peel sub-Basin. Three stations just outside the basin are also included.

SITE INFORMATION				QUALITY				HYDROMETRIC		
Site Name	Coordinates		Jur	Stn #/Name	Funder	Freq	Period of Record	Stn #	Funder	Period of Record
Peel River above Fort McPherson *	67.259	-134.889	NWT	10MC0002	FED NWT	4X/year 2X/year	1960-present 1999-present	10MC002	FED-NWT	1969-present
Rat River near Fort McPherson	67.677	-135.718	NWT	--	--	--	--	10MC007	NWT	1981-1990; 2016-present
Peel River at Frog Creek	67.635	-134.652	NWT	--	--	--	--	10MC022	FED-NWT	1997-present
Mackenzie River (Peel Channel) above Aklavik	68.204	-135.115	NWT	--	NWT	3X/year	2013-present	10MC003	FED	1974-present
Ogilvie River above Engineer Creek	65. 3594	-138. 3040	YT	OLG-001	NWT-YT	1X/year	1999, 2002-2005, 2012, 2013, 2016-present	--	--	--
Ogilvie River 0.5 km upstream of Engineer Creek	65.3581	-138.3056	YT	YT10MA0011	FED-YT	Monthly	1993-1997, 2016-present	--	--	--
Ogilvie River 2 km upstream of Engineer Creek	65.3592	-138.3375	YT	YT10MA0010			1994-1995			
Ogilvie River near Engineer Creek	65.3783	-138.2894	YT	OR_EC			1999-2003			
Ogilvie River near Mouth	65.867	-137.268	YT	OR_M	NWT-YT	1X/year	1999, 2002-2005, 2012, 2013	--	--	--
Ogilvie River at KM 197.9 Dempster Hwy	65. 3625	-138.2972		--			2012-2014	10MA002	Fed-YT	1974-1996 2016-present
Engineer Creek near Ogilvie River	65.3592	-138. 2917	YT	10MA0008	FED-YT	Monthly	1993-1996	--	--	--

SITE INFORMATION				QUALITY				HYDROMETRIC		
Site Name	**Coordinates**		**Jur**	**Stn #/Name**	**Funder**	**Freq**	**Period of Record**	**Stn #**	**Funder**	**Period of Record**
Engineer Creek at YTG Campground	65.3532	-138.269	YT	ENG@CMPG	YT	1X	2002			
Engineer Creek upstream of Red Creek	65.0989	-138.354	YT	ENG@HWY	YT	1X	2002			
Blackstone River near Chapman Lake Airstrip	64.876	-138.283	YT	BLKS-001	YT	1X/year	2013	10MA003	FED	1984-1995 2005-present
Blackstone River near Mouth	65.8515	-137.2573	YT	BR_M	NWT-YT	1X/year	2012, 2013	--	--	--
Peel River above Hart River	65.8565	-136.4006	YT	PEEL-001	NWT-YT	1X/year	2012, 2013	--	--	--
Hart River near Hungry Lake	65. 7057	-136.2996	YT	HART-001	NWT-YT	1X/year	2012, 2013	10MA004	FED-YT	2021-present
Peel River above Canyon Creek	65. 88872	-136. 0441	YT	PEEL-002	NWT-YT	1X/year	2012, 2013	10MA001	FED	1962-1965 1968-1998 2005-present
Dalglish Creek at Mouth	65.8754	-136.3264	YT	DALG-001	YT	1x/year	2014-2018	????	YT	2012-2014
Dalglish Creek - Lower	65. 8827	-136.3403	YT	DALG-002	YT	varies	2014-2018	30MA004	YT	2013-2014
Dalglish Creek - Upper	65.893	-136.349	YT	--	--	--	--	30MA006	YT	2013-present
Wind River near Mouth	65.8371	-135. 2988	YT	WIND-001	NWT-YT	1X/year	2012, 2013	--	--	--
Wind River above Little Wind	65.321	-135.400	YT					10MA005	YT	2021-present

SITE INFORMATION				QUALITY				HYDROMETRIC		
Site Name	**Coordinates**		**Jur**	**Stn #/Name**	**Funder**	**Freq**	**Period of Record**	**Stn #**	**Funder**	**Period of Record**
Peel River above Bonnet Plume River	65.9226	-135.0571	YT	PEEL-003	NWT-YT	1X/year	2012, 2013	--	--	--
Bonnet Plume River above Mouth	65.8801	-134.9438	YT	BP-002	NWT-YT	1X/year	2012, 2013	--	--	--
Bonnet Plume River above Gillespie Creek	64.7416	133.6755	YT	BP-001	YT	1X/year	2012, 2013	10MB004	Fed-YT	1981-1994 2016-present
Peel River above Snake River	65.9812	-134.2251	YT	PEEL-004	NWT-YT	1X/year	2012, 2013	--	--	--
Snake River near the Mouth	65.9696	-134.1805	YT	SNK-001	NWT/YT	1X/year	2012, 2013	10MB003	Fed	1975-1995 2021-present
Snake River above Iron Creek	65.246	-133.403	YT	--	--	--	--	10MB001	Fed	1963-1967
Peel River above Caribou River	65.4984	-134.1539	YT	PEEL-005	NWT/YT	1X/year	2012, 2013	--	--	--
Caribou River above Mouth	66.4833	-134.183	YT	CR_M	NWT	1X	2004	--	--	--

* BWMA Priority Monitoring Station

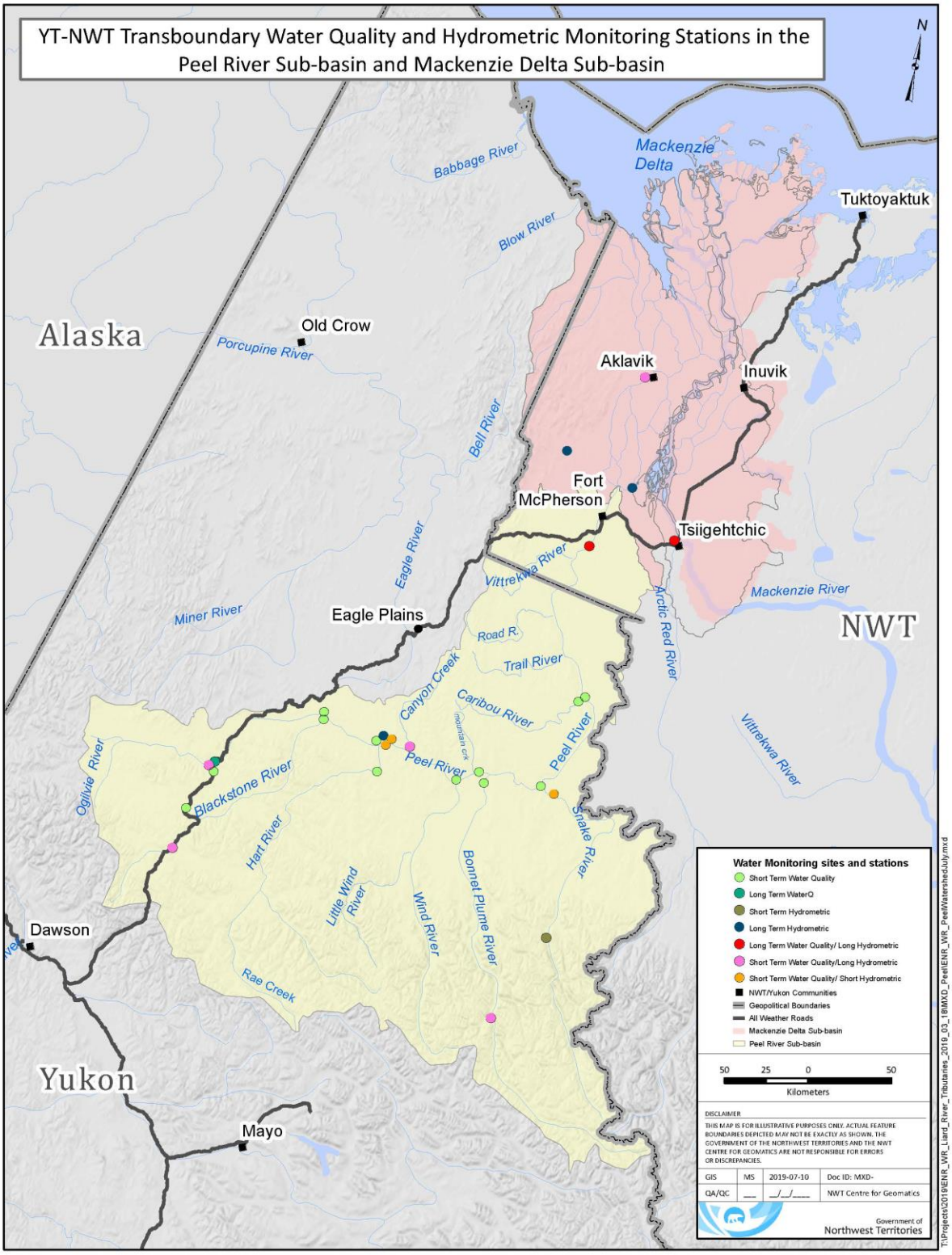

Figure 3. Current Location of Transboundary Water Quality and Hydrometric Monitoring Stations in the Peel sub-Basin. Three stations downstream and just outside the basin are also included.

I5. Groundwater

Groundwater is monitored to track changes in groundwater quantity and quality and to characterize and delineate aquifers. Groundwater monitoring currently exists in the NWT at four sites in the Mackenzie Delta and Peel River sub-Basins, with a total of 39 wells (Table 11). These wells are relatively shallow, installed for site-specific purposes; deeper wells would be installed as needed as per RIM. In Yukon, there is currently one permanent Groundwater monitoring station in the Peel River and Mackenzie Delta sub-Basins. The well was installed to monitor the active layer and changes to the active layer over time. In accordance with the RIM approach, Groundwater monitoring would be established as agreed by the BMC if and when required.

Table 11. Current (2021) Status of Groundwater Monitoring Stations in the Mackenzie River and Peel River sub-Basins.

SITE INFORMATION	NO. OF WELLS	PERIOD OF RECORD	EASTING	NORTHING	UTM ZONE	JUR	OWNER	INSTALLATION DEPTH (MBGS[3])
Tsiigehtchic Active Solid Waste and Sewage Lagoon Facility	8	2018-present	7481609	0555093	08W	NT	MACA, GNWT	0.6 - 4.6
Tsiigehtchic Inactive Solid Waste Facility	3	2018-present	7481602	0554008	08W	NT	MACA, GNWT	2.9 - 3.7
Fort McPherson Active Sewage Lagoon and Solid Waste Facilities	9	2018-present	7481876	0507947	08W	NT	MACA, GNWT	4.6 - 10.1
Aklavik Sewage Lagoon and Solid Waste Facility	19	2016-present (8); 2017-present (11)	7569006	498358	08W	NT	MACA, GNWT	< 2.2
Eagle Plains Well	1	2014-present	398625	7335447	08W	YT	YG	3.4- 4.4
Eagle Plains Solid Waste Disposal Facility	1	2019 - present	310431	1323543	08W	YT	YG	1.1-4.1
Ogilvie Highway and Public Works Camp	1	2020 - present	230521	1221193	08W	YT	YG	1.5-4.5

I6. Biology

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

[3] Metres Below Ground Surface

Some biological monitoring has taken place in the NWT-YT border region 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

Biological monitoring in streams in the Peel Plateau started in 2010 and continues to date. Data for approximately 85 sites have been collected by the NWT Cumulative Impact Monitoring Program (ENR), Gwich'in Renewable Resources Board, Fisheries and Oceans Canada (DFO) and the University of New Brunswick using Environment and Climate Change Canada's Canadian Aquatic Biomonitoring Network protocols. The study underway is being conducted to further understand the effects of permafrost degradation (in the form of retrogressive thaw slumps) on water quality, benthic invertebrate abundance, diversity and community structure, primary productivity, decomposition of organic materials, and patterns of benthic macroinvertebrate drift.

Fish

The most recent Peel River fish contaminants study was done in 1999. This study was carried out due to continued concerns from Fort McPherson residents regarding the safety of eating fish from the Peel River. The concerns were related to an abandoned Shell oil exploration site and possible point source of contaminants upstream on the Peel River near the Peel/Caribou River confluence.

A total of 30 fish, including ten each of inconnu (*Stenodus leucichthys*), broad whitefish (*Coregonus nasus*) and burbot (*Lota lota*), were examined for a suite of heavy metals and organochlorines. Local fishermen at traditional fishing sites captured all fish. Based on the results of the study, the three fish species from the Peel River were deemed safe for human consumption. No further studies were recommended at that time.

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. Biological Indicators and sampling locations may be determined as part of the Learning Plan at the BMC after signing of this Agreement.

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.