



Northeast Water Strategy

Progress Report - 2017



Contents

Executive Summary	04
Overview: Building momentum.....	04
Introduction : Meeting Goals	06
Enhancing information and tools to support water decisions.....	06
Strengthening the regulatory regime	08
Coordinating water decision-making processes across the natural resource sector.....	08
Enhanced reporting, compliance and enforcement.....	09
Building a water stewardship ethic.....	10
1. Enhance Information and Tools to Support Water Decisions	11
Water Research - Intro	11
Update: Water Stewardship Information Source Database.....	12
Research Projects	13
New: Liard and Petitot sub Basins Transboundary Groundwater Resource Agreement.....	13
Update: Permafrost Ecosystems in Transition: Understanding and Predicting Hydrological and Ecological Change in the Southern Taiga Plains.....	13
New: Quantification of Surface Water, Snow and Glacier Ice Over Time From Remote Sensing	14
Update: Northeast Dugout/Impoundment Project	14
Update: Fort Nelson Wetlands Project	15
NEW: Agriculture and Water Management projects in the Northeast	16
A Wrap: Peace River Regional District Surface Water Quality	16
Update: The Dawson Creek Reclaimed Water Project	17
A Wrap: Kiskatinaw Watershed Flow Forecasting Study.....	17
Update: Natural Gas Atlas Project to Trace Original Source of Fugitive Gas Emissions from Wellbores in Northeast B.C.....	18
Water Monitoring – Intro	20
Intro: Enhancing Surface Water Quantity Monitoring in Priority Watersheds	20
Update: B.C. Snow Survey Program	23
New: Spring Assessment Project.....	24
A wrap: Water Quality Data Summary and Characterization.....	25
The Northeast B.C. CABIN model for aquatic ecosystem assessment	28
Update: Federal-Provincial Surface Water Quality Monitoring Program	30
Intro: Building and Coordinating Groundwater Knowledge.....	31
Update: Groundwater Monitoring in the Montney Region.....	33
PaleoValley Drilling	34
Update: Private Well Sampling program	35
Update: Provincial Groundwater Observation Well Network	35
A wrap: Montney Aquifer Characterization Project.....	36
A wrap: Peace River Regional District Aquifer Characterization	37
New: UBC Monitoring	37
New: McGill Well Monitoring and Induced Seismicity	38
New: OGC UBC well monitoring	38
New: Gas Sampling Comparison Study	38
2. Strengthen The Regulatory Regime	39

Water Sustainability Act	39
Environmental Flow Needs	40
Northeast B.C. Dugout Policy	40
Oil and Gas Activities Act.....	40
Canadian Association of Petroleum Producers.....	41
3. Coordinate Decision-Making Processes Across The Natural Resource Sector.....	43
Northeast Water Inter-agency Steering Committee	44
Regional Strategic Environmental Assessment	44
Mackenzie River Basin Transboundary Waters Master Agreement.....	44
Murray River Watershed Partnership	45
4. Enhance Reporting, Compliance And Enforcement	46
Reporting	46
Compliance and Enforcement.....	48
FLNR and Compliance and Enforcement Water Training Program	49
Aboriginal Liaison Program.....	49
5. Build A Water Stewardship Ethic	50
Appendix A: Northeast Water Strategy Implementation Partners	51
Appendix B: Core Principles	55
Public confidence.....	56
Broad participation.....	56
Openness and transparency	57
Appendix C: Water Definitions.....	58

EXECUTIVE SUMMARY

Overview: Building momentum

The *Northeast Water Strategy* (NEWS) was released on March 20, 2015. It was an ambitious project, launching a broad and inclusive partnership to proactively identify, measure and manage water resources across Northeast B.C. The Strategy brought together the needs of First Nations, communities, industry and the environment into a single blueprint for monitoring and oversees water resources for all users in the Northeast. This first year focused on bringing partners¹ together and getting organized.

The *2016 Annual Report* was released on April, 2016. It tells the story of the Strategy's first year: building the foundation, bringing partners together and launching the long-term process of sharing knowledge and resources with each other and the public. Partners started identifying the information gaps and launching projects and initiatives to begin filling those gaps.

This document, the *2017 Progress Report*, outlines key achievements in 2016-17. The list of water research projects (page 8) shows the breadth and scope of work currently underway, and the progress made in reaching one of the key goals: to enhance information and tools to support water decisions.

Entering its third year, NEWS is developing momentum. Partners continue to share information about their water use and quality monitoring. Work continues to identify data gaps, with a focus on surface and groundwater quality and quantity, and generate new research.

NEWS also places a high value on transparency. Partners and the public can access all monitoring and research project results on the website:

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy>

¹ See Appendix A for a full list of implementation partners.

The *Northeast Water Strategy Progress Report – 2017* profiles the range and scope of the work from August 2016 – December 2017. It also lays the groundwork for future projects. Over the coming years, the partners will continue to collaborate to determine priorities, highlight accomplishments and mark progress. These include:

1. Integrate the *Northeast Water Strategy* with the *Regional Strategic Environmental Assessment* and develop a collaborative water monitoring program in Northeast B.C. with Treaty 8 First Nations.
2. Continue to improve communication regarding water research and collaboration opportunities in the region.
3. Continue to support water policy development and implementation.
4. Strengthen compliance and enforcement of water resource activities.
5. Hold a Northeast Water Forum in early 2018 and a roundtable discussion with NEWS partners.

INTRODUCTION : MEETING GOALS

The *Northeast Water Strategy* is organized around five key goals. Here is an overview of how projects and initiatives underway in 2016-17 supported the goals:

Northeast Water Strategy: 5 key goals

1. Enhancing information and tools to support water decisions
2. Strengthening regulatory regime
3. Coordinating water decision-making processes across the natural resource sector
4. Enhancing reporting, compliance and enforcement
5. Building a water stewardship ethic

1

Enhancing information and tools to support water decisions

- ✓ **The following projects continued to enhance water monitoring projects across the region, focusing on surface water and groundwater quantity and quality.**
 - » Surface Water Quality Characterization for Northeast B.C. summarizes available data and provides suggestions for future monitoring
 - » Kiskatinaw Watershed Flow Forecasting Study provided the City of Dawson Creek with a modelling tool to help predict timing and volume of freshet, and when the Kiskatinaw Watershed will reach low flows.

- » Multiple Aquifer Characterizations Studies in the Montney and Peace River Regional District characterizes groundwater.
 - » The Peace River Regional District compiled, sorted, formatted and organized publicly available provincial water well and water analysis data. The data will support development of a conceptual hydrogeological model and an assessment of water chemistry throughout the Peace River Regional District.
 - » Northeast Dugout/Impoundment Project: Hundreds of medium to large dugouts (>0.5ha) were inspected to determine both the water use and identify public safety risks.
 - » PaleoValley Drilling: Eight holes were drilled in key locations, providing excellent ground truth data to calibrate the airborne geophysics and better understand paleovalleys in the area.
-
- The Murray River Watershed Partnership - Water quality monitoring is continuing, and data gaps are being filled with the goal of developing Water Quality Objectives for the watershed. A conceptual model of how contaminants flow through the watershed has also been completed.**
 - Continued to compile water related research projects underway across Northeast B.C. on the Water Stewardship Information Source Database.²**
 - Completed a comprehensive and in-depth regional model to prioritize enhanced surface water quality and quantity monitoring based on surface disturbance and socio-geographic sensitivity.**

² Ministry of Forests, Lands and Natural Resource Operation. Water Stewardship information Sources, Northeast BC. Can be found at <http://www.bcwatertool.ca/info-sources/northeast-bc/>

Strengthening the regulatory regime

- ✓ **Dugout Policy** - The provincial government has revised the policy to clarify authorizations required to use dugouts to divert, store and use water for agriculture and industry. The policy guides potential applicants and government decision-makers in determining the source of water supplying a dugout to determine the types of authorizations required under the **Water Sustainability Act**.³

Coordinating water decision-making processes across the natural resource sector

- ✓ The **Northeast Water Inter-agency Steering Committee** guides provincial government implementation of the Northeast Water Strategy, overseeing various projects in the Surface Water Quality, Surface Water Quantity and Groundwater Knowledge Working Groups. The Regional Strategic Environmental Assessment - B.C. and seven Treaty 8 First Nations came together in late 2015 to focus on a cumulative effects assessment of valued components associated with the practice of Treaty 8 rights including water.
- ✓ **Regional Strategic Environmental Assessment:** B.C. and seven Treaty 8 First Nations began to assess cumulative effects of valued components (including water) associated with the practice of Treaty 8 rights.

3 Ministry of Environment & Climate Change Strategy and Ministry of Forests, Lands, Natural Resource Operations & Rural Development. Can be found at https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/info_bulletin_-_dugouts_livestock_-_aug_2017.pdf

- ✔ Continued to follow the Mackenzie River Basin Transboundary Waters Master Agreement, which allows neighbouring jurisdictions to negotiate **Bilateral Water Management Agreements**. These agreements include broad management principles to maintain ecological integrity of the aquatic ecosystem for all shared groundwater and surface water crossings between jurisdictions within the Mackenzie River Basin.
- ✔ The Murray River Watershed Partnership continues to highlight the benefit and value of collaborative partnership in order to achieve water quality objectives. The partnership works together to align and combine monitoring initiatives in order to better understand the cumulative impacts on the watershed and as well as to develop an aquatic cumulative effects Assessment framework that can be used to inform future management decisions.

4

Enhanced reporting, compliance and enforcement

REPORTING

- ✔ Reported out on the status of water in the region, including updated postings on the Northeast Water Portal.⁴
- ✔ The NEWS website continues to be updated with the latest information as well as updating the key resources and activities in Northeast B.C.
 - » www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy

4 BC Oil and Gas Commission and Ministry of Forests, Lands and Natural Resource Operations and Rural Development. Can be retrieved from <http://waterportal.geoweb.bcogc.ca/#6/56.208/-126.721>

COMPLIANCE AND ENFORCEMENT

- ✓ Initiated a joint working group of staff with the Water Stewardship and Compliance and Enforcement branches of the Ministry of Forests, Lands and Natural Resource and Rural Development (FLNR) to provide training to Compliance and Enforcement officers on water related issues.
- ✓ First Nations communities participating in the Natural Resource Aboriginal Liaison Program build capacity for the oversight, compliance, and reporting of water use and the impact on water resources.

5

Building a water stewardship ethic

- ✓ The Northeast Water Strategy is a collaborative process built on the deeply held value that water stewardship is everyone's responsibility. Partners are working together to build a transparent and accountable approach to managing this precious resource.

1 ENHANCE INFORMATION AND TOOLS TO SUPPORT WATER DECISIONS

Northeast Water Strategy goals:

- » improve information resources
- » address knowledge gaps
- » advance information communication
- » improve access to water data

Enhancing information and tools will:

- » support decisions about water use
- » build on all our efforts
- » reduce duplication
- » compile a thorough and comprehensive overview of the water resource in Northeast B.C.

Water Research - Intro

Sharing research and information gives every partner access to new information, allowing us to identify and systematically identify and start closing the gaps in knowledge and reporting.

Mini Table of Contents

- Water Stewardship Information Source Database
- Research Projects

- Liard and Petitot sub Basins Transboundary Groundwater Resource Agreement
- Permafrost Ecosystems in Transition: Understanding and Predicting Hydrological and Ecological Change in the Southern Taiga Plains
- Quantification of Surface Water, Snow and Glacier Ice Over Time From Remote Sensing
- Northeast Dugout/Impoundment Project
- Fort Nelson Wetlands Project
- Agriculture and Water Management in the Northeast
- Peace River Regional District Surface Water Quality
- Snow Model Validation in the North Area
- The Dawson Creek Reclaimed Water Project
- Kiskatinaw Watershed Flow Forecasting Study
- Natural Gas Atlas Project to Trace Original Source of Fugitive Gas Emissions from Wellbores in Northeast B.C.

Update: Water Stewardship Information Source Database

The Water Stewardship Information Source database is a comprehensive database of hundreds of research and stewardship projects led by dozens of organizations, ranging from government to academia to industry. The project database is continually evolving and partners and non-partners alike are being encouraged to add information as new projects are developed.

Information can be searched by topic, author or location using the search function. The database is available on the *Northeast Water Strategy* website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/key-resources

Research Projects

Here are a few examples and status of the diverse water-related research projects underway in Northeast B.C. that will help build the bigger picture of the state of water in the region.

New: Liard and Petitot sub Basins Transboundary Groundwater Resource Agreement

2017/18 information on water wells, geology, hydrology, current activities and groundwater use is being compiled and analyzed to identify priority watersheds in the region. Using the NEWS sensitivity analysis and priorities identified by First Nations, the project will identify specific area(s) or aquifer(s) for future drilling, testing and aquifer characterization in 2018/19 and 2019/20 respectively.

This project is jointly funded by the FLNR and the Ministry of Environment & Climate Change Strategy (ENV).

Update: Permafrost Ecosystems in Transition: Understanding and Predicting Hydrological and Ecological Change in the Southern Taiga Plains

This three-year (2015–2018) project focuses on the impact of peatland permafrost thaw on water resources. The Consortium for Permafrost Ecosystems in Transition (CPET) is developing models to assess and predict hydrologic and ecosystem change in Northeast B.C. through to 2070. Primary objectives are to improve the base of hydrologic knowledge and produce customized science-based tools to support water management decisions.

CPET established the Suhm Creek Research Station, which has hydrometric and meteorological stations, and other monitoring equipment. The station has built an archive of aerial photos and satellite imagery, including Light Detection and Ranging Remote Sensing Method (LiDAR) and GIS data. An extra remote sensing analysis was completed in 2017 using data from NASA's ABAOVE program.

Ten “Super Sites” were established from Northeast B.C. to the Northwest Territories. Forest loss and wetland conversion dominates all 10 sites, but forest expansion is also present due to increased productivity or increased hydrological connectivity which drains/dries the sites.⁵

The research paper is available on the Northeast Water Strategy website.

- » www2.gov.bc.ca/assets/gov/environment/air-land-water/water/northeast-water-strategy/latest-information/permafrost_ecosystems_geoscience_bc.pdf
- » www.esaa.org/wp-content/uploads/2017/04/2017-8.pdf

New: Quantification of Surface Water, Snow and Glacier Ice Over Time From Remote Sensing

This project will use satellite data to develop and validate GIS tools for use in detecting water, snow and ice in lakes, rivers, seasonal and perennial snow and glacier ice. Satellite remote sensing techniques provide the possibility of updating maps of lake area, river morphology, snow patch size, and glacier area change. Field instrumentation have been installed and preliminary results will be shared in the summer of 2018. It is conducted by FLNR.

Update: Northeast Dugout/Impoundment Project

In 2015, multiple provincial government agencies developed a water classification algorithm to map these new water bodies. Using the algorithm and satellite imagery available through the United States Geological Survey, thousands of new bodies of water have been mapped in Northeast B.C. Most of these new water bodies are dugouts, which collect and store water for future use by the agricultural, construction and gas exploration/development industries.

Data also indicates that they appear to be increasing. Many recently dugouts built over the last decade are larger than 1.0 hectare, with some up to 3.0 hectares. The issues around the dugouts include the lack of clear policy around water use and licencing, water and land management, and compliance and enforcement.

5 Olivia Carpino, Aaron Berg, William Quinton, Justin Adams. 2017. Climate change and permafrost thaw-induced boreal forest loss in Canada’s fringe permafrost zone. 1Department of Geography, University of Guelph; 2Cold Regions Research Centre, Wilfrid Laurier University

Phase 1 of the project (2015) was to identify dugouts on the landscape. Phase 2 (Summer 2017) was to field truth the dugouts/impoundment structures. Hundreds of medium to large dugouts (>0.5ha) were inspected to determine both the water use and identify public safety risks.

Many of these water storage bodies turned out to be much bigger than dugouts. During the initial assessment, a total of 40 are considered dams under the *Dam Safety Regulation* and will require additional inspections dams. Another 34 minor dams were classified.

New policy and regulations under the *Water Sustainability Act* are being produced to provide effective and consistent regulation of water use from dugouts to ensure public safety, reduce pressure on local water supplies and to protect the environment.

Update: Fort Nelson Wetlands Project

The Fort Nelson wetlands project⁶ addresses concerns about land-use development and climate change effects on wetland hydrology and ecology. A hydrometric and meteorological field monitoring program was initiated in 2013 and current activities focus on using field data to calibrate a water balance model for the Coles and Tsea Lakes watershed, including identification of surface and groundwater interactions.

This project started as a Masters project and became a UNBC PhD thesis. A Mike-She model simulating surface water and groundwater flow will provide specific area water balance information, allowing for better water allocation decision making. Two summary papers are currently available on the Geoscience BC website:

- » www.geosciencebc.com/i/pdf/SummaryofActivities2015/SoA2015_Abadzadesahraei.pdf
- » www.geosciencebc.com/i/pdf/SummaryofActivities2016/SoA2016_Abadzadesahraei.pdf

⁶ The work is being completed by the University of Northern British Columbia, in collaboration with the Bulkley Valley Research Center with funding by Ministry of Forests, Lands, Natural Resources and Rural Development.

NEW: Agriculture and Water Management projects in the Northeast

A study Demonstrating the Use of Remote Sensing in Large Farms was launched by the BC Grain Producers Association. It uses remote sensing technology to increase resiliency in the face of changing economic and climate conditions, and will study integrated water management at the farm level. The objective is to use Unmanned Aerial Vehicle (UAV) technology to identify higher risk areas on farms related to topographic challenges which will facilitate development and implementation of integrated water management plans.

Enhancing the Peace Weather Monitoring and Utilization of Weather Data is a project by the Peace Region Forage Seed Association. It will follow up on the installation of weather stations throughout the Peace region and develop crop decision tools related to local weather information to enhance risk management on farms.

A Wrap: Peace River Regional District Surface Water Quality

In September 2016, the Peace River Regional District⁷ completed compiling, sorting, formatting, and organizing publicly available provincial water well and water analysis data. The data will support development of a conceptual hydrogeological model and an assessment of water chemistry throughout the Peace River Regional District.

This project analyzed 11,935 surface water samples from 364 locations, and 875 groundwater samples from 522 locations. Some of the findings included an increase in presence of sodium and sulfate in surface water and groundwater after the year 2000.

The final report is available online.

» prrd.bc.ca/wp-content/uploads/post/prrd-water-quality-database-and-analysis/Water-Quality-Report-Sept-2016.pdf

⁷ This work was done in partnership between the Peace River Regional District, GW Solutions, and the Treaty 8 Tribal Association, with funding support from the BC Real Estate Foundation.

Update: The Dawson Creek Reclaimed Water Project

The Dawson Creek water treatment facility continues to provide reclaimed effluent for industrial purposes and City operations. Reclaimed water accounted for approximately 30% of private industry water use in 2016 (Table 1)⁸.

In 2010, The City of Dawson Creek and Shell Canada partnered on a wastewater treatment plant. Since then, the plant has drawn 4,000m³ of wastewater from the City's existing aerated lagoon wastewater treatment system and treat it to a non-potable standard for industry or municipal use. Shell Canada owns and operates a pumping station and pipeline that transports 75% of the daily maximum to the Groundbirch operations, nearly 50 kilometres away, eliminating three million kilometres a year in truck trips over the course of full gas field development - reducing traffic, emissions, noise and dust for local landowners.

The full story is available on the *Northeast Water Strategy* website:

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/latest-information.

A Wrap: Kiskatinaw Watershed Flow Forecasting Study

The City of Dawson Creek received a modelling tool which can identify the day of the year when 15%, 25%, 50% and 75% of the total flow resulting from runoff will be reached. The model, a University of Northern British Columbia student's Master Thesis, is based on data collected from September to March of each year. Not only will this assist with the timing and volume of freshet, but it will assist in predicting when the Kiskatinaw Watershed will reach low flows if precipitation events do not occur. This work will also improve medium-term water-supply management while accounting for changes in climate.

8 Ekaterina Daviel. 2017. City of Dawson Creek Water Usage Update 2014-2016.

This research:

- » enables annual water withdrawal management when turbidity levels are relatively low
- » improves prediction of both peak and low flow periods during spring snowmelt
- » supports statutory decision makers regarding water withdrawals from the watershed
- » improves medium term water supply management based on climate forecasts
- » builds long term watershed viability for the City of Dawson Creek



The project started in 2014, when the City of Dawson Creek and FLNR signed on to support the student, who was studying the snowpack and changing weather patterns in the Kiskatinaw Watershed to better understand the Kiskatinaw River's flow regime and its link to spring melt. The student defended his thesis in the fall of 2017.

Update: Natural Gas Atlas Project to Trace Original Source of Fugitive Gas Emissions from Wellbores in Northeast B.C.

In 2017, the British Columbia Natural Gas Project shifted its focus because some of the gas submissions had incomplete stratigraphy in the data and some could not be mapped. As a result, a correlation review was started on the entire dataset that is comprised of more than 9000 entries of gas composition and around 200 entries of isotopic data. The work on the BC Natural Gas Project continues in the direction previously identified by Evans and Whiticar in a 2017 report ⁹, with an expected conclusion of the Northeast BC portion in November 2018. ¹⁰

⁹ Evans C. and Whiticar, MJ. 2017. British Columbia Natural Gas Atlas project: 2016 project update; in Geoscience BC Summary of Activities 2016, Geoscience BC, Report 2017-1, p.75-78.

¹⁰ Evans, C. and Hayes, B.J. (2018): British Columbia Natural Gas Atlas update 2017: recorrelation changes the picture; in Geoscience BC Summary of Activities 2017: Energy, Geoscience BC, Report 2018-4, p. 11–14.

This is a three-year funded initiative with Geoscience BC and its partners¹¹ using carbon isotopes from natural gas fields to help “fingerprint” them. They now have the ability to get the “postal code” of a natural gas molecule and are able to pin-point its original source. From this data, they will be able to determine if a trace of natural gas in groundwater is from natural sources or industrial activity. They will also be able to tell what gas pool or field the natural gas originates from in order to expedite curtailment efforts.

This study has value for public, local communities, First Nations, the BCOGC, the natural gas sector, and Governments. Some benefits include:

- » identifying thermogenic versus biogenic natural gas sources
- » providing the initial critical step in the evaluation of potential fugitive gas emissions
- » identifying fugitive gas sources in abandoned and producing wellbores
- » optimizing gas revenue stream by predicting and mapping gas content and quality

The Natural Gas Atlas is an independent geochemical catalogue and mapping of natural gas occurrences in B.C.

- » www.bc-nga.com/BC-NGA_Home.html as well as a recent updates:

The 2016 and 2017 summaries can be found here.

- » cdn.geosciencebc.com/pdf/SummaryofActivities2016/SoA2016_Evans.pdf
- » cdn.geosciencebc.com/pdf/SummaryofActivities2017/Energy/SoA2017_E_Evans.pdf

11 University of Victoria and BC Oil and Gas Commission.

Water Monitoring – Intro

With the population in Northeast B.C. expected to grow by 30 per cent over the next 25 years, water has never been in more demand. So is information about how water is used.¹² The energy sector, forestry, agriculture, tourism industries, First Nations, academia, all levels of government and residents rely on accurate and current water quantity and quality information. For meaningful decisions, we must have – and share – effective, comprehensive, precise, and informed water data, collected through networks of monitoring stations.

Monitoring water quantity and quality in Northeast B.C. is challenging due to the dramatic seasonal and annual variations of water distribution across the region, as well as climate change effects such as the increase in frequency and severity of extreme precipitation, drought and flood events.

Water monitoring projects in Northeast B.C. focus on three key measures:

- » surface water quantity
- » surface water quality
- » groundwater quality and quantity characterization.

Intro: Enhancing Surface Water Quantity Monitoring in Priority Watersheds

Surface water quantity is monitored through strategically located hydrometric monitoring stations. Hydrometric stations measure the instantaneous discharge of water flowing through a river at a given point in time. The information they produce is used by



¹² Stats Canada. <https://www.bcstats.gov.bc.ca/apps/PopulationProjections.aspx>

regional water managers to make water allocation and management decisions, and by water purveyors for flood and drought monitoring. Of the 52 current and historic Water Survey of Canada hydrometric stations in Northeast B.C., 31 stations are active, recording real-time data. Eighteen additional current and historical hydrometric stations in Northeast B.C. are managed by GeoScience BC, local government, Oil and Gas industry, and/or universities(Figure 1). All this water quantity information is publically accessible through the Northeast Water Portal.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/key-resources

New partners are encouraged to become involved with this project to help set and implement priority monitoring sites.

In 2011, the Horn River Basin Surface Water Monitoring Study was initiated by Geoscience BC to establish a surface water flow baseline by installing seven hydrometric stations in the region. In 2016, three of the stations were transferred to be repurposed in the Peace region. Of the three hydrometric stations which were transferred, only the West Kiskatinaw River Station is currently operational. This station is operated and maintained by the City of Dawson Creek with support from the FLNR. The East Kiskatinaw River Station was removed as Water Survey of Canada (WSC) installed a station in a similar location in the spring of 2017.

The four remaining Horn River basin stations (Kiwigana River, Santaneh River, Lower Petitot River at D'easum, and Middle Petitot River at Dilly) operation were transferred from Geoscience BC to Fort Nelson First Nation. These stations will provide new data and a more comprehensive assessment of surface water quantity across the region.

In addition, FLNR plans on installing new hydrometric stations to support the Northeast Water Strategy's enhanced surface water quantity monitoring project. In partnership with First Nations, communities and industry, the Province will install these hydrometric stations in priority watersheds through the coming years.

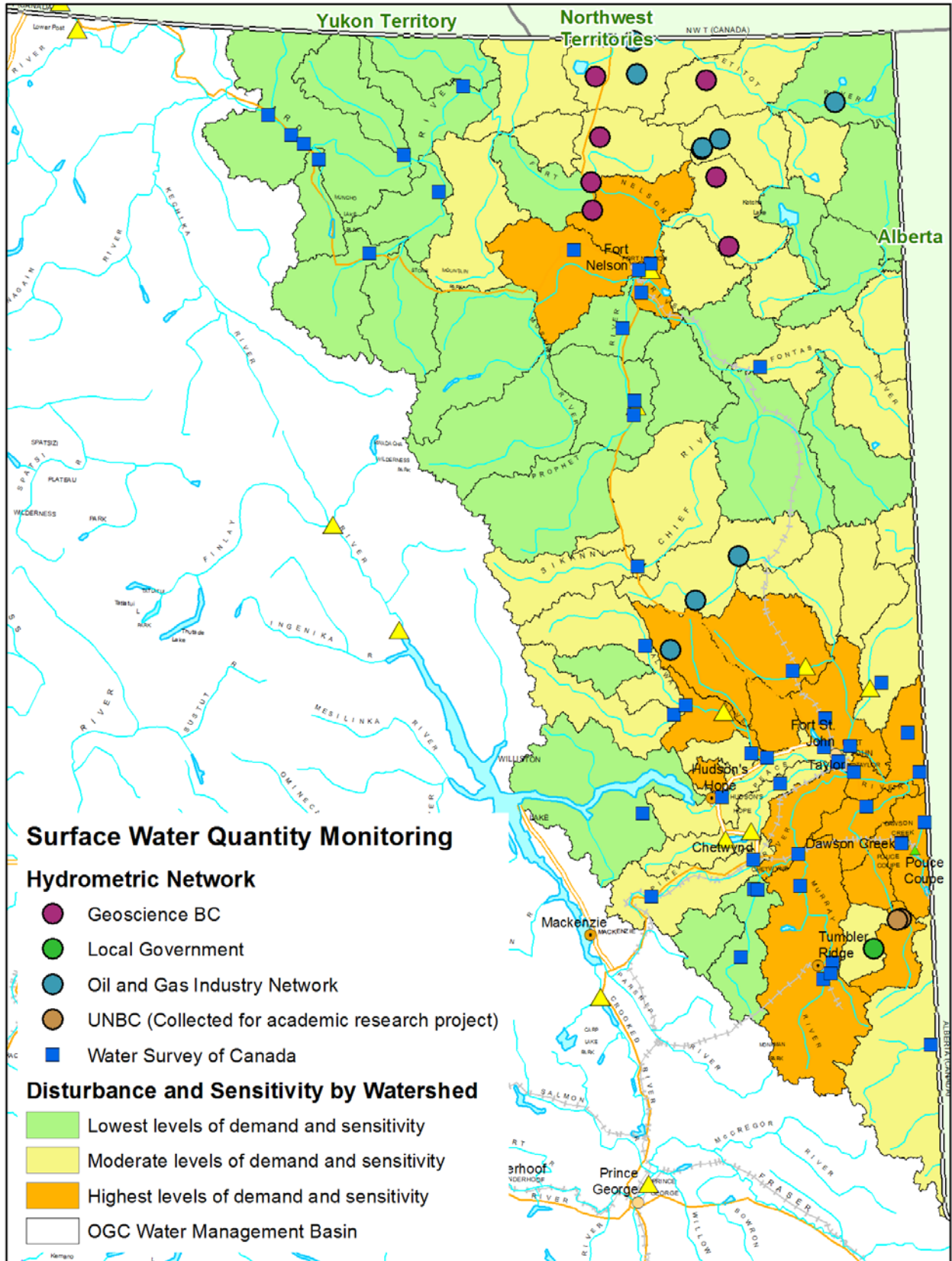


Figure 1. Surface water quantity monitoring in the Northeast BC and disturbance and sensitivity rating by watershed.

Mini Table of contents

- B.C. Snow Survey Program
- Spring Assessment Project

Update: B.C. Snow Survey Program

Snow Survey Program data uses include flood and water supply forecasting and management by provincial, regional and local jurisdictions; climate change analyses; and hydropower generation forecasts. Recent analysis of snow data in Northeast B.C. showed no long-term change in snowpack.

» www.env.gov.bc.ca/soe/indicators/climate-change/snow.html

Two methodologies are employed in the collection of snow survey data: automated snow weather stations (ASWS), and manual snow surveys (MSS). ASWSs typically consist of a datalogger enclosed in a shelter, and instrumentation on towers to measure temperature, precipitation, snow depth, and snow water equivalent (SWE) - all transmitted in near-real time via satellite telemetry. MSS sites are manually sampled by penetrating specially calibrated tubes into the snowpack at 5 to 10 sampling points per location, weighing the contents, and averaging the results. Both types of sites exist at elevations from valley bottoms to elevations of 2200m. All of the data collected are reported back to ENV where they are compiled, archived and made available publicly.

There are currently 8 ASWSs and 17 MSS sites in the Liard and Peace watersheds. Many of these stations are operated by BC Hydro which they use to manage reservoir levels. Future potential expansion plans include the establishment of two snow stations in the vicinity of the Horn River Basin, including a station associated with the Fire Weather Station at Sierra. This information will augment water management and climate data in northeast B.C.

The Snow Survey Program was started in 1935 in response to a prolonged drought. It is one of the longest running environmental monitoring programs by the B.C. government. It is centrally coordinated by the ENV & Climate Change Strategy, though a number of other agencies

conduct operations that greatly contribute to the program including FLNR, and BC Hydro.

Data from the B.C. Snow Survey Program can be found on the B.C. Data Catalogue and the River Forecast Centre websites.

» data.gov.bc.ca/

» bcrcfc.env.gov.bc.ca/data/

New: Spring Assessment Project

The spring assessment project was launched in September 2017 to monitor the quantity and quality of flowing springs, in response to concerns from several spring users that some springs are not producing as much water as they had in the past.

There is currently limited data available to support the claims of changes to the quantity and quality of springwater. This project will assist in creating useful background data and determining influences that might contribute to water quantity and quality changes. It will also assist with geological characterizations and improve an understanding of aquifer dynamics. This project complements ongoing groundwater aquifer characterization in the Montney Aquifer Characterization Project and the Private Well Sampling Program.

Intro: Enhancing Surface Water Quantity Monitoring in Priority Watersheds

In the last year, there have been new developments and updates to ongoing surface water quality projects. Surface water quality continues to be a priority for government in numerous areas including the *Northeast Water Strategy*, the Canadian Aquatic Biomonitoring Network (CABIN) program and the Federal-Provincial Water Quality Monitoring Network. The details on these areas of work are highlighted below.



Mini Table of contents

- Water Quality Data Summary and Characterization
- Showcase Story – The Northeast B.C. CABIN model for aquatic ecosystem assessment
- Federal-Provincial Surface Water Quality Monitoring Program

A wrap: Water Quality Data Summary and Characterization

While water quality data exists for many streams in Northeast B.C., there has not been a water quality data inventory or characterization of the available data for the 69 major watersheds in the region. Establishing a water quality monitoring program is essential in generating representative water quality data to assess overall water quality, and identifying priority watersheds for improved water stewardship and management.

“The Surface Water Quality Data Summary for Northeast B.C.” project’s main goal was to summarize the available data, characterize it and identify trends in water quality so an appropriate enhanced monitoring program could be established for the region. The project will see a network of specified sites monitored over time, guiding future management and stewardship decisions.

The first step was to compile and assess the existing water quality data for each of the 69 watersheds. A data summary of available background and trend water quality data from the ENV’s Environmental Monitoring System Database (EMS) and the provincial CABIN program has been completed for the 69 watersheds.

It was found that only 21 of the 69 watersheds had data from within the last 10 years and 35 watersheds have no data. This more recent data, along with historical data, was characterized to illustrate the overall water quality in these 69 watersheds. Given that many of the watersheds only had historical data and/or data from one sampling location within the watershed, not enough data existed to adequately characterize the current water quality status of the watersheds. Further challenges existed, such as characterizing historical data because instrument minimum detection limits have decreased substantially for many parameters over the decades.

Using the disturbance and sensitivity approach and the available water quality data, monitoring recommendations will be proposed to reach the project goal of establishing a regional monitoring program. As part of this project, new water quality analysis tools have been developed, supporting federal, provincial and local governments' emphasis on open data and shifting water quality analysis into a more repeatable and transparent process. This report will be finalized and published shortly and posted to the NEWS website.

Several methods were used to measure water quality, including benthic invertebrate monitoring in partnership with the CABIN. The ENV is currently working with Environment and Climate Change Canada (ECCC) to develop a CABIN model that can be used to evaluate aquatic ecosystems in the Northeast. The water quality data gathered during CABIN sampling was included in establishing the summary of available water quality data as part of this project.

ECCC recently completed a preliminary CABIN model for the Northeast, encompassing the Lower Fort Nelson, Petitot, and Central Liard Watersheds. ENV and ECCC completed reference site sampling in August 2017 to update the CABIN model to cover the entire Northeast.

New partners are encouraged to become involved with this project to help set and implement priority monitoring sites.

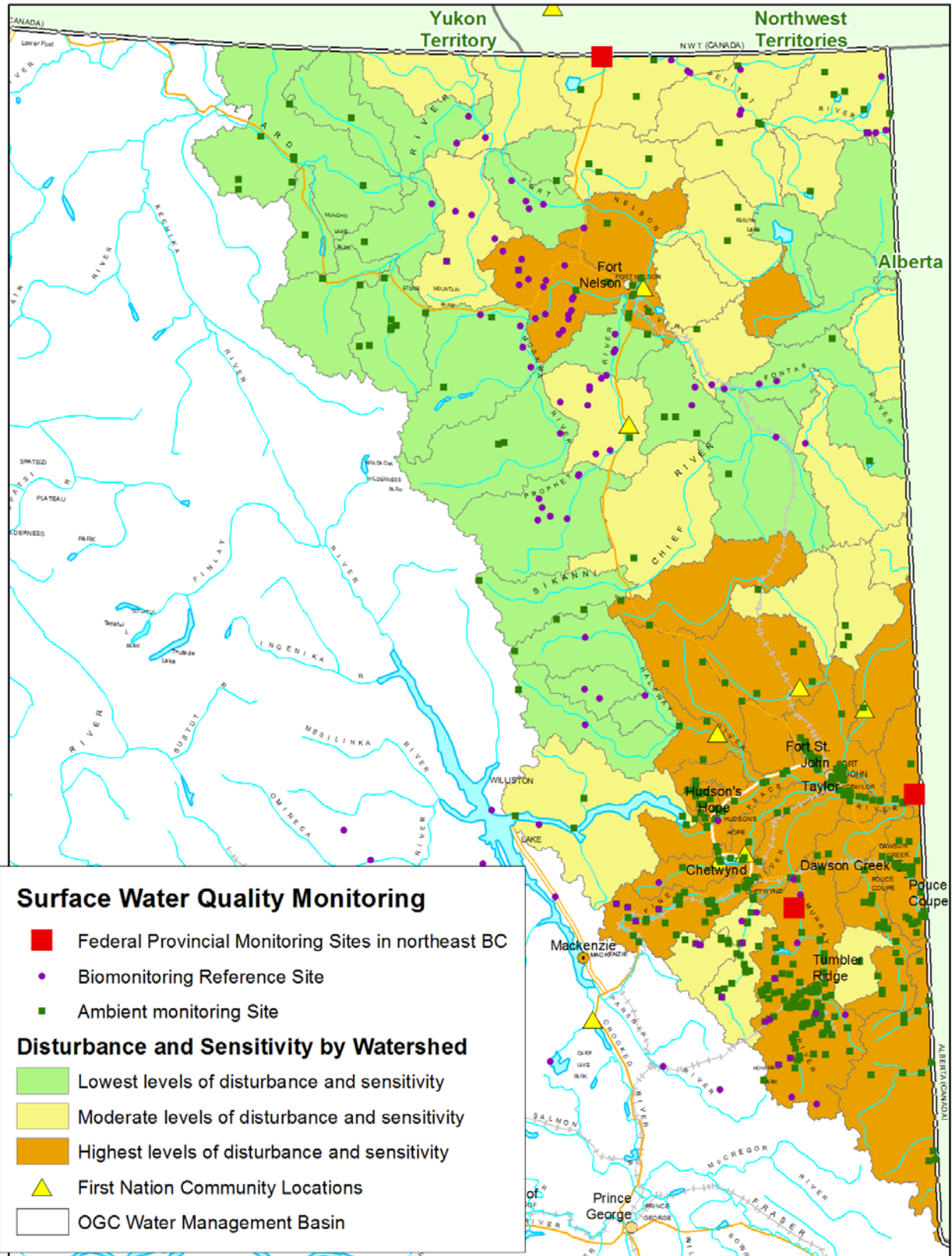


Figure 2. Surface water quality monitoring sites in Northeast B.C. and disturbance and sensitivity rating by watershed.



The Northeast B.C. CABIN model for aquatic ecosystem assessment

“Working in Northeast B.C. over the last two years has been an amazing opportunity as there is such a diverse variety of streams and habitats, many of which are in pristine condition. I have come to appreciate the beauty, remoteness and challenges of working in this part of the province. I’m looking forward to completing work on the expanded CABIN model for the Northeast as it will be an invaluable tool to examine ecosystem condition in this area.”

Jolene Raggett – Provincial Biomonitoring Program Lead.



Traditionally, water quality monitoring has focused on the collection of water and sediment samples. These types of samples provide a ‘snap-shot’ of the chemical and physical characteristics of a water body. However, biological monitoring can be incorporated into monitoring programs to provide a direct measure of the effects of various stressors on aquatic animals. Benthic macroinvertebrates (the insects that live on the bottom of a waterbody) are the most commonly used biological indicators in fresh water bodies because they are relatively sedentary, sensitive to a variety of disturbances, present in all freshwater ecosystems, and are a key part of the aquatic food web.

The ENV is working with ECCC to promote the nationally standardized CABIN program in B.C. and are currently focusing monitoring efforts on Northeast B.C. CABIN is based on the reference condition approach, which uses biological and habitat data from a wide range of reference sites to build predictive models. Reference sites represent habitats that are minimally impacted by human activities. The data collected from reference sites are used to create reference models that are then used to evaluate the condition of test sites in Northeast B.C. where there are concerns about the aquatic ecosystem. The difference between the aquatic macroinvertebrates at the test site versus the reference site provides an estimate of the severity of impacts at the test site.



CABIN reference site samples are collected in the late summer and early fall from riffle areas in wadeable streams. At each site, a comprehensive assessment is conducted, which includes collecting benthic macroinvertebrate samples using a kick net, along with measurements of water quality and habitat within the reach. Landscape level variables, such as climate, geology, and land use are also characterized in the upstream watershed using gis tools, as these factors can influence the benthic communities.



ECCC recently completed a preliminary CABIN model for Northeast B.C., which included the Lower Fort Nelson, Petitot, and Central Liard Watersheds. Expanded reference site sampling was conducted by ENV and ECCC in 2016 and 2017 to ensure the reference sites fully characterize the natural variability of benthic macroinvertebrate communities in the Northeast. These CABIN data will be used to expand and update the preliminary model, which will provide a standard and consistent monitoring tool that can be used to assess aquatic ecosystems across the Northeast.

More information about this project can be found on the B.C. Government Biomonitoring website.

- » www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/monitoring-water-quality/biomonitoring and on [ECCC's CABIN website: http://ec.gc.ca/rcba-cabin/](http://ec.gc.ca/rcba-cabin/)

Update: Federal-Provincial Surface Water Quality Monitoring Program

The Federal-Provincial Surface Water Quality (Fed-Prov WQ) Monitoring Program was established under agreement in 1985 as a partnership between the Federal and Provincial governments. The goal of the program is to provide inter-jurisdictional coordination and integration of water quality monitoring in rivers and streams across B.C. in a cost-shared manner. The Fed-Prov WQ network provides data for long-term trend analysis, status reports and cumulative impact assessments. The water quality stations are generally sampled biweekly or monthly, and measurements include physicochemical parameters such as temperature, pH, major ions, nutrients and metals. Stations are also sampled rotationally for benthic invertebrates using the provincially-adopted CABIN protocol.

There are currently three stations in operation in Northeast B.C.: the Petitot River at Hwy 77, the Peace River at Alces and the Murray River near the mouth. The Murray River station is a recent addition to the network; established in January 2017 to monitor for upstream cumulative effects. The station is sampled by Water Survey of Canada staff and is located at the Water Survey of Canada station in the Murray River. This station will help to fill data gaps and determine Water Quality Objective attainment once they are developed under the Murray River Watershed Partnership.

The BC ENV, in partnership with Environment and Climate Change Canada, plan to report on the status and trends from stations in Northeast B.C. in 2021. In the interim, Fed-Prov WQ monitoring station data can be accessed online by individual station or by basin in the Government of Canada Open Data Catalogue.

» aquatic.pyr.ec.gc.ca/webdataonlinenational/

» open.canada.ca/en/open-data

Intro: Building and Coordinating Groundwater Knowledge

Groundwater flow systems in Northeast B.C. are largely unmapped, and there is sparse knowledge or understanding of where aquifers are located outside of populated areas.

This project aims to coordinate existing groundwater information, and identify collaborative opportunities to develop new research¹³. This includes:

- » Increasing understanding of the location, size and capacity of groundwater flow systems.
- » Increasing understanding of aquifer characteristics and monitoring, including groundwater quality testing.
- » Coordinating and integrating groundwater information across all water users and partners, including a comprehensive inventory of all groundwater-related activities and identifying information gaps and research needs.
- » Improving communication around groundwater research and initiatives, and collecting and disseminating groundwater knowledge, ensuring that partners and users have the information they need to make informed decisions.

Results-to-date have been shared across governments and with First Nations, academics, industry and interested members of the public.

Figure 3 shows some of the expanded activities in the past year including paleovalley well drilling, private well sampling, a new research project by the University of British Columbia and a dissolved gas study.

13 BC Groundwater Association, BC Oil and Gas Commission, Blueberry River First Nations, Canadian Association of Petroleum Producers, Doig River First Nations, Fort Nelson First Nation, Foundry Spatial, Geoscience BC, Halfway River First Nation, Ministry of Environment, City of Dawson Creek, GW Solutions, Hudson's Hope, Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Ministry of Health, Peace River Regional District, Shell, Simon Fraser University, University of British Columbia, University of Victoria

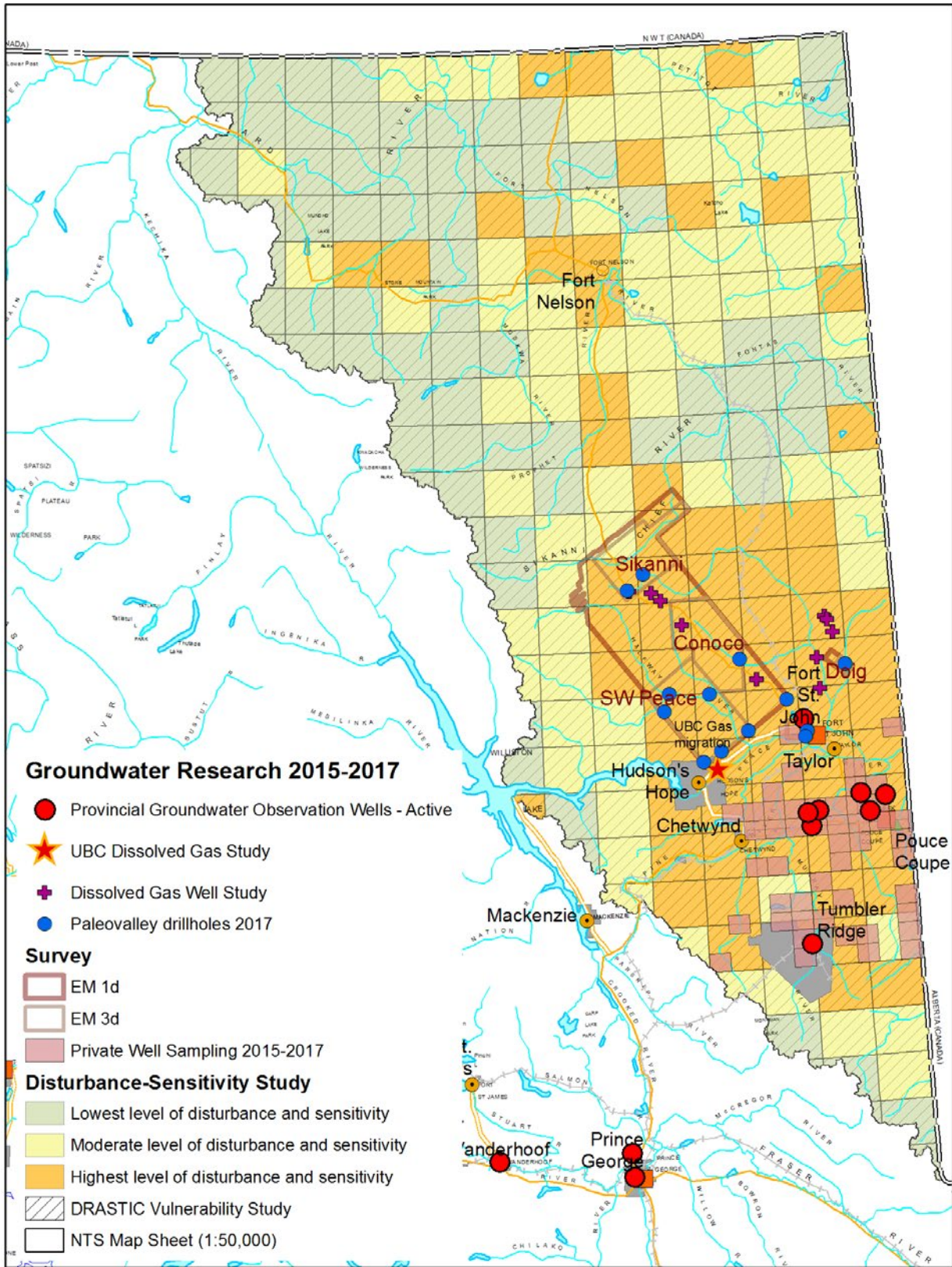


Figure 3: Groundwater quality and quantity monitoring sites in Northeast B.C. and disturbance and sensitivity rating by watershed.

Mini Table of contents

- Groundwater monitoring
- Showcase Story – PaleoValley Drilling
- Provincial Groundwater Observation Well Network
- Montney Aquifer Characterization Project
- Peace River Regional District Aquifer Characterization
- Intrinsic Aquifer Vulnerability Mapping in Northeast B.C. using the DRASTIC Model
- UBC Monitoring
- McGill Well Monitoring and Induced Seismicity
- OGC UBC well monitoring
- Gas Sampling Comparison Study

Paleovalleys are large valleys systems formed as part of a river network system thousands of years ago when the region was under glaciation. Over time and as the topography has changed, these ancient valleys have been infilled with sediment. Although there may be no indication on the surface of their underground existence, paleovalleys can host large quantities of fresh water underground in aquifers. Because some of these water resources can be very deep or potentially under high pressure, they are too expensive and challenging to be of interest to private well owners. However, they are a good source of water for municipal well systems and the oil and gas industry.

Update: Groundwater Monitoring in the Montney Region

There has been substantial research into large ancient valleys buried under layers of sediment in the Montney region. Airborne and ground-based geophysical surveying have mapped paleovalleys in the Montney region, and the geology has been verified by drilling core holes.

Project reports are located on the *Northeast Water Strategy* website.

- » www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/latest-information



PaleoValley Drilling

Since 2009, the BC government has been working with industry and Geoscience BC to better understand paleovalleys.

Several collaborative government initiatives have greatly improved our knowledge of paleovalleys in the Peace River region. Detailed work by Dr. Adrian Hickin and Dr. Mel Best, mapped a small area using ground based geophysics with follow up drilling. Recently Geoscience BC coordinated a large airborne geophysical survey program across a swath of the Montney Play trend. Geoscience BC partnered with the Canadian Association of Petroleum Producers, Simon Fraser University, several First Nations and the Provincial Government to fly more than 600 line kilometers of electromagnetic surveys from Fort St John all the way up to the Sikanni Chief River and as far west as Hudson Hope. Each line flown provided a depth slice of information about what the subsurface geology might look like. A few areas were highlighted for extra work and 3-dimensional models were created from the data.

During the winter of 2017, eight holes were drilled in key locations to help identify the geology that was inferred to exist from the geophysics. In one case, the drill hole encountered enough groundwater to warrant the installation of a monitoring well. Early reconciliation of the drilling results with the geophysics indicates good support of geophysical inferences, but there is room for much improvement. Some of the anticipated depths from the geophysics were not correct

because the line spacing was too wide. The drilling provided excellent ground truth data to calibrate the airborne geophysics and better understand paleovalleys in the area.

The results have been very encouraging and more programs using airborne geophysics to map paleovalleys are anticipated.

More information about this project is located on the *Northeast Water Strategy* website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/latest-information

Update: Private Well Sampling program

The 2016–17 private well and spring survey sampled 52 sites in total (43 new sites, 9 revisits). Parameters sampled included: metals, cations, anions, field parameters (Dissolved oxygen, pH, conductivity, oxidation reduction potential, temperature, turbidity), stable isotopes, dissolved gasses, and microbiological analyses.

Nine sites were sampled across the Saulteau, Halfway River and Doig River First Nations. Fourteen industrial water source wells were captured across the Pee-Jay, Rose Prairie and Pink Mountain areas. The remainder of the private wells sampled were in Chetwynd, Hudson's Hope, Tower Lake, and Charlie lake areas.

Update: Provincial Groundwater Observation Well Network

The Provincial Groundwater Observation Well Network (PGOWN) monitors several wells in Northeast BC and is adding to the network over time. The wells measure both groundwater quantity and quality. Water levels are recorded hourly and water chemistry samples are taken on a schedule. In 2015, benzene, toluene, ethylbenzene, xylene, oil and grease were added to the water-chemistry sampling parameters for wells in the Montney Play area. This project will be ongoing, with new groundwater Observations wells planned for the Blueberry River area as well as Fort Nelson in 2018.

Water level information is publicly available and can be downloaded from the Provincial Groundwater Observation Well Interactive Map which is available on the *Northeast Water Strategy* website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/key-resources

A wrap: Montney Aquifer Characterization Project

The Montney Aquifer Characterization Project has been completed. A university-government consortium¹⁴ characterized aquifers in the Dawson Creek-Groudbirch area within the Peace River watershed in Northeast region. The project included aquifer mapping, drilling and testing observation wells, and water chemistry and isotope analysis from private well sampling in the area.

The study concluded that within the study area, the major river valleys are dominated by unconfined fluvial sand and or gravel aquifers. The eastern part of the study area is dominated by thick deposits of till silty clay with thin lenses of sand which can sustain private wells. The major portion of the study area is underlain by bedrock aquifers, covered by clay till deposits of variable thickness.¹⁵

A report was published in January 2017 and it is available at:

» a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=52034

14 Simon Fraser University; Ministry of Forests Land and Natural Resource Operations; Ministry of Energy and Mines; Ministry of Environment; Ministry of Natural Gas Development; Geological Survey of Canada; BC Oil and Gas Commission

15 Baye, A.; Rathfelder, K.; Wei, M.; Yin, J. 2017. Hydrostratigraphic, Hydraulic and Hydrogeochemical Descriptions of the Dawson Creek - Groudbirch Area.

A wrap: Peace River Regional District Aquifer Characterization

This project has been completed. The Peace River Regional District has compiled, sorted, formatted, organized and interpreted lithological and groundwater elevation data to map aquifers in 3D, and to characterize the groundwater regime (flow directions and hydraulic gradients). GW Solutions has compiled a water quality database which includes a total of 11,935 surface water samples from 364 locations, and collected between 1955 and 2014. At the regional scale, the water appeared to originally be predominantly calcium-bicarbonate for surface water and calcium/sodium-bicarbonate/sulphate for the groundwater samples.¹⁶

Reports are available online.

» prrd.bc.ca/category/aquavine/prrd-water-quality-baseline-project/

New: UBC Monitoring

University of British Columbia researchers are working with partners¹⁷ to determine the transport and fate of dissolved gas in shallow freshwater aquifers. In this multi-year study, which will begin in 2018, researchers will release small amounts of methane into groundwater at a depth of 25 metres. They will track the methane as it travels with the groundwater and as it rises through the unsaturated zone to surface and into the atmosphere. They will also observe any methane interaction with groundwater and any associated changes in water chemistry.

Researchers have already collaborated with Geoscience BC and partners on the paleovalley study to drill a research site near Hudson's Hope and establish a research well there.

Information from this study will help B.C. regulators better understand and manage for the risk of dissolved gas leaks (fugitive gas) from oil and gas production casing.

» science.ubc.ca/news/groundwater-monitoring-methane-required-near-energy-wells-ubc-researcher

16 This work was done in partnership between the Peace River Regional District, GW Solutions, and the Treaty 8 Tribal Association, with funding support from the BC Real Estate Foundation.

17 UBC is working with partners the BC Oil and Gas Commission, FLNR, and Ministry of Energy, Mines and Petroleum Resources

New: McGill Well Monitoring and Induced Seismicity

In 2017, McGill University started research with partners¹⁸ to determine the impact of induced seismicity on groundwater chemistry. This past year, McGill has established eight seismic monitoring stations between Fort St. John and Dawson Creek. Probes have been deployed in six monitoring wells to capture temperature, depth and electrical conductivity. Seismic events catalogued by Natural Resources Canada are being compared with historic groundwater levels at the monitoring wells. This is the first year of a multi-year study.

New: OGC UBC well monitoring

Geoscience BC has just launched a monitoring well study in conjunction with OGC and UBC. This multiyear study will evaluate for dissolved gas in fresh groundwater.

New: Gas Sampling Comparison Study

To better understand whether sampling techniques greatly impact dissolved gas studies, FLNR has collaborated with OGC, SFU and UVIC to sample a series of wells using two sample collection methods. The results are currently being analyzed and will be published in 2018.

18 Oil and Gas Commission, Ministry of Energy, Mines & Petroleum Resources and FLNR

2 STRENGTHEN THE REGULATORY REGIME

Creating new regulations and effectively implementing existing legislation will strengthen the current regulatory water regime.

Mini Table of contents

- Water Sustainability Act
 - Environmental Flow Needs Policies
 - The Northeast Drought Communication and Response Plan
 - Northeast B.C. Dugout Policy
 - Oil and Gas Activities Act
 - BC Oil and Gas Commission
 - Canadian Association of Petroleum Producers
- Oil and Gas Activities Act
 - BC Oil and Gas Commission
 - Canadian Association of Petroleum Producers

Water Sustainability Act

When the *Water Sustainability Act* (WSA) came into force in February 2016, it set the stage for development of regulations, policies and procedures around water use and sustainability across B.C. The WSA introduces new authorizing and permitting requirements for non-domestic groundwater users (e.g., industrial, agricultural), stronger protection for aquatic ecosystems, new fees and rentals for water use, expanded protection of groundwater, enhanced dam safety and awareness, and strengthens water related compliance and enforcement.

- » www2.gov.bc.ca/gov/content/environment/air-land-water/water/laws-rules/water-sustainability-act

The next phase in the WSA is to develop policies and regulations in the following areas.

Environmental Flow Needs

Policies and guidelines to protect Environmental Flow Needs (EFN) include:

- » developing fish periodicity charts, one of the first steps in assessing EFN once there is a risk of low flows
- » providing policy on when a field assessment should be carried out
- » providing guidance on evaluating water availability and EFN at points of diversion
- » updating existing guidance documents for detailed habitat assessments.

Northeast B.C. Dugout Policy

Under the WSA, the Province released a *Water Policy Bulletin* (August 2017) on dugouts to clarify the authorization requirement to divert, store and use water by means of a dugout, whether for use in agricultural, livestock or industry. The updated policy provides information for potential applicants about identifying whether the water source for the dugout is surface runoff, stream or groundwater. It also provides information about determining if the *Dam Safety Regulation* applies to a dugout.

- » www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-policies

Oil and Gas Activities Act

BC Oil and Gas Commission

Key actions around water use by the oil and gas industry include the following.

- » In spring 2017, the Commission inspected 51 unlicensed dams in the Montney region and Horn River Basin. It issued seven compliance orders. The Commission recently designated

existing staff and hired new staff as Dam Safety Officers and Engineers to review dams used for oil and gas purposes.

- » The Commission implemented Planning and Operational Measures to clarify expectations for oil and gas activities proposed in sensitive environmental areas. It also standardized Environmental Objectives operating procedures under the Environmental Protection and Management Regulation (EPMR). Operators are required to follow the specified guidance when in riparian reserves and other resource features.
- » In July 2017, the commission launched a new simplified portal to report Area-Based Analysis (ABA) status information for all ABA values, including riparian and old forests.
- » The Commission continues to regulate oil and gas activities under statutory responsibilities that include the protection of surface water and groundwater resources. It updates various guidelines such as the Environmental Protection and Management Guideline to reflect changes in legislation and regulations.
- » The *WSA* provides incentives for the use of “deep groundwater” over shallow potentially potable groundwater resources for oil and gas purposes.

Canadian Association of Petroleum Producers

Almost 85 percent of the oil and gas industry in B.C. are members of the Canadian Association of Petroleum Producers (CAPP). The Association’s guiding principles for hydraulic fracturing require all members to:

- » safeguard the quality and quantity of regional surface and groundwater resources
- » measure and report on water use
- » support the disclosure and greening of fracturing fluid additives
- » advance and collaborate on technologies and best practices.

CAPP’s has seven operating practices that inform and complement regulatory requirements.

1. Fracturing Fluid Additive Disclosure
2. Fracturing Fluid Additive Risk Assessment and Management
3. Baseline Groundwater Testing
4. Wellbore Construction and Quality Assurance
5. Water Sourcing, Measurement and Reuse
6. Fluid Transport, Handling, Storage and Disposal
7. Anomalous Induced Seismicity: Assessment, Monitoring, Mitigation and Response

A copy of CAPP's Hydraulic Fracturing Operating Practices is on the *Northeast Water Strategy* website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/latest-information.

CAPP members will continue to work with Northeast Water Strategy partners to implement these practices in Northeast B.C. Recent CAPP activities include conversations with government on:

- » barriers and solutions to alternative water use, particularly with respect to storage and transport
- » incentives for produced water and flowback reuse
- » risk-based requirements, including policy and criteria, for the discharge of treated produced water to the environment.

CAPP is working with UBC on a hydraulic fracturing fluid "greenness" assessment system to rate and use more ecologically safe fluids for hydraulic fracturing. This involves integrating past research from two primary sources: HyFFGAS (UBC) and Intrinsik (CAPP).

3 COORDINATE DECISION-MAKING PROCESSES ACROSS THE NATURAL RESOURCE SECTOR

Managing water across Northeast B.C. involves complex decision making processes. Coordinating and streamlining these processes within the large number of NEWS partners is both a strength and a challenge. The strength lies in the wealth of shared information now available to all partners, and the strategic identification and filling of information gaps. The challenge is that each of these organizations is independent, operating with very specific mandates, accountabilities and timelines.

The *Northeast Water Strategy* is becoming the way partners are working together to ensure that activities and decisions around water use, research and on-the-ground actions acknowledge the diverse priorities across the Northeast B.C. region.

Meaningful consultation with First Nations on decisions that may have the potential to infringe upon rights and interests is a foundation of the Northeast Water Strategy. Consultation is a critical element in identifying priorities and improving the efficiency and durability of water related decisions.

Mini table of contents

- Northeast Water Inter-agency Steering Committee
- Regional Strategic Environmental Assessment
- Mackenzie River Basin Transboundary Waters Master Agreement
- Murray River Watershed Partnership

Northeast Water Inter-agency Steering Committee

The Northeast Water Inter-agency Steering Committee continues to guide provincial government implementation of the Strategy. It oversees projects in the Surface Water Quality, Surface Water Quantity and Groundwater Knowledge Working Groups. It is also working on a Water Knowledge Forum for early 2018. This gathering of all partners will establish a common understanding of current water monitoring research and projects in Northeast B.C. with the goal of creating a shared monitoring approach for this region.

Regional Strategic Environmental Assessment

The Regional Strategic Environmental Assessment is a project between B.C. and seven Treaty 8 First Nations. Started in late 2015, it focused on a cumulative effects assessment of valued components associated with the practice of Treaty 8 rights – including water. An assessment of the watershed conditions (surface and groundwater) will assess aquatic ecosystem health as it relates to biodiversity. It will also provide opportunities to undertake traditional uses and the practice of Treaty rights.

Mackenzie River Basin Transboundary Waters Master Agreement

The 1997 Mackenzie River Basin Transboundary Waters Master Agreement provides for neighbouring jurisdictions to negotiate Bilateral Water Management Agreements .

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/water-management-agreements

These agreements include broad management principles to maintain ecological integrity of the aquatic ecosystem for all shared groundwater and surface water crossings between jurisdictions within the Mackenzie River Basin. The agreements set clear ground rules for how neighbouring jurisdictions will manage shared waters through commitments to water quality, quantity and aquatic ecosystem health at the transboundary crossings, and how they will make future water management decisions.

The *British Columbia-Northwest Territories BWMA* was signed in October 2015

» news.gov.bc.ca/releases/2015ENV0063-001715

The *British Columbia-Yukon BWMA* was signed earlier this year in March 2017.

» news.gov.bc.ca/releases/2017ENV0036-001076

Implementation of both agreements is ongoing.

Murray River Watershed Partnership

Work within the Murray River Watershed Partnership continues. In January 2017, a federal-provincial water quality monitoring station was installed on the Murray River, near the mouth in the lower watershed. With this new station's data, along with additional monitoring done by mining companies and the ENV, data gaps have and will continue to be addressed throughout the watershed.

A conceptual model of how contaminants flow through the watershed has also been completed. As mentioned in the *2016 NEWS Annual Report*, all 12 members of the Murray River Watershed Partnership steering committee are sharing water quality data through a shared database. As new monitoring data is gathered, the database is updated. This was used to update the Data Assessment Report and ultimately help develop Water Quality Objectives for the Murray River Watershed.

4 ENHANCE REPORTING, COMPLIANCE AND ENFORCEMENT

Effective water monitoring and reporting are the cornerstones of adaptive management of Northeast B.C.'s water resources. They require coordination across all natural resource activities, and commitment from multiple partners to ensure long-term delivery.

Mini table of contents

- Reporting
 - The Water Portal
 - The NorthEast Water Tool
 - The Groundwater Review Assistant
 - Environmental Monitoring System Database
- Compliance and Enforcement
 - Aboriginal Liaison Program

Reporting

Good data relies on good reporting. The Northeast Water Strategy uses a suite of tools to collect and track information about water use in the region. New tools continue to be developed, contributing to comprehensive, accurate and user-friendly data for key water-use decisions.

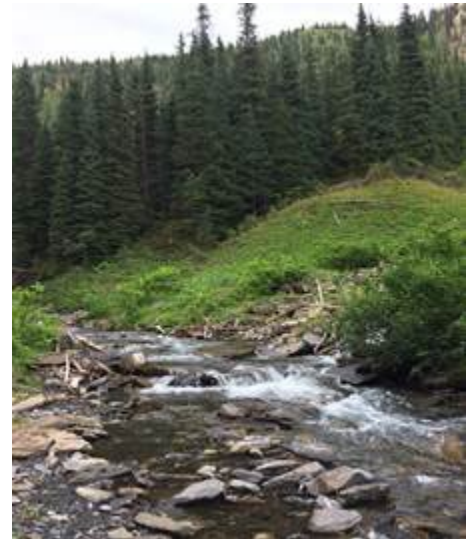
- » **The Groundwater Review Assistant** (GWRA) is the newest tool used by the Northeast Water Strategy to retrieve and compile data on groundwater. It was introduced in January 2017 by the Oil and Gas Commission to assist hydrogeologists and others retrieve and compile groundwater-related data. This data will support projects and tasks requiring a “desktop” level hydrogeological review or assessment. The GWRA allows a user to specify

a location of interest and a search radius to define the area for data retrieval. It retrieves data from public databases and presents it in a comprehensive report.

- water.bcogc.ca/groundwater

» **The Water Portal**¹⁹ is a map-based water information tool providing public access to a wide range of water-related data and information in Northeast B.C. The user-friendly website accesses data collected by multiple government agencies and partners to provide current and historical surface and groundwater quantity information, surface and groundwater quality information and climate information.

- The water portal has expanded to include the Skeena and Omineca regions of the province. The portal is continuously being updated.
- The surface water quantity data produces seven-day flow discharge information, monthly mean flow and a flow duration tool. The surface and groundwater quality data set includes many water quality parameters for monitoring locations over a period of time.
- The weather data set provides daily mean, average high, average low as well as a variety of statistical information.



The Water Portal is on the *Northeast Water Strategy* website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/key-resources

» **The Northeast Water Tool (NEWT)**²⁰ provides custom watershed reports on water availability including monthly flows, environmental flow needs, current allocations and available water for allocation in Northeast B.C. In November 2016, the OGC released Version 3, which:

19 The Water Portal is the result of a joint research by the BC Oil and Gas Commission and Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

20 NEWT was developed in partnership with Geoscience BC, the BC Oil and Gas Commission and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. It has been in operation since 2012.

- provides improved map and query functionality,
- includes projections of future climate and downstream water rights holders to NEWT summary reports
- updates environmental flow needs assessment.

NEWT is available on the Northeast Water Strategy website www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/key-resources

- » **The Environmental Monitoring System (EMS)** web reporting application enables interaction with the ENV's water quality data. It is now available to the public.
 - www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/environmental-monitoring-databases/ems-web-reporting

The database information is already publically available via the B.C. Data Warehouse.

- catalogue.data.gov.bc.ca/dataset/bc-environmental-monitoring-system-results

Compliance and Enforcement

To ensure the water resource continues to be protected, additional training has been and will continue to be provided to Natural Resource Officers in Northeast B.C. Their duty is to uphold the Water Sustainability Act. Natural Resource Officers and Water Officers uphold the Water Sustainability Act. They work together to continue ensuring water use compliance in the region.

FLNR and Compliance and Enforcement Water Training Program

A joint working group made up of the FLNR Water Stewardship personnel and Compliance and Enforcement personnel, provides training to Compliance and Enforcement officers. Training covers water-related issues include identifying streams (as defined under the Water Sustainability Act) and identifying whether a dugout is, in fact, a dam.

Aboriginal Liaison Program

The Natural Resource Sector Aboriginal Liaison Program²¹ was created in Northeast B.C. with the Doig River First Nation in 2014. The program has since expanded to include the Prophet River First Nation, Saulteau First Nations, Haisla Nation, Nisga'a Lisims Government, Carrier Sekani First Nations, and the Lake Babine Nation.

The Aboriginal Liaison Program helps build capacity in communities that want to participate in the oversight, compliance, and reporting of both water use and the impact on water resources. It helps ensure that development complies with regulations and permit conditions. This is a key value in protecting water and natural resources in Northeast B.C.

The opportunity for Aboriginal Liaisons to share their knowledge and information is a critical feature of this partnership. It actively promotes working together towards a common understanding of the important values in managing the land base and how to improve oversight, management, and stewardship.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy/latest-information

21 The Province and all interested First Nations.

5 BUILD A WATER STEWARDSHIP ETHIC

Building a strong water stewardship ethic is a long-term, evolving goal. Water stewardship is everyone's responsibility and the collaborative process that our partners have signed onto ensures that together, we are building a transparent and accountable approach to managing our precious resource.

Part of building water stewardship ethic is engaging with the community. Last Summer (2017), FLNR ministry staff gave a presentation on Water Sustainability Act authorization requirements and landowner water concerns to landowners in the Peace region.

Outreach letters were also sent to more than 300 identified existing groundwater users in the Northeast, indicating that they may need to apply for an groundwater licence.

Next steps and goals for the third year of the Strategy are to:

8. integrate the *Northeast Water Strategy* with the *Regional Strategic Environmental Assessment* and develop a collaborative water monitoring program in Northeast B.C. with Treaty 8 First Nations.
9. continue to improve communication regarding water research and collaboration opportunities in the region.
10. continue to support water policy development and implementation.
11. strengthen compliance and enforcement of water resource activities.
12. hold a Northeast Water Forum in early 2018 and a roundtable discussion with NEWS partners.

There is still a lot more work to do in order to reach our goals. The long-term priorities, including building a strong and vibrant water stewardship ethic, will require years to develop. The success of the Northeast Water Strategy will be measured years into the future, based on the knowledge, awareness and informed actions of the partners.

APPENDIX A: NORTHEAST WATER STRATEGY IMPLEMENTATION PARTNERS

- ▶ B.C. Government
 - Ministry of Agriculture
 - Ministry of Forests, Lands, Natural Resource Operations & Rural Development
 - Ministry of Environment & Climate Change Strategy
 - Ministry of Energy, Mines & Petroleum Resources
 - Ministry of Health

- ▶ BC Oil and Gas Commission

- ▶ Northern Health Authority

- ▶ First Nations
 - Blueberry River First Nations
 - Doig River First Nation
 - Fort Nelson First Nations
 - Halfway River First Nation
 - McLeod Lake Indian Band
 - Prophet River First Nation
 - Saulteau First Nations
 - West Moberly First Nations
 - Treaty 8 Tribal Association

- ▶ Local and Regional Governments

- City of Dawson Creek
- District of Tumbler Ridge
- Hudson's Hope
- Peace River Regional District
- Northern Rockies Regional Municipality

- ▶ Federal Government
 - Agriculture and Agri-Food Canada
 - Environment and Climate Change Canada
 - Geological Survey of Canada

- ▶ Academia
 - Simon Fraser University
 - University of Alberta
 - University of British Columbia
 - University of Calgary
 - University of Montreal
 - University of Northern British Columbia
 - University of Victoria
 - University of Waterloo
 - Wilfrid Laurier University

- ▶ Industry
 - Association of Mineral Exploration BC
 - Arc Resources Ltd.
 - BC Agriculture Council
 - BC Grain Producers' Association

- BC Branch of the Canadian Seed Growers' Association
 - Canadian Association of Petroleum Producers
 - Clean Energy BC
 - ConocoPhillips
 - Council of Forest Industries
 - Devon
 - Encana
 - Mining Association of BC
 - Peace Region Forage Seed Association
 - Peace River Regional Cattlemen's Association
 - Peace River Coal
 - Peace River Forage Association
 - Progress Energy
 - Shell Canada
 - Spectra Energy
 - Talisman Energy
 - Teck Coal
 - Walter Energy
 - West Fraser
- ▶ Non-Governmental organizations
- BC Agriculture and Food Climate Action Initiative
 - BC Groundwater Association
 - BC Oil and Gas Research and Innovation Society
 - BC Real Estate Foundation

- Bulkley Valley Research Center
 - Canadian Water Network
 - Foundry Spatial
 - Fraser Basin Council
 - Geoscience BC
 - GW Solutions
 - Pacific Institute for Climate Solutions

APPENDIX B: CORE PRINCIPLES

The Northeast Water Strategy is guided by seven core principles:

1. *Water stewardship is a shared responsibility between the Province, First Nations, regulatory bodies, federal and local governments, communities, industry and academia.*
2. *The strategy recognizes existing legal and constitutionally recognized rights and responsibilities. These include: existing rights and responsibilities under current water licencing; constitutionally protected treaty rights of the Treaty 8 First Nations; consultation obligations of the Crown with regard to First Nations' treaty rights, aboriginal rights and title claims; conservation of fish habitat; and protection of human health and safety.*
3. *There are limits to the available water supply. Water resources must be managed for quantity and quality within the natural range of variability of individual watersheds and aquifers.*
4. *Accurate data is critical in managing the water supply. Knowledge of the state of Northeast B.C.'s water and its aquatic ecosystems is the foundation for informed and effective decision-making.*
5. *The survival and quality of life in communities and for First Nations in Northeast B.C. depends on healthy aquatic ecosystems.*
6. *Protecting the quality of ground and surface water must be a priority in all decisions affecting community life and economic development.*
7. *Safe and sufficient drinking water is a basic human right.*

Collaboration amongst partners brings significant and specific knowledge, experience, perspectives and priorities to the table. This commitment to partnership is crucial to the development, implementation and ultimate success of the strategy.

Public confidence

The NEWS *Northeast Water Strategy* was developed specifically to build public confidence in both the process and the outcomes. It relies on:

1. Broad participation from all organizations and individuals interested in water-use, watershed and aquifer issues and opportunities in Northeast B.C.
2. Openness and transparency in all the work we do.



Broad participation

Partnerships and transparency are the core operating values in both the development and implementation of the *Northeast Water Strategy*. In order for continued success, the *Northeast Water Strategy* requires participation from all partners.

Bringing a wide range of water users to the table ensures that many diverse and occasionally conflicting views are represented. To further broad participation, the *Northeast Water Strategy* held a Groundwater Knowledge Project workshop on June 2, 2016 in Victoria B.C. The workshop brought together three core groups interested in groundwater research and monitoring in

Northeast BC: 1) government researchers and regulators; 2) non-government researchers (academia, industry, NGOs) and 3) representatives from Treaty 8 First Nations (Fort Nelson, Halfway River, Doig River and Blueberry River) and other residents of Northeast BC. Over forty people attended to hear presentations on ongoing groundwater research activities and to discuss collaborative research and monitoring opportunities. Building on this success, the Northeast Water Steering Committee plans on hosting additional forums or workshops in the near future.

Openness and transparency

Along with reporting to and through our partners, the *Northeast Water Strategy* provides public status and progress reports. Project updates and completed reports, outcomes and summaries from meetings, workshops and forums, and links to information sources and water tools are regularly posted to the Northeast Water Strategy website.

» www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-planning-strategies/northeast-water-strategy

APPENDIX C: WATER DEFINITIONS

Aquifer is an underground deposit of permeable materials (such as sand or gravel or porous bedrock), where groundwater can be readily transmitted and stored. Aquifers can be interconnected to other aquifers and surface water and can occur at various depths.

Deep Groundwater is water found deeper than 600 metres below the surface and is not connected to surface water. Subsurface water tends to become more saline with depth as it is increasingly isolated from recharge by precipitation. Also, it has resided for a long period of time within the aquifer rock and will have dissolved various salts and minerals within the rock.

Groundwater is water found in the soil or rock below the surface where the pores and openings are filled with water.

Flowback Water is water-based hydraulic fracturing fluid that flows back to the wellbore after a hydraulic fracturing stimulation treatment is completed and before the well is transferred to production. Surface discharge of flowback water is not allowed in B.C.

Produced Water is water from an underground formation that is brought to the surface along with oil or natural gas from the well. It may contain salts, organic and inorganic compounds including oil or dissolved gas as well as additives used in drilling and possible naturally occurring radioactive materials dissolved from the rock. Surface discharge of produced water is not allowed in B.C.

Surface Water is water that runs over or sits on the land. This includes lakes, rivers, streams, creeks and ponds. It is usually freshwater and is not stored in the ground. Surface water supports aquatic ecosystems and may be used by communities, agriculture and other industries.

Water Stewardship is the responsible use and care of water resources through conservation and sustainable practices to ensure human and ecosystem needs are met now, and into the future.

Watershed is the area of land that drains into a river, stream or lake. Watersheds are divided by heights of land.



Northeast Water Strategy

Progress Report - 2017

