

British Columbia and Alaska Technical Working Group on Monitoring: Program Review

Final Report



January 2021



For additional information, visit:

<https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/compliance-enforcement/bc-alaska-transboundary-waters>

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Alaska DEC 2018 Rivers Survey

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- B.C. Ministry of Energy, Mines and Low Carbon Innovation (formerly the Ministry of Energy, Mines and Petroleum Resources)
- Central Council of Tlingit and Haida Indian Tribes of Alaska
- Ketchikan Indian Community
- Tahltan Central Government
- Taku River Tlingit First Nation
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EXECUTIVE SUMMARY

The transboundary region between Northwest British Columbia and Southeast Alaska contains important mineral resources and fish habitats that are culturally and economically significant. Following the Mount Polley Mine tailings dam failure and public concerns over mining, the State of Alaska and the Province of British Columbia (B.C.) signed a Memorandum of Understanding and Statement of Cooperation on protection of transboundary waters and initiated a Technical Working Group on Monitoring (TWG-M). The TWG-M was primarily tasked with engaging with the public, reviewing existing environmental data and developing and implementing the Joint Water Quality Program for Transboundary Waters (Joint Sampling Program) to collect additional environmental data throughout transboundary watersheds. This report summarizes activities by the TWG-M from 2015 to 2019 and the outcomes they produced.

The TWG-M engaged with government agencies, Tribes and First Nations, the scientific community, mine industry representatives, environmental organizations and the public at formal and informal meetings to discuss transboundary issues. The workshops and presentations guided how transboundary issues would be addressed by the TWG-M. The Alaska Department of Environmental Conservation (DEC) partnered with the Central Council of Tlingit and Haida Indian Tribes of Alaska (Central Council) to conduct a community resources and values survey which included Traditional Ecological Knowledge (TEK) and explore local community concerns about transboundary issues (Central Council, 2018). British Columbia collaborated with the Taku River Tlingit First Nation (TRTFN) and Tahltan Central Government on the two-year Joint Sampling Program.

To identify existing data for the transboundary region, the TWG-M primarily examined government databases, reviewed industry data and consulted with known data collection sources in the region (e.g. Tribes and First Nations). Water, sediment and bioassessment data were catalogued in a data mining project, the results of which allowed the TWG-M to identify data gaps and future sampling needs. To evaluate B.C. mining industry sampling efforts and data reliability, B.C. conducted a data validation assessment and reviewed recent water quality audit results.

The Joint Sampling Program started in 2016 and was led by DEC and B.C. Ministry of Environment and Climate Change Strategy (ENV) staff. This two year environmental program collected water, sediment and bioassessment samples in the Stikine, Taku and Unuk watersheds using similar methods of sampling in Alaska and B.C. Additional physical habitat surveys were completed at sampling sites to assess environmental conditions.

The sampling effort showed that some water sample results exceeded B.C. Water Quality Guidelines (WQG) at the B.C. sample sites; however, there were no exceedances of Alaska water quality standards (WQS) for all samples taken downstream of the B.C.–Alaska border. Sediment samples from sites in B.C. and Alaska showed exceedances of either B.C. Working Sediment Quality Guidelines (WSQG) or National Oceanic and Atmospheric Administration Sediment Quality Guidelines (NOAA SQG) in all three watersheds. Elevated element concentrations above water quality and sediment guidelines or standards are largely attributed to the naturally occurring mineral deposits in the area of study. Water quality samples collected by B.C. from the data validation assessment of industry data showed significant agreement between data collected by government and data collected by industry, and provided evidence of compliance with B.C.'s regulatory standards and requirements to monitor and assess for potential effects.

Biological sampling explored macroinvertebrate community composition and presence of contaminants in migratory and resident fish species in the watersheds. The evaluation of benthic macroinvertebrate

samples included abundance, taxa richness, percent intolerant taxa, percent Ephemeroptera, Plecoptera and Trichoptera taxa and diversity and evenness of samples. Due to differences in benthic sampling methods, site substrate and habitat and other confounding factors influencing benthic macroinvertebrates, Alaska, B.C. and TRTFN sample results were not compared, but key findings were included from each sample set. The fish sample results showed that the concentrations of elements in juvenile resident fish varied between sample sites and within sites in each watershed. Over the last five years, Dolly Varden char sample results in the Taku watershed revealed similar results both upstream and downstream of the Tulsequah Chief Mine. The results of the Joint Sampling Program and data validation efforts indicate that the overall aquatic conditions of the Taku, Stikine and Unuk transboundary rivers currently support and maintain aquatic life.

With the conclusion of the Joint Sampling Program, the TWG-M recognizes the importance of intergovernmental communication and seeks continued collaboration between federal, provincial and state agencies, Tribes and First Nations and the public. The TWG-M also recognizes the existence of other sampling programs planned by State, Federal, or Provincial agencies throughout the transboundary region that assess environmental conditions. Due to established sampling programs in the transboundary region, continuing the Joint Sampling Program would be redundant at this time. Nevertheless, Alaska and B.C. will continue to collaborate, pursuant to their Memorandum of Understanding and Cooperation, to ensure the long-term protection of transboundary waters.

CONTENTS

EXECUTIVE SUMMARY	III
ACRONYMS	VI
MINING GLOSSARY.....	VI
1. INTRODUCTION.....	1
2. REVIEW OF PROGRAM EFFORTS.....	1
2.1 Tribes and First Nations	2
2.1.1 Alaska Traditional Ecological Knowledge Survey	2
2.1.2 British Columbia’s Relationships with First Nations.....	3
2.2 Aquatic Data Resources	4
2.2.1 Alaska Data Mining Efforts	5
2.2.2 British Columbia Data Mining Efforts.....	6
2.2.3 Data Mining Results.....	6
2.3 Industry Data Validation	6
2.3.1 Split Sampling Quality Assurance Audits.....	7
2.3.2 Side-by-side Water Quality Sampling.....	7
2.3.3 Review of Unuk River Water Quality Data Collected by KSM	7
2.4 Alaska–B.C. Transboundary Rivers Joint Sampling Program	7
3. CONCLUSIONS.....	10
3.1 Recommendations	10
3.1.1 Alaska Recommendations	10
3.1.2 British Columbia Recommendations	10
REFERENCES.....	11
APPENDIX A: SAMPLING EFFORTS DOCUMENTED IN DATA MINING PROJECT	12
APPENDIX B: B.C. REGULATORY REQUIREMENTS AND ACTIVITIES	14
B.1 British Columbia regulatory requirements:	14
B.2 British Columbia Project specific activities:	14

FIGURES

Figure 1. Watershed Use by Survey Respondents	3
Figure 2. Results of Data Mining Efforts in Alaska and B.C. from 1980 to 2017 that Met Quality Control Requirements.....	5
Figure 4. Joint Alaska–B.C. Transboundary Sampling Locations and Mining Activities	9

TABLES

Table 1. Master Project List for Mines in the Transboundary Watersheds	6
Table 2. Summary of Existing Major Aquatic Sampling Efforts in B.C. Transboundary Watersheds.....	12

ACRONYMS

AFE	Alaska Forum on the Environment
AWQMS	Ambient Water Quality Monitoring System
B.C.	British Columbia
DEC	Alaska Department of Environmental Conservation
DFG	Alaska Department of Fish and Game
DNR	Alaska Department of Natural Resources
ENV	British Columbia Ministry of Environment and Climate Change Strategy
EMA	B.C. Environmental Management Act
EMLI	B.C. Ministry of Energy, Mines and Low Carbon Innovation (formerly the Ministry of Energy, Mines and Petroleum Resources)
EMS	Environmental Monitoring System Database
FLNRO	B.C. Ministry of Forests, Lands, Natural Resources Operations and Rural Development
NOAA SQG	National Oceanic and Atmospheric Administration Sediment Quality Guidelines
NRCE	Natural Resources Compliance and Enforcement
SEACC	Southeast Alaska Conservation Council
TRTFN	Taku River Tlingit First Nation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSC	Water Survey of Canada
WSQG	B.C. Working Sediment Quality Guidelines

MINING GLOSSARY

The following terms are used to define the operational status of mining projects referenced in this report. The terms were developed by the Alaska Department of Natural Resources (DNR) and the B.C. Ministry of Energy, Mines and Low Carbon Innovation (EMLI) as part of the Master Project List, which is a key deliverable under the Bilateral Working Group agreement between Alaska and B.C. (DNR and EMLI, 2019).

Advanced exploration project: Exploration with multi-year drill programs, possible permanent camp, access roads, or possible bulk samples from the surface or underground. May include underground drilling and possible dewatering associated with underground exploration activities. These projects are often in preparation for proposed mines. Preliminary engineering or economic assessment may be undertaken.

Proposed mine: This is a mine project that has not yet been certified for construction and operation but is in the process of obtaining necessary certificates or permits.

Operating mine: This is a mine project that has existing authorizations, including permits and an Environmental Assessment Certificate, that allow the production of a mineral, a placer mineral, coal, sand, gravel or rock.

Closed mine: A mine at which all mining activities have ceased but in respect of which the owner, agent, manager or permittee remains responsible for compliance with the B.C. *Mines Act*, the regulations, the code and that person's obligations under the permits for that mine.

Care and maintenance: A mine project that is closed but there is potential to recommence operations. Production is stopped, but the site is managed to ensure it remains in safe and stable condition and the owner, agent, manager or permittee remains responsible for compliance with the B.C. *Mines Act*, the regulations, the code and obligations under the permit(s) for that mine.

1. INTRODUCTION

Transboundary waters spanning Southeast Alaska and Northwest British Columbia are essential in providing important social, economic and cultural resources that are unique to the area. In response to public concerns over historic and proposed development and following the tailings pond breach at Mount Polley Mine in central British Columbia, Alaska and B.C. signed a Memorandum of Understanding (MOU) on the protection of transboundary waters on November 25, 2015. The MOU identified collaborative work in several areas, including workforce development and training, marine transportation, emergency aid, transportation links and joint visitor promotion.

As a part of the MOU, Alaska and B.C. also signed a Statement of Cooperation (SOC) to establish a Bilateral Working Group on the Protection of Transboundary Waters (BWG). The SOC outlined a workplan with commitments for Alaska and B.C. to complete within the geographic and time constraints set by the MOU. The workplan commitments were designed to increase transparency and communication with the public on environmental conditions, generate opportunities to engage Tribes, First Nations and other interested parties on transboundary region issues and establish a Technical Working Group on Monitoring (TWG-M) to assess the current conditions of the Stikine, Taku and Unuk rivers. This report is a summary of the TWG-M's activities and outcomes in fulfilling the workplan commitments established in the SOC and is accompanied by a partner technical report from the two-year Alaska–B.C. Joint Sampling Program.

The MOU and SOC are found at the B.C. Alaska Transboundary Waters webpage:

<https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/compliance-enforcement/bc-alaska-transboundary-waters>

and the DNR Office of Project Management and Permitting–Canadian Large Projects webpage:

<http://dnr.alaska.gov/commis/opmp/Canadian-Mines/>

2. REVIEW OF PROGRAM EFFORTS

The TWG-M, co-chaired by DEC and ENV, was comprised of two representatives from each natural resource agency or ministry within the two governments, as outlined in the SOC. Beginning in 2017, Alaska and B.C. TWG-M representatives met regularly to fulfill the commitments set out in the SOC, which strengthened relationships between Alaska and B.C. The SOC tasked the TWG-M with the following commitments:

- Actively engage with federal agencies, Tribes and First Nations, local governments, industry members, organizations and the public through workshops or other public engagements;
- Catalogue and assess the trustworthiness of historic and current water, sediment and bioassessment data in transboundary regions; and
- Develop a Joint Water Quality Program for Transboundary Waters to sample and assess the environmental condition of the Stikine, Taku and Unuk watersheds using comparable sampling and analytical methods.

The TWG-M participated in several workshops with government agencies, Tribes and First Nations and members of the scientific community. The first was the Alaska Transboundary Environmental Data Workshop held in Juneau, Alaska in April 2016. It was here that B.C. and Alaska staff and scientific community members met to assess current water quality monitoring activities in transboundary waters. In 2016 and 2017, representatives from Alaska and B.C. participated in panel discussions during the

Alaska Forum on the Environment (AFE) in order to interface with the public and discuss transboundary mining and water quality concerns in Southeast Alaska. During AFE, panel members provided an update on the progress made by the TWG-M to address transboundary issues and led discussions on the permitting process in transboundary watersheds, including outlining opportunities for public involvement. In 2017, Alaska government staff also participated in the Water Quality and Transboundary Rivers Workshop organized by SalmonState, an organization that safeguards Alaskan salmon. This was an open-forum workshop with nongovernmental organizations aiming to identify challenges and look for opportunities to collaborate in transboundary waters. Throughout the five-year program, the TWG-M interacted with Indigenous people, community leaders, business owners and locals while in the field. These informal meetings and conversations with the public were powerful tools for communicating and creating relationships. The anecdotal information from these discussions gave the TWG-M a deeper understanding and appreciation of the cultural and social heritage in transboundary watersheds.

Outside of public events, Alaska and B.C. staff participated in internal meetings to review feedback from outreach events, identify concerns and discuss collaborative opportunities for joint monitoring. The discussion of program outreach initiatives revealed the desire of Indigenous people and stakeholders to understand both the existing environmental conditions in transboundary waters and the potential impacts of mining activities on fish and water quality and quantity. Finally, to fulfill their commitment for increasing communication on transboundary issues, members of the TWG-M contributed to annual Transboundary Waters newsletters.¹

2.1 Tribes and First Nations

The Taku and the Stikine watersheds are located within the traditional territories of the Tlingit and Tahltan Indigenous peoples and the Unuk watershed is located within the traditional territories of the Tlingit, Tahltan, Tsetsaut Skii Km Lax Ha and Haida Indigenous peoples. As a part of sharing information, both Alaska and B.C. governments worked with Indigenous peoples to understand community concerns in transboundary areas and incorporate traditional knowledge. The TWG-M partnered with Tribes and First Nations during the Joint Sampling Program to provide training and job opportunities in local communities. These partnerships worked to strengthen relationships on a government-to-government basis.

2.1.1 Alaska Traditional Ecological Knowledge Survey

Alaska DEC collaborated with the Central Council of Tlingit and Haida Indian Tribes of Alaska (Central Council) on a community resources and values survey, which included Traditional Ecological Knowledge (TEK), to assess and document community concerns in transboundary areas.² The Central Council and DEC designed survey questions to explore the background of local communities, current and historical land use practices and knowledge about transboundary issues. Collaboration with the Central Council was essential for building trust with survey participants and documenting important information on traditional land use in transboundary waters. All Tribes in Southeast Alaska were invited to participate in the survey over a period of four and a half months. Outreach for the survey included direct engagement through word of mouth, newsletters and social media announcements.

In total, 118 people participated in the survey, with 63 responding to most, if not all, the questions. Respondents to the survey represented the diverse Indigenous cultures of the transboundary

¹ Newsletters are available on the B.C. Alaska Transboundary Waters webpage and the DNR Office of Project Management and Permitting – Canadian Large Projects webpage. See websites in the Introduction.

² The Central Council TEK Report is available in the Alaska DEC's Water Quality Reports database at <https://dec.alaska.gov/water/water-quality/reports/>

watersheds, including Tlingit, Haida, Metlakatla, Chilkat, Saxman, Tsimshian and Kasaan. Fifty-seven percent of the responses were from within or near the Taku watershed, with 14% in the Unuk watershed and 13% in the Stikine watershed (Central Council, 2018). The remaining were associated with the Chilkat or another watershed. The survey included questions on land and water use and on observed changes in Southeast Alaska. Many respondents selected multiple uses for the watershed, highlighting the unique connection between Tribes and the natural environment (Figure 1). In the survey, 92% of respondents noted environmental concerns with regard to changes in fish runs, plant populations and the ability to perform cultural activities (Central Council, 2018).

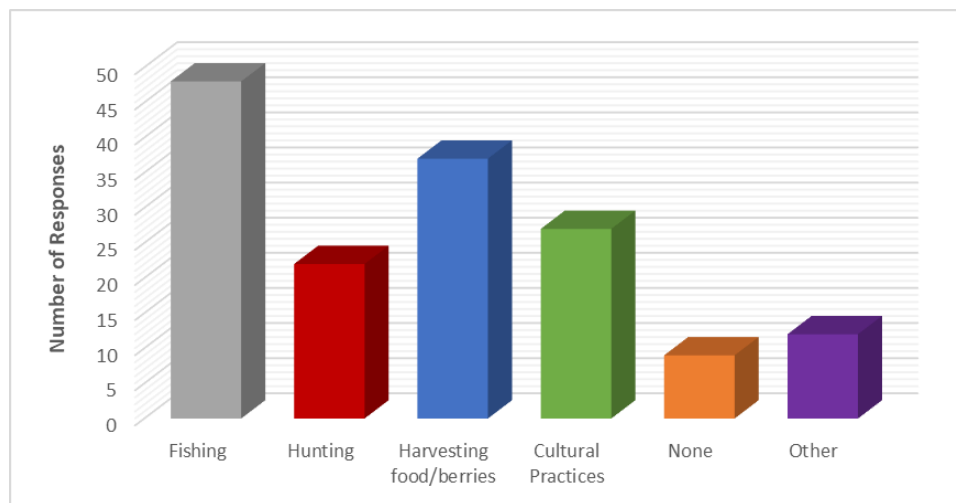


Figure 1. Watershed Use by Survey Respondents

The survey assessed participants’ familiarity with transboundary issues and their confidence in the MOU between Alaska and B.C. A majority of respondents, 71%, categorized themselves as only knowing “a little” about transboundary issues in comparison to 21% knowing “a lot.” For questions about sources of information, in-person meetings and events were the most common response, followed by social media (Central Council, 2018). This validates the efforts made by the TWG-M to host in-person meetings and workshops with Indigenous people. About half of the respondents to the survey, 52%, were uncertain about the success of the MOU, and comments were submitted requesting federal government involvement (Central Council, 2018). Respondents used the feedback portion of the survey to include other issues of concern and perspectives not directly addressed in the survey. The survey was a valuable opportunity for Alaska DEC to grow its partnership with Southeast Tribes and create additional avenues of communication to keep tribal citizens and the public informed of the MOU’s progress and new developments.

2.1.2 British Columbia’s Relationships with First Nations

In May 2018, the Province of B.C. released 10 Draft Principles (B.C. Government. 2020a) to guide its relationship with First Nation communities as it works to implement the United Nations Declaration on the Rights of Indigenous Peoples and the Truth and Reconciliation Commission of Canada’s Calls to Action. These principles emphasize the importance of meaningful engagement on decisions that impact Indigenous peoples and their rights, and work to create a renewed fiscal relationship with Indigenous communities. In November 2019, the B.C. Government passed legislation to bring the United Nations Declaration on the Rights of Indigenous Peoples into provincial law.

B.C.’s *Declaration on the Rights of Indigenous Peoples Act* is a legislative framework for reconciliation, recognizing the constitutional and human rights of Indigenous peoples; setting out a process to align

B.C.'s laws with the internationally recognized standards of the U.N. Declaration; and providing a framework for decision-making between Indigenous governments and the Province on matters that impact their citizens (B.C. Government, 2020b). In the fall of 2018, ENV passed a new *Environmental Assessment Act* to ensure the legal right of First Nations are respected, and the public's expectation of a strong transparent process would be met.

The B.C. Government is currently developing new and innovative ways to work collaboratively with Indigenous people throughout the lifecycle of mining projects. An ongoing example is the Red Chris Mine Management Agreement, which was signed by B.C. and the Tahltan Central Government in January 2017. Under the agreement, Tahltan has a direct role in the permit application review processes, monitoring and oversight and incident reporting at the Red Chris Mine.

Partnership and collaboration with the Taku River Tlingit First Nation (TRTFN) on the development of a conceptual reclamation and closure plan for the Tulsequah Chief Mine demonstrates B.C.'s commitment to fostering opportunities for B.C. and First Nations to work collaboratively on mine projects.

Partnerships with the TRTFN and Tahltan Central Government on the two-year Alaska–B.C. Joint Sampling Program is another example of the collaboration between B.C. and First Nations governments. Starting with the 2017 field reconnaissance work, ENV reached out to First Nations representatives to discuss opportunities to partner on water quality sampling activities in the watersheds. ENV provided First Nations field staff with equipment and training in aquatic sampling on three separate occasions and provided follow-up support over the duration of the two-year sampling program. The training included sample collection and handling procedures for water, sediment, benthic macroinvertebrates and fish. Once trained in the sampling techniques, the First Nations staff conducted sampling under contract on several occasions, helping to ensure that ENV could meet the sampling requirements of the monitoring program.

The partnerships provided participants with a deeper understanding and appreciation for the distinctions and similarities between the various approaches being employed to monitor, protect and preserve multiple facets of the natural environment. ENV looks forward to future opportunities to work with the Tahltan and Taku River Tlingit First Nations.

2.2 Aquatic Data Resources

The TWG-M was tasked with assessing existing water quality and quantity, sediment and bioassessment data in transboundary watersheds within Northwest B.C. and Southeast Alaska, with an emphasis on areas near mining activities. The data mining project catalogued historic datasets and identified data gaps, which steered the sampling program efforts conducted by the TWG-M. Validation and quality control protocols were established for the data mining project to evaluate historical data and assess the reliability of industry data. Figure 2 contains all applicable sampling events submitted to the Ambient Water Quality Monitoring System (AWQMS) and Environmental Monitoring System (EMS) databases.

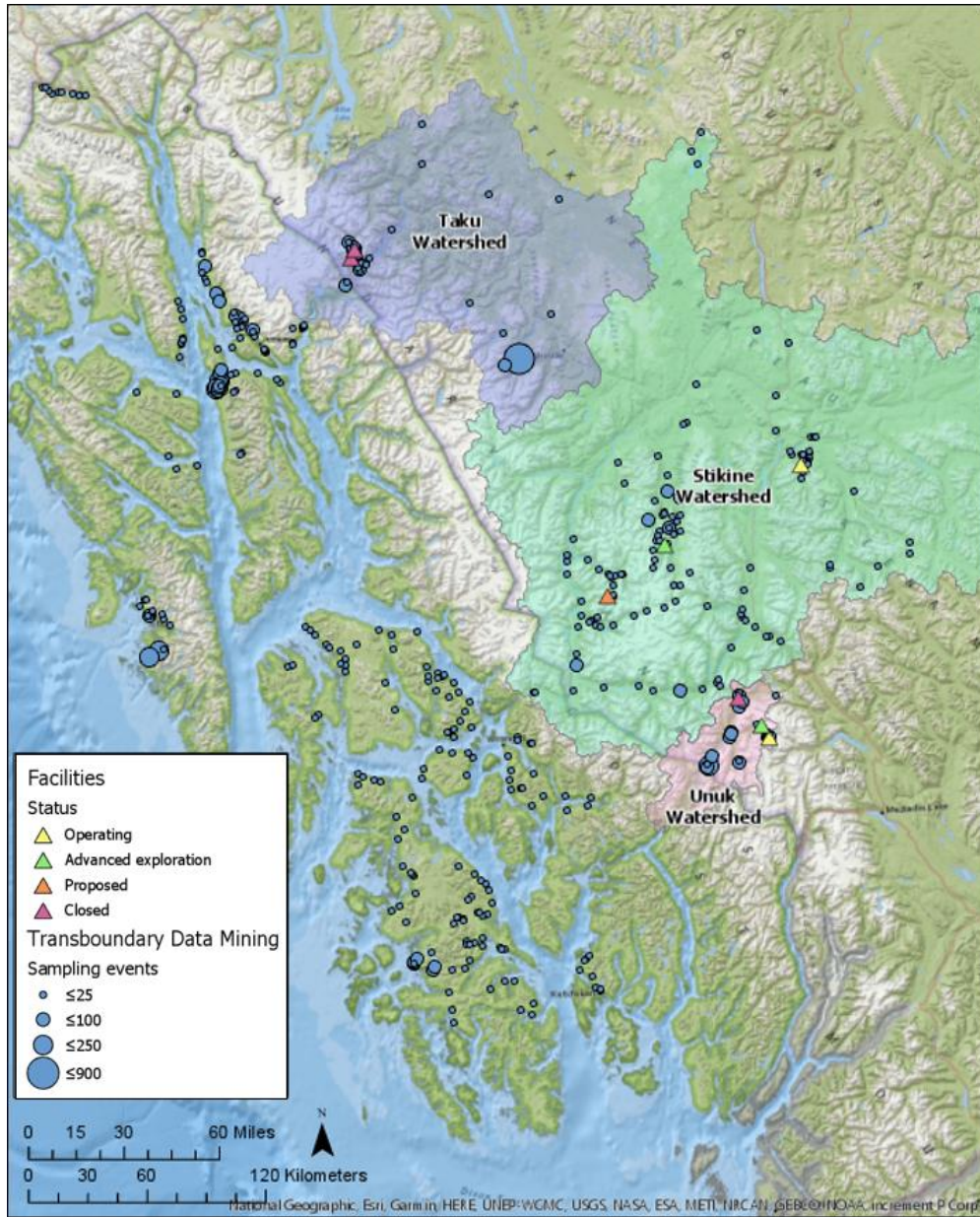


Figure 2. Results of Data Mining Efforts in Alaska and B.C. from 1980 to 2017 that Met Quality Control Requirements.

2.2.1 Alaska Data Mining Efforts

DEC funded the Southeast Alaska Conservation Council (SEACC) to conduct a data mining initiative throughout Southeast Alaska. SEACC led a multifaceted approach and solicited water, sediment and fish tissue data from 24 entities throughout Southeast Alaska (i.e. local governments, universities, state and federal agencies, tribes, private businesses and nongovernmental organizations). Fourteen of the datasets received from these groups met required quality control protocols (SEACC, 2017). Table 1 in Appendix A lists the data sources included in the final project. Additional datasets that were identified but did not meet quality control requirements were not included. SEACC developed templates with DEC

staff to upload and house the data in the AWQMS, which is publicly accessible. DEC staff used data from this effort to select targeted sampling sites in key locations as part of the Joint Sampling Program.

2.2.2 British Columbia Data Mining Efforts

ENV inventoried existing water quality, quantity and bioassessment monitoring information in the EMS database and conducted a review of contributing data sources. The review included federal and provincial water quality monitoring stations, provincial biomonitoring programs and applications and authorizations under the *Environmental Assessment Act* and *Environmental Management Act*. EMLI provided information on the current state of mining activity in B.C. within each watershed. The purpose of the inventories was to understand the amount of existing Canadian aquatic information available and to identify information gaps. The results of the activities were used to select the ENV sites for the Joint Sampling Program. Table 1 in Appendix A includes a summary of existing major aquatic sampling efforts in B.C. transboundary watersheds.

2.2.3 Data Mining Results

Figure 2 shows all applicable sampling events submitted to AWQMS and the EMS databases and is a summary of the findings from the joint data mining efforts. As shown in the map, sampling efforts were focussed around mining activities in the three priority watersheds identified in the Joint Sampling Program. The mining activities identified on the map are classified based on the Master Project List jointly developed by DNR and EMPR (2019)³ and are included in the table below. There are no advanced exploration, proposed or operating mines in the Taku watershed; all activities are associated with remediation and reclamation of the Tulsequah Chief mine.

Table 1. Master Project List for Mines in the Transboundary Watersheds

Watershed	Operation	Classification
Stikine	Schaft Creek Mine	Advanced exploration
	Galore Creek Mine	Proposed
	Red Chris Mine	Operating
Taku	Tulsequah Chief Mine	Closed
	New Polaris Mine	Closed
Unuk	KSM Mine	Advanced exploration
	Brucejack Mine ⁴	Operating

2.3 Industry Data Validation

ENV uses science-based policies, standards and codes of practice along with monitoring to protect human and environmental health. As part of the Joint Sampling Program, ENV performed data quality control reviews and sampled water to verify reporting by the mining industry. These activities included:

³ Further explanation of each classification is provided in the glossary.

⁴ The Brucejack Mine site is in the Bell Irving Watershed, but the wastewater discharge reports to the Unuk watershed.

- 1) reviewing the 2018 and 2019 split sampling quality assurance audits conducted by ENV Compliance staff at the Brucejack and Red Chris mines;
- 2) collecting side-by-side water samples with environmental staff from Brucejack and Red Chris mines in 2019 for quality assurance comparisons; and
- 3) reviewing the range in variability of the long-term Unuk River water quality data collected by the KSM advanced exploration project compared with data collected by ENV in 2018 and 2019.

2.3.1 Split Sampling Quality Assurance Audits

Split sampling is a robust audit mechanism that evaluates and monitors the quality and reliability of environmental data produced by industry. These audits help validate monitoring data provided by industry beyond the validation inherent in their own quality control and quality assurance programs. Split water samples were collected at Red Chris Mine from Quarry Creek and the Klappan River on July 24, 2018 and analyzed for general chemistry and element concentrations. The results provided a performance evaluation score of 90%, resulting in an audit pass. The August 28, 2019 audit of the Brucejack Mine included chemistry (i.e. physical tests, anions, nutrients and total and dissolved elements) and toxicity samples collected at the Brucejack Lake outlet. The audit results produced a performance evaluation score of 99%. Compliance inspections and audit results are available in the Natural Resources Compliance and Enforcement (NRCE) database ⁵

2.3.2 Side-by-side Water Quality Sampling

ENV and mine environmental staff conducted side-by-side water quality sampling in September 2019 at two regularly sampled monitoring sites at the Brucejack and Red Chris mines. The comparability between ENV's and mine environmental staff's samples was affected by analytical detection limit differences for some parameters. The results of the side-by-side sampling were assessed by calculating the relative percent difference (RPD) for parameter concentrations between the paired samples if (1) the parameter was analyzed to the same lab detection limit in each sample, or (2) the parameter's lab detection limits differed, but measurable concentrations were recorded. Of the 158 parameters sampled at Brucejack, 116 (73%) met the above criteria, as did 127 (83%) of the 152 parameters sampled at Red Chris. RPD values differed by more than 25% in less than 8% of all comparable results. Based on these assessments, the data from both mines are considered within acceptable limits for data quality.⁶

2.3.3 Review of Unuk River Water Quality Data Collected by KSM

The KSM project's long-term dataset for the Unuk River near the border currently spans 11 years, from 2008 to 2018. Over this time period, quality assurance sampling at the Unuk 1 sample site consisted of ten duplicate samples. Based on a relative percent difference evaluation of these samples, the duplicate data are within acceptable limits for data quality. Review of the raw data for elements of interest demonstrated that the water quality results collected by ENV at Unuk 1 between 2018 and 2019 are within the range of variability seen in KSM's long-term water quality results for this site.^{5,6}

2.4 Alaska–B.C. Transboundary Rivers Joint Sampling Program

In addition to the outreach and data mining efforts to address Southeast Alaska transboundary river water quality concerns related to mining activities in Northwest B.C., a two-year aquatic sampling

⁵ Natural Resources Compliance and Enforcement (NRCE):

<https://a100.gov.bc.ca/pub/ocers/searchApproved.do?submitType=menu>

⁶ Complete details on the ENV industry data validation assessment are provided in the Final Technical Report for the Alaska–B.C. Joint Water Quality Program for Transboundary Waters.

program, called the Joint Sampling Program, was executed. The TWG-M shared responsibility for all program actions, including design, data assessment and reporting. The Joint Sampling Program was carried out from August 2017 to June 2019 in the Stikine, Taku and Unuk Rivers. It included physical habitat assessments, physical and chemical analyses of water and sediment; and chemical analyses of biological samples, including benthic macroinvertebrates, periphyton and fish. The water, sediment and biological samples were analyzed for elements that tend to be of greatest interest due to their potential ecological impacts (i.e., constituents of concern). Samples in Alaska were collected under the Water Quality Monitoring Program, part of a nationwide United States Environmental Protection Agency (USEPA) effort to survey the environmental condition of U.S. ecological resources. Supplemental sampling of water and sediment quality, benthic macroinvertebrates and fish was conducted by B.C. ENV in partnership with First Nations.

In the final monitoring report, B.C. Guidelines (WQG) for long-term exposure and Alaska Water Quality Standards (WQS) for chronic exposure were used for assessing water samples located within the province and state, respectively, based on the design and objectives of the sampling program; this included the characterization of existing conditions in each watershed. Guidelines for long-term exposure and standards for chronic exposure are the most conservative types of standards, and are intended to protect the most sensitive species and life stages against sub-lethal and lethal effects for indefinite exposures. The B.C. Working Sediment Quality Guidelines (WSQG) for aquatic life and the National Oceanic and Atmospheric Administration Sediment Quality Guidelines (NOAA SQG) for fresh water were used to evaluate the results of the sediment study. To characterize the existing conditions of the biota in each watershed, biological sampling explored macroinvertebrate community composition and element uptake by benthic macroinvertebrates, and migratory and resident fish. Figure 3 shows the selected watersheds and sampling sites, and significant high-priority mining activities.

Overall, results met B.C. WQG for long-term exposure and Alaska WQS for chronic exposure at sample sites; however, there were a few exceedances at B.C. sites. The Unuk watershed contained the greatest concentrations of dissolved elements in water samples, followed by the Taku and Stikine, respectively. Sediment samples from B.C. and Alaska sample sites showed exceedances of B.C. WSQG or NOAA SQG in all three watersheds, with samples from the Unuk watershed reporting the highest concentrations of elements. The observed elevated element concentrations above water quality and sediment standards or guidelines are largely attributed to the naturally occurring mineral deposits in the area of study. This is demonstrated in the Unuk watershed by consistent concentrations of certain elements above B.C. guidelines and NOAA SQG throughout the watershed, including the undeveloped South Unuk River. In the case of the Taku watershed, element concentrations above B.C. guidelines in the Tulsequah River downstream of the Tulsequah Chief Mine may be influenced by both naturally occurring mineral deposits and localized contributions of metals from mine discharge.

Biological sampling explored potential element uptake by benthic macroinvertebrates in B.C. and migratory and resident fish species throughout the watersheds.

Benthic macroinvertebrate community data is available for the Taku watershed from DEC and TRTFN samples in the final joint sampling report (DEC and ENV, 2021). The results of benthic macroinvertebrate sampling by DEC and TRTFN were not comparable due to the seasonality of species presence and size, and the substrate and habitats sampled, among other factors influencing organism distribution, but key findings from each sample set were included. The dominant order for all Alaskan samples was Diptera, which coincides with results from DFG sampling programs in Southeast Alaska glacial waterbodies (Krull, 2019). Alaskan samples had low percentages of intolerant and Ephemeroptera, Plecoptera and Trichoptera (EPT) present. Plecoptera was the dominant order for a majority of TRTFN samples on the

Tulsequah River, followed by Diptera. TRTFN samples had high percentages of intolerant and EPT taxa present.

Resident fish species were sampled in each watershed for whole body element concentrations. Arsenic concentrations in Dolly Varden char collected in the Taku watershed in 2018 and 2019 were greater downstream of Tulsequah Chief Mine and New Polaris Mine relative to fish collected upstream in the Tulsequah River. However, when these data are compared to Dolly Varden data collected in this watershed over the last five years, results show that element concentrations in Dolly Varden have remained relatively constant both upstream and downstream of the Tulsequah Chief Mine. In the Stikine watershed, copper concentrations in sculpin were greater downstream of the B.C.–Alaska border while other elements were similar at all sampling sites in the watershed except for selenium in Alaskan sculpin samples. Selenium was lowest in these samples compared to other samples in the watershed. In the Unuk watershed, Dolly Varden element concentrations were lower in Alaska compared to the B.C. mainstem and tributary sites, including the South Unuk River, a sub-watershed with no mining activity. Dolly Varden samples from Sulphurets Creek, downgradient of the KSM deposits, displayed higher levels of copper relative to samples from elsewhere in the watershed. Despite some differences in fish element concentrations, identifying mechanisms responsible for these differences will require sampling designs that are more focused in area and scope than the objectives of this program.



Figure 3. Joint Alaska–B.C. Transboundary Sampling Locations and Mining Activities

3. CONCLUSIONS

Over the past five years, the TWG-M has communicated with the public on transboundary concerns, developed opportunities for Tribes and First Nations to participate in transboundary resource management and conducted the Joint Sampling Program in the Stikine, Taku and Unuk watersheds. The TWG-M collected and inventoried historic water quality and quantity and biological assessment data throughout Southeast Alaska and Northwest B.C. A data validation exercise to evaluate the reliability of industry monitoring data was carried out by ENV. The industry data validation results support that water quality monitoring programs conducted by operating mines and advanced exploration projects are within acceptable limits for data quality assurance.

To fulfill TWG-M's joint sampling commitment, DEC and ENV staff conducted the Joint Sampling Program from 2017 to 2019 to assess the environmental conditions in transboundary waters. The results of the sampling program are included in the mid-point and final technical reports published by the TWG-M (DEC and ENV, 2020 and 2021).

The results of the sampling program and data validation efforts indicate that the overall aquatic conditions of the Taku, Stikine and Unuk transboundary rivers currently support and sustain aquatic life.

The watersheds will continue to be monitored for potential impact the aquatic environment from mining activities. This will be achieved using provincial regulatory standards, industry aquatic monitoring and reporting requirements and provincial compliance and enforcement programs.

3.1 Recommendations

The TWG-M recommends continued collaboration among federal and state agencies, Tribes and First Nations and the public to support sustainable natural resource management in transboundary waters and foster positive working relationships.

The two-year life span of the Joint Sampling Program has ended. The TWG-M does not recommend additional sampling under this program, as it would be redundant with existing and future water quality monitoring planned by other state, federal and provincial agencies.

3.1.1 Alaska Recommendations

To promote transparency regarding the condition of transboundary waters, Alaska will encourage and assist with the continued submission of water, sediment and bioassessment datasets from Southeast Alaska into AWQMS through a biennial call for data.⁷ Alaska does not recommend continuing participation in a joint sampling program after the end of the two-year sampling effort. This recommendation recognizes mandated monitoring efforts in transboundary watersheds from other entities, including federal and state agencies. Continuous water quantity and quality data is collected at United States Geological Survey (USGS) gaging stations in major transboundary rivers. Additionally, the Central Council of Tlingit and Haida Indian Tribes of Alaska and the Ketchikan Indian Community have well-established monitoring programs on transboundary rivers.

3.1.2 British Columbia Recommendations

As with the TWG-M and Alaska, British Columbia does not recommend continuing participation in a joint sampling program. B.C. recognizes and will continue supporting data collection by third parties and First Nations for site-specific activities in transboundary watersheds. The focus will be on projects designed to

⁷ Alaska solicits water quality data biennially from the public through the Integrated Water Quality Monitoring and Assessment Report.

determine the health of waterbodies and aquatic ecosystems near past, existing and future resource development projects (see Appendix B for current projects). B.C. will promote the submission of water, sediment and bioassessment data into our publicly accessible EMS database. Specifically, we recommend that aquatic data collected for or during the B.C. Environmental Assessment process, and all aquatic environment monitoring data collected related to *Environmental Management Act* (EMA) authorizations, be uploaded into EMS. In addition, we recommend that, where possible, historic data associated with existing mines be added to EMS. Lastly, British Columbia will continue to uphold its regulatory standards and requirements, including assessing industry compliance with their authorizations and conducting data validation audits (see Appendix B for regulatory processes and project specific activities). These standards, projects and recommended data management improvements demonstrate B.C.'s commitments to the MOU to protect and enhance the shared environment, including the transboundary rivers, watersheds and fisheries, for the benefit of both jurisdictions.

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APPENDIX A: SAMPLING EFFORTS DOCUMENTED IN DATA MINING PROJECT

Table 2. Summary of Existing Major Aquatic Sampling Efforts in B.C. Transboundary Watersheds.

Watershed/ Area of Study	Inventory Database / Source	Description of Aquatic Sampling Efforts
TAKU	B.C. EMS	Inventory of ambient water, sediment and biotic sampling efforts in B.C. Taku Watershed
	B.C. Authorization Reports	Tulsequah Chief Mine; EMLI technical assessments and data analysis activities to inform remediation and reclamation planning.
	B.C. FLNRO / TRT Data	Pilot sampling program in 2019 for the long-term monitoring of mining impacts, remediation and ecosystem change in the Tulsequah River. A B.C. Collaborative Stewardship Forum (CSF) initiative with 3 Nations (TRT, Kaska and Tahltan). Sampling program includes water, sediment, fish and benthic invertebrates.
	DEC AWQMS	Monitoring by the Central Council of the Tlingit and Haida Indian Tribes of Alaska to assess trace elements, organics and physical characteristics.
	DFG Division of Habitat	DFG conducted fish monitoring and water quality sampling efforts on the Taku River at various sites.
STIKINE	B.C. EMS	Inventory of ambient water, sediment and biotic sampling efforts in B.C. Stikine Watershed
	Env. Can -WSC	Three long-term active Water Survey of Canada hydrometric stations. Stikine River at Telegraph Creek, Tuya River near Telegraph Creek (sub watershed) Iskut River below Johnson River (sub-watershed)
	Env. Can -WSC	Long-term Canadian-B.C. water quality monitoring station on the Iskut River (sub-watershed)
	B.C. EMS / Permittee Reports	Red Chris Mine aquatic effects monitoring program under their <i>Environmental Management Act</i> authorization. Monitoring includes benthic invertebrates, periphyton, water quality, sediment quality, physical habitat assessment and fish tissue (lakes program includes three years of sampling for selenium).
	DEC AWQMS	Monitoring by the Central Council of the Tlingit and Haida Indian Tribes of Alaska to assess trace elements, organics and physical characteristics.
	DFG Division of Habitat	DFG conducted fish monitoring and water quality sampling efforts on the Stikine River at various sites.
	USGS	Stream gaging station 15024800 downstream of Shakes Lake outlet into the Stikine River monitoring water quality.

UNUK	B.C. EMS	Inventory of ambient water, sediment and biotic sampling efforts in B.C. Unuk Watershed
	Industry Data	Hydrometric stations – two operated and in association with Brucejack Mine; ten operated and in association with the KSM Mining project.
	B.C. EMS / Permittee Reports	Brucejack Mine aquatic effects monitoring program under their <i>Environmental Management Act</i> authorization. Monitoring includes water quality, benthic invertebrates, sediment quality and periphyton.
	CABIN / Industry Data	KSM exploration project aquatic effects monitoring program. Monitoring includes water quality, benthic invertebrates, sediment quality, periphyton and selenium bioaccumulation project associated with KSM; concluded in 2018.
ADMIRALTY ISLAND	DEC AWQMS	Hecla mine monitored water column chemistry, benthic macroinvertebrate, fish tissue and sediment quality in the marine environment. Indicators include dissolved elements, total elements in fish tissue and total elements in sediment.
	DFG Habitat	Biomonitoring work on Greens and Tributary Creeks.
	USGS	USGS stream gage 15101490 monitoring water temperature and stream discharge by Greens Creek Mine.
	DEC AWQMS	Friends of Admiralty Island monitored heavy metals in sediment, water column and fish tissue.
JUNEAU	DEC AWQMS	United States Fish and Wildlife Service (USFWS) is monitoring dissolved oxygen, dissolved iron, sediment loading, debris, turbidity, stream flow and fecal coliform for streams around Juneau.
	USGS	USGS stream gages monitoring water temperature and stream discharge around Juneau at the Mendenhall River (15052500) and the Taku River (15041200).
	DEC AWQMS	Coeur Alaska Mining Company monitored water chemistry, EPT taxa, sediment, chlorophyll A, and fish tissue results for waters around the Kensington Mine. The waters include Sherman Creek, Ophir Creek, Slate Creek and Johnson Creek.
	DEC AWQMS	Publicly Owned Treatment Works (POWT) monitored ammonia, nitrate and mercury levels around Juneau area, including the Gastineau Channel and lower Mendenhall River.
Baranof Island	USGS	USGS stream gage (15087700) monitoring water temperature and stream discharge at Indian River by Sitka, AK.
Chichagof Island	USGS	Historic USGS monitoring water temperature and stream discharge stations at Pelican, AK and Tenakee Springs, AK on Chichagof Island.
Klehini River	DEC AWQMS	Monitoring by the Takshanuk Watershed Council to include dissolved minerals, dissolved elements, alkalinity, conductivity, oxidation-reduction potential, turbidity, pH and temperature.

APPENDIX B: B.C. REGULATORY REQUIREMENTS AND ACTIVITIES

B.1 British Columbia regulatory requirements:

- In British Columbia, both the federal and provincial governments may require an environmental assessment (EA) of a project before it can proceed. These assessments must consider the effects to environmental (aquatic and terrestrial resources), social, cultural, health and economic values, including adverse cumulative effects. The federal EA processes fall under the *Canadian Environmental Assessment Act* and are required whenever a federal authority has a specified decision-making responsibility in relation to a project. The provincial process under the *Environmental Assessment Act* provides opportunities for Indigenous Nations, government agencies and the public to influence the outcome of EAs in British Columbia. An EA process flow chart, Figure 1 in Technical Guidance 6: Water and Air Baseline Monitoring Guidance For Mine Proponents and Operators can be found at <https://www2.gov.bc.ca/gov/content/environment/waste-management/industrial-waste/mining-smelting/guidance-documents>
- EMP and ENV have developed an integrated *Mines Act* and *Environmental Management Act* permitting process for major mine projects that works directly with proponents, Indigenous Nations and government technical advisors to coordinate multi-agency regulatory permits. <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/permitting>
- Permits, site-specific authorizations under EMA, allow for the discharge of safe levels of effluent to the environment from specific industries or activities including mines. The permit application process clearly outlines information requirements necessary to identify safe site-specific discharge levels. These permits also require industry to monitor effluent quality and report any exceedances as a means of confirming permit requirements are met and discharge levels remain safe. The data validation, conducted by ENV in 2019, demonstrates that permittee data (KSM, Brucejack and Red Chris mines) is reliable. In addition, at all stages of mining (proposed through to closure) ENV requires the evaluation and implementation of mitigation measures as well as environmental monitoring programs. This may include Aquatic Effects Monitoring Programs (AEMPs) to assess potential aquatic impacts. Information on the EMA permit application process can be found at https://www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/ema_application_process_map.pdf
- ENV Compliance and Enforcement staff conduct inspections to ensure fulfilment of permit requirements and regularly audit water quality samples from mines to provide further validity to the monitoring data provided by the permittee, beyond that of their own quality assurance and quality control program.

The projects identified below will continue to inform on the health of the watersheds as well as address specific areas of concern around past, existing and future development.

B.2 British Columbia project specific activities:

- Collection of water quality and quantity information from hydrometric stations in the Stikine watershed and water quality and hydrometric data collection from the long-term Iskut River (Stikine sub-watershed) monitoring station under the joint federal-provincial water quality monitoring program. The link for this information is https://wateroffice.ec.gc.ca/index_e.html

- Sampling of background water quality by Seabridge Gold related to the KSM advanced exploration project at key locations in the Unuk River watershed. Data is shared in reports submitted to B.C. ENV and EMLI.
- Reclamation planning for the historic Tulsequah Chief underground mine lead by B.C. and with involvement from the State of Alaska and the TRTFN. Implementation of the reclamation plan is anticipated to reduce loadings of elements downstream of the closed mine.
- Sampling initiated in 2019 to begin long-term monitoring of mining impacts, remediation, and ecosystem change in the Tulsequah River watershed. This project is supported by the B.C. Collaborative Stewardship Forum initiative with the 3Nations (TRTFN, Kaska and Tahltan).