

# 2015 Annual Report

from the

Integrated Watershed Research Group

at the

University of Northern British Columbia

submitted to

Nechako Environmental Enhancement Fund  
Project Manager: Dan Boudreau

Prepared by Barry Booth, Research Manager,  
in conjunction with  
Drs. Déry, Owens, Parkes and Petticrew

Report 2 of 4

March 1, 2016

## General Project Introduction

The University of Northern British Columbia (UNBC) houses an Integrated Watershed Research Group (IWRG) comprising: Stephen Déry (Environmental Science Program), Philip Owens (Forest Renewal BC Chair in Landscape Ecology), Ellen Petticrew (Forest Renewal BC Chair in Landscape Ecology), and Margot Parkes (Canada Research Chair in Health, Ecosystems and Society). These researchers have worked collaboratively for several years on integrated watershed-based research with an emphasis on the Fraser River Basin and other northern BC watersheds including the Nechako River Basin (NRB). The researchers view integrated watershed research as linking biophysical, chemical, social, and human-health processes to address important environmental, landscape ecology, and community issues. This group has begun a four-year research program in the NRB comprised of three foci that address specific questions.

**1 – Water security and climate change (Déry and students):** Is a warming climate leading to more or less surface water availability in the NRB? What is the impact of anthropogenic versus natural influences on the basin's water resources, including streamflow amounts and timing?

**2 – Sediment sources and dynamics (Petticrew, Owens and students):** Fine-grained sediment has been identified as one of the main concerns within the NRB, and some key questions are: Where is the sediment coming from? If we identify the sources of the sediment, can we implement watershed management strategies to help control these sources and limit their detrimental effects? Given anticipated future changes in climate and land use in the watershed, how will sediment sources respond to these changes?

**3 – Tools for integration in watershed management and governance (Parkes and students):** How do decision support tools such as watershed report cards, indicator frameworks, and tools to integrate spatially referenced watershed information feed into broader processes of watershed management and governance? How do we build capacity for developing, managing and maintaining decision-support tools that integrate health, ecological and socio-economic parameters to inform watershed management and governance? How do we better understand the relationship between these decision-support tools and ongoing watershed-based science, given their different timelines, orientations and processes?

## Timeline

The IWRG at the University of Northern British Columbia was awarded a \$500,000 contract from the BC Ministry of Forests, Lands and Natural Resource Operations via the Nechako Environmental Enhancement Fund (NEEF) in late March of 2014. This contract was backdated to January 6<sup>th</sup>, 2014 since the IWRG-NEEF discussions regarding the project contract had been under discussion since September 2013, and the initial proposal indicated a January 2014 start date.

The following represents the work we have accomplished in 2015.

## Overall Project Management

### Development of research office:

- We have secured permanent office space for the IWRG program at UNBC.
- We continue to collate documents and existing knowledge (published reports, journal articles, books, etc.) pertaining to work in the Nechako River Basin. These documents will feed directly into Theme 3. Of particular importance is that Richard Krehbiel's files were accepted by UNBC Archives (see Theme 3 update).

### Presentations, meetings, and extension:

- Barry Booth, IWRG research manager, gave a radio interview on May 27<sup>th</sup> with CIRX-FM relating the 'year that was' for the IWRG program;
- Meeting with Lana Miller, Section Head, Environmental Impact Assessment, BC Ministry of Environment, January 9<sup>th</sup> to discuss overlap with present and planned water quality sampling work in the Nechako Basin. Ellen Petticrew, Phil Owens, and Barry in attendance;
- Meeting with FLNRO and NEWSS in Vanderhoof, May 14<sup>th</sup> to discuss the use of Miradi, a conservation-planning tool. Barry delivered a presentation/workshop on Miradi;
- The IWRG chaired and hosted a meeting of the Nechako Watershed Alliance on May 19<sup>th</sup>, involving a range of government, non-government and First Nations participants to finalize Terms of Reference for the Nechako River Watershed Roundtable (NWR), and to plan for the NWR launch;
- Meeting with Jun Yin, FLNRO and Jianbing Li, UNBC professor in Environmental Engineering, on September 4<sup>th</sup> at the IWRG office at UNBC to discuss FLNRO's proposed ground water research project. Barry and Stephen Déry in attendance;
- IWRG presents annual update of research work to the community in Vanderhoof at W.L. McLeod School, September 9<sup>th</sup>. Presentations by Dr. David Gateuille postdoctoral research associate, Aseem Sharma, PhD candidate and Kate Hewitt, UNBC master's student. Stephen, Phil, Margot Parkes, and Barry also in attendance;
- IWRG worked with NEWSS and other community partners to organize an event that took place in Vanderhoof that highlighted research and restoration projects that are taking place in the Nechako River Basin on September 16<sup>th</sup>. Barry delivered the IWRG presentation. Event also attended by Kate and Sarah Bale, graduate student from York University;
- IWRG and our Nechako Watershed Alliance partners (the Fraser Basin Council and NEWSS) launch the Nechako Watershed Roundtable (see Theme 3 Update for more details).

## Theme Updates

### Theme 1: Water security and climate change (Déry and students)

We have made tangible progress on climate research in the Nechako River Basin (NRB). Our progress so far is summarized below.

#### Reports published and in press:

- In 2015 we were able to publish two documents, have submitted a third for publication, and we finished a technical report. These documents are listed below:
  - Our article in Canadian Geographer that looks at climate change and water at Stelat'en First Nation was published this year. The full reference is:

Sanderson, D., Picketts, I. M., Déry, S. J., Fell, B., Baker, S., Lee-Johnson, E., and Auger, M., 2015: Climate change and water at Stelat'en First Nation, British Columbia, Canada: Insights from western science and traditional knowledge, The Canadian Geographer, 59(2), 136-150.
  - Our article on flooding in the Nechako River basin was published in the Canadian Water Resources Journal was published this year. The full reference is:

Sam J. Albers, Stephen J. Déry & Ellen L. Petticrew (2015): Flooding in the Nechako River Basin of Canada: A random forest modeling approach to flood analysis in a regulated reservoir system, Canadian Water Resources Journal / Revue canadienne des ressources hydriques, <http://dx.doi.org/10.1080/07011784.2015.1109480>
  - We submitted a paper for publication to the Canadian Geographer pertaining to the climate change and resource development in the Nechako:

Picketts, I., Parkes, M. and Déry, S. J., 2015: Climate change and resource development impacts in watersheds: Insights from the Nechako River Basin, Canada.
  - We completed our summary report on climate change scenarios and their implications to resource development in the Nechako watershed. This work overlaps significantly with Theme 3. The title of the paper is:

Matthews, C., Picketts, I., Déry, S. J., Parkes, M. and Sharma, A., 2015: Climate change & Resource Development Scenarios for the Nechako Watershed: Workshop Report May 2015, Technical Report.

And can be found here: [Full Document](#).

### Field work, data collection and analysis:

- We have secured additional funding from the BC Real Estate Foundation of BC Partnering Fund to support Aseem Sharma, our new Ph. D. student. We also received funding from Environment Canada's Science Horizons program to hire a field technician (Mark Taylor) for the project. In addition, we have hired Marco Hernandez-Henriquez with support from Stephen's NSERC-funded "Canadian Sea Ice and Snow Evolution" Network (CanSISE) to assist in some of the analytical work that we are performing. Our team has been working on collating and summarizing historical climate and precipitation data in the Nechako Basin from 1950-2010 and projecting climate and precipitation changes under different scenarios until 2050, as well as adding to the network of climate monitoring stations in the region. We have most recently completed the following tasks:
  - Developed shape files for sub-watersheds of NRB. Delineated based on the hydrological stations within Nechako-Stuart watersheds;
  - Analyzed runoff trends in Nechako and its sub-watersheds;
  - Analyzed past runoff productivity (annual runoff to precipitation ratios) for both the whole Nechako watershed as well as its sub-watersheds;
  - Downloaded/collected observed weather station data of NRB from different agencies such as Rio Tinto Alcan, BC Wildfire Management. Branch, Environment Canada, and Water Survey Canada stations. As a result we now have an extensive collection of historical hydro-climatic data of NRB at UNBC;
  - Quantification and calculations on how regulation in the Nechako River has affected downstream flows and its trend. The data used for this analysis are the streamflow data of Hope station at Hope Fraser River and Kemano Powerhouse station streamflow data;
  - In discussions with our regional partners, we deployed a weather station near Tatuk Lake in the upper reaches of the Chilako River. Details of the weather station can be found in Appendix 1.

### Research extension:

- We also worked on sharing climatological information on Nechako to our local communities and stakeholders, and at an international conference:
  - Poster presented by Aseem Sharma at the Nechako Watershed Round Table open house and working meeting, October 21, 22. Poster title: Past and future climate change in the Nechako river basin, BC;
  - Poster presentation by Aseem at the 2015 American Geophysical Union Fall Meeting held in San Francisco, California, from December 12-18. Poster title: Climate change impacts on water resources in the Nechako River Basin, BC.

## Theme 2 – Sediment sources and dynamics (Petticrew, Owens and students)

### Field work, data collection and analysis:

- Continued to work on research related to sediment sources in the Nechako Watershed:
  - Our research team led by Dr. David Gateuille, Post Doctoral Research Fellow from France, collected suspended fine sediment samples, bank samples and soil samples. David received field assistance from the following individuals: Dr. Leticia Gaspar Ferrer, Post Doctoral Fellow from Spain, Todd French, UNBC research associate, Barry Booth, and UNBC master students Richelle Sussbauer, Kristina Anderson, and Kristen Kieta.
    - Suspended sediments were sampled:
      - at seven locations along the mainstem of the Nechako River (town site of Vanderhoof (2), Hwy 27, near Dog Creek below the Nautley River, at the railroad bridge above the Nautley River, near Greer Creek, and near Cut off Creek);
      - in nine creeks (Stoney, Murray, Clear, Smith, Greer, Swanson, Copley/Targe, 9 Mile, and Tatsutani Creeks,);

A total of 14 suspended sediment samples were retrieved at each site. Some exceptions were noted on the mainstem of the Nechako due to access issues related to high water on the mainstem.

- Bank samples
  - Using a jet-boat samples were collected over a 2-day period from eroding banks at 30 locations along the mainstem of the Nechako from Cheslatta falls to Vanderhoof;
- Soil samples:
  - A total of 50 samples of soils were taken throughout the watershed depending upon land use and location within the watershed. Samples were taken from intact woodlands, burned woodland, logged woodland, roadsides, urban areas, hayfields, croplands, and pastures.

- A series of analyses were conducted on the above sediment samples by Todd and David and other samples collected by other team members. These were as follows:
  - Two cores collected in 2015 by Barry, Leticia, Kristen and Phil were prepared and processed by David for grain size analyses, Cesium 137 and Lead 210 content. The later analyses allowed for dating the cores;
  - David and Todd performed Inductively Coupled Plasma Mass Spectrometry (ICP-MS) metals analyses on the fine sediment samples collected from the mainstem the Nechako, the nine creeks, the eroding banks of the Nechako mainstem, soils in the watershed, sediment cores and on a number of quality assurance/quality control (QA/QC) samples. In total, 600 samples (40 batches of 15 samples each) were analyzed in 2015 for the 42 ICP-MS variables; this equates to 1,200 ICP-MS analyses because each sample was run at 10-fold dilution and 100-fold dilution per standard methods. Details of ICP-MS analytical methodology can be found in Appendix 2. A further 23 samples are left to analyze for the variables described above. These samples consist of suspended sediment materials collected from the Nechako River mainstem and Nechako River tributaries in 2015. These analyses will occur in February 2016;
  - Polycyclic aromatic hydrocarbon (PAH) analyses are planned for sediment samples in 2016.

#### Additional project development

- We received funding from BC Real Estate Foundation of BC Partnering Fund to construct a device that will allow us to collect instantaneous bulk suspended sediment samples. We embarked upon this project because in clear water systems such as the Nechako and Quesnel Rivers it can be challenging to collect a sufficient mass of suspended sediment to permit the analyses of physical and chemical properties. In 2015, Todd French designed and constructed a prototype of an instantaneous suspended sediment sampler that utilized a single 2- $\mu\text{m}$  tubular filter. The prototype was tested alongside Philips samplers and a continuous flow centrifuge at 11 locations in the Nechako River and Quesnel River watersheds in 2015. The suspended sediment collected from each sampler was dried for future comparisons of sediment extraction efficiency and sediment properties. A full report on this project will be produced later in 2016.

#### Integration and collaborative work:

- We convened a meeting of individuals interested in sediment research in the Nechako Basin on June 18, 2015 to explore potential research synergies amongst interested parties. Participants included Barry Booth, Stephen Déry, Aseem Sharma, Mark Taylor, Ellen Petticrew, Phil Owens and Todd French (all from UNBC), John Rex, Philip Krauskopf, Chelton Van Geloven, and Brendan Millar (FLNRO), and Brian Toth (First Nations fisheries consultant). Results from this meeting were summarized by Barry and were distributed to the meeting participants. These

results were also shared with NEWSS and the Fraser Basin Council. Summary matrix appears in Appendix 3.

### **Theme 3: Tools for integration in watershed management and governance (Parkes and students)**

We continue to develop a spatially referenced watershed portal tool to create a platform to bring together existing knowledge and new watershed research. Progress for this theme continued to focus on design and collaborative activities required to develop and test new tools to integrate and share information in the watershed. The development of this theme has been directly informed by the projects described in Theme 1 relating to climate change and resource development in the Nechako and will continue to be informed by the research and results emerging from Theme 2. In addition, we continued to work on watershed governance through our activities with the Nechako Watershed Alliance. Please note that Theme 3's activities, in part, overlapped significantly with Theme 1, including the collaborative work linked to the publications noted above (Matthews et al. (2015), and Picketts et al. (2015).

#### **Fieldwork and technical development of portal:**

- Technical progress on portal:
  - Using funds from our BC Real Estate Foundation grant, we have entered into a formal working arrangement with national research partners (Martin Bunch, York University) who are developing open-source watershed portal technology. Our continued work with Martin's team will ensure that we complement and work synergistically with what is being developed in the Nechako. As part of this work Shulin Zhao, one of Martin's principal programmers, came to UNBC for a week in December to work in conjunction with Scott Emmons, Senior GIS Lab Instructor and his technical team on programming details relating to the development of the UNBC portal;
  - A set of geospatial and data management tools has been created in collaboration with York University (many meetings and development reviews). Initial pilot testing of tools and database initiated the week of October 12, 2015;
  - Technical workshop for portal partners took place October 21, 2015. Participants included Fraser Basin Council, NEWSS, and Cumulative Impacts Research Consortium. Design features and data products were identified and are to be supplied by partners in February 2016;
  - Data loading was performed through a series of pilot testing of portal submission by a variety of users. A series of upgrade suggestions were derived. Implementation of above suggestions have been initiated starting December 2015;
  - Collaborative coding workshop took place December 2015 including developers from UNBC and York University.

- Community/partner development of portal:
  - We have recently reached an agreement with UNBC Library staff for the transfer of Richard Krehbiel's files from his time on the Nechako Watershed Council to UNBC Archives. We are also working with the UNBC library to secure additional material pertaining to the Nechako River Basin from the Fraser Basin Council (FBC). This is an important step in ensuring Nechako-relevant material will be accessible via the watershed portal to individuals in the north;
  - Sarah Bale, a new addition to Martin Bunch's research team as a Masters student, came to Prince George for a portion of the Fall Semester. Sarah participated in various aspects of the development of the portal. In particular, she traveled to Vanderhoof and consulted with staff and students in School District (SD) 91 in order to ascertain how input from students in SD 91 can be incorporated into the portal;
  - Barry Booth and Sarah met with staff of SD 91 and NEWSS in Vanderhoof on December 10<sup>th</sup> to discuss the potential role of the portal in the evolving relationship between NEWSS and SD 91. NEWSS is very keen on engaging schools in their restoration work. Teachers and support staff of SD 91 are similarly interested in working with NEWSS as they develop their new, experience-based curriculum. Barry and Sarah were able to help NEWSS and SD 91 understand how the portal could work for both parties in terms of types of data that could be collected by students, what levels of skills would be required for collection of said data, necessary components for on-going maintenance of the portal and how SD 91's IT program could assist in this to name a few. Future meetings are planned to further this discussion in order to enable both parties to move forward;
  - Kate Hewitt and Sarah met with Mike Robertson, senior policy advisor, Cheslatta First Nation at the Grassy Plain Reserve on November 25<sup>th</sup> to initiate discussions regarding how the UNBC portal could assist the Cheslatta in bringing their story into the public realm. This initial meeting will be followed up by a subsequent visit in January 2016 by Kate, Scott and Barry. This second visit will lay the groundwork for determining how the extensive archival material (documents, photographs, maps) that is in the possession of the Cheslatta may be brought into the portal.

### Integration and collaborative work

- We also continued our collaborative work with the Nechako Watershed Alliance partners, both from a project and a governance perspective, in ways that complement efforts across all three themes. Our work in this area included the following:
  - We continued our work refining the governance structure of the Nechako Watershed Alliance. This ultimately led to the establishment of the Nechako Watershed Roundtable (NWR). The NWR was officially launched at UNBC in October of 2015. The official launch was held in conjunction with our watershed partners, especially the Fraser Basin Council on October 21<sup>st</sup> at UNBC. The

event, co-emceed by Margot Parkes, and opened by Her Honor, Judith Guichon, the Lieutenant Governor of BC, was attended by over 60 people from all walks of life (Appendix 4). Ellen Petticrew presented work completed by the IWRG. Coverage from the launch can be found here: <http://bit.ly/1Rnlyj>;

- The first working meeting of the NWA took place the following day (October 22<sup>nd</sup>) at UNBC. The meeting aimed to formally launch the Roundtable, to engage the community and broaden participation with interested groups and individuals, and to explore priorities and opportunities to work together to improve the health of the Nechako watershed. About 50 participants attended the business meeting. The discussions and participants' comments during the Roundtable Business Meeting provided useful feedback for the Terms of Reference and re-affirmed the Roundtable's general approach to date. Television coverage of the event, including an interview by Stephen Déry, can be found here: <http://www.ckpg.com/2015/10/22/protecting-the-nechako>  
The report from this meeting can be found here: [http://www.fraserbasin.bc.ca/Library/UFR/nwr\\_launch\\_report\\_2015\\_web.pdf](http://www.fraserbasin.bc.ca/Library/UFR/nwr_launch_report_2015_web.pdf)
- The NWA met on December 10<sup>th</sup> in Vanderhoof. During this meeting, interim core committee members were established. Stephen Déry has agreed to be the representative from the IWRG while Margot is on sabbatical.

## Financial Summary

Our financial summary from UNBC Finance is attached\*. You will note that we spent in excess of the planned amount of \$268,250 (50% NEEF, 50% UNBC matched) in our second year of research. This 'overspending' was due to our ability to provide salaries as matching funds for a number of our researchers thereby exceeding the required value for the matched funds paid into our Nechako project. For example, Dr. David Gateuille, our postdoctoral research fellow from France, was fully funded for the ~10 months he worked on our Nechako project.

In 2015 we once again have underspent the NEEF contribution of our budget. Cumulatively, over the two first years of the project, we have underspent NEEF funds in the sum of \$71,201.75 (\$66,209.29 in 2014 and \$4,995.46 in 2015). As per our contract detail discussions regarding rolling over of unspent monies, we are requesting that the unspent NEEF funds that we have accrued over both years (\$71,201.75) be rolled over into our third year, acknowledging that this amount will be matched 1:1 by UNBC over the period of the project.

To facilitate the 2016 fieldwork component of Theme 2, by Owens and Petticrew, we would like to request a reallocation of \$30,000 from the budget category of LABOUR be transferred to EQUIPMENT, ANALYSIS and SUPPLIES. This will enable Theme 2 to provide additional analyses of soil and suspended sediment samples to further enhance our sediment fingerprinting efforts.

\* Please note that receipts related to expenses are available from UNBC Finance upon request.

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 UNBC Finance Department  
 Tel:(250) 960-6534 Fax: (250) 960-5794

**Funding Agency:**

Nechako Environmental Enhancement Fund  
 BOX 101  
 Prince George, BC  
 V2L 4R9

UNBC Fund # 28532  
 UNBC Contract # RC13-2851

Project Title: "Integrated Watershed Research in the Nechako River Basin"

**Statement of Cash Receipts and Expenditures  
 For the period from January 1, 2015 to December 31, 2015**

Opening Fund Balance		\$11,521.30
Funds received in the reporting period		\$134,880.00
Amount of matching funds in the reporting period	Salaries	\$167,987.12
	Expenses	\$52,093.00
Funds Available		\$366,481.42

<b>LABOUR</b>		
Research Assistants	\$95,172.38	
Graduate Student Stipends	\$28,441.01	
Post-Doc Fellows	\$63,150.00	
Part-time Project Manager	\$37,500.24	
<b>TRAVEL</b>		
Travel (Conferences)	\$1,364.67	
Travel (Field work)	\$8,025.33	
Travel (Workshops and Outreach)	\$1,178.04	
<b>EQUIPMENT, ANALYSIS and SUPPLIES</b>		
Computers	\$2,147.79	
Equipment	\$66,786.71	
Laboratory Analysis and Supplies	\$1,332.55	
Materials and Supplies	\$14,675.94	
<b>PROMOTIONAL MATERIAL</b>		
Publication and Poster Costs	\$60.00	
<b>UNBC O/H</b>	\$31,250.00	
<b>Total expenses</b>	<u>\$351,084.66</u>	\$351,084.66
Fund Balance at December 31, 2015		<u>\$15,396.76</u>

  
 Ellen Petticrew, Professor - GEOG

Colleen Smith Director, Finance & Budgets

Date: March 11/16

Date: \_\_\_\_\_

## Appendix 1. Description of weather station at Tatuk Lake

On September 29<sup>th</sup>, 2015, the Northern Hydrometeorology Group, led by Dr. Stephen Déry, deployed their 12<sup>th</sup> meteorological station near the headwaters of the Chilako River. Located at 53° 32' 41" N, 124° 16' 35.5" W at an elevation of 938m, the station sits on the north shore of Tatuk Lake, approximately 80km southwest of Vanderhoof, BC. This new weather station measures several environmental and atmospheric parameters. The data collected every 60 seconds and averaged over 15 minutes, by the numerous instruments installed on the station, will be used to analyze trends and variability in the region's climate.

Installed on the station are instruments that measure, air temperature and relative humidity, atmospheric pressure, wind speed and direction, soil moisture along with temperature, incoming solar radiation, snow depth and finally precipitation, both rain and snow.

Having a newly deployed weather station in the Nechako River watershed is an invaluable tool that will provide information on the many changing characteristics of the watershed and will also act as a resource for collaboration with future research projects.



Tatuk Lake weather station (facing north)

## Appendix 2. ICP-MS Analyses

### ICP-MS variables

QA/QC samples and Nechako watershed sediment cores, suspended sediment, soils and bank sediment were analyzed for total extractable:

1) beryllium, Be	12) iron, Fe	23) cadmium, Cd	34) gadolinium, Gd
2) boron, B	13) cobalt, Co	24) tin, Sn	35) dysprosium, Dy
3) sodium, Na	14) nickel, Ni	25) antimony, Sb	36) holmium, Ho
4) magnesium, Mg	15) copper, Cu	26) cesium, Cs	37) erbium, Er
5) aluminum, Al	16) zinc, Zn	27) barium, Ba	38) thulium, Tm
6) phosphorus, P	17) gallium, Ga	28) lanthanum, La	39) ytterbium, Yb
7) potassium, K	18) arsenic, As	29) cerium, Ce	40) thallium, Tl
8) calcium, Ca	19) selenium, Se	30) praseodymium, Pr	41) lead, Pb
9) vanadium, V	20) rubidium, Rb	31) neodymium, Nd	42) thorium, Th
10) chromium, Cr	21) molybdenum, Mo	32) samarium, Sm	
11) manganese, Mn	22) silver, Ag	33) europium, Eu	

### Sample QA/QC Analyses

1) One calibration solution (comprising all analytes) was prepared and digested with each batch for ICP-MS analysis. This equates to 40 calibration standards being analyzed in 2015.

2) One National Research Council of Canada marine sediment standard was digested with each batch for ICP-MS analysis. Standards were either NRC HISS-1 (Hibernia Shelf, Newfoundland) or NRC PACS-2 (Esquimalt Harbour, British Columbia). This equates to 40 NRC standards being analyzed in 2015.

3) One reagent blank (HNO<sub>3</sub> + HCl only) was digested with each batch for ICP-MS analyses. This equates to 40 reagent blanks being analyzed in 2015.

4) One field sample was digested in duplicate with each batch for ICP-MS analyses. This equates to 40 sample duplicates being analyzed in 2015.

5) To summarize points 1-4 *above*, our sample QA/QC analyses equated to about 27% of all samples analyzed.

6) In addition to running sample QA/QC analyses, we analyzed four (4) samples from the Fishtrap/Jamieson creek watershed (Kamloops, BC, area) at the UNBC laboratory and at an ALS commercial laboratory for an inter-laboratory comparison of ICP-MS results.

## Nechako Watershed Samples

In total, 436 samples from the Nechako River watershed were analyzed by ICP-MS in 2015:

- Subsoils— 55 samples
- Topsoils— 46 samples
- Nechako Mainstem Bank Sediment— 30 samples
- Nechako Tributary Bank Sediment— 11 samples
- Sediment Core Layers— 125 samples
- Nechako Mainstem Suspended Sediment— 69 samples
- Nechako Tributary Suspended Sediment— 100 samples

The <63- $\mu\text{m}$  fractions of Nechako Watershed samples were also analyzed for % organic carbon content (gravimetrically by  $\text{H}_2\text{O}_2$  oxidation) and grain-size distribution (Malvern 3000 grain size analyzer) to permit the standardization of extractable sediment metal concentrations amongst sites.

## Appendix 3. Matrix of sediment research in the Nechako River Basin

Summary of Sediment Meeting held at UNBC on June 18, 2015  
Matrix compiled by Barry Booth, Research Manager, IWRG, UNBC with meeting notes from Stephen Dery

Who	What	Where	Goals	How
UNBC Ellen Petticrew, Phil Owens	Sediment finger printing	Focal area is from Kenny Dam down to Vanderhoof. Suspended sediment being collected from the following sites: <b>Mainstem:</b> Vanderhoof townsite, Hwy 27, Dog Creek, below Nautley, rail road bridge above Nautley, near Greer and Cut off Creeks <b>Creeks:</b> Stoney, Murray, Clear, 9 Mile, Talsutani, Smith, Copley/Targe, Greer, Swanson	<ul style="list-style-type: none"> <li>Determine the main sources of fine sediment (&lt; 63 µ) presently being delivered to the main stem of the Nechako River</li> <li>Examine how these sources changed over time (ca. last 50-100 years) and how might they change in the future (50-80 years) given anticipated changes in climate and land use</li> </ul>	<p><b>Sediment sources:</b> sediment source finger-printing. Comparing instream samples with topsoils (e.g., arable land, forested areas, eroding river banks)</p> <p><i>In stream samples</i></p> <ul style="list-style-type: none"> <li>Phillips traps - traps that are placed into the current, anchored to the bottom with cinderblocks</li> <li>Instantaneous sampler (in development)</li> <li>water samples from bridges</li> </ul> <p><i>Upland sources</i></p> <ul style="list-style-type: none"> <li>grab samples from shoreline/upland areas</li> </ul> <p><b>Temporal changes:</b> similar fingerprinting exercise using cores of floodplain sediment.</p>
UNBC Stephen Dery	Hydroclimatology-climate change and water security	Entire Nechako Basin	<ul style="list-style-type: none"> <li>To examine the relationship between a warming climate and surface water availability in the NRB</li> <li>Explore the impact of anthropogenic versus natural influences on the basin's water resources, including streamflow amounts and timing</li> </ul>	<ul style="list-style-type: none"> <li>Trends in air temperature and precipitation derived from the NRCAN dataset.</li> <li>Long term (1950s to present) water budget assessment for the basin (inputs and outputs)</li> </ul>
FLNRO Chelton van Geloven	Watershed assessment Riparian restoration	Chilako River drainage	Helping to understand and improve 'health' of Chilako watershed	<ul style="list-style-type: none"> <li>Install hydrometric monitoring station on Chilako, considering a turbidity meter</li> <li>snow surveys and aerial surveys of river dynamics</li> <li>restoration projects on private lands under auspices of group farm plan</li> <li>examination of DEMs, surficial maps, airphotos, satellite data with ground truthing</li> </ul>
FLNRO Brendan Miller	Examination of the glacial and postglacial geomorphology and stratigraphy of the central interior of BC, from a broad, landscape perspective	Omineca Region: includes Nechako River Basin	Reconstruction of quaternary history of Omineca Region	<ul style="list-style-type: none"> <li>construction of model based on available data from range of sources</li> <li>model for Vanderhoof area to be completed by December 2015</li> </ul>
FLNRO John Rex	Omineca Water Tool	Omineca Region: includes Nechako River Basin	Development of hazard /risk assessments using three indicators: sediments, peak flow and riparian conditions.	<ul style="list-style-type: none"> <li>establishment of lake monitoring stations on both lakes</li> <li>measurement of discharge on Stoney and Corkscrew Creeks, may include Tachick Creek in future.</li> </ul>
FLNRO Phil Krauskoph	Stoney Creek Monitoring Program (2014-2017)	Stoney Creek watershed including creeks and Tachick and Nulki Lakes	<ul style="list-style-type: none"> <li>To develop a better understanding of water levels and availability in Tachick Lake, Nulki Lake and Stoney Creek</li> <li>Results will inform water allocation decisions in future</li> </ul>	<ul style="list-style-type: none"> <li>enumeration of salmon stocks</li> <li>monitoring of small streams and impacts to Stuart sockeye</li> <li>interest in small stream restoration, including areas impacted by fires (e.g., Nechako Canyon)</li> <li>extensive work on sturgeon</li> <li>water storage/flow augmentation</li> <li>initiation of cumulative impacts study</li> </ul>
FIRST NATIONS: CSTC, T'az'ten Nation, Uheidi, T'enneh, UFFCA Brian Toth	Multiple project many focusing on fish (salmon and sturgeon) Cumulative effects of development	Throughout Nechako Basin, many salmonid projects focused on Stuart River and its tributaries	<ul style="list-style-type: none"> <li>Improved health of fish stocks and fish habitat throughout region</li> <li>Increased understanding of the implications of observed and predicted changes to small and medium streams (e.g., temperature and discharge) as they relate to fish populations</li> <li>Improved understanding of impacts of development on natural systems</li> </ul>	<ul style="list-style-type: none"> <li>enumeration of salmon stocks</li> <li>monitoring of small streams and impacts to Stuart sockeye</li> <li>interest in small stream restoration, including areas impacted by fires (e.g., Nechako Canyon)</li> <li>extensive work on sturgeon</li> <li>water storage/flow augmentation</li> <li>initiation of cumulative impacts study</li> </ul>

## Appendix 4. Letter from Lieutenant Governor to Dr. Margot Parkes



*Lieutenant Governor of British Columbia*

October 28, 2015

*Dr. Margot Parkes, MBChB, MAS, PhD  
Associate Professor  
School of Health Sciences  
University of Northern British Columbia  
TLB 10-3602-3333 University Way  
Prince George BC V2N 4Z9*

*Dear Dr. Parkes:*

*I am so pleased to have been able to join you and the many participants at the recent Nechako Watershed Roundtable. My congratulations go to you and all who are pulling together to address environmental issues surrounding the Fraser River. You have my admiration for your dedication to the stewardship of the entire Fraser Basin, which is a vital water source that impacts so many British Columbians.*

*Thank you for the beautifully carved wooden sturgeon, which will serve as a memento of the great time that I had with you and of the people who look out for our province's environmental health and its future. Your kind gift is very much appreciated.*

*Again, thank you and best wishes for continued success in your most important work.*

*Yours sincerely,*

A handwritten signature in cursive script that reads "Judith Guichon".

*The Honourable Judith Guichon, OBC  
Lieutenant Governor of British Columbia*

*Government House 1401 Rockland Avenue Victoria British Columbia V8S 1V9*

**Appendix 4. Letter from Lieutenant Governor to Theresa Fresco (which was intended for Sarah Bale)**



*Lieutenant Governor of British Columbia*

October 27, 2015

Ms. Theresa Fresco  
Program Coordinator  
Watersheds and Water Resources  
Fraser Basin Council  
1<sup>st</sup>-470 Granville St  
Vancouver BC V6C 1V5

Dear Ms. <sup>Theresa</sup>~~Fresco~~:

*It was a pleasure to join you and your colleagues from across the province as you gathered together for the recent Roundtable. Congratulations to you and the participants for your dedication to tackling environmental issues surrounding the Fraser River and for providing such an exceptional example for others to aspire to.*

*Thank you for the bottle of wine from Northern Lights Estate Winery. I look forward to savouring it, and as I do, I will reminisce on the great time that I had with you and of the brilliant minds and caring hearts who are dedicated to a healthy future for British Columbia's rivers. Your thoughtful gift is very much appreciated.*

*Again, thank you and best wishes for continued success in your most important work.*

*Yours sincerely,*

A handwritten signature in cursive script that reads "Judith Guichon".

*The Honourable Judith Guichon, OBC  
Lieutenant Governor of British Columbia*

*Government House 1401 Rockland Avenue Victoria British Columbia V8S 1V9*