Memorandum

Project Name: Margaree Salmon Association	Project #: SYD-00233605-A0
To: Mr. Lester Wood	From: Fred Baechler, Jim Foulds, Bill Jones
Date: 21 September 2016	
Subject: 09 July 2016 Planning Session – Final Report on Task A (Meeting)	
Prepared By: Fred Baechler, Jim Foulds, Bill Jones	
Distribution: Margaree Salmon Association Board of Directors	

1.0 BACKGROUND

The Margaree Salmon Association (MSA) noted that the Northeast Margaree River has changed considerably over the past number of years. Much of this has been natural migration, but recent government assessments and empirical evidence makes it clear that salmon populations have dwindled alarmingly.

In response, the MSA is considering undertaking scientific research programs that will extend the group's charter to protect, conserve and enhance the environmental health and stability of the Northeast Margaree River. The goal will be to establish meaningful baselines for ongoing research and action.

There has been a notable absence of activity within the organization responsible for the Canadian Heritage River System (CHRS) designation in 1998 of the Margaree-Lake Ainslie River system. Nova Scotia Environment (NSE) was identified as the key provincial department responsible for the CHRS designation and in 2008 undertook the first 10 year assessment of actions undertaken to maintain the designation. It indicated the designation remain intact, noting "The river is worthy of continued designation as a nationally significant river with the Canadian Heritage River System". The next 10 year assessment to ensure continuation of this designation is in 2018. This research and monitoring effort by MSA will aid in addressing a number of actionable issues required to maintain that designation.

In 2015 MSA created a list of broad issues they felt required scientific research to support effective management. MSA has been working with **exp** Services Inc. **(exp**) over the past 5 years to discuss some of these issues**.** As the effort to undertake the necessary research to answer all issues would be significant, in both time and funding, **exp** designed a phased approach including:

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Phase 1

Task A: Interested parties would be brought together for a one-day planning session to refine and prioritize the list of important issues that required research. This Final Report summarizes those findings.

Task B: A Geospatial Database database (GIS) would be developed utilizing existing relevant information.

Task C: An estimated range of costs would then be provided for the priority research programs required to provide sufficient information to aid management.

Phase 2

MSA would use the results of Phase 1 to determine how best to support and fund research on selected items from the priority list.

2.0 MEETING

The Phase 1 - Task A meeting was held on 09 July 2016 at the St. Patrick's Parish Hall in Northeast Margaree.

Eight different groups/agencies were requested to send representatives, including:

1) Margaree Salmon Association/Guides/Collaborative Salmon Initiative
2) Unama'ki Institute of Natural Resources (UINR)
3) Federal Department of Fisheries and Oceans (DFO)
4) Nova Scotia Department of Fisheries/Hatcheries
5) Atlantic Salmon Federation
6) Nova Scotia Department of Natural Resources (NSDNR)
7) NSE
8) Nova Scotia of Transportation and Infrastructure Renewal (NSTIR)

Three **exp** personnel were responsible for leading the session, including:

1) Fred Baechler – Chief Hydrogeologist/Senior Hydrologist
2) Dr. Jim Foulds – Aquatic Ecologist
3) Bill Jones – Geomatics Analyst

To aid in the discussions, **exp** provided large scale, hard copy maps from the Phase 1 - Task B GIS work. These outlined the extent of the watershed, salmon pools, geology, forest cover and topography; copies are provided in Appendix A to this report. Base mapping was a Spot satellite image from 2013 provided courtesy of Parks Canada, Cape Breton Highlands National Park. Additional support information included graphs and photographs taken by **exp** as part of their on-going research programs within the watershed.

A total of 13 participants were present, as documented in Appendix B to this report. Ten were representatives of MSA and other local organizations, with one representative of UINR, NSDNR and Nova Scotia Department of Fisheries/Hatcheries, respectively. The NSTIR declined the invitation indicating the work was outside their jurisdiction. Subsequent discussions were held with Dr. Cindy

Breau, Ms. Louise deMestral and Mr. Daniel Caissie of DFO. As of this date no comments have been received from NSE.

3.0 PRIMARY ISSUES OF CONCERN REQUIRING RESEARCH

A total of 23 major issues of concern were raised during the discussions, as summarized below.

1) Watershed Boundaries

   The initial boundary for the Northeast Margaree River study was established as the watershed upstream of Doyles Bridge. To encompass all the issues, it was suggested that the boundary be moved downstream to the confluence with the Southwest Margaree River. However, it was to be kept in mind that whatever is undertaken in the northeast will impact the channel downstream of the confluence to the tidal zone.

2) Active Channel

   Large reaches of the channel are very active and mobile leading to the view that the river was “out-of-control” or “a mess”. This was exemplified by enhanced meandering (at times leading to straightening of the channel), bank erosion, dry channels, wide channels and braided reaches with multiple channels. Pertinent photographs exemplifying some of these changes are provided in Plates C-1 and C-2 (Appendix C). Major changes in channel morphology appear to have occurred since the mid 1980s, in particular after the large, nearly 1:100 year flood event in 2010. Therefore, the degradation of concern may be a function of natural river processes attempting to return to equilibrium.

3) Degradation of Pools

   Salmon pools are degrading, being partially or totally infilled with gravel. Deep, large pools, which offer cold water refuge during low water warm temperatures, are being lost and/or not as deep.

4) Increased Summer Water Temperature

   Widening of the active channels leads to shallower water during summer low flow periods, with a resultant rise in temperature. Analysis by **exp** of the Provincial monitoring station on the Northeast Margaree River at the Crowdis Bridge noted no noticeable changes in seasonal and annual temperatures at this particular location between 2002 and 2008 (Figure D-4, Appendix D). Maximum summer temperatures were in the 18 to 20˚C range.

5) Loss of Passage Zones to Facilitate Salmon Migration

   The wide shallow channels and reaches of small braided channels make it difficult for salmon to migrate upstream and/or make it to deep, cool pools.

6) Changes in River Flow

   How have the flows in the river changed over time? What is the proper “ecological flow regime” to support salmon habitat, spawning, aquatic invertebrates, sediment transport, etc. Changes in mean annual flows are shown in (Figure D-3, Appendix D), noting an average increase starting in the

1960s, peaking in the 1970s and then declining since then. There is also a 1 to 2 year cycle present. DFO produced relevant reports on this matter, including: a) a report in 2009 on natural flow regimes for a number of Maritime Rivers including Northeast Margaree River; b) a report in 2012 on hydrological conditions for Atlantic salmon rivers in 2011; and c) a report in 2013 on trends in stream flow characteristics in eastern Canada.

7) In-stream Work to Improve Habitat

The history of previous work undertaken by MSA to improve habitat should be assessed to determine what worked, what did not work and why. Was there more success in the tributaries? What is required to ensure long-term maintenance is undertaken. Should future work stay entirely out of the main channel? Should work target specific pools in the main channel and do annual maintenance to keep them deep?

8) Health of the Salmon Population

What is the present day health of the population? How and when do salmon move back and forth from the Gulf into the channel and then up and down the channel? How has it changed with time? How might it be altered due to climate change?

DFO noted that the conservation requirement estimates for salmon in the Northeast Margaree River have been exceeded every year since 1987. For 2014, DFO estimates that salmon abundance was lower than the long-term average for both large and small salmon. Juveniles (fry and parr) are found at all sampling sites and show good densities, although with lower numbers than have been generally found in annual sampling since 1990.

9) Forestry Practices in the Headwaters

What is the impact of past and present forestry operations in the headwater portion of the watershed over the Cape Breton Highlands on streamflow, water chemistry and sediment transport in the lowland reaches critical to salmon habitat? How did clear cutting in the 1980s for the spruce budworm create “memory” effects/impacts in the channel? How is present cutting for the pulp plant (Plate C-3, Appendix C) impacting the present day situation?

10) Agricultural Activities Adjacent the River

Historical land clearing down to the river banks for agriculture (Plate C-4, Appendix C) had Federal government financial incentives (1930s to 1970s). Farmers took care of their own river bank stabilization. However, there are notably less operating farms now, the funding is discontinued, there are no deep rooted trees to stabilize the banks and no monies for maintenance; hence enhanced erosion of stream banks and more active channel migration.

11) Changing Climate

How will changing climate impact the flow, water chemistry, ice buildup, highland snowbelt and sediment transport within the river system? Historical graphs in Appendix D note a long-term trend of rising total annual precipitation in the 1950s, peaking in the late 1980s and declining since then, with a gradual increase in air temperature since the early 1990s (Figure D-1). There has also been a decline in annual snowfall since the late 1950s (Figure D-2). DFO produced reports (2013 and

2015) outlining the potential impact of increasing air temperature in the Maritime Region on water temperatures and their potential impact on Atlantic Salmon.

12) Health of Both the Main Channel and its Tributaries

Is there a method of measuring the biological "health" of the river, e.g. using the CABIN program protocols and water chemistry? Do small channels in braided reaches have good habitat to replace that lost in the main, at times dry, channel? Which tributaries form critical salmon habitat? Graphs (provided in Appendix D) of select chemical parameters between 2002 and 2008 of the main channel at the Crowdis Bridge note generally non-turbid waters, except during select peak flow events, water temperatures fluctuating seasonally between 0 and 20°C and dissolved oxygen concentration varying seasonally between 10 and 15 mg/L (Figure D-4). Detailed water chemical analyses (Figure D-5) noted relatively consistent total dissolved solids (20 to 180 mg/L) and pH (7.0 and 7.8). Threats to salmon are mainly from increased suspended sediments (infilling gravel substrates), as well as bedload transport of gravel/cobble from periods of heavy discharge.

13) Groundwater Stream Interaction

How does the large sand/gravel bedrock aquifer underlying and adjacent the river improve salmon habitat by dampening storm flows, enhance low summer flows, keep certain reaches cool with springs and enhance the water chemistry? Where does this take place and why?

14) Bed Sediment

The nature of the bed sediment changes (bedrock, sand, clay, gravel, cobbles) and, therefore, so does aquatic habitat and spawning areas. What controls these changes? How is this material being transported downstream and changing pools and channel migration?

15) Floods

A number of big floods, beginning in 1986 then followed by ones in 2004, 2008 and 2010, caused a lot of changes in the stream profile and channel instability. What was the cause? Can we expect more frequent events due to climate change and/or forestry? How will that impact what and where MSA does river work? In the 1980s the government funded a number of rock rip-rap work to protect land from erosion, However, that program was discontinued and there are no monies for long-term maintenance.

16) Infrastructure Design

Is the hydrological design for present day infrastructure (bridges/roads) over the main channel and tributaries sufficient to accommodate climate change? What impact are these structures having on the mobility of the present channel?

17) Government

There appears to be a number of government agencies responsible for different aspects of the river. There is no "one-window-approach" agency to be in charge, who interested parties can go to get action on problems. There are a large number of rules and paper work to slow down and restrict

action, which appears to differ depending upon land use. There appears to be minimal enforcement of any rules.

18) Monitoring

DFO (Gulf Region) assesses the stock status for Atlantic Salmon on a regular basis with annual updates. The Margaree River is a major watershed for Atlantic Salmon in Fishing Area 18B. These data include estimates, using a variety of methodologies, of adult returns, spawners, fry, parr and smolts. There is a significant amount of historical data gathered and summarized in available on-line publications.

However, there is a lack of government monitoring for the physical, chemical and sedimentological aspects of ground and surface waters within the watershed, especially in the highland headwaters. There is one good long-term station with over 90 years of flow records and 14 years of indicator chemistry. Who is analyzing the data? (**exp** is analyzing the data for our own research, note graphs in Appendix D). What is it telling us? Should this be enhanced by the Citizen Science monitoring effort noted as one of the actionable items in the 2008 report by NSE on the 10 year monitoring report of the CHRS status?

19) Floodplains

What is the extent of the various floodplains for 1:25, 1:50, 1:100 year flood events? What impact will that have on infrastructure (roads, bridges), buildings (fish hatchery) and private residences (insurance rates)?

20) Interaction Between Various Interest Groups

There are a number of non-government groups (NGOs) with a vested interest in protecting and managing the Northeast Margaree River. However, there is little communication and lack of co-operation between them. The CHRS group is starting up again. To get action and funding from government they need to work closely together and get one group (e.g. MSA) to act as “champion” to represent all views in targeting governments for funding.

21) Value of the Northeast Margaree River Fishery

There is a need to identify the true, present day value of the fishery to the local economy to aid in securing additional research funding from government.

22) Central Library

At the moment there is no central repository for whatever work and research is being carried out within the watershed. No one presently knows who is doing/has done research, what, where, for what reason. The NSE 10 year CHRS assessment of the Margarees encouraged “completion of a central database for historic and future parameter values”. MSA has hired Mr. Nicolas Baker to begin pulling some of the data and reports together, which was invaluable in completing this report. **Exp** is in the process of placing existing relevant data on a GIS database as part of this project (note summary maps in Appendix A). Perhaps MSA should secure funding to build and manage such a repository and issue research permits for those operating in the watershed.

4.0 PRIORITY RANKING

After identifying the main issues in Section 2.0, the participants were asked to identify the top five priority issues to focus future research on. These are identified below.

Priority Issue #1 – Understanding The Active Channel

The focus here is to understand the interaction between natural and man-made physical forces, which are controlling the highly active/mobile channel and what impact does that have on salmon. The causes – prediction – impact on salmon. This would then form a base to understand where and when to undertake stream restoration works and why there was success and failures during previous efforts. It would also aid in being able to predict future changes and what impacts they may have. This comprises a number of the issues identified above including:

#2 - Active Channel
#3 - Degradation of Pools
#4 - Increased Summer Water Temperature
#5 - Loss of Fish Passage Zones to Facilitate Salmon Migration
#6 - Changes in River Flow
#14 - Groundwater Stream Interaction
#15 - Bed Sediment
#16 - Floods

Priority Issue #2 – Defining The “Health” Of The River

The focus here is to define the “health” of the river in terms of salmon. This comprises issues:

#8 - Health of the Salmon Population
#9 - Salmon Migration
#13 - Health (Physical and Chemical) of the River and its Tributaries

Priority Issue #3 – Lack of Monitoring

The key is to enhance the level of monitoring of all facets of physical/chemical/biological aspects of ground and surface waters to track changes in the river system. This will be especially relevant with climate change and forestry operations in the headwaters.

Priority Issue #4 – Central Repository and Library

There is a definite need for a central repository of all relevant water resources and salmon information. It should be developed primarily in digital format as reports, as well as the GIS mapping system. Research permits should be required from MSA for those working within the watershed to ensure no overlap of work and ensure research is focused on the highest priority issues. MSA should consider providing a “one window” approach for all interested parties in order to present a consistent unified view to government.

Priority Issue #5 – Changing Climate

There is a critical need to understand what the impacts of changing climate will be on the Northeast Margaree River system and its impact on salmon populations.

5.0 SUMMARY PHASE 1 WORK PROGRAMS

Task A

The initial planning session meeting was held on 09 July 2016. A draft report of that meeting was submitted to MSA on 20 July 2016 for review and comment by MSA and others.

Comments were received by those who could not be present at the meeting, and upon their subsequent review of the DRAFT. Final comments were incorporated after teleconference discussions were held between **exp** and DFO personnel on 08 September 2016. NSE has not provided any comments as of this date.

This Final Phase 1 Task A report incorporates all of the additional comments.

Task B

MSA has also supplied relevant information on sites where they have undertaken remedial works to improve habitat. These are being loaded up onto the digital GIS database.

Task C

Exp is now working on developing ranges in costs to research the top five priority issues identified in this report.

Sincerely,

Fred Baechler P.Geo.
Chief Hydrogeologist/Senior Hydrologist

exp Services Inc.

APPENDIX A
PERTINENT SUPPORT MAPS

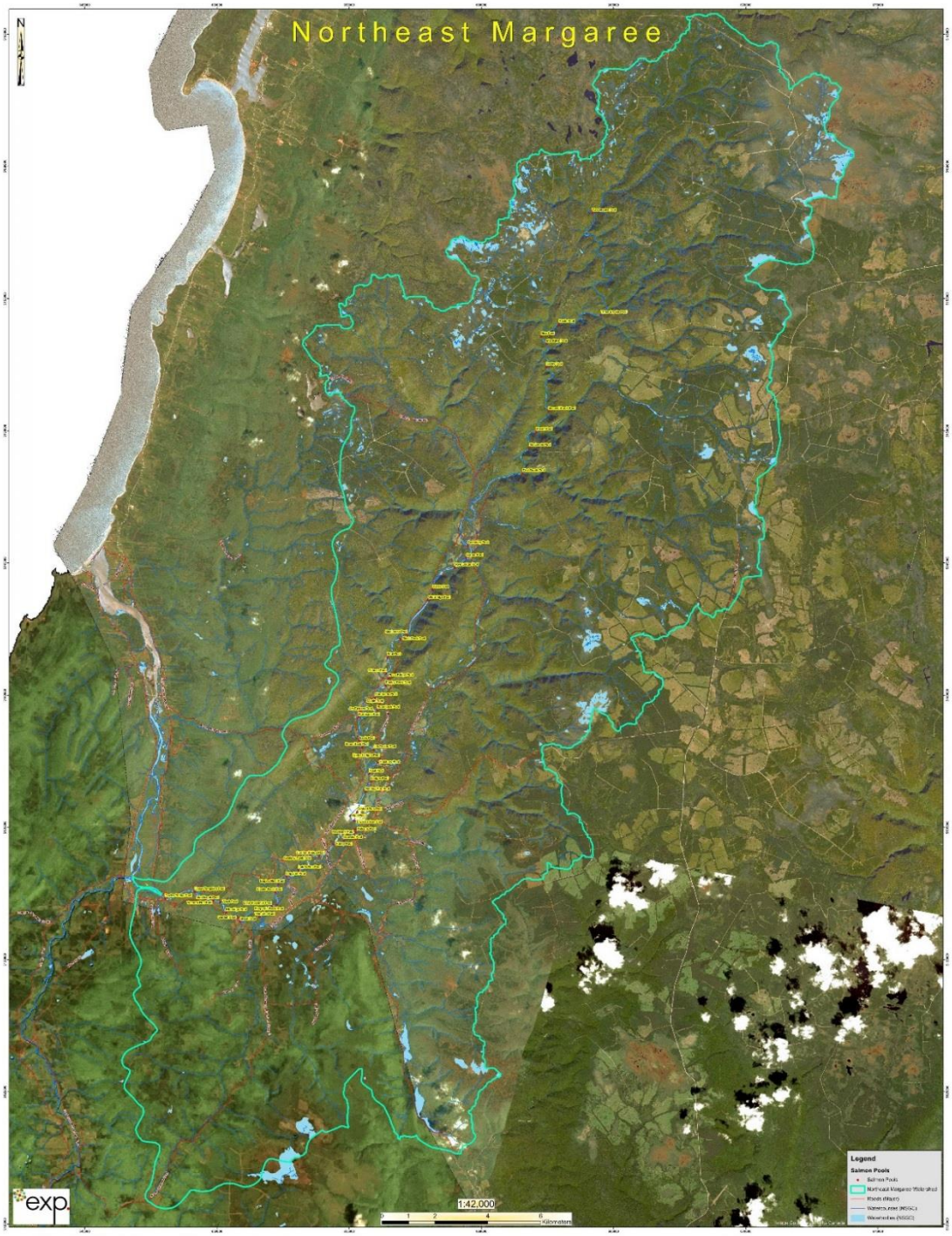

Figure A-1: Northeast Margaree watershed upstream of the confluence with the Southwest Margaree River and location of Salmon Pools. Base mapping courtesy of Parks Canada – Spot satellite image dated 2013.

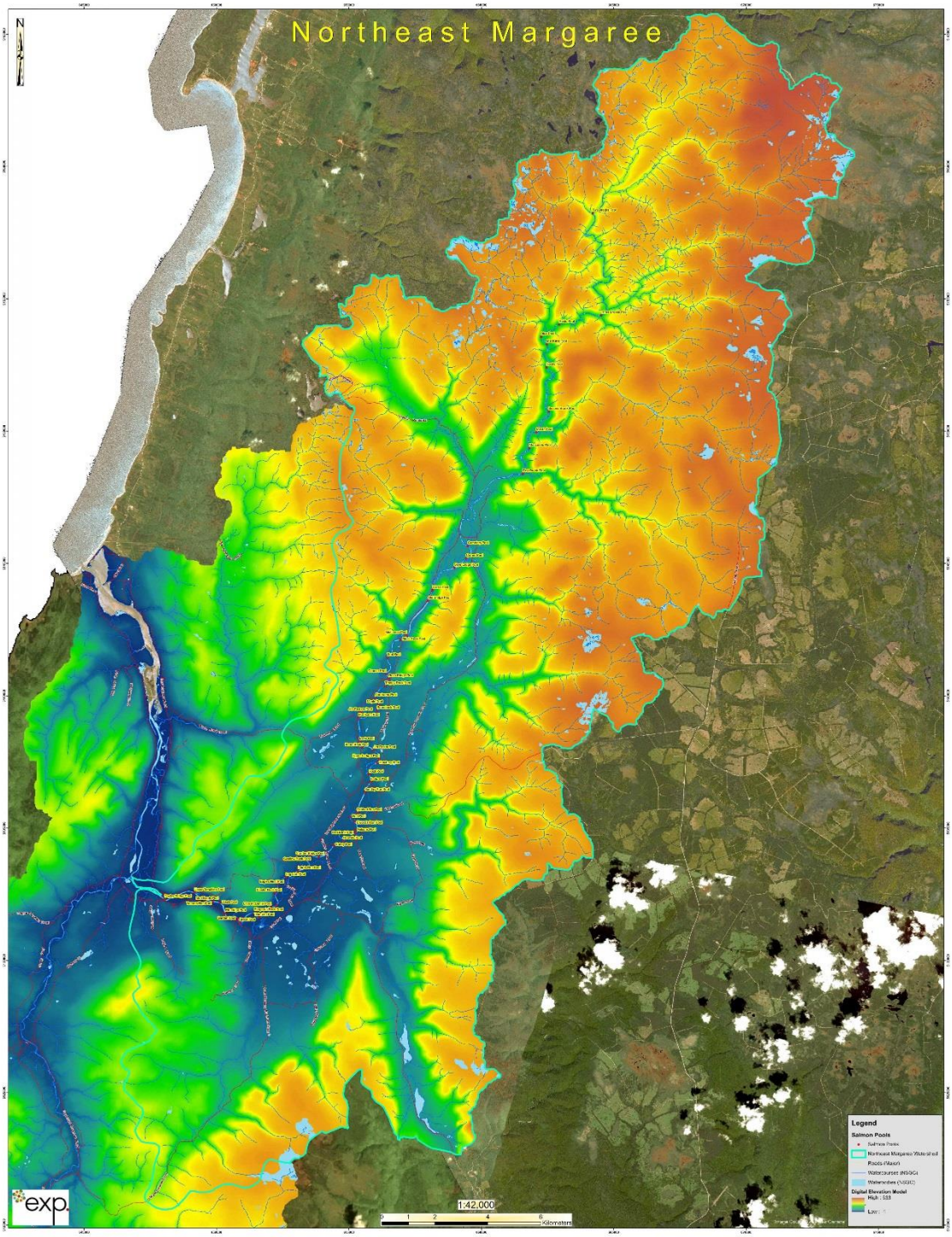

Figure A-2: Topographic Relief within the watershed. Base mapping courtesy of Parks Canada – Spot satellite image dated 2013.

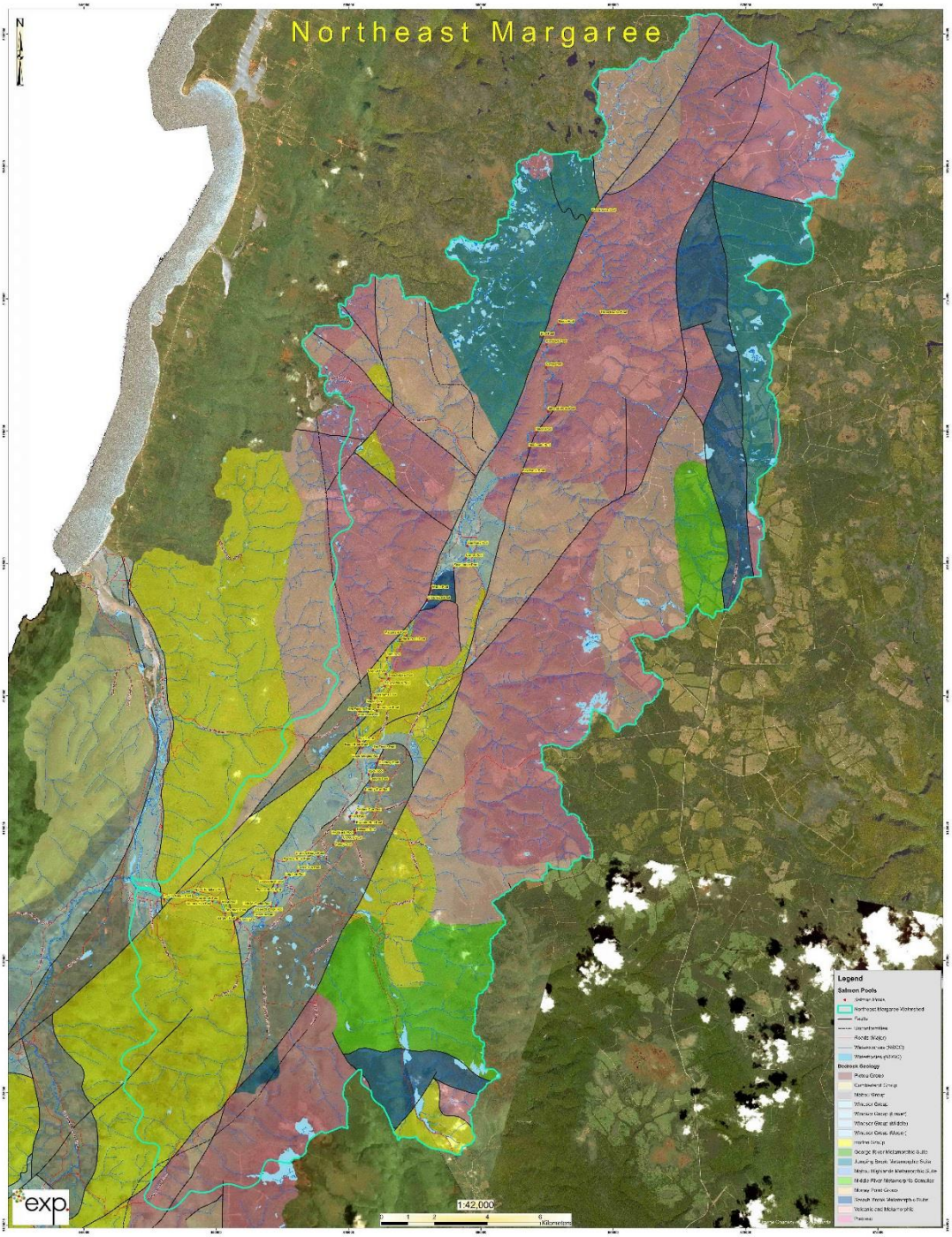

Figure A-3: Bedrock geology underlying the watershed. Base mapping courtesy of Parks Canada – Spot satellite image dated 2013.

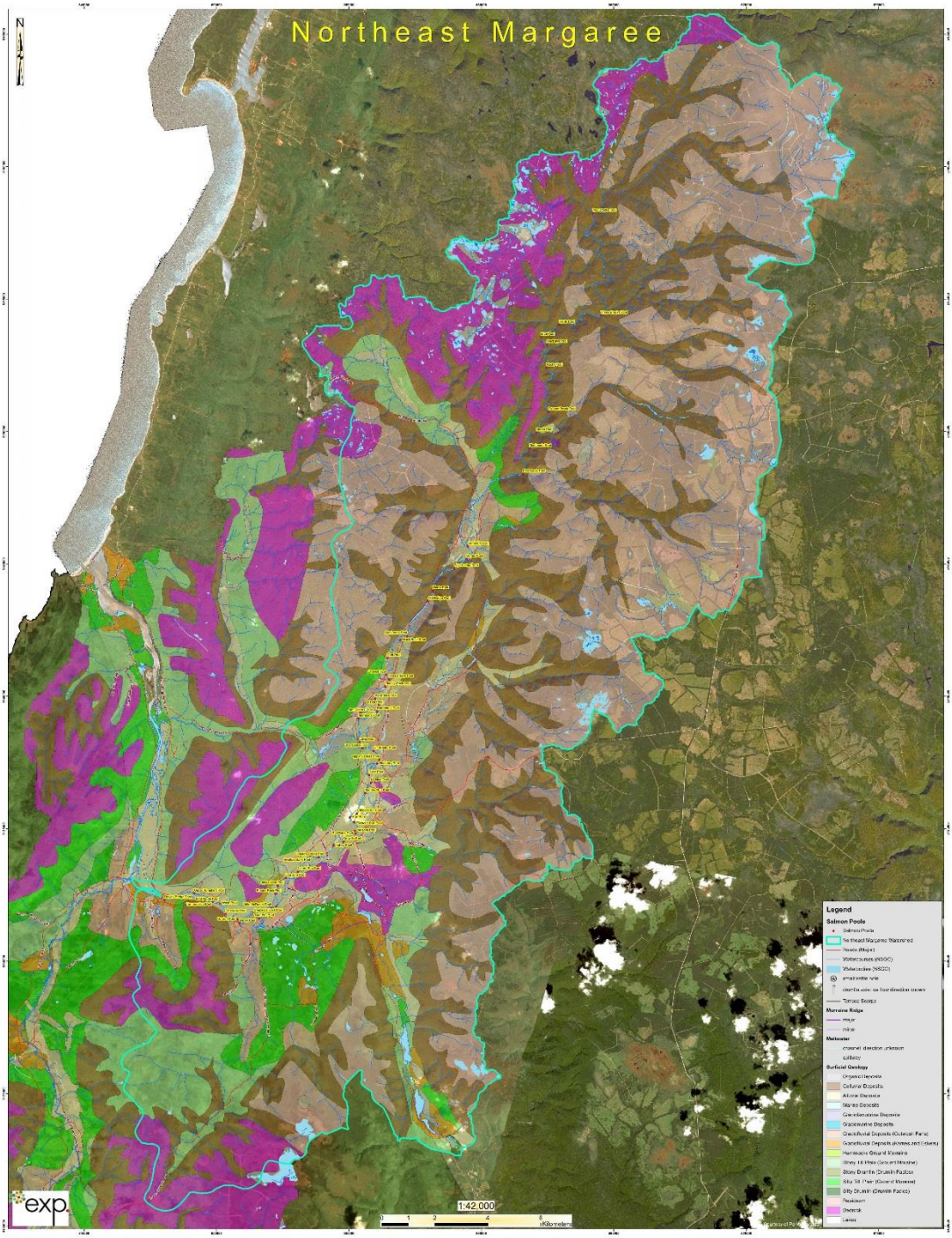

Figure A- 4: Surficial geology within the watershed. Base mapping courtesy of Parks Canada – Spot satellite image dated 2013.

APPENDIX B
LIST OF PARTICIPANTS

1)	**Dr. Greg Lovely**	**MSA**
2)	**Mr. Jack Aikens**	**MSA**
3)	**Mr. Bert Hart**	**MSA**
4)	**Mr. Del Muise**	**MSA**
5)	**Mr. Edsel Art**	
6)	**Mr. Leonard Forsyth**	**MSA**
7)	**Mr. Paul MacNeil**	**MSA**
8)	**Mr. Nicholas Baker**	**MSA**
9)	**Mr. Daryl Murrant**	**NS. Dept. Fisheries**
10)	**Mr. Byron Fraser**	**NS. Dept. Natural Resources**
11)	**Ms. Emma Garden**	**UINR**
12)	**Mr. Lester Wood**	**MSA**
13)	**Mr. Joel Robinson**	**WSU**

APPENDIX C
PERTINENT PHOTOGRAPHS

Plate C-1: Oblique aerial view looking downstream over the Northeast Margaree River Channel on 10 July 2013 from the confluence with Nile Brook (foreground) to the Cranton Bridge (background) showing active channel migration, and dry channels. Photo courtesy of exp Services Inc.

Plate C-2: Oblique aerial view looking west over the Northeast Margaree River Channel at the fish hatchery on 06 July 2011 showing development of multiple channels. Photo courtesy of exp Services Inc.

Plate C-3: Oblique aerial view looking west over Cape Clear on 21 October 2014 showing forest clearing operations in the highlands. Photo courtesy of exp Services Inc.

Plate C-4: Oblique aerial view looking upstream over the Northeast Margaree River valley in October 2007 upstream of the Cranton Bridge showing agricultural activity. Photo courtesy of exp Services Inc.

APPENDIX D
GRAPHS

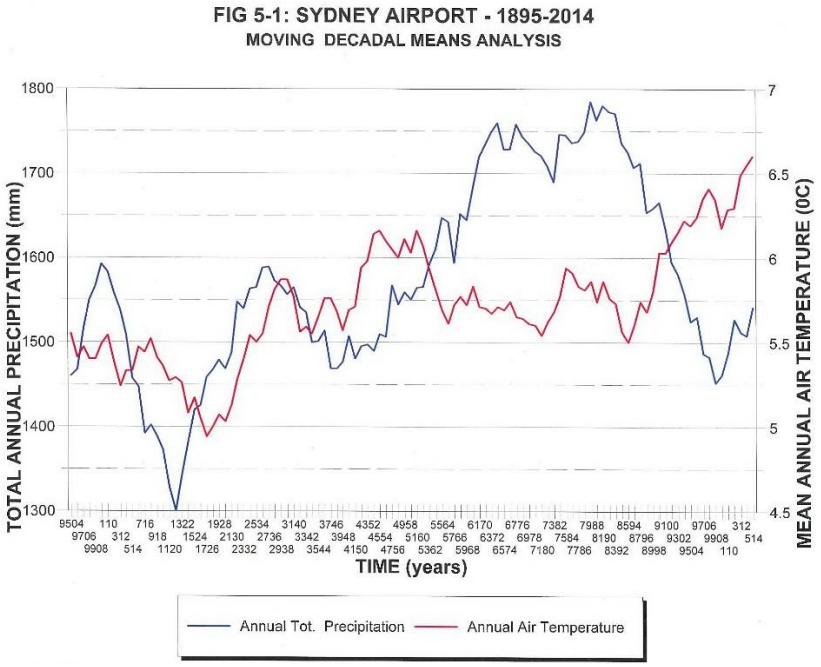

Figure D-1: Long-term trends in total annual precipitation and air temperature at Sydney 1895 to 2014. Research courtesy of exp Services Inc.

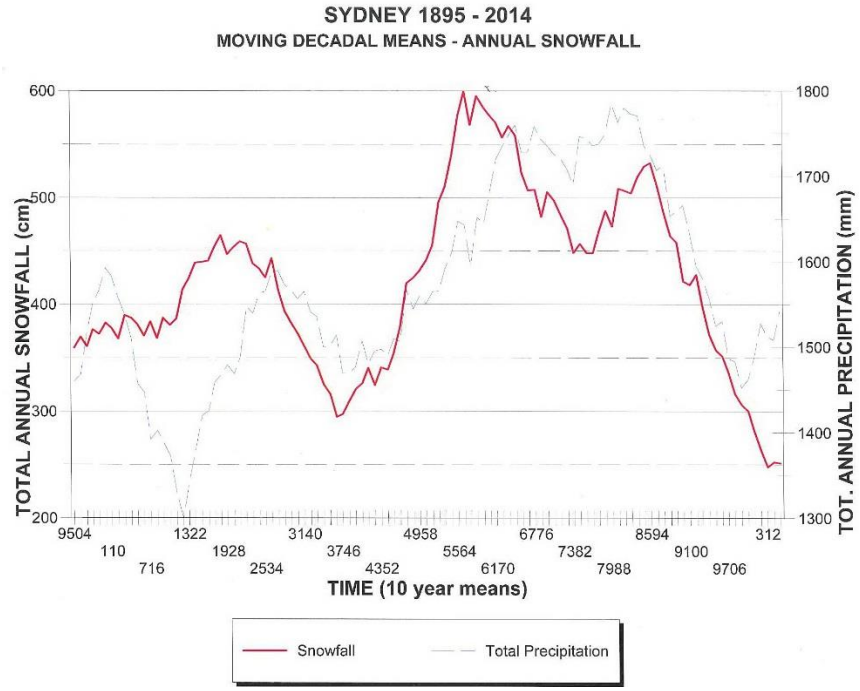

Figure D-2: Long-term trends in annual snowfall at Sydney 1895 to 2014. Research courtesy of exp Services Inc.

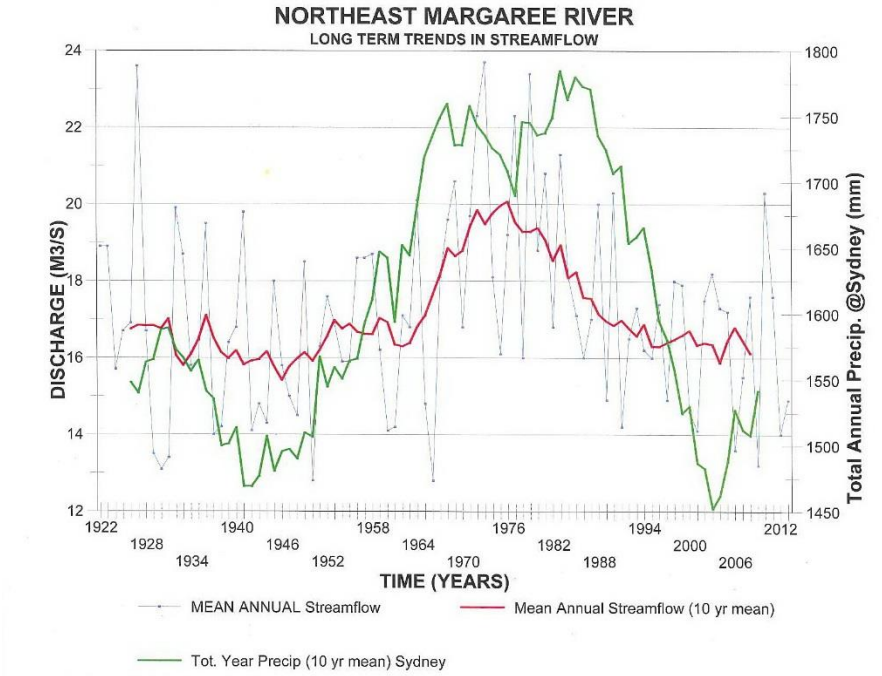

Figure D-3: Long-term trends in streamflow in the Northeast Margaree River 1922 to 2012. Research courtesy of exp Services Inc.

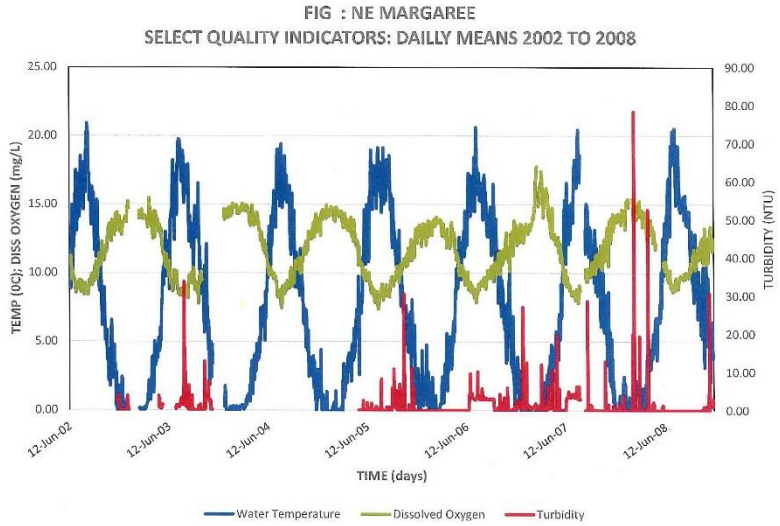

Figure D-4: Daily trends in water temperature, dissolved oxygen and turbidity at the Environment Canada's gauging station above Crowdis Bridge. Research courtesy exp Services Inc.

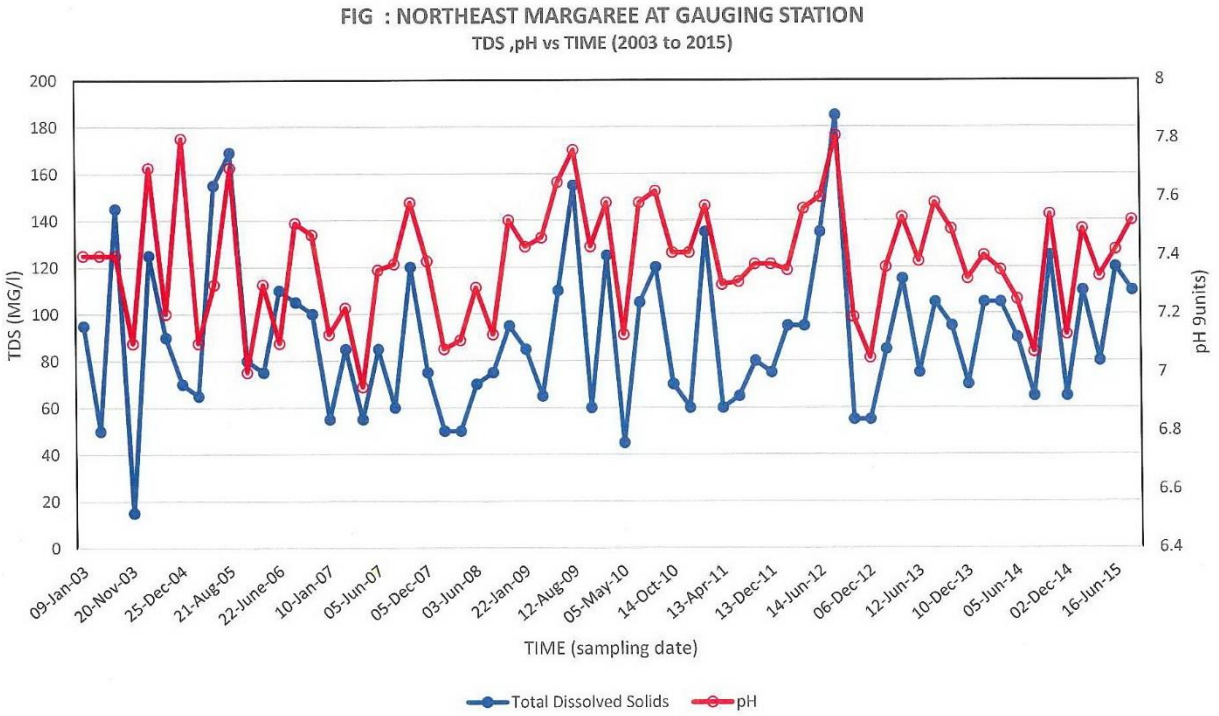

Figure D-5: Trends in total dissolved solids and pH from laboratory analyses 2003 to 2015 by Environment Canada. Research courtesy of exp Services Inc.