

## **Bosworth Creek Monitoring Project**

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### **Introduction**

Bosworth Creek originates at Hodgson (Jackfish) Lake (65° 18'N 126 41'W), Tulita District, Sahtu Settlement Area and parallels the base of Discovery Ridge before changing course and joining the Mackenzie River within the municipal boundaries of the Town of Norman Wells (Page 6). Bosworth Creek has played an important role in local history. Natural flow was impeded with the construction of a weir in 1960 approximately 250 metres from its confluence with the Mackenzie River. The pond created behind this weir supplied both the oil refinery and the Town of Norman Wells with drinking water. The town abandoned this water source in 1991 and closure of the refinery in 1996 prompted channel flow reclamation as recommended by the Government of the Northwest Territories (GNWT). The weir was removed and natural flow restored in 2005 under Imperial Oil Resources NWT Limited's Reclamation and Restoration Plan.

The Bosworth Creek Monitoring Project was developed following concerns raised by local residents regarding the absence of whitefish and other aquatic species. The general question was "Now that the barrier has been removed, will these animals re-inhabit the stream on their own or should they be re-introduced?"

The Sahtu Renewable Resources Board (SRRB) contacted the Department of Fisheries and Oceans (DFO) regarding this question and possible mitigation. Since the barrier no longer exists, it was decided that re-stocking the creek was unnecessary and that natural introductions should occur following stream reorganization.

The recent restoration of Bosworth Creek presents a unique opportunity for local youth to monitor aquatic ecosystem health. A creek monitoring project enables students to learn about local fish, invertebrates, hydrodynamics, sedimentology, streambed morphology, sampling techniques, data collection and evaluation. Therefore, the primary goal of this project is to provide an avenue for Mackenzie Mountain School students to learn a wide range of scientific applications and report their findings to the scientific community through public presentations and publications. Publishing original articles in science journals and working in cooperation with government and industry will give these students significant advantages over other candidates when they apply for post-secondary education.

The objectives of this project include assessing water quality during the development and utilization of two borrow sites proposed by Mackenzie Gas Project; monitoring possible contamination due to erosion that is occurring at a forest fire “fuel break” created in 1995 by GNWT Forestry near the stream bank; monitoring fish for contaminants; creating a comprehensive species inventory of the creek and riparian zones; identifying specific aquatic habitats and their biological, chemical and morphological components; providing a long term record of water chemistry by building upon data previously collected from a specific sample site; contributions towards creating the first Northwest Territories freshwater fish key; and tracking changes in streambed morphology and associated flora and fauna over time.

Twenty three high school students and their teacher, Malcolm Coupe, from Mackenzie Mountain School were involved in various aspects of the project. Three students undertook science fair projects based on their Bosworth Creek experience. It is anticipated that similar and additional projects will be undertaken for the 2009 Regional Science Fair.

All field work followed conventional sampling and analyses practices under the guidance of the DFO, the Canadian Wildlife Service, GNWT Department of Environment and Natural Resources, Royal Ontario Museum, Taiga Environmental Laboratories and the Detroit Zoo.

The Bosworth Creek Monitoring Project (BCMP) is now working in association with IP3 (Improved Processes and Parameterisation for Prediction in Cold Regions). IP3 is a collaborative undertaking between Canadian Foundation for Climate and Atmospheric Sciences for 2006-2010 and other federal, territorial/provincial, community and private sector parties. IP3 is a component of the 2007-2008 International Polar Year, the 2002/2012 International Decade for Prediction in Ungauged Basins, and the climate and Cryosphere project of the World Climate Research Programme based at the University of Saskatchewan’s Centre for Hydrology. The IP3 Network is comprised of several dozen Collaborators and Investigators from across Canada, the United States and Europe.

The BCMP is also contributing to an ichthyological database housed at the Royal Ontario Museum, a northern meteorological database through Environment Canada, Bird Studies Canada, amphibian studies at the Detroit Zoo/University of Calgary, and the Department of Atmospheric, Oceanic and Space Sciences Underground Weather network at the University of Michigan.

## **Methods**

The 2007/2008 field season focused on five types of training including issues related to fishes and fisheries habitat, benthic invertebrates, northern amphibian studies, chemical analyses of soils, water and ice, and creek habitat projects with Mackenzie Mountain School through Northwest Territories Experiential Science Program.

Fisheries habitat training was undertaken by and included field instruction by personnel from Yellowknife, NT and Winnipeg, MB. Students were taught sampling regimes, fish identification and issues related to creek and riparian habitat.

Benthic invertebrate studies were undertaken with the assistance of Dr. Douglas Currie, Senior Curator of Invertebrates from the Royal Ontario Museum, who spent a week collecting and identifying blackfly, stonefly and caddisfly specimens with the students. The 2007/2008 field work identified major range expansions for several species of blackflies and caddisflies.

These findings are considered to be significant and were added to the Canadian Barcode of Life Network.

Amphibians were investigated by Dr. Danna Schock from the Detroit Zoo who worked with students at several locations within the Bosworth Creek drainage basin. In particular, students helped Dr. Schock locate, capture, identify and sample wood frogs for *ranavirus* that constitutes a major amphibian health issue throughout North America. In addition, the largest known wood frog was recorded at the Bosworth Creek outflow at Jackfish Lake.

Water, soil and ice sampling was undertaken for the second year and added to the previously collected chemistry baseline data. These collections included previously unsampled sites, identified a moderate contaminant associated with road maintenance, and previously unknown major preferential transport of heavy metals in a specific type of ground water overflow ice.

Several creek and riparian day projects were undertaken with the assistance of Mackenzie Mountain School teacher Malcolm Coup. These projects were part of the school's new Experiential Science Program curriculum and taught students many skills including application of the scientific method.

The SRRB is the lead facilitator of the BCMP. Logistical assistance and support was provided by the Norman Wells Renewable Resource Council. Six local residents participated in the 2007 season. Four assisted with sampling, one provided local knowledge in preparation for a local knowledge component and one provided logistics and guiding expertise. A member of the Norman Wells Renewable Resource Council will assist with bear monitoring during 2008. A local/traditional knowledge component has been initiated and will be completed through a field excursion and focus group session. It is anticipated that availability will permit this to occur in July 2008.

## **Results**

This project supports both Monitoring and Research AND Capacity Building and Training. Monitoring is a major component of this study and includes water and soil quality monitoring for contaminants due to industrial activities and natural sources, as well as observing changes and interactions between local flora and fauna over time. The collection and evaluation of these data, along with the biological investigations, will encompass the "Research" aspect of this category. The close association between the investigators and professionals are ensuring that all data and methods are valid. Education is the underlying principle of this investigation (Pages 7-8). The students are becoming proficient in freshwater aquatic sampling, identification, data recording and presentation of results. Skills include a wide range of standardized sampling methods for both vertebrates and invertebrates. The streambed vegetation component is exposing the investigators to local animal and forestry compositions and management. School-based monitoring and other activities are now embedded in the Mackenzie Mountain School Experiential Science Program curriculum. Grade 10 students have been involved in project activities since September 2007 and will continue to monitor habitat health and undertake original scientific research until they graduate in 2010.

The project collected data and made observations about six Valued Components including Water and Sediment Quality, Water Quality, Fish Quality, Fish Habitat, Populations, and Harvest, Birds, and Vegetation. The addition of an E3A bio-acoustic bird monitor, a Song Meter

SMI bio-acoustic frog monitor, and animal surveillance and capture equipment will further many of these components.

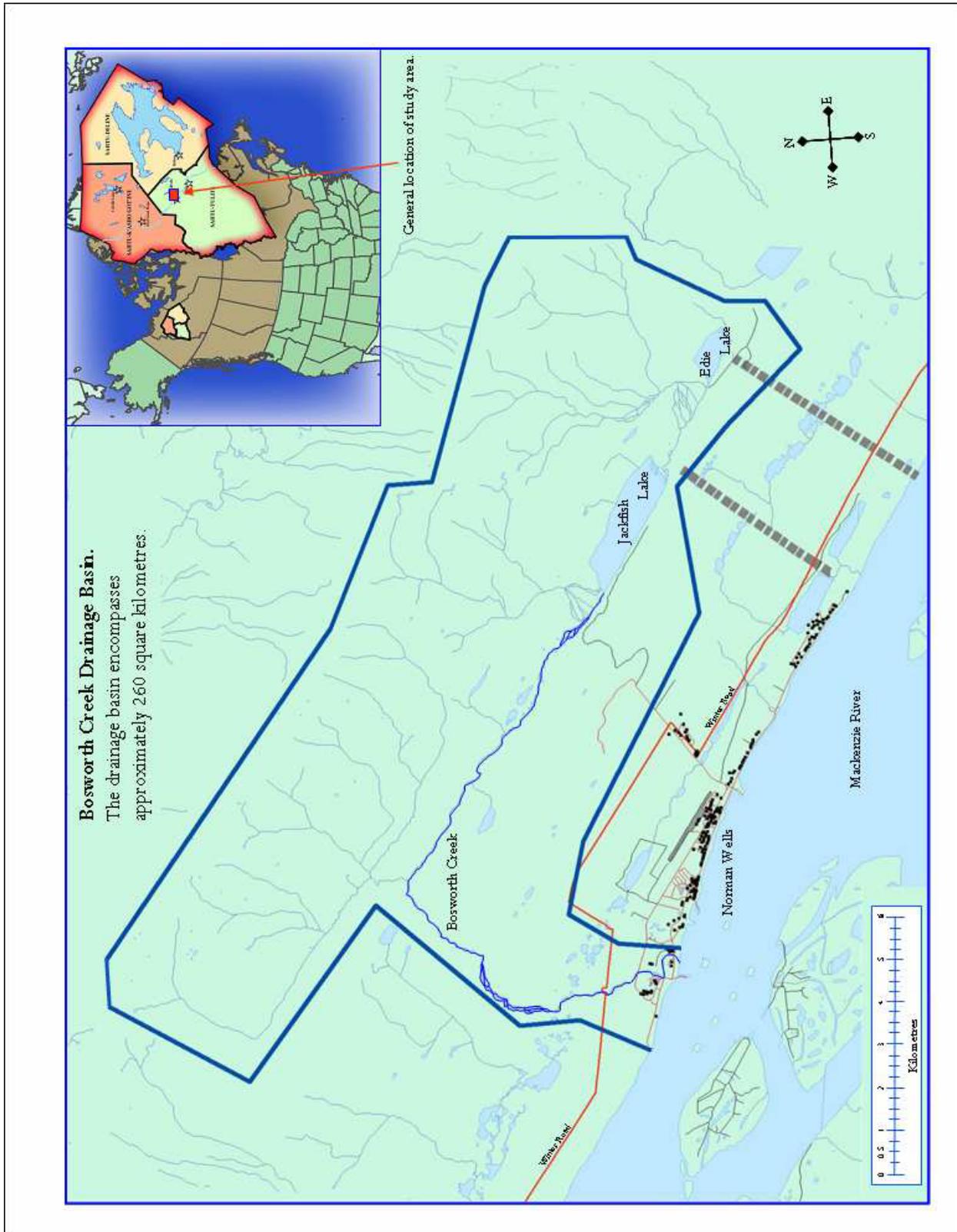
Several significant industrial activities are planned on or near Bosworth Creek over the next several years including the construction and utilization of two borrow sites and the proposed Mackenzie Valley pipeline crossing. In addition, the current winter road crossing is not adequate for current traffic volume that is expected to increase with development. Other sources of impact include sediment deposition from an erosional zone created by a fire break, All Terrain Vehicle crossings and inter-creek travel, and the fine-grained sediments that accumulated behind the weir. This project provides a rather unique means to monitor cumulative impacts through water chemistry and composition analyses. It also offers an avenue to track changes in aquatic biota that may occur due to changes in habitat suitability. This project will provide an on-going record of the creek's health and will be capable of identifying untoward influences and assisting with mitigation. The project will create a comprehensive inventory of all endemic species and will provide a means to track population changes and identify the occurrence of foreign species.

### **Discussion/Conclusions**

Ongoing research and training will take place all summer, followed by classroom projects throughout the next two school years. The project will host four workshops this summer including (1) Summer Water Bug Camp with Dr. Donna Giberson, University of Prince Edward Island, (2) Fisheries Habitat Sciences with Briar Young, DFO and Peter Brunette, Indian and Northern Affairs Canada (INAC), (3) All-Terrain Vehicle Impact, and (4) Bosworth Creek Local Knowledge.

Project results are being made available to all funding agencies in the form of annual progress reports. Results are communicated through a number of avenues including article submissions to refereed science journals and annual presentations to the SRRB that will be posted on their website: [www.srrb.nt.ca](http://www.srrb.nt.ca). On-going announcements about project progress will appear in the SRRB Newsletter. This newsletter is published every two months and is distributed to every post office box in the Sahtu Settlement Area. The newsletter is posted on the SRRB website and is also transmitted to more than 100 recipients via e-mail. Occasional updates are also published in *News/North*. All reports will be made available to anyone and may be obtained from either the SRRB Main Office in Tulita or Satellite Office in Norman Wells.

The Bosworth Creek Monitoring Project is currently operating under Aurora Research Institute Licence # 14308R and Department of Fisheries and Oceans permits EDU-07/08-2000-HR, EDU-07/08-2001-HR, and E-07/08-2003-HR.

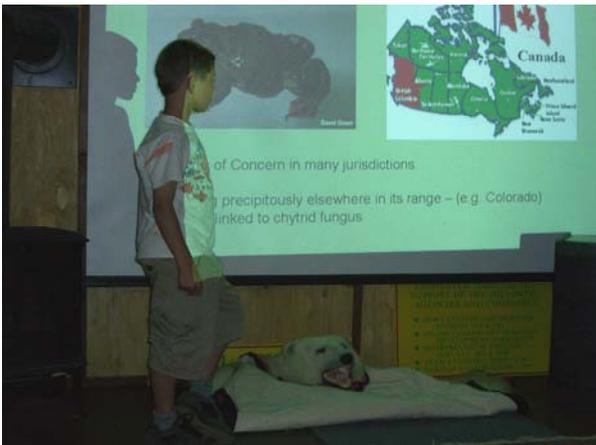




Professional development and public education are priority deliverables. Two special visiting scientists worked on the BCMP with Mackenzie Mountain School students. Dr. Douglas Currie from the Royal Ontario Museum taught benthic capture techniques and field identification procedures. In addition to significantly bolstering the projects baseline collection, several species of blackflies collected by Dr. Currie and the students extended known range distributions by more than 1000 kilometres.



Dr. Danna Schock from the Detroit Zoo demonstrated non-invasive sampling techniques for pathogens that are decimating amphibians in the south. Dr. Schock worked with students at many locations along the creek and within the drainage basin and provided a public presentation at the Norman Wells Historical Society on June 12, 2007.





The BCMP hosted 15 students visiting Norman Wells from Paris, Ontario on March 14, 2008. The students enjoyed a vigorous hike and learned many things about Bosworth ecology, pressure ridges, overflow and winter in the North.



ATV public education is already having a positive influence on reducing the damage caused while driving along a creek. One major employer in Norman Wells is currently drafting a company policy that will prohibit such activities by its employees. Driving ATVs along the length of creeks disturbs sediments which negatively impacts fish spawning beds and many different types of invertebrates. Tire impressions cause further damage by creating sub-channels in the creek bed that lead to accelerated erosion.

