



**GEOLOGICAL SURVEY OF CANADA  
OPEN FILE 6867**

**Nunavut Climate Change Partnership Workshop  
February 15-16, 2011**

**D. Mate, F. Reinhart (Editors)**

**2011**



Natural Resources  
Canada

Ressources naturelles  
Canada

**Canada**



Indian and Northern  
Affairs Canada

Affaires indiennes  
et du Nord Canada



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# **Nunavut Climate Change Partnership Workshop February 15-16, 2011**

**D. Mate<sup>1</sup>, F. Reinhart<sup>2</sup> (Editors)**

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# **Nunavut Climate Change Partnership Workshop February 15-16, 2011**



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## Executive Summary

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The Nunavut Climate Change Partnership was initiated in 2006 between the Government of Nunavut, the Canadian Institute of Planners, Natural Resources Canada and Indian and Northern Affairs Canada. This partnership was focused on helping Nunavut communities adapt to climate change and increasing adaptive capacity and climate change knowledge in the territory. Specifically, the goals of the Nunavut Climate Change Partnership were to: 1) create scientific information that is regionally and locally targeted to help communities adapt to climate change, 2) build capacity for climate change adaptation planning within the Government of Nunavut and in Nunavut communities, and 3) develop tools to collect, publish, share and communicate climate change adaptation knowledge across Nunavut and beyond. Work through this partnership was conducted in the communities of Clyde River, Hall Beach, Iqaluit, Arviat, Whale Cove, Cambridge Bay and Kugluktuk.

A workshop was held in Iqaluit February 15-16, 2011 to report back on all Nunavut Climate Change Partnership activities and outputs, explore new opportunities and discuss lessons learned. Speakers and participants from across Canada including Nunavut communities, governments, scientific, policy and planning organizations and universities participated in the workshop. On February 15th results from scientists and government officials were presented on climate change geoscience research, community climate change adaptation planning work and opportunities for new work. On February 16<sup>th</sup>, participants were asked to focus their attention on two key themes: 1) what research, information and climate change adaptation resources will be needed in the future (a needs assessment) and 2) what lessons can be learned from the current partnership that would enable research and planning to be undertaken more effectively (lessons learned). In total nearly 100 people participated in this workshop. This report provides a summary from the workshop.

## Introduction / Background

### The Nunavut Climate Change Partnership

In response to the complexity of climate change issues in Nunavut, an innovative partnership was formed to support climate change adaptation impacting Nunavut communities. This partnership, named the Nunavut Climate Change Partnership (NCCP), was initiated in 2006 between the Government of Nunavut (GN), the Canadian Institute of Planners (CIP), Natural Resources Canada (NRCan), and Indian and Northern Affairs Canada (INAC). The aim of NCCP was to help Nunavut communities adapt to climate change and increase adaptive capacity and climate change knowledge in the territory. It was coordinated by a steering committee consisting of representatives from all partners (Figure 1). The Government of Nunavut (Departments of Environment and Community & Government Services) provided the overall vision, leadership and on-the-ground knowledge for NCCP. CIP contributed a wealth of experience in community planning and teams of skilled planners to work with Nunavut communities and scientists to develop climate change adaptation plans. NRCan provided leading-edge scientific information and experience in integrating scientific and community knowledge to further the understanding of climate change impacts. INAC provided invaluable support in the form of resources and insight that made the partnership possible.



*Figure 1. The Nunavut Climate Change Partnership steering committee consisted of members from the GN, NRCan, INAC and CIP. From left to right these include John Wall, Gary Davidson and Beate Bowron from CIP, Froeydis Reinhart (GN Department of Environment), Michael Westlake (INAC), Bob Chapple (GN Community and Government Services), David Mate (NRCan) and David Boyle (GN Community and Government Services). Photo credit: Canadian Institute of Planners.*

## Background

The NCCP was formed following a territory-wide climate change workshop organized by the GN and NRCan, with funding support from INAC, in December 2006 (Appendix A). This 3-day workshop titled *Nunavut Climate Change Workshop – Adaptation Action in Arctic Communities* focused on the identification of actions that would assist Nunavummiut in adapting to climate change (Figure 2). This workshop focused on three aspects of climate change adaptation in Nunavut. They were:

1. A review of previous climate change adaptation efforts
2. A summary of the current state of adaptation planning in Nunavut communities
3. Ideas and recommendations to guide future adaptation actions



*Figure 2. The Nunavut Climate Change Partnership was formed after a territory-wide climate change workshop held in December 2006 at Cadet Hall in Iqaluit. It consisted of presentations on range of climate change adaptation issues and break-out groups to discuss Nunavut needs. Photo credit: Government of Nunavut.*

Results from this workshop clearly demonstrated that there was a need for comprehensive adaptation planning in Nunavut. Recommendations generated from this workshop provided strategic direction for the NCCP. Specifically, they included:

1. Establish a small-scale, test case adaptation planning process in a Nunavut community.
2. Support adaptation planning efforts conducted by the City of Iqaluit.
3. Use lessons learned from the small-scale test case (point 1 above) to expand efforts to other communities across the territory.

Hosting this workshop before any scientific or planning work began enabled the identification of keen communities who wanted be involved and the proper planning of collaborative activities. At this time the communities of Clyde River, Hall Beach and Iqaluit stepped forward leading to integrated test cases for climate change adaptation planning work. This initial work laid the foundation for NCCP's much more comprehensive *Atuligtuq* Project.

### **Atuligtuq Project**

The *Atuligtuq* project, meaning “coming into force”, built on the experience and knowledge gained (planning and science) from work in Hall Beach and Clyde River to expand climate change adaptation planning capacity across all three regions of Nunavut (Figure 3; Natural Resources Canada 2010). For more detail on the *Atuligtuq* Project please refer to the backgrounder and poster in Appendix B. The goals of *Atuligtuq* were to:

1. Create scientific information that is regionally and locally targeted to help communities adapt to climate change.
2. Build the capacity for climate change adaptation planning within the Government of Nunavut and in Nunavut communities.
3. Develop tools to collect, publish, share and communicate climate change adaptation knowledge across Nunavut and beyond.

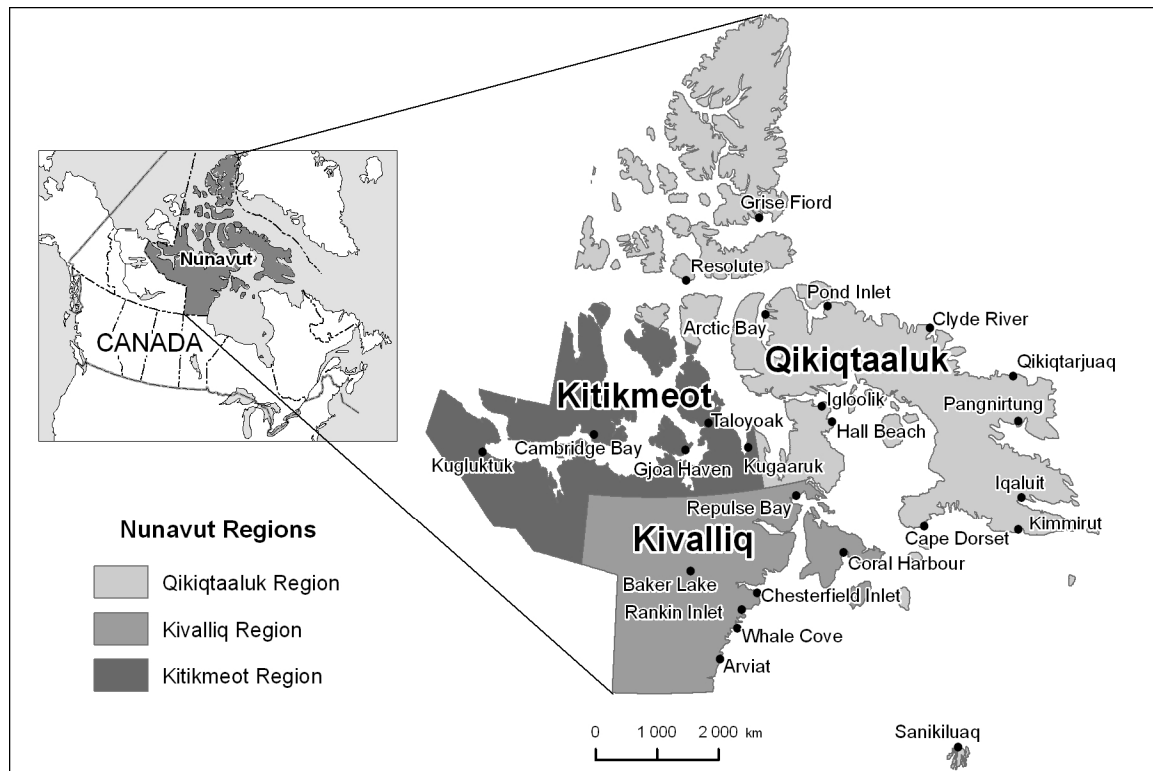


*Figure 3. The Atuligtuq project team consisted of a diverse group of experts and decision-makers. This included 5 volunteer CIP planning teams, scientists from a range of disciplines and GN decision-makers, planners and engineers from across the territory. Photo credit: Canadian Institute of Planners.*

Through *Atuligtuq* new climate change adaptation planning work was conducted in the communities of Kugluktuk, Cambridge Bay, Whale Cove, Arviat and Iqaluit



(Figure 4). As well, a planning tool for additional communities to use was created along with a range of local and regional scale climate change geoscience information.



*Figure 4. Location figure for Atuliqtuq project activities. Work was conducted in the communities of Iqaluit, Arviat, Whale Cove, Cambridge Bay and Kugluktuk, representing all regions of Nunavut (Qikiqtaaluk, Kivalliq and Kitikmeot).*

## Workshop Objectives

A workshop was held in Iqaluit February 15-16, 2011 in order to report back on all NCCP activities and outputs since 2006, explore new opportunities and discuss lessons learned. In the spirit of collaboration built through NCCP, speakers and participants from across Canada including Nunavut communities, governments, scientific, policy and planning organizations and universities participated in the workshop. On the first day (February 15<sup>th</sup>) scientists and government officials presented information on climate change geoscience gathered through NCCP, results from community climate change adaptation planning work and opportunities for new work. On day two (February 16<sup>th</sup>), participants were asked to focus their attention on two key themes: 1) what research, information and resources will be needed in the future (a needs assessment) and 2) what lessons can be learned from the current partnership that would enable research and planning to be undertaken more effectively (lessons learned). In total nearly 100 people participated in this workshop. This report provides a summary of this workshop.

# **Nunavut Climate Change Partnership Workshop Report**

**Workshop Agenda and Participants**

**Workshop Sessions and Findings**

*Science  
Community Adaptation Planning  
Moving Forward*

## Workshop Agenda and Participants

### Nunavut Climate Change Partnership Workshop Agenda Iqaluit, February 15<sup>th</sup>-16<sup>th</sup>, 2011

<b>Tuesday, February 15, 2011</b> Frobisher Inn – Koojesse Room (old pharmacy)	
9:00 am to 9:30 am	Opening Addresses <b>Government of Nunavut,</b> <b>Indian and Northern Affairs Canada,</b> <b>Natural Resources Canada,</b> <b>Canadian Institute of Planners,</b> <b>City of Iqaluit</b>
<b>SCIENCE</b> (Moderator: David Mate, Earth Sciences Sector, Natural Resources Canada)	
9:30 am to 9:40 am	Introduction to the science projects – How we started and where we ended up <b>David Mate, Earth Sciences Sector, Natural Resources Canada</b>
9:40 am to 10:05 am	Coastal Hazards and Sea-level Change Projections for Nunavut Communities and Infrastructure <b>Gavin Manson</b> (Don Forbes, Tom James), <b>Earth Sciences Sector, Natural Resources Canada</b>
10:05 am to 10:30 am	Landscape Hazard and Permafrost Assessment for Nunavut Communities and Infrastructure <b>Anne-Marie Leblanc</b> (Rod Smith, Michel Allard and Trevor Bell), <b>Earth Sciences Sector, Natural Resources Canada</b>
10:30 am to 10:45 am	<b>Health break</b>
10:45 am to 11:00 am	Impact of climate change on water availability in Nunavut <b>Paul Budkewitsch, Canada-Nunavut Geoscience Office</b>
11:00 am to 11:15 am	Climate change visualization project in Clyde River <b>David Flanders, University of British Columbia</b>
11:15 am to 11:45 am	ArcticNet: science for decision-making in the Eastern Canadian <b>Trevor Bell, Memorial University</b>
11:45 am to 13:10 pm	<b>Lunch break (on your own)</b>
<b>COMMUNITY CLIMATE CHANGE ADAPTATION PLANNING</b> (Moderator: John Wall, Canadian Institute of Planners)	
13:10 pm to 13:40 pm	Community climate change adaptation action plans <b>Beate Bowron and Gary Davidson, Canadian Institute of Planners</b>



13:40 pm to 14:10 pm	Climate Change and Community Planning <b>Robert Chapple, GN – Community and Government Services</b>
14:10 pm to 14:25 pm	Climate change adaptation in Clyde River <b>Gordon Kautuk, Ittaq Heritage and Research Centre – Clyde River</b>
14:25 am to 14:45 pm	Whale Cove adaptation action plan and workbook <b>Katie Hayhurst, Kuch &amp; Hayhurst Consulting</b>
14:45 pm to 15:00 pm	Climate change adaptation planning in Arviat <b>Jerry Panegoniak, Hamlet of Arviat</b>
15:00 pm to 15:15 pm	<b>Health Break</b>
<p style="text-align: center;"><b>MOVING FORWARD</b> (Moderator: Michael Westlake, Indian and Northern Affairs Canada)</p>	
15:15 pm to 15:35 pm	Climate Change Impacts and Adaptation in Nunavut <b>Froeydis Reinhart</b>
15:35 pm to 15:50 pm	Nunavut Regional Adaptation Collaborative <b>Jared Fraser, GN-Economic Development and Transportation</b>
15:50 pm to 16:00 pm	Transport Canada <b>Janice Festa</b>
16:00 pm to 16:15 pm	Indian and Northern Affairs Canada <b>Michael Westlake</b>
16:15 pm to 16:30 pm	Closing statements
<p style="text-align: center;"><b>Tuesday, February 15, 2011</b></p> <p>Francophone centre (building 981)</p>	
19:00 pm to 20:30 pm	Tea and Bannock at the Francophone centre (AFN)  Permafrost trends in northern Quebec and southern Baffin Island – with a focus on Iqaluit <b>Michel Allard, Université Laval</b>
<p style="text-align: center;"><b>Wednesday, February 16, 2011</b></p> <p>Frobisher Inn – Koojesse Room (old pharmacy)</p>	
8:30 pm to 9:00 pm	<b>Set-up and muffins</b>

9:00 am to 10:45 am	Needs assessment: What research, information, resources, and data are needed to move climate change adaptation in Nunavut forward? Facilitated round table discussion – open for everyone attending the workshop. We want your opinion!
10:45 am to 11:00 am	<b>Health break</b>
11:00 am to 11:30 am	ArcticNet – Eastern Arctic IRIS <b>Trevor Bell, Memorial University</b>
11:30 am to 12:00 pm	Glacier trends in Nunavut <b>Mike Demuth, Earth Sciences Sector, Natural Resources Canada</b>
12:00 pm to 13:30 pm	<b>Lunch (on your own)</b>
13:30 pm to 15:30 pm	Lessons-learned/evaluation of the Nunavut Climate Change Partnership's Atuliqtuq project. [Facilitated – semi-directed round table discussion. Open for everyone who has been involved in any of the activities undertaken by the Nunavut Climate Change Partnership since its inception.]

### **Opening Speakers Names**

Honourable Daniel Schewchuk, Minister of Environment

Madeline Redfern, City of Iqaluit, Mayor

Bernie MacIsaac, Indian and Northern Affairs Canada, Director of Operations

John Wall, Canadian Institute of Planners, Manager National and International Affairs

David Mate, Natural Resources Canada, Project Leader

## Workshop Participants

Name	Organization
Adule Chris	Government of Nunavut, Community and Government Services
Agnes Simonfalvy	Government of Nunavut, Department of Environment
Alan Johnson	Government of Nunavut, Economic Development and Transportation
Anne-Marie LeBlanc	Natural Resources Canada
Beate Bowron	Canadian Institute of Planners
Bhabesh Roy	Government of Nunavut, Community and Government Services
Brian Sieben	Government of Northwest Territories, Department of Environment and Natural Resources
Bu Lam	Government of Nunavut, Community and Government Services
Carrie Spencer	Natural Resources Canada
Chris Down	Government of Nunavut, Executive and Intergovernmental Affairs
Christian Prévost	Natural Resources Canada
Corey Dimitruk	Government of Nunavut, Community and Government Services
Craig Beardsall	Environmental Technology Program, Arctic College
David Boyle	Government of Nunavut, Community and Government Services
David Flanders	University of British Columbia
Derek Williams	Environmental Technology Program, Arctic College
Devin Aviugana	Environmental Technology Program, Arctic College
Emery Paquin	Consultant
Froeydis Reinhart	Government of Nunavut, Department of Environment
Gary Davidson	Canadian Institute of Planners
Gavin Manson	Natural Resources Canada
Geneviève Bèchard	Natural Resources Canada
Gons Yamazaki	Osaka University, Japan
Gordon Kautuk	Ittaq Heritage and Research Centre, Clyde River
Jamie Flaherty	Qulliq Energy Corporation
Janelle Kennedy	Government of Nunavut, Department of Environment
Janice Festa	Transport Canada
Jared Fraser	Government of Nunavut, Economic Development and Transportation
Jason Carpenter	Environmental Technology Program, Arctic College
Jason Taylor	Environmental Technology Program, Arctic College
Jerry Panegoniak	Hamlet of Arviat
Jodi MacGregor	Environmental Technology Program, Arctic College
Joe A. Evyagotailak	Hamlet of Kugluktuk
John Wall	Canadian Institute of Planners
Jonathan Savoy	Nunavut Planning Commission
Jonny Flaherty	Environmental Technology Program, Arctic College
Karen Simon	University of Victoria
Katie Hayhurst	Canadian Institute of Planners
KC Bolton	McGill University
Keiichi Omura	Osaka University, Japan

Kirt Ejesiak	Inuit Circumpolar Council Canada
Kristen Kennedy	Government of Yukon
Lacey Wallace	Indian and Northern Affairs Canada
Lacia Kinnear	Yukon College
Leah Fusco	Government of Nunavut, Department of Environment
Leata Qaunaq	Hamlet of Arctic Bay
Lee Ann Pugh	Government of Nunavut, Department of Environment
Li Wan	Nunavut Impact Review Board
Linda Vaillancourt	Government of Nunavut, Department of Environment
Makittu Tukpunngai	Hamlet of Cape Dorset
Martin Barbe	Environmental Technology Program, Arctic College
Martin Tremblay	Indian and Northern Affairs Canada
Mary Ellen Thomas	Nunavut Research Institute
Mary Kay Lamonde	Natural Resources Canada
Maurice Quimond	Qulliq Energy Corporation
Megan Lusty	Government of Nunavut, Community and Government Services
Michael Westlake	Indian and Northern Affairs Canada
Michel Allard	Université Laval
Mike Demuth	Natural Resources Canada
Mike Townsend	Nunavut Planning Commission
Milissa Elliot	Government of Nunavut, Department of Environment
Nick Burnaby	Government of Nunavut, Department of Environment
Paul Budkewitsch	Canada-Nunavut Geoscience Office
Phillipe LeBlanc	ArcticNet
Rick Hunt	Qulliq Energy Corporation
Robert Eno	Government of Nunavut, Department of Environment
Robert Sexton	Government of Nunavut, Executive and Intergovernmental Affairs
Robyn Campbell	City of Iqaluit
Samuel Wahab	Government of Nunavut, Community and Government Services
Scott Hatcher	Memorial University
Sheotiarpiri Peter	Environmental Technology Program, Arctic College
Steven Akeeagok	Environmental Technology Program, Arctic College
Suzanne Etheridge	Government of Nunavut, Department of Environment
Tanuja Kulkarni	Indian and Northern Affairs Canada
Tara Rutherford	Government of Nunavut, Community and Government Services
Trevor Bell	Memorial University/ArcticNet
Trish Lewis	Environmental Technology Program, Arctic College
Tristan Brewer	Government of Nunavut, Community and Government Services
Tuktalik Boychuk	Government of Nunavut, Department of Education
Tyler Ross	Government of Nunavut, Department of Environment
William Flaherty	Environmental Technology Program, Arctic College
Yves Theriault	Indian and Northern Affairs Canada

## Workshop Sessions and Findings

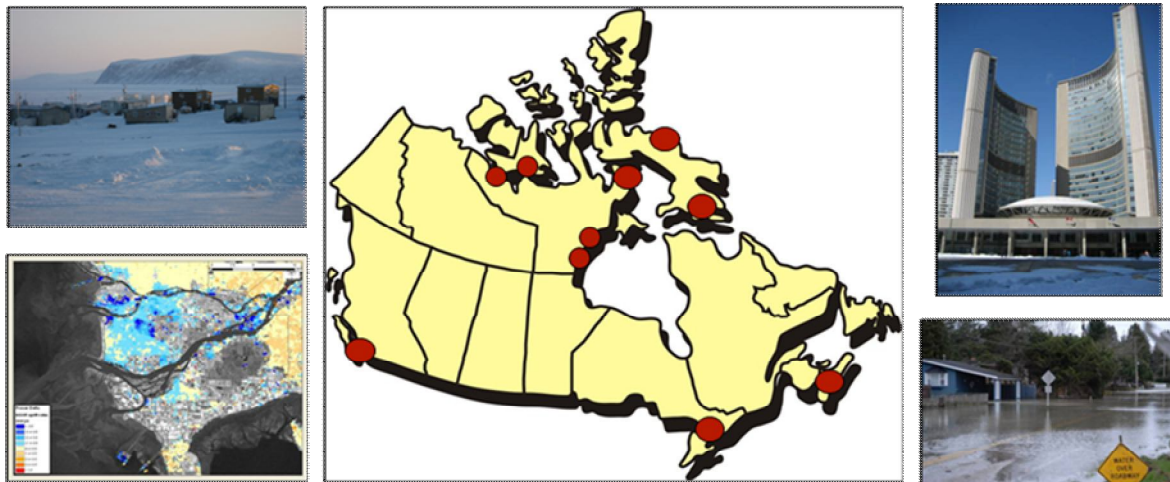
The Nunavut Climate Change Partnership Workshop consisted of a mix of presentations and break-out groups held over two days (Figure 5). Three sessions were held on Day 1 of the workshop (see Agenda in this report for more details). All presentations from these sessions can be found in Appendix C. The intent of the first 2 sessions, titled *Science* and *Community Climate Change Adaptation Planning*, were to report back all NCCP results since 2006. The session titled *Moving Forward* was aimed at providing workshop participants with a glimpse of new initiatives and opportunities on the horizon for Nunavut. In the evening of Day 1 a special keynote presentation on permafrost trends in northern Quebec and southern Baffin Island was presented at the Francophone Centre. On Day 2, breakout sessions focused on identifying future needs (needs assessment) and what lessons had been learned from current NCCP activities. In between these two sessions were presentations by ArcticNet on their new *Integrated Regional Impact Study* initiative and by NRCan on glacier trends in Nunavut. Summaries of each of the sessions are described below.



Figure 5. Photos of Nunavut Climate Change Partnership session presentations and break-out groups. Photo credit: Natural Resources Canada.

## Science

The *Science* session was focused on reporting back scientific results produced during NCCP by NRCan and its university partners. Six presentations (see Science Session folder in Appendix C) comprised this session. NRCan results (reports, maps, etc.) can be downloaded online through NRCan's GEOSCAN publications database. Available results and the url for GEOSCAN are provided in the reference section. An introduction and an overview of how the NCCP was formed was provided by David Mate of Natural Resources Canada. It was noted that NRCan's participation in NCCP was part of a national NRCan climate change adaptation project focused on enabling Canadian communities to identify climate change vulnerabilities and adaptation options (Figure 6). This project was part of NRCan's Climate Change Geoscience Program. In Nunavut, as part of NCCP, NRCan was focused on working with the GN, communities, planners and universities to integrate science into decision-making processes in order to build community climate change adaptation planning capacity. A quick overview of how NCCP started following the Nunavut climate change workshop in 2006 (see Appendix A) and how this initial collaboration (with Clyde River and Hall Beach) expanded into the larger *Atuligtuq* project was provided. A range of scientific expertise was brought together by NRCan including coastal hazards and sea-level change, permafrost and landscape hazards, remote sensing for water resources and landscape visualization for decision-making. These separate science disciplines were integrated amongst each other as well as with planners and communities developing climate change adaptation plans. This presentation finished with a discussion on how to extend scientific research from communities to broader regions that can incorporate numerous communities, resource development, etc.



*Figure 6. NRCan's participation in NCCP was through a project titled Building Resilience to Climate Change in Canadian Communities. This project consisted of local, regional and national activities on the west and east coasts, in Toronto and Nunavut and with the Canadian Institute of Planners.*

An overview of scientific work conducted on coastal hazards and sea-level change in Nunavut was provided by Gavin Manson of Natural Resources Canada. Coastal issues and sea-level change are important to Nunavut because all of the territories communities except one are built in the coastal zone. Examples of climate change related coastal impacts (erosion, flooding, ice pile-up, etc.) were provided for the communities of Arviat, Clyde River and Hall Beach. It was explained that sea-level change is dependent upon both a change in sea level as well as land motion. In Nunavut, large areas of land are still rebounding (moving up) after the last glaciation. In some areas this movement is still happening faster than sea-level is rising. This complex land motion story makes sea-level projections more complicated and varied. Using scientific techniques and observations from traditional knowledge, sea-level rise projections were produced for all 5 of the *Atuligtuq* project communities (James et al. 2011). These projections show the wide range of variation in sea-level across the territory providing useful information for planners and engineers (Figure 7). This presentation concluded with the point that this work could be scaled-up to provide projections for all communities in Nunavut as well as for strategic port facilities required for resource development.

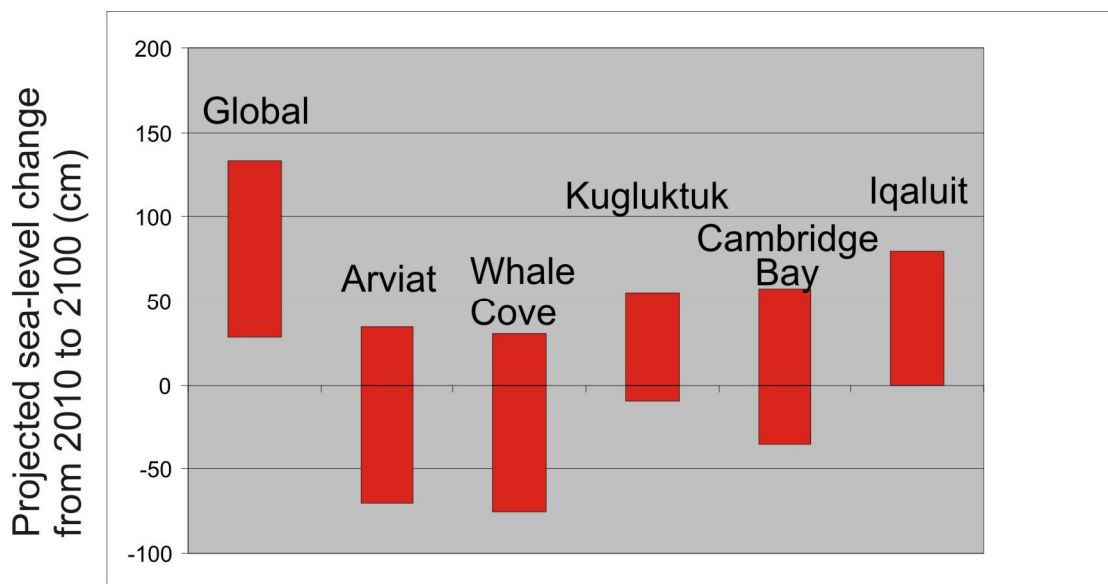


Figure 7. Sea-level projections generated for the five *Atuligtuq* communities as part of NCCP (James et al. 2011).

The importance of permafrost and landscape hazards for supporting land use planning decisions was presented by Anne-Marie Leblanc of Natural Resources Canada. Permafrost related work in the NCCP was conducted in the communities of Clyde River, Pangnirtung, Iqaluit, Arviat, Whale Cove, Cambridge Bay, Kugluktuk, Pond Inlet, Arctic Bay, Igloolik and Resolute. This work involved a range of scientific techniques and analyses including surficial mapping, monitoring and assessing permafrost conditions and landscape hazards. The most comprehensive work was conducted in Pangnirtung, Iqaluit and Clyde



River. In Clyde River a new methodology for evaluating permafrost related landscape hazards and generating landscape hazard maps is being produced (Figure 8). In addition, collaboration between NCCP and NRCan led to the establishment of a Nunavut permafrost monitoring network (Ednie and Smith 2011). This has resulted in the installation of 6 new monitoring sites in communities in the Baffin, 1 in the Kivalliq and 3 in the Kitikmeot regions. A range of results currently available or coming soon from NCCP permafrost work include reports on Pangnirtung (Oldenborger 2010; Leblanc et al. 2010; Leblanc et al. in progress), Clyde River (Irvine et al. in progress, Smith et al. in progress) and public outreach (Sladen 2011). Additional reports and maps from NRCan will be available soon for Clyde River, Iqaluit, Arivat, Whale Cove, Kugluktuk and Cambridge Bay.



*Figure 8. Preliminary landscape hazard map produced for Clyde River (Irvine 2011; Irvine et al. in progress).*

Geoscience information used to help determine the sustainability of water resources in Nunavut communities was presented by Paul Budkewitsch from the Canada-Nunavut Geoscience Office. As part of NCCP this work was conducted in collaboration with the GN (Community and Government Services), Nunavut Research Institute and INAC. Work was targeted in the NCCP communities of Arviat, Whale Cove, Clyde River and Iqaluit. Additional work was also conducted in Cape Dorset and Rankin Inlet. The focus was to use geomatics expertise to determine the catchment area around and bathymetric profiles for community freshwater reservoirs (Armstrong et al. 2009; Budkewitsch et al. 2007, 2009, 2010, 2011). This information, combined with remotely sensed data on snow cover, vegetation, etc allows for a first order assessment of the potential impact of climate change on freshwater supply. Success has also been achieved at transferring technology used to generate accurate maps of community watersheds and reservoirs to teachers and students from Arctic College and planners and engineers from the GN (Figure 9). Results from this work have also proven the utility of satellites for producing elevation models at a resolution high enough for community planning needs.



*Figure 9. NCCP generated technology to generate accurate maps of community watersheds and reservoirs has been transferred to Arctic College and the GN. Photo credit: Natural Resources Canada.*

David Flanders from the University of British Columbia spoke about research being conducted that uses NCCP science and planning results to visualize decisions that could be made to help people and communities adapt to climate change (University of British Columbia 2011). This work was focused in Clyde River (Figure 10) where a good foundation of climate change adaptation information exists and collaboration with the community was strong (Ittaq 2011). To date, scientific (sea-level rise, permafrost, etc.) and planning (community climate change adaptation plans, etc.) results have been combined to visualize solutions to such issues as housing, walkability and energy. For example, scientific information has been combined with community plans to visualize solutions for housing and road development that avoid hazards (Figure 11).

The science session was concluded by Trevor Bell, from Memorial University, who gave an overview on ArcticNet and its research program. ArcticNet ([www.ArcticNet.ulaval.ca](http://www.ArcticNet.ulaval.ca)) is a Network of Centres of Excellence that has recently received new funding for the period of 2011-2018. ArcticNet is spearheading Integrated Regional Impact Studies (IRIS) in several parts of the Canadian Arctic. The goal is to translate the vast amounts of ArcticNet science into a format that is useful for the development of policy and adaptation strategies. Trevor Bell is leading the IRIS effort for Nunavut.

Much of the research effort was partially supported through two Networks of Centres of Excellence. Work on coastal and landscape hazards, sea-level change, and permafrost was undertaken in partnership with the ArcticNet and related work will continue until 2014 or later. The visualization activity is funded by the GEOIDE NCE and will continue until 2012.



*Figure 10. Clyde River, Nunavut looking down Patricia Bay. Photo credit: Natural Resources Canada.*



*Figure 11. Visualization of solution for avoiding hazards in Clyde River. In this scenario scientific information is combined with community plans to avoid major landscape hazard areas such as drainage channels. In this scenario this leads to a reduced community footprint and more multi-family housing (image credit: David Flanders and Nick Sinkewicz, UBC-CALP).*

## ***Community Adaptation Planning***

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The *Community Climate Change Adaptation Planning* session discussed planning results produced by NCCP, processes used to engage communities and scientists and provided important community perspectives on the work. Presentations from this session can be found in the Community Session folder in Appendix C. The first presentation was by Beate Bowron and Gary Davidson, representing the Canadian Institute of Planners. They provided an overview of the community climate change adaptation planning work conducted through NCCP. In particular, they discussed the approach used to develop the plans, how the planning teams and communities were chosen (Figure 12), how scientists and planners worked together (Figure 13) and how the plans were prepared (Figure 14). It was noted that a community climate change adaptation plan integrates scientific, elder and community knowledge, lists climate change impacts, determines levels of community risk, identifies and prioritizes actions that need to be taken and feed into other plans (e.g. community land use plans). Through NCCP community climate change adaptation plans have been delivered for seven communities (Clyde River, Hall Beach, Arviat, Cambridge Bay, Iqaluit, Kugluktuk and Whale Cove) with a planning tool developed for other communities to use (Canadian Institute of Planners 2011). All community climate change adaptation plans and supporting documentation can be found at [www.planningforclimatechange.ca](http://www.planningforclimatechange.ca).





Figure 12a)



b)



c)

Planning teams who worked in NCCP communities include: a) Rory Baksh and Brian Render (Clyde River), b) Christine Callihoo and Dan Ohlson (Hall Beach) and c) back (left to right) John Lewis, Elisabeth Arnold, Kate Miller, Karen Nasmith, Taylor Zeeg; front (left to right) Katie Hayhurst, Todd Romaine, Christine Callihoo, Mike Sullivan and Ken Johnson. Photo credit: Canadian Institute of Planners



*Figure 13. Scientists and planners working together on the Arviat community climate change adaptation action plan. Photo credit: Canadian Institute of Planners.*



*Figure 14. Preparing the Community Climate Change Adaptation Plan with the community of Whale Cove. Photo credit: Canadian Institute of Planners.*

Bob Chapple from GN Community and Government Services (CGS) provided an overview of the GN Planning and Lands Section and how it worked with NCCP. It was noted that CGS Planning and Lands is focused on mapping, lands administration, property assessment and planning in Nunavut's communities.

Incorporation of climate change into GN planning is acknowledged but has been traditionally hampered by a lack of information. NCCP has raised the profile of climate change and planning and produced new information that can be used by GN planners. One of the key reasons why CGS was involved in NCCP was to ensure that relevant climate change information was produced and incorporated into Nunavut community planning processes. CGS participated in the community climate change adaptation planning process, landscape hazard and permafrost studies and community water resources work. This collaboration provided CGS with new knowledge that enabled them to build on landscape hazard and terrain assessment work by conducting new surveys in communities not addressed by NCCP. This is an exciting development.

Community presentations from Clyde River, Whale Cove and Arviat were highlights of this session. Gordon Kautuk, from Clyde River, presented on the involvement of his community in the NCCP with an emphasis on discussing the Ittaq Heritage and Research Centre (Ittaq 2011). Ittaq was founded in 2005 in response to increased levels of research in the community. In addition, the Hamlet of Clyde River identified research as a major economic development opportunity and built this into their Community Economic Development (CED) 5-year plan. In 2006, NCCP became Ittaq's first major research activity to work with in order to develop its business model. Since this time Ittaq has hired its first full-time coordinator (Gordon Kautuk) and transformed an old nursing station into a fully functional heritage and research centre (Figure 15). Part of Ittaq's mission is to provide quality services for researchers and professionals. Ittaq worked closely with NCCP scientists and planners on the Clyde River climate change adaptation plan and numerous scientific activities.





*Figure 15. The Ittaq Heritage and Research Centre in Clyde River, Nunavut. Pictured are Gordon Kautuk and Shari Gearheard. Photo credit: Gordon Kautuk, Ittaq Heritage and Research Centre.*

Jerry Panegoniak, Planning and Lands Administrator for the Hamlet of Arviat, provided a detailed account of his perspectives on community climate change adaptation and shared his experiences working with NCCP. His detailed speech can be found in Appendix C. He noted the importance of incorporating results from the Arviat climate change adaptation action plan (Arviat 2011; Canadian Institute of Planners 2011) into the Official Community Plan and zoning by-laws. This would enable development that avoids hazards, considers snow drifting and minimizes maintenance costs. In addition, Jerry informed workshop participants about two new planning associations that could be involved in future work. They

are the National Aboriginal Lands Managers Association (NALMA) and the Planning and Land Administrators of Nunavut (PLAN).

The development of the Whale Cove adaptation action plan, workbook and poster was provided by Katie Hayhurst, a CIP volunteer planner. The poster is meant to serve as a reminder of the communities climate change adaptation plan and as inspiration to foster climate change discussions in the community. Small versions of the poster were distributed to every household and wall-sized versions were prepared for the Hamlet, school, etc. (Figure 16). A workbook was also distributed throughout the community as well. The first half provided background on the project, how to use the workbook, what is climate change and climate change in Whale Cove. The second half includes a list of tasks for action and a space for someone to fill in their own personal commitment to action. Finally, the climate change action plan was designed for decision-makers and technical experts. It includes information on climate change science, climate change impacts on the north and Whale Cove, community values and implementation recommendations. To date, Whale Cove Council has given approval-in-principle of the plan with final adoption hopefully coming soon. Whale Cove climate change adaptation planning documents can be found at [www.planningforclimatechange.ca](http://www.planningforclimatechange.ca).



Figure 16. The Community Climate Change Adaptation Action Plan poster produced for Whale Cove. This poster and supporting documents are available at [www.planningforclimatechange.ca](http://www.planningforclimatechange.ca).

## ***Moving Forward***

The focus of the *Moving Forward* session was to present to workshop participants new opportunities for climate change adaptation work in the territory. Presentations from this session can be found in the Moving Forward Session folder in Appendix C. It was meant to provide a glimpse of some new initiatives that could be of interest to Nunavut. The first presentation was given by Froeydis Reinhart, GN Climate Change Coordinator, Department of Environment (DOE). It was noted that the GN provided strategic direction, links to communities and territorial decision-makers and facilitation and communication roles to NCCP. The GN has also launched a new website ([www.climatechangenunavut.ca](http://www.climatechangenunavut.ca)) to disseminate climate change information. Newsletters and backgrounders from the current NCCP are currently posted there. An update on additional GN climate change activities was also provided. Currently the GN is working on a climate change gap analysis to identify new priorities for the territory and is working on a new strategic climate change adaptation document titled Upaqiaqtavut (meaning setting the course). Both of these products will provide an important direction for new work in the territory. One additional highlight from this presentation was the recognition that Lee Ann Pugh, hired as a summer student to work with NCCP in 2007 went on to become the GN Climate Change Coordinator and is now advancing her career in other capacities within the territorial government (Figure 17). Her significant contribution to NCCP cannot be overlooked.



*Figure 17. Lee Ann Pugh giving a presentation on her experience as a research assistant with the Government of Nunavut during a climate change workshop in Rankin Inlet. Photo credit: Natural Resources Canada.*

Jared Fraser, GN Department of Economic Development and Transportation spoke about a new initiative focused on understanding the impacts of climate change on natural resource and infrastructure development in Nunavut. This

work is being supported by NRCan's Climate Change Impacts and Adaptation Directorate through its *Regional Adaptation Collaboratives* program. The goals of this work are to conduct a vulnerability assessment of the mining sector to climate change in Nunavut and develop new environmental best practices that can be incorporated into decision-making concerning waste containment facilities, roads, ports, air strips, etc. An advisory group has been developed for this work which will officially begin in March 2011.

The session concluded with presentations by Transport Canada and INAC who discussed complimentary initiatives and ideas for future work in Nunavut. Janice Festa, Transport Canada (TC), gave an overview of northern transportation research being conducted by her department. TC has an evolving northern focus that addresses regulatory, socio-economic and environmental aspects of Canada's Northern Strategy. In consultation with northern stakeholders it was determined that multi-disciplinary partnerships or networks were needed to address climate change related transportation issues. Such networks would bring together appropriate expertise, increase sharing of information and build and retain knowledge in the north. In response to this TC has initiated two new networks of expertise. They are:

- Network of Expertise in Northern Transportation Infrastructure Research in Permafrost Regions.
- Network of Expertise in Transportation in Arctic Waters.

The objectives of these networks is to conduct fundamental and applied research and facilitate outreach and education opportunities. The Government of Nunavut is a full member in both networks. Finally, Michael Westlake of INAC spoke about the importance of partnerships for addressing climate change adaptation in the north. He noted the utility of the Nunavut Climate Change Partnership and how the current network that is in place could evolve to address a broader range of issues and implementation of adaptation measures.

### ***Evening Session***

A community presentation (see Evening Session folder in Appendix C) was held at Iqaluit's Francophone Centre on the evening of February 15<sup>th</sup> as an educational opportunity for the public to learn more about permafrost conditions in changing climate and how it can effect Nunavut communities (Figure 18). The title of the presentation was *Permafrost in Southern Baffin Island and northern Quebec* and was presented by Michel Allard from Université Laval (see poster in Appendix B). At the beginning of this presentation an overview of permafrost, permafrost landscapes and permafrost thermal regimes was given. The general effects of permafrost thawing – landslide, thaw lakes, terrain subsidence and building collapse – on the landscape were presented using images taken from across the Arctic. The permafrost monitoring network and ground temperatures in the eastern Arctic were described and differences in ground temperature



between Nunavut and Nunavik discussed. To conclude the presentation specific examples of landscape changes and hazards in permafrost terrain were provided for the communities of Pangnirtung, Iqaluit and Salluit (Figure 19).



*Figure 18. Community presentation by Michel Allard on Permafrost in Southern Baffin Island and northern Quebec at the Francophone Centre, Iqaluit, February 15<sup>th</sup>. Photo credit: Natural Resources Canada.*



*Figure 19. Photo of the impact of thermal erosion on permafrost terrain in Nunavut. This hazard was partly responsible for the destruction of the bridge in Pangnirtung. Photo credit: Hamlet of Pangnirtung.*

## **Day 2 Presentations**

Presentations on the ArcticNet *Integrated Regional Impact Study* (IRIS) and glacier trends in Nunavut were presented in between the Needs Assessment and Lessons Learned sessions on day two. These presentations can be found in the Day 2 Presentations folder in Appendix C. Trevor Bell from Memorial University presented on the IRIS, which aims to address the knowledge needs of policy/decision makers by identifying and organizing Arctic and climate change science in a useful format. The IRIS has divided the Canadian Arctic into 4

regions – Western and Central Arctic, Eastern Arctic, Hudson Bay and Eastern sub-Arctic. The focus of this session was on the Eastern IRIS (centred on the Baffin Region of Nunavut). Its goal is to synthesize available science knowledge around the concerns and issues of public health and safety, socio-economic development, resource management, culture and lifestyle and the adaptation process. Feedback from workshop participants was solicited during this session in order to help design the Eastern Arctic IRIS.

A keynote presentation on the impact of climate change on glacier and water resources in Canada and Nunavut was presented by Mike Demuth of NRCan. The importance of long-term trends from glaciers for informing development of adaptation policy was clearly articulated. Mass changes in glaciers are a robust indicator of climate history and can effectively decipher weather from climate signals. It was noted that the mass and extent of glaciers in the Canadian Arctic, and globally are decreasing substantially. This provides a clear indication that climate is changing. It was also presented that changes in glacier dynamics provide an interesting opportunity for Nunavut. Increased meltwater from Nunavut glaciers has the potential to provide a new source of energy for domestic and industrial requirements.

# **Nunavut Climate Change Partnership Workshop Report**

**Needs Assessment**

**Lessons Learned**

**Conclusion**

**Acknowledgements**

**Appendices**



## Needs Assessment

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This section summarizes the ideas and recommendations expressed by workshop participants during the *Needs Assessment* roundtable discussion on the morning of Wednesday February 16<sup>th</sup>, 2011. The discussions were open to everyone attending the workshop. Approximately sixty participants were broken into three separate discussion groups and asked to consider the following questions: 1) what information is needed by people and communities in order to plan and implement adaptation measures; 2) what information is needed to support natural resource development decisions that minimize impacts and identify adaptation options; and 3) what should Nunavut's top five priority areas be in moving forward with climate change adaptation?

### Needs Assessment Results

#### **Question 1:**

***What information is needed by people and communities in order to plan and implement adaptation measures?***

#### Accessing and Sharing Information and Knowledge

Probably the most significant theme that emerged is the need for everybody to better understand the changes brought on by climate change and those to come. This requires the accessing and sharing of both community-based knowledge and scientific information among a wide range of practitioners. This need is not only relevant to members of the NCCP but also to scientific researchers, governments and communities and to holders of local and *Inuit Qaujimajatuqangit*. This information needs to be managed and kept up-to-date. It needs to be accessible at the community level so it is useful for community and emergency planning and other community-based adaptation activities. A central database or 'online information portal' was suggested as one means of maintaining the growing library of information, while enabling broad access. Participants identified the Nunavut Research Council or Government of Nunavut as possible managers of such a portal. Such a portal would need to allow scientists, planners and others to be able to input their own data and be searchable through the Internet.

Community decision-makers are expected to be a major user of such a central database. For this reason, expert knowledge (scientific, planning, local and *Inuit Qaujimajatuqangit*) would need to be applicable to community decision-makers and include information on such things as snow drifting, seabed mapping, landscape hazard mapping and erosion control and where to access community climate change adaptation plans. This would enable the mainstreaming of information into all local planning activities and initiatives. Collaboration between researchers, government and community representatives in designing the

database and portal would help to ensure its usability, accessibility and most importantly, its acceptability.

It was noted that information and data are sometimes conflicting, which leads to confusion and uncertainty among users and decision-makers. All reasonable efforts should be taken to ensure the presence of contradictory and inconsistent information is minimized. Although not specifically mentioned by workshop participants, the need for data quality assurance and quality control (QA/QC) protocols is implied.

Other themes emerging from the discussions include the need for continued collection and documentation of *Inuit Qaujimaqatuqangit*, the expansion of landscape hazard mapping to all Nunavut communities and the need for communities to identify their needs, values and priorities before researchers begin to plan their studies. This would better enable the integration of research and the collection of information with community needs and priorities.

#### Communication

Participants expressed the need for more effective and efficient ways of communicating information to community decision-makers and all residents. Some of the current methods include contacting the Senior Administrative Officer (SAO), meeting with community councils, public presentations, workshops, community feasts, local radio announcements and posters. The timing of this communication is also important. Local momentum can easily be lost if the results of studies and research are not communicated to communities in a timely manner. Several participants noted that communications is two-way. Communities should also be prepared to communicate their needs to researchers and government representatives early so programs can be designed to meet specific community needs and priorities.

#### Other Discussion Themes

Participants noted the need for leadership. The most successful initiatives are those that are championed by leaders who are able and willing to carry the project forward. Although this need was identified with respect to community initiatives, it also emerged from discussions related to scientific research and government planning activities.

Much of the discussion and research around climate change has, to date, focused on the negative impacts of a changing climate. Workshop participants recognized that significant benefits and opportunities could emerge from climate change (e.g. a longer Arctic shipping season, better access by communities to less expensive consumer goods and supplies, greater access to oil, gas, mineral and fishery resources, etc.). Participants expressed a need for greater research and information into these potential benefits and opportunities, as well as potential sources of funding and support, to examine and take advantage of the

emerging opportunities. The need for communities to obtain appropriate funding and training to enable a better understanding of climate change impacts and implement adaptation measures was a recurring theme among participants.

**Question 2:**

***What information is needed to support natural resource development decisions that minimize impacts and identify adaptation options?***

Accessing and Sharing Information and knowledge

Specific examples of priority areas for natural resource development identified by workshop participants include:

- Marine shipping – bathymetry and sea ice;
- Linear transportation infrastructure – roads, railways;
- Marine wildlife - impacts of changing sea ice conditions and shipping disturbances; and
- Migratory birds and wildlife.

Similar to the session on community needs, better accessibility and sharing of information and knowledge as a means to support better natural resource development decision-making was a recurring theme throughout the discussions. It was suggested that a gap analysis be undertaken to identify and analyze what information is available, as compared to what is needed. Better accessibility to data and information that already exists, maintaining this information in an up-to-date online database or portal, and better integration of scientific research, local knowledge and *Inuit Qaujimajatuqangit* were also recurring themes.

It was recognized that natural resource developers themselves, as well as university researchers and government scientists and planners, collect significant amounts of relevant information. The difference is that natural resource developers collect information that is tailored to their specific needs or project. By combining industry-generated data with that collected by university researchers, government scientists, planners and others, a much more complete dataset could be accumulated. This could assist in bridging the gap between industry and government information needs.

The Process of Decision Making

Workshop participants identified the need for government and community decision-makers to establish clear expectations and limits for developers. Land use plans (local, regional, territorial), standards and codes are examples of what can be used to establish consistent and predictable 'goal posts'. Once these expectations have been established and clearly communicated, the developer can confidently proceed with their planning processes. Climate change adaptation collaboratives, such as the NCCP, can assist this process by contributing data and knowledge on climate change impacts, benefits and adaptation opportunities. In other words, climate change adaptation needs and

solutions should be integrated into the decision-making processes of natural resource developers at an early planning stage.

#### The Valuation of Natural Resources

Modern financial accounting systems routinely place an economic value on goods and services that are produced and consumed. Workshop participants turned this question around and asked what is the economic value of our natural ecosystem (i.e. a sustainable caribou population, a pristine river ecosystem or safe ice conditions). Participants identified the need to better identify the costs and benefits of change by beginning to 'value' development and ecosystem resources using a common valuation system. This would enable the better balancing of resource development and conservation issues by government and non-government decision-makers.

#### Other Discussion Themes

As with the community discussions, better and earlier communication between natural resource development and government decision-makers, and better information on how natural resource developers could benefit from changes being brought on by a warmer climate were raised by workshop participants.

#### **Question 3:**

***What should Nunavut's top five priority areas be in order to move forward with climate change adaptation?***

Workshop participants were asked to identify Nunavut's top five priority areas in order to move forward with climate change adaptation. Each of the following items were identified by two or more of the three breakout groups. They are listed here in no particular order of priority.

#### Facilitate Community Capacity Building

On-going resources, training, skills development and climate change adaptation planning support is required in order for communities to better move forward on implementing adaptation measures. Improved awareness of climate change impacts and the opportunities brought on by a changing climate would enable community decision-makers to make more informed and timely decisions. A greater awareness of climate change impacts and benefits among community residents would also lead to greater overall acceptance, understanding and support for the necessary decisions.

#### Accessing and Sharing Information

A significant body of scientific and local knowledge and *Inuit Qaujimajatuqangit* exists, with new data and information emerging as scientists continue to study and document Arctic climate change impacts, sensitivities and vulnerabilities. This information and data needs to be made available and shared among a range of users and decision-makers (i.e. academics, planners, governments and

communities) in a useable, accessible and consistent form. Communications between researchers, decision-makers and the public must be encouraged and improved upon to ensure the information is accessible, understandable and incorporated (mainstreamed) into all decision-making.

#### Partnership Building

There was acknowledgment of the significant collaborative efforts of the Nunavut Climate Change Partnership over the past five years, and the need for new partnerships and collaboration in order to continue to address priority issues in the territory. The workshop participants recognized the strength and importance of bringing the various stakeholders together – building partnerships – to address the complexity of a changing climate. It was emphasized that attention be given to ensuring effective and efficient communications both between Partnership participants and with other stakeholders including researchers, government and community decision-makers and the public. Specifically, the need for a written communications plan for any future Partnership initiatives was encouraged. Such a plan would establish clearly the roles and responsibilities of each of the partners to help ensure better, timely and consistent communications, information exchange and program delivery.

#### Community-based Climate Change Adaptation Planning

Community representatives and planners identified specific information needs that would assist them in advancing community-based climate change adaptation planning. Landscape hazard mapping, information on infrastructure vulnerability and made-in-the-north solutions – as compared to southern solutions transferred into northern conditions - were identified as being priority research areas.

#### Recognition and Building upon Emerging Economic Opportunities

Changes being brought on by a changing climate are predicted to bring both economic opportunities as well as social, cultural and environmental impacts. Participants noted that not much is currently known about potential economic opportunities, or how to best take advantage of them. Additional priority and resources should be applied to recognizing and taking advantage of these emerging opportunities. The development of renewable and alternative energy systems and more baseline information to assist natural resource development decision-making were specifically identified as examples.

More than sixty workshop participants came together during the Needs Assessment session to consider what is needed to move climate change adaptation forward in Nunavut. Besides the specific discussions outlined above, there was a recognition of the continuing need for leadership from the Governments of Nunavut and Canada if communities are to continue to plan and implement climate change adaptation measures and if the territory is to develop responsibly.



### Resource Development Needs Assessment

Nunavut is preparing for a decade of record level mining activity with growth concentrated in the Kivalliq and Kitikmeot regions (Hope Bay, Kiggavik and Meliadine) (Figure 20). Additional world-class deposits (Hackett River, Izok Lake and Mary River) could be developed as soon as 2025 (Nunavut Economic Forum 2010). Collectively, these developments will fundamentally transform Nunavut's economy and generate significant wealth for Canada. The issue that is currently hindering the development of these natural resources is that most are stranded by a lack of Infrastructure; namely roads to the coast, ports, airports and a sustainable energy supply. Therefore, massive investments in new and existing infrastructure will need to be made to bring Nunavut resource wealth to market and continue to develop its communities.

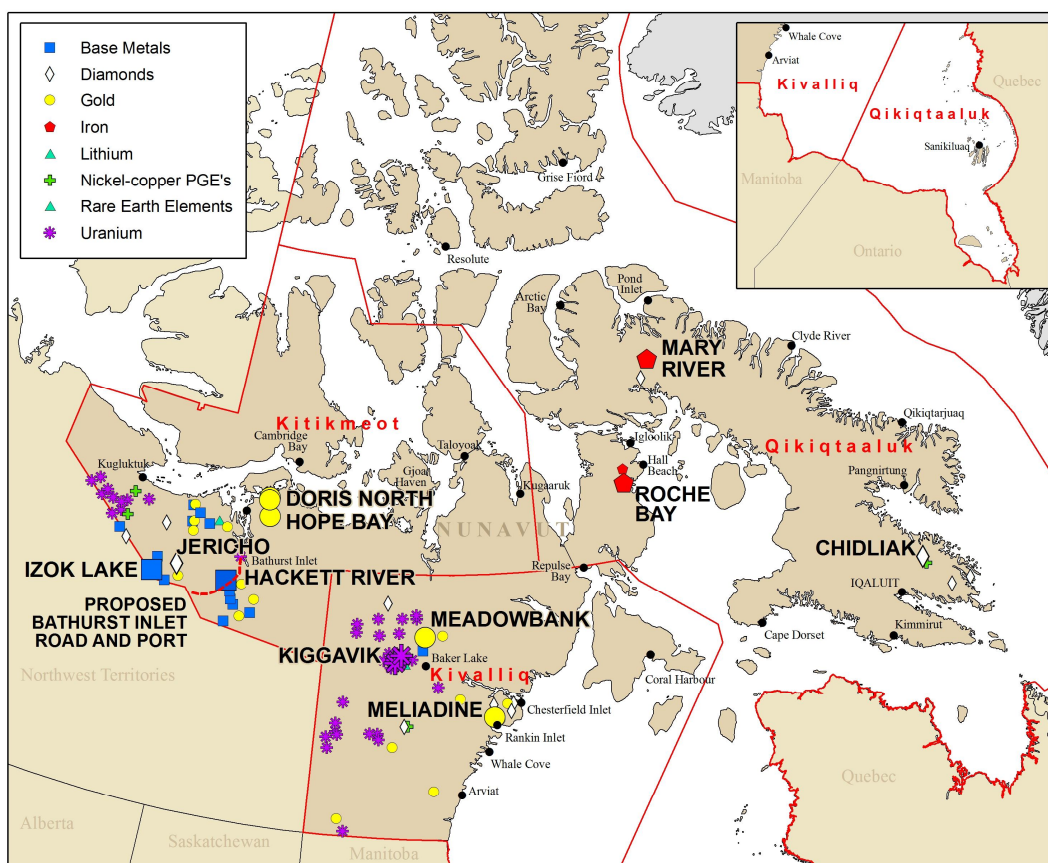


Figure 20. Map of Nunavut showing resource development potential across the territory and relationship of these areas to nearby communities. Figure produced by the Canada-Nunavut Geoscience Office. Point data is from 2009 and supplied by the Nunavut Regional Office, Indian and Northern Affairs Canada.

To begin to discuss the climate change adaptation information needs required for critical infrastructure development in Nunavut, a one-hour meeting with key Nunavut partners was scheduled on the morning of February 17<sup>th</sup>. This meeting

consisted of representatives from GN Economic Development and Transportation and Community and Government Services, Qulliq Energy, INAC, Nunavut Impact Review Board, INAC and NRCan. The objective was to discuss what new types of climate change knowledge on permafrost, coastal sensitivity, remote sensing, etc would assist decisions that minimize impacts of climate change on critical infrastructure for resource development and communities in Nunavut and identify adaptation options. Three priority areas were identified and are listed below.

### 1. Coastal Sensitivity for Resource Development in Nunavut

Numerous ports and harbours are being proposed in Nunavut to support the shipment of supplies to mines and communities, ore concentrate to market and provide basic infrastructure needed to support fishing and offshore petroleum exploration. Information on coastal geology, geodynamics and permafrost that more quantitatively defines sea-level rise projections and coastal sensitivity in Nunavut would be an asset. Priority regions identified include the Coronation Gulf in the Kitikmeot, western Hudson Bay in the Kivalliq and eastern Baffin Island in the Qikiqtaaluk regions. Sea-level rise projections for all communities across the territory would be a great asset in supporting responsible local harbour development.

### 2. Terrain Sensitivity and Landscape Hazards to Support Infrastructure for Resource and Community Development in Nunavut

The natural resource economy of Nunavut is evolving from one based largely on mineral exploration to one that is now experiencing rapid mineral development. The most intense development pressures are occurring in the Kitikmeot and Kivalliq regions while the massive Baffinland Iron Ore mine is moving towards development in the Qikiqtaaluk. Two priority areas were identified under this theme. They include:

- *Regional Landscape Hazards and Sensitivity:* Large regions of the Kitikmeot and Kivalliq contain mineral properties that are transitioning into major operating mines and hub communities critical to support this development. Realizing and enabling this development will require building and maintaining significant new infrastructure in the form of roads, air ports, mine facilities and housing. Integrated information to determine terrain sensitivity and associated landscape hazards in these regions, specifically the areas of Bathurst Inlet west to Kugluktuk (Kitikmeot) and from Baker Lake south to Arviat (Kivalliq), is key for responsible development.
- *Landscape Hazards at Airports:* Nunavut is the only jurisdiction in North America entirely isolated from a highway system. Therefore, reliable and safe air travel is a vital infrastructure asset for transporting supplies, workers and products. An assessment of climate change related impacts on Nunavut airports is key for the development of the territory.

### 3. Sustainable and Secure Power Supply

A sustainable and secure power supply is a key limiting factor for all resource development in Nunavut. Currently, all development in Nunavut is dependent on diesel generation which is expensive to purchase and ship to remote locations. Identifying other credible solutions for power generation is key for the evolution of Nunavut. Hydro-electricity has been identified as one possible solution for providing resource areas and communities with reliable and cheap power. Sparse information exists on the quantity of water resources available for hydro-power generation and what impact climate change will have on this resource.

In summary, this session has provided one of the first attempts at identifying the range of climate change adaptation needs for critical infrastructure for resource development in Nunavut. It is hoped that this information will be useful for future program planning.

## Lessons Learned

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This section summarizes the ideas and recommendations expressed by workshop participants during the Lessons-learned roundtable discussion in the afternoon of Wednesday February 16<sup>th</sup>, 2011. Anyone who had participated in any of the NCCP activities was invited to participate. The objective of this session was to evaluate what NCCP has done well and areas that could have been improved upon. The goal is to be able to apply these lessons learned to any new partnerships in the future. Approximately forty participants were broken into three separate discussion groups and asked to consider the following questions that centered on the themes of collaboration, communication and deliverables. They were: 1) Did the collaboration between communities, planners, government and scientists work to everybody's advantage? 2) Did the Partnership communicate its goals, scope and projects clearly? Could communication have been improved? and 3) Have the deliverables (i.e. workshops, training, plans) met the needs and expectations? Were they delivered in an acceptable manner?

Participants discussed these questions in break-out groups and were given the opportunity to present their findings to workshop participants. Common themes were identified and recommendations were made that can be used to improve future partnerships in Nunavut. Session findings are described below.

### **Question 1:**

***Did the collaboration between communities, planners, government and scientists work to everybody's advantage? Could it have been improved? If so, how?***

There was a general consensus that collaboration could be improved upon. It was noted that with any Partnership there are strengths and weaknesses, however the overall experience had been positive. There was a general sense that the planning process had been improved by NCCP. Themes identified where improvement would be helpful included stakeholder involvement, roles and responsibilities, communication, and deliverables.

Stakeholder involvement was a key item identified. There was general agreement that not all key stakeholders were involved in the initiative from its conception. It was felt that more work up front to identify which partners should be included in the project would have been useful. Following that, an initial meeting with all involved stakeholders would have been beneficial to identify roles and responsibilities, build trust and develop relationships



Workshop participants identified the need for a communication plan where lists of all involved participants, partners and community members would be recorded. This plan would include strategies for project communication and upfront or media (radio) requirements targeting communities that the initiative would impact. It was felt by workshop participants that outreach was variable from community to community and that it was unequal due to a number of factors such as availability of people in the communities, the timing of research, financing etc. Workshop participants suggested that components of the partnerships work could be coordinated by the local communities. For example, community members could help facilitate 'on-the-ground' work and should be consulted with and be involved from the beginning of the process. Better engagement of community members would minimize duplication of efforts. Using tools that track details of consultations with communities, like the *Aboriginal Treaty Rights Information System* (ATRIS) could assist with coordination.

With regard to deliverables it was felt that engagement should be a deliverable within the partnership. Partners could have developed joint deliverables more effectively between themselves and the community (e.g. integrated report). It was also identified that there needs to be a way for adjusting deliverables as changing requirements are identified. Flexibility within the project is needed to ensure deliverables can be met. Finally the products need to be accessible.

Overall it was felt that a good network of scientists, community members and other stakeholders was created and the information produced was relevant. There were good contacts made in all the communities and many of the logistical challenges faced were dealt with. The planners noted their appreciation of having scientists available to explain the science and what it meant at the local level. Workshop participants hoped that the synergy created from this project would not be lost and would be maintained.

**Question 2:**

***Did the Partnership communicate its goals, scope and projects clearly?  
Could communication have been improved? If so, how?***

Workshop participants identified that communication could be improved within the NCCP with an emphasis on developing a communication plan, communication techniques, overall participation and translation. Noted by workshop participants was that project plans were generally well received by those who received them, but the communication and distribution of these plans could be improved. Scientists had a positive experience working with the communities and it greatly improved communication when face-to-face meetings were conducted in the communities. It allowed scientists the opportunity to hear community member concerns and make valuable contacts.

As already stated in Question 1, workshop participants identified that a clear communication plan was needed at project initiation to focus expectations and to ensure efficient delivery of outcomes. Disconnects between stakeholders were noted as it was identified that information was not being effectively communicated to all involved. Workshop participants stated that more thorough communication to planners prior to their arrival in the community would have better prepared them with regard to goals and expectations, background in climate change in the north and familiarity with the working environment. Only hardcopy climate change adaptation plans were delivered to communities with no acknowledgement that they could also be downloaded online. With regard to electronic communication, it was noted that many communities could not manage large file downloads. However, after March 2011, it is expected that all communities will have capacity for large downloads in adult education centres.

A wide range of communication techniques and suggestions were identified by workshop participants. They include:

- To use established communication channels and coordinate with other researchers/projects/organizations.
- To advertise to community prior to arrival (i.e. in local newspapers).
- Establish mailing groups to ensure that everyone is involved from beginning to end.
- To ensure communication and outreach is tailored to the audience.
- Ensure there is a contact in each community and create redundancy by having primary and secondary contacts. Perhaps assigning a school contact such as students and/or teachers; or target the PLAs (Planning and Lands Administrators) of each Hamlet to be the climate change adaptation liaison.
- Utilize Facebook. It is heavily used at the community level, and could be an effective tool for communication in the future, especially when involving youth.
- Improve communication leading up to community meetings. A more rigorous approach to advertising meetings would be effective.
- Use communication procedures adopted by other groups (e.g. Nunavut Employees Union) as best practices for setting up meetings. Using posters/newspaper ads well in advance and radio ads the day before works well. In Kugluktuk an evening radio show was used to ask for comments from the community. This worked very well.
- Streamline the process but allow for flexibility to incorporate community priorities;
- Development of timely products was necessary so partnership success did not disappear. Newsletters, communications products/strategy would enable better partnership cohesion.

Workshop participants felt that it was necessary to build on the strengths of partners, especially when multiple partners were involved. Each partners has its

own bureaucracy to deal with and this takes time. Stated during the workshop was that the community climate change adaptation action plans were seen as very useful, but a key community member such as a champion is needed in order to carry the plan forward. It was noted that more community participation and feedback was needed and that feedback would allow for training of community members. Also identified was that there should be more on-the-ground outreach with communities. Workshop participants stated that there was a disparity/inequality when it came to which communities got researchers/attention/studies. It appeared that some communities had many research projects, while others had very few. Workshop participants thought it would be useful to identify which communities do not receive much research, so that these gaps could be targeted in the future to achieve a better balance.

It was identified that a corporate structure was needed that facilitated redundancy so that the knowledge legacy and transfer of information was not reliant upon a specific individual. The retention of specific positions (e.g., Climate Change Coordinator) needs to be maintained to ensure proper communication. Also identified was the need to improve language translation in order to bridge the cultural barrier between science and technology, and community members and enhance the terminology in Inuktitut to include new technical terms that are otherwise difficult to translate. This would build on the existing Inuktitut Terminology on Climate Change (2005) developed by the GN and NTI.

**Question 3:**

***Have the deliverables (i.e. workshops, training, plans) met the needs and expectations? Were they delivered in an acceptable manner?***

There were specific comments pertaining to deliverables. It was stated that the NCCP should produce an integrated deliverable(s) (summary report, etc.) while at the same time results for specific stakeholders should continue to be produced. It was noted that science and planning projects had different goals and outputs and integrating these into one common deliverable would enhance NCCP success. Other areas noted for improvement include better coordination of funding opportunities, reporting back, a central data repository, implementation and skill development.

It was identified that better coordination / collaboration within federal agencies was needed with regard to funding. Plans are needed to take advantage of funding opportunities. There was a general consensus that communities could develop a local contact for researchers coming into the community to work as a liaison with/between researchers and community for dissemination of information. Incoming researchers could coordinate with other groups (mining, health, etc.) to prevent overburdening the community and also prevent duplicated effort. Also noted was the potential to increase community-based research and use of research advisors. Workshop participants indicated that there should

have been more visits (“walk-about”) coordinated between scientists and planners (Figure 21).



*Figure 21. Science “walk-about” between scientists, planners and Arviat decision-makers during the summer of 2009. Photo credit: Natural Resources Canada.*

More frequent reporting was identified as a need. Progress reports were needed not only to community members, but to other partners as well. Draft annual and field reports throughout the project to keep everyone informed would be beneficial. Yearly updates of the science projects should be provided to and for the communities.

In addition, final results (reports, plans, data) need to be delivered and followed up on. This will determine the legacy of the work and to what extent expectations have been met, especially while the results are still new. It is hoped that deliverables should be used and not shelved. To achieve this, the deliverables should be aligned with community priorities as much as possible.

Implementation of NCCP results was identified as an area for future work. Projects should produce deliverables that can be used to advance adaptation in Nunavut. The question was raised on how to ensure plans are implemented and that the deliverables have been used and are aligned with community priorities. A suggestion presented was to implement a policy of financial incentives for communities, for example, the salary for local staff (PLA) to implement results and training to improve competency. Workshop participants suggested the need for a central repository for all data (reports, GIS, photographs, text etc). In addition it should be communicated where the deliverables, data and information can be found.



Training within the communities, would help increase local capacity. Community-based research and training is vital and should be supported and integrated with incoming researchers. It was identified that skill development and training should have been a larger component and there could be a closer link with schools to provide training.

### ***Recommendations***

The lessons learned outlined above generated the following recommendations for future partnerships in Nunavut. They include:

- It was recommended that new partnerships consider developing a Terms of Reference (TOR) or a Memorandum of Understanding (MOU) between core partners outlining roles, responsibilities, frequency of meetings and other key areas at the onset of any new collaborative effort.
- A communication plan is needed to ensure communication roles, timing and messages are streamlined and agreed upon. The communication plan should outline the range of audiences that need to be engaged and how they should be reached. Communication both between partners as well as with other stakeholders is key to a successful partnership. It was recommended that the communications lead be a Nunavut stakeholder.
- Early stakeholder identification and creation of a steering committee and an advisory committee is recommended. The steering committee would consist of partnership core partners, whereas the advisory body would include other interested stakeholders (universities, Nunavut stakeholders, content experts, etc.) that provide advice and general project direction. This model ensures the participation of the largest number of stakeholders.
- Communicate results frequently during the project by identifying yearly target outputs. This could include maps and a field report that can be shared with communities and other stakeholders explaining the work and results to date.
- Stakeholder expectations need to be defined at the initiation of any partnership to ensure that everyone shares realistic and achievable objectives. Effective communication of these expectations is important.
- It is recommended that some level of science work be completed before planners start their community work. This provides an important information foundation for planners before they start adaptation planning work.
- Face-to-face meetings in communities are very effective and allow the community to bring their concerns directly to planners, government officials and scientists. Everyone involved benefitted from these interactions and they are highly encouraged.
- Investigate if a formal agreement/letter of support/intent is needed with the communities you will be working in.

- A common deliverable (project report) from the partnership would be of great benefit – this product should be defined and set out at the beginning of the partnership.
- Joint community visits or field work involving both scientists and planners is effective at facilitating the integration of scientific and planning information.

## Conclusion

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The Nunavut Climate Change Partnership has been a five-year effort between the Government of Nunavut, Natural Resources Canada, Indian and Northern Affairs Canada and the Canadian Institute of Planners. The partnership has produced a wide assortment of results including seven community climate change adaptation plans, a planning tool, local and regional scientific information on permafrost, sea-level rise and coastal hazards and water resources and has built capacity and enabling partnerships in communities across the territory. This partnership began with a territory-wide workshop in 2006 to develop priorities, synergies and strategic direction.

The focus of this NCCP workshop has been to report back on results and progress made by the partnership, discuss new climate change needs and priorities for the territory and document lessons learned that will enable new collaborations to work more effectively. Many valuable insights and ideas were gathered from this workshop and its approximately 100 participants. The future is bright for continued climate change adaptation research in Nunavut.

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## References

Note: All NRCan reports listed below can be downloaded through GEOSCAN.  
[http://geoscan.ess.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/geoscan\\_e.web](http://geoscan.ess.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/geoscan_e.web)

Armstrong, R., Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. October 2009. Description of Water Depth Survey Datasets from Rankin Inlet, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6751.

Arviat. 2011. Planning and Lands. [www.arviat.ca](http://www.arviat.ca).

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2007. Watershed Mapping and Monitoring for Northern Community Impact Assessment – Iqaluit, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6619.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. August 2007. Watershed Mapping and Monitoring for Northern Community Impact Assessment – Clyde River, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6620.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2007. Description of Watershed Outline and Water Depth Survey Datasets from Geraldine Lake, Iqaluit, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6750.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2009. Watershed Mapping and Monitoring for Northern Community Impact Assessment – Whale Cove, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6848.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2009. Watershed Mapping and Monitoring for Northern Community Impact Assessment – Arviat, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6846.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2009. Description of Watershed Outline and Water Depth Survey Datasets for Whale Cove, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6847.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. July 2009. Description of Watershed Outline and Water Depth Survey Datasets for Arviat, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6845.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. August 2010. Watershed Mapping and Monitoring for Northern Community Impact Assessment – Cape

Dorset, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6843.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. August 2010. Description of Watershed Outline and Water Depth Survey Datasets for Cape Dorset, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6844.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. August 2010. High Precision GPS Data of Cape Dorset, Nunavut. Natural Resources Canada. Ottawa. GSC Open File Series # 6855.

Budkewitsch, P., Prévost, C., Pavlic, G., Pregitzer, M. June 2011. Geomatics Information for Monitoring and Mapping of Freshwater Supplies in Nunavut - A Review. Canadian Symposium on Remote Sensing. Sherbrooke, Québec. (in progress).

Canadian Institute of Planner. 2011. Library. [www.planningforclimatechange.ca](http://www.planningforclimatechange.ca).

Ednie, M. and Smith, S.L. 2011. Establishment of community-based permafrost monitoring sites and initial ground thermal data, Baffin region, Nunavut. Geological Survey of Canada, Open File 6727, 7 pages 1 CD-ROM

James, T. S, Simon, K. M, Forbes, D. L, Dyke, A. S, Mate, D. J. 2011. Sea-level projections for five pilot communities of the Nunavut climate change partnership. Geological Survey of Canada, Open File 6715, 27 pages.

Irvine, M.L. 2011. Living on unstable ground: Identifying physical landscape constraints on planning and infrastructure development in Nunavut communities. Unpublished M.Sc. thesis, Department of Geography, Memorial University. 241 pp.

Irvine, M.L., Smith, I.R. and Bell, T. in progress. Surficial, periglacial, and landscape hazard maps for Clyde River, Nunavut. Geological Survey of Canada, Open File.

Ittaq. 2011. Clyde River Climate Change Adaptation Project. [www.ittaq.ca](http://www.ittaq.ca).

LeBlanc, A.-M., Allard, M., Carbonneau, A.-S, Oldenborger, G., L'Hérault, E., Sladen, W., Pascale, G., and Mate, D. 2010. Assessing permafrost conditions in support of climate change adaptation in Pangnirtung, Nunavut. Conference paper and oral presentation, Sixth Canadian Permafrost Conference, Calgary, Alberta, 1242-1250.

LeBlanc, A.-M., Allard, M., Carbonneau, A.-S, Oldenborger, G., L'Hérault, E., Sladen, W., Pascale, G., and Mate, D. 2011. Assessing permafrost conditions

and landscape hazards in support of climate change adaptation in Pangnirtung. Geological Survey of Canada Open File, in progress.

Natural Resources Canada. 2010. Partnership Helps Nunavut Communities Adapt to Climate Change. Natural Elements Newsletter, Issue 49, July 2010, online <http://www.nrcan-rncan.gc.ca/com/elements/issues/49/panpcn-eng.php>.

Nunavut Economic Forum. 2010. Nunavut Economic Outlook: Nunavut's Second Chance. 79 pages.

Oldenborger, G. A. 2010. Electrical geophysics applied to assessing permafrost conditions in Pangnirtung, Nunavut. Geological Survey of Canada, Open File 6725, 41 pages.

Sladen, W. E. 2011. Permafrost. Geological Survey of Canada, Open File 6724, 1 sheet.

Smith, I.R., Irvine, M.L., Allard, M. in progress. Shallow permafrost coring investigations, Clyde River, Nunavut. Geological Survey of Canada, Open File.

Smith, I.R., Bell, T., Forbes, D., Irvine, M.L.(and others...) in progress. Protocols for undertaking landscape hazard assessments in Nunavut communities. Geological Survey of Canada, Open File.

Terminology of Climate Change. 2005. Published by Government of Nunavut and Nunavut Tunngavik Incorporated, <http://www.tunngavik.com/documents/publications/2008-00-00%20Terminology%20on%20Climate%20Change.pdf>

University of British Columbia. 2011. Collaborative for Advanced Landscape Planning, <http://www.calp.forestry.ubc.ca/>.

## Appendices

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Appendix A - *Nunavut Climate Change Workshop – Adaptation Action in Arctic Communities* Workshop Report

Appendix B - Posters and Background Material

Appendix C - Nunavut Climate Change Partnership Workshop February 15-16 presentations.