

Final Report on FCM Municipal Infrastructure Risk Project: Adapting to Climate Change

Submitted to the Adaptation Liaison Office,
Natural Resources Canada

Climate Change Action Fund (CCAF) project **A316**

March 2002

Citation:

Federation of Canadian Municipalities (2002): Final report on Federation of Canadian Municipalities municipal infrastructure risk project: adapting to climate change; report prepared for the Climate Change Action Fund, Natural Resources Canada, 29 p.

Final Report on FCM Municipal Infrastructure Risk Project: Adapting to Climate Change

Executive Summary

The overall goal of this project was to raise awareness with six pilot municipal governments of six probable climate change impacts that would increase the vulnerability of their communities. One of the key objectives was to facilitate interaction between municipal staff and researchers working on science-based regional climate change projects. The principal investigators selected the six pilot communities, six associated climatic impacts, and six research partners listed below:

1. Sea level rise (Charlottetown, PEI, Environment Canada, Atlantic Region and GSC-Atlantic Region)
2. Drought and water availability (Swift Current, SK, GSC-Ottawa, and University of Regina)
3. Groundwater (United Counties of Stormont, Dundas and Glengarry, neighbouring United Counties of Prescott-Russell, ON, and the University of Ottawa)
4. Flood response and landslides (La Baie, QC and GSC-Ste-Foy)
5. Permafrost change (Norman Wells, NT and GSC-Ottawa)
6. Forest fires (Hinton, AB and Canadian Forest Service-Edmonton)

One of the major objectives was to conduct a survey with 5-7 stakeholders in each pilot community. The following are the major highlights:

Infrastructure decisions are recommended by staff and presented to Council, however Council makes a final decision and directs priorities. This has caused some municipal staff difficulties with following their long-term infrastructure plans and in at least one community, it has meant developing a short term plan (1 to 3 years) to be more in line with the Council' s three-year term. Other staff have had trouble having their Councils approve longer-term infrastructure plans.

All of the pilot communities are facing financial barriers with respect to investment in infrastructure. Attitudinal barriers are also prevalent from the public and Council. These barriers include the lack of awareness about how climate change impacts will affect the cost of infrastructure.

Most interviewees were uncomfortable or unfamiliar with the concept of risk management. None of the pilot communities had a formal risk management system in place except for two communities that had systems limited to one hazard (fire).

Historical information was most often cited as the tool used to determine risks to infrastructure and only one interviewee from a provincial agency mentioned using future climate predictions to estimate risks to infrastructure.

Although there are no formal systems in place, there are a variety of measures underway to reduce risk including proposals to the new Infrastructure Canada program, development of emergency preparedness plans, annual inspections, improving GIS capacity, technical evaluations, and gathering information from stakeholders.

Monitoring and measuring results proved to be another weak area with no systematic method of evaluating decisions taken with respect to managing hazards.

The other major findings were with respect to selecting communities most likely to be successful in achieving increased awareness and capacity to respond to climate change impacts.

The pilot communities that were most successful or have the greatest potential for success were those with the following conditions in place:

- Relationship of trust between the municipal staff/elected official and the project leader and/or the research partner;
- A mechanism in place to ensure constant and regular communication between the municipal staff and the research partner;
- The research partner having committed funding and carrying out research that can directly assist the municipality;
- The climate change impact being a high priority in the community and other programs or research being in place to support addressing this priority;
- The local conditions of the community (economic conditions, political situation, etc...) taken into account when planning project activities such as presentations;
- Regular communication taking place between the project leader and municipal staff;
- Commitment from Municipal Council to the municipal government's participation in the project with a clear understanding of the resources that need to be committed;
- Tangible benefits to the municipality being in place (i.e. potential funding for database development and from the Sustainable Communities Initiative).
- Need for principle investigators to gain first-hand knowledge of the community through travel and face-to-face meetings.
- Local research partner maintaining regular communication with the municipal staff contact.

FCM's most important role proved to be as a facilitator to create the forum for the interaction between the research community and the municipal staff and also as a voice of credibility given its role in representing the interests of its municipal membership.

The last key conclusion was that raising climate change awareness is a long-term undertaking. The 10-month project time span needed to be extended to 12 months given the slower pace at which some activity took place because of local circumstances in the municipal governments. Local conditions regarding political, economic, and human resource circumstances played a part in changing the delivery dates of the project activities. If these local conditions had not been respected, the project would not have been effective.

SECTION 1: INTRODUCTION

Municipal government is the order of government closest to citizens' daily lives. Canada's 4,000 municipal governments have a direct influence upon the environmental, economic, and social factors that define the quality of community life. In managing community assets and providing community services, municipal governments spent more than \$45 billion in 2000, accounting for 10 per cent of all government spending. Capital spending by municipal governments is expected to top \$8.3 billion in 2001, accounting for over 50 per cent of all public investment this year. Municipal infrastructure is aging and tens of billions more need to be spent to ensure safe drinking water, sewage treatment and public transit.

In 2000, the Government of Canada responded to FCM's calls for renewed infrastructure funding by committing \$2.05 billion over six years to a new national infrastructure program and by establishing the Green Municipal Funds. Both programs emphasize green infrastructure, with the latter profiling high levels of performance improvement and innovation by demonstrating new technologies and processes. The aim is to establish, over time, these new approaches as standard operating practices thereby increasing overall environmental performance of municipal infrastructure.

In addition, FCM, in partnership with the National Research Council of Canada (NRC), is committed to facilitating the improvement of community infrastructure through the development of a national guide to sustainable municipal infrastructure. With funding support from the Infrastructure Program, work on the guide is underway to identify best practices in decision-making and proven technology for infrastructure construction, maintenance, and rehabilitation.

With these positive first steps, FCM launched the *Municipal Infrastructure Risk project: Adapting to Climate Change* to complement FCM initiatives on infrastructure and climate protection.

1. 1 Goal

The Infrastructure Risk project's goal is to help municipal governments assess the vulnerability of their communities, specifically municipal infrastructure, to current and potential future climate risks and natural hazards.

1. 2 Objectives

The key objective of year one of the project was to design and complete the foundation work (six tasks as outlined in section 2) necessary to develop case studies of the six pilot communities in year two. Part of the foundation work included facilitating interaction between municipal staff and researchers working on science-based regional climate change projects.

1. 3 Principle investigators and affiliations

Project leader

Azzah Jeena, Department of Sustainable Communities and Environmental Policy, Federation of Canadian Municipalities (also interviewer in Charlottetown and Norman Wells)

Co-principle investigator and funding liaison

Dr. Don Lemmen, Adaptation Liaison Office, Natural Resources Canada (NRCan)

Key partner

Jean-Claude Henein and André Prigent, Sustainable Communities Initiative, NRCan.

Municipal partners

Denis Coulombe, Ville de la Baie

Don Poole, City of Charlottetown

Mayor Risvold, Town of Hinton

Alec Simpson, Town of Norman Wells

Dan Knutson, City of Swift Current

Pierre Mercier, United Counties of Prescott-Russell (Eastern Ontario)

John Meek, United Counties of Stormont, Dundas, and Glengarry (Eastern Ontario)

Scientific partners (Researchers)

Adam Wellstead, Canadian Forest Service

Martha McCulloch, Environment Canada-Atlantic Region and Don Forbes, GSC

Stephen Wolfe, GSC-Ottawa (initially), then role assumed by David Gauthier and David Sauchyn of the University of Regina

Didier Perret, GSC-Ste-Foy

Philippe Crabbe, University of Ottawa

Consultants involved with survey instrument and interviews

Mark Egener, Bob Masters and Diana Dominique, GCSI (Global Change Strategies International)

Adam Wellstead, PhD candidate, University of Alberta

Dr. Roger Needham, Department of Geography, University of Ottawa

Advisory Committee

Dr. Jim Bruce, Global Change Strategies International

Paul Kovacs, Institute for Catastrophic Loss Reduction

Dr. Guy Felio, National Research Council

Paul Egginton, Natural Resources Canada

Dr. Christopher Tucker, Office of Critical Infrastructure Protection and Emergency Preparedness

Start date July 2, 2000

Completion date June 30, 2001

1.4 Preparatory work and methodology

The methodology established for the project was to identify six different climate change impacts in six pilot municipal governments.

To increase awareness and provide resources for the municipal staff, six researchers were chosen to work with their respective municipal partners. These six researchers would then also have the opportunity to interact with municipal colleagues and learn more about the needs in the municipal sector.

Choosing the partners

The development of the proposal involved careful consideration of the pilot communities and researchers who would be involved in the Municipal Infrastructure Risk project.

Six pilot communities were chosen based on the following criteria:

- 1) Existing relationships with FCM (e.g. FCM members, members of FCM's Board of Directors)
- 2) Existing relationship with Geological Survey of Canada (GSC) researchers or other researchers carrying out climate change related projects
- 3) Regional representation

Below is a description of each of the six pilot communities:

La Baie, QC: The Town of La Baie is comprised of 21, 400 inhabitants in the Saguenay-Lac-St-Jean area. Most of the municipality is rural with a small urbanized section. The rural part is comprised largely of forest and agriculture and the urban section is INSERT MORE INFORMATION.

Charlottetown, P.E.I.: City of Charlottetown, PEI: Charlottetown is the capital city of P.E.I with a population of 57, 000 that has three rivers meeting in its harbour. Most of the population is employed in clerical, services, administrative and sales occupations through its retail, services and hospitality industry. Its waterfront area contains a lot of important infrastructure such as Victoria Park, Canadian Coast Guard base, commercial area, shops, marine, yacht club, board walk and private residences.

Eastern Ontario, ON: The United Counties of Prescott-Russell and the United Counties of Stormont, Dundas and Glengarry are both rural municipalities with a primarily agricultural focus. Populations are 74, 000 and 106, 000 respectively. Their territories cover the South Nation River and Raisin Region watershed, and are adjacent to Ottawa.

Hinton, AB: Hinton is a community of 10, 000 located at the Western end of the Foothills Forest in west-central Alberta. It is home to a large pulp mill and saw mill. Hinton is located near the Jasper National Park, and provincial parks. Consequently, Hinton is a service centre for tourism, recreation and many outlying communities.

Norman Wells, NWT: Norman Wells has a population of 8,00. It is located on the east bank of the Mackenzie River, 145 km south of the Arctic Circle. Norman Wells, unlike other settlements in the Mackenzie River valley, was the first town

to be established entirely as a result of the development of non-renewable resources. Norman Wells serves as a regional center for the Sahtu area.

An oil refinery has operated in the community since 1932 and a pipeline was built from Norman Wells to Zama, Alberta in the early 80s. The population of 800 is closely linked to the economic health of the oil industry. The Geological Survey of Canada has a long history of research in the area.

Swift Current, SK: Swift Current is a city of 16,800 people located in the South West corner of Saskatchewan. Swift Current is on the Trans Canada highway and also on the CPR's transcontinental mainline. It is 160 km north of the US border, 250 km (150 mi.) west of Regina and 160 km (100 mi.) east of the Alberta border. The traditional trading area is the south west corner of the province, which includes approximately 45,000 people. Agriculture is the primary driver of the economy, however there are also significant oil and gas fields which provide the local economy with a large boost.

Six researchers were chosen based on the following criteria:

- 1) Access to funds for regional climate change science or policy projects (e.g. CCAF, Social Sciences Humanities and Research Council (SSHRC))
- 2) Knowledge and experience with working with communities and/or municipal governments
- 3) Research expertise with the climatic impacts identified in the project

Choosing the climate change impact

A climate change impact was identified in each community based on the following:

- 1) After reading documents such as the Canada Country Study, and by-laws and official plans from the proposed municipal governments;
- 2) Input from the researchers; and
- 3) Input from the municipal staff contact.

SECTION 2: SIX TASKS FOR YEAR ONE WORK

This section is divided into the activities leading up to and including the six tasks set out in the proposal to the Climate Change Action Fund- Science, Impacts and Adaptation for FCM's Municipal Infrastructure Risk project: Adapting to Climate Change.

Task One: Organizing a national meeting with municipal participants from the six pilot communities and key research partners.

The following objectives were established for the first national meeting.

- A) Networking among municipal representatives and researchers;
- B) Information exchange:
 - purpose of FCM's Municipal Infrastructure Risk project;
 - research projects on climate impacts (permafrost change in Norman Wells, NT; sea level rise in Charlottetown, PEI; groundwater levels in Eastern Ontario; flood response and landslides in La Baie, Quebec; and increased forest fires in Hinton, AB);
 - brief municipal representatives on projected climate change impacts.
- C) Explore the role of the municipality in identifying infrastructure risk and possible responses;
- D) Develop work plan and next steps;
- E) Establish priorities and assign tasks; and
- F) Establish a timeline for the FCM project appropriate to each community.

Participants were sent an information package containing the following a month prior to the September meeting:

- 1) a PowerPoint presentation providing an overview of the Municipal Infrastructure Risk project, climate change science, and potential impacts of climate change;
- 2) *The State of Municipal Infrastructure in Canada*, FCM and McGill University;
- 3) *Municipal Risks Assessment: Investigation of the Potential Municipal Impacts and Adaptation Measures Envisioned as a Result of Climate Change*, a report for the National Secretariat on Climate Change, Municipalities Table, prepared by GCSI
- 4) *Sensitivities to Climate Change in Canada*, Natural Resources Canada
- 5) A memo from Beth Lavender, NRCan regarding posters describing the impacts, on a regional level, of climate change in Canada.

This meeting was a success in terms of participation, information exchange, and networking. All targeted stakeholders attended except for representatives from two municipal governments.

Information exchange on the first day included: information on FCM and the service offerings of the department; information on climate change impacts and

the potential risk to infrastructure; the National Technical Guide to Sustainable Municipal Infrastructure; information on the goals and objectives of the Municipal Infrastructure Risk project; information on the Sustainable Communities Initiative of NRCan and finally presentations from each municipal staff representative and their research counterpart. (See Annex X for full agenda and list of participants).

Networking was fostered on the second day of the meeting which involved the municipal staff and researchers working together in small groups divided by region. The groups were provided with a list of questions to answer and their task was to produce a report of the informational and communication needs of the participants.

Copies of all the presentations are available from the FCM office. Thirty-five people were in attendance including the following:

1) Municipal staff from four of the six pilot municipal governments. One municipal government representative was unable to attend because of staff turnover. Also, it was not possible to find a bilingual representative from the Town of La Baie, so the Town sent the research partner (Geological Survey of Canada from the Ste-Foy Office) as its representative.

2) Researchers/scientists: This group was chosen based on their regional research projects and interests in climate change impacts identified as priorities in each of the six communities. Scientists working in Charlottetown and Norman Wells (from Environment Canada and the Geological Survey of Canada) had received funding from CCAF-SIA to work on regional climate change research. The University of Ottawa (working with Eastern Ontario) had received funding from the Social Sciences Humanities and Research Council (SSHRC) for a project on climate change and water in Eastern Ontario. Three Geological Survey of Canada researchers were also in attendance.

3) Representatives from three different provincial governments: P.E.I., Alberta and Ontario

4) Representative from the Insurance Bureau of Canada.

5) Representatives from the Sustainable Communities Initiative, NRCan, one of the key project partners.

6) Two FCM Board members (municipal councilors)

Objectives related to information exchange, networking and exploring the municipal role in identifying infrastructure risk and possible responses were successfully met. The second day was to be used for stimulating interaction between the researchers/scientists and the municipal staff by having them work

in six small groups focused on climate change impacts in the six communities. However, time was too limited to fully establish the work plans, priorities and time lines though some very useful information was gained from the sessions. The reports from the sessions are attached as Annex X. Reports are available from four of the six municipal governments since there were no municipal staff representatives from either La Baie or from Norman Wells.

Each working group was asked to respond to a series of questions related to each of the six tasks identified in the project. Each working group varied in size. Compositions of groups are detailed below:

Eastern Ontario:

John Meek
S.D.&G. Project Manager
United Counties of Stormont,
Dundas and Glengarry

Emergency Measures, Community
Services,
Inspections and Planning
Government of P.E.I.

Pierre Mercier
Director of Planning
United Counties of Prescott-Russell

Martha McCulloch
Manager
Maritime Weather Centre
Environment Canada

Michel Robin
Professor, Department of Earth
Sciences
University of Ottawa

Kelly MacDonald
Environmental Economics Analyst
Environment Canada

Daniel Lagarec
Professor, Department of Geography

Donald L Forbes
Research Scientist
Geological Survey of Canada-
Atlantic
Natural Resources Canada

Philippe Crabbé
Department of Economics

Swift Current:

Charlottetown:

Don Poole
Planner
City of Charlottetown

Dan Knutson
Engineering Assistant
Engineering Department
City of Swift Current

David E Campbell
Project Manager

Donald Lemmen
Acting Chief – Hazards and
Environmental Geology
Geological Survey of Canada
Natural Resources Canada

Hinton:

Kenneth J. Brands
Fire Chief
Town of Hinton

Adam Wellstead

Forest Social Scientist
Canadian Forest Service

Cordy Tymstra
Forester
Fire, Science and Technology
Government of Alberta

The group provided a written report of their joint answers. Below are some of the questions asked to each group and their insights:

Who should be targeted for presentations in your community on projected climate change impacts?

This question revealed interesting insights. FCM had budgeted funds to make one presentation to municipal council and staff. All four groups named stakeholders beyond town/city staff and municipal council. Two of the groups mentioned provincial and federal government agencies. All mentioned including local non-governmental organizations in the briefing.

This reveals the need for climate change awareness briefings across various sections in the community.

What types of information would be of value in these presentations?

There were many layers of information that staff were interested in having discussed and presented. The Swift Current group stated that one presentation would not be enough and suggested that a local, credible organization associated with climate change issues would be ideal for delivering subsequent presentations.

The FCM presentation was noted as a good first step at delivering information but the responses clearly demonstrated the need for a series of presentations and/or workshops.

All groups were interested in knowing more about potential local impacts. Hinton and Charlottetown groups asked for specific adaptive strategies and were interested in the socio-economic impacts of climate change. Hinton and Eastern Ontario asked for a link to be made between the Infrastructure Risk project and other ongoing studies. Eastern Ontario municipalities had a good working relationship with the other organizations carrying out climate related research. The presentation to Council touched on all three ongoing projects and their commonalities and differences.

Some groups asked for very specific information that would have only been able to be delivered in subsequent workshops and with different partners.

For example, Swift Current indicated a need to discuss water allocation issues with PFRA and SaskWater; Eastern Ontario wanted a session reporting on results from EOWRMS (a provincially-funded study looking at water and climate change); and Charlottetown wanted a session on how new imagery and hazard mapping from an Environment Canada study would be integrated with the city's information system.

The next questions dealt with the SCI initiative of NRCan:

Is this initiative of interest to your municipality? If yes, can a staff member be appointed to work with the SCI to identify software and GIS needs?

All groups answered yes to the question but two municipal governments did not apply to the program. Heavy workloads prevented the municipal governments from taking on another project.

What is your community's present capacity with respect to utilizing GIS data for information and planning?

There was a mix of responses to this question with some municipal governments having no or very limited GIS capacity and others having excellent GIS capacity.

What relevant databases does your community possess, and what gaps need to be addressed to help the municipality improve decision-making?

All groups stated that improving decision-making was a basis for their proposals to SCI.

Who should be interviewed?

Who is involved in decision-making related to infrastructure?

All reports, except for one, provided a long list of not only staff and Council, but also named stakeholders such as provincial and federal governments, hospitals, school boards, agricultural and industry representatives, conservation authorities and so on.

With the time and financial budgets allocated for this project, it would not have been possible to interview stakeholders beyond the five to seven respondents comprised of seven staff and Council. Where possible, provincial stakeholders were interviewed.

It would have been valuable, had the resources been available, to understand the perspective of decision makers outside of staff and Council in order to have an integrated view of the way decisions are made.

Informally, the project leader met or spoke informally with some of these other stakeholders in order to gain more information. For example, meetings with PFRA (Prairie Farm Rehabilitation Administration) and Sask Water were set up while the investigators visited Swift Current for the Council presentation. While in Charlottetown, one of the principle investigators met with the CADC (Charlottetown Area Development Corporation) given that the CADC owns much of the waterfront property that has been affected by recent storm surges.

What type of information is used to make decisions related to infrastructure? What sources of information are used?

The responses in this area were very weak. One group could not answer, another reported that the Official Plan and bylaws were used, the third reported that mainly consultants' reports and reports from the Ontario Clean Water Agency were the basis for decisions and the last mentioned that decision-making was largely reactionary at present.

Is climate data presently incorporated into decision-making? How?

Climate data was reported as not being used in Hinton. In Charlottetown it was used in order to determine setback requirements to shoreline (except for downtown waterfront). In Swift Current it is used to prevent freezing of pipes and stormwater overflow; and in Eastern Ontario historic data is used for winter road maintenance.

What is the present level of communication between the municipal government and the research community (provincial / federal government, universities, other research organizations)?

Swift Current reported that there was a good rapport between the City, PFRA and Sask Water. In Eastern Ontario, an ongoing project funded by the provincial government examining water resources in the area was reported to have improved communication. It was expected that the FCM project and an ongoing project, the Community-University Research Alliance funded by the Social Sciences Humanities and Research Council (SSHRC), was going to provide a mechanism for on-going communications.

In Hinton, there was no regular communication but participants felt there was great potential for this communication to take place. In Charlottetown, there was prior contact between researchers and municipal staff but it had been infrequent.

What is the most appropriate mechanism to enhance communication between the municipal government and the research community?

In half the groups, it was proposed that they needed regular face-to-face meetings and perhaps a working group. Eastern Ontario proposed a partnership and data sharing between sectors.

As a municipal government representative, do you have specific information needs that can be answered by the research community?

Every group agreed that there were informational needs. However, only Charlottetown specifically identified the following needs: socio-economic impacts, data analysis, and ecosystem analysis.

As a local researcher, what information, communication and/or processes are needed to facilitate closer collaboration with municipal governments?

Answers in this category were vague except for in Swift Current. The researchers in the Swift Current group indicated that they needed a point of contact within the municipal government. The researchers from the Charlottetown group indicated a need for modest ongoing funding for monitoring.

What are your recommendations for priority actions by:

- i) your community/municipality
 - ii) researchers
 - iii) Federation of Canadian Municipalities
 - iv) Natural Resources Canada / SCI
-
- i) Eastern Ontario stated that they would work with FCM and CURA to develop a presentation to Council (this was completed). Charlottetown proposed to set up a working group (this was not completed). Swift Current committed to appoint another staff person to take the lead with the SCI task. Another staff person was appointed, however, the appointed staff person did not have sufficient time to prepare a proposal.
 - ii) In Eastern Ontario, the current priority for the researchers was to obtain funding to develop a groundwater model; in Hinton it was to help resolve data issues, mentoring, training, and technology transfer; in Charlottetown, it was to set up a working group; and in Swift Current it

was to establish a core group of researchers from University of Regina, NRCan and PFRA (this has not been done to date).

The responses indicated that there was interest in pursuing a more formal relationship among different sectors but there was either no time or funds to pursue it.

The roles suggested for FCM were the following:

- help with database funding (task four) and to coordinate with local agencies before the presentation to Council.

The roles for SCI were the following:

- to provide feedback to municipal staff on proposals to SCI and to share data among partners.

Subsequent meetings between the municipal staff and researchers/scientists locally would have been a better venue to discuss work plans and priorities and would have allowed for subsequent interaction between the municipal staff contact and the researcher. In some cases, such as Eastern Ontario where the municipal staff contacts and the University of Ottawa (research partner) already had a longstanding relationship, there were many meetings that took place between the two groups given that this was part of the funding agreement between the University of Ottawa and its funder, the Social Sciences Humanities and Research Council.

Task 2: Prepare presentations to Council and staff on projected regional climate change impacts and seek support acting on the results on the FCM project work.

Presentations were made in all six pilot communities participating in the project. Input was sought from the municipal staff representative in each community as to the concerns of the councillors, contentious issues in the community, and any other factors that would help make the presentation relevant to the community.

Based on experiences drawn from a longstanding FCM program in climate protection, the format proposed for the Council presentation was joint presentations from a municipal councillor informed about climate change issues and a researcher/scientist from the region. The peer teaching approach of having a councillor speak to other councillors has proven to be very effective in past FCM presentations.

This format worked extremely well and provided both political and scientific points of view to be conveyed to the councilors and staff.

La Baie was the only community where the research partner was unable to attend and provide information on the projected regional impacts in the area. There was a student from GSC in attendance but his presentation was focused on explaining the contents of the CD-ROM GSC was developing as part of Task 4 (developing databases).

From the political standpoint, the messages conveyed were:

- 1) the link between sustainable community development and climate change;
- 2) the purpose and objectives of the Infrastructure Risk project;
- 3) the link between the Infrastructure Risk project and the rest of the programming in FCM's Department of Sustainable Communities and Environmental Policy;
- 4) the importance of taking steps now to adapt to climate change; and
- 5) the importance of including climate information in municipal decision-making, especially with regards to infrastructure.

In Eastern Ontario, Hinton, La Baie, and Norman Wells, the presentations were made as part of regular Council meetings. In Swift Current and Charlottetown, special meetings were called with broader participation from staff. In Swift Current, the Mayor, Director of Economic Development, Director of Parks and Recreation, City Engineer, and Engineering assistant, and two municipal councilors were in attendance. The presentation included a short talk from the Saskatchewan Research Council that was also carrying out a research project on climate change and municipalities. In Charlottetown, the meeting was called to an opening by the Provincial Minister of Environment and Fisheries, and attended by various representatives from federal and provincial departments as well as the President of the Association of Municipalities of PEI.

In each community, either the principal investigators or the interviewers had in-depth knowledge of the local context which enriched the quality of the presentations. For example, presentations to Council and interviews in Hinton were delayed to the end of the project. The Mayor of Hinton informed FCM that there were major economic problems in Hinton for most of the project duration. Not taking this into consideration would have lessened the impact of both the presentation to Council and the information gathering process with the interviewees.

The feedback we received from municipal staff involved with the project was that it would be premature to seek support for the results of FCM's work during the

presentations to Council but that this was an activity that could be organized in the future.

3. Set up appropriate computers and associated GIS software in communities and provide training. (NRCan)

Objectives met:

This was a task assigned to the Sustainable Communities Initiative (SCI) of NRCan, with FCM facilitating assistance with the municipal staff where needed. Hinton, Eastern Ontario and Norman Wells applied for SCI funding. Hinton and Eastern Ontario are expected to receive funding by October 2001.

FCM set up a conference call in February 2001 with municipal staff from the City of Swift Current, FCM, NRCan, SCI, and the University of Regina to facilitate the development of a proposal to SCI. The conversation was fruitful and the final decision was that the city staff person would develop a proposal for SCI. No proposal has yet been sent due to heavy workloads.

Objectives partially met/not met:

The proposal from Norman Wells did not meet the basic requirements of SCI. It was decided that with some mentoring from a GSC researcher that the Town would be able to re-apply with a purpose more complementary to the SCI objectives.

SCI representatives traveled to Charlottetown in May 2001 to meet with municipal and provincial government representatives interested in pursuing a SCI grant. The meeting was successful and the next step was to wait for a GSC-CCAF funded research report to be released by Environment Canada-Atlantic Region so that all information was available to make a decision on the content of the SCI proposal.

It was identified early on in the process that the Town of La Baie would not qualify for funding because of its existing strength in GIS.

A full report of SCI's activities is attached as Annex X.

4. Develop appropriate databases specific to the identified impact for each community to facilitate community-based decisions on climate change impacts/adaptation (NRCan).

Each research partner was to provide a proposal to FCM to develop additional databases for the community. In two cases when the research partner was not

interested in developing the database, the municipal partner applied for the funding. The principle criteria for funding was that the product proposed be useful to the municipal government and improve its decision-making.

Objectives met:

Every research partner/pilot municipality applied for funding to produce a useful product for the municipal partner.

Objectives partially met/not met:

There were delays experienced with some researchers because initial proposals did not meet the criteria for receiving the database funding. These delays have had an impact on the deliverable of products.

In one case (Swift Current), a considerable delay was experienced due to the University of Regina needing data from the City and the City being unable to assist during a very busy period.

Below is the list of communities, the proposed product, and the anticipated date for the finished product.

Community/Research Partner	Product	Anticipated date
Charlottetown/ Environment Canada (Atlantic Region)	Partial funding of a socio-economic analysis of the impacts of sea level rise and climate change	Draft received at the FCM office in Sept. 2001; product currently being edited.
Swift Current/ University of Regina	Databases of existing runoff for a drainage basin and databases of predicted runoff model	March 2002
Eastern Ontario/University of Ottawa	Database to address flooding issues and mapping for water/wastewater infrastructure	Maps received.
La Baie/Geological Survey of Canada	CD-ROM integrating geographic and geoscientific information	CD-ROM received.
Norman Wells/Geological Survey of Canada	Partial funding for a searchable digital database of all known boreholes	Final version of CD-ROM is under final revision at NRCan. Date to be released

		unknown.
Hinton/Canadian Forest Service	Satellite images and air photos to help identify high risk urban wildlife areas in Hinton and surrounding areas	Photos and images completed.

Products are available from FCM's office.

5. Design interview questions and conduct interviews with municipal leaders, engineering, planning, emergency preparedness and other staff to assess adaptation to current climate conditions and community vulnerability to climate change.

Objectives met:

Interview questions were designed by Mark Egener of Global Change Strategies International Inc. (GCSI) with input from Roger Needham of the University of Ottawa and FCM. Interviews were conducted in all six pilot communities. Staff from four communities were interviewed in person and staff from the other two communities were interviewed over the phone. Interviewees were selected with input from the principle municipal contact and research partner identified in each community.

In Eastern Ontario, interviewees were enthusiastic to share their opinions on infrastructure investment. This could have been partially due to the longstanding relationship between the interviewer and interviewees.

Objectives partially met/not met:

The quality of the information from the respondents could have been enhanced had the same interviewer been used to interview all staff. In practical terms, this was not feasible with the short time frame of the project. Also, using one person to do all of the interviews would have meant that interviewers who had in-depth knowledge in one community would not have been able to use this background information in a specific community. Face-to-face interviews in all communities also would have ensured more in-depth information, but this was impeded due to the project's short time frame.

The depth of information gathered from the interviewees also depended on the general interest in climate change and climate impacts within the community. This level of interest varied in each community and at least one interviewer reported difficulty in obtaining information from the interviewees because they seemed disinterested in the subject.

The key factors in successful interviews were: 1) the level of awareness in the community about the issue, and 2) its familiarity with the interviewer. Roger Needham from the University of Ottawa reported that his interviewees were forthcoming with information and did not have to be prompted to share their perspectives. On the other hand, an interviewer from the Canadian Forest Service, reported that the interest in climate change was not very high in the community and that it was difficult to obtain rich information from the stakeholders.

Stakeholders within the private and public sector that influence municipal decision-making or have the capacity to improve or implement municipal decisions regarding investment in infrastructure would have been included in the interviewing had there been more time and money. For example, the interviewer conducting interviews in Eastern Ontario suggested that conservation authorities be interviewed if resources were available in the future.

In Eastern Ontario, the interviews yielded very rich information from the interviewees. Highlights include the following:

- Capital investment is extremely large and this and on-going maintenance is beyond the means of rural municipalities in Eastern Ontario because their revenue is limited (only from property taxes). This large investment is necessary for all the new residential subdivisions which entail new roads, culverts, bridges, etc.
- Road maintenance is a particular problem since county roads are high capacity and high volume yet there is not enough of a budget to cover maintenance.
- Municipal staff want detailed information on climatic impacts related to specific infrastructure such as climate change and drainage culvert integrity; climate change and waste water lagoons, etc.
- Better information management is going to be needed for effective infrastructure planning and management.
- It is critical to obtain commitment from the provincial government to a specified level of transfer payments on an ongoing basis so that municipalities can undertake long term financial and infrastructure planning with some degree of certainty.
- Medium and long-term infrastructure planning has become meaningless since decision-making on infrastructure is based upon the greatest need as defined by Council.
- Municipal staff are overwhelmed with present climate change impacts and do not have the resources or time to plan for adapting or responding to future climate change impacts.

6. Create communication links between partner communities and regional research nodes. Invite community stakeholders to a series of regional climate change workshops being organized by GSC starting in March 2000.

Objectives met:

Dialogue between the regional researchers and partner communities started at the national meeting held in Ottawa in September 2000 when participants discussed questions designed to foster a better understanding of each other's informational needs. FCM organized a conference call in February 2001 to facilitate dialogue between SCI, the University of Regina and the City of Swift Current.

Objectives partially met/not met:

Due to the delayed start of the project, it was not possible to invite the municipal staff representatives to the regional climate change workshops being organized by GSC. Municipal staff contacts were however put on a distribution list and efforts were made to invite them to other workshops on climate change.

SECTION 3: RESULTS OF INTERVIEWS

Task five of the project was to design interview questions and carry out interviews in the six pilot communities. Below are the summary results of the interviews in order of the questionnaire categories. The analysis below covers five of the six communities. The analysis of the sixth community, Eastern Ontario, is documented in a report entitled ***The Informed Opinion of Municipal Officials: Infrastructure Administration, Planning and Management in Eastern Ontario***" (Annex X). The highlights of that report are documented on pages 20-21.

Section II: Identification

Responsibility with respect to infrastructure: Municipal officials in two of the municipal governments indicated that much of the infrastructure was not built by the municipality, but by the provincial government. The infrastructure is then transferred to the municipality.

Section III: How Infrastructure Decisions are made and funded

Decision-making process for investment in infrastructure and upgrading: Across all communities the common theme is that input from line staff and directors of various departments is presented to Council either directly through staff or through the Town Manager in the form of staff recommendations. Council, however, makes the final decision and directs priorities. In the Northwest Territories, the territorial government decides on the areas of priority funding for infrastructure (currently, water/sewage, solid waste, and fire protection) and will

usually fund 100% of this infrastructure if it is deemed essential for the community.

Maintenance responsibilities: In almost all cases, the municipality is responsible. A common theme across all six communities was that when maintenance entails a large job, it was usually contracted out to the private sector. When the infrastructure is provincially-owned, such as roads and special care facilities, the province is responsible. In the N.W.T, the infrastructure is initially owned by the territorial government, then transferred to the municipal government, and the municipality is ultimately responsible for infrastructure maintenance. However, the territorial government carries out annual inspections of the infrastructure and provides the municipal government with recommendations on maintenance.

Challenges and Barriers: Financial barriers were cited most often as a barrier to investment in infrastructure. Next were attitudinal barriers. There was reference made to three levels of attitudinal barriers: public, council and lack of inter-departmental co-operation. In terms of the public's attitudes, the following comments were made:

- the public is not educated enough about the true cost of infrastructure (especially water supply);
- the public in the North wants the sophistication of infrastructure offered in Canada's south;
- the influence of special interest groups on Council is high;
- there is a lack of public awareness about climate change and about how climate change impacts will affect the cost of infrastructure.

In terms of council, comments included the following:

- difficulty of persuading councillors about the vulnerability resulting from probable climate change impacts;
- the need to have Council use future predictions and not only past events as a basis for revamping design criteria;
- infrastructure decisions being based on the criteria of equalizing projects across wards and the need for "trophy projects";
- difficulty of convincing Council of the need for upgrades to infrastructure that is underground (i.e. out of sight, out of mind); and
- most councillors are willing to co-operate and have an open mind about new approaches.

Inter-departmental cooperation: There was one comment made about a greater need for co-ordination between the Works and Utility departments.

Technical: A shortage of skilled labour and high labour costs were cited as technical problems by every stakeholder interviewed in Norman Wells, NT. In

three of the other communities, technical issues were not mentioned by every interviewee, and when mentioned were not cited as the first barrier.

Standards: The National Building Code was mentioned the most often as the standard used in infrastructure design.

SECTION FOUR: RISK MANAGEMENT

This section proved to be the most difficult section for respondents to answer. The principle investigators were interested in learning whether risk management was a concept that was formally applied at the municipal level and whether climate models or predictions were used in risk management.

None of the pilot communities had a formal, integrated risk management system in place to cover all hazards. In Hinton and Charlottetown, there were formal fire hazard mitigation systems in place.

Determine hazards to infrastructure, determining their magnitude and priority of hazards and risk management estimates: In all pilot communities, historical information (flood levels, snow loads, rainfall) was most often cited as the method of determining hazards to infrastructure. One respondent from the Ministry of Public Safety discussed increasing safety margins to reduce vulnerabilities over the next century.

With this exception, looking towards future climate as a way to identify risk and vulnerability to infrastructure was not cited by any of the respondents. Visual evidence and experience were identified as the second most common method for determining hazards.

Stakeholders consulted or involved in identifying risks: With the exception of one municipal government, a multitude of stakeholders were identified from other levels of government, other departments within the municipality, local organizations and businesses and the general public.

Actions taken to reduce risk: Though there was no formal system in place, there were a variety of studies and activities in place to reduce risk. Some of these included:

- proposals to the new Infrastructure Canada program;
- development of emergency preparedness plans;
- annual infrastructure inspections and evaluations;
- creation of new committees;
- improving GIS systems;
- commissioning studies; and
- gathering information from stakeholders.

Monitoring Risk and Measuring Results: Monitoring and evaluation were the weakest areas of response in the interviews. Some interviewees reported activity, but none were systematic or formal. The exception was the stakeholder from the Quebec Ministry of Public Safety who reported that by law, certain surveillance programs had to be in place for specific infrastructure such as dams.

SECTION 5: MEDIA COVERAGE AND PRESENTATIONS

Media coverage: Media interest was considerable and three interviews took place:

- radio interview in French with SRC-Windsor and Azzah Jeena;
- radio interview with CBC Charlottetown and Councillor John Hachey of Lachine, Quebec; and
- television interview on CBC Newsworld with Councillor John Hachey.

Presentations:

- 2nd Annual Building Resilient Communities Symposium organized by the Institute for Catastrophic Loss Reduction in Toronto, ON on November 15, 2000 (presentation by Azzah Jeena, FCM)
- Dealing with Disaster: A Workshop on Extreme Events and the Assessment of Risk organized by the Institute for Catastrophic Loss Reduction in London, ON on November 24-25, 2000 (presentation by Azzah Jeena, FCM)
- FCM Standing Committee on Municipal Infrastructure, FCM Board meeting in Ottawa, ON on December 7, 2000 (presentation by Don Lemmen, GSC)
- Landscape Climate Change Impacts and Adaptation workshop organized by the Climate Change Impacts and Adaptation Research Network (C-CIARN) in Ottawa, ON on March 9, 2001 (presentation by Azzah Jeena, FCM)
- Climate Change: How Can We Adapt? 1st Annual Meeting and Workshop organized by the Canadian Climate Impacts and Adaptation Research Network - British Columbia (C-CIARN BC) on November 14, 2001 (presentation by former Mayor of Delta, Beth Johnson)

SECTION 6: OTHER FEEDBACK RECEIVED FROM STAKEHOLDERS

A municipal stakeholder in Norman Wells, N.W.T expressed satisfaction that the budget for the project included enough money for travel for the interviewees so

that face-to-face interviews could take place. The person in question felt it was very important that a visit to the community be an integral part of the project and would enhance the quality of responses to the survey questionnaire.

After every Council presentation, the Mayor and/or a councilor expressed thanks for the presentation. In the case of Prescott-Russell in Eastern Ontario, the councilor who thanked the presenters stated that he thought it was important that this type of work was being undertaken by FCM to help municipalities make better decisions.

One of the project partners at the Emergency Preparedness Office in P.E.I. was pleased that FCM was examining the issue of adaptation and wanted FCM to take a leading role in this area in terms of communicating the value of adaptation to its municipal membership.

GCSI was hired by the CCAF-PEO (Public Education and Outreach) to assess the Fund's contribution to PCP (Partners for Climate Protection), a program complementary to FCM's Municipal Infrastructure Risk project. The goal of PCP is to encourage mitigation of GHG emissions which is complementary to the Infrastructure Risk' goal of adapting to GHG emissions. One of GCSI's recommendations in their report to CCAF-PEO was that FCM should include risk management and climate change adaptation considerations in future FCM programming (Assessment of Federation of Canadian Municipalities' Education and Outreach Component of the Partners for Climate Protection Program, 2001, p.iii).

SECTION 7: PRODUCTS DEVELOPED

Community/Research Partner	Product
Charlottetown/ Environment Canada (Atlantic Region)	Partial funding of a socio-economic analysis of the impacts of sea level rise and climate change
Swift Current/ University of Regina	Databases of existing runoff for a drainage basin and databases of predicted runoff model
Eastern Ontario/University of Ottawa	Database to address flooding issues and mapping for water/wastewater infrastructure
La Baie/Geological Survey of Canada	CD-ROM integrating geographic and

	geoscientific information
Norman Wells/Geological Survey of Canada	Partial funding for a searchable digital database of all known boreholes
Hinton/Canadian Forest Service	Satellite images and air photos to help identify high risk urban wildlife areas in Hinton and surrounding areas

Descriptions of the details of each product are listed in a report attached as Annex X.

Other products include:

- Report entitled “The Informed Opinion of Municipal Officials: Infrastructure Administration, Planning and Management in Eastern Ontario” which includes responses from the survey questionnaire and analysis of the responses. This is attached as Annex X.
- Summaries of the interviews conducted in all the other pilot communities is attached as Annex X.
- Draft report on municipal by-laws research attached as Annex X.

SECTION 8: RECOMMENDATIONS AND COMMENTS

FCM Institutional and program capacity

The project was a valuable first step in understanding the barriers that exist to municipal governments adapting to climate change impacts. It also helped identify factors determining the degree of success in raising awareness at the municipal level. This knowledge will be incorporated into other FCM programs such as the Partners for Climate Protection and the National Guide on Sustainable Municipal Infrastructure.

Increasing capacity of municipal staff

The presentations to each municipal government and other communications with research partners and principal investigators resulted in an increased awareness of climate change and related impacts.

This is particularly evident in a submission to FCM’s Green Funds from the Town of Hinton. The Town of Hinton, one of the six pilot communities, has integrated its experience through the Municipal Infrastructure Risk project into another FCM program, the Green Municipal Funds. The Green Funds have accepted to fund Hinton’s construction of its new Government Centre.

Hinton's proposal takes into account both mitigation and adaptation. On the adaptation side, the Centre will reduce the risk of forest fires where urban areas meet natural forestland through the site selection and construction of the building. On the mitigation side it will demonstrate reduced energy consumption and operating costs to less than half of the Model National Energy Code requirements.

Learning from municipal stakeholders

The input from the municipal stakeholders involved in the project is key information that needs to be incorporated into future projects and distributed to government departments at the provincial and federal level that would benefit from the input.

Municipal stakeholders in Eastern Ontario, for example, brought up issues such as:

- Lack of resources for maintenance of municipal infrastructure
- Lack of access to information on the climate impact related to specific infrastructure such as climate change and drainage culvert integrity; climate change and waste water lagoons, etc.
- Better information management is needed for effective infrastructure planning and management.
- The need to have provincial government committed to a specified level of transfer payment on an ongoing basis so that municipalities can undertake long term financial and infrastructure planning with some degree of certainty.
- Municipal staff are overwhelmed with present climate change impacts and do not have the resources or time to plan for adapting or responding to future climate change impacts.

Also evident from the experience with the municipal stakeholders was the lack of human resources at the municipal level. Swift Current, for example, wanted to take part in the project's partnership with the Sustainable Communities Initiative, but was too understaffed to be able to develop a project proposal. Norman Wells could not send a municipal representative to the kick-off meeting of the project in September 2001, even though all expenses were paid, due to staff shortage.

Facilitating interaction between the scientific and municipal communities

Representatives from the scientific community and representatives from municipalities were brought together at the kick-off meeting in September 2001 for a chance to begin to dialogue. Important information on the potential for increased interaction between the research community and municipal

governments was brought to light as a result of small group work that took place on the second day of the meeting.

Selecting municipal partners

Working with smaller municipalities in this project facilitated accessing information and it also provided the potential for a partnership with SCI that works uniquely with remote and rural communities.

The United Counties of Stormont, Dundas and Glengarry and Prescott-Russell were selected primarily due to a long-standing relationship between the project manager, consultants, and the communities. However, the choice of these communities added another layer of complexity in terms of understanding the dynamics between upper-tier and lower-tier municipalities regarding responsibility and barriers related to investment in infrastructure. On the positive side, the interviews yielded rich information because of the relationship between the interviewer and the interviewees.