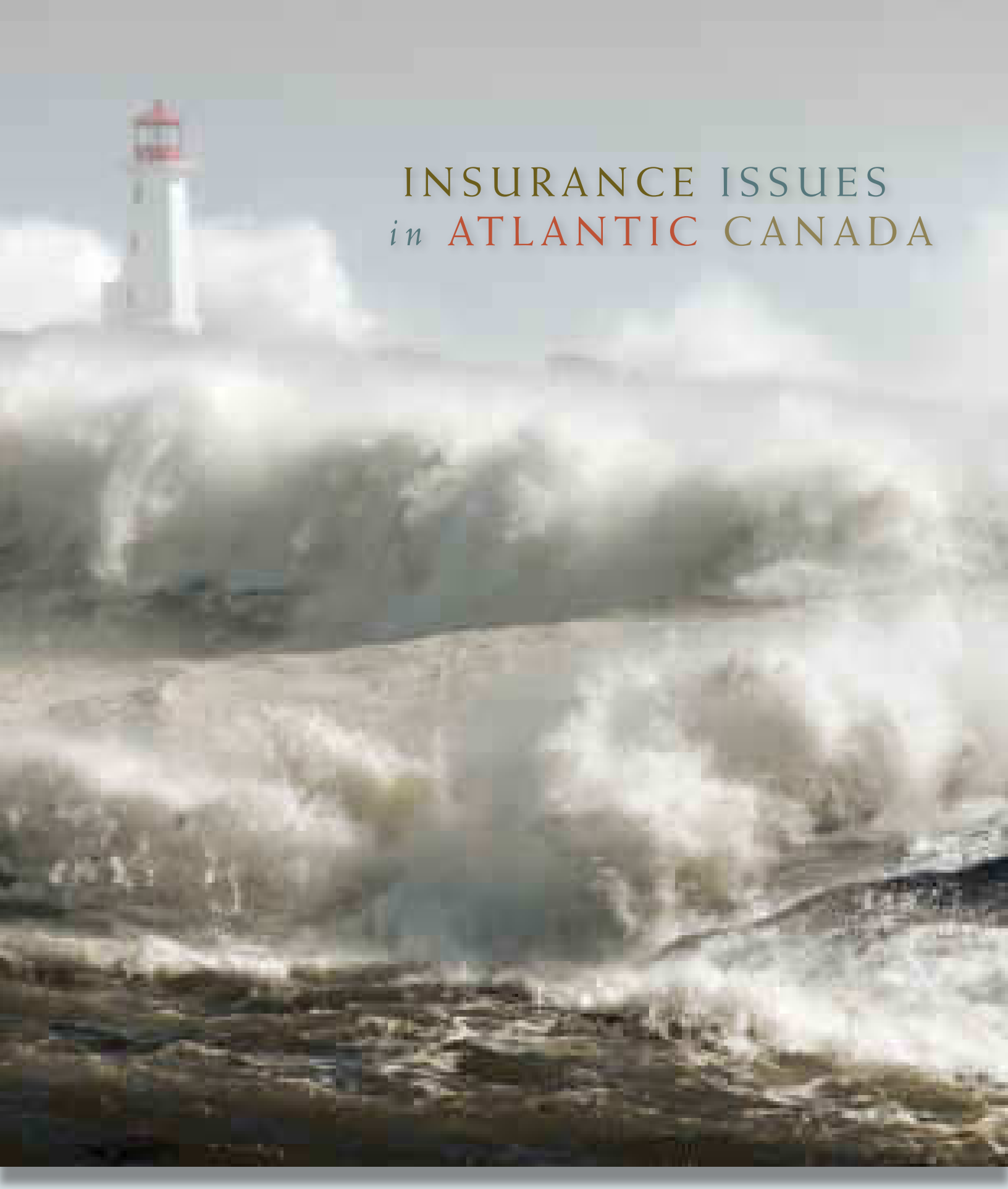

INSURANCE ISSUES *in* ATLANTIC CANADA

NOVA SCOTIA

New Nouveau Brunswick

Newfoundland Labrador

Prince Edward Island CANADA

Natural Resources Canada Ressources naturelles Canada

Canada

Bayshore Drive, Bathurst (Paul Jordan)

INSURANCE ISSUES *in* ATLANTIC CANADA

Report Prepared by: Dan Sandink, Institute for Catastrophic Loss Reduction. Dan is responsible for the development of a community level disaster resilience program, which aims to increase the capacity of municipalities in Canada to mitigate natural hazard risk. Dan has authored and co-authored several reports and articles on urban flood risk, public hazard risk perceptions, disaster risk management, and climate change adaptation. Dan has also presented his research at professional and academic conferences and has presented lectures on urban flood perceptions at the University of Western Ontario and the University of Waterloo
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ACASA is a non-profit organization formed to coordinate project management and planning for climate-change adaptation initiatives in Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador. ACASA is supported through the Regional Adaptation Collaborative, a joint undertaking between the Atlantic provinces, Natural Resources Canada, and regional municipalities and other partners.

SACCA est un organisme à but non lucratif formé pour coordonner la gestion de projet et la planification des initiatives d'adaptation au changement climatique en Nouvelle-Écosse, du Nouveau-Brunswick, Île du Prince Édouard et Terre-Neuve et soutenu par la collaboration pour l'adaptation régionale, une entreprise commune entre les provinces de l'Atlantique, Ressources naturelles Canada et municipalités régionales et d'autres partenaires.

This report is also available on the Internet at www.atlanticadaptation.ca

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INSURANCE ISSUES *in* ATLANTIC CANADA

By Dan Sandink
Institute for Catastrophic Loss Reduction

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Introduction and Background

The primary role of the insurance industry is to pay claims and to manage risk. For the industry to remain economically viable and sustainable, the prices charged for insurance coverage must reflect the risk of experiencing damages. Thus, homes and businesses that occupy areas of high risk pay more for insurance coverage than those that occupy areas of lower risk. For this reason, there is the potential that climate change impacts may affect prices charged for insurable risks. Risk-based pricing can play a role in climate change adaptation by communicating risk to policyholders through incentivizing risk reducing actions.

Many opportunities exist for governments and insurers to work on other aspects of disaster reduction and climate change adaptation, including integrating risk-reduction measures into building codes and building-related bylaws, incorporating risk reduction into existing homes, educating policyholders about disaster risk and risk reduction options, and working to identify and address infrastructure issues.

The key issue described in this paper is the role of insurance in climate change adaptation in Atlantic Canada. Specific topics include:

- Historical disasters and losses (globally, in Canada, and in Atlantic Canada)
- Climate change impacts in Atlantic Canada that will likely be important for the insurance industry
- An outline of issues surrounding insurance, hazards, and climate change
- Challenges, barriers, gaps, and needs for:
    - Water-related damages, including issues surrounding overland flood coverage for homeowners, sewer backup, small business and commercial coverage issues, and potential adaptation needs for water-related hazards
    - Wildfire-related hazards and potential adaptation needs for increased wildfire risk
    - Wind hazards and potential adaptation needs for increased wind risk

We discuss the need for new and existing homes, infrastructure, and small businesses to adapt to climate change. Also discussed in this paper are current climate change-adaptation-related projects and activities relevant to the insurance industry. We identify key linkages and resources related to climate change adaptation and insurance.

Examples of climate change adaptations for water, wildfire, and wind presented in this report are not exhaustive but are intended to give an indication of the types of risk-reduction measures that are relevant to the insurance industry.

Historical Global and Canadian Disaster Events

Insurers have recorded substantial increases in worldwide losses from natural catastrophes over the past few decades. Figure 1 displays losses from natural catastrophes from 1980 to 2010, as recorded by Munich Re, a global insurance company. World losses from natural disasters have been rising at a much greater rate than world population. Swiss Re reported that between 1970 and 1989 average yearly insurance losses for weather-related disasters were $5.1 billion (USD). However, over the last two decades, the yearly average for weather-related losses has reached $27 billion (USD). Increasing losses are associated with a number of factors, including increasing economic growth since the 1970s and greater concentrations of development in hazard-prone areas (such as coastal development in Florida).

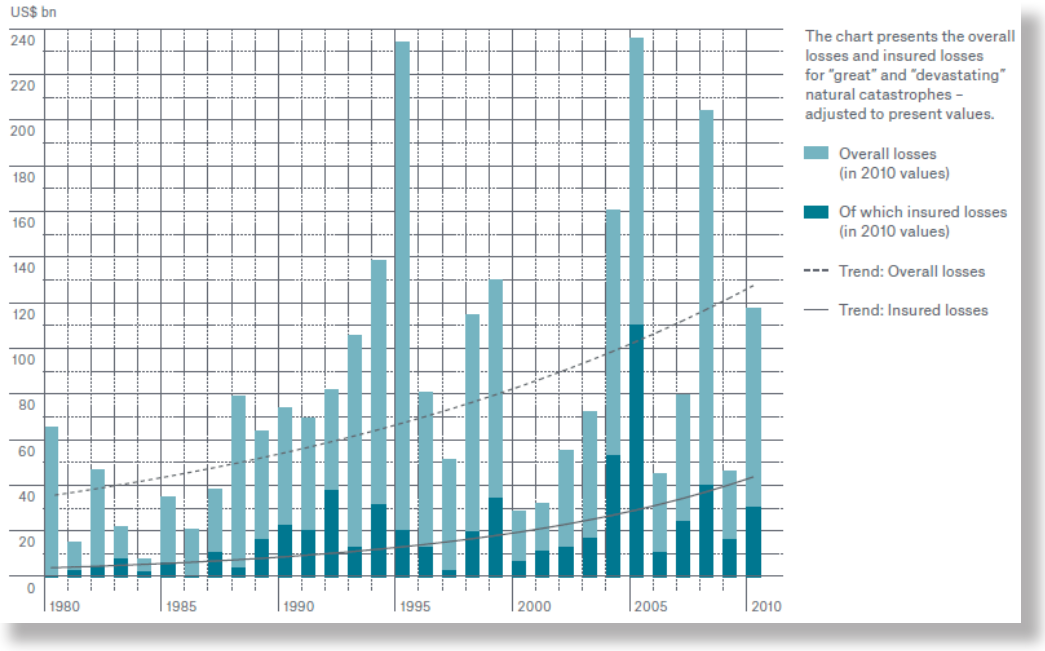

Figure 1. World losses from natural catastrophes, 1980-2010. (Munich Re 2011, 47)

Munich Re has also reported that while between 1980 and 2010 the frequency of geophysical disasters remained relatively stable, there has been a marked increase in the frequency of meteorological and hydrological disaster events globally. The global situation is reflected in Canada, where data indicate that the frequency of geophysical disasters, including tsunamis and landslides, has remained relatively stable, while the frequency of meteorological and hydrological disasters, including floods and droughts, has increased significantly over the past few decades (see Figure 2).

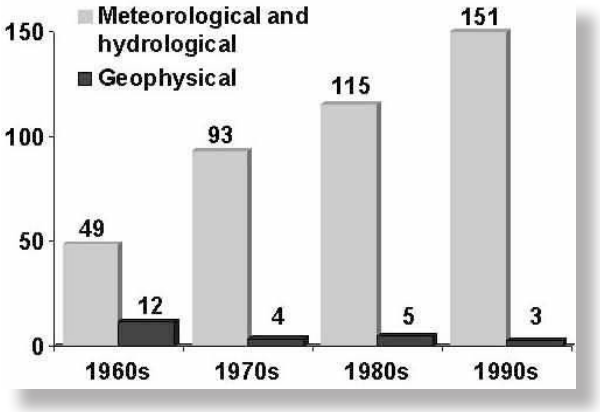

Figure 2. Meteorological and hydrological disasters versus geophysical disasters in Canada, 1960s to 1990s. (Public Safety Canada 2011a)

Historical Global and Canadian Disaster Events

Public Safety Canada (2011a) defines a "significant disaster event" as an event that meets the Emergency Management Framework for Canada (Public Safety Canada 2011b) definition of disaster and meets at least one of the following criteria: 10 or more people killed; 100 or more people affected/injured/evacuated or rendered homeless; an appeal for national or international assistance; an event of historical significance; significant damage/disruption of normal processes such that the community affected cannot recover on its own.

The Canadian Disaster Database recorded only two geophysical disasters in the Atlantic provinces between 1900 and 2005. Over the same period, more than 100 meteorological and hydrological disasters occurred in Atlantic Canada. As displayed in Figure 3, flooding has been the most common type of natural disaster, followed by hurricanes and winter storms. The experience of Atlantic Canada in this regard reflects that of the rest of Canada, where flood is the cause of the majority of disasters.

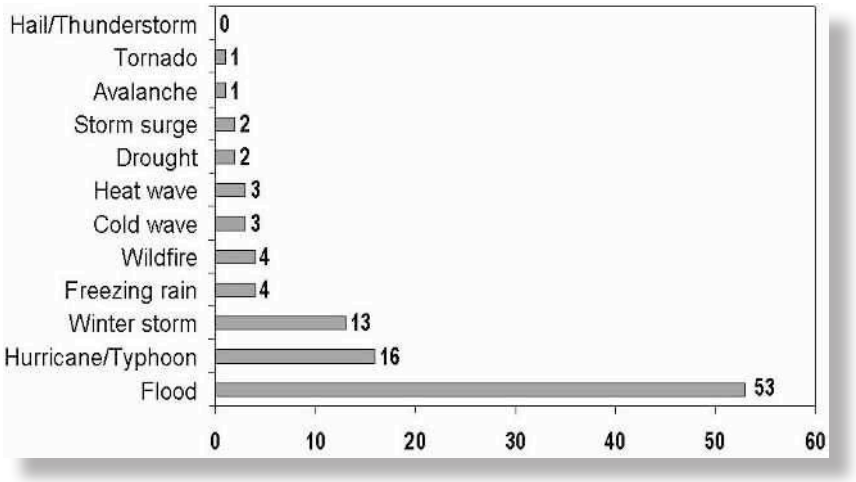

Figure 3. Disasters in Atlantic Canada, 1900–2005. (Public Safety Canada 2011a)

Between 1983 and 2006, the Insurance Bureau of Canada (IBC) recorded eight disaster events that resulted in significant insurance payouts in Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island. In Canada, the bulk of natural-hazard-related property insurance claims are caused by wind and water. This situation is reflected in Atlantic Canada, where large historical insurance industry payout events have been caused by flood and wind (see Table 1). Further, one large insurer contacted for the preparation of this paper reported that wind and water account for the majority of natural-hazard-related claims in Atlantic Canada, where water damages were mostly related to sewer backups. The most expensive event for the insurance industry in Atlantic Canada was Hurricane Juan in 2003. Much of the impact from Hurricane Juan was associated with wind, rain, storm surge, and waves.

Historical Global and Canadian Disaster Events

Table 1: Large Insurance Industry Payout Events in the Atlantic Provinces, 1983-2006

Date	Location	Hazard	Property Claims		Auto Claims		Total Claims		
			#	Loss ($000)	#	Loss ($000)	#	Loss ($000)	Total loss (Adjusted to 2010)* ($000)
Oct. 6–7, 1992	Avalon, NL	Wind	3,549	7,487	641	729	4,190	8,216	11,398
Jul. 28, 1999	Atlantic provinces	Flood	1,661	15,251	858	505	2,519	15,756	19,758
Sept. 22 1999	Atlantic provinces	Flood	1,912	14,391	1,566	1,257	3,478	15,648	19,623
Oct. 30, 2000	Sydney, NS	Flood	346	3,909	86	101	432	4,010	4,873
Dec. 17, 2000	Atlantic provinces	Windstorm	5,478	18,149	1,773	1,607	7,251	19,756	24,006
Sept. 19, 2001	Atlantic provinces	Flood	701	6,201	64	161	756	6,392	7,711
March 30–April 1, 2003	NB	Flood	663	4,695	n/a	n/a	663	4,695	5,346
	NL		118	711	n/a	n/a	118	711	810
	PEI		81	628	n/a	n/a	81	628	715
	NS		1,865	18,557	n/a	n/a	1,865	18,557	21,128
Sept. 28–29, 2003	PEI	Hurricane	1,251	6,665	n/a	n/a	1,251	6,665	7,589
	NS		23,077	132,671	n/a	n/a	23,077	132,671	151,054

Source: Insurance Bureau of Canada (2000, 2008).

** Adjusted using the Bank of Canada inflation calculator: http://www.bankofcanada.ca/en/rates/inflation_calc.html*

Climate Change Impacts in Atlantic Canada

As a result of climate change, Atlantic communities will be affected by sea-level rise, changed wave regimes, storm surges, and changed frequency and severity of storms. Inland communities will be more affected by precipitation and temperature changes, as well as by riverine flooding. Increasing intensity of extreme precipitation is expected to have impacts on storm-water management in urban areas (Vasseur and Catto 2008). Further, it is expected that areas that were once immune to storm-surge impacts will be affected by storm surge in the future, and low lying areas will be affected by storm surge more frequently. Erosion and flooding are expected to increase in coastal and inland areas. These risk factors are combining with increasing development pressures, which exacerbate the potential for higher-cost damages.

More-frequent rain-on-snow flooding has already been identified in some areas of Atlantic Canada. More-frequent winter thaw events are expected to affect ice-jam flooding. Storm surges have already resulted in significant property damage in all of the Atlantic provinces over the past few years. For example, a storm surge event in 2000 in the Beaubassin area of New Brunswick resulted in over $1.6 million in provincial payouts for damages to houses, cottages, and other coastal structures (Vasseur and Catto 2008).

A study based on the Public Infrastructure Engineering Vulnerability Committee (PIEVC) assessment protocol in Placentia, NL, exemplified water-related climate change impacts in Atlantic Canada (PIEVC 2008). This study investigated a breakwater and floodwall that were built in response to historical flooding events, as well as road and culvert vulnerability to climate change. The study provided several projections that related to infrastructure vulnerability, including a predicted 0.15 m increase in sea level and a 12 per cent increase in rainfall intensity by 2050. The projections presented in Table 2 were developed to assess vulnerability of the downtown floodplain area. Coastal infrastructure in the Town of Placentia was found to be especially vulnerable to impacts associated with a combination of rising sea-level and storm surges. It has been argued that coastal infrastructure throughout Canada, including Atlantic Canada, could be exposed to similar risks (Vasseur and Catto 2008).

Table 2. Climate change Impacts (2050) in Placentia, Newfoundland and Labrador

Hazard	Current levels	2050 levels	Change
Sea-level elevation	0 m	0.15 m	+0.15 m
Storm-surge wave elevation	7 m	7.25 m	+0.25 m
Sea-level elevation and storm surge	7 m	7.4 m	+0.4 m
Rainfall		+0.3 m	12%
Sea-level elevation and rainfall	0 m	0.45 m	+0.45 m

Climate Change Impacts in Atlantic Canada *cont'd*

Wildfire

There have been substantial historical wildfire events in the Atlantic Provinces. The Great Miramichi fire of 1825 burned between one and two million hectares of forest in New Brunswick, resulting in the loss of at least 280 lives. The Halifax area was also recently affected by wildfire events, including the 2008 Porters Lake / Lake Echo wildfire, which resulted in the loss of two homes and the evacuation of 800 residents. The 2008 Tantallon wildland fire resulted in the evacuation of dozens of residents and damage to some homes in Nova Scotia. Significant evacuations also resulted from a Halifax-area wildfire in 2009. Increasing likelihood of periods of drought and changes to the duration of the fire season in Atlantic Canada as a result of climate change are expected to have implications for wildfire risk.

Hurricanes

There has been an increasing frequency and severity of hurricanes in the North Atlantic Ocean since 1995, though there are conflicting findings about the expected impacts of climate change on hurricane activity. Sea-surface temperatures in coastal and offshore regions south of Atlantic Canada are expected to increase, which will tend to increase the intensity of tropical storm systems when they make landfall (Saunders and Lea 2008). Hurricanes bring potential complexities for insurance policyholders owing to the combination of wind and water impacts (Vasseur and Catto 2008).

Insurance, Hazards, and Climate Change

Hazards that are likely to pose the greatest concern to the Canadian property and casualty (P&C) insurance industry under changing climate conditions include water, wind, and wildfire hazards. (Property and casualty insurance companies include those that provide home, auto, and commercial insurance and exclude those that insure life and health.) These hazards exist in the Atlantic provinces and in some cases have already resulted in significant damages.

There is opportunity for governments to partner with the insurance industry in reducing risk and adapting to climate change impacts, especially in areas of particular concern to the insurance industry, such as sewer backup. As climate change results in increasing severity of other hazards, especially wind and wildfire, further opportunities to engage insurers in loss-reduction initiatives will emerge. Indeed, there is a strong tradition of insurers working to reduce risk, notably through curbing structural fire damages and reducing the severity and frequency of vehicle accidents.

To help homeowners adapt to climate change impacts, insurers can provide incentives to reduce risk. An example of where this is already taking place is in the mitigation of sewer backup. Insurers in Atlantic Canada are tying sewer backup coverage terms and conditions to the installation of mitigative plumbing measures.

For new homes, the safer building practices can be promoted, and risk reduction can be incorporated into building codes. Since the Atlantic provinces largely adopt the requirements of the National Building and Plumbing Codes, integrating risk mitigation and climate change impacts into the federal model codes will help the Atlantic provinces reduce climate change risk and will help ensure that insurance coverage remains available over the long term.

Education initiatives for homeowners and small business to reduce disaster risk are also beneficial. And there is a role for insurance brokers in disaster education, as brokers serve as the primary point of contact for many insurance policyholders. Currently, the FireSmart program provides comprehensive information on lot-level and community wildfire risk mitigation (Partners in Protection 2011). Cities across Canada have developed and implemented urban flood education programs, including subsidy programs designed to help homeowners install sewer backup-reduction plumbing measures. Educating homeowners about insurance coverage, including what is and what is not covered, will be a continuing effort for the insurance industry.

Small businesses are particularly vulnerable to disasters, owing to limited knowledge of and resources for adaptation. Small businesses, like homeowners, are vulnerable to power outages and damage to property from hazards such as flooding and wind. Thus, there are opportunities to engage small businesses, which may possess many of the same vulnerabilities as homeowners, in risk reduction.

Addressing infrastructure issues is a further area of concern. The Federation of Canadian Municipalities reported that the infrastructure deficit in Canada is $123 billion, $31 billion of which is associated with water and wastewater infrastructure (Mirza 2007). Public spending on infrastructure has been declining in North America in recent decades. Spending on a range of new infrastructure accounted for approximately 4.5 per cent of GDP in the early 1960s but had declined to less than 2 per cent in the 1990s (Auld et al. 2007). Much of Canada's infrastructure is aging and may not be able to handle the storm events expected now, let alone more-extreme future events. The long lifespan of infrastructure increases the need to incorporate climate change impacts into its design. For example, sewer infrastructure and buildings built today will typically last at least 50 years.

Through IBC, the insurance industry is investing in a Municipal Risk Assessment Tool (MRAT) that is intended to tie sewer backup risk to local infrastructure and climate characteristics. This tool is designed to help insurers better reflect the risk of damage in sewer backup policy pricing. The tool will also help identify priorities for municipal adaptation; it is further described in the Current Projects and Activities section of this paper.

CHALLENGES, BARRIERS, GAPS, AND NEEDS

Water

The P&C insurance industry is rooted in the coverage of urban fire. Early fire departments were founded by insurers, and home insurance policies were referred to as "fire policies" until just a few decades ago. Some insurance professionals are reporting that water damage (which includes sewer backup) now comprises nearly half the number of all homeowner claims—an interesting situation for an industry that once focused on insuring damages caused by fire. In some instances, particularly in the case of sewer backup, insurers are experiencing increases in claims associated with weather-related events. Water damage coverage is also one of the more complicated aspects of insurance coverage for homeowners. Here we discuss issues relating to overland flood coverage for homeowners, sewer backup, and commercial coverage.

Overland Flood Coverage for Homeowners

Homeowners in Canada cannot purchase insurance coverage for damages caused by overland flooding, including flooding from rivers, storm surges, tides, and sea-level rise. Further, erosion associated with overland flooding, including coastal erosion, is not covered under typical homeowner policies. Table 3 outlines what is and is not covered under typical Canadian homeowner insurance policies. Sewer backup insurance, which includes coverage for damages caused by sewage that enters homes through sewer connections (and may result from surcharging in municipal sewer systems or blockages of private home sanitary sewer laterals), is available across Canada. Commercial businesses can purchase insurance for flooding (usually as an optional endorsement), and flood damage to vehicles is often covered as part of comprehensive auto policies.

Policyholder uncertainty about flood coverage is an ongoing concern for the insurance industry. Because most perils, including wind, fire, and theft, are covered under standard homeowner policies, there is an expectation that flood is also covered. The fact that flood coverage is available for vehicles and for businesses adds to the uncertainty experienced by home insurance policyholders, as does the fact that homeowner flood insurance is available in many other countries, including the US and the UK. Uncertainty about insurance coverage for flooding has been exemplified in the results of several Institute for Catastrophic Loss Reduction (ICLR) studies and surveys. For example, a 2004 survey conducted by ICLR revealed that close to 70 per cent of Canadian home insurance policyholders believed that flood was covered under typical homeowner policies.

Table 3. What types of Water Damages Are Insured for Homeowners in Canada?

Insurable water damages	Water damages that are not insured
Sudden and accidental escape of water from a watermain Sudden and accidental escape of water or steam from a plumbing, heating, sprinkler, or air conditioning system Sudden and accidental escape of water from a domestic container located inside or outside a dwelling (except when the result of freezing) Water that enters a dwelling through an opening that has been created suddenly and accidentally by an insurable peril (e.g., a falling object like a wind-blown tree) Sewer backup Sump-pump failure	Overland flooding caused by waves tides tidal waves dam breaks storm surges Flooding from any stream, river, or water body, natural or man-made Coastal flooding from lakes, oceans Tsunami Flooding from groundwater (except in Quebec) Overland flood waters or storm-water flows that enter the home through cracks in foundation walls or any opening above the surface of the ground.

Source: The Insurance Bureau of Canada model wordings

Hurricanes

There is scientific uncertainty about the impacts of climate change on hurricane intensity and frequency (Vasseur and Catto 2008). Nevertheless, the possibility of increased hurricane intensity in the Atlantic Provinces could present further insurance coverage difficulties relating to water damages. Uncertainty could arise because damages experienced in hurricane or storm events consist of a mix of wind damage and flood damage. It may be difficult to communicate to homeowners which damages are insurable and which are not.

For example, damage from storm surge caused by high-wind events is not insured, but damages caused by wind are. Let's say that wind causes damage—a tree is blown onto a home during a hurricane and the damage results in rainwater entering the home and causing further damage. This type of damage would likely be eligible for home insurance coverage.

In preparing this report, we talked to insurers. They were aware of the potential difficulties in communicating these nuances to policyholders and suggested that there is a role for insurers, insurance brokers, and governments in educating homeowners about flood coverage. After the severe 2005 hurricane season in the United States, there was significant debate between policy holders and insurers about what damage was caused by insured and uninsured perils, specifically wind and flood. Avoiding this situation in Atlantic Canada is important for both insurers and policy holders.

Sewer Backup

Discussions with insurance professionals revealed some differences in sewer backup coverage between Atlantic Canada and the rest of the country. Two insurance companies that write a significant number of property policies in Atlantic Canada reported lower uptake of sewer backup coverage by home insurance policyholders in Atlantic Canada than in other parts of Canada. One company noted that uptake of sewer backup insurance coverage was 15 per cent lower in Nova Scotia than in Ontario, and nearly 30 per cent lower in New Brunswick. Another insurer reported that only 50 percent of Atlantic Canadian policyholders choose to buy sewer backup coverage.

Because of differing rates of sewer backup coverage in Atlantic Canada, it is difficult to compare claims between Atlantic Canada and the rest of the country. However, one insurer reported that the average sewer backup claim in 2010 in Atlantic Canada was approximately $12,000, while the national average was approximately $13,300. The same insurer reported that in 2010, 12.3 per cent of home insurance claims in Atlantic Canada were for sewer backup, 14.5 per cent nationally. Thus, while it is possible that sewer backup events are more frequent here than in the rest of Canada, the average value of claims does not appear to differ significantly.

A primary factor in increasing sewer backup claims is homeowner behaviour. Over the past few decades, there has been an increasing trend in using basements as living spaces. Where basements once remained unfinished and were used for storage, they are now being remodelled with finished walls, carpeting, and expensive flooring; and they are often outfitted with home entertainment units and other furnishings. Further, in some cases, storm and sanitary sewer infrastructure has been unable to handle the combined stresses of increasing urban development, age, deterioration, and extreme rainfalls. These factors have combined to increase the frequency and severity of sewer backup claims in Canada.

Insurers are beginning to encourage homeowners and provide incentives to reduce sewer backup risk, notably through installation of backwater valves and sump pumps. A review of sewer backup endorsement wording from several insurers in Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island reveals that such measures are being motivated by insurers in several ways. For example, the installation of sewer backup mitigation measures can affect payout caps (the amount that an insurer will pay to a homeowner in the event of a sewer backup claim) and, in some circumstances, the availability of this type of coverage. In some instances, a homeowner who installs mitigation measures might be afforded lower premiums for sewer backup coverage. Further, while insurers formerly applied the same price for sewer backup coverage across large geographic areas (the entire country, for example), they are now beginning to apply rates for sewer backup at the postal-code level. Thus, depending on claims history, residents in some postal-code areas may pay more for sewer backup coverage than others in the same municipality.

Sewer Backup cont'd

Insurance prices that accurately reflect risk are a key component of sustained insurance coverage availability. To better align the risk of sewer backup damage with the pricing of insurance, and to ensure that prices reflect risk under changing climate conditions, a number of things have to be taken into account: predictions for future weather conditions (especially extreme precipitation patterns), the current state of storm and sanitary sewer infrastructure, historical insurance industry claims, and homeowner behaviour (including which homes have adopted risk reducing adjustments).

In the case of sewer backup, insurance data would be very useful for municipalities in identifying areas that have been affected. Combining homeowner complaints with historical claims data can help municipalities determine where sewer backup risk areas are and identify areas that should be prioritized for flood-remediation efforts. IBC is working on obtaining infrastructure and weather data to develop a Municipal Risk Assessment Tool to identify sewer backup risk (see Current Projects and Activities section).

Provincial building codes and municipal building code bylaws that relate to lot-level flood reduction practices are an important means of reducing sewer backup risk. ICLR has submitted several recommended revisions to the Ontario Building Code, one of which was aimed at reducing sewer backup risk in newly constructed homes. Many Canadian municipalities have also implemented basement flood subsidy programs that help offset the costs of installing sewer backup risk reduction measures in existing homes and require the installation of sewer backup reduction measures in new homes. Requiring sewer backup mitigation measures in all new homes will serve as an important risk reduction measure; it is considerably more cost effective than retrofitting existing homes.

Commercial Coverage & Small Business Issues

Commercial businesses can purchase insurance for overland flooding as an endorsement to standard commercial policies. The suggested wording provided by IBC for this type of coverage states that commercial businesses can buy an endorsement that covers "the breaking out or overflow of any natural or artificial body of water," though the specifics of coverage may differ from company to company. This type of coverage is optional, and insurers do not always offer it to all businesses. To identify who may be eligible for coverage, insurers might use historical claims experience, the knowledge and experience of local agents and brokers, and government flood maps; or they may develop their own risk identification resources. As with any other type of peril, a significant increase in risk or occurrence of flood damage to business could be met with changes in terms and conditions for this type of coverage. However, increased risk of damage will likely generate increased opportunities for insurers and governments to work together to mitigate risk.

Education for small business is relevant to all hazards, including water, wind, and wildfire-related hazards. Several regions have educational materials to help small business adapt to climate change. AXA Insurance in the UK, for example, has developed materials designed to help small business identify and mitigate climate-related risks, including flooding (AXA 2006). Development of similar materials for Atlantic Canada would help small business adapt to climate change. Business continuity planning, which helps ensure that businesses can continue to function after a disaster occurs, will also be an important consideration.

Table 4 provides examples of what is needed to help insurers adapt homes, infrastructure, and businesses to climate change impacts associated with water.

Table 4. Examples of Adaptation Needs for Water-related Hazards

Sector	What is needed?
Homes	Better alignment of risk of damage with sewer backup coverage price, terms, and conditions Homeowner education on insurance coverage for water-related risks For existing homes, programs to encourage retrofits for sewer backup risk, including education, subsidy programs, and bylaws For new homes, incorporating risk-mitigation measures into building and plumbing codes and building-related municipal bylaws Information on which homes have adopted risk-reduction measures Land use planning to steer development away from flood-prone areas
Infrastructure	Identification of areas that are at a high risk of sustaining urban flood damages Investigations of infrastructure vulnerability to climate change Ensuring that existing infrastructure has the capacity to withstand changing frequency and severity of extreme precipitation/storm-water flow events Ensuring that new developments are resilient to extreme precipitation (may include increasing design standards for overland flow routes and storm-water management infrastructure and planning based on updated floodplain maps that reflect climate change impacts) Adjusting codes and standards to reflect altered climate change impacts on design parameters Non-structural approaches, if necessary, including altered maintenance, operations, and emergency planning
Business	Development of education programs for disaster awareness, disaster mitigation, and business continuity planning An understanding of which businesses will be exposed to flood risk under climate change conditions, which may include assessments of structural flood-control measures and assessments of climate change impacts on floodplain Land use planning to restrict development in flood-prone areas

Wildfire

Wildland-urban interface (WUI) fires present the greatest wildfire risk to the Canadian insurance industry. WUI fires occur when wildfires affect development located adjacent to or within forested areas. Standard home insurance policies do not differentiate between damages caused by structural or urban fires and damages caused by wildfires. Thus, all Canadian homeowners who purchase home insurance also have coverage for wildfire damage.

The most significant wildfire damages experienced by the Canadian insurance industry occurred during the 2003 fire season in British Columbia, where 334 homes were destroyed and tens of thousands of residents were evacuated from affected regions. A significant portion of the damages experienced during this event resulted from the Mountain Park Fire in Kelowna, where 238 homes were destroyed. As reported by IBC, the 2003 wildfire season in BC resulted in $200 million in payouts. However, no significant changes in insurance coverage for wildfire resulted from this event, and over the next few years it is unlikely that the manner in which wildfire is underwritten in Canada will change. Nevertheless, wildfire remains a topic of concern for the insurance industry. If the predicted increase in wildfire activity occurs and results in growing frequency of homeowner fire claims, the insurance industry could become more engaged in wildfire risk-reduction activities; this could involve aligning insurance terms and conditions with lot-level wildfire risk-reduction activities. Insurance prices that reflect the risk of wildfire—where those at a higher risk of experiencing damage pay more for coverage—can motivate risk-reducing behaviour and also help limit development in wildfire-prone areas.

Insurers are supporting changes to building codes that will increase the resilience of homes. FireSmart is an Alberta program to reduce vulnerabilities of buildings and communities to wildfires. The Halifax Regional Municipality in Nova Scotia has already adopted, and posted on its website, materials for public education about wildfire risk reduction. Applying land use planning to guide development away from WUI areas will be an important means of controlling wildfire risk.

Table 5 provides examples of what may be needed to help insurers adapt homes, infrastructure, and businesses to WUI fire risk.

Table 5 Examples of Adaptation Needs Relating to Wildfire

Sector	What is needed?
Homes	Education programs to inform homeowners of potential wildfire risk, possibly based on the FireSmart approach An understanding of current homeowner perceptions of wildfire risk, including willingness to adopt risk-reducing measures Incorporation of lot-level wildfire risk-mitigation measures into building codes and municipal building-related bylaws Aligning risk of wildfire damage with price of fire coverage Land use planning to steer development away from WUI or wildfire-prone areas
Infrastructure	Land use planning to steer development away from WUI or wildfire-prone areas Non-structural approaches, if necessary, including altered maintenance, operations, and emergency planning approaches
Business	Development of education programs for disaster awareness, disaster mitigation, and business continuity planning Land use planning to steer development away from WUI or wildfire-prone areas

Wind

Strong wind events cause a range of impacts on infrastructure and the natural environment. For example, the structural integrity of walls and roofs can be compromised by strong winds, especially if associated with driving rain, which also accelerates the physical weathering of buildings. Wind can also cause damage to electricity transmission infrastructure. A range of damage is caused by falling trees. Wind-related impacts include erosion of beaches, waterfront property, and river banks, and increased risk of storm surge. Small increases in wind intensity can result in substantial increases in risk. For example, it has been reported that a 25 per cent increase in the speed of wind gusts (such as an increase from 60–75 km/h to 75–90 km/h) is associated with a 650 per cent increase in damage to buildings (Lapp 2010).

In Canada, wind damages are covered under typical homeowner policies. Changes to building codes and building practices are important components in wind-damage reduction, but building codes applied across Canada do not adequately address wind risk for residential buildings. Building codes rely on historical weather data that do not consider the impacts of climate change, resulting in a major gap for climate change adaptation in Canada. Including wind-damage reduction measures in building codes, along with sewer backup and wildfire reduction measures, should be considered as part of climate change adaptation programs. Since the Atlantic provinces largely adopt the requirements of the National Building and Plumbing Codes, integrating risk mitigation and climate change impacts on extreme event parameters with the national model codes will help the Atlantic provinces reduce climate change risk and will assist in ensuring that insurance coverage remains available and affordable over the long term.

While homeowner and lot-level mitigation education information exists for wildfire, and many municipalities across Canada have engaged homeowners in lot-level sewer backup reduction, there is a lack of education material for wind-damage risk reduction. The Canadian Hurricane Centre has produced resources relevant to reducing wind-related risks for homes (Environment Canada 2010), and governments in Australia have produced valuable homeowner resources for risk reduction from cyclones (hurricanes) (Queensland Government et al. 2008). These resources include advice on home inspections to identify vulnerabilities as well as actions that can reduce risk in existing homes. However, development of materials that can be disseminated and applied by the insurance industry in Atlantic Canada will be an important part of helping policyholders adapt to this hazard.

Table 6 provides examples of what may be needed to help insurers adapt homes, infrastructure, and businesses to wind-related climate change impacts.

Sector	What is needed?
Homes	Incorporation of risk-reduction measures into building codes Development and dissemination of education materials to help inform residents and homeowners of wind-related risks Homeowner education on insurance coverage for water-related risks
Infrastructure	Incorporation of climate change impacts into infrastructure design Accommodation of secondary impacts of wind, such as storm surge, in infrastructure design, operations, and maintenance Non-structural approaches, if necessary, including altered maintenance, operations and emergency planning approaches
Business	Development of education programs for disaster awareness, disaster mitigation, and business continuity planning

Table 6. Examples of Adaptation Needs for Wind-related Hazards

Current Projects and Activities

The Institute for Catastrophic Loss Reduction (ICLR) is a disaster mitigation and prevention research institute sponsored by the Canadian property and casualty insurance industry. ICLR has numerous ongoing projects that relate to the reduction of climate change risk, including projects focusing on wildfire, wind, and water damages. In 2006, the Co-operators insurance company, in partnership with ICLR, built Canada's first Designed for safer living home in PEI. It was designed to withstand winds of 200 km/h and serves as an example of how houses can be constructed to be resilient to the impacts of wind.

ICLR has also conducted numerous studies on homeowner hazard perception and mitigation behaviour; three studies focus on urban flood-risk reduction. As part of the Ontario Regional Adaptation Collaborative (RAC), ICLR is producing education materials for homeowners on hazards that are expected to be affected by climate change, including damage from water, wind, and wildfire. Further, through RAC, ICLR has made three recommendations for changes to the Ontario Building Code. The recommended revisions included

- Installation of backwater valves in all new homes to reduce sewer backup risk
- Installation of hurricane tie-down straps for roof framing over garages and carports to reduce wind damages
- Reduction of maximum spacing of fasteners (nails) for roof sheathing from 300 mm to 150 mm along intermediate supports

The third recommendation is an extremely economic means of reducing wind damages, as increasing the number of nails used to fasten roof sheathing to roof supports can double the uplift capacity of sheathing, thereby significantly reducing the risk of wind damage.

The Three Little Pigs project, featuring the Insurance Research Lab for Better Homes (IRLBH), is a wind research lab based at the University of Western Ontario in London, Ontario. IRLBH was built to examine all aspects of house construction by performing experiments on extreme wind effects, moisture penetration, energy efficiency, and mould growth. Three Little Pigs is producing a wealth of research information and knowledge for the reduction of wind risk for homes in Canada and the US. Seed funding for the project was provided by ICLR, and the project has received funding from the Insurance Bureau of Canada.

Allstate, with ICLR, has conducted national surveys on emergency preparedness, disseminated the results and safety advice to the public through mainstream and trade media, and created the website www.goodhandsadvice.ca. This is a comprehensive resource centre for people to learn how to increase their resilience to hazards such as flood and water damage, wildfire, extreme wind, and winter storms. In 2008, ICLR partnered with Co-operators and the Downtown Guelph Business Association to engage small businesses in Guelph, Ontario, in ICLR's "Open for Business" program. The program included surveying small businesses to understand their perceptions of risks, and distributing and completion of business continuity resources.

Many insurers have begun public education programs to engage policyholders in sewer backup risk reduction. Education programs may include web-based resources, brochures, and handbooks. IBC and ICLR are also in the process of developing homeowner sewer backup information resources, including YouTube videos, web pages, and conference and home-show displays. Some insurers have begun to engage insurance brokers in risk reduction education. *cont'd*

Current Projects and Activities cont'd

ICLR is also working with the Insurance Brokers Association of Canada to better understand how Canadian insurance brokers are responding to increasing disaster and sewer backup risk and how insurance brokers—who often serve as the primary contact on insurance information—can help increase awareness and disaster prevention by home insurance policyholders.

Dr. Slobodan Simonovic is Director of Engineering Studies at ICLR and Professor of Civil and Environmental Engineering at the University of Western Ontario. He has conducted numerous studies about climate change impacts on water, precipitation, and riverine flooding. Research reports are available at http://www.eng.uwo.ca/research/iclr/fids/research.html. Of particular interest is "The City of London: Vulnerability of Infrastructure to Climate Change," a study that investigated the impacts of climate change on riverine flooding and has identified infrastructure and areas of London, Ontario, that will be vulnerable to changing magnitudes of 1 in 100 year and 1 in 250 year floods. Dr. Simonovic and his students have also investigated climate change impacts on rainfall intensity-duration-frequency (IDF) curves in London, which have implications for storm-water infrastructure design.

In June 2010, Intact Financial Corporation and the University of Waterloo began a three-year national project aimed at identifying appropriate initiatives and climate change action plans for governments, businesses, and civil society in Canada. The project focuses on how the insurance industry can better adapt to climate change and how insurers can help promote adaptation measures for both private-policy homeowners and governments. The project will also investigate environmental and social issues and infrastructure issues, and it will have components that focus on First Nations.

The Insurance Bureau of Canada (IBC) hosts a national climate change committee that includes executives from several Canadian insurance companies. The committee has guided the development of IBC's adaptation to climate change program. IBC is specifically interested in losses associated with failing infrastructure, including advocating that governments address the current infrastructure deficit. IBC also partnered with FCM for the First Annual Watershed Awards in May, 2010 (http://www.fcm.ca/english/view.asp?x=1271), which recognized innovative storm-water management techniques from several municipalities across Canada. Other initiatives that may be of interest to the Atlantic provinces are IBC's work in supporting the HurriQuake nail and the post-disaster IBC Community Assistance Mobile Pavilion (CAMP).

IBC's Municipal Risk Assessment Tool (IBC MRAT) seeks to combine infrastructure and climate data to provide risk assessment for sewer backup in Canadian municipalities. Fredericton, NB, among other Canadian municipalities, is serving as a pilot test municipality for the MRAT. IBC planned to apply the tool in 20 more municipalities throughout 2011 and is expecting wider application in 2012. The tool could serve as a means to allow insurers to better align the risk of sewer backup damage with terms and premiums for sewer backup coverage. As a prospective underwriting tool, the MRAT may allow insurers to assess risk of sewer backup based on future potential occurrences as well as historical claims data. IBC also purports that participation in the risk assessments will provide several benefits to municipalities, including updated rainfall and climatic information and a basis for prioritization of infrastructure investments.

Linkages and Key Resources

Several ICLR publications relate to climate change impacts and adaptation. The following recently published resources of interest are all available on the ICLR website:

• *The Handbook for Reducing Basement Flooding* (2009) provides comprehensive homeowner information on basement flood reduction. It was developed in consultation with insurance professionals, researchers, engineers, and consultants. The handbook outlines many issues homeowners need to consider before and after they experience basement flooding, including how to physically reduce the risk of future flood events and insurance issues associated with basement flooding.

• *The Home Builder's Guide* (2010) provides home design and construction guidance for home builders to incorporate disaster mitigation features into new homes. The guide outlines how new home builders can increase the resilience of homes to hurricanes and high wind, wildfire, flooding, and earthquake.

• *Open for Business* is a business continuity toolkit aimed at Canadian small businesses.

• *Canadians at Risk: Our Exposure to Natural Hazards* (2010) is an assessment of natural hazards in Canada. It provides comprehensive information on the hazards that affect Canada, including wildfire, flooding, hurricanes, storm surge, and winter storms and how these hazards will be affected by climate change.

• *Climate Change Information for Adaptation: Climate trends and Projected Values for Canada from 2010-2050* (2011) provides information on how climate change will affect various hazards in Canada. Sections focus on every region in the country, including New Brunswick and PEI, Nova Scotia, and Newfoundland and Labrador.

• *Making Flood Insurable for Canadian Homeowners: A Discussion Paper* (2010): researchers from ICLR and insurance professionals from Swiss Re outline a possible method by which overland flooding may become insurable for homeowners in Canada. The paper provides a review of flood management in Canada, including disaster relief, the potential role of insurance in reducing flood risk, and how the government might support insurers in proving flood insurance coverage for homeowners.

Many other publications are available on the ICLR website, including trade publication articles, which outline various issues associated with increasing resilience to natural hazards and climate change impacts.

Key contacts at ICLR include:

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- Grant Kelly, Director, Adaptation Projects (gkelly@iclr.org)
- Dan Sandink, Manager, Resilient Communities and Research (dsandink@iclr.org)
- ICLR Telephone: 416-364-8677
- Dr. Gordon McBean, Director of Policy Studies at ICLR and Professor of Geography and Political Science at the University of Western Ontario (gmcbean@uwo.ca). Telephone: 519-661-2111 x84274 or 86036.
- Dr. Slobodan Simonovic, Director of Engineering Studies at ICLR and Professor of Civil and Environmental Engineering at the University of Western Ontario (simonovic@uwo.ca). Telephone: 519-661-2111 x84075.

Linkages and Key Resources cont'd

The Insurance Research Lab for Better Homes & Three Little Pigs project:

- http://www.eng.uwo.ca/irlbh/
- Primary contact: Dr. M. Bartlett, Associate Professor of Structural Engineering, Dept. of Civil and Environmental Engineering, UWO
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The Insurance Bureau of Canada is Canada's insurance industry association. As discussed earlier in this report, IBC has been involved in several climate change adaptation projects.

- **http://www.ibc.ca/**
- Key contact: Robert Tremblay, Director of Research
- Telephone: 416-362-2031

The Public Infrastructure Engineering Vulnerability Committee (PIEVC) has established a protocol to assess the vulnerability of infrastructure to climate change impacts. The goal of PIEVC is to "assist infrastructure owners and operators to effectively incorporate climate change adaptation into design, development and decision making." The PIEVC protocol has been applied in several Canadian municipalities, including the Town of Placentia, Newfoundland. A PIEVC study is also ongoing for a planned sewage treatment plant in the District of Shelburne, Nova Scotia. The First National Engineering Assessment Report, which outlines the application of the PIEVC protocol on several infrastructure components throughout Canada is available on the PIEVC website.

- **http://www.pievc.ca**
- Key contact: David Lapp, Engineers Canada
- info@pievc.ca

ClimateWise, based in the UK and formed in 2006, is a consortium of international insurers that is concerned with reducing risks for insurance customers associated with climate change impacts. ClimateWise has created a framework for incorporation of climate change into insurance businesses, which several large insurance companies have adopted.

- http://www.climatewise.org.uk/

The Association of British Insurers is the British insurance industry association. Unlike in Canada, UK insurers have worked with governments to provide overland flood insurance coverage to the majority of UK residents. As a result, the British insurance industry has been progressive in encouraging adaptation to rising sea levels and other forms of flooding.

- **http://www.abi.org.uk/**

Linkages and Key Resources cont'd

The Institute for Business and Home Safety, ICLR's sister organization based in the United States, is an insurance-industry-funded disaster-prevention non-profit and has several projects related to the mitigation of the impacts of disasters.

- **http://www.disastersafety.org/**

Dr. Evan Mills of the Lawrence Berkeley National Laboratory in the United States has conducted several studies on global insurance industry participation in climate change mitigation and adaptation. Notably, the "From Risk to Opportunity" reports include market surveys on insurer activities related to climate change mitigation and adaptation.

- **http://eetd.lbl.gov/emills/**

Partners in Protection, FireSmart: Sponsored largely by the Alberta government and other government agencies, the FireSmart program is source of information and best practices for the management of wildfire risk. Through this program, tools aimed at both lot-level and community-level wildfire mitigation have been developed and are widely regarded and adopted throughout Canada.

- **http://www.partnersinprotection.ab.ca/**

Reinsurance companies often provide important, updated climate-change-related information on global insurance issuers. For more information on reinsurance involvement in climate change adaptation, see the following:

- Munich Re **http://www.munichre.com/en/group/focus/climate_change/default.aspx**
- Swiss Re **http://www.swissre.com/rethinking/climate/**
- Lloyd's of London **http://www.lloyds.com/Lloyds/Corporate-Responsibility/Environment/ClimateWise**

Ceres, founded in 1989, is a US national network of investors, environmental organizations, and other public interest groups working with companies and investors to address sustainability challenges such as climate change. Ceres works with insurance partners to encourage climate-change adaptation.

- **http://www.ceres.org/issues/climate-change**
- **http://www.ceres.org/industry-initiatives/insurance**

The Geneva Association is an insurance research organization based in Geneva, Switzerland. It identifies fundamental trends and strategic issues where insurance plays a substantial role or that influence the insurance sector. Climate change has been identified as a key issue, and the Geneva Association has published several reports on the topic.

- **http://www.genevaassociation.org/**
- **http://www.genevaassociation.org/Home/Climate_Risk.aspx**

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