Hot Properties

HOW GLOBAL WARMING COULD TRANSFORM B.C.'S REAL ESTATE SECTOR

David Suzuki Foundation

SOLUTIONS ARE IN OUR NATURE

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Hot properties: How global warming could transform B.C.'s real estate sector

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CONTENTS

Introduction

A one- to two-metre rise in sea level could put many highly valued waterfront properties in British Columbia at risk.

Every day in British Columbia, we burn large amounts of natural gas, gasoline, and oil to heat our homes and businesses and transport goods and people from one place to another. The way we build, the locations we build in, and the distances between these places are responsible for a large amount of our total energy use. The steady increase in the amount of fossil fuels we use, here at home and around the world, is raising the amount of greenhouse gases in our atmosphere and contributing to global warming. Global warming, also called climate change,[1] is one of the most serious challenges facing the world this century.

In British Columbia, we are already seeing the effects of a changing climate:

- Between 1895 and 1995, temperatures in B.C. have increased by 0.5°C to 0.6°C on the coast, 1.1°C in the interior, and 1.7°C in the north.
- Warmer winters have enabled the mountain pine beetle infestation to grow into an epidemic in B.C.'s interior forests. In only four years, the mountain pine beetle has chewed its way through 13 million hectares of trees.
- Warmer, drier summers and milder winters mean we can expect to see more forest fires, such as the devastating Okanagan Mountain wildfire in 2003, which destroyed several hundred homes.
- Severe storms, such as the December 2006 storm that destroyed parts of the Vancouver seawall and Stanley Park, are forecast to become more frequent and more intense.

In British Columbia, climate change is expected to affect equity in land value in a number of ways. Impacts resulting from climate change such as increased frequency and intensity of extreme precipitation or wind events, oceanfront storm surges, or wildfires can result in direct damage to properties and structures. The equity of real estate may be significantly affected by changes in the perceived amenity value of lands as factors such as water availability and the appearance and resilience of local environments shift in response to the changing climate. Global warming will likely result in increased taxes to "harden"

infrastructure against anticipated impacts and to restore services after impacts occur. Beyond this, the increased determination of B.C. residents and the government to take action in reducing emissions, and that of insurers to reduce their exposure to the potential costs of climate change impacts, appears likely to result in further changes to current patterns of land valuation and urban development.

There are two distinct ways to reduce the cost of climate change impacts, both of which must be pursued aggressively in order to achieve success. The first is through mitigation, which aims to reduce the overall emissions of greenhouse gases to a level that allows the global climate to stabilize at levels that avoid "a dangerous level of interference with the global climate system." Because of the emissions we have already produced, however, global warming is already well underway. While it is critical that we reduce the magnitude of global warming as much as we can by reducing our greenhouse gas emissions now and in the future, we no longer have the option of preventing global warming entirely. As a result, we will also need to adapt to the changing climate. This can be done by identifying areas of vulnerability to the impacts of global warming, and then either hardening development within these regions, or shifting investment and development away from these areas. This approach can be implemented at a range of scales extending from the individual property lot to an entire region of the province.

Serious action on climate change is about to become standard operating procedure in every sector of the province's economy. It is incumbent on professionals within the real estate and land valuation professions to understand the risks to equity in land posed by global warming and the possibilities for action to reduce these risks.

How the planning and development community locates and designs new urban development and infrastructure in B.C. will determine not only its vulnerability to global warming itself but also its exposure to the effects of emission reduction activities developed in response to climate change.

Climate change and B.C.'s real estate sector

Kelowna wildfire: Warmer, drier summers and milder winters mean we can expect to see more forest fires, such as the devastating Okanagan Mountain wildfire in 2003, which destroyed several hundred homes.

The United Nations' Intergovernmental Panel on Climate Change (IPCC) is a scientific panel universally recognized as the world's most authoritative voice on global warming. In 2007, the IPCC released a major new report, which stated:

- Climate change is real.
- Climate change is happening now. Many long-term changes are already taking place.
- Most of the observed increase in global average temperatures since the mid-20th century is *very likely*[2] due to increased levels of greenhouse gas concentrations in the atmosphere. Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns.[3]

There is no longer any doubt that we are living in a world undergoing a significant shift due to climate change.

Some degree of global warming is now inevitable. The IPCC notes that even if emissions of greenhouse gases were immediately reduced to zero, a further warming of about 0.1°C per decade would occur because of the elevated levels of greenhouse gases already present in the atmosphere.[4]

Forecasting has now advanced to the point that the largest source of uncertainty in projections of global warming is not our knowledge of global climate systems, but rather the lack of certainty regarding humanity's resolve to reduce its greenhouse gas emissions. To capture this uncertainty, the IPCC has projected the amount of global warming that would occur under a range of different scenarios. These scenarios range from a globalized world fueled by fossil fuels in which economic growth trumps environmental concerns (the "A1F1" scenario) to a globe divided into regional economic blocks in which sustainability concerns are paramount (the "B2" scenario). The climates of these different futures diverge sharply. Unfortunately, there is no longer any room for delay in committing to serious emission reductions: we must take action now if we are to ensure that the total

magnitude of global warming impacts is kept below a truly "dangerous" level (now widely understood to be an increase of more than 2°C in the global average temperature relative to pre-industrial times[5]). A review of the best available science in 2005 indicated that in order to meet this stabilization goal in a globally equitable fashion, Canada would need to adopt the following medium- and long-range emission reduction targets:

- A reduction in Canada's greenhouse gas emissions to 25% below 1990 levels by 2020.
- A reduction in Canada's greenhouse gas emissions to 80% below 1990 levels by 2050.[6]

As such, the responsibility for determining the future of the world's climate is entirely in our own hands. No one will have the power to fix the climate later if we fail to act now.

B.C. is already experiencing climate change impacts

The world is now experiencing the effects of global warming, and British Columbia is no exception. Between 1895 and 1995, temperatures in B.C. have increased by 0.5°C to 0.6°C on the coast, 1.1°C in the interior, and 1.7°C in the north. Most regions of southern B.C. have also seen statistically significant increases in overall precipitation levels of 2% to 4% per decade since 1929.[7]

In recent years, climate change impacts in British Columbia have become increasingly severe. The trend towards warmer winters in recent decades has enabled a local infestation of mountain pine beetles in Tweedsmuir Park – normally kept in check by winter cold-snap die offs – to explode over the past decade. The mountain pine beetle has already killed half of B.C.'s lodgepole pine trees and is expected to kill more than three-quarters of B.C.'s marketable pine forests by 2015.[8] The infestation now covers 13 million hectares of land[9] – an area two-and-a-half times the size of Nova Scotia[10] – and is now spreading into neighbouring Alberta. Almost a quarter of B.C.'s entire volume of market timber will be killed[11], affecting tens of billions of dollars worth of timber and threatening the economic future of many Interior communities, including Williams Lake, Quesnel and Prince George.

Much of British Columbia's developed lands and infrastructure are no longer adequately protected from today's extreme events. In line with projections of global warming, B.C. is projected to experience a wide variety of climate change impacts, ranging from an increased risk of floods to intensified water shortages. Some of the more significant impacts are described below.

EXTREME STORM EVENTS

In recent years, the southwest coast of British Columbia experienced a large number of severe winter storms. The "Sea to Sky" storm[12] of October 2003 dumped up to 600 mm (two feet) of water[13] and was considered to be "perhaps the heaviest deluge to strike the West Coast in more than 200 years." The storm washed out bridges and highways, killed four people and forced 1,200 to flee mud-filled homes, causing damage assessed in the tens of millions of dollars.[14] This was followed 18 months later by a second "1-in-200 year" event; the "Tropical Punch" storm of 2005. This storm caused flooding from Port Renfrew to Abbotsford, and precipitated the Blueridge/Seymour landslide in North Vancouver. [15]

This landslide destroyed two homes, killing one person and seriously injuring another, and resulted in the temporary evacuation of 100 homes. Subsequent safety assessments led to the permanent evacuation of eight properties (purchased by the province at fair market value), and requests that about 40 additional homes install hazard mitigation improvements on their properties.[16] At least one legal suit against the city and the real estate agents who sold these homes prior to the occurrence of the landslide is also underway.[17]

The winter of 2006-7 saw an unprecedented number of severe storms. Mud slides in November affected Metro Vancouver's drinking water reservoirs, which resulted in drinking water with extremely high silt content (turbidity). One million residents in Vancouver, Burnaby, North Vancouver and West Vancouver were forced to boil their drinking water for twelve days before silt levels fell to safe levels.[18] At the worst point, the turbidity of drinking water from the Capilano reservoir exceeded minimum health standards by 80 times.[19] Another severe winter storm in March 2007 also resulted in a landslide within a long-established residential neighbourhood – this time in Mission, B.C. This landslide led to the immediate evacuation of two homes, and the subsequent condemnation of eight other homes in the same subdivision.[20] At the time of writing, the municipality has denied any liability for this landslide, and local residents have initiated legal proceedings.

The "Stanley Park Blowdown" storm[21] in December 2006 uprooted an estimated 10,000 trees in Stanley Park alone.[22] The damage was caused by localized hurricane-force wind gusts, heavy rains, and pre-existing saturation of the ground by other winter storms. As of October 2007, logging salvage operations were still underway, and the direct net recovery costs for the park alone are now estimated at $9 million.[23] On a wider scale, the storm caused widespread property damage and caused record power outages throughout southwestern B.C., leaving up to 250,000 customers without power. Total property damage from the storm was estimated at $100 million in the weeks after the event.[24]

COASTAL STORM SURGES

Coastal areas in B.C. are at risk from climate-change augmented storm surges, which result when El Niño events and/or severe winter storms coincide with high tides.

Vancouver was subjected to what appears to have been a record storm surge of 97 cm during the "Stanley Park Blowdown" storm of 2006. This did not produce a record high level water event, since the regular high tide during the storm was about 1.5 metres below the local maximum levels.[25] Despite this, the large wind-driven waves generated by the storm severely damaged sections of the Stanley Park seawall.[26] The damaged section of the seawall is not scheduled to reopen until the beginning of 2008, more than a year after the storm.[27]

Other recent events have demonstrated the potential for damage to property from coastal storm surge flooding events. More than 150 homes in the low-lying oceanside neighbourhood of Tsawwassen, B.C., were damaged in February 2006 during a winter storm with wind gusts up to 110 km/h. The confluence of high tides and the high winds sent waves crashing "30 or 40 feet high over the seawall", resulting in flood conditions. The waves also washed out a section of seawall along Boundary Bay, leading to additional flooding. The neighbourhood was declared a disaster area, and the province provided $3 million in disaster relief, covering 80 per cent of residents' damage costs up to a maximum

of $300,000.[28] Subsequent analysis by Corporation of Delta engineering staff note that flooding from this incident could have been far worse; modelling indicates that a breach in the Boundary Bay dike could flood most of the Agricultural Land Reserve (ALR) lands in Delta with one-half to two metres of water.[29]

Delta flood storm surge: Coastal areas in B.C. are at risk from climate-change augmented storm surges, which result when El Niño events and/or severe winter storms coincide with high tides.

Vancouver itself may be more vulnerable to storm surges than commonly thought. The City of Vancouver is subject to tides as high as 2.1 metres above the geodetic datum[30] during the winter months, creating the potential for extreme high water levels of 3.1 metres before waves are factored in. In light of this information, the City of Vancouver's 3.5 metre development line appears barely sufficient to prevent damage from today's maximum achievable high water levels, and will almost certainly be inadequate to protect new oceanside developments from climate-change intensified storm surges over their expected lifetime.

While there are very few buildings in Vancouver located below the 3.5 metre elevation line, a great deal of valuable and lucrative civic infrastructure is already installed within this potential damage zone. It is hardly surprising that the city's beaches all fall within the maximum high water level, but so are many of the beach concession structures. The famous seawall that rings Stanley Park, English Bay and False Creek – one of the city's chief recreational amenities for residents and tourists alike – is built at a consistent elevation of just over three metres above geodetic datum. Small portions of the seawall, including recently-completed sections in False Creek, are actually less than three metres above the geodetic datum, and already flood (without apparent damage) during the highest winter tides. Most importantly, most of the city's port terminals have a deck elevation of less than four metres above geodetic datum. While these facilities may not be at immediate risk of

damage within the storm-sheltered water of Burrard Inlet, it is sobering to realize how limited the freeboard of Vancouver's principal economic engine actually is.[31]

Other areas of the province outside the Fraser River delta are also at considerable risk from coastal storm surges. Waterfront areas of Victoria are at risk, as are communities directly exposed to the Pacific Ocean. The low lying eastern shore of Graham Island in Haida Gwaii is identified as an area of particular vulnerability to storm surges. Past events have cut off the only road linking Masset and the ferry terminal to the mainland at Skidegate.[32]

With extreme storm events predicted to become more intense during the 21st century, it is reasonable to expect that the maximum height of storm surges will increase over time, even before sea level rise is taken into account. As the return periods for extreme storm events shrink, the chance of an extreme storm surge coinciding with an extreme high tide will rise, increasing the likelihood that extreme high water level events will approach their theoretical maximum.

SEA LEVEL RISE

The rate of global average sea level rise is now about 3 to 3.5 millimetres per year – about one centimetre every three years, or about one foot per century. The rate of sea level rise has accelerated dramatically over the past 130 years. Between 1870 and 1925, sea level rose at an average rate of 0.71 mm (±0.4 mm) per year, increasing to 1.84 mm (±0.19 mm) per year between 1930 and 2001. Between 1993 and 2000, the rate of sea level rise was 0.3 mm per year. In contrast, from the time of Roman Empire until the 18th century, there appears to have been no net change at all in sea level.[33]

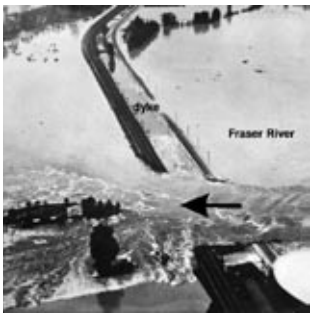
To date, the effects of sea level rise on much of B.C.'s coast have been significantly reduced by 'isostatic rebound' and 'crustal uplift.'[34] Conversely, much of Richmond is gradually sinking as the silt soils compact over time.[35] All of these secondary influences are likely to become less significant if sea level continues to accelerate.

Over the medium- to long-term, sea level rise could become a serious concern for coastal communities throughout British Columbia and the world. Current IPCC projections of 23 to 51 cm global average sea level rise by 2090-2099, relative to 1980-1999, are remarkably low. Unfortunately, this is because the IPCC was unable to reach consensus on how fast the ice in Greenland and West Antarctica would melt, and ended up with numbers that the most conservative scientists agreed to.[36] As a result, many scientists believe that the IPCC estimates of sea level rise are far lower than what the world is likely to experience during the coming century, and sea level rise estimates of one or even two metres by 2100 are being made with increasing frequency.[37]

If sufficiently high shoreline barriers (e.g., seawalls and dikes) are not constructed in time, a one to two metre rise in sea level could render even developments situated above five metres[38] vulnerable to global warming impacts by the end of the century.

WILDFIRES

In addition to the profound increase in fire risk throughout the interior of the province caused by the mountain pine beetle infestation, a shift in the annual precipitation regime further elevates the risk of wildfire, since forests will be facing drier summer conditions



Fraser River 1948 flood: The spring flood of the Fraser River in 1948, in which a number of dikes in the Lower Fraser were breached, was the most extensive and costly disaster in the history of British Columbia.

than experienced in the past. Vulnerability to wildfire has been further enhanced in recent decades by the spread of low-density residential development, and the widespread popularity of landscapes in which homes are located within, or in close proximity to, mature standing trees. The 2003 Okanagan Mountain fire, which occurred under the sort of dry summer conditions that are projected to become more common in the years to come, dramatically highlighted the potential for disaster from wildfire, particularly for high-value scenic amenity homes located in desirable areas. The Okanagan Mountain Park fire burned 239 homes, with estimated losses exceeding $100 million.[39] A second wildfire that occurred at the same time in the working class community of Barrière, B.C., indicates that the risk of wildfire is not restricted to high-end housing, but extends to many other low-density communities within forested areas.

SPRING FLOODING

Even without taking global warming into consideration, spring flooding of the Fraser River poses a great threat to British Columbia. The spring flood of the Fraser River in 1948, in which a number of dikes in the Lower Fraser were breached, was the most extensive and costly disaster in the history of British Columbia. Ten people died, 2,000 homes were destroyed and 16,000 homes were evacuated. Total costs of the disaster have been estimated at $1.8 billion in today's dollars.[40] The Fraser River flood of 1894 was even larger, although damage was far less due to the limited amount of development within the Fraser Valley at the time. Since 1948, populations within the designated floodplain area of the Lower Mainland have expanded rapidly. In 2001, an estimated 327,000 people living in approximately 120,000 homes were now at potential risk of a flood on the Fraser River, and estimates of potential flood damages of a Fraser River flood of record range ranged from $2-$6 billion, not including the indirect costs associated with disruption of critical infrastructure and the economy. [41]

It is also clear that we are not adequately prepared for a repeat of the 1894 flood. A recent detailed review of the hydrology of the Lower Fraser River for the Fraser Basin Council (FBC) concluded that the existing dike system would suffer multiple failures if the peak flood stream flows of 1894 were to occur again.[42] Likely in response to this report, as well as to concerns about record snowpacks in 2007, the provincial government committed $133 million dollars over ten years to improving dikes throughout British Columbia.[43]

On top of this, it is possible that climate change will further increase the risk of a spring flood. The size and intensity of spring flooding in British Columbia could be significantly affected by four separate factors related to global warming: an increase in winter precipitation, a reduction in the extent and duration of snow cover, an earlier spring melt, and increased runoff from watersheds in which forests have been killed by the mountain pine beetle infestation.[44] The FBC study acknowledged the likelihood of climate change altering the size of the peak spring flood, and conducted a sensitivity analysis that found an increase of 10% in the peak model flow would significantly change peak river heights on the Lower Fraser. However, the effect of global warming on Fraser River stream flows was

not directly modeled in the study.[45] As such, the significance of climate change in aggravating (or possibly alleviating) an important pre-existing climate vulnerability is not yet clear. That said, it would be prudent to prepare for peak floods of even greater magnitude than the 1894 event.

STORMWATER FLOWS

A 2002 study for Metro Vancouver found that the intensity of precipitation during time periods to two hours or less had increased significantly during the spring months since the 1970s, and there was "an increasing trend in high-intensity rainfall occurrences particularly during the 1990s."[46] The report concluded, "given that General Circulation Models indicate modest increases in total precipitation over the next century in this region, it would be prudent to upgrade existing storm and combined sewers and drainage systems to higher capacities as part of the regular maintenance cycle."[47]

An update to this report was completed for Metro Vancouver in 2007 by the Pacific Climate Impacts Consortium. The new report found that "patterns of increased rainfall … are still occurring and many have become more accentuated since 2001," and found "statistically significant trends" at some meteorological stations, seasonal increases in overall precipitation during the spring and fall, and an overall trend towards increased precipitation intensity over time periods of less than two hours, particularly during the winter and spring.[48]

An increase in rainfall intensity for average storm events will increase event runoff volumes, while an increase in extreme rainfall intensity will increase runoff flow rates. Increases in the overall volume of stormwater will increase erosion in small urban streams. This impacts stream health[49] and may also degrade the value of nearby properties. Increases in rainfall intensity may or may not require increases in sewer capacity, since this depends on a number of additional factors.

Overall, properly sized "source management" techniques can be effective in mitigating increased runoff flow and volume by slowing stormwater release and increasing local infiltration into the water table[50] particularly during the spring, summer and autumn months. Although increasing the capacity of storm sewers or a greater reliance on emergency "overland" drainage routes (such as designated streets) can likely cope with extreme storms, the health of small urban streams could still be degraded by increases in extreme rainfall intensity or average rainfall intensity.

SUMMERTIME WATER SHORTAGES

The Okanagan basin already has the lowest per capita availability of freshwater in Canada,[51] and the vulnerability of the Okanagan valley to water shortages as a result of global warming has been the focus of an extensive multi-year study over the last decade.

The study developed a suite of water supply and demand scenarios for Kelowna and other cities in the Okanagan, incorporating population forecasts together with climate change projections.[52] The study established that increasing demand for water would be

problematic even if global warming didn't exist; established population growth projections could increase Kelowna's total water demand for non-agricultural uses by up to 360% by the 2050s if there were no changes in building preferences and per capita water demand.

The study found that global warming will both decrease water supply and increase demand. Higher snowlines and reduced summertime precipitation resulting from global warming will reduce summertime water flows within the Okanagan watershed. At the same time, agricultural demand for water will increase as a result of climate change. Increasing temperatures will increase evaporation rates, while a longer growing season will also increase water demands, even without an increase in the amount of irrigated land.[53] The same factor will also increase total municipal water demand by a factor of 10% to 19%.[54]

As a result, the study found that "demand will exceed supply by the 2050s, and as early as the 2020s in relatively dry years."[55] The mostly readily available source of additional water is that contained within the lakes themselves. Given the amenity and real estate equity value provided by the lakes of the Okanagan Valley for properties in general within this region, and for waterfront property in particular, any significant decline in lake levels would likely have a large economic cost in terms of total land value equity. Because of this, if there were an absolute scarcity of water, restrictions on lake water levels would also have large-scale consequences for land values in the valley.

The report notes that "aggressive implementation of residential conservation measures could reduce total demand in the 2050s by about 8-12% (low growth and high population growth scenarios, respectively)." There also appeared to be opportunities for water conservation within the agricultural sector, but the report does not conclude that such efforts would always be able to overcome the supply-demand gap.[56]

B.C. is experiencing a shift in attitudes on climate change

In recent years, government, engineers and planners have become increasingly aware – and concerned – about the potential impacts of global warming. Many B.C. municipalities are now funding climate change studies in order to identify possible vulnerabilities and to map out appropriate adaptation strategies.

As government planners and regulators become aware of how global warming is projected to affect their communities, we can expect them to change their existing policies, advocate for changes to present-day standards, and revise their goals accordingly as they plan for the future.

THE PUBLIC IS CONCERNED AND MOTIVATED TO TAKE ACTION

In 2006, the catastrophic impact of Hurricane Katrina, together with the election of a new Canadian federal government openly skeptical about global warming and the Kyoto Protocol, appeared to galvanize public concern about the environment. This concern swelled during the course of the year until global warming became the number one political issue in Canada. In 2007, climate change and the environment continued to be the top concern of Canadians.[57]

Large numbers of Canadians are now taking on responsibility for action on climate change and sustainability, and are increasingly willing to make significant lifestyle investments in new "green" technologies.

The rapid increase in sales of hybrid cars and other conspicuously-efficient vehicles (e.g., the Smart car) is one clear indicator that many people are willing to make very large investments in sustainable technologies for its own sake – and because of the social status that is increasingly associated with these investments. In May 2007, Toyota announced that it had sold one million Prius hybrid cars throughout the world in 10 years.[58] During the first half of 2007, hybrids accounted for 2.7% of all light-duty vehicle sales in the United States, and 2007 annual sales were expected to increase by 35% over 2006 levels.[59]

All indications are that a substantial portion of Canadians are now willing to invest heavily in sustainability, energy efficiency, and greenhouse gas reductions in particular.

According to a September 2007 poll by the Investors Group, "an overwhelming 82 per cent of Canadians plan to change their behaviour and adopt green practices" with 63% stating that they "would be willing to spend up to $10,000 in changes to their homes to reduce annual energy costs by 25 per cent. Eight per cent would invest up to $25,000 to achieve this goal, while five per cent would do whatever it costs."[60]

GOVERNMENT IS COMMITTED TO IMPLEMENTING SIGNIFICANT MEASURES

In the 2007 Speech from the Throne, the Government of British Columbia made a dramatic and far-reaching commitment to action on global warming. The text of the speech left little room for ambiguity:

> "The science is clear. It leaves no room for procrastination. Global warming is real … The more timid our response is, the harsher the consequences will be."[61]

As part of the speech, the government also committed to "reduce B.C.'s greenhouse gas emissions by 33 percent below current levels by 2020. This will place British Columbia's greenhouse gas emissions at 10 percent below 1990 levels by 2020."[62]

Subsequent announcements by the B.C. Government include a commitment to introduce legislated emission reduction targets for greenhouse gases for 2020 and 2050 in the fall 2007 session of the Legislature. Action on emission reductions will be coordinated with other jurisdictions; the province will take part in an emissions cap-and-trade system with a number of U.S. states including Washington, Oregon and California. The provincial government and all Crown Corporations are to be carbon neutral (i.e., having no net greenhouse gas emissions) by 2010, including emissions from air travel.[63]

One of the most important developments of the province's new global warming agenda is the British Columbia Climate Action Charter, which commits municipalities to advance and implement the province's climate change objectives through the tools available to local government.

B.C. is now entering into an era in which greenhouse gas emissions will be regulated,

where the inefficient use of energy will become increasingly expensive, and in which low-emission solutions will provide direct financial benefits.

INSURERS ARE INCREASINGLY CONCERNED ABOUT LOSSES FROM CLIMATE IMPACTS

Although they have not adopted the activism of the British insurance industry, there now appears to be a heightened level of concern by Canadian insurers. In October 2007 Mark Yakabuski, the incoming president of the Insurance Bureau of Canada, signaled an increased level of concern regarding global warming, commenting that "we end up paying a good portion of the bills related to climate change .... What used to be a 100-year occurrence is increasingly becoming a 20- to 50-year occurrence, and shortly will become more frequent. ... [W]e have to work together to find ways of limiting damage climate change causes and improve infrastructure .... [T]he majority of our municipal infrastructure is not adequate for the rains we get today."[64]

The insurance industry is particularly affected by the impacts of global warming, and the measures the industry takes in response will have an important influence over how and where land development occurs in the future.

Building for the future

British Columbians have embraced the construction of new green buildings in the heart of their cities.

We have reached a turning point on climate change in North America, both in terms of the impacts that are already occurring, and in terms of public concern about the issue. It is clear that all of society will be affected by these changes to one degree or another.

The changes that will most directly affect the land development community come from the following shifts:

- Consumers are becoming increasingly willing to pay for "green" performance in general, and emission reductions in particular.
- Regulators are starting to realize that the public is now overwhelmingly supportive of implementing mandatory measures to address global warming, including greenhouse gas reduction targets. At the same time, regulators are now becoming aware of their exposure to the impacts of global warming and the costs of leaving the public vulnerable to these impacts.

As a result, the land development community should anticipate several important shifts within the next few years, and position itself to take advantage of these developments.

Green buildings are growing rapidly

THERE IS INCREASING MARKET DEMAND FOR GREEN BUILDINGS

A slow trend towards increasing the energy efficiency of buildings has been underway since the "energy crisis" of the 1970s, and has been particularly noticeable in the performance of appliances such as fridges, freezers, and washing machines. New appliances can consume less than a third of the power required by the ones they replace. The efficiency of new natural gas furnaces has also increased by 50% over the past few decades. Recent advances in fluorescent lighting, the commercialization of the compact fluorescent light and the advent of the LED light have allowed for huge energy efficiency gains from lighting.

Since the early 1990s, there has also been a great upsurge of interest in "green" buildings. Green buildings are designed and built in the most environmentally friendly matter possible every step of the way. Of particular interest to the land development community, perhaps, is the stress that green building approaches place on maximizing occupant health and comfort - objectives achieved through measures such as natural lighting, openable windows, and minimal use of petrochemical-based materials, since these emit volatile organic compounds (VOCs).

Helped in large part by the establishment of the LEED green building standards, the present decade has seen an exponential increase in the visibility and demand for green buildings. Vancouver and Victoria are both home to a series of state-of-the-art green buildings in North America, including the C.K. Choi Building at UBC, the Vancouver Island Technology Park in Saanich, B.C.[65], the LEED Platinum Dockside Green development on Victoria's Inner Harbour[66], and what is described as the world's greenest building – the CIRS complex now under development in False Creek Flats in Vancouver.[67] There have also been an increasing number of developments with green attributes within the Interior of the province in recent years, including the use of ground source heat pumps for a number of large resort condominium developments in the Kamloops region.

Even with this rapid growth, one large-scale study concluded that developers of green buildings may be hampering the growth of the sector by underselling the advantages of green buildings. Although the study confirmed that green buildings are indeed "quicker to secure tenants, command higher rents or prices, enjoy lower tenant turnover," and usually cost less to operate and maintain, it concluded that the greatest financial benefits have been consistently overlooked by the real estate industry:

> "[T]he scale of productivity and health benefit is potentially enormous, and may exceed the value of all real estate expenditures (not just energy, operations and maintenance but other costs such as rent/mortgage as well). If developers, owners and valuers can understand how to tap this benefit, the commercial advantage that they would gain would become the most significant aspect of Green Value."[68]

To date, the rapid development and growth of the green building phenomenon has largely come about through voluntary and market forces, albeit with the active support of the building and planning professions and government regulators. Formal regulatory support for energy-efficient and/or "green" buildings by the provincial government has been limited to measures such as the province's Energy Efficiency Act (which serves more to prohibit the use of grossly inefficient appliances or building components), and provincial sales tax exemptions for some energy efficient equipment. With its own municipal charter, the City of Vancouver was able to adopt the ASHRAE 90.1 (1989) energy-efficiency standard in 1991, and the City subsequently adopted the stricter ASHRAE 90.1 (2001) standard in 2004.[69]

Beyond this, one of the most remarkable lifestyle transitions within the past generation has been the reinvention of the downtown core in many of B.C.'s larger urban centres. High-density, high-amenity urban neighbourhoods are now starting to emerge throughout the Lower Mainland, on Vancouver Island, and in the Okanagan. These fast-growing urban areas are being populated by large numbers of people attracted to a completely different set of

lifestyle ideals than those used to sell the old ideal of the large lot detached suburban home. While the expert marketing of these "smart growth" ideals has been a significant factor in the success of B.C.'s emerging new urban form, it is also true that many B.C. residents are independently motivated to live within vibrant and diverse mixed-use neighbourhoods in which the use of a car for transportation becomes a choice rather than an obligation.

CLIMATE CHANGE IMPACTS WILL DRIVE CHANGES TO BUILDING REGULATIONS

Building standards and construction practices are very likely to change significantly within the next few years, particularly within identified hazard areas, as insurers, regulators and financiers seek to limit their exposure to financial and regulatory liability.

Most of the buildings we build now are built to standards intended to make them a sound investment for 100 years or more.[70] Notwithstanding catastrophe, most of the buildings we build now will be here in 2050, and a great many will be here in 2100. The problem, of course, is that future "catastrophe" is becoming increasingly likely in areas at risk from the impacts of climate change (e.g., a coastal or riverine flood plain).

Until now, however, it has been assumed that the climate is essentially unchanging; in order to build for the future, it has only been necessary to protect against the range of weather events experienced in the past. Now that the reality of climate change is broadly recognized, this assumption is no longer tenable. It is only a matter of time before building standards begin to account for potential climate impacts.

Engineers and architects are particularly exposed to liability in the event that structures are damaged as a result of foreseeable events, both because of their crucial roles in developing building standards and designing what gets built, and because of their professional responsibility in guaranteeing the performance of the structures they design. In a 2006 statement, Marie Lemay, CEO of Engineers Canada,[71] acknowledged this professional vulnerability to global warming impacts, noting that climate change will "necessitate changes to building codes, engineering practices and standards, and will affect the way facilities are designed, ultimately altering the economic lifespan of infrastructure and thereby impacting commerce and industry." In response, Engineers Canada created the Public Infrastructure Engineering Vulnerability Committee (PIEVC) in 2006 to "facilitate an assessment of the vulnerability of Canada's public infrastructure to the impacts of climate change."[72]

Changes in building standards may also be encouraged by the insurance industry, which has a huge amount of investment at stake in limiting the amount of damage that occurs to insured properties. Elsewhere in the world, de facto building standards are already changing, as a direct result of insurance companies determined to reduce their exposure to huge aggregate claims from policy-holders in the wake of climate change-related disasters.

The United Kingdom has extensive areas of long-established development situated within floodplain areas. Within the past decade, British insurers have become convinced that global warming will lead to an increasing frequency and severity of flooding within these areas – borne out by the widespread and disastrous floods of summer 2007. In their June 2005 report, Financial Risks of Climate Change, the Association of British Insurers (ABI) noted that:

> "In the UK, climate change could increase the annual costs of flooding by almost 15-fold by the 2080s under the high emissions scenario, leading to potential total losses from river, coastal and urban flooding of more than $40 billion (£22 billion). If climate change increased extreme European flood losses by a similar magnitude, annual costs could increase by a further $120-150 billion ($100-120 billion)."[73]

More pointedly, the report also noted that "if climate change increases both average losses and insurers' capital requirements, risk premiums could increase."

The ABI report goes on to note that "many climate change costs could be avoided by taking action today," and highlights adaptation (in addition to emission reductions) as one of the primary means of doing so.[74]

Government also has a tremendous exposure to global warming impacts, both in terms of financial payments, and legal liability. Government is typically more exposed to the damage and reconstruction costs of disasters since insured losses usually account for far less than half of total costs. Beyond this, governments are effectively obliged to step in with disaster relief payments for victims of disasters, while insurance companies can choose to discontinue insurance coverage in areas that are judged to be at particular risk of damages. That said, government also has the ability to reduce these risks by providing protective infrastructure, by developing and implementing development controls in risky areas and by legislating improvements to building codes and development regulations that will increase the resiliency of properties at risk.

Unfortunately, failure to perform these functions effectively leaves the government open to even more disaster-related costs in the form of legal costs and damage awards resulting from legal actions.

In sum, a wide range of sectors with tremendous influence over building standards and land development have a clear and important motivation to reduce their exposure to possible liability from climate-related impacts.

EMISSION REDUCTION EFFORTS ARE ALSO DRIVING CHANGES TO BUILDING REGULATIONS

The most effective means of making existing and new developments resilient to future climate impacts is by limiting the amount of global warming in the first place. While concerns about adaptation to climate change are only a recent development, many governments throughout B.C. have formally recognized the importance of reducing greenhouse gas emissions for many years now. As noted above, the provincial government has committed to reduce B.C.'s emissions of greenhouse gases to 10% below 1990 levels by 2020. In order to achieve this goal, emission reduction measures will need to be implemented in all economic sectors of the province. This includes land development, which is both directly and indirectly responsible for a significant portion of the province's greenhouse gas emissions.

A review of Canada's greenhouse gas emissions in 2005 shows that energy use from commercial, institutional and residential buildings resulted in almost 79 million tonnes of greenhouse gas emissions, about 10.5% of Canada's total greenhouse gas emissions.[75] Improving the energy efficiency of existing and new homes could play a significant part in reducing Canada's overall emissions.

Changes to B.C.'s building code are coming. Government staff are now developing an energy efficiency regulation for new buildings that is scheduled for implementation in 2010.[76] Developers who already have experience working with B.C.'s experts on energy efficiency measures and green building techniques will be well-positioned to thrive in the years ahead. Those who start preparing now will enjoy an important lead over those who simply wait until the new regulation is enacted before taking action.

The shift towards "smart growth" is accelerating

GOVERNMENTS ARE ENACTING POLICY ON EMISSION REDUCTIONS

Individual structures and property are not the only levels at which change will occur. The imperative to reduce greenhouse gas emissions through energy efficient building components and appliances will also have a profound effect on a broader scale. Existing patterns of land development are likely to change significantly, with a decided shift towards compact development and other "smart growth" measures in response to new requirements to reduce greenhouse gas emissions.

As noted above, the total energy demand from Canadian homes is responsible for almost 80 million tonnes of greenhouse gas emissions each year. Large as this total is, it remains much less than the 135 million tonnes of greenhouse gases that are emitted from the road transportation sector, fully 18.1% of the country's total emissions. If we are to reduce our emissions of greenhouse gases by the more-than-80% from current levels that will be required if we are to prevent a truly dangerous level of global warming impacts, then it will not be enough to improve the efficiency of individual buildings. We will need to drastically improve the emissions performance of communities as a whole. This can be done by developing our existing communities in a more compact manner, mixing compatible land uses together and supporting alternative, less-emitting modes of transportation such as public transit, biking or walking. The importance of community form in reducing overall greenhouse gas emissions is highlighted by findings which show that the location of a home is more important than the energy efficiency of a home in determining overall household greenhouse gas emissions. In terms of greenhouse gas emissions, it is much better to live in an energy inefficient home in the centre of the city than to live in a state-of-the-art "green building" in the suburbs of a metropolitan area.[77] To borrow a well-known real estate maxim, the most important factor in reducing overall greenhouse gas emissions from developed land is "location, location, location."

In addition to its considerable expertise with green buildings and energy efficiency measures, British Columbia also has a remarkable wealth of experience in the planning and development of attractive, livable, and lucrative compact development. Metro Vancouver has achieved considerable success – and international recognition – for its Livable Region Strategic Plan. In turn, this plan owes much of its success to another B.C. innovation, the Agricultural Land Reserve, which has effectively restrained suburban sprawl within Metro Vancouver for the past 30 years. The City of Vancouver – particularly within the downtown peninsula and the regions surrounding False Creek – has not only achieved a remarkable

redevelopment of its old industrial brownfield sites, but has actually become a far more desirable city in doing so. Nor is this success a product of planners alone – Vancouver's remarkable transformation into the "most livable [city] in the world"[78] has in large part been brought about by visionary developers who have invested heavily in the city's urban redevelopment strategy and have realized huge returns. Similar successes have been achieved through the creation of compact urban centres in Richmond, Metrotown, and New Westminster, and large scale brownfield redevelopments in Victoria and Kelowna. The lessons of Vancouver are now being applied in cities throughout North America.

It is clear that both the province and local governments will soon be enacting policy measures to increase compact development within British Columbia. The City of Vancouver has recently embarked on its EcoDensity initiative, which promises to extend the geographical extent of the city's redevelopment initiatives within the city.[79] As of 2007, 74 municipalities[80] have signed the British Columbia Climate Action Charter which calls on local governments to:

"Develop a range of actions that can affect climate change, including initiatives such as: assessment, taxation, zoning or other regulatory reforms or incentives to encourage land use patterns that promote increased density, smaller lot sizes, encourage mixed uses and reduced greenhouse gas emissions; development of greenhouse gas reduction targets and strategies, alternative transportation opportunities, policies and processes that support fast-tracking of green development projects, community gardens and urban forestry; and integrated transportation and land use planning …"[81]

MUNICIPALITIES WILL REDUCE THEIR LIABILITY TO CLIMATE CHANGE IMPACTS

Climate change is a global phenomenon, and many of its impacts will be felt over a broad area. Floods and storm surges have the potential to affect large floodplain areas, while the bitter experience of the 2003 Barrière fire shows that wildfire can sweep through entire communities. On a larger scale, the threat of summertime water shortages affects the entire Okanagan Valley, a region extending for hundreds of kilometres. When entire areas are vulnerable to the same impacts, it is often far more cost-effective to design effective adaptation measures at the scale of the affected area. Unfortunately, not all effective adaptation measures are cost-effective, either at the level of the single property or the wider area. In some areas, the cost of effectively addressing the new or intensified impacts projected to result from global warming may be so high as to substantially undermine the future value of the property. By contrast, other areas may be so advantageously situated with regard to possible climate change impacts (especially relative to other properties) that their value will substantially increase over time. This new overlay of climate assets and liabilities is, in many places, at considerable variance with the existing map of property valuations in B.C. As a result, the geography of land development is likely to change in response to the new imperative of risk reduction.

In B.C., communities with official community plans "must include statements and map designations for the area covered by the plan respecting … restrictions on the use of land that is subject to hazardous conditions."[82] Floodplain areas are a long-recognized form of

hazardous land. Under Section 910 of the Local Government Act, local governments may designate a specific flood level and a minimum setback from the water or dyke for the foundation of a structure. Municipalities can designate other hazard areas as well. For example, the Official Community Plan (OCP) for the City of Kamloops designates "slopes in excess of 25%", and "high-" and "extreme fire risk" areas in addition to its designated floodplain area.[83] Despite this, it is possible to develop lands within most[84] of these designated hazard areas. Within the floodplain area, the city neither prevents new development nor seeks to remove existing development from floodplain areas.[85] Thus, property owners seeking to increase the existing floor space area on the property by more than 25% are required to enter into a covenant indemnifying the City of Kamloops and the Province of British Columbia "in the event of future property damage as a result of flood conditions."[86] Similarly, Kamloops permits new development within the silt slope area if a professional geoscientist certifies that the design and construction of the building will effectively mitigate the risks involved, thereby absolving the municipality of liability. By asking for these requirements, the municipality has limited its liability in case of a disaster.

Severe storms, such as the December 2006 storm that destroyed parts of the Vancouver seawall and Stanley Park, are forecast to become more frequent and more intense.

This approach is entirely rational on the part of municipalities, and would be highly effective in a world without global warming. For many property owners, the risk of a "1-in-200-year" event is a risk worth taking given the opportunities available in developing these properties. Unfortunately, this no longer holds true if the real return period of a nominal "1-in-200-year" event begins to shrink.

Worse yet, early indications are that global warming may lead to significant impacts in areas that had not previously been identified as hazard areas at all. The cases of the landslides in the District of North Vancouver and the District of Mission are particularly important in this regard, particularly in light of the similarities between these events. Although they occurred in different places at different times, both events involved slope failures of residential properties that had been developed several decades before. In both cases, the landslides were directly triggered by extreme storm events, together with high levels of rainfall in the preceding weeks. Finally, both cases show some evidence of poor construction processes, in which loose fill was dumped onto a steep slope in order to enlarge the size of the properties' backyards. In the case of the District of North Vancouver, the Provincial Emergency Program ended up purchasing seven properties at fair market value, while to date, the District of Mission has denied any liability for the landslip.[87]

There are several troubling implications in these events. It is apparent that these properties may have been particularly vulnerable to rainstorm-triggered landslides because of alleged poor construction techniques (in Mission) and the particularly steep angle of the slopes in the District of North Vancouver. However, it is possible that these two locations are simply the most vulnerable instances of a larger population of hitherto-undetected locations at risk of failure during future extreme precipitation events. If it exists, this group of vulnerable properties is hidden within existing developments, and many of them have likely existed for many decades without hint of impending failure.

The changes that the District of North Vancouver has adopted in the wake of the Blueridge/Seymour landslide are likely to prevent development within areas that might have been developed prior to the Tropical Punch storm. The District has adopted new risk

acceptance criteria for landslides of a 1-in-10,000 chance of one fatality per year per site. The new standard, based on existing criteria in Hong Kong, applies throughout the municipality.[88] The District has also adopted a warning and evacuation protocol that sets out thresholds for landslide alerts and warnings based on the amount of rainfall experienced during a storm event, and the amount of precipitation received in preceding weeks.[89] That said, these new standards will mostly alter the city's future development at the scale of a single subdivision.

INSURERS WILL REDUCE THEIR EXPOSURE TO LOSSES FROM CLIMATE CHANGE

As noted above, municipalities have protected themselves to some degree from the liability costs of foreseeable hazards. As a result, the most urgent call for wholesale changes to land development practices may come first from another quarter, one with more exposure to the unexpected costs of climate change – the insurance industry.

Insurers have a remarkable ability to influence settlement patterns. Rather than acting directly through land use controls, insurers act indirectly, by withholding insurance (and thus financing) within the hazard zones they define.

One particularly striking example of the influence wielded by insurers comes from the United Kingdom. Alarmed by widespread flooding in Britain in 2000, and convinced that global warming rendered future floods and increased financial losses inevitable if no changes were made, an association of British insurance companies appear to have presented the British government with what amounted to an ultimatum – if the British government did not step up investments to better protect the 2.2 million properties in flood risk areas, the industry would cease to provide flood insurance. Subsequent negotiations produced a remarkable agreement between the government and the insurers. As reported by the insurance industry, it agreed to:

- Provide flood insurance as a standard feature of household and small business policies within areas where flood risk is 1.3% annual probability (or 1 in 75 years) or less.
- Maintain flood insurance for residential properties and small businesses in areas where improvements in flood protection infrastructure were scheduled for completion by 2007 (later revised to a rolling commitment to include all schemes scheduled for completion within the next five years), that would reduce flood risk to a 1.3% annual probability (or 1 in 75 years) or less. Premiums charged for this group of properties would reflect the risk of extending coverage to these properties.
- Consider providing insurance on a case-by-case basis to properties within areas of significant flood risk (greater than 1.3% annual probability or 1 in 75 years) where no improvements in defenses are planned.[90]

For floodplain properties that remained unprotected, the Association of British Insurers also began to promote flood resilience approaches, which concentrate on ways to proactively reduce the damage to buildings and contents when flooding does occur. Examples of flood resilience include construction with waterproof and highly water-resilient materials, situating electrical devices above the projected flood level, and installing one-way valves into drainage pipes so that damage to the building is limited even with a flood.[91]

According to subsequent reports by the Association of British Insurers, the insurers' ultimatum spurred considerable action by the British government, including a large increase in funding for flood defenses, and the protection of an additional 50,000 homes in England by 2005.[92]

Assuming these approaches are maintained, the result of this approach is likely to result in a significant alteration to pre-existing land-use development patterns. Over time, one would expect to see further concentration of development within adequately protected urban areas, and where the increase in land values justified it, the creation of new flood protected zones in suitable areas. At the same time, one would also expect to see a gradual removal of some existing development from the areas at highest risk of flooding, together with a steady increase in the flood-resilience of developments that remain within the unprotected floodplain areas.

Insurers will not always impose solutions that promote compact development, serve the interests of local government and preserve existing land values where possible. In the aftermath of the 2005 hurricane season, the emphasis which the U.S. National Flood Insurance Program (NFIP) has placed on flood-proofing individual properties at great expense, rather than flood resilience or investment in community flood protection infrastructure, appears to be a significant factor behind the extremely slow economic recovery being experienced within much of the damaged region of the Gulf States. Faced with a choice between committing to a hugely expensive house-raising in order to receive a building permit to repair a home that has lost most of its value[93], or starting again elsewhere, many hurricane victims are choosing the latter, even in areas where community investments in flood protection might prove more cost-effective. As early as three months after Hurricane Katrina, planners were already warning that rebuilding in New Orleans might generate gap-toothed sprawl, in which only a few homes per block would be rebuilt.[94] Here too, the result is likely to be a large scale and lasting change in the pattern of regional land development. Unfortunately, the result in New Orleans may well be a less populous city with a drastically lower total assessed value that still occupies the same amount of land, has the same vulnerability to flood impacts, and requires the same amount of flood protection as before.

The action of private insurers in the wake of the 2005 Gulf Coast hurricanes is also remarkable, since they appear to be cancelling existing flood insurance policies as far away as New York State.[95] A similar large-scale strategy of "non-renewal" for specific types of insurance by Canadian insurers, as a means of quickly reducing the industry's exposure to a perceived excessive risk of catastrophic loss, could conceivably result in a sudden and unexpected loss of assessed values within identified risk areas across the country. This might happen before developers or governments could suggest alternate approaches to risk reduction along the lines of the British experience. Here too, the long-term effect could be substantial changes to land development patterns within hazardous areas, but in a way that maximized economic dislocation for property owners and local governments.

Within Canada, the insurance industry also has the potential to significantly influence the patterns of land development. Insurers provide flood insurance for commercial and industrial properties against flood losses, as well as against losses from interruptions to business. These liabilities alone can be very substantial. During the 1996 flood of the Saguenay

River in Quebec, losses to three industrial sites alone totaled almost $250 million. Beyond this, residential properties are also covered from flooding damage due to sewer back-ups. Flooding in Peterborough in August 2005 caused $400 million in total losses, including $90 million in insurable losses from sewer back-ups. This total was greatly exceeded by a second storm in the same month which resulted in $500 million in insured losses to residential properties in Toronto.[96]

The Insurance Bureau of Canada (IBC) is now becoming more active on global warming issues; as recently as their October 2007 meeting, the Board directed that IBC staff investigate adaptation to climate change.[97] IBC staff is concerned that unless development in areas prone to climate change is mitigated by strong adaptation measures (e.g. flood barriers, more resilient sewer systems and power lines, and improved construction standards) the cost and availability of insurance could become a problem for homeowners and businesses.[98] In the past, the IBC has also urged the development of a "National Disaster Mitigation Strategy" and "Provincial Mitigation Strategies" to address impacts from global warming.[99]

Conclusions

Climate change is shifting both the averages and the extremes of the weather we experience. In B.C. average annual temperatures are increasing, and our "wet" and "dry" seasons are becoming more accentuated over time. Climate change is also increasing both the frequency and the severity of extreme weather events. These trends have become increasingly apparent in recent years. The magnitude of extreme events has now reached the point that some of B.C.'s most vulnerable buildings and infrastructure have been severely impacted.

Until recent years, our existing land development regulations and building standards have been extremely successful in protecting British Columbians from injury, death and property loss for all but the most extreme – and infrequent – weather events. Prior to the onset of rapid climate change, these regulations were effective in protecting land development professionals (e.g., engineers, architects, planners and real estate agents) from liability claims. The stable, predictable risk of low-frequency extreme events has allowed the insurance industry to profitably provide all parties with reliable financial protection against extraordinary loss.

It is now becoming clear to the general public, government, building sector professionals, and insurers that the effects of climate change will require significant changes to current practice. It is necessary both to reduce greenhouse gas emissions and thereby limit the magnitude of climate change, and to implement effective adaptations to the climate change impacts we cannot avoid. This recognition of climate change is driving:

- Changes in purchasing behaviour;
- The introduction of new government regulations;
- The revision of existing professional guidelines and standards; and
- Changes to the manner in which insurers calculate the risk of impacts from extreme weather events, and the extent to which insurers continue to provide coverage against these impacts.

The sum of these changes will affect the design and the location of new developments, and have the potential to substantially alter the valuation of existing developed lands throughout B.C. Some of the likely effects include:

- An increase in building costs, at least during the short term, as new standards for increased resilience, and increased requirements for energy-efficiency in buildings take effect. These costs may well come down again over time as the construction industry becomes accustomed to the new measures and incorporates them into standard practice. To be effective in reducing the overall cost of climate impacts, any increase in overall construction costs should be outweighed by a corresponding reduction in the total amount of public and private liability and insurance costs.
- A shift towards more compact, less land-intensive forms of development. Urban form is likely to become more compact because this form of development directly reduces greenhouse gas emissions from both buildings and transportation, thereby helping to limit the long-term impacts of climate change. Moreover, within hazard areas like floodplains, the enormous cost of adequately protecting large tracts of vulnerable land against the impacts of climate change will create a strong economic incentive to reduce the area of new developments.
- A continued acceleration in market demand for green buildings, coupled with increased regulatory requirements for energy efficiency in all new buildings. Already, large numbers of people are willing to invest in sustainability and reducing their greenhouse gas emissions. These buildings are likely to hold their value better than other buildings of similar age, especially as greenhouse gas emissions become increasingly expensive over time. The number of customers interested in investing in green buildings, and the average premium they are willing to pay, is likely to increase still further as the health and productivity benefits of green buildings become more widely recognized.

Even in a future of climate change, some things will remain the same. With continuing population growth, the real estate sector will continue to be a major area of economic activity in British Columbia. Those who adapt to the changes now underway will continue to find opportunities in the years to come.

Recommendations

Existing patterns of land development are likely to change significantly, with a decided shift towards compact development and other "smart growth" measures in response to new requirements to reduce greenhouse gas emissions.

For the Real Estate Institute of British Columbia (REIBC):

- Act now to help REIBC members understand and adapt to the shifts in public concern, governmental regulation and insurance coverage on climate change-related issues that are now imminent or already underway.
- Strike a committee to research the implications of climate change for the real estate sector and communicate these findings to the REIBC membership. The scope of the committee should include the following:
  - The amount of greenhouse gas emissions reductions that may be required over time within B.C.;
  - Options for reducing greenhouse gas emissions from the real estate sector, including:
    - The retrofit of existing developments; and
    - Reducing (or eliminating) emissions from new development;
  - The projected impacts of climate change within British Columbia; and
  - Options for cost-effective adaptation and risk reduction.
- Reach out to other organizations with expertise in climate change, green buildings and smart growth. B.C. is already a North American leader in the fields of green building and sustainable development; REIBC members can build a competitive advantage by making use of these local resources.

For real estate agents, appraisers and assessors:

- Make sure you are able to identify and accurately quantify the overall added value provided by more energy efficiency or "green" attributes in properties to prospective purchasers.
- Make sure you are able to identify and accurately quantify the potential liabilities of properties inadequately protected from climate change impacts.

For planners and regulators:

- Make sure zoning and development guidelines adequately protect residents and local development against identified vulnerabilities to global warming – and the municipality itself from liability – when planning or permitting new development, installing infrastructure or approving retrofits to existing developments.
- Recognize the influence of urban form over greenhouse gas emissions, and implement policies that result in reduced emissions per capita over time:
  - Intensify town centres by enhancing economic activity and promoting mixed use development;
  - Reinvest along empty corridors and brownfields and redevelop strip mall type roads;
  - Promote regional planning;
  - Promote alternative transportation;
  - Protect existing compact residential neighbourhoods; and
  - Protect agricultural and rural areas by establishing a legislated urban **g**rowth boundary.[100]

For developers:

- Before making an investment decision (purchasing an existing property, deciding to develop a new property), determine:
  - Whether the location is at risk from identified global warming impacts;
  - Whether protective measures are in place or required to protect the property against the existing impact; and
  - Whether these measures take identified climate impacts into account.
- Take account of consumers' increasing consumer willingness-to-pay for green attributes (including project location, construction and amenities) when scoping and developing new projects.

For everyone:

To solve the problem of climate change, we all need to take account of our personal carbon emissions and make continued efforts to reduce them wherever possible. Investigate and implement measures your organization can take to reduce greenhouse gas emissions from its corporate operations, and consider reducing the remaining emissions to zero by going "carbon neutral" and purchasing emission offsets from certified emission reduction projects.[101]

NOTES

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Hot Properties was commissioned by the Real Estate Institute of British Columbia (REIBC) to provide an analysis of how global warming will affect B.C.'s real estate sector. The report finds that changes in purchasing behaviour, government regulations, building standards and the way in which insurers calculate risks are either already underway or imminent. These forces are likely to affect the design and the location of new developments, and could substantially alter existing patterns of property values within B.C. The report also highlights opportunities for the development of a new and vibrant economy based on green buildings and compact design.

The David Suzuki Foundation works through science and education to protect the diversity of nature and our quality of life, now and for future generations.

This report is available online at **www.davidsuzuki.org**.

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