

STRESS POINTS MARCH 2012

1.0 OVERVIEW

CANADA WEST FOUNDATION  
ARTHUR J.E. CHILD FOUNDATION  
WATER PROJECT

# StressPoints

An Overview of Water & Economic Growth in Western Canada

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**CanadaWest**  
FOUNDATION

# The Canada West Foundation Arthur J.E. Child Foundation Water Project

In Canada and around the world, consumers, industries and governments are adjusting to a new environmental and economic reality where resources are becoming increasingly scarce as global demand for energy, food, commodities and water rises. There is a growing recognition that “business as usual” will not yield ample amounts of these supplies for the growing world population. In an age defined by climate change and extreme weather events, ensuring the long-term security and health of water and aquatic ecosystems—which are critical to sustaining economic and population growth—is becoming ever more important. At the same time, friction is building at the interface between the supply of water and economic development.

The objectives of the Canada West Foundation-Arthur J.E. Child Foundation Water Project are to explore the “stress points” found at the interface between water and the western Canadian economy and to encourage a franker public debate about them. An overarching goal is to ensure that western Canadian circumstances, expertise and innovation inform the national debate on the future of Canadian water policy and economic growth.

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# Water Stress Points

Shale Gas Development

Oil Sands Development

Potash & Uranium Mining

Lake Winnipeg

Agriculture in the Okanagan

Agriculture in Southern Alberta

## • Urban Issues

**Lake Winnipeg:** Eutrophication is threatening commercial fishing, drinking water, human and ecosystem health, tourism and recreation and hydropower.

**Shale Gas Development:** Rapid development and the method of hydraulic fracturing are a concern.

**Agriculture in the Okanagan:** A growing population means higher water demand, which may impact the already water-scarce agriculture sector.

**Agriculture in Southern Alberta:** Municipal demand for water is increasingly competing with the agriculture sector but no new water licenses have been issued since 2006.

**Oil Sands Development:** Contaminants in the Athabasca River from development are affecting drinking water and fish habitats.

**Potash and Uranium Mining:** As global demand for potash and uranium increase, there are growing concerns about the impact of mining on water quality.

**Urban Issues:** As urbanization increases, planners will have to meet increasing water demand, mitigate stormwater and increase water treatment.

# Executive Summary

The objectives of the Canada West Foundation-Arthur J.E. Child Foundation Water Project are to explore the “stress points” found at the interface between water and the western Canadian economy. An overarching goal is to ensure that western Canadian circumstances, expertise and innovation inform the national debate on the future of Canadian water policy and economic growth.

Water is not only central to our health and environment, but also to the success of our economy. In western Canada, a series of water challenges or “stress points” are beginning to emerge. These stress points encompass concerns about water quality, quantity and the effects of economic development on communities and aquatic ecosystems. Added to this mix is a range of stakeholders who have different objectives and viewpoints. Ultimately, governments must make the difficult decisions regarding whose water needs take priority.

This paper rests on two assumptions. First, the allocation of water will be one of the most challenging policy issues in the years ahead. How this issue is addressed is of critical importance to the western Canadian economy.

Second, the Canadian policy arena at large is not sufficiently primed for this debate as economic and water policy are often treated as separate, rather than integrated entities. Without acknowledging the link between responsible water management and economic output, our environment, communities and economy are put at risk.

## Setting the Stage

Western Canada is rich in natural resources and arguably water is as important a factor, if not more important, than financial capital, labour, energy, technology and raw materials in producing these resources (Renzetti et al. 2011).

Yet there are concerns about western Canada's water supply, the majority of which comes from glaciers and snowpack. As these sources diminish, water scarcity will become an increasingly important issue.

There are emerging pockets of water problems in western Canada where specific areas are experiencing the pressures of growing threats of contamination, an unstable and shrinking supply, outdated infrastructure and a loss of wetlands—all of which are exacerbated by climate change, extreme weather, increasing global demand for energy, food, commodities and water and increased economic activity on a finite land base in the West. Current practices of water management and allocation must change to reflect these pressures.

## Policy Dilemmas

Information gaps, societal attitudes and lack of public awareness about water, legal issues and desire for greater government leadership are some of the policy dilemmas facing decision-makers. In order to rethink the way we value water and how allocation decisions are made, these dilemmas must be addressed.

## Water Stress Points in Western Canada

Governments in western Canada have limited capacity and political capital to address water challenges. Within these challenges, a series of “stress points”—areas where there are current or emerging concerns regarding water supply and economic productivity—stand out. These stress points include: shale gas development in northern BC, agriculture in the Okanagan Basin, oil sands development in northern Alberta, agriculture in southern Alberta (which is an example of the changing nature of prairie agriculture), potash and uranium mining in northern Saskatchewan, Lake Winnipeg in Manitoba and urban issues in growing cities such as storm water mitigation and infrastructure deficits. Central to all of these stress points is the topic of Aboriginal water rights, which will need to be addressed as water allocation schemes adjust to face these emerging challenges.

## Rethinking the Value of Water

One of the things that makes water such a complex and difficult policy area is that it is a resource like no other—it is a commodity without a clear price. The challenge is that it is not easy to monetize water. This can make decision-making difficult; how can the dollar value of water, and the ecosystems it sustains, be factored into policy options?

Ultimately, the challenge that policymakers face is that of allocation. Should water be allocated to those activities that result in the greatest economic value? Is economic value the basis upon which these decisions should be made? If not, then what criteria should be used to make allocation decisions? Key to this decision is the recognition of how Aboriginal communities view water. Disrespect or negligence in recognition of these views could lead to challenges in relations with traditional territorial rights holders.

## Final Thoughts

Because of the centrality of water in all aspects of a healthy and functioning economy and society, ensuring that it is protected and that our water policies are sound should be a top priority for all levels of government. The stress points that are likely to pose the biggest problems in the near future and require immediate attention include:

- Lake Winnipeg in Manitoba
- Shale gas development in northern BC
- Urban issues in western Canadian cities
- The agriculture sector in the Okanagan Basin, BC
- Potash and uranium mining in northern Saskatchewan
- The agriculture sector in southern Alberta
- Oil sands development in northern Alberta

Even in difficult economic times such as these, protecting our water should not be a task that is facing austerity measures—it is simply too important to leave for another day.



# Introduction

“A nation that fails to plan intelligently for the development and protection of its precious waters will be condemned to wither because of its shortsightedness. The hard lessons of history are clear, written on the deserted sands and ruins of once proud civilizations.”

– LYNDON B. JOHNSON, 36TH PRESIDENT OF THE UNITED STATES, LETTER TO THE PRESIDENT OF THE SENATE AND TO THE SPEAKER OF THE HOUSE

Water is not only central to our health and environment, but also to the success of our economy. We are told to drink eight glasses of water a day to stay hydrated. We rely on clean water for our domestic needs. Cities and Aboriginal communities are often built around a water source, and that water source usually becomes a defining feature. Water is a key component of many recreational activities—think of the joys of canoeing down a river or skating on a frozen lagoon on a wintry day. Wetlands and other aquatic environments support vibrant animal and plant life as well as provide flood mitigation and pollutant filtration. Water, in short, has played and will continue to play a significant role in Canada’s development as a nation—especially in western Canada where a great deal of Canada’s natural resources and agricultural development takes place.

And when it comes to the economy, having access to a clean and stable supply of water is not just important—it is critical. Used to grow food, cool heating plants, extract oil and gas from the earth, provide navigation routes, manufacture a wide range of products, and supply growing urban populations, water is essential to economic growth.

In western Canada (British Columbia, Alberta, Saskatchewan and Manitoba), a series of water challenges or “stress points” are beginning to emerge. From shale gas development in BC and oil sands production in Alberta to uranium and potash mining in Saskatchewan and the eutrophication of Lake Winnipeg in Manitoba, each province is experiencing competing pressures on its water supply that are ultimately linked to economic activity. These stress points encompass concerns about water quality, quantity and the effect on communities and aquatic ecosystems. Added to this mix is a range of stakeholders who all have different objectives and viewpoints, including municipal governments, Aboriginal communities, industry, and environmental groups. Ultimately, governments must make the difficult decisions regarding whose water needs take priority.

These pressures are exacerbated by the uncertain world in which we find ourselves. The climate is changing, extreme weather events are increasing, the world population is growing, developing countries are getting hungrier for energy and the demands on the land and water base in western Canada keep going up. Within this context, western Canada is facing a range of challenges such as water contamination that is leading to excessive algae growth in lakes, natural resource development that is taking place without a full understanding of cumulative environmental effects and increased competition among multiple stakeholders for a fixed—and many argue, declining—water supply.

Water will be a defining issue for western Canada in the coming years and policymakers will have to make some difficult trade-offs. Maintaining the water policy status quo will not hold—a fact that is already recognized by the four western provinces, each of which are either undertaking or planning to undertake a review of their water policies. Sustainability will be the key word: how can water supplies be managed so that both economies and ecosystems are healthy and vibrant now and well into the future?

This paper rests on two assumptions. First, the allocation of water will be one of the most challenging policy issues in the years ahead. Determining which priorities should take precedence is inherently difficult because it is not something that can be determined by technical or scientific criteria—these only frame the discussion. One thing, however, is clear: because water is a necessary component in the western Canadian economy, allocation decisions will have a direct impact on the region's economic success.

Second, the Canadian policy arena at large is not sufficiently primed for this debate as economic and water policy are often treated as separate, rather than integrated, entities. Without acknowledging the link between responsible water management and economic output, both our environment and economy are put at risk.

This paper highlights some of the current water stress points in western Canada and examines the policy dilemmas that are hindering progress in addressing these challenges. This paper is not exhaustive in that it does not address the myriad ways in which water is important to western Canadians and the economy. Water is not just an economic input, component or function, but also a significant cultural, ecological, social, and in some cases, spiritual, entity. While this paper focuses solely on water and its relationship to economic activity, the multi-dimensional nature of water should be kept at the forefront of the reader's mind.



# Setting the Stage

“...water is a key Canadian asset...”

– STEVEN RENZETTI ET AL.

Western Canada is rich in natural resources. What is often not appreciated, however, is how important the region's water supply is to the development of these resources. Indeed, water is a central component of almost all economic activity including manufacturing, energy development, tourism and the service sector. (With regard to the latter, think of hospitals, schools and hotels without a steady supply of water and you get the point.) Arguably, water is as important, if not more important, than financial capital, labour, energy, technology and raw materials (Renzetti et al. 2011).

## Western Canada's Water Resources

Canada is often portrayed as a water-rich country. With a total of 6.5% of the global renewable supply of freshwater and only 0.5% of the global population, we do have a lot of water on a per capita basis. However, the majority of Canada's water is not where it is needed (e.g., in the north while most Canadians live in the south) or easy to access (e.g., in a frozen state). Canada does not have a uniform “waterscape.” That is, water supplies are spread out in different ways across the country and water challenges vary greatly. The real issue is not the amount of water in Canada but “whether there is enough water where it is needed, whether that water is readily accessible and whether that water is of sufficient quality” (Vander Ploeg 2011).

### Water Supplies Vary Across the West

Water is not uniform in quantity across western Canada. British Columbia's rainforests and snow-covered mountains likely will not invoke thoughts of water scarcity, yet five hours inland in the Okanagan Basin, water scarcity is something policymakers and local entrepreneurs must think about on a daily basis. Manitoba, a province of lakes, is also a province of destructive floods, while southern Alberta is prone to drought.

The northern portions of BC, Alberta, Saskatchewan and Manitoba are well endowed with water resources: the Fort Nelson, Athabasca, Peace, Slave, Churchill and Nelson rivers all flow north and eventually reach the Arctic Ocean and Hudson Bay. Yet in the south, where the majority of western Canadians live, water is not as plentiful.

Water issues also vary across the West—water quality is a significant concern in northern Alberta while flood and drought management is a major priority in Saskatchewan and Manitoba (see Figure 1). In all cases, water is a prominent part of the landscape and the economic make-up of the West. Because western Canada's waterscape is so diverse, the region can be viewed as a microcosm of the water issues that might play out on a national scale in the future.

**FIGURE 1: VARIABILITY IN WATER SUPPLY ACROSS THE WEST**

PROVINCE	MAJOR WATER SOURCES & CHARACTERISTICS
Alberta	<ul style="list-style-type: none"> <li>Heavily reliant on surface water, especially rivers.</li> <li>Rivers originate on the east side of the Rocky Mountains.</li> <li>Most water flows north while population is in south. South is relatively dry.</li> <li>Largest irrigated landmass in Canada.</li> <li>Concerns over pollution from oil sands development.</li> </ul>
British Columbia	<ul style="list-style-type: none"> <li>Abundant rainfall and surface water along the coast.</li> <li>Dry and arid in the interior.</li> <li>Rivers originate on the west side of the Rocky Mountains.</li> </ul>
Manitoba	<ul style="list-style-type: none"> <li>Freshwater is abundant in most of the province but droughts do occur.</li> <li>Flooding is a major concern.</li> <li>Water from three provinces and four US states drains into the province.</li> <li>Eutrophication of Lake Winnipeg is a serious concern.</li> </ul>
Saskatchewan	<ul style="list-style-type: none"> <li>Generally freshwater is abundant, but the south is prone to drought.</li> <li>Flooding is a major concern.</li> </ul>

Source: Adapted from Vander Ploeg 2011.

### Where Does the Water Come From?

The most notable supply of western Canada's freshwater comes from glacial melt and annual run-off from the Rocky Mountains. In total, the water stemming from the mountains supplies 11 million people—nearly one third of the Canadian population. The majority of water in the West comes from surface sources—lakes and rivers—rather than aquifers. It is worth emphasizing that almost no water originates in eastern Alberta, Saskatchewan or western Manitoba.

### Water Supply Concerns

Perhaps one of the largest overarching concerns about western Canada's water supply is that western Canadian glaciers are retreating at a rapid rate and are “approaching the lowest levels they have been in 10,000 years” (Hipel et al. 2011). While human activities can have a direct impact on water supply (e.g., an oil spill or the over-pumping of an aquifer), the reason for glacial retreat around the world is thought to be partly due to climate change linked to greenhouse gas emissions and partly due to long-term climatic cycles. Glacial retreat is a serious issue: Canada's glaciers and ice fields hold an amount of water equivalent to all the nation's lakes and rivers combined (Hipel et al. 2011).

There are 1,300 glaciers on the eastern side of the Rocky Mountains, all of which supply water to the prairie provinces (glaciers on the west side provide water to BC). One notable glacier is the Bow, which provides the water that eventually turns into the Bow River—the main water supply for Calgary. The glacier has shrunk by 27% in the last 60 years and there is speculation it could “vanish entirely in 40 years” (Hipel et al. 2011). If this were to happen, how would Calgary—a city with a population of more than one million people and counting—quench the thirst of its citizens?

On top of glacial concerns, the snow pack in western Canada is diminishing. Snow pack is important because it acts as a storage system, "storing" water as snow in the winter months and releasing it as run-off in the spring and summer. Diminishing snow packs result in changes in run-off patterns and timing, two factors that can have substantial effects on aquatic ecosystems and urban water systems.

Dams have helped address some of the challenges resulting from changing water patterns. Dams can divert and store water when it is plentiful and release water when it is needed, even if natural flows are not at "regular" levels. However, storing water for future use without addressing supply concerns is not a sustainable long-term solution. Dams can have negative environmental effects, such as possibly displacing local communities and altering fish habitats. Whatever the cause, the shrinking of western Canadian glaciers will have a direct impact on our future water supply. As population and economic activity grows in the West, water scarcity will likely increase. For example, BC is expected to face growing water shortages and drought frequency is expected to double by 2050 (Felder and Ng 2010).

Glacial retreat and its consequences need to be taken seriously when making water policy decisions. As water becomes increasingly scarce, there is a high possibility that more water quality problems will arise because contaminants will be concentrated in the smaller supply of water.

Policymakers must approach the topic of water with the aim of managing demand. This is a central paradigm shift that must take place (if it has not already happened). Western Canada's water supply is fixed and is shrinking in some places. The main goal must be to curb the thirst of all water users through changes to legislation and using tools such as economic incentives.

Many groups are beginning to sound the alarm for policymakers. Water and how it is managed must be a priority *now*. According to the National Round Table on the Environment and the Economy, we have on our hands a "looming scarcity challenge" (NRTEE 2010). Exploring ways to meet increasing demand for water while supply is shrinking should be a task that is seriously tackled long before a crisis comes our way.

## The Changing Policy Context

The world is changing and western Canada is changing along with it. The sizeable shifts that are underway can be broken into two broad categories: changes that are largely out of our control and changes that are within our control. These changes are having an impact on western Canada's water supply.

### Factors Out of Our Control on a Global Scale—Adaptation Required

Climate change, extreme weather and a growing demand for energy, food, commodities and water are all out of the direct control of Canadian policymakers, but they frame the world of water policy in which we find ourselves today.

- **Climate Change:** A changing climate has the potential to have dramatic effects on water supply and demand. For example, increased flooding can create water quality issues, increased drought can place pressure on irrigation systems and a shift in "normal" seasonal flow patterns (e.g., spring run-off occurring earlier or later than usual) can make planning difficult.
- **Extreme Weather:** The loss of *stationarity*—the concept that weather will fall between projected highs and lows—due to climate change means that weather patterns are becoming increasingly unpredictable. Among other things, this will also impact transportation in northern areas that depend on winter roads for supplies and commerce.

→ **Increasing Demand for Energy, Food, Commodities and Water:** Increasing global population, economic growth and urbanization will result in rising demands for energy, food, commodities and water. The social structure around the world is changing as more and more people are ascending to the middle class and adopting western lifestyles complete with higher demands for consumer goods, energy, and meat and dairy products. Canada's natural resource sectors are expected to grow by 50-65% by 2030 due to the increasing demand for minerals, forest products, agricultural goods and energy (NRTEE 2010). Mirroring the global trends, Canada's population and economy are projected to grow and more people will flock to cities. The nation's population is expected to jump by 25% by 2050 and, even under modest circumstances, the economy is projected to expand by 55% by 2030 (NRTEE 2010). This growth will lead to increased domestic demand and competition for a relatively fixed supply of water.

Policymakers in western Canada need to adopt a mentality of “adaptation” to climate change, extreme weather and the increasing global demand for energy, food, commodities and water.

### Factors in Our Control—Mitigation Required

While issues related to water quality, quantity, infrastructure and land use policy are exacerbated by climate change, extreme weather and increasing global demand, there are changes we can make that address these issues. Policymakers should focus on spearheading change across all water stakeholders through a combination of regulation, legislation, economic incentives and improved technology. Of course, human activity will always have some kind of effect on the environment. But if we can find ways to lessen our impact and better protect our water, our efforts will be more than a drop in the bucket—they will be a wave. Some of the problems we have created for ourselves, and which we have the ability to fix, are:

→ **Water Quality:** Water supplies face contamination from a range of pollutants. Pharmaceuticals and personal care products (PPCPs), agricultural run-off and effluent discharge from industrial activities are all contributors to compromised water quality. While the technology to treat contaminated water exists, it is often extremely costly—further straining the wallets of taxpayers. Water of poor quality may not be able to support aquatic life and can adversely impact ecological and human health. In addition, some water sources are facing threats from invasive species that can threaten the health of aquatic ecosystems (e.g., milfoil in Lake Okanagan).

### → Water Quantity

**Exhausted Sources:** Some water sources can become strained due to over-pumping or withdrawing amounts that exceed the natural recharge rate. In cases where water sources become over-taxed, it can take large amounts of time (sometimes hundreds of years) for the source to be fully replenished. When a water source becomes so over-taxed that it can no longer provide a steady amount of water, this marks a loss of water supply.

**Ecosystem Functioning:** Ecosystems require a certain amount of water to function properly. Excessive withdrawals of water can severely hamper aquatic health and the provision of broader ecological goods and services.

**Use:** Because most western Canadians have access to cheap and plentiful water that reliably flows when the tap is turned on, water is often not used as mindfully as it could be. A lot of water is wasted simply due to a lack of awareness and poor habits.

**Trans-Boundary Agreements (National and International) and Jurisdictional Concerns:** In order to govern water that crosses more than one jurisdiction, various agreements have been arranged. For example, the Prairie Provinces Water Board (PPWB) manages the Master Agreement on Apportionment—an agreement between Alberta, Saskatchewan, Manitoba and Canada that requires Alberta to let 50% of the water flowing in the South Saskatchewan River to flow into Saskatchewan, and Saskatchewan to allow 50% of its share to flow into Manitoba. If water levels decrease in the river, however, the potential for conflict between jurisdictions may increase. Trans-boundary and jurisdictional concerns cannot be neglected as Aboriginal water rights and traditional land uses need to be part of the overall policy picture. For matters related to international trans-boundary agreements, water quality issues are referred to the International Joint Commission (IJC)—an intergovernmental body on water between Canada and the US—for resolution, but not water quantity issues. Quantity issues require a formal and joint reference from both Canada and the US to the IJC, which has the potential to be diplomatically difficult.

#### → Infrastructure

**Municipal Infrastructure:** In Canada, much of the infrastructure is past its prime and requires costly repairs and upgrades. Not only can old infrastructure result in water losses due to leaky pipes, it can also increase the risk of contamination, which subsequently will result in higher treatment costs. Money for upgrades will either have to come from the public purse or from higher water charges.

**Dams, Dikes and Diversions:** Water infrastructure is a term that applies not only to municipal conveyance systems, but also dams, dikes and diversions. Any kind of water infrastructure that changes the natural flow of an aquatic environment can have undesirable environmental and social impacts (e.g., disrupted fish habitats, if a dam is built in a populated area, communities may be displaced).

- **Land-Use and Wetlands—Nature’s “Kidneys”:** Across the West, it is common practice for farmers to drain wetlands on their land. If the land remains as a wetland, that land will not be available to produce a crop. Wetlands can also be drained in order to make room for urban and industrial development. The problem is that wetlands are a valuable component of the environment since they filter pollutants out of water, house numerous species, and help with flood mitigation. One of the factors that has contributed to the eutrophication of Lake Winnipeg is the massive reduction of wetlands across the West.

Although there is no national water “crisis” in Canada, there are pockets of water problems where specific areas are experiencing the pressures of growing threats of contamination, an unstable and shrinking supply, outdated infrastructure and the loss of wetlands, which are all exacerbated by climate change, extreme weather and increasing global demand for energy, food, commodities and water. For these reasons, “water risk” will be a greater consideration for businesses and industry, particularly as municipalities will get priority in any water allocation scheme that addresses increased scarcity (it is probably safe to assume that meeting the water needs of western Canadian citizens will always take priority over other uses). Defined as “those potential disruptions, costs, revenue losses, or growth constraints that can ensue due to a lack of poor water quality, or ineffective use,” water risk will be major consideration in business planning in the future. If companies do not take water risk seriously, the result can be “business instability, lost economic opportunities, societal impact, as well as signal management failure in the form of water scarcity” (Felder and Ng 2010). Ensuring that western Canada (including sizable Aboriginal communities) has a safe and secure water supply is a primary concern that is inextricably linked with the economic health of the region.

## Water Allocation in Western Canada

The way that water is allocated lies at the heart of the discussion about water supply and its importance to economic development. Across the West, provincial governments have the authority to allocate water as they see fit according to their respective water legislation. As an increasing number of stakeholders vie for a fixed water supply, will the allocation status quo be the best way to manage water?

Water allocation policies differ across the West but the key defining characteristic is First-in-Time-First-in-Right, or FITFIR. This is a concept based on the principle of prior appropriation. That is, in order to use water, a license must be issued by the provincial government. Senior license holders (those who have held their licenses for the longest period of time) will always have first priority when it comes to water supply and will almost always be entitled to withdraw their full allocation should they need to do so.

In times of drought, FITFIR can result in two things. First, junior license holders may not be able to withdraw all of their allocation in a time of water scarcity because the senior license holders have priority. In Alberta, this has been addressed in part by senior license holders who do not need all of their allocation selling the remainder to junior license holders for a high fee. Second, the environment can fall victim to the FITFIR system—in times when the water supply is small, less water will be left in a river, lake or aquifer.

Many argue that FITFIR is antiquated and must change to reflect present-day pressures on western Canada's water sources and a more logical prioritization of use than first come first served. But the challenge is figuring out a way to change water allocations when people have been given a certain amount in perpetuity, particularly when it is unknown how much water will be available in the future. Slow and incremental reduction of water allocations may be required for some water users. Very strong political leadership will be required to tackle this uncomfortable challenge.

Another complex issue is that the current allocation schemes do not recognize or incorporate Aboriginal rights to water. If these rights are realized, it could dramatically change how water is allocated. Despite the fact that reform takes time, it appears that western Canada is undergoing a shift in thinking about water allocation. Within the next decade, some would say that it is very likely that FITFIR will be changed and new management schemes, such as water rights trading, will be in place.

# Policy Dilemmas

In order to rethink the way we value water and how we make allocation decisions, some policy dilemmas need to be addressed.

## Data Gaps

Detailed water data are required to make the best allocation decisions possible. Data and research are the foundations of good public policy, and a lack of them can paralyze even the best intentions. There is no question that we are lacking sufficient water data in western Canada. There are many initiatives underway across the West to address this issue such as “Let the Data Flow”—an online data hub that is being created by Western Economic Diversification Canada and the University of Lethbridge. However, data gaps will likely be a persistent problem for some time.

Little is known, for example, about how much groundwater western Canada actually has. How can policy decisions be made when we do not know how much water is available and where it is located? Across the West, small mapping projects are ongoing, which is positive. But a federal initiative to map the locations of major Canadian aquifers is not estimated to be complete until 2030 (Renzetti et. al 2011).

In addition to data collection, networks and data banks should be set up that facilitate the easy access of consistent information to policymakers and researchers.

## Societal Attitudes and Public Awareness

In a culture where water is often taken for granted, it can be a political challenge to introduce policy that attempts to change the way that water is governed and managed. However, if people have a better understanding of the value of water, how it is used to fuel western Canada’s economy, and of the stress points that must be addressed, it is likely that tough policy decisions will be more readily accepted.

If policymakers can communicate to the public that taxpayers rather than polluters are footing the bill to clean up the negative effects of economic development (e.g. eutrophication or water pollution), it is likely that public support for changing water policy will grow. Those dollars spent on fixing water problems could probably be better spent in other areas such as health and education, and public pressure might grow on key economic players to be better environmental stewards.

## Legal Issues

The greatest policy dilemma is that of changing the laws in western Canada that govern water. In BC, for example, legal issues are a very big issue because groundwater is currently not licensed—anyone can take as much water as they like from aquifers. The longer governments wait to enact legislation that will protect water sources and still ensure economic development, the more difficult it will become to implement proactive policies.



Aboriginal water rights are also a major issue that needs to be addressed, but in doing so, could turn current water allocation schemes upside down. This “sleeping giant” is perhaps the most pressing legal challenge policymakers will be facing in the coming years.

## Government Leadership

Government leadership is the key to effective water management. As stated by water economist David Zetland on his *Aguanomics* blog on January 24, 2012, “the biggest water risk to businesses is not risk, it’s political uncertainty. That’s why reliable and predictable rules are the key to business prosperity (jobs, profits and happy customers).” A large challenge facing the water system is governance. Many argue that water scarcity is not a result of climate change but rather of how that water source is governed. Governments are responsible for “establishing the frameworks that will enable optimal water management practices to blossom” (Ng and Felder 2010).

Water policy must become a priority. This has been an ongoing battle for decades. The last major federal government policy on water was the 1987 *Federal Water Policy*—very little of which was put into practice. However, many of the concerns from 1987 are the same concerns we are battling today: a need for better water pricing, integrated water and land use planning and increased public awareness of water challenges.

This is not to say that no programs or initiatives exist to address water problems. While they may not fall under the umbrella of a national or regional strategy, there are smaller initiatives targeted at specific issues. For instance, the *Federal Sustainable Development Strategy (FSDS)*, which is supported by Western Economic Diversification Canada, has identified maintenance of water quality and availability as a key priority. The Strategy outlines targets that federal ministries and departments should strive to follow. Many provinces are currently working on reforming their water legislation and are, at the level of rhetoric at least, paying more attention to water issues.

However, the frustrating thing is that it often takes a crisis for decision-makers to substantially address a problem. Certain events are, if not preventable, easier to adapt to if appropriate planning and preparation have taken place. Australia has fallen prey to this problem. Although widely heralded as a leader in its development of water markets, much of Australia’s water reform took place in the face of a crisis. The 2002 drought created such a dire situation that drastic measures were needed to safeguard the nation’s water and agriculture sector. Politicians made decisions that, in the past, likely would have been resisted, but they were grudgingly accepted because they were necessary to address the crisis. Although this intervention solved many problems (e.g., between 2002 and 2008, per capita urban water use declined by 37%), other problems arose due to the haste of the reforms. The Australian government over-allocated water in some areas—a decision that was detrimental to the environment. Now operating under a market system, the government has spent millions of dollars buying the right to that water back so that it can be allocated for ecosystem purposes. Canadian governments should heed this example and make proactive rather than reactive policy.

# Water Stress Points in Western Canada

“The trouble with water is that they aren’t making any more of it.”

– MARQ DE VILLIERS

In western Canada, there are a variety of water issues, all of which are relevant to the economy, local cultures, ecosystems and human health—yet governments have limited capacity and political capital to address these challenges. Within these issues, a series of “stress points”—areas where there are current or emerging concerns regarding water supply and economic productivity—stand out. In 2005, the Senate Standing Committee on Energy, the Environment and Natural Resources published a report that emphasized the need to address water stress points. In fact, the Senators stated that the “cost of not responding to emerging water challenges would likely dwarf the cost of addressing them, and failure to respond will jeopardize life as we know it, particularly in Alberta and other prairie provinces” (Standing Senate Committee on Energy, the Environment and Natural Resources 2005).

A lack of water, or concerns about sufficient water supply, can greatly limit the social and economic future of a region. This is a dilemma that is being played out around the world. For instance, Las Vegas is currently facing increasing water pressures and is debating whether to pipe water into the city from rural eastern Nevada. Some argue that China’s economic growth will be limited due to a shrinking water supply and increasing environmental pollution. While we in western Canada are not yet in such dire predicaments, other jurisdictions can provide us insight into what *not* to do.

## WATER & ECONOMIC GROWTH LAS VEGAS, NEVADA

Las Vegas is known for its gambling, nightlife and warm weather. It is also the main driver of Nevada's economy.

In addition to its reputation for being "Sin City," Las Vegas boasts majestic water fountains and over-the-top neon light displays. Yet, all of the glitz that makes Vegas what it is requires a lot of water. If the city hopes to remain the epicenter of Nevada's tourist industry, it must ensure it has a stable and sustainable water supply.

Almost all (90%) of the city's water comes from Lake Mead—the reservoir of the Hoover Dam, which is fed by the Colorado River. However, Lake Mead's water levels have been dropping dramatically due to the shrinking flow of the Colorado River, and it does not seem that it will be a reliable water source in the future.

To solve this problem, the Southern Nevada Water Authority—the body that manages Las Vegas' water—has submitted a permit to the state, requesting permission to build a multimillion-dollar pipeline that would transport water from eastern Nevada into the city.

This is a good example of what can happen when water becomes increasingly scarce in a region. Tensions are rising between the urbanites of Las Vegas and the rural community, consisting of mostly ranchers and farmers. The state must make the difficult decision of deciding whose needs should take priority. What is more important, keeping things the same in Las Vegas, or ensuring ample water supply for Nevada's farmers and ranchers? Is there a way to compromise?

If Las Vegas cannot find a way to quench its insatiable thirst, all of Nevada could be affected—nearly 80% of the state's economic activity comes from the city of "What Happens Here, Stays Here." But what would be the economic and social consequences of jeopardizing the future of the farmers and ranchers?

Economics aside, the proposed pipeline could also be detrimental to the environment. A United States Bureau of Land Management survey determined that the pipeline "could lower some water tables [in the rural valleys] between 100 and 200 feet over 75 years, drying out valley soil and harming shallow-rooted plants and irrigated agriculture" (Malewitz 2012).

While the pipeline might not even be built for several decades, the pickle that Nevada finds itself in is serious and raises new concerns: How can water be allocated fairly? Should water be allocated to the highest value economic use, or should it be allocated based on other criteria? Although the environment does not generate revenue, should its needs come before business? Is it time for the city of Las Vegas to change its water use behaviour? What is the consequence of keeping the status quo? Of changing it? If Nevada does not solve these difficult problems, the economic stability of the state could be on the line.



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Jorg Hackemann, Shutterstock.com

Western Canada's stress points can be linked back to how water is governed and managed. While stress points vary by geographic location, in most cases the ability and knowledge to address the issues at hand exists. However, finding enough capacity—both financial and political—to actually put solutions into practice is a difficult task. In many cases, policymakers may feel they do not have enough political capital to implement initiatives that would not yield benefits in the present or near future. The challenge for policymakers then is to determine which issues take priority. Is it more important to ensure that there is enough water for oil and gas development or for ecosystem services or for recreation use or for a new shopping complex? The decisions that must be made will not be easy—they will involve trade-offs and risk management. And unfortunately, they may often be based on a lack of understanding of the value of water as this is not a well-understood topic. In the end, the big questions we all need to ask ourselves are: What kind of future do we want? What do we value most? Can we have both a robust economy and a healthy environment we are proud of? Ideally, the answers to these questions should be widely understood and agreed upon by both policymakers and the public before any of these water stress points comes to a head.

## WATER & ECONOMIC GROWTH CHINA

China's roaring economy may soon be restrained by environmental problems such as contaminated land and a lack of clean water. China has long struggled with air and water pollution. As the economy has boomed, the rate of development is so fast that the environment is often left behind—way behind. If China does not clean up its act, could its future economic growth be in question?

Some experts think so and argue that a shrinking supply of clean water due to overdevelopment, pollution and a growing population could limit the nation's economic success.

The Chinese government recognizes that the situation is not good. The Ministry of Environmental Protection has reported that nearly 60% of the seven major Chinese rivers (including the Yangtze and the Yellow) are of "poor quality" (Dimicco 2011). This is an astounding number. Considering that rivers are often the lifeblood of a country, China seems to be slowly destroying its own natural bounty through nitrogen and phosphorus run-off and industrial pollution.

Not only is China expected to experience water shortages in the future, but the health of its people is likely in jeopardy. Millions do not have access to clean drinking water, and a staggering 190 million citizens drink polluted water, which leads to higher mortality rates. In addition, over four million hectares of land are irrigated with polluted water—which is not only a human and environmental health issue, but also a precursor to poor crop yields (Shen 2011). A stable water supply is required to fuel a large economy, but it is also required to keep people healthy and, thinking again of the economy, fit for work.

The Chinese government is now investing in addressing the water supply problem. Arguably the costliest endeavour is the development of the South-North Diversion Project—essentially a massive diversion system that would send water from the water-rich north to the parched south. A New York Times journalist compared the scale of the project to be "equivalent to channeling water from the Mississippi River to meet the drinking needs of Boston, New York and Washington" (Wong 2011). The \$62 billion project is highly criticized—not only for the expense, but also for the environmental degradation and human displacement that will occur as it is being built.

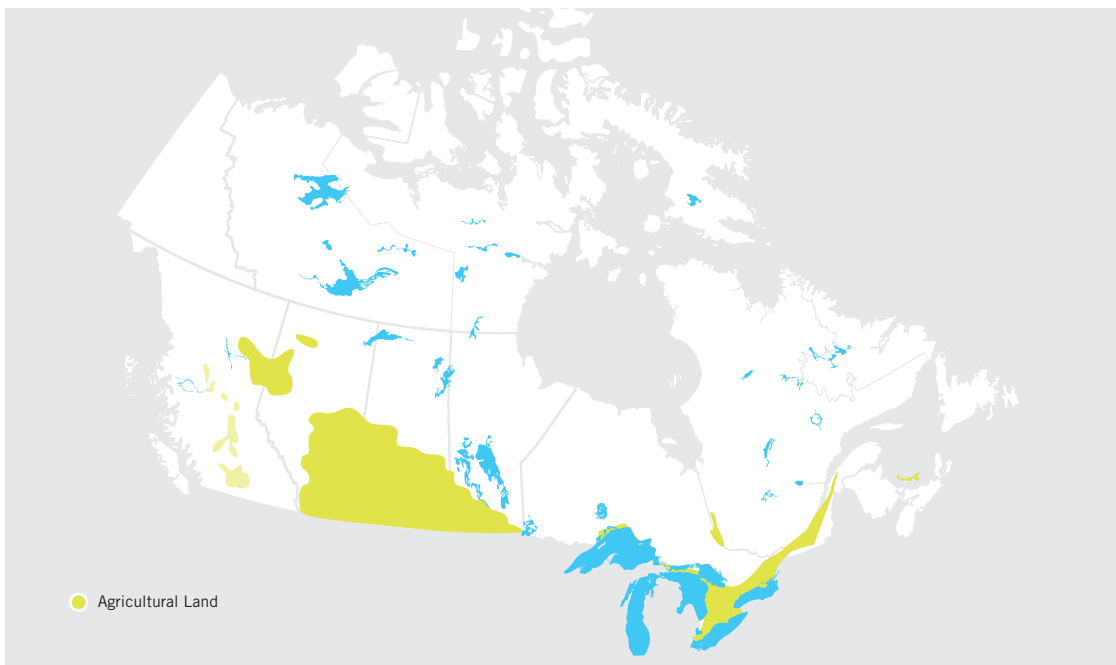
China—viewed with awe by many because of its rapid economic growth—has boomed at the expense of the environment. Now, the government must invest billions of dollars to reverse the damage that has been caused by factors related to pollution, a growing population and poor environmental stewardship. Other jurisdictions may wish to take note that rapid economic expansion may not always be sustainable and can come with a large environmental price tag in the long-term.

Western Canada's most notable water stress points fall under the following categories: agriculture, energy production and urban issues. Mining, manufacturing and forestry are also areas where water stress points exist. In BC, the forestry industry has been hurt due to the pine beetle, yet smaller, landscape size logging is still occurring without knowledge of what the long-term impact will be on regional hydrology.

## Agriculture

Agriculture is a significant industry in western Canada—82% of agricultural activity by surface area in Canada takes place in the West, where 73% of Canada's dependable agricultural land is found (see Figure 2) (Corkal and Adkins 2008; Roach 2010).

**FIGURE 2: CANADA'S AGRICULTURAL LAND**



Source: Adapted from Statistics Canada 2009

Agriculture is completely dependent upon water for its success, and therefore particularly vulnerable to shifts in water supply. No water means no crops and no livestock. Water is needed for growing crops and raising animals, but it is also needed to provide drinking water for farmers and their families, to process food products and to dilute chemicals such as fertilizers.

The key water challenges facing the agriculture sector include:

### Changing Climate

The heartland of Canada's agricultural sector has long been highly vulnerable to climatic variability. The majority of agricultural activity takes place in the southern portion of the western provinces, yet these are the areas that are most prone to water shortages. As climate change intensifies, changes in water levels and seasonal temperatures will place stress on the agricultural community. In particular, those that farm rain-fed agriculture will likely become increasingly vulnerable as a result of increased climatic variability.

Over the last few years, the prairies have been excessively wet. Due to overly saturated land, many farmers were unable to seed their crops at the usual time in 2011. The Canadian Wheat Board estimated that 2.75 million acres of land was left unseeded across the West (Environment Canada 2011b). Fortunately due to an unusual season, the weather in the latter part of the year was suitable for growing and farmers were able to harvest the crops that had originally yielded such low expectations. The last two years—2010 and 2011—have both seen the largest amount of land left unseeded in western Canada since the early 1970s (Environment Canada 2011b).

### Extreme Weather

Western Canada has seen its fair share of extreme weather as of late. Extreme weather can take a severe toll on farmers and ranchers. Unpredictable weather means that it can be difficult to plan for the season ahead, and unexpected floods and droughts can cause financial and environmental havoc. Both extreme floods and droughts have been seen recently across the West and both have exacted large economic tolls.

Environment Canada ranked the topic of spring flooding on the Prairies as the top environmental story of 2011. Engineers called the flooding of Lake Manitoba a one in 2,000-year event. The historic flood across the West marked the highest water levels and flows in modern history in parts of Saskatchewan and Manitoba, and resulted in a loss of three million hectares of Manitoban farmland. The Government of Manitoba eventually declared a province-wide state of emergency. People's safety was at risk, farmers' livelihoods were destroyed and parts of the province were completely inaccessible by road. This event was also devastating to First Nations communities in the area and had an impact on their fishery economy.

Alarmingly, Environment Canada stated that “nobody could have prepared for the flood of 2011 that was unprecedented on so many fronts” (Environment Canada 2011a). At the most recent assessment (December 2011), the Manitoba 2011 floods have cost the province \$815 million, with the amount expected still to increase (CBC News 2011). The flood will likely surpass the economic toll of the 1999–2004 prairie drought, which at the time, was the most expensive natural disaster in Canadian history.

Droughts are a fact of life in western Canada, but they appear to be becoming more severe and more frequent. Droughts deplete soil moisture levels, reduce stream flows, lower lake and reservoir levels and diminish groundwater supplies. Environment Canada has stated that “...droughts present a serious national threat to Canada” (2004). In an age of economic stress, financial losses due to drought can be crippling. And the numbers are high: according to Environment Canada and Natural Resources Canada, the six Canadian droughts between 1984 and 2002 resulted in an estimated cumulative drop in GDP of \$18.8 billion” (Felder and Ng 2010).

Droughts and floods can have a ripple effect through the economy. If crops and livestock cannot be produced, farmers take large financial hits. The products that are available will become more expensive, which can affect both domestic and global consumers. Governments often step in with drought or flood assistance for farmers.

Unfortunately, climate change and increasing extreme weather events are here to stay and there is not much that provincial governments can do except try to plan for the unknown and learn how to adapt to this world of new pressures. However, certain challenges facing the agricultural sector can be addressed and are described below.

### Water Quality

Contamination from livestock, excess nutrients, pathogens, pesticides and herbicides can dirty source water and affect not only those in agriculture, but also neighbouring communities and the environment. For example, fertilizer and manure run-off is believed to be one of the main contributors to the continued eutrophication of Lake Winnipeg and other lakes across the West.

According to a recent study, the increased use of herbicides, pesticides and pharmaceuticals for livestock are likely to “impair eco-services and thereby incur significant costs to society at large that are not currently captured in economic reporting” (Renzetti et al. 2011).

Eutrophication is the most widespread problem affecting rural water resources and must be addressed. Farmers can change the methods they use to fertilize their land and wetlands can be maintained so that they are able to filter contaminants before they reach a large body of water.

### Water Quantity

Because the majority of agricultural activity takes place in the southern parts of the provinces, where water is already in fairly short supply, water quantity is often a concern. The most pointed to example of water quantity challenges is southern Alberta. In 2006, the Government of Alberta placed a moratorium on the issuing of any new water licenses from the South Saskatchewan River Basin (SSRB). Stakeholders in southern Alberta have experimented with trading parts of their water license, but a full-fledged market does not exist, and if it were to, it is likely several years away. However, as water scarcity increases, there will be greater competition between the agricultural community and municipalities and Aboriginal communities for water. On top of that, the environment requires a certain amount of water to be able to thrive—so in dry years, the majority of the water available may have to be left in rivers and lakes.

Water quantity concerns can be addressed in part by changing irrigation practices (e.g., using high efficiency sprinklers), using non-potable water for irrigation and by growing low-water intensive crops.

### Infrastructure

Irrigation infrastructure such as dams, reservoirs and canals can also have effects on ecosystems. Often, the infrastructure is required for the success of an irrigation district. However, the natural environment can be altered by agricultural infrastructure and can contribute to things such as soil erosion. Better dam and canal construction can help address some of these concerns.

### Land Use & Wetlands—Nature’s “Kidneys”

Preservation of wetlands is a great concern across the West. If a farmer’s land includes wetlands, often that farmer will drain the wetland in order to have a greater area of land available for crop production. However, by draining wetlands, farmers are inadvertently changing important environmental services. Wetlands provide habitat to local species and are essential to help manage flooding and to filter out water pollutants. Some initiatives have been developed to tackle this issue. Ducks Unlimited, for example, had an aggressive wetlands campaign in Manitoba that paid farmers a small sum to let their wetlands be, which resulted in a healthier environment and smaller losses to the pocketbooks of farmers.

As is expected, the agricultural challenges vary across the West (see Figure 3). In British Columbia and Alberta, water issues related to irrigation are likely to be of concern. In 2010, the majority of Canadian farms that used irrigation were in British Columbia (40% of all farms) and in Alberta (30% of all farms). In Saskatchewan and Manitoba, less irrigation is required and factors that are related to drastic weather extremes as well as water quality challenges are more likely to be top of mind.



**FIGURE 3: KEY AGRICULTURAL STRESS POINTS**

AREA AFFECTED	PROVINCE	CHARACTERISTICS	KEY ISSUES	MAIN STAKEHOLDERS
<b>Okanagan Valley</b>	BC	Snow-dominated watershed	Water quantity & quality	Municipalities
		Arid	Urban water use	Aboriginal communities
		Agriculture key industry	Growing population & community development	Irrigators
<b>Southern Alberta</b>	AB	Most land is irrigated	Water quantity and quality	Irrigation districts
		Semi-arid	No more water to be allocated (2006 moratorium on the South Saskatchewan River Basin)	Municipalities
		Key agricultural region of the province	New allocation system may be needed	Aboriginal communities
		Irrigated land in the province accounts for about 65% of all irrigated land in Canada	Potential for a water market	
			Contamination from livestock manure	
<b>Saskatchewan</b>	SK	Prone to drought and floods	Uncertain weather patterns	Irrigation districts
		Has 41% of Canada's arable land	Water quality	Municipalities
		Canada's most important grain producing province		Aboriginal communities
		Agriculture is at the root of province's economy		
		Scarce water in south		
<b>Manitoba</b>	MB	Prone to severe flooding	Water quality	Irrigation districts
		Pork production major industry	Uncertain weather patterns	Municipalities
			Water quantity	Aboriginal communities
<b>Lake Winnipeg</b>	MB	Severe algae blooms	Water quality	Municipalities
				Hydro-electric industry
				Fisheries
				Cottage owners
				Agriculture
				Aboriginal communities

## Energy Production

Energy production comes to the forefront of many people's minds when thinking about the linkages between the economy and water supply. Energy production—especially oil sands and shale gas development—is often in the spotlight because of concerns about water use and contamination. In addition to oil sands and shale gas development, hydropower and thermal generation are also major water users in western Canada.

### Oil Sands

Alberta's oil sands are the economic fuel of western Canada—and it looks like they are poised to stay that way. A recent report published by the National Energy Board (NEB) projected that oil sands production is likely to triple by 2035 and that unconventional energy production (which includes shale gas) will emerge as the “dominant source of supply growth” over the next 25 years.

The main water source for oil sands development is the Athabasca River. Generally speaking, it takes about three and a half barrels of water to create one barrel of oil. Water is used in in-situ oil sands extraction, where steam is required to heat up oil in the ground in order to make it flow upward into wells. The Canadian Association of Petroleum Producers (CAPP) expects that water use will increase as oil sands mining increases, but points out that the Athabasca river “will remain one of the least used river basins in the province of Alberta” (CAPP 2011).

### Shale Gas

Shale gas is controversial because of the method employed to extract the gas from the ground. Since 2008, major oil and gas companies have engaged in an aggressive gas development and production enterprise in the remote north of BC. This development is continuing at a rapid rate, despite unknown long-term environmental consequences. A method called hydraulic fracturing or “fracking” is used to remove the shale gas from the rock. This method involves drilling a hole into which a mixture of water, sand and chemicals is pumped.

### Thermal Generation

The majority of the electricity generated in western Canada (not including hydropower) is derived from burning fossil fuels. Large quantities of water are required in thermal generation for cooling purposes. In gas and coal reactors, about 140 litres of water is required to produce one kilowatt of electricity. In fossil fuel plants, the majority of water that is used is non-consumptive—that is, it is recycled through the system many times. The main concern with thermal generation is the quantity of water that is withdrawn from a source and thermal discharge into watersheds.

### Hydropower

Hydropower is the main source of electricity for residents of BC and Manitoba. Hydropower does not need to withdraw water from a source, but the construction of dams and reservoirs can disrupt natural water flows and temperatures, and can displace both wildlife and human communities. It can also alter the timing and quantity of river flows, transport sediment, block fish migration and introduce invasive species into ecosystems.

In order to meet growing electricity demands, more dams will need to be built in the West. This can create controversy. For example, BC Hydro has plans to build Site C, which would be the third dam on the Peace River in the northeastern part of the province. BC Hydro has stated that the dam is needed to provide electricity to meet the needs of a growing province. However, the opponents of the project argue that the construction of a third dam could impinge on Aboriginal treaty rights and destroy fish and wildlife habitats.

Across the West, there is a growing movement to “run of the river” hydropower, which does not store water in a reservoir, and therefore has a small environmental impact. According to Hans Schreier, in BC alone there are over 1,000 proposals to build run of river projects, which is a positive development.

The challenges facing the energy industry are large:

#### Increasing Demand for Energy, Food, Commodities & Water

Both globally and domestically, energy demand is predicted to increase. The debate over the construction of the Northern Gateway pipeline, which would send Alberta oil to Kitimat, BC for export to the Asia-Pacific region, is heated and an indicator of how the world is changing; instead of looking solely to the United States to purchase western Canada's energy, Asia is being considered. If the pipeline gets the go-ahead, production of oil and gas will ramp up. Subsequently, water demand from oil and gas companies will increase. As concerns over the environmental effects of energy development, as well as Aboriginal water and land right claims intensify, companies may find that securing a social license to operate may become increasingly difficult.

#### Water Quality

Water quality issues are perhaps the most perplexing. Effluent from oil sands production ends up in tailings ponds—large lakes that contain naturally occurring clay, sand, fine silts, water, residual bitumen from production, salt, metals and organic compounds (Government of Canada 2011). Although the ponds are surrounded by containment dikes and are constantly monitored, scientists cannot dismiss the possibility of a spill, which would be catastrophic. Also, many are concerned that toxins are slowly leaching into the earth below and around the ponds.

Water quality concerns will likely worsen—they are already well documented in the work of Dr. David Schindler, a well-known scientist at the University of Alberta. Drinking water, fish populations (and the communities that rely on them for food) and ecosystem health are all threatened. This is a grave concern of northern communities—especially Aboriginal—situated downstream from oil and gas development (both within and outside Alberta's borders). Policymakers must decide if they are only responsible for water within their borders, or if they need to deal with the consequences of that water flowing downstream. Will provinces and territories work separately from each other on this matter, or will they be able to work out common strategies?

Water quality concerns are also high with shale gas development. Concern is growing around the world: France, New York state and Quebec have all placed moratoriums on shale gas development until environmental impacts are better understood. One of the biggest worries is due to the chemicals that are included in the slurry or “frack fluid.” The ingredients of what is in the slurry are proprietary, but there has been growing pressure on companies in both the US and Canada to disclose what they are putting into the ground.

Once the hydraulic fracturing process is over, only 30 to 40% of the slurry that was pumped underground is recoverable. The rest remains underground. The worry here is that no one knows what happens to the remaining 60-70%. Does it stay in one place, or does it travel? If so, how far does it travel? Could it potentially permeate up into aquifers and contaminate them? To make the matter even more complex, there is a very incomplete understanding of western Canada's groundwater inventory. The general conclusion from industry is that fracturing is safe and that best management practices and regulations are followed (Pryce 2012).

## Water Quantity

Energy production requires large amounts of water. For instance, between 1.4 to 4 litres of water is needed to extract one litre of synthetic crude from bitumen, and four million litres are needed to bring a new natural gas well into production (Renzetti et al. 2011). Most of the production in the West is situated around large water sources: shale gas development in BC relies on the Fort Nelson river, and companies in the oil sands have the Athabasca river at their disposal. While companies are not allowed to withdraw unlimited amounts of water, they have a relatively secure supply due to loose government regulations. In addition, oil and gas companies are using constantly evolving technology that improves water efficiency and recycling rates.

While water quantity does not appear to be a major problem at the time being, water withdrawals are not comprehensively tracked in the energy sector (NRTEE 2010). If they are tracked, companies are reluctant to disclose their numbers and there is no law that requires them to do so. In the long-run, this will be detrimental to ensuring the security of western Canada's water supplies.

The perception that the world has of western Canadian energy production and environmental protection is critically important to economic success. Concerns about negative environmental impacts associated with development are shifting public policy decisions in the US and the EU. Alberta's oil sands for example, have been put on the black list by environmental organizations in the US and by some European countries (e.g. Austria, Ireland, Sweden). While it is no doubt essential that BC and Alberta's water supplies be protected up north for the sake of environmental and human health, it is also critical that environmental protection continue in order for Canada to have a social license to operate—to be seen on the world stage as a “moral producer” of oil and gas. Although “no significant economic sanctions have yet been imposed on the producers, the rumblings persist and grow” and western Canada must maintain its “global license” to operate (O'Brien and Ritchie 2011).

In addition to oil and gas development and hydroelectric generation, mining and manufacturing are also key industries that heavily rely on water. This is perhaps most relevant to Saskatchewan, where potash and uranium mining are key components of the economy. Saskatchewan is a major supplier of uranium and potash to global markets, a role that will likely expand (Roach 2010).

Overall, mining withdraws very little water in western Canada compared to energy producers, but environmental impacts include effluent discharge and alteration of water temperature.

To further complicate things, not only do the challenges presented above need to be addressed, but the needs and viewpoints of multiple stakeholders, including provincial governments, Aboriginal communities, industry, environmental groups and local residents, need to be reconciled—a difficult, if not impossible, feat to accomplish.

## Urban Issues

Municipalities are responsible for providing clean drinking water to their populations. Municipalities are low water consumers in the sense that almost all of the water that is withdrawn from a source is eventually returned to that source.<sup>1</sup> However, municipalities will face some key challenges in the future:

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<sup>1</sup> Water can either be used or consumed. Water that is **used** is eventually returned to its source, while water that is **consumed** is not returned to its source. A good example of water that is used would be the water that goes down a shower drain. This water will eventually end up in a water treatment plant, and be released back into a river or lake. A good example of water that is consumed would be a farmer watering a field. Once that water has been applied to a crop, it will not go back to the source where it came from because it has evaporated or has been incorporated into a crop.

### Extreme Weather

Extreme weather events such as large floods can cost a lot of money to clean up. Droughts can also strain a city: often water rationing measures will need to be put into place. If cities continue to be built and developed in the same way that they always have been—little green space, lots of paved areas—this could be detrimental to flood mitigation attempts. However, there are now more cities using permeable pavement that allows water to filter through, thus reducing the storm-water burden.

### Water Quality

As cities continue to grow, there is emerging concern about water sources becoming increasingly contaminated. Scientists are beginning to become worried about small pollutants such as endocrine disrupters. The worry is that cost-effective water treatment technology cannot remove every kind of contaminant. Current water prices are often not high enough to support the use of the kind of technology that may be required in the future, nor are they high enough to cover the very basic costs of water supply and treatment. Urban wastewater discharge and non-source point pollution from urban storm-water runoff also pose big problems.

### Water Quantity

Some municipalities are facing increasing strains on their water supply. Cities located in drier areas, such as those in the Okanagan Basin, have a smaller water supply to draw from than cities like Calgary. Many of these small communities are experiencing growing populations (along with high levels of water use) and are faced with the dilemma of not having enough water to meet the needs of their citizens. Cities such as Vernon have begun using reclaimed water in order to ease some of the pressure on the water supply.

## WATER RECLAMATION IN THE CITY OF VERNON

The city of Vernon, located in the northern portion of the Okanagan Valley, uses reclaimed water rather than potable water for commercial and agricultural irrigation purposes.

The Vernon Water Reclamation Centre (VWRC) receives all of the wastewater for the city. However, the city makes use of the daily inflow—both solids and liquids. Solids are “dewatered” and composted, resulting in a final product that is “rich in nutrients and sold commercially” for composting.

After the liquids go through treatment, the reclaimed water is pumped to a reservoir from late April to early October where water is then withdrawn, chlorinated and used as irrigation water. The water is applied to golf courses, orchards, agricultural land used for grazing and hay production and public recreational fields. In many cities, potable water is often used for these purposes, which is a waste of clean water, the energy used for treating it, and money used to pay for its treatment.

### Infrastructure

Water infrastructure is one of the most important issues that municipalities across the country are facing. Old infrastructure results in leaks, which means that treated water is being lost to the system. The challenge is that infrastructure upgrades are extremely costly and require either greater government subsidies or higher water prices to cover the bills.



## LAKE WINNIPEG THE CONFLUENCE OF WESTERN CANADA'S WATER PROBLEMS

Lake Winnipeg is a major western Canadian water stress point, but it does not fit neatly into the categories of agriculture, energy production or urban issues. It is an example of the confluence of many of western Canada's water woes.

Lake Winnipeg is Canada's sixth largest lake and the tenth largest freshwater lake by surface area in the world. Although it is located in central Manitoba, its watershed (the area of land that drains into the lake) is of a regional scope. The nearly one million km<sup>2</sup> watershed covers four Canadian provinces (Alberta, Saskatchewan, Manitoba and Ontario) and four American states (Montana, North Dakota, South Dakota and Minnesota). The regional nature of the lake's watershed is a unique feature that is often not realized outside of Manitoba.

A vast lake known for its beaches and commercial fishing, Lake Winnipeg is a key attribute of the province of Manitoba. It is also essential for power generation. In 1976, Manitoba Hydro completed the building of a dam at the northern outflow of the lake (where it joins into the Nelson River), thus creating the third largest hydroelectric reservoir in the world.

But all is not well with the lake. Since the 1990s, the lake has been experiencing a growing problem with algae blooms that choke out other aquatic life. The once clean shores are now becoming awash with green sludge and many beach dwellers and cottage owners report their sense of smell being assaulted with a pervasive stench.

The problem stems from eutrophication, or nutrient enrichment. The run-off that flows into the lake is full of contaminants that are spurring algal growth. Agricultural run-off, manure run-off from intense pig farming, sewage contamination from the cottage community and certain household items such as detergents are all contributing to an increased amount of nutrients in the lake. Part of the problem is that "prairie potholes," which are essentially mini-wetlands, are being drained all over the Prairies. The natural function of the potholes is to filter out contaminants before they reach a major body of water. In their absence, the contaminants have no choice but flow straight into the lake.

Eutrophication leads to increasing algae blooms. While algae is an integral part of the food chain, too much of it is not a good thing. Due to excessive algae blooms, the ecology of the lake is beginning to change so that algae growth is favoured over the growth of other species. Excess algae consumes the majority of the lake's oxygen, thus leaving little to other species and destroying the natural aquatic environment. This is such a serious problem that the algae growth in the lake can be seen from space.

As the lake becomes increasingly full of algae, there can be some serious consequences. First, the green sludge has made some parts of the lake unsafe and unappealing to swim in. The loss of a notable recreation feature of Manitoba would likely financially hurt the province—recreation and tourism generates more than \$100 million each year (Lake Winnipeg Stewardship Board). The algae blooms can also have an impact on human health. Certain kinds of algae, such as blue-green algae, can be highly toxic to animals and humans. It was reported that a dog died within one hour of drinking lake water that had been contaminated with this kind of algae in July 2009.

There is a large fishing industry that has been built around the Lake. The loss of the fishing industry would be devastating to those communities that rely on it. Manitoba Hydro relies on a healthy lake to fuel its hydro-power and downstream communities situated on the Nelson River rely on water that comes from Lake Winnipeg for their drinking water.

There are currently several initiatives underway to save the lake, including work carried out by the Lake Winnipeg Research Consortium and provincial and federal programs.

# Rethinking the Value of Water

Identifying and understanding water stress points in western Canada is only the first step in addressing how we allocate and value our water.

One of the things that makes water such a complex and difficult policy area is that it is a resource like no other—it is a commodity without a clear price. Indeed, due to the multi-dimensional nature of water as an economic, spiritual, cultural, ecological and recreational substance that is necessary for our survival, many would argue that water is priceless. While this may be the case, it can be difficult for decision-makers to assess how water should be allocated when one option would yield economic benefit while a second would yield cultural and ecological benefits. Or, as stated by Renzetti and his colleagues, the danger is that “when explicit monetary benefits are set against unspecified impairment to the service of an aquatic resource, the latter’s value is easily assumed to be zero” (Renzetti et al. 2011).

So, the logical next step would seem to be to attempt to monetize water. But this is not an easy task. Not only does water have a different value for different stakeholders, it is also challenging to track in terms of its pathway through the economy. A recent study highlighted this difficulty. The conclusion of the authors was that water is responsible for a contribution of \$7.8 to \$22.9 billion to the Canadian economy per annum—not exactly a concrete range that a policymaker would feel comfortable working with (Renzetti et al. 2011). And placing monetary values on water can have social and economic equity ramifications (furthering the debate on whether water is a free, common good or a commodity). Yet, if western Canadian policymakers do not somehow recognize the value of water and environmental services (e.g., wetlands and water filtration, peat lands and carbon capture) then taxpayers will inevitably end up paying for rehabilitation that may be required due to pollution from industry or agriculture.

Placing a dollar value on water is not a panacea. In fact, it raises many questions. For example, how can the dollar value of water, and the ecosystems it sustains, be factored into policy options? In the water policy community, there is a general recognition that nature itself must be considered a stakeholder in water allocation decisions. The difficulty is that “nature” is an abstract concept and nature may have different water needs depending on which watershed is being considered and which scientific study is used to set the level of need. However, if nature is kept out of allocation decisions, the danger is that the ecological systems that sustain us all will be considered last priority. Again citing Renzetti’s study, the “value [of aquatic ecosystems] is at least on the same scale as, and may dwarf, the value of water’s market uses” (Renzetti et. al 2011).

Ultimately, the challenge that policymakers face is that of allocation. Should water be allocated to those activities that result in the greatest economic value? Is economic value the basis upon which these decisions should be made? If not, then what criteria should be used to make allocation decisions? What of Aboriginal rights? These are critical questions that must be addressed.



# Final Thoughts

“Security of water supply needs to be at the top of every country’s agenda.”

– DELOITTE ENERGY & RESOURCES

Given the challenges outlined in this paper, it is essential that governments move to make water policy and its linkages to the economy a higher priority than it currently is. Water is inextricably linked to the economic health of western Canada and looking at water policy only in an environmental light will result in an incomplete policy response and, in turn, an increase in problems at the interface between water and the economy.

There is growing support in the policy community for a national water strategy. This reflects a desire for federal leadership on water policy. Although water is mostly a provincial responsibility, many are looking to the federal government to elevate water on the policy agenda: “It is high time for the Government of Canada to provide leadership and focus, in a coordinated fashion, on what matters most. Water matters.” (Standing Senate Committee on Environment 2005). The federal government should, however, make sure that it does not find itself wading into the issue haphazardly or in ways that inflame federal-provincial tensions.

Provincial governments in the West are beginning to elevate water on their policy priority list. In British Columbia, the government is working on modernizing its *Water Act*. In Alberta, the provincial government has promised a review of the hundred-year old allocation system. Saskatchewan is currently developing a water strategy, and Manitoba—the only province with a Ministry of Water Stewardship—is continuing to address pressing issues. But many argue this is not enough.

Reform at a rhetorical level is one thing, but implementation and enforcement are the real measures of success. Politicians have some choices to make, and many of the choices that would address water policy will not necessarily make the electorate or stakeholders happy in the short-term.

We are now in an age where we cannot afford to postpone these difficult decisions. Climate change, extreme weather events, increased demand and a better understanding of aquatic ecosystems needs are changing the game and public policy must adapt. Inclusion and consultation with Aboriginal communities as an equal partner in determining western Canada’s water future is critical. Many of Canada’s competitors around the world are beginning to tackle water stress points in their countries. If we want to keep up our public image, protect our environment, and maintain our prosperity, we need to get moving.

The stress points that are likely to pose the biggest problems in the near future and require immediate attention include:

- **Lake Winnipeg in Manitoba:** The health of Lake Winnipeg, the largest lake in western Canada, is deteriorating. Poor lake health affects commercial fishing, drinking water, human health, tourism and recreation and hydropower. To make matters more complicated, transboundary water concerns are an issue here (e.g., the dispute that arose between Canada and the US when North Dakota built an flood relief outlet for Devil’s Lake—despite the protestations from Manitoba that water flowing from the Lake into Lake Winnipeg could create a transfer of invasive aquatic species and sulfates).

- **Shale gas development in northern BC:** The shale gas industry is developing at a rapid rate in northern BC. There are concerns about the quantity of water used in production, as well as anxieties about the use of hydraulic fracturing and its affect on groundwater.
- **Urban issues in western Canadian cities:** As western Canadian cities grow, there will be a greater shift to finding innovative solutions to increasing water demand, higher density areas and mitigation of stormwater.
- **The agriculture sector in the Okanagan Basin, BC:** The population is growing quickly in the interior of BC, and so too is water demand. The agriculture industry—a defining feature of the region, and essential to the local economy—is feeling the pinch on water supplies.
- **Potash and uranium mining in northern Saskatchewan:** Mining uses comparatively less water than oil and gas development, yet the impact of mining on water quality is worrisome. As demand increases for Saskatchewan’s potash and uranium—key industries in the province—the environmental impacts of higher production will need to be better understood.
- **The agriculture sector in Southern Alberta:** The government of Alberta has not issued any new water licenses in southern Alberta since 2006. The region’s economy is based on agriculture, yet irrigators are concerned about urban development and increasing water scarcity. Aboriginal concerns about allocation and water licenses are especially profound in Alberta.
- **Oil sands development in northern Alberta:** There are concerns both about the quantity of water used in oil sands production as well as the impact of development on water quality. The impacts of oil sands production on the Athabasca River, including contaminated drinking water and deteriorating fish habitats is a concern of many, especially Aboriginal communities.

Aboriginal treaty rights are the sleeping giant that overshadow each of these stress points. Consultation with Aboriginal communities is essential as policy on water and economic development is made.

Because of water’s centrality in all aspects of a healthy and functioning economy and society, ensuring that it is protected and that our water policies are sound should be a top priority for all levels of government. Even in difficult economic times such as these, protecting our water should not be a task that is facing austerity measures—it is simply too important to leave for another day.

# Appendix: Advisors

*Stress Points: Water and Economic Growth in Western Canada* was reviewed by several water experts. Their involvement in the project does not imply endorsement of the contents of this report and any errors or omissions remain the responsibility of the author.

- David B. Brooks, Director, Water Soft Path Research, POLIS Project on Ecological Governance & Associate, International Institute for Sustainable Development
- Irving Leblanc, Acting Director, Housing & Infrastructure, Assembly of First Nations
- Doug Maley, Assistant Deputy Minister, Alberta Region, Western Economic Diversification Canada
- Hans Schreier, Professor, Institute for Resources, Environment and Sustainability, University of British Columbia

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# A Western Voice on National Policy Issues

In 1971, the Canada West Foundation was established to give the people of the West—British Columbia, Alberta, Saskatchewan and Manitoba—a voice for their dreams, interests and concerns. In doing so, the goal was to put the West on the national agenda and be at the forefront of the most important issues and debates.

Since then, the Canada West Foundation has successfully met that goal, proving itself to be one of Canada's premier research institutes. The Canada West Foundation is the only think tank dedicated to being the objective, nonpartisan voice for issues of vital concern to western Canadians.

For over 40 years, we have represented western viewpoints. We are proud of our accomplishments and know that our research and commentary have improved government policy and decision-making.

Today the West is in, but we won't stop there. We continue to promote important issues and debates that provide made-in-the-West solutions to national problems and keep the West thriving.

**CANADA IS STRONGER WHEN THE WEST IS THRIVING!**