

CHAPTER SEVEN

FOR WHOM THE BELL TOLLS

Lake Winnipeg and the Prairies in the Anthropocene

Not everyone in Canada, or anywhere else for that matter, gets the opportunity of timely reconsideration of their hydro-climatic circumstances in advance of rapid change. In some regions, like the Lake Winnipeg basin, hydro-meteorological change is already occurring and appears to be accelerating. In such places, major efforts are required to first catch up with these changes and then, if possible, get ahead of them. The case of Lake Winnipeg is particularly complicated by the fact that it involves the Red River, which of course originates in the United States. It also involves a century-old treaty between the two countries and an organization created under that treaty for the purpose of anticipating and resolving potential disputes over waters shared by the two countries.

A public forum on the Boundary Waters Treaty, the International Joint Commission and the Future of Lake Winnipeg was held at the University of Manitoba in Winnipeg in May of 2014. The sponsoring partner was the Manitoba Institute for Policy Research, a think tank nested within the University of Manitoba's political studies department. The conference was a joint presentation with the Forum for Leadership on Water, or FLOW, and was advertised as part of the institute's "Citizen Series" of presentations aimed at enhancing the quality of political discourse in Manitoba.

The program was opened by Paul Vogt, formerly the top civil servant in the government of Manitoba and now the director of the Manitoba Institute for Policy Research. The event was moderated by

FLOW co-chair Norm Brandson, who, having spent many years as a deputy minister in Manitoba's Environment and Water ministries, knew the nutrient issues related to Lake Winnipeg as well as anyone in the province.

The keynote presentation was by FLOW's Murray Clamen, who until very recently had been secretary of the Canadian section of the International Joint Commission. Dr. Clamen is an expert on transboundary pollution in the Red River basin and related matters along all of the fluid points of the international border. His keynote addressed the delicate political question of whether the IJC should receive a reference mandate to resolve potential disputes related to the effects of transboundary nutrient flows from the US into Canada and into Lake Winnipeg by way of the Red River.

Dr. Clamen began by explaining what the International Joint Commission is; how it came into existence as a consequence of the signing of the Boundary Waters Treaty in 1909; and how the reference mechanism functions to formalize dispute resolution in cases of Treaty violation or potential threats to harmonious relations between the two nations over shared waters. Dr. Clamen summarized the remarkable success the IJC has had over the past century in identifying and addressing issues before they became disputes and in resolving disputes amicably to the satisfaction of both nations. He then explained that the water quality issues underlying recent claims that key conditions of Article IV of the Treaty were being violated were in fact valid, and that an IJC reference was perfectly in order to address what had the potential to create tension between Canada and the US over the deteriorating condition of Lake Winnipeg.

An astute and experienced diplomat, Dr. Clamen left much unsaid. Citing research findings by Dr. Greg McCullough (which we'll return to in a moment) pointing to American sources as the main contributor of phosphorus into Lake Winnipeg, Dr. Clamen left it to his audience to figure out the extent to which these inputs violated the Treaty provision dealing with transboundary pollutants. He also left it to the audience to determine for themselves whether a reference to the IJC was warranted. He did this not to elicit hard feelings between the two nations but to demonstrate that we are not

utilizing all the resources that are available to us to address the Lake Winnipeg problem.

This failure, however, goes beyond the issue of Lake Winnipeg. In failing to utilize historic resources that have served both nations well, we are in addition eroding important, long-standing, hard-won avenues connecting our two nations politically which will be difficult to recreate if they are lost to neglect and disuse. Clamen concluded by calmly and articulately presenting the logic behind preventing the terms of the Boundary Waters Treaty from being ignored and then forgotten in our time.

A four-person panel of local and international experts, including this author, then responded to Dr. Clamen's presentation. Panellists made it clear that Manitobans face some serious and mounting problems. The panel noted that the Lake Winnipeg problem was too big and far too complicated to rely on government alone to address. Civil society has to work with government of course, but there is also work to be done within civil society itself to begin addressing the problem. The entire process of collaboration needs to be re-energized.

An open forum followed for questions from the audience. A commenter suggested that all parties need to use all the tools that are available to address the eutrophication problem in the Lake Winnipeg basin. It was also noted that equal and similar rights in Canada's relationship with the United States had been institutionalized through the Boundary Waters Treaty, and that a hundred years later the rest of the world is still trying to catch up with the degree of fairness of equity embodied in the transboundary relations between the two countries.

The IJC, it was noted, is the main instrument that puts the value of the Boundary Waters Treaty into relief. But because we no longer use the IJC to fulfill its original purpose, the Treaty is losing its force. One of the panellists argued that in addition to being an outright violation of Art. IV, the claim North Dakota is making – that the state government should be permitted to unilaterally construct major diversions because in funding these themselves they hold such projects to be exempt from the Boundary Waters Treaty – is legally indefensible and warrants an IJC reference in its own right.

Similarly, major flood storage plans being developed in the US by the Red River Basin Commission should be properly vetted under the Treaty, if only because these plans interfere with the current hydrological regimes in both countries. While everyone on both sides of the border may agree that such plans will serve to reduce the growing flood threat, no accommodations have been agreed upon to determine how and to what extent holding back water in the US might affect Canada during prolonged drought.

At present neither country appears to care much that articles of the Treaty are being violated and threatened with further violation. We don't appear to want to use the IJC in a proactive way prevent and resolve disputes between good neighbours. But if we really do need all the tools available to us, then maybe that is a mistake. Evidence from the Great Lakes suggests we shouldn't abandon approaches that have been successful in the past.

It was noted that IJC studies fundamentally underpinned the Great Lakes Water Quality Agreement. While the engagement of the IJC did not involve a formal reference that would trigger a dispute resolution process, it did serve as an effective platform for co-operation between the two countries in dealing with the shared problem of deteriorating ecosystem health in the Great Lakes. Lake Erie is the closest analogue we have to Lake Winnipeg in Canada. It is roughly the same size and has many of the same problems. We have not been able to adequately sustain successful collaboration in the Great Lakes, and now four of the five lakes are in measurable decline. Erie is threatened once again with death. Is Lake Winnipeg going to suffer the same decline?

As the conference proceedings were taking place at St. John's College on campus, it was not surprising that a church bell tolled each quarter-hour throughout the course of the evening's presentations, panel discussion and final summary. It seemed at those moments that the bell tolled for Lake Winnipeg. As Norm Brandson noted in closing, we don't have sixty years to get on top of the lake's eutrophication problem. And if that is the case, then that bell tolls also for us. If we don't want an IJC reference on phosphorus loads in the Red River, then another agency of its kind has to perform the function of unifying efforts of government at all levels; of

harnessing science and interpreting its outcomes; and of re-energizing civil society in both countries in the interest of the common good. The Lake Winnipeg situation will get away on us if we can't organize ourselves to act. We need the equivalent of a Great Lakes Water Quality Agreement for the Lake Winnipeg basin. Can the Red River Basin Commission, the Lake Friendly Accord and Alliance – or a combination of the two – become the IJC equivalent in this process? Or will we just forget the Boundary Waters Treaty and relegate the IJC to other, lesser roles than dispute resolution and proactive diplomacy between the two countries? These questions were not addressed as the bell tolled a final time as the forum came to an end.

A number of participants later gathered at a nearby pub, where the owner, who happened to have a significant interest in a company that manufactures and sells flood protection systems, made a point of reintroducing himself and his company's products. It was an astonishing coincidence that while he did so the bar's very loud sound system was belting out the famous Creedence Clearwater Revival song *Have You Ever Seen the Rain*. In the background you could still hear that bell toll.

LAKE WINNIPEG AND ITS BASIN: HYDRO-METEOROLOGICAL CHANGE AND ITS CONSEQUENCES

The rain is coming down and the nexus between water, food, energy and biodiversity is not holding. After the prairie flood of 2011 the Centre for Hydrology at the University of Saskatchewan expressed the view that what was happening in the Lake Winnipeg basin was emblematic of how the speed at which water moves through the hydrological cycle is accelerating in every part of the country. The manner of its moving is changing too. It appeared that the kind of flooding that was occurring was evidence that the central Great Plains were approaching – or perhaps had even passed over – an invisible threshold into a new hydro-climatic state. Particular concern was expressed about the Lake Winnipeg basin, where mobilization of nutrient-rich agricultural runoff during floods was contributing to what potentially could become one of the largest freshwater ecosystem collapses in the world. While Canadians are shocked that such environmental catastrophes are

occurring in their country, there are few places in the world where they are not occurring.

We are learning the hard way that hydro-climatic stability is a very valuable common-pool resource without which some economic sectors such as agriculture will find sustainability an ever greater challenge. We know that hydrological conditions on this planet have always been changing, but usually that has happened at a much slower pace. We have been fortunate to have had a century or so of relative hydro-climatic stationarity. That era is over. This is a huge new concept – a societal game changer – and it is going to take time to get our heads around it.

As discussed in chapter five, the loss of hydro-climatic stationarity makes the established bell curve of climate risk meaningless. In a more or less stable hydro-climatic regime you are playing poker with a deck you know and you can bet on risk accordingly. The loss of stationarity is playing poker with a deck in which new cards you have never seen before keep appearing more and more often, ultimately disrupting your hand to such an extent that the game no longer has coherence or meaning and can no longer be played. Unfortunately, the Lake Winnipeg basin is the first heavily populated region in Canada to be affected in this way. In this basin we face a growing number of “no analogue” situations where we are facing conditions we haven’t seen before. We are all concerned, for example, about the flooding that occurred in July 2014 in Saskatchewan and Manitoba. In discussions with experts, it seems that what occurred that summer appears to confirm earlier fears that this region has indeed crossed over an invisible threshold into a new and more energetic hydro-climatic regime.

In December 2013, University of Manitoba research Greg McCullough reported that algal blooms on Lake Winnipeg had reached 17,000 square kilometres in area. McCullough was also able to provide the latest research findings with respect to sources of the nutrients that were finding their way into the lake. He reported that there was 10 times the volume of phosphorus in the Red River as compared to the Saskatchewan and Winnipeg river systems. He also noted that the annual flow of the Red has doubled over the past 20 years. As a result of this increase there have been more floods. The

consequence is that more water with twice the phosphorus per unit volume is now entering Lake Winnipeg.

The median total phosphorus concentration in the Red River in flood is twice the concentration in normal summer and fall flows. The concentration of phosphorus in the Red increased by 30 per cent between 1971 and 1980 and by 45 per cent between 1996 and 2005. As a result the productivity of Lake Winnipeg and its fishery has grown but there are serious concerns that the expanding extent of eutrophication will result in anoxia and a sudden collapse of the food web in the lake, which would destroy the fishery. No one knows at what threshold that would occur, however.

We see from this that Manitoba faces a much larger problem than just the eutrophication of Lake Winnipeg. While that is a big enough problem in its own right, Manitoba now also faces the likelihood of a significant increase in the frequency, duration and extent of flooding as a consequence of regional land-use alteration, drainage effects, streamflow changes and the intensification of the larger hydrological cycle. This one-two punch will make it harder to bring Lake Winnipeg and waters like it back from the brink of total eutrophication. Increased flooding could also have a self-limiting impact on the region's ultimate agricultural productivity, as well as unexpected impacts that are passed on to others by way of downstream flooding that accelerates eutrophication not just in the Lake Winnipeg basin but in lakes and streams throughout southern Manitoba and the Great Plains.

More than ever we are worried about what the loss of hydro-climatic stability might ultimately mean to the economy and future prosperity of Manitoba and surrounding jurisdictions. The duration of precipitation events on the Canadian prairies has lengthened by half since 1940. Total precipitation has grown by 30 per cent in some parts of the region since the 1990s. The growing length and intensity of precipitation events has already resulted in a fourfold increase in streamflow during such storms. Researchers have demonstrated that the growth of these larger streamflow volumes and runoff ratios since 1994 is likely due to non-linear, threshold-crossing responses to a combination of changes in land use, recent dramatic increases in wetland drainage and a changing climate.

The effects of drainage have recently received a great deal of research attention. A long-term measurement and computer modelling study undertaken by the University of Saskatchewan's Centre for Hydrology has revealed that wetland drainage is a major factor in increased prairie streamflows and greater flooding in wet years. Because of the intensification of agricultural practices, the basin of Smith Creek, Saskatchewan, just south of Yorkton, has undergone substantial changes in drainage patterns. In 1958 there were some 98 square kilometres of wetlands which covered 24 per cent of the basin. Today there are 43 square kilometres of wetlands covering only 11 per cent of the basin. The prairie hydrological model was set up to cover the years from 2007 to 2013, using reliable weather data from a University of Saskatchewan monitoring station. These years included the largest flood then on record, which took place in 2011. The model was manipulated to decrease or increase wetland volume by simulating both drainage and restoration. In the model, the target for restoration was the measured wetland extent in 1958, while the limit for drainage was complete wetland removal. The study found that wetland drainage has a significant impact on streamflow in flood conditions.

For the flood of 2011, complete drainage of the existing wetlands would have raised the flood peak by 78 per cent and increased the streamflow volume by 32 per cent. Restoration of wetlands from their 2011 extent back to their 1958 size would have reduced the 2011 flood peak by 32 per cent and decreased the total volume of streamflow by 29 per cent. What's more, it appears that drainage has an even stronger effect on streamflow in normal years. For those years, streamflow volumes would increase by a factor of 200 to 300 per cent with drainage of current wetlands, and the yearly peak flow would increase from 150 per cent to 350 per cent.

Over the six years covered by the computer model simulation, total streamflow volumes increased by 55 per cent with complete drainage and decreased by 26 per cent with restoration of existing wetlands to their 1958 state. We have already discussed what all this means. It means we may now be experiencing non-linear, step-like changes in the manner in which water moves through the hydrologic cycle. If this is the case – and scientists believe it is – the

mobilization of nutrients that cause eutrophication is not all we have to worry about. An entire new runoff regime is coming into existence that could further exacerbate eutrophication while at the same time dramatically increasing flood damage and the risk of flooding's diametric and symbolic opposite, drought.

Perhaps the most frightening finding, however, was that no amount of wetland restoration would be adequate to prevent flooding if extreme weather events become more frequent and severe. To be meaningful, wetland restoration must be tied to effective efforts to reduce soil loss, improvements in erosion control, expansion of vegetative buffers and better nutrient management. Without these measures being taken, eutrophication of lakes and watercourses across the prairies cannot be addressed.

If what happened at the Prairie Improvement Network conference held in Virden, Manitoba, in March 2014 is any indication, farmers are already beginning to figure this out for themselves. It was made clear at that conference that southern Manitoba is where everything used by everyone upstream ends up. This includes all the water they use and everything that is dissolved in or mobilized by that water. If this is creating disaster after disaster in southern Manitoba, how long will it be before these impacts advance upstream? Blaming one another for these circumstances is neither fair nor helpful. We have unfortunately inherited the sum total of a century of trade-offs, and unless we want to abandon parts of southern Manitoba, something has to be done about it.

Three months later, as if to completely underscore the outcomes of the Virden workshop, southeastern Saskatchewan and southwestern Manitoba flooded again. While many considered the flooding in 2014 to be déjà vu all over again, it was different from 2011 in one fundamental way: it was caused not by spring snowmelt but by heavy and prolonged late-June rainfall. Other factors exacerbated the flooding. Heavy winter snow had already saturated prairie soils made even wetter by the heavy spring rains. A huge frontal weather system pushed into Canada from the United States and stalled over southeastern Saskatchewan on June 28. The stalling of these large systems over the prairies, which appears to be occurring in both summer and winter, is being attributed to the loss of Arctic sea ice,

which appears to be slowing the northern hemisphere jet stream, making it linger longer over many places, bringing heavy precipitation and more erratic weather to many regions as far south as the mid-latitudes, including the Canadian prairies.

Torrential rains toppled streamflow records set during the 2011 flood. Parts of the region received as much as 200 millimetres over a single weekend – almost as much rain as normally falls in the dry region of southeastern Saskatchewan all year. By July 4 more than a hundred communities in Saskatchewan and downstream in Manitoba had declared a state of emergency. Some 300 people in Saskatchewan and nearly a thousand in Manitoba were forced to evacuate because of overland flooding. Some 8000 in Saskatchewan alone were without power, and the Trans-Canada Highway was closed for days at Brandon. Prime Minister Stephen Harper flew from Ottawa to survey the flood damage.

Manitoba has 160 kilometres of provincial dikes that are almost a century old. No one was sure which ones would hold. The Canadian military was called in to protect 350 rural homes, 150 of which would have been flooded had it been necessary as a last resort for the province to deliberately breach the same dike at Hoop and Holler Bend that had been cut in 2011 to reduce the downstream flood risk on the Assiniboine River. Anger and bitter resignation were registered widely but particularly in communities and on farms that had been flooded by the 2011 dike cutting, who were still disappointed that anticipated compensation and promised action to prevent the same damage from occurring again were still not forthcoming. Worn-out and upset flood victims charged the government with incompetence and pleaded for outside help.

In southwestern Manitoba 50 per cent of the land was covered by water, much of it in the form of floodwaters coming from Saskatchewan. The flooding was so serious that farmers had to ignore the state of their crops and give full attention to saving themselves, their homes and livestock. A million acres of productive prairie farmland went unseeded. We are now finally able to calculate the real costs – including the costs of lost productivity associated with extreme weather. It is now estimated that economic losses due to the Prairie drought of 2000–2004 exceed \$4-billion, while the

damages from the Alberta–Saskatchewan–Manitoba floods of 2011–2014 top \$11-billion.

If issues related to hydro-climatic change were not well understood before the flooding in 2014, it can be said with a high degree of confidence that after what happened that summer, some farmers at least are starting to get the message now. In an example mentioned at the end of that summer by one farmer, hundreds of thousands of tonnes of sediments from Deer Horn Creek were washed in torrents into the Assiniboine River, changing channel morphology in ways that are sure to greatly increase the risk of future flooding. Argued a rural mayor, “It is suicide to ignore the clear and obvious fact that our hydrology is changing.” The days of a farmer gaining fifteen or twenty acres of productive land through drainage that causes the loss of four or five times that as a result of flooding downstream have to come to an end. “We have to learn to live with reality,” the mayor of Virden said. “We need to learn to deal with this rather than continuing to fight it.” Not everyone in Saskatchewan is on the same page with drainage impacts yet, but getting and keeping them on-side is critical if only because in the Anthropocene everyone has to be in on the solution or no one will succeed. If current trends persist, it may not be that difficult to convince enough people to act collaboratively to address the problem.

THE IJC RECONSIDERED

It may be useful in the context of the eutrophication issues and loss of hydrologic stability in the Lake Winnipeg basin to examine other regions that have recently faced inadequate or exhausted relations that needed to be renewed with surrounding jurisdictions over shared water resource matters. Fortunately a peerless example exists right here in Canada to guide us to the resolution of these difficult problems.

Probably the best example of success gained and then squandered in terms of the capacity for Canada and the US to come to full and effective agreement on the co-management of shared waters is the Great Lakes Water Quality Agreement of 1972. How Lake Erie nearly died, was saved and is now again under threat demonstrates that indigenous peoples should not be the only ones to be

concerned that we as a nation have begun to turn our back on the personal and environmental protections that at one time defined our national character. The concern – as has been noted in the Lake Winnipeg basin – is that we are on slippery slope of ineffective action that may over time put any meaningful economic and environmental sustainability out of reach for everybody. This is not a foregone conclusion, however.

What many experts in Manitoba appear to be aiming for in the Lake Winnipeg basin is an as yet undefined, perfected form of adaptive, basin-scale, integrated water resource management. Four elements have been identified through the evolving practice of integrated water resource management which, theoretically at least, are held to build adaptive capacity in socio-ecological systems. The first is learning to live with change and uncertainty. The second is nurturing the kind of diversity you need to create resilience. The third is combining different kinds of knowledge. And the fourth, the creation of self-organizing pathways leading to socio-ecological sustainability. These are the principles that are driving the UN's *Transforming Our World: The 2030 Agenda for Sustainable Development* as well as the various “resilient cities” and similar sustainability movements around the world.

What we learn from Lake Erie is that we are not starting all over here. We know how to do this because have done it before. Research conducted recently by Dr. Savitri Jetoo at McMaster University demonstrates that the determinants of adaptive governance of the kind we seek today were clearly present 50 years ago during the reversal of the eutrophication in Lake Erie, beginning with the Great Lakes Water Quality Agreement in 1972. We just didn't call it “adaptive governance” back then.

The Great Lakes Water Quality Agreement spurred federal-provincial co-operation in Canada. The agreement worked because it went on to encourage binationalism; promoted community participation; demonstrated equality and parity in its structure and obligation; arrived at common objectives such as joint phosphorus reduction targets; facilitated joint fact-finding and research; demanded accountability and openness in information exchange; and featured flexibility and adaptability to changing circumstances.

Looking back at it now in the context of the reconsideration of the Lake Winnipeg problem, it appears that the greatest success of the Great Lakes Water Quality Agreement was that it fulfilled the promise of institutional integration under a binational framework where common interests superseded political partisanship and jurisdictional territoriality.

There was widespread consensus among key players at the time that the International Joint Commission played a crucial leadership role in all the processes that led to nutrient reduction in Lake Erie. It was the IJC that orchestrated significant public participation and ensured that science was central to the decision-making. It was the IJC that helped create strong action-oriented networks charged with implementing recommendations. And it was the IJC that made sure that information-sharing protocols actually worked and that clear leadership was demonstrated in the creation of a common community that was kept going through reliable, adequate funding.

Looking back, many believe it was the sense of community created by the agreement process that drove the political will of both federal governments to meet the obligations of the 1972 agreement. The 1972 agreement went on to be strengthened in 1978 with the addition of the concept of ecosystem management for the elimination of toxic contaminants. The breakthrough there was that in this process science was meant to guide policy, and public reporting was introduced to strengthen accountability in an expanded mandate that now included air, water and all living organisms in the Great Lakes system. Everything was working.

But then the process started to go backward. After an 11,000 tonne limit on phosphorus was set for Lake Erie, the lake began to recover. It was thought that the problem was solved, so the federal government stopped investing in monitoring and research. Because improvements in water treatment and the banning of phosphorus in detergents appeared to work, changes in agricultural practices remained voluntary. Now Lake Erie is back to the same near-death state as it was in 1972.

Why? What is the difference between then and now?

What is different today is that the population of the Great Lakes Basin has grown dramatically and agricultural production in the

region has increased. What's more, the introduction of invasive species has complicated the eutrophication problem, and changing hydro-meteorological conditions have resulted in more frequent flooding, which is mobilizing more nutrients.

What is also different is that the institutional arrangements that made it possible to address the eutrophication of Lake Erie 50 years ago do not exist today. Back then, the federal government was fully funding the Centre for Inland Waters as well as a wide-range of critical research and monitoring programs. Since then, however, monitoring and research have been drastically cut and the remaining federal scientists have been gagged. The technical capacity formerly present in the federal government no longer exists.

Most critically, the political leadership that enabled the saving of Lake Erie in the 1970s is today almost completely absent. We no longer have a reliable mechanism for implementing achieved agreements in a timely manner. Our binational integration processes have been weakened by overrepresentation of provincial and state interests at the expense of partnership and favourable regional and binational relations. This is a trend that has to be reversed if Lake Winnipeg is to be saved.

What we can see by comparing our circumstance then and now is that there is a direct link between the diminished role of the IJC and our failure to uphold today our historic accomplishment with respect to eutrophication in the Great Lakes. It should be remembered that in 1964 the governments of Canada and the United States issued a reference to the IJC with the goal of determining the exact causes of eutrophication in Lake Erie. Funding of the Experimental Lakes Area in Ontario resulted in a broad range of scientific work that changed our understanding of aquatic ecosystem dynamics. That research included some globally significant breakthroughs made by scientists of the calibre of Dr. David Schindler and his associates in the understanding of nutrients.

It should also be noted that although the conventional wisdom today is that the IJC is too bureaucratic and takes too long to render reference decisions, this is not historically accurate. What careful historical research has clearly demonstrated is that delays in handing down IJC decisions were largely the result of the inordinate

length of time the two federal governments took to advise the IJC of their wishes. Surveying all of the facts, it is hard not to conclude that political influence and lobbying by special interests have played a huge role in delaying important decisions – so much so, in fact, that it is difficult not to believe that special interest influence did not intentionally seek to undermine the purpose and function of the IJC.

So, why do we need the IJC today? We need it because if we don't have it, the Boundary Waters Treaty becomes meaningless just when we need it most. The eutrophication of Lake Erie in the 1960s was a straightforward challenge compared to what we face today as a result of new, interacting stressors such as invasive species and climate change. More than ever, we need the neutral, non-partisan, binational objectivity invested in the IJC through the Boundary Waters Treaty.

The chair of the US section of the IJC, Lana Pollack, was the keynote speaker at a lunch session of the Red River Basin Commission annual conference in January 2015. Pollack began by recalling that IJC commissioners are not instructed to uphold each country's interests, but to do their job impartially under both flags. Given that 43 per cent of the international border is water, she said, to think and act otherwise is unproductive. The responsibility must be to the shared waters. The IJC is more about political will than science, she said. Science is easier than politics. Getting people in powerful positions to listen and give consideration to science is not as simple as it might appear.

One of the major problems we face, Pollack stated, is that no one wants to give anything back. Once a government, a corporation, a sector like agriculture, or even an individual acquires rights to a given amount of water or the rights to use water of a certain quality for specific purposes or permission to release certain things into that water without penalty, they don't want to give up those rights or, in many cases, even permit modification of them. They will use political channels to fight having to give anything back. The IJC, she said, is fully respectful of these realities.

One of the IJC's principal duties is to report on how the respective governments are doing with regard to meeting the obligations of the Boundary Waters Treaty. Pollack made it clear to what

I thought was a somewhat indifferent if not rather hostile audience that the IJC was never going to regulate them.

Pollack then offered a very thoughtful caveat. Having reminded participants that the IJC was not a regulatory body in the usual sense, she noted that regulations should not be viewed as restraints but as protections. “You are not allowed to pollute,” she said. “Is that a restraint or a protection?” She then said what no one else at the conference had been prepared to say, and it took the IJC to say it: we are not getting there, by which she meant that we are not solving the problems we have created for ourselves in the Red River system, a failure symbolized by the deteriorating state of Lake Winnipeg. In other words, we are not meeting the conditions of the Boundary Waters Treaty.

In the context of the Treaty, it is important to note that Lake Winnipeg is not a body of water shared by Canada and the US, and thus it is outside the jurisdiction of the IJC. But the Red River, which flows into Lake Winnipeg, is a transboundary watercourse that does fall within the commission’s jurisdiction. The question once again becomes whether we are going to devolve responsibilities for meeting the conditions of the Boundary Waters Treaty to individual states and provinces or restore the function of the IJC. If Manitobans don’t want responsibilities for meeting the conditions of the Treaty to fall into the hands of regional interests without national oversight, then they have to call upon their provincial and federal governments to make a request for an IJC reference that would have to go beyond the situation of Lake Winnipeg itself to address the much larger problem Lake Winnipeg only partially symbolizes. That problem is the issue of transboundary standards, not just for nutrients but also for heavy metals and other contaminants for which no current standards exist.

On this matter Lana Pollack very diplomatically pointed out that there are a number of Canadian problems the US would like to dispute, including Alaska’s concerns about contaminants flowing into that state in the waters of the Yukon River; the effects of sulphite mining on Lake Superior; and selenium mobilization in the waters of the Columbia as it flows from Canada into the United States. From this it is clear that transboundary issues related to the violation of

the Boundary Waters Treaty only start with our concerns about Lake Winnipeg.

In this context, what Manitobans may wish to do is ask the IJC to study nutrients with the aim of assessing what it will take to protect the Red River as part of a larger goal of establishing transboundary standards for nutrients and metals on all shared waters. It could and should be argued that there is urgency in doing so, for without a baseline of knowledge, issues such as these will only get more difficult to manage under greatly energized and far more unpredictable hydro-climatic conditions.

In addition to transboundary standards for nutrients and heavy metals, we need to consider cyanotoxins. Here the spectre of hydro-climatic change looms large. As water temperatures rise and cyanotoxins become harder to control, we will have no choice but to view eutrophication as a public health hazard. There are no standards for cyanotoxins in drinking water in either the US or Canada. If we shift the problem of eutrophication from solely protecting the environment to protecting our own health and regulate it from a public health standpoint, we broaden and strengthen the framework for eutrophication governance. This is adaptive management. For that adaptive management to work, we need the IJC.

In conclusion, there is a great deal we can continue to learn from the challenges the IJC faced with respect to Lake Erie. Solving the eutrophication problem is one thing; keeping it solved is another. Just as happened with Lake Erie, the Lake Winnipeg problem started out as just an issue of excess phosphorus. Although total phosphorus has decreased, the volume of reactive phosphorus from agriculture has increased over the past 40 years. The effects of long-term farm nutrient practices and more frequent intense precipitation events have converged with the introduction of invasive species to bring the eutrophication problem back into existence in Lake Erie. These same factors are already making the problem more complicated in Lake Winnipeg and could make it a lot worse in the future – which will likely alter the political landscape every bit as much as it has affected the region's hydrology.

WHAT WILL AN ANTHROPOCENE FUTURE BRING?

The Anthropocene on the Canadian prairies is going to be a very turbulent time. With further climate disruption virtually inevitable, it won't be long before there are enough people who rely on the prairies and whose lives have been disrupted by extreme weather to constitute a new political force.

A great deal of what Canadians take for granted will be challenged in the Anthropocene. The notion that humans are somehow separate from the rest of nature, and that preserving the non-human areas of the world because they possessed some particular ecological, aesthetic and recreational value would be adequate to preserve hydro-climatic stability, will also come under fire. The idea that there are no limits to human adaptability – and the underlying societal belief that we can either adapt to any circumstance or alter them to suit ourselves through geo-engineering – will be severely tested and very likely rejected. The legitimacy of our economic system will also be highly taxed. Our blind faith in “free markets” will certainly be challenged. The belief in monetary magic, popularized in the 18th century, which holds that economic markets in a capitalist system are somehow “balanced” by the actions of an unseen, immaterial power that ensures that such markets will always function efficiently to optimally address real and enduring human needs may not survive long into the Anthropocene. Unless we change how and what we value, continued market failures will reveal the “invisible hand” of the marketplace to be that of an intergenerational pickpocket.

Those areas of the Earth's surface that used to be frozen, including glaciers, ice sheets, sea ice and permafrost on land, are likely to disappear. Snowpack and the duration of snowcover in much of the northern hemisphere will be reduced. Precipitation patterns on the prairies have already begun to change. As already noted, with each degree of warming, the global atmosphere can carry 7 per cent more water vapour. Projections for the centre of the North American continent are for temperature increases of as much as 5° to 9°C. The basic laws of physics make it likely that floods in the regions will become ever larger. The loss of hydro-climatic stability may make the Lake Winnipeg problem as much as an order of magnitude more difficult to resolve.

It is interesting to note that California's biggest floods have been caused by the storms popularly known as the Pineapple Express. These storms collect huge amounts of water vapour as they cross the Pacific from Hawaii and unload it as heavy rain when the storms hit the coast of North America. When moderate in scale, they bring badly needed water to a dry state. When larger, they cause flooding of a magnitude we can hardly imagine. The atmospheric river that caused epic flooding in California during the winter of 1861–1862, for example, hammered the west coast of North America from Mexico to Canada for 43 days.

The US Geological Survey has published a new emergency preparedness scenario which demonstrates that if struck by an atmospheric river event like the one that happened back then, California would lose one-quarter of all its homes, with projected damage of \$725-billion.

The other thing we need to keep in mind is that water vapour is a powerful greenhouse gas in its own right. The more water vapour there is in an energized atmosphere, the warmer it becomes. Obviously, this will become a climate feedback in itself. As we have seen, other critical weather phenomena are also tremendously affected by differences in the temperature gradient between the poles and the tropics.

There was a time when it was thought that the first clear signal the public would pick up as to the extent and rate of change in our climate would be an obvious decline in local ecosystem function. That was wrong. The surprising thing about ecosystems is how resilient they are. Under the influence of changing temperatures, they will move out from under you, leaving in their wake opportunities for invasive species which will succeed or fail as they may until some sort of new ecosystem stability emerges. As long as human numbers and activities don't cause the Earth system to move to a completely new and different state, life on Earth will likely adapt to these changing conditions just as it has for billions of years. We may find ourselves in what we consider a much altered and diminished world, but life will go on with or without us.

What has captured public attention with respect to climate disruption, however, is the increasing threat it is posing to public

safety and its growing impact on expensive infrastructure. The cost is enormous and has been rising for 40 years. It is becoming increasingly clear that our failure to break the silence over climate disruption and change the behaviour of our society in ways that lead to action could cost some of us our prosperity. It could also cost some of us our lives. What the loss of hydrologic stability tells us is that true sustainability may be beyond our grasp if we don't do the right thing now. This suggests we have to view sustainable development in a completely new light. Such development as we have defined it in the past is not enough. What we need is restorative development. We cannot simply accommodate ourselves. We have to put vital Earth-system function back in place in doing so.

GETTING AHEAD OF THE KEELING CURVE

Charles David Keeling began precise measurement of the concentration of carbon dioxide in the Earth's atmosphere on behalf of the US National Centre for Atmospheric Research in 1956. As the Keeling Curve so elegantly demonstrates, our atmosphere is in part the inhaled and exhaled breath of life on Earth. The northern hemisphere breathes in with the coming of spring and breathes out in autumn.

It took only two and a half years of observations on Mauna Loa in Hawaii to see what was going on. With each semiannual breath, the Earth system is inhaling and exhaling more carbon dioxide. By the early 1960s the scientific evidence was clear and the implications of rising carbon dioxide concentrations on climate-system function were obvious. We now fully understand how sensitive the global atmosphere is to what we put into it and what the consequences of ignoring changes will be.

Leaders are defined as those who can identify the major trends that will influence their business or organization and ride the crest of those trends toward a sustainable and profitable future. The Keeling Curve may well be the defining trend of our age. If you are in a leadership position and ignore this trend, you may not be there long.

We are faced with the fact that we have no choice but to accept that our climate is no longer stable and that this poses a huge danger to our future. If a sustainable world is what we want, we have

to catch up with, get of and stay ahead of the Keeling Curve. So how are we doing in Canada?

According to the eighth annual RBC Canadian Water Attitudes Study, public opinion may be shifting, but only very slowly. Four in ten Canadians still have no idea where their drinking water comes from. This has changed little over the past eight years. The survey also shows we are still complacent about climate change. Few of us know our hydrology is changing. Only 28 per cent are concerned in any way about future water security. So where is the possible shift I mentioned? Here it is: the 2015 survey found that 7 per cent of Canadians were personally affected by flooding in 2014 and 27 per cent knew someone who was. An amazing finding is that some 30 per cent of Canadians now claim to have been impacted in the past by flooding in their communities.

Insurance matters have also begun to haunt Canadians. Some 30 per cent of respondents said adequacy of coverage was an issue for them, and 55 per cent registered serious concern over their ability to pay additional costs from flooding not covered by insurance.

It appears it will just be a matter of time before the growing number of people personally affected by climate disruption forms a constituency in itself. You can bet that if what we have seen elsewhere is any indication, the economic consequences of climate disruption won't be the only concern on the political agenda of this constituency. The moral, ethical and legal implications will also be high on these citizens' to-do list.

It is interesting to juxtapose these results with those of another survey, conducted by the mayors and reeves of the south basin of Lake Winnipeg, into major concerns over the deteriorating condition of the lake. The survey was based on new techniques for analyzing how best to communicate urgency to different types of people in ways that transcend traditional demographic categories such as age, gender, education, ethnicity, income and net worth. The survey revealed that despite the millions of dollars spent on trying to convince Manitobans of the seriousness of the problem they face, only a third of the messages being sent connect with those whose behaviour needs to be influenced if the province is to address what has become one of the largest and most alarming freshwater disasters in the world.

What we learn from this applies nationally. We have to stop demonizing one another. We must adapt our messages to different kinds of people who have different views and values. We need to give people the capacity to understand and think about water and climate on their own terms and then work back from there. Working back from there means reversing the damage we have done to the Earth-system function and doing it promptly, before population growth, more ecological decline and greater climate disruption further destabilize our already fragile global economic system and reverse hard-won development. To restore our global hydro-climatic circumstances to tolerable stability we have to break the socially constructed silence related to climate disruption. Perhaps the best way to start that conversation is to talk about something we can all agree that none of us can do without: water.

If Canadians want to continue to inhabit vulnerable parts of southern Manitoba, we have to keep nutrients and water on the land, not just within the boundaries of Manitoba but everywhere upstream. People in the know throughout the Lake Winnipeg basin have been talking for decades about a basin-scale approach to management of the lands that affect the quality and flow of the valuable water resources of this agriculturally vital region of Canada. If we want agriculture to continue in parts of Saskatchewan and southeastern Manitoba, then we have no choice but to work together toward the objective of effective basin-scale land and water management.

Continuing to manage water in the same jurisdictionally fragmented way as we do today will eventually bankrupt us. There should be no blame attached to arriving at this realization, though. In the Anthropocene, human populations will be concentrated on the as yet undefined and only partially claimed frontier where water, food and energy meet. If anything, the movement toward meaningful integration of land and water management at the basin level should be viewed as the next step in the maturation of the West, a step that would bring the prairie provinces and states closer together and solidify the globally critical agricultural future of the region. Such a step would also heal the growing rift between rural and urban while at the same time allowing the centre of the continent

to become resilient enough to hydro-climatic change to sustain its prosperity long into the future.

Hydro-climatic change, however, is not going to be a simple obstacle to overcome. We need to pay attention to the tolling of the bell. The Lake Winnipeg problem will get away on us unless we can accelerate progress toward better governance without engaging in the usual unproductive partisan politics presently associated with this issue. The Anthropocene offers both an opportunity and a reason to do so. The making of a new, more vibrant and resilient West is not going to be easy. As the Northwest Territories example demonstrates, vision is necessary, and inspired leadership will be required at all levels of government and in all economic sectors if success is to be achieved. Such a transformation will not be possible without the support of an informed and relentlessly courageous citizenship. To elicit that support so that we can get at the very complex kinds of challenge posed by Lake Winnipeg and associated hydro-climatic change, we need to reframe the problem.

At present, policy with respect to dealing with these issues in Canada is moving along at 5 kilometres an hour when the problem is moving at 15 kilometres an hour and accelerating. Catching up with the problem demands a new level of consciousness and non-linear problem solving. It requires creating a new steady state by being dynamic but at the same time self-regulating. In the context of Lake Winnipeg and Manitoba's growing flooding problems and drought vulnerability this means making radical improvements in agricultural practices and integrating supply management with water quality objectives and flood and drought protection through enhanced monitoring and prediction on a basin scale. But before we do that we need to agree on what kind of West we would like to create. Catching up with and staying ahead of the Keeling Curve demands that we decide what hydro-climatic steady state we want where we live and then set self-regulation on the road to achieving that state. What is needed most now is a sense of urgency. The bell is tolling. We know what to do. But we have to do it.

Welcome to the Anthropocene.

