

Towards Sustainability: Phase I

Ideas and Opportunities for Improving Water Allocation and Management in Alberta

November 2009



Where *ideas*
flow

ALBERTA WATER
RESEARCH INSTITUTE

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ABOUT THE ALBERTA WATER RESEARCH INSTITUTE

The Alberta Water Research Institute (AWRI) was established in the spring 2007 to coordinate world class and leading edge research to support Alberta's provincial water strategy, *Water for Life: A Strategy for Sustainability*.

Administered through the Alberta Ingenuity Fund, the AWRI funds specific research initiatives in support of the *Water for Life* goals and objectives of:

- » Safe, secure drinking water supply,
- » Healthy aquatic ecosystems, and
- » Reliable, quality water supplies for a sustainable economy.

Just as importantly, the Alberta Water Research Institute serves as a knowledge broker – providing analysis and context to water research for decision-makers, policy-makers, and water management practitioners and ensuring that the information is understandable, relevant and accessible.

Dedicated to seeking the best solutions and ideas, AWRI's scope is not limited by geographic boundaries. It seeks out both the best thinkers and the best information provincially, regionally, nationally and internationally to help secure the long term safety, quality and sustainability of Alberta's water resources.

The goal of AWRI is best articulated in its slogan as it strives to be a place "*Where Ideas Flow*" – at all levels and in all ways – in order to seize every possible opportunity to advance science, water management and public policy decision-making around the goals and objectives of Alberta's *Water for Life* strategy.

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ABOUT THIS REPORT

Issues surrounding water allocation legislation, policy and practice have been at the centre of Alberta's water debate for much of the past 15 years. The Alberta Water Research Institute (AWRI) identified that it could, by capitalizing on global, national and local expertise, contribute to the body of knowledge and to the range of possible solutions and future directions that Alberta could pursue.

To this end, AWRI was the key sponsor, along with the Alberta Water Council, in organizing a March 2009 symposium – WATER: How Alberta Can Do More With Less. Following the symposium, AWRI determined that it would conduct a more comprehensive review of the role and evolution of market mechanisms in western North America and Australia. These regions appear to have had similar approaches to water laws, governance and practice to that of Alberta. The goal of the review was to examine the underpinnings of water allocation and management in those regions, identify the range of successes and failures, and compare this experience to the Alberta situation.

For the western United States these reviews were accomplished through a review of legislation and pertinent literature, followed by a series of interviews with government officials, regulators and practitioners. For Australia, a number of interviews were carried out in face-to-face meetings with government and private sector water managers. Australia's experiences were seen as having been the most extreme, with the country having had to rapidly adapt to more than a decade's long and continuing drought in a manner that did not and does not allow for slow incremental adaptation.

This report is intended to draw from the information collected through this research and to portray, through the experiences of others, some of the opportunities that exist for Alberta as it moves to meet the goals and outcomes of *Water for Life: Alberta's Strategy for Sustainability*.

The report discusses ideas and opportunities. Future work will identify ranges of future scenarios against which these and other ideas can be tested. Through this process Alberta and Albertans will be able to determine the scope of changes that can be implemented to not only meet current needs better, but also to improve environmental performance and provide opportunities for continued economic development.

EXECUTIVE SUMMARY

Alberta's historic water legislation and its accompanying licensing system have provided the security needed to support much of Alberta's economic growth, especially in southern Alberta. However, with increasing recognition of the need to develop a more deliberate and integrated approach to water management to address a multitude of uses with a watershed context, the effectiveness of allocation legislation and policy must be revisited.

The Alberta Water Research Institute has recently examined water allocation practices and legislation in various jurisdictions around the world to identify lessons, ideas and opportunities that may be applicable to Alberta. These opportunities are presented below in terms of the three major objectives in Alberta's *Water for Life* strategy.

Water for People and Communities

With the population of many communities expected continue to grow rapidly for the foreseeable future, will there be sufficient quality water to support this growth? Current Alberta legislation sees municipal water use being like every other, with priority during dry conditions assigned to uses with the oldest licences, regardless of purpose. There is growing concern that this system of priorities may no longer be appropriate and that critical human needs may be the most important priority during times of drought.

What steps can Alberta take to ensure adequate water for people and communities?

- ◆ Develop criteria for defining critical human uses that should receive priority during extreme shortages
- ◆ Explore how current municipal licences could be shared as part of a regional approach to address drought
- ◆ Re-evaluate and “right size” municipal licences to reflect current and expected water use
- ◆ Make water use reporting mandatory and provide the public with access to the information
- ◆ Improve management of return flows to ensure that treated wastewater and stormwater are returned to streams and are available to downstream users.
- ◆ Ask – should municipal users be exempt from requiring a diversion licence as long as they return as much water after use as they diverted in the first place?

Water for Nature (Healthy Aquatic Ecosystems)

There are increasing concerns about the adequacy and priority of water allocations for nature, especially in those basins where much of the flow has been allocated for consumptive use. Fortunately, Alberta's obligations under the Master Agreement on Apportionment, which restrict us to using only half the flow east flowing rivers, mean that our rivers are healthier than in many other jurisdictions where nearly all of the flows have been allocated for consumptive purposes. However, there still concerns that the Water Conservation Objectives for southern rivers are not currently being met, resulting in deteriorating aquatic health, and that there are no WCOs for rivers elsewhere in the province.

What steps can Alberta take to ensure adequate water for nature?

- ◆ Establish interim WCOs for reaches of streams and tributaries in the South Saskatchewan River Basin and for watersheds that are not yet fully allocated
- ◆ Undertake pilot projects to determine the extent to which water management infrastructure, which is owned by a combination of government and private interests, could be managed in concert to meet multiple objectives without detracting from current licensed allocations
- ◆ Allow organizations other than government to secure and hold water for environmental purposes

Water for the Economy

The key economic drivers in Alberta – agriculture in the south and energy development in the north – are highly reliant on water, and future economic growth will require additional water that simply may not be available in some part of the province. While industry continues to identify and adopt technology and innovation that has resulted in reduced intensity of water use, total water requirements for the economy will continue to increase. In other jurisdictions, industry has been able to secure water by purchasing water rights from other users, resulting in water being reallocated to “high value” purposes, such as higher value horticultural crops rather than irrigation of forages. Most jurisdictions are investigating opportunities to streamline the functioning of their water markets to facilitate the reallocation of water to support economic growth.

What steps can Alberta take to ensure adequate water for the economy?

- ◆ Require better reporting of actual water use by agriculture and industry to support water management and provide clarity on the nature of water use entitlements that can be traded
- ◆ Use grant money to irrigation districts and other water users to promote increased water use efficiency, with the government retaining the rights to some of the saved water.
- ◆ Examine collective opportunities for securing sufficient water for oil sands development, rather than require individual operators to individually address their own water requirements
- ◆ Examine opportunities for treating produced water and municipal effluent so that these resources can be used for other purposes.
- ◆ Develop administrative procedures for water licences transfers that protect third party interests but do not represent significant barriers to the buying and selling of water licences.
- ◆ Assure water for economic development can only be achieved once the issues related to water for communities and water for nature have also been addressed.

In conclusion, it appears that, on “paper”, many of Alberta’s short to medium term (three to 10 years) water management objectives can be attained under the current provisions of Alberta’s first-in-time, first-in-right (FIT FIR) system. This assumes, however, that government, licensees, water users and other stakeholders commit to meeting the long terms needs of water for people and communities and improve the practice of assuring water for nature.

By strategically dealing with these foundational issues, creative solutions can be

found to meeting the changing needs of water in Alberta's economy.

Phase II of this work will explore a number of future oriented development scenarios against which to evaluate ideas, opportunities and solutions.

In 2010, AWRI will convene a number of workshops with key water stakeholders and develop a suite of logical scenarios along with their respective range of solutions.

1.0 CONTEXT FOR EVALUATING OPPORTUNITIES

In evaluating and assessing the experiences of the western United States and Australian jurisdictions and comparing them to the Alberta landscape, the Alberta Water Research Institute (AWRI) chose to focus on specific criteria to help identify opportunities for improving water allocation and management. These criteria were selected by AWRI to provide some structure for comparing the applicability of these opportunities to Alberta, as well as how they might be implemented.

Outcome Based

To best ensure that the opportunities identified and documented in this report were considered in an integrated and comprehensive manner, AWRI determined that these opportunities should be evaluated against well established and measurable outcomes. Experiences in other jurisdictions have suggested that, in some instances, changes in government policies made to address one specific issue worked against other desirable outcomes. AWRI has tried to avoid this outcome in how opportunities have been described by evaluating opportunities in terms of multiple outcomes.

It is clear that *Water for Life: Alberta's Strategy for Sustainability* has a high level of acceptance in many political jurisdictions in Canada and around the world. It is often referenced as one of the most comprehensive and advanced of such strategies. Much of that strength is due to the clear definition of the primary outcomes of the strategy:

- » Safe, secure drinking water supply
- » Healthy aquatic ecosystems
- » Reliable, quality water supplies for a sustainable economy

Where possible, AWRI has attempted to highlight the opportunities in this report in the context of the full range of objectives contemplated in *Water for Life*, and the strategy's recent renewal. Specifically, it is AWRI's assessment that most of the driving forces for change fit well into the scope of these outcomes. This report focuses on the ideas and opportunities to:

- » Ensure the availability of water to meet the needs of population growth (safe, secure drinking water supply)
- » Rapidly advance Alberta's ability to address healthy aquatic ecosystems, particularly in those areas of Alberta where water management and allocation activities are insufficient in meeting existing Water Conservation Objectives (WCOs) in the South Saskatchewan River Basin (SSRB), as well as to suggest means of establishing effective WCOs in streams and/or tributaries that are not yet highly allocated
- » Evaluate the opportunities associated with a wide range of existing and potential mechanisms, economic and policy instruments, as well as market forces to promote improved conservation, water use efficiency and productivity

Fiscally Responsible

Water is often a highly emotional issue that often comes with a high price tag. Water shortages are perceived to occur when water does not occur in the right place, at the right time, or in the amount that we would like to have. Historically, we have engineered ourselves out of the inconveniences of many of these issues by constructing projects to augment water supply, but this approach to water management and associated infrastructure is expensive to expand and commits governments to ongoing operational and management costs.

In Australia, the adverse impacts of the ongoing drought on society, commerce and the environment have meant that the state and national governments have had to commit enormous amounts of capital over a relatively short time (\$12.9 billion over ten years), with the recognition that still more money may be needed. Despite the vast networks of water management infrastructure already in place in the western United States, some states have expressed a renewed interest in building new or expanded reservoirs (California). In other places, treated municipal effluent (once considered as real “waste water”) now trades hands in the market place as the only new source of water to allow for development, and does so for a very high price (Prescott Valley, Arizona).

To the extent possible, AWRI has attempted to explore those opportunities that might be considered as “low hanging fruit”: actions that can be accomplished by strategic investments by government and industry within the confines of existing or slightly expanded budgets. This may be particularly pragmatic as Alberta, along with other jurisdictions, begins the process of financial recovery out of the current recession and global economic climate.

Legislative Framework

Alberta’s *Water Act* (Chapter W-3, RSA 2000) provides a wide range of mechanisms to proactively manage water to meet the full range of demands during periods of scarcity. The key mechanism for redistributing water involves the trading or sale of water licences, but Alberta’s water rights markets is still in its infancy. Other mechanisms which are also available within the structure of the *Water Act*, such as voluntary sharing agreements, have seen little use since the shortages that occurred in 2001.

Despite the commitment in the *Water Act* to retain the historical orderly allocation of water under laws adopted more than 100 years ago, generally referred to within the water community as first-in-time, first-in-right (FIT FIR), there is still much debate about whether this approach is still relevant and appropriate for addressing the full range of water management issues facing Alberta. AWRI has attempted to find solutions that are workable under existing legislation, but has also identified a number of other opportunities that could only be accomplished with commensurate changes to various Alberta statutes.

2.0 IDEAS AND OPPORTUNITIES: WATER FOR PEOPLE AND COMMUNITIES

Many Albertans still take water very much for granted. We expect good, clean, healthy, safe water whenever and wherever we turn on the tap. In most Alberta communities there has been little discussion about whether or not there will be enough water to meet the needs of our growing population and communities. That is beginning to change.

In recent years more and more Alberta communities have recognized that their growth is bumping into (limited by) the terms of their water diversion licence(s). Some communities, such as Okotoks, Alberta, have gone so far as to work with their citizens to determine the ultimate growth limits of their communities – and in the case of Okotoks they made a conscious decision to live within the yield of the Sheep River, their primary water supply.

Other communities have seen their groundwater aquifers dwindle. Still others have experienced increasing variability in both supply and quality. There are also communities that have existing licences, where the volume of those licences exceed their existing requirements and provide for significant opportunities for growth. At the same time, most Alberta communities have been striving to make their residents more water aware and to become more conservation minded.

Alberta's communities are continuing to grow. It is clear, even based on recent experience, that Alberta's move towards a more regional approach to water treatment and distribution services may have some clear advantages. There have already been a number of new projects built that deliver water from a centralized water treatment facility into a number of communities. In some instances, this water was specifically provisioned with a supply from outside the watershed the community is located within (under specific legislative approval).

Add to this a growing recognition that our climate and weather patterns are changing. Today and in the future we will be subject to more extremes. What in the past appeared as a reliable supply is now much more variable and even less certain than our experience might suggest.

Other parts of North America are much farther down this road than Alberta. It is not uncommon in the United States for cities to purchase new water requirements from agriculture and irrigation, or for intricate (and expensive) water infrastructure systems to be developed to bring new water into an area of growth, or to begin to build future water availability from treated municipal effluent.

In some locations in the western United States and Australia, where business and industry have been located in coastal communities, those businesses have begun the process of treating sea water or brackish groundwater (desalination) to meet their industrial water requirements. In some of these regions it has been recognized that relying primarily on a municipal water supply may be insufficient to justify the necessary business investment unless a guaranteed water supply can be obtained. That said, there is a growing body of work that suggests that conservation initiatives and enhanced water reuse may be as secure in meeting such needs and may be able to be accomplished at a lesser cost.

Australia, with its prolonged drought, has had to adapt to a complete rethinking of water for people and communities – something that also has implications for Alberta's future choices. Indeed, in Australia the new terminology for water for

people really translates into water to meet critical human needs. This is not water for commerce, business or industries that locate within communities and get their water from the same supplier that the population does; this really is water for critical human functions, water for drinking, cooking, and sanitation. In many Australian communities it is considered criminal (and in some it actually is criminal) to water one's lawn or garden with water that has been treated to drinking water standards.

Queensland Water Commission – Water Restrictions

Target 230, Low Level [an average of 230 litres per person per day]

Target 200, Medium Level [an average of 200 litres per person per day] [as of November 2009]

Example of Restriction:

For such premises, **water** from the reticulated (town) supply system **is not permitted to be used for the watering of established gardens at any time** on a Monday and on any other day **except where** the watering is performed:

- **Using a bucket or watering can** or another approved watering device between the hours of 4:00 pm and 8:00 am
- **Using only one hand held hose** or, in accordance with the Efficient Irrigation for Water Conservation Guideline, using one efficient sprinkler or efficient irrigation system at any one time
 - ◊ For ODD numbered premises, during the half hour between 4:00 pm and 4:30 pm on each Saturday and each Tuesday
 - ◊ For EVEN or un-numbered premises, during the half hour between 4:00 pm and 4:30 pm on each Sunday and each Wednesday

Target 170, High Level [an average of 170 litres per person per day]

Target 140, Extreme Level [an average of 140 litres per person per day]

Fines

Water patrol officers patrol our streets and will fine anyone caught breaching the current water restrictions.

First offence: \$200

Second offence (within 2 years of first offence): \$600

Third offence (within 2 years of first offence): \$1,400

Mandatory water restrictions in times of extreme drought and short supply are visual cues that often have a high level of public support. Many communities in Australia advertised the current water restriction condition on roads leading into the community. Water shortage has become top-of-mind. That said, there may very well be other mechanisms, such as scarcity pricing, that could be explored to reduce water use without having to create local water police.

Ideas and Opportunities for Alberta

» Water for Critical Human Needs

- ◇ It is clear that people and communities need access to secure supplies of water. Even in times of the most stringent drought there is a general recognition and public acceptance that providing **water for critical human needs may be the most important water use priority**.
- ◇ This is not borne out within the *Water Act* at the present time. That said, the *Water Act* does have provisions for the **sharing of licences between licensees**. Using this provision provides an opportunity for municipal governments to work together within a basin to mitigate the impacts of water shortages on their citizens and to do so by contract. This can be done today. Doing so has precedent in how water shortages were managed in parts of the South Saskatchewan River Basin in 2001.
- ◇ In addition, the *Water Act* contains emergency procedures that could be implemented, although at present, exercising those powers would attract economic costs.
- ◇ To ensure against inefficient use, it will be useful to **create criteria that could be used to define critical human use** and/or the expectations the public could have depending on the severity of any water restriction.

» Water for Other Municipal Purposes

- ◇ Municipalities also provide water for parks, recreation, business and industry. These uses are generally provided from the same license held by the municipality. There have been instances where, during times of drought, municipalities have restricted water availability for parks and recreation, but this has not often (or ever) happened to the provision of water to business and industry.
- ◇ **Some Alberta communities are near the limits of their existing licences**. Meeting even the critical human needs of growing populations may be problematic in some communities, let alone having sufficient water for the economic growth on which the same community relies.
- ◇ *Water for Life* recognized that there may some real advantages to looking at water for municipal purposes within a regional context. While this may have had more to do with water treatment approaches, that rationale is sound when applied to water that underpins economic activity. To this end, there may be a real **opportunity for municipal organizations to explore how water within current licences could be shared (assigned) to support regional economic growth**.
- ◇ There may, at the end of the day, be a need to **re-evaluate the sufficiency of licences held by municipalities and complete some measure of “right-sizing”** and to do so within the confines of the watershed’s water availability.

» The Role of Improved Information and Integrated Management

- ◇ Today most municipalities and other holders of water licences operate their facilities and meet their mandates in a mutually exclusive manner. There is much to be gained in a watershed by moving quickly to adopt a more integrated approach. **Allocations (licences) do not of themselves assure water availability, management does**.

- ◇ **Water use reporting that is publicly accessible and transparent should be mandatory.** There is a need to ensure that a monitoring and reporting framework collects data needed to support management decision-making as simply a compliance with approval conditions approach.

» **Something Else to Consider**

- ◇ In most instances **municipalities return water to the same stream from which it is diverted.** There has been some significant debate about the status of the water within a municipal license that is return flow (treated municipal effluent and storm water). It is clear that Alberta's river could not afford for municipalities to stop returning water to the stream. It is equally clear that water for people and communities is today accomplished in part through the province's licensing process, but that process may not provide sufficient assurance of being able to meet future growth needs (both for critical human uses and other municipal purposes).
- ◇ It may be possible for Alberta to enter into a dialogue leading to a novel and new approach to providing water for people and communities. **Perhaps meeting the water needs for municipalities does not require licensing in Alberta's traditional sense, so long as a municipality returns as much (or more) water as it diverts within a specified time period and that the quality of the water returned does not adversely impact other municipalities and water users downstream.**
- ◇ There may also be a need explore an Alberta-wide approach to water for people and communities, particularly in those areas of Alberta where residents do not live in large urban centres. It may be that **a truly consolidated regional approach to water management needs to be taken, combining and/or licences into a single body that manages, treats and distributes the water.** This approach is in place in many other parts of the world – in recent years it has become standard practice in Australia as a means of managing capital and economic sustainability, as well as in being able to provide quality assurances.

3.0 IDEAS AND OPPORTUNITIES: WATER FOR NATURE (HEALTHY AQUATIC ECOSYSTEMS)

Water for nature has arisen as a significant driver for much of Alberta's current public debate about water. Past water licensing practices did not directly allocate water for nature, with the result that such uses have been assigned very junior priority under Alberta's first-in-time, first-in-right (FIT FIR) licensing system. There are increasing concerns about the adequacy and priority of water allocations for nature, especially in those basins where much of the flow has been allocated for consumptive use.

In today's Alberta there is growing recognition that a healthy environment is a key mechanism by which we assure our quality of life, and indeed that a healthy environment is our virtual life support system. That said, Alberta will continue to see population growth and economic development, both of which will have increasing demands on water supplies.

By comparison to most jurisdictions in the western United States and Australia, Alberta is in a very fortunate position with respect to the amount of water that has been exempted from allocation for consumptive use. In 1969 Alberta was a signatory to the Master Agreement on Apportionment with the Governments of Saskatchewan, Manitoba and Canada. This agreement generally requires Alberta to pass half of the naturally occurring stream flow in east flowing rivers downstream to Saskatchewan. Saskatchewan in turn must pass half of the flow it receives from Alberta downstream to Manitoba. The agreement facilitated the creation of the Prairie Provinces Water Board which continues to oversee the performance of the agreement.

A functional outcome of this apportionment agreement in the South Saskatchewan River Basin (SSRB) is that, on an annual basis, at least half of the flow in Alberta's most challenged watershed is left in the river and represents an instream commitment. Since 1969 Alberta has always exceeded meeting its downstream commitments. In contrast, other jurisdictions in the western United States and Australia have allocated nearly all river flows for consumptive purposes and are now struggling to reacquire water for instream uses. For example, the Colorado River, which supplies water to much of the population and economy of the western United States relies, is so heavily allocated and used that sometimes no water ever reaches its outlet in the Sea of Cortez (in 1996 no flow reached the delta on any day of the entire year). Even though upstream states in Australia had similar provisions to pass water to downstream jurisdictions in the early 20th century that does not compensate for the fact that many streams in Australia are ephemeral in nature. Flows in the Murray-Darling River system, which drains one-seventh of Australia, do not exit from the delta more the 40 per cent of the time.

However, despite Alberta's obligation to leave at least half of its flow in its most challenged river system for downstream use, there are still reaches and seasons of the year where environmental degradation is occurring under normal flow conditions. And, with most of the largest and the most senior licences in Alberta drawing their water supplies from the streams of the South Saskatchewan River, there is very little water left in the river during very dry years. Concerns about how much flow should be left in these rivers have culminated in numerous studies, along with public and stakeholders consultations. These initiatives have sought to determine how much water is really required for nature and how such protection can best be achieved.

The *Water Act* contemplated that watersheds could ultimately be allocated to the extent that no further diversions would be allowed and all remaining water would be reserved for instream purposes. In such circumstances new water users would be expected to acquire already allocated water from other users, through licence transfers. The *Act* also provided a mechanism whereby parts of allocations being transferred could be retained by the Government for environmental purposes. Concerns about the adequacy of water for nature were addressed during both phases of the SSRB planning studies and consultations, which eventually resulted in the setting of Water Conservation Objectives (WCOs). The plan also recommended implementing conservation holdbacks (10 per cent of the amount transferred) on transfers to secure additional water to help meet WCOs. In 2007 the Government of Alberta effectively closed most of the SSRB to the issuance of new diversion licences.

It is apparent, however, that conservation holdbacks are not significant enough to meet the WCOs for the basin within an identifiable time frame. At the same time, applications for water licence transfers have been subject to intense regulatory and public scrutiny. This is one of the key reasons why transaction costs for such transfers remains high (common to all FIT FIR systems), resulting in questions as to whether the transfer system can effectively accommodate new demands for water and protect the environment. These concerns have prompted the Alberta Water Council and its WATSUP (Water Allocation Transfer System Upgrade Project) Project Team to develop an approach and rationale for improving the use of allocation transfers contemplated in the *Water Act*.

Alberta is not alone in attempting to retrofit laws, regulations and practices to meet environmental outcomes, and the province is facing many of the same challenges being faced in other jurisdictions. In the western United States some demands for increased allocations of water for the environment have come about as a result of civil litigation. Government agencies have been forced to purchase water rights to address environmental needs and the resulting reallocation of water has, in many instances, created as many problems as they solve.

In Australia, with the ongoing drought and recognition that even existing water allocations are likely to exceed available supply in the future, initiatives have been put in place to recover water to meet specific environmental outcomes. Some states in Australia have provided specific incentives to water users that could improve their abilities to trade water supplies while also providing a proportion of the allocation to meet environmental needs. Recently, Australia has implemented a federal and state funded buy-back program of water entitlements within an open market place, where recovered water is dedicated to meeting the needs of identified icon sites of high environmental value. This buy-back program is expensive and is only now beginning to achieve some marginal results.

In many locations in the western United States some of the most profound improvements made to recovering water for in-stream uses have been made through partnerships between land owners and non-government organizations. In Montana conservation organizations have worked with individual irrigators and ranchers to lease water for specific times of the year to reclaim and protect water in trout streams. The same is true in Oregon and other western states where water trusts or similar organizations have taken it upon themselves to find workable solutions to local watershed issues and have done so on a collaborative partnership basis.

Ideas and Opportunities for Alberta

» Establishing Interim Water Conservation Objectives (WCOs)

- ◇ In hindsight, the Master Agreement on Apportionment has prevented the heavily used SSRB from suffering the fate of other important rivers in the western United States and Australia. **However, there are ample opportunities to establish interim WCOs on reaches of streams and tributaries within the SSRB (where main stem WCOs already exist) thereby providing modest protection of aquatic ecosystems.**
- ◇ The same approach to **establish interim WCOs** could be taken **within watersheds that are not fully allocated**. In many of these instances WCOs can be established at little economic cost and without adversely affecting existing users within those streams.
- ◇ **This approach should be instituted soon as** experience shows it can be very expensive to try to recover water for the environment once it has been allocated for consumptive use.

» Integrating Water Management Operations Across Water Use Sectors

- ◇ While there is some level of coordination (or water mastering) that takes place today in watersheds, **there is no incentive or opportunity for the owners and operators of facilities which are being operated for distinct single purposes, to collaborate in managing flows to meet their individual objectives and also to benefit the watershed**. Most licensees, despite some high level collaboration, make all of their operational decisions on an individual basis.
- ◇ In most locations around the world, the majority of pressing water issues are resolved through improved operational decision-making, especially during times of drought. In the western United States, significant improvements in operational efficiency have occurred largely because state or federal government agencies own much of the water management infrastructure and have developed multi-objective operational plans. In Alberta, many licensees own infrastructure, so system-wide operational improvements can only be made by finding ways to bring them together to operate collaboratively to address watershed needs. **To do so, the Alberta Government could engage licensees in a number of pilot projects to determine what benefits could be achieved, in essence, by operating multiple facilities to meet specific in-stream objectives while not detracting from their current licensed operations.**
 - As an example, a cursory modelling exercise carried out by AWRI early in 2009 with the OASIS model resident at the University of Lethbridge, found that by artificially setting the priority for the WCO in the Bow River below Bassano Dam to an artificial high priority, that small changes to upstream diversions were able to meet the new low flow criteria of 45 per cent of natural flow in most instances without creating significant deficits to irrigation withdrawals or to water demands by the City of Calgary. This was not intended to suggest that WCOs operate outside of FIT FIR, rather that it may be possible, with the collaboration and agreement of licensees for them to carry out their operations in a collective manner, meet their own needs and also improve environmental performance and to do so much earlier than what might be accomplished through conservation holdbacks attached to future water license transfers.

» **A Role for Water Conservation Trusts et al**

- ◇ **Under the *Water Act*, only the Government is allowed to hold licences or allocations for instream flows**, although experience in various western United States jurisdictions have shown that other organizations can also play a role in securing and or managing water for the environment.
- ◇ **As Alberta's water allocation and watershed management practices evolve, it appears that the province could benefit from an approach that would allow new players to enter the arena to secure water for environmental purposes.**
- ◇ **Experience in the United States and Australia suggests that there are opportunities for non-government organizations to develop working relationships with water users and negotiate water from those users to meet specific needs.** Often these issues are driven within sub-watersheds where many individuals recognize the benefits of improved stream performance. If the negotiations produce mutually acceptable consideration, there should not be a regulatory barrier to their implementation.

» **The Role of Improved Information**

- ◇ **If Albertans are to have long-term confidence** that emerging and future environmental issues are being addressed within the context and framework of *Water for Life*, **increased efforts will be required to ensure they have access to data, information and knowledge.**
- ◇ In addition, **decision-making outcomes and processes will need to be transparent.**
- ◇ **Open source platforms have been developed that allow a much easier sharing of data and information than has been possible in the past.** While there are often debates about how data is collected, it is now possible to disclose information about such practices (the meta data) as part of the data availability itself.
- ◇ Many of the hurdles to making data available have been largely economic. **It is no longer necessary to create elaborate data warehouses. Instead, information portals can be created that capitalize on the efforts on diverse and multiple organizations as they manage data and information for their own needs.**
- ◇ **Alberta is not without some initial success in making important water data publically available:**
 - Alberta Environment has created a licence-viewer for the South Saskatchewan River Basin that allows the public web access to information on licences, and the specific conditions contained within them, http://edmoxpweb01:8093/licence_viewer.html,
 - Alberta Environment also makes information about water in Alberta's river basins available, albeit most of this information is currently housed in text files without archival access to the public via the internet,

- Another example of a more open approach to data, information and knowledge exists within the Alberta Water Portal, <http://www.albertawater.com>. Over the past year, with the support of the Alberta Water Research Institute over 1,000 data sources have been located, along with information about the data and where it exists. In addition, published research and other information is readily accessible. In Phase II of the project more user tools will be developed, tested and implemented, including the ability for the public, non-governmental organizations, commercial enterprises and other to contribute data to the portal.

4.0 IDEAS AND OPPORTUNITIES: WATER FOR THE ECONOMY

There are few economic activities that do not require water as an input. As such, water should have high value. Within the Alberta landscape, the development of irrigated agriculture was vital in settling southern Alberta. Water has served as the growth engine for primary agricultural production and associated food processing throughout the province. More recently, oil and gas exploration and production (including oil sands activities) have come to rely on significant quantities of secure water supplies. Manufacturing, commercial activities and even retail businesses all require water.

Despite the value that water has and the significant role that water plays in the economy of the province, Albertans are largely unaware of its importance and continue to take water for granted. Business and industry simply assume that municipalities will be able to provide them with water and have no concern about the actual source of that water. Certainly the Cross Iron Mills and associated developments were surprised to learn that neither the City of Calgary nor adjacent municipalities would simply provide them with the water they required. This left the M.D. of Rocky View to acquire water from the Western Irrigation District. While this marked the first major use of Alberta's fledgling water rights market, it highlighted the fact that water supplies for new economic growth are limited.

The largest consumptive user of water in Alberta is agriculture. The same is true in the western United States and in Australia. In all three jurisdictions the lands most suitable to the growing of diverse and valuable crops are the areas with the most sun and heat – semi-arid to arid climates, where water management for crop production is critical to success. In all three areas global climate change poses a significant challenge for continued agricultural development, with growing seasons becoming warmer than at present and with precipitation patterns changing: less snow, more winter rain and increased variability.

In Alberta the volumes of water required for conventional oil and gas exploration and production have been declining. However, this sector of the economy has been proactive in replacing the use of fresh surface water with brackish or saline groundwater. In the future other non-water based technologies may free up even more water from enhanced oil recovery operations.

Alberta's oil sands, however, continue to attract global attention. Much of that attention focuses on the use of water in the process of harvesting the bitumen. Water is required in steam assisted gravity drainage (SAGD), in the open pit mining operations, and in heavy oil upgrading. There are significant concerns about oil sands development impacts on watersheds. There remains significant concern about the volume of fluids currently stored in large tailings ponds and the amount of contaminants in the ponds. While these ponds contain water that is being re-circulated and reused on an ongoing basis, there are important environmental concerns about their eventual reclamation.

Other issues around water use in energy production are also important to the future of Alberta's economy. Hydroelectric power meets only five per cent of Alberta's electricity demands, and has historically been used as a cost effective way of meeting peak daily power demands. The rest of the demand is met through thermal production, using coal or natural gas fired boilers to heat water and run it through turbines to create electricity.

As Alberta's and the world's population grows there will be an increasing demand for energy and food. Clearly Alberta's oil sands have positioned Alberta and Canada as a significant player on the world energy stage. However, the challenge is to develop these resources in the most environmentally responsible manner possible. The same is true of food production. Recent reports indicate that Canada is one of five countries in the world with the water, land and developmental capacity to produce more food. It is estimated that world food requirements could double in the next 40 years – and all aspects of food production are water intensive. Alberta and Canada clearly have an important role to play in global food production.

With growing demands for water for energy, agriculture and other economic development and a limited supply of water, a key challenge is how to accommodate these new or changing uses with a reliable supply of water, especially given Alberta's FIT FIR system of water rights that gives priority to the more senior licences. In much of the western United States and Australia one of the solutions to water scarcity issues has been to make the use of markets to move water from where it is currently being used to where the demand is. In some cases this has moved water from agriculture to people and communities. In some instances these markets have moved water from consumptive uses to environmental uses.

The western United States has the longest history of water trading, with first trades occurring nearly 50 years ago. Market activity in these markets has been driven by drought, urban growth on the eastern slopes of the Rocky Mountains and along the California coast, and, most recently, the need to acquire water for the environment. While these states have water rights laws that are also based on FIT FIR systems, closer examination indicates that most trading involves exchanges of water among water users supplied by state or federally-owned water projects, where individual users have equal priority.

While most of the original transfers involved permanent reallocation of water from irrigated agriculture to urban uses, there are growing numbers of short term leases of water as agricultural users choose to buy or sell water to address seasonal droughts. There are actually relatively few transfers of actual water rights in the western United States, due to the existence of poorly defined senior rights, the use of courts to adjudicate the nature of the entitlements, and the challenges in demonstrating that transfers would not adversely affect third parties or the environment. Various states are examining means of reducing these transaction costs to facilitate water rights transfers.

Some valuable lessons can also be learned from Australia where extensive time and effort has been invested in exploring the use of markets to play a role in the reallocation of extremely short water supplies. Water will move from one activity to another of higher value. This is particularly the case in irrigation in Australia, where water has moved from field crops to permanent horticulture crops or unique crop rotation programs that extend the benefits of irrigation across multiple seasons. It is noteworthy that the most experienced, sophisticated and knowledgeable players in water markets in Australia are the irrigators. That may be as a result of how personal water is to them in their livelihoods and commercial enterprises. Alberta is only at the early stages of using market mechanisms to reallocate available water supplies.

Ideas and Opportunities for Alberta

» Resolving Issues About Water for People and Water for Nature

- ◇ **If we are to be successful in managing water to promote economic development, the issues around water for people and communities and water for nature must also be resolved.** Resolution of these issues is, to a very large extent, a prerequisite to future decision-making about water for the economy.

» Lessons From Irrigated Agriculture

- ◇ By far the largest impact of the drought in Australia and parts of the western United States has been on water use by irrigated agriculture. As a result, **the agricultural sector of those economies has become highly adaptable (by necessity) and opportunistic.**
- ◇ With more demands on limited water supplies, there is an increasing need to generate better information on the volumes of water being diverted and used. As an underpinning to entering into the market place and providing opportunities for irrigators, **some Irrigation Districts in Australia opted to settle questions about on-farm water use through installation of Doppler meters with real-time remote telemetry.** This was not inexpensive, but was seen as critical in creating the confidence and transparency needed for any type of future regulatory approach relative to trading in available water supplies.
- ◇ Another key success of water trading within the irrigation community in Australia is that individual irrigators now have the capacity to use their expected annual allocation as they see most economically fit in their individual circumstances. This means that while the Irrigation District is the holder of the gross entitlement, an irrigator has a reasonable expectation of water in any given year (in Australia, dependent upon supply) and **the irrigator has the ability (as long as it is operationally feasible to do so) to use the water either to grow a crop or to trade the water to anyone else within or outside of the district for any purpose.** Most of these trades go to higher value agricultural production and almost all of such trades are temporary in nature. Recently some of the temporary trades have been going to meet environmental objectives.
- ◇ **Governments in Australia have used funding to encourage water savings and better use of water.** Irrigation Districts have been provided with grants for water management infrastructure improvements on a grant basis, on the conditions that the government retains a permanent share of the saved water. The same is true for on-farm improvements. Irrigators can receive funds to improve their on-farm water management capabilities by returning a portion of the water savings back to the government. **In Australia much of the conserved water is going to meet environment objectives.**
- ◇ **Alberta has a long-standing and successful program of cost-sharing the rehabilitation of water management infrastructure within Irrigation Districts.**
 - The programs in Alberta are cost-shared between the government and the Irrigation Districts. Initially the cost-sharing formula was 86 per cent funded by government and 14 per cent by the Irrigation District. In recent years this has changed to 75 per cent government and 25 per cent Irrigation District. While this has allowed Alberta to stay at the forefront

in operational water management efficiency in irrigation operations, additional funding could be added to encourage improved water management practices.

» **Water Solutions for the Oil Sands?**

- ◇ **The operation of existing and future oil sands depends on their having access to secure supplies of water while at the same time providing assurances and meeting public confidence around water management and environmental issues.**
- ◇ Potential mechanisms for managing water in the Athabasca River to meet the needs of the industry, while protecting the river must be identified and evaluated. Some of the options considered in the summer of 2009 at the first of an annual series of Executive Training programs jointly hosted by AWRI and GE Water & Process Technologies included:
 - What if it was the province (or a specifically created entity) that had the responsibility to manage diversions from the Athabasca (and groundwater regimes) to meet the needs of the oil sands producers instead of each operator having to apply for licences with new entrants competing against established producers for a limited water supply?
 - What if this new entity owned and operated (at a cost, with provisions for reclamation) all the water delivery infrastructure to the oil sands operators?
 - What if this new entity constructed the requisite off-stream storage (or aquifer recharge and storage if appropriate) to ensure that there were no diversion violations during periods of low flow in the Athabasca River?
 - In discussion of these ideas (opportunities) it was acknowledge that if the present oil sands producers do not fulfill existing water management requirements that, at the end of the day, the problems with water are owned by the government and citizens of Alberta and thereby perhaps they should own the solution.

» **Existing Water for New Purposes**

- ◇ In Alberta, the western United States and Australia there are many instances where industrial processes end up with produced water as a by-product. **It is not uncommon for these new supplies of produced water to be prevented from being re-used or put to any other use due to concerns about quality.** In many instances, particularly in oil and gas, the produced water is disposed on back into deep aquifers.
- ◇ Efforts are now underway in Australia (Queensland) as part of issues around the production of coal bed methane to **determine what level of treatment might be required to allow the produced water to be used for other purposes**, be they agricultural or commercial or even for the environment.
- ◇ The same is true for treated municipal effluent. **All forms of water reuse are being actively explored to determine the impact they may have on adding to future security of supply.** Recent studies in the United States have shown that water re-use schemes are less expensive and more sustainable than developing new water supplies.

» **Some Thoughts on Markets...**

- ◇ **Water markets are highly touted as being appropriate vehicles to help manage water during times of scarcity.** This appears to be the case within limits. At the same time that individual states in the western US are relying on permanent trades to accommodate changes in demand, and short term trades to address seasonal drought conditions, there is no apparent overall vision of how water should ultimately be used. Many states are proposing the development of drought management plans that could be used to override current water allocations in the case of an extreme drought.
- ◇ **For markets to be successful there is a need for a highly transparent system for accessing data and information and a functional and effective administration system that can quickly process applications.** In Australia many of the permanent trades that originally may have taken months to accomplish now routinely occur.
- ◇ **When water trades hands from one user and one use to another on a permanent basis there can be important third party impacts.** In instances where water is moved out of a community, the seller and buyer of the water may have done well economically, but the community could suffer from reduced economic activity and an increased share of infrastructure operating costs (Aurora, Colorado). There is a potential flip side to the third party impacts, it may be that water moves into an area where the net benefits from the movement provide more economic impact, more environmental benefits and a generally improved condition.
- ◇ While it is important to factor third party effects in evaluating applications for transfers, the process should not be so onerous as to represent a barrier to trade. **The long-term success of Alberta's trading provisions may ultimately depend on developing an easy-to-use process to evaluate third party impacts.**

5.0 IDEAS AND OPPORTUNITIES: INSTITUTIONAL AND OTHER ISSUES

Much of the recent experience in water issues revolves around conflicting uses or competitive demands for a finite and increasingly scarce supply. An alternative view is that water should be seen as an integrator of solutions. In observing experiences in the western United States and Australia there are other key findings that do not easily fit under one of the *Water for Life* objectives, yet they are important to document.

Data, Information, Knowledge and Research

It is clear from activities in Alberta, as well as in the western United States and Alberta that having ready access to data, information and knowledge is key to identifying and evaluating solutions to water issues. This is, in fact, one of the highest value activities that can take place. It is recognized as being a critical part of *Water for Life*. The government and water stakeholders need to advance the availability of data, information and knowledge as quickly as possible.

In Australia there have been major initiatives to define water availability, both surface water and groundwater. These initiatives, carried out by the CSIRO (Commonwealth Scientific and Industrial Research Organisation) and numerous other research and consulting organizations were undertaken on behalf of state and the national government to establish an overview of water availability and water use within the context of current and future climate projections. These reports, and the accompanying data collection and analysis are being viewed as invaluable. CSIRO was deemed to be a neutral platform to assemble and analyse the data and information, while at the same time bridging discussions with a wide range of government departments and stakeholders in the various contributing catchments of the Murray-Darling basin.

Similar synthesized information is also required in Alberta. The AWRI has currently embarked on an initiative to develop a water budget for the province. This work is looking at how much water is there (both surface water and ground water), where it is, when it is available, what it is used for, and what are the high level risks and vulnerabilities associated with land and water management. This is similar in nature to the work carried out in Australia. The report, with contributions from an international team of experts, is scheduled for completion in the latter half of 2010.

Applied research and the use of new and emerging technologies will also play key roles in meeting future water demands from variable and changing water supplies. As gaps in scientific knowledge arise, concerted and strategic efforts to bridge those gaps need to be implemented. Alberta is fortunate in that the government has shown strong commitments to science, research and innovation.

Which Comes First, The Solution or the Institution?

Resolving water issues is often (if not always) complex. There is a strong tendency in our culture and practice to look at significant or complex issues and problems first from a management or institutional (governance) perspective and then to work to find solutions that fit within the box we have created.

In the case of water this approach is not often successful for a number of important reasons. Resolving complex water issues requires collaboration. To be properly collaborative, everything needs to be on the table. Given agreed upon principles and access to credible science-based evidence, collaborative processes can be very

successful, powerful and sustainable. Participants in collaborative processes often know what they can do to change and meet other expectations much quicker than fixed processes might allow. The range of solutions and/or adaptability that might be required in water issues may not fit easily into our past approaches to management or our current institutional framework. As a result, the framework we initially think would work best at the outset could easily be completely unsuited to delivering the solutions that stakeholders might identify and commit to.

The solutions to pressing water issues will be different based on the participants in the collaboration, the watershed for which solutions are required and the range of water issues and land issues that are facing. Alberta has generally committed to place-based solutions, but delivering on the outcomes may require a much more adaptable and flexible approach than can be designed at the outset.

There are a number of examples in North America where transparent, collaborative processes have ended up with highly creative solutions that were then supported by an institutional framework designed to meet the specific solution objectives.

The Role of Storage, Or Is It About Management?

With climate change and its accompanying uncertainty there has arisen a renewed interest in storing more water when it is available. Higher variability in river flows, exacerbated by ongoing glacier recession, suggests that we need to be prepared to deal with changing flows through more intensive and deliberate management of available water. Increased storage in Alberta may have a role to play, but will not be without controversy.

Water storage facilities almost always parallel development. In order to ensure adequate supplies of water are available when they are needed we have learned to engineer variable flows behind dams and in reservoirs to meet our needs. In the western United States and in Australia there is much more on-river and off-stream storage capacity than exists in Alberta. That said, storage alone, is not complete protection against long term drought. As an example, recently completed studies in the Murray-Darling Basin of Australia indicate overall storage equal approximately to two years of natural available inflow. As of the middle of November 2009 the available storage throughout the entire basin was at 28 per cent of capacity heading into the spring and summer period.

In the western United States along the Colorado River, storage in the upper level of the basin for Lake Powell (62 per cent of capacity) and Lake Mead (42 per cent of capacity) are collectively sitting at 57 per cent of capacity. However, with the Colorado system being capable of storing 4.5 years worth of inflow, there is still sufficient water to meet two years of demand and downstream states like Arizona are continuing to store unused Colorado River underground in anticipation of potential future shortages.

While additional storage could improve the security of supply and offer more management flexibility, storage has its own environmental challenges and there may be more cost-effective measures for providing increased security of supply for individual users.

What has become clear is that understanding the entire hydrological network, including storage is critical to meeting water needs. Taking a new look at existing facilities may also provide new opportunities in meeting demand. This could be particularly true if the desire was to integrate facility operations across facility owners and operators.

Ideally any initiatives around storage should also include an understanding of the relationship between surface water and ground water. There may be opportunities in Alberta to explore creative storage solutions, such as aquifer storage and recharge. Doing so, however, will mean that Alberta will need to improve the overall understanding of how the hydrological system works and responds to changes in water availability and use, above and below the ground.

What About Groundwater?

There is much less robust information about Alberta's groundwater resources when compared to the state of knowledge of surface water. That said, Alberta does have a wealth of groundwater information and expertise, albeit widely diffused and not easy to access.

There is growing recognition that meeting future water demands for people and communities, the environment and the economy will mean that surface water and groundwater supplies have to be managed in a more integrated fashion. This will require enhanced monitoring and reporting, much as is contemplated for improved management of surface water supplies, as well as additional research on the interconnections between surface water and groundwater resources.

Made in Alberta Solutions

Water scarcity is a growing problem around the world. It is expected that scarcity issues and their accompanying impacts will continue to be significant drivers for change in Alberta. We are entering an era where Alberta really will need to do more perhaps with less, while at the same time working to achieve the goals and objectives set out in *Water for Life: Alberta's Strategy for Sustainability*.

There is no jurisdiction, particularly in the areas studied by AWRI, that has everything right; there is no system that we should copy. That said, there are experiences from around the globe that we can learn from and adapt to our landscape. This should provide Alberta with the potential to make significant step changes versus incremental change. It should also allow Alberta to avoid the more dire long-term consequences of water catastrophes related to extreme drought. It is the application of these various ideas that will produce our made-in-Alberta solution and will also place the province in a leadership role nationally and internationally.

6.0 THE PATH FORWARD; PHASE II

There is no shortage of potentially workable ideas and opportunities related to water allocation and management. Alberta's challenge will be to create a number of future-oriented development scenarios against which to evaluate ideas, opportunities and solutions. For example:

- » Current forecasts project that Alberta's population may come close to doubling in the next 40 years. What are the water allocation and management policies and practices that need to be put in place now to be able to meet the water needs of an Alberta population of say six million residents?
- » While it is uncomfortable to contemplate, should Alberta find its future climate to experience changes similar to that being experienced today in Australia, how would Alberta cope with having its traditional water supplies halved?
- » It may become vital to determine the level of contribution to future secure water supplies could be met by instituting and mandating much higher levels of water reuse or recycling. How extensive might those opportunities be?

A logical follow-up to this initial overview of ideas and opportunities, informed by practices and experience in other jurisdictions is to convene a few workshops with key water stakeholders and develop a number of logical scenarios and their relative solutions. This process will be of high value to those charged with writing policies to meet the needs of future generations.

Experimenting with Success

As Alberta and Albertans move to better integrate water and land management activities there is a highly valuable role for experimentation (or pilots) to test out the workability of various management and/or policy options. With today's technology it is possible to engage stakeholders in activities that could test a full suite of ideas and options in a virtual water world prior to developing changed legislation, policy and practices. The tools required to carry out these 'experiments' are the same kinds of tools that will be needed for enhanced management and improved transparency of decision making.

The Alberta Water Research Institute has identified the development and testing of these types of tools as a high priority as follows and has embarked on the following initiatives:

- » To be accomplished by 2011:
 - ◊ Practical ecosystem health parameters defined
 - ◊ Selection of two study basins (one open to additional allocations and one closed) in which to assess ecosystem health and model integrated watershed management opportunities
- » To be accomplished by 2015:
 - ◊ Road map and tools for integrated watershed (basin) management

The AWRI considers itself to be a neutral platform within which government, stakeholders and provincial, national and international expertise can be brought together to explore workable solutions.