

Toward a Unique Solution

Sustainable Management of Alberta's Water Resources

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**Alberta
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Energy and
Environment Solutions

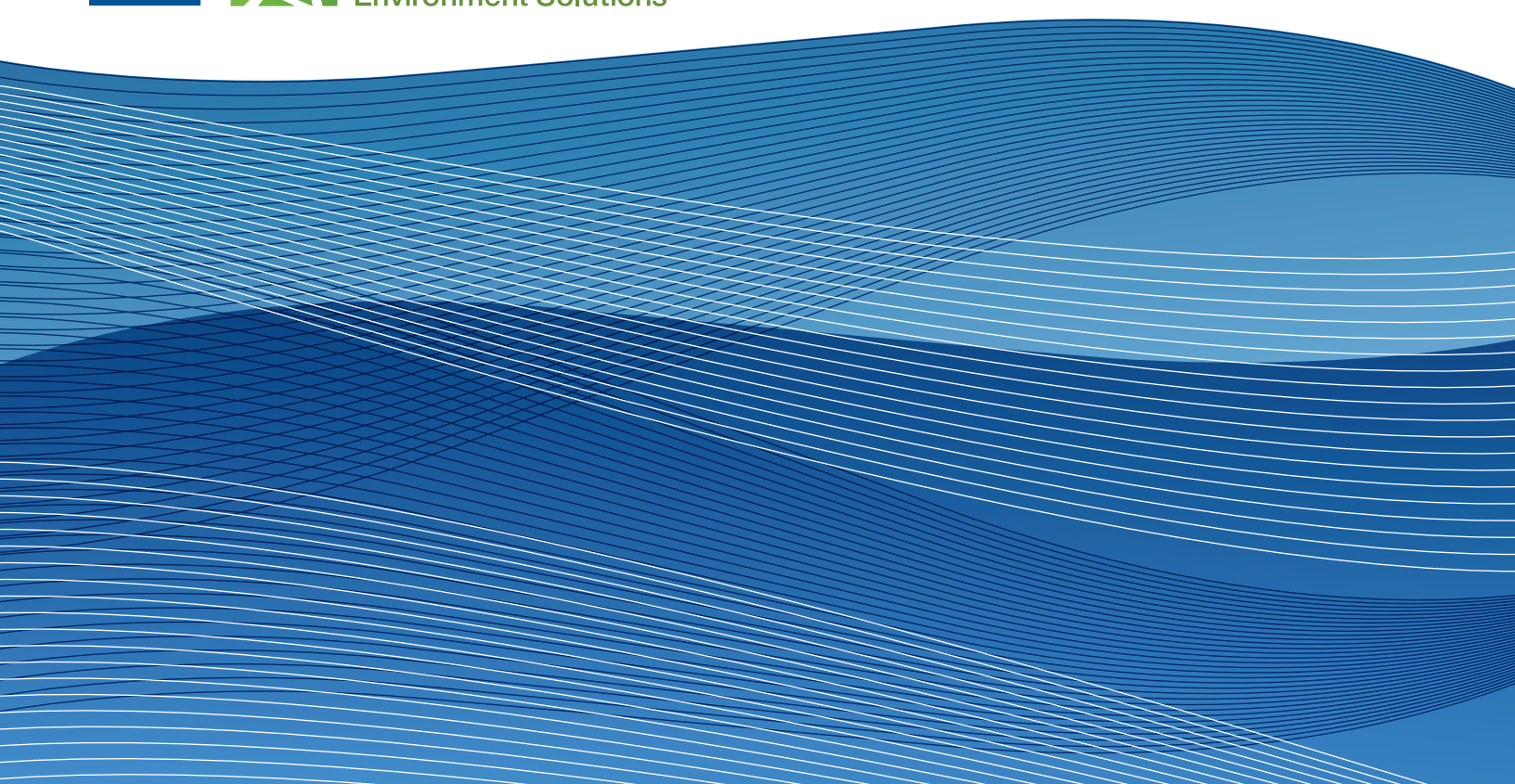


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EXECUTIVE SUMMARY

The mandate of the Alberta Water Research Institute (AWRI) is to explore how various national and international efforts concerning water resource management can be adapted and applied to ensure the sustainable management of Alberta's water resources. These resources are fully allocated in southern Alberta and demands are increasing in the rest of the province. The anticipated economic growth, demographic trajectories, and climate change impacts will amplify the pressure on the already scarce water resources of Alberta. Thus, it is imperative to critically analyze existing management instruments for their ability to cope with Alberta's future water challenges.

AWRI recently launched a major research project to explore financial or market-based instruments for sustainable water resource management. The goal of the larger AWRI project is to determine whether financial and market-based instruments, applied across the entire water sector, can complement, simplify, and perhaps improve the current system of allocating and regulating water use. A key objective is to identify which types of financial or market-based mechanisms may offer the best potential to optimally allocate water to communities, agriculture and industries, while meeting water conservation objectives and environmental management goals linked to ecosystem services.

This project explores the creation of an Alberta Water Exchange to advance the objectives of Alberta's *Water for Life Strategy* – ensuring a healthy, secure, and sustainable water supply for Alberta's communities, environment, and economy.

An exchange could offer both near-term and long-term sustainable environmental and economic benefits to Alberta. First, it would allow for enforceable environmental management goals as part of the exchange's regulatory framework. Second, it would standardize the governance and regulation of market activity. Third, it would reduce the transaction costs of selling or leasing water-use licences by serving as a central trading platform with standardized contracts. Fourth, the exchange would foster market transparency by publicly displaying the prices and quantity of water-related transactions. Fifth, as a clearing mechanism, the exchange would provide for enforceable contractual obligations, thereby eliminating the risk of counterparty default. Finally, the exchange would promote economic development, flexibility, and water conservation by increasing the ease of water-use license transactions. The exchange is thus based on, and compatible with, the principles of the existing Alberta *Water Act*. It honors the dynamic needs of sustainable water conservation, allocation, and management.

Full regulatory compliance and transparency would be guaranteed by a modern governance system with a board of directors, technical committees, independent government-approved regulation, a charter, and an exchange rulebook establishing the guidelines for setting up and running the exchange, its market operations, and conflict resolution.

AWRI's research project concludes with an outline of the next steps to be taken if Alberta was to proceed with the creation of a water exchange. This includes establishing, through a multi-stakeholder approach, a regulatory framework at the convergence of law and economics, that incorporates water conservation and

environmental objectives, while promoting societal and economic benefits. Such a framework, together with standardized contract terms and rules governing market activities, could form the basis for the launch of the Alberta Water Exchange, fully or as a pilot.

The project has been lead by the Canada West Foundation, on behalf of the Alberta Water Research Institute. An international panel (see Appendix) has provided critical guidance.

This summary document is based on the following background papers, all of which are accessible at www.waterinstitute.ca and www.cwf.ca.

- » [From H₂O: Turning Alberta's Water Headache into Opportunity](#), by Casey G. Vander Ploeg (Canada West Foundation);
- » [Alberta's Water Resource Allocation and Management System: A Review of the Current System and Evaluation of Sustainability within the Framework](#), by Victor L. Adamowicz, David Percy (both of the University of Alberta) and Marian Weber (Alberta Innovates and University of Alberta);
- » [Water Pricing: An Option for Improving Water Management in Alberta](#), by Theodore M. Horbulyk (University of Calgary); and
- » [The Potential Benefits of an Organized Exchange for the Sustainable Use of Water in Alberta](#), by Richard L. Sandor, Michael J. Walsh and Jeffrey K. O'Hara (Chicago Climate Exchange).

THE ALBERTA SITUATION

Alberta is in the rain shadow of the Rocky Mountains, resulting in limited precipitation. Thus, Alberta's natural waterscape has always been vulnerable, and three intersecting factors exacerbate the situation. First, the province is heavily reliant on surface water sources since it lacks easily accessible and high quality groundwater. Second, the absence of any sizeable lake bodies in close proximity to the provincial population means Alberta is singularly dependent on "flows" of water in rivers as opposed to "stocks" of water in lakes, which can act as buffers during low flow periods. And third, most of the water in the province's rivers flows north, away from the major population centers. This, combined with the relative dry climate in the south, the developing industrial activities in the heartland, and the growing population in the metropolitan areas means water is never far from the public policy table.

Water usage in Alberta is shared by seven sectors: environment, municipalities, agriculture, industry, commerce, hydropower and petroleum production. Each of these sectors has differential impacts on the seven major river basins. The impact of agriculture, especially irrigation, dominates the South Saskatchewan and Milk River basins, while industrial use dominates the North Saskatchewan River basin. Petroleum production uses water across the province, and dominates usage in the Athabasca River basin. The Peace, except for hydropower, and Hay River basins remain largely untouched and environmental factors predominate. All sectors are in play across the South Saskatchewan River basin (SSRB), which is the most heavily used river system in the province. In 2006, Alberta Environment closed the SSRB to any new surface water allocations. While the Red Deer River was partially exempted, the province has placed a cap on future water diversions from the river. In short, the SSRB has reached, if not surpassed its allocation limits. In many reaches of the SSRB, current management regimes do not meet environmental needs as defined by established Water Conservation Objectives (WCOs). Questions are now emerging on how to accommodate and allocate water among sectors in the SSRB in such a closed and constrained environment.

The province anticipates economic growth and an increasing population. Climate change will impact water availability, primarily through reducing snowpacks and depleting glacial supplies, augmenting potential chances for droughts. Agriculture needs to produce more food to satisfy an expanding customer base. Industrialization of Alberta is advancing. All these factors will increase the demand and will put pressure on the already scarce water resources in Alberta.

Such challenges are necessarily matters of public policy given that the ownership of water is vested in the Crown. The federal *Irrigation Act* declared that the Crown owned all the water within the jurisdiction. The present version of that principle in the Alberta *Water Act* and prior provincial legislation states that "the property in and the right to the diversion and use of all water within the province is vested in the Crown." It has also been clear since 1962 that Crown ownership of water includes groundwater. On the firm foundation of Crown ownership, water legislation controls the allocation of the resource by prohibiting anyone, with limited exemptions, from using or diverting water without first obtaining a licence from the government.

PECULIARITY OF WATER ALLOCATIONS

The development of an improved method for voluntary water trading and the related reallocation across all sectors is complicated by several elements. First, water in water courses is a fleeting or flowing resource which makes it nearly impossible to pin down specific quantities by time and location. The result is usually that rights to water are rights to *use* the water – called usufructuary rights – and not rights to the corpus or body of the water itself. Second, depending upon uses, water may have the characteristics of common property resources or public goods. In both of these circumstances, it is usually impossible to exclude users simply because they refuse to pay, and special institutional arrangements are generally needed to accommodate these features. Finally, it is important to note that the economic characteristics of water are not the only characteristics that are valued. The economic components of water (including water trading) interact with the social, environmental and ethical attributes of water, often resulting in charged debates about the relative importance of each of these components.

Water for basic human needs of drinking, cooking and hygiene can be considered a “social good”, and amounts to about 50 litres per person per day. The Alberta legislation recognizes this principle by permitting riparian owners and owners of land beneath which groundwater exists to abstract about 3.4 cubic meters per household per day without a licence (corresponding to one acre foot per year). There have been several attempts at the national and international level to declare water required for basic human needs to be a human right. However, since the preferences or tradeoffs between the social, environmental, economic, and ethical characteristics of water have not been clearly defined, these attempts failed. The rest of the water used in households, service institutions, and industry can be treated as an “economic good” and thus potentially be subject to higher rates. A few countries have introduced a split market. South Africa, as the pioneer, set a fixed affordable price for the first 6,000 litres per household per month (this translates to about 50 litres per person a day, assuming four persons per household). Each additional litre becomes progressively more expensive. The unresolved question here is the extent to which water for irrigation in food production contributes to basic humans needs and thus can be treated as a social good as well.

The emphasis on water resource management has historically been supply driven in most Organization for Economic Cooperation and Development (OECD) countries. The ability to supply high-quality water at any time to any water user was, and still is, the primary goal of rural and urban water policy. However, water supply infrastructure, including reservoirs, treatment and conveyance facilities, and pumping stations, is capital intensive and expensive, with high investment and capital costs potentially compromising water conservation measures.

Industrial water intake would come closest to a typical water market situation, where the province could act as the de facto supplier. The issues in industrial water use tend to be leaning more towards the quality of the effluent or the spatio-temporal return of water to rivers, as in the case of hydropower production. In such situations, special regulations beyond market mechanisms will be needed to avoid unacceptable negative impacts, such as blocking fish migration and supply volatility adversely affecting ecosystems and their functions.

Typically, water costs for irrigation (as opposed to the capital costs of irrigation systems) are low for agricultural producers in Alberta. To quantitatively control water withdrawals from rivers, the federal Crown and later the province of Alberta, adopted a licensing system to control water usage, assure minimal flow in rivers, and monitor groundwater levels, but have not imposed a price for water.

BASIC MECHANISMS FOR WATER ALLOCATION

There are four basic frameworks for water allocation. **RIPARIAN RIGHTS** permit riparian owners and owners of land with groundwater access to abstract a given amount of water per year without a licence. Since riparian rights are bound to a geographic location and are thought to cover exclusively the basic needs of the occupants of the land, they are not discussed further here. However, it needs to be remembered that lowering groundwater levels by diverse human and industrial activities may sooner or later jeopardize these rights locally. **LICENSING** is the most widely applied management and regulatory tool. Licences, typically given out by a government, allow a defined amount of diversion of water from lakes, rivers or aquifers. **WATER PRICING** is attaching a price to the use of water that can provide incentives for its wise use and re-use. Water pricing can influence the quantity and quality of water available, as well as influencing how the water will be used. There are two pricing mechanisms: either prices are fixed by an administrative procedure, or they can be determined by the market interaction of supply and demand. **WATER ALLOCATION TRADING INSTITUTIONS** include water banks, bulletin-boards, and water exchanges. These market institutions are central institutions more or less strictly regulated that facilitate trading and reduce search costs for market participants. The individual contribution of each framework to sustainability strongly depends on the regulatory provisions.

Licensing

Currently, Alberta uses a sophisticated allocation and management system of water licensing. It is based on the prior allocation principle or FITFIR (first in time, first in right) and has built in a relatively high degree of flexibility. Licences appear to confer more than “a mere personal right of use” on the licensee, and have some characteristics of property rights, since they are ordinarily attached to the land in respect of which they are issued. Licences are transferred to the new owners of the land if it is sold and ordinarily pass with the land by inheritance to the successors of the licensee. They are probably best classified in Alberta as regulatory permissions, but with a rather unique nature. Alberta’s *Water Act* also opens the door to water markets by permitting the voluntary transfer of all or parts of a licensed allocation after approval by the Cabinet of a basin management plan authorizing such transfers in a particular basin. This ensures strong political oversight before transfers are permitted in different regions of the province while at the same time refraining from compulsory reallocation of water from existing to new users.

Alberta’s *Water Act* creates a method for accommodating new users, and it provides an incentive for all water users to reduce wasteful use by allowing the marginal value of their licenced water to be recognized. The *Act* also encourages the many changes in water use that can occur without raising serious issues of

water policy. The *Act* places many safeguards on the transfer of water allocations, but with the result that high transaction costs are imposed on those who wish to use the transfer system. For the moment, transfers are restricted to the South Saskatchewan River Basin.

The Alberta *Water Act* provides a mechanism for integrating water licensing decisions with environmental objectives, although it does not guarantee that the environmental objectives will be fully addressed even when they are contained in an approved water management plan. However, the *Act* brings water allocation issues out of their traditional isolation and provides a defensible basis for any decision to impose protective conditions on environmental grounds.

Water Pricing

Water prices are either determined by a market in which supply and demand set the value, or by an administrative procedure. In a market that accommodates water from different sources, pricing may make expensive water affordable, for example in the case when expensive desalinated water is mixed into fresh water from natural sources. Though prices set by a government administration are thought of as steering mechanisms, reflecting the true scarcity value of water when markets do not operate efficiently, they are often viewed by the customers as (indirect) taxes, levies, rates, or user fees.

The efficiency opportunities from water pricing should be interpreted to include all ways that water adds benefit or contributes to society's general welfare, even if, in practice, these benefits (like the river as a habitat for fish, place for recreation, and provider of environmental and ecological services) are not currently monetized. Since water management is highly dependent upon the volumes of water allocated to competing consumptive and non-consumptive uses at various points in time, new pricing schemes that promote efficient resource use will necessarily be tied to the source and the volumes of water used over time.

It is important to separate the role and effects of administrative water rates in raising (or redistributing) public revenues from their effects in signaling how, when and where water is to be supplied or used. Water rates can achieve objectives other than water management, including revenue raising, cost recovery, income redistribution and resource valuation. Often conflicts can arise in designing a pricing scheme to meet more than one of these purposes at the same time.

The use of a new system of administrative water pricing for both surface water and groundwater offers a potential means of reaching the objective of moving water to its highest and best uses, including environmental and in-stream uses. There are a number of important prerequisites to realizing these outcomes, and these include careful attention to metering and monitoring, as well as the valuation of environmental and non-consumptive uses. Novel features of this approach include the pricing of storage uses as well as consumptive uses, and the option to adopt a refundable or revenue-neutral financing approach that returns fee revenues to the users.

Water Allocation Trading

Water allocation trading institutions have been successful at facilitating the transfer of water from users with lower-use values to users with higher-use values. They function only if water is recognized as a good with all its specific characters and only if equity, environmental and third-party concerns are adequately addressed. Though the terms water bank, bulletin board and exchange are often used interchangeably they are distinguished here as follows:

- » **WATER BANKS** are institutions that conduct transactions through buying or leasing water licences. Like financial banks, their interest is to make profit and they can acquire and possess stock licences to control markets.
- » **BULLETIN-BOARDS** are like exchanges, and unlike water banks, because the price at which transactions occurs is determined by the market participants. However, prices are fixed through non-competitive processes, commonly in the absence of standardized contracts.
- » **A WATER EXCHANGE** is a formal, organized marketplace, with a rules-based transparent platform that provides a centralized trading mechanism assisting market participants with competitive auction processes offering standardized contracts for trading, thus allowing risk transfer and price discovery. Trading activity is governed by regulations and is overseen by compliance officials to uphold equitable and competitive market conditions. An exchange, or an entity designated by the exchange, may “clear” the contract by serving as counterparty to both the buyer and seller. The contracts are distinguished by the timing and obligations associated with payment from buyer to seller and delivery of the good from seller to buyer. Market instruments of the water exchange are spot, forward or futures contracts, and call and put options.

All these centralized markets have network effects. Reducing costs to participants provides positive feedback by increasing market “liquidity”, which is the ease at which transactions can be executed. Greater returns, due to lower transaction costs, imply that additional resources are available to invest in the underlying business activities of buyers and sellers.

TOWARD AN ALBERTA WATER EXCHANGE

Alberta’s *Water Act* has paved much of the way towards the establishment of a water exchange. However, this option has not yet entered the political process or public policy debate as there are a number of seemingly formidable obstacles for more than incremental change. These include the emotional implications of losing access to water – or part of it – after a permanent transfer, complications and lack of transparency during the transfer, the costs and conditions associated with the transfer, and the manner in which environmental impacts will be characterized and accounted for.

Though administrative water pricing has undoubtedly many positive aspects, the introduction of a new “tax” – as it will be perceived by the public – is politically difficult to implement. Price setting is seen as a political process with all possible trade-offs inherent to such a procedure. The question of how agriculture could become part of a pricing system is not yet resolved.

Of all the possible water allocation trading institutions, the water exchange is the most promising. It builds on existing legislation, and is centralized, regulated, transparent, and cost effective. Prices are set through competitive mechanisms, with standardized contracts. It is accessible for pre-qualified participants and offers clearing services, but never trades from its own accounts. Water banks and bulletin-boards have different downsides, such as non-competitive price setting and a lack of clearing services. In addition, water banks can be active partners of the market as buyer or seller, thus actively influencing price settings.

The value of a water exchange is that contracts for both short-term leases and permanent transfers of water licences can be traded among all sectors, such as municipalities, industry, agriculture, commerce and the environment. Exchanges are aspirational – they attract and accommodate new user communities, inspire new solutions, and trigger new ideas. Though exchanges have a rigid framework because of the strict regulation, they have proven to show a high plasticity, be very flexible, and adapt readily to the changing needs of the society. Exchanges also have strong financial safeguards that have proven highly resilient in assuring the reliability of trading contractual commitments.

If exchanges are well-regulated, social goods and environmental needs and services are an integral part of the overall exchange framework, thus safeguarding the need of all Albertans to protect the environment while allowing a flexible and beneficial market to develop.

The prior allocation principle (FITFIR) does not need to be changed in order for the exchange to function, and the rights of households and traditional agricultural users remain intact. Agricultural water-use licences are an asset for their holders, allowing the agricultural sector to act at equal levels with the other sectors.

The governance system for an Alberta Water Exchange could comprise of the following elements:

- » an exchange charter, stating purpose and goals;
- » independent regulation for the functioning of the exchange;
- » a governance structure with a board of directors and technical committees; and
- » a rulebook codifying the governance structure, committee membership, methods for modifying rules, integration into Alberta/Canadian law and regulations, and the details of market access and operation such as contracts, enforcement provisions, trading and clearing mechanisms, and dissemination of market information.

In summary, an exchange is not a one-size-fits-all institution.

It interacts flexibly and iteratively with the different markets and their participants. An exchange can accommodate the peculiarity of individual markets and is by the same token a trigger for more appropriate solutions within and across sectors. As fitting the circumstances of a particular market, the services of an exchange can also be customized to reflect the financial and regulatory requirements of market participants, attributes of the public good, and the economic size of the market. An exchange simultaneously serves a highly dynamic market while addressing water conservation and environmental objectives. An exchange for short-term leases

and permanent transfers for water-use licences is an innovative and flexible, but fully predictable, institution that will be unique to North America, providing an opportunity for Alberta leadership.

SUMMARY: ESTABLISHING AN ALBERTA WATER EXCHANGE

Six distinct steps need to be taken to establish a pilot Alberta Water Exchange. These steps need to be initiated by the Government of Alberta, perhaps through a specific mandate to an agency or arms-length organization, such as the Alberta Water Research Institute. Each step can be individually launched after satisfactory completion of the previous steps.

The steps are:

- 1. IDENTIFICATION OF THE BASIN OR SUB-BASIN FOR WHICH AN EXCHANGE WOULD PROVIDE THE GREATEST SERVICE AND BENEFIT TO ALBERTANS.** Since licences are no longer being issued for surface water in most of the South Saskatchewan River Basin, this policy-imposed cap may provide an ideal starting point for implementing a regulated exchange. If appropriate, other river basins could be included.
- 2. ESTABLISHMENT OF AN EXCHANGE REGULATORY STRUCTURE IN THE FORM OF A CHARTER AND A GOVERNANCE SYSTEM.** This would contain a clear statement of the overarching principles of the exchange, the processes by which environmental needs and water conservation objectives will be met, rules governing participation, and governance structure. The charter will articulate how the goals of the exchange are consistent with social and ecological objectives, while establishing a platform that is cost-effective, transparent, and accessible to participants.
- 3. DEVELOPMENT OF STANDARDIZED CONTRACT TERMS AND RULES GOVERNING MARKET ACTIVITIES.** Critical details that must be specified in contract terms and exchange rules include the compliance, administrative, and operational bodies of the exchange, clearing systems, regulatory oversight procedures, and eligibility of the participants.
- 4. THE WORK DURING STEPS 2 AND 3 WILL LIKELY REVEAL THE NEED FOR LEGISLATIVE ACTION TO SET OUT THE LEGAL BASE FOR THE EXCHANGE.**
- 5. ESTABLISHMENT OF PARTICIPANTS' ELIGIBILITY.** Once the rules of the exchange are created, participants become "members" in order to be eligible to execute transactions. This entails demonstrating that they satisfy the eligibility criteria, as well as those set by exchange oversight and enforcement systems.
- 6. THE LAUNCH OF THE EXCHANGE WOULD COMMENCE ONCE A CRITICAL NUMBER OF PARTICIPANTS HAVE ESTABLISHED ELIGIBILITY.** The exchange operating hours and frequency of market events would also be established based on the feedback and interest of market participants.

APPENDIX

International Panel for the Financial Market-Based Instruments for Sustainable Water Management Project initiated by the Alberta Water Research Institute (AWRI) and managed by the Canada West Foundation (CWF):

Panel Members:

- » **Dr. Victor L. Adamowicz** (Professor, Department of Rural Economy, Faculty of Agricultural, Life and Environmental Sciences; University of Alberta; Edmonton, Alberta, Canada.)
- » **Dr. Roger Gibbins** (Project Leader; President and CEO, Canada West Foundation, and former Professor of Political Science, University of Calgary; Calgary, Alberta, Canada.)
- » **Dr. Theodore M. Horbulyk** (Associate Professor of Economics, University of Calgary; Calgary, Alberta, Canada.)
- » **Dr. Jack Mintz** (Professor, Palmer Chair in Public Policy, School of Policy Studies, University of Calgary; Calgary, Alberta, Canada.)
- » **David R. Percy** (Q.C., Borden Ladner Gervais Professor of Energy Law and Policy, Faculty of Law, University of Alberta; Edmonton, Alberta, Canada.)
- » **Dr. Richard L. Sandor** (Chairman and Founder of the Chicago Climate Exchange; Chicago, Illinois, USA.)
- » **Robert Sanford** (Canadian Chair of the United Nations' International Decade for Action: "Water for Life." Director of the Western Watersheds Climate Research Collaborative, University of Lethbridge; Lethbridge, Alberta, Canada.)
- » **Dr. Henry Vaux Jr.** (Chair of the Rosenberg International Forum on Water Policy and Professor Emeritus of Resource Economics, University of California at Berkeley; Berkeley, California, USA.)
- » **Dr. Marian Weber** (Alberta Innovates Technology Futures and Adjunct Professor, Forest Economics, University of Alberta; Edmonton, Alberta, Canada.)
- » **Dr. Alexander J.B. Zehnder** (Project Chairman; Professor Emeritus and Scientific Director, Alberta Water Research Institute (AWRI); Edmonton, Alberta, Canada.)

Observer:

- » **David Blood** (Senior Partner, Generation Investment Management; London, UK.)