Changing Perspectives – Changing Paradigms:

Demand management strategies and innovative solutions for a sustainable Okanagan water future

By Oliver M. Brandes[1] and Lynn Kriwoken[2]

Abstract

Water is vital to British Columbia's long-term prosperity – it is the foundation of our economy and growing communities, and is essential for a healthy environment. Despite its critical importance, water is undervalued and often wasted. People perceive it to be an abundant and virtually limitless resource. This myth of abundance is entrenched even in water-stressed areas such as the Okanagan, where drinking water supplies are at risk, conflicts among water users are common, economic opportunities are threatened, and aquatic ecosystem health and fisheries are declining. Population growth, coupled with the uncertain, yet increasingly evident impacts of climate change, will only increase these challenges in the future.

Water conservation and demand management are critical components in a lasting long-term and sustainable approach. Demand management offers a genuine win-win solution, as communities can reap both environmental and economic dividends from reducing water use.

To demonstrate that conservation is the next best source of 'new' water in regions where supply is limited, this paper outlines leading national and international demand management approaches. Included in this discussion are some of the critical factors for success, such as setting meaningful targets and promoting early adopters and innovative solutions.

The success of demand management in the Okanagan requires both the involvement of water users and the use of strategic planning to provide the appropriate mix and timing of measures for the region. Addressing this complexity and overcoming the barriers that limit the adoption of demand management are critically important. Beyond this, the paper provides a blue print for dialogue and change by outlining a soft path water management approach for the Okanagan basin.

This paper will demonstrate the need for people with diverse skills and expertise from across the region to animate the debate and create a shared Okanagan vision. Ensuring lasting solutions requires changes in beliefs, attitudes and opinions about water and draws on innovative tools and best practices from elsewhere to create a basin-wide, comprehensive and integrated 'made-in-the-Okanagan' approach.

[1] The POLIS Project on Ecological Governance at the University of Victoria
[2] BC Ministry of Water, Land and Air Protection and Water Sustainability Committee of BC Water and Waste Association

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"Only a broad and representative group of people with interests in a given river basin can determine what the optimum use of that river looks like."

(Postel and Richter 2003: 182)

1. Setting the Context – avoiding the arid future

"*Water will become Canada's foremost ecological crisis early in this century*"

(Schindler 2001)

Water is vital to British Columbia's long-term prosperity. Despite its critical importance, people perceive water as a virtually limitless resource. This myth of abundance is entrenched even in water-stressed areas such as the Okanagan, where drinking water supplies are at risk, conflicts among water users are common, economic opportunities are threatened, and aquatic ecosystem health and fisheries are declining.

Population growth in the Okanagan basin, coupled with the uncertain, yet increasingly obvious, impacts of climate change, will only increase these water supply challenges in the future. Widely held misconceptions or assumptions that the Okanagan basin possesses an abundance of available water have been replaced by pressing reasons to improve the region's water management for the future.

Water conservation and demand management are critical components of a long-term and sustainable approach. Demand management offers a genuine win-win solution, as communities reap both environmental and economic dividends from reducing water use.

Demand management includes a variety of measures, such as conservation-based pricing, water conserving plumbing fixtures, efficient drip irrigation for all outdoor watering (including stocks, crops, turf and gardens), and water reuse and recycling. Projecting how much water can be saved and made available to meet future water needs is simple enough and ample evidence exists, even within the Okanagan basin, to support the use of demand management measures.

However, achieving water savings through demand management does not just happen. It involves changes in perspectives and practices. It requires institutions to creatively manage and accelerate the adoption of more sustainable practices. To help realize this change, various

[3] The POLIS Project on Ecological Governance at the University of Victoria
[4] BC Ministry of Water Land and Air Protection and Water Sustainability Committee of BC Water and Waste Association

critical factors for success have been identified – including the need for a ***shared vision for the basin***, the importance of ***knowledge*** about current and future supply limits, ***adaptive institutions*** to create solutions and lead innovation, and the critical importance of relentless ***education*** to create a lasting water ethic.

Action on each of these critical factors is necessary to achieve water sustainability in the Okanagan. Only when demand management is implemented within a comprehensive, basin-wide, and integrated framework will the full suite of innovative solutions be possible — and the potential for a fundamental shift in attitude and perspectives occur. This is the potential of a 'soft path' approach to water management.

In this context, the challenge of dealing with growing population, changing climate, and water supply limitations becomes an opportunity to embrace innovation and realize a sustainable future for the region's water.

1.1 Water in the Okanagan – a changing reality

Much of the Okanagan is arid or semi-arid. The climate is changing; the population is growing;[5] the agriculture economy is expanding;[6] and water supply conditions are shifting. (Cohen, Neilsen et al. 2004)

In the Okanagan, a changing climate puts significant stress on water supplies. Cohen, Nielsen et al. (2004: 2) suggest that many water supply systems in the Okanagan may not be able to meet future projected demands based on their current supply capacity. Water has always been, and will continue to be, critical to the region's future. But with these significant changes, future perspectives and approaches to water management must evolve if the region is to remain prosperous.

Managing water demands is an effective way of dealing with the current reality and future uncertainty associated with climate change and population growth. A comprehensive and integrated planning process that promotes a suite of locally appropriate demand measures should be the central focus of, what Cohen et al. (2004) calls, an "adaptation portfolio." Such an adaptation portfolio should also include improved planning for droughts and severe floods, improved water quality protection, and better monitoring. These adaptation options are considered "no regret" options that provide benefits regardless of climate change impacts. (Dolan, Kreutzwiser et al. 2000; Cohen and Miller 2001; Schindler 2001; Environment Canada 2004; Natural Resources Canada 2004)

Collectively, such an adaptation strategy is the best way to reduce the vulnerability that may face the Okanagan, and to meet the wide range of environmental, social, and economic objectives

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[5] BC Statistics estimated in 2002 that the population for the three regional districts in the basin exceeded 315,000. The growth in the basin is expected to continue to increase rapidly. BC Stats projected in 2002 that, over the next ten years, the population of the North Okanagan will increase by 15 percent, Central Okanagan by 21 percent and Okanagan-Similkameen by 9.5 percent. As the population grows, the demands on the water supply will increase.

[6] Agriculture is a particularly important component of the regional economy, which is highly dependant on a reliable supply of irrigation water, and "climate change is expected to impact both the demand for and availability of water for irrigation purposes." A significant concern for irrigation is changing availability of in-stream flows. The UBC watershed model for Okanagan streams "shows that a characteristic response to climate change scenarios is earlier peak flows" (Cohen et al. 2004). This changing availability means that in-stream flow would not be available for much of the growing season, causing the supply system to be taxed by early dependence on stored water, as occurred in 2003.

within the region. In particular, water demand management and capacity for institutional flexibility are critical hedges against an uncertain water future.

1.2 Meeting water needs through demand management

Managing water demands to meet water needs is part of a broad continuum of water management paradigms (see Box 1). At one end of the spectrum are *supply-side approaches* that increase capacity through large infrastructure such as additional pumps and reservoirs. At the other end of the spectrum is a truly long-term and comprehensive approach to planning and water resource development and use – a "soft path" for water.[7] In the middle of the spectrum is *demand-side management* (DSM),[8] an approach that includes education, water-efficient technologies, regulatory regimes that promote efficiency and/or reuse and recycling, and conservation-based pricing.

Demand-side management refers to the planning and implementation of programs that influence the amount, composition, or timing of demand for a commodity or service. When the issue is scarcity, the demand management solution is to reduce use rather than automatically supply more of the service or resource being sought. In the context of population growth and urbanization, water demand management increases per-capita water-use efficiency; and, in the context of agricultural production, it entails "more crop per drop" to stabilize or reduce total water use.[9]

Conceptually, supply and demand management strategies are separated by their fundamentally different view of water as a resource. Supply-side management views freshwater as virtually limitless, with resources being developed according to human needs. Demand management, on the other hand, accepts the finite nature of water resources and focuses on improving efficiency—doing more of the same with less water.

Ultimately, by increasing water-use efficiency, demand management measures and programs mitigate the pressures of excessive water use on municipal and regional finances, infrastructure, and the aquatic ecosystems on which these systems rely.

At its core, a water demand management approach recognizes that developing new water sources may be too costly, and that influencing consumer demand is cost-effective. Brooks (2003a: 9) suggests that, "in almost every sector, cost-effective savings of 20 to 50 percent of water use are readily available." This is particularly true when environmental and full economic costs of water services are taken into account. For example, a recent study in California, which is already ahead of the Okanagan with respect to water conservation, demonstrates that total commercial, industrial, residential, and institutional water use could be cost-effectively cut by as much as 30 percent, using similar prices and existing off-the-shelf technologies. And this improvement can be achieved more quickly and cleanly than any new supply project under consideration (Gleick, Haasz et al. 2003).

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[7] "Soft path" for water is a term taken from the energy field. Amory Lovins first coined the term "soft energy paths" in a 1976 *Foreign Affairs* article, eventually developing an energy planning approach that took into account both carefully calculated requirements for energy services and energy economics. Environmental considerations were a core value in this analytical work.

[8] The following section includes an overview of various demand management measures, including technologies to improve water-use efficiency (e.g. toilets and drip irrigation) and the policy instruments used to motivate their use (e.g. building codes that require low-flow fixtures or grants for installing and using drip irrigation technologies).

[9] Brooks and Peters (1988: 3) specifically define water demand management as "any measure that reduces average or peak withdrawals from surface or groundwater sources without increasing the extent to which wastewater is degraded."

In the Okanagan basin, both supply and demand approaches are employed, with the balance between them varying with geography, public attitudes, financial resources, and economic and political choices. Municipalities and their utilities, such as Kelowna and Vernon, employ a variety of demand management techniques, most commonly education programs, metering, watering restrictions and rebate for fixtures and toilets. Yet, supply-side initiatives are often still the primary focus.

'Soft path' for water

As demand management programs become more comprehensive, long-term, and integrated, they begin to fall into a more holistic approach to water management—the "soft path". Similar to a demand management approach, the soft path strives for sustainability and equity in water management by using demand management measures and increasing water productivity, rather than seeking out additional supplies. The soft path also ensures that stakeholders are engaged in decision making and explicitly recognizes ecosystems as legitimate users of fresh water. (Wolff and Gleick 2002; Brooks 2003a)

The soft path for water specifically views water resources as finite and driven by ecological processes. Naturally, the soft path includes many aspects of demand management – in fact, demand management measures such as education, pricing, and conservation technology are important drivers to the whole soft path approach; however, it has a broader perspective. Fundamentally, the soft path challenges the way water is perceived – the focus is on *services* provided by water rather than water as the resource or commodity itself. (Gleick 2002; Brooks 2003)

Moving beyond simply doing the same with less water, the soft path seeks to change how water is used. The primary focus for the soft path approach is to ensure human needs for water are equitably met in the most ecologically sustainable way. This approach requires viewing water as a bundle of services rather than just a natural resource or commodity. Demand for water is not generally for water itself, except for drinking, food preparation, and personal hygiene – often accounting for less than one-third of total domestic water use. Water demand is mainly for services such as pleasing yards, food production, and sanitation. By focusing on the services, many more options can be conceived to satisfy demands, and these options will offer significant opportunities to reduce the pressure to increase water supplies.

A key feature of soft path planning is the recognition that many existing water needs can be met with far less water, and often with water of a *lower* quality than is currently used. High-efficiency toilets, for example, reduce the amount of water used for personal hygiene; however, there is significant potential to further increase water productivity by using reclaimed wastewater to flush toilets or by using dry sanitation systems that completely eliminate water use. The soft path for water is less a series of technical or economic choices than a series of socio-political choices (Brooks 2003a: 11).

To accomplish this fundamental change, however, requires comprehensive planning and clear objectives and targets (such as targets based on a clear understanding of water availability beyond *in situ* needs) and longer lead-times to allow the adoption of new processes and technologies.

Box 1: A continuum of water management

Characteristic	Supply-Side Approach	Demand management (DSM)	'Soft path' for water
Philosophy	Water resources are viewed as virtually limitless. The primary constraint is our capacity to access new sources or store larger volumes of water.	Water resources are viewed as finite and to be used efficiently. Conservation is key and economic cost-benefit analysis guides development strategies.	Water resources are viewed as finite and driven by ecological processes. The focus is on a fundamental re-evaluation of the way we develop, manage and use water.
Basic Approach	Reactive Currently, the status quo approach – developing resources according to human needs and wants.	Short-term and temporary Generally used as a secondary approach, complementing and deferring supply-side options or until future supplies are secured. However, when used in a comprehensive, integrated and long-term fashion, represents an incremental step towards a broader "soft-path" approach.	Proactive Long-term with potential for fundamental change in societal attitudes and resource use.
Fundamental Question	How can we meet the future projected needs for water given current trends in water use and population growth?	How can we reduce current and future needs for water to conserve the resource, save money and reduce environmental impacts?	How can we deliver the *services* currently provided by water in the most sustainable way?
Primary Tools and Examples	Large-scale, centralized, expensive engineering solutions. Examples include dams, reservoirs, treatment plants, pumping stations and distribution systems.	Innovative engineering and economic-based solutions focused on any measure that increases the efficiency and/or timing of water use. Examples include low-flow technologies, drip irrigation, conservation-based pricing, education, and policies and incentives to reduce use.	Encompasses the full suite of social sciences and generally relies on decentralized distribution coupled with management strategies aimed at ultra efficient ways of meeting end-use demand. The focus is on any measure that can deliver the services provided by the resource taking full costs (including environmental and social) into account and identifying new options to provide services associated with water use. Examples include drought resistant native landscaping, grey water reuse, ultra-low-flow technologies, and dry sanitation.
Planning Process	Planners model future growth, extrapolate from current consumption, plan for an increase in capacity to meet anticipated future needs, and then locate and develop a new source of supply to meet that need.	Planners model growth and account for a comprehensive water efficiency and conservation program to maximize use of existing infrastructure. Increasing capacity would be a final option as part of a least-cost approach.	Planners model future growth, describe a desired sustainable water future state (or scenario) and then "backcast" to find a feasible and desirable path between the future and the present using tools such as DSM and ecosystem restoration to address degraded aquatic systems.

Adapted from (Brandes, Ferguson et al. Forthcoming)

In a soft path approach, the focus moves beyond the technical and micro economic efficiencies of demand management, into the social realm of social, political, and cultural changes.

> "*The soft path will not be easy to follow. It will require institutional changes, new management tools and skills, and a greater reliance on actions by many individual water users rather than a few engineers. Yet when compared with the growing cost to society of continuing down the hard path, it is evident that a new way of thinking about our scarce water resources is long overdue." (Gleick 2002: 373)*

A soft path for water in the Okanagan would:

- focus on the underlying services that water provides and not necessarily the volume of water *per se*;
- view water conservation as the best "new supply" of water in the basin;
- match the quality of the water supply to the quality required by end users;
- maintain ecosystem health before allocating water for other social and economic human needs; and
- turn the current planning practices around and "backcast" from a desired future state.[10]

By achieving consensus on a desired future condition (a level of water extraction and use that ensures sufficient water remains available in the ecosystem to sustain ecological function), a basin-wide effort to promote the full suite of innovative solutions and conservation measures is possible – and a fundamental shift in attitude and perspectives may be realized.

1.3 Demand management measures

A wide variety of measures exist to reduce water use. Options range from simple technologies such as drip irrigation and low-flow fixtures and appliances, to alternative sources such as cisterns, rainbarrels, and reuse-recycling technologies. Other measures include education, regulation (watering restrictions and mandated best practices), economic incentives (full-cost accounting, conservation based-pricing, rebates for leading conservation technologies), and subsidies for less water-intensive crops.[11]

Box 2 provides a general list of water demand management measures that are applicable both to the municipal and agriculture sector, a more detailed table of options for improving agricultural on-farm irrigation efficiency and crop productivity can be found in the Appendix.[12]

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[10] To successfully "backcast" requires a vision of a desired future condition. This is a critical step; although it can be time-consuming and challenging, ensuring full stakeholder participation and ecological considerations are key to achieving an acceptable outcome.

[11] Good resources for a detailed discussion of the many options available for reducing water use include Vickers, A. 2002 "Handbook of Water Use and Conservation" Amherst, Waterplow Press; Gleick P, Haasz D, Henges-Jeck C, Srinivasan V, Wolff G, Cushing K, Mann A. 2003 "Waste Not, Want Not: The potential for Urban Water Conservation in California" Oakland, Pacific Institute (www.pacinst.org); American Water Works Association htttp://www.awwa.org; Water Wiser, National Water Efficiency Clearinghouse http://www.waterwiser.org; Canadian Water and Wastewater Association http://www.cwwa.ca; Canadian Council of the Ministers of the Environment (CCME) http://ccme.ca

[12] Improving agricultural water use is critical for the region due to relatively intensive use of water. Stephens et al. (2005), in the following paper, emphasize 3 steps: efficiency, uniformity and scheduling, as key for good irrigation practices.

Collectively, the measures of water conservation, efficiency, education, pricing, recycling and reuse represent significant opportunities to manage water demand and reduce water use. Sandra Postel (1997: 191) believes this "last oasis," is "large enough to get us through many of the shortages on the horizon buying time to develop a new relationship with water systems and to bring consumption and population growth down to sustainable levels."

Box 2: Water demand management measures

General Categories	Specific Examples
Socio-political strategies	• Information and education • Water policy • Water use permits • Landscaping ordinances • Water restrictions • Plumbing codes for new structures • Appliance standards • Regulations and by-laws • Turf limitation by-laws • Once-through cooling system bans
Economic strategies	• Rebates for more efficient technologies (e.g. toilets, showers, faucets, appliances, drip irrigation) • Tax credits for reduced use • Full-cost recovery policies • High-consumption fines and penalties • Pricing Structures o Seasonal rates o Increasing block rates o Marginal cost pricing o Daily peak-hour rates o Sewer and waste water charges
Structural-operational strategies	• Metering • Landscape efficiency • Soil moisture sensors • Watering timers • Micro and drip irrigation • Cisterns • Rain sensors • Efficient irrigation systems • Soaker hoses • Leak detection and repair • Water audits • Pressure reduction • System rehabilitation • Efficient technology o Dual flush toilets o Low-flow faucets o Efficient appliances (dishwashers/washing machines) • Recycling and Reuse – ranging from cooling and process water, to grey water for toilets or irrigation, to treating and reclaiming wastewater for reuse
	Source: Adapted from (Brandes and Ferguson 2003: 40)

2. Being Innovative – promoting and learning from the early DSM adopters

As we peer into the twenty-first century, water conservation is looking far more like an imperative than an option

(Vickers 2001: xv)

Many examples of successful water demand management programs and initiatives are readily available from Australia, Spain, California, Florida, Nevada, South Africa, and Israel.[13] Even here in the Okanagan basin, DSM measures range from cutting-edge leak detection, low-flow and reuse/recycling technologies, agricultural best management practices, drip irrigation systems, governance restructuring, conservation-based pricing systems, incentives and economic instruments, education and information programs, and creative stakeholder partnerships.

2.1 Learning from others

Water reuse-recycling and metering with conservation-based pricing incentives stand out as promising opportunities to reduce water use and promote water sustainability. These options are potentially key components for water management in regions of scarcity and limited supply, such as the Okanagan.

Conservation-based pricing and technological innovation for water reuse and recycling are synergistic. As prices reflect a "truer" cost of the resource, recycling and reuse options become more economically feasible, spurring innovation and technological advance. These advances, in turn, reduce costs, leading to further opportunities for cost-effective alternatives. Reuse and recycling and conservation-based pricing are also equally relevant across sectors – agricultural, industrial and municipal water.

Reuse and recycling

Water recycling may not always be the least-cost alternative, but it does offer the long-term economic benefit of future reliability, in addition to environmental benefits that other alternatives may not offer.

At present, water reuse and recycling in Canada is practised on a relatively small scale and varies regionally depending on the availability of water supplies and regulatory flexibility. (Schaefer, Exall et al. 2004) Typical examples include using treated municipal wastewater to irrigate agriculture non-food crops, urban parkland, landscaping, golf courses, some isolated facilities, and experimental housing. Reuse and recycling is a powerful component of demand management, especially in areas of steadily increasing water demands and conflicts among users. As an alternative source of water, reuse and recycling provides opportunities to save on future expansion of water supply infrastructure. Israel, for example, treats 70 percent of its wastewater, which is then used for agricultural irrigation. (Gleick 1998)

[13] For a detailed discussion of some leading examples, see Sustainable Use of Water California Success Stories (1999), Pacific Institute; Gleick et al. - Waste not Want not (2003), Pacific Institute; Vickers – Handbook of Water Use and Conservation (2001); Water Bucket Web page (www.waterbucket.ca), POLIS forthcoming report - Facing a Watershed: Ecosystem governance and sustainable water management for Canada (www.waterdsm.org); Global Water Partnership tool box (www.gwp.org).

Box 3: Closing the Loop

By using municipal water supplies twice – once for domestic use and again for irrigation – would-be pollutants become valuable fertilizers, rivers and lakes are protected from contamination, irrigated land boosts crop production, and reclaimed water becomes a reliable, local supply. Unfortunately, conventional sanitary engineers tend to emphasize the linear approach to managing water and sewage – use, collect, treat thoroughly, and then dispose of waste. While the benefits of closing the cycle – use, collect, treat partially, and then use again – go unrealized. … St Petersburg, Florida, for example, closed its cycle completely by reusing all of its wastewater and discharging none to surrounding lakes and streams. The city has two water distribution systems – one that delivers fresh water for drinking and most household uses, and another that distributes treated wastewater for irrigating parks, road medians, residential lawns, and for other functions that do not require drinking-quality water. For residents hooked up to the dual system, the reclaimed water costs only about 30 percent as much as the drinkable supply. Also, because of the nutrients it contains, using reclaimed water cuts down on the costs lawn fertilizers.

(Postel 1997: 128, 134)

Roughly three percent of wastewater is reused in BC, and reuse is already a component of BC's water conservation strategy.[14] (Schaefer, Exall et al. 2004: 200) Vernon has recognized for some time that reclamation is not only a treatment method, but also an alternative supply approach. Other leading international examples using recycled water for agriculture include the Cities of Visalia and Santa Rosa in California.

The agricultural examples in Santa Rosa and Visalia mostly use secondary-treated wastewater on fodder and fibre crops. However, growers are also irrigating fruits and vegetables with tertiary treated water, and producing high-quality crops and high yields. (Fidell and Wong 1999) The Laguna water treatment plant provides water to about 4,100 acres of fodder, sod, and pasture, 500 acres of urban landscaping, 700 acres of vineyard, 250 acres of row crops, and seven acres of organic vegetables.[15] (Fidell and Wong 1999: 144)

The key lesson from these two examples is that both projects pushed current boundaries of acceptable uses for reclaimed water and have met almost no resistance – there have been no public complaints or marketability problems.

As noted in Box 3, recycled and reused water also has potential beyond the agricultural sector. The West Basin Water Recycling project in Los Angles County and the South Bay Water Recycling Program in Santa Clara County are examples of leading urban recycling projects.[16] (Owens-Viani, Wong et al. 1999)

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[14] In 2001, BC produced the fact sheet "Guide to Irrigation System Design with Reclaimed Water (BCMAFF 2001) to provide a reference for the design of irrigation systems in British Columbia, using reclaimed water in accordance with the Municipal Sewage Regulation. In May 2001, the Province published a Code of Practice for the Use of Reclaimed Water (BCMELP 2001), which serves as a guide for using reclaimed water in BC, and is designed to support the regulatory requirements prescribed in the Municipal Sewage Regulation (Schaeffer et al. 2004).

[15] The row crops are primarily several varieties of squash, started with recycled water then switched to well water when the fruit sets. Walnut yields in Visalia have increased since switching from surface water to recycled water.

[16] Urban water reuse and recycling also exists in Canada, including specific examples of residential and commercial enterprises including the Waterloo Region Green Home, Sooke Harbour House, Mt Washington Ski Resort, and the Conservation Co-op Residential Water Reclamation Project (an 84-unit apartment in the city of Ottawa). An outstanding example of a closed-loop system (full reuse of all incoming water) is the Toronto Healthy House, which is not connected to the city water system but draws on rainfall and snowmelt for its fresh water supply. (Brandes and Ferguson 2003)

Conservation-based pricing

Experience shows that creative thinking about water rates and prices can have a significant impact on water use and efficiency. In 1991, Irvine Ranch Water District (IRWD) replaced its flat rate-per-unit charge with an innovative ascending block-rate structure. IRWD's rate structure represents an aggressive approach to promoting conservation, and has formed the foundation of a larger water conservation program linked with an existing water recycling program. The program has expanded to include landscape and other water conservation incentives and an education program for all types of customers. As a result of its programs, IRWD has seen a significant drop in per-capita water use (see Box 4). (Wong 1999)

Box 4: Conservation-based pricing

The Irvine Ranch Water District rate structure was created to address drought through increasing wholesale costs and introducing fair customer water costs. It contributed to a long-term water conservation ethic in the district by sending appropriate signals to curtail excessive use.

Five key elements helped ensure the success of this rate structure: 1) adequate customer information and analysis; 2) structure design; 3) equity and customer acceptance; 4) revenue stability; and, 5) coordination with other conservation programs. Increased communications between customers and the agency was embedded in the design. The rate structure itself builds customer awareness, sets targets, and provides incentive for customers to use water efficiently.

The rate structure relies on science and historical water use to determine base allocations. These objective data provide the agency with a defensible standard for all customers. Flexibility was another key component in this rate structure. The rate structure established variances and allowed for adjustment to individual allocations. This flexibility was further enhanced by customer-friendly rebates for those who took action to correct excessive use or those who received new allocations. To make the program more politically acceptable, penalty charges are not used to raise general revenue, but are fed back into conservation programs.

(Wong 1999)

Instituting such a comprehensive pricing structure requires detailed information and, in particular, universal metering is a necessary pre-condition for success. Metering alone, without an adjustment to the pricing structure, can reduce water use. And it is generally accepted that to effectively manage a resource, it must be measured. For fresh water, this means metering.

2.2 Early adopters in the Okanagan

Success stories from within the Okanagan basin abound.[17] These innovative local solutions are proof that change is possible – and already occurring. Box 5 provides a list of many of the more successful initiatives in the region.[18]

Cohen et al. (2004), in a recent detailed report on water and climate change in the Okanagan, discusses some of these successful examples as case studies highlighting their achievement:

> *"Kelowna achieved the pre-set 20 percent reduction target of their single family metering project. Allocated yearly water allotments in SEKID were reduced by 10 percent. Although water reclamation* [in Vernon] *was initially implemented as a water treatment*

[17] Stephens et al. (2005), in the following paper, discuss success stories such as the potential of the *Water Balance Model* and the Southeast Kelowna Irrigation District (SEKID) universal agricultural metering pilot project.
[18] For a detailed discussion of these success stories see the 2004 BC Water Conservation Survey at www.waterbucket.ca

strategy (and an effective one), it is now considered as a potential water re-use, and therefore, efficiency strategy." (Cohen : vi)

Box 5: Okanagan Basin Demand Management Initiatives

Black Mountain Irrigation District:

Watershed protection, collaboration with other utilities, public education

City of Kelowna:

Residential and ICI metering, watering restrictions, demand management planning, water audits, benchmarking, voluntary in-home, low-flow fixture programs, leak detection, sector demand study, Green design/SmartGrowth, water supply upgrades, computer upgrades, watershed protection, residential technologies, programs, pilot programs, pricing review, water conservation applied to operations and maintenance, collaboration with other utilities, public education, education for elected officials

District of Lake Country:

Advisory committee, watering restrictions, sector demand study, Green design/SmartGrowth, computer upgrades; public education, education for elected officials

District of Summerland:

Watering restrictions, metering pilot, water supply upgrades, public education, education for elected officials

Greater Vernon Water:

Residential and ICI metering, demand management planning, water reuse, water supply upgrades, computer upgrades, voluntary in-home low-flow fixture program, public education

Lakeview Irrigation District:

Watering restrictions, sector demand study, computer upgrades, watershed protection, water conservation applied to operations and maintenance, public education

Rutland Waterworks District:

Metering, pricing review, watering restrictions, water supply upgrades, computer upgrades, collaboration with other utilities, drought management planning, demand management planning, water conservation applied to operations and maintenance, public education, education for elected officials

South East Kelowna Irrigation District:

Agricultural metering, collaboration with other utilities, sector demand study, water supply upgrades, computer upgrades, watershed protection, pilot programs, pricing review, drought management planning, demand management planning, water conservation applied to operations and maintenance, public education

Westbank Irrigation District:

Watering restrictions, water supply upgrades, computer upgrades, pilot programs, xeriscaping, public education, drought management planning

Adapted from (deVries 2004)

2.3 Barriers and challenges

The previous two sections demonstrate that many demand management solutions are available to water providers and end users, yet broad implementation in the Okanagan Basin (as in most of Canada) has been limited. To promote wider adoption of conservation initiatives and programs, and a comprehensive and long-term approach to demand management, a variety of barriers and challenges must first be overcome.

Some of the most significant and challenging impediments in the Okanagan include:

Root causes

- a myth of water abundance – the notion that more water is always available undermines efforts to pursue greater conservation;
- resistance to changes in water pricing – viewed as another government tax;
- a belief that reducing water use compromises standards of living;
- fragmentation of responsibility – water crosses international borders and water management involves multiple levels of government. This raises the question of who should bear the cost of water efficiency; and
- public perceptions and political agendas – for example in the Okanagan agricultural users have a strong sense of historically-entrenched ownership over water, and they continue to expect low water rates.

Entrenching factors

- insufficient data – little is known about total supply and use. For example, insufficient information about groundwater and surface water linkages and difficulty in monitoring quantities of water allocated in water licenses and the amount used;
- limited ability of managers to modify water rights (e.g. water licence transferability and conditions);
- disconnect between land use and water management - rapid population growth in the valley is challenging decision makers to find means to effectively integrate water management considerations into land use planning;
- perception that achieved efficiency will simply allow for further development in the region, without a change in the development agenda;
- concern that DSM savings are unreliable and/or insubstantial;
- general preference for high visibility projects;
- publicly subsidized infrastructure expansion without enforced DSM conditions, promotes supply-side solutions; and
- lack of funding for DSM projects and insufficient resources to develop 'good' DSM programs.

The evolution of water management in the region and the influence of root causes and entrenching factors maintain the unsustainable, supply-side focus of the current water management regime in the area. These barriers create a gridlock that limits the widespread adoption of demand management.

Overcoming this gridlock is challenging, but possible. Through an understanding of individual barriers and their inter-relationships, and with the active participation of all stakeholders, the region can create policies and action plans to overcome the existing inertia and promote widespread adoption of a comprehensive, integrated and long-term approach to DSM in the basin. Accomplishing this also requires moving beyond isolated strategies and tackling a number of barriers simultaneously and strategically – embracing a soft path approach to water management.

3. Creating change – a ‘counter’ story for water sustainability

“The water crisis is essentially a crisis of governance”

UNDP World Water Report 2003

Finding the appropriate mix of water demand management tools best suited to the Okanagan is a relatively simple task. It involves planning, discussion, and some basic research, but it is a goal than can easily be accomplished. Many of the methods and technologies for water demand management have been around for centuries (Brooks 2003a:43). The more significant challenge is to change minds to lead fundamental change – the challenge is creating the “counter” story to the myth of abundance in the Okanagan, and thus changing the water management paradigm.

3.1 What’s needed – a change in perspective

To what extent is the region prepared to go beyond merely being more water efficient to fundamentally changing the way it views and manages water? A change in perspective about water is the starting point. A belief must emerge that limits exist, and individuals in the region must respect the full range of economic, social, and environmental benefits that water produces.

Doug McKenzie-Mohr, a leading environmental psychologist, recognizes that changing behaviour can be very challenging. Conventional education programs are focussed on information dissemination and sometimes lack a thorough understanding of the barriers limiting the desired behavioural change. Social marketing is an alternative.[19]. It differs from conventional approaches because more time and effort is invested ‘up-front’ to understand the barriers to desired behavioural changes prior to program design and implementation. (McKenzie-Mohr 2004) Although such an approach is most appropriate at a local action level – it is a place to start and can be a part of a basin wide transformation.

New beliefs, attitudes, and opinions about water are possible. A water ethic and understanding of all the benefits from water as a bundle of services liberates us to seek innovative solutions and alternatives. A shared vision for the region ensures that the many disparate organizations, interests, and individuals can work in concert to create more sustainable behaviors and practices.

Water conservation and living in harmony with our local watershed can become the norm, no longer a ‘regional success story’ but instead ‘the way we do things around here’ – not just because it feels good, but because our future and our prosperity depend on it. And it all starts with how we view and manage the most fundamental resource – water.

Box 6: Creating a water ethic

“Adopting such an ethic [water ethic] would represent a historical philosophical shift away from the strictly utilitarian, divide-and-conquer approach to water management and toward an integrated, holistic approach that views people and water as related parts of a greater whole. It would make us stop asking how we can further manipulate rivers, lakes, and streams to meet our insatiable demand, and instead to ask how we can best satisfy human needs while accommodating the ecological requirement of healthy water systems.” (Postel 1997: 185)

[19] The Region of Durham in Ontario has adopted this approach into its outdoor water efficiency program with notable success. The program commencing 1997, with the region employing summer students in a community-based social marketing program to work with homeowners to reduce residential lawn watering – resulting in a 32 percent reduction in peak water demand over a three-year period (Maas 2003: 16)

3.2 Who's involved – governance more than just government

Overcoming the inertia of the status quo in water management in the basin is difficult but necessary. Implementation of a basin-wide, comprehensive and integrated approach will require action by many different players, including all orders of government, the private sector, non-government organizations, and individuals.

'Good' governance and leadership by publicly accountable authorities are critical to ensure desirable outcomes. Governance certainly refers to more than just government; it includes broader institutions, such as business and 'civil society', and a full range of players who can creatively manage and accelerate the adoption of more sustainable water practices. However, government still has a critical role — especially as leaders signalling the importance of our water resources.

Governance must be adaptive and inclusive if it is to be successful at creating sustainable water solutions. Consensus among technical and scientific experts, resource managers and business leaders exists for the urgency of coordinated and collaborative action. This action must cross disciplines and organizations in order to deal with water sustainability challenges in the Okanagan basin. Effective action will involve enhanced communication, ongoing research, and the development and use of more integrated approaches. This will also require professional, private, and public-sector commitments that involve risk-taking, leadership, innovation, and follow-through to implementation.[20]

Fundamentally, good governance and the challenge of developing sustainability requires input, commitment, and engagement by all members of society.

3.3 Getting there – a 'made-in-the-Okanagan' approach

Many opportunities to create a sustainable water future for the Okanagan are available. Solutions exist – the challenge is making them happen. The following identifies some of the key factors that will enable water demand management and adoption of a basin-wide, comprehensive and integrated 'made-in-the Okanagan' approach:

- achieve a ***shared vision*** – a shared vision for water sustainability must be created by people from all sectors with diverse backgrounds, skills and expertise from across the basin;
- endorse ***basin-wide thinking*** – a clear understanding that everything in the basin is connected and that decisions and actions have impacts throughout the watershed;
- create ***knowledge*** – about current and future supply limits; anticipated demands through population and economic growth; financial impacts of water shortages on social and economic well-being; ecological limits, and the implications of exceeding these limits on habitat and species[21];
- choose ***appropriate options*** – allows for tailored options to address specific local needs, and starts by finding the appropriate suite of demand management measures to address water conservation for the region;

[20] Erik Karlsen personal communication December 22, 2004

[21] Knowledge is more than just data, but data is necessary for knowledge to evolve—currently, many data gaps exist. Important information on streamflow levels, groundwater resources, water use by various end users and the state of conservation is urgently needed.

- commit to ***standards and targets*** – clear expression of sector-specific performance standards and targets for conservation coupled with information about proven and practical ways of achieving these goals will promote success in achieving the targets;
- ensure ***technical and financial support*** – technical support is needed to assist in moving to water-efficient practices and the financial support is critical to help share the risk and overcome start-up deterrents of water-efficient capital and operating practices;
- promote ***early adopters*** – recognition of early and ongoing success embeds change and creates innovation;
- provide ***incentives*** – both the carrot and the stick can promote appropriate choices, such as changing crops to low water options or switching grass to cash;
- embed ***performance planning and adaptive management*** – clearly define performance targets and commitments to achieve these; then monitor and report on these commitments and successes from the basin to the site level; and finally, adapt to changing conditions and make adjustments in response to experience. This allows for continual learning and new solutions for future problems; and
- ***educate, educate, educate*** – raises awareness and empowers people to be part of the solution. Relentless education about the benefits and potential of conservation and demand management is where to start, but ultimately we must educate about the critical need for a region wide water ethic. Specifically we must educate the end users, we must educate our leaders and we must educate our children for they are the future.

A social dilemma cannot be resolved with a technical solution – in the Okanagan, long-term water sustainability in the face of growing populations and a changing climate is a social dilemma and must be resolved with social solutions.

Social solutions entail a focus on the broader social and cultural contexts that shape attitudes and behaviors. To allow this requires institutions to creatively manage and accelerate the adoption of more sustainable solutions. These solutions must start from a paradigm that focuses not on managing watersheds, but managing people in watersheds – a paradigm that doesn't assume endless supply, dreaming up the large-scale technologies to harness it, but instead manages demand and uses innovation to ensure conservation.

Perspectives are changing. The science is clear. Solutions exist. The urgency for the region increases daily. The time for action is now. Changing the world one watershed at a time is the goal – for Canada the Okanagan is the place to start.

4. Appendix

Options for improving agricultural on-farm irrigation efficiency and crop productivity

Category	Option
Institutional	• Conservation coordinator • Conservation plan and program • Policies for efficient on=farm water use and penalties for inefficient use
Educational	• On-farm water audits • Field and workshop training programs • Training materials, workbooks, and software • Newsletters and periodicals • Internet information networks and listservs
Financial	• Conservation-oriented pricing • Water marketing • Low-interest loans • Grants and rebates for purchase of more efficient irrigation equipment and tools
Managerial	• On-farm water measurement (metering) • Soil moisture monitoring • Irrigation scheduling • Evaportranspiration rates and other data from weather station networks • Tailwater reuse • Conservation tillage • Canal and conveyance system lining and management • Limited irrigation/dryland farming • Deficit irrigation
Technical	• Laser-graded land levelling to allow more uniform application of water • Furrow diking to promote soil infiltration and minimize runoff • Low energy precision application (LEPA) to reduce water losses from evaporation and wind drift • Surge irrigation to spread irrigation applications uniformly • Drip irrigation to reduce water losses from evaporation, increase crop yields, and reduce chemical and energy use
Agronomic	• Enhanced precipitation capture (rainwater harvesting) • Reduced evaporation through improved use of crop residues, conservation tillage, and plant spacing • Sequencing crops to optimize yields, given soil and water salinity conditions • Selection of native and drought-tolerant crops to match climate conditions and water quality • Breeding of water-efficient crop varieties
	(Vickers 2001: 342)

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