

Draft Options for a CEC role in the Sustainable Use and Conservation of Freshwater in North America

Commission for Environmental Cooperation (CEC)

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I. Introduction

A. Purpose

The Secretariat of the Commission for Environmental Cooperation (CEC) is seeking public input on whether to recommend to the CEC Council that the CEC undertake two proposed projects as part of its 2004 programs.

These two projects involve examining: (1) affordable techniques to restore aquatic ecosystems; and (2) examples of sustainable watershed management practices in North America.

Please send your comments on these projects to Tim Whitehouse at <twhitehouse@ccemtl.org>. The Secretariat will consider all comments received on these proposals and make changes that it believes appropriate. Final recommendations will be made to the Council in 2003. Included in those recommendations will be a summary of all comments received as a result of this notice.

B. Background

At the 2001 CEC Council session, the environmental ministers of Canada, Mexico and the United States agreed to undertake an initiative to analyze issues related to “local water pricing and watershed management, and promote accessible, affordable technologies for improving water management.”¹ In response to the Council’s initiative, the Secretariat initiated, as part of its 2002 Law and Policy Program, a plan to develop a concept paper outlining a long-term vision of the role of the CEC in the area of watershed management, including consideration of affordable water-related technologies and water pricing. As part of this paper, the Secretariat would develop recommendations for the Council to consider on possible CEC work in this area.²

In January 2002, the CEC began implementation of this plan by holding a Workshop of Freshwater Issues in North America with a small group of experts from Canada, Mexico and the United States. The workshop focused on major threats to ground water in North America and identified some of the major barriers to the integrated management of ground and surface water. The participants identified a wide variety of actions they felt were needed to move towards this type of integrated management. They also identified effective management approaches and tools currently in use in North America and

¹ CEC Council Communiqué, Guadalajara, Mexico, 29 June 2001, p. 2.
<http://www.cec.org/files/PDF/Council/01-00com_EN.pdf>.

² 2002-2004, North American Agenda for Action, 4.3.1, Sustainable Use and Conservation of Freshwater in North America, p. 119 <http://www.cec.org/files/pdf/LAWPOLICY/431_02-04-e.pdf>.

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elsewhere, as well as potential roles that the CEC could play in freshwater and ground water issues in North America.³

After the workshop, the Secretariat hired four experts to work with it on developing an options paper and recommendations for the Council to consider prior to the 2003 Council meeting.⁴ The Secretariat determined that each option considered should:

- i. be consistent with the June 2001 Council Communiqué and the 2002 Law and Policy Program Plan;
- ii. fit within the mandate of the CEC;
- iii. advance the issue of sustainable watershed management;
- iv. add value to and complement the work being done by other jurisdictions; and
- v. be of value to all the Parties

In consultations with the Secretariat, the experts developed a tentative list of seven potential options for CEC involvement, identifying advantages and disadvantages of proceeding with each option. The seven options were: (1) a watershed-based GIS overlay to existing data and information on freshwater in North America; (2) a report documenting the state of groundwater in North America; (3) A report on how the management of transboundary watersheds can be improved through existing transboundary institutions and information among local water managers; (4) a report and recommendations on affordable techniques for improving water management; (5) a report and recommendations on economic tools to achieve water efficiency; (6) a report and recommendations on environmentally beneficial water resource development in North America; and (7) a report on water quality policies and regulations in North America with a focus on aspects of contamination that permanently degrade water resources.

The Secretariat then began preliminary consultations with the governments, the International Joint Commission, the International Boundary Water Commission, the Joint Public Advisory Committee (JPAC)⁵ of the CEC and the public on which of these options would be most suitable for the Commission to pursue. On 3 October 2002, the Joint Public Advisory Committee held a public workshop on freshwater issues in North

³ See Meeting Report of the Expert Workshop on Freshwater in North America <http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=751>; Discussion Paper <http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=806>.

⁴ They are: Gregory Thomas, President, Natural Heritage Institute, Berkeley, CA, USA; Manuel Contijoch, Consultant, International Water Resource and Irrigation Issues, Mexico City, Mexico; Adele Hurley, Senior Fellow, University of Toronto, Toronto, Canada; Joanna Kidd, Lura Consulting, Toronto, Canada.

⁵ JPAC is composed of fifteen members, five from each of the three countries, who are appointed by their respective governments. It acts as a single, transnational body whose members act independently. Their responsibility is to provide advice to the Council on all matters within the scope of the North American Agreement on Environmental Cooperation.

America in which these seven options were discussed.⁶ On 4 October 2002, the Joint Public Advisory Committee provided Advice to Council (#02-10) on the role of the CEC in freshwater issues in North America.⁷

C. *Rationale for Preliminary Recommendations*

After carefully considering the comments it has received to date, the Secretariat is proposing two projects for public review:

1. An examination of how affordable techniques and technologies can be used to restore aquatic ecosystems and conserve water, as well as the barriers to the implementation of these techniques.
2. A review of examples of sustainable watershed practices in North America in order to highlight the management, structures, processes, policies and information systems required for sustainable watershed management.

A more detailed discussion of these two options is found on pages 15–18, below.

The freshwater issues that would be discussed as part of these options have natural links to other existing CEC programs, in particular, the biodiversity, sound management of chemicals, and children's health programs. As final project proposals are developed, these linkages will be fully explored and projects will be coordinated or integrated on an as needed basis.

In addition to these two projects, the Secretariat, as part of the CEC's 2003 work program, is compiling a list of databases of principal governmental and international agencies involved in geospatial mapping of ground and surface water in North America, and available information in these areas. The immediate goal of this project is to better inform ongoing and future CEC projects and to provide access to public information on a North American basis. Further scoping work will occur in order to see how this project can best support the North American Biodiversity Information Network⁸ and whether it would be feasible for the CEC to support a separate water information network.

D. *Changes made from Options Paper of 3 October 2002*

These project proposals are variations on some of the seven options unveiled at the 3 October 2002, Joint Public Advisory Committee public workshop on freshwater issues. The options paper that the Secretariat presented at that workshop may be found in Appendix A.

⁶ Summary Report of the Public Workshop on Freshwater Issues in North America, <http://www.cec.org/files/pdf/JPAC/sr-water_workshop-e.pdf>.

⁷ See <<http://www.cec.org/files/pdf/JPAC/02-10e1-fin.pdf>>.

⁸ See

<http://www.cec.org/programs_projects/conserv_biodiv/project/index.cfm?projectID=21&varlan=english>.

Changes were made based on suggestions that the CEC take as holistic a view as possible regarding North American water issues and in recognition of the CEC's important role and unique perspective in providing a North American forum for environmental information.

E. The Importance of Innovative and Creative Solutions

These proposals were developed in light of the Commission's recognition that long-term success in protecting and conserving the environment depends on the ability of governments to foster innovation and develop creative solutions to address shared environmental, economic and social objectives.⁹ Ensuring access to safe and adequate supplies of freshwater requires this type of innovated and creative problem solving.

II. Challenges to Sustainable Watershed Management in North America

In developing these proposals, the Secretariat considered some of the principal challenges to sustainable watershed management in North America. In many parts of North America, water allocation issues have developed extremely important political, economical, environmental and social dimensions that make long-term planning difficult and contentious. Management problems are compounded by the fact that the fastest growing areas of North America are also the most water-scarce. Even where water is abundant, it is often threatened by contamination from point and non-point sources, physical alterations of watercourses, and the presence of ever-growing numbers of invasive plant and animal species. In some areas, rivers have been pumped dry, aquifers are being mined relentlessly, and pollutants have destroyed drinking water sources.

The following is a brief description of the state of freshwater in North America and some of the challenges to sustainable watershed management.

A. Description of the State of Freshwater in North America

Canada holds 49 percent of North America's renewable freshwater; the US holds 43 percent and Mexico eight percent. On a per capita basis, Canada has about 10 times the water resources of the US, and about 20 times that of Mexico. Much of Canada's water is not easily available though—about 60 percent of it flows northward to the Arctic and Hudson's Bay—while 90 percent of the population lives in the southern part of the country, in a 300-kilometer band along the US border.

North America is home to the Great Lakes, the so-called "sweetwater seas" that hold 18 percent of the world's surface freshwater and also the Pacific northwest coast where the amount of rainfall is enough to sustain the growth of temperate rainforests. But there are also extensive parts of the continent—near-deserts and true deserts—which receive less than 400 mm of rain a year. Water scarcities occur in many parts of North America,

⁹ CEC Council Communiqué, Guadalajara, Mexico, 29 June 2001, p. 2.
<http://www.cec.org/files/PDF/Council/01-00com_EN.pdf>.

including some parts of Canada's prairie provinces, the United States Southwest, and much of northern Mexico.

Mexico is a country with high water stress. It also presents a huge contrast between the humid and arid areas. The humid areas have two-thirds of the total surface runoff but support only one-quarter of the population and generate only about one-seventh of the gross national product. By contrast, the arid northern part of the country receives only about one-third of the runoff but supports three-quarters of the population and generates about six-sevenths of the economic production. Therefore, the battle for water has characterized the development of the country and water is considered the most vital resource in the country.

By far, the greatest stock of freshwater in North America is groundwater. However, most water withdrawn for human use in North America is surface water. Groundwater represents only two percent of withdrawals in Canada, 23 percent in the US and 34 percent in Mexico. These figures are somewhat misleading, however, as to the importance of groundwater as a source. In 1995, North America was home to 388 million people. About half of these (198 million) relied on groundwater for domestic needs. This represented over a quarter of Canadian residents, half of those living in the US, and two-thirds of those living in Mexico.¹⁰ Where surface water is scarce, groundwater has become an increasingly important source to meet local needs. As a consequence, the pronounced and continuing decline in groundwater tables is becoming a large problem in many places in North America, particularly in the southwestern part of the United States and the northern and central regions of Mexico.

The demand for water in North America has increased steadily over the past 100 years of population growth, urbanization, industrialization and the expansion of irrigation in agriculture. On an annual basis, residents of Canada and the US use about three times more water per capita (1,611 m³ and 1,724 m³, respectively) than Europeans (625 m³) or the world average (645 m³)¹¹. Annual per capita use in Mexico is 872 m³. Conservation measures in the US led to declines in both per capita and total water consumption between 1980 and 1995.¹² A modest decline in per capita use has also been seen in Canada between 1991 and 1994.¹³

¹⁰ World Water Vision. 1999. Vision on water, life and the environment for the 21st century: Regional consultations, North America. Discussion draft prepared 2 December 1999. Available at <<http://www.worldwatercouncil.org/Vision/library.shtml>>. Figures based on various sources.

¹¹ North American and World data from, Commission for Environmental Cooperation, The North American Mosaic, 2001, p. 30, <http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=629>. European information taken from United Nations Environment Programme. 2002. Global Environmental Outlook 2000.

¹² North American and World data from, Commission for Environmental Cooperation, The North American Mosaic, 2001, p. 28, <http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=629>.

¹³ United Nations Environment Programme. 2002. *Global environment outlook 3*. Available for order online at <<http://www.unep.org/geo/index.htm>>.

In Canada, the major consumptive use of freshwater is for industrial uses. In the US and Mexico, by contrast, the greatest consumptive use is for agriculture.

B. Key Stresses on the Resource

1. Physical restructuring

To compensate for regional scarcities, North Americans have built vast networks of pipes, canals, channels, dams and reservoirs. Physical restructuring of North America's rivers has taken place on an enormous scale with the building of hundreds of thousands of structures, including reservoirs and dams, to hold water, control floods, and generate hydroelectric power. It has been estimated that less than half of the rivers in Canada and the US still flow in a course that is unaltered by humans.¹⁴ According to the Nationwide Rivers Inventory, only two percent of streams in the US have sufficient high quality features to be considered relatively natural and thus worthy of federal protection.¹⁵ Canada has more dams than any other country in the world, and these have been built primarily for the generation of hydroelectric power.¹⁶ This water management infrastructure has contributed to economic growth and prosperity, but it has not come without impacts on the environment.

The development of water management infrastructure along with changes in land use and cover—including deforestation, the widespread destruction of wetlands, and the removal of riparian cover—has had a profound effect on North America's water resources. These effects include changes in processes (water and energy balance, nutrient and sediment transport), structures (soil stability, drainage networks and channel shape), habitats (water quality and quantity, bed composition) and ultimately biota (species and age composition). These changes have been described as “an enormous uncontrolled experiment in the ways habitat changes influence the movement of water, nutrient, and sediments from land to freshwaters.”¹⁷

2. Discharge of pollutants

North America's ground and surface waters are greatly influenced by both point sources, such as industrial and municipal discharges, septic systems, leaking underground storage tanks and leachate from landfills, and non-point sources such as agricultural and urban run-off.

¹⁴ World Resources Institute. 2002. *North American environment: A thirty-year state of the environment and policy retrospective*.

¹⁵ Benke, A.C. 1990. A perspective on America's vanishing streams. *Journal of the North American Benthological Society* 9: 77-88.

¹⁶ Linton, J. 1997. *Beneath the Surface: The state of water in Canada*. Ottawa, Canadian Wildlife Federation.

¹⁷ Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America's freshwater ecosystems. *Ecological Applications* 10(4): 958-970.

Perhaps the best understanding of the magnitude of pollution from industrial sources in North America is found in the CEC's *Taking Stock 99* report, which is based on data from national pollution release inventories. (The report only presents data from Canada and the US; comparable Mexican data are not yet available.) *Taking Stock 1999* compares industrial releases for the years 1995 and 1999. The overall trend data for the amount of pollutants released or transferred from industries in the two countries is encouraging—an overall decrease of six percent. However, the releases of pollutants to surface water were 26 percent *higher* in 1999 than in 1995.¹⁸

In Canada and the US, most municipal wastewater is treated. However, even where municipal wastewater receives secondary treatment, its discharge can represent significant sources of nutrients, heavy metals and organic compounds to water bodies. In Mexico, only 22 percent of municipal water and five percent of industrial discharges are treated. From the existing information, only 27 percent of the superficial water is considered acceptable for all activities, while 24 percent is considered highly polluted. This leads to serious public health consequences from gastrointestinal disease when people are exposed to water contaminated with raw fecal matter.¹⁹ More than 10 percent of all irrigated areas are using wastewater from municipalities.

As regulations in Canada and the US have progressively ratcheted down on point source discharges, including industrial effluents, non-point sources have increased in relative importance. The major non-point sources of contaminants to water bodies are urban and agricultural run-off. For persistent organic pollutants, pesticides and some metals, deposition from air is also a significant source for large water bodies.

Many of North America's estuaries, rivers, streams, and lakes are polluted by industrial and municipal sources and urban and agricultural run-off. This is also increasingly true for the region's groundwater, once commonly perceived to be a source of "clean" water that had been filtered naturally through soil and rock. Contamination of groundwater by nitrates is widespread, and is related to agricultural application of fertilizers. Pesticides and bacteria are also contaminants of concern.²⁰ Once groundwater becomes contaminated, it is both difficult and expensive to remediate.

3. Overuse

Like any resource, freshwater can be overused. A number of massive North American rivers, including the Rio Grande and the Colorado are so overexploited that they almost literally run dry before they reach their mouths. This has a profound effect on once-

¹⁸ Commission for Environmental Cooperation, *Taking Stock Summary*, 1999, p. 47.
<http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=832>.

¹⁹ OECD. 1998. *Environmental performance reviews: Mexico*. Paris, Organization for Economic Cooperation and Development.

²⁰ See Kidd, J. *Groundwater: A North American resource*. A discussion paper for the Expert Workshop on Freshwater in North America. Commission for Environmental Cooperation, Montreal.
<http://www.cec.org/files/PDF/LAWPOLICY/water_disussion-e1.pdf>.

productive estuarial systems. As surface waters become over-allocated, users are increasingly turning to groundwater supplies to meet municipal, industrial and agricultural demands. Because of technological improvements and decline in infrastructure cost, several counties or municipalities in the US are moving to desalinization plants (in Florida the price difference per cubic meter is less than 30 cents).

Groundwater overuse is acute in many areas of North America. In Canada, this has included the Kitchener-Waterloo area. In the US, key areas of concern include the enormous High Plains (Ogallala) aquifer which spans portions of eight states, the Chicago–Milwaukee metropolitan region, the Sparta aquifer of Arkansas, California’s San Joaquin valley, Baton Rouge in Louisiana, the Phoenix area of Arizona, the Edwards Aquifer around San Antonio, Texas, the Albuquerque basin of New Mexico, and the Hueco Bolsa aquifer that is shared by the cities of El Paso and Juarez at the US-Mexico border. Many aquifers in Mexico are overexploited or at threat of over exploitation, including the Lerma-Chapala Basin and the Valley of Mexico, which together provide support for 65 percent of Mexico’s gross national product.

The environmental effects of overuse of groundwater include reduced baseflows in streams, loss of wetlands, saltwater intrusion into coastal aquifers, consolidation of aquifers and land subsidence.

4. Invasive alien species²¹

Over the last 500 years, North America has seen the introduction of tens of thousands of alien plant and animal species, some intentionally introduced, and some not. Some of these alien species can become “invasive” and have significant impacts on natural systems because they have few natural enemies, reproduce very quickly and take advantages of disturbed conditions. The ecological impacts of invasive alien species can include disruption of aquatic systems by predation or out-competing native species, exhausting primary resources, hybridizing with native species and causing epidemics of disease.²²

Since the 1830s, the Great Lakes system alone has seen the introduction of 83 non-native aquatic plants and 63 species of non-native aquatic animals, including the sea lamprey, alewife, smelt, carp, ruffe, round goby, quagga mussel and zebra mussel.²³ The zebra mussel, a Baltic species that hitched a ride in the ballast water of a ship, has become established throughout the Great Lakes and in many rivers and lakes in the basin and in other areas of North America. The tiny mollusc has had a dramatic effect on the natural

²¹ Invasive alien species are species introduced deliberately or unintentionally outside their natural habitats where they have the ability to establish themselves, invade, out-compete natives and take over the new environments. They are widespread in the world and are found in all categories of living organisms and all types of ecosystems. Secretariat of the Convention of Biological Diversity. September 2002

²² Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America’s freshwater ecosystems. *Ecological Applications* 10(4): 958-970.

²³ Environment Canada and US EPA. 2001. *State of the Great Lakes 2001*.

system, but its ultimate impact is still unknown. A voracious filter feeder, it has improved water clarity in many areas, which in turn has led to greater growth of aquatic plants. In Lake Erie, the zebra mussel is believed to be contributing to the decline in the prevalence of the native unionid mussel species.²⁴

The CEC's Biodiversity Program is stewarding a North American approach to prevent and mitigate the impacts of aquatic invasive species, by fostering cooperative actions in trade-related pathways of common concern.

C. Management of Freshwater Resources

1. Fragmentation

In many areas of North America, many observers have noted fragmentation of jurisdiction as a major stumbling block to improved management of North American freshwater resources. In the US, for example, at least 22 federal agencies and scores of state and local agencies have responsibilities for some aspects of the hydrologic cycle, often with dramatically different aims and perspectives.²⁵

In Mexico, there is one "sole authority" over water under the 1917 Constitution, the *Comisión Nacional del Agua*, which considers water as a common good and a national property. This authority is becoming more decentralized in recent years due to the devolution of management responsibilities to the local water users. This is generally regarded as a positive trend that leads to political democratization of the water resource.

In Canada, the provinces have considerable authority to manage their water resources and regulate the principal land-based activities, subject to the legislative authority of the Federal government. The federal government, for example, plays a strong role in both international and inter-provincial transboundary water issues, as well as issues involving water on federal land.

A comprehensive examination of the three countries' domestic frameworks for managing freshwater is found in the CEC's *North American Boundary and Transboundary Inland Water Management Report*. As the report notes, this fragmentation of responsibilities makes dealing with transboundary water issues involving two countries a great challenge. This is echoed by other observers with respect to the complex problems on the US-Mexico border.²⁶

²⁴ Maps regarding non-indigenous aquatic species can be found at http://nas.er.usgs.gov/mollusks/maps/current_2m_map.jpg.

²⁵ National Research Council. 1998. *New strategies for America's watersheds*. National Academy Press. Washington, DC.

²⁶ Nitze, W.A. 2002. Meeting the needs of the border region: A growing challenge for the United States and Mexico. *Policy Papers on the Americas*, Volume XII, Study 1, Center for Strategic and International Studies, Washington, DC.

The regulatory approach used in the three NAFTA countries varies widely, especially with respect to groundwater. In Mexico, as previously mentioned, water is a federal resource and it is managed in a centralized way by federal agencies. In the US, groundwater rights are defined by the individual states. Most of the northern states use a “prior appropriation/permit” system in which permits specify the rate of withdrawal, location of wells and purpose. Other northern states rely on a “reasonable” use doctrine that entitles landowners to make reasonable use of the groundwater pumped from underneath their property. A third approach is used in the state of Texas, where there is no statutory regulation of groundwater pumping at all, and owners of land have the “right to capture” water that flows under their land.²⁷ In Canada, groundwater is a public resource. Management of aquifers and allocation of water is a provincial responsibility, except where the aquifers cross provincial and international boundaries.²⁸

In the US, the law has traditionally divided water into separate legal classes depending on its place in the hydrologic cycle. The unnatural division of groundwater from surface water, and the application of different laws to the ownership and use of different “classes” of water makes “integrated water resource management difficult, if not impossible.”²⁹

2. Lack of ecosystem approach

Effective management of any resource should be ecosystem-based, but this has generally not been the case with freshwater. There is a basic and fundamental need to incorporate ecological principles into aquatic resource use and management decisions.³⁰ Too often, institutional (municipal, state or national) boundaries have been used to manage the resource, rather than ecological boundaries (watersheds). Although groundwater is an integral and vital part of the hydrologic cycle, it is often managed without adequate regard for its interactions with surface water systems. Land use decisions are too often made without sufficient regard for impacts on surface or groundwater, especially impacts on critical functions such as recharge. Although there has been, for many years, a widespread understanding of the need for effective and integrated watershed management, it is just starting to take place in a meaningful way in some parts of North America.

²⁷ Commission for Environmental Cooperation. 2001. *North American boundary and transboundary inland water management report*. CEC, Montreal.

²⁸ Commissioner of the Environment and Sustainable Development. 2001. Report of the Commissioner of the Environment and Sustainable Development. Available at <http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c2001menu_e.html>.

²⁹ United States-Mexico Foundation for Science. 1998. Water and health at the US-Mexico border: Science, technology and policy issues. Proceedings from a workshop at Tijuana, Baja California, 23-25 June 1997. Fundación México-Estados Unidos para la Ciencia.

³⁰ Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America’s freshwater ecosystems. *Ecological Applications* 10(4): 958-970.

3. Transboundary mechanisms

Managing transboundary watersheds is complicated by differences in water laws, policies, economic development and infrastructure capacities. Regional problems of water scarcity have been a concern for decades along the Mexico/US border, where issues have focused on water allocation, depletion of aquifers, shortages of surface water and effects on riparian systems. Along the border between Canada and the US, disputes over transboundary watersheds have tended to focus more on water quality issues because of the relative abundance of surface water. The roles of existing management structures along the borders (including the International Boundary and Water Commission, the Border Environment Cooperation Commission and the International Joint Commission) are examined in the CEC's *North American Boundary and Transboundary Inland Water Management Report*. This noted that most transboundary watersheds are not being managed in an integrated way (i.e., one that integrates both surface and groundwater). Along the US-Canadian border, however, an effort is underway by the Governors and Premiers of the Great Lakes ecosystem to develop and implement a new common resource-based conservation standard to new and increased water withdrawals from waters of the Great Lakes Basin.³¹

4. Pricing

Water management in North America has long been driven by the principle of supply management: governments and utilities have built ever-bigger dams, reservoirs, aqueducts, treatment plants and pumps to meet the water demands of users. With clean, adequate water becoming a scarce resource in many parts of the continent, water management has begun to shift from supply to demand management. Demand management provides the user with incentives (economic or otherwise) that make it worthwhile to conserve water and protect freshwater resources.

Extensive effort has gone into the development of water efficient technologies such as low-flow toilets, closed loop systems, and high-efficiency irrigation systems. Many argue that we have access to the technologies we need to become more sustainable in terms of our water use. In other words, we know how to become more water efficient. However, in many parts of North America, pricing schemes actively discourage water efficiency and conservation. These economic “disincentives” include lack of water meters in homes, flat rates for water users, and subsidized rates for large industrial or agricultural users. In Texas, for example, irrigators get a break on their income taxes—a “depletion allowance”—for pumping enough water so that the water table under their land drops.³²

In Canada, the need for appropriate water pricing has been recognized as a key issue in water sustainability since the Inquiry on Federal Water Policy in 1985. Despite the recognition in all three countries of the need for appropriate water pricing, it has not widely been embraced. There are many challenges to achieving appropriate water

³¹ <<http://www.cgig.org/1pdfs/Annex2001.pdf>>.

³² Postel, S. 199. When the world's wells run dry. *World Watch*. September/October 1999.

pricing, including the difficulty of defining “full cost,” the difficulty of valuing non-economic (i.e., ecological) impacts, addressing issues of equity and ability to pay, and adjusting for regional discrepancies in availability and use.³³

5. Knowledge gaps

Effective management of North America’s freshwater resources is hampered by large gaps in our knowledge of the resource. Indeed, the very nature of freshwater systems—their scale and the complexity of the hydrologic cycle—makes understanding them a challenge. It has been said that in the US “the nature and severity of water constraints remain ill-defined, largely because of national inadequacies in governmental coordination, data collection and management, and effective application of knowledge.”³⁴ This could equally be said of Canada. The inadequacy of information on water quality and quantity in Mexico has been called a major obstacle to effective water management.³⁵

Many organizations, including the National Research Council, the IJC, and Canada’s Commissioner of the Environment and Sustainable Development have singled out the lack of information on groundwater out as being a major gap.³⁶ Key areas in which information is lacking include current uses; hydrology, quality and availability in shared basins; recharge rates, processes and estimation techniques; and the interaction of ground and surface waters.

D. Indicators of Sustainability

In the Great Lakes, extensive effort has been put in developing a comprehensive suite of indicators to measure the health of the Great Lakes Basin system. These have been developed as part of the binational State of the Great Lakes (SOLEC) process. The first application of these indicators examined 33 of the 80 for which adequate information was available. The overall assessment showed that conditions in the Great Lakes are mixed, with a few ecosystem components such as contaminant levels in colonial shorebirds and amount of walleye harvested being assessed as good. Indicators of toxic chemical concentrations in offshore waters, phosphorus loadings and status of lake trout were mixed. The prevalence of deformities, eroded fins, lesions and tumors in fish from Lake Erie was rated as poor.³⁷

³³ Connor, R. 1999. *North America’s freshwater resources: Emerging trends and issues*. Background report prepared for the Emerging Issues and Trends Expert Group, Commission for Environmental Cooperation.

³⁴ Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America’s freshwater ecosystems. *Ecological Applications* 10(4): 958-970

³⁵ Connor, R. 1999. *North America’s freshwater resources: Emerging trends and issues*. Background report prepared for the Emerging Issues and Trends Expert Group, Commission for Environmental Cooperation

³⁶ See Kidd, J. *Groundwater: A North American resource*. A discussion paper for the Expert Workshop on Freshwater in North America. Commission for Environmental Cooperation.
<http://www.cec.org/files/PDF/LAWPOLICY/water_disucssion-e1.pdf>.

³⁷ Environment Canada and US EPA. 2001. State of the Great Lakes 2001.

To help evaluate the quality and quantity of water resources, the US EPA developed a watershed-based Index of Watershed Indicators program, which is used to assess the health of over 2,000 watersheds. Fifteen indicators were used, including the presence of fish and wildlife advisories, exceedences—of ambient water quality for toxic and conventional pollutants, wetland loss, pollutant loads, population change and hydrologic modification. The results for 1999 showed that only 15 percent of watersheds had relatively good water quality. About 36 percent had moderate problems, 22 percent had more serious problems, and a further 27 percent could not be assessed for lack of information.³⁸ Mexico's Water Quality Index considers only two percent of its surface waters to be of sufficient quality to support wildlife.³⁹

E. Emerging Issues

Particularly in the rapidly growing “sunbelt” areas of the US and along the US-Mexican border, population growth and attendant industrialization is expected to increase pressure on surface and groundwater resources. The population of the communities living in the already water-stressed US-Mexican border region, is growing at a faster rate than either the US or Mexico, and is expected to double over the next 20 years.⁴⁰ Projections from the US Department of Commerce indicate that the pattern of population growth between 1995 and 2025 will continue to be strongest in most of the western and southwestern states. It should be a matter of serious concern that all but one of the states predicted to have significantly high rates of population increase are already experiencing severe water-based environmental challenges.⁴¹

There are many uncertainties associated with climate change predictions. Most scientists believe that the timing and regional patterns of precipitation will change as global warming occurs, but exactly how those changes will manifest themselves in different regions of the continent is unclear. Scientists have a high confidence that rising sea levels will exacerbate the problem of saltwater intrusion into freshwater aquifers. The risks of this are expected to be greatest for shallow island aquifers (such as those in Hawaii and Nantucket) and heavily used coastal aquifers (such as those in Long Island, New York and central coastal California) There is also a high degree of confidence, however, that average precipitation will increase in the higher latitudes, as will annual average runoff.⁴²

³⁸ US Environmental Protection Agency. 1999. Index of Watershed Indicators. Available at <<http://www.epa.gov/iwi>>.

³⁹ National Water Program 2001.

⁴⁰ United States-Mexico Foundation for Science. 1998. *Water and health at the US-Mexico border: Science, technology and policy issues*. Proceedings from a workshop at Tijuana, Baja California, June 23-25, 1997. Fundación México-Estados Unidos para la Ciencia.

⁴¹ Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America's freshwater ecosystems. *Ecological Applications* 10(4): 958-970.

⁴² Gleick, P.H. 2000. *Water: The potential consequences of climate variability and change for the water resources of the United States*. The report of the Water Sector Assessment Team of the National Assessment of the Potential Consequences of Climate Variability and Change. September 2000.

In northern parts of the continent, where warmer temperatures are predicted to lead to more precipitation falling as rain than snow, scientists predict that there will be less snowmelt, it may come earlier in the year, and soil moisture levels will drop. As a result of this, groundwater recharge will decrease, groundwater levels will fall and many wells will become unusable. As groundwater levels fall, less groundwater will be discharged to streams and wetlands. Stream flows will decrease and water chemistry and temperatures of streams will change. This will affect biological communities and the ability of streams to assimilate wastes such as agricultural run-off.⁴³

A further emerging issue is the trend towards globalization and privatization of water systems. Much dialogue has already taken place on the issue, and much more will inevitably occur. A recent report on the issue concluded that “we do not think the trend toward globalization and privatization of fresh water can be stopped, nor do we think it has to be. In some places and in some circumstances, letting private water companies take responsibility for some aspects of water provision or management may help millions of poor people receive access to basic water services. However, there is little doubt that the headlong rush toward private markets has failed to address some of the most important issues and concerns about water. In particular, water has vital social, cultural and ecological roles to play that cannot be protected by purely market forces. In addition, certain management goals and social values require direct and strong government support and protection...Openness, transparency, and strong public regulatory oversight are fundamental requirements in any efforts to shift the public responsibility for providing clean water to private entities.”⁴⁴

F. Freshwater and North American Economic and Societal Health

Access to clean and adequate supplies of freshwater is a fundamental requirement for community and economic health and sustainable development. A recent paper on freshwater in North America noted that “societies are running up against hard limits in water supplies not only for human use but also for environmental needs. Water appears to be becoming the most limiting factor...for human and non-human populations.”⁴⁵ This is certainly becoming a factor in the arid west and southwest parts of the United States, where water resources are now a major constraint to growth and increased activities.⁴⁶ Shortages are so severe that the Texas-Mexico twin cities of McAllen in Texas and

⁴³ Agriculture and Agri-Food Canada. 2000. *The health of our water: Toward sustainable agriculture in Canada*. Agriculture and Agri-Canada Research Branch.

⁴⁴ Gleick, P.H., Gary Wolff, Elizabeth L. Chalecki and Rachel Reyes. 2002. *The new economy of water: The risks and benefits of globalization and privatization of fresh water*. The Pacific Institute for Studies in Development, Environment and Security.

⁴⁵ Naiman, R.J. and M.G. Turner. 2000. A future perspective on North America's freshwater ecosystems. *Ecological Applications* 10(4): 958-970.

⁴⁶ United Nations Environment Programme. 2002. *Global Environmental Outlook 3*. Available for order online at <<http://www.unep.org/geo/index.htm>>.

Reynosa in Tamaulipas have public voiced concern about attracting new maquiladora investment because of the insufficient water supply and infrastructure for industrial use.⁴⁷

Dropping groundwater levels have already had a significant economic impact on some areas, leading to increased pumping costs and reduced well yields. On the agriculturally intensive US High Plains, where aquifer levels have dropped significantly, farmers have begun to abandon irrigated agriculture. In 1978, about 5.2 million hectares were irrigated there: in less than a decade, this had dropped by nearly 20 percent to 4.2 million hectares.⁴⁸

Drought in the Canadian prairies in the summer of 2002, following two years of sub-normal rainfall, has had a devastating effect on water supplies and on local farmers. Unable to provide water, many farmers have been forced to sell off their herds of cattle, losing in the process decades of breeding effort.

In Mexico, the present drought has been partially responsible for reducing the irrigated area by 20 percent nationally and by 34 percent in the Rio Bravo basin. It has also aggravated the over-extraction of groundwater.

Water shortages inevitably lead to conflicts. The conflicts can involve different industrial sectors (such as the oil industry and farmers in western Canada), different user groups (such as recreational anglers and municipal water boards), and different jurisdictions (such as the city of El Paso in Texas and Ciudad Juárez in Mexico, which share and depend on the same dwindling aquifer). Resolving these issues will require ecologically based management of water resources, increased water efficiency, coordinated data collection and information sharing, and new ways of working together to solve common problems.

III. Details of Proposed Options

The Secretariat's proposals recognize the important, but modest, role the CEC can play in this area by providing policy makers and the public with information and policy analysis from a North American perspective.

A. Project One: Affordable Techniques to Restore Aquatic Ecosystems

Goal: Identify how affordable techniques and technologies can help repair aquatic environments and identify barriers to their implementation.

Project: Prepare a report and recommendations to the Council on how affordable techniques and technologies can help repair aquatic environments. The report will be

⁴⁷ Bishop, M.E. 2002. Press release on *Meeting the needs of the border region* by William A. Nitze. Center for Strategic and International Studies, Washington, DC. April 30.

⁴⁸ Postel, S. 1999. When the world's wells run dry. *World Watch*. September/October 1999.

based on case studies, workshops, meetings with public officials, and would include an evaluation of initiatives that governments could undertake to encourage the use of successful techniques.

Rationale: This recommendation embodies the emerging concept that all future alteration in the water management *status quo* should have as an explicit target the net improvement of associated aquatic environments. This thinking recognizes that legitimate water development needs can no longer—and need no longer—be pursued in competition with environmental goals and that the damage of the past can be repaired to some degree by environmentally positive water management strategies. The emphasis is on techniques that can create new water for both future human uses and water for environmental restoration—in a manner that does not impose an environmental cost but actually produces an environmental net benefit.

Examples include:

1. ***Generating water for environmental restoration by reducing losses from irrigation systems***

This report could examine some of the affordable techniques to generating water for environmental restoration by reducing losses to irrigation systems and some of the barriers to their wider application. Agriculture is the predominant user in the water-stressed regions of all three countries. Also, in these regions, the local economy is usually dependent upon a vibrant agricultural industry. The types of affordable techniques for generating water restoration out of agricultural uses—without disadvantages to irrigators—are those that promote cultivation of crops that consume less water per unit of economic value (profit), improve on-farm water application techniques that avoid evaporative losses, and minimize infiltration to saline aquifers.⁴⁹

2. ***Facilitated water transfer techniques***

This report could examine water markets that increase the *value* of water delivered by the government to irrigators without changing the *cost*. When saved water can be sold at market rate, a strong economic incentive exists to invest more in water conservation technologies and techniques than could otherwise be justified. The ability to market irrigation water at prices that exceed delivery costs to the farmer makes it worthwhile for that farmer to invest more than would otherwise be economically justified in water conservation.

Some of these techniques are now being used by urban water supply agencies in Southern California, the Denver Metropolitan Area, and El Paso, Texas. Typical

⁴⁹ Advanced sprinkler and drip irrigation systems are common examples. Sometimes, simple techniques, such as shortened furrow rows or leveling of fields, alone can save substantial amounts of water: in some areas by as much as 40 percent.

of these arrangements is that an urban water agency defrays the cost of water conserving technologies and techniques for farmers and, in exchange, the city is entitled to use most or all of the saved water.

3. *Urban wastewater reclamation*

In some notable cases, water for environmental restoration has been made possible by reducing wastewater discharges from municipal water systems. The Mono Lake restoration in California is such an example. Urban sewage effluent does not represent a waste of water where it is beneficially reused for other purposes, such as irrigation, as in the Rio Grande/Rio Bravo basin below Ciudad Juárez. But where these wastewaters are not reused—where they are discharged to the ocean, for example—reclamation and recycling can offset diversions from freshwater resources that are currently being tapped for that municipal water supply. Advances in water treatment technology can turn effluent into potable water, opening up larger potential for reducing the environmental impacts of municipal water diversions from lakes and rivers. The potential for applying such technology to reduce Mexico City’s impacts on the Rio Lerma-Lake Chapala basin, for instance, could be substantial.

4. *Integrating surface water and groundwater management*

Enhancing the capacity to store runoff during wetter periods for use during dryer periods can be done in ways that also provide water for environmental restoration. One promising technique is called “conjunctive management.” It can augment water supply during dry years by integrating groundwater storage potential with the existing surface reservoir system. The natural channel below the reservoir can be used to move the water from the surface reservoir to the groundwater bank in a flow pattern that partly re-establishes the natural conditions needed for vibrant riparian ecosystems.

B. *Project Two: Sustainable Watershed Management*

Goal: To examine sustainable watershed practices in North America.

Project: The project will draw on workshops, consultations with governments and NGOs, and on published materials to examine sustainable watershed management practices in North America. The project will lead to a report that identifies examples of effective structures, processes, policies and information systems that contribute to sustainable watershed management.

Rationale: The watershed has been recognized as an appropriate unit for managing water resources for at least seventy years. A recent review of international watershed

Draft Options for a CEC role in the Sustainable Use and Conservation of Freshwater in North America

management experience⁵⁰ identified a number of reasons why structuring policy, planning and management on the basis of watersheds makes good sense. These include:

- because of its unique properties, water integrates and catalyzes other biophysical processes in air, land and water environments;
- watersheds define distinct biophysical units;
- watersheds are an easily-understood ecosystem unit;
- the health of rivers and streams is both influenced by and illustrative of the health of the lands through which they flow;
- water systems demonstrate the cumulative effects of environmental stresses;
- quality of life is directly linked to water quality in watersheds;
- most management actions can be integrated using watersheds, at some scale, as a common planning unit; and
- there is strong and growing public support for implementation at the local watershed level.

The use of watersheds as a management unit has been endorsed widely in many jurisdictions, including parts of Canada, England, Wales, Australia, and in many states in the US. A variety of management structures, processes, policies and information systems are in place to manage watersheds. This project would identify what is state of the art in the area of sustainable watershed management. The lessons learned in the project would be widely transferable throughout North America and beyond and will contribute to the sustainable use and conservation of freshwater in North America.

⁵⁰ Beak International. 2001. *A review of watershed management experience*. Research Paper #11, prepared for the Executive Resource Group.



Appendix A:

**Draft Overview of Possible Options for Commission for Environmental Cooperation
Work in the area of Watershed Management, Including Consideration of
Affordable Water-Related Technologies and Water Pricing**

Public Workshop on Freshwater Issues in North America

3 October 2002

Albuquerque, New Mexico

I. INTRODUCTION

At the 2001 Council meeting of the North American Commission for Environmental Cooperation (CEC), the environmental ministers of Canada, the United States and Mexico agreed to undertake an initiative to analyze issues related to “local water pricing and watershed management, and promote accessible, affordable technologies for improving water management.”⁵¹ In response to the Council’s initiative, the Secretariat initiated, as part of its 2002 Law and Policy Program, a plan to develop a concept paper outlining a long-term vision of the role of the CEC in the area of watershed management, including consideration of affordable water-related technologies and water pricing. As part of this paper, the Secretariat would develop recommendations for Council to consider on possible CEC work in this area.⁵²

In January 2002, the CEC began implementation of this plan by holding a Workshop of Freshwater Issues in North America with a small group of experts from Canada, the United States and Mexico. The workshop focused on major threats to ground water in North America and identified some of the major barriers to the integrated management of ground and surface water. The participants identified a wide variety of actions they felt were needed to move towards this type of integrated management. They also identified effective management approaches and tools currently in use in North America and elsewhere, as well as potential roles that the CEC could play in freshwater and ground water issues in North America.⁵³

After the workshop, the Secretariat hired four experts to work with it on developing an options paper and recommendations for the Council to consider prior to the 2003 Council meeting.⁵⁴ The Secretariat determined that each option considered should:

- vi. be consistent with the June 2001 Council Communiqué and the 2002 Law and Policy Program Plan;
- vii. fit within the mandate of the CEC;
- viii. advance the issue of sustainable watershed management; and,
- ix. add value and complement the work being done by other jurisdictions.

In consultations with the Secretariat, the experts have developed a tentative list of seven potential options for CEC involvement, identifying advantages and disadvantages of proceeding with

⁵¹ CEC Council Communiqué, Guadalajara, Mexico, June 29 2001, p. 2. www.cec.org/files/PDF/Council/01-00com_EN.pdf.

⁵² 2002-2004, North American Agenda for Action, 4.3.1, Sustainable Use and Conservation of Freshwater in North America, p.119. www.cec.org/files/pdf/LAWPOLICY/431_02-04-e.pdf

⁵³ See, www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=751;
www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=806

⁵⁴ They are : Gregory Thomas, President, National Heritage Institute, Berkeley, CA, USA; Manuel Contijoch, Consultant, International Water Resource and Irrigation Issues, Mexico City, Mexico; Adele Hurley, Senior Fellow, University of Toronto, Toronto, Canada; Joanna Kidd, Lura Consulting, Toronto, Canada

each option. In addition, the Secretariat has developed a preliminary estimate of the potential resource commitments of each option. Pages 24-29 of this handout contain a summary of these seven options.

II. Overview of Freshwater Issues in North America.

The Council's 2001 water initiative was undertaken with a recognition by the Commission that long-term success in protecting and conserving the environment depends on the ability of governments to foster innovation and develop creative solutions to address shared environmental, economic and social objectives.⁵⁵ Ensuring access to safe and adequate supplies of freshwater requires this type of innovated and creative problem solving. In its most recent Global Environmental Outlook, the United Nations Environment Programme reported that by the mid-1990s some 80 countries, representing 40 percent of the world's population, were suffering from serious water shortages. The report estimates that in less than 25 years from now, as increases in population, industrialization and crop irrigation intensify the demand on the world's water supplies, two-thirds of the world's people will be living in water-stressed countries.

North America is fortunate to have 14% of the world's renewable fresh water. However, the challenges facing North American policy makers are significant. The fastest growing areas of North America are also the most water-scarce, and in large regions of the continent water supply is sorely stressed. Even where water is abundant, it is too often threatened by contamination from both point and non-point sources, physical alterations of watercourses, and the presence of ever-growing numbers of invasive plant and animal species. In some areas, rivers have been pumped dry, aquifers have been mined relentlessly, and pollutants have destroyed drinking water source. In addition, in many parts of North America, water allocation issues have developed extremely important political, economical, environmental and social dimensions that make long-term planning difficult and contentious.

In North America, water resources are managed in a variety of ways. In Mexico, water is considered a common good and national property pursuant to the 1917 Constitution. The authority to manage water resource issues rests with the *Comisión Nacional del Agua*. This authority has become more decentralized in recent years due to the devolution of management responsibilities to the local water users. In the United States and Canada, various federal, state and local agencies have responsibilities for some aspect of the hydrologic cycle and jurisdictional issues often vary throughout the country. In addition to the domestic agencies of each country, the United States and Mexico and the United States and Canada are parties to treaties establishing the International Boundary and Water Commission (IBWC)⁵⁶ and the International Joint Commission (IJC),⁵⁷ respectively. The IBWC and the IJC address, among other things, surface water issues along the U.S.-Mexico and U.S.-Canada borders pursuant to the terms of the treaties.

⁵⁵ CEC Council Communique, Guadalajara, Mexico, June 29 2001, p. 2. www.cec.org/files/PDF/Council/01-00com_EN.pdf.

⁵⁶ See www.ibwc.state.gov

⁵⁷ See www.ijc.org

The CEC is a relative newcomer to water issues in North America. It was established in 1994 by the governments of Canada, the United States and Mexico to address regional environmental concerns, help prevent trade and environmental conflicts and to promote effective enforcement of environmental law. One of its key functions is to provide information and policy analysis to policy makers and the public. Past CEC involvement in water issues include the preparation of reports on preserving transboundary migratory bird habitat on the Upper San Pedro River;⁵⁸ illustrating how regional environmental cooperation helped improve the water quality of the Silva Reservoir, a small impoundment in the high plains of central Mexico where twenty to forty thousand migratory waterbirds died in the winter of 1994-1995;⁵⁹ and, on the legal and management regimes that have evolved for boundary and transboundary surface waters and ecosystems in North America.⁶⁰

III. NEXT STEPS

Given the importance of the issues associated with freshwater resources to the governments of North America and to the public at large, the Secretariat will consult regularly with the governments, the International Joint Commission (IJC), the International Boundary Waters Commission (IBWC), and the Joint Public Advisory Committee (JPAC) in order to help gauge the usefulness of proposed options in advancing the issue of sustainable watershed management and to assist it in developing recommendations. In particular, the Secretariat's consultations with the Joint Public Advisory Committee and the public at JPAC's public meeting in Albuquerque on October 3, 2002, will be critical to better understanding the public's concerns and reactions to these issues. After initial consultations in September and October with the stakeholders, the Secretariat will post for public comments on the CEC website in mid-November, a final draft options paper with tentative recommendations. After reviewing comments received and making changes as necessary, the Secretariat will finalize its options and recommendations to Council in mid-February.

⁵⁸ «An Agenda for Preserving Transboundary Migratory Bird Habitat on the Upper San Pedro River,” (CEC 1999), www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=110

⁵⁹ «Silva Reservoir: An Example of Regional Environmental Cooperation in North America,”(CEC 1999), http://www.cec.org/pubs_docs/documents/index.cfm?varlan=english&ID=282

⁶⁰ «North American Boundary and Transboundary Inland Water Management Report,» (CEC 2002), <http://www.cec.org/files/pdf/LAWPOLICY/NAELP7e.pdf>

IV. AN OVERVIEW OF THE OPTIONS

These draft options fall into three categories: (1) watershed management; (2) water pricing; (3) affordable technologies. They are designed to promote the protection and enhancement of the North American environment by providing policy makers and the public with information and policy analysis designed to advance the issue of sustainable watershed management.

The Secretariat is soliciting input on the value of the CEC in pursuing any of these options. It is also seeking input on other options the CEC could pursue which are consistent with CEC mandate, and it is seeking ideas on a long-term vision of the role the CEC could play in any of these issues.

**OPTIONS FOR A CEC ROLE IN THE SUSTAINABLE USE AND CONSERVATION OF FRESHWATER
IN NORTH AMERICA**

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>A: North America Freshwater Information Network (NAFIN): A Portal for Freshwater Data (watershed management)</p>	<p>A watershed-based GIS overlay to existing data and information on freshwater in North America Possible resource commitment: \$50,000 - \$250,000 over a 2-3 year period to create a basic clearinghouse. Long-term commitment required.</p>	<p>The project would create an internet data portal that provides the user with a GIS overlay to existing data and information on freshwater. The portal will provide the user with free and easy access to geographically based (i.e., watershed-based) information on water resources. This will allow the user to synthesize water-related information in a geographical context and make comparisons to other watersheds. To develop the portal, CEC would create a work group with representation from the key agencies and institutions that collect, manage, or use freshwater data and information.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • Will increase public and government access to information • Will promote regional cooperation • Will promote the use of a watershed-based approach to collecting, managing and sharing data and information • Will contribute to more sustainable management of freshwater resources in North America <p>Disadvantages</p> <ul style="list-style-type: none"> • Because of data limitations, may take years before significant amounts of watershed-based information beyond basic information are accessible in Canada and Mexico

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>B: State of Groundwater Report (watershed management)</p>	<p>A report documenting the state of the groundwater resource in North America</p> <p>Possible resource commitment: \$30,000 - \$150,000, depending on the desired length and detail of the report.</p>	<p>Groundwater is a vitally important resource that is under significant stress in many parts of North America. Lack of public awareness of the importance of the resource, lack of education of users and lack of visibility of the resource itself are barriers to improved management of groundwater. A State of the Groundwater Report would draw on existing data and information to document the state of the resource in North America, including its supply, use, management, stresses and status. It would address transboundary watershed/ aquifer issues and management responses. The report would be targeted widely at agencies, institutions, organizations, users and the public.</p> <p>The report would be developed by a work group with representation from key agencies and experts in the field.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • CEC is one of the few institutions positioned to tackle the issue in the North American context • Will increase public and government access to information • Will help to assess the sustainability of groundwater in North America • Will promote the collection, management, use and sharing of needed data on groundwater <p>Disadvantages</p> <ul style="list-style-type: none"> • Much of the information resides with groundwater users and access to it may be a challenge

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>C: Structures for Effective Transboundary Watershed Management (watershed management)</p>	<p>A report to CEC Council on how the management of transboundary watersheds can be improved through existing transboundary institutions and information exchange among local water managers</p> <p>Possible Resource Commitment:</p> <p>\$40,000 - \$100,000</p>	<p>On both the US/Mexico and US/Canada borders, transboundary watersheds are not being managed in an integrated way (i.e., in a manner that integrates both ground and surface water). This project would identify what is needed for effective and integrated management of transboundary water resources and would examine how the role of existing management institutions including local water districts and user associations could be expanded to allow for integrated water management. The project would include consideration of how public and stakeholder input to the management of transboundary water resources can be improved.</p> <p>A workshop(s) would be convened with stakeholders and experts from both border areas and from other leading jurisdictions. The final output would be a report to CEC Council.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • Will promote regional cooperation to protect and improve the environment • Could help facilitate to more sustainable management of freshwater resources in North America • Could help to address the serious issues of water scarcity along the US/Mexico border • May encourage productive collaboration among existing transboundary water management institutions and state, provincial and federal governments <p>Disadvantages</p> <ul style="list-style-type: none"> • None apparent

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>D: Affordable Technologies for Improved Water Management</p> <p>(Affordable technologies) (Watershed Management)</p>	<p>A report to the national governments on affordable techniques for improving water management with recommendations for concerted action</p> <p>Possible Resource Commitment:</p> <p>\$100,000 - \$1,000,000 depending on the complexity and depth of the report. A 2-5 year project.</p>	<p>The project would involve investigation and analysis of the current application and future potential of a number of affordable techniques for improving water management. These include:</p> <ul style="list-style-type: none"> • conjunctive management of ground and surface water; • urban wastewater reclamation; • advanced water applications in agriculture; • holistic benchmarking of best practices in agricultural water management; • facilitated water transfer techniques; and • desalinization of saline aquifers. <p>Following initial investigation and analysis, an expert, tri-national workshop would be held and then a report would be circulated for public review. A final report would be generated for the CEC Council.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • Will be useful because few other institutions are “up to speed” on the issues • Will serve the objectives of water users and governments in all three countries • Will provide a large return in terms of environmental benefits for a relatively low investment by CEC <p>Disadvantages</p> <ul style="list-style-type: none"> • Will be challenging in both the technical and economic dimensions • Will require significant resources (perhaps \$500,000 to \$1,000,00 US) to do well

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>E: Economic Tools to Achieve Water Efficiency (water pricing) (watershed Management)</p>	<p>A report to the national governments on economic tools to achieve water efficiency with recommendations for concerted action</p> <p>Potential Resource Commitment: (\$50,000 to \$100,000 over a 2-3 year period)</p>	<p>This project would involve investigation and analysis of the current application and future potential of economic tools to promote water conservation in the agricultural sector. These would encourage farmers to use less water to produce an equivalent economic benefit. The tools to be examined include:</p> <ul style="list-style-type: none"> • tiered pricing; • facilitated water markets; and • retargeting public investment from use subsidies to conservation subsidies <p>Following initial investigation and analysis, an expert, tri-national workshop would be held and then a report would be circulated for public review. A final report would be generated for the national governments.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • High “pay-off” option for CEC in terms of environmental benefits • Substantial research has already been done on the first two items • No other institution is tackling the more cutting edge aspects of this issue <p>Disadvantages</p> <ul style="list-style-type: none"> • Some aspects of this option (e.g., agricultural subsidies) may be politically sensitive • Transboundary water investment strategies may be somewhat controversial now due to conflicts over the 1944 Mexico/US treaty • Water transfers are seen as threatening to some segments of agriculture • Requires a high degree of specialized economic expertise which is hard to find and expensive

OPTION	OUTPUT	DESCRIPTION	ADVANTAGES / DISADVANTAGES
<p>F: Environmental Restoration Opportunities in Water Development (watershed management)</p>	<p>A report to the national governments on environmentally beneficial water resource development in North America with recommendations for concerted action</p> <p>Potential Resource Commitment: \$50,000 - \$100,000 over a 2-3 year period</p>	<p>The new paradigm in water development planning is that all projects should have the improvement of aquatic environments as an explicit target. This thinking is being applied to both new developments and existing infrastructure (such as the relicensing of hydropower dams). This project would investigate the opportunities to build environmental enhancement into water resource development projects, with particular focus on the two shared international borders.</p> <p>Following initial investigation and analysis, an expert, tri-national workshop would be held and then a report would be circulated for public review. A final report would be generated for the CEC Council</p>	<p>Advantages</p> <ul style="list-style-type: none"> • No other entity is positioned to act as the catalyst to the 3 governments on this issue • Acknowledgement of the need to modernize water infrastructure and repair the damage from past development should unite both water development and conservation constituencies • May provide opportunity for constructive engagement between the CEC and the IBWC and IJC in addressing border water challenges <p>Disadvantages</p> <ul style="list-style-type: none"> • High level of expertise need to deliver project • Anything related to transboundary water management will be regarded with caution by national agencies.
<p>G: Water Quality Policies, Regulatory Approaches and Standards in North America (Watershed Management)</p>	<p>A report to CEC Council on water quality policies, regulatory approaches and standards in North America</p> <p>Potential Resource Commitment: \$50,000 to \$100,000 over a 2-3 year period</p>	<p>The three NAFTA countries have very different approaches to regulating water quality. This project would examine the different policies and approaches being used and the standards used. The issues examined would include: health implications, water quality indexes, standards versus guidelines, and impacts of harmonization.</p> <p>A work group would be convened to address the issue with representation from the three countries and Mexico. A workshop would be held to review preliminary findings of the work group. The resulting output would be a report to CEC Council.</p>	<p>Advantages</p> <ul style="list-style-type: none"> • No other agency or institution has tackled this issue • Will increase public and government knowledge in this area • May contribute to improved management of water resources <p>Disadvantages</p> <ul style="list-style-type: none"> • High level of expertise required

