EXPERT WORKSHOP ON

FRESHWATER IN NORTH AMERICA
21 January 2002

5 March 2002

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Executive Summary

The Commission for Environmental Cooperation of North America (CEC) sponsored an Expert Workshop on Freshwater in North America on 21 January 2001. The workshop, hosted by the Program on Water Issues at the Munk Centre for International Studies at the University of Toronto, brought together a small group of experts from Canada, Mexico, and the United States to discuss freshwater issues with a focus on groundwater.

The first session of the workshop focused on defining the issue. Participants identified the major threats to groundwater as being overuse, contamination, land-use changes, deforestation, population growth and climate change. They also identified where the greatest pressures on groundwater are found now and where they will likely be found in the future. Many barriers to integrated management of ground and surface water were identified, and these included legal, policy, institutional, technical, knowledge and educational barriers.

The second workshop session focused on moving forward. Participants identified a wide variety of actions that they felt were needed to move towards integrated management of ground and surface water. Many effective management approaches and tools were identified that were currently in use in North America and elsewhere. The participants finished by discussing potential roles for the CEC in integrated management of ground and surface water.

1 BACKGROUND TO THE WORKSHOP

In June 2001, the Council of the Commission for Environmental Cooperation of North America (CEC) held its annual meeting in Guadalajara, Mexico. At that meeting, the Council directed the CEC Secretariat to analyze issues relating to local water pricing and watershed management, and promote accessible, affordable technologies for improving water management. As a preliminary step in identifying how to implement this decision, the CEC sponsored a workshop on freshwater in North America.

The Expert Workshop on Freshwater in North America was held at the University of Toronto on 21 January 2002, and was hosted by the Program on Water Issues at the University of Toronto's Munk Centre for International Studies. Thirteen experts from Canada, Mexico and the United States participated in the one-day workshop, which examined freshwater issues from a North American perspective, including how to integrate groundwater and watershed management. A discussion paper ("Groundwater: A North America Resource") was prepared and circulated to participants in advance of the workshop to aid discussion. The agenda for the day, and the list of participants, observers, consultants and CEC staff are included as appendices to this report.

This meeting report was prepared by Joanna Kidd on behalf of the Program on Water Issues at the Munk Centre for International Studies and has been reviewed by workshop participants.

2 WHAT WAS SAID

2.1 Introductory Remarks

The workshop was opened by **Adele Hurley**, Senior Fellow, Program on Water Issues at the Munk Centre for International Studies at the University of Toronto. She welcomed participants and stressed that the workshop was not intended to be a stakeholder forum, but rather a forum involving key experts in the field of freshwater. Ms. Hurley then introduced the CEC Executive Director and staff, the workshop facilitator, the research writer, observers, Munk Centre staff and translators.

Janine Ferretti, Executive Director of the CEC, warmly welcomed participants and thanked the Munk Centre for hosting the event. She then gave a brief background on the CEC and the workshop. The CEC is the international organization created by Canada, Mexico and the United States under the North American Agreement on Environmental Cooperation to address regional environmental concerns, help prevent potential trade and environmental conflicts, and to promote the effective enforcement of environmental law. The Council is the decision-making body of the CEC: it is formed of the Environment Ministers of Canada, Mexico and the United States and it meets annually. At its last meeting in June 2001 in Guadalajara, the Council identified water as a key concern for them and asked the Secretariat to assist them to examine water-related issues. Specifically, the Council asked that the Secretariat "analyze issues relating

to local water pricing and watershed management, and promote accessible, affordable technologies for improving water management."

Ms. Ferretti noted that water is one of North America's precious natural resources and this is not the first time that CEC has dealt with the issue. The CEC has recently published a report that provides an excellent overview of the legal and policy framework for transboundary water management.[1] The Commission has also been involved with the San Pedro River, in a local issue that has transboundary implications. She noted that one of the CEC's roles is to provide forums for the three countries to come together, and exchange views and ideas, both at the scientific and policy level. This meeting is the first time that the CEC has examined groundwater and broader water issues from a scientific point of view.

Ms. Ferretti indicated that groundwater was identified as a priority for the workshop because it is becoming an emerging concern for all three countries. Concern about groundwater is driven by five issues: water quality problems, water quantity problems, an expanding population that relies on groundwater, climate change, and the growing understanding of the importance of the interactions between ground and surface water. She noted that the CEC is planning to host additional workshops to address other aspects of freshwater issues. The Secretariat's goal is to be able to report to the Parties on water so that they can prepare updates for their next Council meeting in June 2002. She finished by saying that she was looking forward to participants' ideas and advice on freshwater issues and their thoughts on what role the CEC might be able to play in those issues.

Adele Hurley then formally introduced **Rita Pearson Maguire**, the workshop facilitator, and provided background on her extensive experience with water issues in Arizona and elsewhere. Rita described her role as facilitator and outlined the agenda for the day. She reiterated the purpose of the workshop, and emphasized that the workshop was intended to be a scoping session—an initial discussion of freshwater issues with a focus on groundwater. She indicated that this author would be preparing notes of the meeting and that they would be circulated to participants in draft form. She also noted that the comments contained in the meeting report would be unattributed and encouraged all participants to speak freely and frankly.

Ms. Maguire then asked the participants to introduce themselves and provide a brief description of their work on water-related issues.

[1] Commission for Environmental Cooperation, 2001. *North American Environmental Law and Policy: North American Boundary and Transboundary Inland Water Management Report.*

2.2 Defining the Issue

2.2.1 The Threats to Groundwater

The discussion paper ("Groundwater: A North American Resource") identifies the chief threats to groundwater as overuse, contamination, climate change and population growth. Participants were asked whether they felt that the discussion paper accurately assessed the threats to groundwater in North America.

- Participants generally agreed that the discussion paper provided a good, concise summary of the key threats to groundwater in North America. The paper draws from many key references and synthesizes the information from many sources.

- It was suggested that "deforestation" should be added as a threat to groundwater, one that is especially relevant in Mexico.

- Changes in land use (such as housing development, land drainage and the construction of reservoirs) should be clearly identified as a threat to groundwater resources.

- A participant suggested that it would be useful to supplement the threats to groundwater, with an opportunity analysis (e.g., to identify the potential to use depleted aquifers to store both surface and groundwater).

In addition to addressing threats to groundwater, participants made many other comments on the discussion paper. These are described below.

Timing

- A participant noted that the discussion paper was very timely and that he was currently working with five co-authors on a similar paper on the "Intensive Use of Groundwater in North America." It will be published in 2002 as a chapter in a book on managing groundwater around the world.

Pricing

- Some participants suggested that the discussion paper should place more emphasis on market approaches to water pricing. This includes examining the consequences of water demand management (the social benefits and economic returns) and connecting water use rights with the market.

- Following from the above point, a participant urged that discussions of market approaches should reflect the differing legal and policy frameworks for managing water that exist in North America.

Information

- Some participants suggested that the discussion paper should stress the need to improve our understanding of groundwater and surface water use (who is using it, how much is being

used and for what purposes). "Without this knowledge" argued one participant "we cannot effectively manage groundwater and surface water together." Understanding water use was also felt to be necessary for implementing market-based approaches to water pricing.

- Others acknowledge that "water use is crucial in understanding the issue," but emphasized that there is a need to look at the entire system and linkages. "We have to have an understanding of the whole hydrologic cycle."

- On a related note, participants stressed that it was important to make a distinction between consumptive and non-consumptive uses of groundwater.

- A participant suggested that great amounts of information on groundwater exist, but missing are summaries of information (for example, on stocks and withdrawals) at the national level.

- A participant that the discussion paper does not address the critical need for action in some areas, a need that should not be constrained by lack of complete knowledge.

- More recent numbers exist on the amount of renewable freshwater in Mexico, the population relying on groundwater, and groundwater withdrawals by sector. These were passed on to the CEC.

Management

- It was suggested that the discussion paper should indicate that there are many issues associated with local management of groundwater resources.

- A participant noted that although groundwater is local, its use, overuse and contamination can have regional, national and event international impacts. "Although groundwater supplies are local in nature, their use can have impacts on large systems like rivers. It is therefore appropriate for the three nations to be involved in the issue, and a good reason why the CEC should be involved."

- A number of participants noted that it was important to stress the complexities of managing groundwater: not just three nations, but many states and provinces, as well as regions and water management districts are involved in the issue.

- Participants noted the importance of considering the cultural dimensions of the groundwater issue, including the differing cultures of managing water and differing national cultures.

- The discussion paper should recognize the importance of capacity building for Mexico and the potential for joint ventures.

- Some participants suggested that the discussion paper should contain background information on the experience of Mexico's River Basin Councils and its National Program on the Efficient Use of Water and Energy.

- A participant suggested that the discussion paper should reflect the potential for conflicts between the agricultural and environmental sectors, especially in water-stressed areas.

Technologies

- One participant suggested that the discussion paper should mention some emerging technologies, such as aquifer storage, water re-use and efficient irrigation systems.

Education and Awareness

- The discussion paper should include the importance of educating the public about and raising awareness of the importance of groundwater and the need to use it wisely.

Involvement

- The discussion paper should reflect the necessity of involving stakeholders and water users in decision-making processes dealing with groundwater, and the need to build the capacity of stakeholders and users to participate.

2.2.2 The Pressures on Groundwater

Participants were asked their opinions on where the greatest pressures on groundwater are at present and where they expect them to be in the future.

General

- In a general sense, the greatest pressures to groundwater are now found:
  - in areas of intensive agriculture[2] where there is pervasive contamination from nitrates and pesticides;
  - where headwater areas are being developed;
  - where there are dramatic shifts in land use or land-use intensity;
  - where there are significant changes in water use and water-use intensity;
  - where there is inadequate source protection of aquifers;
  - in highly arid regions where surface water supplies are stressed and limited;
  - in areas of rapid population growth where there may be both water quantity problems and water distribution problems;
  - where groundwater is contaminated with biological or chemical contaminants; and
  - where bulk water export is being considered.

- A participant argued that lack of information on groundwater is a pressure itself. “In Canada, we are only just beginning to collect regional-scale information and data on groundwater.”

[2] The Spanish word “agricultura” refers only to the growing of field crops and does not include livestock raising. Throughout this report, the term “agriculture” is used in its English sense to denote both field crops and livestock raising.

Geographic

- Participants identified many geographic areas where groundwater is now under significant pressure.
  - The key problem areas in Canada are found in the southern part of the country where most of the population lives. Key areas where groundwater is under significant pressure include the Cambridge/Waterloo area in Ontario, and the provinces of New Brunswick, Nova Scotia and Prince Edward Island (where 60 to 100 percent of the population relies on groundwater). Pressures are also great in the prairies (where most of the groundwater is being pumped) and the Abbottsford aquifer in British Columbia (which is shared with Washington State).

  - Along the US/Mexico border, the areas under the greatest pressure include: the Rio Grande/Río Bravo watershed, the Colorado River watershed, the Juárez/El Paso area; the Sonora area in Arizona and the San Pedro River.

  - Other important areas in the United States include: coastal regions (such as the southeast states and in the Great Lakes), the Pacific Northwest (along the border with Canada) and the High Plains area (including the Milk River and the Dakotas).

  - In Mexico, groundwater resources are under the greatest pressure in: Mexico City, the Lerma-Chapala Basin, the northern watersheds, the Yucatán Peninsula and the arid High Plains area.

- A participant cautioned that because of the lack of information on groundwater quality and quantity, there may be additional areas under significant pressure that we are currently unaware of. “We don’t really know accurately all the places where there are overpumping problems or the severity of those problems (because we don’t accurately measure inflows and outflows from many groundwater basins) and we don’t monitor water quality in most groundwater basins on a regular basis so the severity of the problem is not well known either.”

- A participant from Mexico noted that the relative importance of groundwater problems may vary from country to country. In Mexico, it was noted, bacterial contamination of groundwater (with its resulting severe health impacts) is a much more significant concern that nitrate contamination (which has much less impact on human health). On this issue, an American participant suggested that bacterial problems are a concern in all three countries, and the importance of them has perhaps been underestimated in the United States and Canada.

- A participant argued that distribution problems are an engineering problem. He suggested that “we should focus on the source—on its availability, suitability and sustainability.”

Future Pressures

- A number of participants predicted that in the future, pressures on groundwater will increase in areas where intensive agriculture is practiced (whether or not irrigation takes place). In such areas, both overuse and contamination of groundwater are a concern.

- Some participants argued that future pressures on groundwater will be extreme in areas where surface water supplies are limited. Users will increasingly turn to groundwater to supplement surface water supplies.

- One participant suggested that in the future, the main groundwater conflicts will be linked to economic success (areas of rapid economic growth) and democracy (pressure on elected officials to act quickly to resolve problems).

- A number of other future pressures on groundwater were identified. These include: land-use changes, climate change, bulk water exports, lack of knowledge and data, access to data, lack of public awareness of the problem and aquifer contamination.

Data Collection and Management Actions

- A number of participants raised the concern that sometimes the need to collect information and data is used as an excuse to not take management actions. There are areas in Mexico, for example, where the quality or amount of groundwater is critical right now. In these areas, participants argued that decision-makers should take action to protect aquifers based on existing information.

- Other workshop participants argued that there was no inherent conflict between the need for management actions and the need for adequate information on groundwater, but that rather "they drive each other." The contamination of aquifers in Bangladesh was cited as an example of what can happen with inadequate monitoring. There millions of people unknowingly drank water contaminated with high levels of arsenic for 15 years before the effects were noticed.

- Another participant argued that lack of information can lead to a vicious cycle in which a lack of information leads to a crisis in water quality or quantity which then leads to management decisions that are made without adequate information which can then exacerbate the crisis. "Gathering information is an investment."

2.2.3 Barriers to Integrated Management of Groundwater and Surface Water

Definition of Sustainable Use

The workshop facilitator, Rita Pearson Maguire, asked participants to offer comments of the definition of sustainable use found on page 15 of the discussion paper. This definition of sustainable groundwater resource development is "the amount of groundwater that can be legally extracted from a hydrologic basin over the long term without causing severe economic, social, ecological and hydrologic consequences."

- A participant suggested against using an overly rigid definition of sustainable use and felt that there may be circumstances that warrant overpumping of an aquifer. “We can’t say that, in every case, groundwater into the aquifer should equal groundwater taken out.”

- In terms of sustainability, one participant noted that groundwater can be both a renewable resource in some places and a non-renewable resource in others. This is important for many reasons, including that there is a GATT exemption for non-renewable resources.

- Factors that can be used to measure the sustainability of groundwater include: decreasing groundwater storage, overpumping, reductions in the flows of rivers and streams, loss of wetlands, changes in groundwater quality and climate change.

- A participant argued that the problem is not a failure of agreement on the definition of sustainable use, but rather the lack of management actions to address it. Another participant noted that in Mexico, the law allows the federal government to allocate water to meet ecological needs, but this is never done because of the “difficulties in computing how much water is needed for ecological ends.”

- One participant stated that any definition of sustainable use must incorporate responsibility for future generations. “We need to guarantee that future generations have access to clean and sufficient groundwater to satisfy their needs. To do this, we need to maintain the hydrologic cycle and the systems associated with groundwater.”

- While generally accepted guiding principles for sustainable use are useful, a participant suggested that it would always be necessary to apply them on a case-by-case basis.

- A participant argued that one of the problems of managing for sustainability is the difficulty of measuring variables such as the rechargeability of aquifers. A working definition of sustainability should be developed and agreed upon, and monitoring used to confirm whether the system is behaving as expected, or not.

Legal, Policy and Institutional Barriers

After the discussion on sustainability, participants were asked to identify what they felt were the key legal, policy and institutional barriers that stand in the way of integrating the management of groundwater and surface water.

- Participants identified the lack of effective management structures to deal with groundwater, both in transboundary situations, and within the three countries

- Where regional or watershed-based surface water management structures such as water districts or Conservation Authorities exist, participants noted that there is the potential to extend control to groundwater. The mandates of these agencies would likely have to be expanded to allow them to effectively address groundwater issues.

- In most of the US states, landowners own the water under their property and this is a key barrier to wise management of groundwater resources. “In most places, groundwater is considered a species of private property that is exploitable virtually at the will of the landowner.”

- Participants noted that the fragmentation of responsibilities for groundwater is a key barrier to effective management. Responsibilities are often spread over numerous agencies.

- The lack of cooperation among agencies was identified as a major barrier to integrated management of surface and groundwater.

- A number of participants suggested that the lack of market-based pricing for groundwater was a major barrier to better management of the resource.

- A participant suggested that government downsizing in Canada has led to a shrinking allocation of resources to address groundwater issues. It was felt, however, that this erosion of resources may being reversed in the wake of the *E. coli* tragedy in Walkerton, Ontario.

- In Mexico, an over-reliance on regulation was identified as a barrier to better management of groundwater. Participants felt that there should be more emphasis on other approaches, including education and incentives for conservation.

- By contrast, a participant suggested that in Canada there is often an under-reliance on regulation as a tool and an over-reliance on negotiation.

- Another noted that there is a disconnect between land use decision-making (which is usually carried out at the local level) and water management (which is usually the responsibility of state/provincial and federal agencies).

Technical and Knowledge Barriers

- The lack of understanding of how aquifers operate was identified as a barrier, albeit one that was considered “a manageable problem.”

- One of the key barriers to integrated management was identified as lack of information on water use (who is using it, how much is being used, and for what purposes).

- The lack of summary (trend) information, at regional and national scales, was emphasized as a key barrier.

- Participants identified recharge mechanisms and the linkages between groundwater and surface water systems as important knowledge gaps that need to be filled.

- A participant noted that while groundwater contributes to surface water in streams, lakes and wetlands and is important to ecosystem integrity and biodiversity, we know very little about these functions and need to know more.

- The lack of a national groundwater strategy for Canada was identified as a major barrier; however, it was noted that work is underway to develop such a strategy.

- A participant cited the lack of communication about best practices in freshwater management as a barrier to improved groundwater management.

- Participants noted that *access* to information can be as significant a barrier to integrating the management of surface water and groundwater as is lack of information.

Education and Awareness Barriers

- Lack of public awareness of the importance of groundwater and lack of education among users about proper practices were identified as major barriers to integrating the management of ground and surface water. The bilateral citizens committee set up in El Paso/Juárez to address air quality issues was cited as a potential model for stakeholder involvement in water management.

- The lack of visibility of groundwater was identified as a major barrier. "Because it is largely invisible," argued one participant, "groundwater doesn't really have an advocate."

2.3 Moving Forward

2.3.1 Actions to Move towards Integrated Management

Participants were asked to identify what they felt were the most important actions that are needed to move towards integrated management of ground and surface water.

Management Structures and Approaches

- A participant suggested that a key action would be to select one or more geographical areas and develop pilot projects to try and define the best approach to integrating the management of ground and surface waters.

- Another participant suggested studying some "success stories"—areas where action has been triggered because groundwater use is already affecting surface water and aquatic systems—and analyzing what was learned and what has worked. The Florida Everglades, the California Bay Delta, the San Pedro River, Oregon's Klamath Basin, the Colorado River Delta, and Ontario's Kitchener-Waterloo area were identified as candidates for potential study.

- It was noted that the Natural Heritage Institute had recently finished an analysis of successful approaches to integrated management of ground and surface water[3] and that the Institute would be happy to share its findings with others.

- It was also suggested that it would be useful to examine the potential for integrated management of ground and surface water through existing transboundary institutional structures.

- Because of the number of agencies involved in managing freshwater and the differing legal and policy frameworks across North America, a participant argued that we need to find a new model for cooperation for integrated water management. It was suggested that such a model could build on the principles used by the International Joint Commission, which include common fact-finding, dialogue with stakeholders and operating by consensus.
- A participant commented that three factors are required for any successful attempt to integrate the management of ground and surface water: adequate funding, committed leadership and effective stakeholder involvement processes.

- A key action would be to improve links between state/provincial and federal agencies that have responsibilities for protecting groundwater and local (municipal and regional) bodies that are responsible for land-use decision-making.

Legislation

- A participant argued that water legislation should be amended so that it explicitly recognizes the interconnections between ground and surface water.

Data, Information and Knowledge

- A participant suggested a three-step approach should be taken to address knowledge issues. These steps are:
  - identifying data availability and data gaps;
  - setting priorities for filling data gaps; and
  - implementing programs to fill those gaps.

- On a pragmatic note, a participant noted that it is very important to make sure that we are squeezing the most information out of the data that we currently have.

- In order to set priorities for action, a participant suggested that it would be useful to identify and rank the regions are most vulnerable to groundwater depletion or contamination.

- A participant suggested that a key action would be to improve communication between government decision-makers and scientists.

[3] Thomas, G.A. August 2001. *System-wide Conjunctive Water Management. Designing Successful Groundwater Banking Programs in the Central Valley: Lessons from Experience*. The Natural Heritage Institute.

- In order to raise awareness of the importance of groundwater, it was suggested that we needed to find an advocate for groundwater.

Education and Awareness

- A number of participants argued for improved education and awareness programs aimed at stakeholders and water users. It was felt that these are prerequisites for informed public participation in decision-making on water issues.

2.3.2 Effective Management Approaches or Tools

Look Worldwide

- A participant cautioned against looking only at North America for effective approaches and tools. Lessons may be learned from looking elsewhere, such as the pricing schemes and water metering used in France, and the education and awareness programs in Israel.

Integrated Management Approaches

- In Mexico, more than 50 groundwater technical committees have been created. These have been set up to deal with issues such as withdrawals.

- Also in Mexico, many lessons can be drawn from the transfer of Irrigation Districts to Water Management Districts that are trying to integrate ground and surface water management. Where this has taken place, the government has made a commitment to train users and transfer assets. A number of good outcomes have resulted, such as better crop selection and more efficient use of water.

- A participant noted that Dan Sheen from Columbia, Maryland, has had much success with simulation techniques in demonstrating the benefits of integrated ground and surface water management and the need for institutional change.

- The conjunctive use projects studied by the Natural Heritage Institute in California were cited as effective approaches for integrated management of ground and surface water.

- The municipal planning instruments used in the City of Waterloo, Ontario, to protect groundwater were identified as being effective. These include good wellhead protection strategies and restrictions on certain types of land use.

- Watershed planning in Ontario was also identified as a successful approach to managing water resources and protecting environmental values.

Legal Instruments

- The 1909 Boundary Waters Treaty was identified as an effective instrument that provides principles and mechanisms for resolving boundary and transboundary disputes over water along the United States/Canada border. The International Joint Commission, created under the Treaty, has dealt with groundwater-related issues on a number of occasions.

Data and Information

- It was noted that the US Geological Survey has real-time water-level data from 600 wells available on the Internet, along with some real-time data on groundwater quality.

- The US Geological Survey will forward to participants copies of four important reports on groundwater:
    - Groundwater and Surface Water: A Single Resource (USGS);
    - Sustainability of Groundwater Resources (USGS);
    - Investigating Groundwater Systems on Regional and National Scales (NRC); and
    - Envisioning an Agenda for Water Resources Research in the 21st Century (NRC).

Technologies

- Participants noted that many efficient irrigation systems have been developed, but these are not widely used due to low pricing for water, and other socioeconomic factors such as low prices for agricultural products.

- Aquifer storage (or "groundwater banking") was cited as a promising approach in which groundwater storage is integrated with existing surface water storage and delivery systems. This has been used in California and in Arizona, through the Arizona Water Bank Authority.

- It was noted that the Pacific Institute has studied both aquifer storage and the use of treated wastewater.

Education and Awareness

- The Groundwater Foundation in Nebraska was cited as an organization that has developed a novel way of educating people about groundwater through its Children's Groundwater Festival.

- Public pressure was identified as an important tool that has been instrumental in protecting groundwater recharge areas in the Oak Ridges Moraine, north of Toronto, Ontario.

2.3.3 Potential Roles for the CEC

Participants were asked to identify potential roles that the CEC could play in freshwater and groundwater issues.

Management Structures and Management Approaches

- A participant suggested that the CEC could carry out research into the design of effective transboundary water management institutions. This could include defining what is possible to achieve by expanding the roles of existing institutions, conducting a needs appraisal, and evaluating the ability of existing institutions to address integrated management of ground and surface waters.

- A number of participants argued that the CEC should use a "pilot project" approach. It should work with agencies, universities and stakeholders to develop a pilot project on integrated ground and surface water management. This should build on the lessons learned at some of the "success stories" mentioned by participants and effective approaches and tools used elsewhere.
    - A participant cautioned that, as an outside agency, it might be difficult for the CEC to get "in the door" to access stakeholders for such types of projects.
    - Concern was also raised about not duplicating efforts that were already underway.

- The Rio Grande/Río Bravo basin was identified by a number of participants as an area in which groundwater will become a huge, bilateral issue, and an area where creative problem solving is needed. The CEC could hold stakeholder meetings in the basin to identify the key issues that need to be resolved.

- The Chihuahua area was also identified as an area in which the CEC could carry out research on effective management approaches.

- A participant noted that sixty years ago, surface water management was "the issue" along the United States/Mexico border and suggested that groundwater may soon assume a similar status. Given this, it was suggested that the CEC could coordinate efforts to examine conjunctive water management along the United States/Mexico border.

- The CEC could take the principles used by the IJC (joint factfinding, stakeholder involvement and consensus approaches) and apply them to integrated management of ground and surface waters in nonboundary areas of North America. The need for consensus-based approaches was emphasized by many participants as being critical for sustainable management of water resources over the long term.

- Whatever projects were undertaken, a participant emphasized that the CEC needed to consider the whole environment (i.e., to integrate groundwater not only with surface water, but also with wildlife, economic and social issues).

- The CEC could broaden the criteria for accessing the North American Fund for Environmental Cooperation (NAFEC) and direct funds to local interests to promote improved groundwater management.

Data and Information

- The CEC could develop an inventory of data availability and data gaps.

- A participant suggested that the CEC could examine the effects of climate change on transboundary waters along both the United States/Mexico and United States/Canada borders.

- A participant suggested that, as a neutral third party, the CEC can host meetings and conferences that would bring local governments, NGOs and agencies together to address

the issues associated with integrated management of ground and surface water. This is a role that CEC has played effectively in the past.

- The CEC could support the First International Symposium on Transboundary Waters Management that is being held in Monterey, Mexico, in November 2002.

Education and Awareness

- The CEC could develop a role for itself in raising public awareness about the importance of groundwater. It could "become an advocate for the sustainable use of groundwater."

Other CEC Issues

- A participant suggested that the CEC could examine the links between groundwater and other issues that it is involved in, such as free trade.

2.3.4 Next Steps and Adjournment

Greg Block thanked participants for sharing their experience, ideas and time. He briefly commented on the CEC's previous experiences in the water issue. He felt that the CEC's work in the San Pedro River had been very productive, but that it was a mechanism that should be used judiciously. The recent publication, *North American Boundary and Transboundary Inland Water Management Report*, referenced many of the items discussed and recommendations made at the workshop. Greg noted the ideas generated in the Expert Workshop would be used by the CEC to craft water-related options to be considered by the Council in their next meeting.

Rita Pearson Maguire thanked Adele Hurley and the Munk Centre for hosting the workshop, and thanked participants for their participation, creativity and enthusiasm.

3 KEY THEMES AND OBSERVATIONS

Discussions at the workshop were lively, interactive and thought-provoking. A number of key themes emerged through the day.

- First, there was consensus among the experts on the need for action on groundwater. All agreed that it was a vital North American resource that was under threat from human stresses (overuse, contamination, population growth, climate change, land-use changes and deforestation).

- There was also general agreement that in many parts of North America, groundwater is in a critical state right now, primarily due to overpumping and contamination of aquifers. The workshop participants were able to identify many areas in each country where this is the case. In such areas, the experts argued, immediate action was needed to address groundwater problems and could be taken on the basis of available information.

- There was a general agreement that in the future, pressures on groundwater will increase as populations expand, climate change takes place and surface water supplies are used up.

- The complex nature of the groundwater issue was a common thread that linked many of the day's sessions. Groundwater is institutionally complex: across North America, its management is scattered among dozens of regional, provincial, state and federal agencies. It is scientifically complex in that it forms part of the hydrologic cycle, which is itself an intricate and not fully understood system. Finally, groundwater is complex in that it is not just part of our ecological systems, but also part of our economic and social systems.

- A related theme was that of diversity. Many participants noted the differing legal and policy frameworks for managing groundwater that are found across North America, and the differing national cultures. Not only are there important differences from country to country, but also there can be large differences from state to state or province to province. The characteristics of watersheds and aquifers also differ widely. In addition, priorities for action may well differ from country to country. One important aspect of this diversity is the differing capacity to address the issue between Mexico and the United States and Canada. One implication of this diversity is the inappropriateness of a "one size fits all" approach to the integrated management of ground and surface water.

- Participants generally agreed on the need to manage ground and surface water in an integrated manner and also that this would be challenging to achieve. Although at present there is no one place where integrated water management is being done in a totally successful manner, participants were able to identify a number of effective tools and approaches that are being used in North America and elsewhere. There was a general agreement that studying these "success stories" and developing an understanding of why

they work will aid greatly in moving towards improved management of ground and surface water resources.

- Many participants spoke of the need for effective management structures to manage ground and surface water in an integrated manner. Many suggested that some existing structures (including some watershed-based structures) might be able to manage water conjunctively if their mandates were broadened.

- The need for improved information on groundwater was another common theme in the workshop. Participants argued that good information is the bedrock of effective water management, and that without it, we are handicapped in our decision-making. Among the key information gaps identified were: water use, recharge rates and summary information at regional and national scales. The lack of understanding of how aquifers operate and of how groundwater and surface water interact were also identified as important information gaps that must be filled.

- In every session, participants mentioned the importance of increasing the public's understanding of groundwater issues through education and awareness. Many commented on the challenge of "getting people excited about a resource that is largely invisible." Developing informed and aware stakeholders and users was felt to be necessary for protecting North America's groundwater resources from contamination, for conserving water and effective participation in decision making.

- Yet another theme that echoed throughout the workshop was the importance of involving stakeholders and water users in the management of groundwater. Again and again, participants noted that effective stakeholder involvement mechanisms were integral to successful water management processes.

- Finally, the participants in the Expert Workshop generally agreed that there were a number of useful roles for the CEC that would aid more sustainable use of groundwater in North America. Many of these reflect the CEC's demonstrated strength in bringing stakeholders together to address important issues, its history of dealing with both science and policy, its ability to communicate well on complex issues, and its inclination to work through consensus.

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APPENDIX B: AGENDA

Expert Workshop on Freshwater in North America

Munk Centre for International Studies, University of Toronto
1 Devonshire Place, South House, Campbell Room
21 January 2002

AGENDA

The purpose of the workshop is to examine, from a North American perspective, how best to integrate groundwater and watershed management, including considerations of pricing and technology.

MORNING

8:30 Coffee

9:00 Opening Remarks

- Welcome to participants and introduction of North American Commission for Environmental Cooperation (CEC) Executive Director and staff, workshop facilitator, research writer, observers, Munk Centre staff and translators — Adele Hurley, Senior Fellow, Program on Water Issues, Munk Centre for International Studies, University of Toronto
- Background on the CEC and goals for the day — Janine Ferretti, Executive Director, CEC
- Formal introduction of workshop facilitator — Adele Hurley
- Purpose of the workshop and agenda review — Rita Pearson Maguire, workshop facilitator

9:30 Participant Introduction

- Each participant to provide brief description of work in water-related issues

10:00 Break

10:15 Session 1: Defining the Issue

- Does the discussion paper accurately describe the threats to groundwater in North America?
- Where are the greatest pressures on groundwater currently?

Where can we expect them to develop in the future?
- What are the key barriers that stand in the way of integrating the management of groundwater and surface water, including transboundary considerations?

12:00 Lunch

AFTERNOON

12:30 Session 2: Moving Forward
- What are the most important actions that are needed to move toward integrated management of groundwater and surface water?
- Are there examples of effective management approaches or tools that are currently being used?
- Potential roles for the CEC
  - information

2:30 Break

2:45 Session 3: Wrap Up
- Observations and discussion — Rita Pearson Maguire et al.
- Acknowledgements and next steps

4:30 Adjournment