Policy Research Initiative | Projet de recherche sur les politiques

Sustainable Development
Briefing Note

Integrated Water Resource Management

Highlights

- Integrated water resource management (IWRM) has become the new paradigm for freshwater policy development.
- IWRM integrates land use and water management at a watershed level, to optimize economic, social, and environmental outcomes simultaneously.
- There are as yet few large-scale examples of IWRM in practice; one of the best is the management of a watershed to protect New York City's drinking water supply.

Background

Sustainable development requires that economic, social, and environmental outcomes be optimized simultaneously. In water resource management, this process has come to be referred to as integrated water resource management.

Historically, water management in Canada has tended to be a matter of ensuring:

- water supply for irrigation in drought-prone regions; and
- the quality of fish habitat and drinking water supplies through regulation of toxic chemicals and other forms of pollution including municipal wastewater effluent.

Until recently, these two concerns were frequently handled in very separate "stove-piped" planning processes and, often, neither concern was taken into account in land-use planning decisions. Pollution regulation in Canada is still largely through "end-of-pipe"[1] approaches, and water supply managers still have little input in most land-use planning decisions.

While there have always been isolated cases of more integrated approaches, the Walkerton crisis of 2000 served as a wake-up call in Canada. Now, IWRM is the preferred approach, and decision makers across the country are struggling to better understand the principles and practical implications of IWRM.

What Is IWRM?

While there is no one generally accepted definition, all definitions do share common elements. The Global Water Partnership defines IWRM as "a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant

1 "End of pipe" regulation limits the concentration and/or amount of a particular chemical being deposited in a water body by a particular source; it is contrasted with the "total maximum daily load" approach, which determines the maximum quantity of a pollutant that a receiving body can tolerate in a day, and limits total deposition by all sources. End of pipe approaches are generally believed to be less integrative than total maximum daily load approaches, in that they do not take into account the total load from all polluters, or allow for variation between water bodies in receiving capacity. The US Environmental Protection Agency is promoting total maximum daily load approaches.

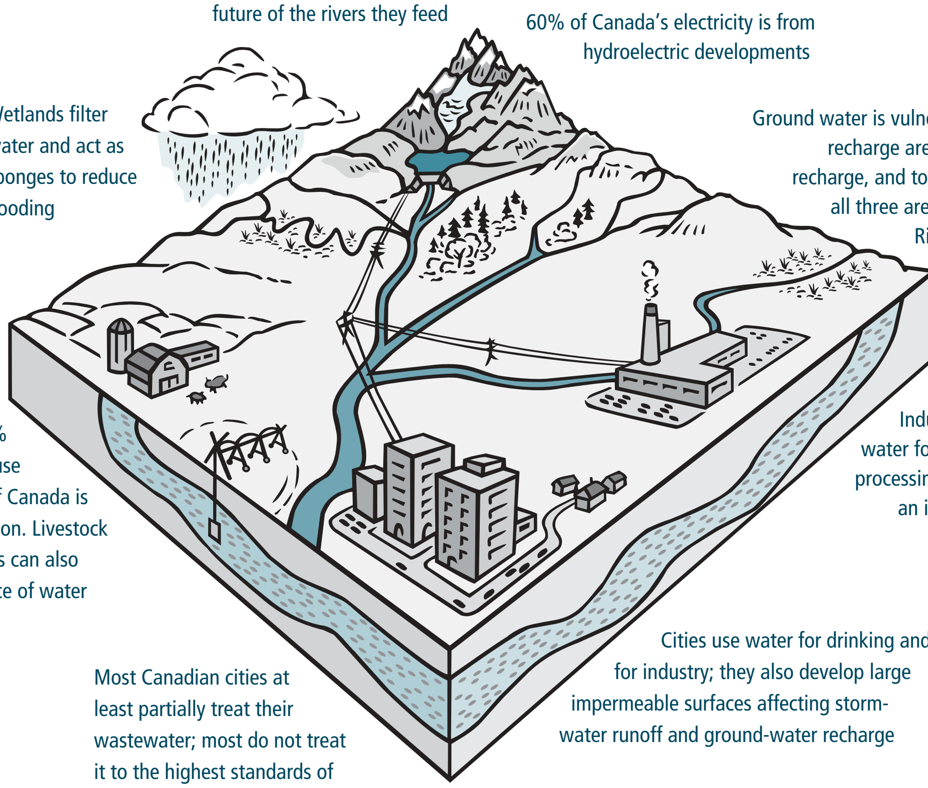
Canada

economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." All practitioners agree that this requires a highly consultative process, engaging the community as well as other stakeholders. Indeed, to maintain equity for present and future stakeholders, IWRM is normally a highly consultative process.

Integrated water resource management is generally presented as based on the Dublin Principles (adopted by an international conference in Dublin in 1992):

- Fresh water is a finite and vulnerable resource, essential to sustain life, development, and the environment.
- Water development and management should be based on a participatory approach, involving users, planners, and policy makers at all levels.
- Women play a central part in the provision, management, and safeguarding of water.
- Water has an economic value in all its competing uses and should be recognized as an economic good.

Integrated water resource management is essentially sustainable development applied specifically to water management. With this approach and a focus on land uses that affect water, such as forestry, agriculture, industrialization, urbanization, and conservation, IWRM often seeks to reduce the impacts of various forms



of development in a watershed through alternative land-use practices with less impact, but similar or better economic and social benefits or by buying out landowners to change the land use completely. For example, by developing improved manure management on farms, the farm becomes more productive at the same time as the nutrient loading to adjacent water bodies is reduced.

How Is IWRM Applied?

At its core, IWRM must consider possible uses of both water and land in a linked fashion. For example, afforestation of a non-irrigated farm region is likely to result in reduced stream flow, leaving less water for other uses. At the same time, removing or upgrading intensive livestock operations is likely to reduce the threat of *E. coli* and other pollutants in the water supply. Conversely, if water is allocated to industry, such as oil and gas extraction, there may be insufficient water remaining for other land uses, such as agriculture. Finally, all these choices will have impacts on the quality and quantity of water available for human consumption and environmental services.

Most often, IWRM is applied when a specific problem needs to be addressed without excessive cost or economic dislocation. The issue is frequently either a contaminated drinking water supply or insufficient water availability for agriculture or industry.

IWRM focused on safe drinking water: New York City

When faced with deteriorating input water quality, New York City had the choice of building a new water treatment plant at an anticipated cost of US$6 billion or taking measures to improve and protect the quality of the source water. With an IWRM approach, the issue was resolved at a cost of only US $1.6 billion. To accomplish this, New York used a combination of voluntary buyouts of farmland (over 130 km^2 had been acquired by 2002), subsidies for implementing best practices in farming, forestry, and other industrial operations, grants to upgrade upstream wastewater treatment plants, and direct cash payments to communities in the watershed to compensate for foregone development potential due to these and other conservation-oriented measures. The results have been impressive with a more than 50 percent reduction in coliform bacteria, total phosphorus, and several other major contaminants. This protects the City's drinking water supply, as well as the ecosystem services provided by the lakes, streams, and wetlands in the watershed.

IWRM focused on recreation: Pine Lake, Alberta

Pine Lake is one of Alberta's première recreational lakes. Located between Calgary and Edmonton, it draws many summer campers and tourists. In the late 1980s, local residents noticed an increase in the frequency of algal blooms, which degraded the recreational appeal of the lake. Scientific research showed excess phosphorus, nearly one third of which came from surrounding farmland.

A community-based effort, supported by the government of Alberta, organized information sessions, and some financial support for area farmers willing to improve their manure and fertilizer management. Campground and domestic septic systems were also upgraded. Alberta Environment installed a hypolimnetic withdrawal system[2] and water chemistry monitoring stations. The result has been cleaner lake water with fewer algal blooms. Since most of the changes were either low-cost adjustments to farming practices, or were subsidized by the community association and government of Alberta, the cost to farmers was minimal. The program is viewed as a success, and is being used as an example of community-led IWRM.

2 A hypolimnetic withdrawal system removes nutrient-rich water from the bottom of the lake where organic matter decays. Nearly two thirds of the phosphorus in Pine Lake came from the bottom water.

IWRM focused on water availability for agriculture

In 1858, Henry Hind suggested a dam across the South Saskatchewan River to connect the South Saskatchewan to the Qu'Appelle River, creating a waterway stretching from Lake Winnipeg to the foothills of the Rocky Mountains. This vision was realized in 1967, with the completion of the Gardiner Dam and the creation of Lake Diefenbaker. But the motivation was no longer to provide for water transport, but rather to provide surface water storage for multiple purposes, principally irrigation for agriculture.

Side benefits built into the project include hydro-electric generation, recreation, and a drinking water supply for 45 percent of Saskatchewan's population. Habitat for waterfowl, such as the endangered piping plover, and for other aquatic wildlife is one visible environmental co-benefit of the project. Other co-benefits include the diversification of regional agriculture and thus of Saskatchewan's economy, thanks to the increased reliability of the irrigation water supply, abundant groundwater recharge, and even an effect on the regional climate – the lake is large enough that evaporation from its surface increases precipitation in the dry regions downwind of the lake.

IWRM in the Coming Decades

Many other examples of successful partial applications of IWRM principles can be found. As a planning approach, IWRM is well accepted for municipal watersheds and other regions where upstream water uses threaten water quality. In Canada, economic aspects of water use continue to be difficult to incorporate fully into IWRM approaches, largely because the abundance, or perceived abundance, of water in Canada means it is not generally valued economically, and externalities associated with the use of water are rarely incorporated in economic analyses.

More and more, IWRM is taught at colleges and universities around the world as being the way things are done. As it becomes more ingrained in the thought processes of planners, managers, and policy makers, it will continue to inform the development of solutions that optimize social, economic, and environmental outcomes simultaneously, and will thus serve as an example of how sustainable development principles can be implemented. One impetus toward the adoption of IWRM in Canada is the Plan for Implementation from the World Summit for Sustainable Development in Johannesburg, which requires Canada to develop IWRM and water efficiency plans by 2005.

Further Reading[3]

Environment Canada offers a Canadian perspective on IWRM in *Water and Canada: Preserving a Legacy for People and the Environment.* 2003. Please see at <www.ec.gc.ca/water/en/info/pubs/wwf/e_contnt.htm>.

Global Water Partnership has an IWRM toolbox that provides valuable case studies and other insights, at <www.gwp.ihe.nl/wwwroot/GwpORG/handler.cfm?event=home>.

New York City offers details of its watershed management program, at <www.ci.nyc.ny.us/html/dep/html/watershed.html>.

Solanes, Miguel and Fernando Gonzalez-Villarreal review the Dublin Principles and their application in legislation around the world, at <www.thewaterpage.com/SolanesDublin.html>.

3 All URLs were accessed February 25, 2004.