Source Water Protection
The Basics

Source water protection takes a preventative and comprehensive approach to water treatment for drinking water. It goes beyond the traditional water treatment option that treats water at the treatment plant. In very simple terms, protecting the 'source' of drinking water is the next major advancement to assuring safe drinking water.

What is a Source Water Protection?

Source water is untreated water from rivers, lakes, or aquifers.

Source water protection seeks to protect sources of drinking water from contaminants and excessive withdrawal.

Photo: Trevor Dwyer

The benefits to communities of protecting their drinking water supplies might best be understood by describing the costs of failing to protect them.
— United States Environmental Protection Agency & Drinking Water Academy, 2002

The cost of failing to protect source waters

Source water protection removes heavy reliance on treatment technology and operation, instead ensuring drinking water protection before water arrives at the treatment plant.

Walkerton, Ontario. May 2000. Contamination of groundwater supply by highly dangerous O157:H7 strain of *E. coli* in farm runoff during a heavy rain event.

- Cost: at least 7 lives, over 2,300 people seriously ill.
- Financial cost (CBC 2004a):
  - At least $64.5 million and an estimated $155 million, if including human suffering
  - About $4000 on average per household in town of 5000, for a total of $6.9 million
  - Real estate values in Walkerton fell $1.1 million
  - Town's lost revenues estimated at $2.7 million from May 2000 to April 2001
  - More than $9 million to fix Walkerton's water system
  - Ontario government spent about $3.5 million on legal fees
  - Ontario government spent $1.5 million to supply clean water to institutions

- The Walkerton tragedy resulted in new legislation (the *Clean Water Act*) in Ontario to institutionalize source water protection throughout the province.

North Battleford, Saskatchewan. Spring 2001. Reduced efficiency of the surface water treatment plant failed to adequately remove cryptosporidium from the river water, likely contaminated by cattle feces upstream of the community.

- Cost: 5,800 to 7,100 persons in and near North Battleford became ill with gastrointestinal symptoms

Milwaukee, Wisconsin. March-April 1993. Malfunctioning water treatment plant did not adequately remove cryptosporidium from the water source.

- Cost: about 100 people died and over 400,000 more became ill.
- Financial cost (Corso *et al.* 2003): $96.2 million ($31.7 million in medical costs and $64.6 million in productivity losses). The average cost for those persons who became ill was up to $7,808.

Where are people proactively protecting water sources?
- *New York*
- *Ontario*
- *Victoria*

See detail below for source protection initiatives.

Reasons to protect source water

- Public health: Clean drinking water protects human health
- Healthy aquatic ecosystems: Protected source water areas often translate to more healthy aquatic ecosystems and water-dependent wildlife
- Economically smart: Protecting sources is the most cost-effective method of ensuring clean drinking water
- Public trust: Safe water builds trust in public agencies
- Water security: Protected source water areas can ensure water is abundant and safe

Threats to our source waters

Land use decisions often affect our water resources. Contamination from pollutants such as pesticides and hydrocarbons, extra nutrients from point and non-point sources, and sedimentation from erosion are all threats to the source of our drinking water as well as aquatic ecosystems.

Threats include:

- Agricultural runoff: Nutrients (from fertilizers and manure), sediments (from top-soil erosion), pesticides, and pathogens (from livestock manure).
- Pathogens and algal toxins in source water from waste in water and algal blooms caused by high levels of nutrients.

- Forestry activities: Erosion due to removal of stream buffer areas, road and other linear features, and off-highway-vehicle use, which increase sediment and nutrients in water bodies.
- Hydrocarbons from pipeline leaks and other water and ground contamination.
- Water quantity pressures including excessive withdrawals, dams, and climate change
- Acidification from long-range atmospherically transported chemicals
- Excessive withdrawal of water can reduce that river's (or other water body's) capacity to dilute or assimilate pollutants, nutrients, and sediments.

Urban threats include:

- Stormwater from heavy rains: Hydrocarbons, chemicals, pesticides, and sediment. Impervious surfaces (roads, pavement, roofs) *decrease* infiltration of precipitation into ground and thereby *increase* the amount of stormwater. Higher amounts of stormwater can impact water quality and the integrity of stream channels.
- Wastewater effluent returned to river: Pharmaceuticals (from unmetabolized, or improperly disposed of drugs), endocrine-disrupting substances (e.g., from birth control pills), high levels of nutrients, and chlorine and ammonia byproducts from treatment processes.
- Residential or industrial development over groundwater recharge areas and alluvial aquifers can inhibit recharge of groundwater due to impervious surfaces, and can lead to contamination of groundwater due to spills or leakage of contaminants in area.
- Chemicals in industrial effluent, and leaching from waste management facilities.
- Lack of proper training and capacity of staff, emergency reporting processes, and ongoing monitoring.

Development does matter!
In an undeveloped watershed, ~ 50% of the precipitation infiltrates the ground and only ~ 10% flows over the land surface as 'runoff.' In a highly developed watershed with more impervious surfaces and less vegetation, only ~ 15% of the water infiltrates and 55% becomes surface runoff which carry pollutants to surface water bodies (Ernst 2004, 11).

Strategies to protect source water

Better land management is central to assuring source water protection because it addresses the challenge of non-point pollution and water system integrity. In the US, the leading cause of source water degradation is non-point source pollution (Ernst 2004).

Protection approach

Buy the watershed and prevent access to area.

Examples: Capital Regional District of **Victoria, BC** owns almost 20,000 hectares of land dedicated to the protection of the region's water supply (CRD).

Collaborative approach

Collaborate with "owners" of the upstream watershed. Partnerships, multi-stakeholder collaboration are necessary to share the watershed to the benefit of all or readjust trade-offs of activities in the watershed.

Examples: **New York City** and the Catskills watershed

Management approach

Establish protection areas, or management areas to control the types of activities that can occur in the watershed. Land-use zones can allow specific activities in specific areas, or avoid specific activities in protection areas.

Examples: Groundwater management areas in **Victoria, Australia**, **Oak Ridges Moraine, Ontario**, Protected Water Areas designated under the *Environment Act* in **Nova Scotia**.

What is Alberta's approach?
Logging, mining, oil and gas extraction, and, in particular, the associated roads in Alberta's headwaters, the Eastern Slopes, have put two-thirds of the southeastern watersheds at moderate risk and one-third at high risk of erosion and stream channel change by the 1990s (Maywood *et al* 1998).

Pollution-prevention approach

Prevent contaminants from getting into the source, such as wellhead protection, treating stormwater (or better stormwater management) and street cleaning.

Incentive approach

Price water withdrawals and discharges to promote full-cost accounting and prevent pollution.

Education

Educate the public and stakeholders about the effects of activities on water and the importance of source water protection.

Multiple Barrier Approach

Source water protection is part of a *multiple-barrier approach*. The multi-barrier approach involves "a series of safeguards along the water supply route to prevent or reduce contaminants from making it through the drinking water system" (Nova Scotia Environment and Labour 2002, 18).

The multiple barriers in source water protection include:

- Keeping the water clean
- Treating water to make it safe
- Monitoring the water to ensure it remains safe
- Taking action if a problem occurs.

Steps to develop a source water protection plan (SWPP)

A source water plan is similar to a watershed plan but utilizes a multi-barrier approach for the purpose of protecting drinking water. Source water protection planning is key to reducing threats to source water and it needs to be a central theme of all land-use planning.

1. Delineate a source water protection boundary (e.g. a watershed boundary).
2. Complete an inventory and characterization of the water source.
3. Develop an up-to-date inventory of all pollution sources and other threats affecting the water source's quality and quantity.
4. Develop the source water protection plan.
    a. Stage 1: Develop objectives and priorities based on information gathered.
    b. Stage 2: Identify and select alternatives to meet objectives. Identify strategies to implement alternatives, and determine how to measure progress.
    c. Stage 3: Write action plan and implement strategies and periodically evaluate progress.
5. Develop a monitoring program to verify SWPP is being implemented and meeting objectives.

Adapted from Indian and Northern Affairs Canada (INAC 2006), and Nova Scotia Environment and Labour (2002).

How have other jurisdictions worked toward source water protection?

Many provinces and states in North America are working to protect drinking water sources.

Ontario's *Clean Water Act*, established source water protection multi-stakeholder committees develop source water protection plans on a watershed basis. These committees report to source protection authorities (a new role for conservation authorities). These plans will require approval from Ontario's Minister of Environment. (MOE 2008)

The *Drinking Water Strategy for* ***Nova Scotia*** (2002) makes source-to-tap protection of drinking water a central goal. At least 24 of Nova Scotia's 82 municipal water supplies are designated as Protected Water Areas or have in place a comprehensive water supply protection strategy (NSEL 2002, 10). The Department of Environment and Labour through the new Inter-Departmental Drinking Water Management Committee is using a number of strategies to implement an action plan for source-to-tap protection of Nova Scotia's water.

British Columbia's *Drinking Water Protection Act*, 2001 has some provisions for source water protection, where a water supplier must inventory and assess land use and other activities and conditions that might affect the drinking water source (GBC 2001, S.18(2)(a)).

To safeguard the city's drinking water source, **Seattle, Washington** worked over a century since 1896 to permanently protect 100,000 acres of the Cedar River Watershed (Ernst 2004).

A grassroots effort in the early 1990's around **Suffolk Country, New York** led to protection of the Pine Barrens, a critical groundwater recharge area. The *Pien Barrens Protection Act* in 1993 established a commission that oversaw development and implementation of the Comprehensive Management Plan (CMP). The CMP outlined two major regions within the 100,000 acre area – a 52,000 acre core preservation area where no new development is permitted, and a 48,000 acre area where environmentally compatible development is allowed (Ernst 2004, 12-13).

The **New York City's** Watershed Management Plan is a much-touted example of cooperating with and incenting landowners to protect the Catskills and Delaware watersheds for high quality downstream drinking water. It allowed the City to avoid over $6 billion in costs for two new water filtration plants. In response to the 1989 Surface Water Treatment Rule (SWTR) issued by the United States Environmental Protection Agency, the city of New York developed a comprehensive watershed management plan to avoid filtration of its two primary drinking water sources (UNEP; ICE; Murphy *et al*). For more information visit Environmental Protection Agency.

The **US federal 1989 rule** required all municipalities to filter surface water sources of public drinking water unless the municipalities are able to meet certain health criteria and approve watershed management strategies that protect the water supply from risk (Tyrchniewicz & Tyrchniewicz 2007). In **1996, amendments to the U.S. *Safe Drinking Water Act*** prompted a new focus on source water protection to prevent contamination of drinking water supplies rather than simply removing the contamination. The law required every state to develop Source Water Assessment Plans (SWAP) to identify threats to a public water supply. This law recognized the need to broaden treatment options to an integrated approach that focused on 'contamination prevention' and therefore watershed protection (Ernst 2004).

How does Alberta protect its drinking water and source water?

Alberta Environment regulates municipal drinking water systems under the following legislation:

Environmental Protection and Enhancement Act

Potable Water Regulation

Activities Designation Regulation

Approvals and Registration Procedure Regulation

Code of Practice for a Waterworks System Consisting Solely of a Water Distribution System

Code of Practice for Waterworks Systems Using High Quality Groundwater

Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems

However, there is no specific source water protection policy or legislation that exists to comprehensively achieve source water protection. *While Water for Life: Alberta's Strategy for Sustainability* holds the promise of a new drinking water strategy, there is substantial room for meaningful progress on source water protection in Alberta.

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