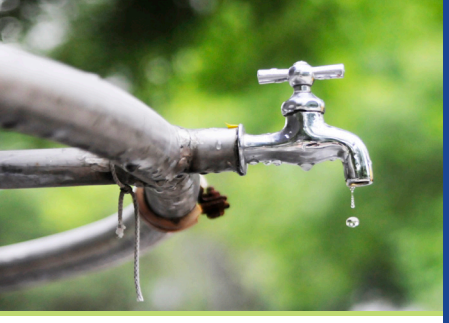
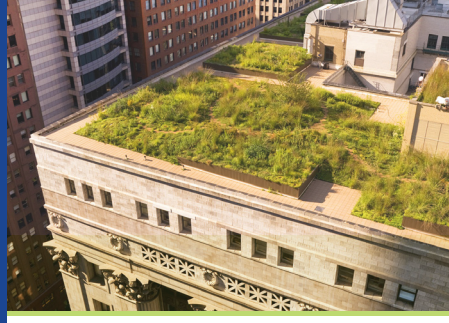


GREATER LAKES

Reconnecting the Great Lakes Water Cycle



Healing Fractured Water Systems through Integrated Water Management

Greater Lakes Project | September 2015

All across the Great Lakes basin, the natural water cycle has been fractured—and in some cases completely broken. Our built environment inhibits infiltration and increases runoff and the gathering and pushing of pollution into nearby surface waters. The impacts are ecologically destructive and socially and economically damaging.

Through an integrated approach that treats all our water services – water supply and wastewater and stormwater management - as part of the hydrologic cycle, the Greater Lakes Project aims to help heal these fractures. We hope to do so by reconnecting the Great Lakes water cycle through more integrated, sustainable management of our water uses in ways that restore and support the natural water system and our watersheds. This requires shifting from a paradigm where water is just something to be used and gotten rid of to one where water is valued and its essential ecological roles are appreciated. It also requires integrating water conservation and efficiency and green infrastructure into our standard ways of handling water. Fortunately, many municipalities in the Great Lakes basin are now taking actions to heal the fractured water systems. But we have much further to go.

The Natural Water Cycle

In the natural water cycle, when rain or snow falls onto the ground, part of it infiltrates into the groundwater where it replenishes ground water supplies critical for habitat and human uses. Some of the water runs off the surface of the ground into streams, rivers and lakes. And some of it evaporates into the atmosphere where it again contributes to precipitation.

The extent to which the water takes each of these paths in an undeveloped area varies according to natural conditions (weather patterns, slope, soil type, etc.). Under typical natural conditions, as shown in Figure 1, approximately half of the precipitation that falls infiltrates the ground, while about 40 percent evaporates back into the atmosphere, and approximately 10 percent immediately runs off into streams, rivers and lakes. Under

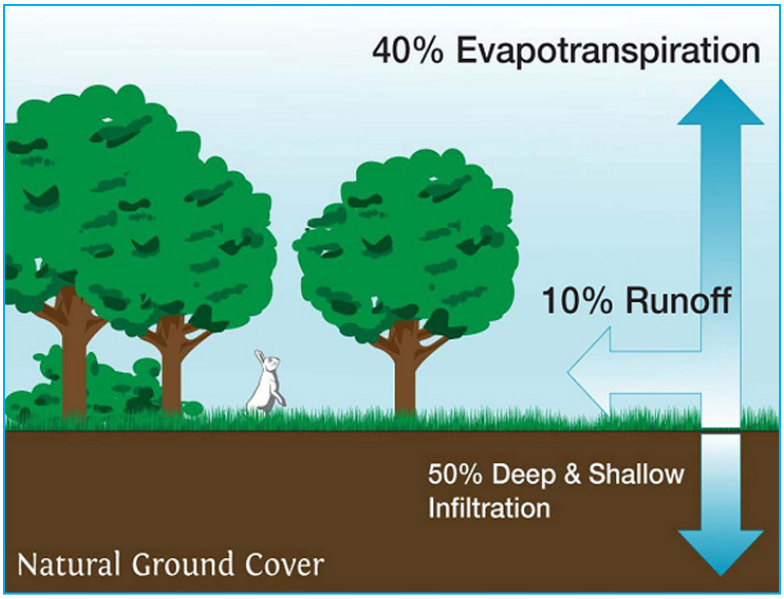


Figure 1. Source: Credit Valley Conservation

natural conditions, water that falls on the ground infiltrates into the soils replenishing groundwater supplies. These groundwater supplies are critical because they gradually release water into marshes, streams, rivers and lakes, sustaining life over the long-term as well as sustaining water supplies for human uses.

The Fractured Water System

However, most of the Great Lakes basin is no longer in a natural condition. The paths that water travels have been substantially disrupted and/or modified by urban development and attendant water infrastructure.

Impervious Surfaces

Between 30 and 50 percent of the land in urban areas is typically covered with roads, roofs, parking lots and heavily compacted lawns that have no or low permeability. This traditional type of urban development interrupts or disrupts the natural flow of precipitation, which would otherwise allow infiltration to occur slowly in the location where it falls (Figure 1). Instead, impervious surfaces create massive surface runoff that picks up pollutants from streets, parking lots and rooftops and flows either directly into streams and rivers or goes into drains that discharge into rivers and lakes (Figure 2).

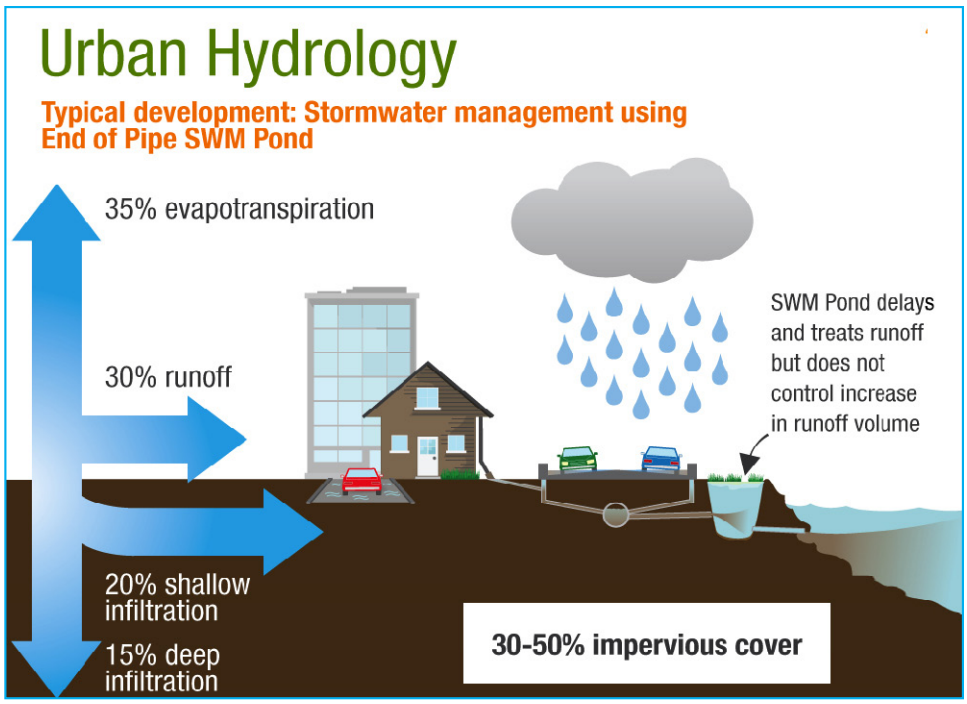


Figure 2. Source: Credit Valley Conservation

Pipes and Drains

We withdraw water from the ground, rivers and lakes for our use, but rarely return it to the place from which we withdrew it. Once used, water is treated as a waste to be gotten rid of as quickly as possible through drains and pipes that discharge to streams, rivers or lakes. Likewise, we catch rainwater or snowmelt in storm sewer systems and send it away from where it fell as quickly as possible.

Negative impacts of the fractured urban water cycle are significant. Receiving waters are easily overwhelmed by the rapid delivery of large quantities of storm and wastewater discharges causing stream scouring (e.g., cutting away of banks that stabilize streams and hold vegetation in place). Too often, the receiving waters simply cannot handle the vast quantities of water, and often nearby floodplains no longer exist to provide much needed backup. Pipes back up, resulting in the flooding of streets, homes and businesses. As shown in Figure 2, in this urbanized system, about 30 percent of the water that falls is moved through pipes to major discharge points This is three times more water being rushed out into rivers and streams during a rainfall or snowmelt. While the amount of water moving over the surface is tripled, the amount of water infiltrating and recharging groundwater is reduced to about two-thirds of what it would be under more natural conditions, resulting in more vulnerable groundwater supplies.

In addition to too much water, the quality of storm and wastewater is variable. Many Great Lakes urban areas have combined sanitary and storm systems that overflow during storm events releasing untreated sewage—a problem that occurs even where sanitary and storm systems are separated if the systems are not designed with adequate capacity. As we invest millions to move water away as quickly as possible, we are creating million dollar problems as we deprive habitats and aquifers, in the areas where the water was taken, of the water needed to thrive and recharge.

These problems are exacerbated by aging and failing water infrastructure, poor land use planning, wasteful behaviors toward water use, and divergent and disjointed approaches to water management. This scenario is amplified in a climate-changing world where more frequent and severe storms are predicted for the Great Lakes, and are already occurring.

Reconnecting the Water Cycle

To mend the fractured water cycle, we must develop a more integrated, holistic approach to water management that explicitly recognizes that all water is part of a single hydrologic cycle. We need to eliminate the separate concepts of "source water", "wastewater" and "stormwater." It is one water.

Then, we need to restructure our governance institutions and decisionmaking processes in ways that maximize the natural water cycle and its attendant ecological, social and economic benefits. Ecological benefits include aquifer recharge, improved aquatic and riparian habitats, the associated ecosystem services of a more safe and secure water supply and improved recreational opportunities, including fishing, and even improved fisheries as a source of food supply. Social benefits include reduced economic disruption due to loss of life and property as a result of flooding or exposure to untreated or poorly treated water. Economic benefits include reduced capital expenditures on gray infrastructure and minimized economic losses due to flooding.

We must also make our decisions based on restoring the natural water cycle for the diversity and health of all life within the ecosystem – not just for human purposes. Restoring the water system to a more natural condition will better serve both human needs and the needs of wildlife and other parts of the ecosystem.

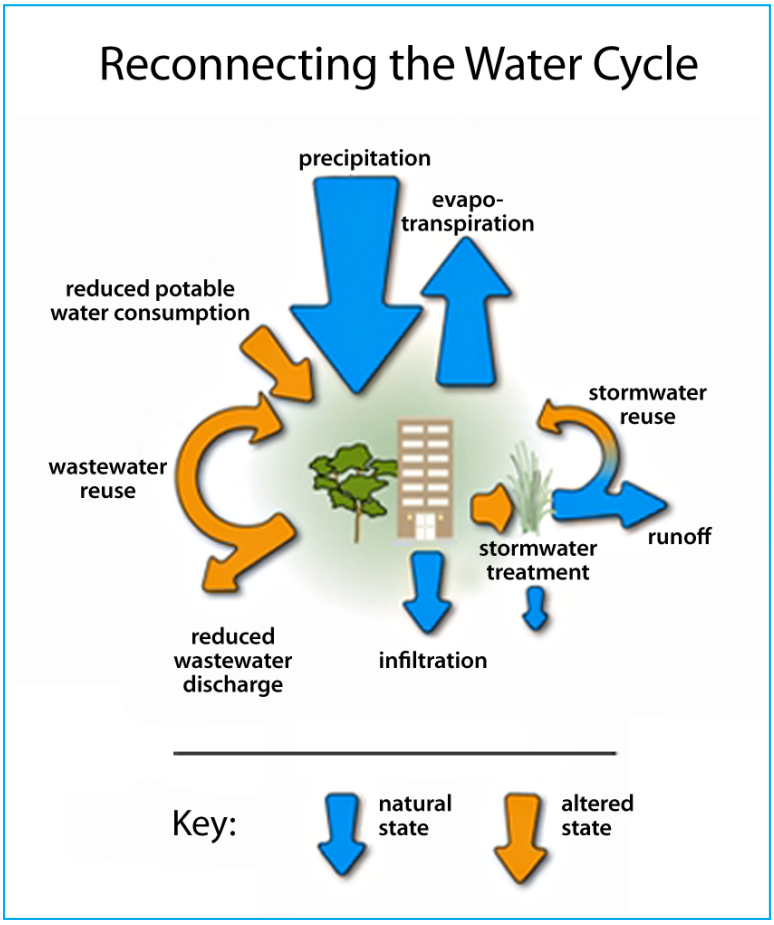


Figure 3. Source: Healthy Waterways (www.healthywaterways.org)

We should make decisions about water supply, waste water and storm water in an integrated way that ensures that all decisions have positive impacts on the entire water system (See Figure 3). Unfortunately, our current decisionmaking process with respect to water management is often disjointed, usually being carried out within departmental or sub-departmental silos within each level of government.

What We Can Do

- Set up strong source water protection programs to protect the waters of the watershed for both natural and human purposes;
- Engage in water efficiency and conservation programs to reduce the removal of water for human consumption;
- Set up waste water reuse systems to further reduce water consumption, instead of our now standard "use once and throw away" approach to water use;
- Use heavily treated (and consequently the most costly) drinking-quality water only for uses that require that level of purity. That means, for example, do not use potable water for most outdoor uses, for flushing toilets and washing clothes;
- Redesign our urban areas to reduce the use of impervious surfaces to allow for more infiltration where the water falls;
- Actively design for water infiltration of storm water by implementing green infrastructure systems to reduce the need for the standard water piping systems. Green and grey infrastructure systems need to become part of one integrated, mutually supportive system;
- Set up systems such as cisterns and rainbarrels to capture stormwater for outdoor purposes and for indoor uses such as toilet flushing and clothes washing to reduce the mining of water sources.

An integrated water management approach with a focus on water efficiency and conservation, and on green infrastructure as core components of the water system enhances the environment, avoids potential problems such as flash floods and water supply scarcities and decreases government costs.

Fortunately, many municipalities are now adopting these kinds of solutions. The Greater Lakes: Reconnecting the Great Lakes Water Cycle Project is working with municipalities to find solutions to the barriers that sometimes arise when municipalities try to implement these solutions.

For information on the lessons that we and others have learned, check out our website at http://glc.org/projects/water-resources/greater-lakes.

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