Chapter One

PHYSICAL INTEGRITY: IMPACT OF URBAN AREAS ON GREAT LAKES WATER QUALITY

Introduction

The need to plan and manage urban growth and mitigate its impact on the natural environment, particularly on urban watersheds and nearshore areas, is one of the major challenges in restoring and maintaining the physical integrity of the waters of the Great Lakes basin ecosystem. **The fundamental question to be addressed by governments is whether the sum of their policies, programs and management efforts are sufficient to protect water quality from the impact of continued expansion of its major urban areas in the Great Lakes basin.** This is an important question that is best answered binationally at the lake basin level, with participants drawn from all three levels of government (municipal, state/provincial and federal). Lake Erie has extensively shared boundaries and major urban areas, and the Lakewide Management Plan as called for under the Agreement and ongoing Lake Erie Millennium Network ecological study could provide an important ecosystem context for such an integrative assessment of the impact of urban land use on Great Lakes water quality.

The Impact of Urban Development on Water Quality

Principal water pollution sources from urban areas include:

- treated effluents discharged from sewage treatment plants and untreated effluents that bypass sewage treatment plants;
- treated and untreated storm water runoff;
- combined sewer overflows that carry a mixture of untreated sewage and storm water;
- air emissions from incidental and accidental releases and mobile sources; and
- ground water discharges to adjacent receiving waters.

The multi-billion dollar investments in wastewater and combined sewer overflow controls substantially reduced the worst pollution problems during the 1970s to the 1990s. However, most urban and suburban watersheds – including nearshore areas of major Great Lakes cities — are still not safe for swimming, do not have fish that are completely safe to eat, or do not support diverse biological communities.[1] The increase in hardened surfaces from roads, roof tops and parking areas means more pollutants enter surface waters via runoff without undergoing treatment, which has a significant impact from a basin wide perspective. For example, recent Canadian estimates indicate that the sum of major storm water-related discharges to the Great Lakes are in excess of 90,000 tonnes/year (~100,000 tons/year) of sediment, oil, grease, metals, and other contaminants.[2]

The expansion of major urban areas in the Great Lakes basin (Figure 1) can be attributed to many factors: population growth; land use preferences (for example, favoring suburban greenfields over urban brownfields); the tendency towards fewer people living in each household, thus necessitating more housing; and large suburban commercial and retail properties with extensive hardened areas for parking and access to highways. Unless these trends are anticipated and managed effectively, the continued expansion of major urban areas in the Great Lakes basin will have serious consequences for Great Lakes water quality.

Science and Policy Approaches to Managing Urban Hydrology

Most modern urban hydrology management practices focus on storm water, combining elements of flood protection, groundwater recharge,[3] runoff reduction and protecting natural areas, and are based on widely accepted scientific understanding.[4]

Extreme weather events can produce very high pollutant concentrations during initial phases and can have a thermal impact from the "first flush" of standing water heated by hardened surfaces. Real time sensors used by some jurisdictions evaluate storm water quality to ensure adequate initial treatment, storage and then gradual treatment and release when water quality standards have been attained. Other innovative practices include the use of green roofs that incorporate living plants or pervious[5] pavement to allow rain and melting snow

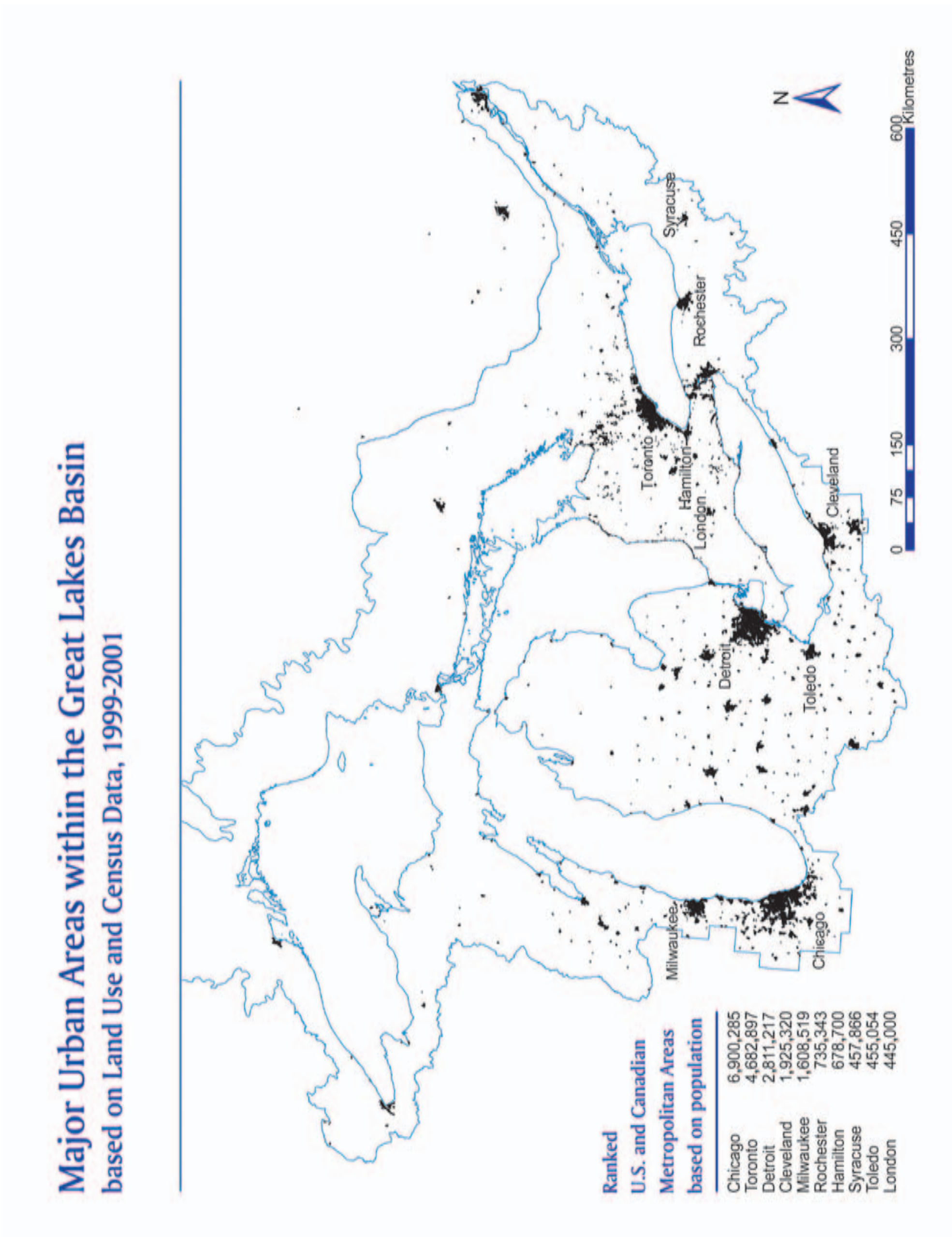

Figure 1. Major Urban Areas within the Great Lakes Basin based on Land Use and Census Data, 1999-2001

to percolate through to the subsurface and water gardens. Although best management practices can be easily identified in scientific literature and may be well understood by professional government agency staff, they are less familiar to local officials, citizens and developers who are making everyday land use decisions. A regional database of such practices and an information-sharing network among basin communities could provide an inventory to be used by local public and private decision makers. A U.S. initiative by the National Low Impact Development Clearing House illustrates how this could benefit Great Lakes developers and decision makers, and has particular merit for the binational context of the Great Lakes basin.[6]

The most innovative approaches recognize that successfully managing urban hydrology is more complex than simply managing storm water.[7] By applying concepts of ecological sustainability to land use management, a broader understanding and appreciation can be gained of a locality's natural processes, impacts and specific conditions. For example, the same commercial development may impact water quality differently depending on where it is located in that basin. Very specific everyday activities, such as the timing and frequency of street cleaning, can also affect water quality. In other cases, so-called best management practices can exacerbate negative impacts if not implemented in ecologically sound ways.[8] Many local and regional planning efforts fail to adequately link the fundamental relationship between the natural and built environments in this way, and thus inadvertently undermine the region's precious land and water resources.

In the United States and Canada, urban runoff is managed and regulated through a combination of federal, state and provincial programs implemented at the local level. The U.S. Environmental Protection Agency's (EPA) overall approach is one of pollution prevention within a larger context of watershed planning. The concept of watershed plans – as contrasted to community plans within city, township or county geopolitical boundary lines – is relatively new. Several planning commissions, councils of governments, and county and township planning boards throughout the region in the U.S. have written and adopted watershed and sub watershed plans. Many involve planning and implementation cooperation among neighboring local units of government. This degree of cooperation demonstrates that storm water management can be effectively addressed as a matter of national or regional policy, and then implemented at the local level using planning and best management practices.[9]

Ontario's experience of watershed planning represents one of the earliest water resource planning activities adopted by any jurisdiction in North America. Under the *Conservation Authorities Act* in 1946, Ontario established a system of conservation authorities throughout most of the province. In 1997, the province reaffirmed its commitment to watershed planning after an inter-ministerial review program that commenced in 1994 and culminated in a final report, *An Evaluation of Watershed Management in Ontario.*[10] The report concluded that **successful integrated planning for land and water uses depended on planning for entire watersheds.** The importance of watershed management gained further impetus in May 2002, when Justice Dennis O'Connor released the *Walkerton Inquiry*; *Part 2* report.[11] This report emphasized protecting the source of drinking water and pollution prevention, based on the premise that poor water quality at the source increases health risks at the tap. To implement the *Walkerton Inquiry's* recommendations, Ontario has proposed to establish 24 watershed-based planning areas to develop source water protection plans.[12]

Several policy initiatives in the United States and Canada have explored broad land use issues under the general term *smart growth.*[13] *Smart growth* encompasses a range of land policy and management concepts, including adopting a longer term vision in order to sustain economic and community development, while at the same time protecting the natural environment.

Urban policy issues of greatest relevance to water quality — land use, transportation and infrastructure — are also central to managing growth and protecting water resources.[14] Basin jurisdictions developing *smart growth* strategies and best practices should share these, which might collectively form the basis for future binational cooperation and coordination among local, state/provincial and federal governments. Future progress under the Agreement, particularly in relation to urban land use, will be further advanced by involving these local governments of Great Lakes cities who have created the programs and policies outlined. Their participation in broader policy and decision-making will recognize their potential role in the achievement of the broader purpose of the Agreement.

The Impact of Urban Development on Groundwater

Within the Great Lakes basin, a significant portion of groundwater discharge occurs directly to the lakes or their tributaries. Most groundwater contaminants are closely linked to urban land use practices: excessive pesticide and fertilizer use; leaking underground storage tanks; malfunctioning private septic systems; and spills or leachate from industrial sites, uncapped wells and road salts. Groundwater also serves as a pathway for bacterial pollution of urban beaches.[15] Within a watershed, the combination of extensive hardened surfaces and groundwater withdrawals for water use can limit the potential to recharge groundwater supplies, diminishing the ability to sustain historic and current stream flow rates. Reduced flows exacerbate the impact of urban pollutants, causing degradation in overall water quality. In some cases, especially under low flow conditions, base stream flow can be predominantly made up of wastewater discharge and urban runoff. Because of the variety of urban development activities that may significantly impact groundwater quality and quantity, any regional watershed plans must incorporate groundwater issues.

As noted in previous reports, progress and commitment to the implementation of Annex 16 of the Agreement, *Pollution from Contaminated Groundwater*, has been limited.[16] While the broad regional approach implied in Annex 16 would provide the best basin wide context for wise development decisions, an alternative approach could be to require developers to explicitly provide for ground water protection in their development plans. Such site hydro geological assessments would contribute to daily decision-making, and could also be compiled into a regional perspective to manage and control contaminated groundwater affecting the boundary waters of the Great Lakes system, as required under Annex 16.

The Impact of Climate Change on Groundwater and Surface Water Quality

Recent scientific research suggests that a new climate, quite distinct from that present at the turn of the 20th Century, may be already in place in the Great Lakes basin.[17] Of great importance is the potential change in water supply that may occur in parallel with increased demand for water as population increases in the basin.[18]

In 2001, the Commission identified the impact of climate change and variability for the Great Lakes region and its residents as a key priority to be addressed by the Water Quality Board during the 2001-2003 priority cycle. In response, the Water Quality Board developed a detailed report, *Climate Change and Water Quality in the Great Lakes Basin 2003*. The board's key findings indicate the potential for climate change to profoundly affect all aspects of the natural and built environment in the Great Lakes basin.[19]

Climate change scenarios continue to evolve as predictive capabilities and scientific models improve. The impact on urban areas, with their extensive hardened surfaces and inadequate storm water infrastructure to manage urban runoff, could be significant if total annual precipitation and the intensity of specific storm events increase as predicted. Extreme weather events can readily mobilize contaminants that have accumulated on hardened surfaces, and can increase the quantity of water bypassing water treatment facilities during storm events. Under such scenarios, the potential for more polluted runoff to bypass treatment is of real concern.

A full understanding of, or appreciation for, the magnitude and consequences of climate change is yet to emerge, and therefore there is no consensus on how to best adapt or mitigate its impacts at a local, regional, national or global level. However, best management practices at the local level could be effective in adapting locally and managing the impact of excessive storm water runoff due to extreme weather events. In the absence of scientific certainty and consensus for action, such practices could represent "no regret" decisions that, in some instances, could provide cost-effective alternatives to major new investments in urban storm water infrastructure.

Conclusions

Some gaps in knowledge may exist regarding the effectiveness of individual technologies, best management practices, policies and processes adopted by local jurisdictions to address the impact of their urban area on Great Lakes water quality. However, the overarching challenge in terms of Agreement goals is whether current approaches are sufficient from an overall, basin wide perspective. A comprehensive and binational assessment of the effectiveness of these policies and programs from a basin wide perspective could provide a

broader context for local decisions, and at the same time advance achievement towards an ecosystem approach as envisioned by the Agreement. While a binational effort to link local, state/provincial and federal agencies to address the impact of urban land use on Great Lakes water quality has not existed since the days of the Pollution From Land Use Activities Reference Group[20], many other examples of binational strategic cooperation exist since that time, such as the Binational Toxics Strategy, Lakewide Area Management Plans and the State of the Lakes Ecosystem Conference (SOLEC). Given the growing interest and awareness of citizens, mayors, developers and all levels of government on the need for effective planning and management of urban growth, the opportunity for a binational Great Lakes basin wide approach to managing pollution due to land use activities is especially timely, practical and relevant.

In the United States and Canada, land use decisions are generally regarded as the exclusive domain of local government, yet local decisions cannot simply be viewed in isolation of other responsibilities at the provincial, state, and federal levels. Because wise land use decisions and effective land management are fundamental to implementing and progressing toward the ecosystem approach envisioned by the Great Lakes Water Quality Agreement, governments need to improve their institutional capacity to coordinate and integrate roles, responsibilities and decisions between and among all levels.

Recommendations

The Parties take binational actions to address the impact of urban land use on Great Lakes water quality by:

- evaluating under what circumstances best management practices[21] are effective in managing urban runoff;
- ensuring that information on urban best management practices reaches local authorities and implementers; and
- assessing the cumulative effects of management actions to minimize the impacts of urbanization on the Great Lakes, using the Lake Erie basin as an example.