Chapter two

THE WATERFRONT OF TODAY

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The Lake Ontario waterfront that we see today is the combined result of powerful natural and cultural forces, which continue to shape its future. Neither land nor lake is static – constant change is a vital part of this ecosystem, whether expressed over days, or seasons, or centuries.

Over the past two centuries, the pace and rhythm of that change has been influenced by human actions along the lakeshore – cutting trees, hardening the shore, removing fish and adding wastes to the lake waters. Increasingly, the dominant force within the North Shore ecosystem has become a single species – humankind – using a greater and greater share of the energy and resources of the ecosystem to support its burgeoning population.

Yet every storm that washes away a seawall, every dandelion that pushes through a crack in a sidewalk, is a reminder that natural forces retain their power. If we are to create a future waterfront that provides a safe and pleasant habitat for ourselves, along with a sustainable habitat for a diverse array of other species, we must learn to shape those actions we can control in harmony with the natural forces that we cannot alter.

To begin, we must understand the nature of today's waterfront, and the forces that have shaped it.

Powerful natural and cultural forces shape the waterfron

THE GREAT LAKES AND BIOREGIONAL CONTEXTS

Lake Ontario is the fifth and lowest in elevation of the Great Lakes, a location that influences its character enormously (see Figure 1). The watershed area draining directly into Lake Ontario, for example, is relatively small – only about three times the surface area of the lake itself. But the volume of water entering the lake through the Niagara River from the other Great Lakes is very large, some 80% of the total flow into Lake Ontario. As a result, despite the 244 metre depth of Lake Ontario, it takes water an average of only six years to reach the St. Lawrence River.

The Great Lakes have other profound effects as well. Their capacity to trap and slowly release heat significantly modifies the climate of the surrounding region, making this part of the continent cooler in summer and milder in winter than other areas at a similar latitude. This moderating effect is especially pronounced close to the water's edge. Another climatic effect is the tendency of areas downwind from the lakes to receive significantly larger winter snowfalls than elsewhere in Ontario.

Partly as a result of these climatic effects, the north shore of Lake Ontario acts as the northern edge of a broad vegetation zone known as Carolinian forest. Remnants of these forests of oak, hickory, and other hardwoods are well-expressed near the western end of the Greenway, gradually being replaced by more hardy mixed forests to the north and east. As well as permitting the survival of southern plant life and associated birds and other wildlife, the mild winters along the Lake Ontario shore often mean open waters and snow-free fields that support many types of wintering birds.

The Great Lakes have also strongly influenced human settlement patterns in this region (see Figure 2). The almost universal human tendency to settle near the shore probably began with native travel routes and seasonal fishing patterns, extended into the location of the first trading posts and military bases, and was reinforced by early industrial activities which used water for transportation and

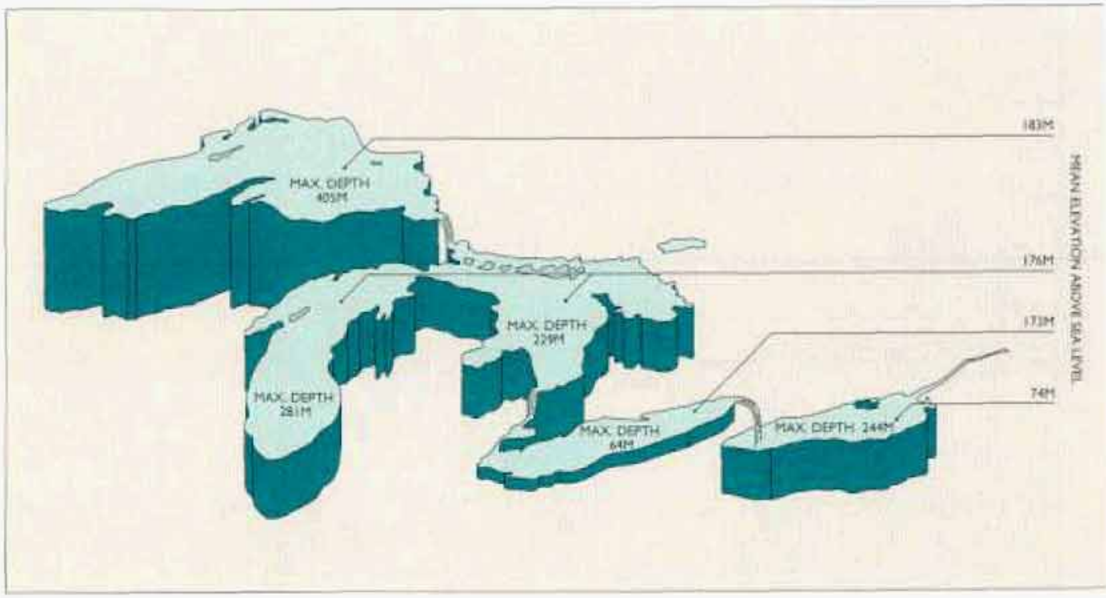


Figure 1
The Great Lakes
Source: Canada, Environment Canada. 1987. *The Great Lakes*

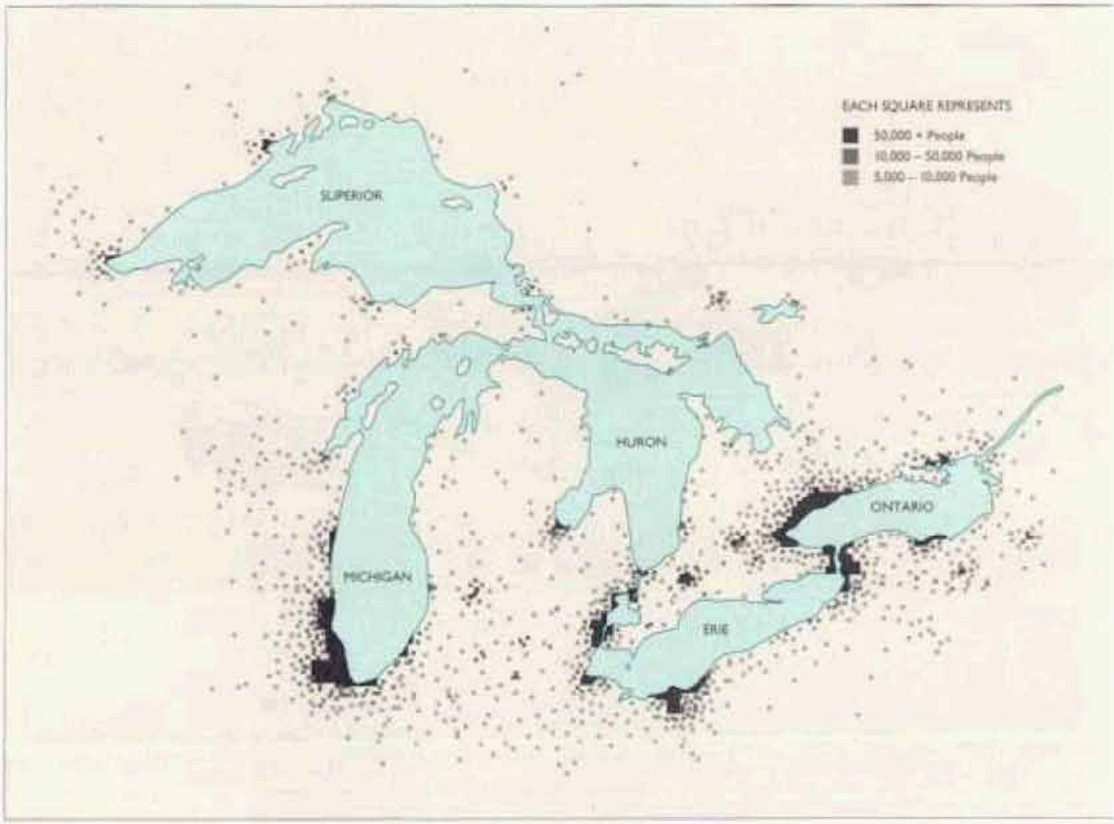
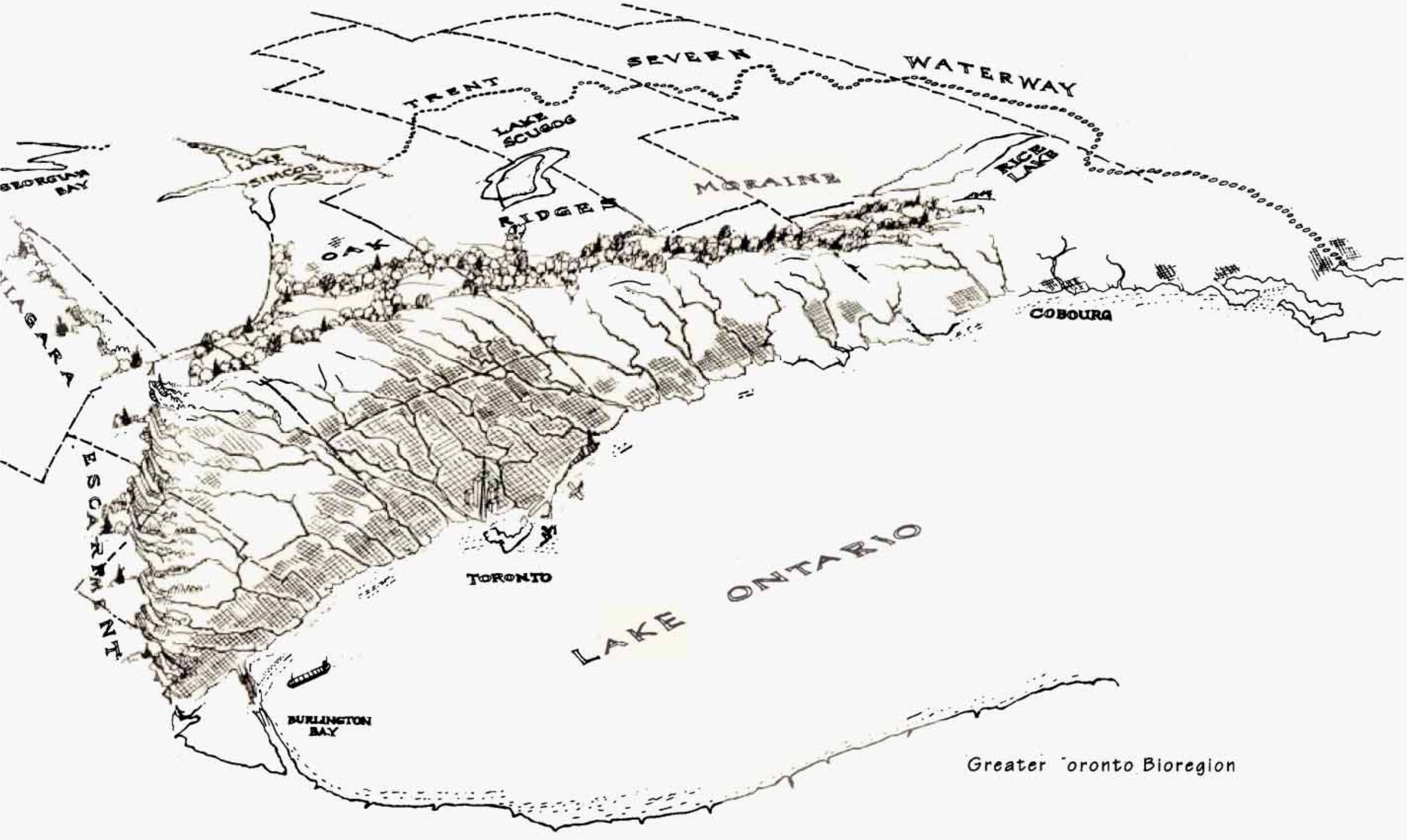


Figure 2
Great Lakes Basin population density
Source: adapted from Canada,
Environment Canada. 1987.
The Great Lakes

for mills. The role of the Great Lakes region as an industrial heartland was further strengthened by the development of the St. Lawrence Seaway system, and the electrical generating stations which used Great Lakes water for cooling or to spin turbines. Even when rail, roads and eventually airports supplanted the role of the lakes in transporting goods, their location conformed largely to the lakeside pattern already established.

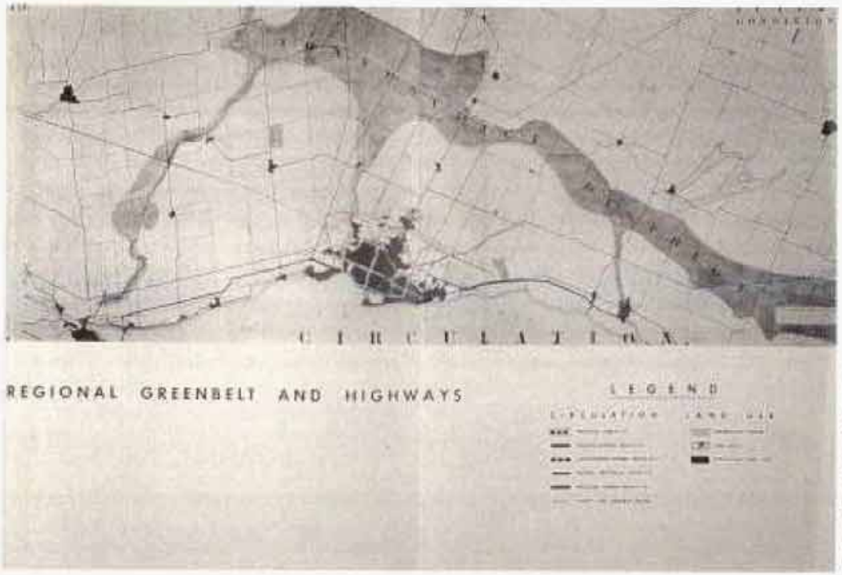
The north shore of Lake Ontario must also be viewed in the context of its bioregion – a wedge-shaped area bounded by the Niagara Escarpment, the Oak Ridges Moraine, and the Lake. This area, known as the Greater Toronto Bioregion, encompasses a gently sloping plain tilted southwards to the lake. Of the 35 major watercourses draining into the Greenway, 4 have their sources within or just above the Escarpment area; another 16 have their headwaters in the Oak Ridges Moraine; and the remaining 15 smaller streams draw much of their base flow from sandy deposits associated with the former Lake Iroquois shoreline.

Three centuries ago, almost all of the Bioregion was clad in lofty forests of maple and beech, oak and pine. By the mid-1800s, most of the original forest was gone, with the Bioregion converted into one of the most productive farming areas in the country. Over the past century, especially the last 30 years, the growth of Canada's largest urban concentration has spread over a significant portion of the Bioregion, and greatly altered the remaining rural areas.



Greater ˉoronto Bioregion

Concern about environmental deterioration within the Bioregion is not just a recent phenomenon. Even as early as 1860, the once-abundant Atlantic salmon were gone from Lake Ontario, removing an important food source. By the 1940s, widespread erosion in the sandy hills of the Oak Ridges Moraine prompted the acquisition of large areas by county governments and conservation authorities for tree planting. The Ganaraska Forest is one result of these initiatives. Other early planning efforts recognized the importance of the Moraine to the City of Toronto, as shown on a 1943 map produced by the Toronto City Planning Board (see Figure 3).

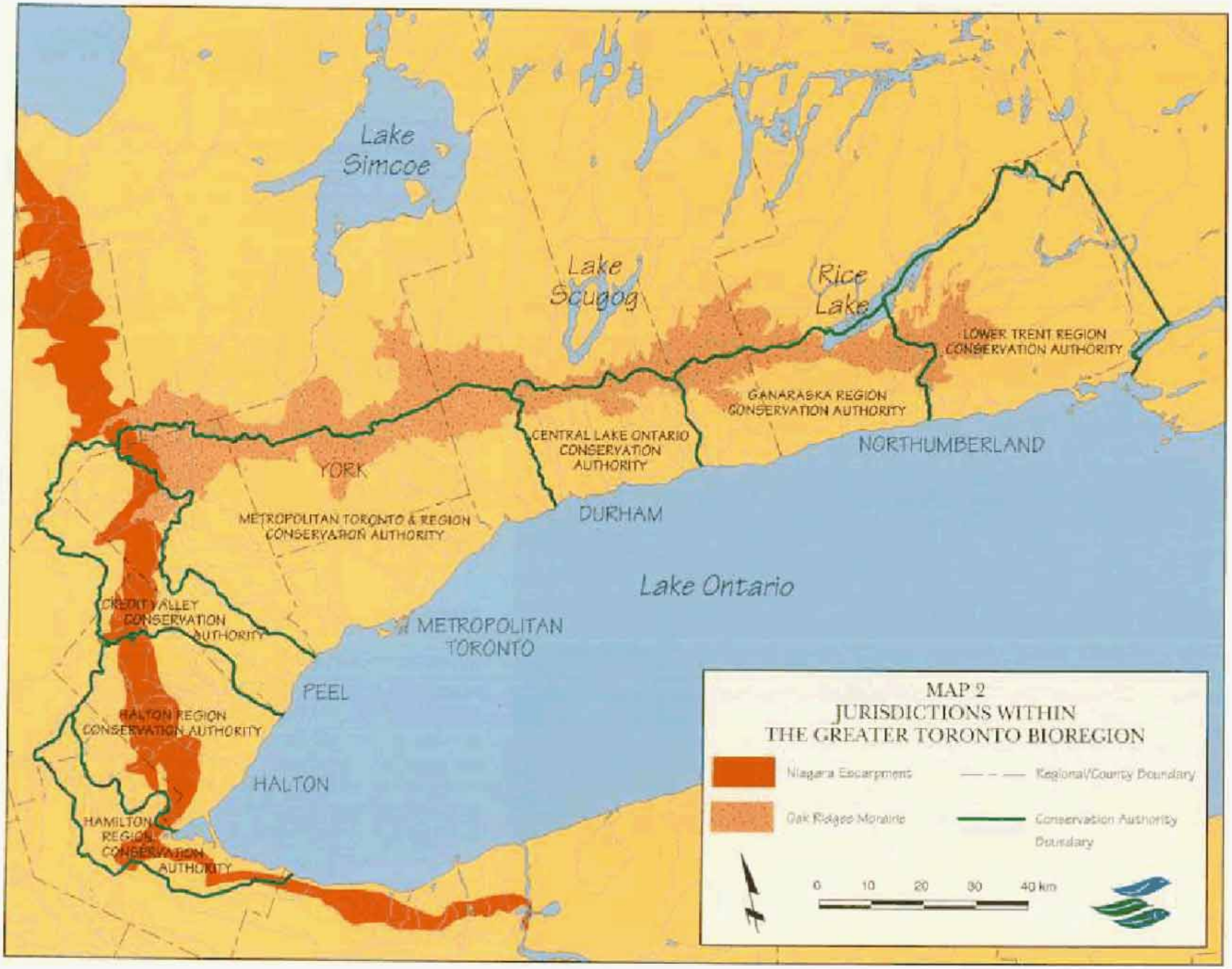


City of Toronto Archives

Figure 3
1943 Regional Greenbelt

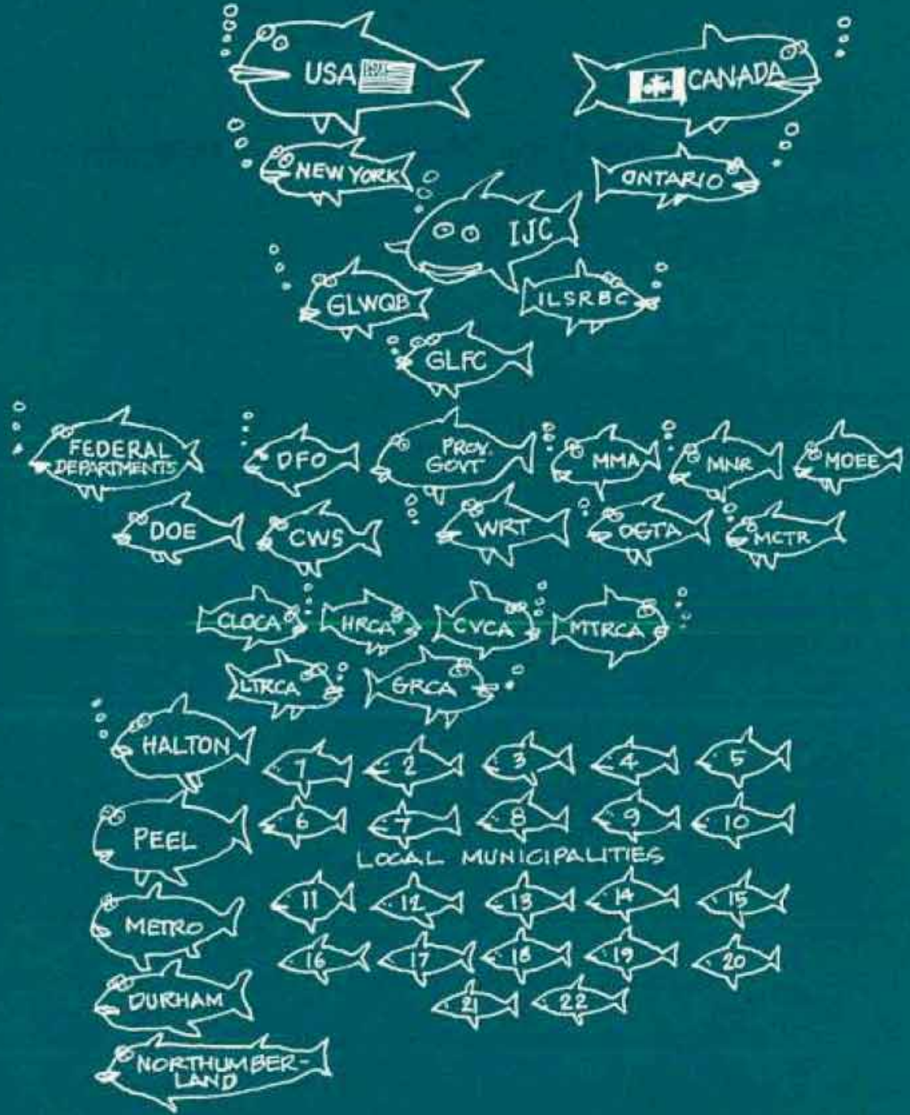
Together with the biological and cultural context, a complex institutional context has evolved within the Bioregion. Along the shoreline from Burlington to Trenton, 22 local municipalities deliver municipal services and administer the planning system. In the western and central sections of the Greenway, broader-scale functions are provided by the Regional Municipalities of Halton, Peel, York and Durham, and by Metro Toronto. The provincial Office for the Greater Toronto Area plays a coordinating role in these five regions. To the east, the County of Northumberland administers roads, waste management, tourism promotion and other functions, but does not currently have formal planning responsibilities.

Six conservation authorities provide watershed and resource management functions within the Bioregion, together with several provincial ministries. Responsibility for waterfront matters at the provincial level involves primarily the Ministry of Municipal Affairs, Ministry of Natural Resources, Ministry of Environment and Energy, and the Ministry of Culture, Tourism and Recreation, although many others have specific areas of responsibility. The Waterfront Regeneration Trust, a relatively new agency, has a mandate to provide advice and coordination of waterfront policies and programs.



MAP 2
JURISDICTIONS WITHIN
THE GREATER TORONTO BIOREGION

Institutional Context



There is also a federal presence along the waterfront, particularly related to ports and harbours, water quality, and fisheries. The primary federal departments involved are Transport Canada, Fisheries and Oceans Canada, Environment Canada, and Canadian Heritage. Lake Ontario fisheries management also involves cooperative efforts between the Province and New York State, and the participation of an international body, the Great Lakes Fishery Commission. Another long-standing institution for Great Lakes issues is the International Joint Commission (IJC), which makes recommendations on such topics as water quality and water levels regulation. Subsidiary agencies such as the Great Lakes Water Quality Board, the Science Advisory Board, and the International St. Lawrence River Board of Control advise the IJC on specific matters.

THE PHYSICAL ENVIRONMENT

Lake Ontario sits in a cup-like depression in the underlying bedrock of limestone and shale, relatively young and soft rocks which are exposed in a few locations along the shore. Along most of the shoreline, however, the rock has been covered with a mantle of tills and sands from at least four glaciers that have ploughed their way southwards over the past 100,000 years. Some of the best geological records in Canada of the history of those glaciations are found along the waterfront, particularly at Scarborough Bluffs and the Don Valley Brickyard.

As the most recent glacier melted away, only some 12,500 years ago, it left behind a range of landforms created by both the scraping actions of the ice and the sorting of sediments by the melt-waters. These landforms have shaped human uses of the landscape to a large degree – the flat, rich clay plains of Halton, for example, were almost entirely cleared for farmland, while the steep-sided drumlins of Northumberland have kept much more of their native forest. Map 3 provides a brief overview of differences in present-day landforms and land uses along the waterfront.

These glacial landforms also form much of the bed of Lake Ontario, but the area along the shoreline has been considerably modified by the lake. The scouring action of the waves moves and sorts the finer sediments, often cleaning off bedrock, creating bluffs along the shore, and depositing sands into beach areas. This unending process can be seen not only along today's lakeshore, but also along abandoned shorelines from periods when the lake was higher than today.

The most prominent of these remnants is the Lake Iroquois shoreline, created about 12,500 years ago, which runs parallel to the current north shore a few kilometres inland (see Map 6). In many areas, this shoreline shows as a prominent wooded bluff, with relatively smooth beach deposits along the base. Transportation planners have made use of these old beaches – both the QEW through Halton and much of Highway 401 from Cobourg to Trenton follow the base of the Lake Iroquois shoreline.

Other lake levels produced their own shoreline remnants, although not as prominent. A good example of abandoned beaches from the glacial Lake Belleville stage, about 12,000 years ago, is found just south-west of Colborne. For most of the next 3,000 years, water levels were lower than current Lake Ontario, so many former shorelines exist underwater. For the past 3,500 years, lake levels on average have been relatively stable, but water levels still fluctuate considerably on a shorter term.

As the last in the chain of Great Lakes, the amount of water flowing into Lake Ontario, and hence the water levels, are greatly influenced by precipitation throughout the entire Great Lakes basin. Power dams both upstream and downstream of Lake Ontario can modify these natural fluctuations by only a very small amount, and a recent report by the International Joint Commission concluded that further stabilization of lake levels is neither practical nor desirable. Future management of the shoreline will have to be designed to take into account an irregular and unpredictable cycle of water levels that ranges over 2 metres over the course of decades, as well as normal seasonal fluctuations of up to 0.5 metres.

Landscape Units

In order to integrate the various elements of the Lake Ontario Greenway and provide a basis for suggesting more detailed actions for specific places, landscape units have been defined (see Map 3). They represent segments of the Greenway that display homogeneous or recurring patterns of the following elements:

- shoreline characteristics based on substrate type and coastal processes (many of the shoreline units contain several landscape units),
- landform, especially valleys, bays, hills and the Lake Iroquois shoreline,
- vegetation, especially tree cover,
- cultural landscapes, and/or
- major land use patterns.

The characteristics of each landscape unit are described in more detail in the companion document *Lake Ontario Greenway Strategy: Next Steps.*

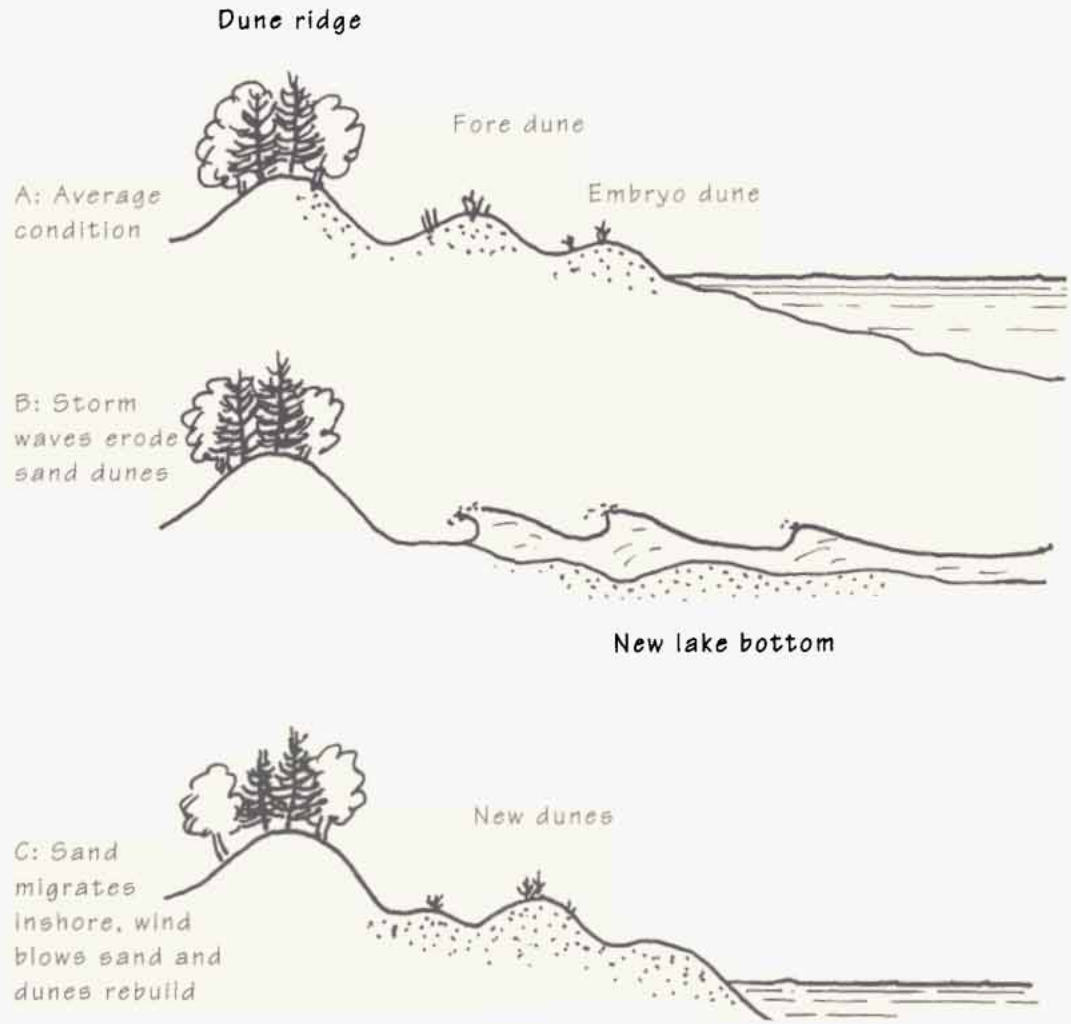


Figure 4
Sandy dynamic beach process

Future climate changes related to global warming may affect lake levels. While it is difficult to predict the nature or magnitude of changes to the current pattern of water level fluctuations at this point, research and modelling studies in the climate change field should be monitored so that effects on Lake Ontario can be addressed appropriately.

SHORELINE PROCESSES

As outlined in the *Shoreline Management Workgroup Report* in the toolkit, the processes that created and maintain the shoreline we see today are complex and dynamic.

The primary driving force for long term shoreline change in this part of Lake Ontario is wave action cutting downwards into the lakebed, which in turn causes bluff erosion and slumping along the shore. The effects of wave action in altering shoreline features are most apparent during storms in periods of high water levels.

A critical factor in determining the rate of shoreline erosion is the controlling substrate, that is, the material that makes up the main body of the lakebed near the shore. As shown on Map 3, nine shoreline units have been defined on the basis of different controlling substrates. While the nature of this substrate may be masked along the water's edge by local deposits of sand or cobble, or by shoreline armouring, it provides a basis for understanding the broad effects of shoreline processes.