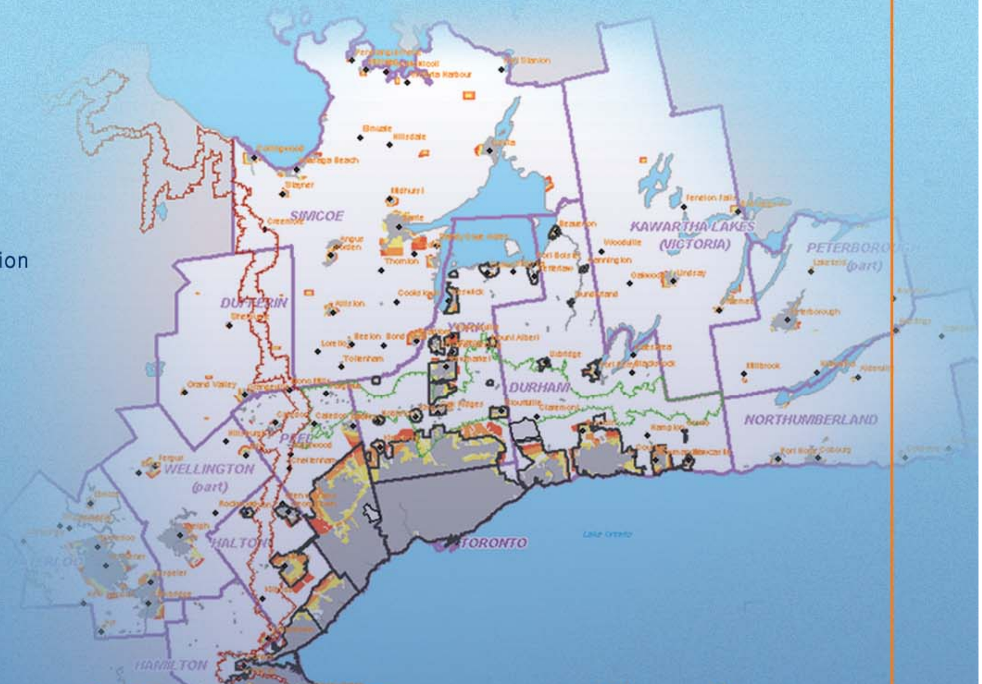
neptis foundation



Toronto-Related Region Futures Study

Interim Report: Implications of Business-As-Usual Development

AUGUST 2002

IBI GROUP in association with DILLON CONSULTING LIMITED

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Toronto-Related Region Futures Study

Interim Report: Implications of Business-As-Usual Development

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DILLON CONSULTING LIMITED

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IBI
GROUP

August 19, 2002

Mr. Anthony C. Coombes
Executive Director
The Neptis Foundation
50 Park Road
Toronto, Ontario M4W 2N5

Dear Mr. Coombes:

Toronto-Related Region Futures Study
Interim Report: Implications of Business-As-Usual Development

As commissioned by the Neptis Foundation, we have prepared this study of a possible future scenario for the Toronto-related region. The report examines the way urbanization may occur in this major region if current development planning and implementation processes remain in place and the region's rapid growth of people and jobs continues over the next three decades. It is also intended to provide an objective basis for subsequent work to consider possible alternative policy scenarios and compare them with Business-As-Usual. It is, therefore, an interim report as part of a larger study contemplated by Neptis to explore alternative development and infrastructure scenarios and their implications.

Owing to the length of the report, an Executive summary is included which presents a reasonably comprehensive summary of the study approach and findings. More details are presented in the main body of the report.

The study team acknowledges with thanks the advice and input of the staff and advisors of Neptis and of members of the wider planning community, while accepting responsibility for the findings and conclusions of this report.

Respectfully submitted,

IBI GROUP

Neal A. Irwin
Managing Director

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EXECUTIVE SUMMARY

E.1 INTRODUCTION

THE URBAN FUTURES STUDY

As Canada's largest urban area and most diverse economy, the Toronto-related region continues to generate and attract rapid growth in population and jobs, with related economic and social benefits. At the same time, rapid growth creates challenges in terms of required infrastructure, land consumption and related environmental issues. The manner in which the opportunities offered by growth are realized and the challenges are addressed will greatly affect the region's ongoing success, both as a dynamic growth centre and a good place to live.

Building on the area's strengths while addressing its challenges is a complex process. If the area's citizens and leaders are to make intelligent, informed decisions, they will require objective and reliable information on the likely future implications of their policy, planning and management decisions. Individual municipal jurisdictions and government departments regularly prepare forecasts and plans for their respective areas of interest, but it is rare that a comprehensive approach is taken to assess consequences for the entire urban and urbanizing region, dealing strategically with both urban development patterns and major infrastructure systems.

In this context, the Neptis Foundation commissioned IBI Group in the fall of 2001 to undertake a major study of the future of the urban region. Pamela Blais of Metropole Consultants has acted as a special advisor to Neptis for the study, focusing in particular on urban structure aspects of the work. IBI Group retained Dillon Consulting Limited to carry out the water/wastewater infrastructure component.

STUDY PURPOSE AND SCOPE

The Toronto-related region has experienced for many years a net population growth of about 100,000 persons per year, of which about two-thirds results from net immigration and the remaining one-third represents natural increase. This study addresses the following question: What would the likely outcome be if this substantial rate of population growth and related economic growth continues for the next three decades? The "Business-As-Usual" scenario presented in this report is based on the premise that this ongoing growth will be accommodated by a continuation of current consumer behaviour and market conditions, public policies and approval processes, and the planning and delivery of physical infrastructure, during the period to 2031. The study focuses on settlement patterns and requirements for new urban land, infrastructure to serve transportation and water/wastewater needs, and related measures of infrastructure performance and cost.

The scenario is described and analyzed at a strategic level. This is not a planning study but rather a "What If" assessment of the urban structure and major infrastructure implications 30 years from now under particular assumptions. As such, the Business-As-Usual scenario helps to provide an understanding of one possible "future" for the entire Toronto-related region. It also provides a basis for considering other possible scenarios based on alternative urban structure and infrastructure assumptions and is a benchmark against which alternative scenarios may be compared.

This report presents the study's findings for the Business-As-Usual scenario only. Drawing in part on the results presented here, Neptis plans to extend the study to describe several alternative future scenarios and the implications of each scenario in terms of urban structure, physical infrastructure, and various performance and cost implications of the alternatives.

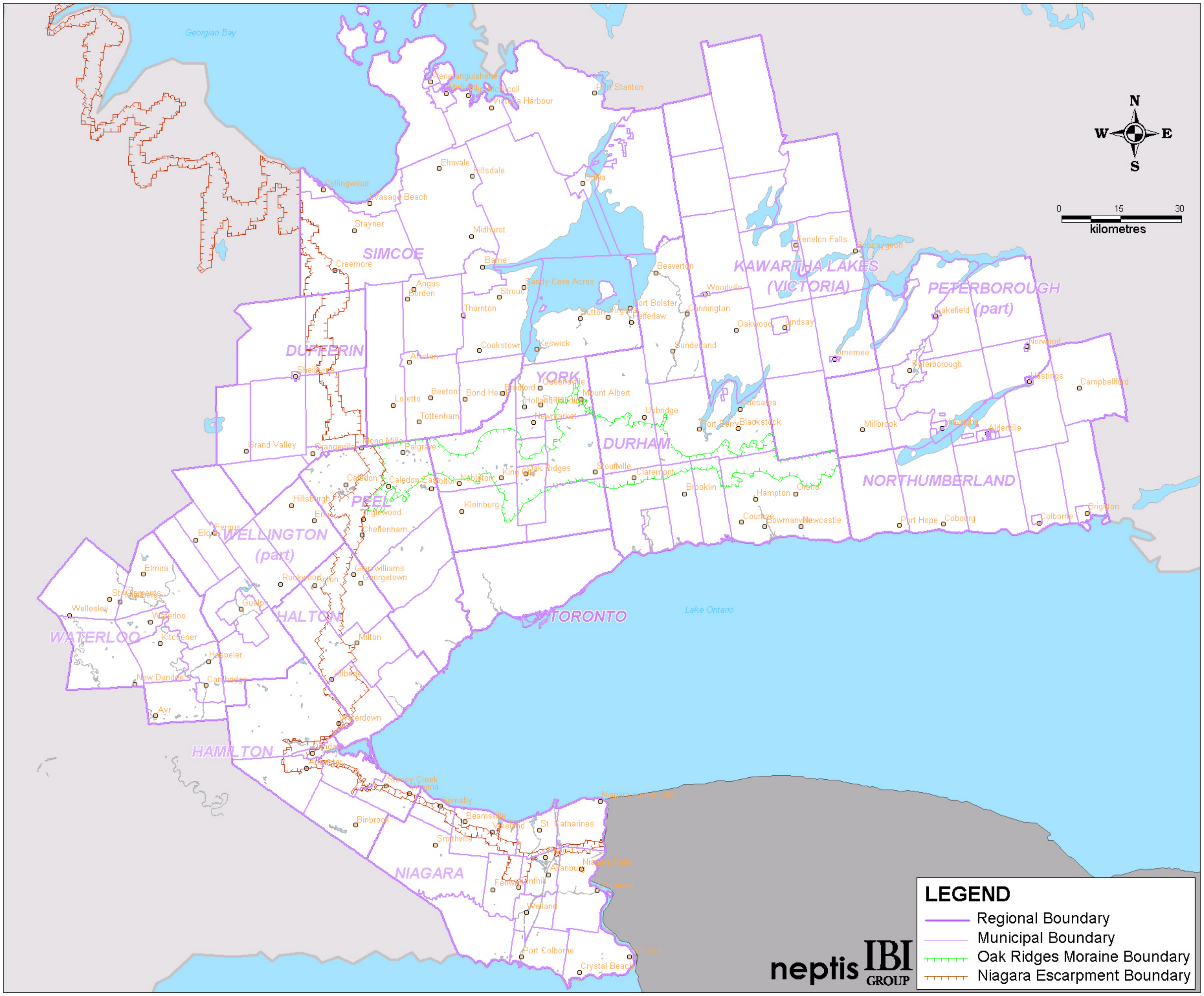
The study will not produce policy or planning recommendations, but will provide an objective description of several alternative futures for the Toronto-related region as "food for thought" and to help inform discussion by the public and its decision-makers regarding policy and planning choices.

STUDY AREA

The study area for this work is illustrated in Exhibit E.1. It is considerably larger than the area made up of the city of Toronto and the four regional municipalities (Durham, Halton, Peel and York), which together constitute The Greater Toronto Area (GTA), plus the new City of Hamilton. This area is referred to herein as the inner study area. The outer study area comprises eight upper-tier municipalities: the Regional Municipalities of Niagara and Waterloo; the Counties of Wellington (south part), Dufferin, Simcoe, Peterborough (south part) and Northumberland; and the City of Kawartha Lakes, formerly the County of Victoria.

The study area was extended beyond the GTA and Hamilton in order to include interactions with urban centres such as St. Catharines, Kitchener/Waterloo/Cambridge, Guelph, Barrie and Peterborough, while also considering the "urban shadow" implications affecting more rural parts of the study area. People throughout the entire urban region are interconnected in terms of their social, economic and recreational activities, their need for – and use of – transportation and water/wastewater infrastructure, and the performance and cost implications of ongoing growth.

Exhibit E.1: Study Area



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E.2 URBAN STRUCTURE

Chapter 2 of the report outlines the approach and assumptions associated with estimating the extent and distribution of urbanization to 2031 for the Business-As-Usual (BAU) scenario.

BUSINESS-AS-USUAL: KEY ASSUMPTIONS

The following assumptions were used for the BAU scenario.

Demography:

- International immigration will remain steady at recent levels (i.e., about 200,000 per year, of which the study area is projected to continue to attract about 45%).
- The rate of natural population growth will decline as fertility rates remain low (i.e., at about 1.5; the replacement rate is 2.1).
- Population will increase from 7.4 million to 10.5 million (i.e., by 3.1 million or 100,000 per year, a continuation of past trends).
- Household size will continue to decline slightly, consistent with long-term trends.

Cultural/Economic:

- Strong employment growth will continue and jobs will grow from 3.5 million to 5.5 million.
- Employment growth will be higher than population growth in percentage terms, reflecting a continuation of increasing participation rates.
- Consumer preferences in housing types and modes of travel will stay as they are.
- Capital investment will be available for the expansion of road, transit, water, and wastewater infrastructure at levels consistent with recent experience; almost three-quarters of this investment will be required for rehabilitation and renewal to maintain these systems in a state of good repair and will therefore be largely unaffected by alternative urban structure and infrastructure policies.
- The economics of development – land and housing costs and prices, property taxes, development charges, etc. – will not fundamentally change.
- Redevelopment and infill development in existing urban areas will continue at current levels.

Land Use:

- Urban development in new urban areas (formerly rural) will occur first on land designated "urban" in official plans.
- Urban development will next occur beyond designated urban boundaries, with municipal approval, in places where the market demands it and the physical infrastructure permits it. As a consequence, currently rural land, including agricultural land, will become urban, reflecting a transition to the urban economy from the rural/agricultural economy.
- Environmentally sensitive lands protected in upper-tier official plans will not be available for urban development.
- Development on the Oak Ridges Moraine will generally be restricted according to recent Ontario government policy.
- Rural land, including land classified as agricultural, will be available for urban development, with municipal approval.

Density:

- Average residential densities in new urban areas will continue to rise slightly.
- Development densities in new employment lands will remain constant.
- As the urban area expands, overall residential and/or non-residential densities will tend to increase as a result of infill and redevelopment, reflecting economic pressures to use land more intensively in established areas.

DETERMINATION OF APPROPRIATE FORECASTS

Drawing on census data, historic 25-year population trends (1971-1996) were examined and extrapolated in a linear fashion; the results of this trend analysis were compared with the range of available forecasts for each of the five GTA upper-tier municipalities (UTMs). The charts in Appendix A show graphically the past trends compared to a number of available population forecasts for the GTA municipalities.

In terms of the GTA upper-tier municipalities (UTMs), a number of population projections were reviewed, including those prepared by/for the following:

- Office for the Greater Toronto Area (OGTA);
- Greater Toronto Co-ordinating Committee (GTCC);
- Central Ontario Study (Ministry of Transportation – Ontario);
- Ministry of Finance (Government of Ontario);

- the UTM official plans; and
- a market-based forecast prepared for and used by IBI Group for a range of transportation-related analyses; this is referenced as the "market forecast".

It is of interest to note that all these forecasts have similar overall total projections for the GTA to 2031. The differences among the various forecasts relate primarily to the distribution of population among the UTMs.

Based on the review of alternative population projections for the GTA UTMs as well as the results of comparative analyses for other parts of the study area, it was concluded that the UTM forecasts should be based initially on the market forecast. Generally, a key differentiating factor in this forecast is that slightly lower population and employment forecasts for Toronto are estimated, to reflect trends that targets for potential infill and intensification development may have been over-estimated. **The market forecast most closely replicates a linear extrapolation of the historic population trends and is considered to be most representative of the BAU scenario principles.**

FUTURE URBANIZATION PATTERNS

In order to estimate future population, employment and land consumption for each of the municipalities in the study area, a typology of municipalities in the study area was developed, reflecting five different stages in the urbanization process viewed at the scale of the entire urban and urbanizing region. The five categories, and a prototypical example of each one, are:

1. ***Already Urbanized Municipalities (Type 1)*** are communities that are largely built-out or have significant compact, mixed-use areas and contain full transportation/public transit systems largely supported by subcentres or nodes throughout their geographic area; prototype example: City of Toronto.

2. ***Rapidly Urbanizing Municipalities (Type 2)*** are communities currently experiencing a rapid rate of growth (residential and non-residential) primarily on rural land (typically through Plan of Subdivision) contiguous to existing urbanized areas; prototype example: Markham.

3. ***Newly Urbanizing Municipalities (Type 3)*** are communities that lie beyond the current wave of rapid suburban development but are starting to experience moderate levels of residential and non-residential growth through the Plan of Subdivision process; prototype example: Halton Hills.

4. ***Rapidly Growing Leapfrog Municipalities (Type 4)*** are similar to Rapidly Urbanizing Municipalities (Type 2) as they are communities experiencing a rapid rate of growth primarily on rural lands (typically through Plan of Subdivision); however, they are at some distance from the current growth concentration and there remain intervening lands that are currently undeveloped; prototype example: Barrie.

5. ***Urban Shadow Areas (Type 5)*** are communities located in largely rural areas beyond the rapidly developing fringe. They have not experienced significant development but, over the course of the study period, may be faced with pressures to accommodate future growth (residential and non-residential); prototype example: Shelburne.

For analysis purposes, it was assumed that a municipality would remain in its category throughout the forecast period. As a municipality evolves, however, it will eventually exhibit characteristics of a more mature municipality.

An analysis similar to the estimation of population and employment projections for the UTMs was carried out for the prototype municipalities selected, also shown graphically in Appendix A. The result of that analysis was the decision to adopt the market forecast at this level of analysis, as it reflects a continuation of the historic trend.

DEVELOPMENT DENSITIES

Having adopted the BAU forecasts, each prototype community was reviewed to determine appropriate assumptions for development density and household size trends to yield generic population and employment densities per gross acre for each prototype. These are summarized in Exhibit E.2.

Exhibit E.2: Density Assumptions for Development on New Land by Municipal Prototype Category

Municipal Prototype Categories	***Gross Density for Growth (persons per gross acre, p.p.a.)***					
	2000-2011		**2011-2021**		**2021-2031**	
	Population	Employment	Population	Employment	Population	Employment
Type 1 Already Urbanized	22.0	25.0	22.0	25.0	22.0	25.0
Type 2 Rapidly Urbanizing	16.5	18.0	17.5	18.0	18.5	18.0
Type 3 Newly Urbanizing	10.0	14.0	13.0	14.0	15.0	14.0
Type 4 Rapidly Growing Leapfrog	14.0	15.0	16.0	15.0	18.0	15.0
Type 5 Urban Shadow	7.0	7.0	8.0	7.0	9.0	7.0

Population density consists of two components: (1) residential units per gross acre, and (2) household size. **Gross** residential density is the number of residential units divided by the total amount of primarily residential lands.[1] Gross residential densities are assumed to be increasing through the forecast period. Consistent with historic trends, household size will continue to decline slightly. Therefore, the combination of these two factors will result in overall gross population density increasing slightly. It is of interest to note that **net** residential densities have generally been increasing in the latter 1990s. However, this increase in net residential densities has been substantially offset by increasing amounts of land used for infrastructure and public uses (e.g., stormwater management ponds, wide streets, parks, schools, etc.). Thus, **gross** residential density is not increasing at the same rate as **net** residential density. Gross employment density excludes Environmental Sensitive Area (ESA) lands but includes all other uses found on non-residential lands.

As illustrated in Exhibit E.3 (on the following page), all single-tier municipalities in the study area were classified according to the typology. Combining the assumptions of the market forecasts of population and employment and the generic growth characteristics of each category, the amount of land to be urbanized over the forecast period was estimated. These results are summarized for each of the five categories in Exhibit E.4.

Exhibit E.4: Growth Allocation to 2031 by Municipal Category

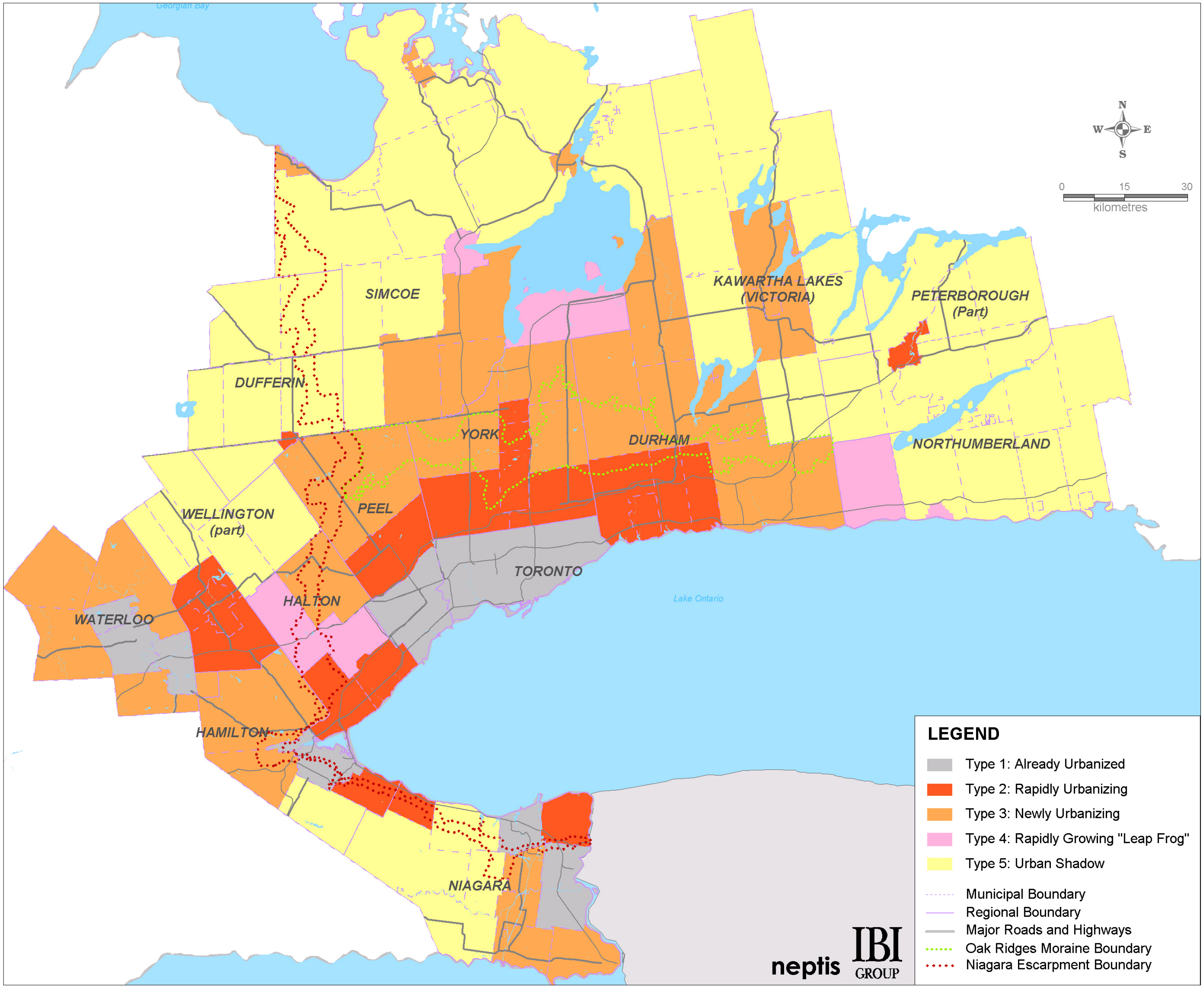
	2000 to 2031 GROWTH						
	Absolute Growth		**Percentage Growth**		**Urbanized Land**		
TYPE OF MUNICIPALITY	Population	Employment	Population	Employment	acres	km^2	%
Type 1 Already Urbanized	695,826	719,696	21.9%	37.6%	26,058	105	9.9%
Type 2 Rapidly Urbanizing	1,466,015	781,771	46.2%	40.8%	126,765	513	48.0%
Type 3 Newly Urbanizing	519,400	202,152	16.4%	10.6%	53,911	218	20.4%
Type 4 Rapidly Growing Leapfrog	316,318	159,230	10.0%	8.3%	29,337	119	11.1%
Type 5 Urban Shadow	175,120	51,764	5.5%	2.7%	27,967	113	10.6%
TOTAL GROWTH	3,172,679	1,914,613	100%	100%	264,038	1,069	100%

As shown, the largest share of growth, most of it on rural land, goes to Type 2, Rapidly Urbanizing Municipalities. Land consumption varies significantly reflecting the differing development densities shown in Exhibit E.2.

Appendix B shows the classification and the estimated new urbanized land areas for each municipality.

[1] Lands used for residential lots, streets, parks and other infrastructure, and other uses included in a plan of subdivision.

Exhibit E.3: Municipal Typology



MAPPING AND GROWTH PATTERNS

The results of the above analyses provided estimates of requirements for newly urbanized land in each area municipality resulting from the population and employment growth forecasts for the study area. These results were plotted on a base map of the broader study area. Existing urbanized land was identified on the base map using information obtained and analyzed by the University of Toronto Cartography Department from satellite imagery. Exhibit E.5 shows the distribution of urbanized land as of late 1999; this was used as the starting point for mapping anticipated future urban development patterns. Also shown on Exhibit E.5 are the designated urban area boundaries for local municipalities.

ALLOCATION OF NEWLY URBANIZED LAND

Generally, newly urbanized land was assumed to occur adjacent to existing urbanized land. This analysis drew from the collective knowledge of the study team in terms of the plans and approvals status in various municipalities, consultation with municipal planning staff, the location and anticipated influence of existing, committed and planned water/sewer infrastructure and transportation infrastructure, and trends in land use planning and development. Development was projected to occur largely within the designated urban boundaries shown on Exhibit E.5, but also outside the designated urban boundaries in cases of overspill, as described in the body of the report.

Development on the Oak Ridges Moraine was projected in accordance with the Oak Ridges Moraine Act; it was assumed that development on the Moraine that received municipal approval prior to the passage of the Act will occur as originally planned.

Development in more rural areas was anticipated to occur adjacent to smaller settlement areas such as towns, villages, etc., but also along township roads as rural non-farm development. In some rural areas where such growth is anticipated and there are no sizeable communities, newly urbanized land is shown as a representative rectangle illustrating the overall area of newly developed land but not its actual location. Examples of this can be seen in the more rural parts of the study area in Exhibit E.6.

GROWTH AND LAND REQUIREMENTS TO 2031

Exhibit E.6 shows the anticipated urban structure of the Toronto-Related Region to 2031. This map should be viewed in association with Exhibit 2.7 in the body of the report, which provides an overview of population, employment, activity rate, urbanized land and urban density by upper-tier municipality within the study area.

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Exhibit E.5: Existing Urban Land and Designated Urban Boundaries

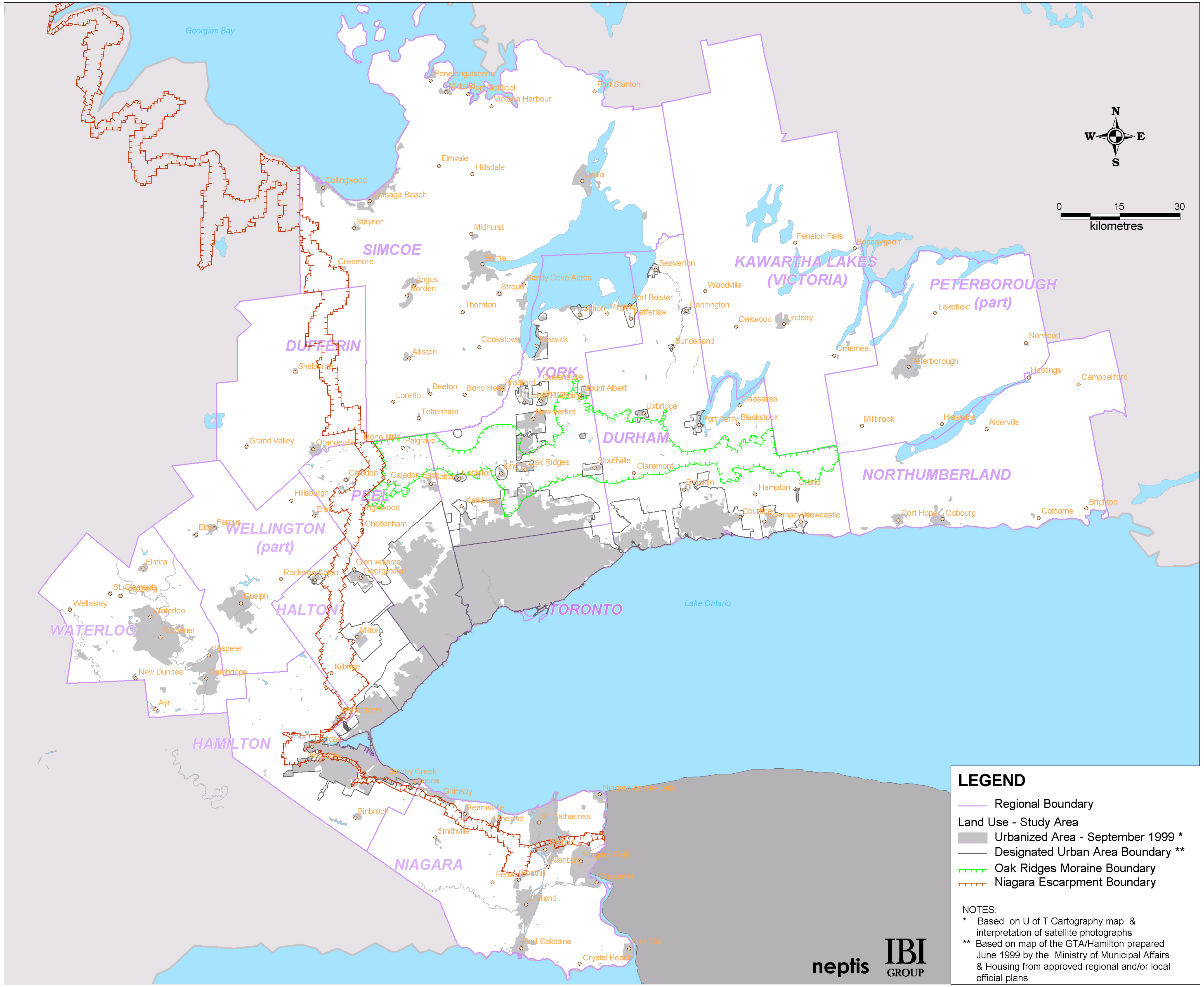

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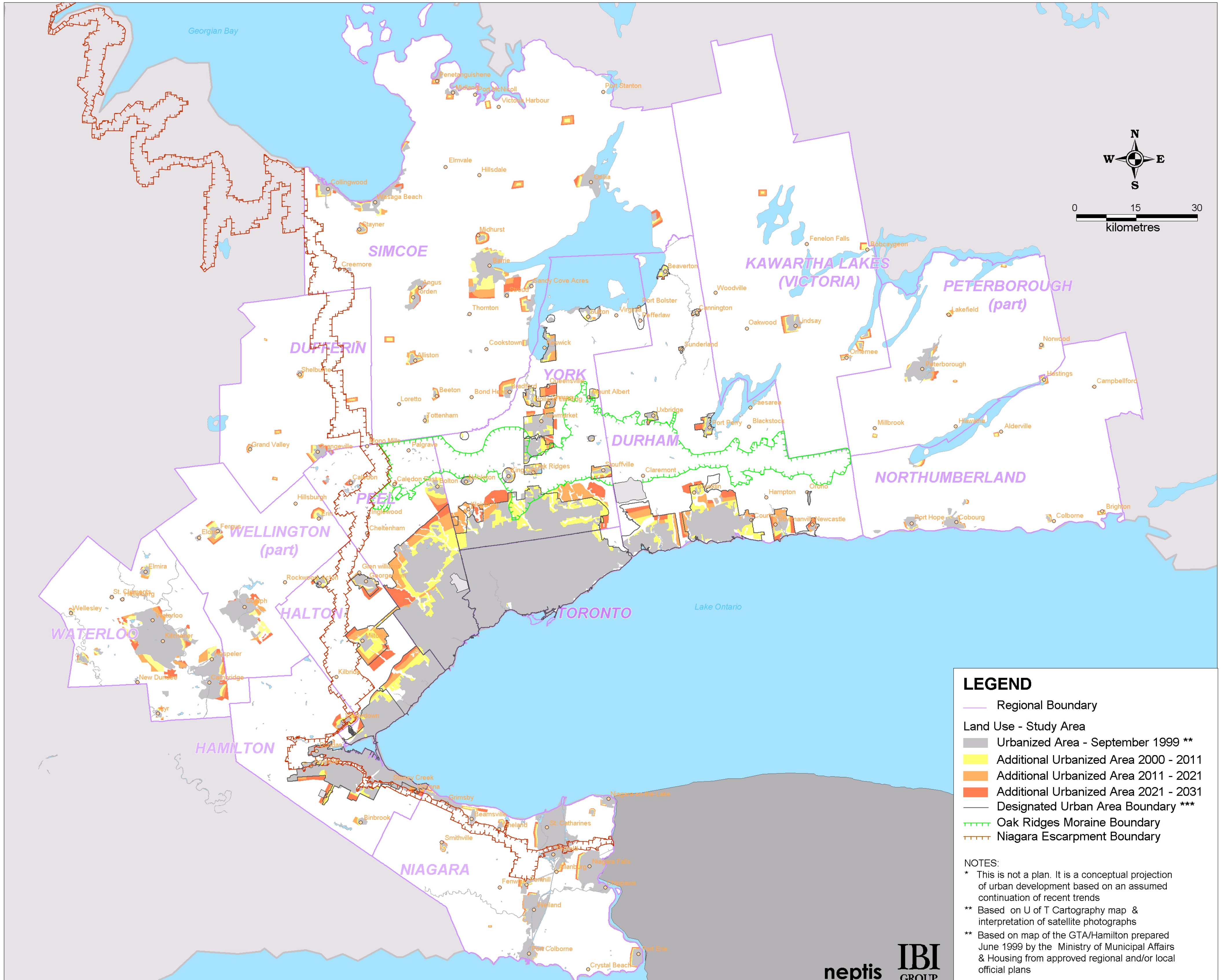
Exhibit E.6: Urbanized Land 2000 – 2031 Under the Business-As-Usual Scenario *



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POPULATION GROWTH VERSUS ANTICIPATED URBAN LAND CONSUMPTION

A comparison of the population growth rate relative to the rate of land urbanization provides a useful measure to ascertain trends. The projected population growth and the anticipated growth in urban land in each of the three decades is as follows:

- 2000 to 2011: urbanized land growth 18.6%; population growth 15.8%;
- 2011 to 2021: urbanized land growth 12.4%; population growth 12.2%;
- 2021 to 2031: urbanized land growth 8.8%; population growth 10.2%.

These trends suggest that newly urbanized land will increase more rapidly than population during the first decade, newly urbanized land and population will increase at roughly the same rate during the second decade and population will increase more quickly than land consumption during the third decade. **In other words, a continuation of current policies, plans and programs, coupled with overall growth in line with past trends, is projected to lead to a gradual decrease in the per capita consumption of land for urbanization over the 31-year study period.**

For the upper-tier municipalities in the study area as a whole, the pattern of population growth relative to urban land consumption is anticipated to be generally similar. Closer analysis, however, suggests that there will be significant differences. For example, many municipalities within the inner study area are likely to experience population growth that is higher than the anticipated urban land growth across all three decades. In all cases, however, the differential between population growth and urban land consumption is projected to diminish through the forecast period.

The upper-tier municipalities in the outer study area are expected to vary substantially in terms of their population and urban land growth rates. The more “urban” municipalities such as Niagara, Waterloo, Simcoe and Wellington tend to have a narrower differential between population and urban land growth rates. The more “rural” municipalities (Northumberland, Peterborough, Dufferin and Kawartha Lakes), however, have a much wider gap, with urban land growth rates being substantially higher than population growth rates. The gap diminishes through the forecast period, but the pattern of urban land growth exceeding population growth persists.

KEY IMPLICATIONS

In 2000, the study area had an estimated population of 7.4 million and employment of 3.5 million. The urbanized land is estimated at just under 586,000 acres (2,370 km^2) yielding a gross density (i.e., for population plus jobs) of 18.6 people plus jobs per acre or 45.9 per hectare. The estimated population and employment in 2031 is 10.5 million and 5.4 million respectively. The urbanized land in the overall study area is estimated at 850,000 acres (3,440 km^2), resulting in an overall gross density of 18.8 people plus jobs per acre or 46.5 per hectare, about 1% higher than the existing density.

Anticipated growth through the 31 years will occur primarily on designated urban land close to already urbanized areas. Exhibit E.6 shows the physical extent of projected population and employment growth. The anticipated implications associated with such growth patterns include the following:

- Over the 31-year timeframe an estimated 264,000 acres (1,070 km^2) of land will be urbanized. This is almost double the area of the City of Toronto.

- In most municipalities, land already designated as urban in official plans (much of which is currently undeveloped) will be sufficient for urban development until 2021, and in some municipalities until 2031. The region has enough additional land for many more years of urban expansion – if it chooses to continue current development patterns and consumption of non-urban land – even with most of the Oak Ridges Moraine protected from development.

- As shown in Exhibit E.7, the greatest shares of population growth and newly urbanized land – 46.2% and 48.0%, respectively, by 2031 – are expected to occur in rapidly urbanizing municipalities (Type 2). Land consumption per capita in Type 2 municipalities (residential and employment lands) is about 2,500 sq.ft. (288 m^2) per person plus job, more than three times that of already urbanized municipalities (Type 1).

Exhibit E.7: Growth Allocation to 2031 by Municipal Category

	2000 to 2031 GROWTH						
	Absolute Growth		Percentage Growth		Urbanized Land		
TYPE OF MUNICIPALITY	Population	Employment	Population	Employment	acres	km^2	%
Type 1 Already Urbanized	695,826	719,696	21.9%	37.6%	26,058	105	9.9%
Type 2 Rapidly Urbanizing	1,466,015	781,771	46.2%	40.8%	126,765	513	48.0%
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Type 5 Urban Shadow	175,120	51,764	5.5%	2.7%	27,967	113	10.6%
TOTAL GROWTH	3,172,679	1,914,613	100%	100%	264,038	1,069	100%

- Although rising residential densities are assumed in new suburban developments, and expected in existing urban areas, the density of population and employment for the overall study area will increase very little – from 18.6 to 18.9 people plus jobs per acre (45.9 to 46.5 per hectare) of urbanized land. This is primarily because the greatest population growth is expected in areas with densities that, although rising, are and will remain below the study area average. As well, density declines are expected in many urban shadow communities, as low-density development is expected to occur outside existing relatively compact rural towns and villages.

- The only upper-tier municipality showing a substantial increase in density is the City of Toronto, where infill and redevelopment are expected to raise density from 31.7

to 37.7 people and jobs per acre (78.2 to 93.1 per hectare). This is the main reason for the slight rise in the overall density of the study area.

- Population growth of some 513,000 will be accommodated through infill or redevelopment. This is most prevalent in built-up urban areas, particularly in the City of Toronto. Of the total growth accommodated through infill/redevelopment, 68% is expected to occur in Toronto. This level of infill or redevelopment may be considered conservative when compared to municipal intensification targets; however, it reflects the BAU principles.

- A number of lower-tier municipalities will need to extend their current designated urban boundaries to accommodate anticipated population and employment growth to 2031. In some instances, the anticipated growth relative to designated urban boundaries in a rapidly growing municipality may cause development to occur in adjacent municipalities. In the BAU scenario a relatively small proportion of newly urbanized land was reallocated for this reason.

- The study area is located within an area that has comparatively high agricultural capability. According to an analysis carried out by the University of Toronto Cartography Department on behalf of the Neptis Foundation, about 92% of the future urbanized land requirement – approximately 244,000 acres (987 km^2) – is Class 1, 2 or 3 agricultural land as classified by the Canadian Land Inventory; about 69% – approximately 181,000 acres (733 km^2) – is Class 1, top-quality, agricultural land. This 181,000 acres is about 7.2% of all the Class 1 agricultural land in the study area, which totals about 2.5 million acres (10,200 km^2). Much of the 181,000 acres is located within designated urban boundaries and may or may not be actively farmed at present.

- The activity rate[2] provides an indicator of expected trends in jobs/worker balance. Overall, modest increases are anticipated in the activity rate from .48 to .52. The inner study area has, as expected, slightly higher activity rates relative to the outer study area, suggesting that the six upper-tier municipalities in the inner study area will continue to have a higher level of jobs per capita, with continuing net in-commuting from the outer study area to fill those jobs.

- Declining rates of new urban land consumption per capita are projected over the study period such that, while new urban land is expected to grow in percentage terms more quickly than population during the decade to 2011, the growth rates will be approximately equal in the following decade, and new urban land is expected to grow more slowly than population in the third decade, 2021 to 2031.

[2] The activity rate is a derived number based on employment (jobs) divided by population.

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E.3 TRANSPORTATION

Transportation is a major factor in shaping and serving urban development patterns. An important element of this study, therefore, is to estimate future transportation demand levels, system performance, transportation costs and community implications for the Business-As-Usual land use concept and, in future phases which Neptis may carry out, for alternative land use/transportation scenarios. The focus in this work is on the transportation of persons rather than goods, reflecting the important peak period pressures imposed on the urban transportation system by the movement of people.

BUSINESS-AS-USUAL: KEY ASSUMPTIONS

The following transportation assumptions were used for the Business-As-Usual scenario.

Transportation Supply

- Government spending levels and funding sources for transportation in the study area will remain largely unchanged from those of the 1990s.
- Existing limited-access highways, comprising some 6,110 lane-km, will be expanded by an additional 1,910 lane-km or about 30%.
- The existing arterial road network of some 41,500 lane-km will be expanded by about 2,500 lane-km, or about 6%.
- The number of buses, streetcars and rapid transit vehicles will be increased in proportion to population growth, and service coverage will be extended into newly urbanizing areas.
- No new rail rapid transit lines are assumed (the Sheppard Subway is expected to open in 2002), but priority transit (e.g., faster, more reliable services expedited by transit lanes, queue-jumping arrangements and/or signal priority) will be introduced on a limited basis.
- Commuter rail service will be expanded by implementing GO Transit's 10-year capital program and 2021 plan.
- Auto operating costs and transit fares will remain unchanged in real terms (non-inflating dollars).

Transportation Demand

- Increases in daily trips per capita, average work trip length, and car ownership per capita will continue, but at rates lower than those experienced during the past three decades (see Exhibit E.8).

Exhibit E.8: Study Area Growth 1964– 1996: Population, Employment and Travel

	1964	1996	1964-1996 % Increase
Population	3,766,000	6,756,000	79%
Employment	1,508,000	3,042,000	102%
Adult Daily Trips	4,059,000	12,900,000	218%
Daily Trips/Capita	1.4	2.48	77%
Avg. Work Trip Length (straight-line kilometres - GTA trips)	11.4	14.1	24%
Car Ownership/Capita	0.32	0.51	60%

Sources: Metro Toronto and Region Transportation Study; Transportation Tomorrow Survey; Census data.

Transportation Policy

- Existing levels of transportation demand management and transportation system management will continue throughout the study period.
- No additional transportation taxes or user charges (e.g., road pricing, parking surcharges) will be introduced.
- No new transportation funding arrangements will occur: shortfalls in capital and operating funds will be a continuing challenge, only partially offset by one-time grants from the provincial and federal governments.

The transportation supply assumptions, in particular, reflect the continuation of ad-hoc transportation funding arrangements among the various government levels and a lack of adequate revenue sources at the municipal level. It should be recognized that the above assumptions regarding future expansion of the municipal transit and GO Rail modes reflect funding levels more typical of those experienced in the 1970s and 1980s rather than the more constrained levels of the 1990s.

TRAVEL DEMAND FORECASTS

A computer-based transportation model was used to estimate future transportation demand levels (in 2011, 2021 and 2031). The forecasts include future travel volumes and system performance levels on roads and transit facilities (including commuter rail) serving the study area. The forecasting process is sensitive to settlement patterns, population and employment distribution, and transportation system characteristics including capacities, travel times and costs, and transit service levels.

As part of this process, the study area was divided into 2,052 traffic zones and future population and employment in each zone were projected as inputs to the model.

Exhibit E.9: A.M. Peak period Trip Growth 2000 - 2031 for the Business-As-Usual Scenario

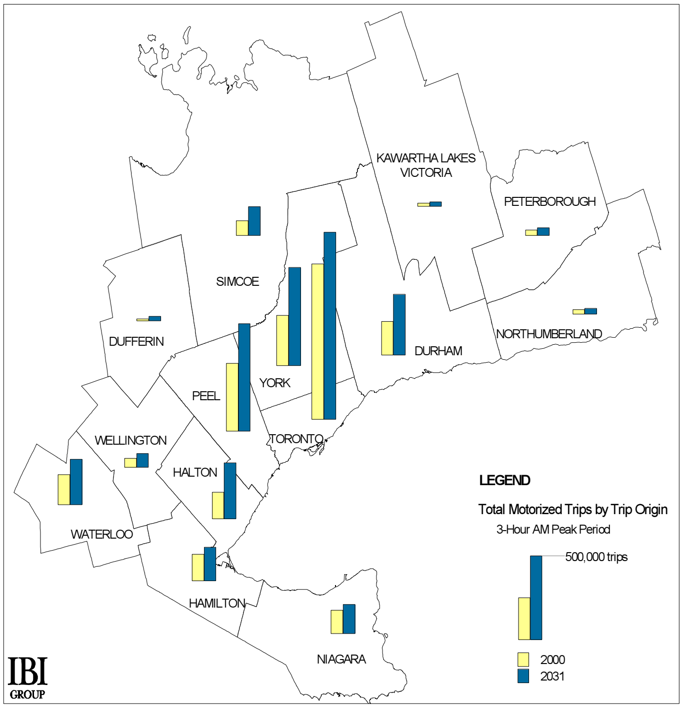
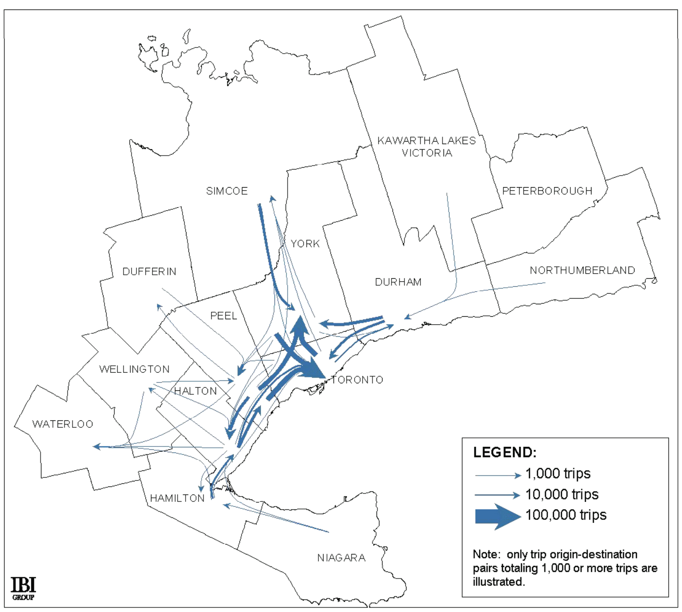


Exhibit E.10: Growth in A.M. Peak period Inter-Regional Travel Volumes (2000 – 2031)

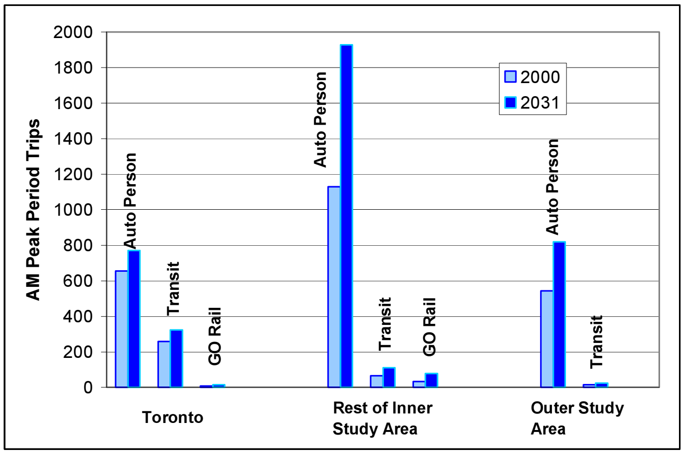


TRANSPORTATION OUTLOOK TO 2031

Overall, the study area will see significant growth in travel demand in the next three decades under the BAU scenario. Total motorized person trips in the three-hour a.m. peak period are forecast to increase from 2.7 million to 4.0 million, an increase of about 50%. As illustrated in Exhibit E.9, the majority of this growth will occur outside the City of Toronto, especially in York, Peel, Halton and Durham. There will be significant growth in interregional travel volumes between pairs of upper-tier municipalities, as shown in Exhibit E.10. Other significant transportation indicators by 2031 include the following:

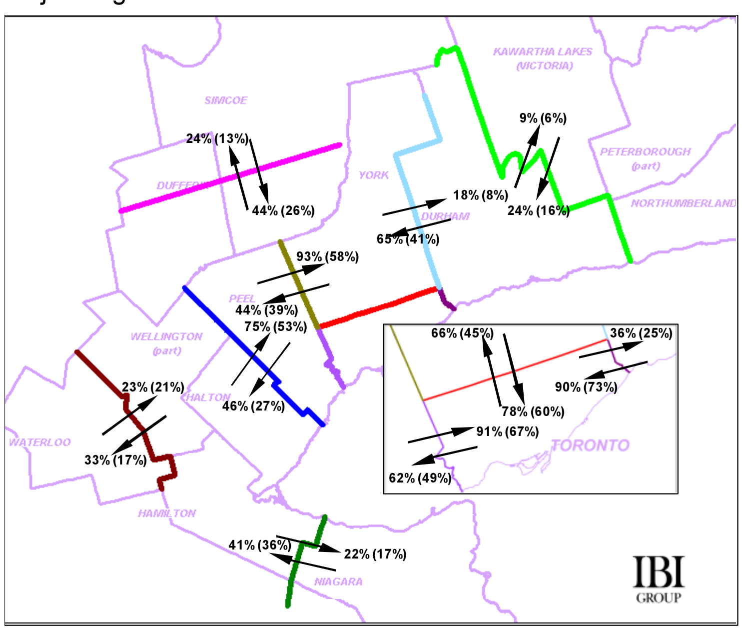
- **Travel Mode Trends**: Between 2000 and 2031, automobile trips are expected to increase by 51% for the overall study area; of this increase, about 10% is accounted for by trips originating in Toronto, 67% by trips from the rest of the inner study area, and 23% by trips from the outer study area. Municipal transit ridership will increase by approximately 35% based on the service increases assumed under the BAU scenario. In contrast, GO Rail ridership is forecast to increase by 140% or 2.4 times, with the majority of the growth coming from the inner study area outside of Toronto. In absolute terms, municipal transit trips will continue to exceed GO Rail trips in 2031 by a large margin for trips originating in Toronto, but GO ridership will close the gap significantly for trips originating in the rest of the inner study area (see Exhibit E.11). The estimated modal split in 2031 for the entire study area is about 86.5% auto, 11.2% municipal transit (including GO bus ridership) and 2.3% GO Rail. In the inner study area these modal shares are about 84%, 13% and 3%, respectively. Auto shares are essentially unchanged from 2000 levels, and declines in municipal transit are offset by increases GO Rail ridership.

Exhibit E.11: A.M. Peak period Trips by Mode and Area of Origin



- **Transportation Demand/Supply Balance:** The percentage increase in the municipal transit fleet is projected to keep pace with population growth. Average service levels will decline, however, as transit service coverage is extended into new urban areas which tend to have lower densities and less mixed-use development than established areas and are more difficult to serve cost-effectively with transit. GO Rail is currently operating at 110% of capacity and there is a latent demand which it cannot meet owing to capacity restrictions at Union Station and other parts of the rail network, resulting from budget limitations. By 2031, the much larger GO Rail ridership will continue to fully use the available capacity of the expanded system. Daily vehicle-km of automobile travel are estimated to grow by approximately 64% between 2000 and 2031. This will significantly outpace the increase in transportation capacity that can be expected under the BAU scenario, which is projected to produce a 30% increase in highway lane-km, a 6% increase in arterial road lane-km, and an overall increase of 9% for highways plus arterial roads. As illustrated in Exhibit E.12, the ratios of road traffic volume versus road capacity crossing key screenlines will grow substantially, particularly in the inner study area.

Exhibit E.12: 2000 and 2031 A.M. Peak period Volume/Capacity Ratios across Major Regional Screenlines



LEGEND: ( ) = 2000 Ratios

- **Congestion Levels:** As a result, substantial increases in traffic congestion (defined as a volume/capacity ratio of 80% or greater) are projected under the BAU scenario. By 2031 it is projected that arterial roads in the inner study area will experience congestion on 51% of the lane-km (up from 30% in 2000) and on 67% of highway lane-km (up from 48% in 2000). In the outer study area, 21% of the arterial road and 24% of the highway lane-km will be congested (up from 8% and 5% in 2000, respectively).

- **Transportation Capital Costs:** Estimated public-sector capital costs for transportation infrastructure associated with the BAU scenario are about $44 billion to 2031 (an average of about $1.4 billion per year), of which about 71% applies to the inner study area and the remaining 29% to the outer study area. This reflects a continuation of recent capital expenditure levels, which have been in the range of $1.0 – 1.5 billion during the 1993 – 2000 period. About 57% of the projected investments in the inner study area are for highways and arterial roads, and the remaining 43% are for municipal transit, rapid transit and GO Rail. By contrast, almost 98% of the outer study area investments are projected for highways and arterial roads, with the remaining 2% on municipal transit. All costs are expressed in 2000 dollars. About one-quarter of projected transportation capital costs are for expansion and three-quarters for system rehabilitation and renewal over the 31-year study period. The rehabilitation and renewal costs are not unique to the BAU scenario and will be required under any scenario in order to maintain the transportation system in a state of good repair. Under the projected continuation of current policies, most of the rehabilitation and renewal investment will be funded by municipalities from property taxes, with periodic one-time contributions from the provincial and federal governments. System expansion costs will be funded partly by development charges and partly by governments.[3]

- **Transportation Operating Costs:** By 2031 operating and maintenance costs experienced by transportation providers (transit costs net of fare revenues) will total some $850 million per year, of which about 72% will be experienced in the inner study area and the remaining 28% in the outer study area. In contrast, the annual operating costs for auto drivers in 2031 are projected at about $7.5 billion, of which 78% applies to the inner study area and 22% to the outer study area. While the transportation provider expenditures represent a continuation of past trends, transportation **users** will experience a very substantial increase in annual operating costs (up 63% from year 2000 levels), reflecting the increased congestion levels and increased travel effort projected for those travelling by automobile. Increasing gridlock for auto travellers will also translate into substantially increased delays and costs for goods movement by truck, although these are not included in the present study.

[3] Development charges cover 100% of growth-related capital costs of regional roads, 90% of the cost of growth-related capital transit equipment (e.g., vehicles and shelters) and (at present) one-third of 90% of growth-related capital expenditures for GO Transit infrastructure.

- **Energy Consumption and Vehicular Emissions:** Under the BAU scenario there is a mixed result in terms of future trends in energy consumption and vehicular emissions from transportation operations. These projections are affected by the increase in vehicle-km of travel (estimated at 64% between 2000 and 2031) and reductions in fuel consumption and vehicular emissions per vehicle-km as a result of technological improvements. For example, it is estimated that there will be a 15% improvement in fuel efficiency over the study period and a slightly larger reduction in the emissions rate per vehicle-km of greenhouse gases (primarily carbon dioxide [CO_2]), which are implicated in global climate change. Fuel consumption and CO_2 emissions are closely related, since CO_2 results from the combustion of carbon, which is a major constituent of most existing fuels. Taking into account these factors and interactions results in an estimated increase of about 2 billion litres annually in automobile fuel consumption between 2000 and 2031, an increase of 44%. The emissions of greenhouse gases are projected to increase by 42% over the same period. In contrast, technological improvements are projected to decrease the emissions rates (grams per vehicle-km) for other major contaminants: an 82% reduction for nitrogen oxides (NO_X), a 75% reduction for volatile organic compounds (VOCs) and a 70% reduction for carbon monoxide (CO). When combined with the projections of increased vehicle-km and decreased travel speeds, the overall emissions of these three contaminants are expected to decrease under the BAU scenario by significant amounts: a 68% reduction of NO_X, a 49% reduction for VOCs and a 35% reduction for CO. Since NO_X and VOCs are the precursors of urban smog, which is implicated in a significant increase during the past decade in respiratory ailments, this is an encouraging trend. In contrast, however, the World Health Organization has stated that emissions of nitrogen oxides and VOCs need to be reduced by 90% to minimize impacts on human health and eco-toxicity.

- **Travel Effort:** Average a.m. peak period automobile trip distances are projected to increase by 9%, from about 15.7 km to 16.9 km. Work trip distances will show a smaller increase of 6%, from 17.9 to 18.5 km, reflecting improvements in the job/worker balance within individual municipalities. The average a.m. peak period trip distance by transit will increase from 11.0 to 12.1 km for the overall study area. The average GO Rail trip length, currently about 32 km, will remain essentially unchanged under the BAU scenario, which assumes more trains operating on the existing network. Average automobile travel times for the study area will increase by 44%, from approximately 15 to 22 minutes. This is primarily due to increased congestion. Average travel speeds during peak periods under the BAU scenario are forecast to decrease by 25%, from an average of 61 km/h to 45 km/hr.

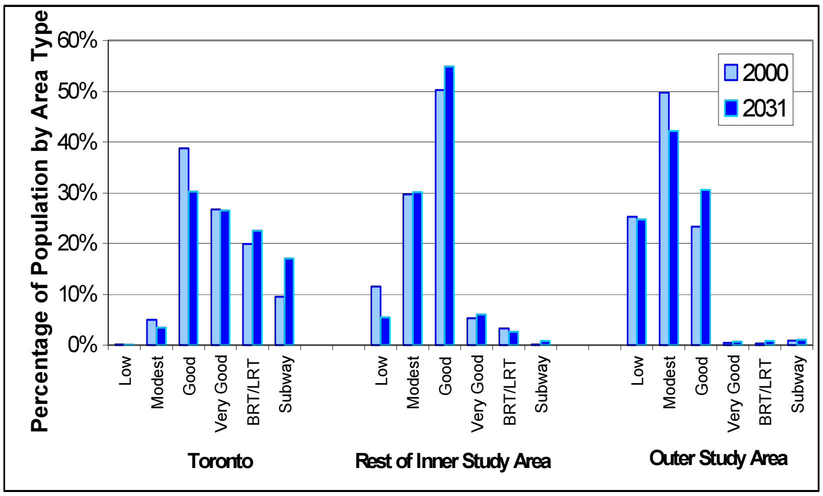
- **Transit Viability:** As noted in a number of reports, density is a key determinant of the viability of transit.[4] In order to understand how transit viability would change under the BAU scenario, each traffic zone was categorized according to transit

[4] Transit-Supportive Land Use Planning Guidelines, Ministry of Municipal Affairs and Ministry of Transportation, Ontario, April 1992.

potential based on development density measured in terms of people plus jobs per hectare. Generally, transit potential, as measured by this density variable, decreases with distance from the downtown core of Toronto or from other urban centres in the study area, as shown in Exhibits 3.31 and 3.32 in the main report.

Using these maps of transit potential, a weighted average of the percentage of the population in each category can be calculated. The results are shown in Exhibit E.13. In general, under the BAU scenario, there will be little or no gain in the percentage of population living in areas that are viable for high-order transit based solely on the criterion of development density. There will, however, be marginal gains in areas suitable for bus service, which could include priority transit on some routes, as noted earlier. Service in such areas could also include high-order transit routes with appropriate feeder/distributor connections. GO Rail with park-and-ride access is an example. As discussed in Chapter 2 of the main report, the viability of transit in these areas (in terms of both ridership and cost-efficiency) can be increased by a more transit-supportive urban structure, for example, greater emphasis on compact, mixed-use subcentres and corridors which can be effectively served and shaped by improved trunk and local transit services. This would have the important related effect of reducing the required subsidy per passenger carried.

Exhibit E.13: Population by Transit Potential Area



KEY IMPLICATIONS

Summarized below are major transportation implications of the Business-As-Usual scenario, including some implications for individual residents and travellers in the study area:

- About 66 % of the 2000 – 2031 population growth and 73% of the employment growth under the BAU scenario is projected to occur in the inner study area, excluding the City of Toronto. Reflecting a continuation of relatively low transit service levels under the BAU scenario, residents of this area will depend heavily on automobile travel, as will those living in the outer study area. Auto ownership in the study area is projected to increase by about 1.9 million vehicles to 2031.
- A public-sector capital investment of about $44 billion, or $1.4 billion per year, is projected for transportation, drawing on a combination of government expenditures

and development charges. Of this, about one-quarter is for system expansion; the remaining three-quarters is for system rehabilitation/renewal and will be required regardless of alternative urban structure/infrastructure policies in order to keep the transportation system in a state of good repair. This overall level of capital investment by government in the transportation system represents a continuation of average investment levels during the past decade.

- Notwithstanding this investment, hours of delay experienced by auto drivers on a typical weekday are projected to increase from about 300,000 hours per day to about 1.2 million. At a conservative value of drivers' time of $10 per hour, the total cost of delay to auto drivers in 2031 would be $12 million per day or $3.8 billion per year, the latter up from about $1 billion in 2000.

- The average commuting time spent each month in 2031 by a household located in the north central GTA with two workers, each driving to work, is estimated to be about 38.5 hours in 2031, up from 30.8 hours in 2000, a 25% increase.

- The average monthly auto operating cost of commuting for a similar household in 2031 is estimated to be $195, up from $144 in 2000, an increase of $51 per month or over $600/year in constant dollars, up by 35% from year 2000 costs. If vehicle ownership costs are included, monthly vehicle ownership and operating costs for both vehicles would total $1,303 in 2031, an increase of 4.1% from $1,252 in 2000.

- The lack of attractive transit service for most households in suburban areas deprives them of a travel mode choice which might otherwise save the cost of purchasing and operating an additional automobile if, for example, one of the breadwinners could commute by transit.

- A through trip passes through a municipality and uses its transportation infrastructure, thereby placing a non-beneficial burden on the municipality. Considering through trips at the scale of upper-tier municipalities, in 2000 there were approximately 144,000 a.m. peak period through trips or 5.3% of all study area trips. By 2031, UTM through trips are estimated to increase by 85% to 266,000 trips. Peel Region presently has the highest number of through trips at just over 50,000 trips in 2000, growing to about 82,000 by 2031. As discussed in the main report (Section 3.6.3) the implications of through traffic for the "host" municipality depend on whether such trips can be accommodated on trunk transportation facilities (e.g., expressways, GO Rail) and whether there is sufficient capacity on those facilities to accommodate both through and locally generated traffic.

- As traffic volumes increase, the costs associated with traffic accidents can also be expected to increase; for example, the cost of traffic accidents in the study area, estimated at some $3.8 billion in 2000, is projected to increase to $6.3 billion per year by 2031, an absolute increase of $2.5 billion or approximately $75 per capita.

- Emissions of greenhouse gases (implicated in global climate change) are estimated to increase by some 42% between 2000 and 2031 under the BAU scenario. In contrast, vehicular emissions of other major contaminants are projected to decrease significantly, as improved vehicular technology more than compensates for increased vehicle-km of travel: emissions of nitrogen oxides are projected to decrease by 68%, volatile organic compounds by 49%, and carbon monoxide by 35%. Since the former two contaminants are the precursors of urban smog, which is implicated in significant increases in respiratory ailments, this is a promising trend, although the World Health Organization has stated that considerably greater reductions are required to minimize impacts on human health.

Under subsequent phases of the Futures Study, Neptis plans to explore the extent to which alternative land use and transportation scenarios may hold the promise of improved transportation system performance and cost.

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E.4 WATER/WASTEWATER

Chapter 4 of the report, prepared by Dillon Consulting Limited, describes water and wastewater systems which will be required to serve the Business-As-Usual scenario, and the costs and other implications of such systems. Owing to differences in the level of urbanization, scale of water/wastewater systems and other factors between the inner and outer study areas, these are described separately in the chapter and in this Executive Summary.

PAST SYSTEM DEVELOPMENT

Inner Study Area

In the GTA and Hamilton, the development of water and wastewater infrastructure goes back decades.

While much of the focus has been on growth-related infrastructure, the older parts of the water/wastewater systems in the inner study area are now facing critical renewal challenges. As an example, much of the City of Toronto's system is over fifty years old and in need of rehabilitation. Increased public concerns regarding water quality are leading to new regulations requiring municipalities to upgrade their water treatment plants. As well, there is pressure to upgrade wastewater plants to improve effluent quality and Toronto is undertaking a Wet Weather Flow Master Plan to address combined sewer overflows and the need for storm water quality improvement to clean up polluted rivers and beaches.

The challenges facing Toronto region's water/wastewater infrastructure today may be somewhat different from those of the past fifty years, but are no less important; it is critical that the systems be upgraded, older infrastructure renewed, and growth accommodated.

Outer Study Area

The urban centres of the outer study area face water/wastewater infrastructure challenges similar to those in the inner study area (i.e., infrastructure renewal, system upgrades and new infrastructure to accommodate growth), but to a lesser extent. Generally, the systems are newer and many upgrades have been undertaken because of the sensitive nature of the sources of water supply and the receiving bodies for wastewater effluent. These activities are likely to be reinforced as a result of the events in Walkerton and recommendations of the subsequent inquiry.

Most of the urban centres in the outer study area do not have large lake-based systems like the inner study area, with the exception of the Region of Niagara and southern Northumberland County (Cobourg, Port Hope). Many of them rely (or mostly rely) on groundwater for their water supply, e.g., Barrie, Guelph and Kitchener/Waterloo/ Cambridge (Tri-Cities). Many of the urban centres discharge their treated wastewater effluent to smaller, more sensitive receiving bodies compared to Lake Ontario, e.g., Peterborough to the Otonabee River, Barrie to Lake Simcoe, Guelph to the Speed River, and the Tri-Cities to the Grand River. As a result, they have had to apply a higher level of wastewater treatment compared to cities with large lake-based systems.

MAJOR INFLUENCING FACTORS

Inner Study Area

The discussion of the inner study area in Section 4.1 identifies the following major factors that have influenced development of water/wastewater infrastructure.

- **Governance Structure:** the creation of regional governments, first Metro Toronto and subsequently the surrounding Regions, was a major factor in infrastructure development, providing the broad geographic scale, expertise and financial resources necessary for an integrated and effective infrastructure development program.
- **Provincial Funding:** the creation of the Ontario Water Resources Commission (OWRC) made available provincial resources to front-end finance the large lake-based schemes in South Peel and York-Durham. In addition to the write-off of millions in capital for the York-Durham Sewer System, there were also significant provincial subsidies for the scheme.
- **Developer Funding:** in the initial development of the Metro system, developers partially funded the trunk systems; for development in the surrounding regions, developers primarily paid for the local systems. More recently, developers have paid for virtually all growth-related infrastructure.
- **Inter-Municipal Servicing Agreements:** examples of these include the water supply agreements between York Region and Peel Region/City of Toronto and the wastewater agreements between York Region and Peel Region/Durham Region.
- **Environmental Regulation:** regulations affect water and wastewater treatment requirements.
- **Aging infrastructure:** large investments are required to restore older infrastructure to current standards.

Outer Study Area

The discussion of the outer study area in Section 4.2 identifies the following major factors that have influenced development of water/wastewater infrastructure.

- **Reliance on Groundwater:** because of the limitations on quantity, and concerns with quality, there has been more investment in demand management and source protection.

- **Sensitive Receiving Bodies:** because of the smaller and more sensitive receiving bodies, these municipalities have built wastewater treatment plants with higher levels of treatment than those of cities with large lake-based systems.

- **Inter-Municipal Servicing Agreements:** examples of these include the water supply agreement between Collingwood and New Tecumseth. Further consolidation of municipal systems is expected among smaller communities to achieve more favourable economies of scale with respect to facilities, operations and management capacity.

- **Environmental Regulation:** regulations affect water and wastewater treatment requirements.

- **Aging infrastructure:** large investments are required to restore older infrastructure to current standards.

OUTLOOK TO 2031

Inner Study Area

For the Business-As-Usual scenario, water/wastewater system requirements were prepared for the inner and outer study areas. The existing system and the required system by 2031 are illustrated in Exhibits E.14 and E.15, respectively, and discussed in Sections 4.6 and 4.7 of the report. Growth related system expansion was based on the population, employment and urban development patterns projected by the study team. Cost estimates were provided in three components:

1. **System Renewal Costs:** costs for upkeep of existing infrastructure through rehabilitation and replacement.

2. **System Upgrade Costs:** costs to improve water quality, including upgrades to existing treatment plants, and to address existing combined sewer overflows and existing stormwater discharges to receiving bodies.

3. **Growth-Related Costs:** costs of new infrastructure to service development growth for the 10-year, 20-year and 30-year horizons.

The needs for plant capacity expansions contained in regional and municipal Master Plans were checked against Ministry of Environment per capita water consumption and sewage generation rates of 750 L per capita per day (Lpcd) and 450 L per capita per day, respectively, multiplied by the projected population in each municipality. No significant deviations were noted with the exception of the Region of York, which was experiencing higher growth rates than that forecast in its Master Plan for water and wastewater.

Exhibit E.14: Water/Wastewater System: Year 2000

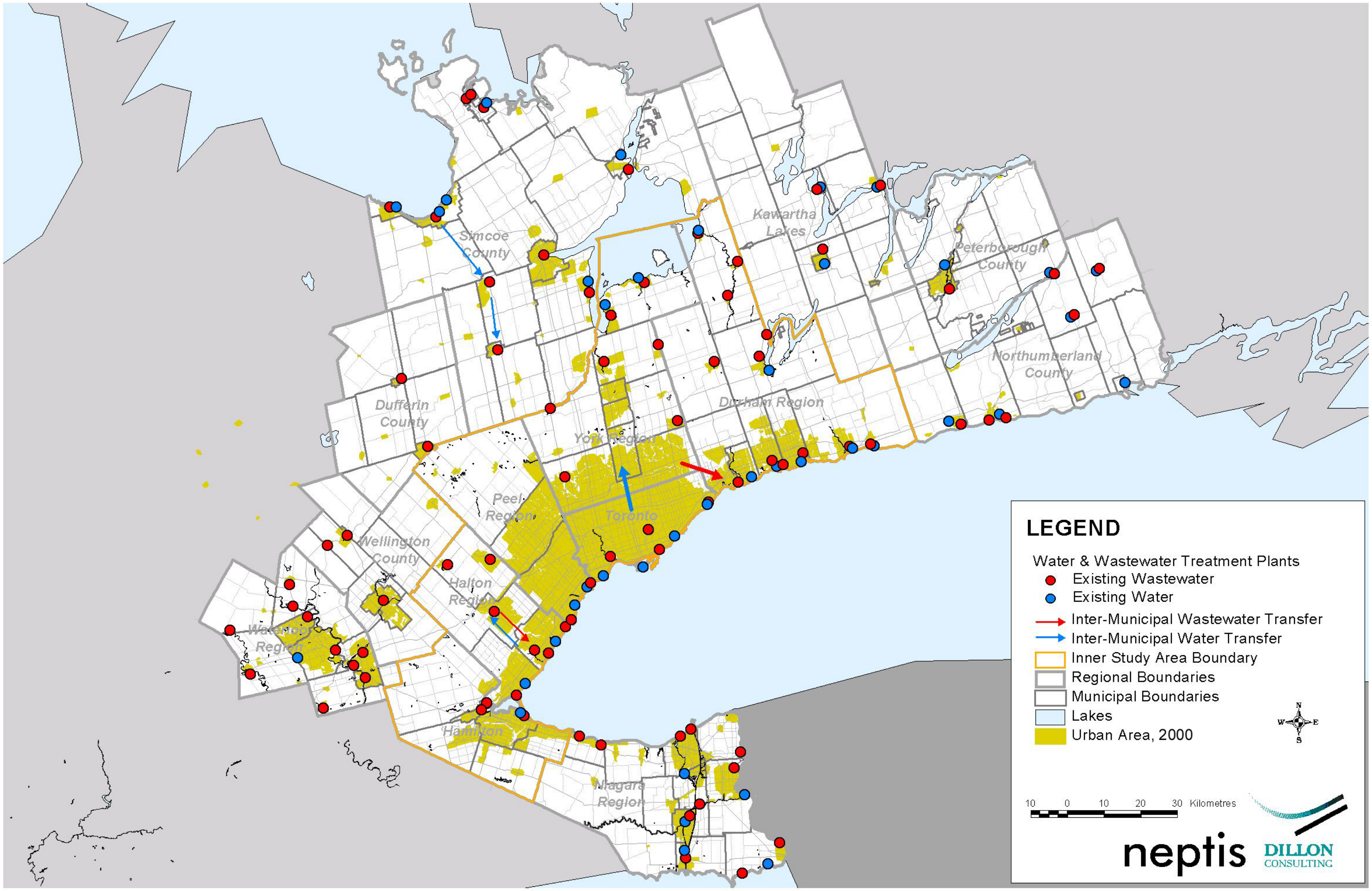
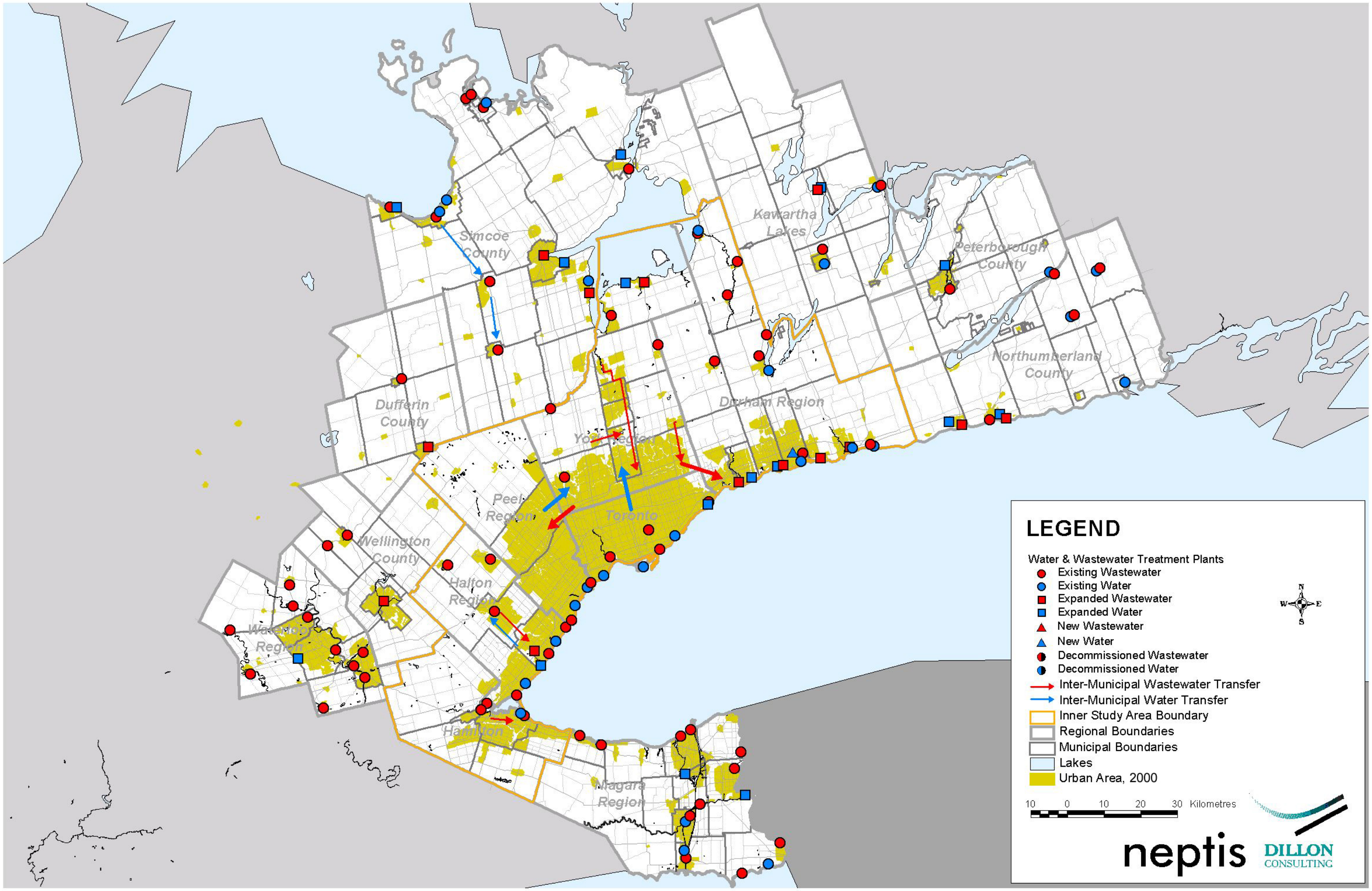


Exhibit E.15: Water/Wastewater System: Year 2031



Additional plant expansion has been included for the Region of York to address this shortfall.

The three water/wastewater system cost estimates for the inner study area are summarized in Exhibit E.16.

Exhibit E.16: Water/Wastewater Cost Summary for the Inner Study Area

	Cost Estimates ($millions)			
Horizon Year	**2011**	**2021**	**2031**	**Cumulative Total (30 years)**
System Renewal	5,800	5,800	5,800	17,400
System Upgrades	860	7,90	2,290	3,940
Growth Related	2,280	1,350	1,610	5,240
Total Costs	$8,940	$7,940	$9,700	$26,580

The cumulative cost for the inner study area is $26.6B, or almost $1B per year.

Outer Study Area

The per capita generation rates for water demand used in forecasts for the outer study area are lower than those for the inner study area, reflecting a greater reliance on groundwater in the former. Typically, groundwater systems have lower per capita water demands and lower peak factors (e.g., Waterloo, Guelph and Barrie). Water demand was projected based on approximately 670 Lpcd. The wastewater generation rate was projected based on 430 Lpcd; this was not significantly reduced from the Ministry of the Environment value of 450 Lpcd in order to account for infiltration and inflow, which is often a large component of sewage flows and is difficult to effectively reduce. As in the inner study area, water efficiency has not been specifically addressed in the preparation of these estimates, apart from the reductions noted above.

The three water/wastewater system cost estimates are summarized for the outer study area in Exhibit E.17.

Exhibit E.17: Water/Wastewater Cost Summary for the Outer Study Area

	Cost Estimates ($millions)			
Horizon Year	**2011**	**2021**	**2031**	**Cumulative Total (30 years)**
System Renewal	1,700	1,700	1,700	5,100
System Upgrades	150	220	190	560
Growth Related	450	450	495	1,395
Total Costs	$2,300	$2,370	$2,385	$7,055

The cumulative cost for the outer study area is $7.1B, or almost $250M per year.

The total water/wastewater costs for the inner and outer study areas are summarized in Exhibit E.18.

Exhibit E.18: Water/Wastewater Cost Summary for Total Study Area

	Cost Estimates ($millions)			
Horizon Year	2011	2021	2031	Cumulative Total (30 years)
Inner Study Area	8,940	7,940	9,700	26,580
Outer Study Area	2,300	2,370	2,385	7,055
Total Costs	$11,240	$10,310	$12,085	$33,635

The cumulative cost for the total study area is $33.6B, greater than $1B per year.

KEY IMPLICATIONS

This analysis of BAU water/wastewater investment requirements over the 30-year period has several key implications:

- The investments are significant at $11.2B in the first decade, $10.3B in the second and $12.1B in the third; this translates to $1,320, $1,080 and $1,150 per capita in the first, second and third decades, respectively.[5] **Approximately 80% of the costs are for system renewal and upgrades, and these costs are not unique to the BAU development scenario**. As well, when considering growth-related costs (20% of the total cost), the cost of plant expansions will be common to all development scenarios; therefore, only a relatively small portion of the above total costs will vary by development scenario, i.e., the pipes. These typically account for about 50% of growth-related capital costs.

- In general, investments in the system will become increasingly weighted towards renewing existing infrastructure and upgrading treatment; financing for those types of expenditures will require both higher user fees and related senior government leadership (e.g., the Sustainable Water and Sewage Systems Act and relevant regulations) in order to succeed. Without financing, there would be a continuing and growing problem of deferred renewal and deferred upgrading of the water/ wastewater system, leading to increased waste of water and potential reduction of water quality.

- Growth-related capital expenditures, while significant, are recovered from development charges programs.

- The drive to full cost recovery, higher levels of treatment, groundwater protection and more management expertise will likely spur system consolidation, particularly in the outer study area. The higher levels of treatment have been addressed in the

[5] Based on the projected population at the end of the decade in each case.

above cost estimates under system upgrades. Again, this assumption is not unique to the BAU development scenario.

The investment will result in a greatly improved water/wastewater system, far more sustainable with adequate renewal expenditures, improved drinking water quality, reduced water consumption, improved water quality in receiving bodies through wet weather flow management and improved wastewater effluent quality, and greater water resource protection, especially for groundwater.

E.5 SUMMARY OF FINDINGS

Exhibit E.19 provides a summary of key findings showing anticipated trends estimated for the Business-As-Usual scenario. This provides an array of some of the more important measures selected from those discussed in the body of the report.

Many of the measures show very large growth during the study period to 2031. These include population (up 43%), employment (up 54%), urbanized area (up 45%), through trips (up 85%), daily trips by adults (up 53%), daily vehicle-km of auto travel (up 64%), a.m. peak period GO Rail ridership (up 58%), car ownership (up 50%), GO Rail peak period seat-km per capita (up 40%), average auto trip time in the a.m. peak (up 45%), a.m. peak period delay per auto trip (up 161%), carbon dioxide emissions (up 42%), fuel consumption (up 44%), GO Transit operating and maintenance costs (up 130%) and auto drivers' operating and maintenance costs (up 65%).

Other measures show a substantial downward trend, including a.m. peak period transit modal share for the total study area (down 11%), highway and arterial road lane-km per capita (down 24%), peak period average auto travel speeds (down 25%), nitrogen oxide emissions (down 68%), carbon monoxide emissions (down 35%) and volatile organic compounds emissions (down 49%). Other indicators show smaller degrees of change, either positive or negative.

At this interim stage in the study, the study team has identified the following issues in examining the BAU scenario:

- a large growth in population, employment and related activities, which will result in a significant increase in the urbanized area and related impacts on the uses of rural land including agricultural land;
- the proliferation of relatively low-density, single-use areas on newly urbanized lands which are difficult to serve cost-effectively by transit, walking or cycling and require automobile use;
- major increases in automobile travel, with reductions in municipal transit ridership and in modal choice available to travellers;
- increases in commuting and other travel times and costs due to increasing travel distances and congestion, thus affecting the region's economic competitiveness as goods movement times and costs also increase due to automobile congestion;
- continuing reliance primarily on limited local governmental funding sources and development charges for capital funding of transportation and water/wastewater infrastructure – estimated to total some $77 billion over the period to 2031 – of which about three-quarters (some $59 billion) is required for system rehabilitation, renewal and upgrading, and the remainder (some $18 billion) for growth-related investments. While the latter is driven primarily by overall growth in population

Exhibit E.19: Key Measures for the Business-As-Usual Scenario

INDICATORS	2000	2031	Absolute Change	Percent Change
LAND USE				
Population (millions)	7.4	10.5	3.2	43%
Employment (millions)	3.5	5.4	1.9	54%
Activity Rate (employment/population)	0.48	0.52	-	8%
Urbanized Area (thousands of acres)	586	850	264	45%
Gross Density (pop+emp/ acre of urbanized area)	18.6	18.8	-	1%
Through Trips (passing through Upper Tier Municipalities)	144,000	266,000	122,000	85%
TRANSPORTATION				
Transportation Demand				
Adult Daily Trips (millions)	14.07	21.47	7.4	53%
Daily Trips/Adult	2.48	2.65	-	7%
Daily Vehicle-km of Auto Travel (millions)	157	258	101	64%
A.M. Peak Period Transit Modal Share (of motorized trips)				
Toronto	28%	29%	-	4%
Total Study Area	13%	11%	-	-11%
GO Rail	1.5%	2.3%	-	58%
Transportation Supply				
Car Ownership (millions of passenger vehicles)	3.72	5.60	1.9	50%
Car Ownership per 1000 capita	506	531	0%	5%
Arterial and Highway Lane-km	47,600	52,000	4,400	9%
Arterial and Highway Lane-km per 1000 capita	6.47	4.94	0%	-24%
A.M. Peak Period Transit Seat-km per capita				
Municipal Transit and GO Bus	1.34	1.25	-	-6%
GO Rail	1.02	1.43	-	40%
Transportation Performance				
A.M. Peak Period Average Auto Trip Length (km)	15.6	16.9	-	9%
A.M. Peak Period Average Auto Trip Time (min)	15.3	22.2	-	45%
A.M. Peak Period Average Auto Travel Speed (km/h)	61	46	-	-25%
A.M. Peak Period Delay per Auto Trip (min)	3.6	9.3	-	161%
A.M. Peak Period Transit Trip Length (excl. GO Rail) (km)	11.0	12.1	-	10%
Average Monthly Household Commuting Time (h)	30.8	38.5	7.7	25%
Average Monthly Household Commuting Costs ($)	144	195	51	35%
Environmental Impact				
Annual Emissions and Fuel Use from Passenger Automobiles				
Nitrogen Oxides (kilotonnes of No_x)	69.5	22.5	(47.0)	-68%
Carbon Monoxide (kilotonnes of CO)	437.2	283.1	(154.2)	-35%
Volatile Organic Compounds (kilotonnes of VOCs)	51.1	26.0	(25.1)	-49%
Carbon Dioxide (kilotonnes of CO_2 equivalents)	10,870.9	15,455.5	4,584.6	42%
Fuel (billions of litres)	4.4	6.3	1.9	44%
Transportation Expenditures (2000 $millions)				
Annual Operating and Maintenance Costs				
Roads and Highways	469	510	41	9%
Municipal Transit	193	249	56	29%
GO Rail	40 *	92	52	130%
Auto drivers	4,580	7,510	2,930	65%

EXPENDITURES (2000 $millions)	Total Investment	Average/ Year
TRANSPORTATION		
Capital and Rehabilitation Costs (2000 - 2031)		
Roads and Highways	30,000	970
Municipal Transit	9,500	307
GO Rail	4,300	141
TOTAL	43,800	1,418
WATER AND WASTE WATER		
System Investment Costs (2000-2031)		
System Renewal	22,500	723
System Upgrades	4,500	144
Growth-Related Expansion	6,600	212
TOTAL	33,600	1,080.00

* Note that this value is not the actual 2000 value, as the actual value for this year was found to be inconsistent with other recent values. The value presented here represents annual spending throughout the mid- to late-1990s.

and employment, it would also be subject to change if alternative urban structure and infrastructure policies were put in place rather than the BAU assumptions considered in this report.

These issues raise questions regarding the extent to which land consumption for urban development might be reduced by greater reliance on redevelopment in existing built-up areas and more compact, mixed-use subcentres and corridors in designated parts of developing areas. Related to this is the question of the extent to which auto-dependency may be reduced, the choice of alternative modes increased and transportation efficiency improved through such development strategies and patterns integrated with significantly improved transit in key corridors.

A key question in this regard is the extent to which alternative land use and infrastructure policies might effect such changes and the performance and cost implications of attempting to implement these policies.

For example, as noted earlier, the Business-As-Usual scenario is based on the assumption that government capital expenditures on transportation will continue in future at approximately the same levels as in the recent past. On the other hand, levels of capital investment for the water/wastewater system are assumed to be higher in future, reflecting heightened awareness of water quality issues in the wake of the Walkerton events, recommendations from the Walkerton Inquiry for system renewal and upgrading, and recent provincial legislation to achieve full-cost recovery, which would help fund these improvements. In theory, it would have been possible to assume capital investment increases in transportation as well, but the study team concluded that a continuation of existing funding arrangements and investment levels – in the absence of legislative changes or other initiatives signalling a more comprehensive approach to funding transportation in the study area – is more in keeping with the expectations under BAU. Clearly, either of these assumptions could be changed: higher levels of investment in transportation and/or lower levels of investment in water/wastewater could be assumed, and these would have implications in terms of the performance and cost of the infrastructure systems. The team has concluded that the assumptions and results presented in this report are in line with the premises of the BAU scenario and constitute a useful benchmark against which to consider possible alternative policy scenarios. It seems quite likely that any alternative scenarios considered will involve different levels of capital investment in infrastructure, among other differences from the BAU scenario.

The next stage of the study, as being considered by Neptis, would focus on defining two or three alternative development and infrastructure concepts and comparing them with the BAU concept in terms of the types of measures presented in this interim report. The intent will be to compare the implications of the alternatives in terms of land use characteristics and infrastructure performance and costs, using the BAU scenario as a benchmark. In the meantime, the findings of this report provide food for thought on these aspects of the urban region as it might be in 2031 based on a continuation of Business-As-Usual and continuing rapid growth.

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1 INTRODUCTION

1.1 BACKGROUND

The urban and urbanizing region centred on Toronto has become Canada's largest, building on its many natural advantages. These include its relatively central location in Canada and proximity to other major urban centres in North America, a benign climate (in North American terms), plentiful sources of fresh water, and the natural amenities of a lakefront location, proximity of good farm land and extensive greenlands. Economically the region benefits from its location at the centre of Canada's largest manufacturing area and from the presence of many corporate head offices, major providers of financial, legal and other professional services and significant clusters of high technology firms plus extensive educational, medical and related research establishments. A multi-cultural area where vibrant ethnic communities live in harmony and many of the streets are "people places" with thriving retail and cultural establishments, the Toronto-related region also has advantages in attracting knowledge-based firms and workers as well as continuing high levels of immigration.

1.1.1 Challenges of Continuing Rapid Urbanization

In common with other rapidly growing urban areas, however, the Toronto-related region also faces substantial challenges as its residents and leaders seek to address continuing rapid growth in a sustainable manner that maintains or improves the performance and cost-effectiveness of the area's development and infrastructure. Key issues raised in recent years include:

- continuing consumption of land for urban purposes with implications for former rural land uses, including agriculture;
- lack of meaningful choice of alternative travel means to the automobile (e.g., public transit, walking, cycling) in rapidly growing suburban areas;
- growing levels of traffic congestion leading to excessive commuting times and costs, with related impacts on goods movements and the region's economic competitiveness;
- environmental issues relating to continuing rapid urbanization including effects on air and water quality; and

- growing capital and operating costs for urban development and infrastructure coupled with inadequate revenue streams and financial arrangements to address these needs.

The Toronto-related region has achieved many successes in evolving to its present size and form, including dealing relatively effectively with rapid growth in the half century since World War II. The outlook is for continuing rapid growth over the coming decades. The region's ongoing success will depend greatly on the manner in which it accommodates and manages this growth.

1.1.2 Understanding Development Trends and Options for the Entire Urbanizing Region

Building on the area's strengths while addressing its challenges is a complex process. If the area's citizens and leaders are to make intelligent, informed decisions, they will require objective and reliable information on the likely future implications of their policy, planning and management decisions. Individual municipal jurisdictions and government departments regularly prepare forecasts and plans for their respective areas of interest, but it is rare that a geographically comprehensive approach is taken in which consequences of alternative development and infrastructure policies are assessed for the entire region.

One such approach, titled the ***Greater Toronto Area Urban Structure Concepts Study,***[1] was commissioned in 1990 by the Greater Toronto Coordinating Committee, comprising provincial and municipal senior staff, and sponsored by the Office for the Greater Toronto Area (OGTA), an arm of the Ontario government. That study assessed three alternative growth scenarios for the Greater Toronto Area (comprising the upper-tier municipalities of Metropolitan Toronto, Durham, York, Peel and Halton, with a total area of 7,060 km^2 of which some 1,520 km^2 were urbanized in 1991). Infrastructure requirements, costs and performance implications were assessed not only for transportation and water/wastewater systems, but also for recreation and greenlands, health, education and other social services.

Flowing from the results of that study, there was considerable consensus among provincial and municipal leaders that the "nodal" development concept (involving greater emphasis on compact, mixed-use centres, subcentres and corridors served by improved public transit) would be the most appropriate basis for future development and infrastructure decisions.

[1] ***Greater Toronto Area Urban Structure Concepts Study***, prepared for the Greater Toronto Coordinating Committee and the Office for the Greater Toronto Area, IBI Group et al., June 1990.

The concept was further developed by provincial/municipal working groups into the "GTA Vision" and various reports were published in 1992[2] describing the vision. The Official Plans of the relevant upper-tier municipalities (UTMs) and area municipalities, which were approved during the mid 1990s, tended to reflect the provincial/municipal vision as a basis for policy and plans. Although subsequent development approvals and decisions have in many cases fallen short of these objectives, there has been an evolution in policy thinking and a renewed interest in "smart growth" as a means of achieving more sustainable development.

In this context, there is an increasingly urgent need for consistent and comprehensive information on development trends, as well as possible alternative development and infrastructure concepts and their implications for the entire urban and urbanizing region.

1.1.3 Relevant Reports by the Neptis Foundation

The Neptis Foundation commissioned a number of reports during 1999[3] which documented the land use, land resources, transportation, economic, social and fiscal trends of the past several decades. It has commissioned the present study to project and assess the implications of continuing development in line with these trends.

Drawing on an analysis of development and infrastructure trends and the underlying factors on which they are based, this study projects likely urban development, infrastructure and performance/cost implications over the next three decades, on the assumption that current policies, development approval processes and related infrastructure/management approaches will continue largely unchanged over that period. This is referred to as the Business-As-Usual (BAU) scenario.

This is the first step of a broader study being considered by Neptis which, based on issues identified for the BAU scenario, will formulate a number of alternative scenarios reflecting possible changes in policies and procedures. The information in this initial study and the broader study to follow from the Neptis Foundation are offered as a basis for informed discussion as the region's citizens and leaders address the important decisions that will have to be made.

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[2] ***Urban Form: Bringing the Vision Into Focus***, Office for the Greater Toronto Area, Report of the Provincial-Municipal Urban Form Working Group, March 1992.
GTA 2021 – Infrastructure, Office for the Greater Toronto Area, Report of the Provincial-Municipal Infrastructure Working Group, March 1992.
[3] ***The Evolving Physical Condition of the Greater Toronto Area: Space, Form and Change***, a report to the Neptis Foundation, Robert M. Wright, University of Toronto; February 2000.
Inching Toward Sustainability: The Evolving Urban Structure of the GTA, a report to the Neptis Foundation, Pamela M. Blais, University of Toronto, March 2000.
Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century, a report to the Neptis Foundation, Enid Slack, University of Toronto, February 2000.
People and Places: A Portrait of the Evolving Character of the Greater Toronto Area, a report to the Neptis Foundation, Larry S. Bourne, University of Toronto, January 2000.
A Region in Transition: The Changing Structure of Toronto's Regional Economy, a report to the Neptis Foundation, Meric S. Gertler, University of Toronto, March 2000.
Travel in the Greater Toronto Area: Past and Current Behaviour and Relation to Urban Form, a report to the Neptis Foundation, Eric J. Miller, Amer Shalaby, University of Toronto, January 2000.

1.2 STUDY PURPOSE AND SCOPE

1.2.1 Study Purpose

The purpose of the overall study will be to describe several alternative future scenarios for the Toronto-Related Region and the strategic implications of each scenario in terms of urban structure, physical infrastructure (e.g., transportation, water/sewer systems), and related performance and cost implications.

To the extent feasible and at a strategic scale, the study will provide a quantitative description of each scenario and the underlining forces and policies behind it, along with both quantitative and qualitative implications. The study will not produce policy or planning recommendations, but rather will provide an objective comparison of several alternative futures for the GTA as "food for thought" and to help inform discussion by the public and its decision-makers regarding policy and planning choices.

1.2.2 The Business-As-Usual (BAU) Scenario

The approach for the BAU scenario described and assessed in this interim report has been to project and describe the likely physical development and performance of the urban region (in terms of development patterns, land uses and densities, physical infrastructure and performance and cost implications), if existing policies remain in effect along with continuing rapid growth and current responses of the consumers and providers of urban development and its infrastructure. Reflecting the long-term implications of land use and infrastructure decisions, the study has, as noted earlier, a long-term planning horizon, to 2031. The estimates of future land use and infrastructure conditions are also provided for intermediate decades: e.g., 2011 and 2021, as well as the 2000 base year and the 2031 horizon year.

1.2.3 Alternative Scenarios

Based on insights gained from projecting and considering the BAU scenario presented in this report, a number of alternative policy and policy response scenarios will be developed and their future implications will be estimated in the same timeframe. so that direct comparisons can be made with the BAU scenario. Without trying to prejudge the details of this process, we anticipate that one fundamental "dimension" to be considered in defining the alternative scenarios will be land use/urban structure (e.g., a continuation of "spread" development or, as an alternative, greater emphasis on infill within existing built-up areas, greater emphasis on compact, mixed-use centres and corridors in developing suburban regions, etc.). Another major dimension will be alternative infrastructure policies (e.g., the timing, locations, types and pricing regimes for transportation and water/wastewater facilities and services).

It is well recognized that there are strong interactions between land use development patterns and the physical infrastructure which serves and helps shape them; the study will attempt to reflect these interactions as realistically as possible, using forecasting models and quantitative estimating procedures where appropriate, and more qualitative approaches including "expert judgement" where necessary.

1.2.4 Not a Planning Study

A major challenge in conducting a study of this type is the extent to which the plans of municipalities and others (e.g., conservation authorities, energy companies, provincial ministries) are taken into account. The approach taken in this study has been to include, to the extent feasible, committed and planned urban development initiatives and infrastructure expansion/extensions, and to focus on the upper-tier municipality (UTM) level and avoid more detailed planning issues, reflecting the study's strategic, non-prescriptive focus.

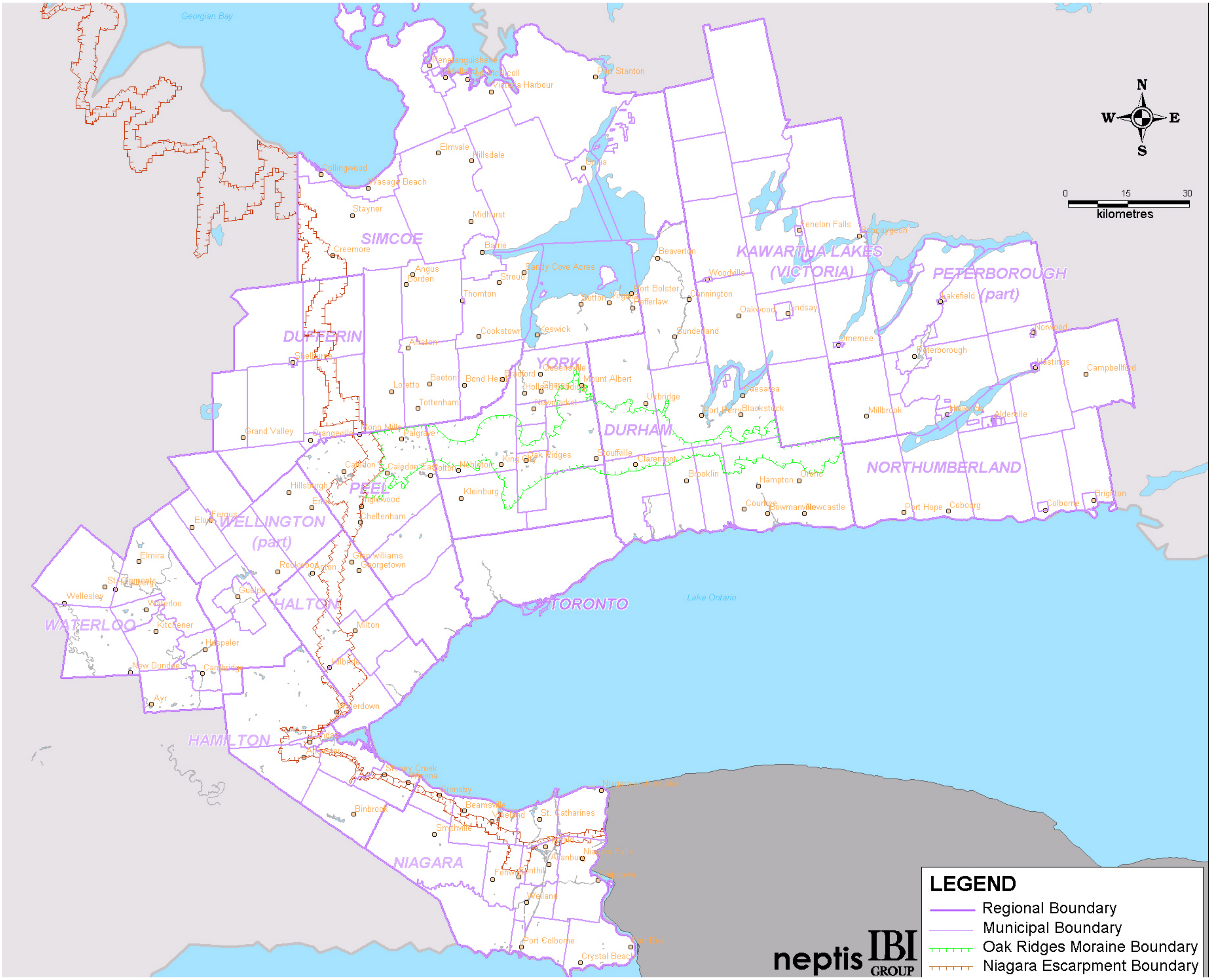
We emphasize that this is not a planning study, in that neither the Business-As-Usual concept nor the alternative concepts to follow, are being put forward as recommended plans. Rather, each of the concepts is a case study, offered on a "what if" basis in order to examine the infrastructure and related functional and cost implications of future urban development and infrastructure/management alternatives for the study area.

1.2.5 Study Area

The study area for this work is illustrated in Exhibit 1.1. It is considerably larger than the six upper-tier municipalities comprising the GTA plus the new City of Hamilton; this area is referred to herein as the inner study area. The outer study area comprises eight upper-tier municipalities: the Regional Municipalities of Niagara and Waterloo, the Counties of Wellington (part), Dufferin, Simcoe, Peterborough (part) and Northumberland, and the City of Kawartha Lakes, formerly the County of Victoria.

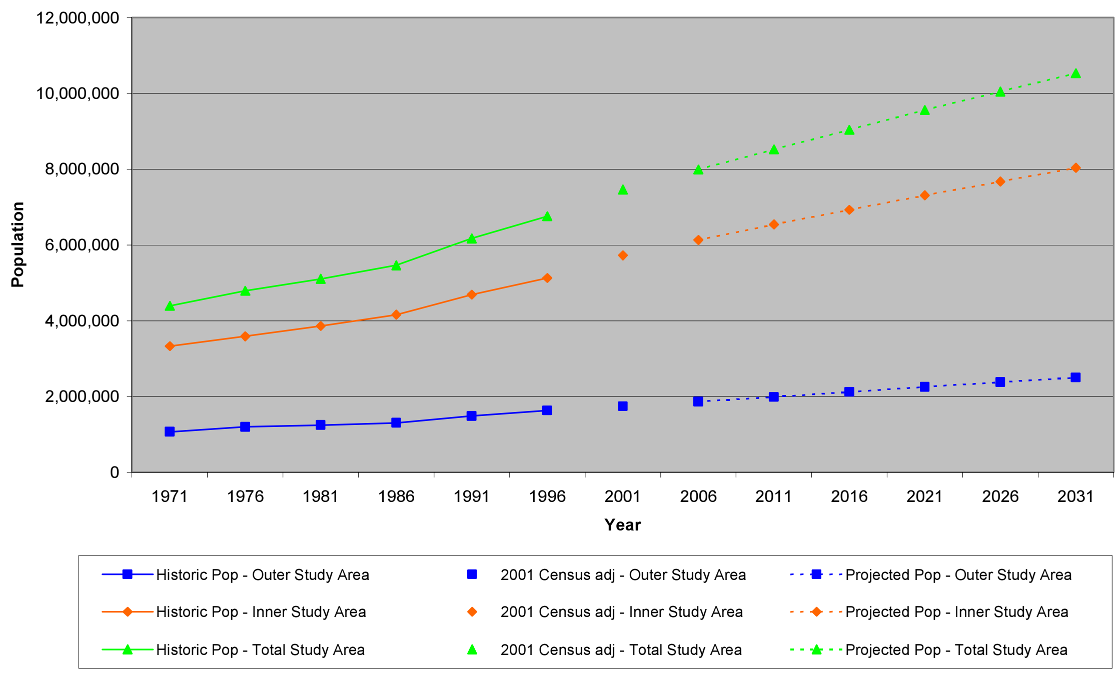
The extensive study area was defined in order to take into account the "urban shadow" and related effects of continuing urbanization and economic development on currently rural parts of the region and to include the implications of "leapfrog" urbanization in rapidly growing urban centres such as Barrie and the Waterloo/Kitchener/Cambridge conurbation. The large study area was also selected in recognition of the growing urban/rural interactions and challenges to be addressed over the relatively long 30-year time horizon.

Exhibit 1.1: Study Area



As shown in Exhibit 1.2, the population of the study area has grown steadily over the past three decades. These growth trends are expected to continue such that the study area's estimated population in 2000, 7.4 million, is anticipated to grow by some 3.1 million people by 2031. The study area's total land area is 25,897 km^2, of which some 2,371 km^2 were urbanized at the beginning of the 2000 base year.

Exhibit 1.2: Study Area Historic and Projected Population



1.3 BAU CONCEPT DEVELOPMENT AND STUDY PRODUCTS

1.3.1 Urban Development

In terms of population and employment, the approach for projecting the BAU scenario was to develop "market-based" population and employment projections to 2031 (and interim projections for 2011 and 2021) reflecting a continuation of existing development trends and approval processes. These population and employment projections for each municipality were then subdivided into each of 2,052 analysis zones (as required for EMME/2 transportation modelling purposes) for the base year (2000) and for the future decade years 2011, 2021 and 2031. Maps and related information showing at a strategic scale major existing land use categories, environmentally sensitive areas, and densities of built-up areas, etc., were also used as appropriate, drawing on the earlier Neptis reports and strategic planning studies by the upper-tier municipalities and the Greater Toronto Services Board (GTSB). As well as attention to residential development, special attention was given to the densities and land requirements for commercial and industrial development, which have been relatively neglected in previous analyses.

1.3.2 Transportation and Water/Wastewater Infrastructure

The BAU development approach also included assumptions regarding the timing and nature of changes in transportation service and infrastructure and water/wastewater systems and service over the coming three decades. These reflected a continuation of past and current planning and delivery approaches and investment levels, drawing on the findings of "planned and committed" systems as documented in planning studies carried out by the province, the GTSB, and upper-tier municipalities.

1.3.3 Scope and Structure of this Interim Report

This report documents the premises and assumptions on which the BAU scenario is based and relevant methods and sources of information used. Study products, all reflecting the Business-As-Usual assumptions, include: future settlement patterns, densities and urban land consumption; transportation and water/wastewater infrastructure requirements, performance and costs; and related liveability implications. Broader socio-economic issues (e.g., income distribution, affordable housing) and social infrastructure (e.g., schools, hospitals, recreation facilities) are beyond the scope of this study.

The study results for the BAU urban structure are presented in Chapter 2, transportation implications in Chapter 3, water/wastewater implications in Chapter 4, and a summary of overall implications in Chapter 5.

2 URBAN STRUCTURE

2.1 OVERVIEW OF PAST DEVELOPMENT POLICIES AND TRENDS

2.1.1 Past Development Policies

The evolution of major regional strategic concepts for development in the broader Toronto area has a considerable history. An early springboard to a regional approach was the formation of the Ontario Department of Planning and Development in 1944 and the ensuing development of the Toronto Metropolitan Area Master Plan. In 1953, Metropolitan Toronto, comprising 13 municipalities, was formed. The Metropolitan Toronto Act defined the Metropolitan Toronto Planning Area (MTPA), which covers some 720 square miles, of which Metropolitan Toronto occupied roughly one-third. By 1967, the original 13 municipalities had amalgamated into six cities and boroughs. The MTPA envisioned that Metropolitan Toronto was to be surrounded by greenbelts to separate it from surrounding communities and allow for some control over growth. The ability to work beyond the Metropolitan Toronto jurisdiction proved difficult. While local planning had been reasonably successful, regional planning issues became the focus as continued growth brought pressures to the Toronto region.

Significant strategic planning initiatives for the Toronto-Centred Region began in the early 1960s when the Government of Ontario issued an Order-in-Council establishing the Metropolitan Toronto and Region Transportation Study (MTARTS). It was recognized that significant pressures for growth were occurring at the Metropolitan Toronto boundaries and thus the Province initiated this milestone study, which stated that a holistic, integrated approach to the regional urban structure was required – at least in terms of transportation. In June 1968, the MTARTS report ***Choices for a Growing Region*** [4] was released. It included a study of emerging development pattern alternatives and related transportation infrastructure requirements.

In April 1966, the Province announced ***Design for Development***,[5] which provided the basis for province-wide planning on a regional basis and was largely based on one of the MTARTS Goals Plans.[6] The Toronto-Centred Region development concept established a guideline for all government decisions affecting the Region and provided a basis for public reaction. The main purposes of the Toronto-Centred Region development concept were to: (i) shape the growth of the Region's metropolitan core into a two-tiered urbanized area, (ii) encourage growth in selected communities beyond easy commuting range of Metropolitan Toronto, and thus help to decentralize the Region within and near Metropolitan Toronto, and (iii) set basic guidelines for regional land use.

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[4] ***Choices for a Growing Region***, Metropolitan Toronto and Region Transportation Study (MTARTS), June 1968.
[5] ***Design for Development: A Status Report on the Toronto-Centred Region***, Ontario Department of Treasury, Economics and Intergovernmental Affairs, August 1971.
[6] ***The GTA Background and Context***, Dr. Phillip Coppack, School of Applied Geography, Ryerson Polytechnic University, 1999.

Leading up to the TCR plan there were specific areas of concern that prompted action. For example, growth was concentrated in the metropolitan core and towards the west and southwest with only modest growth to the north and east. Within the commuting area surrounding Metropolitan Toronto sizeable areas of land were being removed from agricultural and recreation use for both low-density residential purposes and speculation. In the peripheral belt beyond the commutershed, land was being taken up for summer residences, particularly along lakefronts.[7]

At the time it was thought that these trends would likely lead to the following problems:

- **Massive Urbanization and Congestion:** Difficulties in environment, housing, traffic, recreation, urban design and access to and from the hinterland.

- **Urban Form**: Inefficiencies in the provision of flexible, least-cost, high-performance transportation, water and sewer services.

- **Regional Space and Resources:** Insufficient use of districts with good development potential, but beyond easy commuting range of Metropolitan Toronto.

- **Provincial Integration:** Detraction from effective integration of the northern and eastern parts of the province with the Toronto-Centred Region because of the strong thrust to the west and southwest of Metropolitan Toronto.

- **Regional Environment:** Misallocation of prime recreation and agricultural areas.

The main principles of the TCR were aimed at addressing the above trends and concerns and can broadly be summarized as follows:

- Growth in the TCR would take place primarily in a broad band along the shore of Lake Ontario between Hamilton and Oshawa in the form of distinct, identifiable communities.

- An extensive area to the north of this band would be maintained as a largely rural and recreational area.

- Beyond this second area (beyond easy commuting range of Toronto), growth would be encouraged in selected areas to ease the development pressure on the lakeshore area.

The TCR concept was not a detailed plan but rather a policy statement outlining a general urban development pattern. One of the fundamental principles of the concept was its acceptance of the fact that growth would occur but recognition that the anticipated scale of growth (8 million population by 2000) had to be managed to keep

[7] ***Design for Development***, op.cit.

urban development attractive and efficient and to preserve agriculture and recreational lands.[8]

A 1976 status report on the TCR re-affirmed the commitment to the plan and efforts to "move more vigorously in putting the policy into effect."[9] Another key step towards managing growth in the Province was the establishment of regional municipalities in areas where development pressures were significant. The Acts that established regional municipalities also required them to prepared regional official plans, which were intended to guide future development. It was thought that the regional municipal planning approach would ensure that development would proceed in an orderly, least-cost manner.

The 1976 review of the TCR concept by the province raised three key areas of concern:

- preservation of agricultural land,
- preservation of recreation and open space (most notably the Niagara Escarpment and the Parkway Belt System), and
- development of a regional transportation system.

Additionally, the review focused on the following planning issues related to each of the regional municipalities:

- **Hamilton-Wentworth:** The western terminal of the TCR was reaffirmed as a strong regional centre that exerts influence well beyond the TCR. The preservation of prime agricultural land and recreational resources were cited as goals.
- **Halton:** The original growth forecast was not expected to be realized as soon as originally expected; potentially second-tier communities might be lost but lakeshore communities might be enlarged.
- **Peel:** One of Canada's fastest-growing urban areas was anchored by Mississauga, a strong regional centre west of Metropolitan Toronto. Continuing rapid growth within the limits set by provincial policy was anticipated, along with preservation of prime agricultural land, recreational land and other open space resources.
- **York:** Pressures for growth in this area had not been foreseen by the TCR concept, which expected a population of 350,000 by 2000 and a largely agricultural character. The review suggested that additional population could be accommodated while retaining agricultural character. A new estimate of population was established at 550,000, of which 450,000 would be served by the York-Durham Servicing Scheme. Highways 404 and 407 were to be developed to satisfy broad regional transportation

[8] ***Toronto Centred Region Program Statement***, Ministry of Treasury, Economic and Intergovernmental Affairs, March 1976.
[9] Ibid, p. 4.

requirements; these highways were to be designed for through traffic, therefore, the number of interchanges were to be minimized.

- **Durham:** A key principle of the TCR concept was to encourage development east of Metropolitan Toronto in order to reduce development pressures elsewhere in the TCR and to increase opportunities for social and economic development in the eastern portion of the TCR. Job growth was lagging behind population growth and needed to be addressed; the establishment of an industrial promotion board was suggested. The servicing of residential and employment lands was to be addressed. Second-tier communities were not likely needed but would not be eliminated. The government was proceeding with the development of the new community of North Pickering.

- **Simcoe:** Four major urban centres were anticipated – Barrie, Orillia, Midland and Collingwood. Growth outside these centres would be in accordance with provincial policies and would preserve prime agricultural land and recreational resources. A population of 500,000 was anticipated by 2000. Servicing was to be examined and addressed to allow for orderly growth. Lakeshore development on Lake Simcoe and Lake Couchiching would not be encouraged.

- **Northumberland:** A population of 125,000 was anticipated by 2000. Approximately 50% of new urban population would be accommodated in Port Hope, Cobourg, Brighton, Campbellford and Colborne. Balanced population and job growth would be encouraged and dormitory suburbs avoided. Particular attention was to be paid to prime agricultural land and recreational resources. The province was examining the extension of economic development programs (Ontario Business Incentives Program, new industrial parks program) to Northumberland. Assistance to Port Hope and Cobourg would be provided in the area of municipal services. Attention would also to be given to the matter of managing solid waste.

The government's 1976 review confirmed the Provincial commitment to managing growth in accordance with the fundamental principles of the TCR concept.

In an attempt to address regional development that included the entire province, the Government of Ontario identified the Central Ontario Region (COR) as one of five development regions in the province. The TCR remained the focus of the COR.

An intergovernmental task force was established to refine that part of the TCR concept related to the urban portion of the Toronto-Centred Region along the shore of Lake Ontario; this task force was known as the Central Ontario Lakeshore Urban Complex (COLUC) task force. COLUC suggested the following criteria for managing growth:

- Urban development would take the form of a series of distinct communities along the lakeshore, thus minimizing the cost of water supply and sewage treatment, as well as damage to the environment.

- Such a linear development pattern would make it possible to build efficient, high-capacity transportation facilities: in particular, mass transit.

- A second series of communities would parallel the first, or lakeshore series, separated from it by a system of parkway belts. This arrangement would help to reduce congestion in the lakeshore communities and provide for intervening open space, while transportation and other utilities would be located within the parkway belts.

- The communities within the lakeshore urban complex would form a hierarchy of urban centres, providing local diversity of living and working opportunities.

- Development to the east of Metropolitan Toronto would be encouraged, to reduce development pressures elsewhere in the region and to help expand social and economic development opportunities in the eastern flank of the Toronto-Centred Region.

The COLUC plan was similar in detail to the TCR plan and identified Toronto, Hamilton, Mississauga/Malton, Oshawa and the Pickering New Town/New Airport complex as growth poles.

Along with COLUC, provincial-municipal planning task forces were established to prepare development strategies for Simcoe and Northumberland counties. The province accepted the final reports prepared by these task forces in principle as a basis for proceeding with development in Simcoe and Northumberland.

While the intent of the various plans initiated by the province was to manage growth, the plans were largely without teeth. The TCR concept languished in the late 1970s despite the commitment in the 1976 report.[10] In 1987 the Greater Toronto Coordinating Committee was formed which focused on the area known as the Greater Toronto Area (GTA) comprising Metropolitan Toronto, Durham, York, Peel and Halton. The following year the Province opened the Office for the Greater Toronto Area (OGTA). Since that time there have been a number of studies, including Ron Kanter's ***Greenlands Plan*** [11] for the GTA, the ***Urban Structure Concepts Study*** (as noted earlier) and the Crombie Federal Royal Commission on the Future of the Toronto Waterfront report ***Regeneration***.[12]

More recently, with the economic upswing of the late 1990s, the broader Toronto area has been subject to significant development pressures. Terms such as "smart growth" and "sprawl" have become the focus of urban development discussions, yet there is no common understanding of these concepts. Based on a review of the chronology of regional development in the Toronto area since the mid 1950s, it appears that while

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[10] ***The GTA Background and Context***, Dr. Phillip Coppack.
[11] ***Space for All: Options for a Greater Toronto Area Greenlands Strategy***, prepared for the Greater Toronto Coordinating Committee, R. Kanter, 1990.
[12] ***Regeneration***, prepared for the Royal Commission on the Future of the Toronto Waterfront, 1992.

several regional development policies have been published over the period, they have had a limited effect on actual growth patterns. These have continued to reflect market forces and traditional development approval procedures administered by individual municipalities and adjudicated by the Ontario Municipal Board, largely independent of provincial policy intentions at the broader scale. The concerns identified 50 years ago remain today.

2.1.2 Past Development Trends

Through the 1990s there was considerable development in the GTA and surrounding area. Residential land development was viewed as a key contributor to the economic growth of the broader region. While non-residential development was at a standstill through much of the 1990s, there was considerable activity in the residential sector. From 1991 to 1998 there were approximately 177,000 housing unit starts in the GTA, or about 22,000 units per year. More than two-thirds occurred in York and Peel Regions and the City of Toronto. Almost 60% of all housing starts in the GTA through this timeframe were single detached or semi-detached units.

This continued rate and level of development has been the subject of considerable analysis and discussion across the broader Toronto Region. New urbanism, sustainability and smart growth concepts have been put forward as the basis for "good planning." Sprawl is to be avoided. Much of the debate cannot be succinctly described, as the issue is extremely complex. However, a key variable is the matter of density of development.

The ***Inching Toward Sustainability*** (Blais) report notes that "Density numbers in and of themselves do not mean much. They are important because they are a reflection of the economic efficiency and sustainability of our communities. In the GTA, as in other cities in North America, the density of development is a contentious issue. Some contend that densities, particularly those of new, fringe development, are rising, and we therefore do not have problem with urban sprawl in the GTA. Others argue that low density, single use development continues to be the norm in the GTA, and that this poses considerable problems related to sustainability, such as traffic chaos, the loss of prime agricultural land, environmental impacts associated with auto dependency, etc."

The Blais report included an analysis of residential density trends,[13] which noted that generally through the 1990s residential densities were rising. More urban municipalities located outside the City of Toronto reached gross residential densities on the order of 4-6 units per gross acre (10 – 15 units per gross hectare) while more rural municipalities were in the 1-3 units per gross acre range (3 – 7 per gross hectare). However, even though residential densities in the areas outside the City were increasing, they were still

[13] Gross residential density was defined in the Blais report to mean the number of residential units divided by the total amount of *primarily residential* lands – that is, lands used for residential lots, streets, parks and other infrastructure, and other uses included in the plan of subdivision, such as commercial, industrial or institutional uses. This density measure differs from "gross urban density" which generally includes all lands such as non-residential development, as well as major regional infrastructure, such as highways, arterial roads, utility corridors, etc.

low when compared to pre-war areas of Toronto, such as Riverdale and The Beaches, which have densities about two to three times the level of recent fringe development.

While the housing yield per acre is an interesting measurement, it does not provide sufficient insight into the development outcome. For example, the amount of land devoted to public infrastructure has increased significantly over time. Public infrastructure in new communities includes roads, parks and school sites. In newer communities, about 40-50% of gross land area is devoted to such uses, compared to 35-40% in older communities. Further, an examination of newer vs. older communities shows that the municipal setback requirements on a lot are far more generous in newer communities relative to the older communities, thus reducing the prospect of achieving higher densities in the newer communities.

The non-residential development sector is less well understood in terms of its contribution to current urban conditions, partly because of the heterogeneity of the non-residential sector, which includes commercial (office and/or retail), industrial and institutional activities. Further, there is little data available to undertake a meaningful analysis of employment density and factors affecting non-residential site development (i.e., site coverage, separation from adjacent uses, parking requirements etc.), which may affect the density of development. Some observers have suggested that employment densities are decreasing, while others argue that they are increasing. There is no coherent analysis or body of work to reference on this topic. Nonetheless, development of land for non-residential purposes is an important aspect of the urban environment and needs further study to understand its dynamics.

Non-residential lands are an important component of future urbanization in the study area. It is of interest to note that in estimating the appropriate amount of land to designate for employment purposes, many municipalities include a “market contingency” factor to ensure that the municipality has a competitive supply of vacant employment land. This “market contingency” ranges from 25% to 50% of either vacant employment lands or total employment lands. Thus, at the extreme, a municipality with a total supply of 3,000 acres of designated employment lands might require that between 800 to 1,500 acres of employment lands remain vacant in order to provide a competitive supply. This would appear to be an inefficient use of land resources. It is of interest to note that the Province’s *Projection Methodology Guideline*[14] is silent on the matter of a “market contingency factor” in determining employment land needs for municipalities. Further, the *Projection Methodology Guideline* specifically notes that a market contingency is not necessary for long-term projections. Thus, in some cases, municipalities in the study area may have over-designated lands to address employment requirements.

[14] *Projection Methodology Guideline, A Guide to Projecting Population, Housing Need, Employment and Related Requirements*, Province of Ontario, 1995.

2.2 MAJOR FACTORS AFFECTING DEVELOPMENT TRENDS IN THE STUDY AREA

Future land development or urbanization in the study area is the result of many actions and decisions and is a complex and dynamic process. The following attempts to provide some context for understanding the urbanization or land development process and identifies some of the major factors affecting development trends.

Fundamentally, ***growth fuels land development or urbanization*** – more specifically, population growth. As noted elsewhere in this report, population growth is essentially the result of (1) natural increase (i.e., births minus deaths), and (2) net migration. With regard to the first component, the population replacement level in Ontario is identified at 2.1 children per woman; however, actual fertility rates generally are at about 1.55 children per woman. If this were the only consideration in population growth and the current situation prevailed, the Province as a whole would experience population decline. The second component of population growth, net migration consists of international immigration, in-migration from other provinces and out-migration to other countries and provinces. The federal government has an international immigration policy of allowing about 200,000 immigrants annually. Based on past trends, about 53% of these immigrants will reside in Ontario and about 45% will move into the study area. The overall effect of international immigration, in-migration from other provinces and out-migration to other provinces has resulted in substantial population growth in the Province and the study area overall.

Individual consumer choices, private-sector investments and government responses to growth all have an impact on urbanization. The Business-As-Usual development concept is based on the assumption that existing government policies and approval processes will continue during the forecast interval and that market forces will continue to influence location, travel and other decisions in a manner similar to that which has been experienced in the recent past. Within the government planning and regulatory/judicial framework, not only individual consumers of housing, employment and other commercial opportunities, but also developers, providers of infrastructure and physical and social services, farmers, landowners and others participate in the development process, and their individual decisions taken in the aggregate determine the rate and shape of urban development over any given period.

Planning and development in the study area are affected by the following factors:

- the planning approval process;
- water/wastewater infrastructure;
- transportation infrastructure;
- federal, provincial and local policy;
- consumer choice;
- land ownership patterns;

- housing prices;
- non-residential development;
- employment growth.

Each of these is discussed briefly below.

The Planning Approval Process

The planning approval process includes provincial legislation and regional and local municipal policies. Many involved in the land development field – in both the public and private sectors – would suggest that ***generally*** (but certainly not universally) the planning approval process continues to be lengthy and sometimes onerous, despite recent changes. The planning approval process is in itself quite complex, and requires input from a broad range of stakeholders including the land owner/developer, various government departments and agencies, politicians, community groups and others.

Water/Wastewater Infrastructure

Much of the development in the GTA has been shaped by the availability of water and wastewater infrastructure. If servicing was not available, the extension of services was examined and, if feasible, infrastructure was built to service the proposed development. Given increasing concerns for the environment and water quality, there is a general view that development not serviced by water and wastewater infrastructure (i.e., served by wells and septic tanks) is no longer tenable, except in low-density, rural areas.

Transportation Infrastructure

The availability of highway infrastructure continues to be a key consideration in land development. Growth has historically gravitated to major road corridors and interchange points as they provide regional access to an area where cross-commuting is the norm. Development of local road networks is also essential to provide the basic access without which urban development cannot occur.

Both local and regional transit have been and will continue to be influencing factors in new development. Local transit in the form of subways, other rapid transit and bus services provides an incentive for intensification, and is available in Toronto and other built-up areas. Inter-regional transit, including GO Transit and cross-boundary municipal transit services, has played a role in the development of communities around Toronto. The prospect of increased levels of inter-regional and local transit service in the suburban areas of the GTA increases the attractiveness of the suburbs to potential homebuyers and offers an alternative to daily car commuting.

Federal, Provincial and Local policy

The lack of policy-related initiatives at all levels of government has been cited as playing a key role in the current pattern of spread development and the continued extensive consumption of land for urbanization.

Consultation with regional planning officials suggested that a key deterrent to the building of rental accommodation is current taxation policy. It has been suggested that changes to taxation policy could provide incentives for the creation of rental accommodation. Incentives could include income tax reductions, tax increment financing, property tax changes and/or similar tools. The broader issues of user charges (e.g., full-cost pricing for transportation and water/wastewater infrastructure) and local governance able to provide consistent policies across the entire urban region have also been identified by some observers as important policies which have been lacking in terms of achieving greater efficiency in housing, transportation, water/wastewater infrastructure and use of land.

Others suggest that the absence of government policy related to the protection of agricultural lands has played a role in the continued development of prime agricultural lands.

Some recent research[15] also suggests that municipal financial tools such as property taxation may influence the location, type and density of development. For example, the property tax system generally favours single-family residential property, largely for political reasons, thus discouraging higher density residential development.

Of considerable importance in this discussion is the policy of the Bank of Canada in the area of interest rates. In recent years, continued low consumer mortgage rates have had a significant impact on home ownership. Low interest rates combined with population growth have resulted in increased demand for housing across the study area.

The development policies that were in place before World War II and during the decades of rapid growth immediately following the war (e.g., less extensive land consumption for public uses, incentives for rental housing, transit-supportive densities and street layouts) were quite different from those that have influenced more recent development in suburban communities. This is an important factor in explaining the higher per capita land consumption in the latter communities. "Reinventing" some aspects of the earlier policies may be worth considering as future development strategies are studied by the Central Ontario's Smart Growth Panel convened by the Province of Ontario for this purpose.

Consumer Choice

An individual's choice of a home is the result of many considerations. These include choice of area/community, neighbourhood characteristics, type of house, housing price, availability of services, accessibility and a range of other factors. The predominance of ground-related housing in suburban areas of the inner study area has not been driven by the developer/builder community as much as by consumer preference and demand. Housing affordability has become less of an issue as the development community provides a range of choices in terms of unit type (single detached, semis and row housing), size, cost and location. For many people, the "dream" of a single family home

[15] ***Municipal Finance and the Pattern of Urban Growth,*** prepared by Enid Slack for the C.D. Howe Institute, February 2002.

and a patch of grass persists, despite growing traffic congestion and lengthening commuting times. Other individuals and families prefer to live in older, more compact and mixed-use communities. The surge of condominium construction in built-up areas has been a market response by developers.

Land Ownership Patterns

Consultation with planners identified a perception that land ownership was a factor in land development. For example, fringe municipalities in the study area have diversified land ownership consisting of generally smaller owners/developers, resulting in smaller residential developments which occur in an incremental fashion. By comparison, land ownership is quite varied throughout the suburban Toronto area and includes a range of owners/developers of various sizes and capabilities. While land ownership is a factor in land development, the creation of residential or non-residential developments is largely a response to market demand. Thus, with the suburban Toronto area being an area of high demand relative to other parts of the study area, the land development that occurs varies in terms of the number of owners responding to demand and the scale of that response.

Housing Prices

Comparatively lower land prices in outlying suburban areas have resulted in the delivery of lower-priced housing. Communities that might be considered on the fringe, are being targeted for additional growth in response to a growing demand for less expensive housing. Examples of such communities include those situated along the Hwy 400 corridor. Housing in these areas is considerably less expensive than housing in the suburban areas adjacent to Toronto.

Non-Residential Development

Non-residential development also plays a significant role in land development trends. This category consists of a broad range of potential uses – e.g., industrial; office; and retail/service or "people" serving (including institutional) – each of which has specific locational requirements.

In the case of industrial uses, key locational criteria include: good regional accessibility to ensure efficient delivery of inputs and outputs; access to skilled labour; availability of serviced land at a reasonable cost; and competitive operating costs (property taxes and utility costs). Typically, industrial activity tends to be land extensive, with low-density development, surface parking and generous setbacks to avoid conflicts with neighbouring activities. Many businesses also purchase larger-than-required land parcels to allow for possible future expansion. There has been little change in land development practices as they relate to industrial land use activities. However, in recent years, there has been increasing interest in the opportunity to increase employment densities.

Office development in suburban areas, particularly those well served by transit or highways, has occurred with some success. Higher-density development has occurred within the City of Toronto in the core area and at the intersection of major arterial roads that also have transit service; or in city centre areas (e.g., Mississauga). Comparatively lower-density office development is also occurring at the intersection of 400 series highways (e.g., Markham and Richmond Hill). Locational factors include transit availability or highway accessibility together with ample parking.

Retail, service and institutional non-residential development follows residential development. Therefore, it can be expected that if residential development keeps moving the urban edge outwards, there will be an associated need for land to accommodate this type of non-residential development. It is of interest to note the intensification of regional mall properties that has occurred in recent years as the landowners attempt to increase the value of their developments. Intensification occurs through the development of "outpads" on site, which include stand-alone restaurants or retailers. Examples include Markville Mall in Markham and Square One in Mississauga.

Employment Growth

Employment growth, like many of the other factors previously discussed, is a complex and dynamic factor affecting land development. The decision to invest in a given region relates to many factors – as noted under *Non-residential Development.* Growth in the number of jobs in a region adds to the desirability of the area and attracts further population and employment growth.

The location of job opportunities in and of itself is a factor affecting development patterns in the study area. Much of the job growth has occurred within the GTA. Opportunities at the "edge" of the GTA allow for workers to live in non-GTA communities. For example, jobs in the western GTA allow employees to live in areas further west such as Guelph or Kitchener; those working in Newmarket might choose to live in Barrie or Orillia; and those working in Oshawa might live in Port Hope or Peterborough.

The Business-As-Usual development concept projected in this study, as described in the next section, is different from that developed in the 1990 ***Urban Structure Concepts*** Study, because government policies and plans were changed during the 1990s to reflect the "GTA Vision" which flowed in part from the 1990s study. The Business-As-Usual outlook at the beginning of the 21st century therefore includes, for example, the upper-tier municipalities' Official Plan policies and the continuation of those plans and policies over the forecast period. At the same time, however, the BAU concept is based on the assumption that development approval processes, as actually applied, and new urban development as actually built, will not reflect the Official Plans in their entirety. In other words, implementation of the Official Plans will continue to be "eroded" by market forces and the manner in which these – particularly the interactions between landowners/developers and municipal governments – affect actual development decisions. The projection methodology and assumptions of the BAU concept reflect an attempt to understand the forces and key factors described above and the manner in which they can be expected to interact under a continuation of BAU conditions.

2.3 PROJECTION METHODOLOGY AND ASSUMPTIONS

This section outlines the approach and the assumptions associated with estimating the extent and distribution of urbanization to 2031 for the Business-As-Usual (BAU) scenario. The assumptions are intended to reflect the most realistic future conditions based on current market trends and development practices in the study area.

As a first step in the methodology, the study team reviewed various population and employment projections available and determined the most appropriate and relevant projection relative to the BAU scenario. Sections 2.3.1 and 2.3.2 address the population and employment projections, respectively. The determination of the most appropriate projections provided the foundation of the analysis at the upper-tier municipal (UTM) level. (There are a total of 14 UTMs in the study area.) These projections provided the "control totals" of population and employment for the overall study area.

The challenge in carrying out the more detailed analysis arose at the local municipal level – 95 such municipalities[16] are considered within the study area. Given the strategic nature of the study, a methodological approach was developed to determinate appropriate population and employment forecasts and density assumptions. This component of the methodology is documented in Section 2.3.3.

Given that the land use/urbanization assumptions have a major impact on the transportation and water/sewer infrastructure requirements (and vice versa), estimating the level and pattern of urbanization required a systematic check of the results to ensure that the output of the approach was reasonable and in accordance with the overall projections for the study area. The results were plotted on a map of the study area and reviewed. In some instances, reconciliation of land requirements generated by the approach with available land inventory was required. This process is documented in Section 2.3.4.

The use of the projection base year 2000 is the result of a number of factors. The study commenced in mid-2001, thus excluding the option of using preliminary Census results, which were released in March 2002. However, the population projections used in this study were compared to the preliminary Census results[17] and were found to compare favourably. Another determining factor in using the year 2000 as a base relates to the fact that the measure of urbanized land comes from late 1999.

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[16] The 95 municipalities are primarily lower-tier municipalities. In the count of 95 municipalities, for reasons of data availability, the City of Toronto is included as a single-tier municipality, but the former lower-tier municipalities now making up the New City of Hamilton are included individually. Some former lower-tier municipalities in the City of Kawartha Lakes (formerly Victoria County) have been combined due to data availability constraints. Appendix B (a) input pages provide details.

[17] Typically, an "undercount" is identified approximately one year after the release of the Census results. In IBI Group's examination of the population projections used in the BAU analysis compared to the 2001 Census results, an undercount factor of 2.73% was added to the preliminary 2001 Census results. The 2.73% undercount factor reflects the 1996 undercount for the Province of Ontario.

2.3.1 Population Projections – Upper-Tier Municipalities

Population projections provide the foundation of the analysis. Given the strategic nature of the study and the premise of the Business-As-Usual scenario, it was important to differentiate between policy-related population forecasts (which typically provide the basis for population projections or targets found within Official Plan documents) and trend or market-based forecasts. The analysis of population projections occurred at two levels: upper-tier and prototype communities (discussed in a subsequent sub-section of this report).

In terms of the GTA upper-tier municipalities (UTMs), a number of population projections are available. The various projections were reviewed, including those prepared by/for the following:

- Office for the Greater Toronto Area (OGTA);
- Greater Toronto Co-ordinating Committee (GTCC);
- Central Ontario Study (Ministry of Transportation – Ontario);
- Ministry of Finance (Government of Ontario);
- UTM official plans; and
- a market-based forecast prepared for and used by IBI Group for a range of transportation-related analyses; this is referred to as the "Market Forecast".

Exhibit 2.1 provides a summary of the 2031 forecasts by source and by GTA UTM.

Exhibit 2.1: Summary of Population and Employment Forecasts

Upper-Tier Municipality	Official Plan Horizon	2031 OGTA Sc 1	2031 GTCC	2031 Market Forecast	2031 Central Ontario Study	2028 Ministry of Finance
Population						
Toronto	3,000,000	2,870,000	3,000,000	2,900,000	3,000,000	2,952,500
Peel	1,327,900	1,350,000	1,400,000	1,474,823	1,400,000	1,693,000
York	1,280,000	1,220,000	1,360,000	1,438,765	1,360,000	1,444,600
Durham	970,000	1,070,000	1,000,000	914,693	1,000,000	854,100
Halton	592,300	750,000	690,000	703,119	689,000	643,100
GTA Total	***4,659,352***	***7,260,000***	***7,450,000***	***7,431,400***	***7,448,900***	***7,487,400***
Employment						
Toronto	1,154,200	1,870,000	1,835,100	1,700,000	1,835,000	–
Peel	421,000	720,000	759,700	835,147	760,000	–
York	292,000	620,000	738,000	724,440	738,000	–
Durham	164,000	400,000	434,100	364,304	434,000	–
Halton	159,000	360,000	369,700	389,509	370,000	–
GTA Total	***2,190,200***	***3,970,000***	***4,136,500***	***4,013,400***	***4,136,900***	–

Notes: Generally the horizon year for Regional Official Plans is 2021; York Region's forecast is to 2026. The City of Toronto has not published population or employment forecasts but references the GTCC forecasts. Ministry of Finance Forecasts do not include employment and are prepared up to the year 2028.

It is of interest to note that the forecasts all have similar overall total projections for the GTA to 2031. The differences among the various forecasts relate primarily to the distribution of population among the UTMs.

The following provides a brief overview of the population projections.

- **OGTA (1993) Scenario One** - Produced in 1993 for the Office for the Greater Toronto Area by Hemson Consulting, the OGTA Scenario One forecast has been used for most of the transportation planning work in the GTA until very recently. The forecasts were developed through a collaborative effort of the GTA municipalities and were based on achieving significant changes in the way GTA residents live, work and travel, with a more efficient urban form consisting of mixed-use corridors and nodes. To achieve the population and employment projections of Scenario One, a greater level of policy intervention was considered necessary to change urban form and growth patterns from those currently unfolding. These forecasts are now considered to be dated, since they were based on 1991 Census data and have been superseded by OGTA 2000 forecasts.

- **GTCC -** The GTCC population and employment projections at the regional level are based on forecasts prepared by Strategic Projections for the Office for the Greater Toronto Area in January 2000. Like the previous OGTA 1993 forecast, it represents a collaborative effort among the City of Toronto, GTA regions and the Ministry of Municipal Affairs and Housing. It is intended to provide the basis for land use and transportation planning work in the GTA to the year 2031. Compared to existing trends, the forecast assumes a more compact urban form, with reduced dependence on the private automobile, a better balance between housing and employment and the need to protect rural/agricultural land and the natural environment. As with OGTA 1993 forecast, a much greater level of policy intervention would be necessary than is currently in place for the forecast to be realized, likely more than what was assumed in 1993. The GTCC forecast was accepted by the GTA UTMs.

- **Market Forecast -** The Market Forecast[18] is based on recent and current observations of the market for new housing (which largely drives the location of population growth) and the market for office and employment land development (which largely drives the location of employment growth).

  The Market Forecast assumes a continuation of the current level of planning intervention in land markets to achieve policy goals. This level of intervention can generally be described as accommodating expected growth while directing its location in accordance with a continuation of existing servicing, financial and planning goals. Other than by stating general objectives, the current policy

[18] The basic work on the Market Forecast was undertaken by Hemson Consulting Ltd. as input to various transportation studies by the Ministry of Transportation (Ontario), IBI Group and others. For example, IBI Group applied the forecast as part of the 1998 Highway 407 Traffic and Revenue Estimates Study and used a slightly revised version of the forecast for the Simcoe County Provincial Highway Study (2000).

environment does not attempt to implement policy that dramatically changes urban form or current growth patterns.

Generally, a key differentiating factor in this forecast is that lower population and employment forecasts for Toronto are estimated. This forecast does not have official status for GTA planning, but is often used as an input for planning studies in the GTA.

It is important to note that the Market Forecast includes population projections for a broader geographic area and covers most of the subject study area. Those geographic areas not included in the Market Forecast are discussed in greater detail below.

- **Central Ontario Transportation Perspectives Study Forecast -** These population and employment forecasts were prepared by the Planning Partnership in 2000 to provide a consistent set of forecasts for use in three concurrent MTO highway network studies: the Central Ontario Highway Perspective, the Simcoe County Provincial Highway Network Assessment Study and the Niagara Peninsula Transportation Needs Assessment Study. As with the OGTA/GTCC forecasts, the Central Ontario forecast may be described as a policy-based forecast, as it was intended to be consistent with Regional Official Plans, which are typically based on planning desires to achieve greater growth and development in more central urban areas and reduced growth and development elsewhere when compared to market expectations.

  While the Central Ontario forecast reflects each region's official plan initiatives to curtail spread development, it also corresponds to their growth aspirations, which generally result in different forecasts by region compared to the OGTA 2000 forecast. As well, there is uncertainty as to the achievability of the City of Toronto population increases. This and other reasons have led to several regions' continuing to use their own official plan forecasts. As a result, the intent of the OGTA 2000 forecasts to provide a common basis for GTA land use and transportation planning has not been endorsed by all of the regions.

- **Ministry of Finance – Ontario -** The Ministry of Finance forecast (July 2000) is also shown in these exhibits, given that it is the official provincial forecast and therefore a useful point of comparison. These projections have a horizon year of 2028.

- **Non-GTA Forecasts -** With respect to the non-GTA UTMs, the availability of both population and employment forecasts is much more limited. Five of the nine non-GTA UTMs did not have population and employment projections available. The remaining four non-GTA UTMs had prepared detailed forecasts for land use planning and/or transportation planning purposes that are predominantly policy driven. As well, the Ministry of Finance (Ontario) population projections are available for all UTMs in Ontario to 2028. The Market Forecast is also available for the majority of the non-GTA UTMs.

Immigration is Key Variable in the Population Projections

With declining fertility rates across the country, immigration plays a key role in any projections of future growth.

Immigration levels or targets are determined by federal government policy. In recent years, immigration levels have been in the 200,000-to-225,000 range; it is anticipated that this will continue over the next 30 years and the projections reflect this.

During the 1990s, Ontario consistently received at least 53% of total international immigration to Canada; the majority of these immigrants came to the GTA and surrounding area. Based on historic trends and the anticipated immigration targets, it is estimated that Ontario will have immigration levels of between 115,000 to 120,000 annually, most of whom will be accommodated in the GTA and the broader study area. This assumption is generally consistent across all the population projections.

Determination of Appropriate Forecast

Drawing on census data, historic 25-year population trends[19] (1971-1996) were extrapolated in a linear fashion; the results of this trend analysis were compared with the range of available forecasts for each of the five GTA UTMs. Appendix A contains a graphic depiction of the trend analysis compared to available population forecasts for the GTA municipalities.

Based on the review of alternative population projections and the results of the comparative analysis, it was concluded that the analysis should be carried out using the Market Forecast. The Market Forecast most closely replicates the linear extrapolation of the historic population trends and is considered to be most representative of the BAU scenario principles.

The overall anticipated growth from 2000 to 2031 was broken down into three intervals (i.e., 2000 to 2011, 2011 to 2021, 2021 to 2031):

- Under the BAU scenario, it is estimated that the Toronto-Related Region will grow from a 2000 population of 7.36 million to 10.53 million by 2031. Of this total study area population, the GTA + Hamilton had 5.62 million people in 2000; by 2031 the population of the GTA + Hamilton is expected to reach 8.03 million, maintaining an overall share of just over 76% of the study are population throughout the 31-year timeframe.

- **Of the total growth of some 3.17 million people over the 31-year timeframe, an increase of about 1.16 million (36%) is expected to occur in the first decade,**

[19] The historic trend analysis of population was based on Census data provided by Statistics Canada. Population data examined did not include the Census undercount.

1.04 million (33%) in the second decade, and the remaining 975,000± (31%) in the third decade.

- The long-term decline in the rate of population growth reflects the ongoing impacts of a less than break-even fertility rate (as experienced during the past three decades and projected to continue during the next three decades), and the assumption that net immigration rates will also remain at average levels experienced during the past three decades.

As previously noted, the Market Forecast covered a substantial portion of the subject study area. However, in those areas not addressed in the Market Forecast, IBI Group drew on other projections. The following table, Exhibit 2.2, provides an overview of the projection sources for the various UTMs within the subject study areas.

Exhibit 2.2: UTM Population and Employment Projection Sources

UPPER-TIER MUNICIPALITY	PROJECTION SOURCE	NOTES
Dufferin, Durham, Halton, Hamilton, Northumberland, Peel, Peterborough (portion only), York, Simcoe, Toronto, Victoria (now City of Kawartha Lakes), and Wellington (portion only)	Market Forecast	
Niagara	Regional forecasts to 2011 and 2026	- 2021 is interpolated between 2011 and 2026 - 2031 is extrapolation of 1996-2026 trend
Waterloo	Regional forecast to 2016; Ministry of Finance to 2028	- 2021 based on annual growth 2016-2028 - 2031 extrapolation of 2016-2028 trend - 2021 & 2031 employment based on extrapolation of 1996-2016 activity rate

2.3.2 Employment Projections – Upper-Tier Municipalities

An approach similar to the population analysis was carried out for employment growth. The analysis of employment projections occurred at two levels: upper-tier and prototype communities (discussed in a subsequent sub-section of this report). Similar to the population analysis, in terms of the UTM projections, available employment projections were reviewed, including those previously noted in section 2.3.1; the only exception is the Ministry of Finance – Ontario, which did not include employment projections.

Historic trends were examined and extrapolated in a linear fashion. It should be noted that employment data has not been collected consistently across the broader study area over the last 25 years [20]; best efforts were made to obtain employment data for at least 15

[20] Census data is generally available, however, inconsistent methodologies exist in the Labour Force by Place of Work data. Further, this data has not been collected across the broader study area.

years. The results of this trend analysis were compared with the range of available forecasts. As a result of this comparative analysis and the review of available employment forecasts previously noted, it was determined that the analysis should be carried out using the Market Forecast. This forecast most closely replicated the linear extrapolation of the historic employment trends. Appendix A provides the graphic depiction of the employment trend analysis for each of the inner six UTMs.

The overall anticipated employment growth from 2000 to 2031 was also broken down into three intervals:

- The BAU employment forecasts indicate growth from a 2000 base of 3.53 million jobs to 5.45 million by 2031. The GTA + Hamilton retains just under a 79% share of the total employment, rising from a base of 2.78 million jobs in 2000 to 4.26 million in 2031.

Over the three intervals, about 939,400 jobs or 49% are expected to be generated in the first 11 years, with 559,700 (29%) from 2011 to 2021 and 415,400 (22%) in the 2021-2031 decade. This declining rate of growth mirrors the declining rate of growth for population, although total employment is projected to increase somewhat more than total population in percentage terms over the 31-year period, reflecting an increasing tendency for people to work beyond retirement age, and the constant renewal of a relatively young labour force from ongoing high levels of immigration.

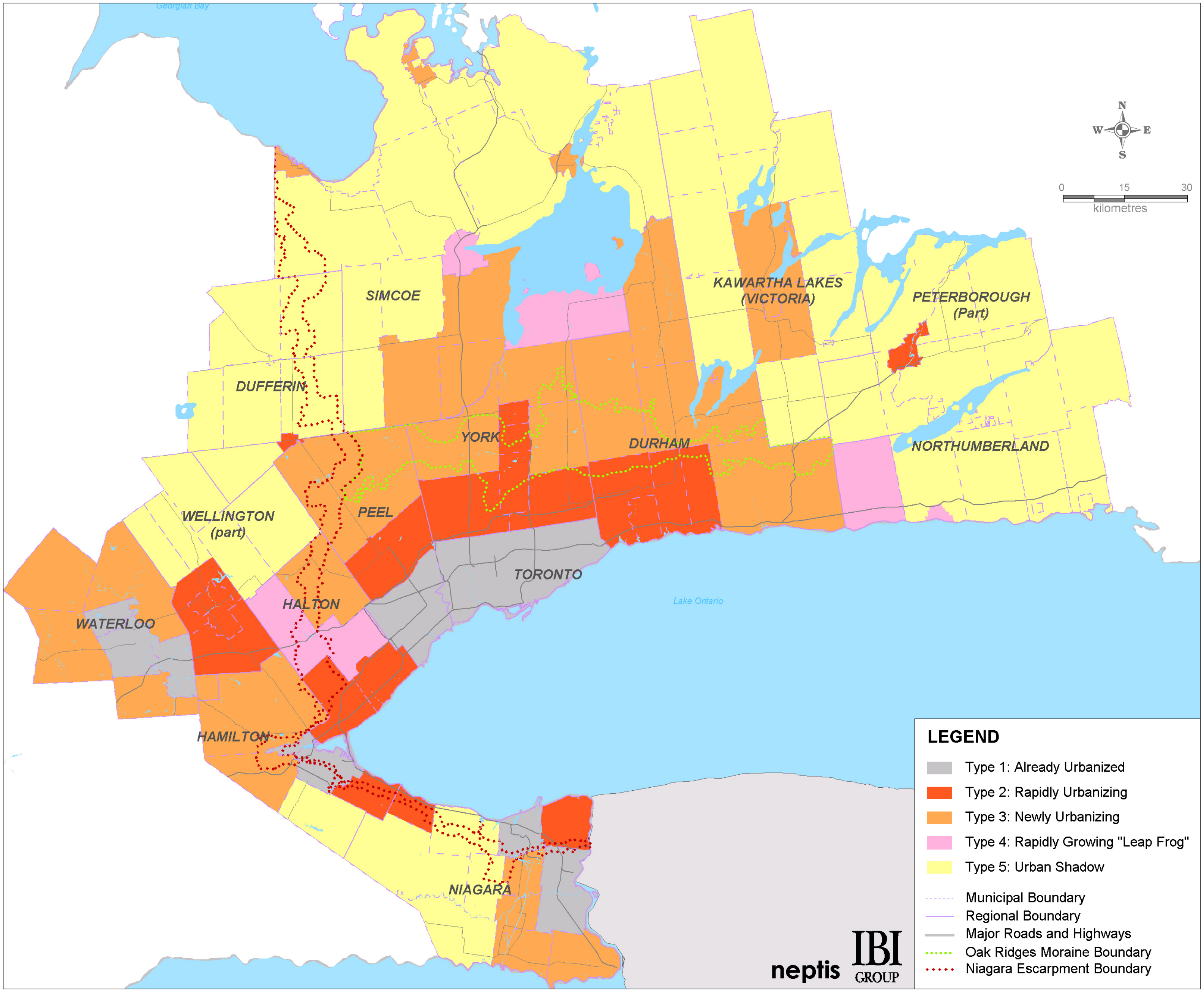
2.3.3 The Urbanization Process

A typology of communities in the study area was determined, reflecting five different stages in the urbanization process viewed at the scale of the entire urban and urbanizing region. The five categories, which are illustrated in Exhibit 2.3, are as follows:

1. ***Already Urbanized Municipalities (Type 1)*** are communities that are largely built-out or have significant compact, mixed-use areas and contain full transportation/ public transit systems largely supported by nodes throughout their geographic area. These communities offer full municipal services. Future development will consist mainly of infill and redevelopment of existing/underused sites, brownfields and a few undeveloped portions of land (i.e., through Plan of Subdivision).

2. ***Rapidly Urbanizing Municipalities (Type 2)*** are communities currently experiencing a rapid rate of growth (residential and non-residential), primarily on greenfields land (typically through Plan of Subdivision) contiguous to existing urbanized areas. These communities will likely continue to experience growth on currently undeveloped land for some time as they experience the full effect of the wave of rapid suburban development moving outward from the metropolitan centre. They offer full municipal services and are also currently installing new services in order to facilitate growth. These communities offer extensive road transportation and some public transit systems to residents.

Exhibit 2.3: Municipal Typology



3. ***Newly Urbanizing Municipalities (Type 3)*** are communities that lie beyond the current wave of rapid suburban development but are starting to feel its effects; i.e., they are experiencing moderate levels of residential and non-residential growth through the Plan of Subdivision process. They have arterial road networks and may or may not offer public transit services. These communities provide full municipal services in some areas, while septic systems service the remainder. Over the period of this study, they are anticipated either to provide full municipal services or to be in the process of implementing them.

4. ***Rapidly Growing Leapfrog Municipalities (Type 4)*** are similar to Rapidly Urbanizing Municipalities (Type 2) as they are communities experiencing a rapid rate of growth primarily on non-urban lands (typically through Plan of Subdivision); however, they are at some distance from the current growth concentration and some intervening lands remain undeveloped. These municipalities offer full municipal services and are also installing new services to facilitate growth. Generally, it is assumed that rapidly growing leapfrog municipalities are currently developing at lower residential densities compared to those in Rapidly Urbanizing Municipalities.

5. ***Urban Shadow Areas (Type 5)*** are communities located in largely rural areas beyond the rapidly developing fringe. They have not experienced significant development but, over the course of the study period, may be faced with pressures to accommodate future growth (residential and non-residential). Currently, these communities are accessible by major highways and offer no public transit services. Most of these communities are currently serviced by septic tank systems.

An example of each prototype community was identified for analysis purposes:

1. Already Urbanized Municipalities (Type 1) – Toronto

2. Rapidly Urbanizing Municipalities (Type 2) – Markham

3. Newly Urbanizing Municipalities (Type 3) – Halton Hills

4. Rapidly Growing Leapfrog Municipalities (Type 4) – Barrie

5. Urban Shadow Areas (Type 5) – Shelburne

An analysis similar to the determination of population and employment projections for the UTMs was carried out for the prototype municipalities selected. The result of that analysis was to adopt the market/trend forecasts prepared by IBI Group as they generally reflect a continuation of the historic trend. Appendix A provides a graphic depiction of the trend analysis relative to the various population and employment forecasts available for the 5 prototype communities.

The Market Forecast generally provided population and employment projections for the lower-tier-municipalities in those instances where the projections for the UTMs were available. However, there were some instances where IBI Group drew on alternative projections and information in order to identify an appropriate forecast. Sources and notes on the approach for lower-tier municipalities (LTMs) are documented in Exhibit 2.4.

Exhibit 2.4: LTM Population and Employment Projection Sources

LOWER TIER MUNICIPALITY	PROJECTION SOURCE	NOTES
All lower-tier municipalities in: Dufferin, Durham, Halton, Hamilton,[21] Halton, Peel, Toronto,[2l] Simcoe, Victoria (now City of Kawartha Lakes), York	Market Forecast	
All lower-tier municipalities in Niagara Region	Regional forecasts by local municipality to 2011 and 2026	25% of growth in each local municipality directed to St. Catharines to acknowledge development pressures, i.e., market forces
Waterloo Region	Regional forecast to 2016; Ministry of Finance to 2028	Local municipal projections available for 2000 and 2016 2011 based on equal annual growth between 2000 & 2016 2031 based on extrapolation of 2016 (regional) to 2028 (Province); breakdown to local municipality based on 2000 share of total 2021 based on equal annual growth between 2011 and 2031 Employment estimate based on extrapolation of activity rates and share of regional employment
Northumberland County	Market Forecast	Allocation to local municipal level based on 1996 Census share of total county
Peterborough County	Market Forecast	Allocation to local municipal level (except City of Peterborough) based on 1996 Census share of total county

Having adopted the BAU forecasts, each prototype community was reviewed to determine appropriate assumptions to be applied in terms of development density and household size trends to yield generic population and employment densities per acre for each prototype. These are summarized in Exhibit 2.5.

[21] Market Forecast projections for the former local municipalities in the New City of Hamilton were available and were used in the analysis.

Exhibit 2.5: Density Assumptions by Prototype Municipal Category

MUNICIPAL CATEGORIES	GROSS DENSITY FOR GROWTH (persons per gross acre, p.p.a.)					
	2000-2011		2011-2021		2021-2031	
	Population	Employment	Population	Employment	Population	Employment
Already Urbanized	22.0	25.0	22.0	25.0	22.0	25.0
Rapidly Urbanizing	16.5	18.0	17.5	18.0	18.5	18.0
Newly Urbanizing	10.0	14.0	13.0	14.0	15.0	14.0
Rapidly Growing Leapfrog	14.0	15.0	16.0	15.0	18.0	15.0
Urban Shadow	7.0	7.0	8.0	7.0	9.0	7.0

All lower-tier municipalities in the broader study area were subsequently classified according to the typology; refer to Appendix B (a) for the classification of each municipality within the study area. Combining the assumptions of the market population and employment forecasts and the generic growth characteristics, an estimate of the amount of land to be urbanized over the forecast period was prepared.

Population Density

Population density was estimated through a review of existing information in terms of housing units per gross acre and household size trends for each prototype municipality. The residential density estimate was achieved primarily through an analysis of recent development applications, and, in some instances, specific area or policy studies carried out on behalf of the municipality. The review of available residential density data resulted in an estimate of the number of units per gross acre by prototype municipality. The earlier Neptis study ***Inching Toward Sustainability: The Evolving Urban Structure of the GTA*** had indicated that overall residential densities (i.e., units per gross acre) were generally increasing.

An estimate of average household size or persons per unit (ppu) was prepared through a combination of historic ppu trends in the prototype municipality combined with estimates of household size in new housing units. This analysis indicated that household size is generally declining. Combining the residential density results for each prototype with the household size analysis by prototype municipality resulted in the estimates of population density on a gross acre basis by prototype municipality.

Based on the findings that generally residential densities were increasing and that household size was decreasing, overall, it was expected that population density would increase over the time horizon of the study analysis. The absolute change in population density by decade varied by prototype municipality. For example, for *Already Urbanized Municipalities (Type 1)* it was estimated that population density would remain constant over the forecast period as it applied to development on non-urban land; for *Rapidly Urbanizing Municipalities (Type 2),* modest increases are anticipated; for *Newly Urbanizing Municipalities (Type 3),* a 50% increase is anticipated over the next 30 years; for *Rapidly Growing Leapfrog Municipalities (Type 4),* a 30% increase is anticipated over the next three decades; and for *Urban Shadow Areas (Type 5),* modest increases were estimated. The resulting population density was applied to the population growth anticipated for each decade to estimate urban land consumption through the forecast period.

Employment Density

Employment density (i.e., number of jobs per gross acre) was estimated through a review of existing information related to historic trends and recent non-residential development applications in each prototype municipality. The availability of employment density data was inconsistent across the prototype municipalities. In most cases, "employment" covered all employment types combined, including population-related (i.e., primarily retail, service and institutional), as well as "basic" (major office and industrial jobs). There was no conclusive information available on employment density and historic trends. For the purposes of this analysis, employment density was assumed to be constant through the forecast period for new employment lands in each of the five municipal categories. Note that overall employment density in each community will tend to increase owing to employment intensification on existing employment lands in urban areas.

Other Factors

In carrying out the analysis, two other factors came into play, both of which affect estimates of greenfields land consumption for urban purposes: redevelopment of already urbanized land to higher densities; and possible changes in the home-based component of employment.

For redevelopment factors, IBI Group reviewed data available from the ***GTA Residential Land Inventory 2000***.[22] Appendix V of that document identifies the number of units redeveloped relative to the total units developed within the year by upper-tier municipality within the GTA. This data, expressed as a percentage, was deemed to be representative of a redevelopment factor at the regional level. The area municipalities within the regional municipality were reviewed and the likelihood of redevelopment occurring in each area municipality was examined. For example, in York Region, the more urbanized municipalities (e.g., Markham) are more likely to be subject to redevelopment than the less urbanized municipalities (e.g., Georgina). The redevelopment factor previously noted was used as a guideline in estimating the level of redevelopment in each area municipality. Future population growth on greenfields land was reduced by this redevelopment factor. Thus, the estimate of newly urbanized land takes into account a portion of population growth that will be accommodated through redevelopment of already urbanized land. For *Already Urbanized* or *Type 1 municipalities*, higher levels of redevelopment are generally anticipated, as this is the manner in which population growth is accommodated in already built-up areas.

[22] ***The GTA 2000 Residential Land Inventory Survey***, Canada Mortgage and Housing Corporation, Ministry of Municipal Affairs, 2001.

With respect to home-based work, the 1996 Census provides the share of Labour Force by Place of Work which worked at home. This share was applied to future employment growth, thus keeping the overall share of home-based work constant over the forecast timeframe.

Additionally, the practice of "backfill" was raised during the course of the study. This practice consists of building predominantly low-density residential units in suburban areas in accordance with an approved draft plan of subdivision, while leaving some medium-density and the majority of high-density residential parcels vacant for future construction. Development then "leapfrogs" to the next approved draft plan of subdivision, again focusing on the building of low-density residential units. In some cases the remnant medium- and high-density residential parcels remain vacant for longer periods of time and are developed at a later date ("backfilled"). In other instances, the remnant parcels are downzoned to accommodate lower residential densities than originally contemplated in the original plan. While it was acknowledged that this practice occurred, there was no meaningful data available to account for this occurrence. After due consideration, the density assumptions were nominally reduced to reflect the implications of this "backfill" practice.

Anomalies

The approach described above provided a methodological framework for estimating future consumption of non-urban land for urbanization associated with population and employment growth in each area municipality. While the prototype approach is appropriate, the analysis revealed a number of anomalies or deviations from the estimated population and employment densities, and these have been incorporated into the projections. These variations were identified based on the experience of study team members in specific municipalities as well as consultation with the planning departments of the upper-tier municipalities.

2.3.4 Mapping and Growth Patterns

Mapping

The above analysis provided estimates of newly urbanized land in each area municipality resulting from the population and employment growth forecasts for the study area. These results were plotted on a base map of the broader study area. Existing urbanized land was identified on the base map using information obtained from satellite imagery and analyzed by the University of Toronto Cartography Department. Exhibit 2.6 shows the distribution of urbanized land as of late 1999; this was used as the starting point for mapping anticipated future urban development patterns. Also shown on Exhibit 2.6 are the designated urban area boundaries for local municipalities.[23]

[23] ***York Region GIS Department,*** prepared for the Greater Toronto Services Board (GTSB) based on information from local official plans.

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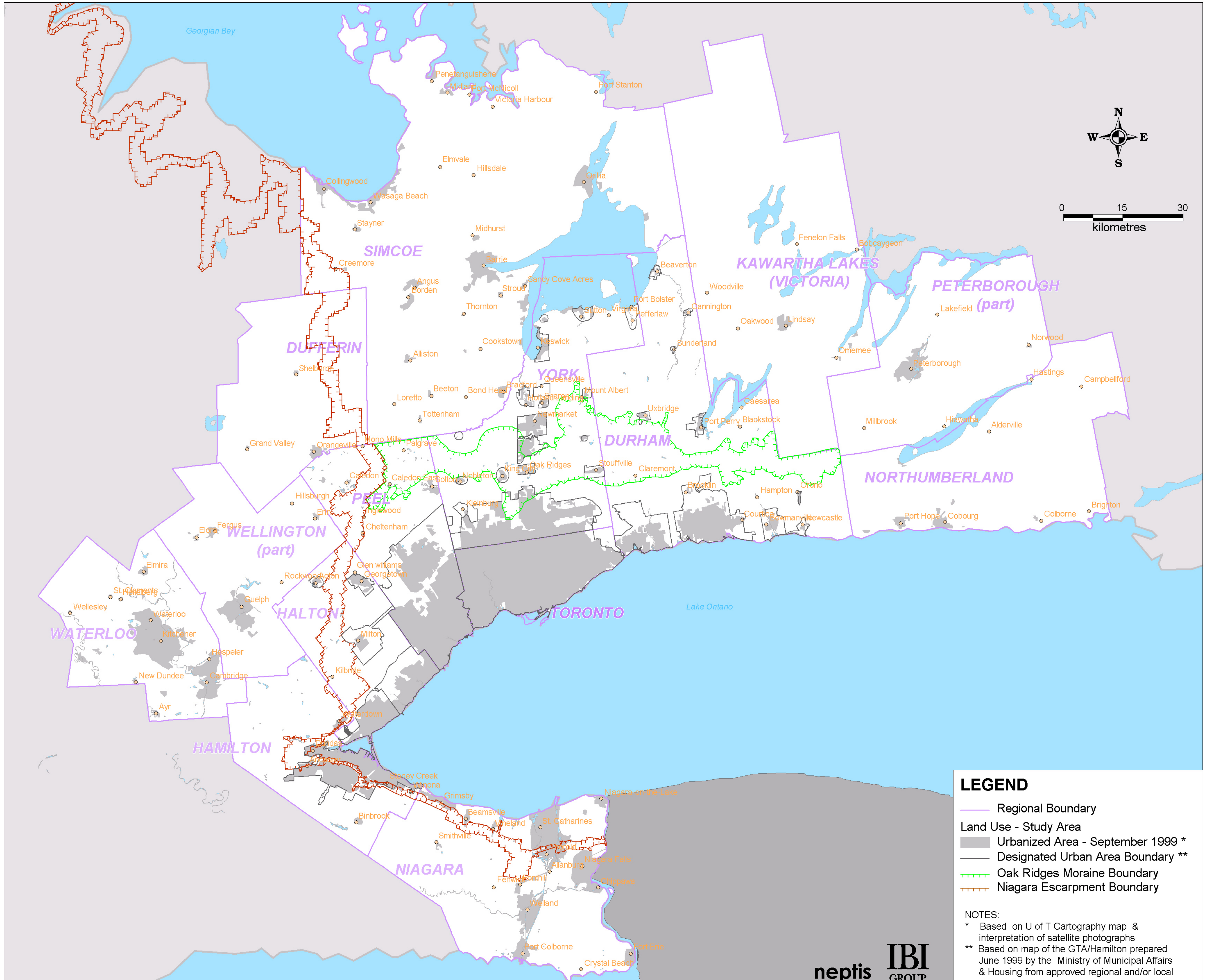
Exhibit 2.6: Existing Urban Land and Designated Urban Boundaries



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Allocation of Newly Urbanized Land

Generally, urban development was assumed to occur adjacent to existing urbanized land. Exhibit 2.7 shows in map form the projected patterns of urbanization over each of the three decades in the study period under the Business-As-Usual scenario. These projections drew on the collective knowledge of the study team in terms of the status of plans and approvals in various municipalities, the location and anticipated influence of existing, committed and planned water/sewer and transportation infrastructure, and trends in land use planning and development. The following assumptions were also used in mapping the distribution of future urbanized land:

- Development is not allocated to designated greenlands[24] or lands designated as provincially sensitive wetlands.
- Development will likely occur initially within the designated urban boundaries shown on Exhibit 2.6, but can also occur outside these boundaries.
- Development on the Oak Ridges Moraine is in accordance with the Oak Ridges Moraine Act; development on the Moraine which received municipal approval prior to the Oak Ridges Moraine Act is assumed to occur.
- Development in more rural areas is anticipated to occur adjacent to smaller settlement areas such as towns, villages etc. However, in some rural areas where some growth is anticipated and there are no sizeable communities, newly urbanized land is shown as a notional rectangle illustrating the overall area of newly developed land but not its spread out nature. Examples can be seen on Exhibit 2.7.

We refer to the last type of development as "rural non-farm" development. Typically, it occurs as strip residential development along township roads, on one-acre lots severed from farm properties fronting on the road. In some cases, development of this type is clustered in a small enclave located off the arterial road. This type of clustered development generally requires municipal approval of a communal septic system, granting of which depends on the specific situation at the site. Development of both types typically occurs at a density of 1 unit per acre or about 3 persons per acre, approximately one-third to one-half of the density which applies for *Type 5: Urban Shadow Areas.* Unfortunately, census data is not available which would allow a rigorous treatment of the proportion of Type 5 population, which is rural non-farm in nature.

[24] Within the GTA, upper-tier municipal Official Plans provided the basis for designated greenlands information.

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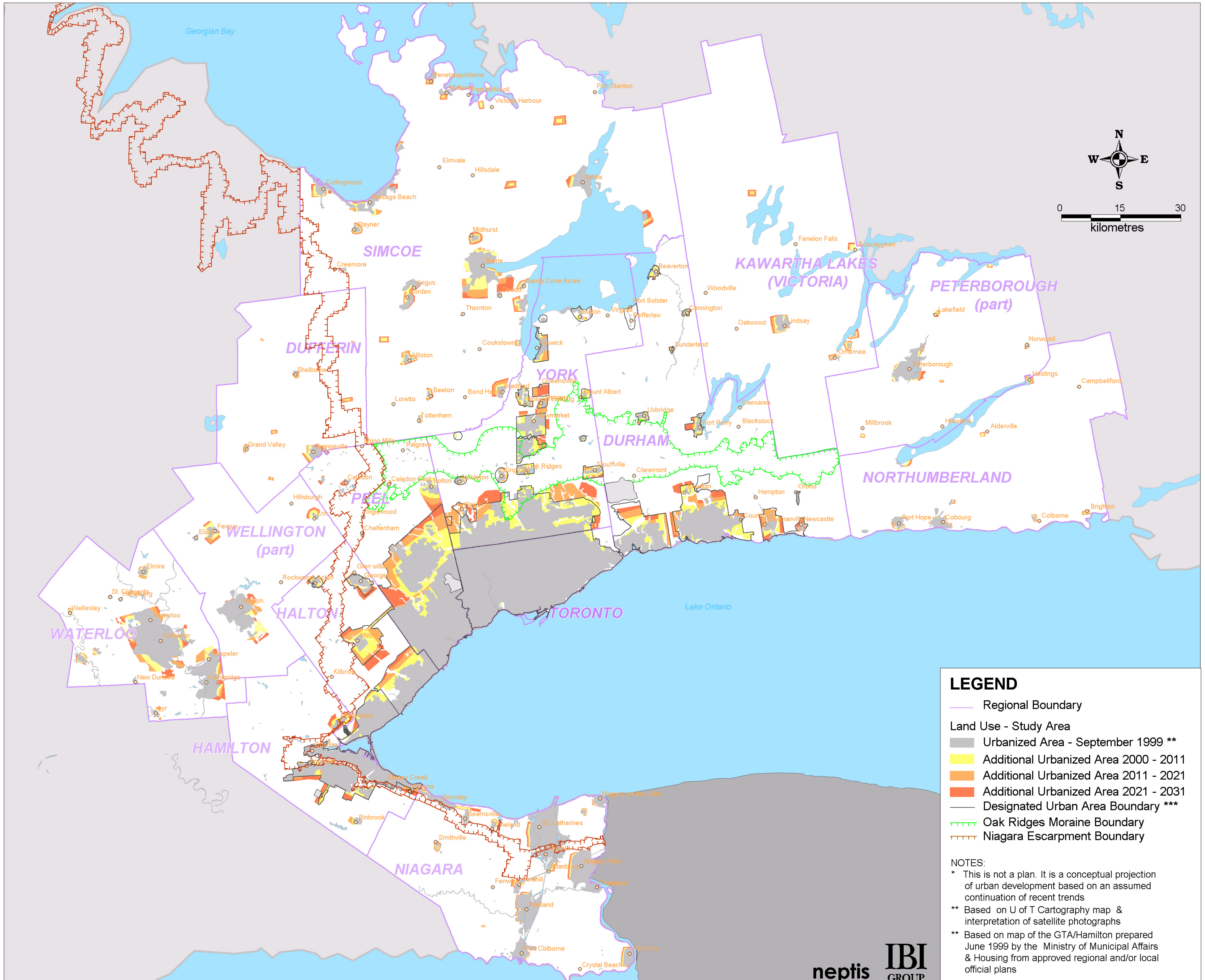
Exhibit 2.7: Urbanized Land 2000 – 2031 Under the Business-As-Usual Scenario



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To provide an approximate indication of implications of this type of development for land consumption, we have applied a lower density (3 persons per acre) to the areas shown as rectangles on Exhibit 2.7, which indicates that an additional 14,500 ± acres of land would be "urbanized" by 2031, relative to the results presented in Appendix B, if this adjustment is made to allow for rural non-farm development in more rural parts of the study area. This difference is quite small in proportion to total new urbanized land, but not insignificant in local areas. Rural non-farm development occurs throughout the non-urbanized parts of the entire study area (not just in the outer, more rural parts) and similar adjustments could be considered throughout if the relevant data were available. It is to be hoped that, in future, census data will distinguish rural non-farm from other rural population, so that this type of development can be monitored and more fully understood, for example, in terms of its land consumption implications.

This mapping and allocation approach resulted in much of the anticipated future urbanized land being accommodated within existing municipal boundaries. However, there were a few instances where the anticipated future urbanized land exceeded the available land within a given municipality. In these instances, it was assumed that development would occur in adjacent municipalities.

With respect to the situation in Richmond Hill, the additional urban land requirements are a result of the initiatives to protect the Oak Ridges Moraine. For purposes of this analysis it is anticipated that the demand for housing which previously would have been directed to that area of Richmond Hill, would likely occur in adjacent areas in Markham and Vaughan, and the BAU development concept reflects this. However, the redirected growth could go elsewhere.

Review with Regional Planners

Consultation between the study team and regional planners occurred during the course of this phase of work. Each upper-tier municipality was provided with a preliminary map of their municipality under the BAU scenario as of 2021 (generally in accordance with the time horizon of their official plans, where applicable), similar to Exhibit 2.7. This map identified the current extent of urbanization as well as the study team's estimate of the extent and location of future growth. A description of the methodological approach, as well as a table identifying the amount of additional urbanized land 2000 to 2021 was also provided, as were the underlying density assumptions. A follow-up meeting/ telephone discussion occurred to obtain feedback from the regional planners.

The purpose of this consultation was not intended to result in a common vision or outcome, but rather to ensure that the fundamental approach and assumptions were reasonable. The study team used the comments and feedback from this consultation to in identify anomalies as well to gain additional insight into specific issues or development phenomena.

As noted on Exhibit 2.7, the urbanization concept shown is not a plan. It is a conceptual projection of urban development patterns based on an assumed continuation of recent trends. It is recognized that development patterns for the next decade are largely committed based on plans and approvals already in place; the effects of possible changes in development policies and infrastructure investment programs (which are not the subject of this interim report) would tend to become more evident in the following two decades, after 2011.

2.4 URBAN STRUCTURE TO 2031 UNDER BUSINESS-AS-USUAL

2.4.1 Growth and Land Requirements to 2031

Exhibit 2.7 shows the anticipated urban structure of the Toronto-Related Region to 2031, derived as described in the previous section. This map should be viewed in association with Exhibit 2.8, which provides an overview of existing and projected population, employment, activity rate, urbanized land and urban density by upper-tier municipality within the study area.

Exhibit 2.8: Overview of Population, Employment, Activity Rate, Urbanized Area and Gross Density by Upper-Tier Municipality, Toronto-Related Region

Year	1996	2000	2011	2021	2031
Durham					
Population (P)	470,000	512,332	656,738	786,366	914,693
Total Employment (E)	164,000	185,200	258,300	326,400	364,304
Activity Rate	0.349	0.361	0.393	0.415	0.398
Urbanized Area (acres) [U]		39,419	53,420	65,080	74,431
Gross Density ([P+E]/U)		17.70	17.13	17.10	17.18
Halton					
Population (P)	339,875	384,597	505,900	607,373	703,119
Total Employment (E)	159,000	196,800	281,900	351,900	389,509
Activity Rate	0.468	0.512	0.557	0.579	0.554
Urbanized Area (acres) [U]		38,456	51,061	61,239	68,878
Gross Density ([P+E]/U)		15.12	15.43	15.66	15.86
Hamilton					
Population (P)	467,830	498,120	530,154	566,794	601,131
Total Employment (E)	184,000	192,372	211,717	229,626	248,253
Activity Rate	0.393	0.386	0.399	0.405	0.413
Urbanized Area (acres) [U]		43,217	46,738	50,061	53,037
Gross Density ([P+E]/U)		15.98	15.87	15.91	16.01
Peel					
Population (P)	852,526	977,510	1,214,535	1,351,754	1,474,823
Total Employment (E)	421,000	540,700	703,800	799,100	835,147
Activity Rate	0.494	0.553	0.579	0.591	0.566
Urbanized Area (acres) [U]		88,134	107,070	118,680	127,356
Gross Density ([P+E]/U)		17.23	17.92	18.12	18.14
Toronto					
Population (P)	2,385,451	2,523,547	2,600,000	2,750,000	2,900,000
Total Employment (E)	1,154,200	1,300,000	1,573,000	1,610,000	1,700,000
Activity Rate	0.484	0.515	0.605	0.585	0.586
Urbanized Area (acres) [U]		120,815	122,040	122,040	122,040
Gross Density ([P+E]/U)		31.65	34.19	35.73	37.69
York					
Population (P)	611,500	727,313	1,029,627	1,244,707	1,438,765
Total Employment (E)	292,000	368,700	535,300	660,400	724,440
Activity Rate	0.478	0.507	0.520	0.531	0.504
Urbanized Area (acres) [U]		71,940	100,014	119,647	133,998
Gross Density ([P+E]/U)		15.24	15.65	15.92	16.14
Inner Study Area Subtotal					
Population (P)	5,127,182	5,623,420	6,536,954	7,306,994	8,032,531
Total Employment (E)	2,374,200	2,783,772	3,564,017	3,977,426	4,261,653
Activity Rate	0.463	0.495	0.545	0.544	0.531
Urbanized Area (acres) [U]		401,982	480,343	536,747	579,740
Gross Density ([P+E]/U)		20.91	21.03	21.02	21.21

Exhibit 2.8: Overview of Population, Employment, Activity Rate, Urbanized Area and Gross Density by Upper-Tier Municipality, Toronto-Related Region (Cont'd)

Year	1996	2000	2011	2021	2031
Niagara Region					
Population (P)	416,000	422,798	443,806	481,851	510,306
Total Employment (E)	161,065	177,613	198,779	206,783	220,508
Activity Rate	0.39	0.42	0.45	0.43	0.43
Urbanized Area (acres) [U]		62,323	64,879	68,055	70,588
Gross Density ([P+E]/U)		9.63	9.90	10.12	10.35
Waterloo Region					
Population (P)	417,200	450,940	514,830	569,904	621,966
Total Employment (E)	198,400	223,102	275,190	335,134	386,612
Activity Rate	0.48	0.49	0.53	0.59	0.62
Urbanized Area (acres) [U]		45,935	52,818	59,470	65,284
Gross Density ([P+E]/U)		14.67	14.96	15.22	15.45
Dufferin County					
Population (P)	47,000	51,000	60,000	74,000	87,999
Total Employment (E)	14,230	16,091	21,002	26,000	29,999
Activity Rate	0.30	0.32	0.35	0.35	0.34
Urbanized Area (acres) [U]		2,743	3,735	5,399	6,725
Gross Density ([P+E]/U)		24.46	21.69	18.52	17.55
Northumberland County					
Population (P)	84,000	87,001	94,999	103,000	110,002
Total Employment (E)	29,500	33,181	38,799	42,098	44,601
Activity Rate	0.35	0.38	0.41	0.41	0.41
Urbanized Area (acres) [U]		6,153	7,606	8,718	9,577
Gross Density ([P+E]/U)		19.53	17.59	16.64	16.14
Peterborough County (Part only)					
Population (P)	112,000	117,349	126,518	135,689	143,943
Total Employment (E)	50,200	53,243	59,420	63,855	67,106
Activity Rate	0.45	0.45	0.47	0.47	0.47
Urbanized Area (acres) [U]		9,278	10,438	11,428	12,223
Gross Density ([P+E]/U)		18.39	17.81	17.46	17.27
Simcoe County					
Population (P)	339,580	380,870	476,970	579,420	681,300
Total Employment (E)	125,920	147,700	193,990	242,090	282,380
Activity Rate	0.37	0.39	0.41	0.42	0.41
Urbanized Area (acres) [U]		39,610	51,932	63,758	74,158
Gross Density ([P+E]/U)		13.34	12.92	12.88	13.00
City of Kawartha Lakes					
Population (P)	70,000	73,000	85,000	100,000	115,000
Total Employment (E)	18,600	22,040	29,000	34,000	38,800
Activity Rate	0.27	0.30	0.34	0.34	0.34
Urbanized Area (acres) [U]		3,346	5,264	7,115	8,799
Gross Density ([P+E]/U)		28.41	21.66	18.83	17.48
Wellington County (part only)					
Population (P)	143,125	153,634	182,743	207,001	229,642
Total Employment (E)	69,630	78,098	94,017	106,532	117,683
Activity Rate	0.49	0.51	0.51	0.51	0.51
Urbanized Area (acres) [U]		14,589	18,060	20,671	22,902
Gross Density ([P+E]/U)		15.88	15.32	15.17	15.17
Outer Study Area Subtotal					
Population (P)	1,628,905	1,736,592	1,984,866	2,250,865	2,500,159
Total Employment (E)	667,545	751,069	910,196	1,056,492	1,187,689
Activity Rate	0.410	0.43	0.46	0.47	0.48
Urbanized Area (acres) [U]		183,976	214,732	244,615	270,256
Gross Density ([P+E]/U)		13.52	13.48	13.52	13.65
TOTAL STUDY AREA					
Population (P)	6,756,087	7,360,012	8,521,820	9,557,859	10,532,690
Total Employment (E)	3,041,745	3,534,841	4,474,213	5,033,918	5,449,342
Activity Rate	0.450	0.480	0.525	0.527	0.517
Urbanized Area (acres) [U]		585,957	695,075	781,362	849,996
Gross Density ([P+E]/U)		18.59	18.70	18.67	18.80

In 2000, the study area had an estimated population of 7.36 million and employment of 3.5 million, resulting in an activity rate (the ratio of employment to population) of .48. The urbanized land[25] is estimated at just under 586,000 acres (2,371 km^2), yielding a gross density (i.e., for population plus jobs) of 18.59 people plus jobs per acre or 45.9 per hectare.

Based on the anticipated population and employment to 2031 of 10.5 million and 5.4 million respectively, the activity rate is expected to increase to just under .52. The urbanized land in the overall study area is estimated to total some 850,110 acres (3,440 km^2) resulting in an overall gross density of 18.8 people plus jobs per acre or 46.5 per hectare, about 1% higher than the existing density.

- Over the 31 years, the combined population and employment growth of just over 5 million will require 264,038 acres (1,069 km^2) of newly urbanized land. This is approximately equivalent to the total area of the New City of Hamilton (1,113 km^2), slightly more than all of Halton Region (959 km^2) or just less than double the existing City of Toronto area (twice 630 km^2).

- Under the Business-As-Usual scenario, **new** growth in the overall study area is estimated to occur at an average gross density of about 19.3 people plus jobs per acre (47.7 per hectare), about 3.8% higher than the **existing** gross development density of 18.6 people plus jobs per acre (45.9 per hectare).

The majority of growth and urbanization is anticipated to occur in the inner study area. Generally the inner study area is estimated to maintain its share of the study area population (76%), employment (79%) and urbanized land (69%) throughout the forecast period with little variation. By 2031, the inner study area is estimated to have about 8 million people and 4.3 million jobs on 579,740 acres (2,346 km^2) of land, resulting in a gross urban density of 21.2 people plus jobs per acre (52.3 per hectare).

- The incremental growth in the inner study area over the 31 years of 3.9 million people plus jobs is estimated to be accommodated on about 177,758 acres (719 km^2) of newly urbanized land, an area larger than the City of Toronto.

- The gross density of this new urban development is estimated to be 21.9 people plus jobs per acre (54.1 per hectare) compared to an existing density of 20.9 per acre in the inner study area (51.7 per hectare).

A more focused view of the anticipated growth and development recognizes that ***almost all of the anticipated new land consumption for urbanization in the inner study area will occur outside of the City of Toronto***, which is almost completely urbanized, with the exception of a small parcel in the northeast. Population and employment growth in Toronto will continue to be accommodated through redevelopment and intensification. Currently, the inner study area excluding Toronto (i.e., Durham, York, Peel, Halton and

[25] The estimate of urbanized land excludes designated greenlands as shown in official plans.

Hamilton) accommodates some 4.6 million people plus jobs on 281,170 acres (1,138 km^2), resulting in an urban density of 16.3 people plus jobs per acre (40.3 per hectare). The addition of 3 million people plus jobs will require about 176,533 acres (714 km^2) – an area larger than the existing City of Toronto.

By comparison, Toronto currently has a total of 3.8 million people plus jobs on 120,815 acres, resulting in a gross urban density of 31.7 people plus jobs per acre (78.2 per hectare). By 2031, the incremental population and employment growth of just over 776,500 will be accommodated on essentially the same urbanized land base, thereby increasing the gross urban density to 37.7 people plus jobs per acre (93.2 per hectare).

Focusing on population density (i.e., population divided by total urbanized land), the City of Toronto has a current density of just under 20 persons per acre; by 2031, it is anticipated that the City's population density will be just under 24 persons per acre. This population density is comparable to Paris, London or Vienna (19, 23, 29 persons per acre, respectively) but considerably less than Tokyo (42 persons per acre) or Hong Kong (117 persons per acre).[26]

Anticipated growth trends by time period for the BAU scenario are summarized below:

2000 to 2011

About 41% of the overall growth in people plus jobs for the study area is anticipated to occur in the first eleven years. Thus some 2.1 million people plus jobs will require 109,118 acres (442 km^2) of new urban land, a growth of 19% in urban land. The incremental gross urban density is anticipated to be 19.3 people plus jobs per acre (47.7 per hectare) compared to a base of 18.6 per acre (45.9 per hectare) in 2000.

In this first period, the inner study area is expected to experience 81% of the growth in the study area, on 72% of the land required to accommodate that growth. This proportionate share reflects the dominance of Toronto in the inner study area together with the increasing densities projected for the inner study area. Conversely, the outer study area is anticipated to accommodate 19% of the growth on 28% of the land. This result reflects the relatively low-density of development estimated for Type 5 (Urban Shadow) municipalities, which are more prevalent in the outer study area compared to the inner study area.

Overall, it is anticipated that municipalities will experience rising gross urban densities. However, the output suggests that some municipalities in the study area could experience a nominal decline in their gross urban densities. For example, it is anticipated that Durham and most of the UTMs in the outer study area will experience a nominal decline in densities in the areas that will become urbanized in this first ten years. This is an outcome of the study methodology, which assumes that the total

[26] From "Learning from the Best and the Worst: Thirty-Two International Cities with Implications for Gasoline Use and Emissions," J.R. Kenworthy and W.P.G. Newman, October 1987. While the paper is dated, it provides some comparative data that is helpful in illustrating relative densities.

population and employment in a UTM lives and works on urbanized land. In the outlying areas a considerable proportion of the population and employment lives and works on rural land. Data constraints prevented further refinement and clarification of this result. However, it is likely that the gross urban densities in the outlying areas are somewhat lower than identified and will change insignificantly through the forecast period. Overall, however, the results provide useful information at the strategic level of analysis.

2011 to 2021

The rate of growth of population and employment is anticipated to decline moderately in the second decade; accordingly, land consumption is expected to slow. Overall, the growth in this decade represents 31% of the projected total population and employment growth over 31 years in the study area. In those ten years, the study area growth is estimated to be just under 1.6 million people plus jobs on 86,287 acres (349 km^2), for an incremental density of 18.5 people plus jobs per acre (45.7 per hectare).

Through the second decade, the inner study area represents 74% of the growth on 66% of the land. Similar to the first decade, the inner study area is expected to grow substantially and with increasing overall densities. It is expected that the City of Toronto will continue to experience increasing densities, as the only opportunity to accommodate population and employment growth will be through infill and intensification. This will also occur in the City of Mississauga, but to a lesser degree.

2021 to 2031

The slowing growth rate is projected to continue during this final decade, which is expected to experience 27% of the total anticipated growth in people plus jobs over the 31 years. The actual people plus jobs growth in this decade is anticipated to be 1.39 million on 69,110 acres (278 km^2). Gross urban density is expected to be on the order of 20.3 people plus jobs per acre (50.2 per hectare).

The inner study area continues to dominate in terms of growth and development through this third decade. The area represents 73% of the study area growth in population plus jobs and 63% of land urbanization.

2.4.2 Growth to 2031 by Municipal Category

Exhibit 2.9 summarizes the anticipated growth in the study area according to the municipal categories used in this analysis.

Exhibit 2.9: Growth Allocation to 2031 by Municipal Category

TYPE OF MUNICIPALITY	2000 to 2031 GROWTH						
	Absolute Growth		Percentage Growth		Urbanized Land		
	Population	Employment	Population	Employment	acres	km^2	%
Type 1 Already Urbanized	695,826	719,696	21.9%	37.6%	26,058	105	9.9%
Type 2 Rapidly Urbanizing	1,466,015	781,771	46.2%	40.8%	126,765	513	48.0%
Type 3 Newly Urbanizing	519,400	202,152	16.4%	10.6%	53,911	218	20.4%
Type 4 Rapidly Growing Leapfrog	316,318	159,230	10.0%	8.3%	29,337	119	11.1%
Type 5 Urban Shadow	175,120	51,764	5.5%	2.7%	27,967	113	10.6%
TOTAL GROWTH	3,172,679	1,914,613	100%	100%	264,038	1,069	100%

- In all measures of growth (i.e., population, employment and urbanized land), the Type 2 (Rapidly Urbanizing) municipalities are expected to experience the most growth. Type 2 municipalities are estimated to have 46.2% of the total population growth, 40.8% of the total employment growth and 48% of the growth in urbanized land within the study area.

- Type 1 (Already Urbanized) municipalities will experience substantial growth as well. Based on the analysis, it is estimated that Type 1 municipalities will experience 37.6% of employment growth and 21.9% of population growth, but only 9.9% of growth in urbanized land. This result is attributed to infill and the intensification of land use, particularly in the City of Toronto. Other Type 1 municipalities are also expected to experience increased infill and intensification, but to a lesser extent than the City of Toronto.

- Type 4 (Rapidly Growing Leapfrog) and 5 (Urban Shadow) municipalities are expected to experience approximately the same amount of growth in urbanized land over the 30-year timeframe. Each of these categories is expected to contribute about 10% of the total growth in urbanized land, a much smaller share of the population and employment growth than the Type 1 and Type 2 municipalities

- Type 3 (Newly Urbanizing) municipalities are anticipated to make up 16.4% of population growth, 10.6% of employment growth and 20.4% of growth in urbanized land.

2.4.3 Population Growth vs. Anticipated Urban Land Consumption

A comparison of the population growth rate relative to the rate of land urbanization provides a useful measure to ascertain trends. Exhibit 2.10 summarizes the projected population growth and the anticipated growth in urban land by the three time intervals.

Exhibit 2.10: Comparison of Population Growth and Urban Land Consumption

Upper-Tier Municipality	2000 to 2011		2011 to 2021		2021 to 2031	
	Population Growth	Increase in Urbanized Land	Population Growth	Increase in Urbanized Land	Population Growth	Increase in Urbanized Land
INNER AREA						
Durham	28.2%	35.5%	19.7%	21.8%	16.3%	14.4%
Halton	31.5%	33.9%	20.1%	20.6%	15.8%	12.8%
Hamilton	6.4%	8.1%	6.9%	7.1%	6.1%	5.9%
Peel	24.2%	21.5%	11.3%	10.8%	9.1%	7.3%
Toronto	3.0%	1.0%	5.8%	0.0%	5.5%	0.0%
York	41.6%	39.2%	20.9%	19.7%	15.6%	12.1%
Sub-total	**16.2%**	**19.6%**	**11.8%**	**11.9%**	**9.9%**	**8.1%**
OUTER AREA						
Niagara	5.0%	4.3%	8.6%	4.9%	5.9%	3.7%
Waterloo	14.2%	15.0%	10.7%	12.6%	9.1%	9.8%
Dufferin	17.6%	36.2%	23.3%	44.5%	18.9%	24.6%
Northumberland	9.2%	24.3%	8.4%	14.9%	6.8%	10.0%
Peterborough (part only)	7.8%	12.5%	7.2%	9.5%	6.1%	7.0%
Simcoe	25.2%	31.1%	21.5%	22.8%	17.6%	16.3%
Kawartha Lakes	16.4%	57.3%	17.6%	35.2%	15.0%	23.7%
Wellington (part only)	18.9%	23.8%	13.3%	14.5%	10.9%	10.8%
Sub-total	**14.3%**	**16.8%**	**13.4%**	**13.9%**	**11.1%**	**10.5%**
TOTAL STUDY AREA	**15.8%**	**18.7%**	**12.2%**	**12.5%**	**10.2%**	**8.8%**

For the study area as a whole:

- It is expected that the first 11 years will result in urbanized land growth (18.6%), which exceeds the estimated population growth (15.8%).
- During the following decade (2011 to 2021), population growth and urban land growth are expected to be approximately equal (about 12% each).
- In the last 10 years, there is expected to be a reversal of the current circumstance and population growth (10.2%) will slightly exceed the anticipated growth in urbanized land (8.8%).

Some municipalities within the inner study area (e.g., Peel, Toronto and York) are projected to experience population growth that is higher than the anticipated urban land growth across all three timeframes, while the others are expected to have higher increases in urbanized land than in population in the first decade with a reversal in relative growth rates during the third decade. In most cases, the differential between population growth and urban land consumption is projected to diminish through the forecast period.

The upper-tier municipalities in the outer study area are expected to vary substantially in terms of their population and urban land growth rates. The more "urban" municipalities such as Niagara, Waterloo, Simcoe and Wellington tend to have a narrower differential between population and urban land growth rates. The more "rural" municipalities (i.e., Northumberland, Peterborough, Dufferin and Kawartha Lakes) have a much wider gap, with urban land growth rates being substantially higher than population growth rates. The gap diminishes through the forecast period, but the pattern of urban land growth exceeding population growth persists.

Exhibit 2.11 provides an alternative approach to understanding the trends in population and job growth relative to land by identifying the current and anticipated urban land per capita (expressed in sq.ft. per capita). Overall, the results show a slight and gradual decline over the thirty-year timeframe from 2,343 sq.ft. per capita to 2,317 sq.ft. per capita.

Exhibit 2.11: Square Feet of Land per Capita (Population + Jobs)

	Land Per Capita (Population + Jobs) (sq.ft.)			
Upper-Tier Municipality	**2000**	**2011**	**2021**	**2031**
INNER AREA				
Durham	2,462	2,543	2,548	2,535
Halton	2,881	2,823	2,781	2,746
Hamilton	2,726	2,744	2,738	2,720
Peel	2,529	2,431	2,404	2,402
Toronto	1,376	1,274	1,219	1,156
York	2,859	2,784	2,736	2,698
Sub-Total	**2,083**	**2,071**	**2,072**	**2,054**
OUTER AREA				
Niagara	4,522	4,398	4,305	4,207
Waterloo	2,969	2,912	2,862	2,820
Dufferin	1,781	2,009	2,352	2,482
Northumberland	2,230	2,476	2,617	2,698
Peterborough (part only)	2,369	2,445	2,495	2,523
Simcoe	3,264	3,372	3,381	3,352
Kawartha Lakes	1,533	2,142	2,313	2,492
Wellington (part only)	2,742	2,842	2,872	2,872
Sub-Total	**3,221**	**3,231**	**3,222**	**3,192**
TOTAL STUDY AREA	**2,343**	**2,330**	**2,333**	**2,317**

2.5 KEY IMPLICATIONS

In 2000, the study area had an estimated population of 7.4 million and employment of 3.5 million. The urbanized land is estimated at just under 586,000 acres (2,370 km^2) thus yielding a gross density (i.e., for population plus jobs) of 18.6 people plus jobs per acre or 45.9 per hectare. The estimated population and employment in 2031 is 10.5 million and 5.4 million respectively. By that time the urbanized land in the overall study area is estimated to total 850,000 acres (3,440 km^2).

Anticipated growth through the 31 years will occur primarily on designated urban land. Exhibit 2.7 shows the physical extent of projected population and employment growth. Generally, this growth is expected to occur adjacent to already urbanized areas. The implications of these anticipated growth patterns include the following.

2.5.1 Development Densities

Density trends have important implications for land consumption and also for infrastructure requirements and performance:

- **Newly Urbanized Land:** Although rising gross residential densities are projected in new suburban developments, and expected in existing urban areas, the density of population and employment for the overall study area is projected to increase very little – from 18.6 to 18.9 people plus jobs per acre (45.9 to 46.5 per hectare) of urbanized land. This is primarily because the greatest population growth is expected in newly urbanized areas with densities that, although rising, are and will remain below the study area average. As well, density declines are expected in many urban shadow communities, as low-density development is expected to occur outside existing relatively compact rural towns and villages.

- **Established Areas:** The only upper-tier municipality showing a substantial increase in density is the City of Toronto, where infill and redevelopment are expected to raise density from 31.7 to 37.7 people plus jobs per acre (78.2 to 93.1 per hectare). This is the main reason for the slight rise in the overall density of the study area.

- **Infill and Redevelopment:** Population growth of some 513,000 will be accommodated through infill or redevelopment. This is most prevalent in built-up urban areas, particularly in the City of Toronto. Of the total growth accommodated through infill or redevelopment, 68% is expected to occur in Toronto. This level of infill or redevelopment may be considered conservative when compared to municipal intensification targets; however, it reflects the BAU principles.

2.5.2 Land Consumption and Availability

- **New Urbanized Land:** Over the 31-year timeframe, an estimated 264,000 acres (1,070 km^2) of land will be urbanized. This is almost double the area of the City of Toronto.

- **Land Availability:** In most municipalities, new land already designated as urban in official plans (much of which is currently undeveloped) will be sufficient for urban development until 2021, and in some municipalities until 2031. The region has enough additional land for many more years of urban expansion – if it chooses to continue current development patterns and consumption of non-urban land – even with most of the Oak Ridges Moraine protected from development.

- **Extension of Urban Boundaries:** A number of lower-tier municipalities will need to extend their current designated urban boundaries to accommodate anticipated population and employment growth to 2031. In some instances, the anticipated growth relative to designated urban boundaries in a rapidly growing municipality may cause development to occur in adjacent municipalities. In the BAU scenario a relatively small proportion of newly urbanized land was reallocated for this reason as described in Section 2.3.4.

- **Rapid Growth Areas:** The greatest shares of population growth and newly urbanized land – 46.2% and 48.0%, respectively, by 2031 – are expected to occur in rapidly urbanizing municipalities (Type 2). Land consumption per capita in Type 2 municipalities (residential and employment lands) is about 2,500 sq.ft. (288 sq.m) per person plus job, more than three times that of already urbanized municipalities (Type 1).

- **Agricultural Land:** The study area is located within an area which has comparatively high agricultural capability. According to an analysis carried out by the University of Toronto Cartography Department on behalf of the Neptis Foundation, about 92% of the future urbanized land requirement – approximately 244,000 acres (987 km^2) – is Class 1, 2 or 3 agricultural land as classified by the Canadian Land Inventory; about 69% – approximately 181,000 acres (733 km^2) – is Class 1, top-quality, agricultural land. This 181,000 acres is about 7.2% of all the Class 1 agricultural land in the study area which totals about 2.5 million acres (10,200 km^2). Much of the 181,000 acres is located within designated urban boundaries and may or may not be actively farmed at present.

- **Activity Rate:** The activity rate[27] provides an indicator of expected trends in jobs/worker balance. Overall, modest increases are anticipated in the activity rate from .48 to .52. The inner study area has, as expected, slightly higher activity rates relative to the outer study area, suggesting that the six upper-tier municipalities in the inner study area will continue to have an excess of jobs relative to resident labour force and will attract in-commuting from the outer study area.

- **Trends in the Consumption of Urbanized Land Per Capita:** Declining rates of new urban land consumption per capita are projected over the study period such that, while new urban land is expected to grow in percentage terms more quickly than population during the decade to 2011, the growth rates will be approximately equal in the following decade, and new urban land is expected to grow more slowly than population in the third decade, 2021 to 2031. These projections suggest that there will be a modest trend towards more intense use of land as urbanization proceeds, under the BAU scenario.

[27] The activity rate noted is a derived number based on employment (jobs) divided by population.

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3 TRANSPORTATION

3.1 BACKGROUND

Transportation is a major factor in shaping and serving urban development patterns. An important element of this study, therefore, is to estimate future transportation demand levels and system performance for the Business-As-Usual scenario and, in future phases of the work, for alternative land use/transportation scenarios. These forecasts are carried out by means of travel demand modelling, which simulates travel decisions and behaviour based on mathematical relationships relating travel demand to underlying factors such as land use patterns, the distribution of population and employment, and transportation system coverage, service levels and pricing. The focus in this work is on the transportation of persons rather than goods, reflecting the important peak period pressures imposed on the urban transportation system by the movement of people.

Section 3.2 describes transportation demand in the study area, focusing on past trends and underlying factors. Section 3.3 deals with past trends in transportation supply and discusses supply/demand interactions. The process of transportation modelling, including analysis methodology and assumptions, is discussed in Section 3.4, and the results of this work, including transportation demand, supply, costs and performance to 2031 under the BAU scenario, are presented in Section 3.5. Major transportation characteristics of the BAU scenario are described in Section 3.6 and key implications of the transportation findings are presented in Section 3.7.

3.2 TRANSPORTATION DEMAND: PAST TRENDS AND UNDERLYING FACTORS

3.2.1 Reasons Behind Increased Transportation Demand

As shown in Exhibit 3.1, while the growth in the study area population over the past 32 years (1964 to 1996) has been substantial (79%), employment has grown even more (102%) and the growth in daily trips has been even larger (218%). The number of adult daily trips per capita has increased by about 77% over the 32-year period, reflecting a number of demographic, economic and transportation trends.

- Following the unprecedented drop in fertility in the mid-1960s (which marked the end of the 1946-1966 "baby boom"), the average household size has dropped significantly (from 3.9 persons in 1961 to 2.7 in 1996) as fewer children were born, more and more women joined the work force, and the proportion of adults per household increased. These trends meant more travel generated per capita.

- Increasing prosperity since World War II has meant higher real incomes and greater car ownership (a 60% increase in car ownership per capita) which has meant that growing numbers of new entries to the labour force have used automobiles for their trips to work and for other purposes.

Exhibit 3.1: Study Area Growth 1964 – 1996: Population, Employment and Travel

	1964	1996	1964-1996 % Increase
Population	3,766,000	6,756,000	79%
Employment	1,508,000	3,042,000	102%
Adult Daily Trips	4,059,000	12,900,000	218%
Adult Daily Trips/Capita	1.4	2.48	77%
Avg. Work Trip Length	11.4	14.1	24%
(straight-line kilometres GTA trips)			
Car Ownership/Capita	0.32	0.51	60%

Sources: Metro Toronto and Region Transportation Study; Transportation Tomorrow Survey; Census data.

- During the same period, the construction of freeway networks and the demand for quicker and more reliable door-to-door deliveries has produced a major shift in the mode of goods movement from rail to truck, adding additional vehicular demand on top of the burgeoning passenger travel by road.

As also shown in Exhibit 3.1, not only has there been a substantial growth in daily trips per capita, but also the trips have, on average, been getting longer. The average work trip length has grown from about 11.4 km in 1961 to 14.1 km in 1996. The reasons for this include:

- the greater scale of the urbanized area;

- rapid household formation: the "baby boomers" bought their first house generally during the period 1980-2000, which created very strong demand (similar to that by returning servicemen in the 1950s) for single-family houses, which can be provided most easily on newly urbanized greenfields land, located farther and farther from the metropolitan centre;

- the high land costs generated by rapid growth, which have pushed the locations for new housing even farther afield, into “ex-urban” developments beyond existing urban envelopes, lengthening work and other trips even more;

- the fact that most households have two or more adults in the labour force, which often means that it is impossible to choose a residential location close to both jobs, so that at least one of the workers has a longer work trip than would ideally be the case;

- an extreme shortage of rental accommodation, resulting from the lack of incentives for construction of new rental units, which has exacerbated the above trends, since rental accommodation tends to be located in established urban areas, thereby allowing shorter trips to work, shopping and other destinations.

As can be seen from Exhibit 3.1, each person in 1996 was making, on average 77% more trips daily than in 1964 and each trip was, on average, 24% longer. Therefore, the transportation system had to cope with about 119% greater demand **from each person** in terms of vehicle-km than it had 32 years previously. In light of the 79% growth in population in the study area, it is easy to understand the transportation problems we are now facing.

While we are focusing here primarily on trips generated within the study area, similar trends have been occurring for inter-urban and recreational trips. These trends have increased automobile traffic within the study area, particularly in the summer months, and placed additional loads on the transportation system.

3.3 TRANSPORTATION SUPPLY: PAST TRENDS AND SUPPLY/ DEMAND INTERACTIONS

3.3.1 Transportation Supply Trends

As shown in Exhibit 3.2, the provincial and municipal governments have provided substantial new transportation facilities in the GTA over the past five or six decades. The province built the Queen Elizabeth Way just before World War II and Highways 400 and 401 after the war. All were substantially widened subsequently and other links in the network of “super highways” were added, including Highways 427, 403, 404 and 410. Highway 407, constructed and operated as a toll road and opened in 1998, is the only major addition to the network of 400-series highways in the past 15 years, although there has been extensive widening of Highway 401 on the western and eastern approaches to the City of Toronto.

During the late 1950s and early 1960s, Metropolitan Toronto constructed the Gardiner Expressway and the Don Valley Parkway and planned a number of other links in the expressway network serving Metro: the Highway 400 extension south to the Gardiner, the Richview and Crosstown Expressway and the Spadina Expressway linking it northward to Highway 401 and beyond. As we know, these planned expressways were rejected by a public, which was increasingly sensitized to environmental and urban quality issues, although Mount Pleasant Road was extended south of St. Clair through a ravine system linking to Jarvis Street, the Allen Roadway was built as far south as Eglinton, and Black Creek Drive created an extension of Highway 400 south to St. Clair Avenue.

During the same period, Metropolitan Toronto and the surrounding municipalities worked to complete their grids of arterial roads, and this work is still ongoing. Here again, public pressures relating to neighbourhood integrity and the environment have prevented Toronto and other municipalities from filling in a number of “missing links” in their arterial road networks.

In the field of transit, Metropolitan Toronto built the first leg of the Yonge Street subway in the mid-1950s, followed by the University/ Bloor/Danforth subway, the Spadina subway and various extensions, including the Scarborough Rapid Transit extension of the Bloor subway from Kennedy Station to the Scarborough City Centre and McCowan Road, and the Spadina light rail transit line between Bloor Street and Queen's Quay, connecting to Union Station.

Exhibit 3.2: Major Study Area Transportation Improvements: Last 50 – 60 Years

	DATE OPENED
ROADS	
Queen Elizabeth Way	1939
Highway 400	1951
Highway 401	1952
Highway 427	1955
Gardiner Expressway	1958
Don Valley Parkway	1961
Highway 404	1967
Highway 410	1976
Highway 403	1985
Highway 407	1998
Arterial Grid Completion	Ongoing
TRANSIT	
Yonge Subway	1954
Bloor/Danforth Subway	1966
University/Spadina Subway	1963 – 1978
Scarborough Rapid Transit	1985
Spadina Light Rail Transit	1997
Metro-wide TTC	Post 1954
Other Transit Systems	Ongoing
COMMUTER RAIL (GO Transit)	
Lakeshore East and West	1967
Georgetown	1974
Richmond Hill	1978
Milton	1981
Bradford	1982
Stouffville	1982

During the same period, under the aegis of Metropolitan Toronto, the TTC system was established throughout Metro, providing a grid of high-frequency bus, streetcar and trolley coach services linked with free transfers and convenient access to the subway system. Other transit systems were also established or expanded, in cities such as Oshawa, Mississauga, Oakville, Burlington, Brampton, Markham, Vaughan and Richmond Hill. In 2001 York region amalgamated the latter three with the Aurora and Newmarket transit systems, to form the York Region Transit system.

As new development moved farther and farther from the metropolitan central area (the "tidal wave" urban growth phenomenon), the provincial government realized that the existing radial network of rail lines could be used to provide commuter rail service linking areas beyond the Metro boundary to the downtown area surrounding Union Station. GO Transit was established in 1967, as an alternative to freeway expansion, and a high level of service was implemented over time on the Lakeshore East and West lines, followed by service on five other lines joining Georgetown, Richmond Hill, Milton, Bradford, and Stouffville to Union Station.

The investment in transportation infrastructure was substantial, particularly in the 1950s and 1960s, when government funds were less restricted than they are now and an integrated approach was possible for most of the urbanizing area under the new Metropolitan Toronto regional government. The pace of new transportation construction, particularly serving built-up areas, slackened during the 1970s, 1980s and 1990s, as government spending priorities turned more and more to social, education and health requirements as environmental concerns made approvals more difficult to obtain, and as development spilled over into an increasing number of municipalities beyond the boundaries of Metro Toronto.

3.3.2 Supply/Demand Interactions

As a result, it is perhaps not exaggerating to say that parts of the study area have been "coasting" for much of the past two or three decades, with development being based on major transportation infrastructure constructed in the 1950s, 1960s and 1970s. These facilities and the new roads and transit facilities/services introduced subsequently have served the area well, but they have not been able to keep up with rapidly growing transportation demand.

The result has been a losing battle against congestion. Some of the areas of most severe congestion are on radial roads crossing the City of Toronto boundary, with chronic problems on the west, north and east sections of the City boundary, crossing the Credit River and Cawthra Road screenlines in Mississauga, throughout the Highway 7 corridor in York Region, in the 401 corridor in Toronto and in Durham and Peel regions and in the QEW/Highway 403 corridors in South Peel and Halton. Highway 401 is experiencing substantial peak period congestion throughout its length in the GTA, particularly in the area southeast of Pearson Airport, between Islington Avenue and Highway 427, which has become what is probably Canada's biggest highway bottleneck during the past two decades.

Increasingly during the 1980s and 1990s, there was recognition by most leaders at the provincial and municipal levels that attempting to address the growing imbalance between demand and supply solely by building more or wider roads would not solve the problem in the built-up and rapidly developing fringe areas of urban development. This reflects not only the community disruption and high cost of new or expanded roads in built-up areas, but also the phenomenon of "induced traffic" which tends to overload such roads with new traffic, particularly in peak periods, as the additional road capacity encourages people to make additional automobile trips.

The "GTA Vision" which was developed by provincial and municipal working groups under the auspices of the Office for the Greater Toronto Area (OGTA) in 1991 and 1992, as described in Chapter 2, reflected this realization and placed considerable emphasis on additional transit facilities and related transportation demand management aimed at increasing the market share of transit relative to private automobile trips. The rationale for this policy approach included the fact that transit can provide very much higher transportation capacity than roads per unit of land required and is therefore better able to meet capacity requirements in dense travel corridors with less community disruption. Experience in the study area and many other urban areas has shown that attractive, compact, mixed-use subcentres can be developed around rapid transit stations, thereby improving rather than degrading the liveability of urban areas. Other reasons for the pro-transit policy documented in the 1992-93 GTA Vision included the greater choice of travel modes provided by this approach, the greater safety of public transit relative to private automobile traffic streams, and the greatly reduced environmental impacts (e.g., air, water and soil pollution, noise) caused by transit travel relative to private automobile travel per passenger-km.

While the OGTA Vision calls for substantial improvements in public transit, as well as additional roads, and while this goal was reflected in the Official Plans of the upper-tier municipalities that were published during the following few years, implementation of improved transit and roads has lagged considerably behind expectations since that time. Owing to budget limitations, the only significant rapid transit facilities implemented since the 1990s were the Spadina Avenue LRT and the extension of the Spadina subway to Sheppard Avenue. Phase 1 of the Sheppard Avenue subway is nearing completion. There have been limited GO Transit service increases on some lines, but a cutback in services to and from Barrie and Guelph. Even with the addition of the Highway 407 toll road, the additional capacity provided by these facilities is very much less than the growth in transportation demand and leaves a growing capacity shortfall.

As described in the remainder of this chapter, the Business-As-Usual scenario assumes a continuation of current development policies not only in terms of land use but also in terms of transportation infrastructure. Transportation demand modelling has been carried out to estimate how well the roads and transit improvements anticipated under this policy would likely serve the forecasted travel demand levels, and the implications of these findings for travel times, costs, emission levels and other indicators of transportation performance. The process used to make these forecasts is described in the next section.

3.4 FUTURE TRANSPORTATION DEMAND ESTIMATION

Zone System

The traffic model was based on a system of 2,052 traffic zones developed for this study. The zone system covers all of the study area; that is, the entire coverage area of the 1996 Transportation Tomorrow Survey (TTS) and an extension of this area to include Northumberland County. The 1996 GTA/Hamilton TTS zone system was used as the starting point, with the zone system adapted to fit study needs while ensuring that zone boundaries are consistent with known political or TTS traffic zone boundaries to exploit available land use and travel data. The most refined zone system that was practical was used to define the built-up areas, with larger zones representing exurban and rural areas in the study area. Large zones are also used to represent external areas adjacent to the study area.

Land Use

The BAU land use concept, including the municipal population and employment forecasts presented in Chapter 2, were used to prepare the base year and future years (2011, 2021, 2031) population and employment levels in each of the traffic zones.

3.4.1 Travel Modelling Process

A computer-based transportation modelling framework using the Emme/2 transportation planning system was used to provide a systematic and state-of-the-art procedure to forecast future travel volumes and system performance levels on roads and transit facilities serving the study area. The forecasting process is sensitive to settlement patterns, population and employment distributions, and transportation system characteristics, including capacities, travel times and costs and transit service levels. It includes a four-stage process for estimating trip generation (number of trips originating in, and attracted to each traffic zone), trip distribution (number of trips in each direction, between each pair of traffic zones), modal split (market share of trips between private auto and public transit, for each trip interchange) and trip assignment (travel volumes on each link of the road, municipal transit and commuter rail [GO Transit] networks).

Trip generation equations were developed for the a.m. peak period for work and non-work trip purposes. For work trips, per capita work trip generation rates were assumed to remain constant, with work trip productions increasing in proportion to the zonal population and work trip attractions increasing in proportion to zonal employment. Regression analysis was used to develop equations to estimate work and non-work trip productions and attractions based on zonal population and employment.

A Fratar process was used to expand the 1996 TTS trip table to produce total origin-destination trip tables for the future years. The technique assumes that trips between pairs of zones will increase in proportion to the estimated growth in trip productions and attractions, as calculated in the trip generation stage above. The result is horizon year trip matrices for work and non-work trip purposes for the a.m. peak period.

The modal split component of the process uses a multinomial logit model, which estimates the market share of each mode based on the "utility" (travel time, cost and convenience) associated with it. Modal splits are estimated for auto person trips, regular (municipal) transit trips and GO Rail trips.[28] The logit model is applied at the traffic zone trip interchange level and takes into account the following attributes associated with individual trip linkages:

- travel costs for each mode:
  - auto costs include direct operating costs (e.g., fuel, oil, tires, etc.), calculated on a per-kilometre basis; as well as parking costs;
  - transit costs include fares and auto access costs where park-and-ride is used;
- travel times by mode:
  - auto times include in-vehicle times;
  - transit times are separated into in-vehicle and out-of-vehicle time components reflecting the different perceived weighting for these times;
- zone-specific factors:
  - a mode-specific factor reflecting whether the origin zone is within walking distance of rapid transit (e.g., subway, light rail transit [LRT], bus rapid transit [BRT]);
  - a mode-specific factor reflecting whether the origin zone is within a GO Rail service area, as determined by examining GO Rail origins from the TTS.

For trip assignment, the Emme/2 system uses a capacity restrained equilibrium assignment algorithm that converges to a "user equilibrium" where no one user can improve their travel time by changing their travel routing. A multi-path assignment algorithm is used for the assignment of transit trips.

The travel forecasting model was calibrated based on 1996 land use and travel data, with the travel patterns developed from the 1996 Transportation Tomorrow Survey. The calibrated model was then applied based on 2000 land use conditions to create the 2000 base year travel estimates and to test the model. Forecasts were then prepared for the horizon years of 2011, 2021 and 2031. Given the differing usage characteristics of

[28] The express bus services provided by GO Transit, and ridership on these services, are modelled along with municipal transit since they are similar to municipal bus services, most of which operate in mixed traffic. GO buses on the 400-series highways achieve substantially higher speeds than most municipal transit services and these are simulated by the model, reflecting the higher average speeds on expressways relative to arterial roads.

various sections of the transportation system, an a.m. peak hour model was used to capture weekday commuter-oriented travel, and seasonal and peaking factors were used to expand these results to weekly, monthly and annual levels.

Forecasts for the weekday a.m. peak hour were used to calculate an equivalent horizon year design hour volume[29] for each road and transit link, which was used to determine the level-of-service and to size capacity requirements.

3.4.2 Assumptions Regarding Future Travel Characteristics Under Business-As-Usual

Implicit within the BAU Scenario are the following anticipated travel trends and characteristics:

- **Dispersion of Travel Patterns:** the BAU Scenario will see the majority of the population and employment growth over the next 30 years occurring in the regional municipalities outside the City of Toronto and other existing built-up parts of the study area. This will lead to more dispersed and complex travel, with a reduced focus on Toronto and greater auto dependence. These characteristics and future travel orientations are captured in the transportation model.

- **Stabilizing Auto Ownership and Use:** auto ownership levels have risen significantly over the last 40 years; however, these trends have tapered off in the last decade, and auto ownership in the GTA actually decreased from 1.41 vehicles per household in 1991 to 1.35 vehicles per household in 1996. The proportion of the population in the age category with the highest auto use (30 to 55) is currently near its peak. Increasing suburbanization of the study area and auto-oriented land uses also contribute to high relative auto ownership. Over the longer term, auto use per household will likely stabilize as the proportion of women entering the labour force has levelled off and as relatively affluent "baby boomers" are likely to use their automobiles at existing levels per person in their retirement years. The transportation model estimates future modal splits between auto and public transportation.

- **Stabilizing of Per Capita Trip Making:** over the past 30 years, daily trip rates for motorized travel per person have increased significantly due to an increased proportion of working age people, an increased number of women in the work force, and increased auto ownership, among other reasons. These factors appear to be levelling off, at least for work trips leading to more moderate growth rates of average per capita trips per day in the future. The transportation model estimated the trips generated in and attracted to each traffic zone, separately for work and non-

[29] Typically, roads and transit facilities are designed to accommodate estimated future peak hour traffic volumes, often for a 20 year planning horizon. Rather than sizing the facility to accommodate the **highest** hourly volume anticipated during the horizon year (e.g., 5 – 6 p.m. on the Friday afternoon of the July 1st holiday weekend), designers use a somewhat lower traffic level known as the **design hour** volume which represents a less extreme peak, more usually experienced.

work trips, using regression equations that relate trip-making to population and employment levels, as described earlier.

- **Auto Occupancy:** between 1985 and 1998, the average number of occupants per automobile during peak periods decreased from 1.22 to 1.15 for trips crossing the Toronto boundary. Data from the three Transportation Tomorrow Surveys (1986, 1991and 1996) also suggest that auto occupancies are decreasing. For the BAU Scenario, future auto occupancy levels are projected to remain at 1996 levels, although occupancy rates could continue to decline marginally which could increase auto volumes slightly beyond levels estimated by the transportation model.

- **Stabilizing Off-Peak Travel :** a greater proportion of trip-making is occurring during off-peak periods for various reasons, including increased part-time employment and contract work, more flexible work hours, increased congestion in peak periods, which causes people to travel outside of peak periods when possible, and increased affluence, leading to more time spent on social activities and more non-work related travel. The duration of peak periods has also expanded, reflecting peak-spreading in the face of capacity limitations. For the BAU Scenario, it is assumed that the factors leading to the diversion of travel to off-peak periods have largely run their course. Relative peak/off-peak travel is therefore estimated to remain at 1996 levels.

- **Stabilizing Market Share of Goods Movement by Truck:** reduced competitiveness of rail and marine modes, reflecting the increased flexibility and reliability of trucks, and emphasis on just-in-time deliveries and the type of goods produced and consumed in Ontario (e.g., higher-value finished goods) has led to large growth in the trucking industry in the past few decades. Trucking now predominates for short- or medium-haul shipments, with rail serving long-haul shipments. While the railways are attempting to recapture some of the short/medium haul market and new intermodal facilities are presently being planned/constructed, the BAU Scenario assumes that trucking will continue to maintain its existing market share in the future.

3.4.3 Vehicles

- **Technology:** changes in automotive technology could strengthen the trend to more auto use and less transit use. New automotive technologies have the capacity to significantly increase the fuel efficiency of automobiles, with accompanying reductions in emissions per vehicle-km. No other major shifts in automotive technology are anticipated to occur in the BAU Scenario.

- **Auto Operating Costs**: in general, auto operating costs have remained relatively stable since the 1970s, following a spike in costs based on temporary fuel shortages at that time. This stability has resulted from increased operating efficiencies of automobiles and gasoline prices that have increased only slightly in real terms since the 1970s. Stable auto operating costs are projected for the BAU Scenario over the next 30 years, reflecting a continuation of past trends.

- **Parking Costs:** parking costs have remained relatively stable and are assumed to remain constant in real terms. Suburban areas are anticipated to continue providing ample and largely free parking.

3.4.4 Future Transportation Network

Highways [30]

Assumptions: The Ministry of Transportation Ontario (MTO) is now emerging from a restructuring of its role, which has included the downloading a significant portion of the provincial highway system to municipalities. Recently, the MTO has been focusing on rehabilitating and maintaining existing highway infrastructure. Given funding limitations, the Province expects toll highways to pay for a significant portion of the capital cost of building new highways to address existing traffic congestion and anticipated traffic growth.

Network Improvements: Reflecting the current fiscal environment and the expectation that there will be no new funding sources for transportation infrastructure, the BAU scenario assumes that future highway expansions will be limited to those that are currently in the advanced stages of planning/design and considered highly probable by MTO. The following is a selected list of major projects relevant to the study area:

- Highway 410 extension from Bovaird Drive to Highway 10 in north Brampton at 4 lanes;
- Highway 406 new alignment from East Main Street to West Side Road in Welland at 2 lanes;
- Highway 406 widening from south of Beaverdams Road to Main Street in Thorold from 2 to 4 lanes;
- Highway 404 widening from Major Mackenzie Drive to Aurora Road from 4 to 6 lanes;
- Highway 404 extension to Green Lane at 4 lanes;
- Highway 403 widening from QEW to Highway 407 from 4/6 to 8 lanes;
- Highway 401 widening from Harwood Avenue to Brock Street from 8 to 10 lanes;
- Highway 401 widening from Trafalgar Road to Highway 25 from 6 to 8 lanes;
- Highway 400 widening from Langstaff Road to Major Mackenzie Drive from 6 to 10 lanes;

[30] The term "highways", as used in this report, means limited access, multi-lane roads, which include all 400-series highways and municipal expressways such as the Gardiner Expressway and the Don Valley Parkway.

- Highway 400 widening from Major Mackenzie Drive to King Road from 6 to 8 lanes;
- Red Hill Creek Expressway from the Queen Elizabeth Way (QEW) to Lincoln Alexander Parkway;
- QEW widening from Red Hill Creek to Burlington Street from 6 to 8 lanes;
- QEW widening from Highway 420 to Mountain Road from 4 to 6 lanes;
- QEW widening from Guelph Line to Third Line from 6 to 8 lanes;
- QEW widening through St. Catharines from 4 to 6 lanes;
- QEW eastbound widening from Trafalgar Road to Highway 403 from 3 to 4 lanes.

The above highway improvements are included in the BAU scenario up to 2021; most of them will be completed by 2011. The Province has also recently announced several new highways, likely to be constructed as toll roads, although the formal planning process, design, environmental assessment and public consultation have yet to be undertaken for these projects. These new highways are also included in the BAU scenario (but not as toll roads except for the Highway 407 extensions), consisting of the following:

- Highway 407 – to Highway 403 in the west and Brock Road in the east (2001);
- Highway 407 East Completion – extension from Brock Road to Oshawa (by 2011) and to Highway 35/115 (by 2021);
- Highway 404 – extension north to Highway 12 (by 2011);
- Highway 427 Extension – from Highway 407 to Bradford Bypass (by 2011) and to Highway 400 Extension (by 2021);
- Bradford Bypass – east-west facility connecting Highway 404, Highway 400 and the Highway 427 Extension (by 2011);
- Mid-Peninsula Corridor – from Fort Erie to 407 in Burlington (by 2021).

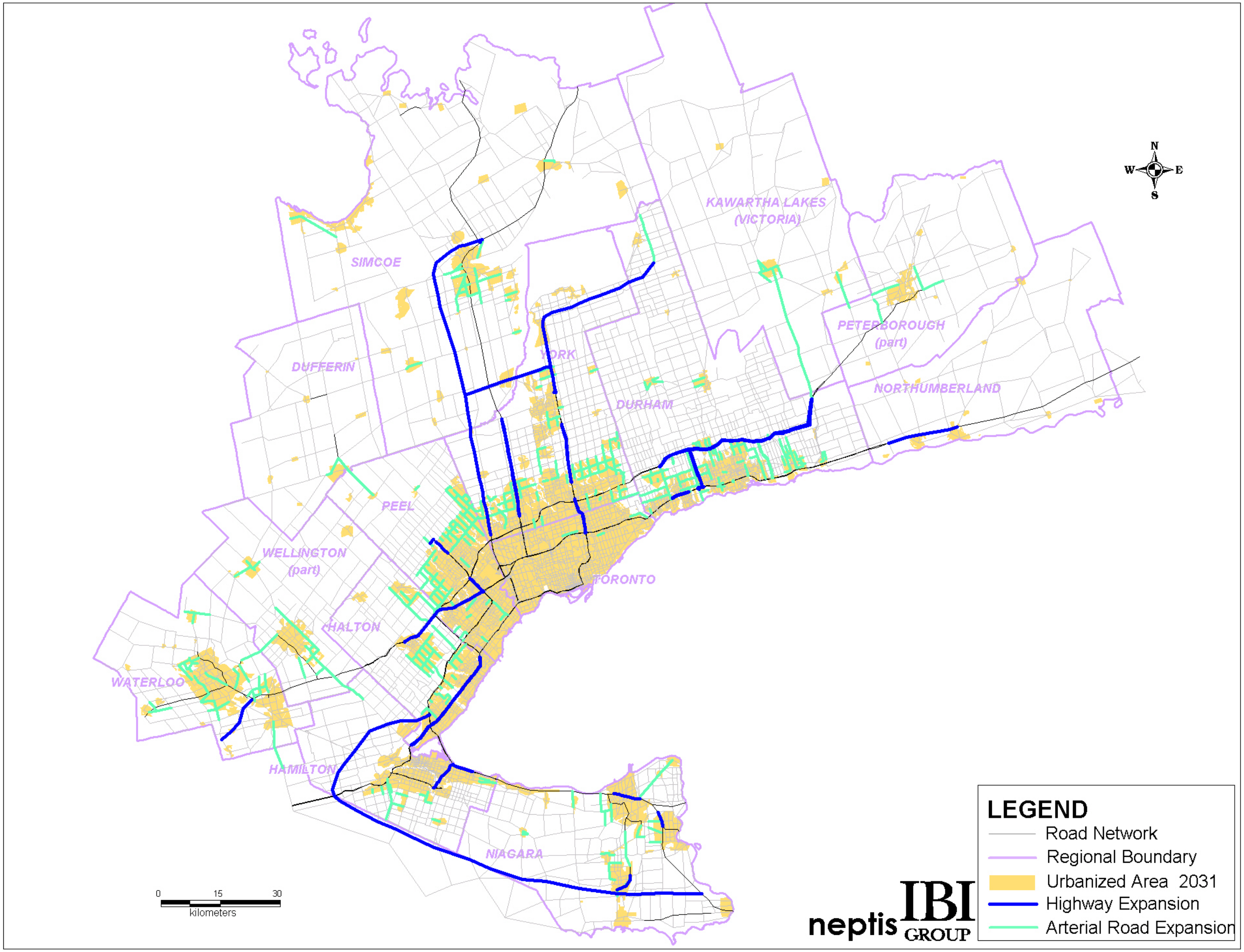
The above expansions, illustrated in Exhibit 3.3, result in an increase in highway lane-km from 6,110 in 2000 to 8,020 in 2031, representing an increase of 1,910 lane-km, or about 30%.

Arterial Roads

Assumptions: Municipalities will continue to be responsible for constructing and maintaining the arterial road network.[31] Expansion of the arterial road system will occur predominantly in the high growth areas of the study area, particularly the regional

[31] Arterial roads, as referred to in this report, include major non-limited access roads under provincial or municipal jurisdiction but do not include municipal local and collector roads.

Exhibit 3.3: BAU Highway and Arterial Road Improvements



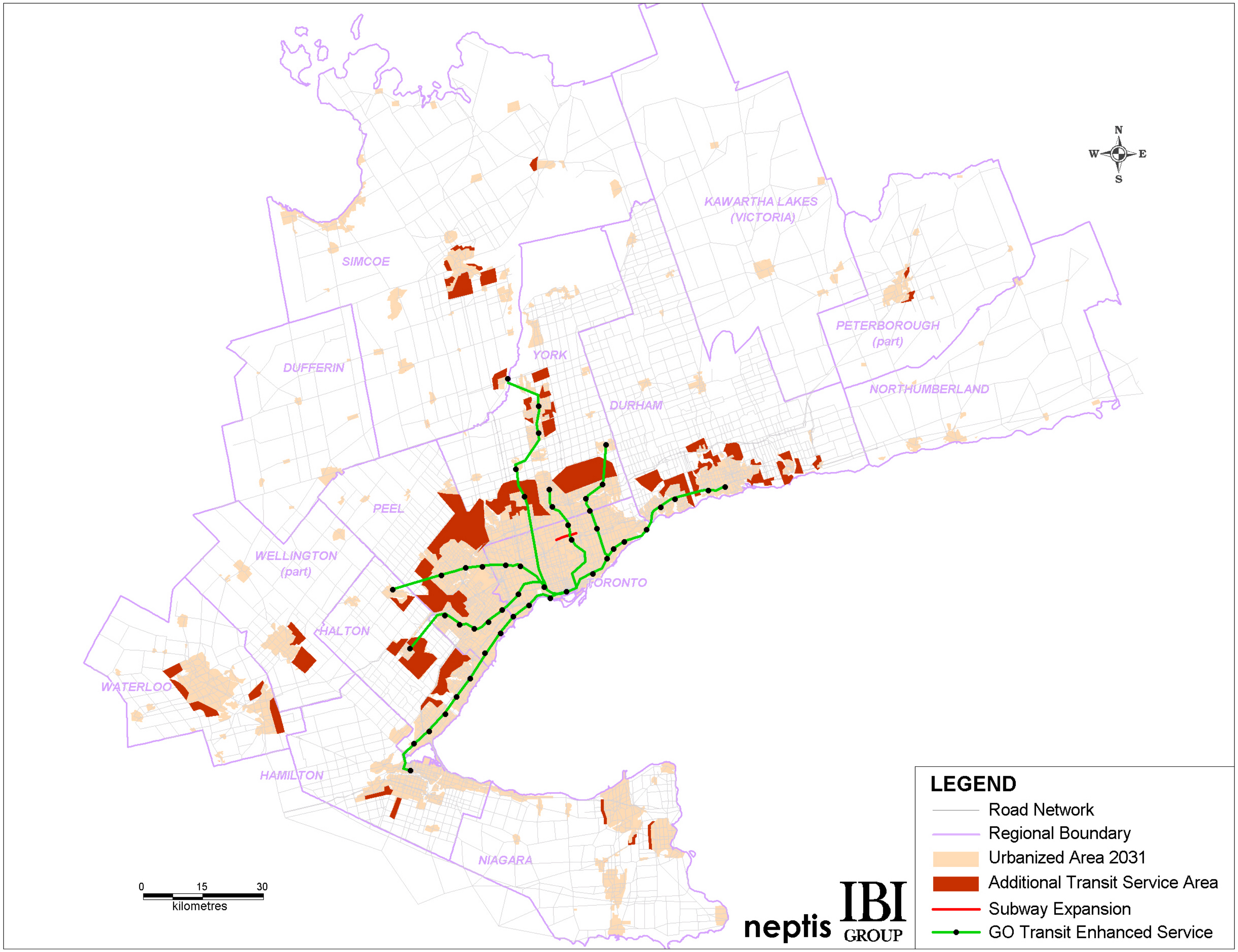
municipalities outside the City of Toronto. Road pricing of arterial roads is not anticipated under the BAU scenario, with the possible exception of the Gardiner Expressway, for which a proposal is being considered to institute tolls as a means of funding the re-engineering and possible "burying" of this facility. The BAU scenario assumes no tolling or re-engineering of this facility, although the Front Street extension from Bathurst Street west to Dufferin Street with ramps to/from the west connecting to the Gardiner Expressway is included as a new arterial road link.

Network Improvements: Five- and ten-year capital road programs have been obtained from each upper-tier municipality within the inner study area. In the near term to 2011, road widenings, extensions and new road facilities identified in these road programs are included in the BAU scenario, as well as other road improvements projected to serve continuing urbanization, particularly in the outer study area and rapidly urbanizing parts of the inner study area. Over the mid- to long-term horizon, there is no documented basis on which to base arterial road improvements, as they are beyond the municipal funding horizon. Beyond 2011, for the purposes of this strategic analysis, new arterial roads and arterial road widenings were assumed to keep pace with the expanding urban envelope of the respective municipalities based on the BAU estimates of population and employment growth. As such, the arterial and regional road densities in newly developed areas were assumed to generally match the density of roads in the adjacent urbanized areas, with this approach reflected in the road network developed in the transportation model. Exhibit 3.3 displays the location and timing of the arterial road improvements identified. In total, these improvements will increase the lane-km from 41,500 to 44,000 over the next 30 years, reflecting an increase of 2,500 lane-km, about 6%.

Public Transit

Assumptions: Provincial downloading of public transit to municipalities and pressures to increase funding in health, education and other municipal services are assumed to continue curtailing rapid transit expansion and transit operating budgets in the BAU scenario. Greater emphasis on bus-based transit, transit priority treatments and high-occupancy vehicle (HOV) lanes is assumed to occur over the short to medium term, with the geographic coverage of transit services expanding to include newly urbanized areas over the study period, as shown in Exhibit 3.4. The need to reduce annual operating subsidies may also require transit agencies to increase cost-performance requirements of transit services, which could result in reduced services or the elimination of services in low-density suburban areas. The number of buses, streetcars and rapid transit vehicles will be increased in proportion to population growth, and service coverage will be extended into newly urbanized areas. It should be recognized that the above assumptions regarding future expansion of the municipal transit and GO Rail modes reflect funding levels more typical of those experienced in the 1970s and 1980s rather than the more constrained levels of the 1990s.

Exhibit 3.4: Municipal/GO Transit Service Improvements



Network Improvements:

- ***Fares and Services:*** Greater integration of fares and service coordination will be achieved among the eleven transit operators in the GTA and between each of them and GO Transit. This will encourage modest increases in ridership, particularly across municipal boundaries and will assist operators in their efforts to maintain their existing market shares in the face of ongoing auto-dependent development at relatively low suburban densities. These factors are captured in the transportation model, which simulates ridership response to travel times, service frequency and fare levels based on surveyed travel behaviour.

- ***Subway Expansion:*** TTC's Rapid Transit Expansion Program (RTEP) of the 1990s included the Sheppard Subway, the Eglinton West subway, and extension of the Spadina Subway to York University. However, only the Sheppard Subway from Yonge Street to Don Mills Road has been committed, with completion of this segment expected in 2002. No commitments have been made for extension of the Sheppard Subway or for the construction of the other proposed subway facilities. The TTC is in the process of studying its subway expansion priorities. The Province and Transport Canada have invited proposals to construct and operate rapid transit facilities throughout southern Ontario based on the model of private-public partnerships. This includes a possible rail link connecting Union Station with Lester B. Pearson International Airport and York Region Rapid Transit, among numerous other proposals. Private-public-partnership (PPP) projects represent a large departure from the conventional methods of rapid transit funding and construction and have uncertain status. Specific PPP rapid transit proposals are therefore not included in the BAU scenario. This is in line with the relatively limited expansion of transportation facilities assumed under BAU, based on continuing funding limitations and the need for increased government funding to create the revenue streams necessary to support private-sector equity financing for rapid transit.

- ***High Order Transit in the Suburban Regions*:** The MTO has protected sufficient right-of-way for the implementation of a grade-separated bus transitway in the Highway 407 Parkway Belt West Corridor and Mississauga Highway 403 corridor and the Region of Halton has included provisions in its long-range transportation plan for a transitway in the Highway 5 corridor. The timing for these facilities is considered to be beyond 2031 under the BAU scenario.

Parameters:

- ***Fares:*** Existing fares will remain unchanged in real terms.

- ***Service levels:*** The vehicle-hours of transit service will increase in the same proportion as population growth. Subway frequencies will remain constant, with a 4 – 5 minute peak period headway assumed for the Sheppard Subway.

- ***In-Vehicle Travel Times.*** No changes in travel times are assumed for transit vehicles separated from auto traffic. Buses in mixed traffic will suffer reduced speeds due to congestion, with decreases in the same proportion as those experienced by general traffic. Limited introduction of priority bus routes is assumed to occur in conjunction with HOV lanes on a few major arteries (e.g., Yonge Street, Highway 7, Highway 10, Highway 5, Highway 25).

- ***Access and Egress Times.*** These are, respectively, the travel time from the trip origin to the stop where transit is boarded and the travel time from the final transit stop to the trip destination. No changes are assumed from existing levels, with the exception of auto access times for park-and-ride, which are simulated by the model and reflect changes in road levels of service.

GO Transit

Assumptions: GO Transit will grow at a much greater rate than all of the other transit systems in the study area, owing to the large increase in suburban population levels and in travel from these areas to Toronto that is projected over the short-, medium- and long-term and increasing levels of congestion on the radial roads serving auto trips to and from the metropolitan centre. System capacity increases will be accommodated by service level increases in existing GO Rail corridors, as opposed to service expansion onto rail lines which currently have no GO service. GO Rail services will continue to focus on radial travel to central Toronto. GO Transit's Ten-Year Growth Program and 2021 Plan (February 1998) are assumed for establishing BAU service levels on the GO Rail system.

The following assumptions describe future conditions for the BAU Scenario:

- ***Services*:** The GO Rail expansion plan includes provisions for upgrading and refurbishing of existing track, improvements to Union Station and increases in rolling stock to accommodate higher service levels. Bus services (Union Station buses) will be added to provide additional capacity and span of service to supplement service in corridors with peak period train service.

- ***System Expansion*:** New rail corridors in the Havelock subdivision (to Peterborough) and Mactier subdivision (to Bolton) and North Toronto subdivision have been proposed, but have no formal standing. They are not part of the BAU scenario.

- **GO Bus:** Municipal transit operators in the regions will gradually take over some GO bus services in urban corridors with development growth in the study area. GO bus will continue to serve urban corridors and to operate a growing number of inter-regional express bus services.

Network Improvements:

- No new GO rail lines are assumed to be introduced, either on existing or newly constructed lines**.**

Parameters:

- ***Fares*****:** No changes in real terms from existing levels.

- ***Service levels*****:** Increased train frequencies on all lines, consistent with GO Rail's service expansion plan. This implies service to accommodate an approximate 40% increase in ridership over the next 10 years and a 100% increase by 2021. This includes the following service increase on GO Rail lines:

  - **Lakeshore West** - additional express and local service during peak periods;
  - **Lakeshore East** - additional express and local service during peak periods;
  - **Milton** - 10 peak period trains, supplemented by off-peak train-bus service;
  - **Georgetown** - Enhanced peak period service and new off-peak service to Bramalea, with connecting buses; potential link to the Airport.
  - **Richmond Hill/Stouffville/Bradford** - enhanced peak period service (up to 5 trains) with off-peak train-bus service.

- ***In-vehicle travel times*****:** No changes in average train speeds and travel times are assumed.

- ***Access and Egress Times:*** No changes are assumed (except for the modelled effects of increasing road congestion), but increases in park-and-ride station parking capacity are assumed, commensurate with service level increases.

The future expansion assumptions for municipal transit and GO Transit are more in line with funding levels experienced in the 1970s and 1980s than the more constrained levels of the 1990s, reflecting stated intentions of more financial support by the federal and provincial governments, and the fact that Ontario has resumed responsibility for GO Transit.

3.5 TRANSPORTATION OUTLOOK TO 2031 UNDER BUSINESS-AS-USUAL

This section describes the major transportation trends over the next three decades as estimated using the transportation modelling process and related baseline factors discussed above.

3.5.1 Traffic Zone Characteristics

As discussed previously, the transportation model developed for this study is based on a detailed traffic zone system. To satisfy these requirements, the population and employment projections for the BAU scenario as described in Chapter 2 were allocated to the 2,052 traffic zones defined for the study area for 2000 and the 2011, 2021 and 2031 horizon years. The allocation process matched municipal and regional control totals established for the BAU scenario, with the future growth consistent with the Urbanized Land map, presented in Exhibit 2.7, which shows the present urbanized area and the projected new land consumed by each horizon year.

The traffic zone level forecasts are therefore consistent with the population and employment projections described in Chapter 2 , with the assumed traffic zone distribution of growth generally derived based on the growth patterns shown in Exhibit 2.7 and on each region's interpretation of likely growth based on land use zoning, plans and approvals. In addition to this data, traffic zone level land use projections were also obtained from Niagara Region and Waterloo Region.

Adjustments were then required to match the BAU land use and urbanized area/urban boundary controls for each region and municipality, reflecting BAU density and urbanization assumptions and the location of major nodes in each region.

The resulting population and employment mix and densities at the traffic zone level are illustrated on Exhibits 3.5 to 3.10 (on the next six pages). As demonstrated in the following sections, the distribution of future population and employment throughout the study area has a significant influence on transportation performance.

Exhibits 3.5 and 3.6 illustrate the distribution of population density by traffic zone in the years 2000 and 2031, respectively, colour-coded in terms of seven density categories. Exhibits 3.7 and 3.8 provide a similar illustration of employment densities by traffic zone for 2000 and 2031, respectively. Generally, the darker the shade, the greater the density. The maps illustrate the growth in urbanized land (as shown in Exhibit 2.7). Also illustrated is the BAU projection that the rapidly growing fringe areas of urbanization, while experiencing modest increases in gross population density, are expected to experience densities considerably lower than those in existing built-up areas. The densities shown in Exhibits 3.5 through 3.8 are gross densities, using the same definition presented in Chapter 2. As described there, while net population densities of development on new urban land in such areas have generally been increasing, increases in gross densities have been considerably lower owing to increased land consumption for public uses (e.g., streets, parks, school yards, etc.).

A similar type of presentation is used in Exhibits 3.9 and 3.10 to illustrate broadly the predominant land uses by traffic zone in 2000 and 2031, respectively. Zones in which the ratio of employment to population is less than 0.5 are coloured yellow, signifying that they are primarily residential in nature. Zones in which the ratio of employment to

Exhibit 3.5: Population Density by Traffic Zone – 2000

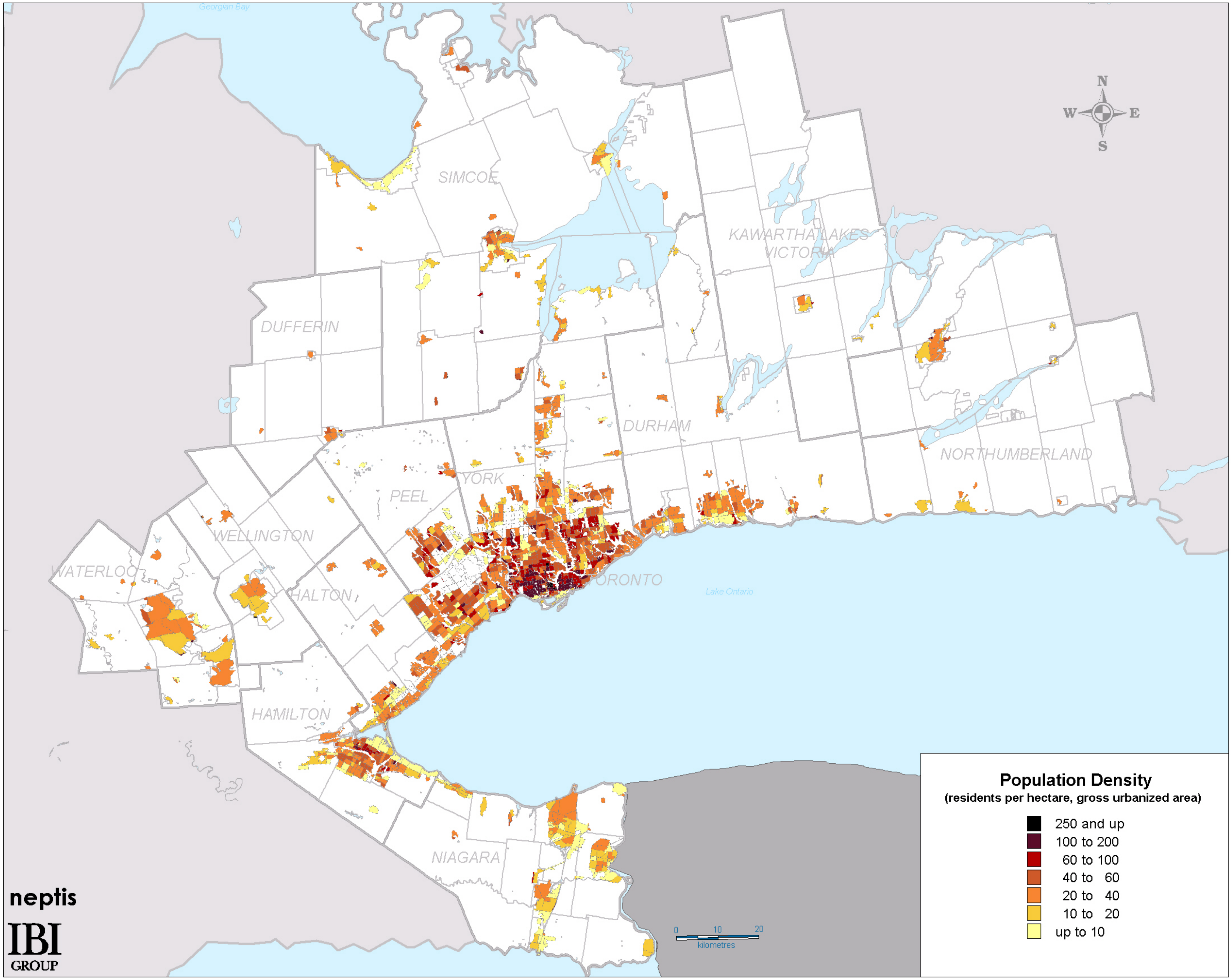


Exhibit 3.6: Population Density by Traffic Zone – 2031

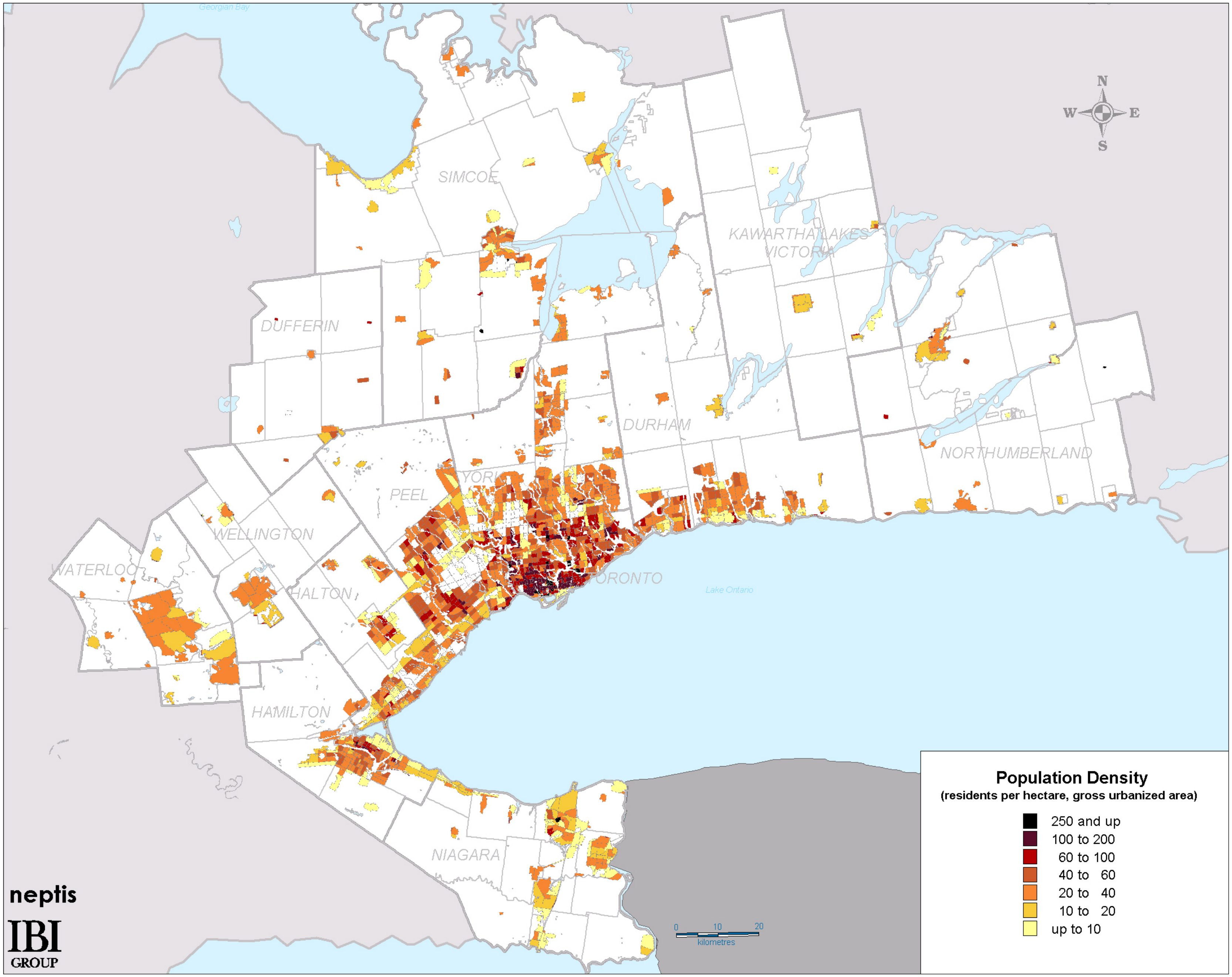


Exhibit 3.7: Employment Density by Traffic Zone – 2000

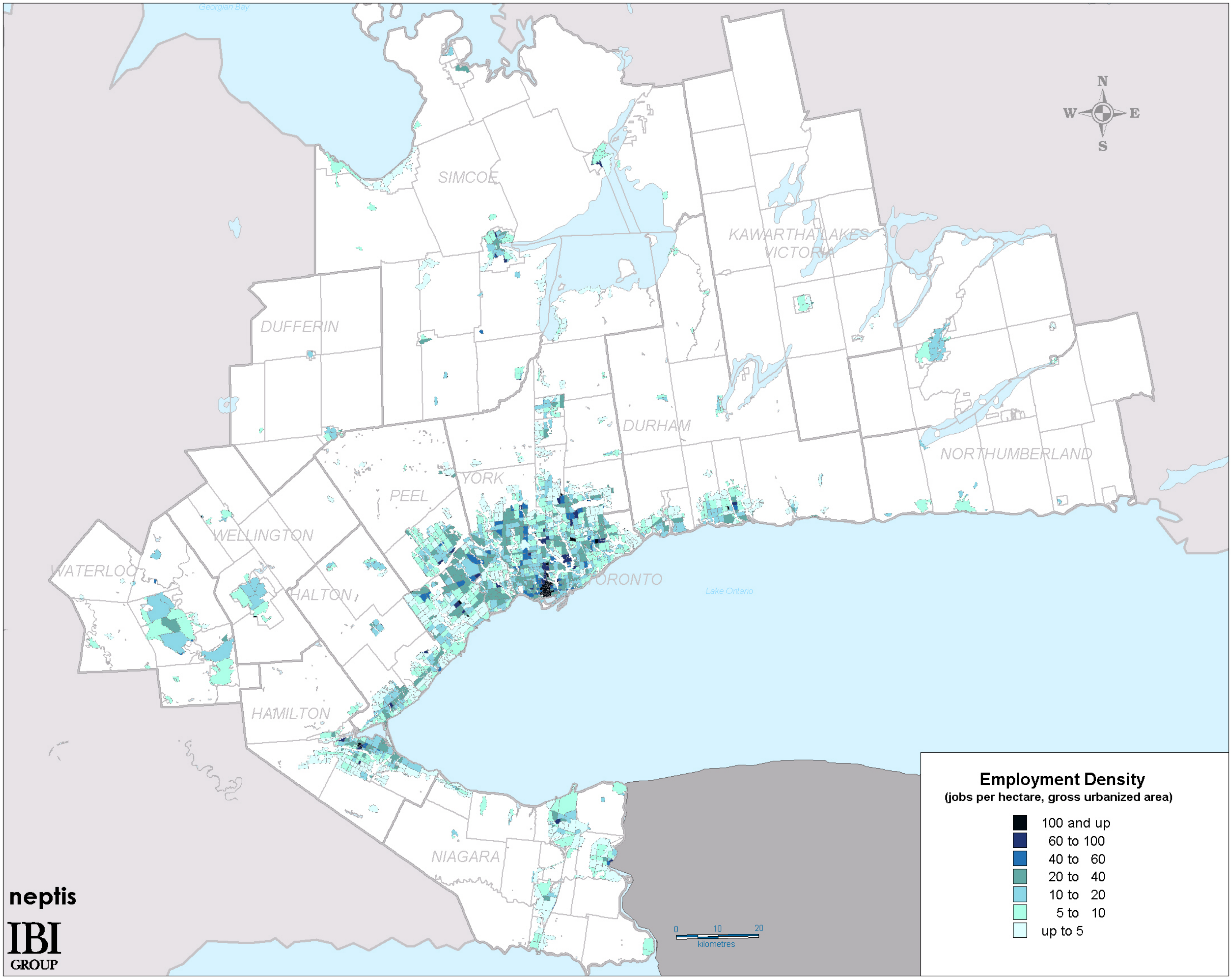


Exhibit 3.8: Employment Density by Traffic Zone – 2031

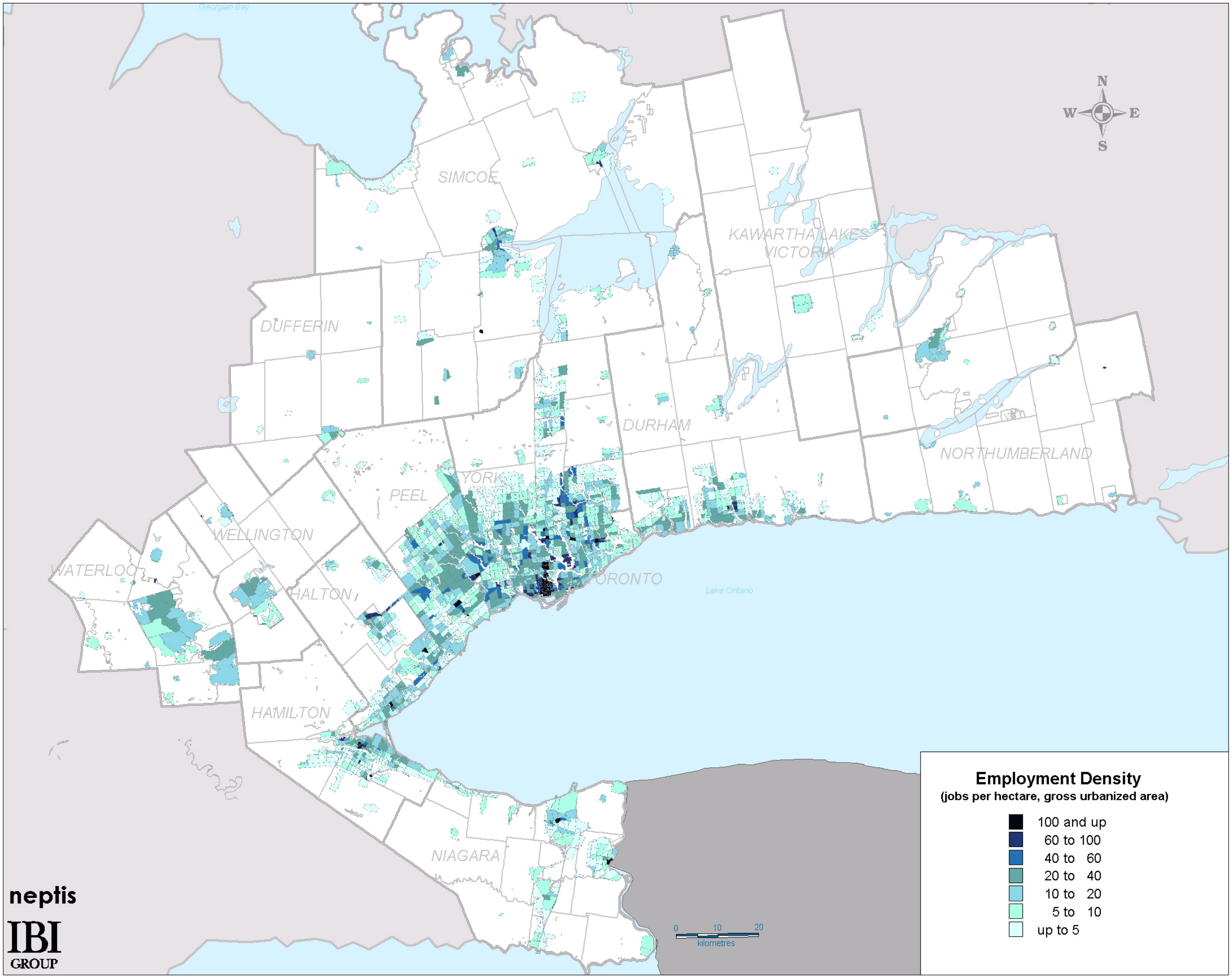


Exhibit 3.9: Land Use Mix Categories by Traffic Zone, 2000

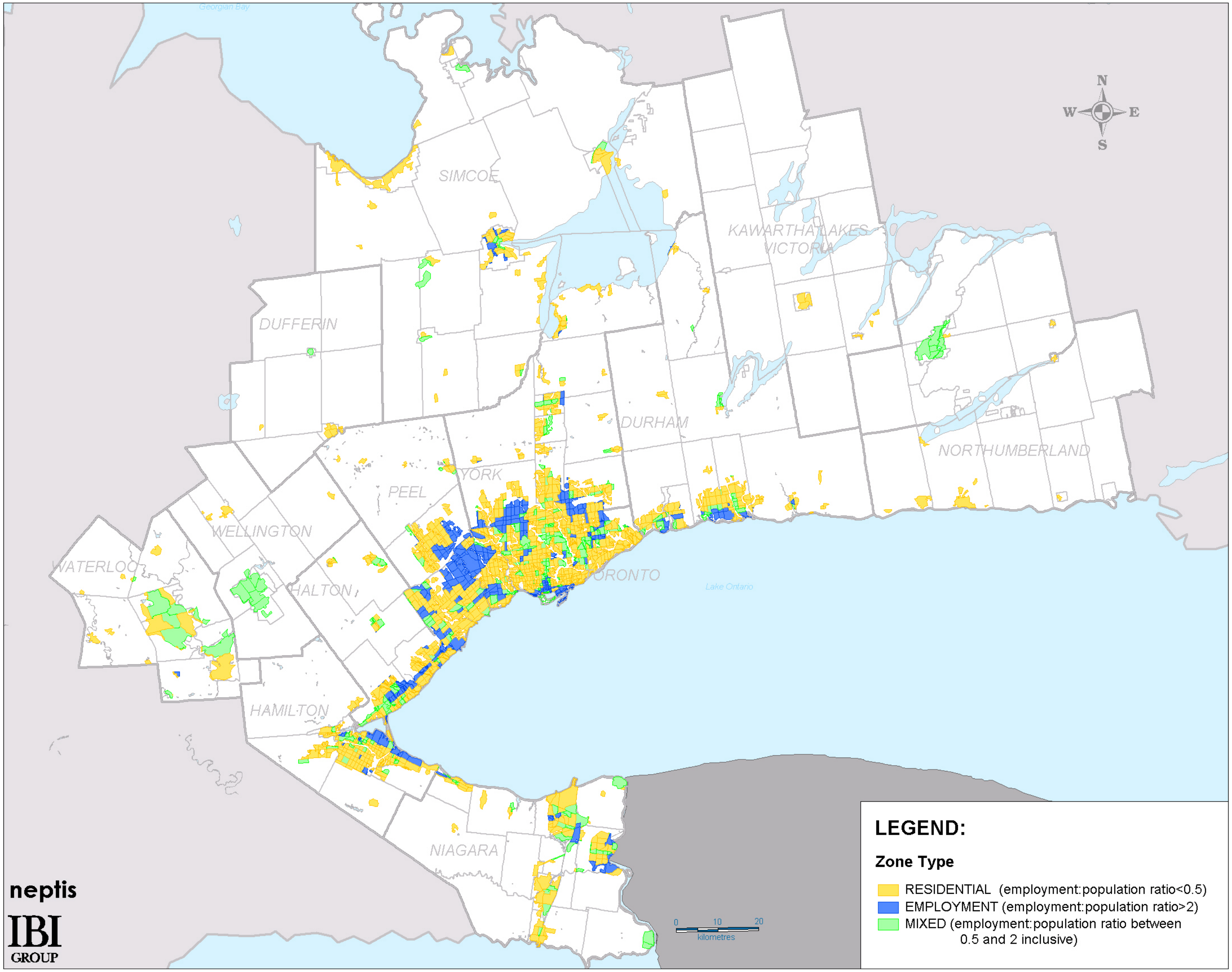
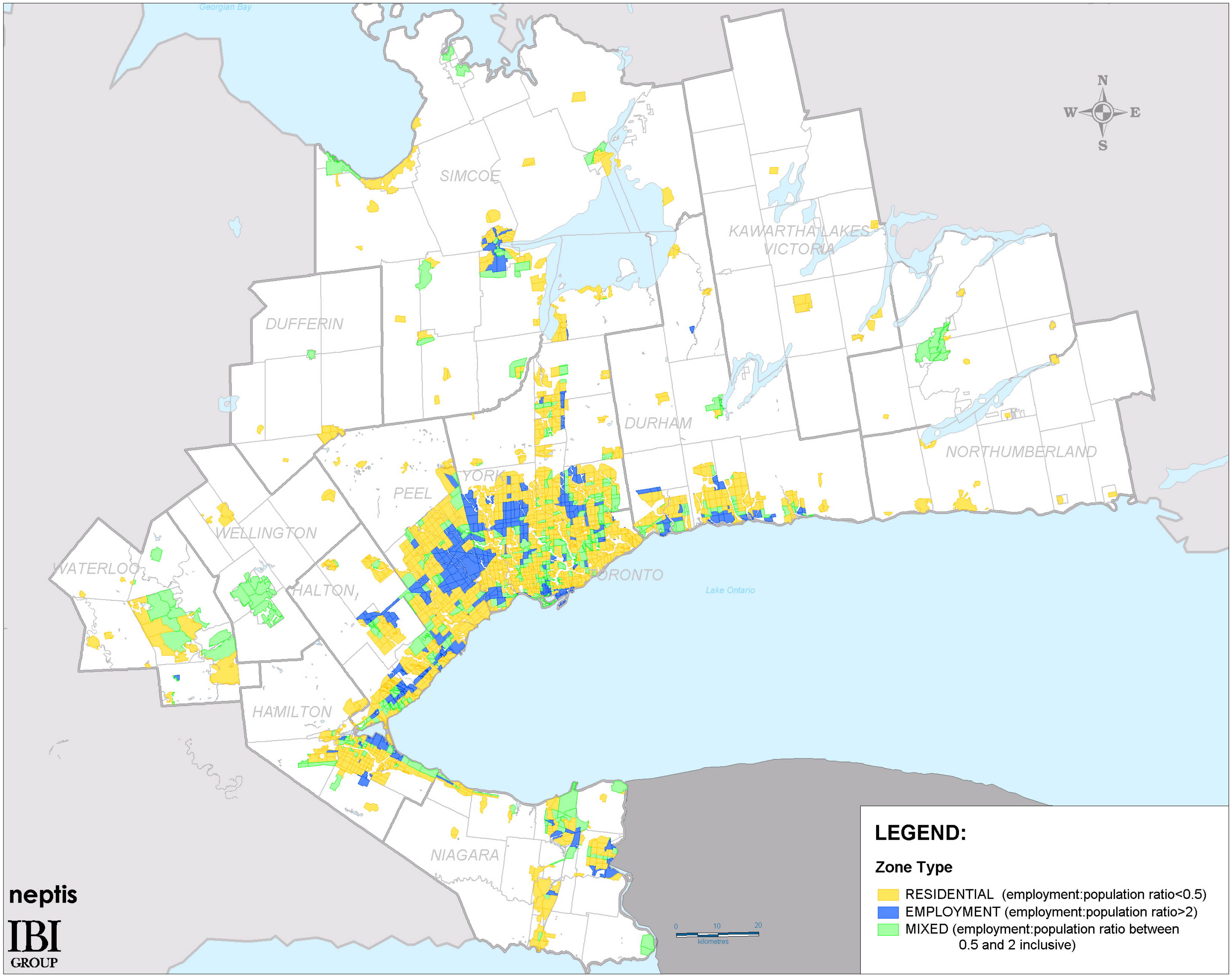


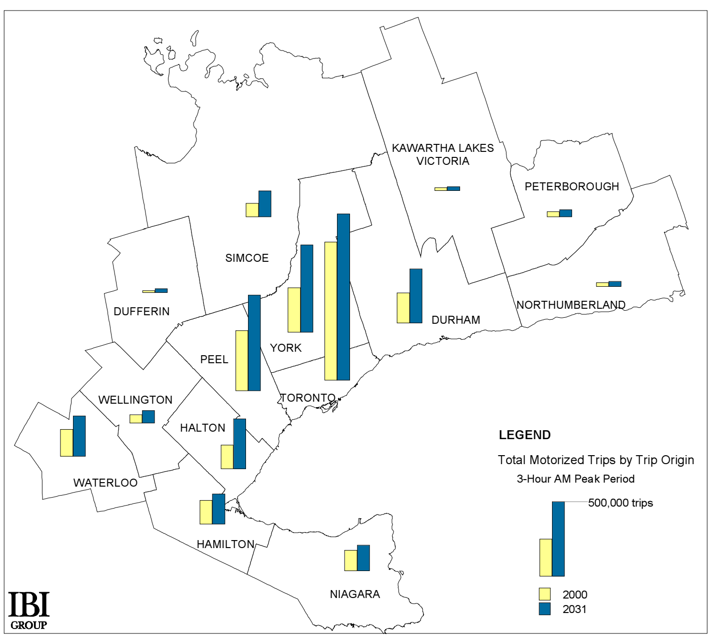
Exhibit 3.10: Land Use Mix Categories by Traffic Zone, 2031



population is greater than 2 are coloured blue, signifying that they are predominantly in employment uses. A third category of traffic zones is coloured green, signifying mixed-use development, in which the employment/population ratio is between 0.5 and 2.0 inclusive. Again, these two exhibits illustrate the spread of urbanization and the predominance of zones which are primarily residential on newly urbanized land, but with accompanying growth in primarily employment-oriented zones and mixed use zones in some areas. Mixed-use zones tend to predominate in central areas of urban centres located in the outer study area. This is because of the relatively large size of traffic zones in those areas. Larger zones are appropriate in most parts of the outer study area, where traffic density levels are lower than in the inner study area; the larger zones tend to show mixed-use, which includes the significant employment levels in such central areas plus adjacent residential uses in the same zone.

It should be recognized that, while the land use characteristics illustrated in Exhibits 3.5 – 3.10 show a finer level of geographic and land use detail than is presented in Chapter 2 – required as input to the transportation demand estimating model – they are based on the strategic level estimates of future urbanization patterns and the greater level of detail should be interpreted with caution. Relatively broad categories of densities and land use mix have therefore been used, and also as a means of presenting the information in graphic form.

Exhibit 3.11: A.M. Peak Period Trip Growth 2000 – 2031 for the Business-As-Usual Scenario



3.5.2 Travel Patterns

Overall, the study area will see significant growth in travel demand in the next three decades under the BAU scenario. Total motorized a.m. peak period person trips[32] are forecast to increase from 2.7 million to 4.0 million, an increase of 50%. As illustrated in Exh`ibit 3.11, the majority of this growth will occur outside the City of Toronto. Consistent with the discussion of population trends in Chapter 2, the fastest-growing areas are York, Peel, Halton and Durham.

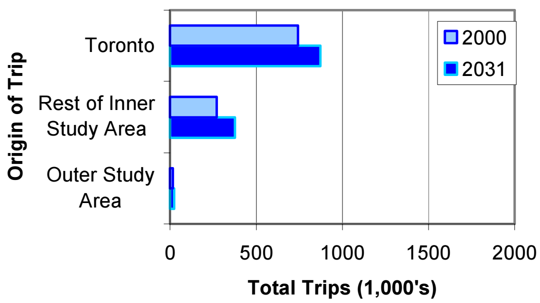
Exhibit 3.12 provides an indication of the changes in the distribution of trips within the study area. Of the total increase of 1.3 million a.m. peak period trips, 14% is due to trips originating in Toronto, 65% from trips originating in the rest of the inner study area and 21% from trips originating in the outer study area. Between 2000 and 2031, trips originating in the rest of the inner study area will increase by 50%, compared to a 20%

[32] This section refers to total motorized person trips, which includes auto trips, municipal transit trips and GO Rail and bus trips.

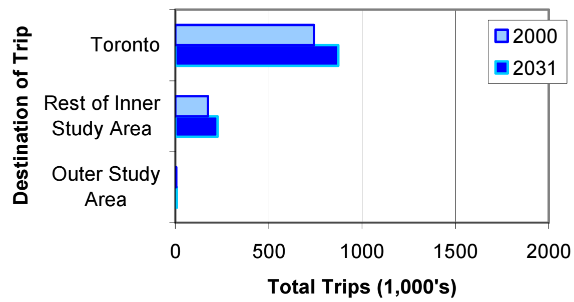
increase for trips originating in Toronto. As with the inner study area, there will be significant growth in the outer study area; between 2000 and 2031, trips originating in the outer study area will increase by 50%. There will be a somewhat lower rate of increase in work trips between the outer and inner areas during the a.m. peak period, reflecting the significant growth in jobs in areas such as Waterloo Region and Simcoe County, providing local opportunities for resident labour force.

Exhibit 3.12: Trip Distribution 2000-2031 (A.M. Peak Period Motorized Trips)

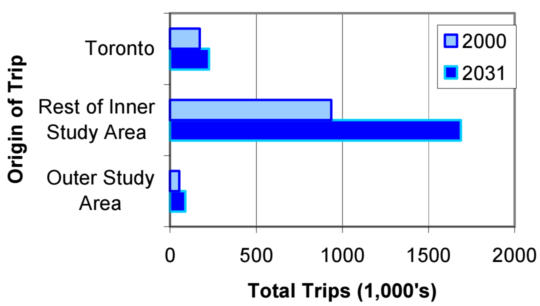
Trips to Toronto



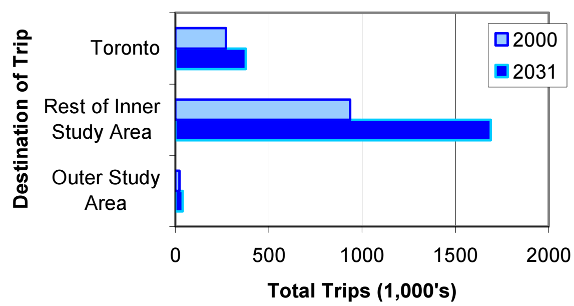
Trips from Toronto



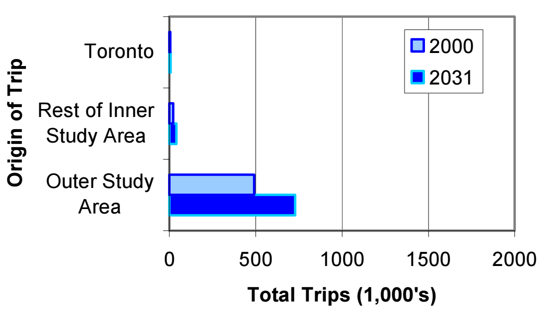
Trips to Rest of the Inner Study Area



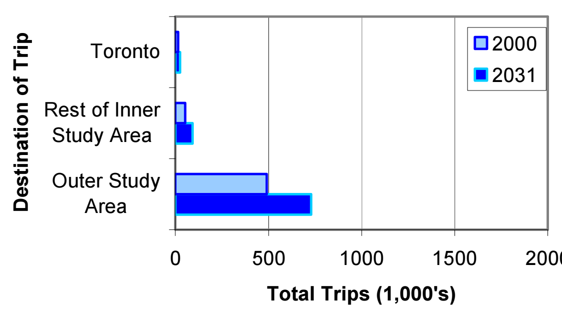
Trips from Rest of the Inner Study Area



Trips to Outer Study Area



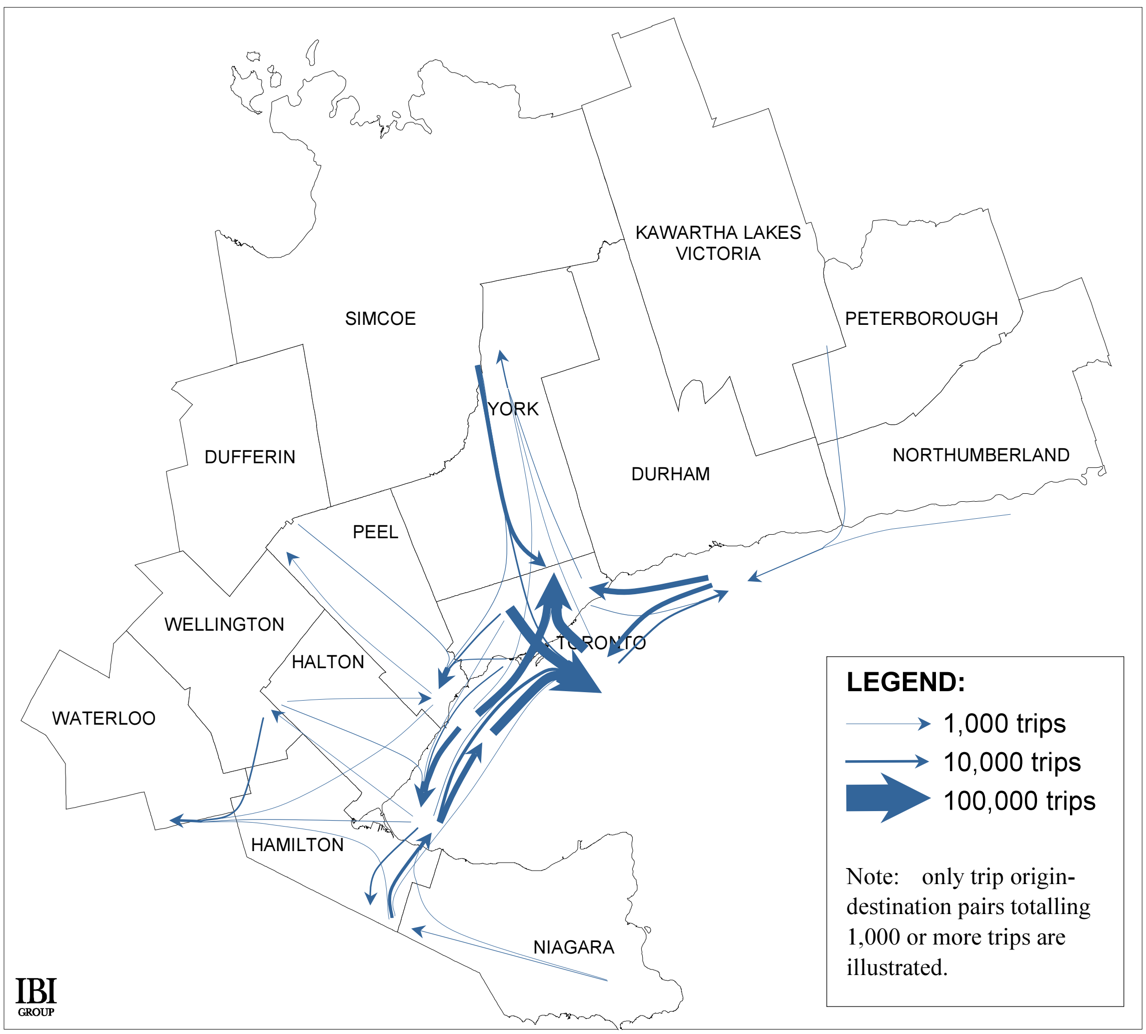
Trips from Outer Study Area



As discussed later in this report, these growth patterns have significant implications for the growth of auto trips, since trips in most parts of the inner and outer study areas (excluding the City of Toronto and other established urban centres) are not well served by transit.

Exhibit 3.13 graphically presents the increase in travel flows between pairs of upper-tier municipalities in the study area over the next 30 years, with the width of the arrows indicating the magnitude of the growth in trips. While the City of Toronto is projected to grow at a lower rate than the surrounding UTMs, the absolute increase in employment opportunities within the City will result in a significant increase in in-commuting during morning peak periods. Throughout the rest of the study area, the greatest increases are projected for York, Peel and Halton Regions, with linkages between Simcoe County and York Region and Halton and Peel Regions also experiencing large increases in travel flows.

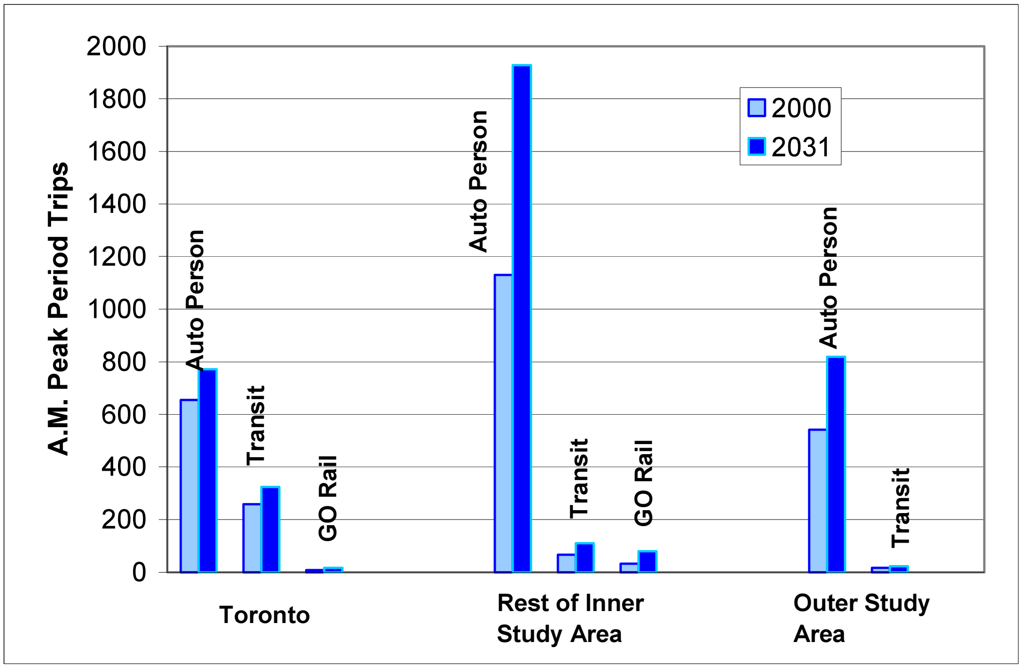
Exhibit 3.13: Growth in A.M. Peak Period Inter-Regional Travel Volumes (2000 – 2031)



3.5.3 Modal Outlooks

Under BAU, growth in travel activity over the next three decades will be significant for all modes. Expected BAU trends are shown in Exhibit 3.14. Between 2000 and 2031 automobile trips are expected to increase by 51% for the overall study area. Of this increase, 10% is accounted for by trips originating in Toronto, 67% by trips from the rest of the inner study area and 23% by trips from the outer study area. In the rest of the inner study area, automobile trips are expected to grow by 71%, which is more than the number of auto trips currently originating in Toronto.

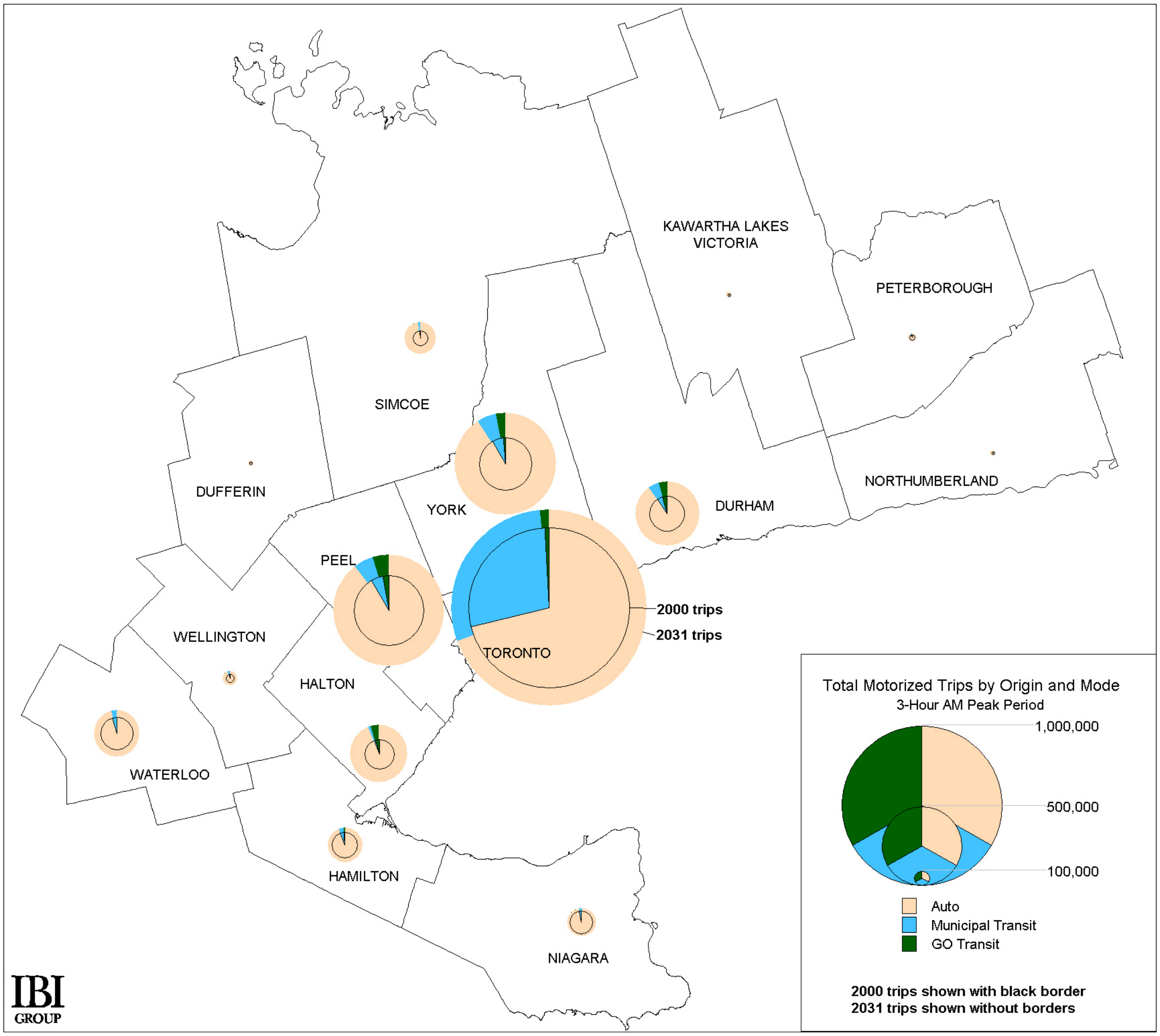
Exhibit 3.14: A.M. Peak Period Trips by Mode and Area of Origin



Due to the fact that the majority of growth in trips will occur in areas not well served by municipal transit, transit trips are not expected to grow as fast as auto trips, although the growth is significant. Between 2000 and 2031, trips made on municipal transit (excluding GO Rail) are forecast to increase by approximately 35%. The largest increase in municipal transit trips will be for trips originating in Toronto, which will account for over half of the growth. However, the largest percentage growth in public transit will occur in the rest of the inner study area, where transit usage is expected to increase by approximately 65%. GO Rail will experience significant growth over the next three decades because a large portion of the forecast population growth will occur in the areas surrounding Toronto served by GO Rail, which links them to the pre-eminent and growing employment opportunities in the metropolitan centre. Overall, GO Rail trips are forecast to increase by 140% or 2.4 times, with the majority of the growth coming from the inner study area outside of Toronto. In absolute terms, municipal transit trips will continue to exceed GO Rail trips in 2031 by a large margin for trips originating in Toronto, but GO Rail ridership is projected to close the gap significantly in the rest of the inner study area, under the conditions assumed in the BAU scenario.

Exhibit 3.15 shows how these changes in trips and resulting mode shares are distributed across the study area. Within the City of Toronto, where higher levels of municipal transit service are provided, the growth in travel is shared by auto and transit modes. However, the majority of the growth is projected to occur in the rest of the inner study area and the outer study area (see Exhibit 3.11), which is highly auto-oriented and will therefore result in dramatic increases in auto trips over the study period.

Exhibit 3.15: A.M. Peak Period Modal Shares

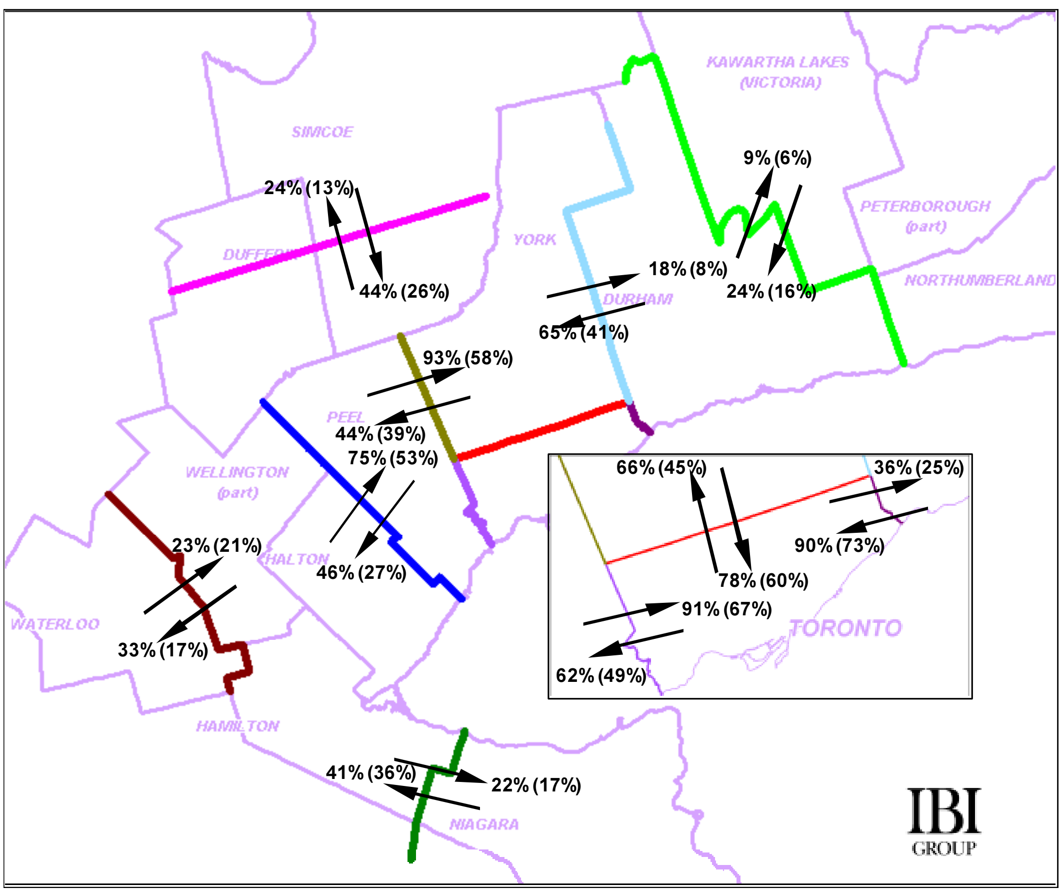


3.5.4 Transportation Demand/Supply Balance

The projected population and employment forecast for the BAU scenario will translate to an estimated growth in peak period trip-making of approximately 50%, and a 64% increase in automobile vehicle-km of travel between 2000 and 2031. In absolute and percentage terms, this significantly outpaces the increase in transportation capacity improvements that can be expected over this same period under the BAU scenario, as presented in Section 3.4.5. The BAU scenario assumes that future investment in transportation infrastructure will approximately reflect historic spending levels. This translates to an approximate 30% increase in highway lane-km and a 6% increase in arterial road lane-km in the next 30 years.

The demand-supply imbalance is also demonstrated in Exhibit 3.16, which shows the existing and 2031 volume/capacity ratios over several major screenlines throughout the study area. Volumes across the west, north and east Toronto boundaries are currently at or near the theoretical capacity of the road system crossing these screenlines. Large growth in future auto demands, in spite of a more than doubling of GO Rail ridership over this same period, will translate to very intense congestion levels and substantial increases in travel delays. The projected large increases in suburb-to-suburb type travel will also place large strains on the road system serving travel into the City of Toronto and among Durham, York, Peel and Halton Regions surrounding the City. The outer study area, while experiencing significant growth, is not projected to experience such high congestion levels between regions, reflecting the generally larger residual road system capacities available currently relative to traffic volumes.

Exhibit 3.16: 2000 and 2031 A.M. Peak Period Volume/Capacity Ratios across Major Regional Screenlines



LEGEND:
xx% (yy%)
xx% – 2031 v/c
yy% – 2000 v/c
Note: v/c greater than 80% indicates congested conditions

( ) = 2000 ratios

The high growth in auto traffic in relation to road infrastructure may also be shown in terms of the extent of congestion on individual road links throughout the study area. Exhibit 3.17 indicates the road links in 2000 that experience high levels of congestion based on the volume-capacity (v/c) ratio estimates from the transportation model. This plot of current conditions indicates that traffic congestion is quite pervasive in the inner study area during the a.m. peak period, with pockets of congestion on the Gardiner Expressway, the Don Valley Parkway, the Queen Elizabeth Way and several 400-series highways. The model run of existing conditions estimates that approximately 30% of arterial road and 48% of highway lane-km in the inner study area are congested (v/c > 0.8) [33] during the a.m. peak hour. In the outer study area, the extent of congestion is much lower with 8% of arterial road and 5% of highway lane-km experiencing congestion.

Exhibit 3.18 shows the forecasted levels of road congestion in 2031 based on the volume-capacity (v/c) ratio estimates from the transportation model. The forecasted growth in traffic results in much higher levels of congestion, with the extent of the congestion spreading to a much broader area that almost fully encompasses all of the urbanized areas of the inner study area and extends into many areas in the outer study area. By 2031, it is projected that peak period congestion levels will significantly worsen, even with planned system expansion. The arterial roads in the inner study area will experience congestion on 51% of the lane-km (up from 30% in 2000) and 67% of lane-km on the highway system (up from 48% in 2000). In the outer study area, 21% of the arterial road and 24% of the highway lane-km will be congested (up from 8% and 5% in 2000, respectively).

3.5.5 Transportation Costs

The capital costs for transportation infrastructure associated with the BAU scenario are presented for highway, arterial road, municipal transit and GO Rail improvements, corresponding with the infrastructure expansion assumptions presented in Section 3.4.5. As shown in Exhibit 3.19, capital costs are presented by decade by infrastructure type based on a best estimate of the year of implementation. The funding and capital planning horizons of all municipalities and transportation agencies in the study area do not extend beyond 10 years, given fiscal uncertainties and the lack of dedicated funding sources to support transportation infrastructure investment. For this reason, the assumed investment is more heavily weighted to the earlier horizon years. In general, the investment is considered typical of historic spending levels.

[33] The volume-capacity (v/c) ratio is a quantitative measure which shows the extent to which the capacity of a given road is being used by traffic volumes at various levels. A v/c ratio of 0.3 means that only 30% of the road's capacity is being used and traffic can be expected to flow relatively freely at or near the speed limit. Speeds can be expected to drop as traffic volumes increase and the v/c ratio approaches 1. Traffic congestion is generally experienced at v/c levels between 0.8 and 0.95, characterized by unstable traffic speeds fluctuating between 0 and something less than the speed limit but with significant bunching of traffic and average speeds generally about half the speed limit or less. A v/c ratio of 0.95 or greater signifies severe congestion, characterized by stop-start conditions and bumper-to-bumper queues with significant delays of unpredictable duration.

Exhibit 3.17: Volume to Capacity Ratios 2000 in A.M. Peak Period

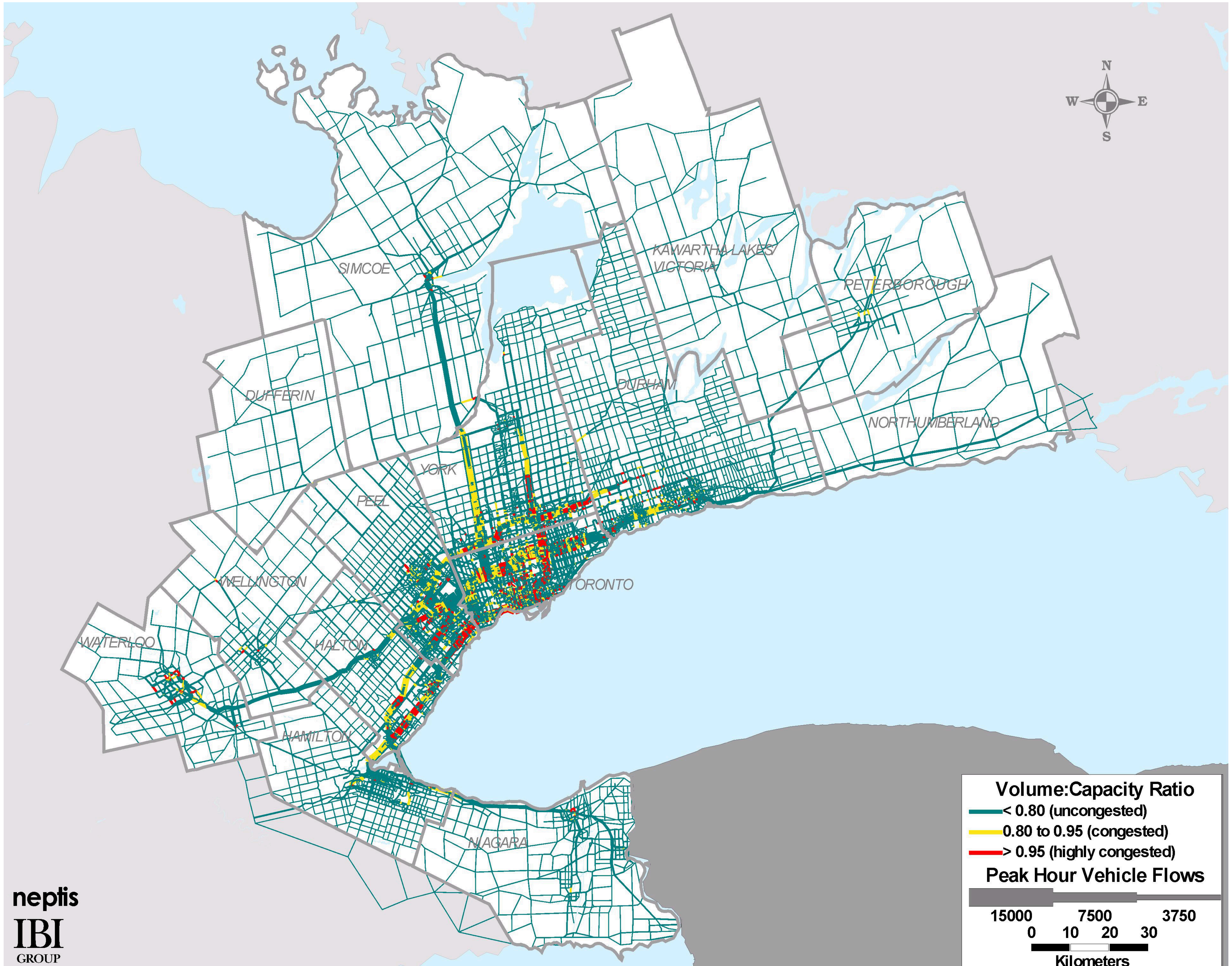


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Exhibit 3.18: Volume to Capacity Ratios 2031 in A.M. Peak Period

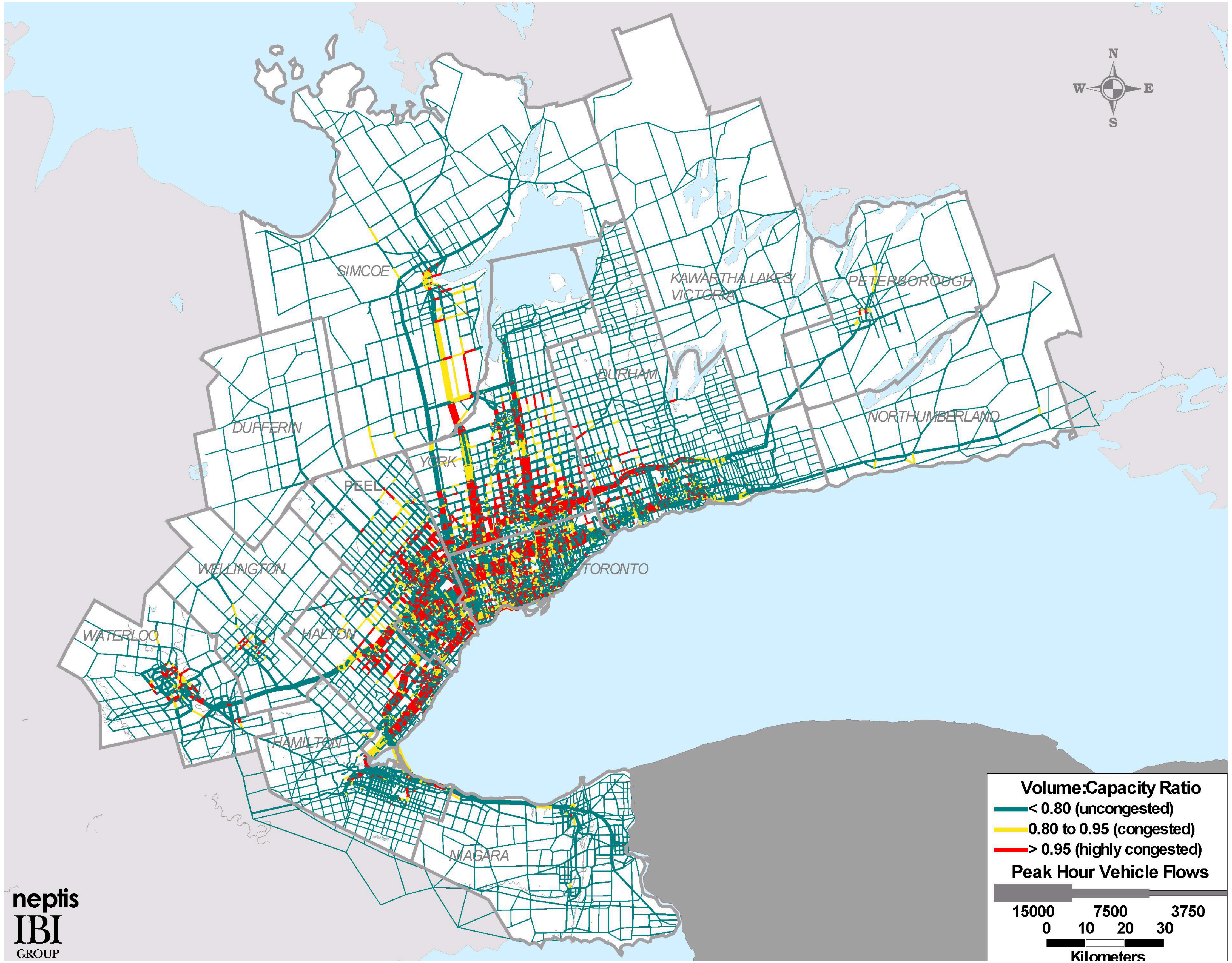

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Exhibit 3.19: Projected Public-Sector Capital Expenditures for Transportation (Millions of 2000 Dollars)

Sector	2001 – 2011		2012 – 2021		2022 – 2031		2001 – 2031	
	Average Annual	Decade Total	Average Annual	Decade Total	Average Annual	Decade Total	Average Annual	Total
Provincial Highways	697	7,666	666	6,662	424	4,245	599	18,573
Arterial Roads	452	4,973	337	3,366	325	3,251	374	11,590
Municipal Transit	194	2,137	195	1,949	193	1,927	194	6,013
Rapid Transit	140	1,540	100	1,000	100	1,000	114	3,540
GO Rail	133	1,460	173	1,730	118	1,180	141	4,370
Total	1,616	17,776	1,471	1,4707	1,160	1,1603	1,422	44,086

In the near term (first decade), the assumed improvements represent the compilation of capital improvement programs from various municipalities and agencies and reflect committed or "highly probable" projects. Actual capital cost estimates are typically available for these projects and used in this study, with adjustments to express all monetary figures in constant 2000 dollars. Where no capital cost estimates were available, the project's capital cost was based on the application of unit cost factors on a cost per lane-km basis, derived from other MTO highway and arterial road projects with known costs. A cost for rehabilitation of the existing road and highway system is also projected based on historical per-lane-km spending trends applied to the road and highway systems. Over the planning period, the resulting capital costs for highways average $697 million per year over the period to 2011, $666 million per year between 2012 and 2021, and $424 million per year between 2022 and 2031. For arterial roads, the BAU scenario has an average annual investment by decade of $452 million, $337 million and $325 million, respectively. By 2031, this will provide an increase of approximately 30% in lane-km for the highway network, 6% for the arterial road network, and 9% overall for the combined highway and arterial road network.

Municipal transit (streetcars and buses, including GO Transit bus services) is assumed to expand by adding vehicles at a rate proportional to population increases and by extending service coverage into newly urbanizing areas as they occur. This, plus vehicle replacement costs, produces a cumulative 31-year capital investment of about $6.0 billion.

Rapid transit capital costs for public transit include the cost of construction of rapid transit projects, rehabilitation costs and expenditures for the purchase of new vehicles. The Sheppard Subway is the only rapid transit facility expected to be implemented in the near term (expected to open in Summer 2002), and there are no solid plans at present to expand the rapid transit system further. The total capital cost for rapid transit infrastructure over the planning period is $3.5 billion dollars, representing the cost to complete the Sheppard Subway, system rehabilitation, new vehicles and vehicle replacement.

GO Rail system expansion is defined by GO Transit's Ten-Year Capital Program and Year 2021 Plan, which include increased frequencies in all existing corridors. As noted in Section 3.4.4, no new or extended GO Rail lines are assumed in the BAU scenario; rather, service frequencies are increased by adding more trains on existing lines. The capital costs for GO Rail improvements are based on estimates provided in the 2021 Plan. While the GO 2021 Plan is considered highly probable, there are no funding commitments for these improvements at the present time. The main elements of the Plan and costing include the provision of a minimum of 5 peak period trains in all existing corridors, the use of train-buses during off-peak periods, a Union Station bus terminal, Union Station Corridor capacity improvements and other station area improvements. The total capital cost for the assumed GO Transit improvements, including rehabilitation, is approximately $4.4 billion.

Exhibit 3.20 presents a summary of projected public-sector capital expenditures for transportation, broken down into expenditures for system realization/renewal and for system expansion, respectively. As shown, about 74% of the total investment over 31 years is projected to be for system rehabilitation, with the remaining 26% for system expansion. The proportion spent for rehabilitation tends to increase during the three decades of the study period. This is based on the BAU transportation assumption that system expansion will be more rapid during the first two decades, and reflects the fact that, as the transportation system expands, rehabilitation costs will also increase in proportion. **The expenditures for system rehabilitation would be relatively insensitive to alternative policy scenarios and any capital cost implications of such scenarios would tend to be affected only by the system expansion expenditures, which total $11.7 billion for the BAU scenario.**

Exhibit 3.20: Projected Public-Sector Capital Expenditures for Transportation Rehabilitation and Expansion (Millions of 2000 Dollars)

	2001 – 2011	2012 – 2021	2022 – 2031	2001 – 2031	
System Rehabilitation	11,319	10,772	10,276	32,367	(73.5%)
System Expansion	6,457	3,935	1,327	11,719	(26.5%)
Total	17,776	14,707	11,603	44,086	(100%)

Exhibit 3.21 presents the estimated annual operating and maintenance costs for road and public transit services for the 2000 base year and estimated for the 2011, 2021 and 2031 horizon years. In each case, current unit cost estimates of operating and maintenance costs were derived from available data and applied to predict future costs. The gross annual operating and maintenance cost for highways and arterial roads in the study area is projected to increase from approximately $469 million in 2000 to $510 million in 2031.

Exhibit 3.21: Net Annual Transit and Gross Annual Road Operating & Maintenance Costs (Millions of 2000 Dollars)

Sector	2000	2011	2021	2031
Provincial Highways	178	190	194	194
Arterial Roads	291	302	310	316
Municipal Transit	193	212	232	249
GO Rail	40[34]	56	73	92
Total	701	759	809	851

For public transit, operating and maintenance costs were based on existing reported costs of the transit agencies, with the level of productivity assumed to remain constant in the future by transit agency. The net annual operating cost of all public transit systems within the study area is projected to increase from $233 million in 2000 to $341 million in 2031.

3.6 MAJOR TRANSPORTATION CHARACTERISTICS

3.6.1 Accessibility

Accessibility is one of the most important indicators in evaluating transportation performance, yet it is difficult to define and quantify. In basic terms, accessibility is defined as the ease of reaching various types of destination as measured by any combination of average travel time, cost and/or distance.

It is important to distinguish between accessibility and mobility. Mobility, which is discussed in Section 3.6.2, is generally related to movement or amount of movement and can be measured in terms of passenger-km or vehicle-km of travel. Invariably, car-dependent societies tend to exhibit high levels of mobility, which has a negative impact on the environment. On the other hand, improved or increased accessibility achieved through more compact, mixed-use development, can have a positive result through shorter trips, more walking and transit use, reduced vehicle-km of travel (VKT) and reduced emissions.

Four basic measures of accessibility have been developed for characterizing the implications of BAU and are discussed below. Three of the measures are shown in Exhibit 3.22.

[34] Note that this value is not the actual 2000 value, as the actual value for this year was found to be inconsistent with other recent values. The value presented here is representative of spending throughout the mid- to late-1990s

Exhibit 3.22: Implications of BAU For Accessibility

AREA	Employment to Population Ratio			Employment Density (1)			Average Distance to Country (km) (2)		
	2000	2031	% chg.	2000	2031	% chg.	2000	2031	% chg.
Toronto	0.52	0.59	14%	10.8	13.9	29%	10.8	15.3	42%
Rest of Inner Study Area	0.48	0.50	4%	5.3	5.6	6.1%	1.9	3.4	79%
Outer Study Area	0.43	0.48	10%	4.1	4.4	7.6%	1.4	1.6	14%
STUDY AREA	0.48	0.52	8%	6.0	6.4	6.3%	4.8	6.2	29%

Notes:
(1) Gross density based on employment per acre of urbanized land.
(2) Measured as the weighted average distance to the nearest edge of the urbanized area.

Jobs/Worker Balance

The ratio of jobs to workers within a given area provides an indication of how easy it is for people to travel to work. With a jobs-to-worker ratio of less than one, more workers have to commute into another area, thereby increasing travel effort. Conversely, if there are sufficient jobs for the number of workers, the jobs are more "accessible."

For the purpose of this study, the employment to population ratio is used as a surrogate for the jobs/worker balance. As shown in Exhibit 3.22, under the BAU scenario, the employment-to-population ratio in most areas will increase since there is a net gain for the entire study area. The largest gains will be made in Toronto. Fairly modest gains will be made in the rest of the inner study area and intermediate gains in the outer study area. Although it can be argued that this may improve accessibility, many of the resulting suburb-to-suburb work trips can be long distance and difficult to serve by transit.

Employment Density

Similar to jobs/worker balance, employment density is a measure of accessibility. There tends to be an interaction between employment generators; therefore the higher the employment density, the greater the probability that interaction between employment generators can occur in the same area. Also, from a transit perspective, areas with high employment densities can justify higher transit service levels, which results in greater accessibility.

As shown in Exhibit 3.22, increases in employment densities are projected to occur for the entire study area, indicating that the rate of expansion of urbanized land for employment is less than the rate of growth of employment. This is due primarily to the significant increases in employment densities projected in Toronto. Fairly modest increases are expected in the rest of the inner study area as well as the outer study area, suggesting modest increases in accessibility as measured by this indicator.

Retail Walking Access Rating

The availability of retail establishments within one's neighbourhood, particularly if they are within walking distance, can have a significant impact on the need for motorized travel. The example most often used is whether you can walk to a corner store to buy milk.

Although this indicator is difficult to quantify without very detailed information by neighbourhood, most new neighbourhoods in the study area, particularly in the inner study area excluding Toronto, do not include retail opportunities within walking distance, although there are certainly some exceptions. The overall implication is a greater reliance on automobiles for shopping trips in the future. This is compounded by the recent trend towards "big-box" retailing. It is reasonable to conclude that, under a BAU scenario, a significant decrease in retail accessibility will occur, particularly in newly urbanizing areas relative to older established areas.

Average Distance to Country

Average distance to "country" reflects the ease of getting to recreation areas. For the purpose of this indicator, "country" is defined as any area outside of the urbanized area. Distance to country was calculated for each traffic zone using the distance from the centroid of the urbanized area in each traffic zone to the nearest point of the urban boundary (excluding lakes), or zero distance if the zone is rural, and weighted by the population in the traffic zone to develop the regional averages. Distance is taken as the straight-line distance.

As shown on Exhibit 3.19, with the expansion of the urbanized area, the distance to country for residents in Toronto has increased significantly, from approximately 11 km in 2000 to 15 km in 2031. Distance to country in the rest of the inner study area will nearly double; however, there the impact is not as significant, since most of these areas are fairly close to non-urbanized areas. This measure also suggests, therefore, that accessibility to countryside/recreational activities will decline.

Accessibility: Summary

In summary, the BAU scenario is estimated to provide modest gains in accessibility to employment, but a potentially significant decline in accessibility to retail opportunities and a less significant decline in accessibility to countryside recreational areas.

3.6.2 Mobility

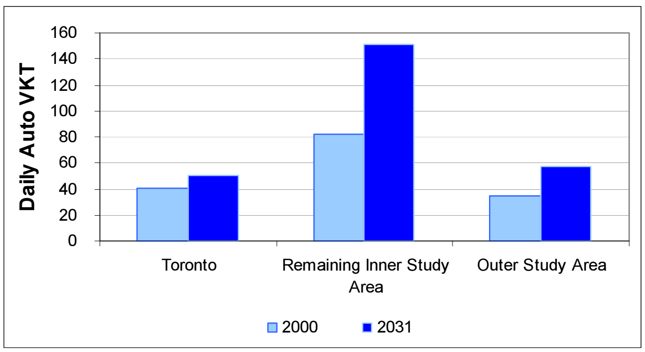
As discussed above, mobility refers to the amount of travel that individuals undertake. One of the goals of sustainable transportation is to increase or maintain accessibility while reducing mobility. This can be accomplished by reducing trips or by reducing trip distances.

Two key measures of mobility are vehicle-km of travel (VKT) per capita and transit passenger-km of travel (PKT) per capita.

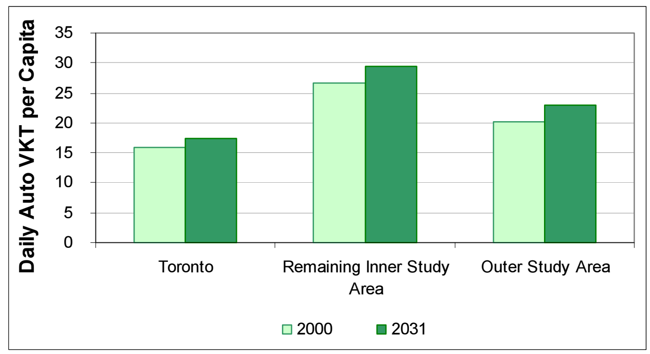
Exhibit 3.23 illustrates the estimated changes in total VKT as well as VKT per capita for the 2000 and the BAU scenario in 2031. Under the BAU scenario, total VKT increases significantly. Whereas overall trips by automobiles for the study area increase by about 50% to 2031, VKT by automobiles increases by 64%, with the rest of the inner study area (not including the City of Toronto) increasing by the largest amount (83%). Since the BAU scenario is based on stable per capita trip frequencies, the increase in VKT per capita is primarily a function of increased trip distances. It is also influenced, however, by the fact that automobile mode shares are increasing at a faster rate than transit mode shares, due to the fact that more people will be living in areas not served well by transit, and auto trips are longer than transit trips on average. This phenomenon is illustrated by the increases in per capita trip rates, also shown in Exhibit 3.23.

Exhibit 3.23: Implications of BAU Regarding Mobility: Daily VKT

Total Daily Vehicle-km of Travel (millions)



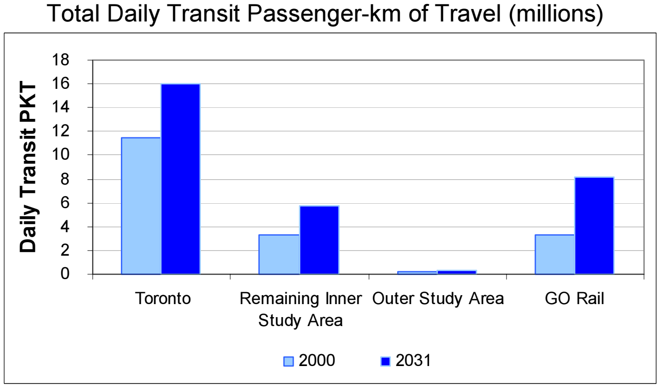
Vehicle-km of Travel Per Capita



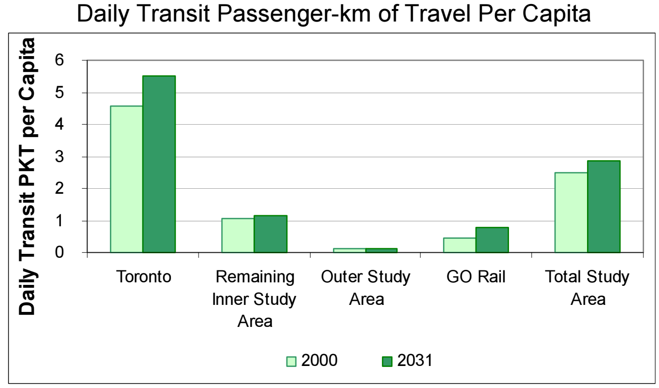
Trends in transit passenger-km of travel (PKT) are similar to those of VKT with significant increases estimated under the BAU scenario. Between 2000 and 2031, PKT (including GO Transit) for the study area will increase by 73%. Much of this increase is influenced by GO Rail, which, due to its relatively long trip lengths, accounts for a large portion of PKT. On a per capita basis, PKT is expected to increase slightly due to increases in trip distances as a result of expansion of the urbanized area. These trends are shown in Exhibit 3.24.

Exhibit 3.24: Implications of BAU Regarding Mobility: Daily Transit PKT

Total Daily Transit Passenger-km of Travel (millions)



Daily Transit Passenger-km of Travel Per Capita



3.6.3 Travel Effort

Travel effort reflects the efficiency of a transportation system both in terms of time spent travelling and in terms of costs. Both of these are a function of distance travelled and of congestion levels.

Average Travel Distance

Due to the expansion of urban boundaries and associated dispersion of population and employment, average travel distances for residents of the GTA will increase fairly significantly by 2031. It is projected that average a.m. peak period automobile trip distances will increase from approximately 15.6 km to 16.9 km under the BAU scenario, representing a 9% increase. Work trip distances will increase from 18.5 km to 19.7 km or 6%, which is less than total trips, reflecting improvements in the jobs/worker balance in the regions.

For trips using transit, the average a.m. peak period trip distance will increase from 11.0 to 12.1 km for the overall study area.

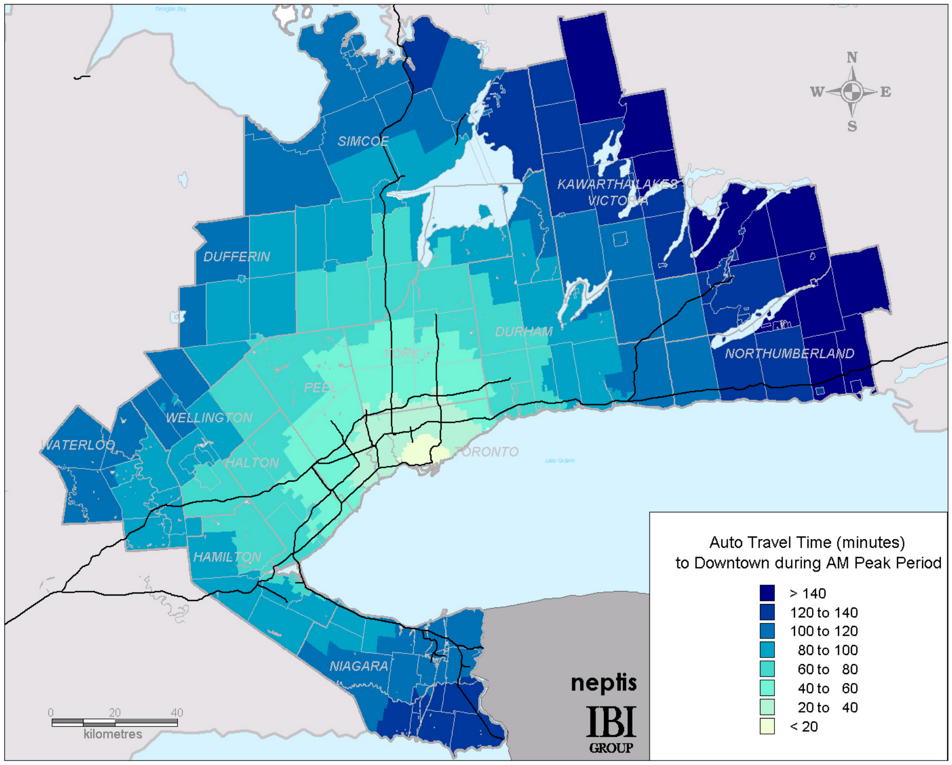
Average Travel Times

Under the BAU scenario, peak-hour average automobile travel times for the study area are expected to increase from approximately 15 minutes to 22 minutes, representing a 44% increase. This increase is partially a result of increases in average trip distance as described above, but mainly due to increased congestion and reduced travel speeds. Between 2000 and 2031, average travel speeds under the BAU scenario are forecast to decrease from an average of 61 km/h to 45 km/h, a reduction of 25%.

When work trips only are considered, automobile trip times will increase from 20 minutes to 25 minutes, or by about 25%.

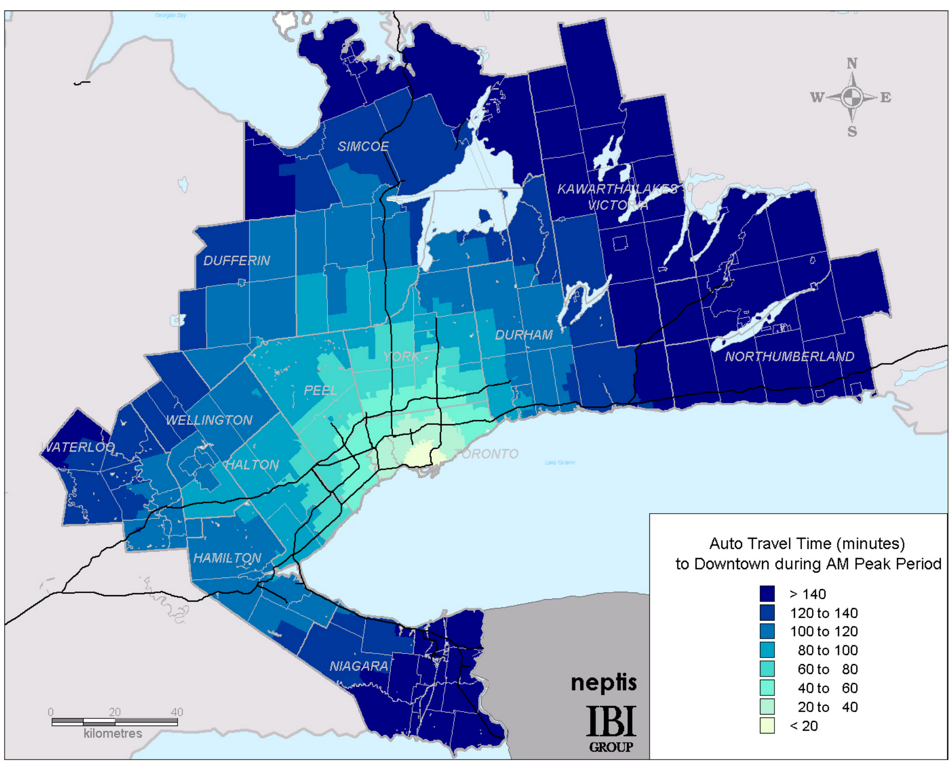
This reduction in speeds has a marked impact on journey times, as illustrated by Exhibits 3.25 and 3.26, which show auto journey times to the intersection of Bay and King Street in downtown Toronto plotted as 20-minute isochrones. The increased times are mainly due to slower speeds in the inner area – this can be seen by the tightening of the inner 80 minute isochrones, while they remain fairly wide in the outer area.

Exhibit 3.25: 2000 Car Journey Times to Downtown Toronto (20-Minute Isochrones)



* In the a.m. peak period

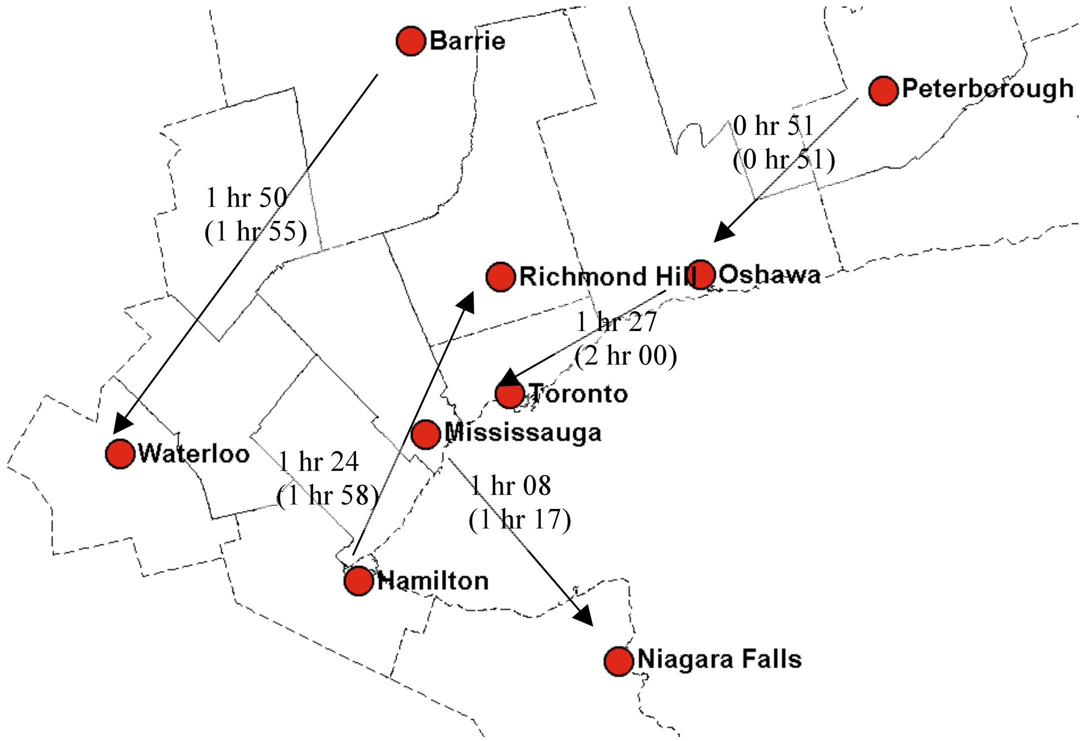
Exhibit 3.26: 2031 Car Journey Times to Downtown Toronto (20-Minute Isochrones)



* In the a.m. peak period.

Exhibit 3.27 shows the change in travel time between nine pairs of centres in the study area. Once again, journeys made through the inner study area, such as Oshawa to Toronto, are affected substantially more than those made entirely in the outer study area, such as Barrie to Waterloo.

Exhibit 3.27: Auto Travel Times* Between Selected Centres in 2000 and 2031



* In a.m. peak period; 2031 travel times are in parentheses

Through Trips

Given the geographic scale of the study area, there are an increasing number of through trips, where neither the trip origin nor the trip destination is in a municipality, but the transportation infrastructure within that municipality is used to make the trip. It may be argued that through trips impose a non-beneficial traffic burden on the affected municipality, as they do not serve local employment or commercial or retail areas and do not represent trips by local residents. A limited analysis of through trips by auto was carried out for 2000 and 2031. In 2000, it is estimated that approximately 144,000 a.m. peak period trips or 5.3% of all study area auto trips are upper-tier municipality (UTM) through trips. By 2031, UTM through trips are estimated to increase by 85%, to 266,000 trips.

Peel Region presently has the highest number of through trips, at just over 50,000 trips in 2000, growing to 82,000 by 2031. The City of Toronto will replace Peel Region as the area with the greatest number of through trips over the study period, growing 115% from

43,000 through trips in 2000 to 92,000 in 2031. Through traffic has also been estimated for a small number of lower-tier municipalities, and similar levels of increase were identified. For example, through traffic in Mississauga is estimated to increase from about 32,000 trips in 2000 to about 48,000 trips in 2031 (a 50% increase). Through trips in Brampton are estimated to increase from 12,000 to 25,000 (an increase of 108%), in Caledon from 6,000 to 9,000 (a 50% increase), and in Markham from 45,000 to 75,000 (a 67% increase). The higher growth rates for Brampton and Markham are attributed to their location in the rapidly growing urban fringe, while Mississauga is located to the south of that area and Caledon Hills to the north. The lower rate of through traffic in Markham relative to Brampton is attributed to the larger proportion of north-south through trips in Markham (carried on Highway 404) which are growing more slowly than east-west trips and the fact that the growth in Markham is from a considerably larger base. Both municipalities will experience a very significant increase in east-west through trips, carried largely on Highway 407.

In generic terms, growth in through trips may be an indicator of traffic disruption in the affected municipality, but this depends significantly on the transportation modes on which the through trips are carried and the extent to which these are operating at or close to capacity. For example, if most of the through trips are carried on trunk facilities such as expressways and GO Rail, the impacts on the “host” municipality may not be particularly significant, unless these facilities are fully loaded; if that is the case (as projected for the BAU scenario by 2031) local traffic may experience delays gaining access to freeways, freeway traffic may divert onto arterial roads (with more direct community impact) and potential GO Rail riders in the community may be frustrated if the trains are fully loaded on arrival.

It can be argued that growth in through trips is an attribute of any large and growing metropolitan region, and a reflection of the ability of the region’s inhabitants and visitors to move freely throughout the region and take advantage of the many opportunities offered, for employment and other purposes. The key issue is the extent to which through trips can be carried on trunk facilities, thereby providing a high level of transportation service while avoiding or reducing impacts on the communities through which the trips must pass.

Travel Delay

Travel delay can be measured as the extra time spent travelling as a result of congestion vs. the time it would take to travel the same distance on an uncongested or free-flowing network. Using this definition, the transportation model was used to estimate the total number of delay hours in a typical weekday. In 2000, there are about 300,000 hours of delay each day in the study area. For 2031 BAU, this climbs to 1.2 million hours, or approximately a 300% increase. This results from a combination of increased congestion, increased trip lengths and an increase in the number of trips. On a per trip basis, delay will increase from about 4 minutes per trip to 9 minutes per trip. If one were to convert the total delay hours to a dollar value, assuming a conservative value of time of $10 per hour, the total cost of delay in 2031 would be $12 million per day. On an annual basis, this works out to a cost of about $3.8 billion. The same figure for 2000 is about $1 billion.

Commuting Times and Costs

The average commuting time spent each month in 2031 by a household located in south-central York Region with two workers, each driving to work, is estimated to be about 38.5 hours in 2031, up from 30.8 hours in 2000, a 25% increase. The average monthly auto operating cost of commuting for a similar household in 2031 is estimated to be $195, up from $144 in 2000, an increase of $51 per month or over $600/year in constant dollars. This is a 35% increase from year 2000 costs. If vehicle ownership costs are included, monthly vehicle ownership and operating costs for both vehicles would total $1,303 in 2031, an increase of 4.1% from $1,252 in 2000.

Accident Costs

As traffic volumes increase, the costs associated with traffic accidents can also be expected to increase; for example, the cost of traffic accidents in the study area, estimated at some $3.8 billion in 2000, is projected to increase to $6.3 billion per year by 2031, an absolute increase of $2.5 billion or approximately $75 per capita.

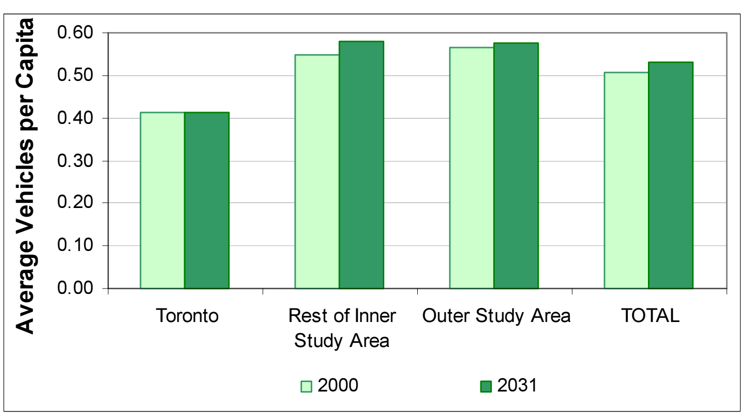
3.6.4 Transportation Choices

One of the goals of a sustainable transportation system is to provide users with choice. A key yardstick measurement is whether an individual can live without a car and experience reasonable access to essential activities. This would mean that transit, walking and cycling would be feasible alternatives. Three indicators of transportation choice are discussed below.

Auto Ownership

Under BAU, it is expected that auto ownership rates will remain relatively stable by sub-area, which has significant implications on an overall study basis. While auto ownership rates depend on many factors such as income, number of people per household and employment status, ownership rates generally increase as one moves away from the downtown core of Toronto to lower-density areas which are not as well served by transit. Since the majority of population growth in the next three decades under the BAU scenario is expected to occur outside Toronto, this translates into higher overall auto ownership rates for the study area.

Exhibit 3.28: Auto Ownership 2000-2031



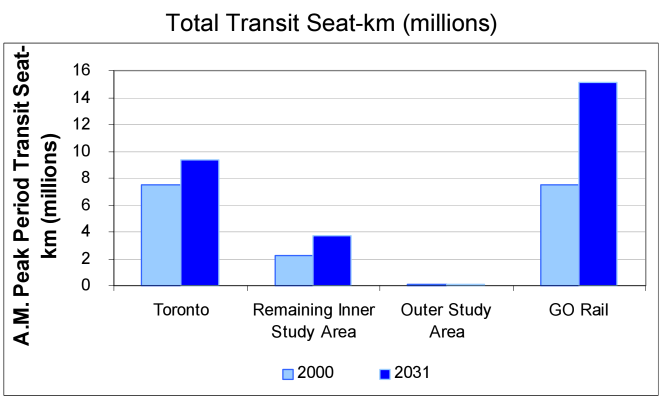
As shown on Exhibit 3.28 between 2000 and 2031, average auto ownership rates for the study area are expected to increase from 506 cars per 1,000 capita to 531 cars per 1,000 capita, an increase of 5%. Overall the number of vehicles in the study area will increase from 3.7 million cars to 5.6 million cars, or about 50%. In comparison, population is forecast to increase by 43%. As noted earlier, the highway and arterial road network serving the study area is projected to be expanded by 4,400 lane-kilometres (a 9% increase) between 2000 and 2031 under the BAU scenario.

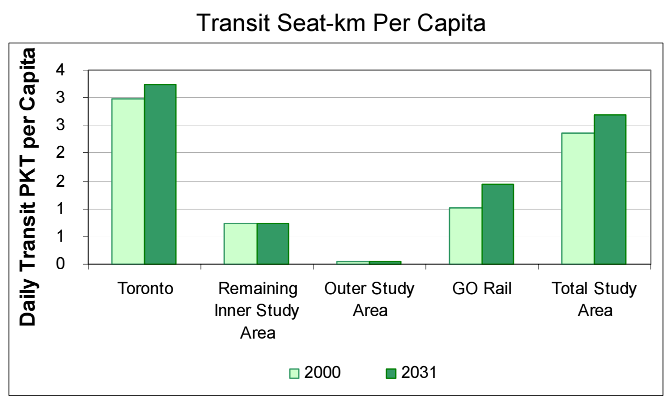
Transit Supply

Transit-seat kilometres per capita is a measure of the availability of transit. Under the BAU scenario, transit will essentially be expanded at a rate consistent with growth in population. In other words, transit supply increases will not be used as a tool to effect a change in modal shares but rather as an attempt to maintain existing service levels. This reflects a rate of expenditure on new transit vehicles which is higher than that experienced in the 1990s, being more typical of funding levels in the 1970s and 1980s. If expansion budgets for municipal transit – and also for GO Rail as noted below – are limited to levels experienced in the 1990s, the ridership increases as projected for the BAU scenario in this report will not be achieved, and auto travel will increase even more than estimated, with further increases in congestion levels as a result.

Exhibit 3.29 illustrates the anticipated trends in transit seat-km in absolute and per capita terms. Between 2000 and 2031, municipal transit-seat km (the first three columns) is expected to remain relatively stable on a per capita basis. When accounting for the fact that more of the population will be living in areas with lower per capita rates, the overall average will decrease by approximately 6%. However, when GO Rail seat-km are included, there will be a slight increase in per capita public transportation seat-km. This suggests that there may be an evening-out of modal choices; however, both modes will suffer from increased congestion as discussed previously.

Exhibit 3.29: A.M. Peak Period Transit Supply





3.6.5 Use of Public Transit and Non-Motorized Transit

Transit Market Share

Section 3.5.3 provided a discussion of forecasted travel trends by each mode for motorized trips. Exhibit 3.30 summarizes how the changes in each mode translate into modal shares.

Exhibit 3.30: A.M. Peak Period Modal Shares for Motorized Trips

	2000			2031 BAU		
AREA	**Auto**	**Transit**	**GO Transit**	**Auto**	**Transit**	**GO Transit**
Toronto	71%	28%	0.9%	69%	29%	1.4%
Rest of Inner Study Area	92%	5.4%	2.6%	91%	5.2%	3.7%
Inner Study Area	83%	15%	2.0%	84%	13%	3.2%
Outer Study Area	97%	2.9%	-	97%	2.7%	-
STUDY AREA	86%	12.6%	1.5%	86.5%	11.2%	2.3%

Under the BAU scenario, municipal transit will lose market share in the study area overall, because a large portion of the population growth is occurring in areas with low transit service levels. However, these declines in municipal transit mode shares will be offset to an extent by increases in GO rail mode shares, meaning that the auto mode shares will remain relatively constant.

The BAU scenario does not improve the overall position of transit.

Transit Viability

As noted in a number of reports, density is a key determinant of the viability of transit.[35] In order to understand how transit viability would change under the BAU scenario, each traffic zone was categorized according to transit potential based on development density measured in terms of people plus jobs per hectare. The results are shown in Exhibits 3.31 and 3.32 for the 2000 base year and 2031 scenario, respectively. Generally, transit potential decreases with distance from the downtown core of Toronto or from other urban centres in the study area as measured by this variable.

Using these maps of transit potential, a weighted average of the percentage of the population in each category can be calculated. The results are shown in Exhibit 3.33. In general, under the BAU scenario, there will be little or no gain in the percentage of population living in areas that are viable for higher-order transit based solely on the criterion of development density. There will, however, be marginal gains in areas suitable for bus service, which could include priority transit on some routes as noted earlier. Service in such areas could also include high-order transit routes with appropriate feeder/distributor connections. GO Rail with park-and-ride access is an example.

[35] Transit-Supportive Land Use Planning Guidelines, Ministry of Municipal Affairs and Ministry of Transportation, Ontario, April 1992.

Exhibit 3.31: Transit Potential by Traffic Zone, Based on Urban Density, 2000

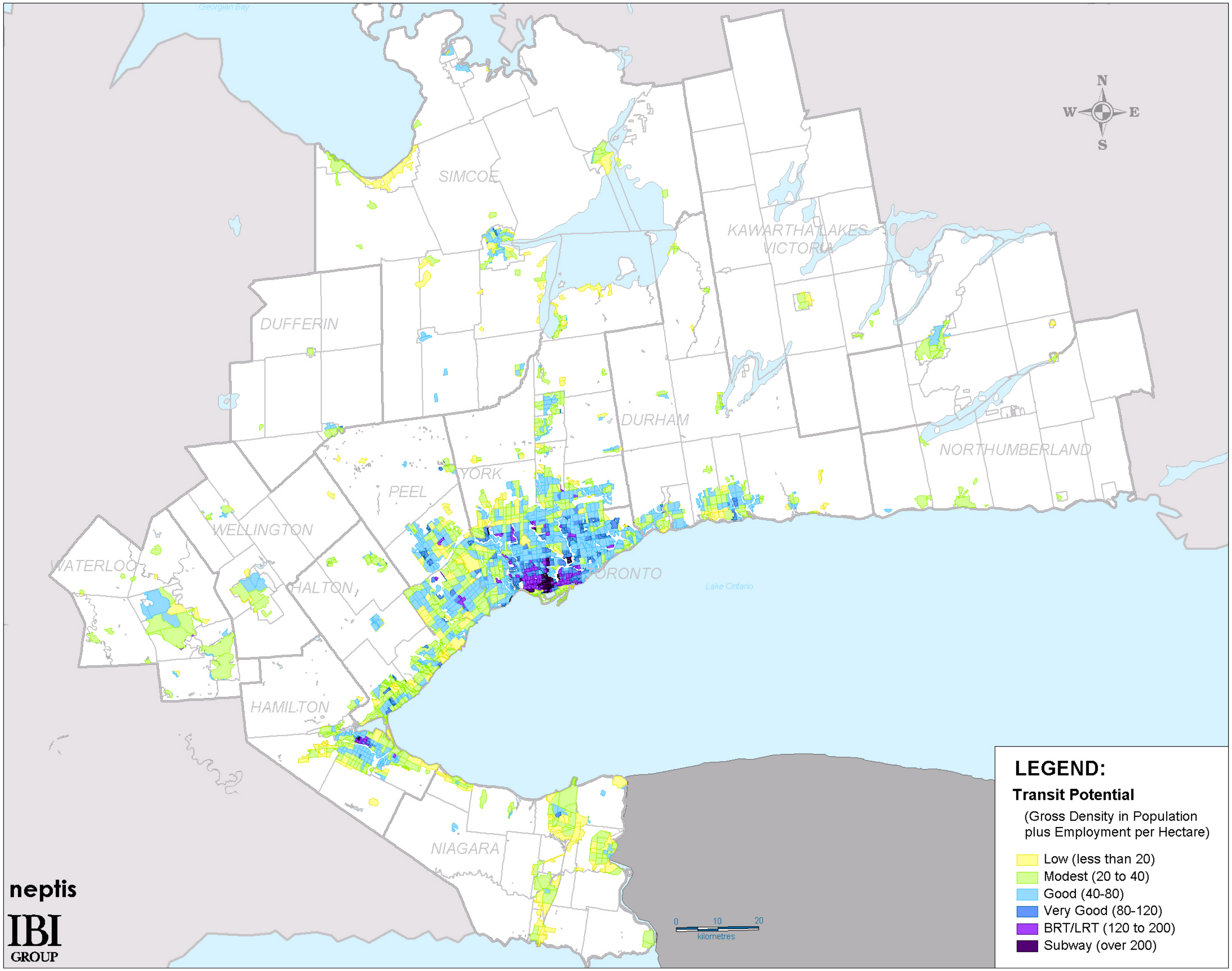


Exhibit 3.32: Transit Potential by Traffic Zone, Based on Urban Density, 2031

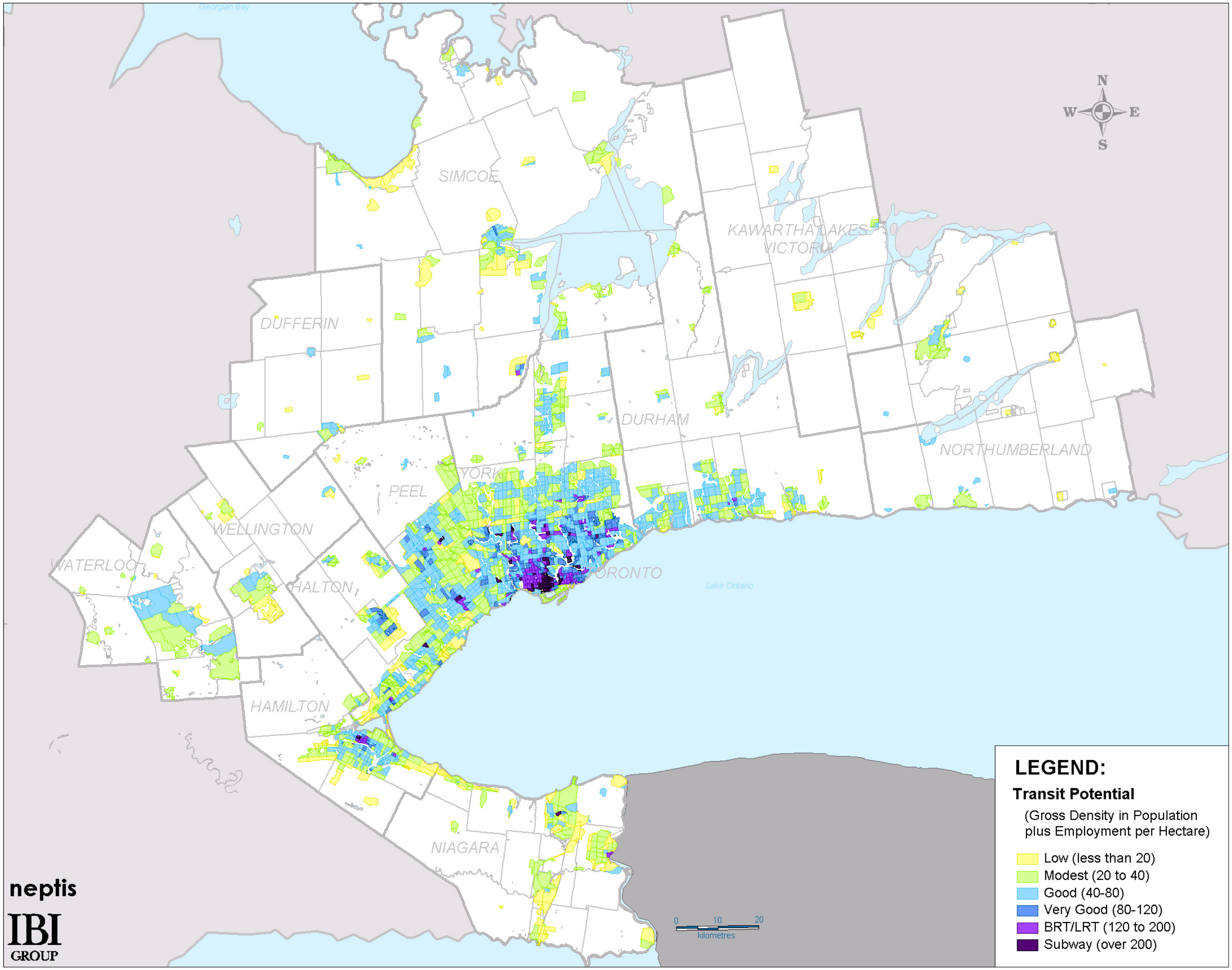
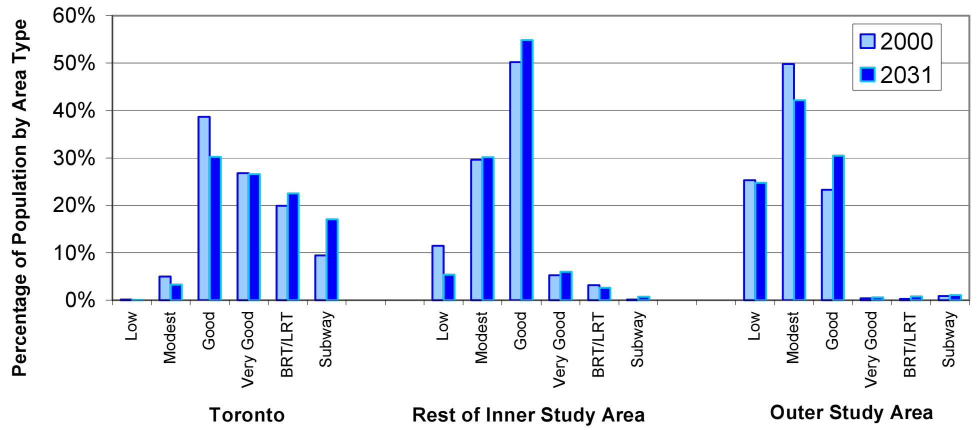


Exhibit 3.33: Population by Transit Potential Area



Legend: Transit potential ✦ as indicated by gross density of population plus employment per hectare in each traffic zone:

Low* (fewer than 20 people plus jobs/ha)
Modest* (20 to 40)
Good* (40 to 80)
Very Good* (80 to 120)
BRT/LRT (120 to 200)
Subway (over 200)

Notes: ✦ It should be recognized that transit potential and viability are affected by other factors in addition to development density at one end of the trip (e.g., density at the other end of the trip, transit feeder/distributor services to/from trunk route stations, etc.) and the above measures should therefore be used with caution.

* Typically transit service for these densities of development is provided by buses or streetcars operating in mixed traffic.

It should be recognized that, while development density is important, it is not the only factor influencing transit viability. For example, transit ridership and cost-effectiveness are affected by the supply, quality and pricing of transit services and of roads and parking for private autos. As discussed in Chapter 2, the viability of transit in an area (in terms of both ridership and cost-efficiency) can also be increased by a more transit-supportive urban structure, for example, greater emphasis on compact, mixed-use subcentres and corridors that can be effectively served and shaped by improved trunk and local transit services. This would have the important related effect of reducing the required subsidy per passenger carried, since higher ridership levels and load factors would likely be achieved, thereby increasing the productivity of transit vehicle operations. Typically, minimum levels of peak period transit service (e.g., 30-minute headways between successive buses) would apply at the lower densities for the Low and Modest categories listed in Exhibit 3.33, while 15 – 20 minute headways would apply for the Good category, 5 – 15 minutes for the Very Good category and 2 – 10 minutes for the BRT/LRT and Subway categories. These are approximate ranges which depend very much on the other factors listed above as well as on density of development.

3.6.6 Energy Use and Atmospheric Emissions from Automobiles

Energy Use

Energy use is a fundamental indicator of environmental sustainability. Transportation consumes energy through the manufacturing, operation and disposal of vehicles as well as for the construction of related infrastructure (e.g., roads); however, this study focuses on energy use for passenger vehicle operation, which is directly related to fuel consumed.

Fuel use by automobiles was estimated based on results of the transportation demand model and takes into account vehicle-km of travel, expected improvements in average fuel efficiency of the evolving vehicle fleet, and the impacts of average travel speeds. Relationships between speed and fuel efficiency were derived from US data[36] adjusted to reflect average fuel consumption rate estimates. These rates reflect average speeds and do not take into account the impacts of stops and starts caused by congestion, which are difficult to estimate at the planning level. Estimated changes in fuel efficiency (approximately a 15% improvement by 2031) were obtained from the Analysis and Modelling Group of the National Climate Change Process.[37]

Under the BAU scenario (and assuming no change in real fuel prices/taxes, as noted earlier), it is estimated that fuel use from automobiles will increase by approximately 2 billion litres annually between 2000 and 2031, an increase of 44%. This increase reflects the combination of a 64% increase in VKT and a 15% improvement in fuel efficiency. Reductions in average speeds also have a modest impact on the results, in some cases improving fuel efficiency because speeds are reduced. As noted above, the transportation model and the energy efficiency factors are not capable of estimating the impacts of stop-and-go traffic. Therefore, the changes in fuel consumption should be interpreted with caution, and also the estimates of vehicular emissions described below.

Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions are gases in the atmosphere that trap solar energy. Increases in greenhouse gases from human activities have been linked to global warming and climate change. Transportation is a major contributor to GHGs. In 1999, transportation activities accounted for approximately 25% of Canada’s greenhouse gas emissions.[38]

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[36] Oak Ridge National Library, Transportation Energy Data Book: Edition 20, prepared for the Office of Transportation Technologies, U.S. Department of Energy, November 2000.
[37] ***Canada’s Emissions Outlook, An Update***, Analysis and Modelling Group, National Climate Change Process, December 1999.
[38] Canada’s Greenhouse Gas Inventory 1990-1999, Environment Canada, April 2001.

GHG emissions are measured in tonnes of CO_2 equivalent. The primary greenhouse gases include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), of which CO_2 accounts for about 80% of the total impact from transportation. Direct CO_2 emissions can be estimated directly from fuel use as the factors are not affected appreciably on the technology changes assumed for the BAU scenario or on driving conditions. However, emissions factors for CH_4 and N_2O, the other primary GHGs, are more affected by the BAU technology assumptions. On a CO_2 equivalent basis, CH_4 and N_2O also have a greater impact on climate change than CO_2, molecule for molecule.

GHG emissions for the BAU scenario were estimated based on fuel estimates developed from the model results and applicable fuel efficiency factors as described above. Existing and future emissions factors were obtained from Natural Resources Canada and include anticipated changes in technology that will affect the production of methane and nitrous oxide.[39] The factors are consistent with the BAU scenario in that they do not include technology improvements beyond 2005, which are uncertain.

Under the BAU scenario, GHG emissions are expected to increase over the 31-year study period from approximately 10.8 Megatonnes (MT) to 15.5 MT. representing a 42% increase. To put this into context, the total GHG emissions in Canada from gasoline-powered cars and light-duty trucks (comparable to automobile emissions in this study) in 1999 were estimated at 85 MT. In other words, in 2031, GHG emissions from auto passenger transport in the study area are projected to be about 18% of the current equivalent total in Canada. This suggests that policies that govern the study area could significantly influence what can be achieved or not achieved for Canada in the area of transportation-related greenhouse gas reductions. The projected 42% increase in GHG emissions under the BAU scenario demonstrates the challenge of meeting Canada's commitment under the Kyoto target established in 1997, which calls for a reduction of 6% from 1990 levels by 2010 or 2012.

Air Contaminants

Air quality is a major and growing concern in urban areas. According to Environment Canada, "Federal studies show there are 5,000 deaths a year that can be attributed to air pollution, and the Ontario Medical Association says air pollution costs Ontario citizens more than $1 billion a year in hospital admissions, emergency room visits and absenteeism. Toronto Public Health Department figures show that air pollution causes 1,000 deaths a year and numerous health-related problems."[40] While these figures are subject to a high degree of uncertainty, they do suggest that air quality is a serious issue.

Transportation is a major contributor to air emissions and in turn air quality. In addition to GHGs, the primary air emissions from transportation include the following:

Hydrocarbons (HC): Hydrocarbons react in the presence of nitrogen oxides and sunlight to form ground-level ozone, a major component of smog. Ozone irritates the eyes,

[39] Greenhouse gas emissions factors and CO_2 equivalents as supplied by Natural Resources Canada to the Climate Change Process Tables.
[40] Environment Canada website, 2002. (www.ec.gc.ca/air)

damages the lungs, and aggravates respiratory problems. VOCs or **volatile organic compounds** are a form of hydrocarbon.

Nitrogen Oxides (NOx): Nitrogen oxides, like hydrocarbons, are precursors to the formation of ozone. They also contribute to the formation of acid rain.

Carbon Monoxide (CO): Inhaled carbon monoxide reduces the flow of oxygen in the bloodstream and is particularly dangerous to persons with heart disease.

Particulate Matter (PM): This is tiny airborne particles that can carry toxic substances, including heavy metals and chemicals, and cause irritation to the lungs.

Source: Compiled from US Environmental Protection Agency publications [41] and Environment Canada's website (www.ec.gc.ca/emission/2-5e.html).

The basic approach used to estimate air emissions from automobile transportation is similar to that for fuel use. Emissions factors in grams/vehicle-km are applied to the vehicle-km of travel on each link of the road network. Base year emissions factors are developed from the MOBILE 5c Model,[42] which produces emissions rates for different average travel speeds and vehicle types. The emissions factors are based on average travel speeds and do not reflect the impacts of stop-and-go congestion, but are acceptable for planning purposes. Due to a lack of conclusive information on how particulate matter will change, these emissions were not estimated for this report.

Various reports were consulted to determine how emissions rates (in grams per vehicle-km) for automobiles might change between 2000 and 2031.[43] Based on these reports, the following assumptions were made regarding changes in emissions rates between 2000 and 2031:

- NO_x – 82% reduction in emission rate due to stricter standards and lower sulphur gasoline
- VOCs – 75% reduction in emissions rate due to stricter standards and lower sulphur gasoline
- CO – 70% reduction in emission rate due to fleet turnover and lower sulphur gasoline

[41] Automobile Emissions, An Overview, EPA 400-F-92-007, August 1994, Fact Sheet OMS-5
[42] Emissions factors are based on prior work carried out by SENES Consultants Limited which utilized the MOBILE 5C Model. Rates were validated by IBI Group for this study based on a recent report by Environment Canada entitled 1995 Criteria Air Contaminants Emissions Inventory Guidebook (Preliminary Draft), National Emissions Inventory and Projections Task Group (NEIPTG), March 1999.
[43] Reports consulted included Updated Estimate of Canadian On-road Vehicle Emissions for the Years 1995-2020, prepared for Environment Canada by SENES Consultants Limited and Air Improvement Resource, Inc. , July 2001, and the Environmentally Sustainable Transportation Study for the Quebec-Windsor Corridor, prepared by IBI Group for Environment Canada, March 1998.

These changes in emissions rates assume that Canada will fulfil its commitment to align its emissions standards to those of the U.S. The Environmental Protection Agency (EPA) has proposed to introduce new standards, referred to as Tier II standards, which reduce the limits on hydrocarbon (HC) and nitrogen oxide (NO_x) emissions from both cars and light trucks. The proposal is focused largely on NO_x, requiring proportionately greater reductions (as much as 90% below current limits). Since the Tier II standards affect vehicles manufactured after 2004, it is reasonable to assume that by 2031, the majority of the fleet in Canada will have met the Tier II standards.

It is estimated that overall emissions in the study area will decrease in all categories, despite significant increases in vehicle-km of travel under the BAU scenario. Estimated changes in emissions are as follows over the period from 2000-2031:

- NO_x – 68% reduction
- VOCs – 49% reduction
- CO – 35% reduction

Relatively lower reductions are expected for VOC and CO, since these emissions factors increase fairly significantly with lower speeds, whereas NO_x emission rates are relatively constant for speeds between 20 km/hr and 80 km/hr.

It appears likely that the Tier II standards will be adopted as proposed. Projections by others[44] suggest that, if the Tier II standards are not adopted, current Tier I standards would also result in reduction in the above contaminants, for example, by 20% for NO_X and by 42% for VOCs.

Despite anticipated reductions in air contaminants, the BAU Scenario should not be portrayed as one in which air quality is not a concern. For example, the World Health Organization has stated that emissions of Nitrogen Oxides and VOCs need to be reduced by 90% to minimize impacts on human health and eco-toxicity.[45]

3.7 KEY IMPLICATIONS

Some key implications of the transportation findings presented in Chapter 3 are summarized below, including how they may affect individual residents and travellers in the study area:

3.7.1 Transportation System Performance and Cost

- **Automobile Travel:** About 66 % of the 2000 – 2031 population growth and 73% of the employment growth under the BAU scenario is projected to occur in the inner study area, excluding the City of Toronto. Reflecting a continuation of relatively low transit service levels, as assumed under the BAU scenario, residents of this area

[44] E.g., the Analysis and Modelling Group of Environment Canada, November 2000.
[45] World Health Organization, 1996 as quoted in the OECD Report Scenarios for Environmentally Sustainable Transport, Report on Phase 2 of a project on Environmentally Sustainable Transport, PPCG Task Force on Transport, September 1997.

will depend heavily on automobile travel, as will those living in the outer study area. Auto ownership in the study area is projected to increase by about 1.9 million vehicles to 2031.

- **Suburban Transit:** The lack of attractive transit service for many such households under the BAU scenario deprives them of a travel mode choice which might otherwise save the cost of purchasing and operating an additional automobile if, for example, one of the breadwinners could commute by means of transit.

- **Capital Investment:** A public-sector capital investment of about $44 billion, or $1.4 billion per year, is projected for transportation, drawing on a combination of government expenditures and development charges. Of this, about one-quarter is for system expansion; the remaining three-quarters is for system rehabilitation/renewal and will be required regardless of alternative urban structure/infrastructure policies in order to keep the transportation system in a state of good repair.

- **Travel Delays:** Hours of delay experienced by auto drivers on a typical weekday are projected to increase from about 300,000 hours per day to about 1.2 million. At a conservative value of drivers' time of $10 per hour, the total cost of delay to auto drivers in 2031 would be $12 million per day or $3.8 billion per year, the latter up from about $1 billion in 2000.

- **Commuting Times:** The average commuting time spent each month in 2031 by a household located in south-central York Region with two workers, each driving to work, is estimated to be about 38.5 hours in 2031, up from 30.8 hours in 2000, a 25% increase.

- **Commuting Costs:** The average monthly auto operating cost of commuting for a similar household in 2031 is estimated to be $195, up from $144 in 2000, an increase of $51 per month or over $600/year in constant dollars. This is a 35% increase from year 2000 costs. If vehicle ownership costs are included, monthly vehicle ownership and operating costs for both vehicles would total $1,303 in 2031, an increase of 4.1% from $1,252 in 2000.

3.7.2 Community Implications

- **Through Traffic:** A through trip passes through a municipality and uses its transportation infrastructure, thereby placing a non-beneficial burden on the municipality. Considering through trips at the scale of upper-tier municipalities, in 2000 there were approximately 144,000 a.m. peak period through trips or 5.3% of all study area trips. By 2031, UTM through trips are estimated to increase by 85% to 266,000 trips. Peel Region currently has the highest number of through trips at just over 50,000 trips in 2000, growing to about 82,000 by 2031. As discussed in Section 3.6.3, the implications of through traffic increases depend very much on whether or not most of the traffic is carried on trunk facilities which have sufficient capacity to also serve trips by those travelling to or from the "host" municipality as well as through trips. For auto traffic under the BAU, through trips contribute significantly to the congestion levels shown for 2031 in Exhibit 3.18, particularly in communities which are located on high-traffic-volume corridors.

- **Accidents:** As traffic volumes increase, the costs associated with traffic accidents can also be expected to increase; for example, the cost of traffic accidents in the study area, estimated at some $3.8 billion in 2000, is projected to increase to $6.3 billion per year by 2031, an absolute increase of $2.5 billion or approximately $75 per capita.

- **Vehicular Emissions:** Emissions of greenhouse gases (implicated in global climate change) are estimated to increase by 42% between 2000 and 2031 under the BAU scenario. In contrast, vehicular emissions of other major contaminants are projected to decrease significantly, as improved vehicular technology more than compensates for increased vehicle-km of travel: emissions of nitrogen oxides are projected to decrease by 68%, volatile organic compounds by 49%, and carbon monoxide by 35%. Since the former two contaminants are the precursors of urban smog, which is implicated in significant increases in respiratory ailments, this is a promising trend, although the World Health Organization has stated that considerably greater reductions (e.g., 90%) are required to minimize impacts on human health. These findings are based on adoption by the United States and Canada of the Tier II standards proposed by the US Environmental Protection Agency, which will mandate reduced emission rates for all automobiles and light trucks (including sport utility vehicles) manufactured after 2004.

Under subsequent phases of the futures study, Neptis plans to explore the extent to which alternative land use, transportation and other infrastructure scenarios may hold the promise of improved transportation system performance and cost.

4 WATER/WASTEWATER

The history of urban settlement in Central Ontario, as elsewhere, is closely tied to the availability and delivery of portable water and the treatment of wastewater .[46] The existing urban development pattern in the study area has been shaped significantly by the water and wastewater systems that were developed in the region from its earliest days and, more particularly, during the 20th century. Similarly, the water/wastewater system described in this chapter is conceptualized to serve the future urban structure while also helping to shape it by ensuring that this essential service is available where and when required.

4.1 PAST SYSTEM DEVELOPMENT: INNER STUDY AREA

In the Regions of Durham, York, Peel and Halton, and the Cities of Toronto and Hamilton (the inner study area), the development of water and wastewater infrastructure goes back decades.

It began in earnest in the post-war period of the 1950s with the creation of Metropolitan Toronto. In the 1950s and 1960s Metro Toronto undertook a massive program to build an integrated system of Lake Ontario-based water and wastewater treatment plants. The trigger to this undertaking was the creation of a regional governing body (Metro) that could plan, fund, build and operate this large-scale system. By 1965 Metro had invested $150 million in its water and wastewater system, most of it borrowed money with little upper level government funding. By the end of the decade most of Metro was fully serviced with water and wastewater infrastructure, and attention started to focus on the problem of combined sewer overflows, and the need to separate storm from sanitary sewers in the older neighbourhoods. Capital investment in water/wastewater infrastructure dropped at this point.

In the regions surrounding Metro, there was less urgency in the 1950s to establish a major water/wastewater system, except for the southeast part of Peel County next to the Metro border. That changed with ongoing suburban development and the creation of the Ontario Water Resources Commission (OWRC) by the province in the late 1950s. The OWRC became the provincial funding conduit for municipal water/wastewater infrastructure. Through OWRC, the province built the Lakeview sewage treatment plant in southeast Peel in the late 1950s along with some associated trunk sewers. Development pressures continued to the point that the South Peel System was approved in the late 1960s and built in the 1970s, all with provincial dollars.

North of Metro Toronto, in York County, water/wastewater challenges also existed in the 1950s and 1960s. The County's big constraint was it did not border Lake Ontario; therefore, it relied on local groundwater supplies and upstream sewage treatment plants. With the construction of the R.L. Clark water treatment plant in Metro in the late 1960s,

[46] Reference: Richard White, Urban Infrastructure and Urban Growth in the Toronto Region, 1950 to 1990, Neptis Foundation, Draft July 2001.

water supply capacity was made available for York; however, sewage was still a challenge, because the Metro sewer system did not have capacity for the County. Hence, in the late 1960s the York-Durham Sewer System (YDSS) was proposed by OWRC. It was delayed for a number of years as a result of the Province's Toronto-Centred Region plan that was to restrict development north of the Parkway Belt in southern York. With the formation of Regional governments in York and Durham, agreements were consummated for Metro to supply York with water and the YDSS to be built with provincial funding.

Durham County to the east of Metro had its urban centres adequately serviced by lake-based treatment plants, and coverage was expanded following establishment of the YDSS in 1974 to serve western Durham (and southern York Region). The YDSS was completed in the 1970s, fully financed by the province, but, as in Peel, the municipalities paid for its operation, including some of the cost of capital (some capital was forgiven by the province to make the system "affordable" to the municipalities).

The YDSS was the last of the large publicly funded water/wastewater mega-projects in the area. It completed the transition to large lake-based systems from groundwater and upstream systems. During the 1970s and 1980s Halton, Hamilton and eastern Durham continued to develop their lake-based systems. As well, the other regions focused on upgrading and expanding existing plants and systems to service new growth.

Rapid growth in the area during the 1990s continued to cause expansions to the lake based systems. The development of Halton's Urban Structure Plan has opened up north Halton to lake-based servicing. This project was funded by the developments that would benefit from the infrastructure. There are also new agreements between municipal governments to supply growth-related water/wastewater infrastructure, e.g., the new agreement between Peel/York for Peel to supply some of York's future water supply needs.

While much of the focus has been on growth-related infrastructure, the older parts of the water/wastewater systems in the inner study area are now facing critical renewal challenges. As an example, much of the City of Toronto's system is over fifty years old and in need of rehabilitation. New regulations are pushing municipalities to upgrade their water treatment plants. As well, there is pressure to upgrade wastewater plants to improve effluent quality and Toronto is undertaking a Wet Weather Flow Master Plan to address combined sewer overflows and the need for storm water quality improvement to clean up polluted rivers and beaches.

The challenges facing Toronto region's water/wastewater infrastructure today may be somewhat different from those of the past fifty years, but are no less important; it is critical that the systems be upgraded, older infrastructure renewed, and growth accommodated.

4.2 PAST SYSTEM DEVELOPMENT: OUTER STUDY AREA

The urban centres of the outer study area face water/wastewater infrastructure challenges similar to those in the inner study area (i.e., infrastructure renewal, system upgrades, new infrastructure to accommodate growth), but to a lesser extent. Generally, the systems are newer and many upgrades have been undertaken because of the sensitive nature of the sources of water supply and the receiving bodies for wastewater effluent. These activities are likely to be reinforced as a result of the events in Walkerton and recommendations of the resulting inquiry.

Most of the urban centres in the outer study area do not have large lake-based systems like the inner study area, with the exception of the Region of Niagara and southern Northumberland County (Cobourg, Port Hope). Many of them rely (or mostly rely) on groundwater for their water supply, e.g., Barrie, Guelph and Kitchener/Waterloo/ Cambridge (Tri-Cities). Many of the urban centres discharge their treated wastewater effluent to smaller, more sensitive receiving bodies compared to Lake Ontario, e.g., Peterborough to the Otonabee River, Barrie to Lake Simcoe, Guelph to the Speed River, and the Tri-Cities to the Grand River. As a result, they have had to apply a higher level of wastewater treatment compared to cities with large lake-based systems.

With the heavy reliance on limited groundwater resources for water supply, some of the municipalities (e.g., the Region of Waterloo, Guelph) have invested extensively in demand management and groundwater protection.

The Region of Niagara has a number of separate water/wastewater systems serving the various urban centres; it is not an integrated system like that of the Tri-Cities or other urban systems in the inner study area. On a Region-wide basis, adequate capacity would appear to exist; however, some treatment plants are currently at capacity, and will require an expansion to service growth in the local area (e.g., Niagara Falls and Welland wastewater treatment plants).

There are some inter-municipal systems in the outer study area. An example includes the water supply agreement between Collingwood and New Tecumseth. As well, Collingwood is actively seeking to supply other communities along the pipeline route.

4.3 MAJOR INFLUENCING FACTORS: INNER STUDY AREA

The discussion of the inner study area in Section 4.1 identifies a number of major factors that have affected or influenced development of water/wastewater infrastructure. These are briefly described below:

- **Governance Structure:** the creation of regional governments, first Metro Toronto and subsequently the surrounding Regions, was a major factor in infrastructure development, providing the broad geographic scale, expertise and financial resources necessary for an integrated and effective infrastructure development program.

- **Provincial Funding:** the creation of the OWRC made available provincial resources to front-end finance the large lake-based schemes in South Peel and York-Durham. In addition to the write-off of millions in capital for the YDSS, there were also significant provincial subsidies for the scheme.

- **Developer Funding:** in the initial development of the Metro system, developers partially funded the trunk systems; for development in the surrounding regions, developers primarily paid for the local systems. More recently, developers have paid for virtually all growth-related infrastructure.

- **Inter-Municipal Servicing Agreements:** examples of these include the water supply agreements between York Region and Peel Region/City of Toronto and the wastewater agreements between York Region and Peel Region/Durham Region.

- **Environmental Regulation:** regulations affect water and wastewater treatment requirements.

- **Aging infrastructure:** large investments are required to restore older infrastructure to current standards.

4.4 MAJOR INFLUENCING FACTORS: OUTER STUDY AREA

The discussion of the outer study area in Section 4.2 identifies the following major factors that have affected or influenced development of water/wastewater infrastructure:

- **Reliance on Groundwater:** because of the limitations on quantity, and concerns with quality, there has been more investment in demand management and source protection.

- **Sensitive Receiving Bodies:** because of the smaller and more sensitive receiving bodies, these municipalities have built wastewater treatment plants with higher levels of treatment than those of cities with large lake-based systems.

- **Inter-Municipal Servicing Agreements:** examples of these include the water supply agreement between Collingwood and New Tecumseth. Further consolidation of municipal systems is expected among smaller communities to achieve more favourable economies of scale with respect to facilities, operations and management capacity.

- **Environmental Regulation:** regulations affect water and wastewater treatment requirements.

- **Aging infrastructure:** large investments are required to restore older infrastructure to current standards.

4.5 ANALYSIS METHODOLOGY AND ASSUMPTIONS

The following water/wastewater infrastructure assumptions were used for the Business-As-Usual (BAU) scenario. The assumptions are intended to reflect the most realistic future conditions based on historic trends, current practices and the existing policy environment in the inner study area and the outer study area.

- **Treatment trends:** water treatment processes will be upgraded to meet new drinking water protection regulations (Regulation 459), to deal with taste and odour; specific pathogenic bacteria, viruses and parasites; trihalomethanes (THMs); synthetic and volatile organic compounds; and waste residues. This means adding additional on-line monitoring, improving disinfection effectiveness, and adding treatment steps such as ozonation, membrane filtration, powder activated carbon (PAC) and granular activated carbon (GAC), ultraviolet (UV) disinfection, and residues management. With wastewater treatment, there may be a move to add tertiary treatment and expand the use of UV for non-toxic effluent disinfection. Nitrification is being requested by the Ministry of the Environment for plants that are undergoing expansions. It is likely that nitrification will be required at all plants in the future. Biosolids will continue to be incinerated, applied to land and turned into fertilizer (pellets).

- **Environmental protection:** currently there is inadequate protection of the GTA's rivers and shorelines that are being affected by wet weather flows, combined sewer overflows (CSOs) and storm water. The existing older urban areas require infrastructure investment to deal with this problem. For example, the City of Toronto is currently undertaking a Wet Weather Flow Master Plan to deal with this problem over the next 20 to 30 years.

- **Full-cost recovery and system expansion:** a financially sustainable system requires full-cost recovery that encourages water conservation and adequate investment. The introduction of the Sustainable Water and Sewage Systems Act in December 2001 will provide the impetus to accelerate a movement to full-cost recovery and adoption of standard accounting practices. The success of this initiative will depend on the details provided in the regulations, which have not yet been released. Implementation of full-cost recovery during the 30-year projection period is assumed. It is reasonable to anticipate that per capita demand may decline in response to higher prices. This decline has not been quantified in the current study. In qualitative terms, it means that the system expansion (growth-related) costs presented later in the chapter may be conservatively high, since reduced per capita demand may defer the timing and/or extent of required expansions.

- **Reinvestment in existing infrastructure:** it is acknowledged that we are not investing in the sustainable upkeep of existing infrastructure. Some municipalities are taking action in this regard (e.g., Halton's cast-iron watermain replacement program), but it will require large water rate increases. The Sustainable Water and Sewage Systems Act will require municipalities to prepare Asset Management Plans as input to the development of full-cost recovery. This initiative should move the reinvestment process along faster than history has previously demonstrated.

- **Water conservation:** some municipalities have taken proactive steps on demand management, e.g., York Region with leakage control, residential retrofits and industrial water audits. Demand management is generally an integral component of water supply master plans in the GTA. With the implementation of full-cost pricing, per capita water consumption should decline.

- **Small municipal systems:** there will be a move to connect smaller locally serviced systems with septic problems, e.g., King City, into the larger municipal systems, especially where the connection distances are relatively short.

- **Source water protection:** in light of Walkerton, source water protection will increase, especially with groundwater. A number of municipalities already have water protection strategies, e.g., the Region of Waterloo. The Province is now providing $10 million in funding for groundwater protection studies throughout Ontario.

For the Business-As-Usual scenario, capital cost estimates to 2031 were prepared for three water/wastewater system components in the inner study area and the outer study area:

1. **System Renewal Costs:** costs for upkeep of existing infrastructure through rehabilitation and replacement.
2. **System Upgrade Costs:** costs to improve water quality, including upgrades to existing treatment plants, and to address existing combined sewer overflows and existing stormwater discharges to receiving bodies.
3. **Growth-Related Costs:** costs of new infrastructure to service development growth for the 10-year, 20-year and 30-year horizons.

4.6 OUTLOOK TO 2031: INNER STUDY AREA

Preliminary cost estimates for the inner study area are summarized below.

4.6.1 System Renewal Costs

A summary of the estimated annual renewal costs for the water and wastewater systems in the inner study area is provided in the table below followed by the assumptions used:

	TOTAL ASSET VALUE ($millions)	ANNUAL EXPENDITURE ($millions)
Water supply system	$18,500	$240
Wastewater system	$23,500	$340
TOTAL	$42,000	$580

Assumptions:

- Water supply system costs include treatment plants, wells, reservoirs, pumping stations, watermains (trunk and local), hydrants, valves, water services and meters.

- Wastewater system costs include treatment plants, pumping stations, sanitary sewers (trunk and local) and sanitary services.

- In-ground infrastructure (distribution and collection systems) has an expected service life of 75 to 100 years; therefore, an average annual expenditure of approximately one percent of the asset value or slightly more is required to keep the system at a sustainable standard. One percent was assumed.

- Above-ground infrastructure (plants, pumping stations, reservoirs) has an expected service life of 25 to 75 years (depending on the component, i.e., structures last longer than mechanical systems); therefore, an average annual expenditure of approximately two percent of the asset value is required to keep up the system.

- Total asset value information from Durham, Toronto, Halton and Hamilton was used in this analysis; asset values for Peel and York were pro-rated from the information received for the other municipalities.

While specific data on actual expenditures for system renewal are not available, it is widely acknowledged that current spending falls significantly short of the required annual expenditures.

Assuming the above annual expenditure for system renewal is spent each year on average for the next 30 years, the expenditures by decade are as follows:

	COST ESTIMATES (millions)			
RENEWAL COSTS	**2011**	**2021**	**2031**	**Cumulative Total (30 years)**
Water Treatment Plants	$2,400	$2,400	$2,400	$7,200
Wastewater Treatment Plants	$3,400	$3,400	$3,400	$10,200
TOTAL COSTS	$5,800	$5,800	$5,800	$17,400

4.6.2 System Upgrade Costs

Water and Wastewater Treatment Plant Quality Upgrades

A summary of the costs for the water and wastewater treatment plant quality upgrades is provided in the table below, followed by the assumptions used:

PLANT QUALITY UPGRADE COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Water Treatment Plants	$230	$150	$60	$440
Wastewater Treatment Plants	$70	$200	$1,830	$2,100
TOTAL COSTS	$300	$350	$1,890	$2,540

Assumptions:

- Water treatment plant upgrades include meeting new regulatory requirements of Regulation 459 (10-year horizon); taste and odour control using powdered activated carbon (PAC) for all plants (10-year horizon), except post-filter granular activated carbon (GAC) contactors for City of Toronto (20-year horizon); primary disinfection of pathogenic organisms using ultra-violet light (UV) (30-year horizon); and stand-alone residue management (10-year horizon for those plants without any treatment and 30 year horizon for plants with partial treatment of residues). Some municipalities will be utilizing ozone for taste and odour control as a permanent solution instead of, or in conjunction with PAC or GAC (e.g., Region of Halton). Expected long-term costs are similar for these technologies.

- Wastewater treatment plant upgrades include UV for disinfection (10-year horizon), sand filtration for tertiary treatment (30-year horizon) and increased aeration capacity for nitrification (20-year horizon for all plants). Several GTA plants (e.g., Peel) are currently scheduled for expansion in the next 10 years with planned nitrification upgrades, which have been included in the capital growth cost estimates. The increased investment level for the 2021-2031 decade shown for wastewater treatment plants in the previous table reflects the need for sand filtration for tertiary treatment at that time.

Combined Sewer Overflows (CSOs) and Stormwater Discharges

The Cities of Toronto and Hamilton have combined sewer overflow problems and plans to deal with them. The City of Toronto also plans to deal with stormwater discharge problems as part of its Wet Weather Flow Master Plan (currently underway). The estimated costs to address the problems are as follows:

CSO/STORMWATER COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Toronto	$400	$400	$400	$1,200
Hamilton (CSO only)	$160	$40	-	$200
TOTAL COSTS	$560	$440	$400	$1,400

The City of Toronto costs come from an annual estimate of $40 million per year to implement the Wet Weather Flow Master Plan.

The City of Hamilton costs for CSOs come from its Pollution Control Plan. Hamilton has not proposed a stormwater discharge program, and therefore no stormwater discharge costs have been included in the BAU cost estimates.

Total Water/Wastewater System Upgrade Costs

A summary of the total system upgrade costs is provided below:

TOTAL SYSTEM UPGRADE COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Treatment Plants	$300	$350	$1,890	$2,540
CSO & Stormwater Discharges	$560	$440	$400	$1,400
TOTAL COSTS	$860	$790	$2,290	$3,940

4.6.3 Growth-Related Costs

In the inner study area, water supply and wastewater treatment demands are expected to grow by approximately 40% over the next 30 years. System capacities will need to be expanded to meet these growth demands. Exhibit 4.1 shows the existing water and wastewater treatment plants for the inner study area. Exhibits 4.2, 4.3 and 4.4 show the new, expanded and decommissioned water and wastewater treatment plants for the 10-year, 20-year and 30-year horizons, respectively.

As noted in Section 4.5, the increase in water demand and wastewater generation used in this study did not specifically take into account a significant reduction in per capita rates to account for improvements in water efficiency (conservation). The majority of the municipal Master Plans included a water efficiency impact in their forecasts of future needs, and therefore this study reflects those considerations. It is anticipated that, with general increases in water and sewage rates, a higher percentage of new water-efficient plumbing fixtures and aggressive water efficiency programs will be implemented (e.g., Region of York), and the per capita values will reduce over time. The exact impact cannot be readily predicted and the effect on maximum or peak rates is different from that on average rates, where conservation is more recognizable. If conservation is successful, the resulting impact would be a somewhat lower rate of expansion and capital investment than assumed here and/or an increased life for the treatment facilities; this would mean that the cost estimates contained in this report would be higher than would actually be experienced.

Data generated for this study, based on Master Plan information, supports the recognition that municipalities are undertaking plant expansions with shorter design horizons. At the end of the 30-year planning period, the sum of all demands is approximately 80% of the plant capacity, in contrast to about 75% at the beginning of the study period. This is also a recognition that plant expansions are typically undertaken in smaller modules of the original plant capacity than in the past, therefore resulting in less over-capacity.

Exhibit 4.1: Water/Wastewater System: Year 2000

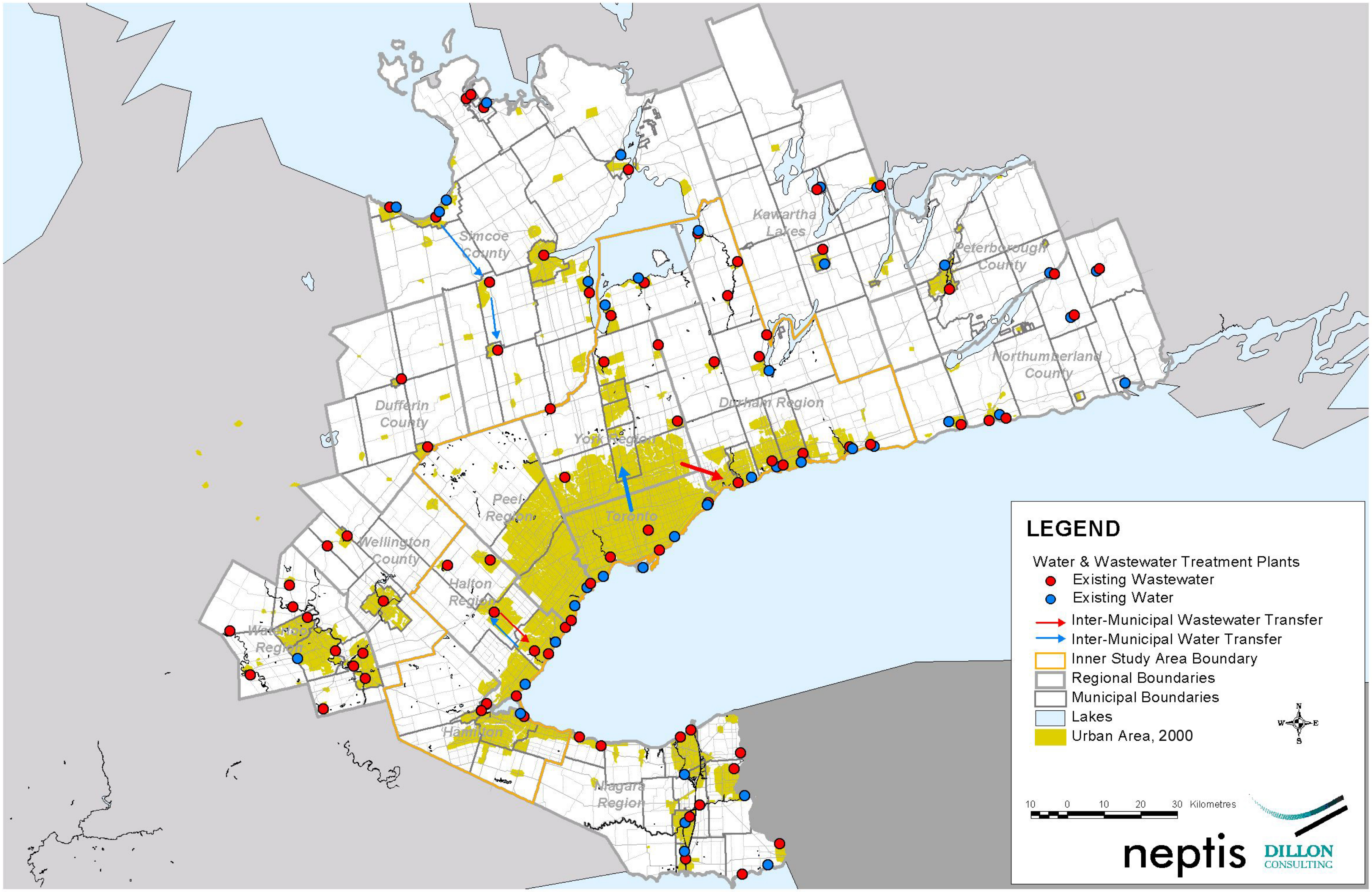


Exhibit 4.2: Water/Wastewater System: Year 2011

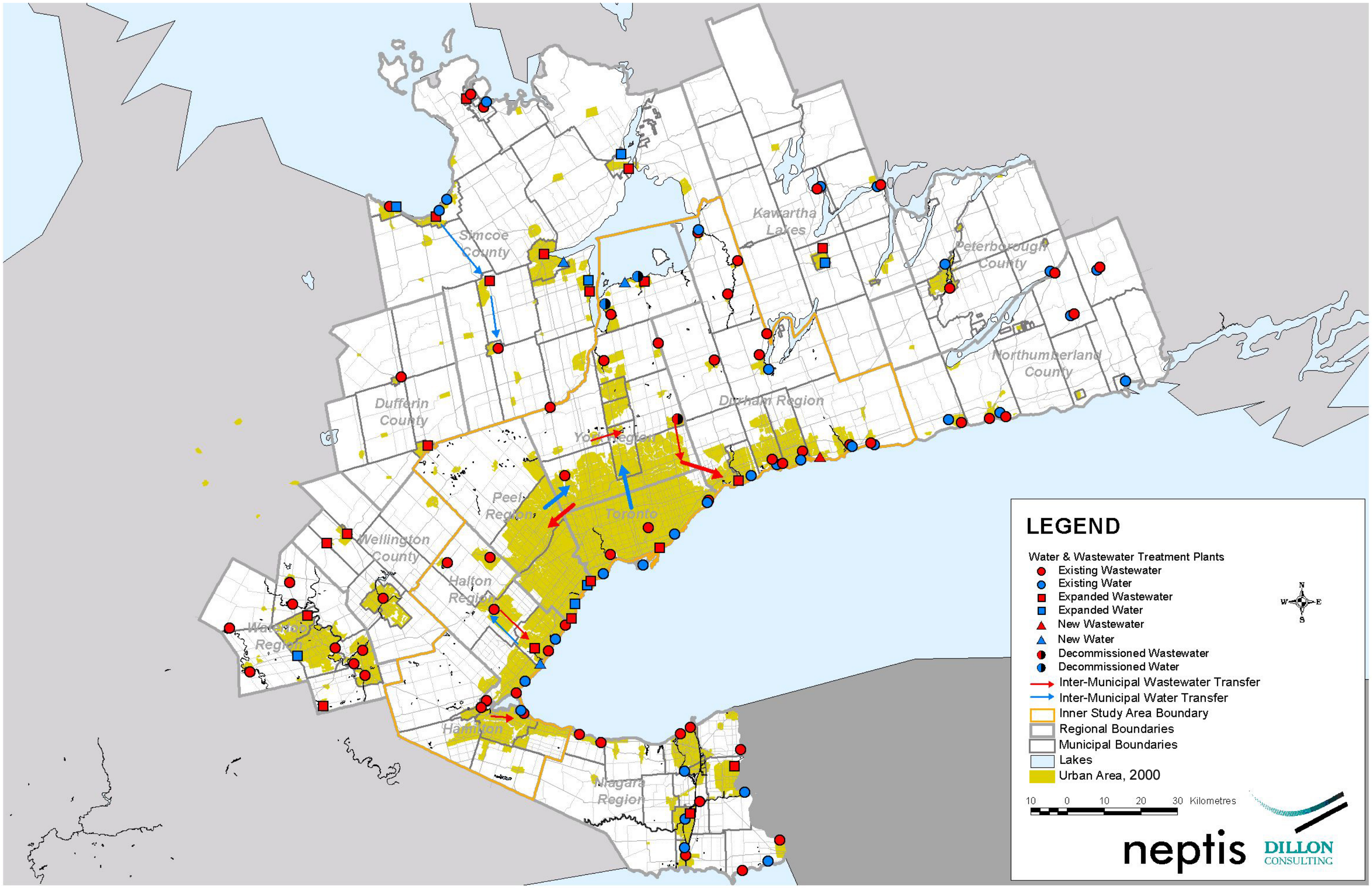


Exhibit 4.3: Water/Wastewater System: Year 2021

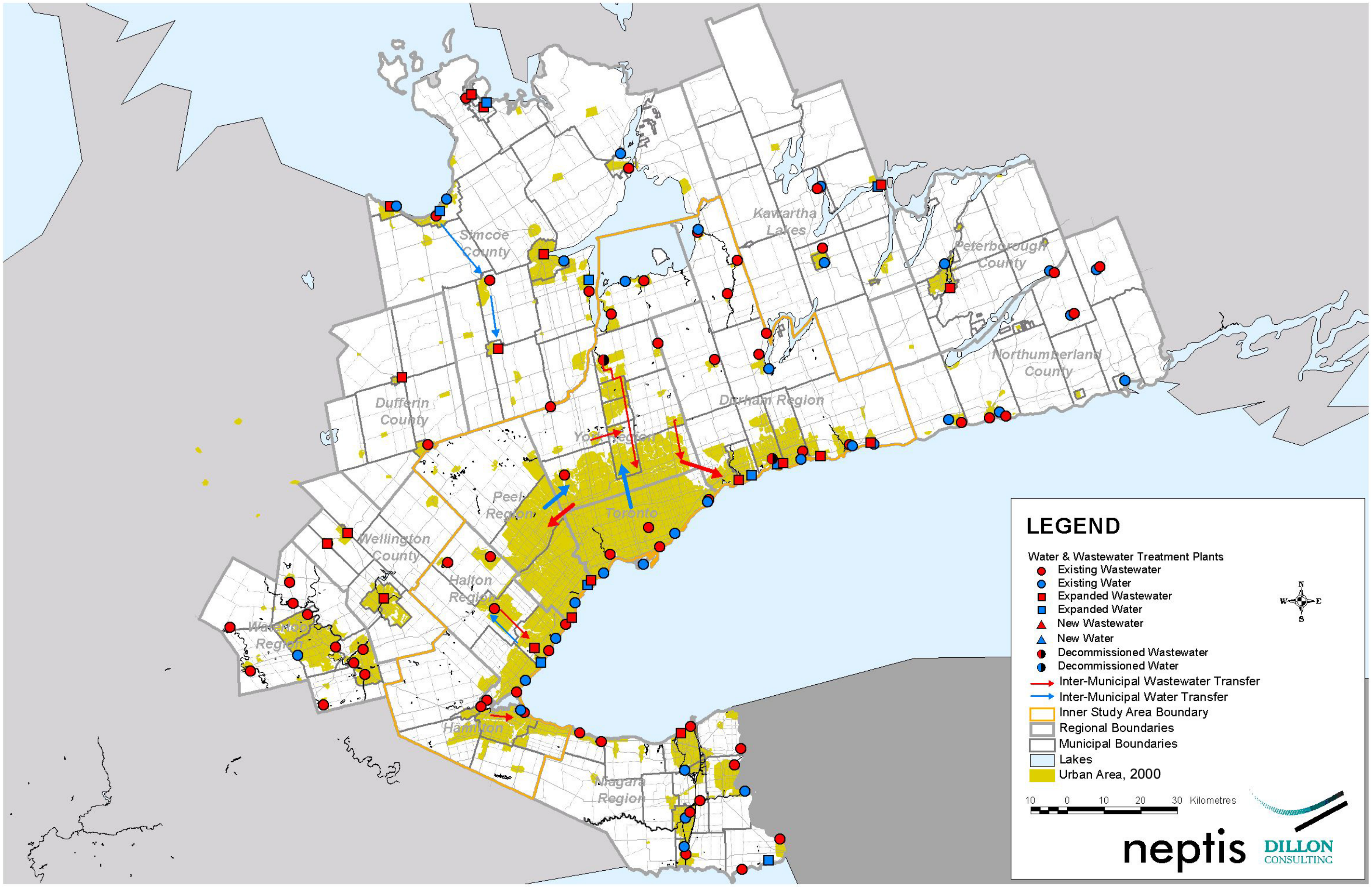
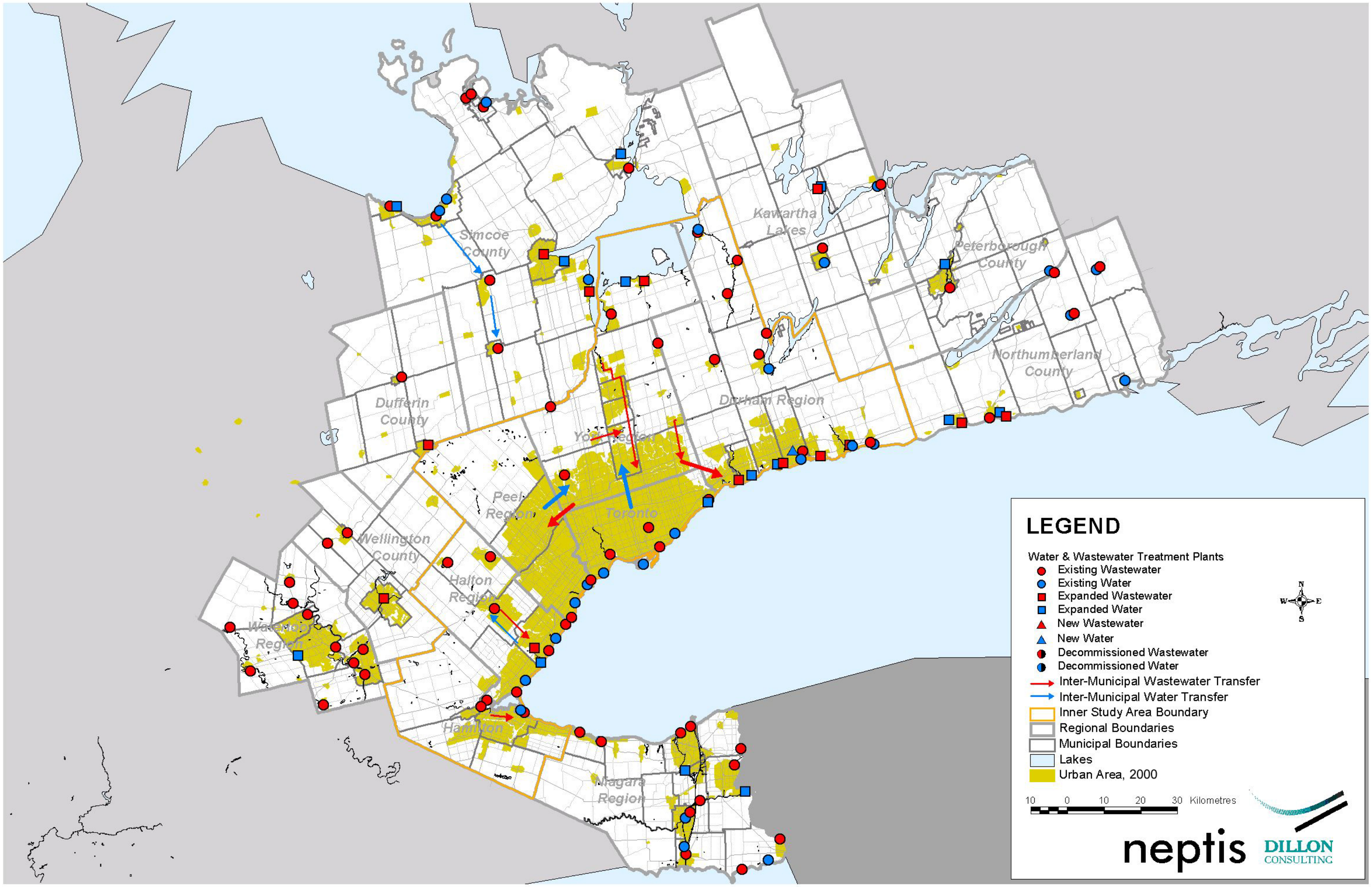


Exhibit 4.4: Water/Wastewater System: Year 2031



The capital cost estimates associated with the system expansions discussed above are summarized in the following table.

GROWTH-RELATED COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Water System	$720	$540	$860	$2,120
Wastewater System	$1,560	$810	$750	$3,120
TOTAL COSTS	$2,280	$1,350	$1,610	$5,240

Capital costs include estimates for treatment plants, pumping stations, water reservoirs, trunk distribution mains and wastewater collection trunks and forcemains. Costs do not include the local water distribution and sewage collection systems, as these are built using private sector funds as part of new land development.[47]

Cost information used in the forecasts was extracted from Master Plan documents for the municipalities and updated for inflation at approximately 3% per year. In some cases, capital budget information was available for a 10-year forecast (Peel) or obtained through interviews held with municipal staff (Halton). Where information was lacking, estimates were prepared based on population growth and unit costs used in other municipalities. In some cases, the estimates contained in the published data were adjusted upwards, where they appeared to be significantly below typical unit costs demonstrated in other communities.

The needs for plant capacity expansions contained in the Master Plans were checked against Ministry of Environment per capita water consumption and sewage generation rates of 750 L per capita per day (Lpcd) and 450 L per capita per day, respectively, multiplied by the projected population in each municipality. No significant deviations were noted, with the exception of the Region of York, which was experiencing higher growth rates than that forecast in its Master Plan for water and wastewater. Additional plant expansion has been included for the Region of York to address this shortfall.

New water treatment plants have been identified as needed for the Regions of Halton, York (Georgina) and Durham. A new wastewater treatment plant has been identified as required for the Region of Durham. The Region of York will receive additional water supply from Peel and additional sewage capacity from Durham (YDSS) and Peel.

[47] Local water distribution and sewage collection systems were included under renewal costs as the existing systems are owned by the municipalities and public sector funds would be used to pay for the system renewal.

4.6.4 Water/Wastewater Cost Summary for the Inner Study Area

The three water/wastewater system cost estimates are summarized below.

	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
System Renewal	$5,800	$5,800	$5,800	$17,400
System Upgrades	$860	$790	$2,290	$3,940
Growth-related	$2,280	$1,350	$1,610	$5,240
TOTAL COSTS	$8,940	$7,940	$9,700	$26,580

The cumulative 30-year cost for the inner study area is $26.6 billion, or almost $1 billion per year.

4.7 OUTLOOK TO 2031: OUTER STUDY AREA

4.7.1 System Renewal Costs

A summary of the estimated annual renewal costs for the water and wastewater systems in the outer study area is provided in the table below followed by the assumptions used:

	TOTAL ASSET VALUE ($millions)	ANNUAL EXPENDITURE ($millions)
Water supply system	$3,900	$70
Wastewater system	$5,700	$100
TOTAL	$9,600	$170

Assumptions:

- Water/wastewater asset value based on assumed value of $5,500 per capita with 40% associated with water supply (these values reflect the greater use of groundwater in the outer study area).

- Annual investment cost is 1.75% of total asset value, reflecting that the outer study area systems typically have less trunk piping, so treatment plant assets are proportionately higher than for larger inner study area systems.

Assuming the above annual expenditure for system renewal is spent each year on average for the next 30 years, the expenditures by decade are as follows:

RENEWAL COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Water Treatment Plants	$700	$700	$700	$2,100
Wastewater Treatment Plants	$1,000	$1,000	$1,000	$3,000
TOTAL COSTS	$1,700	$1,700	$1,700	$5,100

4.7.2 System Upgrade Costs

Water and Wastewater Treatment Plant Quality Upgrades

A summary of the costs for the water and wastewater treatment plant quality upgrades is provided in the table below, followed by the assumptions used:

PLANT QUALITY UPGRADE COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Water Treatment Plants	$105	-	$5	$110
Wastewater Treatment Plants	$15	$190	$155	$360
TOTAL COSTS	$120	$190	$160	$470

Assumptions:

- Water Treatment Plant upgrades have been assumed to include upgrades as required by the updating of the Certificates of Approval, including the requirement for residues management plans (with the exception of Niagara, Waterloo and Collingwood, which already have such facilities at their plants), and the provision of UV disinfection (10-year horizon for majority of groundwater sources and 30-year horizon for Great Lakes based systems). Taste and odour control has been achieved at many of the lake-based plants already.

- Wastewater Treatment Plant upgrades have been assumed to include increased aeration capacity for nitrification, sand filtration for tertiary treatment and UV disinfection at the lake-based plants in Niagara and south Northumberland County. It was assumed that UV would be installed in the 10-year horizon, with nitrification being implemented in the 20-year horizon, while tertiary treatment would be required in the 30-year horizon. The Tri-Cities wastewater plants, in the Region of Waterloo are assumed to require tertiary treatment in the 20-year horizon. The majority of the other plants on more sensitive receivers are assumed to have already been upgraded.

Combined Sewer Overflows (CSOs) and Stormwater Discharges

As an older municipality, the Region of Niagara has combined sewer overflow problems and a wet weather flow control program. The estimated costs to address the problems are as follows:

CSO/ WET WEATHER FLOW COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Niagara	$30	$30	$30	$900
TOTAL COSTS	$30	$30	$30	$90

Niagara's capital program for CSO/wet weather flow control/pollution control for 2002-2011 of approximately $30M has been assumed for the following two decades as well.

Total Water/Wastewater System Upgrade Costs

A summary of the total system upgrade costs in the outer study area is as follows:

TOTAL SYSTEM UPGRADE COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Treatment Plants	$120	$190	$160	$470
CSO	$30	$30	$30	$90
TOTAL COSTS	$150	$220	$190	$560

4.7.3 Growth-Related Costs

In the outer study area, water supply and wastewater treatment demands are expected to grow by approximately 40% over the next 30 years. System capacities will need to be expanded to meet these growth demands. Exhibit 4.1 shows the existing water and wastewater treatment plants for the outer study area. Exhibits 4.2, 4.3 and 4.4 show the new, expanded and decommissioned water and wastewater treatment plants for the 10-year, 20-year and 30-year horizons, respectively.

The per capita generation rates for water demand used in the forecasts are lower than in the inner study area, reflecting a greater reliance on groundwater in the outer study area. Typically, groundwater systems have lower per capita water demands and lower peak factors (e.g., Waterloo, Guelph and Barrie). Water demand was projected based on approximately 670 Lpcd. The wastewater generation rate was projected based on 430 Lpcd; this was not significantly reduced from the Ministry of the Environment value of 450 Lpcd in order to account for infiltration and inflow, which is often a large component of sewage flows and is difficult to effectively reduce. As in the inner study area, water efficiency has not been specifically addressed in the preparation of these estimates, apart from the reductions noted above.

As in the inner study area, data generated for this study supports the recognition that municipalities are undertaking plant expansions with shorter design horizons. At the end of the 30-year planning period, the sum of all demands is approximately 85% of the plant capacity, in contrast to about 75% at the beginning of the study period. This is also a recognition that plant expansions are typically undertaken in smaller modules of the original plant capacity such that somewhat lower levels of excess plant capacity (which generally exists at all times in a study area of this size) are expected to be required in the forecast period.

The capital cost estimates associated with the system expansions discussed above are summarized in the following table.

GROWTH-RELATED COSTS	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Water System	$220	$200	$225	$645
Wastewater System	$230	$250	$270	$750
TOTAL COSTS	$450	$450	$495	$1,395

Capital costs include estimates for treatment plants, pumping stations, water reservoirs, trunk distribution mains and wastewater collection trunks and forcemains. Costs do not include the local water distribution and sewage collection systems as these are built using private-sector funds as part of new land development.

Cost information used in the forecasts was extracted from Master Plan documents for the municipalities (Niagara), and 10-year forecasts (Barrie, Waterloo and Niagara), and were updated for inflation at approximately 3% per year. Where information was lacking, estimates were prepared based on population growth, capacities assuming an 80% utilization factor and unit costs used in other municipalities.

The needs for plant capacity expansions contained in planning information were checked against per capita water consumption and sewage generation rates of 750 L per capita per day (with the exception of Region of Waterloo, Barrie and Guelph, which documented lower rates) and 450 L per capita per day, respectively, multiplied by the projected municipal population levels as listed in Appendix A. No significant deviations were noted, with the exception of the Region of Niagara, which had two wastewater plants at capacity, requiring expansion in the first decade to 2011, although excess capacity exists elsewhere in the Region. These additional plant expansions were included and were reflected in the growth-related cost estimates.

A new water treatment plant has been identified as needed for Barrie and has been included as an addition to the system during the first decade.

4.7.4 Water/Wastewater Cost Summary for the Outer Study Area

The three water/wastewater system cost estimates are summarized below.

	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
System Renewal	$1,700	$1,700	$1,700	$5,100
System Upgrades	$150	$220	$190	$560
Growth-related	$450	$450	$495	$1,395
TOTAL COSTS	$2,300	$2,370	$2,385	$7,055

The cumulative 30-year cost for the outer study area is $7.1 billion, or almost $250 million per year.

4.7.5 Water/Wastewater Cost Summary for Total Study Area

The total water/wastewater costs for the inner and outer study areas are shown below.

	COST ESTIMATES (millions)			
	2011	2021	2031	Cumulative Total (30 years)
Inner Study Area	$8,940	$7,940	$9,700	$26,580
Outer Study Area	$2,300	$2,370	$2,385	$7,055
TOTAL COSTS	$11,240	$10,310	$12,085	$33,635

The cumulative 30-year cost for the total study area is $33.6 billion, greater than $1 billion per year.

4.8 KEY IMPLICATIONS

This analysis of BAU water/wastewater investment requirements over the 30-year period has several key implications:

- The investments are significant at $11.2 billion in the first decade, $10.3 billion in the second and $12.1 billion in the third; this translates to $1,320, $1,080 and $1,150 per capita in the first, second and third decades, respectively.[48] Approximately 80% of the costs are for system renewal and upgrades, which are not unique to the BAU development scenario. As well, when considering the growth-related costs (20% of the total cost), the cost of plant expansions will be common to all development scenarios; therefore, only a relatively small portion of the above total costs will vary

[48] Based on the projected population at the end of the decade in each case.

by development scenario, i.e., the pipes. These account for about 50% of growth-related capital costs.

- In general, investments in the system will become increasingly weighted towards renewing existing infrastructure and upgrading treatment; financing for those types of expenditures will require both higher user fees and related senior government leadership (e.g., the Sustainable Water and Sewage Systems Act and relevant regulations) in order to succeed. Without financing, there would be a continuing and growing problem of deferred renewal and deferred upgrading, leading to increased leakage of water and deterioration of water quality.

- Growth-related expenditures, while significant, are likely to be achieved due to development charges programs. These expenditures may be somewhat lower than presented here owing to the effects of full-cost recovery in moderating per capita demand levels and reducing or deferring system expansion requirements and investment levels.

- The drive to full-cost recovery, higher levels of treatment, groundwater protection and more management expertise will likely spur system consolidation, particularly in the outer study area. The higher levels of treatment have been addressed in the above cost estimates under system upgrades. Again, this will not be unique to the BAU scenario.

The investment will result in a greatly improved water/wastewater system, far more sustainable with adequate renewal expenditures, improved drinking water quality, reduced water consumption, improved water quality in receiving bodies through wet weather flow management and improved wastewater effluent quality, and greater water resource protection (for groundwater especially).

5 SUMMARY OF OBSERVATIONS

This is an interim report that describes and assesses implications of the Business-As-Usual scenario as a basis for establishing the study methodology and providing insights to help subsequent consideration of possible alternative scenarios. As a step in this direction, this chapter presents a summary of key implications regarding urban structure, transportation and water/wastewater respectively, followed by a presentation and brief discussion of key trend measures for the BAU scenario.

5.1 URBAN STRUCTURE: KEY IMPLICATIONS

In 2000, the study area had an estimated population of 7.4 million and employment of 3.5 million. The urbanized land is estimated at just under 586,000 acres (2,370 km^2) thus yielding a gross density (i.e., for population plus jobs) of 18.6 people plus jobs per acre or 45.9 per hectare. The estimated population and employment in 2031 is 10.5 million and 5.4 million respectively. By that time the urbanized land in the overall study area is estimated to total some 850,000 acres (3,440 km^2).

Anticipated growth through the 31 years will occur primarily on designated urban land. Exhibit 2.7 shows the physical extent of projected population and employment growth. Generally, this growth is expected to occur adjacent to already urbanized areas. Key implications associated with such anticipated growth patterns include the following.

5.1.1 Development Densities

Density trends have important implications for land consumption and also in terms of infrastructure requirements and performance. Key findings from Chapter 2 are as follows:

- **Newly Urbanized Land:** Although rising gross residential densities are projected in new suburban developments, and expected in existing urban areas, the density of population and employment for the overall study area will increase very little – from 18.6 to 18.9 people plus jobs per acre (45.9 to 46.5 per hectare) of urbanized land. This is primarily because the greatest population growth is expected in areas with densities that, although rising, are and will remain below the study area average. As well, density declines are expected in many urban shadow communities, as low-density development is expected to occur outside existing relatively compact rural towns and villages.

- **Established Areas:** The only upper-tier municipality showing a substantial increase in density is the City of Toronto, where infill and redevelopment are expected to raise density from 31.7 to 37.7 people and jobs per acre (78.2 to 93.1 per hectare). This is the main reason for the slight rise in the overall density of the study area.

- **Infill and Redevelopment:** Population growth of some 513,000 will be accommodated through infill or redevelopment. This is most prevalent in built-up urban areas, focusing particularly in the City of Toronto. Of the total growth accommodated through infill or redevelopment, 68% is expected to occur in Toronto. This level of infill or redevelopment may be considered conservative when compared to municipal intensification targets; however, it reflects the BAU principles.

5.1.2 Land Consumption and Availability

- **New Urbanized Land:** Over the 31-year timeframe, an estimated 264,000 acres (1,070 km^2) of land will be urbanized. This is almost double the area of the City of Toronto.

- **Land Availability:** In most municipalities, new land already designated as urban in official plans (much of which is currently undeveloped) will be sufficient for urban development until 2021, and in some municipalities until 2031. The region has enough additional land for many more years of urban expansion – if it chooses to continue current development patterns and consumption of non-urban land – even with most of the Oak Ridges Moraine protected from development.

- **Extension of Urban Boundaries:** A number of lower tier municipalities will need to extend their current designated urban boundaries to accommodate anticipated population and employment growth to 2031. In some instances, the anticipated growth relative to designated urban boundaries in a rapidly growing municipality may cause development to occur in adjacent municipalities. In the BAU scenario a relatively small proportion of newly urbanized land was reallocated for this reason as described in Section 2.3.4.

- **Rapid Growth Areas:** The greatest shares of population growth and newly urbanized land – 46.2% and 48.0%, respectively, by 2031 – are expected to occur in rapidly urbanizing municipalities (Type 2). Land consumption per capita in Type 2 municipalities (residential and employment lands) is about 2,500 sq.ft. (288 sq.m) per person plus job, more than three times that of already urbanized municipalities (Type 1).

- **Agricultural Land:** The study area is located within an area which has comparatively high agricultural capability. According to an analysis carried out by the University of Toronto Cartography Department on behalf of the Neptis Foundation, about 92% of the future urbanized land requirement – approximately 244,000 acres (987 km^2) – is Class 1, 2 or 3 agricultural land as classified by the Canadian Land Inventory; about 69% – approximately 181,000 acres (733 km^2) – is Class 1, top-quality, agricultural land. This 181,000 acres is about 7.2% of all the Class 1 agricultural land in the study area which totals about 2.5 million acres (10,200 km^2). Much of the 181,000 acres is located within designated urban boundaries and may or may not be actively farmed at present.

- **Activity Rate:** The activity rate[49] provides an indicator of expected trends in jobs/worker balance. Overall, modest increases are anticipated in the activity rate from .48 to .52. The inner study area has, as expected, slightly higher activity rates relative to the outer study area, suggesting that the six upper-tier municipalities in the inner study area will continue to be dominant in job creation.

- **Trends in the Consumption of Urbanized Land Per Capita:** Declining rates of new urban land consumption per capita are projected over the study period such that, while new urban land is expected to grow in percentage terms more quickly than population during the decade to 2011, the growth rates will be approximately equal in the following decade, and new urban land is expected to grow more slowly than population in the third decade, 2021 to 2031. These projections suggest that there will be a modest trend towards more intense use of land as urbanization proceeds, under the BAU scenario.

5.2 TRANSPORTATION: KEY IMPLICATIONS

Some key implications of the transportation findings presented in Chapter 3 are summarized below, including how they may affect individual residents and travellers in the study area:

5.2.1 Transportation System Performance and Cost

- **Automobile Travel:** About 66 % of the 2000 – 2031 population growth and 73% of the employment growth under the BAU scenario is projected to occur in the inner study area, excluding the City of Toronto. Reflecting a continuation of relatively low transit service levels, as assumed under the BAU scenario, residents of this area will depend heavily on automobile travel as will those living in the outer study area. Auto ownership in the study area is projected to increase by about 1.9 million vehicles to 2031.

- **Suburban Transit:** The lack of attractive transit service for many such households under the BAU scenario deprives them of a travel mode choice which might otherwise save the cost of purchasing and operating an additional automobile if, for example, one of the breadwinners could commute by means of transit.

- **Capital Investment:** A public-sector capital investment of about $44 billion, or $1.4 billion per year, is projected for transportation, drawing on a combination of government expenditures and development charges. Of this, about one-quarter is for system expansion; the remaining three-quarters is for system rehabilitation/renewal and will be required regardless of alternative urban structure/infrastructure policies in order to keep the transportation system in a state of good repair.

[49] The activity rate noted is a derived number based on employment (jobs) divided by population.

- **Travel Delays:** Hours of delay experienced by auto drivers on a typical weekday are projected to increase from about 300,000 hours per day to about 1.2 million. At a conservative value of drivers' time of $10 per hour, the total cost of delay to auto drivers in 2031 would be $12 million per day or $3.8 billion per year, the latter up from about $1 billion in 2000.

- **Commuting Times:** The average commuting time spent each month in 2031 by a household located in south-central York Region with two workers, each driving to work, is estimated to be about 38.5 hours in 2031, up from 30.8 hours in 2000, a 25% increase.

- **Commuting Costs:** The average monthly auto operating cost of commuting for a similar household in 2031 is estimated to be $195, up from $144 in 2000, an increase of $51 per month or over $600/year in constant dollars. This is a 35% increase from year 2000 costs. If vehicle ownership costs are included, monthly vehicle ownership and operating costs for both vehicles would total $1,303 in 2031, an increase of 4.1% from $1,252 in 2000.

5.2.2 Community Implications

- **Through Traffic:** A through trip passes through a municipality and uses its transportation infrastructure, thereby placing a non-beneficial burden on the municipality. Considering through trips at the scale of upper-tier municipalities (UTM), in 2000 there were approximately 144,000 a.m. peak period through trips or 5.3% of all study area trips. By 2031, UTM through trips are estimated to increase by 85% to 266,000 trips. Peel Region currently has the highest number of through trips at just over 50,000 trips in 2000, growing to about 82,000 by 2031. As discussed earlier (Section 3.6.3) the implications of through traffic for the "host" municipality depend on whether most such trips can be accommodated on trunk transportation facilities (e.g., expressways, GO Rail) and on whether or not there is sufficient capacity on those facilities to accommodate through traffic as well as locally generated trips.

- **Accidents:** As traffic volumes increase, the costs associated with traffic accidents can also be expected to increase; for example, the cost of traffic accidents in the study area, estimated at some $3.8 billion in 2000, is projected to increase to $6.3 billion per year by 2031, an absolute increase of $2.5 billion or approximately $75 per capita.

- **Vehicular Emissions:** Emissions of greenhouse gases (implicated in global climate change) are estimated to increase by 42% between 2000 and 2031 under the BAU scenario. In contrast, vehicular emissions of other major contaminants are projected to decrease significantly, as improved vehicular technology more than compensates for increased vehicle-km of travel: emissions of nitrogen oxides are projected to decrease by 68%, volatile organic compounds by 49%, and carbon monoxide by 35%. Since the former two contaminants are the precursors of urban smog, which is implicated in significant increases in respiratory ailments, this is a promising trend, although the World Health Organization has stated that considerably greater reductions are required to minimize impacts on human health.

In a subsequent phase of the futures study, Neptis plans to explore the extent to which alternative land use, transportation and other infrastructure scenarios may hold the promise of improved transportation system performance and cost.

5.3 WATER/WASTEWATER: KEY IMPLICATIONS

This analysis of BAU water/wastewater investment requirements over the three decade study period has several key implications:

5.3.1 System Costs and Performance

The analysis of BAU water/wastewater investment requirements over the study period has several key implications in terms of system costs and performance:

- **Investment Requirements:** The investments are significant at $11.2B in the first decade, $10.3B in the second and $12.1B in the third; this translates to $1,320, $1,080 and $1,150 per capita in the first, second and third decades, respectively.[50] Approximately 80% of the costs are for system renewal and upgrades, which is not unique to the BAU development scenario. As well, when considering the growth-related costs (20% of the total cost), the cost of plant expansions will be common to all development scenarios; therefore, only a relatively small portion of the above total costs will vary by development scenario, i.e., the pipes. These typically account for about 50% of growth-related capital costs.

- **Funding Sources:** In general, investments in the system will become increasingly weighted towards renewing existing infrastructure and upgrading treatment; financing for those types of expenditures will require both higher user fees and related senior government leadership (e.g., the Sustainable Water and Sewage Systems Act and relevant regulations) in order to succeed. Without financing, there would be a continuing and growing problem of deferred renewal and deferred upgrading of the water/wastewater system leading to increased waste of water and potential reduction of water quality.

- **Growth-Related Investments:** Growth-related capital expenditures, while significant, are likely to be achieved due to development charges programs. These expenditures may be somewhat lower than presented in Chapter 4 owing to the effects of full-cost recovery in moderating per capita demand levels and reducing or deferring system expansion requirements and investment levels.

[50] Based on the projected population at the end of the decade in each case.

- **Full-cost recovery:** The drive to full-cost recovery, higher levels of treatment, groundwater protection and more management expertise will likely spur system consolidation, particularly in the outer study area. The higher levels of treatment have been addressed in the above cost estimates under system upgrades. Again, this will not be unique to the BAU scenario.

The investment will result in a greatly improved water/wastewater system, far more sustainable with adequate renewal expenditures, improved drinking water quality, reduced water consumption, improved water quality in receiving bodies through wet weather flow management and improved wastewater effluent quality, and greater water resource protection, for groundwater especially.

5.4 SUMMARY OF FINDINGS

Exhibit 5.1 provides a summary of key findings showing anticipated trends estimated for the Business-As-Usual scenario. This provides an array of some of the more important measures selected from those discussed in the body of the report. These results should be interpreted with caution, because of the uncertainties inherent in all forecasts, and because the results for this scenario are sensitive to the specific set of assumptions on which the scenario is based.

Many of the measures show very large growth during the study period to 2031. These include population (up 43%), employment (up 54%), urbanized area (up 45%), through trips (up 85%), daily trips by adults (up 53%), daily vehicle-km of auto travel (up 64%), a.m. peak period GO Rail ridership (up 58%), car ownership (up 50%), average auto trip time in the a.m. peak (up 45%), a.m. peak period delay per auto trip (up 161%), carbon dioxide emissions (up 42%), fuel consumption (up 44%), GO Transit operating and maintenance costs (up 130%), auto drivers' operating and maintenance costs (up 65%).

Other measures show a substantial downward trend, including a.m. peak period transit modal share for the total study area (down 11%), highway and arterial road lane-km per capita (down 24%), peak period average auto travel speeds (down 25%), nitrogen oxide emissions (down 68%), carbon monoxide emissions (down 35%) and volatile organic compounds emissions (down 49%). Other indicators show smaller degrees of change, either positive or negative.

At this interim stage in the study, the study team has identified the following issues in examining the BAU scenario:

- a large growth in population, employment and related activities, which will result in a significant increase in the urbanized area and related impacts on the uses of rural land including agricultural land;

Exhibit 5.1: Key Measures for the Business-As-Usual Scenario

INDICATORS	2000	2031	Absolute Change	Percent Change
LAND USE				
Population (millions)	7.4	10.5	3.2	43%
Employment (millions)	3.5	5.4	1.9	54%
Activity Rate (employment/population)	0.48	0.52	-	8%
Urbanized Area (thousands of acres)	586	850	264	45%
Gross Density (pop+emp/ acre of urbanized area)	18.6	18.8	-	1%
Through Trips (passing through Upper Tier Municipalities)	144,000	266,000	122,000	85%
TRANSPORTATION				
Transportation Demand				
Adult Daily Trips (millions)	14.07	21.47	7.4	53%
Daily Trips/Adult	2.48	2.65	-	7%
Daily Vehicle-km of Auto Travel (millions)	157	258	101	64%
A.M. Peak Period Transit Modal Share (of motorized trips)				
Toronto	28%	29%	-	4%
Total Study Area	13%	11%	-	-11%
GO Rail	1.5%	2.3%	-	58%
Transportation Supply				
Car Ownership (millions of passenger vehicles)	3.72	5.60	1.9	50%
Car Ownership per 1000 capita	506	531	0%	5%
Arterial and Highway Lane-km	47,600	52,000	4,400	9%
Arterial and Highway Lane-km per 1000 capita	6.47	4.94	0%	-24%
A.M. Peak Period Transit Seat-km per capita				
Municipal Transit and GO Bus	1.34	1.25	-	-6%
GO Rail	1.02	1.43	-	40%
Transportation Performance				
A.M. Peak Period Average Auto Trip Length (km)	15.6	16.9	-	9%
A.M. Peak Period Average Auto Trip Time (min)	15.3	22.2	-	45%
A.M. Peak Period Average Auto Travel Speed (km/h)	61	46	-	-25%
A.M. Peak Period Delay per Auto Trip (min)	3.6	9.3	-	161%
A.M. Peak Period Transit Trip Length (excl. GO Rail) (km)	11.0	12.1	-	10%
Average Monthly Household Commuting Time (h)	30.8	38.5	7.7	25%
Average Monthly Household Commuting Costs ($)	144	195	51	35%
Environmental Impact				
Annual Emissions and Fuel Use from Passenger Automobiles				
Nitrogen Oxides (kilotonnes of No_x)	69.5	22.5	(47.0)	-68%
Carbon Monoxide (kilotonnes of CO)	437.2	283.1	(154.2)	-35%
Volatile Organic Compounds (kilotonnes of VOCs)	51.1	26.0	(25.1)	-49%
Carbon Dioxide (kilotonnes of CO_2 equivalents)	10,870.9	15,455.5	4,584.6	42%
Fuel (billions of litres)	4.4	6.3	1.9	44%
Transportation Expenditures (2000 $millions)				
Annual Operating and Maintenance Costs				
Roads and Highways	469	510	41	9%
Municipal Transit	193	249	56	29%
GO Rail	40 *	92	52	130%
Auto drivers	4,580	7,510	2,930	65%

EXPENDITURES (2000 $millions)	Total Investment	Average/ Year
TRANSPORTATION		
Capital and Rehabilitation Costs (2000 - 2031)		
Roads and Highways	30,000	970
Municipal Transit	9,500	307
GO Rail	4,300	141
TOTAL	43,800	1,418
WATER AND WASTE WATER		
System Investment Costs (2000-2031)		
System Renewal	22,500	723
System Upgrades	4,500	144
Growth-Related Expansion	6,600	212
TOTAL	33,600	1,080.00

* Note that this value is not the actual 2000 value, as the actual value for this year was found to be inconsistent with other recent values. The value presented here represents annual spending throughout the mid- to late-1990s.

- the proliferation of relatively low-density, single-use areas on newly urbanized lands which are difficult to serve cost-effectively by transit, walking or cycling and require automobile use;

- as a result, and reflecting the substantial growth of population, jobs and car ownership, major increases in automobile travel, with reductions in municipal transit ridership and in modal choice available to travellers;

- increases in commuting and other travel times and costs due to increasing travel distances and congestion, thus affecting the region's economic competitiveness as goods movement times and costs also increase due to automobile congestion;

- major continuing pressures on limited local governmental funding sources and development charges for capital funding of transportation and water/wastewater infrastructure – estimated to total some $77 billion over the period to 2031 – of which about three-quarters (some $59 billion) is required for system rehabilitation, renewal and upgrading, and the remainder (some $18 billion) for growth-related investments. While the latter is driven primarily by overall growth in population and employment, it would also be subject to change if alternative urban structure and infrastructure policies were put in place rather than the BAU assumptions considered in this report.

These issues raise questions regarding the extent to which land consumption for urban development might be reduced by greater reliance on redevelopment in existing built-up areas and more compact, mixed-use subcentres and corridors in designated parts of developing areas. Related to this is the question of the extent to which auto-dependency may be reduced, the choice of alternative modes increased and transportation efficiency improved through such development strategies and patterns integrated with significantly improved transit in key corridors.

A key question in this regard is the extent to which alternative land use and infrastructure policies might help to effect such changes and the performance and cost implications of attempting to implement these policies.

For example, as noted earlier, the Business-As-Usual scenario is based on the assumption that government capital expenditures on transportation will continue in future at approximately the same levels as in the recent past. On the other hand, levels of capital investment for the water/wastewater system are assumed to be higher in future, reflecting heightened awareness of water quality issues in the wake of the Walkerton events, recommendations from the Walkerton Inquiry for system renewal and upgrading, and recent provincial legislation to achieve full-cost recovery which would help fund these improvements. In theory, it would have been possible to assume capital investment increases in transportation as well, but the study team concluded that a continuation of existing funding arrangements and investment levels – in the absence of legislative changes or other initiatives signalling a more comprehensive approach to funding transportation in the study area – is more in keeping with the expectations under BAU. Clearly, either of these assumptions could be changed: higher levels of investment in transportation and/or lower levels of investment in water/wastewater could be assumed, and these would have implications in terms of the performance and cost of the infrastructure systems. The team has concluded that the assumptions and results presented in this report are in line with the premises of the BAU scenario and constitute a useful benchmark against which to consider possible alternative policy scenarios. It seems quite likely that any alternative scenarios considered will involve different levels of capital investment in infrastructure, among other differences from the BAU scenario.

The next stage of the study, as being considered by Neptis, would focus on defining two or three alternative development and infrastructure concepts and comparing them with the BAU concept in terms of the measures presented in this interim report. The intent will be to compare the performance of the alternatives in terms of land use characteristics and infrastructure performance and costs, using the BAU scenario as a benchmark. In the meantime, the findings of this report provide food for thought on these aspects of the urban region as it might be in 2031 based on a continuation of Business-As-Usual.

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APPENDIX A

Historic and Projected Population and Employment

- **Inner Six Upper-Tier Municipalities**
- **Prototype Communities**

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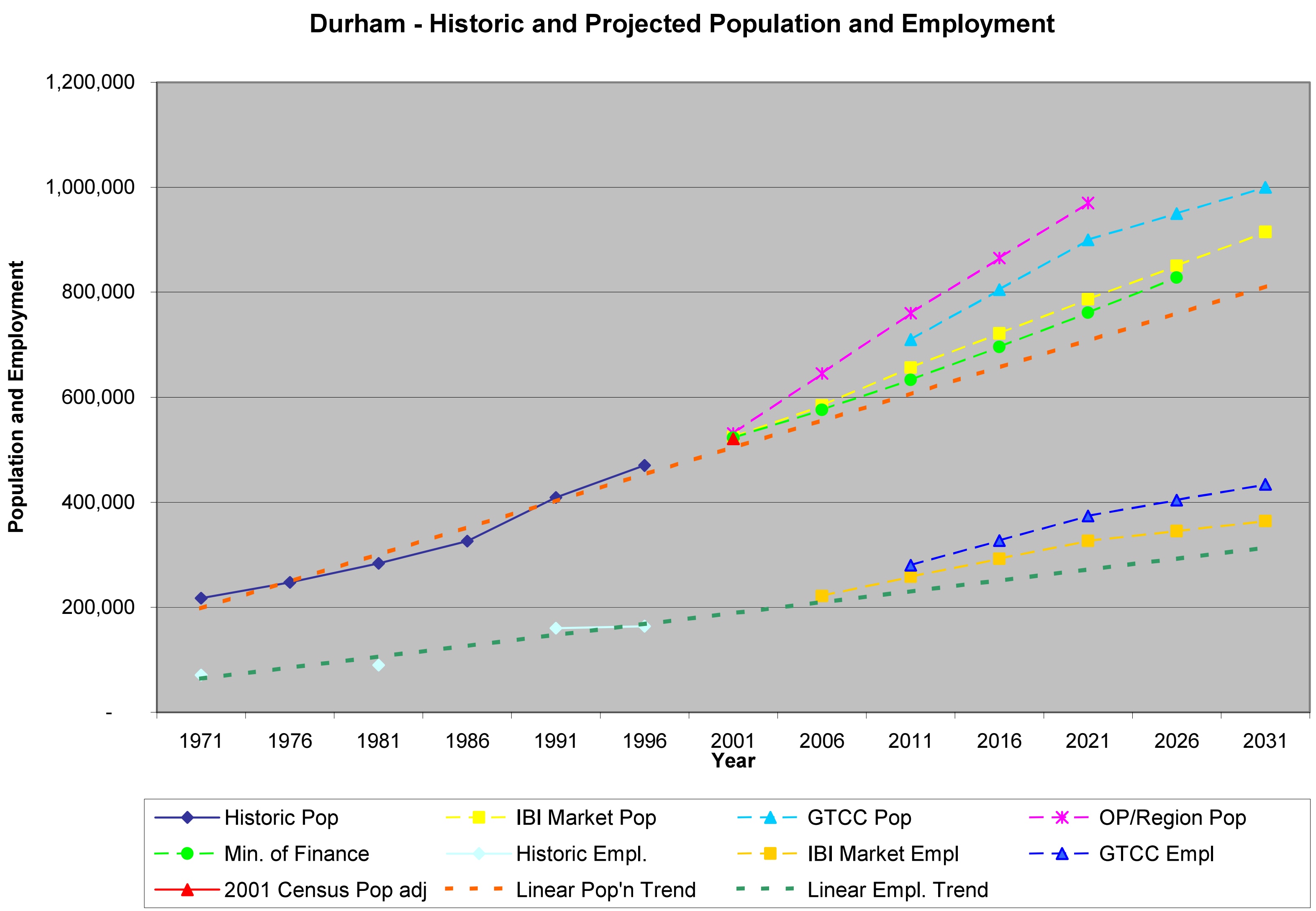
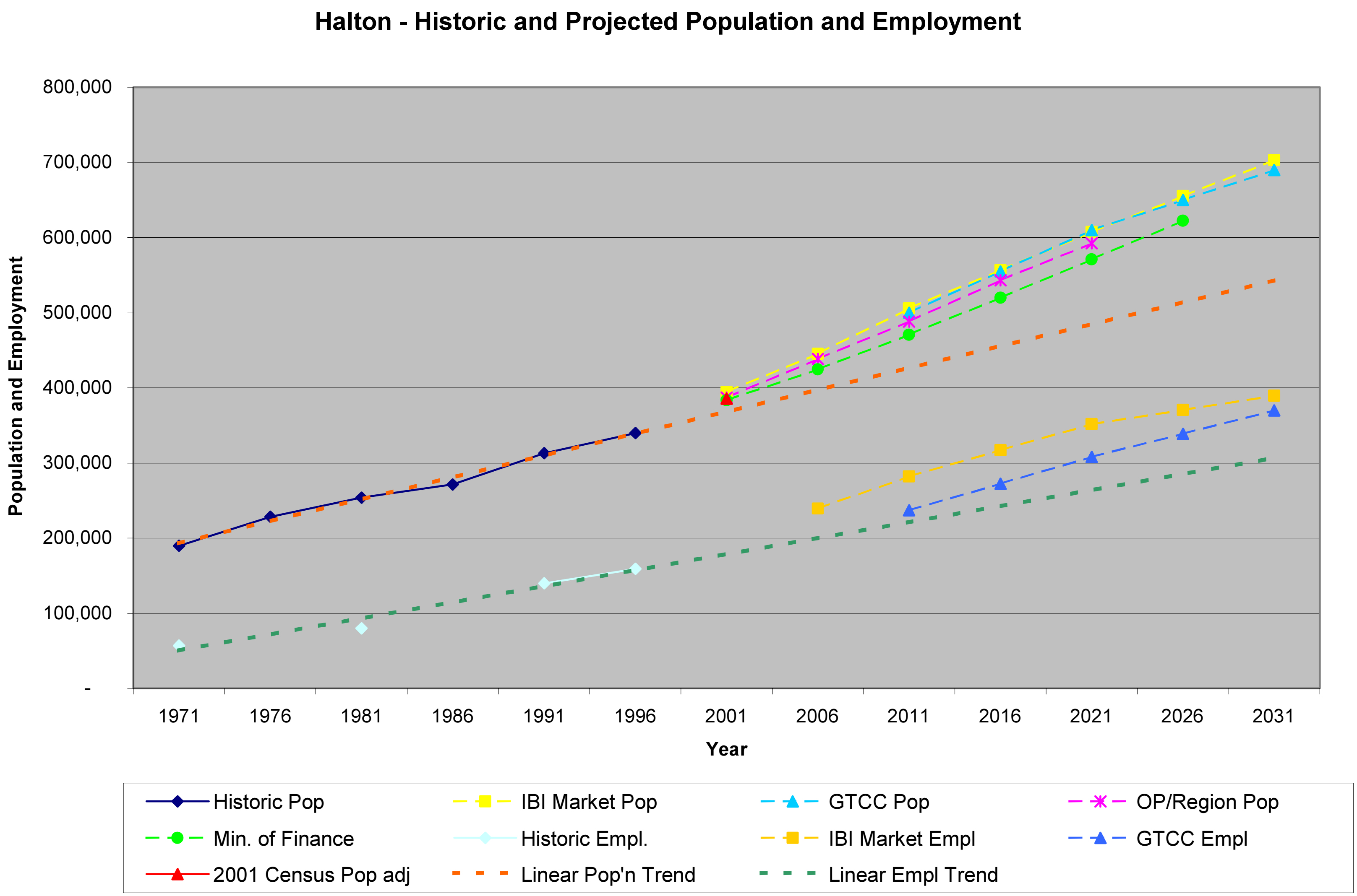
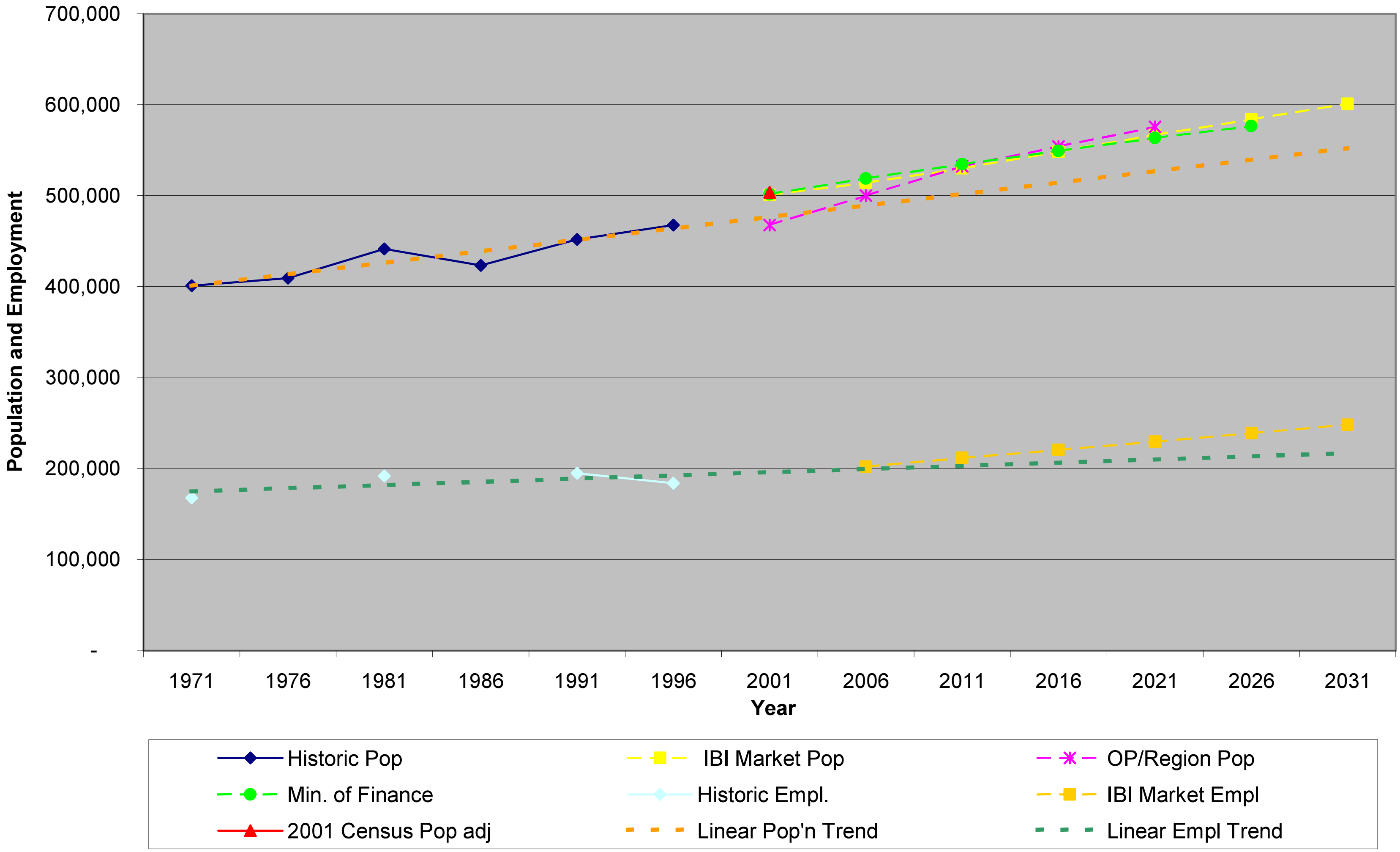
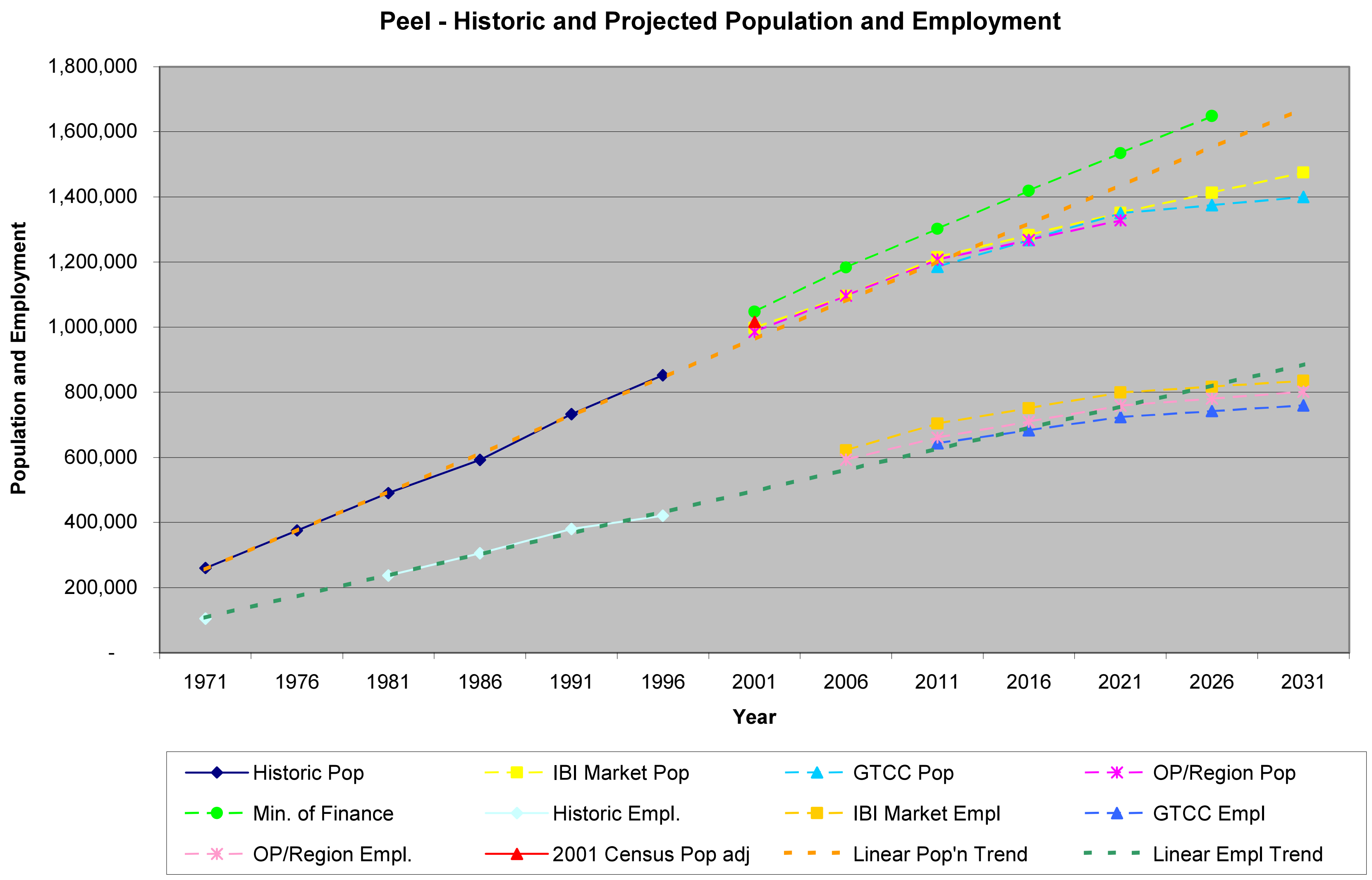
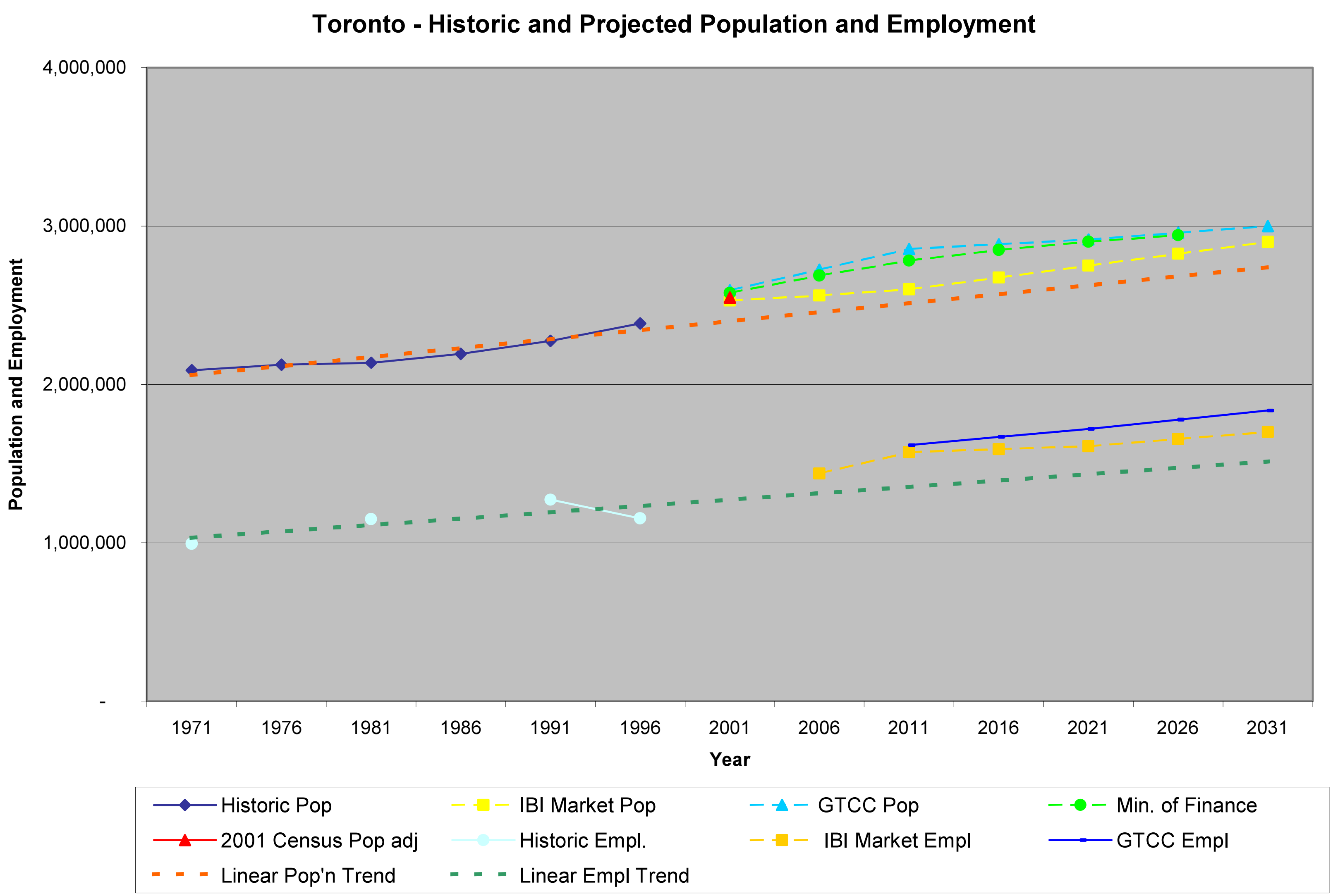

Durham - Historic and Projected Population and Employment
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
IBI Market Pop
GTCC Pop
OP/Region Pop
Min. of Finance
Historic Empl.
IBI Market Empl
GTCC Empl
2001 Census Pop adj
Linear Pop'n Trend
Linear Empl. Trend


Halton - Historic and Projected Population and Employment
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
IBI Market Pop
GTCC Pop
OP/Region Pop
Min. of Finance
Historic Empl.
IBI Market Empl
GTCC Empl
2001 Census Pop adj
Linear Pop'n Trend
Linear Empl Trend

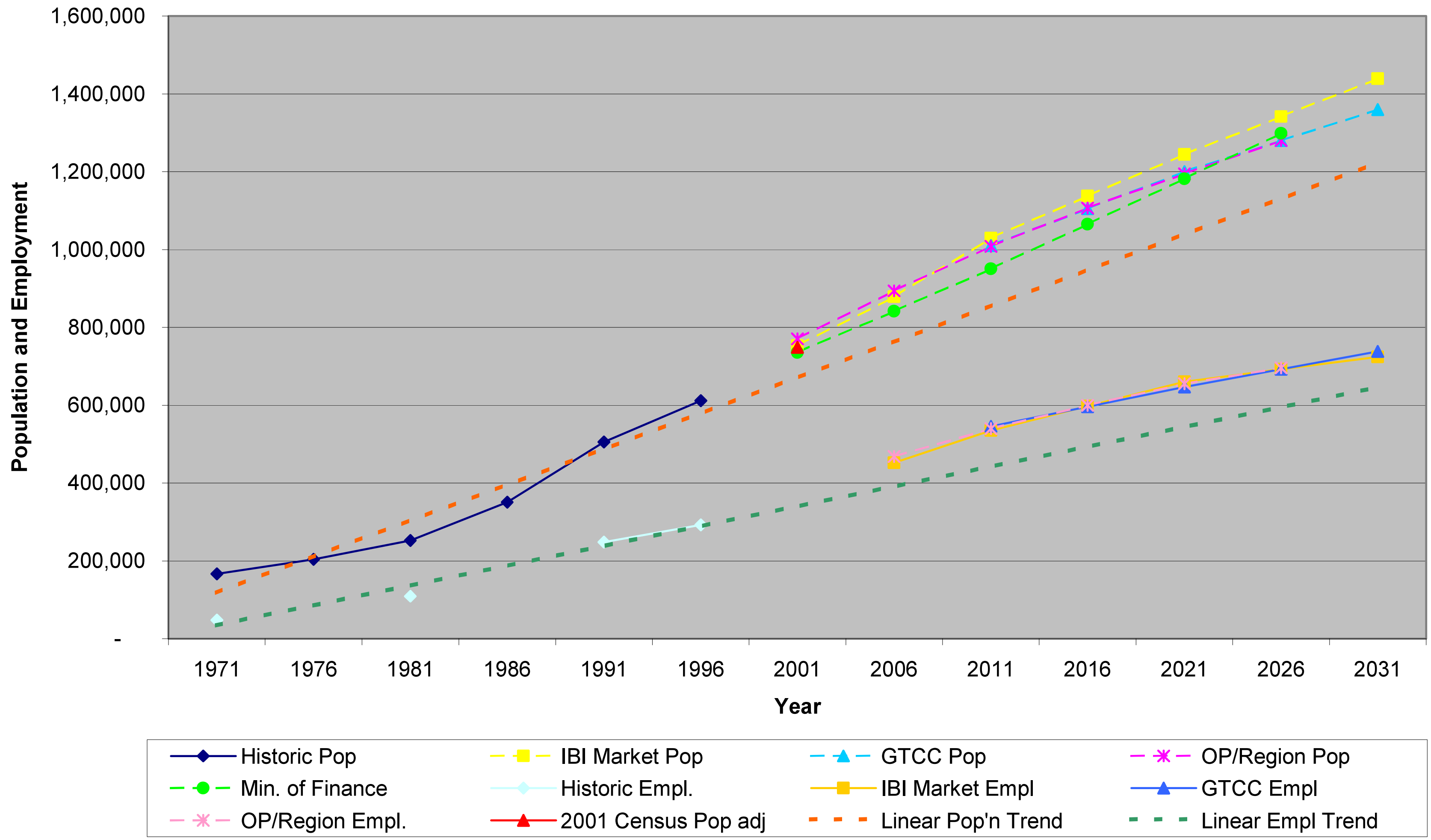
Hamilton - Historic and Projected Population and Employment

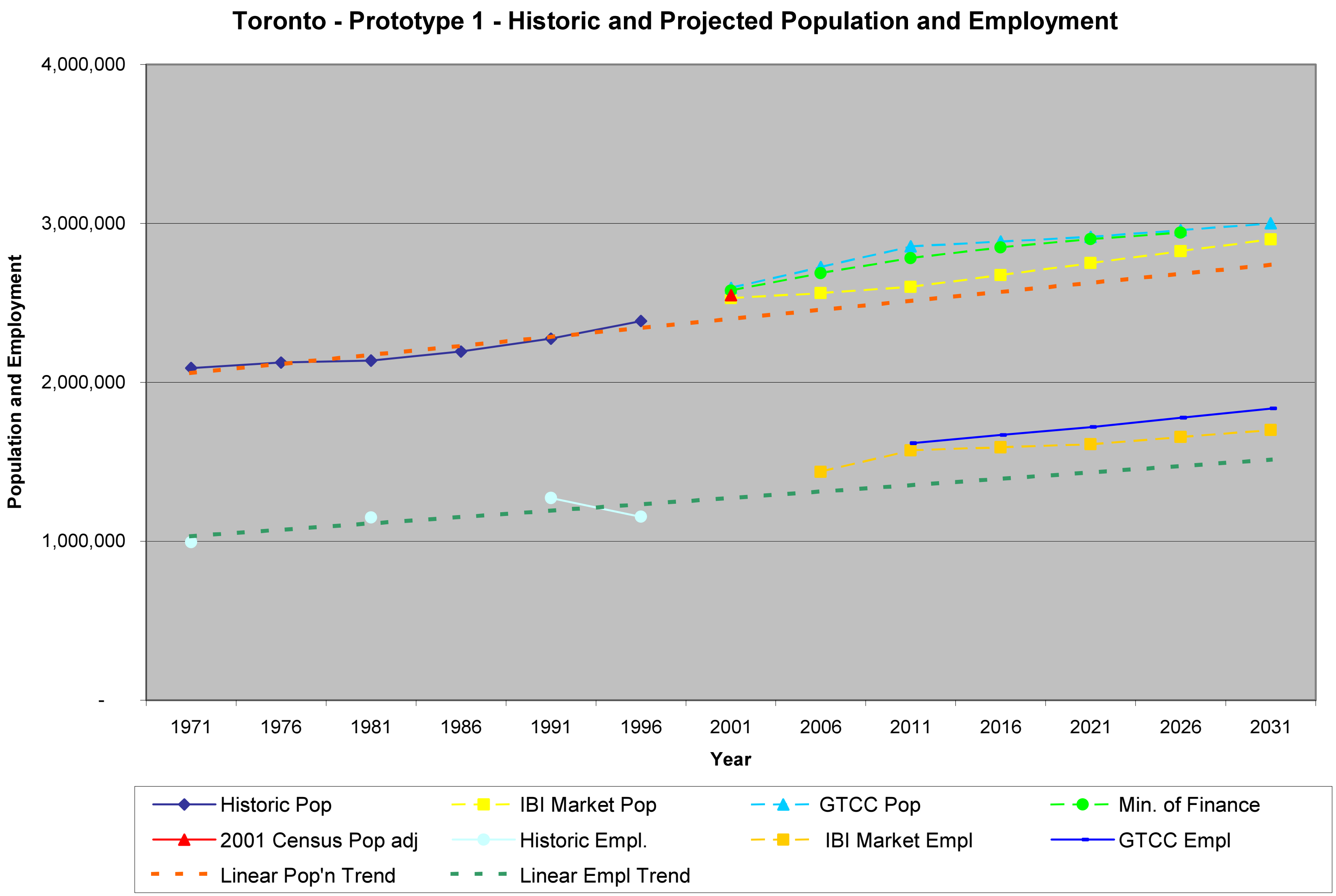


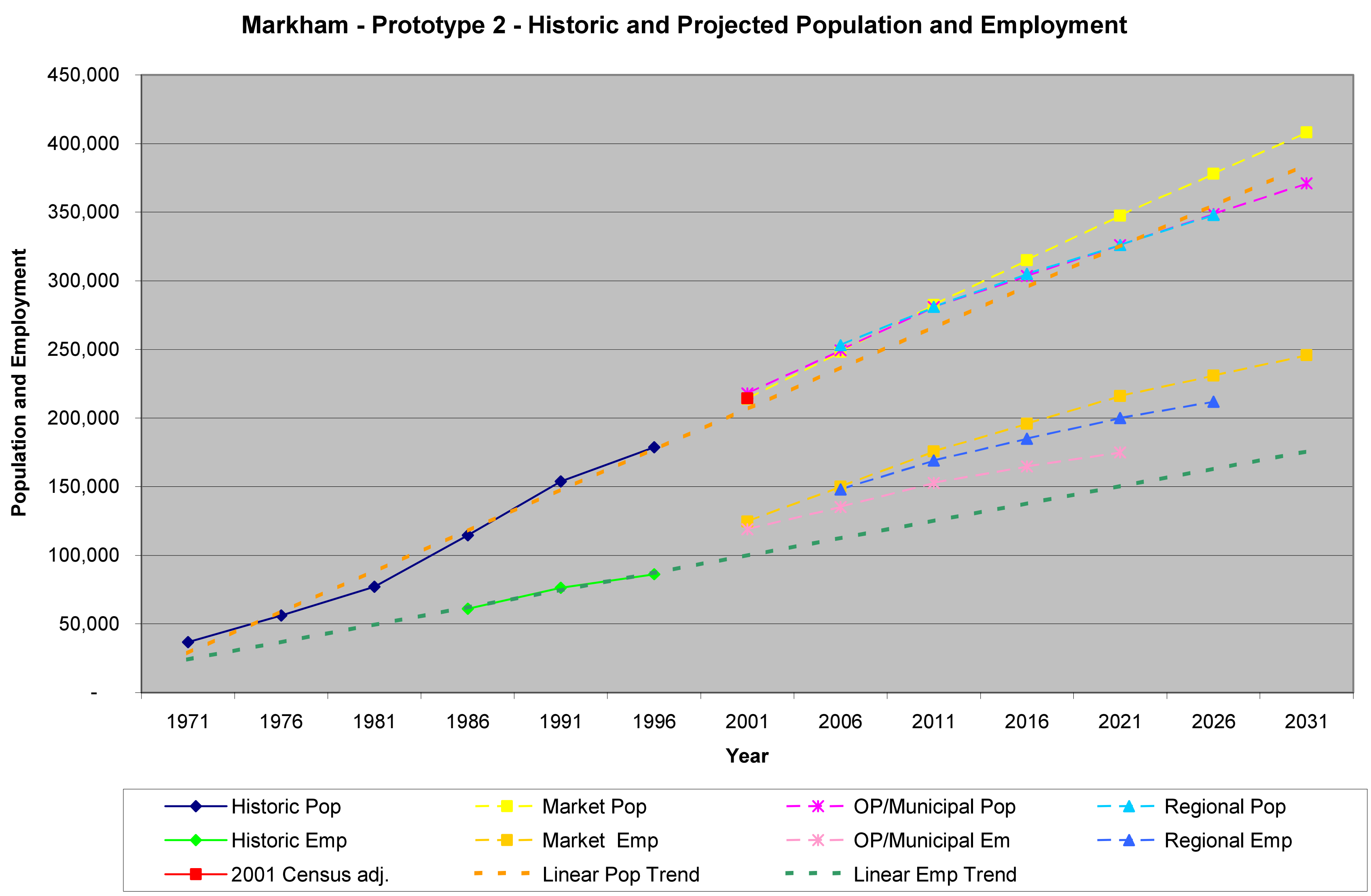

Peel - Historic and Projected Population and Employment
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
IBI Market Pop
GTCC Pop
OP/Region Pop
Min. of Finance
Historic Empl.
IBI Market Empl
GTCC Empl
OP/Region Empl.
2001 Census Pop adj
Linear Pop'n Trend
Linear Empl Trend

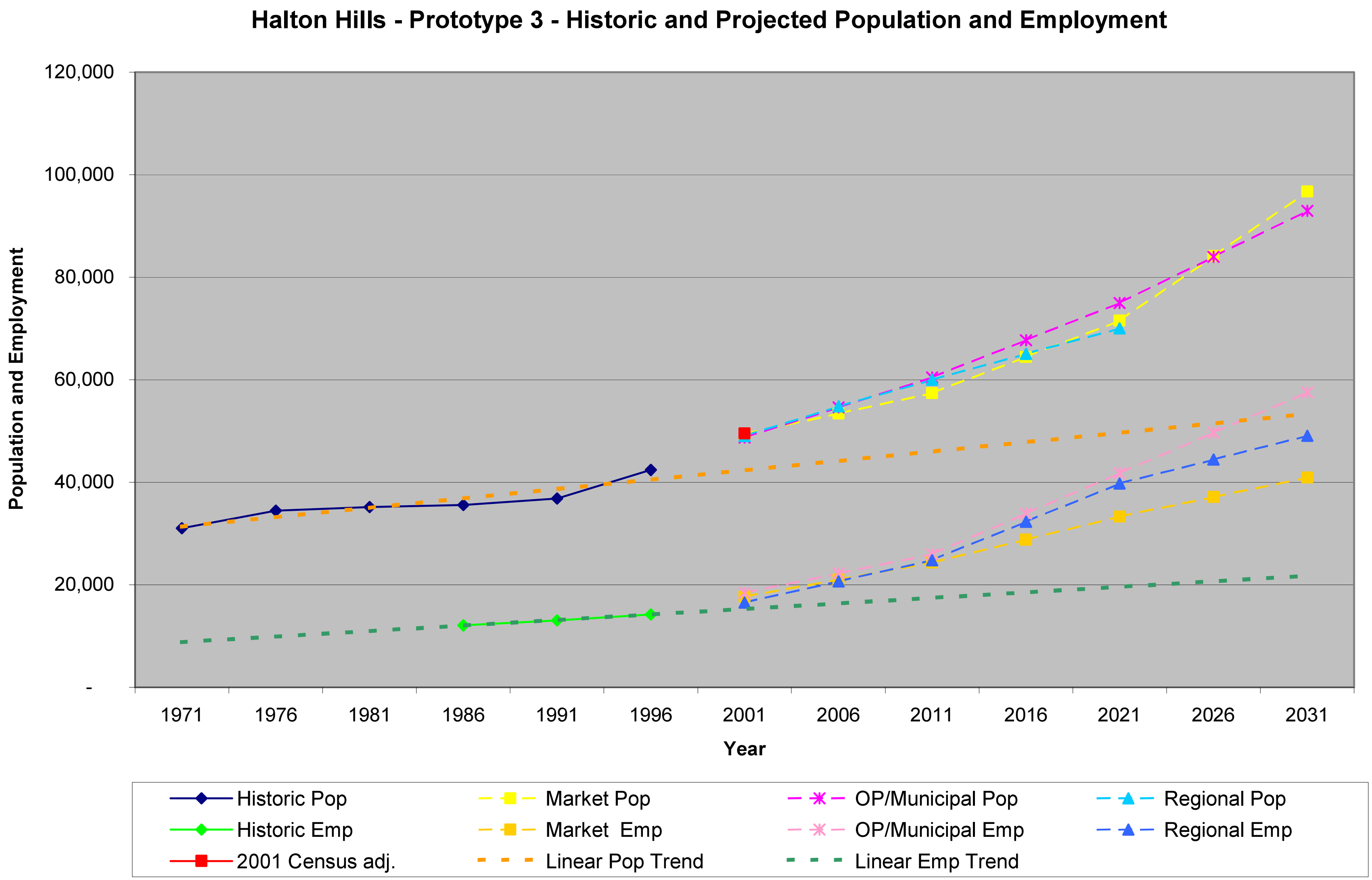

Toronto - Historic and Projected Population and Employment
4,000,000
3,000,000
2,000,000
1,000,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
IBI Market Pop
GTCC Pop
Min. of Finance
2001 Census Pop adj
Historic Empl.
IBI Market Empl
GTCC Empl
Linear Pop'n Trend
Linear Empl Trend

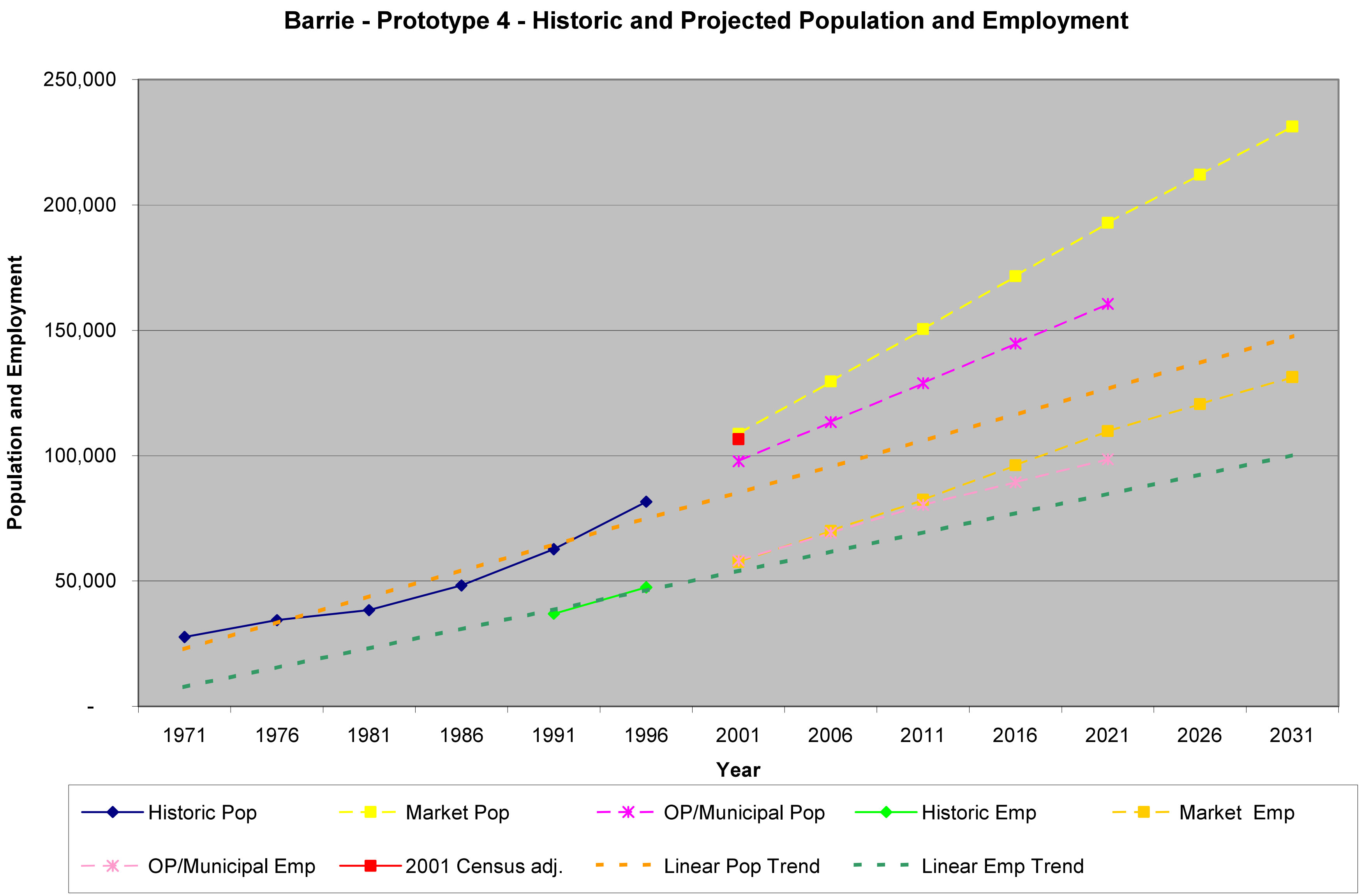
York - Historic and Projected Population and Employment



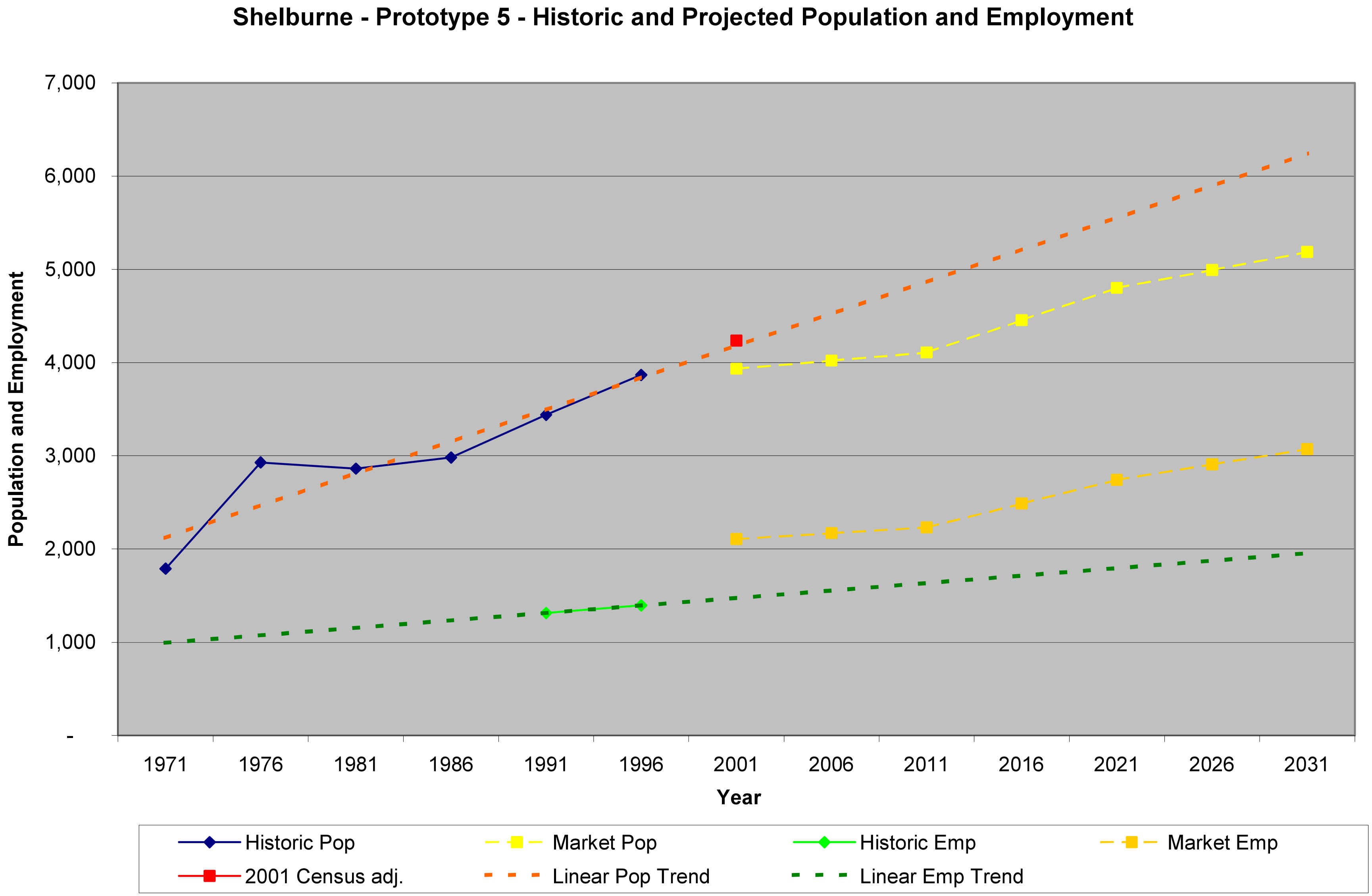

Toronto - Prototype 1 - Historic and Projected Population and Employment
4,000,000
3,000,000
2,000,000
1,000,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
IBI Market Pop
GTCC Pop
Min. of Finance
2001 Census Pop adj
Historic Empl.
IBI Market Empl
GTCC Empl
Linear Pop'n Trend
Linear Empl Trend


Markham - Prototype 2 - Historic and Projected Population and Employment
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
Market Pop
OP/Municipal Pop
Regional Pop
Historic Emp
Market Emp
OP/Municipal Em
Regional Emp
2001 Census adj.
Linear Pop Trend
Linear Emp Trend


Halton Hills - Prototype 3 - Historic and Projected Population and Employment
120,000
100,000
80,000
60,000
40,000
20,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
Market Pop
OP/Municipal Pop
Regional Pop
Historic Emp
Market Emp
OP/Municipal Emp
Regional Emp
2001 Census adj.
Linear Pop Trend
Linear Emp Trend



Barrie - Prototype 4 - Historic and Projected Population and Employment
250,000
200,000
150,000
100,000
50,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
Market Pop
OP/Municipal Pop
Historic Emp
Market Emp
OP/Municipal Emp
2001 Census adj.
Linear Pop Trend
Linear Emp Trend


Shelburne - Prototype 5 - Historic and Projected Population and Employment
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
Population and Employment
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021
2026
2031
Year
Historic Pop
Market Pop
Historic Emp
Market Emp
2001 Census adj.
Linear Pop Trend
Linear Emp Trend

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APPENDIX B

Input Assumptions and Estimates of Additional Urbanized Land

(a) Projected Population & Employment

(b) Community Typology and Estimates of Additional Land Requirements

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(a) Projected Population and Employment

	Growth Forecast							
	00 pop	00 emp	11 pop	11 emp	21 pop	21 emp	31 pop	31 emp
City of Toronto	2,523,547	1,300,000	2,600,000	1,573,000	2,750,000	1,610,000	2,900,000	1,700,000
York Region								
Region Total	727,313	368,700	1,029,627	535,300	1,244,707	660,400	1,438,765	724,440
Peel Region								
Region Total	977,510	540,700	1,214,535	703,800	1,351,754	799,100	1,474,823	835,147
Halton Region								
Region Total	384,597	196,800	505,900	281,900	607,373	351,900	703,119	389,509
Durham Region								
Region Total	512,332	185,200	656,738	258,300	786,366	326,400	914,693	364,304
GTA Total	**5,125,300**	**2,591,400**	**6,006,800**	**3,352,300**	**6,740,200**	**3,747,800**	**7,431,400**	**4,013,400**
New City of Hamilton								
New City Total	498,120	192,372	530,154	211,717	566,794	229,626	601,131	248,253
GTA + New City of Hamilton	**5,623,420**	**2,783,772**	**6,536,954**	**3,564,017**	**7,306,994**	**3,977,426**	**8,032,531**	**4,261,653**
Niagara Region								
Region Total	422,797	177,501	443,806	198,779	481,851	206,783	510,306	220,508
Waterloo Region								
Region Total	450,940	223,102	514,830	275,190	569,904	335,134	621,966	386,612
Dufferin County								
County Total	51,000	16,091	60,000	21,002	74,000	26,000	87,999	29,999
Northumberland County								
County Total	87,001	33,181	94,999	38,799	103,000	42,098	110,002	44,601
Peterborough County (Part Only)								
County Total (Part Only)	117,349	53,243	126,518	59,420	135,689	63,855	143,943	67,106
Simcoe County								
County Total	380,870	147,700	476,970	193,990	579,420	242,090	681,300	282,380
City of Kawartha Lakes (Victoria County)								
County Total	73,000	22,040	85,000	29,000	100,000	34,000	115,000	38,800
Wellington County (Part Only)								
County Total (Part Only)	153,634	78,098	182,743	94,017	207,001	106,532	229,642	117,683
Non-GTA/Hamilton Total	**1,736,591**	**750,957**	**1,984,866**	**910,196**	**2,250,865**	**1,056,492**	**2,500,159**	**1,187,689**
GRAND TOTAL	**7,360,011**	**3,534,729**	**8,521,820**	**4,474,213**	**9,557,859**	**5,033,918**	**10,532,690**	**5,449,342**

(b) Community Typology and Estimates of Additional Land Requirements

		Community Typology Code	2000-2031 New Land Required Acres Total	Sq. Km. Total
City of Toronto		1	1,225	4.96
York Region				
C	Vaughan	2	19,500	78.92
T	Aurora	2	3,009	12.18
T	East Gwillimbury	3	4,752	19.23
T	Georgina	4	3,372	13.65
T	Markham	2	16,208	65.59
T	Newmarket	2	3,425	13.86
T	Richmond Hill	2	7,584	30.69
T	Whitchurch-Stouffville	3	2,489	10.07
TP	King	3	1,718	6.95
	Region Total		62,058	251.14
Peel Region				
C	Brampton	2	29,976	121.31
C	Mississauga	1	3,829	15.50
T	Caledon	3	5,417	21.92
	Region Total		39,221	158.73
Halton Region				
C	Burlington	2	3,800	15.38
T	Halton Hills	3	4,777	19.33
T	Milton	4	12,503	50.60
T	Oakville	2	9,341	37.80
	Region Total		30,422	123.12
Durham Region				
C	Oshawa	2	4,500	18.21
C	Pickering	2	5,640	22.82
M	Clarington	3	8,408	34.03
T	Ajax	2	4,568	18.49
T	Whitby	2	8,322	33.68
TP	Brock / Scugog / Uxbridge	3	3,574	14.46
	Region Total		35,012	141.69
GTA Total			**167,938**	**679.63**
New City of Hamilton				
C	Stoney Creek	2	2,045	8.27
TP	Glanbrook	5	1,443	5.84
T	Ancaster	3	1,956	7.92
C	Hamilton	1	1,770	7.16
T	Dundas	1	152	0.62
T	Flamborough	3	2,455	9.93
	New City Total		9,820	39.74
Inner Study Area			**177,758**	**719.38**

(b) Community Typology and Estimates of Additional Land Requirements

		Community Typology Code	2000-2031 New Land Required	
			Acres Total	**Sq. Km.** Total
Niagara Region				
C	Niagara Falls	1	1,225	4.96
C	Port Colbourne	3	154	0.62
C	St. Catharines	1	1,324	5.36
C	Thorold	3	597	2.42
C	Welland	3	887	3.59
T	Fort Erie	3	815	3.30
T	Grimsby	2	274	1.11
T	Lincoln	5	1,321	5.35
T	Niagara-on-the-Lake	2	482	1.95
T	Pelham	5	630	2.55
TP	Wainfleet	5	87	0.35
TP	West Lincoln	5	468	1.90
	Region Total		8,265	33.45
Waterloo Region				
C	Cambridge	1	5,715	23.13
C	Kitchener	1	6,377	25.81
C	Waterloo	1	4,440	17.97
TP	North Dumfries	3	404	1.64
TP	Wellesley	3	210	0.85
TP	Wilmot	3	1,053	4.26
TP	Woolwich	3	1,149	4.65
	Region Total		19,349	78.30
Dufferin County				
T	Orangeville	2	1,777	7.19
T	Shelburne	5	293	1.18
T	Mono	5	713	2.89
TP	Amaranth	5	409	1.66
TP	East Garafraxa	5	231	0.93
TP	East Luther Grand Valley	5	309	1.25
TP	Melancthon	5	115	0.46
TP	Mulmur	5	135	0.55
	County Total		3,982	16.11
Northumberland County				
T	Cobourg	4	485	1.96
T	Hope and Port Hope	4	447	1.81
M	Brighton	5	518	2.10
M	Campbellford/Seymour,Percy & Hastings	5	730	2.95
TP	Alnwick/Haldimand	5	318	1.29
TP	Cramahe	5	323	1.31
TP	Hamilton	5	604	2.44
	County Total		3,425	13.86

(b) Community Typology and Estimates of Additional Land Requirements

	Community Typology Code	2000-2031 New Land Required	
		Acres	**Sq. Km.**
		Total	Total
Peterborough County (Part Only)			
C Peterborough	2	1,597	6.46
TP Asphodel-Norwood	5	125	0.51
TP Cavan-Millbrook-North Monaghan	5	264	1.07
TP Douro-Dummer	5	219	0.89
TP Otonabee-South Monaghan	5	210	0.85
TP Smith-Ennismore-Lakfield	5	530	2.15
County Total		2,945	11.92
Simcoe County			
C Barrie	4	12,530	50.71
C Orillia	3	1,081	4.38
T Bradford-West Gwillimbury	3	2,109	8.54
T Collingwood	3	1,407	5.70
T Innisfil	3	2,259	9.14
T Midland	3	582	2.36
T New Tecumseth	3	2,363	9.56
T Penetanguishene	3	568	2.30
T Wasaga Beach	5	1,943	7.86
TP Adjala-Tosorontio	5	852	3.45
TP Clearview	5	797	3.23
TP Essa	5	1,623	6.57
TP Oro-Medonte	5	1,195	4.84
TP Ramara	5	939	3.80
TP Severn	5	1,656	6.70
TP Springwater	5	1,625	6.57
TP Tay	5	630	2.55
TP Tiny	5	386	1.56
County Total		34,548	139.81
City of Kawartha Lakes (Victoria County)			
Manvers-Emily-Omemee	5	1,940	7.85
Bobcaygeon-Fenelon-Fenelon Falls- Lindsay	3	2,726	11.03
Bexley-Carden-Dalton-Eldon-Laxton-Digby-Longford-Somerville-Woodville	5	787	3.18
County Total		5,453	22.07
Wellington County (Part Only)			
Guelph-Puslinch-Guelph TP	2	4,717	19.09
Erin / Eramosa	5	1,343	5.44
Centre Wellington	5	2,254	9.12
County Total (Part Only)		8,314	33.65
Outer Study Area		**86,280**	**349.17**
GRAND TOTAL		**264,038**	**1,068.55**