



Growing Together :

Prospects for Renewal in the Toronto Region

A Report Prepared for the City of Toronto

Background Reports

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GROWING TOGETHER: PROSPECTS FOR RENEWAL IN THE TORONTO REGION

BACKGROUND REPORTS

A Series of Reports Prepared for the City of Toronto's
Departments of Works and Emergency Services, Urban
Development Services and the Oak Ridges Moraine Steering
Committee,
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BACKGROUND REPORT 1:

ESTIMATING CO₂ EMISSIONS AND OTHER TRANSPORTATION IMPACTS OF ALTERNATIVE URBAN FORMS SUMMARY OF MODELLING METHOD

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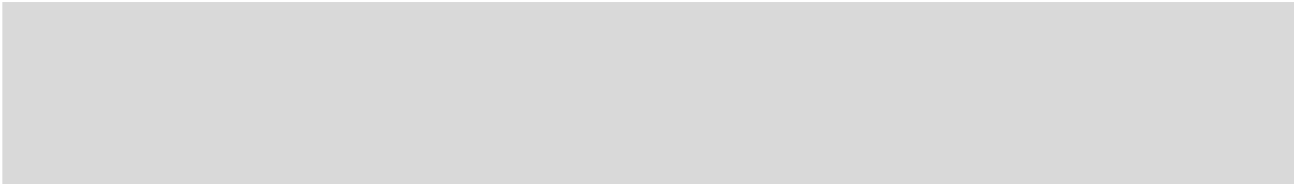


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1. PROJECT PURPOSE

The purpose of this study is to generate estimates of transportation CO₂ emissions for a “typical” twenty-four hour, weekday period which can be expected to result from alternative land use (population and employment distribution) scenarios for the Greater Toronto Area (GTA). In addition, other impacts of importance generated by the transportation system (air quality related emissions, road congestion levels, etc.) will also be estimated for these scenarios. As discussed further below, the modelling capability to generate estimates of twenty-four hour travel behaviour for future year conditions in the GTA did not exist at the start of this project. Thus, a second objective of this study is to develop such a modelling capability.

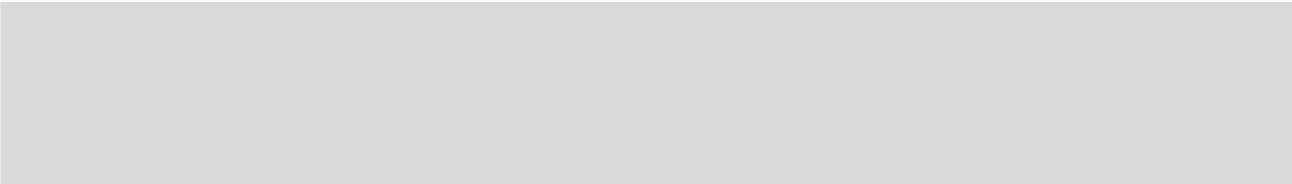
Section 2 provides a brief background to this report in terms of describing current modelling capabilities within the GTA. Section 3 then presents a brief (and largely non-technical) description of the twenty-four hour modelling approach implemented in this study. Results from the model runs undertaken in this project are presented in separate report.

2. BACKGROUND

Travel demand modelling in the GTA is supported by the Transportation Tomorrow Survey (TTS) series of surveys of household travel behaviour in the GTA. These consist of telephone interviews of up to 5% of GTA households in order to elicit one-day travel behaviour for all household members, along with relevant household and personal socio-economic attributes. To date, surveys have been undertaken in 1986, 1991, 1996 and 2001. The 2001 survey data, however, will not be available for use until June, 2002. As a result, 1996 represents the most recent year for which detailed travel behaviour data are available, and, as a result, all models discussed in this report use 1996 as their base year. All TTS data for all survey years are maintained within a relational database management system by the Data Management Group (DMG) within the Joint Program in Transportation, University of Toronto on behalf of GTA planning agencies. For documentation of the 1996 survey see [DMG, 1997].

The second major element in support of travel demand modelling in the GTA is the EMME/2 transportation network modelling software, also maintained by the DMG in support of GTA planning agencies. This software system allows one to “assign” observed or predicted origin-to-destination flows of people or vehicles to paths through the transit and road networks. In so doing, it estimates link and route volumes, travel times and speeds, and roadway congestion levels. In addition, other calculations which depend upon these quantities such estimation of CO₂ and other emissions can be programmed into the system. The EMME/2 network modelling system is used by all planning agencies within the GTA as their primary tool for transportation network planning analysis. For documentation of the EMME/2 software, see [INRO, 1999].

GTAModel V2.00 is a regional multi-modal travel demand forecasting system which has been developed over the past several years by Prof. Eric Miller for use by GTA planning agencies. It estimates morning peak-period travel by all modes for all trip purposes within the GTA (as well as trips to/from the GTA and areas immediately adjacent to the GTA). GTAModel uses EMME/2 for all road and transit network calculations. The travel demand forecasting modules within GTAModel have been developed based on observed travel



behaviour as captured in the 1996 TTS data, and have been implemented as an interconnected set of Fortran programs, controlled by a menu-based, interactive user interface. For an overview of GTAModel V2.00, see [Miller, 2001].

In 2001 the Joint Program in Transportation developed an “emissions audit” for the GTA under contract with the Toronto Atmospheric Fund (TAF) . In this project the observed 1986, 1991 and 1996 TTS auto trips for a typical twenty-four hour weekday period were assigned to the road network within the EMME/2 modelling system to generate an estimate of travel times, volumes, speeds and congestion levels for each link in the system for each time period within the day. An emissions model originally developed by Dr. David Checkel of the University of Alberta for the City of Edmonton [Checkel, 1996] was adapted to GTA conditions and used to estimate the levels of CO₂, CO, HC and NO_x for the given survey years, thereby building a historical time-series of estimated emissions from personal use vehicles for a typical weekday for the GTA. A key advantage of the “Edmonton emissions model” is that it was explicitly designed to interface with EMME/2 road assignment results in a robust but theoretically acceptable manner. A more complete description of the model and the results of the TAF project are contained in the project final report [Miller and Lee, 2001]. As a result of this project, this emissions model is now available for use in other GTA planning studies.

Although useful for many transportation planning applications, GTAModel is not directly of use in this project due to its limitation to the morning peak-period. Twenty-four hour emissions levels are essential in order to understand the full impact of alternative land use - transportation options and policies. Extrapolation from morning peak-period to all day results is not an easy task to do satisfactorily, especially in the case of emissions. Similarly, while useful for establishing a historical context for the current study, the TAF study results are a function of historical travel behaviour, not projected future flows, and, again, extrapolation from past behaviour into the future is difficult to do well. What is required for this project is a new travel demand model for the GTA which can estimate future weekday travel flows over an entire twenty-four hour period. These predicted flows can then be used as inputs to the emissions model to generate the required future year twenty-four hour emissions estimates for a given population/employment distribution scenario. A prototype version of a twenty-four hour travel demand model for the GTA has been developed and used in this project, as is briefly described in the following section.

3. A TWENTY-FOUR HOUR TRAVEL MODEL FOR THE GTA

Simply extending the current GTAModel to other time periods within the weekday (e.g., mid-day, afternoon peak, evening/night) so as to generate twenty-four hour travel flows and emissions is not an attractive proposition for at least three important reasons:

1. The current GTAModel takes up to 15 hours of computer time to run for a single scenario for the morning peak-period. Adding another three time periods to the analysis would imply a total run time of approximately 60 hours (i.e., two and half days!). This is simply not acceptable.¹
2. Travel within the various time periods within the day is inter-related, and so can not be properly modelled as independent phenomena. As one obvious example, consider afternoon peak-period mode choice. If one drove to work in the morning, chances are that one will also drive home again in the evening! Yet, modelling the morning and afternoon peaks as independent events will not guarantee this result. Further, the reason why one chose to drive to work in the morning may have as much to do with afternoon peak travel activities (need to shop on the way home, etc.) as with the travel time/cost trade-offs during the morning peak period which we usually assume determine modal choices. Many other examples of the interconnections between time periods in travel decision-making can be readily constructed.
3. Further, the “four-stage” modelling system used in conventional travel demand models such as GTAModel has long been criticized for a number of behavioural shortcomings.² As long as one restricts oneself to modelling the morning peak-period, these shortcomings might be tolerable, at least for some planning purposes. As one expands into twenty-four hour analyses, however, the weaknesses of the four-stage approach become accentuated.

Thus, for all of these reasons, an alternative “paradigm” for travel demand modelling is highly desirable for twenty-four hour modelling. Fortunately, such a paradigm has been under development for some time within the transportation research community. It is known as the activity-based approach in which travel is explicitly derived from the participation in activities. That is, such models begin with modelling participation in activities (work, school, shopping, etc.), from which comes the need to travel by various modes to various destinations at different times of day. Research and development efforts with respect to activity-based travel models world-wide have progressed to the point that operational planning models exist in several cities (e.g., Stockholm [Algers, et al., 1995] and Portland Oregon [Bradley and Bowman, 1998]), and general consensus exists within both the research and planning communities

¹ Alternatively, the time periods could be run in parallel on separate computers so as to keep the run time in the order of 15 hours. This is the approach currently used in Edmonton, which is the only Canadian city currently doing twenty-four hour forecasting. This is not feasible here, due lack of the computer resources to implement this approach. Even if the resources were available, however, it is highly questionable whether this would represent a cost-effective approach to the problem.

² For a discussion of the four-stage modelling system, see, among many others, [Meyer and Miller, 2001] or [Miller, 2001]. For critiques of the four-stage approach see, again among many others, [Stopher, 1993], [Deakin and Harvey, 1993] or [Goulias and Kitamura, 1996].



that activity-based models represent the “next generation” approach for urban travel demand modelling.³

Activity-based models must be developed at the very disaggregated level of individual trip-makers (persons, households, etc.), since it is only at the level of the actual “agents” or “actors” making activity participation and travel decisions that powerful predictive models can be developed. In order to implement such disaggregate or “micro” models within a forecasting model, it is widely felt that a simulation framework is required, in which individual trip-makers are explicitly represented within the model (as opposed to flows of people/vehicles from zone to zone in traditional models such as GTAModel) and the behaviour of these individuals is explicitly simulated over time. In this case, this implies simulating the behaviour of GTA households and their members over the course of a twenty-four hour period as they go about their daily “activity schedule”, including the travel which they undertake in order to execute this schedule.

Research has been underway for some time within the Joint Program in Transportation, University of Toronto on the development of microsimulation-based activity/travel models [Miller, 1996; Miller and Salvini, 2001a, 2001b; Doherty, et al., 2001]. As a result, at the outset of this current project, we felt confident that we could take on the development of a “simplified” twenty-four hour, activity-based, microsimulation model of GTA travel behaviour which could meet the needs of the City and Regional Strategies project within the project timeframe. While it has taken longer to accomplish this task than originally anticipated, we have, indeed, succeeded in building this model and using it to generate estimates of future year twenty-four hour emissions.

³ For introductions to the activity-based approach, see, among others, [TTI, 1996] or [Meyer and Miller, 2001].

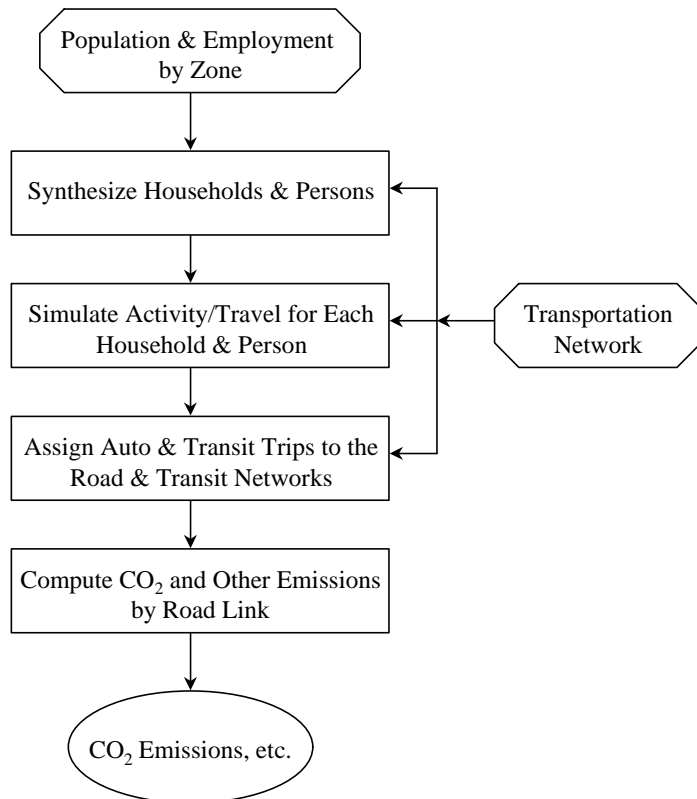


Figure 1
Overall Modelling Process

The basic inputs to the model are the same as for the current GTA Model:

1. Estimates of the future year total population and employment for each traffic zone in the GTA.
2. The future year transportation network (roads and transit).

The model proceeds to convert these inputs into emissions and other output measures in four major steps:

1. Convert the zonal population and employment totals into a synthetic list of households, persons, workers and students, along with any other attributes of these agents required by the model to estimate activity/travel behaviour (in this case, at a minimum: age, occupation, possession of a driver's licence, and number of vehicles in the household).

2. Household by household, determine the activity/travel patterns of all household members for the “typical weekday” being modelled. The trips generated by the simulated activity patterns are accumulated into traditional zonal origin-destination flow matrices by auto and transit modes by time period with the day for input into the EMME/2 network model.
3. The EMME/2 network model is used to assign auto trips to the road network, thereby generating estimates of road network link flows, speed, volumes and congestion levels. Transit flows are also be assigned to the transit network.
4. The outputs from the EMME/2 network assignments become the inputs to the emissions models developed within the TAF project.

Steps 4 is discussed in Miller and Lee [2001]. Each of the first three steps in the modelling system are discussed in somewhat greater detail in the following sub-sections.

3.1 SYNTHESIZING HOUSEHOLDS AND PERSONS

In this model a very straightforward approach to creating a representative list of households (and, within each household, persons) for the GTA. The entire set of households and persons in the 1996 TTS dataset are simply used, with the following updating to account for future year conditions:

1. The expansion factor or weight attached to each person which allows one to expand sample observations up to estimate population totals is recalculated so that when these weights are summed over the sample for a given zone, the result is the future year total population for the zone. That is, if POP_b and POP_f are the base year and future populations for a given zone, respectively, and if W_b is the base year weight for a given person, then the future year weight applied to this person is: $W_b(POP_f/POP_b)$. All attributes of each of these persons (age, employment status, etc.) and households (number of persons, number of vehicles, etc.) are not changed in this process. Thus, this approach preserves age distributions, etc. within each zone in the future year. While this is not likely to be completely correct, it is the typical assumption implicitly made in conventional models.⁴
2. Work locations for each worker in the sample are synthesized, using essentially a “Fratar” method in which the probability of a worker living in a given zone working in any other zone is determined by the observed 1996 base place of residence - place of work distribution, “updated” by the growth in workers in residence zone and jobs in employment zones. These calculations are done for worker occupation class, with four classes being used in the model, based on available TTS occupation data.

¹ Research is underway at the Joint Program in Transportation on “updating” models that will allow us to “evolve” population attributes over time within the simulation model, but these models are not available for operational use at this time.

3.2 SIMULATING ACTIVITY AND TRAVEL

The heart of the model is the activity/travel simulator. This model takes each synthesized household and estimates a full set of out-of-home activities for each person 11 years of age or older in the household.⁵ Participation in these out-of-home activities obviously requires travel; thus, trip origins, destinations and start times are determined by the timing and locations of these activities. Once trip locations and start times are known, the model estimates the travel modes which will be used for each trip undertaken by each person.

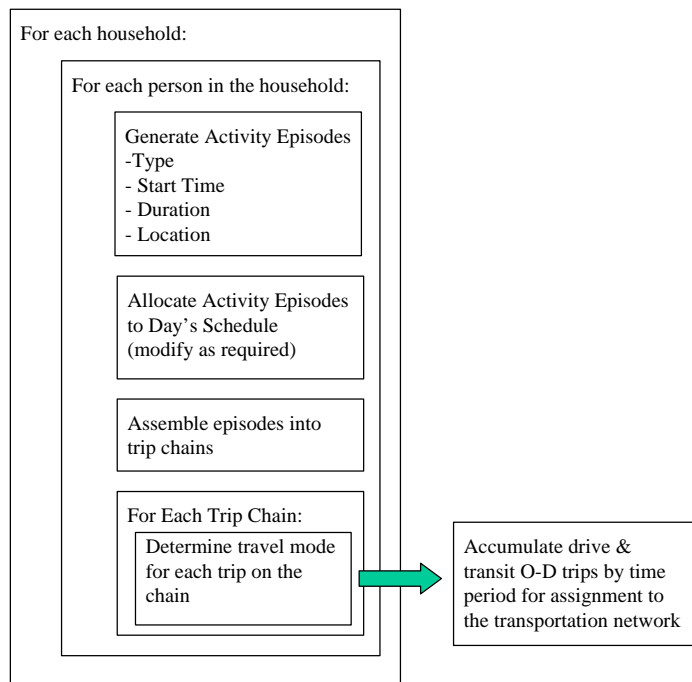


Figure 2
Activity-Based Scheduling & Travel
Demand Model

A full description of the activity/travel simulator is well beyond the scope of this overview report, and will be the subject of a future, detailed technical report. Figure 2 provides an overview of the model.

⁵ TTS does not collect travel information for children younger than 11, so it is difficult/impossible to explicitly model their travel behaviour.

Key points to note about the model include the following.

1. “Activity episodes” are generated for each person in each household for work, school, shopping and “other” activity purposes. Each episode has a desired start time and duration. Usual places of work and school locations are known for each synthesized worker and student. Locations for work-based business trips, business trips for people working at home, shopping and other activities are generated using destination choice models. Shopping and other activities may be undertaken by individuals or jointly among two or more household members. Table 1 lists the full set of activities (trip destination purposes) used in the model, along with a number of other key model attributes. Activity episodes are generated randomly for each person, based on observed 1996 TTS rates for number of episodes per day, start times and durations, as a function of person and household attributes (household size, worker occupation, person’s age, etc.). In-home activities represent the default activity and so are not generated as explicit episodes. Rather, in-home episodes simply represent the residual times that are not scheduled for out-of-home activity.
2. Once a list of all desired activity episodes have been generated for each person in a household, these episodes are “scheduled” into a plan for the day’ activities for each person. Rules are used to resolve conflicts in cases where two or more desired episodes overlap. These rules will modify episode start times and/or durations so as to attempt to maximize the number of episodes which can be successfully scheduled while minimizing the changes required in trip start times and durations. In some cases, episodes must be rejected as being infeasible to schedule. In this case, a new episode of the same type is generated and the model then attempts to schedule the new episode. In the current implementation of the model, the time to travel from one episode to another is simply represented as the time it would take to make the trip by car. In later implementations of the model, the effect of travelling by transit or other modes will be incorporated into the scheduling algorithm.

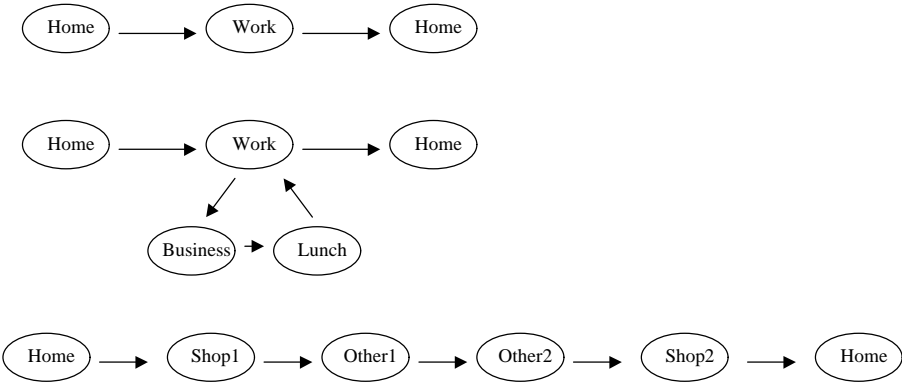


Figure 3
Example Trip Chains

3. The output from the scheduling procedure is a set of “trip chains” for each person, which consist of one or more out of home activities. Figure 3 provides representative examples of the sort of trip chains that might be generated by the scheduler. Actual mode choices for each trip on these chains must then be determined. This is done on a trip chain basis, in which individual trip mode choices are predicted within the context of the trip chains within which they occur. In particular, if the auto-drive mode is chosen, it must be used for the entire trip chain, since the car must return to the home location. On the other hand, different modes of travel may be used for individual trips in the chain if the “non-drive” option is chosen for the chain. Figure 4 illustrates the overall trip chain mode choice process. This process is operationalized through the development of a special nested logit model which has been formulated specially for this application.

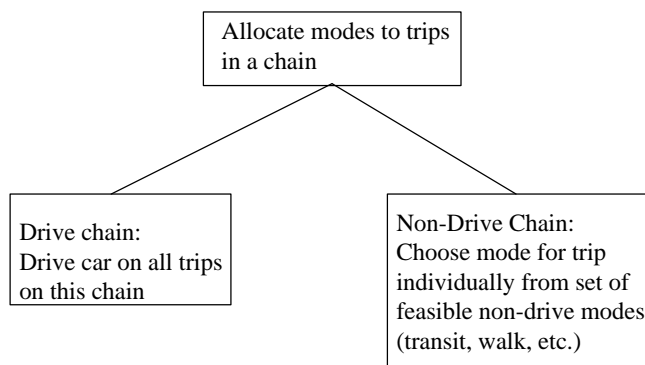


Figure 4
Decision Tree for Chain-Based Mode Choice

4. Individual trips predicted to use the drive and transit modes are accumulated into origin-destination trip matrices for assignment to the road and transit networks, respectively.
5. Activity start times and durations are generated over the entire 24-hour day for a representative weekday on a 5-minute interval basis. Thus, a near-continuous representation of daily activity is generated. For mode choice and network assignment purposes, however, activity and trip start times are aggregated into four time periods: morning peak period (0600-0859), mid-day (0900-1459), afternoon peak period (1500-1859) and evening/night (1900-0559). Thus, for example, four road and four transit assignments are performed, one for each time period, thereby generating representative travel times, congestion levels and emissions for each time period.

3.3 NETWORK REPRESENTATION AND MODELLING

In order to estimate future year travel demand, a computerized representation of what the future year road and transit networks are likely to look like is required. This is a non-trivial task when dealing with a very long range forecasting exercise such as this one, both in terms of estimating what additions to the transportation system will happen over the forecast period, and in terms of the physical work involved in coding and testing the computerized network representation within the EMME/2 network modelling package.

In this study, a single, “ultimate” year network was developed by a sub-consultant (Jim Bate) and coded into EMME/2. Full documentation of this network is provided in Bate [2002]. Major assumptions adopted in the development of this network are:

No major new expressways were added, beyond what are currently committed.

Many arterial roads, etc. were widened in areas projected to experience significant growth/urbanization over the forecast period.

Considerable new transit facilities were added, using GTSB proposals for regional transit improvements [GTSB, 2000a, 2000b, 2001] as the “blueprint” for defining these facilities.

Population and employment growth projected within this study also had to be allocated to individual traffic zones in order to use the travel demand model. In the absence of better guidelines, this was done using the following procedure.

1. For each region in the GTA, population and employment growth forecasts from 1999 to 2031, and from 2031 to the ultimate “10 million” scenario were separated into growth forecast to occur within the urban boundary, and growth forecast to occur outside of the urban boundary.
2. A GIS representation of the urban growth boundaries was overlaid on a map of GTA traffic zones, thereby identifying those traffic zones that correspond to growth inside of and outside of the urban boundary in each growth.
3. In each growth period (i.e. from 1999 to 2031, and from 2031 to the ultimate “10 million” scenario), new regional population and employment outside the urban area was allocated to traffic zones in proportion to the amount of land in that zone slated to become a new urban area. The assumption, therefore, is that all development in new areas will be of equal density within each region. For growth in existing urban areas, it was assumed that new population and employment would be distributed in proportion to the 1996 zonal distribution population and employment, which was available from TTS. This results in a consistent percentage increase in population and employment density in every urban zone within each region.

The zonal population and employment growth for each period was then incrementally added to the estimated 1999 zonal population and employment, which was obtained by factoring up the 1996 zonal population and employment to reflect 1999 regional totals.

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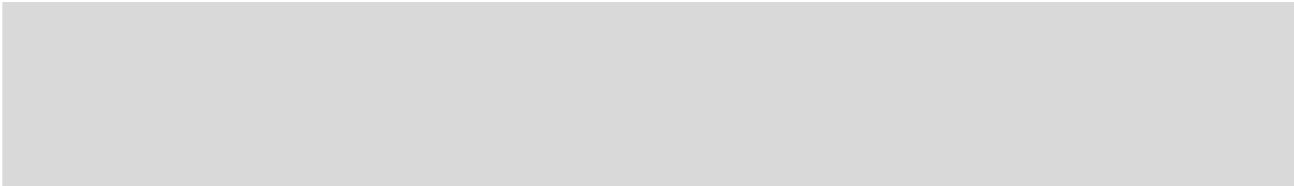
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BACKGROUND REPORT 2:

ESTIMATING CO₂ EMISSIONS AND OTHER TRANSPORTATION IMPACTS OF ALTERNATIVE URBAN FORMS

REPORT II: SUMMARY OF BASE NETWORK MODEL TEST RESULTS

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1. INTRODUCTION

This report presents summary results for initial forecast runs using the new GTA activity-based, 24-hour travel demand forecasting model which has been developed by the Joint Program in Transportation, University of Toronto in support of the “City and Regional Strategies for Growth” project. Summary documentation of this new model is provided in Miller [2002].

It must be stressed that the 24-hour model is very much a prototype, which is still undergoing extensive testing and improvement. Thus, the results presented below have not been fully validated, and almost certainly will be refined in the coming months as the model is improved and extended. For the very broad, long-range, “sketch-planning” type of application represented by the City and Regional Strategies study, however, it is believed that even these fairly raw numbers will prove to be useful.

Section 2 of this report briefly describes the scenarios analyzed in these runs. Section 3 presents the summary results for the runs. More detailed results by time-period and trip purpose are presented in Appendices A and B, respectively.

2. SCENARIOS TESTED

Three land use (population/employment distributions) are considered in this study:

1. 1996 base case;
2. 2031; and
3. “Ultimate” future year scenario (10 million GTA population).

1996 was chosen as the base case, since it corresponds to a Transportation Tomorrow Survey (TTS) year for which observed data are available. 1996 also corresponds to the model base calibration year.

Year 2031 and Ultimate year population and employment forecasts were prepared by the main study team. These forecasts were allocated to traffic zones by the Joint Program in Transportation using the procedure described in Miller [2002].

It was intended to test two transportation network scenarios:

1. 1996 base case; and
2. “Ultimate” future year network.

The 1996 network represents a “status quo” situation in which no changes to road and transit networks are made over time. This is not very realistic, but represents a “worst case” scenario corresponding to minimum future year transit usage and maximum auto usage, congestion and auto-based emissions.

The “Ultimate” future year network includes modest road expansion (principally widening of arterial roads as development occurs in previously rural areas) and extensive transit expansion, particularly outside of the City of Toronto. GTSB reports on possible region-wide transit expansion were used to define the location and nature of these transit improvements [GTSB, 2000a, 2000b, 2001]. Unfortunately, the Ultimate year network is not yet operational. Thus, in this report results from only three model runs are shown: travel forecasts for the three land use scenarios, all assuming the 1996 base transportation network. Once the Ultimate year network has been adequately validated, model runs for 2031 and the Ultimate year will be undertaken using this network. Results from these additional runs will be submitted in a subsequent report.

3. SUMMARY OF RUN RESULTS

Results from two analyses are presented in this section. First, the performance of the new model is compared with an existing model in order to establish some measure of confidence level with respect to the new model’s performance. Second, the forecast results from the three model test runs described in Section 2 are presented.

3.1 COMPARISON OF MORNING PEAK-PERIOD RESULTS WITH GTAMODEL V2.00

As one validation test of the new 24-hour model, the morning peak-period trips by mode predicted by this model are compared with comparable results from GTAModel V2.00, as well as with observed TTS data. GTAModel V2.00 is a conventional, four-stage, morning peak period travel forecasting model for the GTA which is currently used by the City of Toronto, Ontario Ministry of Transportation, and others for regional planning applications. Table 1 summarizes the morning peak results.

TRIPS	AM Peak Period Trips (1000's)			AM Peak Period Mode Splits (%)		
	TTS96	AMPk Model	24hr Model	TTS96	AMPk Model	24hr Model
Total Trips	2331	2428	2438			
All Transit	394	401	413	16.9	16.5	16.9
Auto-Drive	1335	1292	1123	57.3	53.2	46.1
Auto-Passenger	285	268	312	12.2	11.1	12.8
Walk	216	206	453	9.3	8.5	18.6
Other	100	0	137	4.3	0	5.6
Intrazonals	0	259	0	0	10.7	0

Direct comparisons among GTAModel, the new model and observed TTS are difficult to make for several reasons. These include:

1. GTAModel separates intrazonal trips from interzonal trips prior to computing mode splits. As a result, no modes are attached to intrazonal trips in GTAModel, and the modal values shown in Table 1 for GTAModel (labelled AMPk Model in the table) are for interzonal trips only. Conversely, the 24-hour model assigns modes to intrazonal as well as interzonal trips. The “0” in the 24-hour model and TTS columns simply indicates that the intrazonal trips are included in the modal trip totals in these cases.
2. The 24-hour model estimates school trips for all children, whereas TTS and GTAModel only deal with trips by children 11 years of age or older.
3. The 24-hour model currently does not include all “serve passenger” auto trips due to complexities in modelling the scheduling of these trips (these will be included in future versions of the model), whereas TTS and GTAModel include these trips (although the GTAModel treatment of serve passenger trips is extremely simplistic).
4. GTAModel only actually predicts mode choices as a function of modal level of service, etc, for home-to-work trips. Mode choices for school and “other” trips are generated using fixed, observed TTS mode split rates. The 24-hour model predicts mode choices for all trip purposes for all time periods using a system of logit mode choice models, which are functions of modal service levels and trip-maker attributes. Thus, the new model is much more ambitious in what it is attempting to do than GTAModel.
5. The new model has a more complete specification of modes than GTAModel. Table 2 compares the modal definitions used in the two models. As can be seen, the key difference is that GTAModel lumps all non-personal-auto, non-transit modes into “walk/other”, while the new model explicitly differentiates among walk, bicycle, school-bus and taxi modes of travel. In Table 1, the GTAModel “walk/other” trips are include under “Walk”, hence the zero entry for “Other” in this table.

Table 2	
Mode Definitions	
GTAModel V2.00	24-Hour Model
1. Auto-drive	1. Auto-drive
2. Auto-passenger	2. Auto-passenger
3. Transit, walk access, (excludes GO-Rail)	3. Transit, walk access, (excludes GO-Rail)
4. Subway, auto access	4. Subway, auto access
5. GO-Rail, trasnit/walk access	5. GO-Rail, trasnit/walk access
6. GO-Rail, auto access	6. GO-Rail, auto access
7. Walk/other	7. Walk
	8. Bicycle
	9. School-bus
	10. Taxi

Given all of these considerations, points to note from Table 1 include the following.

1. Both models yield very similar estimates of total morning-peak period trips, both of which are high relative to the observed TTS value. The 24-hour model result is largely explainable by the inclusion of the under-11 year olds' trips, which do not exist in the TTS numbers. Why GTAModel over-predicts total trips is not clear.
2. Both models do a good job of predicting total transit and auto-passenger trips, both in terms of absolute values and modal shares. The 24-hour model probably is doing a slightly better job than GTAModel, given the presence of under-11's in the auto-passenger total, which would explain the slight over-prediction relative to TTS.
3. Given the various problems discussed above, it has difficult to make definitive judgements concerning the performance of the two models with respect to the "walk/other" modes, since both the intrazonal and the under-11 effects will be strong for these modes. Certainly it is the case that the 24-hour model numbers are reasonably credible, although it may be the case that walk trips are being over-predicted somewhat.
4. Both models under-predict auto-drive trips, with the 24-hour model performing more poorly than GTAModel. This almost certainly reflects the omission of many of the "serve passenger" trips from this version of the model.

In summary, the new model seems to be performing well relative to the current morning-peak period model, with the exception that it is under-predicting auto-drive trips somewhat. While this is obviously of some concern, one should note that the omitted trips are generally quite short in nature and so will result in relatively minor under-estimations of system vehicle-kilometres-travelled (VKT) and emissions. In addition, in a study such as this it is always generally relative changes in system performance which are primary importance, and the outputs from the new model should be much more reliable on a relative basis (e.g., changes and percentage changes) than in absolute terms.

3.2 Forecast Run Results

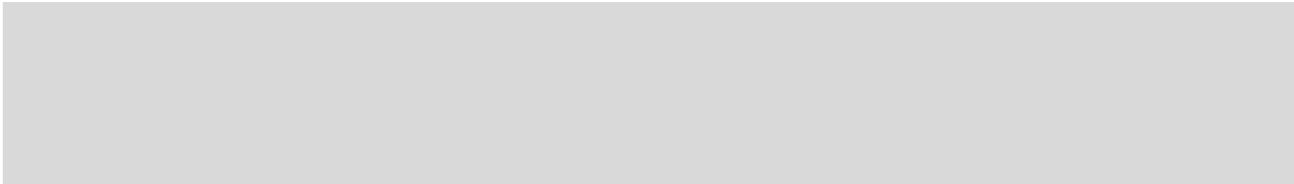
Table 3 presents summary results from the three test runs undertaken to date. All runs use the 1996 base network to define the transportation system. Columns correspond to the 3 forecast years/land use scenarios being tested: 1996 base, 2031, and the "Ultimate" year 10 million population scenario. Summary results include trips (total and by mode), modal splits, VKT and emissions for the entire 24-hour "typical" weekday being simulated. Breakdowns of these daily totals by time period for each model run are provided in Appendix A, while Appendix B provides trips and modal splits by trip purpose.

Note that the emissions reported are for personal-use, light-duty vehicles only and do not include emissions from transit vehicles, trucks or other commercial vehicle movements. The emissions modelling procedure is the same as was used in a recent study for the Toronto Atmospheric Fund (TAF) to generate a historical "emissions audit" for the GTA [Miller and Lee, 2002]. Also, all emissions are estimated using 1996 Ontario fleet average rates from the TAF study, with no attempt being made to adjust these rates to account for future technology improvements.

Table 3							
Summary of Model Run Results -- 1996 Base Network							
VARIABLE	Forecast Year			Change from 96		% Change from 96	
	1996	2031	Ultimate	2031	Ultimate	2031	Ultimate
Trips (1000's)							
Auto-Drive	5347	9026	12221	3679	6873	68.8	128.5
Auto-passenger	1485	2488	3275	1003	1790	67.6	120.6
Transit	1268	1702	2037	435	770	34.3	60.7
GO-Rail	68	140	186	72	118	105.7	173.5
Walk	1031	1669	2091	638	1060	61.9	102.8
Bicycle	74	123	168	49	94	66.6	127.5
School-bus	231	464	759	233	529	101.2	229.2
Taxi	34	48	58	14	24	42.5	71.6
Total	9537	15661	20794	6124	11258	64.2	118
Mode Splits (%)							
Auto-Drive	56.1	57.6	58.8	1.6	2.7		
Auto-passenger	15.6	15.9	15.7	0.3	0.2		
Transit	13.3	10.9	9.8	-2.4	-3.5		
GO-Rail	0.7	0.9	0.9	0.2	0.2		
Walk	10.8	10.7	10.1	-0.2	-0.8		
Bicycle	0.8	0.8	0.8	0	0		
School-bus	2.4	3	3.7	0.5	1.2		
Taxi	0.4	0.3	0.3	0	-0.1		
Total	100	100	100				
VKT (1000's km)	24157	40492	59075	16335	34917.5	67.6	144.5
Emissions (tonnes)							
CO2	7082	12391	19793	5309	12711	75	179.5
CO	183	327	524	144	341	78.3	185.9
NOx	14	24	35	9	20	65	140.1
HC	25	48	85	23	60	95.2	246.3
Fuel	2345	4107	6561	1761	4215	75.1	179.7

Important points to note from Table 3 include the following.

1. Very large growth in travel and auto-based emissions is projected to occur over the course of the forecast period. This is not surprising given the large population and employment growth assumptions for the GTA which fundamentally drive these travel forecasts. In particular, total weekday travel in the GTA is projected to increase by 64% relative to the 1996 base by the year 2031 and by 118% by the Ultimate forecast year.
2. All modes of travel also grow significantly in absolute terms. In the absence of significant investment in new transit infrastructure, however, transit (excluding GO-Rail) is projected to only grow at about half the rate of most other modes (i.e., 34% 1996-2031 versus 60-70% for most other modes), and as result, to lose 2.5-3.5% of total market share over the course of the analysis period. GO-Rail is projected to grow at an above-average rate and thereby gain market share, reflecting the growth in the inter-regional commuting market that it serves over this time period. The magnitude of this growth, however, is not sufficient to compensate for the decline in other transit market share, with the net result that total transit modal share is projected to decline. This is, in fact, consistent with very long-term GTA trends in which transit ridership has grown in absolute terms but has slowly declined in market share [Miller and Shalaby, 2000].
3. Conversely, both auto-drive and auto-passenger modes grow at rates greater than the total trip growth rates (69% and 68%, respectively, relative to total growth of 64%, 1996-2031) and so gain market share. The result is that VKT and emissions also increase more than proportionally relative to the growth in travel. In addition to the lack of transit service expansion assumed in these runs, this relative growth in auto usage also reflects the projected land use changes, in which a considerable proportion of growth in both population and employment is assumed to occur outside of the City of Toronto and, indeed at what is currently the urban fringe. This growth will be very auto-oriented in nature (except for Toronto CBD-oriented trips served by GO-Rail), especially in the absence of significant improvements in transit service outside the City of Toronto.
4. There is little evidence in these aggregate numbers that the continuing suburbanization of both population and employment will result in significantly shorter average trip lengths and, hence, some degree of “efficiency” in travel. In particular, VKT and auto-drive trips are projected to grow at virtually the same rate over the 1996-2031 period (67.6% versus 68.8%), implying little/no change in trip length. Indeed, over the longer time period, trip lengths clearly are projected to lengthen, with VKT growth projected to be significantly higher than auto-drive trip growth (144% versus 129% over the 1996-Ultimate forecast period), representing increasing “diseconomies of scale” as the urbanized area continues to grow.

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5. Although not explicitly shown in Table 3, congestion clearly worsens over the entire forecast period due to the significant increase in auto travel without commensurate increases in roadway capacity. This is directly reflected in the emissions and fuel consumption estimates, which grow much more quickly than either auto trips or VKT. CO₂ emissions and fuel consumption, for example, are projected to grow by 75% and 180% over the 1996-2031 and 1996-Ultimate time periods, respectively, while the comparable VKT numbers of 68% and 145%, respectively. The emissions and fuel consumption models are both sensitive to roadway congestion effects, and the non-proportional growth in emissions relative to VKT directly reflects increased roadway congestion. Note, as with VKT, the increasing diseconomies of scale associated with growth as one moves further into the future.
 6. The assumption of 1996 emissions factors clearly results in over-estimating the absolute magnitude of the emissions projections, given expected technological improvements in automobile emissions performance. In the absence, however, of truly revolutionary technological breakthroughs (e.g., total adoption of a perfectly clean fuel cell technology) they do not invalidate the conclusions concerning the likely general trend. The numbers shown also provide a “bench mark” against which some combination of technological improvements, “demand management” induced changes in travel behaviour, transit improvements, and/or shifts in land use must operate if significant emissions reductions are to be achieved. In particular, an average (uncompounded) projected growth rate of over 2% per year in transportation CO₂ emissions over the 1996-2031 time period (75% more CO₂ over a 35-year time period) does not bode well for attaining Kyoto-type objectives with respect to greenhouse gas emissions, at least within the GTA transportation sector.

ATTACHEMENT 1: SUMMARY RESULTS BY TIME PERIOD, INDIVIDUAL RUNS

Table A.1					
Aggregate 24-Hour Model Run Results by Time Period					
Forecast Year: 1996 Network: 1996 Base					
	TIME PERIOD				
VARIABLE	AM Peak	Mid-day	PM Peak	Evening	Total
Trips (1000's)					
Auto-Drive	1123	1461	1618	1145	5347
Auto-passenger	312	343	494	336	1485
Transit	383	319	404	162	1268
GO-Rail	30	8	23	8	68
Walk	453	115	410	53	1031
Bicycle	25	15	28	7	74
School-bus	112	28	88	3	231
Taxi	1	15	10	8	34
Total	2438	2303	3074	1722	9537
Mode Splits (%)					
Auto-Drive	46.1	63.4	52.6	66.5	56.1
Auto-passenger	12.8	14.9	16.1	19.5	15.6
Transit	15.7	13.8	13.1	9.4	13.3
GO-Rail	1.2	0.3	0.7	0.5	0.7
Walk	18.6	5	13.3	3.1	10.8
Bicycle	1	0.7	0.9	0.4	0.8
School-bus	4.6	1.2	2.9	0.2	2.4
Taxi	0	0.6	0.3	0.5	0.4
Total	100	100	100	100	100
Time Splits(%)	25.6	24.2	32.2	18.1	100
VKT (1000's km)	9366	3470	6914	4407	24157
Emissions (kg)					
CO2	2754534	1010924	2031216	1285544	7082218
CO	72867	25338	52716	32438	183359
NOx	5488	2063	4275	2645	14471
HC	10323	3184	6918	4102	24527
Fuel	913020	334379	672760	425323	2345482
Time Splits(%)					
CO2	38.9	14.3	28.7	18.2	100
CO	39.7	13.8	28.8	17.7	100
NOx	37.9	14.3	29.5	18.3	100
HC	42.1	13	28.2	16.7	100
Fuel	38.9	14.3	28.7	18.1	100

Table A.2					
Aggregate 24-Hour Model Run Results by Time Period					
Forecast Year: 2031			Network: 1996 Base		
VARIABLE	TIME PERIOD				
	AM Peak	Mid-day	PM Peak	Evening	Total
Trips (1000's)					
Auto-Drive	1893	2452	2716	1966	9026
Auto-passenger	537	558	832	560	2488
Transit	520	424	536	223	1702
GO-Rail	61	17	45	17	140
Walk	745	175	671	79	1669
Bicycle	44	22	47	9	123
School-bus	227	56	175	6	464
Taxi	1	21	14	12	48
Total	4027	3726	5035	2873	15661
Mode Splits (%)					
Auto-Drive	47	65.8	53.9	68.4	57.6
Auto-passenger	13.3	15	16.5	19.5	15.9
Transit	12.9	11.4	10.6	7.8	10.9
GO-Rail	1.5	0.5	0.9	0.6	0.9
Walk	18.5	4.7	13.3	2.7	10.7
Bicycle	1.1	0.6	0.9	0.3	0.8
School-bus	5.6	1.5	3.5	0.2	3
Taxi	0	0.6	0.3	0.4	0.3
Total	100	100	100	100	100
Time Splits(%)	25.7	23.8	32.2	18.3	100
VKT (1000's km)	15189	5905	11551	7847	40492
Emissions (kg)					
CO2	4952786	1715732	3410632	2311670	12390820
CO	131883	43831	91254	60015	326983
NOx	8590	3565	6811	4911	23877
HC	21423	5602	13023	7831	47879
Fuel	1642087	567920	1131007	765660	4106674
Time Splits(%)					
CO2	40	13.8	27.5	18.7	100
CO	40.3	13.4	27.9	18.4	100
NOx	36	14.9	28.5	20.6	100
HC	44.7	11.7	27.2	16.4	100
Fuel	40	13.8	27.5	18.6	100

Table A.3					
Aggregate 24-Hour Model Run Results by Time Period					
Forecast Year: Ultimate Forecast Year			Network: 1996		
VARIABLE	TIME PERIOD				
	AM Peak	Mid-day	PM Peak	Evening	Total
Trips (1000's)					
Auto-Drive	2495	3246	3647	2832	12221
Auto-passenger	704	728	1096	747	3275
Transit	626	486	646	279	2037
GO-Rail	80	22	59	25	186
Walk	941	210	848	91	2091
Bicycle	62	29	65	12	168
School-bus	373	93	281	12	759
Taxi	1	25	17	14	58
Total	5283	4840	6658	4013	20794
Mode Splits (%)					
Auto-Drive	47.2	67.1	54.8	70.6	58.8
Auto-passenger	13.3	15	16.5	18.6	15.7
Transit	11.8	10	9.7	7	9.8
GO-Rail	1.5	0.5	0.9	0.6	0.9
Walk	17.8	4.3	12.7	2.3	10.1
Bicycle	1.2	0.6	1	0.3	0.8
School-bus	7.1	1.9	4.2	0.3	3.7
Taxi	0	0.5	0.3	0.4	0.3
Total	100	100	100	100	100
Time Splits(%)	25.4	23.3	32	19.3	100
VKT (1000's km)	21409	8285	16872	12509	59075
Emissions (kg)					
CO2	8162805	2426761	5462847	3740312	19792725
CO	215117	62978	146186	99979	524260
NOx	12513	5106	9620	7504	34743
HC	38778	8241	23565	14365	84949
Fuel	2705242	803767	1811557	1240284	6560850
Time Splits(%)					
CO2	41.2	12.3	27.6	18.9	100
CO	41	12	27.9	19.1	100
NOx	36	14.7	27.7	21.6	100
HC	45.6	9.7	27.7	16.9	100
Fuel	41.2	12.3	27.6	18.9	100

ATTACHMENT 2:

SUMMARY RESULTS BY TRIP PURPOSE, INDIVIDUAL RUNS

FORECAST YEAR 1996; NETWORK 1996 BASE

Thu Mar 14 15:25:31 EST 2002

Re-run of 96 base, revised model; full model; 3 iterations

TRIPS BY MODE FOR DESTINATION PURPOSE= Home

MODE	TRIPS	(%)
Auto-passenger	678599.	16.131
Transit allway	522172.	12.413
Subway, auto access	45734.	1.087
GO-Rail, transit acc.	8145.	0.194
GO-Rail, auto access	22234.	0.529
Walk allway	502014.	11.934
Auto-drive	2262429.	53.782
Bicycle	35982.	0.855
School-Bus	113666.	2.702
Taxi	15725.	0.374
Other	0.	0.000
TOTAL TRIPS	4206700.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Work

MODE	TRIPS	(%)
Auto-passenger	183068.	8.968
Transit allway	270414.	13.246
Subway, auto access	44436.	2.177
GO-Rail, transit acc.	8193.	0.401
GO-Rail, auto access	22847.	1.119
Walk allway	101076.	4.951
Auto-drive	1409951.	69.068
Bicycle	564.	0.028
School-Bus	0.	0.000
Taxi	850.	0.042
Other	0.	0.000
TOTAL TRIPS	2041400.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Work-business

MODE	TRIPS	(%)
Auto-passenger	20390.	7.082
Transit allway	27322.	9.489
Subway, auto access	1 613.	0.560
GO-Rail, transit acc.	202.	0.070
GO-Rail, auto access	559.	0.194
Walk allway	6027.	2.093
Auto-drive	231275.	80.321
Bicycle	219.	0.076
School-Bus	0.	0.000
Taxi	332.	0.115
Other	0.	0.000
TOTAL TRIPS	287938.	

TRIPS BY MODE FOR DESTINATION PURPOSE= WAH-business

MODE	TRIPS	(%)
Auto-passenger	9778.	17.845
Transit allway	4611.	8.415
Subway, auto access	1.	0.003
GO-Rail, transit acc.	0.	0.000
GO-Rail, auto access	0.	0.000
Walk allway	258.	0.470
Auto-drive	39454.	71.999
Bicycle	275.	0.502
School-Bus	0.	0.000
Taxi	420.	0.767
Other	0.	0.000
TOTAL TRIPS	54798.	

TRIPS BY MODE FOR DESTINATION PURPOSE= School

MODE	TRIPS	(%)
Auto-passenger	188109.	19.203
Transit allway	170348.	17.390
Subway, auto access	4918.	0.502
GO-Rail, transit acc.	729.	0.074
GO-Rail, auto access	1560.	0.159
Walk allway	390725.	39.887
Auto-drive	85656.	8.744
Bicycle	24211.	2.472
School-Bus	113313.	11.568
Taxi	0.	0.000
Other	0.	0.000
TOTAL TRIPS	979570.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Joint

MODE	TRIPS	(%)
Auto-passenger	80391.	33.265
Transit allway	12300.	5.090
Subway, auto access	730.	0.302
GO-Rail, transit acc.	151.	0.063

SUMMARY RESULTS BY TIME PERIOD, INDIVIDUAL RUNS

GO-Rail, auto access	314.	0.130
Walk allway	2553.	1.057
Auto-drive	143331.	59.309
Bicycle	832.	0.344
School-Bus	37.	0.015
Taxi	1029.	0.426
Other	0.	0.000
TOTAL TRIPS	241669.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Ind.

MODE	TRIPS	(%)
Auto-passenger	77259.	16.780
Transit allway	58423.	12.689
Subway, auto access	958.	0.208
GO-Rail, transit acc.	168.	0.037
GO-Rail, auto access	438.	0.095
Walk allway	9820.	2.133
Auto-drive	300881.	65.348
Bicycle	5204.	1.130
School-Bus	696.	0.151
Taxi	6581.	1.429
Other	0.	0.000
TOTAL TRIPS	460429.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Joint

MODE	TRIPS	(%)
Auto-passenger	114774.	35.692
Transit allway	14647.	4.555
Subway, auto access	672.	0.209
GO-Rail, transit acc.	132.	0.041
GO-Rail, auto access	432.	0.134
Walk allway	2963.	0.921
Auto-drive	185527.	57.695
Bicycle	984.	0.306
School-Bus	71.	0.022
Taxi	1363.	0.424
Other	0.	0.000
TOTAL TRIPS	321564.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Ind.

MODE	TRIPS	(%)
Auto-passenger	131098.	14.148
Transit allway	83577.	9.019
Subway, auto access	2306.	0.249
GO-Rail, transit acc.	412.	0.045
GO-Rail, auto access	1169.	0.126
Walk allway	14551.	1.570
Auto-drive	677661.	73.132
Bicycle	5523.	0.596
School-Bus	2789.	0.301
Taxi	7539.	0.814
Other	0.	0.000
TOTAL TRIPS	926624.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Home from work

MODE	TRIPS	(%)
Auto-passenger	1295.	8.197
Transit allway	2107.	13.341
Subway, auto access	347.	2.196
GO-Rail, transit acc.	66.	0.415
GO-Rail, auto access	203.	1.286
Walk allway	919.	5.819
Auto-drive	10859.	68.746
Bicycle	0.	0.000
School-Bus	0.	0.000
Taxi	0.	0.000
Other	0.	0.000
TOTAL TRIPS	15796.	

TRIPS BY MODE FOR DESTINATION PURPOSE= All Purposes

MODE	TRIPS	(%)
Auto-passenger	1484762.	15.569
Transit allway	1165922.	12.226
Subway, auto access	101715.	1.067
GO-Rail, transit acc.	18198.	0.191
GO-Rail, auto access	49758.	0.522
Walk allway	1030906.	10.810
Auto-drive	5347024.	56.069
Bicycle	73795.	0.774
School-Bus	230571.	2.418
Taxi	33839.	0.355
Other	0.	0.000
TOTAL TRIPS	9536489.	

FORECAST YEAR 2031; NETWORK 1996 BASE

Sun Mar 17 09:45:54 EST 2002

S1, 2031 pop/emp; Continuation of Run 1

TRIPS BY MODE FOR DESTINATION PURPOSE= Work

MODE	TRIPS	(%)
Auto-passenger	319026.	9.417
Transit allway	343061.	10.126
Subway, auto access	68778.	2.030
GO-Rail, transit acc.	18764.	0.554
GO-Rail, auto access	43281.	1.278
Walk allway	161995.	4.782
Auto-drive	2430916.	71.754
Bicycle	814.	0.024
School-Bus	0.	0.000
Taxi	1228.	0.036
Other	0.	0.000
TOTAL TRIPS	3387862.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Work-business

MODE	TRIPS	(%)
Auto-passenger	32317.	7.259
Transit allway	37136.	8.341
Subway, auto access	2288.	0.514
GO-Rail, transit acc.	564.	0.127
GO-Rail, auto access	1074.	0.241
Walk allway	8930.	2.006
Auto-drive	362132.	81.337
Bicycle	319.	0.072
School-Bus	0.	0.000
Taxi	463.	0.104
Other	0.	0.000
TOTAL TRIPS	445225.	

TRIPS BY MODE FOR DESTINATION PURPOSE= WAH-business

MODE	TRIPS	(%)
Auto-passenger	15227.	16.695
Transit allway	6439.	7.060
Subway, auto access	13.	0.014
GO-Rail, transit acc.	0.	0.000
GO-Rail, auto access	0.	0.000
Walk allway	453.	0.496
Auto-drive	67994.	74.548
Bicycle	440.	0.483
School-Bus	0.	0.000
Taxi	642.	0.704
Other	0.	0.000
TOTAL TRIPS	91208.	

TRIPS BY MODE FOR DESTINATION PURPOSE= School

MODE	TRIPS	(%)
Auto-passenger	328607.	20.040
Transit allway	240938.	14.693
Subway, auto access	8484.	0.517
GO-Rail, transit acc.	2101.	0.128
GO-Rail, auto access	4349.	0.265
Walk allway	637817.	38.897
Auto-drive	144113.	8.789
Bicycle	43463.	2.651
School-Bus	229902.	14.020
Taxi	0.	0.000
Other	0.	0.000
TOTAL TRIPS	1639776.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Joint

MODE	TRIPS	(%)
Auto-passenger	128047.	32.643
Transit allway	17172.	4.378
Subway, auto access	1272.	0.324
GO-Rail, transit acc.	301.	0.077
GO-Rail, auto access	681.	0.174
Walk allway	4441.	1.132
Auto-drive	237518.	60.551
Bicycle	1231.	0.314
School-Bus	76.	0.019
Taxi	1522.	0.388
Other	0.	0.000
TOTAL TRIPS	392262.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Ind.

MODE	TRIPS	(%)
Auto-passenger	124201.	16.673
Transit allway	75651.	10.156
Subway, auto access	1672.	0.224
GO-Rail, transit acc.	479.	0.064
GO-Rail, auto access	1068.	0.143
Walk allway	14546.	1.953
Auto-drive	509199.	68.358
Bicycle	7313.	0.982
School-Bus	1541.	0.207
Taxi	9236.	1.240
Other	0.	0.000
TOTAL TRIPS	744906.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Joint

MODE	TRIPS	(%)
Auto-passenger	190577.	35.083
Transit allway	19705.	3.628
Subway, auto access	1272.	0.234
GO-Rail, transit acc.	309.	0.057
GO-Rail, auto access	804.	0.148
Walk allway	5516.	1.015
Auto-drive	321554.	59.194
Bicycle	1421.	0.262
School-Bus	132.	0.024
Taxi	1930.	0.355
Other	0.	0.000
TOTAL TRIPS	543219.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Ind.

MODE	TRIPS	(%)
Auto-passenger	211499.	14.017
Transit allway	110183.	7.302
Subway, auto access	3804.	0.252
GO-Rail, transit acc.	988.	0.065
GO-Rail, auto access	2307.	0.153
Walk allway	20966.	1.389
Auto-drive	1134984.	75.219
Bicycle	7972.	0.528
School-Bus	5330.	0.353
Taxi	10877.	0.721
Other	0.	0.000
TOTAL TRIPS	1508910.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Home from work

MODE	TRIPS	(%)
Auto-passenger	2657.	9.635
Transit allway	2914.	10.565
Subway, auto access	601.	2.180
GO-Rail, transit acc.	176.	0.637
GO-Rail, auto access	444.	1.611
Walk allway	1509.	5.471
Auto-drive	19279.	69.900
Bicycle	0.	0.000
School-Bus	0.	0.000
Taxi	0.	0.000
Other	0.	0.000
TOTAL TRIPS	27581.	

TRIPS BY MODE FOR DESTINATION PURPOSE= All Purposes

MODE	TRIPS	(%)
Auto-passenger	2488206.	15.888
Transit allway	1543328.	9.855
Subway, auto access	159062.	1.016
GO-Rail, transit acc.	42697.	0.273
GO-Rail, auto access	97070.	0.620
Walk allway	1669160.	10.658
Auto-drive	9026271.	57.635
Bicycle	122931.	0.785
School-Bus	464026.	2.963
Taxi	48209.	0.308
Other	0.	0.000
TOTAL TRIPS	15660960.	

RECAST YEAR ULTIMATE; NETWORK 1996 BASE

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TRIPS BY MODE FOR DESTINATION PURPOSE= Work

MODE	TRIPS	(%)
Auto-passenger	420590.	9.351
Transit allway	395016.	8.783
Subway, auto access	95987.	2.134
GO-Rail, transit acc.	29165.	0.648
GO-Rail, auto access	51027.	1.135
Walk allway	182427.	4.056
Auto-drive	3321337.	73.845
Bicycle	898.	0.020
School-Bus	0.	0.000
Taxi	1279.	0.028
Other	0.	0.000
TOTAL TRIPS	4497726.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Work-business

MODE	TRIPS	(%)
Auto-passenger	41851.	7.026
Transit allway	44655.	7.497
Subway, auto access	3391.	0.569
GO-Rail, transit acc.	904.	0.152
GO-Rail, auto access	1294.	0.217
Walk allway	10274.	1.725
Auto-drive	492459.	82.676
Bicycle	344.	0.058
School-Bus	0.	0.000
Taxi	475.	0.080
Other	0.	0.000
TOTAL TRIPS	595648.	

TRIPS BY MODE FOR DESTINATION PURPOSE= WAH-business

MODE	TRIPS	(%)
Auto-passenger	22464.	17.265
Transit allway	7878.	6.055
Subway, auto access	4.	0.003
GO-Rail, transit acc.	11.	0.009
GO-Rail, auto access	0.	0.000
Walk allway	507.	0.389
Auto-drive	97870.	75.219
Bicycle	589.	0.453
School-Bus	0.	0.000
Taxi	791.	0.608
Other	0.	0.000
TOTAL TRIPS	130113.	

TRIPS BY MODE FOR DESTINATION PURPOSE= School

MODE	TRIPS	(%)
Auto-passenger	437636.	19.879
Transit allway	292756.	13.298
Subway, auto access	11703.	0.532
GO-Rail, transit acc.	3392.	0.154
GO-Rail, auto access	7531.	0.342
Walk allway	822343.	37.353
Auto-drive	186284.	8.462
Bicycle	61616.	2.799
School-Bus	378278.	17.182
Taxi	1.	0.000
Other	0.	0.000
TOTAL TRIPS	2201540.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Joint

MODE	TRIPS	(%)
Auto-passenger	164839.	31.926
Transit allway	19720.	3.819
Subway, auto access	1704.	0.330
GO-Rail, transit acc.	549.	0.106
GO-Rail, auto access	1178.	0.228
Walk allway	5164.	1.000
Auto-drive	319683.	61.917
Bicycle	1478.	0.286
School-Bus	228.	0.044
Taxi	1770.	0.343
Other	0.	0.000
TOTAL TRIPS	516312.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Shopping-Ind.

MODE	TRIPS	(%)
Auto-passenger	163149.	16.695
Transit allway	88643.	9.071
Subway, auto access	2745.	0.281
GO-Rail, transit acc.	946.	0.097
GO-Rail, auto access	1461.	0.150
Walk allway	16877.	1.727
Auto-drive	680148.	69.599
Bicycle	9281.	0.950
School-Bus	2587.	0.265
Taxi	11403.	1.167
Other	0.	0.000
TOTAL TRIPS	977241.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Joint

MODE	TRIPS	(%)
Auto-passenger	246176.	34.448
Transit allway	23646.	3.309
Subway, auto access	2175.	0.304
GO-Rail, transit acc.	685.	0.096
GO-Rail, auto access	1270.	0.178
Walk allway	5790.	0.810
Auto-drive	430504.	60.241
Bicycle	1754.	0.245
School-Bus	352.	0.049
Taxi	2286.	0.320
Other	0.	0.000
TOTAL TRIPS	714640.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Other-Ind.

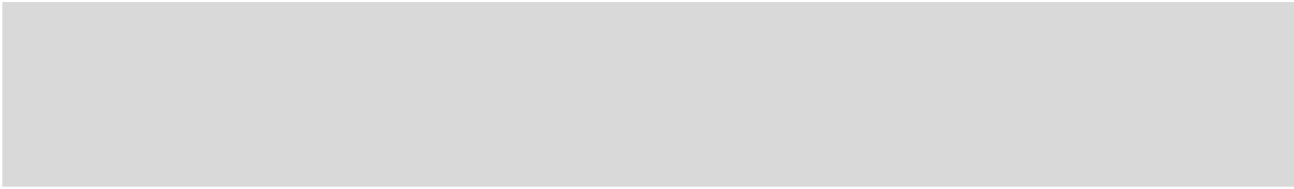
MODE	TRIPS	(%)
Auto-passenger	281522.	13.912
Transit allway	129995.	6.424
Subway, auto access	5947.	0.294
GO-Rail, transit acc.	1696.	0.084
GO-Rail, auto access	3407.	0.168
Walk allway	25098.	1.240
Auto-drive	1541279.	76.166
Bicycle	10023.	0.495
School-Bus	11543.	0.570
Taxi	13081.	0.646
Other	0.	0.000
TOTAL TRIPS	2023590.	

TRIPS BY MODE FOR DESTINATION PURPOSE= Home from work

MODE	TRIPS	(%)
Auto-passenger	2852.	8.746
Transit allway	3109.	9.534
Subway, auto access	932.	2.859
GO-Rail, transit acc.	344.	1.054
GO-Rail, auto access	550.	1.687
Walk allway	1852.	5.679
Auto-drive	22973.	70.441
Bicycle	0.	0.000
School-Bus	0.	0.000
Taxi	0.	0.000
Other	0.	0.000
TOTAL TRIPS	32613.	

TRIPS BY MODE FOR DESTINATION PURPOSE= All Purposes

MODE	TRIPS	(%)
Auto-passenger	3274702.	15.748
Transit allway	1815577.	8.731
Subway, auto access	221737.	1.066
GO-Rail, transit acc.	66620.	0.320
GO-Rail, auto access	119209.	0.573
Walk allway	2090819.	10.055
Auto-drive	12221121.	58.770
Bicycle	167891.	0.807
School-Bus	759093.	3.650
Taxi	58081.	0.279
Other	0.	0.000
TOTAL TRIPS	20794848.	



BACKGROUND REPORT 3:

WATER & WASTEWATER SERVICES IN SOUTH CENTRAL ONTARIO

Prepared by: Earth Tech Canada Inc
May, 2002

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1. INTRODUCTION

The availability of water and wastewater services are today a key requirement for new development to proceed. This has not always been the case. In Toronto for example, the construction of watermains and sewers only proceeded when the City incorporated in 1835. Major improvements to the system such as extending the water intake beyond the Toronto Islands and conveying sanitary sewage away from the Inner Harbour to Ashbridges Bay were not implemented to service new development, but in response to epidemics caused by waterborne diseases. Water filtration plants and sewage treatment plants were added in the early twentieth century, primarily to reduce illnesses from waterborne diseases and to improve public health.

Today, legislation and regulations are in place to ensure that water and wastewater infrastructure will be planned and constructed before new urban development is built. The planning, public consultations, approval process and design period for new water and wastewater infrastructure typically takes significantly longer than the time it takes to actually construct the work. Municipalities have long range plans for the upgrading and extension of water and wastewater infrastructure and secure funding to implement such works well in advance of new developments being constructed.

Most Municipalities in South Central Ontario have responded to this challenge and developed long range plans to expand their key water and wastewater infrastructure or prepared comprehensive Master Plans for their water and wastewater systems. These plans are generally based on Official Plan growth projections and, in most cases, extend over the next 10 to 20 years (e.g. 2021). However, municipalities in the GTA, have extended their Official Planning documents to 2031 and in response, Water and Wastewater Master Plans have also been updated to 2031 or are in the process of being updated. At this time, very little planning beyond 2031 has been carried out for Water and Wastewater Services.

Funding for water and wastewater capacities to support new development is primarily obtained through development charges and development pre-financing.

Chapters 1 through 11 provide a summary of the current state and proposed additions and major expansions of Water and Wastewater Infrastructure for major municipalities in South/Central Ontario. The summary is based on information obtained from the Ministry of the Environment and from municipalities as well as interviews with engineering staff involved in water and wastewater infrastructure planning and construction.

Map No. 1 attached shows the location of existing and proposed water supply facilities and wastewater treatment plants located in the study area.

Chapter 12 summarizes findings and conclusions which have been derived from the information collected.

Map No. 2 attached shows the limits of Conservation Authority boundaries in relation to municipal boundaries. Conservation Authority boundaries follow watershed boundaries, however, some Conservation Authority areas include the watersheds of several rivers.

Table 1 attached shows the list of the Conservation Authorities shown on Map No. 2 together with a list of watershed related activities performed by the Conservation Authorities.

2. CITY OF TORONTO

The City's Water and Wastewater Division provide water supply and wastewater services for Toronto's 2.6 million residents and its many industrial and commercial businesses. The City draws water from Lake Ontario, purifies and distributes it, collects and treats wastewater and returns it to Lake Ontario. The Division is also responsible for the management of storm water collection and disposal.

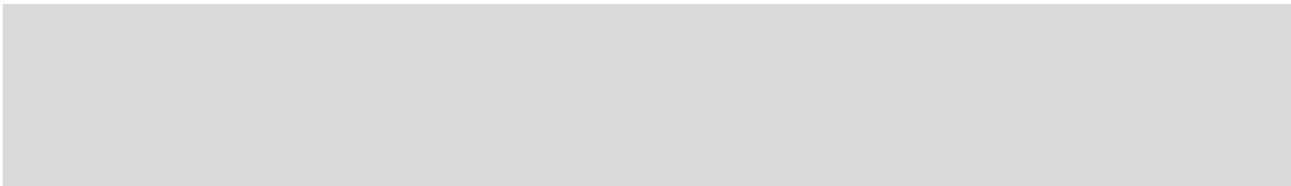
Toronto is part of the Lake Ontario catchment area with three major rivers located within its boundaries; the Humber, Don and Rouge Rivers as well as number of smaller creeks. Of major importance to the City is the waterfront water quality along Lake Ontario. The impact of storm water management, control of combined sewer overflow (CSO) and effluent from the City's water pollution control plants on the water front and water courses has been subject to much attention of citizens and City Council.

2.1 WATER SUPPLY

Toronto's water supply system services 2.6 million people and businesses located in Toronto. In addition, Toronto sells water to the Region of York to service approximately 500,000 people and businesses in the southern part of the Region.

The water supply system consists of four water filtration plants, namely the F.J. Horgan Filtration plant, the Island Filtration Plant, R.L. Clark Filtration Plant, and the Harris Filtration Plant. These plants have a combined capacity of 2700 million litres per day (ML/d) and are associated with 5800 km of transmission and distribution mains. The Island Filtration Plant is currently only operated seasonally during the warm weather. With its current construction the plant is not equipped to function in the winter months. The City is planning the winterization of this plant to allow it to work year round. This would give the City more flexibility in its water plant operations. Additionally, the City is considering a major expansion of the F.J. Horgan Filtration Plant, and this project is scheduled to enter its planning stages in the coming year.

Toronto's water distribution system is the oldest in Ontario with some mains dating back to the 1850's. Parts of the system have deteriorated to the point that significant investments are necessary to rehabilitate or replace old pipes. However, from a capacity point of view the pipe system generally has sufficient capacity to meet current and future demand for anticipated growth. Water purification plants and transmission facilities (e.g. reservoirs) may require expansions to increase capacities by 5-10% for anticipated growth if per capita water consumption remains unchanged. However, the City has adopted proactive water conservation/efficiency policies and programs, and furthermore current plumbing regulations will assist in gradually reducing water consumption as plumbing fixtures are being renewed. Accordingly, it is quite possible that demand for future growth within the City may be met through reduction in water consumption.



The Region of York will require additional water supply to support anticipated growth in the area designated to be serviced with water from Lake Ontario estimated at approximately 380 MLD by 2031. However, the Region has the option to obtain water from either the City of Toronto, Region of Durham, Region of Peel or a combination of any or all of these municipalities and it is not known how much water the Region will acquire from Toronto. At this time Toronto and York have jointly commissioned an optimization study to assess the potential to provide additional water supply to York Region from existing water supply facilities.

2.2 WASTEWATER

Toronto has three Water Pollution Control Plants (WPCP), namely the Ashbridges Bay WPCP, Humber WPCP, and Highland Creek WPCP. These plants have a combined capacity of 1500 ML/d. Its sewer system includes 10,000 km of sanitary, combined and stormwater pipes and services approximately 2.6 million people. The older parts of the City, e.g. Toronto, York and East York are primarily served by combined sewers which regularly overflow to the Humber and Don Rivers as well as the Lake Ontario waterfront during periods of rainfall and cause increased contamination and beach closings.

Both structural solutions (storage facilities) and non-structural solutions (downspout disconnections) are being implemented to address these problems and a master plan is currently being prepared to develop a long range plan to remediate the overflow problem on a City-wide basis.

Parts of Toronto's sewer system are old dating back to the time when the City was first incorporated (1835). Hence ongoing rehabilitation/replacements are required to maintain service. Some areas served by combined sewers experience basement floodings from backup through floor drains and the City is currently addressing these problems through a combination of measures such as sewer separation, down spout disconnection and backflow preventors. However, the pipe system generally has sufficient hydraulic capacity to accommodate additional sanitary flows from future growth.

The City is conducting an Environmental Assessment for the expansion of the Ashbridges Bay WPCP. However, the City expects that the expansion will not be necessary until the year 2011 if the City's water conservation targets are being achieved.

The other WPC plants may also require expansions in the future to meet growth unless flow rates can be maintained as a result of water conservation efforts. However, biosolid treatment and disposal facilities will require increase in capacity proportionally to growth, e.g. 15% by 2031.

3.0 REGION OF YORK

The Region of York has been rapidly growing over the last 30-40 years and has now reached approximately 751,000. The population is expected to reach 1,360,000 by the year 2031.

The Region is composed of ten area municipalities and residents and businesses are served by two tier municipal water and wastewater systems. The municipalities include Newmarket, Aurora, Richmond Hill, Markham Vaughan, King City, Nobleton, Holland Landing, Queensville, and Stouffville. The York Region Water and Wastewater Division provides wholesale services, by delivering potable water to its area municipalities which in turn operate local distribution systems, and sell water to residences and businesses. Local municipalities also operate sanitary sewer systems, collect sanitary sewage and pass it on to regional trunk sewer facilities and WPCP plants for treatment and subsequent disposal.

The dominant physical features of the Region are the Oak Ridges Moraine and Lake Simcoe (see Map No. 2). The Oak Ridges Moraine is an east-west ridge of rolling topography and is the source of the Schomberg, Black and Holland Rivers, which flow north to Lake Simcoe, and the Humber, Don and Rouge Rivers, which flow south towards Lake Ontario. The natural environment is characterized by many forested areas, wetlands and kettle lakes, which dot the Region and are part of a sensitive and attractive ecosystem. It's importance as a groundwater recharge and discharge area, which feeds rivers and creeks in the GTA, is generally acknowledged, and recently legislation/regulations have recently been established to protect the area from development pressures.


3.1 WATER SUPPLY

Most of the York Region population and businesses are located in the southern part of the municipality. Purchasing potable water from the City of Toronto with some being provided from well systems primarily provides water supply for this land locked area.

Water supply for the northerly part is primarily provided by wells. Well supply systems include the Aurora, Newmarket and Stouffville Well Systems. The construction of a major water purification plant near Sutton drawing water from Lake Simcoe is currently underway and is expected to be on line by mid 2003. In total, approximately 400 ML/d is currently being obtained from the City of Toronto, approximately 20 ML/d is drawn from Lake Simcoe and approximately 50 ML/d is being pumped from wells.

York has examined several options to secure more water supply for the current and future users including supplies from Durham, Toronto, Peel and Lake Simcoe.

Expansion of current transmission and purification facilities are needed to service York Region by year 2031. Additional capacities in the northerly part may come from Lake Simcoe. Additional capacities for the southerly service area would be obtained from Lake Ontario through the City of Toronto and the Region of Peel.



The Region of York and the City of Toronto are currently carrying out a water supply joint optimization study to assess how much of York's future water supply needs can be met through optimal utilization of existing water supply infrastructure. This study will determine what additional capacity can be cost-effectively supplied beyond the current supply agreements through upgrades of Toronto's and York's systems. York has also entered into a water supply agreement with the Region of Peel to provide a second Lake Ontario based source of supply from Peel's Lakeview WTP. This study is expected to be completed later this year and will determine York's intention to meet their long-term water supply needs through agreements with Toronto and Peel.

The Region has also embarked on the implementation of a water use efficiency program across the Region and expects that this will result in a 10% reduction in water consumption.

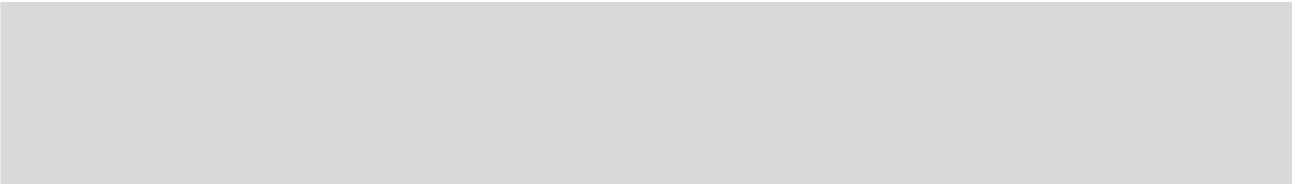
3.2 WASTEWATER SERVICES

Before rapid growth occurred in the Region, municipalities depended on small community based wastewater treatment facilities while rural areas were served by on site private septic system. To service new large-scale developments in the Region, additional wastewater systems were required. Rivers and creeks in the land-locked Region are relatively small and not capable to receive large discharges from new treatment plants. Therefore, in the 1970's the Region entered into agreements with the Ministry of Environment and the Region of Durham to construct the York-Durham Trunk Sewer System (YDSS). This system collects sanitary sewage in the southern part of the Region and conveys it to the Duffin Creek Water Pollution Plant in the Region of Durham. The YDSS is comprised of a main trunk sewer located to the north of the Region's boundary with the City of Toronto running from west to east and through the Region of Durham in south-easterly direction to the Duffin Creek WPCP located at Lake Ontario in Pickering. Several tributary trunks serving Newmarket, Aurora, Richmond Hill, Markham and Vaughan run from the north to the south connecting to the main trunk sewer. Within Durham Region, the YDSS also services Ajax and Pickering. King City, Nobleton, Holland Landing, Queensville, and Stouffville are not currently serviced by the YDSS. Today 94% of the Region's urban area is serviced by the YDSS. The remaining 6% are serviced by smaller community based systems.

The Duffin Creek WPCP is jointly owned both York and Durham Region, and operated by the Region of Durham who charges York Region for the treatment of YDSS sanitary flows. The plant has a rated capacity of 363 ML/d and 80% of the flow treated at the plant is from the Region of York. The plant is being expanded to increase its capacity to 431 ML/d to satisfy additional growth in York Region. It is anticipated that this expansion will be completed in 2005.

As a result of the rapid growth taking place in the Region of York, the capacity of the YDSS has been exhausted and the Region has undertaken Master Plan studies in 1997 and 2001 to identify wastewater service requirements and service alternatives to meet current and future growth needs as identified in the Region's Official Plan (ROP).

York's Master Plan forecasted approximately \$750 million of capital improvements to meet servicing needs to the year 2031. Implementation schedules have been developed and an effective program of securing upfront contributions from the benefiting developers has been



implemented as a result. The plan in effect will result in paralleling approximately 50% of the east-west main trunk increasing capacity. In addition, the plan provides for the construction of trunk sewers and a pump station to divert sewage flows generated in the Woodbridge area to the Region of Peel's Lakeview WPCP. Currently Peel & York have entered an agreement that an anticipated 616 ML/d sewage will be diverted from York to Peel by 2031.

Other components of York's wastewater master plan include additional capacities and sub trunks to service Vaughan, King City, Newmarket, Aurora, Richmond Hill and Markham.

It should be noted that the Region has implemented a water use efficiency program across the Region and expects that it will result in a 10% flow reduction in the wastewater system. This flow reduction will directly affect the Duffin Creek WPCP and may allow deferral of plant expansions.

4. REGION OF PEEL

Peel Region is comprised of three municipalities, namely the City of Mississauga, the City of Brampton and the Town of Caledon. The Region has a current population of approximately 1,018,000 and is expected to reach 1,400,000 by 2031. The majority of the population growth in the Region over the next 20 years is centered in the cities of Mississauga and Brampton.

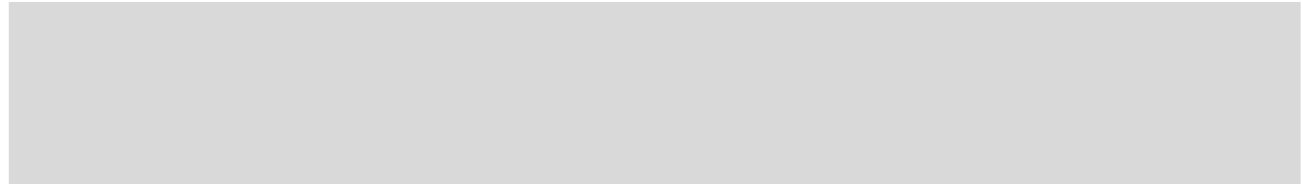
4.1 WATER SUPPLY

Water supply for Peel Region comes from Lake Ontario for the Cities of Mississauga, Brampton and parts of Caledon, and from groundwater sources for the balance of the Town of Caledon. The Region is considering increasing the lake-based water supply to include more communities within Caledon to satisfy environmental and water quality concerns that exist with the well-based water supply systems.

The Lake-based water system consist of two water treatment plants. The Lorne Park Water Treatment plant is a 227 ML/d plant that is currently being expanded by 120 ML/d (estimated completion June 2002) to supply growth on the west side of Peel. The Lakeview WTP is a 560 ML/d plant that has a planned 260 ML/d expansion that is due for completion in 2006. This plant expansion will service the east side of Peel as well as satisfy a portion of the growth requirements in York Region. Further expansions at these plants to satisfy the growth over the next 20 years include a 120 ML/d expansion at the Lorne Park WTP scheduled for 2011 completion and a 260 ML/d expansion at the Lakeview WTP scheduled for 2015 completion.

4.2 WASTEWATER SERVICES

The sewage generated by that component of the population that receives the lake based-water supply is treated by wastewater treatment facilities located along Lake Ontario, and which discharge into the lake. The effluent discharges to Lake Ontario continue to be under scrutiny by the Ministry of Environment as well as the federal government and there is a movement to try and ensure non-toxic effluent discharges to the lake. The ramifications of this include the provision of dechlorination facilities, potential elimination of chlorine for



disinfection altogether, and most notably the requirement for nitrification at the plants to minimize the ammonia concentration in the effluent. This latter initiative on its own would have the result of derating many of the existing wastewater plants and require significant plant expansions to bring the plants back to their currently rated capacities. The groundwater supplied population have individual private septic systems.

The Lake-based wastewater systems consist of two wastewater plants. The 336 ML/d Lakeview WWTP and 163.5 ML/d Clarkson WWTP are to be expanded concurrently with construction for both plant expansions scheduled for completion in early 2006. Lakeview is being expanded by 112 ML/d and Clarkson by 36.5 ML/d. The Clarkson expansion will satisfy growth on the west side of the Region while the Lakeview expansion will satisfy growth in the east part of Peel as well as the growth in York's Woodbridge community. Further plant expansions that are planned to satisfy growth over the next 20 years include a 70 ML/d expansion at the Lakeview WWTP scheduled for completion in 2014 and a 50 ML/d expansion at the Clarkson WWTP scheduled for 2014 completion.

5. REGION OF HALTON

Halton Region is comprised of four municipalities, namely, the City of Burlington, and the Towns of Halton Hills, Milton, and Oakville. The Region has a current population of approximately 387,000, of which approximately 80% is in Burlington and Oakville. The Region's population is expected to grow to 439,000 by 2006, and then to 538,000 by 2016. Growth subsequent is expected to proceed at a similar pace and expected to reach 690,000 by 2031. The majority of growth over the next ten years is centered in Milton and Oakville.

5.1 WATER SUPPLY

Halton owns and operates four water treatment plants that treat on average of 163 ML/d. Halton's water supply is from the lake based Burlington WTP, Oakville WTP, and the groundwater-based systems including the Georgetown Well Supply, Milton Well Supply, and Prospect Park Well.

Growth in the Oakville and Milton urban areas has resulted in planned construction of a new Oakville Water Plant and expansions to the Milton well supply. The new Oakville Water Treatment Plant is planned for completion somewhere between 2006 and 2007. Growth in North Oakville and Burlington urban areas are being satisfied by a current expansion at the Burlington Water Plant, which is scheduled for completion in 2003. Growth, albeit to a much smaller extent, in the Acton urban area is being facilitated through upgrade and expansion project at the Prospect Park Well, which is due for 2002 completion.

5.2 WASTEWATER SERVICES

Halton maintains and operates seven wastewater treatment plants and treats an average of 235 ML/d of wastewater. Wastewater treatment plants include the Mid-Halton WPCP, Burlington Skyway WPCP, Acton WPCP, Oakville SW WPCP, Oakville SE WPCP, Milton WPCP, and the Georgetown WPCP. There are currently 1,302 km of sanitary sewers in the Region's collection system.

Growth in the Milton and Oakville urban areas has resulted in planned expansions at the Mid-Halton WPCP. New growth in the north Oakville, and Burlington urban areas are being satisfied by current expansions at the Burlington Skyway WPCP, which is scheduled for completion in 2002. The next expansion at the Burlington WPCP is expected in 2020. Growth in the Acton urban area is being facilitated through upgrade and expansion of the Acton WPCP, which is due to be completed in 2002.

6. REGION OF DURHAM

Durham Region is comprised of 8 municipalities, including the Cities of Pickering and Oshawa, the Towns of Ajax and Whitby, Municipality of Clarington, and Townships of Scugog, Uxbridge, and Brock. The Region provides water and wastewater services to 120,500 customers within these municipalities. The Region owns and operates 13 water supply plants, 19 booster pumping stations, 19 water storage reservoirs, 10 wastewater treatment plants, and 49 sewage pumping stations, along with 1,955 km of watermains and 1,554 km of sanitary sewers.

The current population of the Region is approximately 522,000 and is expected to grow to 900,000 by 2021 and to 1,000,000 by 2031. Significant growth is projected for the Seaton Community located in northwest Pickering including land development and a new regional airport. It is anticipated that water service to this area will be supplied by an expanded Ajax Water Supply Plant and that sanitary sewage from the area will outlet to the York-Durham Sanitary Trunk Sewer for treatment at the Duffin Creek Water Pollution Control Plant.

6.1 WATER SUPPLY

Durham Region water supply facilities include Lake Ontario-based water treatment plants at Ajax, Oshawa, Bowmanville, and Newcastle. The Ajax WTP serves Pickering and Ajax and the Oshawa WTP serves Whitby, Oshawa, and the Community of Courtice. The Ajax/Pickering and Whitby/Oshawa/Courtice systems are interconnected affording the Region the flexibility of staging plant expansions irrespective of where growth occurs in this area. The Ajax Water Treatment plant was recently constructed and built with a capacity of 163 ML/d with expansion capability to 327 ML/d. Other water supply plants serving the Region include the Orono WTP, Beaverton WTP, and Sunderland Well Supply.

6.2 WASTEWATER SERVICES

Durham Region sewage treatment facilities generally have tributary areas defined on a watershed basis. Durham Region wastewater plants include the Beaverton River 2 Lagoon in Cannington, Harmony Creek WWTP, Nonquan River Lagoon in Port Perry, Pringle Creek WPCP, Corbett Creek WPCP, Port Darlington WPCP, Newcastle WPCP, and the Uxbridgebrook WPCP. Design is underway on the new Courtice WPCP that will be constructed by 2005 and will replace the Harmony WPCP plus accommodate the additional growth in the urban area. Durham Region is also a party to the York-Durham Sewage System agreement and sewage flows generated in Pickering and Ajax are treated at the Duffin Creek WPCP which is located in Pickering and jointly owned by the Regions of York and Durham. The Duffin Creek WPCP has a capacity of 363 ML/d and is scheduled to be expanded to 431 ML/d by 2005 primarily to accommodate growth in the Region of York.

7. CITY OF HAMILTON

The new City of Hamilton was amalgamated in January, 2001, and includes the former municipalities of Ancaster, Dundas, Stoney Creek, Flamborough, Glanbrook, and Hamilton. The City has a current population of approximately 482,000 people.

7.1 WATER SUPPLY

The City of Hamilton operates approximately 1,800 km of watermains, 15 reservoirs and one major Water Treatment Plant. The Woodward plant has a capacity design of 909 ML/d. There are smaller well facilities outside of the City serving rural areas in the former Town of Flamborough however their capacities are not significant.

The Woodward treatment plant has capacity to accommodate some additional development and existing capacities could also be upgraded to meet additional demand. Furthermore, the site would allow for additional expansion if required.

7.2 WASTEWATER SERVICES

The City operates approximately 1,000 km of sanitary and 550 km of combined sewers, 64 wastewater pumping stations, 5 combined sewer overflow storage tanks and has jurisdiction over stormwater drainage systems within the municipality. Most of the population within the City is serviced by the Woodward Avenue WPCP. Smaller WPCPs also exist in Dundas and Waterdown. All of these WPCP's discharge to the Hamilton Harbour.

The Woodward Avenue WPCP currently services a population of 380,000 and it is expected that by 2025, the service population for this plant will grow to 500,000 people. The plant serves the City of Hamilton, the Town of Ancaster, the Township of Glanbrook, and the City of Stoney Creek. The plant provides conventional secondary treatment and has a rated capacity of 409 ML/d. Based on current growth projections in the serviced area, provided by the Region of Hamilton-Wentworth, the capacity of the plant will be reached in the year 2008 and expansion of the plant may be necessary to service additional growth.

The Waterdown WPCP provides 2.7 ML/d design capacity to the downtown core of Waterdown in the Town of Flamborough. The area served by this plant has limited growth potential. Flows in excess of plant capacity are diverted via the Borer's Creek trunk sewer to Dundas.

The Dundas WPCP treats wastewater from the Town of Dundas and a portion of Waterdown. Tertiary filtration was added in 1988. The Dundas WPCP Certificate of Approval provides capacity for an average day flow of 18.2 ML/d.

8. REGION OF NIAGARA

Niagara Region is comprised of twelve area municipalities, including the Cities of Niagara Falls, Thorold, St. Catharines, Port Colborne, and Welland, the Towns of Fort Erie, Grimsby, Lincoln, Niagara-On-The-Lake, and Pelham, and the Townships of Wainfleet and West Lincoln. The Region is responsible for the treatment and transmission of water, and the treatment and collection of wastewater for eleven of its twelve municipalities (Township of Wainfleet excepted). The Region has a current population of approximately 423,000 people and provides water and wastewater services to 380,000 people. Additionally, with over 14 million tourists visiting the Niagara Region every year, there is added stress on the water and wastewater infrastructure. The Region's serviced population is expected to grow, reaching 477,000 by 2028. The majority of this growth (approximately 80%) is expected to happen in Niagara Falls, St. Catharines, Thorold, Welland, Fort Erie, and Lincoln.

The Region's water infrastructure in general consists of 6 water treatment plants, 12 reservoirs, 15 pumping stations, 15 elevated tanks and approximately 245 km of watermain. The Region's wastewater system infrastructure consists of 9 secondary sewage treatment plants, 5 lagoon systems, 103 Regionally owned and operated pumping stations, 13 municipal pumping stations, and approximately 210 km of trunk sewers and forcemains.

8.1 WATER SUPPLY

The Region's six water treatment plants include the Niagara Falls WTP serving Niagara Falls and a part of Niagara-on-the-Lake, and DeCew Falls WTP serving the City of St. Catharines and parts of the City of Thorold, Town of Lincoln and Town of Niagara-on-the-Lake. Welland WTP serving the City of Welland and parts of the Town of Pelham and the City of Thorold, and Port Colborne WTP serving the City of Port Colborne. Also Grimsby WTP serving the Town of Grimsby and parts of the Town of Lincoln and the Township of West Lincoln, and Fort Erie (Rosehill) WTP serving the Town of Fort Erie. These plants have a combined capacity of 610 ML/d. The Town of Grimsby also shares its water supply with a small area in the new City of Hamilton.

8.2 WASTEWATER SERVICES

The Region's nine secondary treatment plants include the Stanley Ave. WPCP serving Niagara Falls, Queenston WPCP serving Niagara-on-the-Lake, and the Baker Road WPCP serving Grimsby, Lincoln and West Lincoln. Port Weller WPCP and Port Dalhousie WPCP servicing St. Catharines and Thorold, Anger Avenue WPCP and Crystal Beach WPCP serving Fort Erie, and Seaway WPCP serving Port Colborne, and Welland WPCP serving Pelham and Welland. These plants have a combined capacity of 340 ML/d. Lagoon systems within the Region include Biggar and Smithville serving Grimsby, Lincoln and West Lincoln, Niagara-on-the-Lake serving Niagara-on-the-Lake, Stevensville serving Fort Erie, and Port Robinson servicing St. Catharines and Thorold. The lagoon systems have a combined capacity of 11.5 ML/d.

9. CITY OF BARRIE

The City of Barrie is located approximately 100 km north of Toronto. The City is situated on three shores (South, West and North) of Kempenfelt Bay, which is part of Lake Simcoe. Barrie's current population is approximately 104,000 people with growth projected to increase to 123,000 by 2006 and 156,000 by 2020.

During the past decade the rate of development and associated population growth for the City of Barrie has significantly increased. Currently experiencing an annual growth rate of more than four percent, the City is expected to grow an additional 45% in the next ten years. The City of Barrie has also witnessed the growth of numerous infrastructure projects including a \$120 million hospital expansion, a 40,000 square-foot library, as well as substantial growth of existing industries coupled with a significant number of new industries. Barrie's economy has seen unprecedented growth in all sectors, with the City granting more than \$354 million in building permits including approximately \$207-million residential, \$60-million institutional, \$40-million commercial and \$38-million industrial for 1999 alone. This economic growth is accordingly being addressed by many different programs, which the City has initiated in order to maintain and/or increase this rapid pace of development. The City's 1999-2008 draft capital works program includes \$310-million worth of waterfront, cultural, and infrastructure projects that will not only address current and future demands but also attract further economic growth.

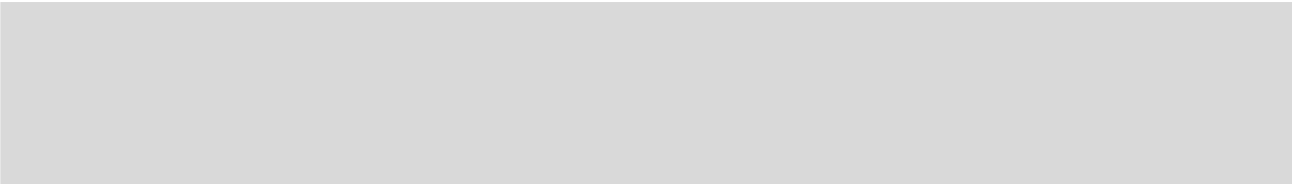
Land available for new development within the boundaries of Barrie is expected to be exhausted in the near future. The city has initiated a local Government Reform Study and invited neighbouring municipalities to participate. The goal of the study is to arrive at fewer and stronger single tiered municipalities.

9.1 WATER SUPPLY

Potable water supply for the City of Barrie is currently provided from groundwater sources through a system of 15 deep aquifer groundwater wells. A new well (Brown Wood Drive – Zone 2 North) is currently under construction. Furthermore, one more well (#17 – Zone 2S) is being developed presently while one more (#18) is planned for the same pressure Zone. These wells are all owned and operated by the City of Barrie.

Barrie's water distribution system presently includes five pressure zones:

- Zone 1 – located west and north of Kempenfelt Bay (includes City Centre)
- Zone 2 North – located north of Kempenfelt Bay
- Zone 2 South – located south of Kempenfelt Bay
- Zone 3 North – located northwest of Kempenfelt Bay
- Zone 3 South – located southwest of Kempenfelt Bay



The current groundwater supplies are generally located in Zone 1 with the exception of three wells in Zone 2 North (Johnson Wells #9, #13 and Well #16) and one in Zone 2 South (Huronian Well #10).

The total capacity of the existing wells is approximately 95 ML/d, which would increase to approximately 117.5 ML/d with commissioning of wells #17 and #18.

Water supply to higher zones is provided by direct well feed connections (Centennial Wells and Huronia Well into Zone 2 South, Johnson Wells into Zone 2 North) and booster pumping from lower zones.

Supply storage is provided at two elevated tanks (Bayfield St. – Zone 2 North and Mapleview Drive – Zone 3 South), three ground storage reservoirs (Anne St. and Bayview Park – Zone 1 and Harvie Rd. – Zone 2 South) and at some well pumping stations. An additional elevated water storage reservoir for Zone 3 North is being designed presently.

It has been recognized that the existing groundwater supply would not be able to support the anticipated population growth. As such, the City is currently preparing to develop a new supplemental water supply system using surface water of Kempenfelt Bay. Based on current growth projections, it is anticipated that a new water supply filtration plant will be required by the year 2007.

9.2 WASTEWATER SERVICES

The wastewater is collected in the City by the system of gravity sewers and lift stations, and transported to the treatment plant located on the West shore of Kempenfelt Bay. The capacity of the treatment plant is approximately 57 ML/d. The effluent from the plant is discharged to the lake through a submerged outfall into Kempenfelt Bay.

Because of the rapid growth in Barrie, capacity at the Kempenfelt Bay plant will be exhausted in the near future. The City has commenced an Environmental Assessment (EA) study for the expansion of the plant, which will also determine the planning horizon and the design capacity. One issue, which is key to this study, is defining the service area and service population because new development will likely extend into neighbouring municipalities. It is possible that municipal boundaries may be revised as an outcome of the Local Government Reform Initiative or that infrastructure sharing arrangements with neighbouring municipality be agreed upon. On the other hand, neighbouring municipalities may decide to build their own water and wastewater infrastructure to serve new development..

10. REGION OF WATERLOO

The Regional Municipality of Waterloo was created in 1973 from the County of Waterloo and a small section of the County of Wentworth. Fifteen former local governments were reorganized as seven Area Municipalities including: Townships of Wellesley, Woolwich, Wilmot, and North Dumfries and the Cities of Waterloo, Kitchener, and Cambridge. The Region is located in southwestern Ontario, one hour west of Toronto.

The total area of the Region of Waterloo is 1382 square kilometers. The existing (2001) population is approximately 452,000 (excluding non-resident university students). The population is expected to reach 606,000 by the year 2028.

10.1 WATER SUPPLY

The Region's water comes from both groundwater and surface water. The Region has 126 wells, 14 groundwater treatment plants for the treatment of iron and manganese and one surface water treatment plant (the Mannheim WTP). Groundwater sources provide approximately 80% of the total amount of water supplied in the Region with the remaining 20% coming from the Mannheim Water Treatment Plant which is treated Grand River water. Iron sequestration is provided at Linwood, Lloyd Brown, Conestogo Plains and Linwood Eastgate Meadows. Iron and manganese filtration plants have been constructed and are operating in Ayr, Branchton Meadows, Foxboro Green, Heidelberg, Roseville, St. Clements, Wellesley, East Montrose, New Hamburg, Maryhill, Greenbrook in Kitchener, and Shades Mills, Turnbull and Pinebush in Cambridge. The Region is responsible for the bulk (wholesale) service delivery of potable water to the cities of Cambridge, Kitchener and Waterloo and to the Townships of North Dumfries, Wellesley, Wilmot and Woolwich. The seven area Municipalities are responsible for the distribution of water to their customers (retail services). Water distribution systems for the City of Cambridge, City of Kitchener, City of Waterloo and Elmira/St. Jacobs are interconnected. The Township of North Dumfries water supply system includes four water treatment facilities, located in Ayr, Branchton Meadows, Lloyd Brown and Roseville communities. The Township of Wellesley owns and operates six water treatment facilities: Heidelberg WTP, Linwood PS, Linpine Well, Linwood Eastgate Meadows, St. Clements WTP and Wellesley WTP. The Township of Wilmot has ten water treatment facilities: New Hamburg, Foxboro Green, Mannheim Village System Wells (4), New Dundee, Shingletown System Wells (2), and St. Agatha. The Township of Woolwich has seven water treatment facilities: Breslau (2), Conestogo Golf PS, Conestogo Plains PS, Elmira, Maryhill, Maryhill Village Heights, and West Montrose.

The Region's 2001 Water and Wastewater Monitoring Report stated that firm or system water supply capacities were adequate to meet actual maximum demand in all communities in 2000, except in the community of Ayr. An expansion to the Ayr water system is scheduled to be completed by 2007.

Water System	Existing capacity (1000 m3/d)	2000 demand (1000 m3/d)	2010 capacity (1000 m3/d)
Integrated Urban Water System	256.8	187.8713	308.5
Baden-New Hamburg	12.11	4.4261	12.11
Ayr	2.33	2.1322	3.33
Wellesley	2.97	1.3494	2.97
St. Clements	1.77	1.2079	1.77
Rural	Not summarized		

System water supply capacities in 2010 based on the 10 year forecast for water are anticipated to be adequate to accommodate all current development commitments for water supply. There is currently water servicing capacity available for an additional 100,000 persons in the Region of Waterloo. The Region has undertaken a long term water strategy study to provide water servicing to the Region for the next 40 years. Also there has been discussions on constructing a future water transmission line from Lake Erie or Lake Huron to provide for future water supply. But no definite plans have been developed.

10.2 WASTEWATER

The Region owns ten wastewater treatment plants. Operation is contracted out to the Ontario Clean Water Agency. Existing and planned capacities to 2010 are provided in the following table:

Wastewater capacities were sufficient at all Regional plants to treat actual average flows in 2000. Elmira, St. Jacobs, Baden and New Hamburg WPCPs were operating at or close to capacity in 2000. Construction to increase capacity at the Elmira WPCP was completed in 2001. Expansion and upgrades to the St. Jacobs WPCP were completed in late 2000. The New Hamburg WPCP was expanded and upgraded to the Baden/New Hamburg WPCP, which now receives all flows from Baden and New Hamburg. The Baden WPCP was decommissioned and converted to a pumping station. A project to re-rate the Ayr WPCP has commenced and its completion is anticipated in early 2002. A plant expansion is scheduled to be completed by 2005. Effluent from the larger WPCP discharges into the Grand River and smaller WPCPs discharge into local creeks.

WPCP	Existing capacity (1000 m3/d)	2000 flow (1000 m3/d)	2010 capacity (1000 m3/d)
Kitchener WPCP	122.7	69.14	122.7
Waterloo WPCP	62.5	42.24	72.7
Galt WPCP	56.8	33.72	56.8
Preston WPCP	16.82	11.74	16.82
Hespeler WPCP	9.32	7.03	9.32
Baden/New Hamburg WPCP	5.2	2.75	5.2
Elmira WPCP	7.61	4.79	7.61
St. Jacobs WPCP	1.45	0.95	1.45
Ayr WPCP	1.18	1.18	1.63
Wellesley WPCP	1.1	0.62	1.1



11. CITY OF GUELPH

The estimated population of the City of Guelph is 106,000 in the year 2001. Population projections for years 2011 and 2021 are 121,800 and 137,300 respectively.

11.1 WATER SUPPLY

The City is serviced with water from groundwater sources, supplied from 15 wells and a shallow collector system. Forty percent of the water is pumped from 10 wells scattered throughout the city and sixty percent of the water originates from the Arkell Spring grounds, an extensive well field located outside Guelph's southeast border in Puslinch Township.

Guelph's groundwater meets all health-related Ontario Drinking Water Objectives, and therefore the City is only required to disinfect the water by adding chlorine.

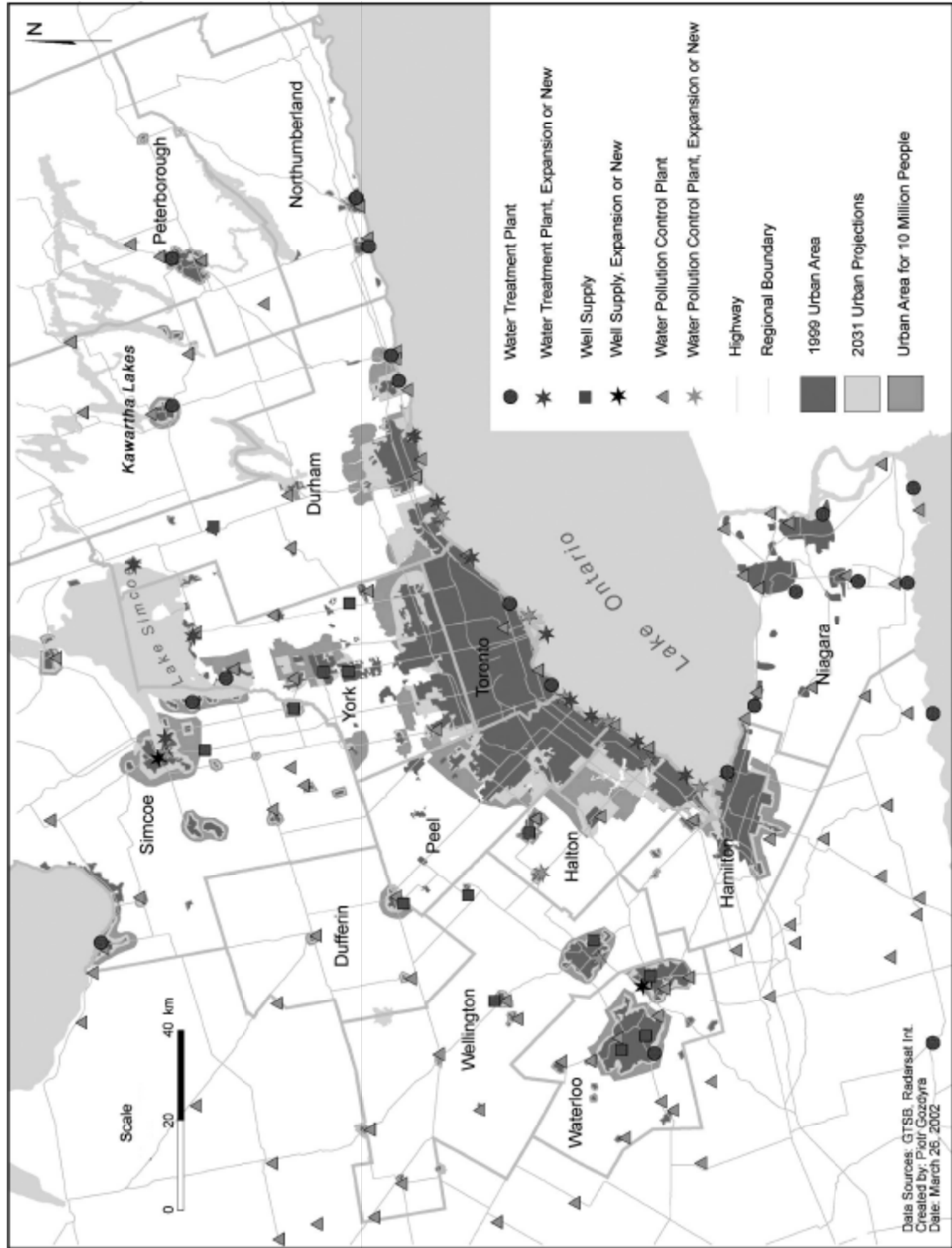
The existing system capacity is 75 ML/d, however, in a dry period during the summer, the system capacity may drop to 65ML/d.

The City is currently undertaking a Master Plan to update the long term water demand projection taking water efficiency measures into account, and is commencing a Class EA to review options for a Water Supply Enhancement Strategy.

11.2 WASTEWATER

The City owns and operates one wastewater treatment plant. Existing rated capacity is 64 ML/d (recent upgrade and expansion). Current flows to the plant average 58ML/d. A second phase expansion is scheduled in 2006, which will increase average design capacity to 73 ML/d. All studies have been completed for this construction and compliance limits are provided in the existing Certificate of Approval. Actual timing of construction will be dependent on population growth.

MAP1: WATER WASTEWATER TREATMENT FACILITIES IN SOUTH CENTRAL ONTARIO



12. STUDY FINDINGS AND CONCLUSIONS

- **Municipalities Planning for Growth** –The majority of water and wastewater treatment plants and some water transmission/trunk sewer facilities in the study area are operating at or near capacity. Most plants are located on sites that allow for some future expansion. Municipalities in general have been proactive and developed plans for the expansion of water and wastewater to service projected growth over the next 10 to 20 years. Municipalities in the GTA, where Official Plans extend to 2031, have updated, or are currently in the process of updating their Master Plans to 2031.

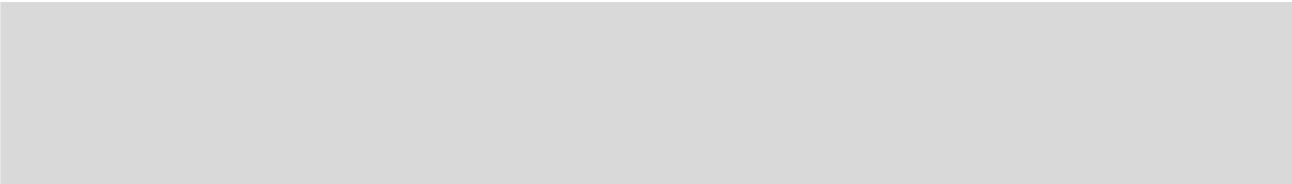
Map No. 1 attached shows existing water and wastewater facilities in South Central Ontario as well as new and proposed expansions.

Significant costs are forecasted to implement these capital improvements, e.g. York Region alone forecasts \$750 million of capital improvements to meet water and wastewater needs by the year 2031, and across the GTA several billions in capital improvements will be necessary to service anticipated growth. Funding for these improvements is generally provided through development charges and upfront contributions from benefiting developers.

Formal plans beyond 2031, for example when the Toronto area reaches 10 million, have not been developed. However, significant additional expansions and new plants at different locations will be necessary to service 10 million people with water and wastewater, as space at existing plant sites may be exhausted.

- **Old Infrastructure Needs Rehabilitation/Replacement** – The condition of older water and wastewater infrastructure in municipalities such as Hamilton, Toronto and St. Catharines is deteriorating and requires rehabilitation or replacement. These municipalities have embarked on developing asset management plans and infrastructure improvement plans to deal with the renewal. The cost of rehabilitation/reconstruction is generally provided from water and sewer rates, and therefore rates in older Municipalities such as Toronto are being increased to generate the necessary funds. Intensification and new development in existing municipalities offers the opportunity to upgrade the capacity of water and wastewater facilities and fund a portion of the costs related to capacity increases through development charges.
- **Lake Ontario a Key Water Source** - Municipalities located along the shores of Lake Ontario traditionally have taken their potable water from Lake Ontario and returned WPCP effluent to the lake. Raw water from Lake Ontario is generally easily treated with conventional treatment methods. The existing plants on Lake Ontario are in general technologically low-end direct filtration treatment systems although some water plants use complete treatment. All of these plants produce good quality water. Lake Ontario is a source of high quality drinking water available in large quantities and there is little concern that its supply will be exhausted by consumption.

Smaller municipalities further away from the lake depend on water supply from wells or rivers. Wastewater effluent is treated by local wastewater systems or private septic systems. As urban development extends in and around these smaller communities, water supply from aquifers is no longer sufficient and sewage effluent exceeds what local creeks and



streams can accept. Hence, the lake-based systems, particularly in the GTA, have been extended on a continuous basis northerly from the Lake, even serving municipalities such as land locked York Region, who has made arrangements with neighbouring municipalities such as Peel, Toronto and Durham for water supply from Lake Ontario and WPCP effluent return to the lake.

- **Improving Effluent Discharge** - While there is little concern about taking drinking water from the Lake, the ever increasing amounts of effluent from WPCPs to Lake Ontario and its impact on the water quality in Lake Ontario is a concern. The level of effluent treatment from sewage works has continuously improved over the last 100 years from rudimentary screening to primary treatment, activated sludge treatment, effluent disinfection and chemical phosphorus removal. Currently, effluent discharges from major WPCPs are under scrutiny by Provincial and Federal governments to improve effluents to “non-toxic” discharges. This may require dechlorination processes or possibly elimination of the use of chlorine for disinfection of effluent, as well as nitrification of effluent to minimize ammonia concentrations. To achieve such water quality improvements in existing WPCPs will, at a minimum, result in down-rating capacities at many existing plants and would require significant plant expansions and upgrades to bring plants back to current rated capacities.
- **Opposition to Water and Sewer Line Extensions** - The extension of the Lake Ontario based water and wastewater systems to the north is often opposed by rural and local communities who prefer the independence of getting their water locally from wells and consider their local water of superior quality.

In addition, many believe that it is water and sewer services that will bring new development, urbanization and a change in their way of life. In reality, planning for new development by necessity is completed long before water and sewer services are constructed. Based on official planning and zoning, the construction of water and sewer services is only part of the implementation process.

The quality of drinking water supplied by large municipalities who operate lake-based systems is thoroughly monitored and tested and exceeds regulatory requirements. In addition, larger municipalities also have comprehensive safety/security provisions for their water supply systems to protect against contamination, which often cannot be matched by smaller communities who lack trained and professional water and wastewater staff.

- **Lake Simcoe and Georgian Bay will serve New Development** – The existing development north of the Oak Ridges Moraine is predominantly serviced by smaller well water systems, some Georgian Bay and Lake Simcoe based water treatment plants. They are also serviced by smaller private and communal sewage treatment plants that either utilize tile fields or discharge directly to these same waterbodies.

Federal/Provincial regulations do not permit inter-basin transfer between Lake Ontario and Lake Simcoe/Georgian Bay and taking water from Lake Ontario and discharging effluent into Georgian Bay, for example, would not be permitted. Given the stress on the groundwater systems and the accompanying problems with aquifer mining and deteriorating well water quality in many of the areas north of the moraine, it can be



assumed that most of the new larger developments north of the moraine will be serviced by surface water plants drawing water from Lake Simcoe and Georgian Bay.

Sewage generated by larger development areas will have to be directed to new or expanded water pollution control facilities that would ultimately discharge treated effluent to either Georgian Bay or Lake Simcoe. Some of the smaller developments north of the Oak Ridges Moraine may take water from some of the adjacent rivers and creeks north of the moraine that flow towards either Georgian Bay or Lake Simcoe. Sewage generated within these smaller developments may be treated in smaller plants located in the communities, with effluent discharged back into the adjacent rivers or creeks. Water taking and effluent discharges to these rivers and creeks will be limited to the extent that existing flows and water quality should not be adversely affected by these works.

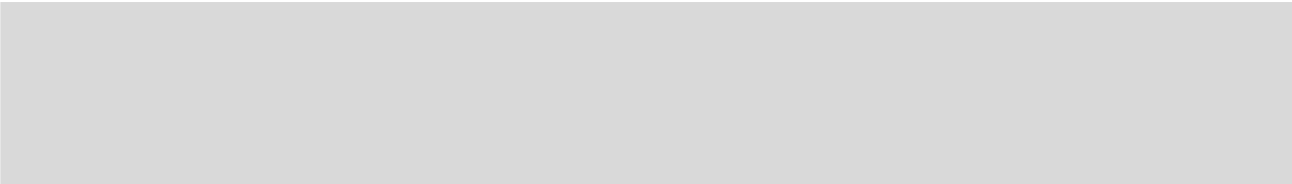
Overall significant growth north of the moraine will result in the construction of larger scale water and wastewater treatment facilities than currently exist in these areas. This further reduces the likelihood of water taking and sewage effluent discharges from rivers and creeks in this area.

- **High-end Treatment Improves Safety of Drinking Water** – Georgian Bay water is relatively clean and easy to treat. There have been concerns, however, about the existence of a parasite (*Cryptosporidium*) in the raw water from Georgian Bay waters, which has resulted in one town constructing a very high end membrane filtration water treatment plant. This plant now produces excellent quality treated water.

The raw water from Lake Simcoe has more impurities than either Lake Ontario or Georgian Bay. This water, which has a much higher level of organics, has significantly more turbidity, and has more frequent and severe taste and odour problems than the water from the other two lakes. This water is also generally considered more difficult to treat. York Region has recently constructed a new plant using this water supply and has also employed membrane filtration technology. This plant produces exceptional quality water due to the high level of treatment provided.

It is widely believed that in the future, most new plants in the GTA will likely utilize high-end treatment processes, such as membrane treatment, due to public and regulatory demands for high water quality standards across the Province, especially since the Walkerton incident. Such treatment plants are also thought to significantly reduce the risk of pathogen and parasite infection from drinking water supplies.

- **New Wastewater Plants to serve north of the Oak Ridges Moraine** – New water pollution control plants and plant expansions to serve new development north of the moraine will have to meet current Federal/Provincial Government requirement and meet Remedial Action Plans. Wastewater treatment requirements are expected to be stringent and will likely include requirements for nitrification to reduce ammonia in effluents and introduce chlorination/dechlorination or ultraviolet disinfection in lieu of chlorination before effluent can be discharged into a receiving body.

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- **Water Efficiency will Improve Infrastructure Utilization** – Most municipalities in the Study Area have water efficiency plans involving public and private water conservation measures. Furthermore, changes in Provincial plumbing regulations, which require the use of more water efficient plumbing fixtures already contribute to an overall reduction in per capita water consumption.

Water efficiency measures will conserve water resources and reduce effluent from WPCPs. Furthermore, reduction in water consumption will allow more people to use existing or new water and wastewater infrastructure and to defer, reduce or eliminate the construction of new infrastructure. The Region of York has embarked on a comprehensive water efficiency plan and has been able to base its master plan projections on a 10% reduction in wastewater flows.

- **Preserving Green Areas protects Water Resources** – Intensification of development will result in transforming less agricultural land into urban land and, as a result, will assist in protecting water resources and safe drinking water.

Reductions in hard surfaces (e.g. pavements, roof tops) will allow more rainwater to infiltrate into the ground and replenish groundwater resources. Groundwater resources are important in the supply of base flows in creeks, ponds, lakes and wetlands. Both aquatic life and much of our vegetation depends on the balancing function which groundwater plays in our environment. Furthermore there are many rural dwellings such as farms, which depend on water supply from wells.

- **Watershed Planning will protect Aquifer** - Most rural, many small communities, as well as larger municipalities further away from the lake, such as Waterloo and Guelph, obtain their water supply from groundwater. Large regional municipalities such as York, Durham, Peel and Halton all operate well systems to service smaller communities in the northern part of their service area. Currently the City of Barrie is entirely serviced by groundwater.

Groundwater systems work well as long as the amount of water obtained from wells replenishes itself through infiltration and the quality of the groundwater can be maintained. If the amount of groundwater obtained from wells is increasing to serve new development, then there is the risk of “aquifer mining”, and groundwater levels drop. Farming, industrial and urban uses all can impact on the quality of groundwater.

Groundwater plays an important role in the ecosystem and provides the base flow in rivers and creeks and supports both aquatic and terrestrial life.

Watershed planning studies are necessary to assess the current quality and quantity of groundwater, and determine what is necessary to protect the groundwater in the course of new development. Conservation Authorities have conducted or are in the process of conducting watershed plans in a number of watersheds and some municipalities have also carried out watershed studies. Planning for Water and Wastewater Infrastructure extension should therefore be included as an important component of watershed planning studies, to ensure that groundwater aquifers are protected.

- **Stormwater Management based on Watershed Planning** – Developers are required by municipalities to prepare Environmental Servicing Plans including comprehensive stormwater management plans.

Stormwater Management Plans are reviewed by Conservation Authorities on the basis of watershed planning documents and their comments are part of the municipalities' approval process. The process is successful and stormwater management measures such as stormwater ponds, infiltration facilities and wetlands have alleviated increases of stormwater runoff and pollutant loadings from new developments.

- **Retrofit Old Storm and Combined Sewers** – Older urban communities are served by storm sewer systems, which were built before regulations for stormwater management came into effect. Some municipalities, such as Toronto, Hamilton and St. Catharines, are also served by combined sewers, which by design overflow on a regular basis, a mixture of stormwater and sewage into rivers and lakes.

Combined sewer and stormwater management retrofit measures such as detention tanks, stormwater ponds and wetlands, are being installed by municipalities, however the progress has been slow and more needs to be done to eliminate combined sewer overflow and control pollution from old storm sewers. Stormwater retrofit measures must be planned on a watershed basis and be an integral part of watershed planning. The public is demanding, and has a right to, a clean waterfront and clean rivers and creeks.

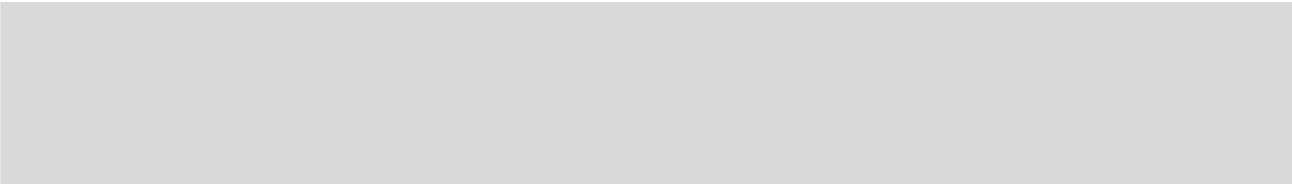
- **Improve Infrastructure Utilization** - Placing new development within existing urban areas, will take advantage of existing water supply, wastewater collection and treatment infrastructure. This will improve the utilization of water and sewage infrastructure and reduce the cost of these services for developers/residents and businesses.

Some of the existing infrastructure has aged and may require rehabilitation or replacement. However, this is required in any case to ensure that existing development continues to be served.

Adding new water and sewage users to the system will allow sharing the cost of upgrades and in the end both existing and new users will benefit.

By adding new development into existing areas, it is necessary to ensure that water and sewage systems are not overtaxed. Local water distribution systems are generally sized to convey flows for fire protection and such flows are significantly higher than what is required for domestic/commercial consumption. Therefore local water distribution systems can in most cases accommodate new development.

Transmission watermains/facilities and water filtration plants are generally sized for "maximum consumption day." In Ontario maximum consumption days occur during hot, dry weather when outdoor water use (e.g. lawn watering) is at its peak. Outdoor water uses are reduced as urban development intensifies because there is less green area. Water efficiency initiatives have also led to a reduction in outdoor water use. Furthermore, as the overall number of water users increases, water consumption peaks will be flattened out.



In summary even so new development in existing urban areas will increase the demand for water supply in terms of overall volume, the requirement for additional transmission and water filtration capacities will be less than what would be required for new “green field” development.

Sanitary sewers also often have spare capacity to accept additional flow from new (water efficiency) development. This is particularly true in the case of combined sewers serving the older parts of Toronto, Hamilton and Oshawa. Water efficiency programs, new plumbing regulations, changes (reductions) in industrial uses and inflow/infiltration control in sewer pipes through sewer rehabilitation will all result in reduction of sanitary flows and free up capacity for new users. These initiatives will also reduce flows at sewage treatment plants and thereby allow additional flow from new development to be accepted.

Detailed evaluations are necessary for all infill developments to confirm that capacities are indeed available or whether strengthening of the system is necessary. In some cases, strengthening can be combined with rehabilitation/reconstruction projects, which are required in any case, and the additional cost of increasing capacity may be relatively small.

The volume of biosolids to be managed at water pollution control plants will increase proportionally to the increase in population and industrial/commercial discharges. Therefore new development will require new biosolid facilities irrespective of where development takes place.

- **A Co-ordinated Water and Wastewater Strategy** – At this time there is no formal co-ordinated strategy, which applies across the Toronto region for the delivery of water supply and wastewater services.

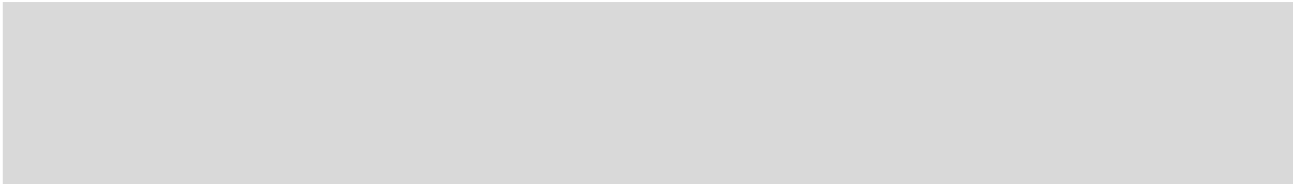
In a few cases neighbouring municipalities have made individual arrangements for the delivery of water and wastewater services, but these have been ad hoc and no structure exists to facilitate such arrangements. Municipalities have in general developed water and wastewater master plans based on growth projections in their respective official plans and their own needs.

A co-ordinated approach for water and wastewater services will benefit all municipalities by improving the protection of our natural and water resources and providing opportunities for infrastructure sharing, optimal utilization and cost savings.

- **Sharing Water and Wastewater Infrastructure** - Even with intensification of development and placing more new development into existing urban areas, water and wastewater infrastructure will require continuous expansion to serve 47,000 ha of additional urban area by 2031 and a further 60,000 ha by the time the GTA reaches a population of 10 million.

As development expands and urban areas grow closer together, opportunities for sharing infrastructure will increase.

Some infrastructure sharing has already occurred, for example, in the case of the Region of York who does not have direct access to Lake Ontario. York shares wastewater facilities



with the Region of Durham, water supply from the City of Toronto, and has entered into agreements with the Region of Peel for the sharing of water supply and wastewater facilities. The City of Toronto and the Region of Peel also share some wastewater services to facilitate servicing in the vicinity of the Toronto/Peel municipal boundary. These arrangements are currently ad hoc and there is no formal structure in place to coordinate water and wastewater infrastructure planning across the GTA.

Taking advantage of optimizing the utilization of new and existing water and wastewater infrastructure in terms of capacities, layout, scheduling, financing and implementation will reduce cost and overall impacts on the environment. To achieve this, it would be necessary that the water and wastewater services be coordinated and be reviewed in terms of the needs and constraints of the entire region and opportunities for efficiency.

- **Optimize Utilization of Infrastructure** – A co-ordinated approach for the planning of water and wastewater infrastructure would allow optimizing the utilization of infrastructure. Municipalities sometimes have reserves or unused capacities in their water and wastewater system. Unused capacities may be used for new development within the same municipality or, in some cases, neighbouring municipalities, and thereby eliminate or defer the need for new water and wastewater infrastructure.

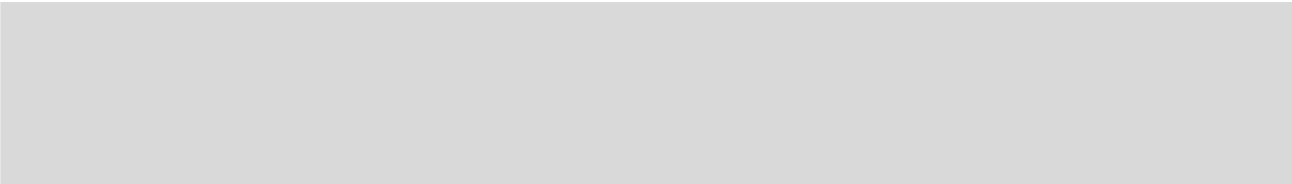
The City of Toronto and the Region of York have embarked on a “Joint Optimization Study” for their water supply systems. The study will identify unused water supply capacity in treatment plants and in the transmission system, which may be used to support new development in the Region of York. A co-ordinated approach for the planning of infrastructure between municipalities may identify similar opportunities between other municipalities.

- **Governance of Water is Fragmented** – In Ontario the responsibility for water is shared between many jurisdictions that each have their own legislation/regulations and procedures.

The Federal government has legislation to protect, regulate and improve water quality, fisheries, navigation, international and heritage, rivers, harbours, wetlands, areas of natural or significant interest (ANSIs) and issues related to environmental protection and environmental assessment.

The Provincial government has legislation to protect, regulate and improve water resources, wetlands, waterways, lakes and rivers, beds of navigation, water transfer, operation of clean water, drainage and issues related to environmental protection and environmental assessment.

Municipalities have various bylaws to regulate wetlands, drainage, water and wastewater services, stormwater management and zoning. They are represented on Conservation Authorities who are responsible for and regulate flood control measures, habitat protection, river and valley protection, land acquisition and outdoor recreation. In addition, there is the International Joint Commission, which is based on bilateral agreements between Canada and the U.S., and has the mandate to improve water quality in the Great Lakes. The Commission has been active in such issues as developing Remedial Action Plans.



As a result, approval processes for water and wastewater often involve several levels of government, and many laws and regulations to comply with. Overlap and duplications lengthen the approval process to the point that “getting the approval” often becomes the primary focus rather than arriving at a best solution. If this process is to become more effective and efficient, then the various jurisdictions need to agree on delegating their approval and enforcement process to one specific agency or government authority.

Governance of water has been reviewed as part of the Walkerton inquiry and the recommendation in the Part I and II reports of the commissioner’s inquiry may result in a review of governance and the opportunity for actions to streamline and make the process more effective.

- **Catchment Area Planning** - Except for the Grand and Thames Rivers, watersheds in south/central Ontario are relatively small and do not lend themselves to effectively conducting water management and carrying out planning of water and wastewater infrastructure for large urban areas as part of individual watershed planning studies. Considering urban growth in South Central Ontario and the fact that much of the potable water is taken as surface water from lakes, it would be more effective to carry out water management on the basis of larger districts or catchment areas which include several watersheds, e.g. the entire GTA or areas tributary to the north shore of Lake Ontario, Lake Simcoe, or the south shore of Georgian Bay.

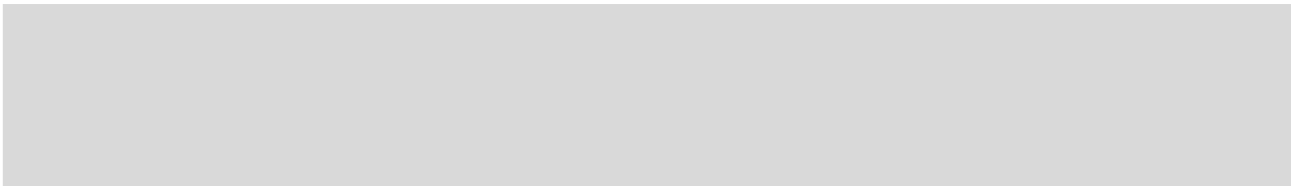
Currently, there is no formal structure in place to co-ordinate water management for the larger urban areas across several watersheds and involving more than one municipality.

Districts or catchment areas may cover several municipalities, would permit water management and the co-ordination of planning for water and wastewater services on a large scale and co-ordinated basis while ensuring that the needs of individual watersheds can also be addressed.

- **Mandate of Conservation Authorities** - One option to facilitate water management and the co-ordination of planning for water and wastewater infrastructure for larger urban areas is to expand the mandate of Ontario’s Conservation Authorities.

Conservation Authorities have been very successful in regulating/implementing flood control, protecting sensitive wetlands, valleys and ravines, acquiring lands for conservation and developing watershed plans. Watershed plans already address surface and groundwater quantities and quality as well as aquatic and terrestrial habitats and species (see Table 1 attached, List of Watershed Planning Activities). In addition, Conservation Authorities also undertake reviews and provide comments to municipalities on how Master Environmental Service Plans for new development application affect the watershed under their jurisdiction. Conservation Authorities also have a strong local/municipal connection because members are representatives of member municipalities.

Conservation Authorities, under current legislation, are mandated to restrict and regulate the use of water in and from rivers and lakes. However, this responsibility excludes the water use by municipalities. Furthermore, there are currently five (5) Conservation Authorities in the GTA and a total of 9 in South Central Ontario. Some of them cover only one watershed which is distributed over several municipalities and therefore only



cover a small area in each of the municipalities. Map No. 2 attached shows the limits of Conservation Authorities in relation to municipal boundaries. A list of Conservation Authorities within the study area is provided in Table 1 attached to this report.

If Conservation Authorities are mandated a greater role in water management, e.g. the co-coordinating or some regulatory responsibility for the planning of water and wastewater services for new urban areas, then they must combine into larger geographic entities covering areas such as the entire GTA and be provided with extended responsibilities. Mandating Conservation Authorities to assume water management responsibility is one option to co-ordinate water issues across larger areas such as the Toronto Region and would also offer the opportunity to some provincial ministries, such as the Ministries of Natural Resources and the Environment, to reduce their day-to-day involvement in municipal water issues.

Delivery of water and wastewater services in urban areas would continue to be the responsibility of municipalities or water utilities and the extent of the mandate for water management would have to be defined by stakeholders.

- **The Catchment Management Authority Model** - The CMA model used in France and in similar forms being implemented in other European countries, is another option to consolidate and co-ordinate water management. CMAs are responsible for enforcing and overseeing all regulations, policies and guidelines put in place regarding water by Federal, Provincial and Municipal governments. For example, they would administer all permits and Certificates of Approval for water and sewage works including water withdrawal and discharge permits. Also they would assist and oversee the planning of water and wastewater services within the district or catchment area they are responsible for. In effect, CMAs are an objective, separate entity with powers to prosecute and fine service delivery agencies if they do not meet federal, provincial or local legislation or regulations.

The jurisdiction of CMAs typically extends over a larger river basin or over a number of watersheds. The delivery of water and wastewater services remains with municipalities or is transferred to separate private or public water utilities.

The advantages of CMAs are that the new entity is responsible for enforcing and overseeing all water related regulations, policies and water management issues within a larger area such as the entire Toronto region, ensures a consistent, systematic and co-ordinated approach to water management and offers a one-stop shopping solution.

Establishing CMAs in Ontario would require a significant reform of jurisdictional water related responsibilities. Buy-in from stakeholders may be difficult to achieve because it would involve the transfer of responsibilities from all levels of government to the new CMAs.

MAP 2: MUNICIPAL CONSERVATION AREA BOUNDARIES

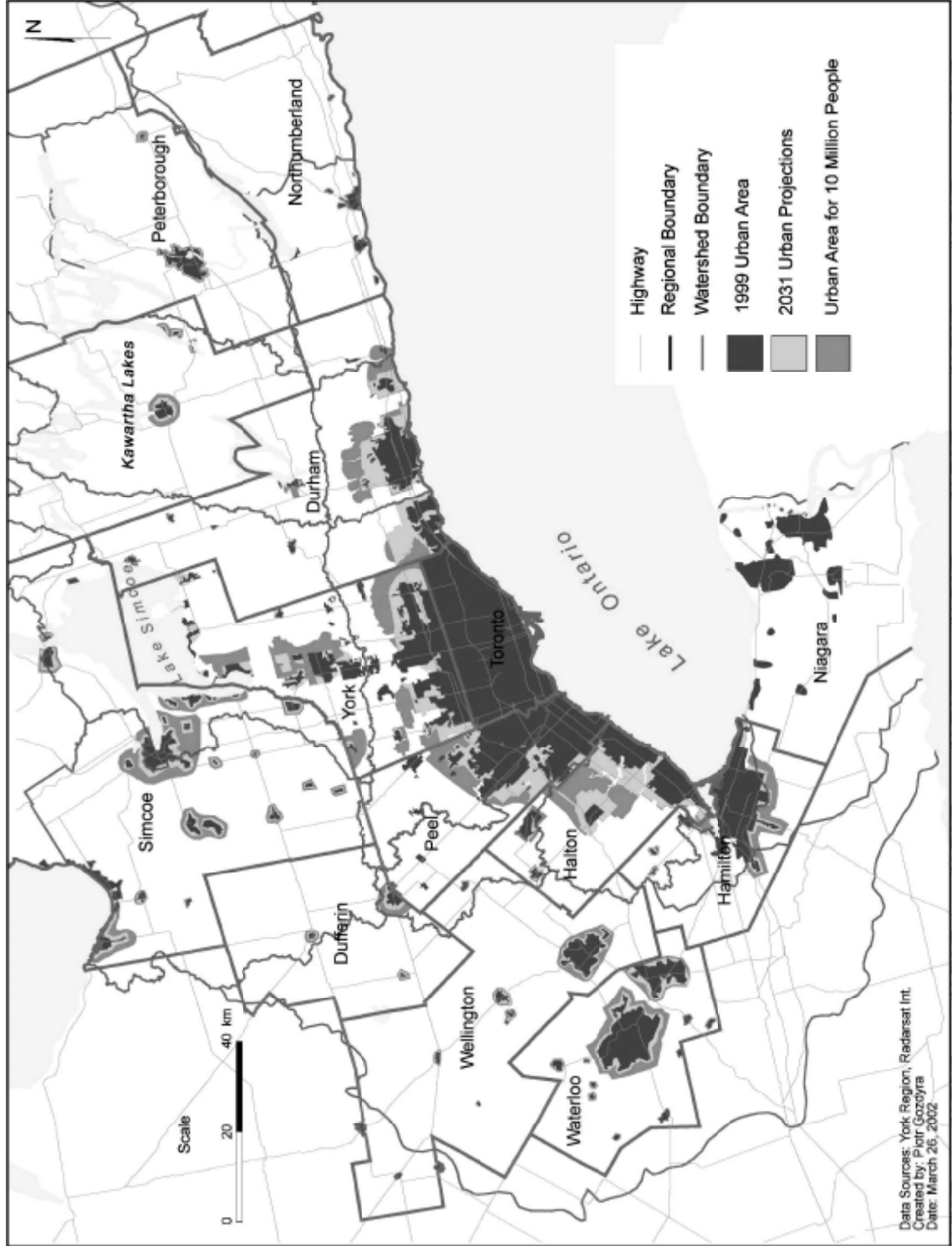


TABLE 1:

List of Conservation Authorities and Watershed Planning Activities

1. LIST OF CONSERVATION AUTHORITIES IN SOUTH CENTRAL ONTARIO

Map No. 2 attached shows the boundaries of the following Conservation Authorities in relation to municipal boundaries:

- Niagara Conservation Authority
- Grand River Conservation Authority
- Halton Conservation Authority
- Credit Valley Conservation Authority
- Nottawasaga Conservation Authority
- Toronto Region Conservation Authority
- Lake Simcoe Conservation Authority
- Central Lake District Conservation Authority
- Kawartha Conservation Authority
- Ganaraska Conservation Authority

2. WATERSHED PLANNING ACTIVITIES

The following are activities which are performed by Conservation Authorities as part of Watershed Planning:

- Integrated Watershed Plan Document
- Surface Water Quality
 - Hydrological modelling
 - Floodplain base mapping
 - Flood and Fill Line Mapping
 - Flood Vulnerable Sites Database
 - Flow Distribution database
 - SWM Criteria for Flood
 - Guidelines for Floodplain Mapping Update
 - Flood Warning Database
 - Remedial Flood Works Identification
 - Fluvial geomorphic stream assessment
 - Continuous flow modelling
 - SWM Criteria for Erosion Control
 - Geomorphic database
 - Erosion Hazard Site database
 - Remedial Erosion Site Identification
 - SWM Pond Database
 - Major Study Area Database
 - Base flow Inventory
 - Water taking inventory
 - Base flow distribution mapping
 - Surface Takings Mapping
 - Protocol for Water Takings
 - Water Budget

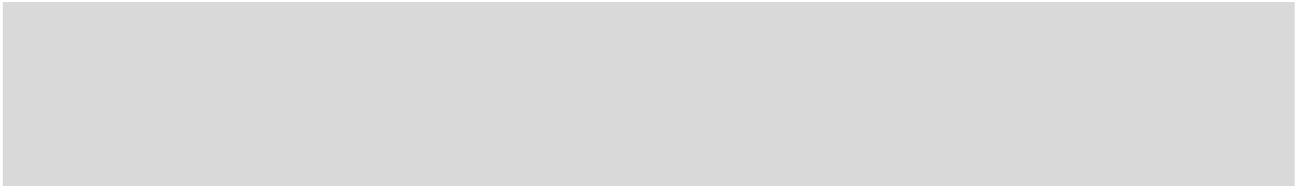
- Surface Water Quality
 - Water quality assessment
 - Water quality/contaminant modelling
 - Spills inventory and mapping
 - SW retrofit opportunities assessment
 - Priorization of contaminant sources
 - SWM Criteria for water quality control
 - Urban SW Retrofit Plan
 - Rural Water Quality Management Plan

- Groundwater Quantity
 - 3D Geological Mapping Compilation
 - Well Record Compilation
 - Aquifer Mapping and Flow Interconnections
 - Groundwater Flow Modelling
 - Water Use Inventory
 - Groundwater Discharge Mapping
 - Delineation of Permanent/Ephemeral Streams
 - Priority recharge area mapping, rates/volumes
 - SWM Criteria for Recharge
 - Protocol for Water Use
 - Priority Discharge Area Mapping, rates/volumes
 - Groundwater Management Plan

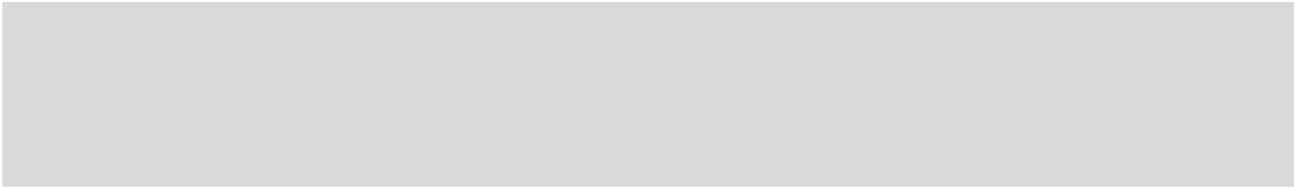
- Groundwater Quality
 - Analysis of MOE-CA GW quality data
 - Correlation
 - Compilation of contaminant audit
 - GW quality trends at MOE-CA network sites
 - Identification of potential contaminant areas
 - Source Protection Plan

- Aquatic Habitat And Species
 - Fish habitat surveys
 - Fish community surveys
 - Benthic Invertebrate community surveys
 - Riparian zone surveys
 - Regional reference community assessment
 - Water temperature survey and modeling
 - Fisheries management plans
 - Aquatic community targets
 - Priority regeneration activities and sites
 - Aquatic comm. eval. Tools and pred. Models

- Terrestrial Habitat And Species
 - Digitization of natural cover and land use
 - Field data collection and mapping
 - Terrestrial natural heritage modelling

- 
- Reporting on current conditions
 - Terrestrial natural heritage system targets
 - Terrestrial natural heritage strategy

· Watershed Monitoring Network



BACKGROUND REPORT 4:

CITY AND REGIONAL STRATEGIES TO PROTECT COUNTRYSIDE AND AIR QUALITY: A BIBLIOGRAPHY AND SYNOPSIS OF STUDIES AND INITIATIVES IN THE GTA

Prepared by: GHK Canada
May, 2002

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INTRODUCTION

This bibliography has been prepared to provide background material for a study commissioned by the City of Toronto on “regional strategies for managing development patterns, protecting valuable countryside such as the Oak Ridges Moraine, and reducing greenhouse gas emissions and air pollution”. The basic premise is that urban form has a direct impact on the natural environment and that this is inextricably intertwined with the nature and pace of development in the City of Toronto and in the Region generally.

The following report provides an update on the current Provincial and Greater Toronto regional policy strategies to protect the environment, manage population growth and influence urban form. The first section of this report highlights what is currently happening regarding growth management in the Greater Toronto Area. This includes a review of the Ontario government’s Smart Growth program, initiatives underway at the Greater Toronto Services Board and planning reviews undertaken by the regional municipalities and conservation authorities.

The second section organizes recent studies on growth management and environmental protection in the Greater Toronto Area by topic area. It highlights reports (or portions of reports) that present various design, financing and policy tools to encourage more sustainable urban form.

Key extracts and paraphrases from each document are cited to guide the reader through this varied list of resources. A similar overview of growth management policies and planning tools with an international perspective to complement this literature review has also been completed.

PART I CURRENT INITIATIVES

1. THE PROVINCE OF ONTARIO

1.1 SMART GROWTH

In the summer of 2001, the Ontario government invited public input on its land-use policies and encouraging development that meets Smart Growth criteria. Part of this strategy included three phases of consultations that involved key stakeholders such as the Canadian Urban Institute and the World Wildlife Fund and a range of Ontario developers, municipal staff, community leaders and environmentalists. The Ministry of Municipal Affairs and Housing planned to utilize ideas gathered to develop their Smart Growth policies (Ministry of Municipal Affairs and Housing, 2001).

These consultations included 17 day-long sessions with more than 700 stakeholders, 33 meetings with municipal representatives, and more than 460 written submissions from the public and organizations. The final document “Listening to Ontario: A Summary of Consultations,” outlined the following areas of concern raised in these meetings:

- land use planning;
- multimodal transportation;
- telecommunications;
- environmental planning;
- economic development;
- agriculture;
- housing; and
- municipal governance.

Smart Growth management councils were then created to provide guidance on how the province grows. The province is encouraging public and stakeholders to offer their ideas on the mandate of these councils, who should sit on them and the boundaries of the zones they would cover. These Smart Growth management councils have been established in five zones across the province to provide advice and support to the province and municipalities on promoting and managing growth. These councils could be composed of representatives from the province, municipalities, and the private and non-profit sectors.

The primary purpose of the management councils is to establish Smart Growth management plans which provide a long-term vision for economic growth along with strategies to protect the environment and improve the quality of life and in each zone. The plans would help achieve the provinces principles of Smart Growth, “a strong economy and communities and a clean, healthy environment.”(Ministry of Municipal Affairs and Housing, 2001).

1.2 THE OAK RIDGES MORaine

On May 17th 2001, the Provincial Government of Ontario placed a six-month freeze on development on the Oak Ridges Moraine. In June they initiated a consultation process on how the Moraine should be protected.

The Oak Ridges Moraine consultation process involved two key components:

1. an advisory panel with representatives from environmental and conservation groups, the development and resource industries, municipal government and academia that met throughout July to advise the Ministry of Municipal Affairs and Housing on a long-term strategy for the moraine's use and protection; and
2. an inter-ministry team that will lead public consultations in late August and early September and analyze as well as formalize the findings.

The objectives of these groups was to explore how to protect the water recharge functions of the Moraine, how to promote orderly growth in existing built-up areas and how to provide environmentally sustainable economic activities on and near the Moraine (Ontario Ministry of Municipal Affairs and Housing, 2001).

On August 14, the Advisory Board released a Draft Strategy for Community Growth and Natural Protection. The recommendations in this report include classifying the moraine lands into four broad land-use designations:

- 1) **Natural Core Areas** - containing large concentrations of key natural features, significant hydrological areas and complex landforms;
- 2) **Natural Linkage Areas** - comprising woodlots, wetlands and rural areas that link natural core areas with each other and with other natural corridors, such as the river valleys north and south of the moraine;
- 3) **Countryside Areas** - where rural and agricultural land uses take place; and
- 4) **Settlement Areas** - made up of lands approved for urban land uses.

The report also recommends and that publicly owned natural lands be increased to 12 percent of the moraine.

Some of the tools for implementing the strategy include:

- creating an Oak Ridges Moraine Legacy Trust, an arms-length partnership body to apply the non-regulatory aspects of the plan including tools to protect water resources and create a continuous natural corridor.
- supporting voluntary action and good stewardship by providing resources to government and volunteer groups preserving the moraine.
- applying property-tax reductions to privately held lands that contain trails, sensitive natural areas, hydrological areas and important linkage areas.

- encouraging the federal, provincial and municipal governments to contribute to the Oak Ridges Moraine Legacy Trust, share expertise, and assist with actions to protect the moraine.

In December, 2001, The Oak Ridges Moraine Conservation Act “to protect water resources and natural features on the Oak Ridges Moraine” was passed by the Ontario Legislature. This Act allows the government to institute a land use plan for the future protection of 100 percent of significant natural and water resource features on the Moraine, protect agricultural land and focus development in approved settlement areas. Decisions on planning and development applications that commenced on or after November 17, 2001 are required to conform to the Oak Ridges Moraine Conservation Plan (Ministry of Municipal Affairs and Housing, 2001).

The plan includes strict policies to protect water quality and quantity on the Moraine. It will protect cold water streams, wellheads, and all kettle lakes on the Moraine. It will also require innovative stormwater management practices to protect sensitive recharge areas, and prohibit technologies that cause rapid infiltration of stormwater into groundwater. The plan aims to preserve the Moraine now and in the future, providing certainty for a range of stakeholders including environmentalists, developers, municipalities, aggregate producers and farmers.

The legislation also includes amendments to:

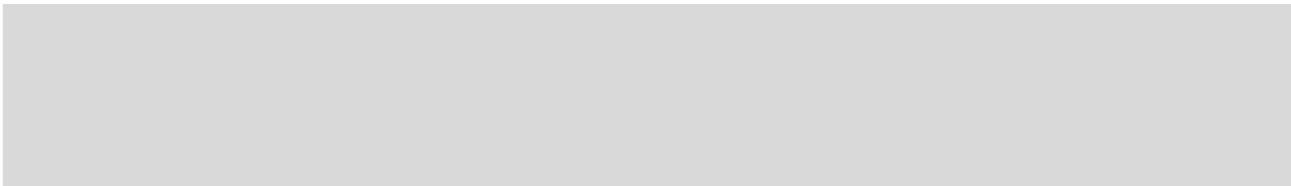
- require a revocation of the Oak Ridges Moraine Conservation Plan to be subject to a public process;
- require public consultation when the plan is reviewed in 10 years;
- ensure that the 10-year review cannot remove lands within natural core and natural linkage designations; and
- require final approval by the Minister of Municipal Affairs and Housing for zoning amendments required to bring local zoning into conformity with the plan.

With this legislation in place, future Oak Ridges Moraine strategies that the provincial government, non-governmental organizations and the private sector are negotiating include the creation of an Oak Ridges Moraine trail system with a continuous east-west trail along the Moraine; and the appointment of an interim board of directors for a new Oak Ridges Moraine Foundation. This foundation will have a mandate to fund activities such as land securement, research, monitoring and public education.

1.3 FIVE YEAR PROVINCIAL POLICY STATEMENT REVIEW

The provincial government is in the process of reviewing its Provincial Policy Statement under the Planning Act. Stakeholder consultations and public open houses were held through the summer and fall to examine these policies. The Ministry of Municipal Affairs and Housing is currently reviewing submissions from stakeholders. Information on the state of this process is available on the Ministry of Municipal Affairs Housing web site.

The Planning Act requires that the policies in the Provincial Policy Statement be reviewed every five years. This is the first time the province has comprehensively reviewed the Provincial Policy Statement since it came into effect in 1996.



The purpose of the review is to give the government an opportunity to assess its land use planning policies and determine required revisions. It will also assist the government in determining whether its land use policies support Smart Growth objectives (Ontario Ministry of Municipal Affairs and Housing, 2001).

Results are being used to shape some of the government's Smart Growth policies. The Planning Act requires that municipalities, provincial ministries, the Ontario Municipal Board and other decision-makers consider specific policies in the Provincial Policy Statement when implementing any planning strategies.

1.4 BROWNFIELD LEGISLATION

In May 2001, the Minister of Municipal Affairs and Housing introduced legislation to encourage the cleanup and revitalization of abandoned or contaminated lands known as "brownfields."

The Brownfields Statute Amendment Act, 2001 forms part of the government's Smart Growth strategy. The Ministry believes that redeveloping brownfields encourages smarter patterns of growth since it cleans up contaminated land, makes more efficient use of existing infrastructure (like roads, sewers and schools), and provides an alternative to developing on greenfields and farmland (Ontario Ministry of Municipal Affairs, 2001).

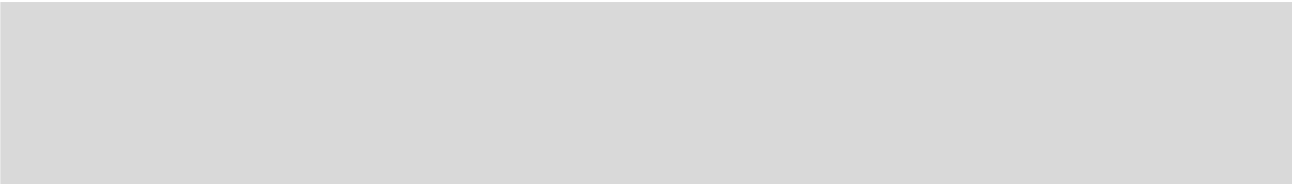
The proposed legislation is the result of two years of consultations and discussions. It incorporates recommendations made by a panel of brownfields experts appointed by the province in September 2000. It addresses the key challenges to brownfield cleanup and redevelopment: environmental liability, planning processes and financing (Ontario Ministry of Municipal Affairs, 2001).

The main barrier to encouraging brownfield redevelopment is concern over environmental liability. Despite the benefits to be gained from developing brownfields, financial institutions and developers are often nervous to invest in these sites. Their caution is based on concerns over the potential liabilities of health and environmental problems and the financial implications of these liabilities.

The proposed legislation sets out clear rules for limiting future environmental liability complemented by checks and balances to ensure that environmental standards are met and that the people of Ontario are protected. The proposed changes do not alter the Ministry of the Environment's powers to issue orders to address environmental emergencies or to take strong action against polluters. The ministry will continue to assess site clean ups.

Some key elements of the proposed changes to environmental legislation include:

- Clear rules for cleanup.
- Clear rules for environmental liability.
- Amendments to community improvement provisions in the Planning Act to expedite brownfield projects.
- Methods to encourage owners of brownfield sites to undertake site cleanup by providing them with property tax relief to assist in remediating their brownfield properties.



The Brownfield legislation is currently being reviewed in the legislative process and will be debated in the legislature in mid-September.

1.5 DEMONSTRATION PERMIT SYSTEM PILOT PROJECTS

The province has issued a regulation that allows five municipalities to investigate a new development permit system (DPS). The development permit system is an optional planning tool meant to simplify the planning approvals process. If successful, the methods used in these pilot projects can be replicated in other communities. Municipalities can then identify areas for development that meet Smart Growth criteria and utilize this permit system.

The DPS is a flexible planning tool that combines zoning, minor variance and site plan control into one approval process. A DPS can be established by municipalities by adopting an official plan amendment and a development permit (DP) by-law, using the public notice and appeal processes for official plan amendments and zoning by-laws (Ontario Ministry of Municipal Affairs, 2001).

The five DPS pilot project areas were chosen because they characterize a broad cross section of development areas. The pilots will assess the effectiveness of the DPS and identify implementation issues. Pilot project areas include:

- **The City of Hamilton** - to encourage the revitalization of the Gore historic area;
- **The Region of Waterloo** - to regulate development around sensitive well-head areas;
- **The Township of Lake of Bays** - to allow appropriate development in environmentally sensitive shoreline areas;
- **The City of Toronto** - to assist redevelopment of the Central Waterfront Area and to provide an expeditious land use approval process for the waterfront;
- **The Town of Oakville** - to allow the development of the Winston Park West Employment District.

To confirm that the DPS will result in better development and faster approvals, the pilot project areas will be monitored with defined assessment criteria. Once the pilot projects are finished, the DPS will be evaluated, by the municipalities and the province, and can be utilized by other municipalities.



2. THE ROLE OF THE GREATER TORONTO SERVICES BOARD

Disbanded in December 2001 by the Ministry of Municipal Affairs and Housing, the Greater Toronto Services Board (GTSB) grappled with issues regarding regional coordination of transportation and infrastructure planning. The main policy focus of the GTSB was GO Transit which is now under provincial jurisdiction. The newly established Smart Growth management councils will also provide growth management policy direction.

With limited financial resources to direct towards transportation and increasing concerns with road congestion, and the increasing population of the Greater Toronto Area, the GTSB focussed on methods to coordinate GTA transit, improve goods and services movement and develop strategies to preserve green space and agricultural lands. These initiatives were driven by concerns that deteriorating infrastructure and the increase in congestion were resulting in the decline in the quality of life in the Greater Toronto Area (GTSB, 2001).

Current GTSB studies included:

- a strategic transportation plan for the GTA and Hamilton;
- work with regions and municipalities to protect future transit corridors through the preparation of the “Transit Corridors Priority and Phasing” studies;
- a study on transit funding as a follow up to the IBI/Hemson study prepared for the regional and City Treasuries a few years ago;
- a Goods and Services Movement Strategy to address the needs of safe and efficient goods and services movement in the GTA and Hamilton Area;
- a GTA Countryside Strategy following the Draft Countryside report produced in the year 2000; and
- a review of options for the future structure of the GTSB.

3. REGIONAL INITIATIVES

Current regional initiatives that address urban growth and the implications of urban form include, A) “Tri Regions” study on the Oak Ridges Moraine by the Regional Municipalities of Durham, Peel and York together with partner conservation authorities and municipalities on the Oak Ridges Moraine, B) “The City and Regional Strategies to Protect Countryside and Air quality” funded by the City of Toronto, C) The joint study by the Ontario Professional Planners Institute and Urban Strategies on Smart Growth, and D) Official Plan updates and research on population growth and urban form by Greater Toronto Area Regional Planning Departments.

3.1 THE TRI REGIONS STUDY

This study provides a list of recommendations to improve our understanding of the Moraine and to strengthen existing Official Plan policies with regards to the Moraine. Regarding the Oak Ridges Moraine as a complex system of natural features with significant ecological functions essential to our quality of life and economy. This document provides recommendations to encourage a Moraine-wide approach to groundwater management, development policy and landform conservation (Regional Municipalities of Durham, Peel and York, 2001).

3.2 THE CITY AND REGIONAL STRATEGY

This study explores strategic approaches to guide the future form of urban development and infrastructure provision in the Greater Toronto Region. Areas that this study highlights include strategies for managing development patterns, protecting valuable countryside, reducing greenhouse gas emissions and air pollution and maximizing existing infrastructure (GHK International Canada, 2001). This research will be included in submissions as part of the Provincial policy formulation process on “Smart Growth.”

3.3 REGIONAL MUNICIPALITIES

Current research by Greater Toronto Regional Planning Departments on the implications of population growth include:

City of Toronto

- Currently in the process of reviewing the Official Plan which is expected to be out late Spring 2002.
- The recent Toronto Plan Directions Report identifies planning and policy strategies to deal with a forecasted growth increase of 540,000 to a million more people and 540,000 jobs over the next 30 years.
- Key strategies outlined in the Directions report include tools for reurbanizing arterial roads in “The Avenues” reports, providing a diversity of housing options and investing in the economy, livable communities and the environment

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- Five “Campaigns of Action” in the Directions Report that focus on these strategies include: “The Campaign for Beautiful Places,” “the Campaign for Making Housing Happen”, “The Campaign for a Dynamic Downtown,” “ The Campaign for Next Generation Transportation” and “The Campaign for a Green Toronto”
 - The Official Plan review incorporates a strong regional perspective as a result of consolidating, for the first time, the fragmented policies of the former municipalities now forming the City of Toronto.

Durham Region

- Recently established some site-specific agricultural and conservation easements. These encourage the conservation of tributary streams and agricultural lands from subdivision development in specific sites.
- Undertaking the Transportation Master Plan developed through the Durham mobility study. This document will act as a blueprint to help guide the Region’s future transportation programs and investments.
- Recently collaborated with the Tri-Region study to create proposals to better manage the Oak Ridges Moraine in areas of hydrology, natural heritage data management, policy development and securement.
- Currently in the process of preparing background discussion papers that will initiate an Official Plan review process. Background discussion research will explore commercial structure, urban land requirements, environment and open spaces and rural and agricultural lands.

Halton Region

- Currently in the process of reviewing the Halton Regional Official Plan.
- Areas of focus include improving natural areas, expand greenlands, providing woodlot protection, making agricultural industry sustainable, remedying gridlock, reviewing transit options, encouraging investment in nodes and providing affordable rental housing.

Peel Region

- Currently in the process of weighing the pros and cons of an Official Plan review. One argument for revising the Official Plan is that growth in Peel Region is higher than anticipated in 1997 Official Plan.
- Currently involved in background research for a Transportation Master Plan in collaboration with Peel municipalities.
- Recently collaborated on the Tri-Region study to create proposals to better manage the Oak Ridges Moraine in areas of hydrology, natural heritage data management, policy development and securement.



York Region

- Vision 2026 process is currently underway. This is a process to encourage public participation in Official Plan policy formation.
- Recently adopted the Greenlands Securement Strategy to protect York Region's natural areas and entered into a formal partnership with the Nature Conservancy of Canada to assist in protecting natural areas.
- Recently collaborated with the Tri-Region study to create proposals to better manage the Oak Ridges Moraine in areas of hydrology, natural heritage data management, policy development and securement.

4. CONSERVATION AUTHORITIES

Provincial Conservation Authorities are encouraging sustainable urban form with a range of programs, policy recommendation and community-based initiatives. The Living City Program, for example, is a series of projects that aim to transform Toronto and surrounding regions into living, breathing eco-system. Healthy river programs, bio-diversity and green space initiatives, environmental education and natural habitat restoration projects are some of the Living City programs.

Another policy focus of the Ontario Conservation Authorities is Watershed Management. This includes initiatives to protect drinking, ground and surface water, as well as monitoring how climate change affects water management throughout Ontario.

PART II LITERATURE REVIEW

The following provides extracts and paraphrases from literature on urban growth and structure in the Greater Toronto Area. In order to develop a broad sense of the impacts of population growth in the region, a range of reports examining urban form, environmental, economic and social policy and local governance structure are categorized under a number of subject headings. Policy, design and financial tools to encourage more sustainable growth forms are also highlighted. The section is organized according to topic area rather than alphabetically by study, hence the same study may be referenced in different headings, highlighting the aspects of the study that pertain to the particular topic area.

1. IMPLICATIONS OF URBAN GROWTH AND STRUCTURE

1.1 SOCIAL IMPLICATIONS

City of Toronto Development Services. 2000. Choosing Where to Live. Toronto: City of Toronto

- Accommodating housing desires has led to urban sprawl and a range of negative economic, environmental and quality of life concerns for the entire GTA.
- Addressing the demand for affordable rental and owner-occupied housing is critical to the economic health and social vitality of the city.
- One half of the people moving out of the city are young husband-wife households with children moving to one of the surrounding GTA regions.
- These households tend to have upper to high incomes and live in single-family residences.

City of Toronto Urban Development Services. 2001. Unlocking the Opportunity for New Rental Housing: A Call to Action. Toronto: City of Toronto, 2001

On Line Available <http://www.city.toronto.on.ca/torontoplan/reports.htm#19>

- Rental housing ensures more efficient land uses and service delivery. Without an increase in rental housing in Toronto and the GTA, Smart Growth is difficult to achieve.
- There is an increasing awareness that the current state of rental housing is not sustainable. Newcomers, seniors and young people are affected the most by a shortage in rental housing.
- The business community is affected by a lack of rental housing. For instance, the high-tech and bio-medical sectors, (that rely on a young, highly-skilled mobile labour force) relies on rental housing to provide homes for employees.
- Key changes in taxation, legislation, the business environment, and program responses which have resulted in the shift from significant production levels of rental housing in the 1970's to the minimal production levels of the 1990's.

Gilbert, Richard, Larry Bourne and Meric Gertler. 2000. The State of the GTA in 2000. Toronto: Greater Toronto Services Board

- Immigrants now account for over 40 percent of the GTA population. A number of issues are related to immigration such as language training, accessible and affordable housing and job opportunities.
- Income polarization is becoming more of a serious issue, as the incidence of poverty is higher in the GTA than in the province as a whole. The proportion of people living below the poverty line increased between 1991 and 1996 from 14 per cent to 20 per cent.
- The ageing population raises concerns about increasing social dependency. This population will impact service provision, municipal finance, housing and transportation.
- The lack of affordable rental housing is an ongoing issue that affects the quality of life of many Torontonians.

IBI Group and Hemson Consulting Ltd. 1999. Funding Transportation in the Greater Toronto Area and Hamilton- Wentworth. Toronto: Greater Toronto Area Regions and the City of Toronto

- Many aspects of quality of life depend on the transportation system. Declining transportation service levels limit individual choice in almost every aspect of life from residential and work location to access to shopping, recreation and social support networks. Social costs of long commuting times include family disruption and road rage.
- Increased auto emission levels degrades the health of many individuals and their quality of life. This also affects the health care system.

Slack, Enid. 2000. Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century: A report prepared for the Neptis Foundation. Toronto: Neptis Foundation

- Although Toronto has benefited from globalization, increasing income polarization seriously undermines the ability of the region to provide needed services.
- Toronto has an uneven share of poor households compared to other GTA municipalities.
- The province has taken over funding responsibilities for elementary and secondary education while, because of the ageing population, the expenditure demands of education are reduced and the social service demands for municipalities are increasing.
- The downloading of many services, including social services, to the municipalities has put increased financial pressure on them and all municipalities may not have the resources to provide these services.

City of Toronto Economic Development. 2000. Toronto Economic Development Strategy. Toronto: City of Toronto

- If the housing prices drop enough, an increasing number of middle income young families looking for home ownership opportunities may begin to look within the city causing a change in the types of services needed in those neighborhoods.

1.2 ECONOMIC AND COST IMPLICATIONS OF URBAN STRUCTURE

Blais, Pamela, Berridge, Lewinberg, Greenberg, Dark and Gabor Ltd. 1996. The Economics of Urban Form: A Report Prepared for the GTA Task Force. Toronto: Greater Toronto Area Task Force

- If the low density, green fields development pattern that characterizes urban development in the GTA today is maintained, future growth is estimated to require \$90 billion of supporting capital investment in new infrastructure over the next 25 years.
- The current development pattern needs to be modified to include compact development and mixed land use. Then the capital investment required would decrease by \$10 billion, and operating and maintenance costs would decrease by \$2.5 billion to \$4 billion.
- Encouraging more efficient, compact urban form to contain future growth will result in a cost savings of \$700 million to \$1 billion annually. These savings result from external costs such as the health costs of emissions and accident policing.
- Property taxes, development charges, and user fees generate a subsidy for residents of low-density suburban areas. This subsidy artificially decreases the cost of inefficient urban development and distorts the urban housing and property markets.
- Renters in the GTA pay two to four times the amount of property tax as single-family homeowners.

IBI Group and Hemson Consulting Ltd. 1999. Funding Transportation in the Greater Toronto Area and Hamilton-Wentworth. Toronto: Greater Toronto Area Regions and the City of Toronto

- GTA/Hamilton Wentworth cannot continue to defer investment into transportation infrastructure. Seventy percent of the freeway network is congested in peak periods. This has negative impacts on services to businesses and residents.
- Congestion and inadequate services levels have direct costs in productivity through time wasted on a congested transport system and increased accident costs.
- Gridlock drives away existing business and deters new business from coming to GTA/Hamilton Wentworth.

Slack, Enid. 2000. Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century: A report prepared for the Neptis Foundation. Toronto: Neptis Foundation

- Under investment in infrastructure will result in increasing traffic congestion and reduction in the quality of life, affecting Toronto's ability to attract business in the future.
- Commercial and industrial taxpayers in Toronto have been subsidizing single-family homeowners much more than in other GTA municipalities.

Slack, Enid, Municipal Finance and the Pattern of Urban Growth, a report prepared for the C.D Howe Institute. 2002. Toronto: C.D Howe Institute

- Empirical studies reveal that the property tax, Canadian municipalities' main source of revenue, sometimes encourages low-density development A system that does not match property taxes with services received has the potential to reduce property improvements

and the density of development and is likely to affect some decisions about business location.

City of Toronto Economic Development. 2000. Toronto Economic Development Strategy. Toronto: City of Toronto

- Quality of place is a critical factor in determining where people, particularly knowledge workers, choose to locate and invest. The quality of neighbourhoods, parks, ravines, schools, theatres, museums, galleries and urban design as well as our employment areas, roads, streets, sidewalks and public transit have a direct impact on our quality of life and the city's competitiveness.
- Physical and social infrastructure, under the City's direct or partial control, are assets that can be leveraged to support economic growth and provide a competitive advantage over other cities.
- Ensuring the fiscal sustainability of the City is critical to competitiveness, economic growth, and enhancing our quality of life.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade
On Line Available, <http://www.bot.com/policystatements/policy01-6-27.html>

- The cost of congestion to businesses could reach \$3.0 billion annually, or 1.3 percent of regional GDP by 2021.

1.3 ENVIRONMENTAL IMPLICATIONS

Berridge Joe, Greenberg, Ken and Lewinberg, Frank. 1991. Guidelines for the Re-urbanization of Metropolitan Toronto. Toronto: Municipality of Metropolitan Toronto

- If current low density, peripheral development continues, 233,000 acres of Greenfield land will be urbanized in the GTA in the next 30 years. This is equal to 1.5 times the size of Metro.

Blais, Pamela, Berridge, Lewinberg, Greenberg, Dark and Gabor Ltd. 1996. The Economics of Urban Form: A Report Prepared for the GTA Task Force. Toronto: Greater Toronto Area Task Force

- Some significant costs associated with low-density urban form include traffic congestion, air and noise pollution, traffic related accidents and highway policing and medical costs.

Blais, Pamela. 2000. Inching Towards Sustainability: The Evolving Structure of the GTA: A Report prepared for the Neptis Foundation. Toronto: The Neptis Foundation

- A majority of the new growth taking place in the GTA is on fringe Greenfield sites and prime agricultural land due to weak or failed planning policies.

Conservation Ontario. 2001. The Importance of Watershed Management in Protecting Ontario's Drinking Water Supplies. Newmarket Ontario: Conservation Ontario

- A major watershed issue in southern Ontario is keeping the watershed healthy (economically, socially and environmentally) while accommodating growth.
- Urban areas are progressively looking for additional surface and groundwater supplies. Increasingly, these supplies are being depleted by others or are being contaminated by pollutants.

Federation of Ontario Naturalists. 2001. The Oak Ridges Moraine Greenway. Toronto: Federation of Ontario Naturalists
On Line Available, <http://www.ontarionature.org/issues/orm.html>

- The Oak Ridges Moraine is home to sixty-five rivers and streams, twenty-eight percent of the moraine is forested, a diverse range of wildlife and acts as a water and air filter for the GTA and surrounding regions.
- Keeping the GTA competitive has a lot to do with the cost and efficient operation of infrastructure. The Moraine provides the opportunity to establish an outer limit for urban sprawl in the GTA.

Gilbert, Richard, Larry Bourne and Meric Gertler. 2001. The State of the GTA in 2000. Toronto: Greater Toronto Services Board

- Low-lying greenfield development is an ongoing problem in the GTA.
- In the face of an additional two million inhabitants in the next two decades, action must be taken immediately to achieve more efficient, compact urban form. It is important from a sustainability perspective that considerable investments be made to support alternatives to the automobile.
- Urban form and transportation are closely linked to the ongoing issue of smog.
- Travel demand, especially automobile travel and truck travel, has increased dramatically between 1986 and 1996 by 30 percent.
- There is a need to find more lasting solutions to the garbage issue, particularly addressing commercial and industrial waste, and the initial generation of waste.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Toronto: Rural GTA Working Group, Office of the Greater Toronto Area

- The emergence of relatively large planned developments outside of existing settlement areas (such as retirement and golf communities) threatens the rural character and values of these communities and places new stresses on the natural environment.

Greater Toronto Services Board. 2000. GTA Countryside Strategy. Toronto: Greater Toronto Services Board

- Approximately two thirds of the GTA is countryside.
- The negative effects of the growth patterns in the GTA are increased traffic gridlock, loss of agricultural lands, loss of open space, decline in quality of life and impacts on groundwater, wildlife and plants.

IBI Group and Hemson Consulting Ltd. 1999. Funding Transportation in the Greater Toronto Area and Hamilton-Wentworth. Toronto: Greater Toronto Area Regions and The City of Toronto

- Increased congestion has environmental impacts through increased auto emissions that affect air quality.

Regional Municipalities of Durham, Peel and York with Conservation Authorities and Municipalities on the Oak Ridges Moraine. 2001. The Oak Ridges Moraine: Proposals for the Protection and Management of a Unique Landscape. Regional Municipalities of Durham, Peel and York

- The Oak Ridges Moraine is an intricate system of natural features, with significant ecological functions that are essential to our quality of life and economy.
- Aquifers within the Moraine provide a source of drinking water for over 250,000 people in the Greater Toronto Area and a water supply for agricultural, industrial, commercial, and recreational uses.
- Key stresses and threats to groundwater on the Moraine include: urban and rural development pressure and potential for contamination from urban storm water, septic systems, landfills, crop farming, peat extraction, sewage treatment effluent, golf courses and feedlots.

The City of Toronto Environmental Task Force. 2000. Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto. Toronto: City of Toronto
On Line Available, http://www.city.toronto.on.ca/council/environtf_clean_green.htm

- Stresses on the environment include transportation, sprawl, energy production and use, solid waste generation and disposal, hazardous material use and disposal, habitat loss and degradation, the introduction of exotic species, wastewater, storm water, emission of air pollutants and the regions' ecological footprint.

Wright, Robert. 2000. The Evolving Physical Condition of the Greater Toronto Area: Space, Form and Change: A Report Prepared for the Neptis Foundation. Toronto: Lverage Center for Landscape Research, University of Toronto, Neptis Foundation

- The loss of working agricultural land is about 17% of the farmland in the GTA over a five-year period (1976-1996). This reveals an approximate loss of 625 square kilometers or 1500 hectares.
- The province needs to take a stronger role to implement measures to protect the Oak Ridges Moraine.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade
On Line Available, <http://www.bot.com/policystatements/policy01-6-27.html>

- Road congestion has become a major concern in the GTA. More than 70% of major highways in the GTA are now congested in peak periods. Off-peak congestion is also occurring in many parts of the region. Without alternatives to highways, congestion is forecast to increase dramatically throughout the region over the next twenty years.

1.4 STRUCTURAL IMPLICATIONS

Berridge Joe, Ken Greenberg and Frank Lewinberg. 1990. Guidelines for the Re-Urbanization of Metropolitan Toronto. Toronto: Municipality of Metropolitan Toronto¹

- The urban structure of a city has many implications. The pattern of distribution of development affects air pollution, the length of daily commutes, transit use, sense of community, access to services and shopping and opportunities for business location.

Blais, Pamela. 2000. Inching Towards Sustainability: The Evolving Structure of the GTA: A Report prepared for the Neptis Foundation. Toronto: The Neptis Foundation

- A small amount of development is happening in designated nodes.
- The City of Toronto has accounted for less than one-quarter of regional residential growth over the last decade.
- Densities in the 10 to 15 units per gross hectare range, which is the current range in the urbanizing municipalities of the outer GTA, are around the minimum threshold needed to support even a basic level of transit service.
- There is a total of 350,000 housing units either currently in the planning approvals process, or approved and ready for building permits to be issued. These homes will likely accommodate upwards of one million people.

Canadian Urban Institute. 2001. Smart Growth in Canada. Toronto: Canadian Urban Institute, On Line Available, <http://www.canurb.com/home.html>

- The main distinguishing feature of sprawl is the way in which new development consumes land at a faster rate than the rate at which the population is growing.

City of Toronto Urban Development Services. 2001. A Transportation Vision for the City of Toronto Official Plan. Toronto: City of Toronto, On Line Available, http://www.city.toronto.on.ca/torontoplan/trans_intro.htm

- Competition for limited road capacity by automobiles, cyclists, transit, and pedestrians places severe limitations on the range of viable transportation options.
- The fundamental reason for defining a 'new' vision of transportation is to provide a basis for transportation and land use planning that will counteract as many as possible of the perceived negative impacts of the current system on the community, the economy, and the environment, while contributing simultaneously to orderly economic growth and development.
- By and large, there is a growing awareness that these problems result directly from increased dependence on private automobiles.
- Some growing concerns regarding transportation and land-use include:
 - congestion;
 - public health impacts of automobile use;
 - road safety;
 - urban sprawl; and
 - the high costs associated with public transportation.

¹The Metro Toronto Official Plan was based on the approaches proposed in this report. These concepts are also influencing policy directions for the City of Toronto Official Plan under review.

Deloitte Consulting. 2001. Getting Started: A Review of the Greater Toronto Services Board. Toronto: Greater Toronto Services Board

- The general consensus is that the major challenges in the GTA are growth management, transportation and transit, environmental infrastructure, economic development and tourism and social issues.

Gilbert, Richard, Larry Bourne and Meric Gertler. 2000. The State of the GTA in 2000. Toronto: Greater Toronto Services Board

- Gross residential densities in the GTA are variable. In some areas residential densities are increasing while gross densities are falling because of areas allocated for park spaces, roads, and low-density employment lands.
- Limited data suggests that employment densities are dropping faster than residential densities.

Greater Toronto Services Board. 2000. GTA Countryside Strategy. Toronto: Greater Toronto Services Board

- The GTSB envisions the GTA evolving into a region of more compact urban form with a series of nodes and corridors of employment and housing

Greater Toronto Services Board. 2000. Removing Roadblocks to Continued Economic Prosperity for the Greater Toronto Area, Ontario and Canada: A Strategic Transportation Plan for the GTA and Hamilton-Wentworth. Toronto: Greater Toronto Services Board

- Travel patterns are shifting. Growing numbers of people live in suburban GTA and more companies are choosing to locate in these areas.
- Increasingly, growth will not be from the suburbs to the downtown core, but from one suburban center to another.
- Car travel for commuting and day-to-day purposes is on the increase.
- Transportation and land use patterns do not match municipal attempts to promote centers and corridors.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Ontario: Rural GTA Working Group, Office for the Greater Toronto Area

- The extension of transportation, water and sewer infrastructure is resulting in predominantly bedroom communities in the rural GTA that are increasingly extensions of urban settlements.
- The overall challenge for rural municipalities is how to balance growth with the protection of greenlands, farmlands and other natural and cultural features and resources that define the rural landscape.

Hare, Melanie. 2001. Exploring Growth Management Roles in Ontario: Learning from “Who Does What” Elsewhere, a report prepared for the Ontario Professional Planners Institute. Toronto: Urban Strategies Inc.

On Line Available, <http://www.ontarioplanners.on.ca/content/issues/policypapers.asp?section=policypress>

- Ontario’s growth management efforts have not been keeping up with the shifting nature of our communities.
- Existing management tools do not address the scale or level of complexity of our urban centers and the rural/urban interface.
- There is a need to implement new approaches if we are to be able to guide and manage growth.
- Population projections foresee growth of 100,000 people per year in the Greater Toronto Area alone - growth management will become increasingly important in helping Ontario cities accommodate growth while maintaining liveability over the next few decades.

IBI Group. 1990. Greater Toronto Concepts Study. Ontario: Office of the Greater Toronto Area

- Low-density, spread development has the highest transportation operating costs when compared to more centralized and nodal land use forms.
- Nodal and centralized development forms consume less agricultural land for urbanization, have less growth impact on existing community character, provide a variety of community sizes, a broad range of density in housing types and a mix of residential and job activity compared to low-density, spread urban form.
- Centralized development forms receive higher ratings for transportation because of shorter trips and greater transit use followed by a Nodal formation. Low density, spread form ranks highest for level of service in the suburbs and in terms of intercity connections and access to rural area, but would have higher operating costs and a greater possibility of road congestion in central areas.
- Nodal development will create less pressure for the GTA low-density overspill and will produce less pressure of GTA-oriented road traffic in the hinterland.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade

On Line Available, <http://www.bot.com/policystatements/policy01-6-27.html>

- Sprawl is consuming the countryside. An amount of land equivalent in area to the City of Toronto could be lost to development across the GTA in the next 20 to 30 years if current land-use trends continue.

Wright, Robert. 2000. The Evolving Physical Condition of the Greater Toronto Area: Space, Form and Change: A Report Prepared for the Neptis Foundation. Toronto: Lverage Center for Landscape Research, University of Toronto, Neptis Foundation

- Planning policy should focus on the densification of designated development nodes and increasing the density of land uses.

- Investment in and planning for expanded service infrastructure on the fringe is facilitating the spread of urban sprawl in the GTA. Curtailing access to water and sewer services is probably one of the best forms of planning and growth control that could be implemented in the GTA.
- A system of regional sub-centres outlined in most regional Official Plans is a viable and attractive option for the diversification and growth in the zones between core and fringe.

Miller, Glen, Janice Emeneau and John Farrow. 1997. GTA Urban Structure: An Analysis of Progress Towards the Vision. Toronto: The Canadian Urban Institute

- Despite doubts about the marketability of higher density development and concerns about the availability of funding for public transit infrastructure, the regions have made attempts to integrate growth management policies.
- The regions have made progress in establishing the policies for mixed use, compact development in nodes.
- They have not been successful in policy development and planning for higher density corridors to encourage links between the nodes.
- Corridors traverse jurisdictions involving multiple layers of bureaucracy that sometimes have competing or conflicting goals making it difficult to satisfy transit demands.
- There is currently no agency with a mandate to respond to the very different requirements of a multi-centered regional urban structure.
- The regions and area municipalities are not effective in using the power of capital spending on infrastructure to influence development focused on nodes and corridors.
- In terms of consumer demand, the market for higher density, compact development has not been successfully developed and marketed

Weinstein Leeming and Hinde and Associates Limited, McCormick Rankin, duToit Allsopp Hillier and Hemson Consulting Limited. 1995. Highway 7 Corridor Land Use and Transit Study. Toronto: Office of the Greater Toronto Area, Ministry of Transport and Region of York

- The demand for transit on Highway 7 is expected to grow significantly over the next 30 years given projected increases in population and employment.
- Without early action to initiate transit and to integrate transit and land use plans, the opening of Highway 407 will reinforce the current auto dependency of suburb-to-suburb travel, making it difficult to realize the vision for “Avenue Seven” recommended by this study.

1.5 AGRICULTURAL IMPLICATIONS

Blais, Pamela. 2000. Inching Towards Sustainability: The Evolving Structure of the GTA: A Report prepared for the Neptis Foundation. Toronto: The Neptis Foundation

- If the past rate of farmland loss continues into the future, in the GTA we will lose on average 3,000 hectares of prime farmland each year, totaling 67,000 hectares lost by 2021. This is an area larger than the new City of Toronto.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Ontario: Rural GTA Working Group, Office of the Greater Toronto Area

- Official plan approvals for urban expansion since 1993 have resulted in about 134,000 acres of the rural area being approved for urban use up to 2021.

Greater Toronto Services Board. 2000. GTA Countryside Strategy. Toronto: Greater Toronto Services Board

- 150,000 acres of farmland lost to urbanization between 1976 and 1996.
- There are many factors that lead to the loss of farmland. These include people valuing the suburban lifestyle, municipal plans and infrastructure design, OMB decisions on a wide range of development appeals and applications by developers to subdivide and build.
- Local planning authorities must not perceive agricultural land as vacant land waiting to be developed. Preserving identifiable countryside to reduce sprawl is important.

Walter and Hunter Planning Associates, Betsy Donald, J. Ross Raymond and Associates. 1999. Greater Toronto Area Agricultural Economic Impact Study. Toronto: Ontario Federation of Agriculture

- Because of rapid urbanization and inefficient development patterns, between 1976 and 1999 16.5% or 150,024 acres of farmland in the GTA was lost.
- Protecting farmland is necessary to protect the long-term health of agricultural industries.
- According to the 1996 census there were 4,621 farms producing over \$585 million in crops in the GTA in 1996. This amount is larger than \$512 million for the County of Huron, \$384 million in Nova Scotia and \$326 million in New Brunswick.
- The physiography, soil capability and heat units that characterize the GTA combine to create a prime agricultural area. Its geographic characteristics qualify as part of the 5% of the Canadian landmass that is designated as prime agricultural land. A significant proportion of it is part of the even more limited .5% of Canadian landmass that qualifies as Class 1 land under the Canada land inventory.

2. GROWTH MANAGEMENT TOOLS

2.1 REURBANIZATION TOOLS

Berridge Joe, Ken Greenberg and Frank Lewinberg. 1990. Guidelines for the Re-urbanization of Metropolitan Toronto. Toronto: Municipality of Metropolitan Toronto

- All major Metro centers, corridors and infill areas should be mixed-use and include both housing and employment uses, as well as community facilities and public spaces.
- Re-urbanization should stress improving the connectivity of places by pedestrian means. This includes encouraging street edge buildings, providing lighting, adequate sidewalks, street trees and special features like boulevards, medians and public art. Parking lot design is important because it can contribute and detract from the urban environment. Surface parking should not be permitted to reduce the quality of the public realm.
- The height, size and typology of buildings should be compatible with what exists. They should have proportions that do not result in sudden change and do not “dwarf” the existing design fabric.
- Some past re-development projects in Metro have resulted in very large or tall buildings, which are out of context with their surroundings. Contextual building is important.
- Micro-climactic effects and condition in existing parks and public spaces should be considered for all re-urbanization areas

Berridge, Joe, Urban Strategies 1999. Reinvesting in Toronto: What the Competition is Doing. A Report for the Canadian Urban Institute. Toronto: Canadian Urban Institute

- Toronto is currently investing about one-fifth the rate of its competitor cities for investing in infrastructure.
- Of the ten cities surveyed by Urban Strategies, approximately \$263 million per year has been spent on downtown and central waterfronts over the past decade.
- On average the ten cities surveyed spend \$670 million in project like sports stadia and theatres, \$448 million was spent on public-private partnerships and \$1.5 billion on roads, transit and parking facilities. Of these roughly 60, 40 and 90 percent of the funding came from the public sector.
- The city-region needs the kind of regeneration management capacity characteristic of modern world cities.

Blais, Pamela. 1996. The Economics of Urban Form. Toronto: Berridge, Lewinberg, Greenberg, Dark and Gabor Ltd.

- Capital expenditures for schools, hospitals can be lowered by making better use of existing capacity in already urbanized areas by re-urbanization.
- Municipal development standards must be loosened to allow for less capital intensive infrastructure.

City of Toronto. 2000. Bloor and Lansdowne, The Avenues: A Concept Plan for the Study Area. Toronto: City of Toronto²

- In order to initiate area-specific design work it is important to start by utilizing the knowledge of those who will be affected by and involved in its future development. It is important to build on an understanding of the area's historical, physical and location characteristics.
- It is important to encourage parking solutions that are compatible with the creation of a healthy public realm and enhanced pedestrian amenities.
- On-street parking should be designed wherever possible.
- Plans should buffer pedestrians from the negative effects of the vehicular roadway, using landscaping, street improvements, and signalized street crossings.
- The large development sites south of Bloor Street should be redeveloped with residential and live-work buildings.
- Streetscape improvements include: new treeplanting, sidewalk paving, painted murals on underpasses, footbridge connections and active street frontage.

City of Toronto Policy and Research. 2001. Unlocking the Opportunity for New Rental Housing: A Call to Action. Toronto: City of Toronto,
On Line Available, www.city.toronto.on.ca/torontoplan/rental_housing.htm

- There is no shortage of development sites for rental buildings in Toronto.
- Possible development sites include:
 - main streets in the former city of Toronto;
 - areas in Scarborough and Etobicoke;
 - the downtown and Central Waterfront;
 - Brownfields sites; sites along major arterial roads;
 - near subway stations; older shopping plazas and malls often located in suburbs; and
 - "Tower in the park" apartment sites that can be intensified.

Hare, Melanie. 2001. Exploring Growth Management Roles in Ontario: Learning from "Who Does What" Elsewhere, a report prepared for the Ontario Professional Planners Institute. Toronto: Urban Strategies Inc.
<http://www.ontarioplanners.on.ca/content/issues/policypapers.asp?section=policypress>

- With regards to reurbanization, the following are key ingredients for an effective growth management strategy:
 - promoting cities as the engines of the economy and ensuring that downtown cores, main streets, towns and cities are liveable;
 - investing in the physical infrastructure of existing communities through infill, reuse and intensification of well-serviced centres and corridors; and
 - ensuring that existing and new communities support the broad mixture and range of land uses, development densities, and housing options that make communities liveable and meet economic and social needs;

² This is only one of the four "Avenues Reports"- the three other study areas include concept plans for Finch Avenue at Weston Road, The Queensway: Mimico Creek to Kipling Avenue and Kingston Road: Guildwood GO station to Highland Creek

Ontario Ministry of Municipal Affairs. 2000. Brownfields Showcase: Realizing the Environmental, Economic and Community Building Benefits of Brownfields Redevelopment. Toronto: Queen's Printer for Ontario

- Tools used by Ontario municipalities to assist in the financing of brownfield development include:
 - municipal loans and grants (e.g. core area grants, building façade improvements loans, building renovation loans);
 - tax increment equivalent financing to leverage the difference between current and potential tax yields on redevelopment properties; and
 - the waiver of municipal fees where appropriate.
- Liability Tools for brownfields revitalization include:
 - Ministry of Environment Liability Agreements signed with local municipalities and lenders that limit exposure to liability risks under circumstances such as site investigations;
 - technology databases that provide remediation technology and project detail information that help manage the risks of a brownfields project; and
 - environmental liability insurance that can form part of a comprehensive risk management program for brownfields redevelopment projects.
- Process Tools brownfields revitalization include:
 - a process model developed by the Regional Planning Commissioners of Ontario; and
 - "one window" customer service offered by a number of local municipalities to simplify and streamline the requires approvals for brownfields redevelopment projects.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade
On Line Available, <http://www.bot.com/policystatements/policy01-6-27.html>

- Expanding rail-based transit would support such urban intensification and would be consistent with the recent "Smart Growth" initiative of the Government of Ontario.
- The GTA Vision of 1992 was based on the premise that development across the GTA should be concentrated around nodes and corridors that could be served by economically viable public transit.

2.2 FINANCING TOOLS AND BUSINESS STRATEGIES

Berridge, Joe. 1999. Reinvesting in Toronto: What the Competition is Doing, A Report for the Canadian Urban Institute. Toronto: Urban Strategies

- Public investment funds in U.S cities primarily comes from the federal government, although a multitude of urban programs exist at the State and local levels as well. Some of these investment programs are:
 - Transportation Equity Act (TEA-21);
 - The Community development block grant (CDBG);
 - The Home Investment Partnership Program (HOME); and
 - The Revitalization of Severely Distressed Public Housing Program (HOPE –VI).
- On a comparative scale, a U.S region the size of the GTA could receive \$42 million annually in TEA-21 base funding, \$155 million in CDBG's, \$46.5 million in HOME funds.
- Flexible urban financing instruments exist at all government levels in the United States. These include tax abatements, capital grants based on increment financing (TIF), future revenue obligation bonds for particular cities or agencies, local sales tax and personal and corporate income tax exemptions and Federal and State historic tax credits.
- Earlier Canadian programs such as the Neighbourhood Improvement Program (NIP) and the Residential Rehabilitation Action Program (RRAP) have been eliminated or reduced.
- A strategic vision that defines the GTA's needs and a target of about 10 percent of total operating budget is needed to develop a truly competitive, global city.
- Alternative models to provide municipal services must be implemented to improve cost effectiveness.
- The GTA should be able to acquire “soft money” from the public sector such as tax credit schemes, abatements and guarantees rather than requesting grant monies.
- The province should assist and supplement an infrastructure fund at the GTA level.

Blais, Pamela. 1996 The Economics of Urban Form. Toronto: Berridge, Lewinberg, Greenberg, Dark and Gabor Ltd.

- A variety of taxation, subsidy and development charges, and user fee practices currently fragments the GTA. A single property tax and a single development charge system needs to be established across the GTA.
- An appropriate tool for the coordination of service provision and infrastructure investment at the GTA level is essential to reduce costs and improve services.
- More efficient land use patterns would be achieved by implementing the principle that property owners should pay for services and infrastructure in relation to the degree to which they generate infrastructure and service costs.
- A cost-based pricing approach improves the efficiency of the market and resource allocation and can generate the revenues needed to pay for land use patterns.
- User fees are a revenue-generating option. For example road pricing is an effective tool for generating revenue to pay for transportation and to manage transportation demand effectively.
- Provincial grants should be awarded taking efficiency of infrastructure and land use patterns into account.

City of Toronto Urban Development Services. 2001. Unlocking the Opportunity for New Rental Housing: A Call to Action. Toronto: City of Toronto
On Line Available, www.city.toronto.on.ca/torontoplan/rental_housing.htm

- Recommendations for the Federal Government to encourage more rental housing:
 - revise the underwriting criteria it uses to approve mortgage insurance for rental developments;
 - lower the requirements for equity demanded of rental investors;
 - establish a tax-credit program;
 - allows the creation of tax-exempt savings accounts that act as investment pools;
 - allow the use of labour-sponsored investment funds for affordable housing; and
 - make suitable surplus federal land available, on preferential terms, to encourage the creation of new rental housing.
- Recommendations for the Provincial Government to encourage more rental housing:
 - amend the Planning Act, the Building Code Act and the Development Charges Act to allow municipalities to reduce or waive fees, charges or requirements (e.g parking) for rental housing;
 - continue to provide PST incentives for rental housing by explicitly including low-rise and townhouse rental housing in its PST rebate program;
 - eliminate or reduce the PST on construction materials used in building new rental housing; and
 - take steps to increase the number of people trained in construction-related trades every year to prevent a shortage of skilled tradespeople.
- Recommendations for the Municipal Government to encourage more rental housing:
 - enact by-laws that will encourage reducing fees, charges and requirements to foster the production of private rental housing; and
 - conduct a parking survey to determine rates of automobile ownership among tenants to assist in setting appropriate parking requirements for new rental housing.

Federation of Canadian Municipalities. 2001. Early Warning: Will Canadian Cities Compete. Ottawa: Federation of Canadian Municipalities
On Line Available, http://www.canadascities.ca/fcm_execsummary_e.pdf

- The fiscal tools available in municipalities in the United States offer more choice than those in its Canadian counterparts. These tools include property tax, sales tax, hotel/motel tax, business tax, fuel tax, license fees, income tax, development charges, tax-exempt municipal bonds, tax incentives and grants to corporations.
- Municipal officials across Canada emphasize the need for funding solutions to allow roads, better transit, modern waste systems and rehabilitated sewers.
- Once a foundation for funding large capital projects, infrastructure grants in Canada are now too small and too infrequent to provide a reliable revenue source.



Hare, Melanie. 2001. Exploring Growth Management Roles in Ontario: Learning from “Who Does What” Elsewhere, a report prepared for the Ontario Professional Planners Institute. Toronto: Urban Strategies Inc.
On Line Available, <http://www.ontarioplanners.on.ca/content/issues/policypapers.asp?section=policypress>

The following are key financial strategies to support an effective growth management strategy:

- strategically investing in and efficiently operating multi-modal transportation;
- implementing incentive-based systems and performance measures that consider and reflect social, economic and environmental priorities; and
- investing in the physical infrastructure of existing communities through infill and reusing brownfields.

Ontario Ministry of Municipal Affairs. 2000. Municipal Financial tools for Planning and Development. Toronto: Queen’s Printer for Ontario

- Key financial tools available to Ontario municipalities include grants and loans, tax increment equivalent loans or grants, fee exemption, refunds, waivers and reductions.
- In the City of Oshawa, the city entered an agreement with a financial institution under which a bank took applications and approved loan and for municipally determined eligible works. The Municipality underwrote the interest rate of the loan so that it was significantly below market.
- London and Thunder Bay have set up programs that provide property owners with grants equivalent to a deemed tax increment.
- Some examples of grants allotted to communities in Ontario:
 - core area grant program – a grant of 50 percent of the remediation costs, up to a maximum of \$1,000 per unit, payable on issuance of a building permit;
 - development application and building permit fees waiver – applies to new residential units constructed on rehabilitated contaminated sites in the core areas;
 - building permit fee waiver – applies to all development in the core area;
 - realty equivalent tax grant – a three year program which applies to non-contaminated property in core areas. Grants relate to increases in realty taxes (city tax portion only) resulting from property improvements;
 - building revitalization program – provides low interest loans for improvements to core area properties;
 - DesignGuide Program – provides grants for owners to retain professional assistance in designing property improvements;
 - development allowance credit – applies to a property required to be cleaned up equal to the amount of the assessment and cleanup costs of the property, not to exceed the total development charge payable to the city;
 - development charges exemption – applies to core areas by the city, Waterloo region and Hydro Electric Commission; and
 - development charges credit – for properties designated under the Ontario Heritage Act.

Organizational Sub-Committee Downtown Brampton Transition Team. 2001. Establishing a Downtown Development Corporation in the City of Brampton. Brampton, Ontario: City of Brampton

- In order to establish a Downtown Development Corporation in Brampton, the City of Brampton must be able to borrow money and receive grants for the purpose of attaining goals in the strategic plan.
- The Corporation should also be granted the ability to acquire strategic property for economic development purposes.

Peterson, Paul. 2000. Alternative Tools for Protection of the GTA Countryside, A Background Report prepared for the GTA Countryside Strategy. Toronto: The Greater Toronto Services Board

- **Gift of Land or Income Tax Incentives** - Land owners who are willing to make a gift of land can qualify for a charitable tax receipt and for a reduction in income tax.
- In the February of 2000 federal budget, significant changes were made to the rules affecting gifts of qualifying “ ecologically sensitive land.” Just one half of the taxable capital gain arising from the disposition of the land will now be included in income.
- There is a valuable opportunity for municipalities to use these incentives in co-operation with conservation organizations in business of land owner contact and stewardship programs.
- **Property Tax Incentives** – In Ontario, there programs are in place for relief from property taxes in order to support agriculture and to promote appropriate stewardship of forests and natural areas.
- The Conservation Land Tax Incentive Program is administered by the Ministry of Natural Resources and by the Ministry of Municipal Affairs and Housing.
- Qualifying lands include provincially significant wetlands and habitats of endangered species. Landowners must apply for designation of the eligible land and are required to agree to allow property inspections. Eligible land is exempted from municipal property taxation under this policy.

Slack, Enid. 2000. Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century: A report prepared for the Neptis Foundation. Toronto: Neptis Foundation

- Development charges are a useful method to encourage efficient land and infrastructure use.
- Charges must be designed to be area-specific in order to compensate for the different infrastructure costs created by each area. Therefore, locations further away from existing services will be more expensive creating a disincentive to develop sprawl.
- Lagging investment in existing infrastructure means more expenditures are required or the tax base will be eroded.

Slack, Enid, Municipal Finance and the Pattern of Urban Growth, a report prepared for the C.D Howe Institute. 2002. Toronto: C.D Howe Institute

- Cities use planning tools to influence the location, type and density of development. But they should not ignore the potential impacts of revenue-raising tools.
- User fees can be an effective tools for achieving a desired development pattern if they are correctly applied.
- Development charges also have the potential to encourage the efficient use of land and infrastructure. They must be structured to reflect the full costs and benefits of development.
- In the absence of such charges, developers consider only their own costs and benefits, not the impact of the city's costs of providing services.
- A charge applied uniformly across the city can encourage inefficiency; developers that impose higher municipal costs (usually developments in existing high density neighbourhoods).
- Cities should remove distortions in the property tax system, eliminating the overtaxation of apartments and commercial and industrial properties relative to single-family houses.
- User fees and development charges should be set so they do not work against planning objectives.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade

- Most municipal transit systems throughout the world normally require operating and debt service subsidies from governments to cover all their costs.
- A concept that has been used in a number of jurisdictions as part of project franchises is negative tendering. A negative tender is when the tender asks the private sector supplier for the maximum government subsidy required to build and/or operate the project. The bidder with the lowest government subsidy wins the bid.
- There are several types of franchises that a public-private partnership could pursue:
 - “Design-Build-Transfer-Operate” - Instead of owning the facility during operations, the private sector enters into an operating lease before the facility is operational to traffic;
 - “Design-Build-Operate-Transfer” – A model where the private sector acquires rights-of-way on an existing facility prior to construction, makes improvements, operates and collects revenues under the terms of the agreement, and then transfers the facility back to the public sector upon the expiry of the franchise.
 - “Design-Build-Own-Operate” - This model represents a franchise of unlimited duration in that the developer is never obligated under the franchise agreement to transfer the project to the public sector.
- There is great potential for public-private partnerships to participate in the financing of the projects outlined in this report.
- Financing arrangements between the public and private sectors ensure that the GTA will be able to reap the benefits of rail-based transit.

2.4 DESIGN, TRANSPORTATION AND LAND USE PLANNING TOOLS

Blais, Pamela, Berridge, Lewinberg, Greenberg, Dark and Gabor Ltd. 1996. The Economics of Urban Form: A Report Prepared for the GTA Task Force. Toronto: Greater Toronto Area Task Force

- Holding gross site density constant, but moving from a site design which spreads development over an entire area to one which “clusters” houses in certain locations and frees other areas for common open space has been shown to reduce on-site servicing costs by about \$2,000 or 15%.
- A 1990 study for the Ontario Ministries of Municipal Affairs and Housing estimates that the adoption of alternative development standards would reduce the cost of a dwelling unit by \$4,000 to \$6,000 (1990 dollars).
- When land costs were included, the savings totaled \$9,000 to \$9,5000 per unit - savings resulting both from more compact form and revised construction and design standards.
- Frontage capital costs in a CMHC study amounted to \$12,904 per unit for the conventional plan, versus \$8,606 for the alternative plan – a savings of \$4,298 or 33%.

Blais, Pamela. 2000. Inching Towards Sustainability: The Evolving Structure of the GTA: A Report prepared for the Neptis Foundation. Toronto: The Neptis Foundation

- The following urban structure characteristics are necessary to realize the GTA planning policy goals, and move towards sustainable development:
 - reurbanization - directing development at already urbanized areas;
 - compact development at the fringe - minimizing development on greenfields;
 - nodal development – directing development toward denser nodes,
 - consistency across regions in defining and identifying types of land and land uses; and
 - consistency in strength of policy across regions.

Canadian Urban Institute. 2001. Smart Growth in Canada. Toronto: Canadian Urban Institute On Line Available, <http://www.canurb.com/home.html>

- We need transportation alternatives, updated infrastructure, a wider choice of housing options, better environmental protection, more reinvestment in city centers.
- An alternative to sprawl has to curb the rate at which suburbs expand relative to the size of the population. This means reconsidering housing forms and lot sizes in new suburbs and accommodating a greater proportion of growth in previously developed areas.

City of Toronto Policy and Research. 2001. Unlocking the Opportunity for New Rental Housing: A Call to Action. Toronto: City of Toronto On Line Available, www.city.toronto.on.ca/torontoplan/rental_housing.htm

- Recommendations for the Municipal Government to encourage the building of more rental housing includes - ensuring the Official Plan and the zoning bylaw allow for the production of more housing, including rental housing, to meet the anticipated demand over the next 30 years, monitoring its development approval process to ensure that applications to build rental developments are handled as quickly as possible.

City of Toronto Urban Development Services. 2001. A Transportation Vision for the City of Toronto Official Plan. Toronto: City of Toronto

- This report describes the development of a transportation ‘vision’ intended to support the broader vision for growth and development embodied in the Official Plan now being prepared for the amalgamated City of Toronto.
- The term ‘vision’ describes various attributes of the transportation system as characterized by:
 - the degree of integration between land use and roads;
 - parking, and transit, as well as local, inter-regional, and intercity transportation;
 - road system characteristics;
 - transit system characteristics such as ridership, mode share, cost recovery, coverage, and general performance;
 - accessibility to transit for those with special needs and those without cars;
 - friendliness of the system for pedestrians and cyclists
 - costs and travel times related to the movement of goods
 - levels of automobile ownership and use;
 - parking policies and pricing, both on-street and off-street;
 - energy consumption, air pollution and greenhouse gas emissions related to transportation; and
 - methods of finance and funding.
- City policies such as zoning and other land use controls, capital investment in roads and public transportation, fare and parking policies, and regulations pertaining to the use of road space, are just some of the more important factors that influence where, how, and when individuals travel.
- Travel patterns within the City are also influenced by a variety of external transportation and land use policies such as automobile oriented residential development and relatively modest transit services in neighboring municipalities, both of which contribute to more use of automobiles for trips to the City.
- Route configuration and transit priority also influence the variety of purposes for which transit may be more attractive.
- The key attributes of the proposed transportation vision include:
 - integrated land use and urban design that leads to fewer and shorter vehicular trips for personal travel;
 - improved accessibility by public transit service for all constituents that is also competitive with the private automobile in terms of cost and convenience for most personal travel.
 - a comprehensive system of regulations and facilities for goods movement that enhances the economic competitiveness of the City and the Region;
 - traffic engineering and street design that encourage walking and cycling;

- less need to own an automobile or to use an automobile for most travel within the City;
- strong safeguards for the protection of the natural environment;
- reduced air pollution and greenhouse gas emissions from transportation; equitable pricing and financing of transportation services.

City of Toronto Urban. 2001. City of Toronto Bike Plan: Shifting Gears. Toronto: City of Toronto, On Line Available, www.city.toronto.on.ca/cycling/bikeplan.htm

- Implementation of the Toronto Bike Plan (TBP) is expected to encourage people to leave their cars at home and cycle, especially for utilitarian purposes.
- Based on previous municipal initiatives and activities, plus the extensive consultation undertaken during the preparation of the TBP, a clear direction for cycling in Toronto has emerged.
- This direction has been captured in a Plan that the City is confident will re-establish Toronto's position as the best cycling city in North America.
- The Toronto Bike Plan is more than a proposed network of bikeway facilities. It sets out a vision for cycling that is supported by a comprehensive set of principles, objectives and recommendations that address the need for education and promotion as well as the provision of facilities.
- The vision for the Toronto Bike Plan is to create a safe, comfortable and bicycle friendly environment in Toronto, which encourages people of all ages to use bicycles for everyday transportation and enjoyment.
- The primary goals of the TBP are: to double the number of bicycle trips made in the City of Toronto, as a percentage of total trips, by 2011; and to reduce the number of bicycle collisions and injuries.
- The Plan is structured along six key components, which is analogous to "six integral spokes". The six spokes are integrated through a common implementation strategy, represented by the hub of the wheel. Like the spokes of a bicycle wheel, all six spokes must work together to achieve the two primary goals and realize the vision of a Bicycle Friendly City.

The Six Spokes:

1. Bicycle Friendly Streets

- Ensure that transportation policies, practices and regulations support increased bicycle safety and access for intersections, roadways, bridges and underpasses;
- Expand and improve road maintenance programs to enhance cyclist safety, access; and
- Ensure that cyclist safety, access and comfort are maintained through or around construction zones.

2. Bikeway Network

- Complete the bikeway network in 10 years.
- Ensure the safe and comfortable year round operation of bikeways through design, signage, enforcement and maintenance.
- Connect Toronto's network to bikeways in adjacent municipalities.

3. Safety and Education

- Develop innovative ways, such as public/private partnerships, to fund and sustain safety education programs.
- Expand the CAN-BIKE program, including developing a unit for drivers.
- Establish a protocol in response to cycling collisions.
- Work co-operatively with outside agencies to deliver messages about safe cycling in Toronto.

4. Promotion

- Encourage cycling for everyday transportation.
- Promote cycling to a wide audience via effective use of media and public outreach.
- Demonstrate leadership through innovative policies and facilities that encourage City employees to cycle.
- Market Toronto as a cycling tourist destination.

5. Cycling and Transit Links

- Improve bicycle accommodation on transit vehicles.
- Improve bicycle parking facilities at transit stations.
- Improve bicycle access to transit stations.
- Increase promotion of bike-and-ride.

6. Bicycle Parking

- Expand the basic bicycle parking program to serve all public cycling destinations;
- Develop and provide enhanced bicycle parking facilities which provide security from theft and protection from the elements;
- Require and encourage the private sector to provide bicycle parking at their buildings;
- Develop effective strategies to prevent bicycle theft.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Toronto: Rural GTA Working Group, Office of the Greater Toronto Area

- Regional plans should establish a hierarchy of settlements (growth centers, rural service centers and hamlets).
- Growth centers would be the primary focus of growth in the countryside, while hamlets would have limited growth and commercial uses.
- Regional plans should manage growth on the basis of the roles of these settlements and their ability to accommodate growth from an infrastructure and environmental point of view.
- Local official plans should clearly establish the boundaries, size, growth rate, development phasing and uses within settlements.
- Regional municipalities should undertake a comprehensive review of the current servicing capacity, servicing constraints and servicing potential in all areas.
- Further estate residential development should be severely restricted, and prohibited adjacent to serviced settlements.

Peterson, Paul. 2000. Alternative Tools for Protection of the GTA Countryside, A Background Report prepared for the GTA Countryside Strategy. Toronto: The Greater Toronto Services Board

- **Density Bonus** – Section 37 of the Ontario Planning Act provides authority for density bonus by-laws where additional development density can be granted in exchange for specified public benefits.
- The Town of Caledon’s Official Plan has density bonus policies for specific estate lot designations, allowing additional units in exchange for the protection or enhancement of forest lands.
- **Transfer of Development Rights** – Policies for the transfer of development rights may be useful within a local area, or between abutting properties where the objective is the permanent protection of lands on one of the properties. Schemes for density transfers between countryside lands and distant urban areas or even across local municipal boundaries would require a careful review of enabling legislation.
- **Development Permits** – The use of development permits is authorized under Section 70 of the Ontario Planning Act. In a development permit system, there is no guaranteed entitlement to building permits or the use of land as there is under a zoning by-law.
- Each development proposal requires an individual review and approval. Such a system is used in the Niagara Escarpment Plan.

Royal LePage Advisors and The Planning Partnership. 2001. City of Mississauga Labour Force Needs Study: Housing and Other Issues. Mississauga: City of Mississauga

- This study found that public transit is an important service to employees with lower incomes. Some issues pertaining to transit include schedules, particularly for shift workers, inadequate connections and the expense of crossing fare zones for employees living in other municipalities.
- For many employees, it is also important that affordable rental housing be located on transit lines.
- Some suggestions for policy options that would further strengthen the provision of a variety of housing types and affordable units were made.
- Housing affordability was identified as the most important concern among major employers; The type and size of affordable housing is also important; and, The accessibility of Mississauga is a key attribute in its ability to attract businesses.
- Planning needs expressed in a survey of employees include:
 - Transportation policy goals:
 - extend bus services to employment areas later into the evening/early morning and on weekends;
 - work towards a coordinated plan for transit in order to facilitate more efficient travel between cities; and,
 - investigate the opportunity for municipal parking in the City Centre area. Ensure that plans for future growth provide for the necessary amount of parking.

- Housing policy goals:
 - enhance the stock of more modestly priced dwelling units, of all types and tenures, within the City; and,
 - continue to provide excellent community amenities (including recreational resources, cultural facilities and shopping) throughout the City.
- Community Service policy goals:
 - provide assistance to subsidize day care spaces, especially targeting locations around employment areas so that parents can be close to children or close to elderly adult relatives;
 - provide financial incentives for employers to offer on-site childcare or elderly daycare; and, Distribute information to employers detailing the services offered by the City to assist new immigrant families and a list of contacts at various agencies and departments.

Greater Toronto Services Board. 2000. Removing Roadblocks to Continued Economic Prosperity for the Greater Toronto Area, Toronto and Canada: A Strategic Transportation Plan for the GTA and Hamilton-Wentworth. Toronto: Greater Toronto Services Board

- Roads and transit and truck routes should be planned, coordinated and implemented to be convenient and continuous across the region.
- Fully accessible transit should be available at effective and appropriate levels across the region, be given priority over low-occupancy vehicles and be supported by coordinated services, integrated fares, quick and convenient intermodal connections, transit priority measures and transit-supportive parking policies.
- Development patterns that support travel by alternative to low-occupancy vehicles should be implemented in rural, suburban and urban communities according to concepts of their official plans.
- There should be more compact development and more mixed-use communities whose designs support transit use, walking and cycling.
- The existing transportation infrastructure is the foundation for the future network for the GTA and Hamilton Wentworth and offers the most cost-effective way to expand capacity.
- Through the preparation of asset management plans for transportation infrastructure, costs can be minimized and disruptions can be avoided.
- Managing traffic flows on roads and expressways is a useful method to optimize the use of existing infrastructure.
- Demand management through encouraging telecommuting and flexible work hours offer opportunities to reduce the numbers of people and vehicles commuting to work.
- The proposed transit network builds on existing and committed GO Transit commuter rail system and the TTC's subway and other rapid transit services.
- The plan recognizes three broad areas. 1) the central area of the City of Toronto 2) an urban area including former Etobicoke, North York and Scarborough and extending Lake Ontario from Hamilton to Oshawa and northward to Brampton, Vaughan, Richmond Hill and Markham 3) the rural areas of the GTA.
- An expanded and improved Union Station is a first priority in developing a strong GTA transit network.
- The GTA transit network includes enhanced connections to Pearson airport.

Miller, Glen, Janice Emeneau and John Farrow. 1997. GTA Urban Structure: An Analysis of Progress Towards the Vision. Toronto: The Canadian Urban Institute

- The GTSB or another coordinating body should establish a strategy for expanding transit service to nodes and corridors. This strategy can be linked to long-term capital planning for all infrastructure and provide the basis for complementary private sector investment.
- Municipalities' capital plans at both the regional and area level should pay attention to the demands created by the urban structure.
- To achieve the desired urban form of nodes and corridors, the regional municipalities should agree on methods to reach and collaborated with market forces.
- Municipalities and transit agencies should liaise with the development industry to establish partnerships aimed at developing an appropriate identity, amenities and image for selected nodes and corridors in order to attract customers and investment.

The Toronto Board of Trade. 2001. A Strategy for Rail-Based Transit in the GTA. Toronto: The Toronto Board of Trade

- There is wide consensus among planners that this growth must be focussed in more concentrated developments. There is a need for more compact land use instead of sprawl, more mixed use of land instead of the segregation of uses, more possibilities for walking and cycling rather than having to drive to everyday destinations.
- **Business As Usual Scenario** - Annual capital investment of \$425 million would enable the Toronto Transit Commission and GO Transit to maintain their existing systems in a State of Good Repair indefinitely into the future.
- **Wealthy City-Region Scenario** - This scenario includes the Business-as-Usual Scenario, additional annual capital investment of \$690 million for the expansion of rail transit networks. It would be required to accommodate the region's expected growth. This investment would be used to:
 - expand the GO Transit Base System to accommodate expected growth of demand for the type of large commuter train services now offered by GO Transit;
 - introduce Urban Frequency Services of 20-minute headway or less, using two-car trains on GO Transit lines to serve non-work related trips that make up the majority of travel in the GTA throughout the day;
 - create a Cross-GTA Light Rail Transit System, stretching from Oakville in the west, along the Highway 403 /Mississauga Transitway and Finch Hydro Corridors to Pickering;
 - create an LRT Connector System between the proposed Cross-GTA LRT system and the existing TTC subway system; and
 - develop a Commutershed Rail System to connect urban centres such as Niagara Falls/ St.Catherines, Kitchener-Waterloo, and Barrie with the GTA.
- Consideration should be given to electrification of GO Transit lines starting with the Lakeshore corridor. Benefits of electrification include lower noise and air pollution, higher acceleration and potential for air rights development in high density areas.

- The implementation of a comprehensive rail-based transit strategy and firm policies and incentives that result in more concentrated, mixed-use development patterns throughout the GTA would double transit use in the region by 2021.

Weinstein Leeming and Hinde and Associates Limited, McCormick Rankin, duToit Allsopp Hillier and Hemson Consulting Limited. 1995. Highway 7 Corridor Land Use and Transit Study. Toronto:

- Better connections between Highway 7 and the surrounding land uses are needed to optimize transit use.
- The shift of regional traffic to Highway 407 and the future implementation of a transitway along Highway 7 and 407 will present a new range of development possibilities for the Highway 7 corridor.
- There is generally sufficient right of way along Highway 7 to build a transitway.
- Integrated with a service along Highway 407, this route can provide rapid transit service along Highway 7.
- The best distribution of land use to support a transit system on Highway 7 would locate alternating nodes of residence and workplace, “ a string of pearls,” along the corridor.
- To achieve a maximum mix of origins and destination in the Highway 7 corridor to optimize transit use, a significant increase in the number of people living in the corridor is required.
- It is important to alter the public’s perception about Highway 7 through an educational program.
- To support the further use of transit, municipalities, the provincial government and other agencies need to consider the highway corridors land use planning and urban design differently. There must be more frequent and regularly spaced north south pedestrian connections.
- Current design standards, building setback requirements and other regulations pertaining to provincial highways should be reexamined for “Avenue Seven.”

2.5 GREENBELTS AND GROWTH BOUNDARY TOOLS

Federation of Ontario Naturalists. 2001. The Oak Ridges Moraine Greenway. Toronto: Federation of Ontario Naturalists

- A range of measures could define land-use such as designating Greenway Natural Areas, Greenway Rural Lands, Greenway Communities, Transportation and Utility Corridors.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Toronto: Rural GTA Working Group, Office of the Greater Toronto Area

- Regional and local official plans should clearly establish limits of urban, rural and greenspaces and contain policies and maps to identify and protect natural heritage features and a greenland networks.
- The province should consider amendments of new legislation to provide various levels of government with the necessary tools to protect greenlands. These include the Planning Act, Trees Act, Conservation Authorities Act, Heritage Act, and the Environmental Assessment Act.
- Additional provincial policy direction should be provided on the protection of woodlands and wetlands, natural and cultural heritage resources, watershed planning, impact analyses and water and landform conservation.

Hare, Melanie. 2001. Exploring Growth Management Roles in Ontario: Learning from “Who Does What” Elsewhere, a report prepared for the Ontario Professional Planners Institute. Toronto: Urban Strategies Inc.

On Line Available, <http://www.ontarioplanners.on.ca/content/issues/policypapers.asp?section=policypress>

- Some examples growth management strategies in the United States and Canada:
 - the State of Maryland has led an impressive campaign to address the challenges of enormous rates of sprawl around its urban centers;
 - the State of Maryland introduced smart growth legislation premised on limiting state funding to smart growth areas and initiatives;
 - the City of Baltimore has recently completed its first comprehensive plan in 20 years and is taking advantage of state funding and initiatives aimed at urban areas experiencing decline;
 - Portland’s growth management has been coordinated at the regional level by Metro Portland;
 - Portland still faces serious growth challenges and the region continues to expand outward rapidly;
 - policies strongly linking transportation and land use decisions are complemented with an urban growth boundary; and
 - current challenges include an imbalance between employment and housing within the and the provision of sufficient affordable housing.
 - the City of Calgary’s growth management policy framework has had minimal impact on the form and location of growth within the City;
 - Calgary is a rapidly growing city with a market-driven approach to urban development;
 - a long-standing precedent of growth through annexation has curbed the ability of planning policy and public investment to guide growth;
 - in the Town of Cobourg, growth is being accommodated in a controlled and deliberate manner;

- the Town relies on community and Official Plans to direct growth and to unleash capital funding opportunities from senior levels of government;
- the City of London has put in place a strong policy framework, financial incentives and initiatives that promote growth management;
- the City accepts that development will be driven by market forces, but provides a policy framework to direct that growth.
- the City has an established voluntary development fund called the Urban Works Reserve Fund in addition to the Development Charges Fund;
- the primary challenge to managing growth in London is ensuring sufficient employment growth to balance London's residential growth.
- Waterloo is recognized for its proactive and progressive planning policies that place a high priority on the environment;
- a clear definition of the roles of local and regional government has encouraged supportive relationships with respect to growth management and environmental policy; and
- one of the most serious challenges in this urban region is planning for the growth of each distinct community in the framework of a much larger contiguous urban region.

Peterson, Paul. 2000. Alternative tools for the Protection of the GTA Countryside. Toronto: Greater Toronto Services Board. Toronto: Greater Toronto Services Board

- An urban growth boundary (UBG) is a line drawn around a community that defines an area to accommodate anticipated growth for a given period of time.
- An urban growth boundary is a growth management tool designed to prevent sprawl. It is often used to guide decisions on infrastructure development, such as the construction of roads and the extension of municipal water and sewer services.
- The urban service boundary is a similar concept. The limit of a jurisdiction's service area to prevent municipal funds from being used to extend utilities outside the designated urban core.
- Urban growth boundaries and urban service boundaries provide a physical border for development by removing development pressures on the land outside the boundary.
- The boundary should include land necessary to fill in and complete existing neighbourhoods while using existing public investments to the fullest.
- Benefits of urban growth boundaries include:
 - they tie the county to a policy that urban development takes place in locations where urban services can be provided in the most efficient and economical manner;
 - they preserve greenspaces lands outside the boundary while reducing urban sprawl; and
 - they lessen confusion about future urban uses and reduce long-term speculation in fringe areas not designated for future urban development.

- Some limitations include:
 - they may reduce the supply of developable land, which may lead to higher land prices; and
 - after the boundary is adopted, decision-makers may face pressure from those seeking to develop within the urban area boundary in places not acceptable to the city and the urban vision.
- The Portland metropolitan region applies UGB policies. A 365 square mile area boundary encompasses 24 cities and the urban areas of three counties.
- Beyond this boundary, urban growth is discouraged.
- Inside the boundary, a 20 year supply of vacant land for future growth and development is encouraged.

2.7 ENVIRONMENTAL PLANNING TOOLS

Conservation Ontario. 2001. The Importance of Watershed Management in Protecting Ontario's Drinking Water Supplies. Newmarket, Ontario: Conservation Ontario

- The watershed should be respected as the viable unit for managing water and groundwater resources.
- There should be a strategic shift in managing the environment towards a place-based approach with boundaries that make environmental sense and facilitate a cross-media approach.
- While groundwater aquifers sometimes extend beyond surface water drainage boundaries, the human activities and resulting influences occur and can be managed within a surface watershed context.
- The Province should expand its interests in watershed management beyond flood and erosion control operations to achieve maintenance and enhancement of ground and surface water for all users.
- Watershed management includes identification, protection and enhancement of significant natural features including, headwaters, groundwater recharge and discharge areas, wetlands, vegetated stream buffers and forest areas.
- Water does not fit into simple federal, provincial and municipal responsibilities. To protect water supplies requires collaboration and co-ordination at various levels.
- The conservation authority model provides an opportunity to co-ordinate, focus and streamline local delivery of water management and protection actions.
- The Province has the broadest jurisdiction over water and thus a leadership responsibility in ensuring the best water management.
- The Province should encourage research into water issues and the development, transfer and application of decision-support tools for the implementation of watershed management. These tools provide the basis for implementing provincial regulatory actions that support water supplies and quality from a watershed perspective.
- Monitoring networks need to be improved, maintained and accessible for effective local watershed management.
- The Province should encourage the Federal Government to develop a national framework for water policy and to strengthen co-operative agreements with provinces under the Canada Water Act.

Peterson, Paul. 2000. Alternative tools for the Protection of the GTA Countryside. Toronto: Greater Toronto Services Board. Toronto: Greater Toronto Services Board

- **Provincial and Municipal Funded Land Acquisition** - In Ontario, the Natural Areas Protection Program administered by the Ministry of Natural Resources provides up to \$20 million over four years for acquisition on the Niagara Escarpment and in the Rouge Valley and Lynde Creek.
- As land in the GTA is expensive, financial resources for acquisition must be used strategically.
- Plans focused specifically upon natural heritage protection may be required to identify those priority lands that deserve protection by acquisition. Although official plans may go some distance to identify a “greenlands system,” they will not typically have provided the kind of focus required to justify the acquisition of particular properties.
- There are creative methods to acquire land of land. Purchase followed by limited development, leasing back to farmers or selling back to private ownership subject to title and easement restrictions are all possibilities.
- The Ontario Realty Corporation process of land disposition in Pickering is an example.
- **Working with Land Trusts and Other Conservation Organizations** - Land Trusts are non-government, non-profit organizations with citizen boards that work to protect environmental land resources within their geographic area of interest.
- The Oak Ridges Moraine Land Trust is an example.
- The land trusts are involved in a variety of initiatives to protect land resources, including public education and awareness programs, landowner contact and stewardship and fundraising for the purchase of environmentally sensitive lands.
- The land trust must incorporate (federally or provincially) in order to properly arrange their affairs and to hold title to land. They will also seek charitable status under the Canada Income Tax Act.
- Land Trust funding will come from individual donors, corporations and private foundations. Currently, government funding is also available, from the federal Nature Legacy 2000 program and the provincial Community Conservancy Program.

Regional Municipalities of Durham, Peel and York with Conservation Authorities and Municipalities on the Oak Ridges Moraine. 2001. The Oak Ridges Moraine: Proposals for the Protection and Management of a Unique Landscape. Regional Municipalities of Durham, Peel and York

- Strategic directions are proposed in four areas: groundwater management, natural heritage data management, policy and land securement.
- A Regionally led, co-coordinated natural heritage data management system is recommended, which will require common data standards, improved Moraine-wide mapping, analysis on the state of the Moraine and effective monitoring.
- Regional Official Plan policies should be coordinated and strengthened by filling gaps in five key policy areas: tableland woodlots, functional corridors and linkages, minimum ecological buffers, groundwater protection and landform conservation.
- A coordinated Land Securement Strategy is proposed, using policy, stewardship, monitoring and acquisition to protect the Moraine.

City of Toronto Environmental Task Force. 2000. Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto. Toronto: City of Toronto

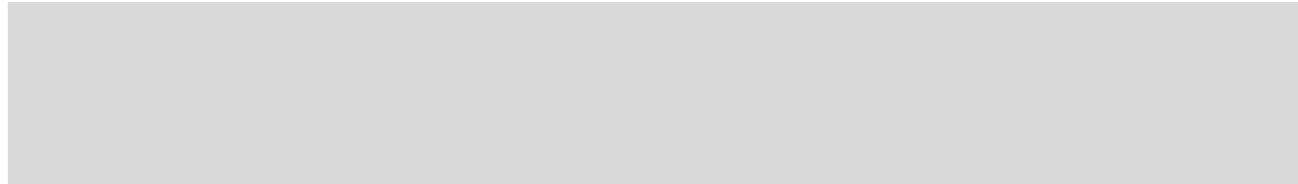
On Line Available, http://www.city.toronto.on.ca/council/environtf_clean_green.htm

- Strategies for healthy land-use include - increasing parks and natural areas, encouraging green roofs, increasing the diversion of solid waste, exposing the feasibility of curbside collection of and producer responsibility for household hazardous waste, cleaning up contaminated land.
- Strategies for healthy water include- restoring the health of rivers, streams and waterfront, eliminating combined sewer overflows and improve stormwater management, prevent the discharge of pollutants into sewers, reduce water use, improve the environmental performance of sanitary sewers, expand the use of alternatives to chlorine for wastewater treatment, monitor drinking water guidelines.
- Strategies for Healthy Air include- recognizing the right of Torontonians to clean air, developing a comprehensive air quality strategy, reducing air emissions, monitoring ambient air quality and standard setting.
- Sustainable transportation should be affordable, operate efficiently, offer citizens choice and support a vibrant economy.
- The City should make long term plans to coordinate sustainable energy efforts, help Green industry develop and support environmental education.

2.8 POLICIES – AGRICULTURAL POLICY AND PLANNING TOOLS

Peterson, Paul. 2000. Alternative tools for the Protection of the GTA Countryside. Toronto: Greater Toronto Services Board. Toronto: Greater Toronto Services Board

- Official plans and zoning by-laws established under the Planning Act are powerful tools to direct urban growth and to protect existing agricultural communities and natural landscapes.
- There is potential to strengthen the drafting of official plans for the protection of agricultural and natural heritage lands. For example, designating “permanent agricultural reserves” on those high quality farmlands and viable farm communities can preserve these areas.
- Municipalities can adopt and implement “smart growth” principles to direct urban development and infrastructure to intensified urban areas.
- The application of agricultural zoning to land areas with active farming and high capability soils is standard practice in Ontario.
- The principal characteristics of the agricultural zoning are restrictions on land uses that are not related to or compatible with the agricultural use of land. In addition, lot size minimums will be large, typically ranging from two hectares to 40 hectares, as local conditions dictate.
- Agricultural zoning is flexible and can be adapted to local circumstances. It can provide a degree of protection to large areas of agricultural land at relatively low administrative costs and can reduce conflicts with non-farm uses.
- Permanent protection of the most valuable countryside lands may be secured in combination with other tools described herein, including:



- provincial legislation and policy
 - conservation Easements – land use restrictions registered on title which are not subject to Planning Act review
 - agricultural districts where regulations and incentives are co-coordinated to maintain the viability of the agricultural community.
- **Agricultural Districts** - Agricultural districts are programs that have evolved in the U.S. to allow farmers to voluntarily form special areas where commercial agriculture will be encouraged and protected. Farms within the agricultural district will be eligible for a package of benefits which can be tailored to the needs of that community.
 - It might be possible to implement a form of agricultural district using the existing legislative framework within Ontario.
 - At least 15 states have adopted agricultural district programs.
 - The emphasis in these programs is for support to the farming community and for maintenance of a critical mass of farmland area and supporting agricultural services and infrastructure.
 - These incentives and supports may not be sufficient under development pressure. Combining with municipal planning controls and with programs to compensate for relinquishing development rights is often considered.

GTA Working Group. 1999. Vision for the Countryside: A Progress Report for the Greater Toronto Coordinating Committee. Toronto: Rural GTA Working Group

- An agricultural impact analysis should be undertaken to present the implications of the loss of future agricultural lands.
- This should include an assessment and mapping of existing and proposed land uses in the rural GTA such as golf courses, estate residences and other non-agricultural lands and uses.
- Prime agricultural lands need to be identified in official plans and protected from fragmentation, introduction of non-agricultural uses, and encroachment from urbanization.
- Strategies and programs to improve the economic viability of the agri-food industry are needed if they are to continue to play an important role in the rural economy and the GTA economy.

3. POPULATION PROJECTIONS

GTA Steering Committee on Population and Employment Forecasts for the Greater Toronto Area. 2000. Report to the Greater Toronto Coordinating Committee. Toronto. GTA Steering Committee on Population and Employment Forecasts

- The recommended forecast assumes average annual population growth to the GTA of just under 100,000 to the year 2011 with a gradual decline over the forecast period falling to approximately 50,000 for the last decade of the forecast.
- The GTA must be prepared for periods of very strong growth over the next 15 years followed by a GDP and population slowdown beyond the year 2015.
- The distribution of the GTA forecast to the GTA Regions has been based on a series of assumptions:
 - Highway 407 will continue to act as a stimulus for growth in the Regions;
 - the existing airport and 400 series infrastructure will continue to draw growth north and west;
 - the City of Toronto will continue to experience strong growth;
 - the implementation of plans for the Pickering Airport;
 - the cost and availability of land;
 - the availability of affordable housing;
 - the availability of water and sewer infrastructure; and
 - the availability of roads and other infrastructure, services and facilities that will influence the choice of location.
- It is estimated that 4.1 million jobs will be located in the GTA by 2031, an increase of 78% over the 1996 total of 2.3 million.

McCormack, Tom, Ernie Stokes and David Carter. 2000. GTA Population and Employment Projections Final Report. Toronto: Strategic Projections

- Over the next decade the GTA's population will increase to 6.3 million and by the year 2031 it could be home to 7.4 million.
- To reach these population levels and to generate enough new jobs to sustain this level of population, the GTA economy will need to grow at an average of 2.6 percent in real terms over the next 32 years.
- The GTA could fall short of its economic potential. By failing to support economic growth with the appropriate facilities and infrastructures could lose businesses, jobs and people to other locations in Ontario and other centers in Canada and the U.S.
- The GTA's population will likely reach a peak of no more than 6.4 million people over the next three decades and the population will likely fall during the final decade of the projected horizon.
- The future of the GTA depends on two critical factors: 1) the economic environment that prevails in Ontario outside the GTA, in Canada outside Ontario and in the rest of the world; and 2) the urban structure and built form put in place within the GTA over the next several decades.

Hemson Consulting Ltd and the Coopers and Lybrand Consulting Group. 1993. The Outlook for Population and Employment in the GTA. Toronto: Office of the Greater Toronto Area

- The GTA is well positioned to participate in the knowledge-based economy of the 21st century.
- The population of the GTA is anticipated to rise from the 1991 level of 4.2 million to 6.7 million people by the year 2021. This growth level represents an annual rate of population growth of 1.5 percent for the next 30 years, down from the 2.3 percent annual growth experienced over the 30-year period 1961 to 1991.
- Many other areas of Ontario and Canada will experience virtually no population growth in the period to 2001.
- After 2001, population decline will commence in many parts of the country.
- Total employment in the GTA is forecast to rise from 1991 levels of 2.3 million to 3.8 million by 2021. Of this 1.5 million growth over 30 years, 40 percent is anticipated during the ten years of the forecast. During this short term, the core rate of unemployment is anticipated to remain high due to a continuation of the economic restructuring.
- The forecast range could produce a GTA population of 5.8 million to 7.7 million by 2021.
- In the next 30 years, over 90 percent of the population growth anticipated in the GTA Reference Forecast is likely to occur in the four Regions. This growth pattern is primarily a result of households migrating to the Regions to occupy new ground-related housing.
- As the population base in the four regions increases, growth in employment follows both to serve the resident population and to utilize the expanding labour force.

The City of Toronto Environmental Task Force. 2000. Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto. Toronto: City of Toronto
On Line Available, http://www.city.toronto.on.ca/council/environtf_clean_green.htm

- It is expected that the GTA will continue to experience growth from 4.6 million in 1996 to 6.1 million by 2011.
- Toronto's density has been increasing and in 1996 reached 3,786 people per square kilometer. The highest densities are in the municipalities of Toronto, York and East York. In the 905 regions, the density is about 1,571 people per square kilometer.

4. GOVERNANCE

Blais, Pamela. 2000. Inching Towards Sustainability: The Evolving Structure of the GTA: A Report prepared for the Neptis Foundation. Toronto: The Neptis Foundation

- The systematic expansion of urban areas, villages and hamlets is being initiated by local and regional governments
- The realty market governs the development pattern, however the market is shaped by planning policy, public policy, financing urban growth, and the nature of investments in infrastructure.
- Implementing a cost-pricing basis for development charges is important.
- Regional coordination is crucial for encouraging sustainable growth patterns.
- With regards to nodal structure, there is a lack of consistency at the regional level. For example, Peel designates only two major urban nodes, while Durham and Halton have designated several.

Deloitte Consulting. 2001. Getting Started: A Review of the Greater Toronto Services Board – Final Report. Toronto: Greater Toronto Services Board

- The necessity for the GTA to have a united voice with both the Provincial and Federal governments is a priority of the GTSB.
- The GTSB has been in existence only two years and has made progress in its mandate to coordinate and facilitate strategies. These include:
 1. issuing a transportation strategy for the GTA;
 2. working on a Countryside Strategy with consultations; and
 3. developing various protocols and memorandum-of-understandings with GO Transit and municipalities in areas such as dispute resolution.
- There is a perception that the GTSB has been slow to start initiatives, has not yet shown demonstrated results and makes numerous delays in decision-making.
- These frustrations may reveal weaknesses in the governance, operations and authority of the GTSB.
- There is concern with the ability of the GTSB to ensure that its strategies or decisions will be implemented and that the GTSB should focus on two or three critical areas and not diffuse its efforts.
- Four potential options that would involve significant change in the GTSB's authority:
 - establishing a planning authority to guide the growth management activities in the GTA;
 - creating an expanded authority in planning and services.;
 - establishing a GTA-wide government that is directly accountable to the public; and
 - appointing a Minister of the GTA with a supporting ministry to focus on and coordinate Provincial Government interests, policies and priorities for the GTA.

- Targets set by each separate municipality that guide the development mix are necessary to clarify the municipal commitment.
- The regions and area municipalities should agree on a framework that will encourage all municipal monitoring efforts to fit into a common GTA-wide monitoring program.
- The regions and area municipalities should cooperate and monitor the performance, capacity and utilization of development, infrastructure and transit use for nodes and corridors.
- The municipalities should partner with the private sector to identify monitoring reports and provide data that can be developed in partnership with mutually beneficial results.

Federation of Canadian Municipalities. 2001. Early Warning: Will Canadian Cities Compete. Ottawa: Federation of Canadian Municipalities

- Municipal governments face increasing costs and shrinking revenues affected by the offloading of provincial responsibilities, rapid growth, shrinking inter-governmental transfers, regulated caps on tax increases and heightened expectations of citizens.
- Federation of Canadian Municipalities adopted a Worldwide declaration of local self-government which rests on these four principles:
 - “principles of local self government shall be recognized in the Constitution or in the basic legislation”; and
 - “local self government denotes the right and the duty of local authorities to regulate and manage public affairs under their own responsibility and in the interests of the population;”
 - “public responsibility shall be exercised by those basic units of local government that are closest to its citizens;”and
 - “local authorities shall have a general right to act on their own initiative with regard to any matter that is not exclusively assigned to any other authority nor specifically excluded from the competence of local government.”

Federation of Ontario Naturalists. 2001. The Oak Ridges Moraine Greenway. Toronto: Federation of Ontario Naturalists
 On Line Available, <http://www.ontarionature.org/issues/orm.html>

- The protection of the Moraine raises several concerns such as:
 - the inability to plan in a cohesive way for the Moraine;
 - the existing planning regime allows developer to bypass local and upper-tier plans and go directly to the Ontario Municipal Board (OMB);
 - the lack of clear and specific expression of the provincial interest that leaves the OMB and municipalities to make policy by default;
 - it is unfair that the OMB considers each individual development appeal through a site-specific process without clear direction based on the bigger regional picture; and
 - the Oak Ridges Greenway is a strategy to preserve the value of the Moraine by considering it as a whole and then providing a framework and governance system to protect the character of the Region.

Greater Toronto Services Board. 2000. GTA Countryside Strategy. Toronto: Greater Toronto Services Board

- There is a need for a GTA wide vision that shares a sustainable vision for the countryside. This vision can be reached through strategies developed by the various municipalities and regions.
- A countryside strategy is not meant to override local planning authorities, but to provide a GTA wide perspective that goes beyond the scope and framework of municipal official plans and helps local and regional municipalities coordinate programs, services and investment that ensure the viability of the GTA countryside.

Greater Toronto Services Board. 2000. Removing Roadblocks to Continued Economic Prosperity for the Greater Toronto Area, Ontario and Canada: A Strategic Transportation Plan for the GTA and Hamilton-Wentworth. Toronto: Greater Toronto Services Board

- In recent years our transportation has failed to keep pace with demand.
- This report calls for all member municipalities of the Greater Toronto Services Board, the provincial government and the federal government to cooperate immediately.

IBI Group and Hemson Consulting Ltd. 1999. Funding Transportation in the Greater Toronto Area and Hamilton-Wentworth. Toronto: Greater Toronto Area Reagins and the City of Toronto

- Municipal governments are currently under financial pressure as a result of municipal restructuring and the new property tax system.
- The municipal levels of government cannot meet the transportation needs of a growing GTA alone.
- The Governments of Ontario and Canada are already raising significant revenues from transportation-related sources in the area, particularly through gasoline taxes, vehicle registration fees and sales taxes.
- A partnership of municipal and senior levels of government is required to uphold a competitive transportation system.
- Funding for or the tools to fund the required infrastructure improvements are needed from the senior governments.
- The quality of transportation system in the GTA is critical to productivity and economic competitiveness of the entire province and country.

Miller, Glen, Janice Emeneau and John Farrow. 1997. GTA Urban Structure: An Analysis of Progress Towards the Vision. Toronto: The Canadian Urban Institute

- The regions should explore the potential to produce an officially sanctioned map for the GTA to illustrate the urban structure identified in regional official plans.
- The regions should support the concept of a central registry where all official plans, studies and relevant documentation on development issues in the GTA can be reviewed.
- The regions should establish common terminology and graphical symbols as a basis for clearer communication and decision-making.

Organizational Sub-Committee Downtown Brampton Transition Team. 2001. Establishing a Downtown Development Corporation in the City of Brampton. Brampton, Ontario: City of Brampton

- There is a need to coordinate business development, marketing, beautification, capital programs, strategic planning, merchant promotions and tourism activities in the downtown should be under one umbrella organization/development Corporation with semi-autonomous powers. These activities are currently “splintered.”

Regional Municipalities of Durham, Peel and York with Conservation Authorities and Municipalities on the Oak Ridges Moraine. 2001. The Oak Ridges Moraine: Proposals for the Protection and Management of a Unique Landscape. Regional Municipalities of Durham, Peel and York

- A partnership led by Durham, Peel and York Regions and including nine Conservation Authorities, five counties, and other stakeholders collaborated to recommend a practical action plan to protect and enhance the Oak Ridges Moraine.
- This approach builds on existing Regional Official Plans utilizing the 1994 draft Oak Ridges Moraine strategy.

Slack, Enid. 2000. Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century: A report prepared for the Neptis Foundation. Toronto: Neptis Foundation

- In terms of urban regeneration, there is little or no ability to intervene in the areas of the GTA trapped by a tangle of regulatory, jurisdictional and ownership.
- Downloading of social housing and social services contradicts public finance principles and the advice of every committee and task force commissioned to review these services.
- The fiscal capacity of GTA municipalities varies between urban and rural areas, which decreases the ability to fund services.
- Municipalities in the GTA are not financially self-sufficient and with the increased responsibilities at the local level combined with current property tax freeze across the province.
- Public finance principles suggest a two-tier governing structure in the GTA. With the upper tier being responsible for services that thrive in economies of scale, and the lower tier providing services that permit responsiveness, access, and accountability.
- The ability to redistribute income increases with the size of the jurisdiction and a smaller jurisdiction is more responsive to citizens.

The City of Toronto Environmental Task Force. 2000. Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto. Toronto: City of Toronto
On Line Available, www.city.toronto.on.ca/council/environtf_clean_green.htm

- Institutional Issues include a lack of long-term thinking, lack of integration of the environment, economy and society, the lack of consideration of environmental costs and benefits and jurisdictional fragmentation.

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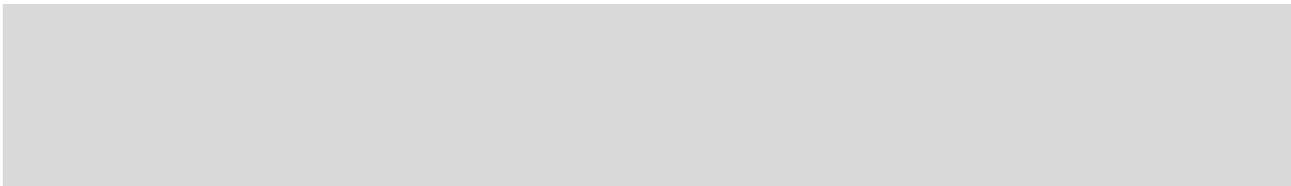
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Slack, Enid. 2000. Municipal Finance and Governance in the Greater Toronto Area: Can the GTA Meet the Challenges of the 21st Century: A Report prepared for the Neptis Foundation. Toronto: Neptis Foundation

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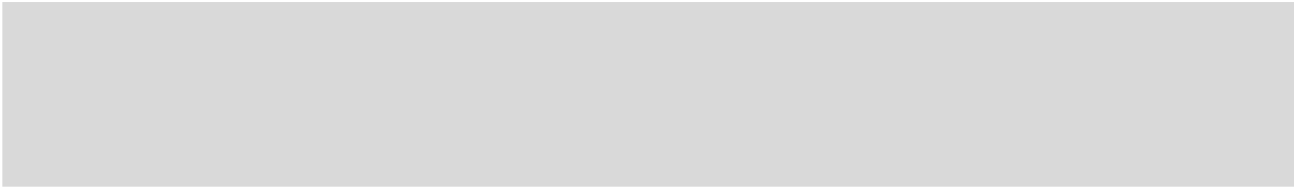
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Federation of Canadian Municipalities	www.fcm.ca/english/
GTA Regional/Municipal Web Sites	www.mah.gov.on.ca/GTA/whatsnew-e.asp
Ontario Ministry of Municipal Affairs	www.ofa.on.ca/
Ontario Professional Planners Institute	www.ontarioplanners.on.ca/index.asp
Toronto Board of Trade	www.bot.com/



BACKGROUND REPORT 5:

CITY AND REGIONAL STRATEGIES TO PROTECT COUNTRYSIDE AND AIR QUALITY: A BIBLIOGRAPHY AND SYNOPSIS OF CURRENT STUDIES AND INITIATIVES IN CANADA, BRITAIN AND THE UNITED STATES

Prepared for the City of Toronto Departments of
Works and Emergency Services, and
Urban Development Services

Prepared by: GHK Canada

May, 2002

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INTRODUCTION

This bibliography has been prepared to provide background material for a study commissioned by the City of Toronto on “regional strategies for managing development patterns, protecting valuable countryside such as the Oak Ridges Moraine, and reducing greenhouse gas emissions and air pollution”. The basic premise is that urban form has a direct impact on the natural environment and that this is inextricably intertwined with the nature and pace of development in the City of Toronto and in the Region generally.

The following document is a bibliography of recent writing on urban growth and structure in Britain, the United States and Canada. The aim of this document is to provide a range of information on the implications of urban growth on the natural environment, quality of life and economic growth in a variety of cities. It also highlights policy and finance tools as well as computer-aides that may assist planners to encourage sustainable urban development. Key extracts and paraphrases from each document are cited to guide the reader through this varied list of resources.

The report is divided into three parts. Part 1 outlines those studies or portions of studies that address the implications of population growth and urban form. Part 2 highlights policy and planning tools that can be used to promote sustainable urban form. Part 3 presents governance issues. As many reports and studies cover more than one of the topics covered in this literature review, references pertaining to the particular topic area under discussion will be repeated.

PART 1. IMPLICATIONS OF POPULATION GROWTH AND URBAN FORM

1.1 SOCIAL IMPLICATIONS OF GROWTH AND URBAN FORM

Dunn, James. 1998. Driving Forces: The Automobile, its Enemies, and the Politics of Mobility. Washington: Brookings Institution Press

- In 1995 the United States experienced 6,613,000 car accidents that resulted in 3,386,000 injuries and 41,798 deaths. In the 25 years between 1970 and 1995, 1.2 million Americans died in traffic accidents. Over a third of traffic fatalities in American cities are pedestrians and cyclists killed by car and truck drivers.
- Many Americans get little or no exercise partly because of car use for even short trips. This sedentary, car-based lifestyle leads to one of the world’s highest proportions of obesity (one-fifth of all adults) and serious health problems.
- A 1992 study for the British Medical Association found that the time spent cycling and walking is more than offset by the health benefits of such cardiovascular exercise, thereby extending life expectancy by more than the extra time it takes to walk or cycle.
- An auto-based society discriminates against the disadvantaged. The poor, the elderly, and the disabled are the main victims of low-density neighbourhoods. Their opportunities are already restricted through financial and physical handicaps; substandard accessibility further disadvantages them and segregates them from the rest of society. Even affluent households are adversely affected by a transport system that immobilizes anyone who cannot drive a car. Suburban children are totally dependent on their parents to get

anywhere. Since auto-oriented land-use patterns are so spread out that trips to almost all desired destinations are either too long or too dangerous to cover by foot or by bicycle.

Jackson, Richard and Chris Kochtitzky: Creating a Healthy Environment: The Impact of the Built Environment on Public Health. Washington: Sprawl Watch Clearinghouse.
On line Available, <http://www.sprawlwatch.org/health.pdf>

- Motor vehicle traffic is the main source of ground-level urban concentrations of air pollutants with recognized hazardous properties.
- Approximately 36,000 to 129,000 adult deaths a year can be attributed to long-term exposure to air pollution generated by traffic in European cities.
- Sedentary lifestyles contribute to poor health outcomes as they are a significant factor in the incidence of overweight and obesity.
- According to a recent survey, one of the most important determinants of physical activity is a person's immediate environment (one's neighbourhood). Some environmental variables are the presence or absence of sidewalks, heavy traffic, street lights, enjoyable scenery, frequent observations of others exercising and high levels of crime.
- Positive environmental determinants of physical activity included enjoyable scenery, while the greatest perceived barrier was the lack of a safe place to exercise.
- People tend to get less exercise as outlying suburbs are further developed and the distance between malls, schools, and places of employment and residence increases.
- In 1977, children aged 5 to 15 years walked or biked 15.9 percent of all trips. By 1995, children made only 9.9 percent of their trips by foot or bicycle – a 37 percent decline.
- A study in Houston Texas found that three out of five disabled and elderly people do not have sidewalks between their residences and the nearest bus stop. Fewer than 10 percent of the disabled and elderly use public transportation in Houston. Without community access, these groups cannot adequately participate in physical activity, establish a community of support, or utilize health care facilities.

Starr Group. 2000. Secondary Rental Market Study Final Report. Ottawa: Canada Mortgage and Housing Corporation and the Ministry of Municipal Affairs

- In many communities low mortgage interest rates and stable building costs for most of the 1990's have made some forms of ownership housing as affordable as some forms of secondary rental housing. This trend discouraged the rental of full, single, semi and row dwellings.
- Secondary rental housing is plays a significant role in meeting the affordable housing needs of many communities.
- Security of tenure is an important issue in any policy aimed at encouraging expansion of secondary rental housing.
- 70% of all rental housing in the Suburban GTA is made up of secondary suites.
- In most areas rents for secondary housing has been rising sharply, while vacancy rates have been decreasing.
- Secondary rental housing, accessory apartments, units over stores and duplexes/triplexes are increasingly less affordable especially for those on social assistance or working at minimum wage.
- Accessory apartments were found to be playing a particularly strong role in housing students population and seniors.

- In many municipalities regulatory barriers presented by zoning by-laws are discouraging the creation of secondary units.

Surface Transportation Policy Project. High Mileage Moms: A Transportation and Quality of Life Study. Cited August 22, 2001. On line Available, <http://www.transact.org/Reports/highmilemoms/splash.htm>

- Women, especially mothers, are spending significant amounts of time in a car.
- According to the most recent available US data, women overall spend 64 minutes per day in a car. Single mothers spend 75 minutes a day in the car while married mothers with school-aged children spend 66 minutes a day driving (both of these figures are close to 17 solid days).
- As suburban schools consolidate into larger buildings and recreation centers are built far from residential areas, parents find themselves left with no choice but to drive their kids just about everywhere.
- Subdivisions and neighborhoods often have few sidewalks or safe places to bike.
- The number of trips children take by foot or bicycle has been declining steadily, from 15.8 percent of all trips in 1977 to 14.1 percent in 1990, and 9.9 percent in 1995.
- Almost 50 percent of five- to nine-year-olds get to school by car, and only 11 percent actually walk. Since 1990, the number of children walking to school has gone down 23 percent, as car trips have continued to rise.
- Three-quarters of elderly people now live in rural or suburban areas where they are dependent on others to help them get around.
- Women are spending a lot of their time on the road running errands. When women get in the car, it is often the beginning of a complex “chain” of trips, as they drive from home or work to the grocery store, the pharmacy, the dry cleaners, and the day care center. This pattern is changing the character of the daily commute.
- The majority of women in one US study reveals that 61 percent make at least one stop after work and almost 30 percent make two stops or more, whereas just under half of men (46 percent) stop on the way home.
- The commute to work is no longer the focal point of the day’s travel.
- Going to work now accounts for only 18 percent of the average American’s trips, whereas shopping, chauffeuring, and conducting other errands accounts for 46 percent of trips.

Synder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- The average worker now spends about 9 hours per week, or more than a full working day, traveling in a car due to increased commuting time and congestion

1.2 ENVIRONMENTAL IMPLICATIONS OF GROWTH AND URBAN FORM

Dunn, James. 1998. Driving Forces: The Automobile, its Enemies, and the Politics of Mobility. Washington: Brookings Institution Press

- Air, water, and noise pollution remain serious problems of the highway transportation system. Cars and trucks are a major source of noise and air pollution in most cities.

IBI Group. 2000. Greenhouse Gas Emissions From Urban Travel: Tools for Evaluating Neighbourhood Sustainability. Ottawa: Canada Mortgage and Housing Corporation and Natural Resources Canada

- The presence of wide arterial roads either within the neighbourhood or on its periphery slightly increases auto use.
- Neighbourhoods with a curvilinear road layout type tend to have slightly increased auto ownership levels.

International Council for Local Environmental Initiatives. 2000. Urban Land Management and Global Sustainability: A Document Prepared for Local Environment. Toronto: International Council for Local Environmental Initiatives

- Low densities impel the use of personal transport that can use much more energy than alternatives. Larger lots also encourage the construction of larger buildings, with greater surface area, that require more energy per resident for heating and cooling.
- Urban development is generally the most ecologically disruptive activity within urban areas. The primary disruptive activities are land use related: the infill of wetlands, mangroves and estuaries; destruction of natural coastlines; canalization of rivers and streams; and the elimination of forests and native plant life.

Sauve, Carole. 1996. The Automobile Culture in Canada: Choice of Albatross? A Report Prepared for Carlton University's Canadian Studies Department
Available On line, <http://www.flora.org/afo/albatros.html>

- Ground-level ozone is Canada's most serious air quality problem and three quarters of the ground level ozone in urban areas is caused by automobiles.
- Six per cent of all respiratory admissions in Canadian hospitals are smog related and in the United States, the American Lung Association reports that air pollution from motor vehicles causes \$40 to \$50 billion in annual health care costs.
- An automobile-centred transportation system contributes to high noise levels, greater congestion, and dangerous streets- all of which foster serious stress in our cities.

United States Environmental Protection Agency. 2001. Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality. Washington, DC: United States Environmental Protection Agency

- The built environment has direct and indirect effects on the natural environment. Land consumption, habitat fragmentation, endangered species, and replacement of natural cover with impervious surfaces directly impact habitat, ecosystems, endangered species,

and water quality. Air pollution and climate change can adversely affect water quality and climate.

- Development patterns and practices also affect environmental quality since urban form influences the travel decisions that people make. Certain patterns of development encourage increased use of motor vehicles, which is associated with growth in emissions of air pollutants and the greenhouse gases that contribute to global climate change.
- The environmental consequences of vehicle travel and dependency include degradation of air quality, greenhouse gas emissions and increased threat of global climate change and noise.
- In 1991, air pollution from highways is estimated to have caused between 20,000 and 46,000 cases of chronic respiratory illness.
- Atmospheric deposition of vehicle pollutants into bodies of water adversely affects water quality. The economic impacts of air pollution in terms of health impact, crop damage, and building material damage are significant.

1.3 PHYSICAL DESIGN IMPLICATIONS OF GROWTH AND URBAN FORM

Canadian Urban Institute. 2001. Smart Growth in Canada. Toronto: Canadian Urban Institute, Available On Line, <http://www.canurb.com/home.html>

- A problem with sprawl is the sense of placelessness.
- Land uses are segregated, creating huge areas with nothing but housing interspersed with multi-lane highways, shopping centers and vast business parks.
- According to Real Estate trends, standard suburban development may not be able to sustain itself. Many low-density suburban communities will suffer lower land values because of poor planning, increasing traffic and deteriorating housing stock.

Lang, Robert. 2000. Office Sprawl: The Evolving Geography of Business. Washington, DC: The Brookings Institute
Available On Line, <http://www.brook.edu/es/urban/officesprawl/report.html>

- An analysis of the location of office space in 14 of the largest US commercial real estate markets found that:
 - between 1979 and 1999, cities' share of metropolitan office space significantly diminished. 1979, 74 percent of office space was in central cities and 26% in suburbs;
 - in 1999 the central city share of office space dropped to 58 percent while suburban share grew up to 42%;
 - metropolitan commercial office space is no longer found within a few high-density clusters. 37% of office space are highly dispersed. These "edgeless" locations lack well-defined boundaries, extending over tens if not hundreds of square miles of urban space.
 - The policy implications of office sprawl include the difficulty to provide transit, increased commute times, extended commuter sheds, and a mismatched jobs/housing ratio..

Maryland Office of Planning. 2001. Models and Guidelines for Managing Maryland's Growth: Smart Neighborhoods Models & Guidelines. Baltimore: Maryland Office of Planning Available On Line, <http://www.mdp.state.md.us/smartgrowth/index.html>

Barriers to "Smart Neighbourhoods" include:

- **Development Codes-** Current zoning and development regulations are designed to guide typical suburban development that often prohibit or impede mixed-use development.
- **Institutional Bias-** Developers, lending institutions, and builders have more experience with and are more comfortable developing, providing financial support for, and marketing single-use developments. Concerns about the marketability of mixed-use communities, established lending guidelines and the difficulty of assessing risk associated with mixed-use projects have proven major obstacles in the past. However, some members of the development community have adapted to and profited from mixed-use.
- **Citizen Opposition-** Citizens often oppose mixed-use development due to fears about traffic, noise, density, low-income housing, and strain on infrastructure. In a 1999 National Association of Home Builders survey, 79 percent of respondents cited traffic as the most negative aspect of growth. Most people assume that higher density and mixed-use necessarily leads to greater traffic.
- **Cultural Bias-** Developers often state that they produce the large lots and single-family detached homes people want. Eighty-eight percent of respondents in a survey preferred a single-family house, while fewer than ten percent selected higher density options such as townhouses, condominiums, and apartments. Visual preference surveys, however, reveal that many people respond to design (design that ensures privacy and safety, provides attractive open spaces, and is generally aesthetically pleasing) more than to an inherent need for single-family detached homes on large lots. A growing segment of the population appreciates the lifestyle choice offered by smart neighborhoods.

Nivola, Pietro. 2002. Laws of the Landscape: How Policies Shape Cities in Europe and America. Washington: Brookings Institute Press
On Line Available, <http://brookings.nap.edu/books/0815760817/html/index.html>

- The combination of housing and offices that are designed according to well-established real estate development formulas produces a homogenous and standardized urban landscape.
- The gains in convenience and economy may be great, but so are the losses in individual identity.
- It is important to acknowledge urban design when planning for public and quasi-public buildings – city halls, courthouses, museums and concert halls.
- Toronto has nine feet of road per inhabitant compared to New York City (15.5 feet) and Chicago (16.5 feet).

Sauve, Carole. 1996. The Automobile Culture in Canada: Choice of Albatross? A Report Prepared for Carlton University's Canadian Studies Department.
On Line Available, <http://www.flora.org/afo/albatros.html>

- The Transportation Master Plan prepared by the Regional Municipality of Ottawa-Carleton revealed that public subsidies for public transportation modes were about one-fourth the amount of subsidies to automobile transportation.
- Specifically, the figures for 1993 showed that in monetary terms, public transit received about \$80 million, while the automobile system received just over \$315 million.
- In True Costs of Road Transport, costs associated with the automobile are categorized as internal, external, fixed or variable, market or non-market, direct or non-direct. Consumers tend to be most affected by internal and variable costs (i.e. fuel, parking, vehicle maintenance) and, as a result, external, fixed and longer term costs (such as road construction, “free” parking, traffic planning, land use impacts, and social inequity) are undervalued or ignored.
- The fact that drivers are exempted from paying a fair share of these external costs (which comprise one-third of total car costs) makes the car option an attractive and cheap one, thus contributing to automobile dependence.
- In 1992, Pollution Probe carried out a study on the costs of the car in Ontario, and placed the estimate at over \$4.5 billion. In this figure, costs for highway construction and maintenance, automobile-related interest on the provincial debt, healthcare costs and car-related policing are included. An additional \$3.75 billion was spent on external, variable, and indirect car-related costs which included: loss of farmland; crop damage due to ground-level ozone; loss of productivity due to delays, injury and death; and environmental damage due to acid rain.

Synder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html> and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair-Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development
On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- By 1990, 159 million people in the US sprawled outward into low density neighbourhoods while only one-third lived in central cities.
- Businesses have moved to the suburbs to take advantage of tax incentives and to avoid higher land and capital costs in downtown areas. These businesses have exacerbated the problem of vehicle dependence by providing free parking to employees at facilities.
- From 1970 to 1996, the number of cars has also outgrown the population. During the same period the number of cars grew to more than 97 million, while the population in U.S only increased by 61 million.
- Studies have shown as much as a doubling of vehicles miles traveled per capita for people living in sprawl-like development compared to older transit-oriented development.

Lord Richard Rogers. 2000. Towards an Urban Renaissance The Report of the Urban Task Force. London: Department of the Environment, Transport and the Regions
On Line Available, <http://www.regeneration.detr.gov.uk/utf/renais/>

- Car traffic in Britain is expected to grow by a third in the next 20 years. Average commuting time is 40% higher than 20 years ago.

1.4 ECONOMICS AND COST IMPLICATIONS OF GROWTH AND URBAN FORM

Biodiversity Project. 2001. Sprawl: Economic Costs at a Glance. Madison, WI: Biodiversity Project

Available On Line, <http://www.biodiversityproject.org>

- Subsidies for new highway construction, services, and other infrastructure encourage more low density development.
- New houses and businesses built in sprawling developments do not generate enough taxes to support the infrastructure and service costs these developments require.
- More fire stations and police cruisers are needed to protect the same number of households when those dwellings are scattered rather than built on smaller, adjoining lots. These extra costs are then made up by general taxes on all residents in a metropolitan area, rather than only those living in the new subdivisions.
- Central city residents often end up subsidizing the services provided to homes on the fringe. Residential development in general takes more in services than it pays in taxes, while farm-land and open space pay more than they require.
- Each new home in the outer suburbs receives an average subsidy of \$900 to \$1,500 per year.
- Each household in the central city and inner suburbs makes a yearly contribution of \$600 to \$800 toward those subsidies.
- Residential development requires a median of \$1.15 in services for every \$1.00 paid in taxes, whereas farmland and open space require a median of \$.35 in services for every \$1.00 paid in taxes.
- In 1987, Milwaukee spent 21 percent of property tax revenues on highway-related projects.
- Each major city resident bears a cost of nearly \$3,000 to pay debt service on infrastructure expansion to support new, poorly planned development.

Snyder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- Sprawl has been a dominant growth practice partly because it appears to cost less. Land outside city centers is less expensive than land in downtown areas. And yet infrastructure costs (the costs of new facilities, and the cost of public services) are often higher for sprawl.
- A major problem is that homebuyers and developers do not pay all of the costs of sprawl.
- One study in San Francisco found that development in infill areas is 75% higher on average. This drives moderate and low-income families out of the city onto previously undeveloped lands.
- Construction, permitting, parking and design costs are less and developers often find it easier to obtain approvals in outlying lots because there are fewer concerned neighbours to hold up the process.
- The cost of owning and operating a car costs about \$3600 a year, which translates to about 16-20% of total household expenditures. Put another way, a median income family would spend 27 hours a month to pay for the 32 hours a month they spend on average in a car.

1.5 AGRICULTURAL IMPLICATIONS OF GROWTH AND URBAN FORM

American Farmland Trust. 2000. Smart Growth Versus Sprawl in California: How State and Local Public Policies Perpetuate Inefficient Development in the World's Most Productive Agricultural Valleys. Washington: American Farmland Trust
On Line Available, <http://www.farmland.org/cfl/centvalleyexec.htm>

- Low-density suburban development is consuming far more of California's agricultural land than is necessary to accommodate its growing population. The number of people living in the state's most important agricultural valleys expected to triple within about a generation.
- A myriad of public policies, from property taxation to development fees to zoning, skew the economics of land development in favor of sprawl and against smart growth.
- Today, smart growth has a hard time competing with sprawl in the marketplace. This is not simply the result of a free, impartial economic system in which consumers naturally choose low-density housing and "big box" retailers because they are cheaper and more convenient.
- Included among the state and regional policies that exert a bias in favor of sprawl are:
 - spending on infrastructure such as freeways and water supply systems that subsidize low-density development; and
 - the "fiscalization of land use" by Proposition 13, which causes local governments to continually seek revenue from new development regardless of its efficiency;
- Local policies that most significantly promote sprawl include:
 - failure to implement general land use plans;
 - subdivision standards that waste land;
 - siting of schools and other public facilities at remote locations; and
 - development fees that fail to reflect the public service cost differences between sprawl and smart growth.

Snyder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html> and Lori Bird.

- The American Farmland Trust has estimated that the U.S. is losing about 50 acres an hour to sprawling developments. If this trend continues, the Trust estimates that 13% of prime U.S. farmland could be redeveloped by 2050.
- Between 1982 and 1987, California's Central Valley lost almost a half-million acres of productive farmland.
- Loss of agricultural land in close proximity to urban centers represents a loss in efficiency, and loss in ability for small farmers to easily sell their fruits and vegetables in local markets. Out of a total of about 250 million acres of cultivated farmland in the U.S., only 48 million areas are within 50 miles of the 100 largest urbanized areas.

PART 2: POLICY AND PLANNING TOOLS TO PROMOTE SUSTAINABLE URBAN FORM

The following section presents reports that highlight policy, design and financing tools to promote more sustainable urban growth. These reports are from a range of non-profit organizations and municipal planning agencies in cities in Canada, the U.S and Britain.

2.1 REURBANIZATION AND REGENERATION TOOLS

Danielsen Karen, William Fulton. 1999. - Retracting Suburbia: Smart Growth and the Future of Housing. Washington DC: Fannie May Foundation Housing Policy Debate On Line Available, http://www.fanniemaefoundation.org/programs/hpd/pdf/hpd_1003_danielsen.pdf

- A high proportion of interviewees in a Professional Builder's study were willing to live closer to city to reduce commute time.
- Empty nesters, gay, childless couples are looking for convenience when purchasing homes on in-fill sites. Studies show many demographic groups prefer short commutes, high levels of amenities and low maintenance homes.

Department of the Environment, Transport and the Regions. 2001. London. Planning Policy Guidance Note No.3. Cited August 30, 2001. On Line Available, <http://www.planning.dtlr.gov.uk/ppg3/5.htm#1>

- The British government is committed to maximizing the re-use of previously-developed land and empty properties, and converting of non-residential buildings for housing, in order both to promote regeneration and minimise the amount of greenfield land being taken for development.
- The national target is that by 2008, 60% of additional housing should be provided on previously-developed land and through conversions of existing buildings.

Hall, Tim. 1996. "The Landscape of Urban Regeneration: Public Art," London: Landscape Issues. Cited August 2001, On Line Available, <http://www.chelt.ac.uk/cwis/pubs/landiss/vol12/page2.htm>

- To ensure any level of sustained investment, and economic survival, it has become essential that cities seek to differentiate and assert themselves through the creation of unique urban identities.
- In former industrial cities some of the most interesting alliances between urban regeneration, place promotion and public art emerge. In urban design terms, most of these schemes involve the making or re-making of urban place.
- The widespread deindustrialization of Britain's manufacturing regions has had a devastating effect not only on the economies of Britain's major cities, but also on their image.

- Since the early 1980s British cities have launched a plethora of urban promotional campaigns including 'Glasgow's Miles Better', 'Sheffield, Hallmark for the Future' and 'Birmingham, the Big Heart of England'.
- All of these cities have complemented these programs by endorsing public art strategies.

Lord Rogers of Riverside. 2000. Our Towns and Cities: The Future Delivering an Urban Renaissance. London: The Department of the Environment, Transportation and The Regions
On Line Available, <http://www.regeneration.dtlr.gov.uk/policies/ourtowns/seminars/>

- Regeneration policies need to encourage:
 - people living in attractive, pedestrian friendly towns and cities which use space and buildings well; and
 - good design and planning which makes it practical to live in a more environmentally sustainable way, with less noise, pollution and traffic congestion;
- Places need to be created that:
 - provide attractive homes;
 - have plenty of good quality public spaces in which people feel safe;
 - allow people easy access to local shops, schools, health and leisure facilities on foot or bike; and
 - are sustainable and well served by efficient and reliable public transport.

In order to reach these goals policies need to aim to:

- use previously developed land to prevent urban sprawl;
- invest £180 billion in a 10 year plan for transport to modernise and up-grade transport networks;
 - introduce Local Strategic Partnerships which will give communities a clear voice in the development of the Community Strategy for their areas; and
 - create a New Opportunities Fund initiative to enable communities to fund their ideas for improving the local environment.

Lord Richard Rogers. The Urban Task Force. 2000. Towards an Urban Renaissance: The Report of the Urban Task Force. London: Department of Environment, Transport and the Regions
On Line Available, <http://www.regeneration.detr.gov.uk/utf/renais/>

Tools to improve urban spaces include:

- introducing a national urban design framework;
- introducing key design principles through planning and funding guidance supported by a series of best practice guidelines;
- initiating regeneration demonstration projects that adopt an integrated approach;
- creating neighbourhoods with a mixture of tenure and housing;

- introducing Urban Priority Areas where regeneration can be undertaken by dedicated companies, assisted by streamlined planning decisions, easier land acquisition, tax incentives and additional resources;
- establishing a Renaissance Fund for local groups to improve their own neighbourhoods; and
- changing the ethos of planning to make it more positive in securing urban change and including local people in the decision-making process.

2.2 SMART GROWTH TOOLS

Canadian Urban Institute. 2001. Smart Growth in Canada. Toronto: Canadian Urban Institute Available On Line, <http://www.canurb.com/home.html>

- Smart Growth consists of a coalition of many different interests sharing the idea that the current way in which cities grow needs to change.
- Smart Growth advocates recognize the need for transportation alternatives, updated infrastructure, a wider choice of housing options, better environmental protection, and more reinvestment in city centers.
- Sprawl is the way in which new development consumes land at a faster rate than the rate at which the population is growing. This means reconsidering housing forms and lot sizes in new suburbs and accommodating a greater proportion of growth in previously developed areas.
- Smart Growth actions to rein in sprawl include:
 - setting meaningful urban boundaries and implementing regional growth management policies;
 - ensuring new residential developments follow transit supportive guidelines and provide alternatives to car use;
 - establishing regional plans to promote efficient use of existing infrastructure; and
 - enforcing local plans to promote mixed use.

Crombie, David. 2001. “Grow smart or grow worse: The rebirth of America’s inner cities is putting Canada’s urban landscapes to shame.” The Globe and Mail. Toronto: Globe and Mail On Line Available, http://webhome.idirect.com/~jleeson/crombie_smart_growth.htm

- Healthy communities and strong neighbourhoods are basic building blocks for competitive city regions.
- Business people, commuters, environmentalists and local governments demand an alternative to endless outward expansion.
- “Smart growth” emerged as a solution that endorsed development, but in ways that are less wasteful of resources.
- Smart growth is about using regional and local planning to promote efficient use of existing infrastructure, and to create strict criteria for any investment in new infrastructure.
- Studies reveal that gridlock not only harms the environment, but slows the movement of goods, adding unnecessary costs for industry. Only increased public commitment to transit will attract private investment and allow transit to expand and operate efficiently.

- When housing is unaffordable, poorly located or unattractive, cities have a hard time attracting employers and workers.
- While Ottawa is backing out of public housing programs, Washington is getting back in, offering programs and cheap mortgages that become even more affordable where work and home are near each other.

1000 Friends of Maryland. [Making Smart Growth Smarter Maryland's Next Steps](http://www.cbf.org/gmla_report/gmla_frames.htm). On Line Available, http://www.cbf.org/gmla_report/gmla_frames.htm

- Counties should retool their development regulations and plans to maximize the amount and quality of growth that occurs in smart growth areas. The development patterns and standards of traditional neighborhood developments are model alternatives.
- Efforts to develop smart codes should examine county development regulations to determine their effect on land consumption and develop a model code of regulations counties could adapt.
- The state should develop guidelines that provide local governments with the means for using land within growth areas efficiently, and should use infrastructure funding as an incentive for best land use practices within growth areas.
- Many growth-related problems such as traffic congestion, concentration of poverty, and air pollution can be dealt with successfully only on a regional scale. Large development projects can have economic, social, and environmental effects that transcend county lines. A statewide map of smart growth areas offers observations about growth from a regional perspective. Smart growth areas located next to or near one another can form a complementary regional grouping which may make sense as a focus of state policy.
- The state should establish mechanisms and incentives for encouraging the regional coordination of growth and regional approaches to solving growth-related problems, such as regional revenue sharing.
- The state should establish a process for state and inter-jurisdictional review of projects of regional impact. The state should withhold smart growth funds from a jurisdiction that has not mitigated negative inter-jurisdictional impacts resulting from a development project.
- The state should mandate improvements in the performance and public accountability of the metropolitan planning organizations responsible for transportation and air quality programs.

2.3 FINANCING TOOLS

Berridge, Joe. 2001. "Ottawa-On Becoming a Big City," *Ontario Planning Journal*. Toronto: Ontario Professional Planers Institute

- If Ottawa were capital of the U.S it would receive almost \$80 million a year in regular transit and community development capital funding, plus huge project-specific funding. The U.S six-year TEA-21 transportation development program has been funded at \$217 billion US.
- Most of the groundbreaking developments in architectural or city-building terms have been sponsored or promoted by some civic agency – Battery Park City in New York, St. Lawrence Neighbourhood in Toronto, as well as developments in Barcelona and Bilbao are some examples.

Biodiversity Project. 2001. Sprawl: Economic Costs at a Glance. Madison, WI: Biodiversity Project

On Line Available, http://www.biodiversityproject.org/mediakit/sprawl_1B_economic_costs.pdf

- Many local governments now charge developers an impact fee for new developments to try and recoup some of the costs of those new developments. Lancaster, PA, charges impact fees based on the distance of the new development from existing services.
- Location Efficient Mortgages promote a move back to central cities. These mortgages provide savings to the borrower based on the transportation cost savings of living near mass transit. Homes are made more affordable to low-and moderate-income urban residents, and the average homeowner can purchase mass transit alternative.
- In the U.S, this would create a 20 percent federal income tax credit that could be used to restore homes in historic districts where community revitalization is needed. This credit could also be used to reduce the mortgage rate for historic homebuyers.

Booth Geoffrey, Leonard Bruce and Pawlukiewicz Michael. 2001. Ten Principles for Reinventing America's Suburban Business Districts. Washington: Urban Land Institute.

On Line Available, <http://www.uli.org/>

- A sense of place within business districts is determined by a range of factors including development density, spatial separation between buildings, pedestrian interconnections, street layout, and choice in mode of transit. It is these factors that have played a large part in the resurgence of central business districts in the 1990s and that will be the focus of smart growth and the reinvention of suburban business districts.
- Compact suburban business districts typically consist of big buildings on small lots close together.
- In reinventing suburban business districts, it is essential that a range of principles be applied during the strategic planning and development stage in order to maximize the place-making dividend—the intrinsic value that accrues to a community when districts possess a strong sense of place that in turn results in high levels of repeat visits, increasing rents, retail sales, leasing demand, and capital value. Such a dividend occurs when individual real estate projects are so well designed and interconnected that they work as one integrated place.
- Ten principles to apply during the strategic planning of suburban business districts:
 - understand your position in the market;
 - build community support;
 - develop a vision and a plan;
 - stress results over regulation;
 - break up the superblocks and optimize connectivity;
 - embrace mixed use;
 - honor the human scale by creating a pedestrian-friendly place;
 - think transit—think density;
 - create a public/private partnership; and
 - share and manage parking.

- Fragmented suburban business districts include big buildings on large lots that separate the buildings from one another and therefore promote vehicle trips.

Danielsen Karen, William Fulton. 1999. Retracting Suburbia: Smart Growth and the Future of Housing. Washington DC: Fannie May Foundation Housing Policy Debate, On Line Available, http://www.fanniemaefoundation.org/programs/hpd/pdf/hpd_1003_danielsen.pdf

- Smart growth can be financed as long as development packages are presented in a way that allows commercial lenders to understand and reduce risk to acceptable levels.
- If developers can make innovative projects look more like conventional ones that can be sold into the secondary market or securitized, their projects will be easier to finance.
- Two main obstacles currently reduce financing options for smart growth:
 - difficulties with appraisals and finding suitable comparables; and
 - lack of good market research to show the financial feasibility of higher density smart growth projects

Lord Rogers of Riverside. 2000. Our Towns and Cities: The Future Delivering an Urban Renaissance. London: The Department of the Environment, Transportation and The Regions On Line Available, <http://www.regeneration.detr.gov.uk/utf/renais/>

- In Britain, a comprehensive £1 billion package of national taxation measures to increase investment in urban areas including plans includes:
 - Tax exemptions for all property transactions in disadvantaged in communities;
 - accelerated payable tax credits for cleaning up contaminated land;
 - one hundred per cent capital allowances for creating second suites;
 - a package of tax reforms to encourage additional conversions of properties for residential use; and
 - consultation on options for funding Town Improvement Schemes and for a Local Tax Reinvestment Programme.

U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation Urban and Economic Development Division. 2001. Smart Growth Tools. Washington: U.S Environmental Protection Agency

- “Clean Air Credits for Urban Policy Changes” provide incentives under the CAA for urban policy changes which reduce automobile dependence and transportation-related emissions.

Carson, Richard. 1998. Paying for Our Growth in Oregon, Beaverton: New Oregon Meridian Press.

- The state legislature should enact new financing tools to help both local government and schools districts pay for growth. The best methods are to: expand the use of system development charges to include city general fund and school capital improvements; lift the moratorium on the use of the real estate transfer tax; and allow cities to levy a charge on land annexed to the urban growth boundary and the city.

- Off-site conditions of approval require a developer to demonstrate a reasonable relationship to the development's impact on the community. A method to achieve this is to require exactions based solely on the Capital Improvement Plan and the use of system development charges, and not by directly requiring the individual developer to make off-site improvements.
- A state infrastructure financing bank or fund should be created where a city can borrow the money, build the infrastructure, and repay it with the system development charges collected. The problem cities face today is that they cannot bond improvements with system development charges like they can with utility rates.
- A variation on the 'infrastructure bank' is to encourage cities to utilize public-private development agreements. Some developers are financially solvent enough to finance and build complete off-site infrastructure systems and then collect SDC reimbursements from later development.
- The State of Oregon should develop a cost-benefit allocation methodology by which cities can determine and charge for the actual costs of growth, put the software on a disk, and update it every three to six months.
- The state should assume responsibility for its fair share of school district improvement costs.

Canadian Urban Institute. 2001. Smart Growth in Canada. Toronto: Canadian Urban Institute
On Line Available, Available On Line, <http://www.canurb.com/home.html>

- Tax increment financing (TIF) enables a city to use the additional property taxes generated by a new development to pay for certain development expenses. With TIF, a city "captures" the additional property taxes generated by the development that would have gone to other taxing jurisdictions and uses the "tax increments" to finance the development costs. Since the city will gain when a run-down area is re-developed, it should contribute some money up front to ensure that improvements are made.
- Tax exempt bonds are debt obligations issued by cities and towns to raise money for public works, schools, highways, affordable housing and other projects. If the projects are intended to benefit the general public, the bonds are from federal income tax. The bonds are redeemed though the increased property tax revenues generated by a particular project.
- In the U.S the internal revenue service allocates a certain number of housing credits to each state- each state has an agency to administer. Tax credits are offered to private and non-profit developers who meet certain criteria. The developers use tax money to raise capital.

Danielsen, William Fulton. 1999. - Retracting Suburbia: Smart Growth and the Future of Housing. Washington DC: Fannie May Foundation Housing Policy Debate
On Line Available, www.fanniemaefoundation.org/programs/hpd/pdf/hpd_1003_danielsen.pdf

- The Natural Resources Defense Council found that significant savings accrue from living in higher density neighborhoods that feature public transit and pedestrian access to everyday services.
- Mortgage markets should consider these savings when calculating loan risk. The savings from higher density development need to be better quantified; when common measures for these savings are created, standardized mortgage products can be developed.

- If smart growth housing is to achieve parity with low-density/large-lot residential development, it needs better access to the secondary mortgage market.
- A major challenge facing developers and institutions seeking to standardize smart growth projects is that these developments mix land uses in a way that does not lend itself to standardization. The credit market for single-family homes relies on the creditworthiness of a borrower. The better the credit, the lower the risk.
- American regions lack integration and unity. The single greatest challenge facing smart growth is finding inventive ways to adapt highly focused financial instruments to complement development practice.
- Smart growth prescribes a customized or locally tailored approach to development, while the secondary mortgage market favors standard products.
- The financial instruments and institutions underlying American development deliberately isolate components of the built environment to better securitize their risk.

Synder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- Impact Fees have been used extensively in Florida, California, Oregon, Colorado and Texas. They are used for the expansion or construction of new facilities that provide municipal services. Most commonly, fees are used to recoup the cost of water and sewer hookups.
- The connection between a new development and the additional cost of services must address sprawl.
- Impact fees are based on size, location, and land-use mix of each project then calculated for infrastructure, public facilities and operations.
- Basing impact fees on square footage and/or density can help mitigate the regressive nature of fees.
- In Boston and San Francisco, a per-square foot assessment on new downtown office construction translates into proceeds used by the city to provide additional lower cost housing to qualifying households.
- Development excise taxes are similar to impact fees and can also be used to control sprawl. The two main differences between impact fees and excise taxes are that 1) taxes must be approved by the public and 2) the level of the tax does not have to bear any relationship to the cost of providing services to the development.
- Excise taxes may represent a better alternative for incorporating some of the social costs associated with air quality impacts and vehicle dependence. Given the flexibility in setting the fees, these costs could be incorporated in the tax. A number of cities, like Boulder, Colorado have adopted development excise taxes to help pay for growth, although none have instituted a tax that varies by location.
- Impact fees and /or excise taxes must be applied consistently across jurisdictional boundaries for them to effectively contain regional growth.

Tomalty, Rae. 2001. How Does Your Community Grow? A Report for Smart Growth British Columbia

Available On Line, <http://www.smartgrowth.bc.ca/news.html>

- Development Cost Charges - Fees for subdivision plans that incorporate access to transit, bike paths, mixed use, and a range of housing types, etc. should be reduced or waived to encourage more compact, mixed use developments.

1000 Friends of Maryland. Live Near Your Work: Smart Growth and Neighborhood Conservation in Maryland

Available On Line, <http://www.op.state.md.us/smartgrowth/lnyw.htm>

- The Maryland Department of Housing and Community Development is implementing a pilot “Live Near Your Work (LNYW)” Program to encourage employees of Maryland’s businesses and institutions to buy homes near their workplace. This initiative will stabilize the neighborhoods surrounding the State’s major employers by stimulating home ownership in targeted communities. In addition to providing resources for LNYW Programs sponsored by public and private institutions, the State is participating in LNYW as a major employer.
- The LNYW program provides a minimum \$3000 to homebuyers moving to designated neighborhoods. The local government designates LNYW areas with the department’s concurrence and administers the program within its jurisdiction.
- Participating employers, businesses, non-profits, colleges or universities, or government agencies must set eligibility requirements and promote the program to their employees and provide matching resources. To qualify, the employee must purchase a home in a designated LNYW area, and live there for at least three years.

2.4 TRANSPORTATION, HOUSING AND LAND-USE PLANNING TOOLS

American Farmland Trust. 2000. Smart Growth Versus Sprawl in California: How State and Local Public Policies Perpetuate Inefficient Development in the World’s Most Productive Agricultural Valleys. Washington: American Farmland Trust

Available On Line, <http://www.farmland.org>

- The following initial steps toward meaningful policy reform are recommended by the American Farmland Trust:
 - adopt local general plans that favor more efficient development and enforce them in the zoning and development permitting process;
 - build efficiency into zoning and subdivision standards by permitting greater flexibility in housing configuration, set backs and street widths;
 - reinforce general plans by appropriately siting public facilities and making infrastructure investments that encourage efficient development patterns;
 - remove artificial financial obstacles to smart growth by immediately reducing development fees on compact housing and eventually adjusting entire local fee structures to reflect higher costs of sprawl;
 - study reforms of local government finance that could ameliorate the pressure on them to attract development - any development – for cash;

- study mechanisms for greater regional cooperation in land use policymaking to avoid competition that leads to sprawl;
- examine reforms of electricity and other utility rate structures that could take advantage of the cost savings of smart growth patterns; and
- put smart growth to a fair market test with pilot projects that guarantee developers a reasonable rate of return if they build more efficient housing and commercial projects.

Condon, Patrick. 1996. Sustainable Urban Landscapes: The Surrey Design Charrette. Vancouver: UBC Press

The following are key characteristics of a case study of a more sustainable grid land-use pattern with an “ecological underlay” design.

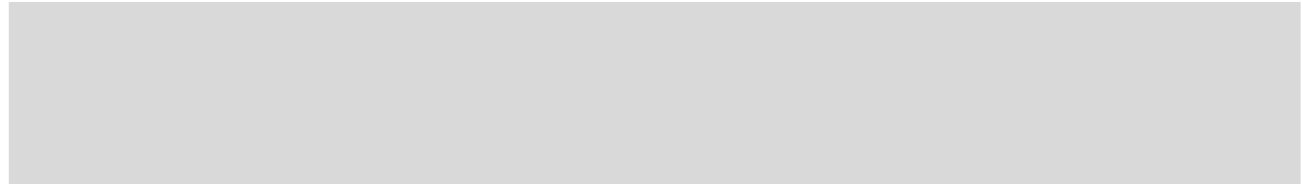
- Streets are arranged in a grid configuration that has been modified to allow for the preservation of existing streams. The larger context outside the site would include commercial/transit corridors within a five-minute walk of all residents.
- There are 47.7 dwelling units per hectare in this case study site, with 4,767 dwelling units per square kilometre, or a total population of 11,918 people per square kilometre (assuming an average of 2.5 people per dwelling unit).
- Of the total site area, 26 percent is paved road, driveway, garages, parking pad, or sidewalk. This produces 51 square meters of pavement per dwelling unit (either on it or directly adjacent to it)
- Street-side swales feed into retention swales which frame the community parks. Excess water slowly re-enters adjacent natural streams which are preserved to receive water. This slow filtration process helps to cleanse the water and prevent flooding.
- The Traditional Pattern with the Ecological Underlay follows roads and lanes. There is, on average, 3.8 metres of utility run per dwelling unit. Gas lines are buried in the lanes while electric, telephone, and cable television lines are held aloft on poles also located in the lane. Sanitary and water mains are buried in the street right-of-way. The surface storm drain system eliminates the need for a sub-surface storm drain system.
- Road widths should be narrower. An example of a more ecologically friendly residential road design can include a 15 meter right of way, a 1.25 meter sidewalk, a 3.0 meter shoulder including swale, street trees and parking, a 6.0 meter paved street and a 3.0 meter boulevard including swale, street trees and parking.
- On average, 14 percent of each individual lot is paved sidewalk with a further 36 percent covered by house, carriage house, storage, garage structures and/or paved car pads. Fifty percent of the total site is permeable surface which includes lawn, planting beds, street shoulders and unpaved lanes.
- Local recreation space is provided by nearby schools, neighbourhood parks, and riparian strips associated with preserved natural streams and swales. These provide a mix of field and court sport areas as well as natural areas. Assuming a 10 minute walking radius, there are approximately 18 square meters per dwelling unit of recreation space located in the immediate neighbourhood. On average, it would take 1 minute to walk to the nearest recreation area. Virtually 100% of residents are located within a 5 minute walk to the closest recreational space.
- Commercial nodes in the Traditional Pattern with an Ecological Underlay are linear in form and typically located along commercial roads. Additional secondary commercial nodes occur regularly throughout residential neighbourhoods. Shop fronts are usually built to the sidewalk, and parking is mainly on-street or underground. Public transit is

typically provided by busses, which have routes along commercial streets. On average it would take 2.5 minutes to walk to the nearest commercial and transportation node.

- The preserved streamways in the district also include bike and walkways. Virtually every part of the community is accessible via this system which provides complete intra- and inter-community access.

Department of the Environment, Transport and the Regions. 2001. London: Planning Policy Guidance Note No.3. Available On Line, <http://www.planning.dtlr.gov.uk/ppg3/5.htm#1>

- The Government places particular emphasis on the importance of integrating decisions on planning and transport in order to reduce the need for travel by car. Local planning authorities should seek to exploit opportunities to locate larger housing developments around major nodes along good quality public transport corridors (both existing and those with firm proposals for improvement in local transport plans) and seek to ensure that all housing developments are accessible by a range of non-car modes. This applies to development both within and outside existing urban areas. Public transport should be used positively to shape the pattern of development and new housing development can be used to make public transport services more viable.
- Local authorities should promote developments which combine a mix of land uses, including housing, either on a site or within individual buildings such as flats over shops. This is important not only to accommodate new households but also to bring new life into our towns and cities.
- To increase housing opportunities in town centres, local authorities should identify sites or areas where housing or mixed-use development will be required, including, where appropriate, specifying the proportion of floor space which should be residential within such developments.
- Local planning authorities should facilitate mixed-use development by:
 - encouraging more housing, including affordable housing, in town centres by, for example, converting space above shops and vacant commercial buildings;
 - identifying appropriate sites in development plans;
 - preparing development briefs for sites likely to become available for development; assembling sites for redevelopment; and
 - adopting flexible planning standards for car parking and density which facilitate such developments.
- Local authorities should promote additional housing in town centres within the context of their overall strategy for each centre, taking into account the existing balance of uses in the centre.
- Priority should be given to employment-generating uses such as shopping, offices and leisure especially at ground floor level but opportunities to add housing on upper storeys should be taken. Local planning authorities should allow housing developments with limited or no off-street car parking in areas with good public transport accessibility, and where effective on-street parking control is present or can be secured.



Greater Vancouver Regional District. 2000. Liveable Region Strategic Plan. Burnaby: Greater Vancouver Regional District
Available On Line, http://www.gvrd.bc.ca/services/growth/lrsp/lrsp_toc.html

- The proportion of people walking to work and taking transit is significantly higher in the downtown and in regional centres. The work travel patterns of residents living near centers shows that 18% of the region's population lives within walking distance of the downtown or a regional town centre but these people account for 40% of all transit, walk, or bike trips in the region.
- Walking to work is increasing, especially in regional town centres as more job opportunities become available. For example, in Metrotown, 12% of residents walk to work, twice the regional average, and 31% take transit, which was more than double the regional average. In the West End, the number of residents walking to work actually outnumbered the number driving with almost 40% walking to work.

Greenbelt Alliance. Greenbelt Alliance's Livable Communities Program: Smart Growth, Good Transit, Housing Choices and Open Space. Available On Line
http://www.greenbelt.org/about_us/livable_communities.html

The following planning goals that aim to relieve traffic congestion, improve affordable housing access and preserve open space:

- build communities in a more compact fashion, putting housing, stores, and jobs close to each other so that people can do errands on foot and walk or take public transit to work and to school;
- invest not only in public transportation, but in transit-oriented urban design such as pedestrian-oriented streets and clusters of shops and housing around subway stations; and
- build balanced, inclusive communities where there is housing for all the kinds of people who live or work there. This means including affordable housing in every city so that the schoolteachers, firefighters, hospital workers, childcare providers and other people essential to life in every town can live near their jobs.

IBI Group. 2000. Greenhouse Gas Emissions From Urban Travel: Tools for Evaluating Neighbourhood Sustainability. Ottawa: Canada Mortgage and Housing Corporation and Natural Resources Canada

- Studies show that densities affect travel behaviour variables such as auto ownership and use. However, the influence of density can be overestimated in studies that do not account for other variables, such as household income, that are correlated in density.
- Mixed land use results in more "intervening opportunities" and shorter trip lengths, which favour more walking, cycling and transit use.
- Higher transit service and accessibility levels are correlated with higher transit use, but transit service also depends on other factors such as density.
- Research has found that the ease of access to regional jobs and activities by transit influences modal choice.

Maryland Office of Planning. 2001. Models and Guidelines for Managing Maryland's Growth: Smart Neighborhoods Models & Guidelines. Baltimore: Maryland Office of Planning, Available On Line, www.mdp.state.md.us/

- With the Neighborhood Conservation and Smart Growth Act of 1997, the state of Maryland directed its resources to revitalize established communities, support new development within priority funding areas, and preserve valuable resource and open space lands.
- Maryland has withdrawn its support for inefficient and expensive sprawl development, but we still need to use land that is developed inside the priority funding areas more efficiently, and to build communities that offer people an attractive alternative to single-use, low-density developments.
- In 2000, the General Assembly passed legislation directing the Maryland Department of Planning to prepare models and guidelines for “smart neighborhoods” and infill and redevelopment. The models and guidelines will help local governments transform smart growth from the realm of the theoretical to brick and mortar reality.
- Smart neighborhoods are relatively self-contained communities with a compact mix of residential, commercial, employment/office, and civic land uses. Their design offers a range of housing choices while fostering pedestrian and bicycle activity, public safety, environmental protection, long-term investment, efficient use of infrastructure, and efficient provision of public services.
- The term “smart neighborhoods” generally refers to new development on large infill and greenfield sites located within priority funding areas and consistent with the local government’s master plan.
- The goals of smart neighborhoods are:
 - to minimize demand for new services with compact, mixed-use designs that reduce the cost of on-site infrastructure;
 - to provide of a range of housing types that encourage socioeconomic diversity within communities bringing people closer to jobs;
 - to encourage compact, mixed-use design that improves access to daily destinations for people who cannot or do not wish to drive. These designs treats pedestrian, bicycle, and automobile travel as equally important;
 - to encourage compact, mixed-use design that reduces excess consumption of land, loss of natural resources and regional vehicle miles traveled and improves regional air and water quality;
 - to foster a mutually reinforcing relationship between residential and commercial uses. In mixed use neighbourhoods, residents provide a market and employees for businesses, and in turn, businesses provide desired amenities and employment opportunities for residents; and
 - to build the logical extension and integration of communities with the connectivity of pedestrian and vehicular networks, natural systems, and open space networks that disperse traffic, promote efficient movement for all modes of transportation, enhance environmental protection, increase access to nature and recreation, and provide existing communities with needed amenities. The provision of civic, commercial, employment/office, residential, and open space uses can fill unmet needs of surrounding communities.

- In order to achieve the goals listed above, smart neighborhoods should exhibit all of the following characteristics:
 - mix of uses, including residential, commercial, employment/office, civic, and open space;
 - range of housing types;
 - compact design;
 - interconnected streets designed to balance the needs of all users, with sidewalks and on-street parking;
 - open spaces integral to the community; and
 - locations adjacent to and extended from the fabric of existing development.

Sauve, Carole. 1996. The Automobile Culture in Canada: Choice of Albatross? A Report Prepared for Carlton University's Canadian Studies Department. Available On Line, <http://www.flora.org/afo/albatros.html>

- Mixed-use zoning requires less automobile dependency and is more conducive to a thriving cycling and pedestrian culture.
- With smaller distances to travel, cycling and pedestrian networks develop.
- Narrow roads, as opposed to wide boulevards, encourage more pedestrians and cyclists to reclaim their streets.
- Currently, roads are largely inhospitable and unfriendly places for non-car drivers due to high speeds, noise and toxic car exhaust. Originally, roads and streets were the focal points for healthy communities, and dynamic street life.
- In the Netherlands for example, the Dutch national transportation policy made provisions to devote 10 per cent of the surface transportation budget to bicycle facilities starting in 1975.
- Today, over 30 per cent of all trips in the Netherlands are made by bicycle, while 25 per cent of all access trips to railway stations are also made by bicycle. The fact that the Netherlands has over 13,500 km of connecting cycle paths, giving riders uninterrupted access to destinations, undoubtedly contributes to a reduction in automobile reliance. The Netherlands provides cycling facilities holistically, that is, to and from as many different destinations as possible.

Snyder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- Incentive zoning encourages but does not mandate development of certain uses, amenities or design qualities in return for defined benefits, such as increased densities. Incentives are often used in downtown areas and suburban business centers to gain open spaces, special building features, or public art.
- Incentive zones, such as enterprise zones, can involve tax breaks for businesses and developers trying to develop in economically depressed regions.

Starr Group. 2000. Secondary Rental Market Study Final Report. Ottawa: Canada Mortgage and Housing Corporation and the Ministry of Municipal Affairs

- Recommendations to enable effective monitoring of the secondary rental market include:
 - the Province should provide mechanisms to encourage municipalities to allow accessory apartments in residential zones across the Province including the provisioning of enabling zoning by-laws;
 - the Provincial and municipal levels of government should ensure that property tax rates and/or personal income tax rates for homeowners creating legal accessory apartments encourage such activity; and
 - the Federal and Provincial governments should review the Income Tax Act to ensure that they provide incentive to homeowners creating legal accessory apartments.

Tasker-Brown, Julie. Energy Pathways. 1998. Shared Ownership Housing Pilot Project: A Report Prepared for The Federation of Canadian Municipalities, Canadian Homebuilders Association, Canadian Housing and Renewal Association, Canadian Mortgage and Housing Corporation

- The City of Trois-Rivières is initiating an urban revitalization strategy to make its older, central areas attractive places to live and work. In this context, the non-profit housing group, Habitations Populaires Desjardins du Centre du Québec (HPDCQ), plans to design and build two semidetached units that will demonstrate how revised land-use planning regulations can make housing more affordable.
- Trois-Rivières' existing zoning and subdivision regulations limit opportunities for affordable housing alternatives such as semi-detached housing, particularly for first-time homebuyers. The demonstration project will reform regulations in order to build affordable, small-lot semidetached housing in areas currently zoned for up-and-down duplexes. For example, the HPDCQ would like the City to reduce the minimum lot size for duplexes from 9 x 26 metres to 5 x 12 metres and to permit the construction of small semi-detached houses and rowhouses of 84 to 93 square metres.
- The project will also promote the advantages of "shared ownership". Shared ownership offers a way to make housing affordable, especially in the urban core where land costs are high. This type of ownership arrangement allows the homeowner to reduce the mortgage by purchasing the house without the land, with the option to buy the land later.
- The implementation of this project will require the following regulatory modifications:
 - the revision of the zoning by-law to permit the construction of semidetached houses and rowhouses in a duplex zone; and to reduce front, side and rear setbacks; and
 - the revision of the subdivision by-law to permit smaller lot sizes.
- This project will improve access to homeownership, increase density and offer greater housing quality and choice in Trois-Rivières' city core. The proposed regulatory modifications and the shared ownership concept are applicable to other parts of Canada.

Tomalty, Rae. 2001. How Does Your Community Grow? A Report for Smart Growth British Columbia. Available On Line, <http://www.smartgrowth.bc.ca>

- **Cluster Zoning**- This type of zoning allows groups of dwellings on small lots on one part of a site so as to preserve open space and/or natural features on the remainder of the site. It also reduces minimum lot and yard sizes for the clustered development.
- **Employment Location**- Regional districts and municipalities should minimize the designation of employment lands outside nodal areas and work with the provincial government to provide incentives for job growth in designated centers.
- **Land Trusts**- These private, nonprofit organizations seek to obtain conservation of land through donated or purchased easements or through buying land outright through custom-tailored deals with private landowners. The net effect, in either case, is preservation of open spaces that provide aesthetic relief, recreational opportunities, new tourism, a stronger agricultural base, and a healthier ecosystem.
- **Greenways**- Corridors that protect a stream, scenic view, or other natural resource from development and provide connections and opportunities for pedestrian and bicycle travel. Many states have created special funds or taxes to acquire land for conservation.
- **Transfer of Development Rights**- Many municipalities have programs that allow a developer to buy development rights at one location where there is an historic site, wetlands, special natural site, and transfer the right to develop to another place within the jurisdiction.
- **Complete Communities**- Efforts need to be made at building more “complete communities,” where people can meet a majority of their needs close to home.
- **Development Concentration Areas**- To concentrate development in higher density nodal areas that would be pedestrian-friendly and well-served by transit, some lands could be removed from urban reserves in municipalities that have excessive reserve capacity, and rigid planning controls on bringing any more land into the urban reserve could be instituted. Strong urban growth boundaries can also be created to concentrate growth in nodal areas. Incentives for infill development and brownfield redevelopments should be provided, and comprehensive smart growth principles should be used in planning and designing new developments, especially greenfield sites.

United States Environmental Protection Agency. 2001. Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality. Washington, DC: United States Environmental Protection Agency

- Techniques for encouraging compact development include the following:
 - infill development;
 - brownfield redevelopment;
 - cluster development; and
 - mixed use developments where complementary functions are located close together.
- Microscale urban design features enhance the environment for nonmotorized travel such as walking and bicycling can lead to reduced vehicle travel. Microscale urban design features that improve the pedestrian environment include:
 - sidewalks;
 - clearly marked crosswalks and walk signals;

- lighting and other amenities like shade trees;
 - benches; and
 - streetscapes designed with the pedestrian in mind.
- Features that improve the bicycling environment include;
 - bicycle paths and lanes on streets;
 - bicycle parking, and signage to identify recommended bicycle routes; and
 - raising awareness of drivers to bicycle traffic.

2.5 GREENBELTS AND GROWTH BOUNDARY TOOLS

Berridge, Joe. 2001. "Ottawa-On Becoming a Big City," Ontario Planning Journal. Toronto: Ontario Professional Planners Institute

- Growth increases cannot be left to passive planning policies and subdivision developers to organize.
- A city has to be interventionist in a meaningful way to achieve its desired outcomes and provide the infrastructure in ways that direct most efficiently. It has to "carrot and stick" growth towards the areas it best serves, it has to share the risk and understand the dynamics of the growth it is managing.
- Two examples of working with growth dynamics:
 - Ottawa high tech business parks are demanding six parking spaces per thousand square feet: twice as much space as people. By-laws and zoning incentives cannot help this. The answer is for the city to co-venture structured parking garages, and to ensure that competitive sites can be developed in transit-supported locations, or to promote fully integrated parking in a mixed-use scheme; and
 - the local community near the Sheppard subway extension blocked any attempt to intensify either nodes of corridors with the result that the line will be underused and development will continue to occur on the fringe. To deal with this NIMBYism, the creation of corridors has to be tied as a piece of civic business to the initiation of adjacent development through public/private partnerships.

British Department for Transport, Local Government and the Regions. London: Planning Policy Guidance Note 2: Green Belts
Available On Line, <http://www.planning.dtlr.gov.uk>

- The Green Belts approved through structure plans now cover approximately 1,556,000 hectares, about 12 per cent of England.
- There are 14 separate Green Belts, varying in size from 486,000 hectares around London to just 700 hectares at Burton-on-Trent.
- The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open.
- Green Belts can shape patterns of urban development at sub-regional and regional scale, and help to ensure that development occurs in locations allocated in development plans. They help to protect the countryside, be it in agricultural, forestry or other use. They can assist in moving towards more sustainable patterns of urban development.

- There are five purposes of including land in Green Belts:
 - to check the unrestricted sprawl of large built-up areas;
 - to prevent neighbouring towns from merging into one another;
 - to assist in safeguarding the countryside from encroachment;
 - to preserve the setting and special character of historic towns; and
 - to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

- Once Green Belts have been defined, the use of land in them has a positive role to play in fulfilling the following objectives:
 - to provide opportunities for access to the open countryside for the urban population;
 - to provide opportunities for outdoor sport and outdoor recreation near urban areas;
 - to retain attractive landscapes, and enhance landscapes, near to where people live;
 - to improve damaged and derelict land around towns;
 - to secure nature conservation interest; and
 - to retain land in agricultural, forestry and related uses.

Biodiversity Project. 2001. Sprawl: Economic Costs at a Glance. Madison, Wi: Biodiversity Project
 Available On Line, www.biodiversityproject.org/mediakit/Sprawl_1B_economic_costs.pdf

- Urban Growth Boundaries (UGBs) - The designation of specific areas for limited development helps to encourage more livable urban spaces and to protect farmlands and open space from sprawling development. Local governments estimate the amount of land needed for new business, housing, recreation, etc., for a period of time. They then draw a line around this land. New development can occur within the line but not outside it. Statewide urban growth boundaries are now mandated in Oregon, Washington, and more recently in Tennessee.
- Plans should require that half of all developable residential space be zoned for multifamily or attached housing. Multifamily housing is typically more affordable, zoning it in abundance promotes the construction of affordable housing. Once the urban growth boundary lines are drawn, metropolitan areas must encourage creative development techniques. The following zoning and land use principles are needed:
 - zoning flexibility such as residential cluster and zero-lot-line zoning, and mixed-use zoning allowing three or more linked land uses;
 - urban infill and redevelopment at higher intensities than surrounding land uses, often facilitated by redevelopment agencies;
- creative zoning that encourages diversity of housing opportunities (through “inclusionary” zoning), innovative subdivision designs (through cluster and zero-lot-line zoning), and clear separations between potentially incompatible uses (through nontraditional and “exclusive use” zoning);
- minimum density and intensity zoning that assures that land intended for higher density development such as apartments and town houses is not developed as low-density, single-family housing;

- neighborhood conservation: targeted infill of vacant lots with compatible housing, allowing accessory residential housing in existing older and larger homes; and providing sufficient residential choices to allow for life-cycle and lifestyle housing; and
- strategic uses of new communities, such as transit-oriented developments near transit stations and New Urbanist communities.

Danielsen Karen, William Fulton. 1999. - Retracting Suburbia: Smart Growth and the Future of Housing. Washington DC: Fannie May Foundation Housing Policy Debate Available On Line, www.fanniemaefoundation.org/programs/hpd/pdf/hpd_1003_danielsen.pdf

- Three main options that may also be used in combination are available for developing urban containment strategies:
 - fixed UGBs sharply define where growth is allowed;
 - urban reserve boundaries encompass areas outside UGBs that will be the target of UGB expansion after the 20 years specified in the original UGB; and
 - urban service areas direct growth to built-up areas or places where the infrastructure to accommodate growth already exists. Maryland uses this technique under its recently enacted smart growth law.
- Those using Portland as a planning model should consider its key lesson: that UGBs work best when linked to comprehensive regional planning.

Greater Vancouver Regional District. 2000. Liveable Region Strategic Plan. Burnaby: Greater Vancouver Regional District

- The Green Zone protects Greater Vancouver's natural assets, including major parks, watersheds, ecologically important areas and resource lands such as farmland. The Green Zone also establishes a long-term boundary for urban growth.
- The Green Zone makes up over 200,000 hectares, or about two-thirds of the area of Greater Vancouver. Its importance is highlighted in the local plans and policies of all member municipalities.
- A number of municipalities have identified additional lands to be included in the Green Zone and these efforts will increase the total area of the Green Zone.
- One of the key challenges is to maintain and enhance the recreational and ecological values of the Green Zone in the face of continued population growth in the region. Many municipalities and the GVRD are taking initiatives to construct greenways, protect stream corridors, and promote environmental stewardship of the Green Zone.
- Continuing efforts to contain sprawl will be critical to the success of the Green Zone as an urban growth boundary. To advance environmental protection and biodiversity, significant gains can be made if new development can be contained within existing drainage catchment areas.
- The plan supports the public's desire for communities with a wider range of opportunities for day-to-day life. Focused on town centres, more complete communities would result in more jobs closer to where people live, shops and services near home, and a wider choice of housing types. Arranging land use in a convenient way helps minimize the need for long trips and makes alternatives to car use more practical.

- The increased proportion of multi-unit dwellings compared to detached housing, and higher household size have helped reduced the demand for greenfields site.

Greenbelt Alliance. The Bay Area Greenbelt. cited, August, 2001. http://www.greenbelt.org/the_greenbelt/bay_greenbelt.html

- The Bay Area Greenbelt is a broad band of open lands that surrounds the cities and towns of the nine County San Francisco Bay Area.
- Of the Bay Area's 4.5 million acres, approximately 731,000 are urbanized and remaining 3.75 million acres constitute the Greenbelt. By comparison, San Francisco covers 30,000 acres, Santa Rosa covers 22,000 and San Jose covers more than 100,000 acres.
- The Greenbelt provides many benefits to Bay Area residents, including: recreational opportunities; plant and wildlife habitat; cleaner air and water; a close-by refuge from urban life; distinct community identities; and annual farm output worth \$1.2 billion.
- The Greenbelt contains public and private land. Half the Greenbelt (1.8 million acres) is in agriculture. More than 864,000 acres (larger than Yosemite National Park) are publicly owned. These lands are mostly parks and watersheds. The remainder of the Greenbelt is a diverse mix of privately owned lands.
- 490,525 acres of the Greenbelt are at risk of new suburban development in the next 30 years, according to a computer mapping survey conducted by Greenbelt Alliance and San Francisco State University.
- Developing that land would nearly double the Bay Area's urban land area, eliminate most prime farmland, make traffic congestion unbearable, worsen air quality, and destroy some of the region's most scenic ridges.

Snyder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- Urban Growth Boundaries or Urban Service Limits - These are mapped lines that mark of areas development should or should not occur. Such boundaries are intended to promote compact urban growth in order to provide services more effectively and efficiently and to protect agricultural land and natural resources.
Combining growth boundaries with impact fees and excise taxes helps draw a hard line where development can and cannot occur whole making sure development within the growth boundary pays the full cost of development.
- Growth Limits and Moratoriums - These establish annual quotas for building permits to limit the rate of growth either permanently or temporarily. They are put into place to retain small-town character or preserve open space or are used to regulate the pace of a development to an amount that can be serves by the community's infrastructure improvement program.

1000 Friends of Oregon. What is an Urban Growth Boundary. Available On Line, <http://www.friends.org/resources/resourceguide.html#ugbs>

- Each of Oregon's 241 cities is surrounded by an "urban growth boundary" or "UGB." The UGB is line drawn on planning and zoning maps to show where a city expects to grow.

- Land outside the UGB will remain rural. Urban services like sewers won't be extended there, and the zoning will prohibit urban development and the creation of small new lots. Most of the land outside the urban growth boundary will continue to be used for farming, forestry, or low-density residential development.
- The amount of land to be included in the UGB depends on how much the city is expected to grow. City officials estimate growth by making population projections or by using projections already done by some state or regional agency. The city's projections must be consistent with those of other local governments in the area.
- The city decides how much vacant land is likely to be needed to accommodate the expected growth. Community leaders, planners, and citizens estimate how many acres will be needed for the new houses, offices, stores, factories, and parks that will serve the future population.
- If a city's population is projected to increase by 1,000 people, the city planners then calculate "housing mix" (the distribution of those new people among houses, apartments, and mobile homes). They estimate what the vacancy rates, household sizes, and densities of development will be. Using this information, the planners can predict how much land will be needed for the housing and development to serve 1,000 people.
- After they decide how many acres of vacant land will be needed to accommodate future growth, the planners subtract the amount of vacant land that is already available within the current city limits. The remainder is the amount of urbanizable land beyond city limits that is needed for future growth.
- A UGB typically creates an urban growth area that encircles the city. Land in that area is not within the city's corporate limits. It is under county jurisdiction. But since much of that land may be annexed to the city someday, it is important for the city and county to work together in planning and zoning that area.
- The urban growth area is subject to the city's comprehensive plan, but the county controls zoning and land use permits there until the area is annexed or becomes developed to urban standards.
- To amend its UGB, a city must comply with the "exception" requirements from Statewide Planning Goal 2 and apply Goal 14's standards for establishing an urban growth boundary.
- Oregon's 15 years of experience have shown urban growth boundaries to be highly effective. UGBs have helped to hold down the costs of public services and facilities.

2.6 ENVIRONMENTAL POLICY TOOLS

Department of the Environment, Transport and the Regions. 2001. London: Planning Policy Guidance Note No.3. Available On Line, <http://www.planning.dtlr.gov.uk/ppg3/5.htm#1>

- Greening initiatives can enhance quality, assist the permeability of land for storm drainage and contribute to biodiversity. Well-designed layouts can also contribute to the energy efficiency of new housing. Landscaping should be an integral part of new development and opportunities should be taken for the retention of existing trees and shrubs, and for new plantings.
- Local planning authorities should have clear policies for the protection and creation of open space and playing fields, and new housing developments should incorporate sufficient provision where such spaces are not already adequately provided within easy access of the new housing.

- Developing more housing within urban areas should not mean building on urban green spaces.

Department of the Environment, Transport and the Regions. 2001. The Countryside - Environmental Quality and Economic and Social Development. London: Department of the Environment, Transport and the Regions, Available One Line www.planning.dtlr.gov.uk/ppg/ppg7/annexd.htm

- Development of greenfield land, including the best and most versatile agricultural land, should not be permitted unless opportunities have been assessed for accommodating development on previously-developed sites and on land within the boundaries of existing urban areas.
- Where development of agricultural land is unavoidable, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality, except where other sustainability considerations suggest otherwise.

International Council for Local Environmental Initiatives. 1999 Urban Land Management and Global Sustainability: A Document Prepared for Local Environment. Toronto: International Council for Local Environmental Initiatives

- Policies to improve urban environments include: Promoting more efficient uses of resources (notably through recycling of materials); reducing land consumption; reducing fossil fuel use for heating buildings; and reduced energy use for transportation.
- Research reveals a direct correlation between urban density and urban energy use in seven of eight studied cities. Cities with higher densities were able to finance public transit, energy-saving district heating and cooling, and reduce transportation energy demand due to the shorter travel distances between home, work and other services.
- Reducing energy consumption through effective land use can support national economic objectives by reducing expensive energy imports that cannot be justified by the contribution energy use makes to enhanced productivity.

United States Environmental Protection Agency. 2001. Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality. Washington, DC: United States Environmental Protection Agency

- Land use measures can improve water quality by reducing impervious surface area and regulating the flow of stormwater. These measures include:
 - narrowing and shortening streets and minimizing the provision of parking areas;
 - using porous surfaces when feasible, such as lattice blocks and bricks set in sand, rather than concrete or asphalt;
 - detaining stormwater for short periods in swales and filter strips and for longer periods in ponds and wetlands; and
 - using special landscaping practices, such as the application of mulch to retain soil moisture and conserve water usage.
- Sensitive natural areas such as streams, wetlands, floodplains, steep slopes, mature forests, swamps, critical habitat areas, and shorelines can be safeguarded through the following measures:

- minimizing impacts by avoiding development in sensitive areas; and
- creating buffers and greenbelts by establishing “green corridors.”

2.7 COMPUTER AIDS AND INDICATOR PROJECTS

US Environmental Protection Agency, Office of Policy, Planning and Evaluation Urban and Economic Development Division. 2001. Smart Growth Tools. Washington: US Environmental Protection Office

- There is a need for a protocol to quantify reductions in transportation-related air emissions resulting from differences in neighbourhood design. As some designs require more automobile trips than others, this protocol will quantify these differences and allow metropolitan areas to gain credits for urban policies which encourage reduced-drive neighbourhoods.
- To enable local governments to evaluate the fiscal costs and benefits of alternative development scenarios a series of spreadsheet models on infrastructure costs, transportation costs, and fiscal impacts should be developed. The model will accept local data and make projections of fiscal and other costs of alternative developments.

Synder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

- GIS Tools like PLACE3S, INDEX or SMARTPLACES can be used to quantify the impacts of different types of development in terms of energy, water, air quality and other indicators. Certain costs, like air quality impacts, could actually be assigned to those responsible through emissions taxes or other mechanisms.
- Ecological mapping of sensitive areas can help recognize the ecological value of different areas.
 - The objective of this process is to give decision-makers quantitative information that strengthens the argument for resource-efficient choices. This process is enhanced by spatial accounting and Geographic Information System (GIS) mapping tools which enable communities to track multiple issues and see how they relate to each other.
 - Identify social, environmental and/or economic measures that can be used for tracking community objectives such as:
 - locally relevant indicators include factors such as the number of salmon spawning each year in near-by rivers or the number of clean air days; and
 - indicators over time that provide evidence of specific progress in growth management programs.
- With modeling and spatial accounting programs, communities can also project the impact of different growth patterns on different indicators.

2.8 AGRICULTURE POLICY TOOLS

Tomalty, Rae. 2001. How Does Your Community Grow? A Report for Smart Growth British Columbia, On Line Available, <http://www.smartgrowth.bc.ca/news.html>

- Agricultural Protection Zoning (APZ)- This zoning practice stabilizes the agricultural land base, by designating areas where farming is the desired land use, generally on the basis of soil quality as well as a variety of locational factors. The density of residential development in these areas is then limited by agricultural protection zoning. Maryland has several county ordinances that permit a maximum density of one unit per 20 acres.

PART 3. GOVERNANCE

International Council for Local Environmental Initiatives. 2000 Urban Land Management and Global Sustainability: A Document Prepared for Local Environment. Toronto: International Council for Local Environmental Initiatives

- To perform their roles effectively, local governments often need resources and capacity building that can be provided by national and sub-national governments, both directly and through local government organizations (LGOs) at the sub-national, national, and international levels. In general, the sustainable management of land resources requires the thorough coordination of land, transport, housing, and economic development policies among national, sub national and local levels of government.
- Particularly urgent requirements exist for the enhancement of local government's capacities in relation to land inventory, taxing, zoning and the development control, transportation planning, and environmental regulation generally.
- Urban regions require regional governments that have clear jurisdiction and mandates to promote and implement sustainable development, including the sustainable use of urban land.
- As a first step, governments at all levels could undertake a coordinated country-level review of priority urban land management issues. Such reviews should include the establishment of guidelines for the sustainable planning and management of urban land resources and recommend mechanisms to enhance sustainable urban land use through inter-governmental policy coordination.
- The powers and capacities of local government are not sufficient to permit them to effectively manage the functions of land use control.
- There is lack of clear or complete jurisdiction over land use in an urban region.
- Policies of national and subnational government contradict local policies and objectives often in hidden ways.

Robson, Brian, Michael Parkinson, Martin Boddy and Duncan MacLennan. 2000. The State of English Cities. London: Department of Environment, Transportation and Regions

- Single sector boxes may lead to waste of resources- modern urban governance is about making critical connections. It is important to establish a national - to - local framework to allow local policy choices, but assure wider connections and objectives.

- Addressing issues of sprawl and promoting coordinated approaches to regional growth are essential.
- Partnership processes have tended to revolve more around established institutional structures and structures of governance. It is important to foster citizens panels to encourage collaborative planning.

Synder, Ken and Lori Bird. 1998. Paying for the Cost of Sprawl: Using Fair Share Costing to Control Sprawl. Washington: Centre of Excellence for Sustainable Development, On Line Available, <http://www.sustainable.doe.gov/articles/sprawl.html>

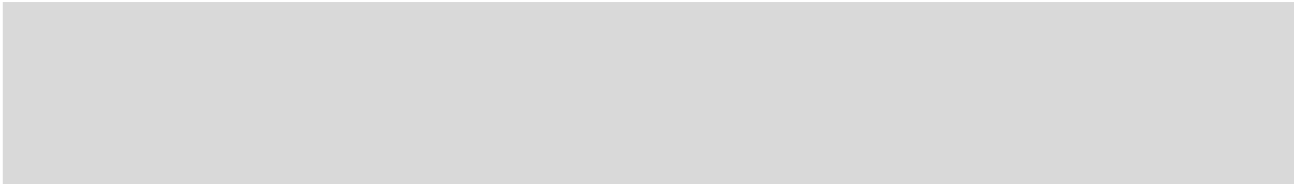
- It is common for cities to have a variety of agencies making decisions on land use. For instance, the city of New York has over 700 governmental jurisdictions in three different states. These agencies have not been able to effectively control sprawl in the New York Metropolitan Area. Between 1960 and 1985, New York City expanded its land area by over 65%, while the regional population only grew by 8%.
- Competition for sales tax revenue amongst adjacent jurisdictions also pushes each tax district to seek retail build out.

PART 4. COMMUNITY DEVELOPMENT AND BUSINESS STRATEGIES

Organizational Sub-Committee on Economic Development. 2001. Establishing a Downtown Development Corporation in the City of Brampton. Brampton: Organizational Sub-Committee on Economic Development.

The following are some examples of Downtown Development Corporations:

- The Edmonton Downtown Development Corporation is a non-profit, membership sponsored, civic improvement organization that is a private-public partnership.
- This corporation focusses on specific projects including the City Market, the Arts District and the Jasper East Village, Petro Canada Park. Some of their programs include:
 - working collaboratively to create an arts district;
 - creating urban-rural connections to promote the City Market;
 - revitalizing Jasper East Village; and
 - establishing a housing Round table.
- In Winnipeg, the organization CentreVenture is the primary force in downtown for creating investment and opportunity. Some of CentreVenture's goals include:
 - encouraging integrated planning for the downtown;
 - facilitating appropriate private and public sector investment and development;
 - coordinating downtown organizations and government departments as they relate to the downtown;
 - enhancing housing, cultural and intellectual Capital; and
 - promoting sustainable development through community greening initiatives.
- In Denver, Colorado the Downtown Denver Partnership, Inc. (DDP) is a non-profit business organization that creatively plans, manages and develops Downtown Denver as the



economically healthy urban core of the Rocky Mountain region. Since 1955, DDP has been the advocate for the center city's business community, bringing together leaders from a broad range of industries and markets to ensure that Downtown Denver remains an active, livable place. DDP is the downtown's leadership organization through which members, civic organizations and governmental entities promote downtown.

- DDP initiatives include:
 - promoting downtown as a regional destination and unique urban neighbourhood;
 - expanding jobs in downtown through recruitment and retention;
 - facilitating residential development;
 - increasing mobility and improving air quality.
 - marketing downtown business advantages through a year round marketing presence;
 - initiating center city neighbourhood campaign; and
 - strengthening neighbourhood connections in downtown.

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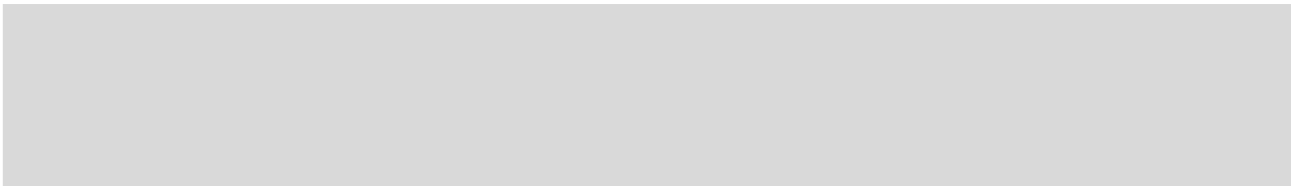
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