Planning Towards Sustainable Rural-Residential Development:

A Manitoba Capital Region Case Study.

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by

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A Practicum
Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements for the Degree

MASTER OF CITY PLANNING

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Abstract

Large-lot rural-residential development is now common beyond the suburbs of many North American urban regions. Such development has, increasingly, been associated with many detrimental impacts on the regional environment. A review of land-use planning and scientific literature has revealed that large-lot rural-residential parcels have been associated with negative impacts on ground and surface water, air quality and soil quality. This type of development has also been implicated in decreasing the amount of agricultural land in production, negatively affecting drainage and flood control and threatening local biodiversity.

The Capital Region of Manitoba is a Canadian urban region that has been experiencing an increasing incidence of rural-residential development. Recent population data, housing start trends, subdivision statistics, and parcel vacancy rates have been analyzed for the Capital Region. The findings indicate that rural-residential development within the Region exhibits several different indicators of environmentally detrimental, non-sustainable development. A review of the official (provincial) land-use policy within the Region suggests that the increasing amount of rural-residential development can probably be attributed to policy that encourages large lots, low densities, and the use of on-site sewage disposal. Recommendations are made for policy reform and planning initiatives that would better direct future rural-residential development in the Capital Region of Manitoba in a more sustainable and less environmentally detrimental manner.

Keywords: rural-residential, large-lot development, sustainable development, environmental impacts, regional planning, population density, on-site sewage disposal, water quality.

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1.0 Introduction

The creation of large-lot rural-residential developments on urban/rural fringes has been occurring in many North American metropolitan regions since the end of World War II (Fulton *et al*, 2001). Uneven, low-density fringe development has been criticized for increasing the threat to the long-term environmental sustainability of metropolitan regions (Sierra Club, 2001). Poorly planned large-lot rural-residential developments have been associated with fostering detrimental effects on air quality, surface and ground water quality, drainage efficiency, floodwater control, and soil quality, and are also criticized for their depletion of natural and non-renewable resources, threat to species diversity (biodiversity), and consumption of prime agricultural land (Biodiversity Project, 2002(b)).

Though it is likely impossible to altogether prevent unsustainable, non-agricultural rural-residential development from occurring on the urban/rural fringes of metropolitan regions, it should be possible to identify preferential patterns of rural-residential development that would be more supportive of long-term environmental and regional sustainability. In selecting the Capital Region of Manitoba as a case study, I intend to identify the environmental implications associated with the different patterns of rural-residential development found within the Region, and contribute policy recommendations that would better direct future rural-residential development within the Region.

The main objectives of this research are to contribute to a better understanding of, and how to better plan to mitigate, the environmental

impacts associated with large-lot rural-residential development on urban/rural fringes. I expect the research findings to add to the existing knowledge base in such a way that future rural-residential development in Canadian city-regions can be guided in a manner that better maintains and promotes long-term regional sustainability.

1.1 Urban Dispersal

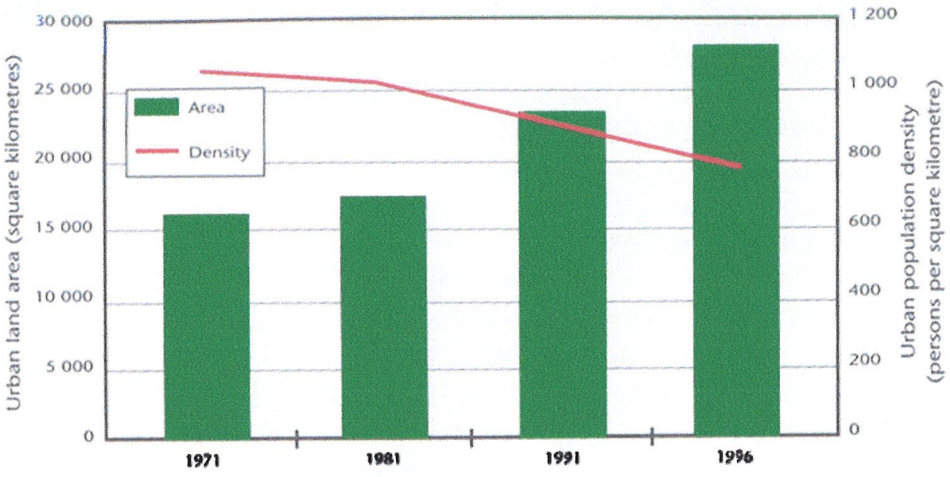
Poorly planned rural-residential development on the urban-rural fringe has been occurring in the majority of North American metropolitan regions for well over half a century. Lewis Mumford forewarned, *'The more a city grows...the less there is to call a city that remains'* (Mumford, 1963). Mumford was not alone in his apprehensiveness over the wave of low-density development that has been spreading over the countryside surrounding most metropolitan North American centres. Not only has rural-residential development been blamed in contributing to a number of socio-economic problems in urban areas (Churchman, 1999), but many authors also attribute low-density fringe development as a threat to the long-term environmental sustainability[1] of metropolitan regions (Galster *et al*, 2000; Pendall *et al*, 2000; Grant, 1999; Beatley, 1995; Tomalty *et al*, 1994).

In the twenty-five years between 1971 and 1996, Canada's urban population grew by 37% to a total of 22.5 million people (Environment Canada, 2001(b)). Because this growth was very often accommodated by the

[1] The terms *'sustainability', 'sustainable'* and *'sustainable development'* became prominent when the Brundtland Commission defined such actions as: *'meeting the needs of the present without compromising the ability of future generations to meet their own'* (Hough, 1995).

development of low-density suburbs, urban land area has actually increased at a much greater rate than that of urban population. During the same twenty-five years, Canada's urban land area grew by over 77%, or an additional 12,250 square kilometres (Haldenby, 2001) (see Figure 1.0).

Figure 1.0: Canadian Land Use and Population Density (1976 - 1996).



Source: Environment Canada, 2001(a).

A number of factors contributed to the increasingly common occurrence of rural-residential development near the urban fringe. One important cause of rural-residential development on the metropolitan fringe is the migration of urban residents from the inner city neighbourhoods of central cities (Talen, 2001). Such rural-residents are choosing to leave the city core for a number of reasons. Some choose to move to rural areas to reside in an environment that they perceive to be safer and more removed from inner-city crime (Southworth, 1997; Marchand and Charland, 1992). Others seek a greener environment, one that will provide them with more open spaces,

larger residential lot sizes, and less air pollution (Talen, 2001; Hollis *et al*, 1997). Others choose to migrate from traditional urban areas to:

- escape the higher levels of urban property taxes (Lennon and Leo, 2001);
- buy or build a house in an area where they perceive the appreciation potential to be relatively high (Downs, 1999); or
- reside on a large-lot parcel with on-site septic and water services to avoid paying monthly utility bills (Daniels, 1999).

Though a number of different reasons for urban dispersal have been documented, none of the above mentioned reasons identify whether these choices are environmentally sustainable. Proponents of 'sustainable development' identify specific goals intended to guide land use decision making and policy generation. One important objective that has been noted is resource conservation (McHarg and Steiner, 1998; Blowers, 1993). Sustainable development should strive for the efficient use of land, not be wasteful of non-renewable resources, and should promote biological diversity. Forms of development considered to be sustainable would also have to maintain environmental quality (Janetos, 1997; Blowers, 1993). Municipalities should strive toward sustainable development to prevent or diminish processes that degrade or pollute the environment and avoid developments that are detrimental to human health or that diminish the quality of life.

It can be determined from the above mentioned objectives that any type of development having a detrimental impact on air, water and soil quality could not be considered sustainable. Likewise, development that is wasteful

of land and resources and harmful to biodiversity is fundamentally in conflict with 'sustainable development'. The next chapter evaluates large-lot rural-residential development in relation to the objectives of sustainable development.

Migration to the urban/rural fringe has had significant consequences. As with the various reasons that people have given for their decision to settle in developments on the urban/rural fringe, there are also various definitions for, and patterns of, rural-residential development – each with differing environmental costs and benefits (and differing degrees of sustainability). Differing rural-residential settlement patterns are examined subsequently in this document. However, it can be safely established that a number of current authors in the planning literature argue that detrimental environmental impacts are most severe in large-lot[2] (low-density) rural-residential development (Berke and Conroy, 2000; Hollis *et al*, 2000; Arendt, 1997; Beatley and Manning, 1997; Alexander and Tomalty, 1994).

Large-lot rural-residential development on the urban-rural fringe has been associated with producing detrimental environmental effects on air quality, surface and ground water quality, drainage efficiency, floodwater control, and soil quality. Large-lot developments have also been criticized for their depletion of natural and non-renewable resources, threat to species diversity, and consumption of prime agricultural land. Each of the aforementioned environmental impacts of large-lot rural-residential

development will be examined at length. In addition, qualities of rural-residential development are identified for the effects that each would have on the long-term environmental sustainability of a region.

1.2 The Manitoba Capital Region

The Capital Region of Manitoba is one of many North American metropolitan regions experiencing a relative abundance of low-density rural-residential fringe development (Fulton *et al*, 2001). The Capital Region is composed of the City of Winnipeg, thirteen surrounding Rural Municipalities[3] (see Figure 1.1), the City of Selkirk, and the Town of Stonewall. Though thirteen 'rural' municipalities are located within the Capital Region boundary, some of these municipalities can not be considered traditional resource-related rural municipalities but rather 'rural non-farm municipalities'. A member of the Rural Municipality of West St. Paul Council recently estimated that only four farmers within that municipality actively farm land as their main source of income (Gord Kraemer, RPAC Submission, 23/05/02). Municipalities such as East St. Paul and Headingley would also fall into this category. The Reeve of the Rural Municipality of Headingley describes his municipality as "*semi-urban, semi-rural*" (Wilf Tallieu, RPAC Submission, 21/05/02).

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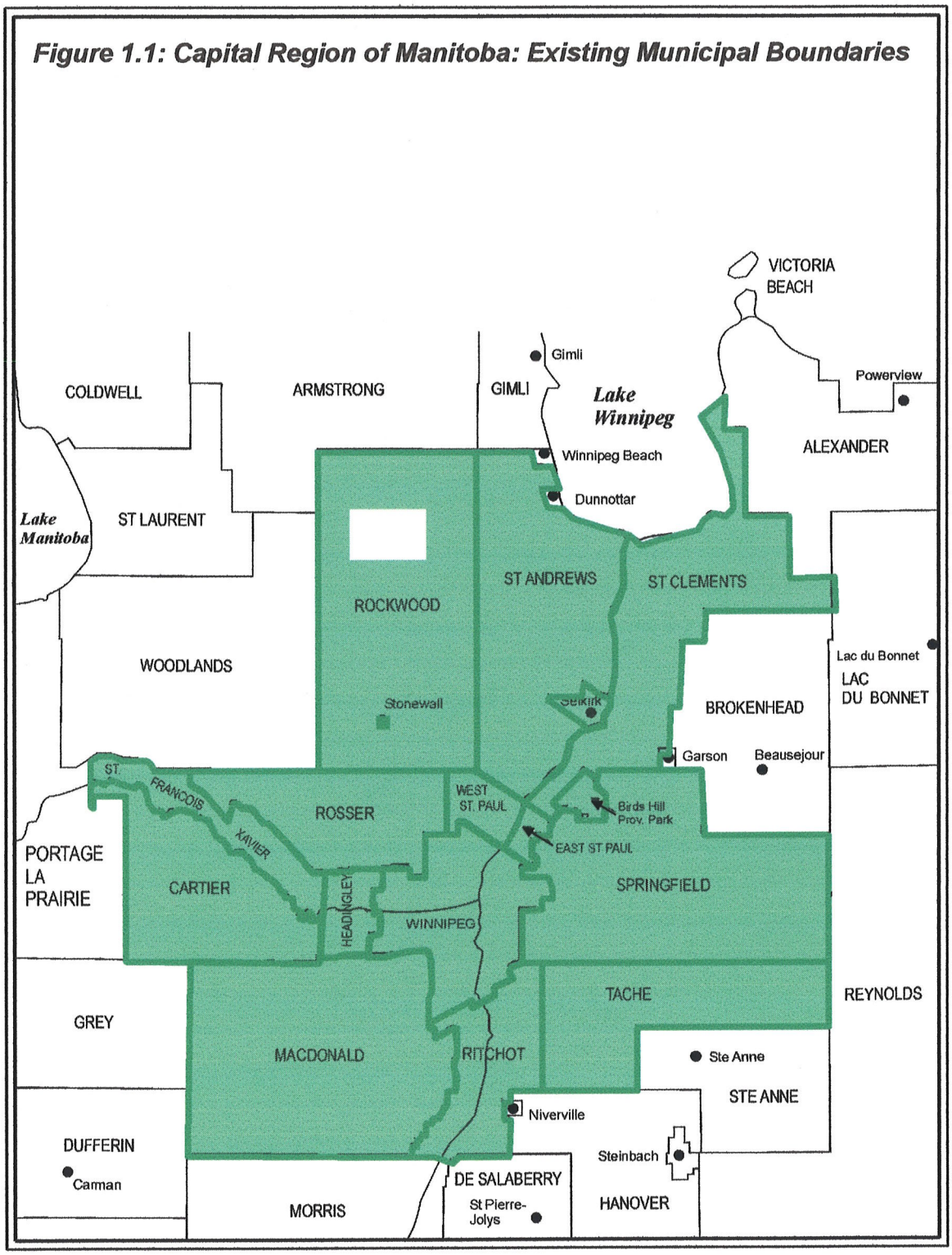
[2] The term *'rural-residential development'* refers to all residential parcels greater than 0.5 acres and less than 10.0 acres throughout the extent of this document. Similarly, the term *'large-lot rural-residential development'* refers to all residential parcels greater than 2.0 acres.
[3] Capital Region Rural Municipalities include: East St. Paul, West St. Paul, St. Andrews, St. Clements, Rockwood, Rosser, Cartier, St. Francois Xavier, Macdonald, Headingley, Ritchot, Taché, and Springfield.

2001 Statistics Canada census data reveal that the Manitoba Capital Region has a population of just over 711,000 and that approximately 87% of the regional population lives within the City of Winnipeg. However, recent trends indicate that the City's proportion of both population and regional housing starts is steadily declining (see Tables 4.0 & 4.6).

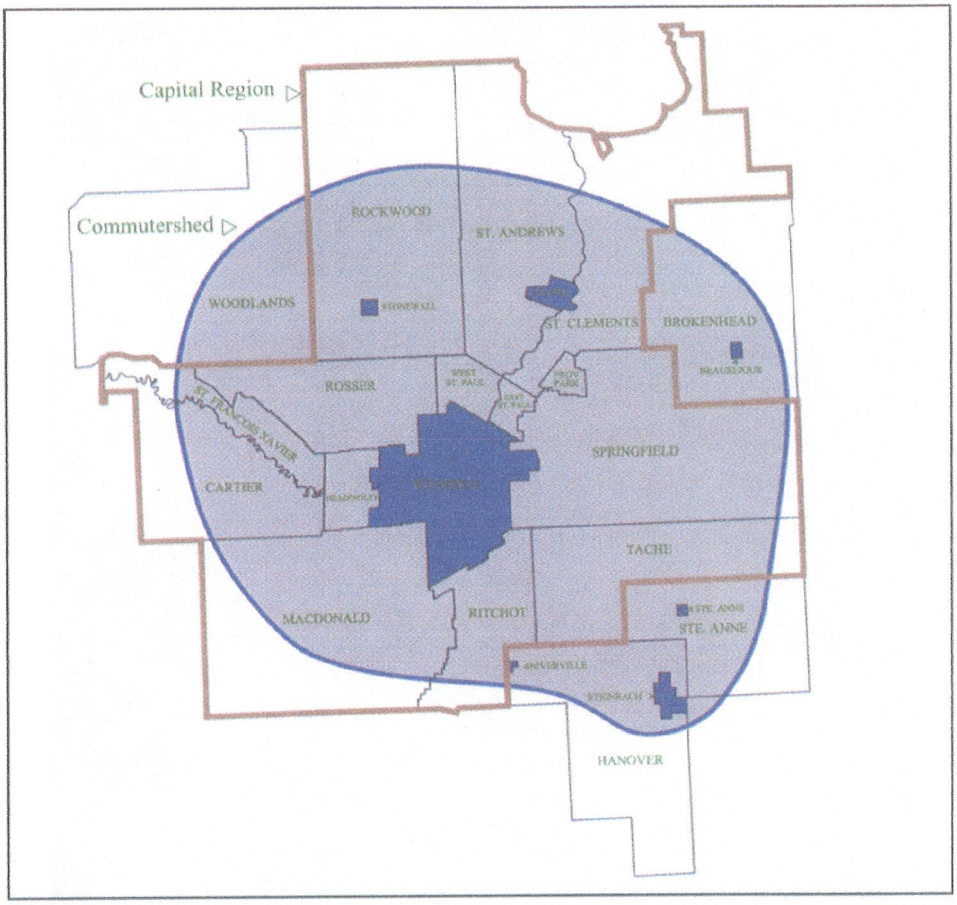
Figure 1.1: Capital Region of Manitoba: Existing Municipal Boundaries



Source: Manitoba Intergovernmental Affairs.

The relevance and pertinence of the current boundaries of the Capital Region of Manitoba are regularly debated. Research by the Province of Manitoba (1999(d)) showed that a regional watershed or commutershed may serve as more appropriate indicators of regional boundaries. Communities that constitute a significant part of the regional commutershed, but are not currently included as part of the Capital Region of Manitoba, include the City of Steinbach, the Towns of Beausejour and Niverville, and the Rural Municipalities of Hanover and Brokenhead. Another municipality (the Rural Municipality of Cartier) currently considered part of the Capital Region insists on being excluded from any form of urban-related regional planning. Debate over the appropriateness of the existing Capital Region boundaries will likely be ongoing. Therefore, for the present purposes, the sixteen municipal constituents currently recognized by the Province of Manitoba as composing the Capital Region are recognized here as the sole constituents of the Region (see Figure 1.1).

Figure 1.2: Existing Capital Region Boundary vs. Commutershed Boundary



Source: Province of Manitoba, 1999(c).

Winnipeg and much of Southern Manitoba have evolved from strong parochial roots and, to some degree, these strong individual community ties are still evident (Levin, 1993). Though the Capital Region currently embodies only sixteen municipal jurisdictions (far fewer than many other Canadian city-regions (Hodge and Robinson, 2001)), there are visible and invisible distinctions and boundaries between municipalities that have made

regionally-directed, inter-municipal cooperation very difficult to achieve (Levin, 1993). Strong alliances and divisions are apparent among and between urban municipalities, semi-rural municipalities, suburban municipalities, and agriculturally dominant municipalities, as well as allegiances still remaining within the City of Winnipeg to traditional parochial roots dating back prior to the formation of 'Unicity' in 1972.[4]

In 1990, the Capital Region Committee of elected officials from the Capital Region municipalities was first constituted. Since the creation of the Capital Region, the Capital Region Committee (1989) and the Capital Region Review Panel (1998) were established in hopes of leading to a better understanding of regional issues and the development of a more streamlined inter-municipal system of planning and cooperation. The most recent committee that has been established is the Regional Planning Advisory Committee (RPAC), whose final report is slated for release in the second half of 2003.

1.3 Regional Development Issues

In 1976, the Province of Manitoba adopted a new provincial *Planning Act* (Province of Manitoba, 1999(a)). Among a variety of other legislative reforms, *The Planning Act* allowed for the creation of planning districts in Manitoba, giving individual rural municipalities and small urban municipalities

[4] In 1972, the current City of Winnipeg was formed via the unification of twelve municipalities including; Charleswood, East Kildonan, Fort Garry, North Kildonan, Old Kildonan, St. Boniface, St. James-Assiniboia, St. Vital, Transcona, Tuxedo, West Kildonan, and Winnipeg (the current Rural Municipality of Headingley has since seceded from the 'Unicity' of Winnipeg).

a potential for greater authority over land-use practices within their jurisdiction (Manitoba Intergovernmental Affairs, 2001). As a result of their newfound planning authority, individual Capital Region municipalities and inter-municipal planning districts have since approved the subdivision of large parcels of agricultural land for non-agricultural rural-residential development. Both the South Interlake Planning District and the Selkirk Planning District – two planning districts that account for seven Capital Region municipalities – have approving authority for the subdivision of land within their boundaries. What has resulted from over twenty-five years of isolated planning without a regional perspective is a landscape that can be described as containing an abundance of rural-residential subdivision developments that are considered unsustainable from an environmental perspective. Large-lot rural-residential development has directly contributed to the loss of arable agricultural land in the Capital Region, as well as increasing the environmental ramifications associated with issues relating to ground and surface water, air and soil quality, resource depletion, and issues relating to drainage and flood control.

Since the adoption of *The Planning Act* (1976), a number of demographic and environmental trends have been identified (Manitoba Rural Development, 1998; Province of Manitoba, 1996). As indicated earlier, the City of Winnipeg's proportion of the total population of the Capital Region has been steadily declining. Although the actual population of the City of Winnipeg has not decreased, it has increased at a relatively small percentage rate compared to most other Capital Region municipalities (see Table 4.1). Also

on a steady decline has been Winnipeg's proportion of the total new single-family housing starts per annum in the Capital Region. It can be inferred that a relative decrease in the total number of regional housing starts can be associated with the decline of Winnipeg's inner-city housing stock (Fulton *et al*, 2001; Downs, 1999; Dekel, 1997).

The amount of land in the Capital Region that has traditionally been used for agricultural purposes has also continually decreased in recent years (Manitoba Intergovernmental Affairs, 2001). Though the regional population is increasing at a relatively slow rate compared to other Canadian metropolitan areas (Hodge and Robinson, 2001), the amount of land that is being developed is notably disproportional - on the large side - when compared to other Canadian regions (see Table 2.1) (Lennon and Leo, 2001). The observed losses of agricultural land will not only increase the reliance upon neighbouring regions and municipalities for food resources for the Capital Region, but may also have negative socio-economic effects on many traditionally agricultural Capital Region municipalities (Lennon and Leo, 2001; Manitoba Intergovernmental Affairs, 2001).

1.4 Objectives

While it is unrealistic to expect to fully deter or discourage non-agricultural rural-residential development from occurring in rural areas in Capital Region municipalities, it is possible to identify rural-residential development trends that should be discouraged on account of the negative impacts they have on the long-term environmental sustainability of the

Region. Analyses have shown that rural-residential developmental patterns are not consistent throughout the Capital Region (Lennon and Leo, 2001; Frontier Centre For Public Policy, 1999). By electing to achieve a more compact pattern of rural-residential development, certain Capital Region municipalities, such as Macdonald and East St. Paul, have significantly increased their population base without fragmenting large parcels of agricultural land. It is widely recognized that as the densities of rural-residential developments decrease, associated environmental impacts greatly increase (Lucy and Phillips, 2001; Grossi, 1999; Bowler, 1997).

In considering the Capital Region of Manitoba as a case study, inter-municipal variations in rural-residential development are identified. By focusing on the environmental impacts associated with the different patterns of rural-residential development, I aim to contribute a better understanding of the environmental effects associated with large-lot rural-residential development. I distinguish and analyze the various forms of development found within the Region so that future rural-residential development in Canadian city-regions can be guided in a manner that best promotes, and contributes, long-term environmental and regional sustainability.

The Province of Manitoba is committed to increasing the awareness of, and knowledge about Capital Region issues, especially those involving environmental issues related to incongruent, low-density development (Manitoba Intergovernmental Affairs, 2001; Province of Manitoba 1999(a), 1999(b); Manitoba Rural Development, 1998). The findings and

recommendations identified within this Practicum should aid the evolution of future provincial and municipal land-use policy, and its implementation, in the Capital Region of Manitoba.

1.5 Project Limitations and Directions for Future Research

Rural-residential development is just one of a number of different land uses to consider when evaluating land use from a regional perspective. Downs (1998) listed low-density residential development as one of a number of indicators of poor rural-urban fringe land use decisions. In addition to low-density residential development, other indicators of poor land-use decisions and poor policy making in the rural-urban fringe include: unlimited commercial strip development, leap-frog development, fragmentation of powers over land use among small localities, dominance of transportation by private automobiles and segregation of land uses in different zones. To obtain a comprehensive understanding of the environmental sustainability of a region, one must examine more than simply rural-residential development patterns and trends.

Similarly, to assess the sustainability of a region, more than environmental sustainability must be considered. Regional sustainability is also dependent on elements of social and economic sustainability. Though certain rural-residential development patterns (such as compact, serviced development) may be beneficial to long-term regional sustainability of the environment, such development patterns can potentially be unfeasible economically or may foster social or demographic inequalities.

Likewise, to achieve a complete understanding of regional land use sustainability, land use practices involving commercial, industrial, and agricultural activities must be considered alongside residential land use activities. However, the scope and direction of the present research is focused almost entirely on the environmental impacts related to differing patterns of rural-residential development on the urban/rural fringe. Attempts to achieve a comprehensive view of more of the factors contributing to a complete analysis of regional sustainability would be highly unrealistic, given the time and financial resources required to perform a project of such magnitude. However, obtaining a better understanding of the environmental impacts associated with different patterns of rural residential development is a necessary building block in trying to develop a complete representation of regional sustainability.

Another concession that must be made is that there are widespread opinions as to the appearance of exemplary residential development. When conducting a study of this nature, it was difficult to disregard innate personal biases towards preferred patterns of rural-residential settlement. Although I have aspired to practice full objectivity when researching and analyzing environmentally preferred patterns of rural-residential development, I acknowledge that I have resided in only urban and/or compact rural settings (City of Winnipeg and the former Town of Gimli), and therefore may hold innate biases towards such patterns of residential development.

It must also be recognized that an individual's academic experience can play a large role in influencing one's convictions and directing their research. While pursuing my undergraduate degree in Environmental Sciences, I was commonly exposed to literature that identified aspects of unsustainable development and the perils of poor land use planning. Conversely, my exposure to land use practices that promote social and economic sustainability is relatively limited. I acknowledge that by possessing a high regard towards environmentally sustainable development and related land use practices and principles, it is possible that I may hold some skepticism towards patterns of development which might be considered less sustainable, regardless of the possible social and economic benefits of such patterns of development for the individuals concerned.

1.6 Chapter Outline

The research addresses the three following questions:

i. *What are the environmental impacts of rural-residential development?*
ii. *How significant is the incidence of rural-residential development in the Capital Region of Manitoba?*
iii. *How can future rural-residential development in the Capital Region of Manitoba be directed in a more sustainable and less environmentally detrimental manner?*

The following chapter (Chapter 2) will address the first research question. It examines and analyzes current planning literature that has documented the numerous environmental impacts associated with rural-residential development, as well as identifying policy reform initiatives and design options for future rural-residential development. Chapter 3 serves as a

link between the first and second research questions. It identifies patterns of development that can be associated with producing detrimental impacts on the environment. Chapter 4 addresses the second research question by examining a number of data sources to determine the impact that recent rural-residential development has had on the regional environment of the Capital Region of Manitoba. Chapter 5 addresses the third research question by identifying and recommending a number of policy and design initiatives that would direct regional development in a sustainable manner as well as identifying suggested areas for future research. The fifth and final chapter concludes by reviewing current development trends to context found within the *Provincial Land Use Policies* (Province of Manitoba, 1994) and recommending six policy review initiatives that would result in strengthened land-use policies better able to direct sustainable development within the Capital Region of Manitoba.

Table 1.0 summarizes the structure and objectives of the following chapters.

Table 1.0: Chapter Outline, Objectives and Structure.

Research Question	When Addressed	Topic Area	Objectives
What are the environmental impacts of rural-residential development?	Chapter 2	Environmental Impacts	▪ *Identify negative environmental impacts that have been associated with rural-residential development.*
	Chapter 3	Indicators of non-sustainable development	▪ *Identify physical 'indicators' or characteristics of non-sustainable development or development that produces a negative environmental impact.*
		Preferable forms of development	▪ *Identify patterns of development that minimize the negative environmental impacts of rural-residential development by meshing the understanding of the impacts of rural-residential development (identified in Chapter 2) with the indicators of non-sustainable development.*
How significant is the incidence of rural-residential development in the Capital Region of Manitoba?	Chapter 4	Data Analyses	▪ *Analyze various sources of data to reveal characteristics of non-sustainable development (Chapter 3) found within the Capital Region and compare such development with less-detrimental forms of development.*
How can future rural-residential development in the Capital Region of Manitoba be directed in a more sustainable and less environmentally detrimental manner?	Chapter 5	Policy Review & Policy Direction	▪ *Identify six policy initiatives that would incorporate characteristics of sustainable development (Chapter 3).* ▪ *Examine existing land-use policy in the Capital Region to identify why non-sustainable development has occurred within the Region (Chapter 4).* ▪ *Identify specific areas of research that would be beneficial in directing land-use policy in the Region in a manner that will ensure the long-term environmental sustainability of the Region.*

2.0 Environmental Impacts Associated with Large-Lot Rural-Residential Development

Low-density rural-residential development comes with inherent impacts. Many authors of current planning literature are critical of low-density rural-residential development for the adverse social and economic impacts it can inflict on a region (Thomas, 2001; Churchman, 1999; McHarg and Steiner, 1998). However, the majority of authors readily agree that the most severe impacts of low-density rural-residential development are felt by the regional environment (United States Environmental Protection Agency Office of Water, 2002; Orchsner, 2001; Talen, 2001; Mitchell, 2001; Beatley, 1995).

Environmental impacts of low-density rural-residential developments include the loss of land for agricultural purposes, open spaces, wetlands, and the depletion of wildlife habitats – a contributing factor to a decrease in biodiversity (Hollis *et al*, 1997; Hough, 1995). Low-density development has been associated with environmental impacts involving air, water, noise, and soil pollution, as well as increased storm runoff and a decrease in flood protection (Clean Water Network, 2002; Sierra Club, 2002; Daniels, 1997), and has also been noted as being detrimental to long term species diversity (Biodiversity Project, 2002(b); Aberley, 1994).

Biodiversity is commonly described as the interconnections that support various forms of life (Biodiversity Project, 2002(b); Wilson, 1988). Scientifically, biodiversity is often expressed through genetic variability, the diversity of populations of a species in both the number of individuals within a local group and the extent of their geographic range, and the diversity of

species within a natural community (Benfield, 1999; Wilson, 1988). By relating these terms of reference to the physical limitations of the landscapes that are often formed as a result of rural-residential development, the negative impact that such land use practices have on regional biodiversity become evident. Large-lot rural-residential development is often responsible for fragmenting habitat corridors, promoting the growth of foreign and invader species, and limiting the geographic range of both floral and faunal species (Sierra Club, 2002; United States Environmental Protection Agency Office of Water, 2002; Sustainable Measures Organization, 2001; Wilson, 1988; Spirn, 1984).

Specific environmental impacts often associated with low-density rural-residential development are now reviewed for the specific affect they have on the regional environment.

2.1 Ground and Surface Water Effects

Water pollution resulting from poorly planned regional development has potential wide-ranging impacts on the environment. Many ground and surface water quality problems are natural, but some can be directly attributed to human actions. Some sources of contamination include leaching from underground petroleum storage tanks, sewage holding tanks, sewage lagoons, and septic fields. Other societal contributions to ground and surface water pollution include industrial waste disposal and municipal landfills (Manitoba Environment, 1997). Though not all of these sources of groundwater pollution can be directly linked to rural-residential development,

it can be safely argued that the greater the amount of the natural land base occupied by rural-residential development, the greater the chances are for groundwater contamination resulting from leaching of contents from septic fields, holding tanks, and sewage ejectors.

Water first percolates into the ground, collecting in spaces between grains of sand or silt, or in cracks and crevices in solid rock, then progresses downward into the underlying aquifer. The rate of groundwater movement through various soil formations varies significantly depending on the permeability of the ground. Permeability is a measure of the amount of water that will pass through a soil sample in a given period of time. In a year, water may move hundreds of metres in fractured limestone, tens of metres in coarse sand, and only a few centimetres in heavy clay (Richardson and Eby, 2000; Manitoba Environment, 1997). Much of the urban fringe encompassing the Capital Region of Manitoba where rural-residential development is occurring is situated in areas with heavy clay based soils (see Figure 2.0). We can see, for example, that the vast majority of the Rural Municipality of East St. Paul is situated atop predominantly clayey soils. This is typical throughout the Capital Region, particularly in municipalities that are situated along the Red, Assiniboine, or Seine Rivers. It is often areas in close proximity to riverbanks that are sought after for large-lot rural-residential development. Development of this nature is often serviced via septic fields and, as identified earlier, clay soils are extremely impermeable. During periods of heavy rain,

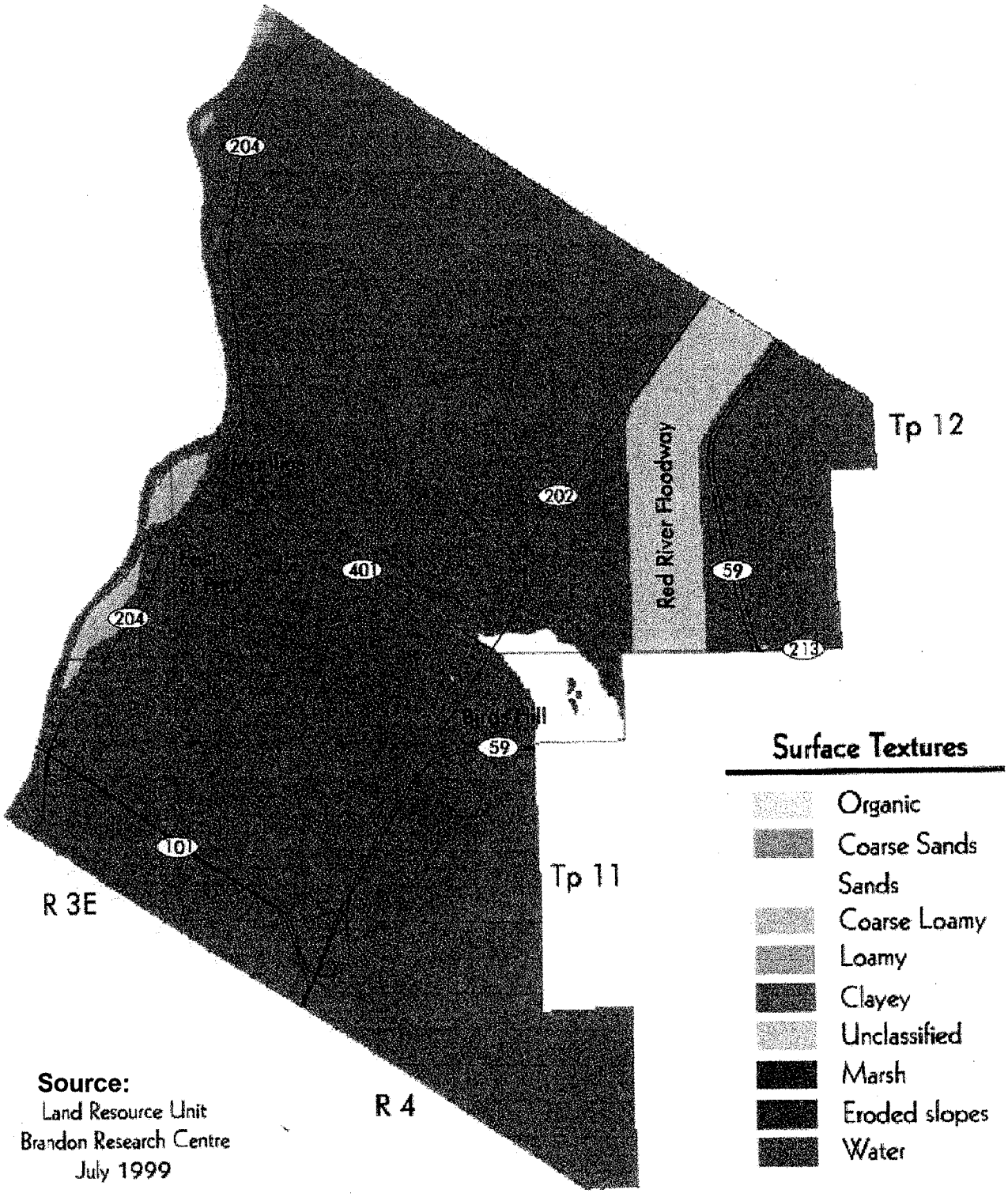
clay soils quickly become heavily saturated and untreated sewage can flow directly into nearby watercourses.

Factors affecting water quality generally include both point and non-point sources of pollution. Point sources are often associated with large-scale polluters, such as industrial land uses, wastewater treatment, and other closely regulated land uses. However, point sources of water pollution also include existing land uses in which the careful monitoring of effluents is extremely difficult, if not impossible, to achieve.

A specific source of contamination that is often difficult to quantify and analyze is the environmental impact related to leaching sewage from domestic rural-residential septic tanks and septic fields (United States Environmental Protection Agency Office of Water, 2002; Manitoba Conservation, 2001; Province of Manitoba, 1996). Regional policy makers have identified that one of the main environmental concerns regarding low-density rural-residential development is the tendency to rely almost entirely on well water and septic tanks (Manitoba Intergovernmental Affairs, 2001; State of South Carolina, 2001; Manitoba Environment, 1997).

Septic fields, or the septic drainfield (Marsh, 1998) method of waste disposal relies heavily on soils to absorb, filter, and disperse wastewater. The system is designed to keep contaminated water out of contact with the surface environment and to filter chemical and biological contaminants from ground and surface water. Many septic drainfield systems are comprised of both a holding or septic tank which is designed to settle out solids, and a

Figure 2.0: RM of East St. Paul - Soil Index



drainfield through which wastewater is dispersed into the soil (Environment Canada, 2001(b); Marsh, 1998; Manitoba Environment, 1997).

Critical to the operation of a septic drainfield is the rate at which the soil can receive wastewater and diffuse it into the soil column. Soils with a high permeability are clearly preferred over those with a low permeability (Environment Canada, 2001(b); Marsh, 1998). Generally, finely grained soils, or clay-based soils, transmit water much more slowly than do coarse-grained soils. As a result, fine-grained soils are at risk of becoming saturated quite rapidly, and may lead to premature surface runoff from septic fields (Winnipeg Free Press, 2002(a); Environment Canada, 2001(b)).

Soil moisture also plays a significant role in measuring the permeability of soils. Soils with high watertables, such as those which are clay-based and in a floodplain (Marsh, 1998), are limited for wastewater disposal because they are already near saturation. High levels of precipitation can quickly cause the septic systems to back up and overflow (Haldenby, 2001; Richardson and Eby, 2000).

Recently observed de-concentration of many Canadian metropolitan region populations, including the Manitoba Capital Region, has given rise to an urban-rural fringe that is largely reliant on septic systems (Clean Water Network, 2002; Alexander and Tomalty, 1994). Recent estimates by Environment Canada (2001(b)) indicate that over 26% of Canadian households are serviced by on-site, untreated sewage systems. It has also recently been estimated by health officials in Ontario that over 30% of private

septic tanks in that province are failing, contaminating drinking water and exposing the public to health hazards (Haldenby, 2001).

The causes of system failure are usually related to either improper siting with respect to soil drainage, improper design of the drainfield with respect to the size of the field, overloading, and inadequate maintenance of the system (Marsh, 1998). On average, the lifetime of a septic field is between 15-25 years (Environment Canada, 2001(b); Manitoba Environment, 1997), depending on local conditions. Over this period, the soil may not filter or drain properly because either the watertable has risen over the years of service, or the buildup of nitrogen and phosphorous-based nutrients and chemical compounds in the soil has effectively eliminated the filtering capacity of the soil (Environment Canada, 2001(b); Marsh, 1998). As a result, environmental agencies of both the United States and Canadian governments recommend that, once a septic field has surpassed its effective life-span, the old field be abandoned and a new septic field be constructed in a different location (United States Environmental Protection Agency Office of Water, 2002; Environment Canada, 2001(b)). However, given that many rural-residential lots in the Capital Region of Manitoba that utilize septic fields are on parcels too small to effectively be serviced by septic fields (Winnipeg Free Press, 2002(a)), there is no space available for rural-residents to upgrade or replace their septic systems in this way.

As identified earlier, the environmental impact resulting from failing and/or leaching septic fields and sewage holding tanks is magnified in regions

with predominantly clay-based soils, such as the Capital Region of Manitoba[1]. In the event of heavy precipitation or leakage, the nutrient-rich effluent cannot percolate into the ground freely. As a result, sewage tends to rise to the surface and flow rapidly overland instead of dissipating into the soil. A 2002 article in the Winnipeg Free Press (2002(a)) documented the severity of the potential impacts to water quality resulting from overflowing septic fields in many Capital Region municipalities. Manitoba Conservation officials estimate that at least six rural municipalities in the Capital Region are allowing the development of rural-residential lots on Red River clay lots that are far too small to be effectively serviced through the use of a septic field. Our understanding of the effects associated with improperly sited septic fields has grown and evolved over recent decades. Planners and policy makers throughout the Capital Region of Manitoba, now have the capacity to ensure that rural-residential development (reliant on on-site sewage treatment) is directed to areas that can best utilize such sewage treatment methods.

Current guidelines established by the Province of Manitoba recommend that rural-residential parcels to be serviced by septic fields be a minimum of one-and-a-third acres in size (Manitoba Conservation, 2001). However, not only are these guidelines often overlooked or varied for smaller-sized parcels, the guidelines were also strongly questioned in a recent study undertaken by a local engineering firm that estimated that rural-residential lots

[1] Soils throughout much of the Capital Region of Manitoba are commonly referred to as Red River clay, or Red River gumbo, as a result of glacial deposition as well as deposition left behind by centuries of flooding in the Red River Valley.

developed on Red River clay soils would have to be at least four acres in size to be effectively serviced by a septic field (Winnipeg Free Press, 2002(a)).

The size of the parcel of land that is being serviced via septic fields is not the only environmentally associated impact resulting from rural-residential development. Though a rural-residential parcel four acres in size may provide enough room to develop a large enough septic field to effectively service the residence on the parcel, a parcel of this size would, in turn, increase many other environmental impacts associated with low-density rural-residential development. Rural-residential development consisting of four acre parcels would dramatically increase the consumption of agricultural land, and contribute to a decline in local biodiversity and an increase in vehicular-emitted airborne pollutants (American Farmland Trust, 2002; Clean Air Trust, 2002; Biodiversity Project, 2001).

Riverbank erosion has also caused many septic fields built alongside the Red and Assiniboine Rivers to collapse into regional waterways (City of Winnipeg Water and Waste Department Engineering Division, 2002; Winnipeg Free Press, 2002(b)). When rural-residential development is situated alongside a riverbank, it is not uncommon to observe property owners clearing the riverbank of natural foliage and replacing it with a manicured lawn. The removal of the natural riparian vegetation from a riverbank can severely weaken the area and make it far more prone to the forces of water erosion (Hough, 1995). The heavier the vegetative cover density along a river, either in the form of groundcover or tree canopy, the

lower the soil loss to runoff and the greater the riverbank stability (Marsh, 1998).

The weight of the development occurring near the newly exposed riverbank further contributes to weakening the soil underneath. What often results is the physical slumping of the riverbank and the direct loss of both property and septic fields to the natural forces of the waterways (Winnipeg Free Press, 2002(b); City of Winnipeg Water and Waste Department Engineering Division, 2002; Manitoba Conservation, 2001).

Overland flow of liquid sewage from flooded septic fields and septic field exposure due to riverbank erosion are not the only sewage-related impact on water quality associated with rural-residential development in the Capital Region. The Winnipeg Free Press (2002(b)) has also reported on the occurrence of rural-residential homes piping raw sewage directly into the Red and Assiniboine Rivers. Penalties exist for property owners that pipe raw sewage into local rivers. However, a combination of a lack of resources in terms of the number of provincial enforcement officials, and a lack of severe repercussions to offenders, has resulted in a number of reported incidents of rural-residential Capital Region homeowners freely pumping raw sewage directly into regional watercourses (Winnipeg Free Press, 2002(b)).

Expanding population and increasing residential development on the urban-rural fringe has led to an increase in the biological supply of nitrogen and phosphorous, the two most critical nutrients for aquatic wildlife (Environment Canada, 2001(a)). Excess nutrients, including nitrogen and

phosphorus compounds, that escape from failing septic tanks can cause excess growth of aquatic plants, which then die and decay, deplete water of dissolved oxygen, and kill fish (Ross, 2001; Hutchinson, 2000). This process, known as eutrophication, encourages excessive plant production in aquatic ecosystems (Environment Canada, 2001(a)). It has been estimated that human-induced eutrophication can create eutrophic conditions over a span of mere decades (which would normally take tens of thousands of years to occur in the absence of humans) (Hutchinson, 2000; Hough, 1995).

Prior to residential development in previously undeveloped areas, nitrogen and phosphorous compounds were added to soils primarily through the weathering of rocks and excretion from natural wildlife (Environment Canada. 2001(b); Hutchinson, 2000). Development on the urban-rural fringe has largely magnified and altered natural nitrogen and phosphorous cycles primarily through activities such as fuel combustion and the use of nitrogen-based fertilizers (Quon *et al*, 1999; Rees, 1998; Perks *et al*, 1996). As rural-residential density decreases, the amount of fertilizers utilized by residents of the urban-rural fringe tends to increase (Hough, 1995; Spirn, 1984). Well-manicured (and well-fertilized) lawns often surround large rural-residential parcels in the Capital Region of Manitoba. Likewise, as the density of urban development decreases, the physical proportions of urban areas, and the amount of fossil fuels required to circumnavigate urban areas, also increases (Clean Air Trust, 2002; Meck *et al*, 1999). This relationship strongly suggests that as the density of rural-residential development decreases, the amount of

nitrogen and phosphorous compounds entering ground and surface water sources increases.

The City of Winnipeg Waste and Water Department has recently estimated the impact on water quality that rural-residential development has had on the Red River (City of Winnipeg Water and Waste Department – Engineering Division, 2002). The annual amount of phosphorous released into the Red River, from both surface runoff and untreated sewage, throughout the length of the river between the Perimeter Highway and the Lockport Bridge, accounts for nearly as much as that released from the three wastewater treatment plants that service the City of Winnipeg (see Table 2.0).

Of far more concern are the figures for the annual discharge totals of nitrogen effluents entering the Red River. More nitrogen is released into the Red from untreated sewage and surface runoff between the Perimeter Highway and the Lockport Bridge than the amount that is released from the three wastewater treatment plants that provide service to the entire City of Winnipeg[2].

Table 2.0: Nitrogen and Phosphorus Loading in the Red and Assiniboine.

	Total Tonnes of Phosphorus Discharged/Year	*Total Tonnes of Nitrogen Discharged/Year*
West End Water Pollution Control Centre	40	226
South End Water Pollution Control Centre	82	516
North End Water Pollution Control Centre	232	2569
Winnipeg Total	354	3311
Downstream of Winnipeg	242	3604

Downstream of Winnipeg - Effluent Discharge / Runoff between the Perimeter Highway and Lockport Bridge (PTH 44).
From: City of Winnipeg Water and Waste Department – Engineering Division, 2002

[2] These figures account for *treated* sewage entering the Red and Assiniboine Rivers from the three sewage treatment plants utilized by the City of Winnipeg.

As mentioned earlier, to precisely measure the amount of discharge from non-point sources is extremely difficult. It is likely that a portion of the annual totals of nitrogen and phosphorus entering the Red River between the Lockport Bridge and Winnipeg City limits can be attributed to agricultural runoff. The Grassmere Drain, which drains much of the Rural Municipality of Rockwood and the Town of Stonewall, discharges into the Red River just north of the Perimeter Highway. Though this drain likely carries nutrient-rich agricultural runoff to the Red River, it is believed that failing rural-residential septic fields and holding tanks and residential runoff contribute much of the measured nitrogen and phosphorous effluent (Szoke, 2002; Winnipeg Free Press, 2002(b)).

It is difficult to argue that current rural-residential development north of the City of Winnipeg is environmentally sustainable and without a significant impact on regional water quality - when it has been estimated that the untreated sewage of approximately 15,000 - 20,000 rural-residents residing north of the Perimeter Highway and south of the Lockport Bridge discharge more nitrogen to the Red River than does the treated sewage of over 600,000 residents within the City of Winnipeg.

In addition to surface water management, groundwater management and protection issues in Canada are expected to increase in importance in coming years. In the wake of recent events of drinking water contamination in Walkerton, Ontario and North Battleford, Saskatchewan, it is expected that attention to the protection of drinking water sources will greatly increase

(Canada-Manitoba Infrastructure Program, 2002; Ross, 2001; Manitoba Conservation, 2001). Given that the majority of Capital Region residents living outside of the City of Winnipeg rely on groundwater for domestic use, it would be entirely reasonable to promote rural-residential developments that would better accommodate piped water and sewer systems.

Recent estimates have placed the cost of servicing many existing rural-residential homes in the Capital Region at well over double the cost to service similarly-sized homes in a more compact urban environment (Winnipeg Free Press, 2002(a)). The reason for the dramatic increase in the cost to service rural-residential homes can be attributed to the increased depth and frontage of rural-residential lots, as well as the large separation between homes and the distance to existing sewage treatment plants (United States Environmental Protection Agency Office of Water, 2002; Manitoba Conservation, 2001; Grant, 1999; Walker and Rees, 1997).

The Province of Manitoba has acknowledged the importance of protecting ground and surface water in a series of water policies (Manitoba Conservation, 2001; Manitoba Rural Development, 1998; Manitoba Environment, 1997; Province of Manitoba, 1996). While most Manitobans take for granted that the water in their homes is potable and safe to drink, some residents within rural-residential areas of the Capital Region have recently experienced boil-water advisories. Nearly 3,000 residents in the Rural Municipality of Ritchot were under a boil-water advisory in the fall of 2000. The community of Balmoral (within the Rural Municipality of Rockwood)

also experienced a boil-water advisory in the summer of 2000 after local health authorities found high levels of contamination within a number of local wells, thought to be a result of contamination from nearby septic fields.

Unfortunately, since piped services are expensive to install, the only economically-feasible measure available to most rural Capital Region communities, that have to treat polluted drinking water, is to add chlorine to the water supply (Joliat and Willson, 2000; Manitoba Environment, 1997; Manitoba Roundtable on the Environment & Economy, 1996). However, water treated with chlorine, in hopes of preventing the spread of waterborne pathogens, is not without its own negative impacts. Water treated with chlorine can combine with organic pollutants to produce disinfection by-products in the form of carcinogenic compounds (Spirn, 1984). These by-products have been linked to escalating the carcinogenic hazard to human consumers (United States Environmental Protection Agency Office of Water, 2002; Schwartzenberger, 2000; Manitoba Environment, 1997). There is a delicate balance between the benefits of adding chlorine to provide protection against microorganisms and parasites, and the hazards associated with the resulting disinfection by-products. While increased disinfection helps reduce health risks due to micro-organisms, higher rates of added chorine increase the rate at which disinfection by-products are produced, thus increasing health risks to the consumers of treated drinking water (City of Winnipeg Water and Waste Department Engineering Division, 2002).

Water protection objectives and policies in Manitoba include such statements as, '*land use planning that ensures land uses are compatible with the protection of drinking water sources*' and '*regulating human activities to ensure that essential potable water sources are neither adversely degraded or depleted*' (Manitoba Environment, 1996). These and other existing policies within provincial legislation can easily be related to potential detriments experienced by ground and surface water as a result of current trends of large-lot rural-residential development within the Capital Region.

2.2 Resource Depletion

Low-density rural-residential development is a significant contributor to the depletion of a number of natural resources. According to Alexander and Tomalty (1994), Canada has the highest per capita use of energy in the world. They identify the heavy demand for fuels, not only as a result of the cold climate (as argued by Wood (1995)), but largely as a result of the physical composition of many Canadian cities. The typically sprawling pattern of many Canadian cities, results in half the energy consumed by the average Canadian urban household being utilized by private automobiles (Alexander and Tomalty, 1994). Likewise, it has also been argued that typical patterns of low-density development, which are observed in many rural-residential areas throughout the Capital Region, also contribute to an excessive consumption of fossil fuels (Thomas, 2001; Manitoba Environment, 1996).

Another valuable resource that is over-consumed as a result of uneven, low-density rural-residential development within the Capital Region of

Manitoba is prime agricultural land (Lennon and Leo, 2001; Province of Manitoba, 1999(b); Province of Manitoba, 1999(c)). Many Canadian cities, including Winnipeg, were traditionally established in areas adjacent to prime agricultural lands, for their easy access and convenient use. However, because of recent population dispersal, much of the land that is converted to rural-residential development, is of high agricultural quality.

It has been estimated (Alexander and Tomalty, 1994) that in the twenty years of urban growth from 1966 to 1986, 58% of rural land that was urbanized was of high agricultural capability. It can also be safely assumed that since the majority of the land within the Manitoba Capital Region is agriculturally productive (Manitoba Intergovernmental Affairs, 2001), most of the recent rural-residential development within the Region has been at the expense of prime agricultural land.

Farmland surrounding urban areas is often an attractive target for suburban residential development - as it is often found in low-lying, fertile plains and valleys (Grossi, 1999; Tomalty *et al*, 1994(b)). As acreages used for agricultural purposes are lost to suburban and rural-residential development, readily available cropland, that once provided food to nearby urban areas, is also lost. It has been estimated that nearly 50 acres of farmland are lost to suburban development every hour in North America (Biodiversity Project, 2002(b)). Though the Capital Region of Manitoba obviously does not account for a great portion of this figure, it can be suggested that if all metropolitan regions throughout North America

subdivided large-lot rural-residential parcels at the same rate as this Region, the figure of 50 acres of farmland lost each hour would be significantly higher.

An estimated 60% of food produced in North America is produced in municipalities surrounding urban centres (Bowler, 1997). Over 30% of the best quality farmland in the most productive farming regions of the continent has already been irretrievably lost to development (Grossi, 1999). Farmland advocacy groups have stated that urbanization is claiming farmland at the rate of up to 1.2 million acres a year (American Farmland Trust, 2002). Mitchell (2001) has gauged that, in the 40 years following 1950, the urban population in North America has doubled, yet the amount of urbanized land has almost quintupled (a five-fold increase).

The loss of agricultural land means not only a loss in the capacity for the growth of local fresh food, but also contributes to a loss of biodiversity. Farms innately provide habitat for many different species of plants and animals and offer a physical corridor for species to move between natural areas (Janetos, 1997; Hough, 1995; State of Oregon - Department of Land Conservation and Development, 1992). Natural physical links and corridors are vital to the health and long-term viability of faunal species because they enhance the genetic diversity by providing for interbreeding among diverse populations and allowing a dispersal of individuals throughout a species' natural range (Sierra Club, 2001; Bryant, 1997). As mentioned earlier, agricultural land located near physically expanding metropolitan areas provides key natural areas for harbouring and enhancing biodiversity. As

these areas are fragmented, so too are the natural habitats of many regional floral and faunal species.

Farmland also provides positive benefits for the quality of life in many rural communities. It provides open space, contributes to rural economic stability, and provides a link to traditional rural and agricultural lifestyles. The intrusion of housing developments into formerly rural, agricultural land can put farmers at odds with their new neighbours over the basics of farming, such as slow-moving machinery on roadways and the smell of manure and fertilizer on fields (American Farmland Trust, 2002; Pendall *et al*, 2000; Walton, 2000; Grossi, 1999; Manitoba Rural Development, 1998).

One approach used to estimate sustainability, and the ability of a region to provide for itself, is an 'ecological footprint analysis' (Walker and Rees, 1997). An ecological footprint analysis translates the total ecological impact associated with different settlement patterns and different consumption rates and calculates the area of productive land required to support the required resource consumption. To estimate the ecological footprint of a given population, the total area of productive land and water that would be required (on a continuous basis) to produce all the resources consumed by that population is calculated. It has been estimated (Walker and Rees, 1997) that the ecological footprint of the average Canadian is roughly 4.3 hectares[3], a figure remarkably far from being a sustainable use of land.

[3] Comparing this calculation with the actual per capita productive land available on the planet produces a shocking result. If everyone on the planet consumed like the average Canadian, we would need at least two additional 'Earth's' to support the demands of the world population (Walker and Rees, 1997).

Table 2.1: Land Consumed Per 1,000 Change in Population (1966-86).

Canadian CMA	Hectares Consumed	Acres Consumed	ft² per person
Toronto	27	66.7	2,905.5
Vancouver	34	84.0	3,659.0
Montreal	35	86.5	3,767.9
Calgary	43	106.3	4,630.4
Ottawa - Hull	47	116.1	5,057.3
Quebec	51	126.0	5,488.6
Edmonton	59	145.8	6,351.1
Winnipeg	95	234.7	10,223.5

* from Lennon and Leo, 2001.

What makes estimating the ecological footprint of Canadians even more disturbing is when rural-residential development trends observed in the Capital Region of Manitoba, one of the most agriculturally productive regions in Canada, are also taken into consideration. Lennon and Leo (2001) have identified that (between 1966 and 1986) for every increase in population of 1,000 people, the Winnipeg Census Metropolitan Area consumes 95 hectares of land (Table 2.1). When comparing this figure to those of other Canadian Census Metropolitan Areas, we see that land consumption for development in Winnipeg is significantly greater than that of the other Canadian metropolitan areas surveyed (Lennon and Leo, 2001).

The estimation of the ecological footprint of Canadians identified by Walker and Rees (1997) leads us to the view that Canadians are not living in a sustainable society. When also considering the estimation of land consumption identified by Lennon and Leo (2001), we see that perhaps the development pattern of Winnipeg and its surrounding region is the least sustainable of a broad sample of Canadian metropolitan regions.

2.3 Drainage and Flood Control

Sprawling development requires more square kilometres of road right-of-ways and more acres of parking lots and rooftops than more carefully planned development (Galster *et al*, 2000). It is estimated that subdivisions made up of houses situated on large rural-residential lots have from 10% to 50 % more paved or non-porous surface area than do clustered or traditional developments with the same number of households (Biodiversity Project, 2002; Spirn, 1984). These paved, monocultured, and channel-drained surfaces prevent rain and snowmelt from soaking into the ground and returning to the water table (Hutchinson, 2000). Instead, water runs directly off these impervious surfaces and into local streams and rivers. This runoff dramatically increases the rate of water flowing through wetlands and streams, thus altering aquatic habitats and destroying species-specific niches (Rees, 1998). Increased water flow strips vegetation from riverbanks and destroys habitat for mammals, reptiles, and amphibians that live along these watercourses (Hutchinson, 2000). Such an increase in water flow can also cause devastating floods in areas surrounding overloaded streams and rivers (Hough, 1995; Spirn, 1984).

It is also very common to observe large-lot rural-residential properties covered with manicured lawns. In addition to increasing the rate of soil erosion, properties with expansive stretches of fertilized lawns greatly increase the likelihood of nutrient runoff (Hough, 1995; Spirn, 1984). Nutrients, commonly associated with fertilizers and particularly rich in nitrogen

and phosphorus compounds, enter surface water systems and contribute to algal buildup. As identified earlier, the growth and demise of these aquatic algal plants cause a depletion of dissolved oxygen in the water (Ross, 2001), which can lead to large fish-kills and watercourses with limited aquatic life (Ross, 2001; Schwartzenberger, 2000).

In addition to the algal blooms that occur as a result of excessive overland runoff and poor drainage, many important wetland areas in the vicinity of major Canadian cities have been drained to accommodate urban and rural-residential development. It has been estimated (Biodiversity Project, 2002) that over half of the original wetlands in North America have been lost to urban development. Wetlands filter polluted water, by absorbing heavy metals and toxins, and take up excess water from storms to prevent floods (Wood, 1995; Gardner, 1989). When wetlands are lost, groundwater is replenished far more slowly, and replenished water is not fully cleansed of toxins (Richardson and Eby, 2000). The resulting severity of environmental and economic damage from flooding is greatly increased (Schwartzenberger, 2000).

Patterson (1993) has estimated that by 1981, 98% of the wetlands in the vicinity of the City of Winnipeg had been drained. Natural wetland areas are extremely essential in the absorption of floodwaters (McHarg and Steiner, 1998; Hough, 1995). In the Chicago area, suburban development has raised the flood stage of the Des Plaines River by at least one foot and has

threatened over two-dozen suburbs that are now located in the enlarged flood plain of the river (Biodiversity Project, 2002).

As we were reminded in the spring of 1997, much of the Capital Region of Manitoba lies directly within an active floodplain. Yet, wetlands in the Capital Region are still being drained for rural-residential development (Manitoba Conservation, 2001). When considering the effects of poor land use planning, it would be more environmentally and regionally beneficial to design rural-residential developments that fit '*in with nature*' instead of developments that are built '*instead of nature*' (McHarg and Steiner, 1998).

2.4 Air Quality Impacts

It is widely noted, both by authors of planning literature and by many agents of planning policy, that low-density developments are extremely difficult to service effectively with public transportation (Pendall *et al*, 2000; Churchman, 1999; Manitoba Rural Development, 1998). As a result, residents of low-density rural-residential developments are often completely reliant on private vehicular use. The personal automobile, a device that originally enabled the easy separation of land uses, has since become a necessity for almost anyone living in rural-residential areas (Lennon and Leo, 2001).

The extensive use of private automobiles in such fringe developments has been identified as being responsible for dispensing unnecessarily large amounts of carbon dioxide, ozone, and nitrogen dioxide emissions into the regional atmosphere (Clean Air Trust, 2002; Ewing, 1997). Increased atmospheric carbon dioxide will likely lead to an increase in air temperatures

and exacerbate ozone problems (Hough, 1995). Ozone is formed by a photochemical reaction of nitrogen oxides and volatile organic compounds in ultraviolet sunlight and moisture, and has been linked to elevating effects on respiratory tissues and functions in humans (Clean Air Trust, 2002; Hollis *et al*, 1997).

Vehicular transportation is also responsible for releasing pollutants, such as carbon monoxide (CO), and sulfur dioxide (SO_2), into the atmosphere. Dilute sulphuric acid emissions are primarily caused by fuel combustion. These pollutants have been implicated as reducing the oxygen carrying capacity of blood, inhibiting plant growth, affecting food sources and natural habitat for a multitude of species of flora and fauna (Biodiversity Project, 2002; Hough, 1995). The aforementioned pollutants also impact human food sources by ulcerating leaf surfaces, thus slowing the growth of crops such as corn and canola (Grossi, 1999).

In addition, sulfur dioxide and nitrogen oxides together form ozone, a major component of smog (McHarg and Steiner, 1998). A group of organic compounds in smog resulting from burning fossils fuels, polycyclic aromatic hydrocarbons, exert a damaging effect on the genetic material in the cells of people breathing contaminated air, and drinking and eating tainted water and food (Clean Air Trust, 2002; Ravetz, 2000). These compounds also combine with moisture to form acid rain, which kills plants and animals on land, and contaminates surface water (Ravetz, 2000; Rees, 1998). It is widely believed that most of the aforementioned airborne vehicular emissions are likely to

continually increase as urban residents continue to increase their reliance on their automobiles (Clean Air Trust, 2002; Mitchell, 2001; McMahon, 2001; Orchsner, 2001; Hollis *et al*, 1997).

Conversely, some authors (Gordon and Richardson, 1997) believe that impending advances in vehicle emission control technology will solve or mediate most air quality problems. Possibilities for future personal automobile technological advances include cars outfitted with harder, stiffer 'low-friction' tires, vehicles with an infinite number of computer-orchestrated gears, more finely tuned catalytic converters, and changes in the coolants used in air-conditioning systems (Washington Post, 2002; Ewing, 1997). However, despite any recent increases in technology surrounding vehicular emissions, over half of all North Americans live in urban areas that exceed one or more federal air quality standard (Clean Air Trust, 2002; Ewing, 1997).

Ultimately, if rural-residential development continues to grow in the same traditional low-density patterns, which are difficult to efficiently service with public transportation, personal automobiles will be required to burn less gasoline. Increasing fuel efficiency is the only certain way to reduce emissions of carbon dioxide (Clean Air Trust, 2002; McHarg and Steiner, 1998; Dekel, 1997). Unfortunately, increasing fuel efficiency of the modern fleet of personal automobiles strongly contradicts recent consumer demand for larger, more powerful vehicles, such as sport utility vehicles, minivans, and trucks (Biodiversity Project, 2002).

Air pollution resulting from low-density rural residential development is not only a regional concern. There is now strong agreement within the scientific community that carbon dioxide build-up in the atmosphere is a leading factor contributing to global climate change (Ewing, 1997). Though the long-term effects of global climate change are not known, it is suspected that they are likely irreversible and potentially catastrophic (Clean Air Trust, 2002; Biodiversity Project, 2002).

2.5 Soil Quality Impacts

Another environmental impact associated with low-density rural-residential development is the effect that such land uses have on the regional soil quality. Hollis (*et al*, 1997) has identified soil erosion as the predominant factor influencing soil quality of an area. Soil erosion is largely influenced by a number of factors, including amount of precipitation, storm frequency, and storm intensity (Spirn, 1984). However, on most surfaces it is believed that vegetation cover is the single most important factor that regulates soil erosion (Marsh, 1998). Foliage acts as an interceptor of rainwater and reduces the force at which precipitation strikes the surface of the soil (American Farmland Trust, 2002). Organic litter on the ground also reduces the impact of rain on underlying soil, while plant roots bind together aggregates of soil particles that increase the resistance of the soil to the force of the resulting surface water (Marsh, 1998).

It has been noted by numerous authors that soils which are covered predominantly by monocultured lawns are much more susceptible to events

of high rainfall, and hence much more susceptible to soil erosion (Grossi, 1999; Burchell and Shad, 1998; Marsh, 1998; Hough, 1995). Many rural-residential developments, particularly those in areas with little natural tree cover, contain residences with large, expansive lawns, thus making underlying soil extremely vulnerable to erosion, and therefore hindering its use for future agricultural purposes.

When considering the above environmental impacts resulting from poorly located, situated and designed rural-residential development, it becomes readily apparent that future rural-residential development within the Capital Region of Manitoba cannot continue in the recent manner. The Capital Region of Manitoba needs to ensure that development in the Region occurs in a more sustainable manner than is currently observed. To achieve this objective, guiding land-use policy must be reviewed to determine if the Provincial Land Use Policies (Province of Manitoba, 1994) promote and encourage sustainable land-use within the Region. The following chapter identifies and examines alternatives for future rural-residential development in the Capital Region of Manitoba.

3.0 Options for Directing Alternative Rural-Residential Development

Many authors of current planning literature have identified alternative patterns of rural-residential development, which they believe to be far less environmentally detrimental than the standard large-lot developments, commonly observed throughout the Capital Region of Manitoba. Numerous authors have identified that urban and suburban development would be more environmentally sustainable if it were based on the principles of so called "Smart Growth" (McMahon, 2001; Mitchell, 2001; Thomas, 2001; Smart Growth Network, 2001; Grant, 1999; Meck, 1999). The Smart Growth Network (2001) has summarized the principles of Smart Growth based on the following six directives:

- *use land resources more efficiently through compact building forms, infill development, and moderation in street and parking standards in order to lessen the amount of land consumption and preserve natural resources;*
- *support the more efficient use of public and private infrastructure by creating neighbourhoods where more people use existing services like water lines and sewers, roads, emergency services, and schools;*
- *support the location of stores, offices, residences, schools, and recreational spaces within walking distance of each other in compact neighbourhoods. The intent is to provide independence of movement through opportunities to walk, bicycle, or ride transit, reduce auto use, especially for shorter, non-work related trips, and provide a variety of housing choices, so that the young and old, singles and families, and those of varying economic ability may find places to live;*
- *support transportation systems that are safe, convenient, and interesting through walking, cycling, and transit as attractive alternatives to driving, the provision of alternate routes that disperse, rather than concentrate, traffic congestion, and lower traffic speeds in neighbourhoods;*

- *emphasize detailed human-scale design through similar massing of buildings, orientation of buildings and building features, such as windows, doors, and porches, to the street, and effective use of landscaping; and*

- *emphasize streamlining the development review process and development standards so that developers are actively encouraged to apply the principles and stress the use of incentives and flexibility, while providing certainty and predictability.*

Advocates of Smart Growth insist that these principles can be applied to urban centres, suburbs and small towns as well as rural-residential areas.

It is often argued that increased density is the most important indicator of Smart Growth and the most effective measure of environmental effects relating to rural-residential development (Fulton *et al*, 2001; Glaeser and Shapiro, 2001). By simply measuring density as a ratio of total population of a metropolitan region to its total land area, inferences regarding the environmental sustainability of the region can be made. Churchman (1999) and Dekel (1997) have identified numerous environmental benefits associated with increasing the density of rural-residential developments. Environmental benefits described by Churchman include enrichments in regards to air quality, water quality, resource use, and species biodiversity.

Like Churchman and Dekel, Tomalty *et al* (1994(a)) identified benefits regarding the development of compact cities within Canada that display higher than normal population densities. They identify numerous advantages to the regional environment that can be directly associated with an increase in density of rural-residential development. Tomalty *et al* (1994(a)) identify Canadian examples (Toronto and Vancouver) displaying how moderate increases in population density have led to a reduction of environmental

detriments associated with low-density sprawling developments, such as degradation of air quality, and losses to agricultural lands, natural areas and biodiversity.

An observed increase in population density in metropolitan regions can be directly related to a decrease in the amount of land base required to accommodate that given population. Densely populated urban regions also enable residents to be less reliant on personal automobiles, more easily and efficiently serviced with public transit, and less likely to be serviced by individual wells, septic fields, or sewage ejectors.

However, population density is not the only physical indicator of the impact of development on the regional environment. Eight indicators of sustainable regional development, and their relationship to common rural-residential development within the Capital Region may be summarized as follows:

3.1 Eight Indicators of Sustainable Regional Development

George Galster, Royce Hanson, Hal Wolman, Stephen Coleman, and Jason Freihage co-authored a study for the Fannie Mae Foundation (2000) that looks beyond population density as the lone physical indicator of the efficient use of an urban land base. Though density is one indicator of sustainable regional development that the authors detail as being an important measure of regional sustainability, they have identified a total of eight physical indicators equally capable of gauging regional sustainability. Galster *et al* (2000) have determined that, to best increase regional

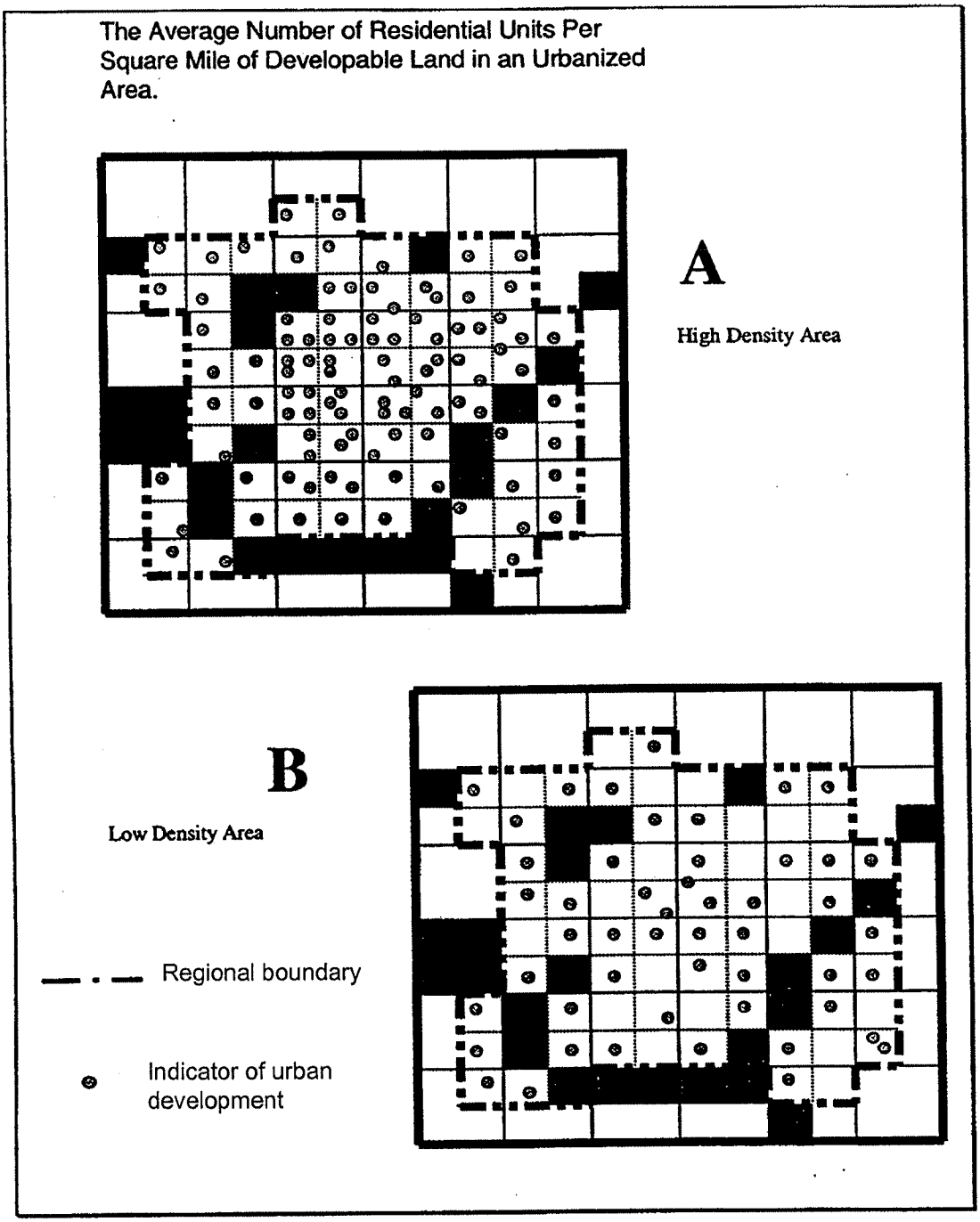
environmental sustainability, rural-residential developments – and all land uses as a whole – should also be continuous, concentrated, compact, and diverse. They have also affirmed that the regional landscape should contain positive aspects of density, nuclearity, centrality, and proximity.

The following eight sub-sections (and associated figures) summarize the eight characteristics of 'sustainable regional development', as identified by Galster *et al* (2000). The figures are not drawn to any particular scale, nor do they represent a particular area within the Capital Region. They are provided as a visual representation of the terms and development pattern identified by Galster *et al* (2000). Included with each of the following eight characteristics, are brief synopses of how current development trends, and the current form of the Capital Region of Manitoba, can be related to characteristics of a sustainable region.

3.1.1 Density

Density can best be described as the average number of residential units distributed over a given area of developed land within a region. As illustrated by Galster *et al* (2000) (see Figure 3.1), area A exhibits a greater number of residential units over the same gross land area. As a result, it exhibits a higher density and occupies a far lower proportion of the regional land base. Decreasing the amount of the land base that is occupied by urban and rural development amounts to a reduction in the amount of agricultural land lost unnecessarily to development. Increasing the amount of undeveloped land would also lead to a reduction in the threat to regional

Figure 3.1: Regional Density



Source: Galster *et al*, 2000.

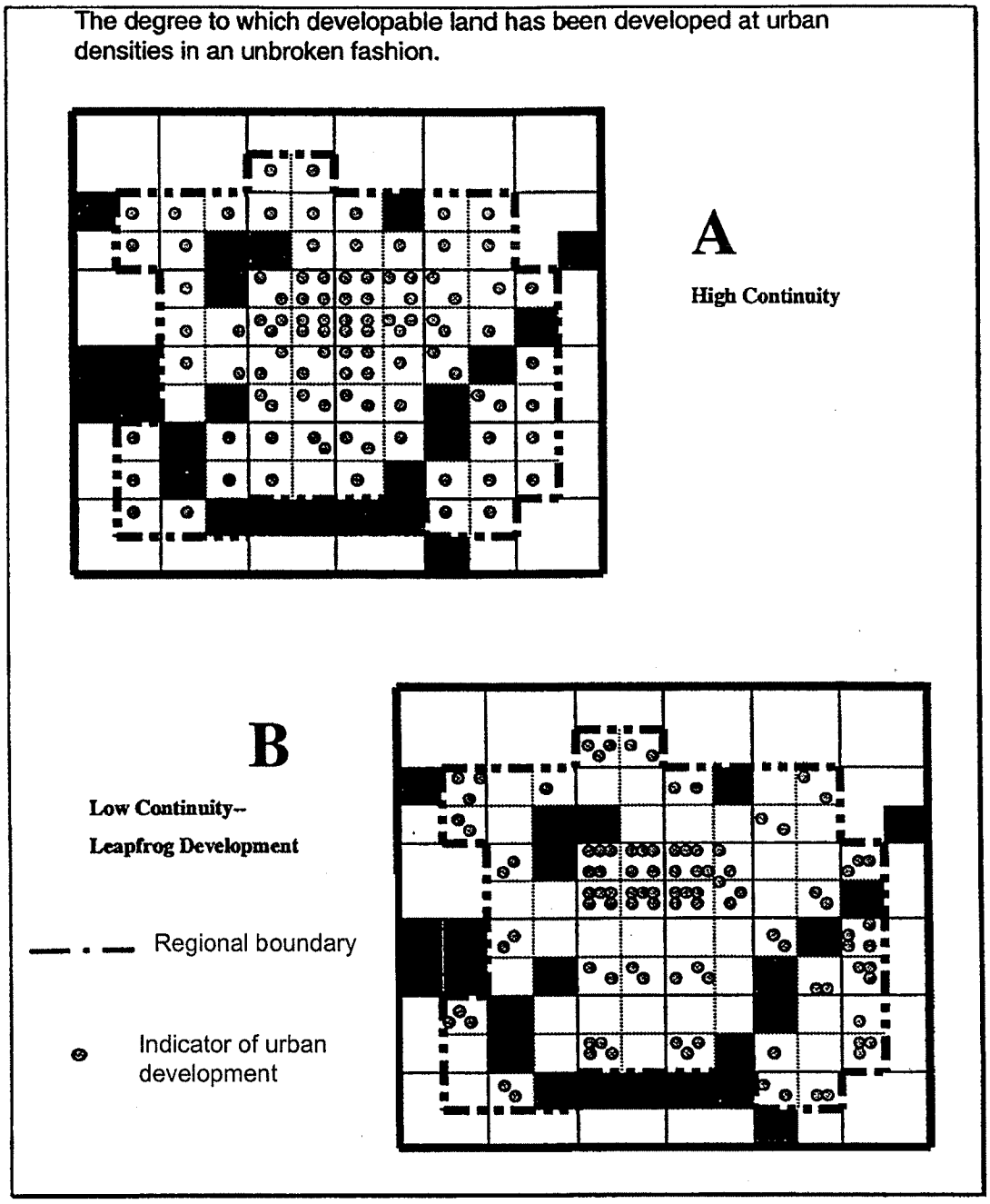
biodiversity (threatened with reduced and/or fragmented habitat). Regional air quality can also benefit from an increase in density as the intensity and lengths of vehicular distances traveled are dramatically diminished.

As discussed earlier, recent development within Winnipeg and the Capital Region of Manitoba displays the lowest population densities of all major metropolitan areas in Canada (Lennon and Leo, 2001). Low-density development in the Capital Region of Manitoba is found throughout a number of rural municipalities in the Region. It is not uncommon to observe rural-residential subdivisions made up of parcels between 2 and 5 acres in size (as will be identified later in this document). Rural-residential developments of this density are essentially impossible to efficiently service with public transit (Smart Growth Network, 2001; Hollis *et al*, 2000), are often serviced via aging and ineffective on-site sewage systems (Winnipeg Free Press, 2002(b)), and are a major consumer of prime agricultural land (American Farmland Trust, 2002; Ackerman, 1999).

3.1.2 Continuity

The continuity of a region (see Figure 3.2) is often described as being a measure of the degree to which developable land has been developed at urban densities in an unbroken fashion (Galster *et al*, 2000; Marchand and Charland, 1992). Continuous development may occur at any level of density; however, non-continuous development is often observed and associated with sprawling developments (Southworth, 1997). Non-continuous development is also often termed "strip" (Forsyth, 1997) or "ribbon" (McMahon, 2001)

Figure 3.2: Regional Continuity



Source: Galster *et al*, 2000.

development and is often constructed alongside major highways. Another form of non-continuous development is often referred to as "leapfrog" development (Smart Growth Network, 2001; Gordon and Richardson, 1997). Leapfrog development frequently skips over undeveloped land, leaving behind a pattern of developed and undeveloped tracts. From an individual municipal perspective, many Capital Region municipalities display a high degree of continuous development. Stonewall and Selkirk, as well as certain Local Urban Districts within Capital Region municipalities, such as Oakbank, Stony Mountain, Elie, Lorette, and La Salle are all examples of compact, relatively continuously developed centres.

However, when examining development from a regional perspective, and when factoring rural-residential development outside of urban centres into the picture, it can be argued that development within the Region is highly non-continuous. Much of the rural-residential development observed between the cities of Winnipeg and Selkirk, along both sides of the Red River, is interspersed with fragmented agricultural parcels and is, as a result, non-continuous in nature. The same can be said for rural-residential development south of the Assiniboine River in the Rural Municipality of Headingley, as well as along the Seine River in the Rural Municipality of Taché.

Non-continuous development in the Capital Region is not only a result of rural-residential development. Urban/suburban development within the City of Winnipeg is also highly non-continuous. Certain residential neighbourhoods, such as Whyte Ridge, Southland Park, and Harbour View,

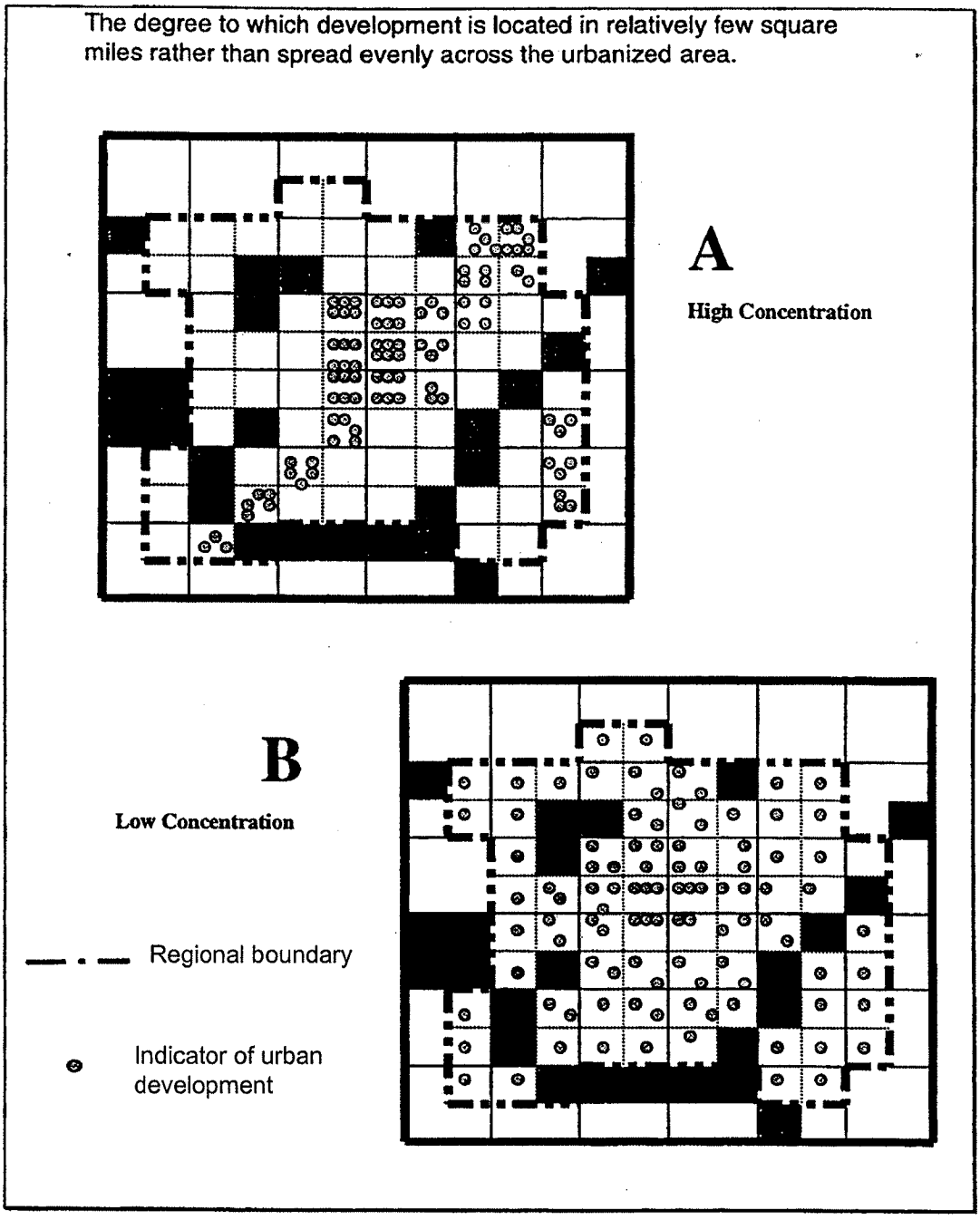
can also be described as examples of "leap-frog" or non-continuous development. While commercial development along the Trans-Canada Highway (both west and east of Winnipeg), Brookside Boulevard, and Pembina Highway are all examples of "strip" or "ribbon" non-continuous development.

3.1.3 Concentration

Another environmental indicator of the health of an urban region is the concentration of development within the region. Often used as a measure of density, concentration (see Figure 3.3) is measured by the degree to which development is located in a relatively small urban area (Galster *et al*, 2000). Though urban areas are occasionally continuously developed, very seldom are they evenly developed. What results is a poorly concentrated pattern of development. The measure of density alone does not tell us how residential uses are distributed. The concentration dimension distinguishes urban areas where housing units (and often employment) are located in relatively few places at high densities from those where development is more evenly distributed across the landscape (Nelson and Duncan, 1995).

As illustrated in Figure 3.3, two patterns of regional development are illustrated at different levels of concentration. The sketch shows that area A is more highly concentrated and more evenly distributed than area B. Development of low concentration can severely impact the long-term environmental sustainability of a region. As with low-density developments,

Figure 3.3: Regional Concentration



Source: Galster *et al*, 2000.

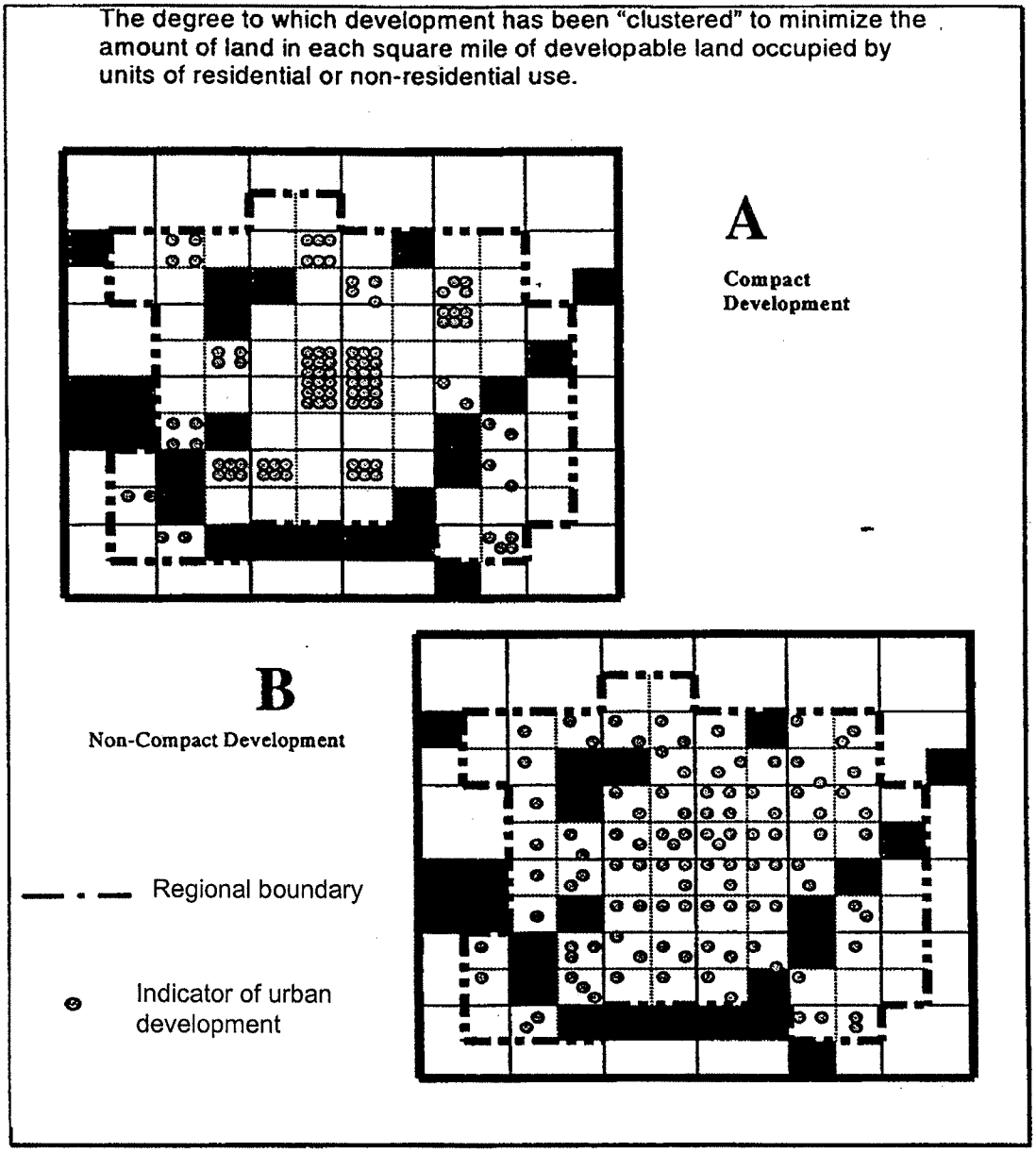
non-concentrated developments result in an unnecessary loss of land base and an increase in the reliance and frequency of vehicular use.

It is difficult to directly relate the measure of concentration to the Capital Region of Manitoba. No two municipalities within the Region have both similar land areas and comparable populations. However, indirect observations of municipal concentration levels can be made. Municipalities that display relatively low-levels of scattered rural-residential development, such as Macdonald, Rockwood, and Rosser, exhibit a more concentrated form of development than municipalities that have relatively high levels of scattered rural-residential development, such as Springfield, Taché, St. Andrews, and St. Clements.

3.1.4 Compactness

Many authors also advocate the environmental benefits of highly compact rural-residential developments or "cluster zoning" (Arendt, 1997; Daniels, 1997; Bowler, 1997). Galster (*et al*, 2000) identify the compactness (see Figure 3.4) of an area to be the degree to which development has been "clustered" to minimize the amount of developable land occupied by urban related development. Compact or clustered development is often used as an antonym for "sprawling" development because its footprint occupies only a small portion of the land area associated with it (Gordon and Richardson, 1997; Bryant and Lemaire, 1993). Development may be concentrated and yet may still not be compact (Walker and Rees, 1997). Compactness deals with the footprint or net area of development, regardless of the way in which it is

Figure 3.4: Regional Compactness



Source: Galster *et al*, 2000.

distributed across the whole region. A measure of compactness does not measure how densely the developed footprint is occupied (Galster *et al*, 2000).

Compact development can help decrease detrimental environmental effects associated with low-density rural-residential development. Compact development is more likely to be serviced via piped water and sewer. As a result, regional ground water sources would be exposed to less contamination from faulty or poorly placed septic fields and sewage holding tanks. Compact development would also result in a reduction of impervious surfaces associated with such rural-residential development. A more compact form of development would also localize and minimize events of flooding and erosion.

As illustrated in Figure 3.4, displaying compact versus non-compact development, the development in area A has been clustered so that it occupies half or less of the land area in each of the large squares. This produces a more compact pattern of development than that shown in area B, where the same amount of development in each large square is more evenly distributed.

Examples of both compact and non-compact development can be found within the Capital Region of Manitoba. Communities such as Stonewall, Oakbank, Lorette, and Stony Mountain are all examples of relatively compact centres. Recent developments within the communities of La Salle, Sanford, and Starbuck are also examples of how communities can be developed in a relatively compact form. Conversely, much rural-residential development

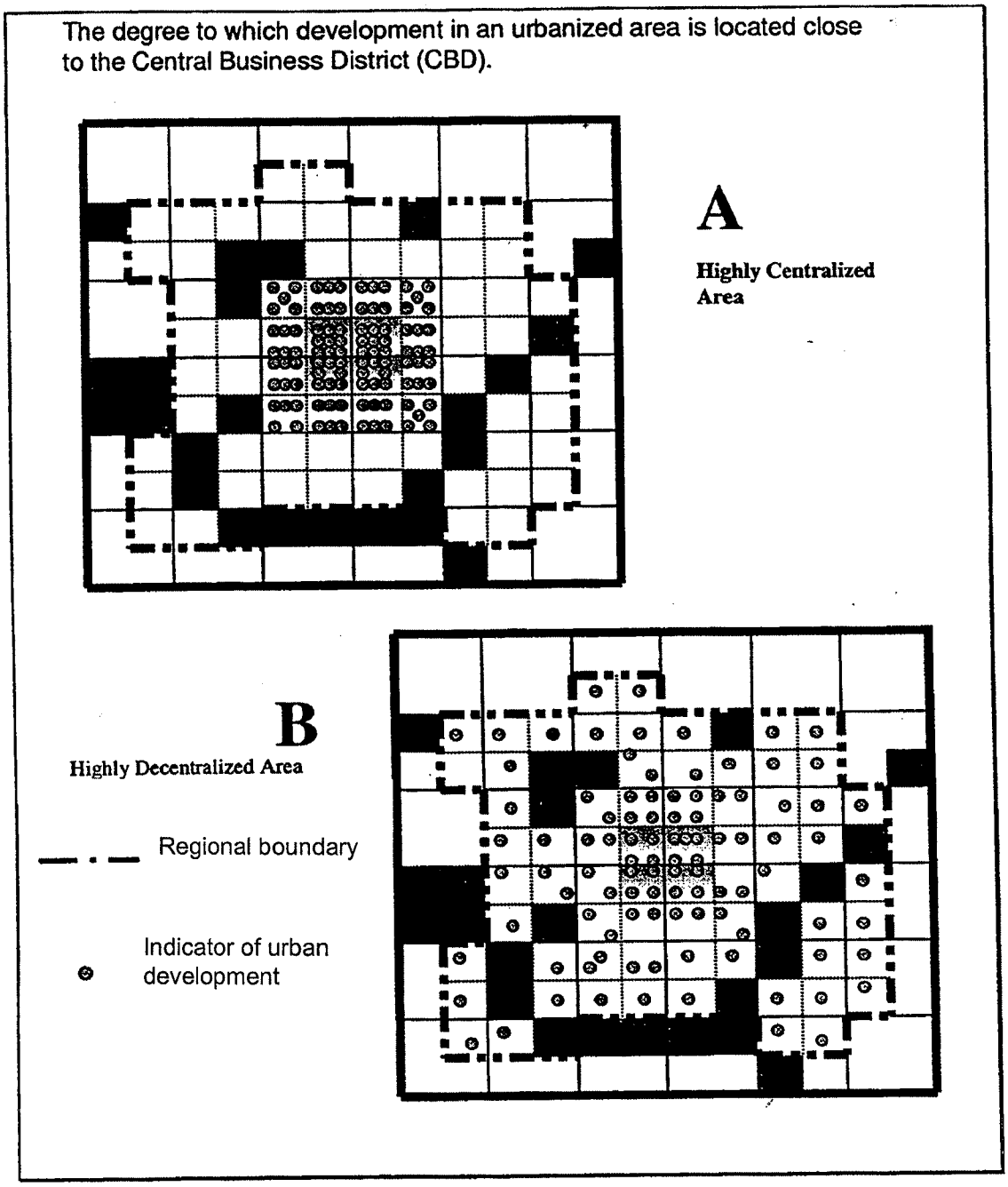
within East St. Paul, West St. Paul, Taché, St. Andrews, St. Clements, Ritchot and many rural areas of Springfield are relatively non-compact. Rural-residential parcels that are created away from established, existing settlement centres are very often non-compact, difficult to service, and largely reliant on personal automobiles.

3.1.5 Centrality

Another common criticism of low-density development is the damage caused to the central nucleus of development (Hodge and Robinson, 2001; Lennon and Leo, 2001; Thomas, 2001). Centrality (see Figure 3.5) is the degree to which residential development is located close to the central business district of an urban area (Galster *et al*, 2000). A loss of centrality is commonly observed in development that has been diffused across the regional landscape from the historic core of an urban area (Orchsner, 2001). Decentralization of urban areas is commonly associated with causing longer travel distances, an increase in consumption of the regional land base, and general inefficiencies in land use.

As shown in Figure 3.5, illustrating highly centralized versus highly decentralized situations, areas with a low level of centralization display a much higher dimension of "sprawling" development (Galster *et al*, 2000). Figure 3.5 illustrates two forms of development that vary significantly in their degree of centrality. When examining the two areas, it becomes readily apparent that area B would be much more difficult to service with public transportation, more costly to service with piped water and sewer, necessitate

Figure 3.5: Regional Centrality



Source: Galster *et al*, 2000.

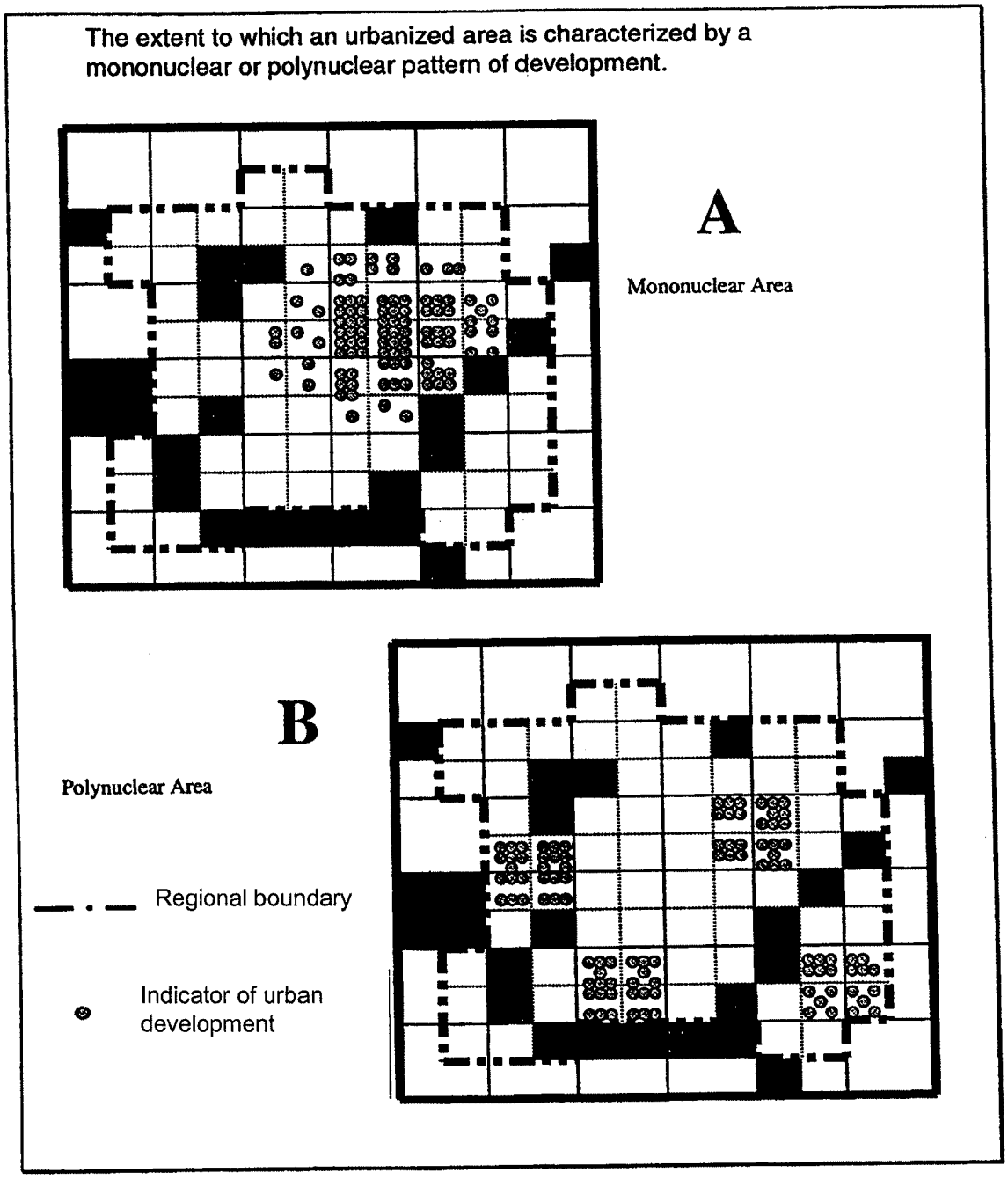
residents to be much more reliant of the use of personal automobiles, and an extremely inefficient use of the regional land base.

The two diagrams schematically illustrate recent development trends that have been occurring within the Capital Region of Manitoba. A relatively stable population that was once centered mainly in the core area of the City of Winnipeg has since dispersed outward throughout the City and throughout the Region as a whole (Frontier Centre For Public Policy, 1999). New residential neighbourhoods (such as Whyte Ridge and Southland Park) have developed outside existing developed areas within the City of Winnipeg and, more recently, rural-residential developments (such as Pritchard Farm Estates and Lower Fort Garry Estates) have cropped up in rural municipalities outside of Winnipeg City limits. If recent housing start and population trends continue (as will be examined in detail in Chapter 4), the degree of centrality of development within the Capital Region of Manitoba will continue to decline.

3.1.6 Nuclearity

The sixth indicator of regional development identified by Galster *et al* (2000) is the nuclearity (see Figure 3.6) of a region's physical composition. Nuclearity is measured by the extent to which an area is characterized by mononuclear patterns of development. Centrality is a measure that is best suited to mononuclear regions, or a region with one dominant city such as the City of Winnipeg is to the Capital Region of Manitoba. Recent urban trends throughout North America have shown that metropolitan regions across the continent have become more polynuclear in past decades as outlying "edge

Figure 3.6: Regional Nuclearity



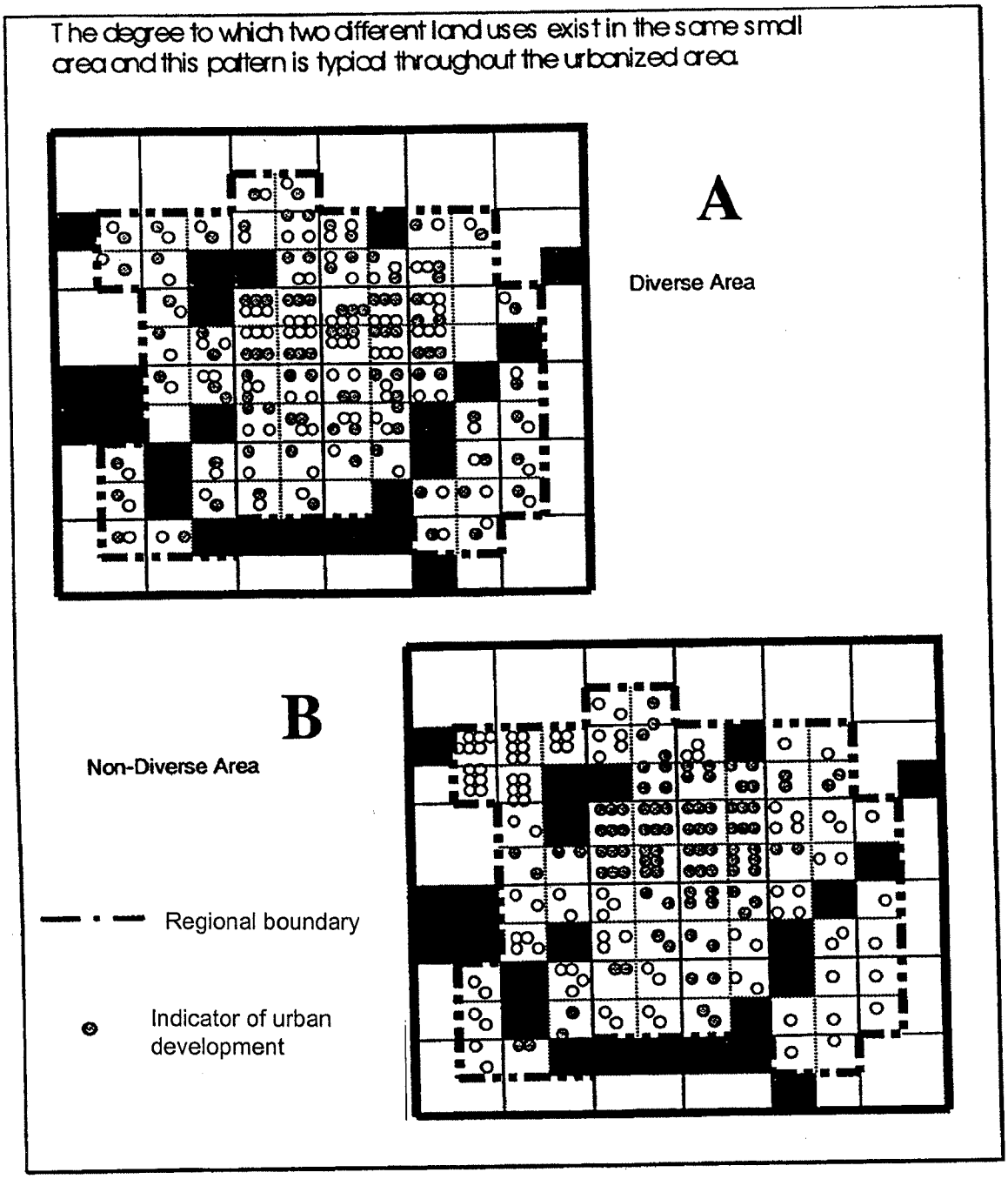
Source: Galster *et al*, 2000.

cities" have grown in scale (Fulton *et al*, 2001; Ewing, 1997; Bryant and Lemaire, 1993). A polynuclear pattern may reduce effects on air quality by reducing travel time between work and home for some residents of the region. However, a polynuclear development pattern may increase travel time and automobile reliance for others, and may also occupy unnecessarily large amounts of the regional land base.

Nuclearity is the one indicator of Galster's (*et al*, 2000) eight indicators of "sprawl" for which the Capital Region of Manitoba can be rated favourably. The Capital Region, without question, is a mononuclear region. The City of Winnipeg has historically been the major urban centre within the Region and within the Province (Levin, 1993). The city is also home to much of the regional employment base and most of the essential services and tourist destinations in the Region. Though officials of neighbouring municipalities would likely state that recent development in their communities has been an effort to create self-sufficient "edge" communities, and though many people who live in neighbouring municipalities also work in those municipalities, recent analyses of commuter patterns within the area show that Winnipeg is still the dominant economic force in the Region (Province of Manitoba, 1999(d)).

If the Capital Region of Manitoba were ever to develop into a polynuclear region, recent examples of rural-residential development would severely hinder these efforts. As mentioned earlier, much of the recent rural-residential development within the Region is not concentrated near existing

Figure 3.7: Regional Diversity



Source: Galster *et al*, 2000.

settlement centres and, as a result, is largely reliant on neighbouring urban communities for both services and employment.

3.1.7 Diversity

Though the focus here is primarily with the environmental effects associated with rural-residential development, it is often necessary to examine other land uses to attain a full analysis of effects on the regional biosphere and atmosphere, without weighing how rural-residential development harmonizes with adjacent land uses. The diversity (see Figure 3.7) between adjacent land uses is an important feature used to determine efficiency of land utilization. A region that is lacking diversity between land uses often occupies more of the regional land base than that of a diverse metropolitan region (Galster *et al*, 2000). When regional land uses are commonly separated from one another, often as a result of minimum lot sizes or different zoning distinctions, the landscape is often more fragmented and extensive than that of a diverse region with intermixed land uses (Downs, 1999; Grant, 1999; Forsyth, 1997; Roseland, 1997). Land use segregation often causes the separation between work and home to increase. Likewise, the distance between residential and commercial areas also tends to increase, which often results in an increase in reliance on the personal automobile for the most basic of needs (Clean Air Trust, 2002; Smart Growth Network, 2002).

This pattern is easily demonstrated when examining Figure 3.7, which illustrates a diverse versus a non-diverse region. In area A, all squares

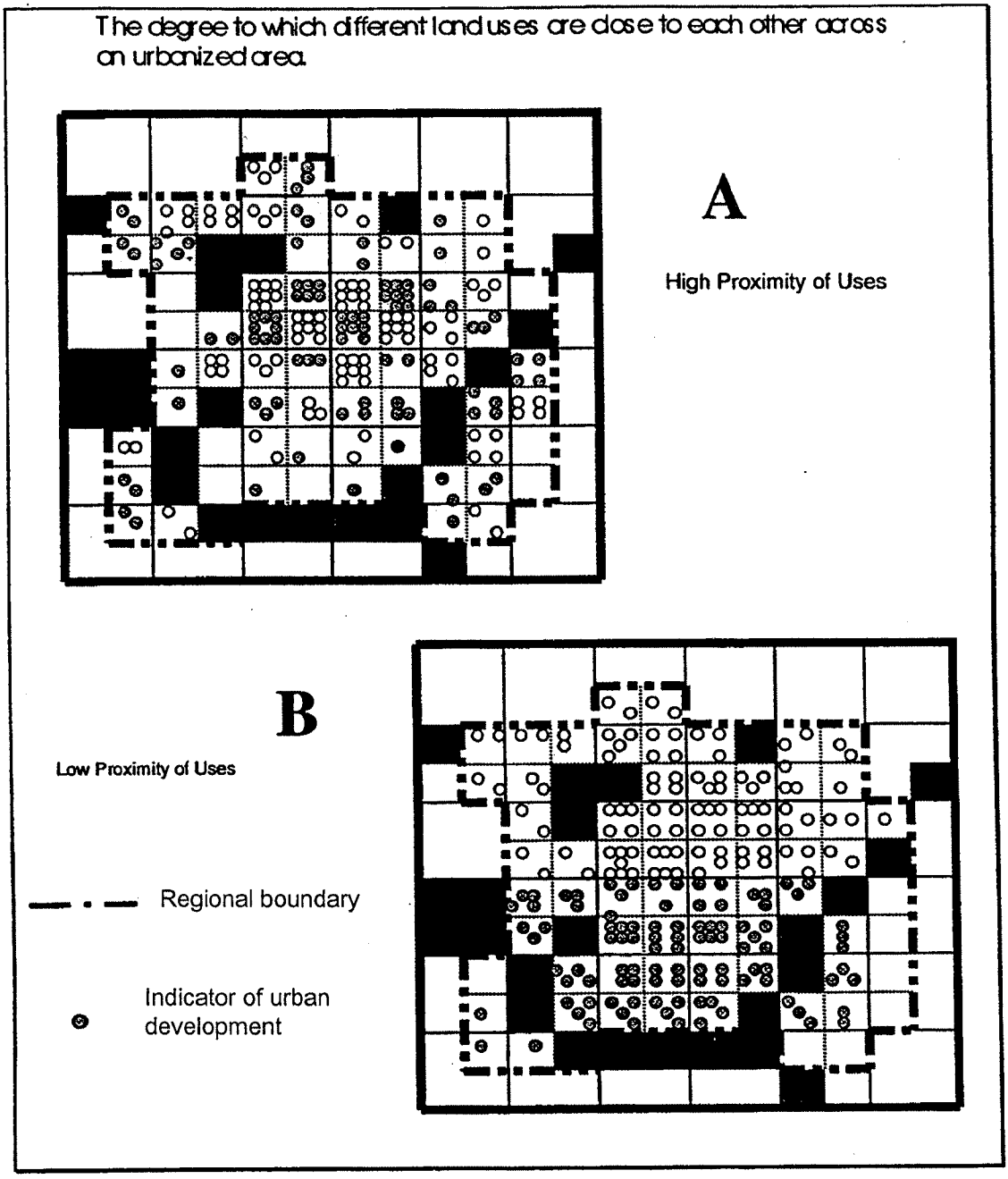
contain equal proportions of residences and employment. This pattern of high diversity is considered much more efficient use of land than that of area B, where each square contains only a single land use.

Galster's measure of diversity echoes the sentiment of many proponents of mixed-use development (Smart Growth Network, 2001; Freeman, 2000; Grant, 1999; Hollis *et al*, 1997; Southworth, 1997). The majority of recent suburban and rural-residential development, both within the City of Winnipeg and neighbouring municipalities, is largely non-diverse. Residential uses are separated and often isolated from commercial uses. Resulting development makes residents largely reliant on the use of personal automobiles (Lennon and Leo, 2001; Frontier Centre for Public Policy, 1999).

3.1.8 Proximity

The eighth and final measure identified by Galster *et al* (2000) is that of regional proximity. Expanding on regional diversity, regional proximity is the degree to which different land uses are close to each other across a metropolitan region. The diversity dimension of development patterns measures primarily the extent to which small areas of a region are typically devoted to a single land use. Proximity is the dimension that recognizes the typical distance between different uses, such as the average distances workers must travel for employment, or the average distance consumers must travel to shop (Smart Growth Network, 2002). This is illustrated in Figure 3.8, which identifies high and low regional proximity between land uses. Area A displays high proximity, whereas area B illustrates a region with low proximity.

Figure 3.8: Regional Proximity



Source: Galster *et al*, 2000.

Relating Galster's (*et al*, 2000) measure of proximity to the Capital Region of Manitoba echoes many concerns identified during the discussion on regional nuclearity. With the City of Winnipeg containing much of the regional employment base, many surrounding municipalities, particularly those with a large amount of rural-residential development, contain a disproportionately higher number of residential uses over non-residential uses. As a result, these areas do not contribute to the diversity of the Capital Region.

Like Galster *et al* (2000), Beatley and Manning (1997) have identified physical factors such as density, concentration, and diversity as being important measures of regional sustainability. Beatley and Manning recognize a need for policy developments that would encourage infill development, re-urbanization, and brownfield development. Beatley and Manning also identify the need for growth containment, and the preservation of open spaces and natural areas.

The following subsections analyze specific patterns of regional development that certain authors believe would benefit the local and regional environment.

3.2 Cluster Zoning

One approach to increasing density, while preserving agricultural land, that certain authors of planning literature are promoting, is known as "Rural Cluster Zoning" (Arendt, 1997; Daniels, 1997; Bowler, 1997). Rural-residential developments that are arranged in a clustered pattern provide a portion of

land to be developed for a cluster of residential dwellings, with the remaining land being available for agricultural or ecological reserve uses.

It is believed that such clustered developments would reduce the losses of agricultural land, enable piped water and sewer service, and would be able to be more efficiently serviced by public transportation (Arendt, 1997). To maintain their rural character and agricultural productivity, it is suggested that such cluster developments be limited in size by strict growth boundaries (Daniels, 1997).

Cluster zoning is fundamentally contrary to zoning practices common throughout most agriculturally based rural municipalities in the Capital Region of Manitoba. Agriculturally zoned areas throughout the Capital Region quite commonly list non-farm, single-family dwellings as a permitted use in their zoning by-laws. Municipal zoning by-laws often contain a series of bulk tables, which list the *minimum* site area and width requirements for such uses in agricultural areas throughout the municipality[1].

The cluster method of zoning is similar to contemporary methods of zoning in that they both recognize areas of agricultural significance and attempt to preserve low densities. The cluster method of zoning differs from standard forms of zoning in that it establishes a cap on the number of dwellings that can be developed on a specified area of land. It then establishes *maximum* lot sizes for non-farm, single-family dwellings, very often in the neighbourhood of one to two acres (Arendt, 1997). The

establishment of a restriction on the number of non-farm dwellings constructed on a specified area of land would ensure that when the maximum number of dwellings is reached, the remaining land is then guaranteed to remain in use for agricultural purposes.

Proponents of cluster-based zoning emphasize that in establishing a maximum lot size for non-farm dwellings, not only is the amount of agricultural land lost to rural-residential development minimized, but surface and groundwater sources are also protected (Bowler, 1997). A maximum lot size of one acre would make it impossible to safely service these developments with sewage ejectors or septic fields. As an alternative, the non-farm single-family dwellings would be encouraged to cluster together in relatively close proximity with common well, holding tank, or piped services (Daniels, 1997).

When examined over a small area of land, cluster zoning exhibits favourable characteristics of high density, concentration, and compactness (Galster *et al*, 2000). However, one criticism of cluster zoning is that it only appears to work well in areas of strong farming economies (Daniels, 1997). In areas where commercial farming is largely successful, farmers realize that the fewer neighbours they have, the less likely the chances are that those neighbours will complain about farming practices that cause a large amount of noise, dust, or odour. However, in areas in which commercial farming is not always a successful venture, many large-parcel landowners are more willing

[1] Minimum site area and width requirements for non-farm, single-family dwellings in agriculturally zoned areas in many Capital Region municipalities are often 2 acres and 200 feet, respectively.

to subdivide and sell a portion of their holding to supplement their income (Daniels, 1997).

3.3 Conservation Subdivisions

Similar to the cluster method of zoning, many authors of planning literature also promote the benefits of "conservation-based subdivisions" (Hollis *et al*, 2000; Burchell and Shad, 1998; Arendt, 1997; Forsyth, 1997; Southworth, 1997). The principles of conservation subdivisions are largely based on encouraging developers to build on smaller lots, if the developers set land aside for green space. If traditional residential zoning calls for the minimum site area of rural-residential development to be no less than two acres, a conservation subdivision allows developers to build the same number of homes on one acre lots if the other half of the land is left undeveloped and in its natural state.

Conservation based subdivisions can also be very appealing to developers of rural-residential development (Burchell and Shad, 1998; Hollis *et al*, 1997). Developers can reduce expenses by cutting fewer trees, grading less land and, in some cases, building fewer and shorter roads because homes are clustered closer together on smaller lots. By constructing rural-residential developments on smaller parcels, the developments are more feasible to service with piped water and sewer. Clustered lots would also reduce servicing costs to the developer because they also have less water and sewer piping to run through the development.

Conservation subdivisions have recently become popular in many regions of the United States (Smart Growth Network, 2001; State of South Carolina; 2001). The trend toward conservation subdivisions has addressed not only homebuyer preferences but also metropolitan Atlanta's impending water crisis (Atlanta Journal-Constitution, 2002). As land is lost to low-density rural-residential development, pastures and forests are replaced with parking lots, driveways, streets and other impervious surfaces. Remaining greenspace is often in the form of manicured lawns. These traditional features of rural-residential development often lead to rapid storm water runoff which, as mentioned earlier, is a primary source of ground and surface water pollution, and soil erosion (Sierra Club, 2001; Roseland, 1997; Hough, 1995; Spirn, 1984). Conservation subdivisions set aside a portion of the natural environment to allow storm water to seep into the ground, instead of draining over fields, roads, and parking lots, picking up pollutants and depositing them into local watercourses. If conservation subdivision designs are used effectively, natural, undisturbed land can store floodwaters, protect fields from soil erosion, buffer streams, and maintain natural habitats for animals (Atlanta Journal-Constitution, 2002; Sierra Club, 2001; Burchell and Shad, 1998; Hollis *et al*, 1997).

3.4 Urban Containment

In recent years, the concept of urban containment, or urban growth boundaries has been endorsed as an effective tool for curbing sprawling, low-density development (Pendall *et al*, 2002;. Hollis *et al*, 1997). Essentially, the

simplest form of enacting an urban containment policy would create a geographical containment of urban growth. However, a wide array of practices can affect urban containment, including regulation, public ownership of land, and policies regarding the timing and sequencing of public infrastructure construction (Nelson and Duncan, 1995).

The geographical pattern of urban growth in metropolitan areas is generally shaped in part by natural factors, such as the presence of mountain ranges or water bodies, and in part by the placement of centralized systems of public facilities (Mumford, 1963). These two important factors, natural open space constraints and infrastructure location, or the "push" and "pull" factors that shape urban form, are often viewed as the most important factors that shape regional growth (Pendall *et al*, 2002). Since the Capital Region of Manitoba essentially has no natural physical limits to urban growth, suburban development can "push" outward in all directions. This makes public policy and decision making regarding infrastructure location increasingly important.

Enacting an urban containment policy would involve an array of public policy tools to manipulate these "push" and "pull" factors so that regional development may take a desirable form. The goals of an urban containment policy can vary widely (Pendall *et al*, 2002), but they often include the following:

- *preservation of natural land, as well as farmland and resource extraction land whose economic value will not be able to compete with urban development;*
- *the cost-effective construction and use of existing urban infrastructure;*

- *reinvestment in existing urbanized areas that might otherwise be neglected; and*
- *the creation of higher-density land-use patterns that encourage a mix of uses and patronage of public transit, leading to a more efficient utilization of land in urbanized areas.*

Fundamentally, urban containment policies often utilize three different tools to shape regional development (McMahon, 2001). Greenbelts and urban growth boundaries are used to influence the geographic "push" factors and urban service areas are used to influence the infrastructure related "pull" factors. Each of these three urban containment policies, and their potential influence on regional planning in the Capital Region of Manitoba, are examined below.

3.4.1 Greenbelts

A greenbelt usually refers to a band drawn fairly tightly around a metropolitan area or region that is intended to be a permanent, or extremely difficult to change, physical limit of urban development (Pendall *et al*, 2002). Greenbelts are very often created by public or non-profit purchase of open space lands or development rights on farmland (American Farmland Trust, 2002; Grossi, 1999).

Though the use of greenbelts is fairly common in countries such as England and South Korea, only a few metropolitan regions in North America have conscious greenbelt policies (Lucy and Phillips, 2001). One North American metropolitan area that has had both success and failure in controlling and directing development has been Boulder, Colorado (City of Boulder, 2001). A greenbelt has been maintained around the City of Boulder

for nearly 35 years. The City and County of Boulder have promoted a systematic and successful approach to protecting open space, natural habitat, and biodiversity largely carried out through public land purchase. However, Boulder's greenbelt formation was largely accomplished without the cooperation and support of neighbouring jurisdictions. What has resulted has been the development of a series of communities built outside of Boulder's greenbelt. The resulting increase in commuting vehicular traffic is reported to have had significant negative impacts on regional air quality (Burchell and Shad, 1998).

Though the greenbelt around Boulder has been successful in terms of preserving open space and promoting a higher density form of development, the greenbelt policy has also been blamed for not only creating a series of bedroom communities outside the greenbelt, but also for significantly driving up the price of real estate within the region (City of Boulder, 2001). Many authors argue that where Boulder failed was in creating a mono-jurisdictional greenbelt policy that substantially limited growth in a metropolitan region that already had a relatively high population density and a number of topographical and geographical limits to urban development (Pendall *et al*, 2002; Lucy and Phillips, 2001). It is likely that the establishment of a greenbelt would not have as many side effects in a region with a relatively low population density and no significant geographical or topographical limits to urban growth, such as the Capital Region of Manitoba. However, the establishment of a greenbelt within the Capital Region of Manitoba may be

counter-productive in that it may potentially drive up the cost of real estate in the core of the Region and lead to an increase in population dispersal.

3.4.2 Urban Growth Boundaries

An urban growth boundary can best be described as being a line between urbanized and rural lands (Pendall *et al*, 2002). Urban growth boundaries, which are also referred to as "urban limit lines" (Smart Growth Network, 2001) or "green lines" (Sierra Club, 2002), are distinguishable from greenbelts in that urban growth boundaries are often deliberately designated to accommodate growth for a specified number of years. Such growth boundaries often utilize regulatory techniques, such as land-use designation and zoning, to prevent urban development outside of the urban growth boundary (Pendall *et al*, 2002).

Portland, Oregon is one North American jurisdiction that is often identified for its effort to direct growth by establishing urban growth boundary policies. In 1973, the State of Oregon connected state and local planning programs by drawing urban growth boundaries around all the metropolitan areas in the state (State of Oregon - Department of Land Conservation and Development, 1992). Oregon's urban growth boundaries both restrict the outward geographical expansion of the state's urbanized areas, but also maintain a rotating supply of developable land.

Essentially, an urban growth boundary would be highly ineffective at a regional scale without provincial intervention, such as the establishment of a provincially governed regional planning body or a great deal of inter-municipal

cooperation. Unfortunately, historical accounts of inter-municipal relations in the Capital Region of Manitoba reveal that inter-municipal cooperation has not been very successful (Levin, 1993). Likewise, feedback from recent Regional Planning Advisory Committee meetings has shown that many municipal officials and residents are highly reluctant to support any form of a provincially governed regional planning body. At recent meetings it was repeatedly stated that the Province should play a leadership role in regional planning, but should not consider implementing any new level of government. This negative response to a regional planning body, and the historical reluctance towards inter-municipal cooperation in the Region, greatly reduces the likelihood of the establishment of any form of an urban growth boundary in the Capital Region of Manitoba.

3.4.3 Urban Service Boundaries

An urban service boundary denotes the edges of an urban service area, and is typically more flexible than an urban growth boundary. Though urban service areas resemble urban growth boundaries in the sense that they create geographical limits on urban growth, they also tend to be more flexible and easier to move because they tend to be concerned with the geographical sequencing of growth rather than its constraint (Pendall *et al*, 2002). An urban service boundary essentially denotes a line beyond which a city has decided that its infrastructure, typically water and sewer, shall not extend (Meck, 1999).

One method of urban service boundary initiation is the establishment of a tier system. Tier systems utilize infrastructure capacity, current levels of development, and assessments of rural resource viability to identify areas within a region that are: (i) currently developed; (ii) areas that could host infill development; (iii) areas for new growth over a given time period; and (iv) areas where development should be avoided (Pendall *et al*, 2002). A regional planning body would be responsible for planning and building regional infrastructure such as highways, sewers, parks, airports, and solid waste management systems, as well as overseeing the development of a regional planning policy document and land use map (regional development plan and land use designation map). Ensuing municipal zoning by-laws would also be consistent with the regional tier system of land use planning.

However, similar to an urban growth boundary, an urban service boundary or any form of a tier system would require some form of regional planning or strong inter-municipal cooperation to be effective. Without a high degree of inter-jurisdictional cooperation, an urban service boundary may lead to leapfrog or non-contiguous development (McMahon, 2001; Mitchell, 2001; State of South Carolina, 2001). When individual jurisdictions create urban service boundaries within their own boundaries, they often do not act together to complement this with a comprehensive metropolitan strategy to contain or direct growth. Individual municipal development plans often are created according to economic, political, developmental and fiscal pressures felt by that individual municipal government, rather than respect regionally

based goals and objectives (Frontier Centre For Public Policy, 1999). In addition, when individual municipal plans deliberately attempt to shape growth, plans are not always consistently implemented or coordinated with plans of neighbouring municipalities, and are often subject to changes when municipal governments are pressured by developers (Pendall *et al*, 2002; Neiman and Fernandez, 2000; State of Oregon - Department of Land Conservation and Development, 1992).

Some authors make the argument that such an individualistic form of planning currently exists in the Capital Region (Lennon and Leo, 2001; Frontier Centre For Public Policy, 1999). The City of Winnipeg has extended its hard infrastructure services to City limits without consideration of extending services into neighbouring municipalities. It is argued that if these service extensions or service-sharing agreements were in place, ex-urban and rural-residential development would be easier to plan and direct. Without effective inter-municipal service sharing or a satisfactory form of regional planning, suburban and rural-residential development has simply traversed City of Winnipeg limits and occurred in traditionally agricultural rural municipalities surrounding the City of Winnipeg (Lennon and Leo, 2001).

It is apparent that the environmental systems (ground and surface water, resource base, drainage and flood control, air quality, and soil quality) are all impacted detrimentally by large-lot rural-residential development. Galster (*et al*, 2000) has identified that development that is low in density,

non-compact, lacking continuity and concentration, has negative impacts on the regional environment.

The next chapter analyses quantitative data sources and identifies development and population trends within the Capital Region of Manitoba. The results obtained from the review of data will be weighed against detrimental rural-residential development patterns identified earlier in this chapter. It will affirm that examples of existing development within the Capital Region, as well as recent development patterns and inter-municipal demographic trends, possess negative qualities identified in this chapter.

If detrimental rural-residential development practices continue unchecked, the regional environment stands to suffer greatly. Statistical data analyses performed in Chapter 4, combined with the indicators and alternatives identified in this chapter, will provide the framework for initial policy directives that would better protect the regional environment from impacts associated with large-lot rural-residential development.

The combination of the review of current planning literature and the identification of recent population dispersal trends will also provide a solid base for reviewing current planning policy within Manitoba. If existing planning policy is unable to control rural-residential development, the synthesis between understanding the impacts and the identification of the trends will produce a background for the subsequent review of existing planning policy in the Capital Region. These findings will also include specific areas for future research to solidify planning policy direction in the Region.

4.0 Data Collection and Analysis

So far, the examination and analysis of the environmental impacts associated with different patterns of large-lot rural-residential fringe development within the Manitoba Capital Region have primarily involved a thorough review of relevant planning literature. This chapter consolidates and condenses diverse sources of information, acquired from different levels of government and different departments and agencies within individual levels of government, and relates the findings towards the long-term environmental sustainability of the Region. The trends revealed in this chapter will be compared to indicators of sustainable regional development identified in Chapter 3. These findings will be utilized to gauge what impact current development in the Capital Region is having on the regional environment.

4.1 Census Data

Statistics Canada census data has been examined to identify intra-municipal and inter-municipal trends in population and population densities. The analysis of census data information dating back to the early 1900s provides an introduction to individual Capital Region municipalities as to their historical role and significance within the region. When relating the following tables and graphs – displaying population and density changes – to subdivision and housing start statistics that will be identified later, the findings will identify that the relative percentages of large-lot rural-residential population in many rural municipalities has increased significantly in recent census years. The examination of census data alone does not yield

conclusions on rural-residential development patterns and development trends within individual municipalities. However, the analyses of regional population density, subdivision starts, and population dispersal trends – along with past census data – displays the extent to which land use patterns within the Region have altered. The following table is a chronicle of historical population data of Capital Region municipalities and the proportion of the regional population accounted for by the City of Winnipeg.

Table 4.0: Capital Region of Manitoba - Historical Population Data

	Capital Region Population						
Municipality	*1921*	*1941*	*1961*	*1971*	*1981*	*1991*	*2001*
Cartier (RM)	2,476	3,590	3,161	2,987	2,825	3,115	3,120
East St. Paul (RM)	667	1,055	1,982	2,616	3,596	5,820	7,677
Headingley (RM)*	N/A	N/A	N/A	N/A	N/A	1,575	1,907
Macdonald (RM)	2,993	3,676	2,983	3,169	3,403	3,999	5,320
Ritchot (RM)	1,880	2,624	2,509	2,946	4,262	5,146	4,958
Rockwood (RM)	5,177	5,369	4,872	5,341	6,321	6,990	7,654
Rosser (RM)	3,730	1,709	1,751	1,771	1,326	1,364	1,412
Selkirk (City)	3,726	4,915	8,576	9,331	10,037	9,815	9,752
Springfield (RM)	5,345	6,863	5,608	5,955	8,989	11,102	12,602
St. Andrews (RM)	4,319	6,476	5,326	5,865	7,990	9,471	10,695
St. Clements (RM)	5,212	6,769	5,247	5,047	6,294	7,823	9,115
St. Francois Xavier (RM)	692	824	694	645	780	898	1,024
Stonewall (Town)	1,112	1,020	1,420	1,583	2,217	2,997	4,012
Taché (RM)	2,185	3,748	3,450	3,749	5,893	7,576	8,578
West St. Paul (RM)	510	1,032	2,032	2,429	2,745	3,658	4,085
Winnipeg (City)**	228,035	299,937	471,884	535,217	564,473	615,215	619,544
Total Population	268,059	349,607	521,495	588,651	631,151	696,564	711,455
Winnipeg's % of CR	85.1%	85.8%	90.5%	90.9%	89.4%	88.3%	87.1%

*Historical population data for Headingley was not tabulated until it seceded from the City of Winnipeg in 1991.
** Historical population data for the City of Winnipeg accounts for all municipalities that were annexed to form Unicity, though the unification did not occur until 1972.

Table 4.1 displays the percentage change in population amongst Capital Region municipalities from the 1976 census to the most recent 2001 census (see Figure 4.0 for a bar-graph representation). The twenty-five year span was chosen not only because it is a round figure, but also because it

was in 1976 that the Province of Manitoba adopted a new *Planning Act* to help direct and regulate the subdivision of land within the Province of Manitoba.

Table 4.1: Municipal percentage population change: 1976 - 2001.

Municipality	*% change from 1976 - 2001*
Cartier (RM)	7.7%
East St. Paul (RM)	127.9%
Headingley (RM)*	21.1%
Macdonald (RM)	63.8%
Ritchot (RM)	31.6%
Rockwood (RM)	28.4%
Rosser (RM)	11.3%
Selkirk (City)	-1.1%
Springfield (RM)	81.5%
St. Andrews (RM)	56.7%
St. Clements (RM)	59.4%
St. Francois Xavier (RM)	48.0%
Stonewall (Town)	119.7%
Taché (RM)	93.4%
West St. Paul (RM)	58.9%
Winnipeg (City)	10.5%
Capital Region Total	14.7%

* % change for the Rural Municipality of Headingley is from 1991 - 2001.

Figure 4.0: Capital Region Population Change

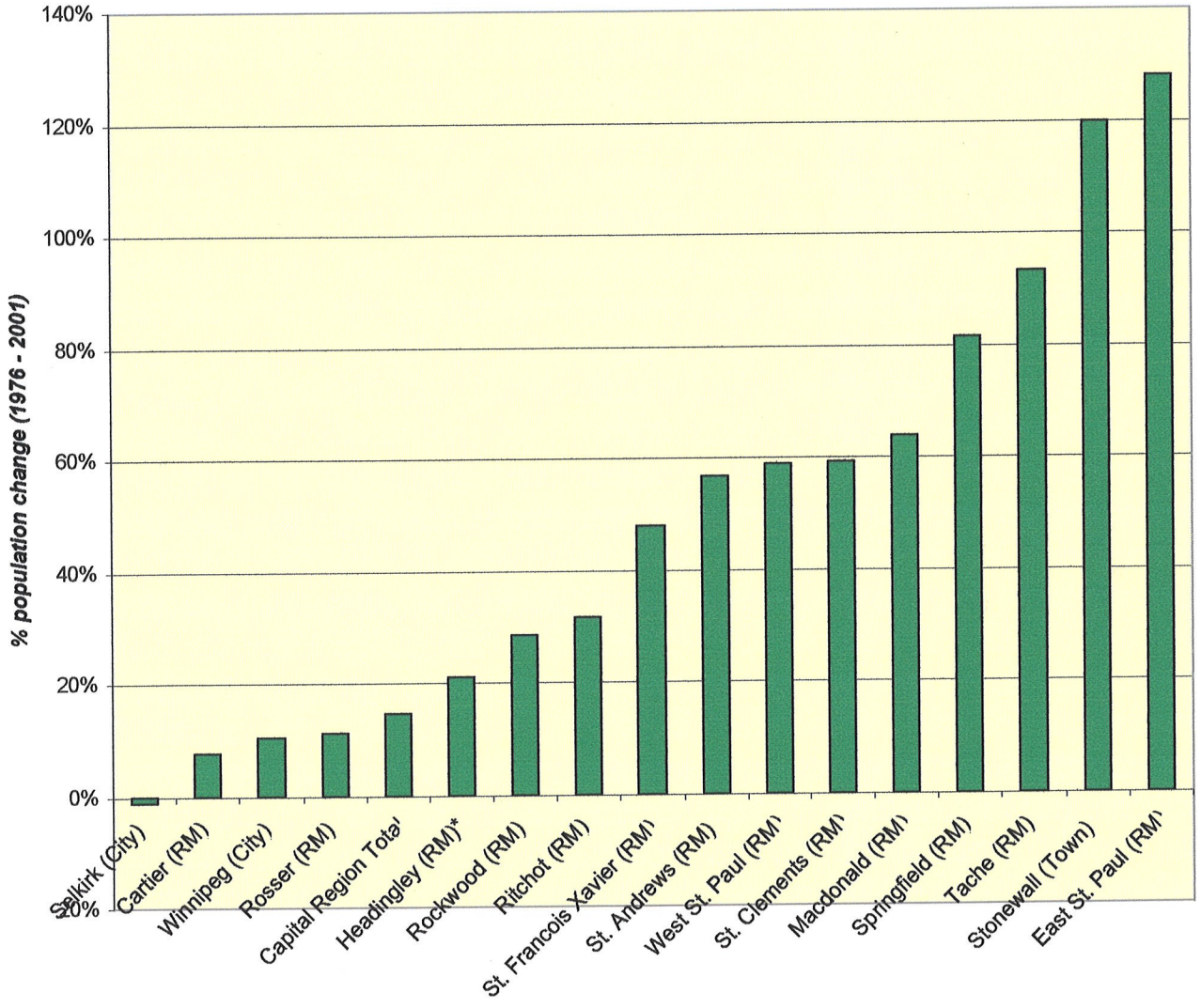


Table 4.2: Urban vs. Rural Municipalities: Population changes (1981-2001).

Rural Municipalities	*1981*	*1991*	*2001*
Cartier (RM)	2,825	3,115	3,120
East St. Paul (RM)	3,596	5,820	7,677
Headingley (RM)*	N/A	1,575	1,907
Macdonald (RM)	3,403	3,999	5,320
Ritchot (RM)	4,262	5,146	4,958
Rockwood (RM)	6,321	6,990	7,654
Rosser (RM)	1,326	1,364	1,412
Springfield (RM)	8,989	11,102	12,602
St. Andrews (RM)	7,990	9,471	10,695
St. Clements (RM)	6,294	7,823	9,115
St. Francois Xavier (RM)	780	898	1,024
Taché (RM)	5,893	7,576	8,578
West St. Paul (RM)	2,745	3,658	4,085
Total Rural Population	54,424	68,537	78,147
% "rural" population change (1981 - 2001)			43.6%

Urban Municipalities	*1981*	*1991*	*2001*
Selkirk (City)	10,037	9,815	9,752
Stonewall (Town)	2,217	2,997	4,012
Winnipeg (City)	564,473	615,215	619,544
Total Urban Population	576,727	628,027	633,308
% "urban" population change (1981 - 2001)			9.8%

* % change for the Rural Municipality of Headingley is from 1991 - 2001.

When examining the historical raw municipal population data and the percentage change in population for certain Capital Region municipalities it is possible to associate the above tables with many environmentally related detriments and benefits regarding recent rural-residential development within the Region.

4.1.1 City of Winnipeg

As population throughout the Region grew over the past century, the City of Winnipeg's proportion of the Capital Region population appears to have peaked at the 1971 census. Though the population of Winnipeg has continued to increase (albeit at an extremely slow rate when compared to

other major Canadian cities (Hodge and Robinson, 2001)), the percentage of the regional population that resides in the City of Winnipeg has declined from a high of 90.9% in 1971 to 87.1% in 2001. At first glance, this may not appear to be a significant change. In regions with a rapidly expanding population, intensive growth at the metropolitan fringe is often anticipated and expected. However, in a region that has not experienced a significant increase in the total population, the observed drop in Winnipeg's percentage of the regional population, can be directly translated to a dispersal in regional population, and a resulting decrease in density, concentration and compactness.

It can be argued that population dispersal observed within the Region is partly attributed to suburban development within City limits. As shown in Appendix 1, the population of neighbourhoods that composed the pre-unicity City of Winnipeg have decreased by 11% since 1971. By contrast, neighbourhoods that are currently within the City of Winnipeg boundaries that were not within the original city limits have increased in population by 42% since 1971. Some might argue that those residents who have migrated from older areas of Winnipeg have simply moved to newer subdivisions within Winnipeg City limits. However, the observed decrease in (post-unicity) Winnipeg's *proportion* of the regional population identifies that in this relatively slow growing region, a disproportionally large amount of development seems to be occurring outside City limits.

As a whole, a larger percentage of the regional population is now living in municipalities that were traditionally rural (Levin, 1993) (see Table 4.2). As

a result, the amount of agricultural land available for production within the Region is declining, as is the feasibility of effectively servicing the regional population with public transportation (resulting in a negative effect on regional air quality), and as is the amount of natural land available for the long-term sustainability of the regional biodiversity.

When examining the population trends of the two other urban municipalities within the Capital Region, the City of Selkirk and the Town of Stonewall, differing population trends are witnessed.

4.1.2 City of Selkirk

Selkirk, the second most populated urban centre in the Capital Region, has actually experienced a decrease in population in recent censuses. The observed decline in the population of the City of Selkirk, and increase in the populations of rural municipalities surrounding Selkirk (St. Andrews and St. Clements) strengthens the argument that traditionally urban areas within the Capital Region of Manitoba are suffering. As a result, the Capital Region as a whole is exhibiting a decline in population compactness and concentration. When the overall population of the Capital Region is increasing and the second largest urban municipality displays a decrease in population, the result is a decrease in regional population density and a probable likewise decrease in the amount of agricultural land available for production within the region.

4.1.3 Town of Stonewall

Contrary to recent trends observed in the City of Selkirk, the Town of Stonewall has had a relatively significant increase in population over recent years. The population of Stonewall has nearly doubled over the past twenty years alone. However, though Stonewall's population has increased significantly from an individual municipal perspective, when relating the growth of the Town to recent regional trends, it does not nearly account for the proportionate loss in population realized by the other urban areas within the Capital Region (see Table 4.2) (Winnipeg and Selkirk). The thirteen *rural* municipalities throughout the Capital Region have displayed over four times the proportional increase in population since 1981 when compared to the three urban municipalities within the Region.

Although recent population trends (and resulting environmental impacts) associated with the Capital Region, as a whole, are not encouraging, the recent growth of the Town of Stonewall is, relatively speaking, environmentally exemplary. Stonewall displays a relatively compact urban form and provides many residents with a variety of services that are within walking distance for most town residents. As a result, Town residents are not entirely reliant on personal automobiles for the most basic of needs. Development within Stonewall has not contributed to a significant loss of productive agricultural land, and as a result, displays traits of high compactness, concentration and centrality. The community of over 4,000 is developed over only approximately two square-miles of land. Town residents

are also provided with municipal water and sewer services, so growth and development within this centre is not as environmentally detrimental to regional surface and ground water, as would be ex-urban development reliant on septic fields.

Though Stonewall is a good local example of a relatively compact, non-polluting form of development, the town is largely reliant on the City of Winnipeg in a number of ways. Other than a variety of local professional, service sector related, and associated agricultural and quarry-related employment, Stonewall is largely a "bedroom" community of Winnipeg, i.e. a community in which much of the labour force works in (and commutes to) a larger neighbouring centre (Smart Growth Network, 2001; Talen, 2001).

4.1.4 River Lot Municipalities

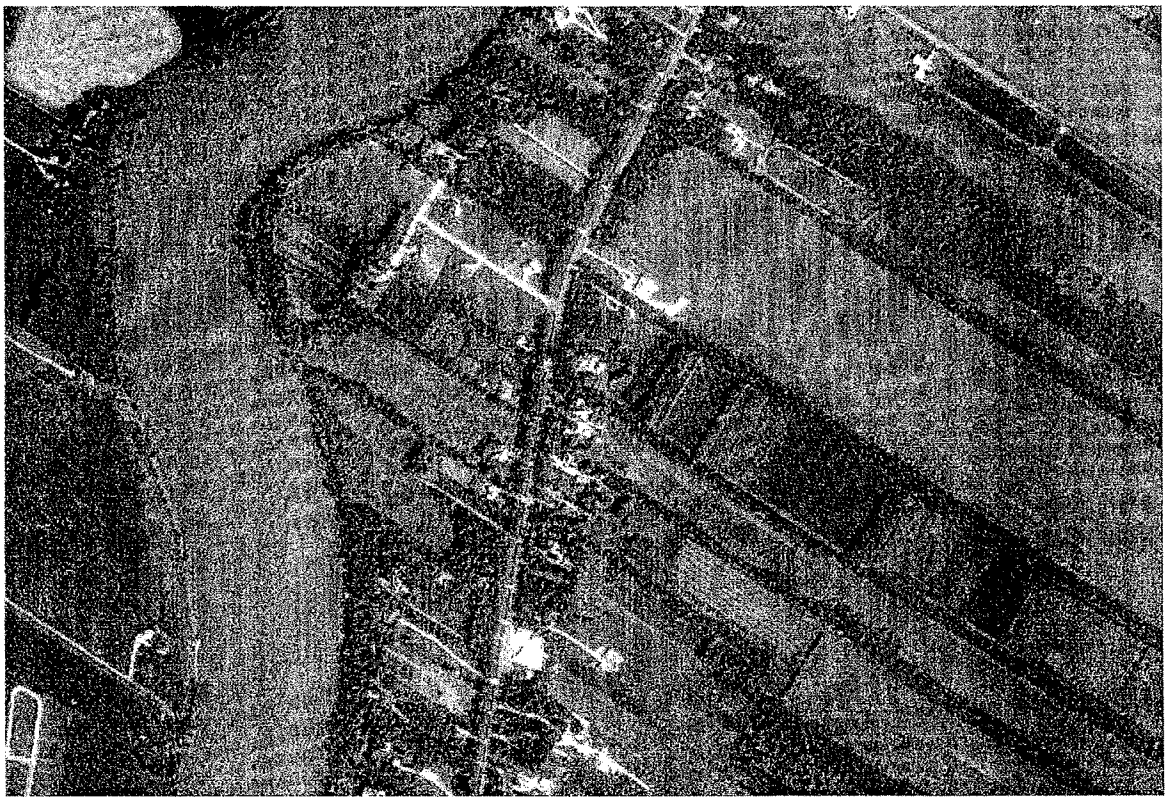
Another trend that is observed when examining regional population trends over the past century is the dramatic increase in the population of particular, traditionally agricultural, rural municipalities. The populations of Taché, East St. Paul, West St. Paul, St. Francois Xavier, Ritchot, St. Andrews, and St. Clements have increased significantly over recent decades (see Table 4.0). The Rural Municipalities of Ritchot and St. Francois Xavier have both experienced a proportional population increase over double the increase observed for the Region as a whole. Three Rural Municipalities located in the strip of land along the Red River between Winnipeg and Selkirk - West St. Paul, St. Andrews, and St. Clements - have observed percentage population increases of nearly four times the increase observed by the entire

Region. The percentage population increase of the Rural Municipality of Taché was over six times that of the regional percentage increase, while the population of East St. Paul has increased over eight-and-a-half times that of the Capital Region percent increase over the same period of time. Though specific population densities of these municipalities have increased (as will be analyzed subsequently), the increase in municipal population has come largely, it must be assumed, at the expense of agricultural lands.

One specific parallel can be identified among the aforementioned rural municipalities that have experienced significant increases in population in recent decades. Nearly every rural municipality in the Capital Region that is, in whole, or in part, made up of the seigneurial system of river lots, has displayed a relative abundance of rural-residential development in recent decades.

French-Canadian settlers instituted the seigneurial system of constituting land ownership in the mid-to-late 1800s. The seigneurial system of land ownership divided land into a series of narrow parcels called *River Lots* or *Parish Lots*. These parcels, which often extended four miles in each direction from the river, together formed a *'Parish'* or *'Settlement'*. Settlers favoured river lots because it ensured each landowner would have access to the river, the riparian forest, and the river road (see Figure 4.1). Parishes established in southern Manitoba were subdivided similarly to those that were created along the banks of the Saint Lawrence River, and other rivers throughout eastern Canada, centuries earlier (Levin, 1993).

Figure 4.1: RM of St. Clements – River Lot Land Division



Source: Manitoba Land Initiative, 2003.

Towards the end of the last century, agricultural practices changed dramatically across much of North America (American Farmland Trust, 2002). To become more economically competitive in a global market, many small family farms were consolidated and increased dramatically in size to establish intensive agricultural operations. However, farm consolidations, and hence property consolidations, would have been much more difficult to achieve in areas where adjacent properties were divided into a series of narrow parcels, as they are in areas divided into river lots. It is quite probable that, prior to the adoption of *The Planning Act* in 1976, and the resulting provincial regulation of the subdivision of land, many owners of agricultural land located on river lots found it more feasible to further subdivide their land than to consolidate it with adjacent agricultural parcels.

The practice of further subdividing river lots continued after the adoption of *The Planning Act* in 1976. Municipal governments seemingly viewed the further fragmentation of these parcels for rural-residential use as an efficient form of low-density, infill development. The Rural Municipality of Taché Development Plan states that "*within…existing rural residential clusters…limited infill subdivision may be allowed*" (Policy A.5.6, pp. 10). Essentially, narrow strips of agricultural land located between existing rural-residential parcels are often viewed as useless for modern large-scale agricultural activities. As a result, municipal governments, such as the Rural Municipality of Taché, have provisions within their Development Plans to accommodate this type of development. Such development is often viewed as

being economically beneficial from the perspective of the provision of existing municipal services such as "*all-weather roads, hydro, school bussing* [sic]" (Policy B.5.6 (iv), pp. 12).

Unfortunately, the environmental impacts that can be associated with rural-residential development along river lots in the Capital Region of Manitoba are quite severe. Not surprisingly, rural-residential parcels developed on river lots are often very close to surface water bodies. As illustrated in Figure 2.0, the soil base in the Region is high in clay content and often impermeable to the percolation of liquids. Soils near rivers and streams are particularly likely to have a high content of clay (Manitoba Environment, 1997). Rural-residential parcels found on river lots are often between one and four acres in size and are often serviced via individual wells and septic fields. What often results during periods of severe precipitation, is the surface flow of sewage from saturated septic fields directly into nearby the watercourses (Winnipeg Free Press. 2002(a)).

Table 4.3 compares land area and population densities for the municipalities of the Capital Region of Manitoba. Population density has been identified at five-year intervals to illustrate population density changes over the past decade within the Region. A comparison of population density among rural municipalities in the Region is an effective method of observing differences in agricultural land fragmentation between municipalities.

Table 4.3: Capital Region Municipalities - Land Area & Population Density

		Population			Density (people / km^2)		
Municipality	**Area (km^2)**	**1991**	**1996**	**2001**	**1991**	**1996**	**2001**
Cartier (RM)	512	3,115	3,009	3,120	6.1	5.9	6.1
East St. Paul (RM)	44	5,820	6,437	7,677	132.3	146.3	174.5
Headingley (RM)	107	1,575	1,587	1,907	14.7	14.8	17.8
Macdonald (RM)	1,106	3,999	4,900	5,320	3.6	4.4	4.8
Ritchot (RM)	337	5,146	5,364	4,958	15.3	15.9	14.7
Rockwood (RM)	1,154	6,990	7,504	7,654	6.1	6.5	6.6
Rosser (RM)	425	1,364	1,349	1,412	3.2	3.2	3.3
Selkirk (City)	25	9,815	9,881	9,752	392.6	395.2	390.1
Springfield (RM)	1,059	11,102	12,162	12,602	10.5	11.5	11.9
St. Andrews (RM)	705	9,471	10,144	10,695	13.4	14.4	15.2
St. Clements (RM)	729	7,823	8,516	9,115	10.7	11.7	12.5
St. Francois Xavier (RM)	215	898	992	1,024	4.2	4.6	4.8
Stonewall (Town)	6	2,997	3,689	4,012	499.5	614.8	668.7
Taché (RM)	559	7,576	8,273	8,578	13.6	14.8	15.3
West St. Paul (RM)	84	3,658	3,720	4,085	43.5	44.3	48.6
Winnipeg (City)	464	615,215	618,477	619,544	1325.9	1332.9	1335.2
Total	**7,531**	**696,564**	**706,004**	**711,455**	**92.5**	**93.7**	**94.5**

Though the majority of Capital Region municipalities are experiencing an increasing population density, this can simply be related to individual gains in municipal populations. An increase in density does not result in a corresponding increase in compactness, centrality, contiguity and concentration. Table 4.3 also illustrates the differences in population densities amongst Capital Region municipalities. As expected, the three urban municipalities within the Region display much higher population densities than rural Capital Region municipalities. More noteworthy, is the difference in population densities between "rural" municipalities within the Region. The municipalities of East St. Paul and West St. Paul have much higher population densities compared to municipalities such as Rosser, Cartier, Macdonald and Rockwood. The observed difference in densities can be

attributed to a lower degree of concentration in the East and West St. Paul and a higher degree of compactness in the four others municipalities.

4.2 Municipal Subdivision Statistics

Statistics for individual lot sizes and lot densities have been calculated for all Capital Region municipalities. These analyses not only display inter-municipal subdivision trends, but also help identify probable environmental impacts resulting from certain densities of rural-residential development.

The subdivision of agricultural land for non-agricultural uses has been a common occurrence throughout the Province of Manitoba in recent years. Based on subdivision statistics compiled by Manitoba Intergovernmental Affairs, Manitoba Agriculture and Food has estimated that approximately 14,719 acres of agricultural land has been subdivided for rural-residential uses in Manitoba between 1991 and 2001 (Kabernick, Christine. Manitoba Agriculture and Food - Agricultural Land Use Planning Specialist, Personal Communication, 02/07/03). This is the equivalent of approximately 60 square-kilometres of productive agricultural land being lost for rural-residential purposes.

Rural-residential subdivision not only consumes agricultural land, but can also have a negative impact on water quality. Generally, the larger the individual parcel of land in a rural-residential subdivision, the less likely it is that each parcel will be serviced with water and sewer systems (Haldenby, 2001; Marchand and Charland, 1992). Rural-residential lots that are larger than one-half acre (21,780 ft^2) in size often rely on individual wells and

groundwater for their source of drinking water and are also strongly reliant on individual sewage disposal systems such as septic fields, sewage ejectors, or holding tanks (Manitoba Conservation, 2001; The Sierra Club, 2001; Marsh, 1998).

As discussed earlier, it is strongly believed and often argued that large-lot rural-residential subdivisions that utilize wells and septic tanks pose greater risks to the quality and quantity of ground and surface water, and are more prone to experience drainage and erosion difficulties than are more compact, serviced developments (Winnipeg Free Press, 2002 (a); Ross, 2001; Richardson and Eby, 2000; Walton, 2000; Arendt, 1997; Walker and Rees, 1997).

Subdivision statistics dating back to 1996 have been tabulated and analyzed for all municipalities within the Capital Region of Manitoba with the exception of the City of Winnipeg (see Table 4.4). The following municipal subdivision statistics identify the number of urban and the number of non-farm (rural-residential) parcels that have been subdivided within the Capital Region of Manitoba over the past five years.

Table 4.4: Capital Region Subdivision Statistics (1996-2001)

	Urban Subdivisions[1]		
Municipality	*Number of lots*	*Number of acres*	*acres / lot*
Cartier (RM)	4	3.41	0.85
East St. Paul (RM)	661	333.83	0.51
Headingley (RM)	146	136.02	0.93
Macdonald (RM)	53	38.81	0.73
Ritchot (RM)	55	19.11	0.35
Rockwood (RM)	8	3.60	0.45
Rosser (RM)	1	4.00	4.00
Selkirk (City)	3	0.41	0.14
Springfield (RM)	3	0.75	0.25
St. Andrews (RM)	1	1.37	1.37
St. Clements (RM)	17	27.29	1.61
St. Francois Xavier (RM)	9	9.00	1.00
Stonewall (Town)	64	14.79	0.23
Taché (RM)	59	23.21	0.39
West St. Paul (RM)	0	0.00	0.00
Totals	*1,084*	*615.70*	*0.57*

	Rural-Residential Subdivisions[2]		
Municipality	*Number of lots*	*Number of acres*	*acres / lot*
Cartier (RM)	6	29.53	4.92
East St. Paul (RM)	44	143.35	3.26
Headingley (RM)	14	45.58	3.26
Macdonald (RM)	4	17.76	4.44
Ritchot (RM)	11	45.53	4.14
Rockwood (RM)	16	118.16	7.39
Rosser (RM)	4	25.40	6.35
Selkirk (City)	0	0.00	0.00
Springfield (RM)	97	559.20	5.76
St. Andrews (RM)	118	229.97	1.95
St. Clements (RM)	29	90.04	3.10
St. Francois Xavier (RM)	15	36.97	2.46
Stonewall (Town)	0	0	0.00
Taché (RM)	112	516.06	4.61
West St. Paul (RM)	51	176.11	3.45
Totals	*521*	*2033.66*	*3.90*

[1] Manitoba Intergovernmental Affairs Provincial Planning Services Branch regards all subdivisions within incorporated villages and towns, local urban districts, or designated settlement areas as urban subdivisions.

[2] Manitoba Intergovernmental Affairs Provincial Planning Services Branch tabulates all rural, non-farm, subdivision under 10 acres in size, and not located within an incorporated village or town, local urban district, or designated settlement area, as a rural-residential subdivision.

When totaling both the number of urban and rural-residential subdivisions within the Capital Region of Manitoba over the past five years, a cumulative total of 1,605 parcels, under 10 acres in size, have been created. Likewise, when totaling the number of acres of land involved in both urban and rural-residential subdivisions in the Capital Region, we see that 2649.36 acres of land have been subdivided over the past five years. This is the equivalent of over 4.1 square-miles of being subdivided for either urban or rural-residential purposes over the past five years alone.

The increase in population in Capital Region municipalities (excluding the City of Winnipeg) between 1996 and 2001 totaled 4,384. If we divide the number of acres of land that have been subdivided for residential purposes in the Capital Region of Manitoba over the past five years by the increase in the number of people, each individual person is accounting for 0.6 acres of land. This is the equivalent of approximately 26,300 square feet of land per person.

Granted, the figure obtained from this calculation is based on an obviously over-simplified method of estimating the effect that recent population growth and subdivision activity has had on agricultural land in the Capital Region. It is also acknowledged that farmstead subdivisions for retiring resident farmers are also tabulated as rural-residential subdivisions, and that this calculation also does not account for current residents of rural Capital Region municipalities who are simply moving to new residences within their home municipality. However, regardless of these considerations, the

parcels of land have been subdivided and have likely been taken out of agricultural production.

When relating land consumption to population growth, it cannot be argued that current rates of subdivision and rural-residential development are highly unsustainable for a region not experiencing significant population growth. In a period of agriculture where small family farms are frequently incorporating and merging with neighbouring farms in attempts to become more economically viable (Homsy, 1995), one would expect to be observing an increase in parcel consolidations, rather than a significant increase in the number of parcel subdivisions.

However, the amount of farmland lost to this pattern and pace of development is arguably unsustainable. Considering that each additional resident to the Capital Region is accounting for over one-half acre of land, it is safe to assume that the majority of recently subdivided residential parcels are not serviced with municipal water and sewer infrastructure. Likewise, the feasibility of efficiently servicing such patterns of residential development with public transit is next to impossible, thus resulting in detriments to regional air quality.

The above calculations are rough indicators of how recent residential subdivision trends and development patterns in the Capital Region of Manitoba are environmentally unsustainable in regards to loss of agricultural land, and degradation of surface and groundwater quality, and air quality. Though not all parcels subdivided for residential purposes are immediately

developed, land that is subdivided is often permanently removed from agricultural production.

Development fees and residential property taxes are important sources of revenue for all municipalities. However, the subdivision of land for residential development on non-serviced, large-lot parcels can be associated with a number of negative environmental impacts. By examining population growth rates and subdivision trends of two particular municipalities within the Capital Region of Manitoba, it becomes apparent that a *rural* municipality may be able to experience residential growth without severely depleting regional agricultural land resources.

4.2.1 Macdonald vs. Springfield

When comparing population and subdivision trends between the Rural Municipalities of Macdonald and Springfield, the variation in subdivision and development trends between Capital Region municipalities becomes readily apparent. Recently released 2001 census data shows that the population of the two municipalities grew by roughly the same amount. In the five years between 1996 and 2001, the population of the Rural Municipality of Springfield increased by 440, while over the same five-year span, the population of the Rural Municipality of Macdonald increased by 420.

However, when comparing subdivision activity for the two municipalities over the same period of time, significant contrasts become evident. Though both municipalities have a number of existing settlement centres (see Appendix 3), development within settlement centres in the two

municipalities differed greatly. Between 1996 and 2001, 53 urban lots encompassing a total of approximately 39 acres were created in the Rural Municipality of Macdonald. Over the same five-year span only 3 urban lots, accounting for less than one acre of land, were created in the Rural Municipality of Springfield.

When examining rural-residential subdivision activity in the two municipalities between 1996 and 2001, major differences are apparent. In Macdonald only 4 rural-residential parcels, totaling approximately 18 acres were created. However, over the same five-year span, 97 rural-residential lots that encompassed approximately 560 acres of land were created within the Rural Municipality of Springfield.

Combining the totals of both urban and rural-residential lots created in the two municipalities over the past five years, 57 lots were created in Macdonald at an average parcel size of just under 1 acre. Meanwhile, in the past five years in Springfield, a total of 100 urban and rural-residential parcels were created at an average parcel size of approximately 5.6 acres.

This brief analysis, of two primarily agricultural Capital Region municipalities, underlines the difference in development patterns occurring within the Region. In just five years, in two rural municipalities that occupy comparable land areas, one municipality created close to twice as many parcels occupying close to ten times as much of the regional land base, to accommodate approximately the same increase in population.

This analysis suggests that some form of region-wide subdivision policies, and a region-wide development plan and land use map may be necessary to help direct regional development in a more sustainable manner.

4.3 Capital Region Housing Starts

The number of annual municipal housing starts was tabulated for municipalities within the Capital Region of Manitoba. The analysis of inter-municipal housing starts makes it possible to identify recent residential development trends and patterns within the Capital Region, and relate these trends to previously mentioned environmental impacts.

Generally, as development spreads farther from the regional urban core, negative environmental impacts on air quality and resource utilization are intensified as rural-residential developments become increasingly difficult to service effectively with public transportation (Bourne, 2001; Berke and Conroy, 2000; Daniels, 1997; Ewing, 1997; Forsyth, 1997). Accordingly, as residential development disperses from the urban core, households become increasingly reliant on use of the personal automobile (Clean Air Trust, 2002). As reliance on the personal automobile increases, so too do the number of roadways and the number of lanes required for highways to function efficiently (State of Oregon - Department of Land Conservation and Development, 1992).

This observation is readily apparent by examining a local road map of the Capital Region of Manitoba (see Appendix 2). A total of eight four-lane highways radiate from the urban core of the Region (City of Winnipeg).

However, of these eight four-lane highways, only three (the Trans-Canada Highway eastward and westward, and PTH 75 south) are four-lane highways beyond the limits of the Capital Region.

Comparing the Capital Region of Manitoba to other prairie urban regions underlines the dispersal transpiring within the Region. Both Calgary and Edmonton, two urban regions with larger and faster growing populations, both without significant geographic limitations to development, and both located in a province (Alberta) that has more financial and physical resources per capita to develop highway infrastructure, have fewer four-lane highways radiating from their urban cores.

Table 4.5: Total Number of Housing Starts in Capital Region Municipalities.

Municipality	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*Totals*
Cartier (RM)	12	9	10	9	9	10	8	4	7	3	8	101
East St. Paul (RM)	40	37	70	58	46	63	65	109	87	60	57	749
Headingley (RM)	4	4	12	2	8	8	6	7	41	28	29	120
Macdonald (RM)	37	52	49	65	52	42	27	37	30	36	35	463
Ritchot (RM)	20	22	20	30	17	17	40	38	10	10	9	214
Rockwood (RM)	11	19	18	23	16	17	19	21	16	16	4	250
Rosser (RM)	3	2	1	1	4	3	4	2	3	1	1	25
Selkirk (City)	7	7	24	13	10	6	15	10	10	6	4	120
Springfield (RM)	75	80	67	78	62	63	49	60	57	30	41	530
St. Andrews (RM)	50	51	62	62	47	55	42	51	74	18	36	595
St. Clements (RM)	40	40	47	61	49	42	51	39	53	51	47	582
St. Fr. Xavier (RM)	7	11	8	7	1	5	6	5	4	7	4	34
Stonewall (Town)	15	25	72	58	34	29	39	23	24	14	14	341
Taché (RM)	33	46	43	70	53	61	61	43	49	32	37	467
West St. Paul (RM)	14	15	15	15	8	35	39	29	28	18	19	221
Winnipeg (City)	896	1,192	1,036	1,053	679	659	883	768	814	707	840	9,527
Total	1,264	1,612	1,554	1,605	1,095	1,115	1,354	1,246	1,307	1,037	1,185	14,339
Winnipeg's % of CR	70.9%	73.9%	66.7%	65.6%	62.0%	59.1%	65.2%	61.6%	62.3%	68.2%	70.9%	66.4%

* Table 4.5 accounts for only single-family housing starts.
** Source: Manitoba Intergovernmental Affairs – Assessment Branch

Table 4.5 and Figures 4.2 and 4.3 illustrate the number of municipal housing starts within Capital Region municipalities over the fifteen-year span between 1985 to 2000. Over this time, it becomes evident that the City of

Figure 4.2: Capital Region – Single-Family Housing Starts (1985-2000) City of Winnipeg, Remaining Capital Region Municipalities, and Capital Region Total.

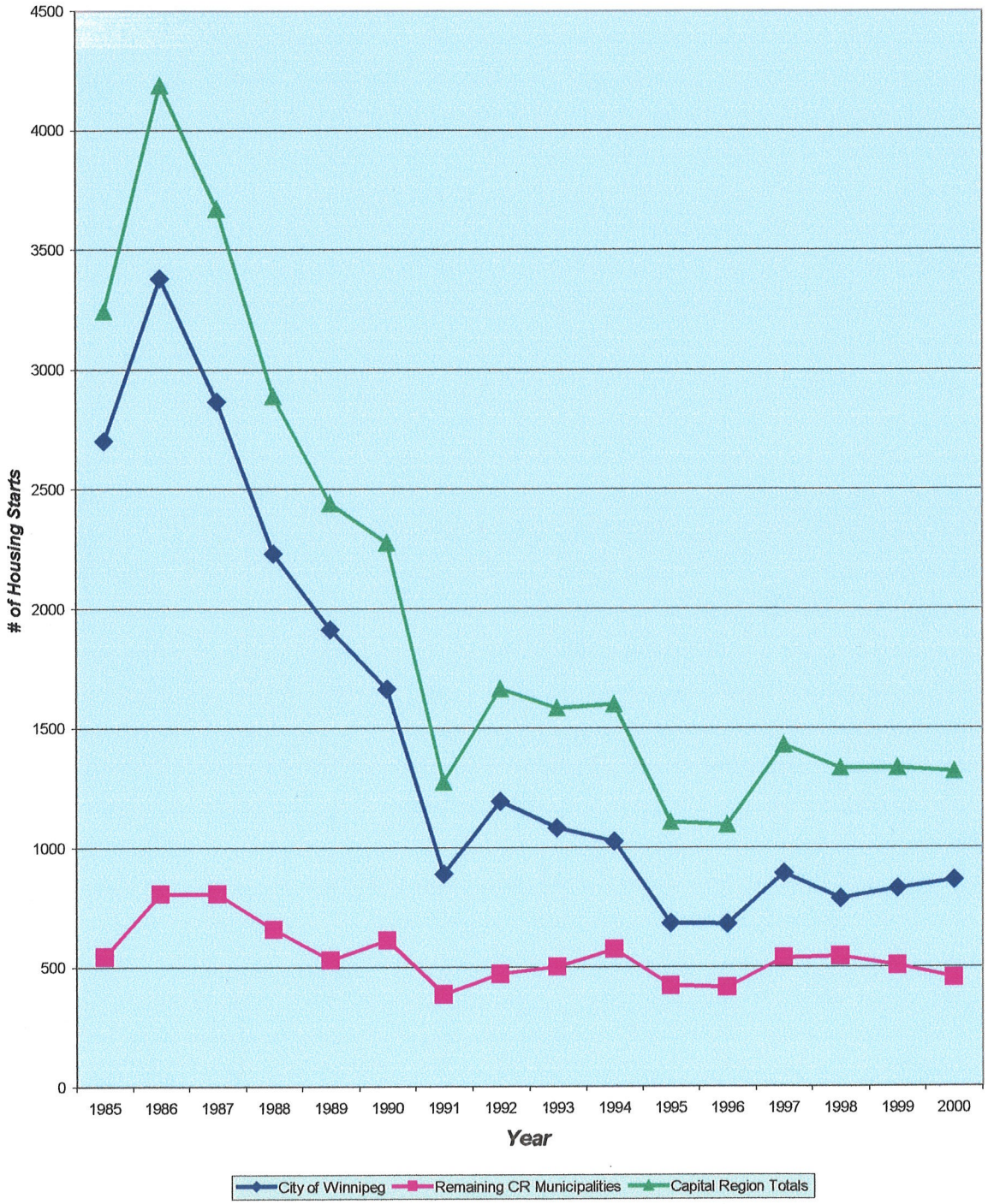
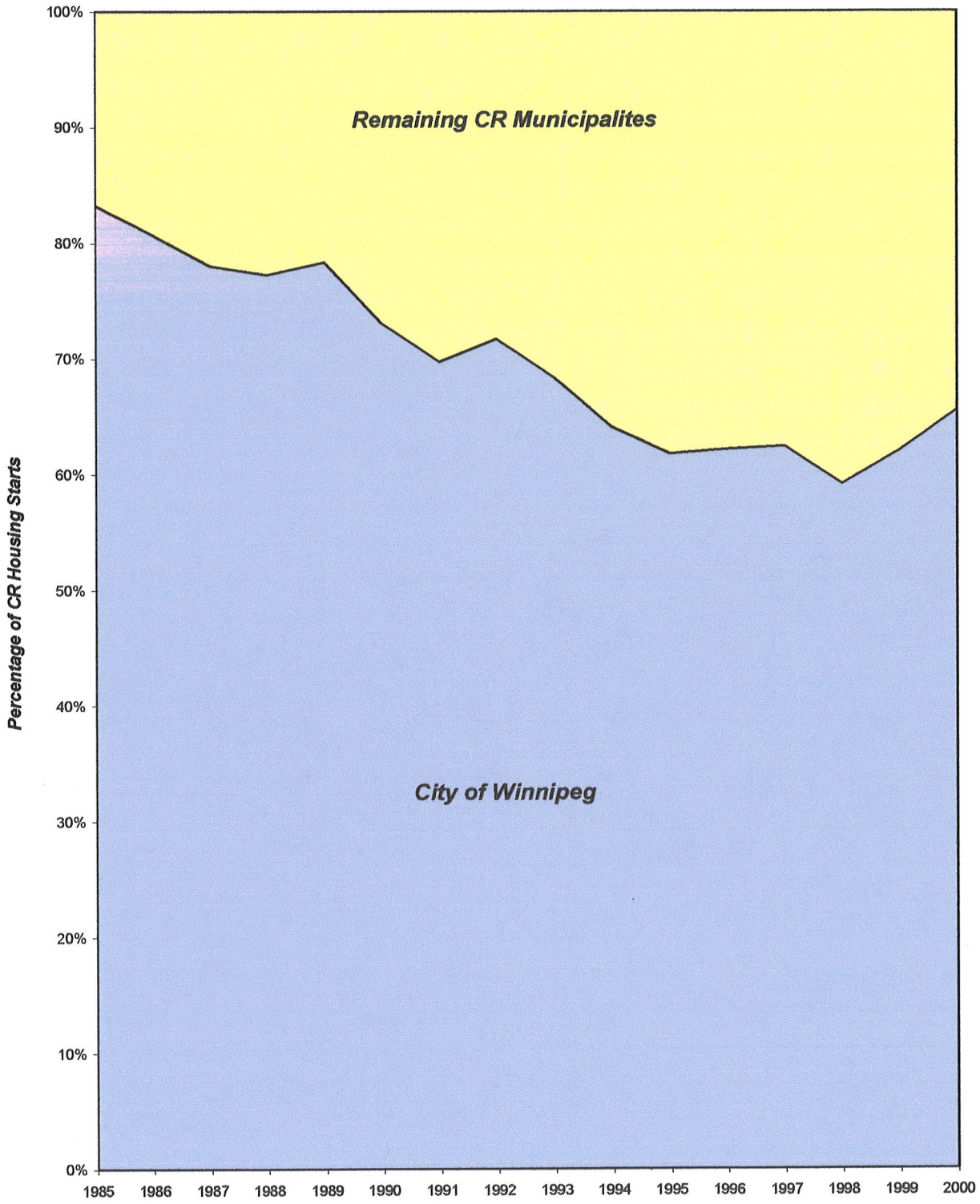


Figure 4.3: Capital Region Single-Family Housing Starts (1985-2000) % Split by City of Winnipeg and Remaining Capital Region Municipalities



Winnipeg's proportion of regional housing starts has consistently declined. As a result, the density, concentration, and compactness of the regional urban core have also decreased.

A dispersing regional population base often displays an increasing reliance on the personal automobile. In addition to having a greater adverse impact on regional air-quality, a region displaying sprawling development patterns will eventually require additional infrastructure such as highways, bridges, and overpasses (Smart Growth Network, 2001; State of South Carolina, 2001) which have a detrimental affect on local biodiversity and habitat corridors.

Such patterns of regional dispersal, and the resulting transportation corridors required to service such development, entail a corresponding increase in the amount of agricultural land lost to urban, ex-urban, and rural development, as well as threatening regional biodiversity (Sierra Club, 2002) and regional soil quality (Hollis *et al*, 1997; Marsh, 1998; Spirn, 1984).

Table 4.6: Percentage of the Regional Total of Housing Starts (1985-2000)

Municipality	*Totals*	*% of Regional Total*
Rosser (RM)	53	0.2%
St. Francois Xavier (RM)	55	0.2%
Cartier (RM)	174	0.5%
Headingley (RM)	196	0.6%
Selkirk (City)	274	0.8%
Ritchot (RM)	394	1.2%
West St. Paul (RM)	473	1.5%
Rockwood (RM)	496	1.5%
Stonewall (Town)	534	1.6%
Macdonald (RM)	693	2.1%
Taché (RM)	881	2.7%
St. Clements (RM)	1,029	3.2%
St. Andrews (RM)	1,070	3.3%
Springfield (RM)	1,106	3.4%
East St. Paul (RM)	1,341	4.1%
Winnipeg (City)	23,676	73.0%
Total	32,445	100%

Table 4.6 (above) identifies proportionate municipal shares of the total number of regional housing starts over the fifteen year span between 1985 to 2000. It indicates that the City of Winnipeg is not experiencing a proportionate number of regional housing starts relative to its share of the regional population. This table also identifies that the five Capital Region municipalities that placed 2nd through 6th in municipal proportionate share of regional housing starts are all rural municipalities experiencing development primarily in the form of rural-residential growth.

If these trends continue unchecked over the next fifteen years, population density, continuity, and concentration in the Capital Region of Manitoba will be at levels far lower than they are today. Likewise, environmental impacts associated with dispersed patterns of development will also have increased. A regional increase in reliance on the personal automobile and the amount of agricultural land lost to rural-residential development would be expected. The Capital Region of Manitoba would also experience a further decline in the quality of ground and surface water resources, as a result of large-lot development largely reliant on individual wells and sewage ejectors or septic fields for basic services.

4.4 Capital Region Undeveloped Parcel Analysis

The following section examines occupancy rates of existing subdivided parcels in Capital Region municipalities. The analysis of the occupancy rates of existing subdivided parcels has made it possible to identify Capital Region

municipalities experiencing excessive amounts of regional subdivision activity, and hence a high loss in the amount of agricultural land in production.

Table 4.7 (and the corresponding Figure 4.4) presents the total number of undeveloped parcels of land for various sizes of urban and rural development in Capital Region municipalities (excluding the City of Winnipeg). These analyses have made it possible to identify the number of undeveloped parcels of land currently subdivided for rural-residential use within the Capital Region. The greater the number of undeveloped parcels of land, the greater the number of acres of agricultural land prematurely lost for rural-residential 'development'.

Table 4.7: Capital Region of Manitoba - Existing Vacant Lot/Parcel Inventory - 2001

Municipality	*15,000 ft² - 21,779 ft²*	*0.5 ac. - 0.99 ac.*	*1 ac. - 1.99 ac.*	*2 ac. - 3.99 ac.*	*4 ac. - 5.99 ac.*	*6 ac. - 9.99 ac.*	*Total # of Undeveloped Rural-Residential Lots*
Cartier (RM)	12	31	57	50	24	18	**192**
East St. Paul (RM)	290	90	40	43	20	16	**499**
Headingley (RM)	30	185	37	25	25	12	**314**
Macdonald (RM)	55	43	32	27	16	31	**204**
Ritchot (RM)	11	18	31	56	48	37	**201**
Rockwood (RM)	35	52	37	23	30	20	**197**
Rosser (RM)	2	5	9	14	5	21	**56**
Selkirk (City)	10	12	6	1	7	6	**42**
Springfield (RM)	22	38	127	75	199	65	**526**
St. Andrews (RM)	32	85	265	74	121	56	**633**
St. Clements (RM)	80	98	152	147	146	109	**732**
St. Fr. Xavier (RM)	1	9	42	17	10	7	**86**
Stonewall (Town)	27	8	5	6	2	1	**49**
Taché (RM)	41	58	34	106	51	22	**312**
West St. Paul (RM)	15	25	56	73	31	17	**217**
Total # of Lots	**663**	**757**	**930**	**737**	**735**	**438**	**4,260**

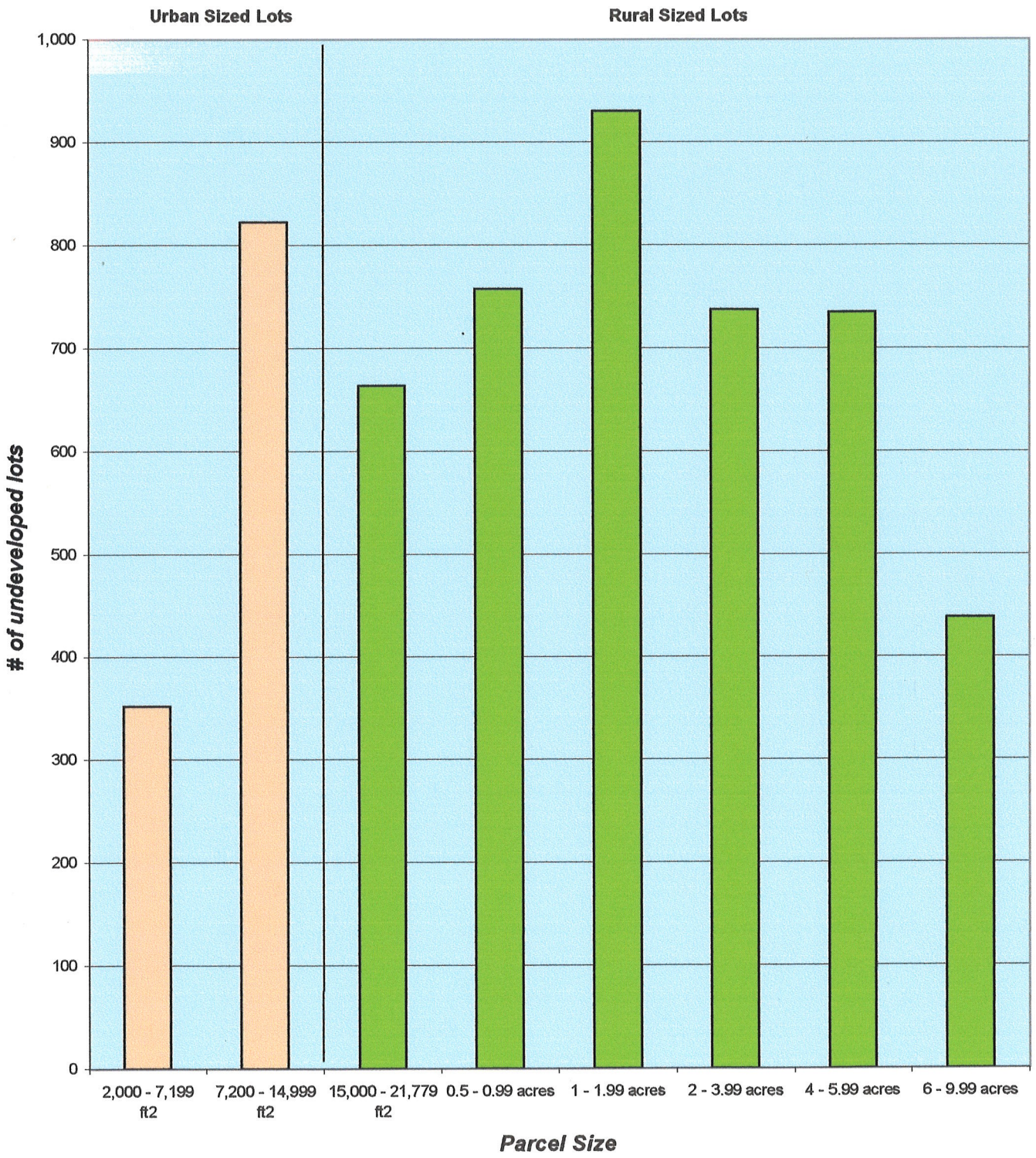
Source: MAVAS (Manitoba Assessment Valuation and Administration System)

- parcels owned by HMQ, individual municipalities, religious institutions, crown corporations were not included in these figures.
- parcels of land that contain residential garages or storage sheds, but do not contain dwelling units are included in these figures.
- agricultural parcels with greater than $10,000 worth of assessed buildings were excluded from these figures.
- parcels of land upon which mobile homes were found were also excluded from these figures.

Table 4.7, which was compiled during the summer months of 2001, identifies that there were over 4,200 privately owned, undeveloped parcels under 10 acres, in Capital Region municipalities (excluding the City of Winnipeg). A numbers of factors are likely contributing to the large number of undeveloped rural-residential parcels in the Region. Land speculation is a well-documented factor involved in suburban and ex-urban development (Atlanta Journal-Constitution, 2002). Investors often abstain from developing their parcels, wait for the surrounding area to develop, and hope to sell their parcels for an inflated value. In a slow-growth region however, land speculation can play a significant role in the supply of lots available. Another factor contributing to the over-abundance of rural-residential parcels in the Capital Region of Manitoba is individual municipal development plans and zoning by-laws that do not relate to regional development trends and parcel supplies. When creating a development plan without considering development from a regional perspective, an excessive amount of land has been cumulatively designated and zoned for rural-residential use. Other contributing factors include the non-requirement of supply and demand analyses for larger rural-residential subdivision developments, and individual municipal development plans that easily accommodate the subdivision of farmstead parcels.

If the regional housing start data, presented earlier, is manipulated to determine the average number of annual regional housing starts (excluding the City of Winnipeg), it can be determined that there have been an average

Figure 4.4: Capital Region – Number of Undeveloped Lots



of approximately 548 annual housing starts between 1985 and 2000. When dividing this number into the 4,260 vacant parcels in these fifteen Capital Region municipalities, we see that, at current residential development rates, there are currently enough undeveloped parcels to accommodate over seven-and-a-half years of development.

Municipal officials and advocates of rural-residential growth in rural Capital Region municipalities dispute claims that rural-residential development is occurring at unsustainable levels. At a Regional Planning Advisory Committee (RPAC) meeting held in Oakbank in 2002, John Holland, Reeve of the Rural Municipality of Springfield described provincial concerns over rural-residential development in the vicinity of Bird's Hill Park as being "*greatly exaggerated*" (John Holland, RPAC Submission, 26/06/02). Granted, some of the of the over 4,200 undeveloped parcels that exist in Capital Region municipalities may be in areas designated or zoned for industrial or commercial uses, or may be located in areas not suitable (flood prone or swampy) for residential development. However, the sheer magnitude of the number of undeveloped parcels in the Region indicates that there is a surplus of undeveloped residential building sites in most Capital Region municipalities.

Though many of the vacant, undeveloped parcels within the Region are not presently available on the real estate market or currently proposed for residential development, they must be considered as developable parcels. These parcels are in existence and could be made available for residential

development at any time. It must be acknowledged that without any planning provisions (*The Planning Act* permits one residence to be located on each parcel of land) over 4,200 single-family residences could be constructed in ex-urban areas of the Capital Region of Manitoba at any given time. These 4,200 residences could represent over 10,000 additional rural-residents to the Capital Region of Manitoba (a population greater than that of the City of Selkirk).

Land speculation should not be allowed to direct or influence regional planning. If region-wide limitations or controls on the subdivision of land were tightened, prospective developers and potential rural-residential homeowners would then likely have to pay higher costs to achieve the rural-residential lifestyle they seek. By increasing the costs associated with purchasing and developing rural-residential parcels, perhaps this form of development would then bear greater financial responsibility for the environmental impacts with which it has been associated.

The previous sections have suggested that past and present subdivision, dispersal, and housing start trends within the Capital Region of Manitoba are highly unsustainable on a long-term basis. If these trends continue to proceed unchecked in future decades, the Capital Region of Manitoba will be fated as a region with limited biodiversity, limited agricultural potential, polluted surface and ground water sources, poor air quality, and depleted soil resources. Table 4.8) summarizes some of the detrimental

environmental impacts that have been identified as associated with recent rural-residential development in the Capital Region of Manitoba.

Table 4.8: Data Analysis Summary

Data Source	Observed Trend	Land Use Indicator	Environmental Impact
Population Data	Rural population is increasing	• Low density • Non-concentrated • Non-compact • Non-central	• Decrease in the amount of agricultural land in production. • Impact on water sources from homes reliant on on-site sewage disposal.
	Regional population dispersal	• Low density • Non-concentrated • Non-central	• Population heavily reliant on private automobiles
Subdivision Statistics	A significant amount of rural-residential subdivision is occurring in many rural municipalities bordering regional waterways.	• Non-concentrated • Non-central • Low continuity	• Impact on water sources from homes reliant on on-site sewage disposal. • Development of riparian habitat adversely impacts flood control, biodiversity, and water quality.
	Subdivision of rural parcels for non-farm use is increasing.	• Low density • Low continuity • Non-compact	• Decrease in the amount of agricultural land in production. • Rate of soil erosion increases as land is excavated and seeded with lawns.
Housing Start Numbers	Proportion of regional housing starts occurring in 'rural' municipalities is increasing	• Non-concentrated • Non-central • Low nuclearity	• Impact on water sources from homes reliant on on-site sewage disposal. • Decrease in the amount of agricultural land in production.
	A greater amount of infrastructure is required to service a dispersing population.	• Non-concentrated • Non-compact	• Regional biodiversity and habitat corridors are adversely affected
Vacant Parcel Inventory	There is a large amount of undeveloped rural-residential parcels in the Region.	• Low density • Low continuity • Non-concentrated • Non-compact	• Decrease in the amount of agricultural land in production.

The following chapter identifies policies and initiatives that planners, policy-makers, and developers within the Capital Region can consider to help ensure that the Region will develop in a more sustainable and environmentally safeguarding manner. The following chapter also contributes a review of the policies that guide land-use and subdivision within Manitoba (*Provincial Land Use Policies* – Province of Manitoba, 1994). The suggested

policies and initiatives identified in Chapter 5, as well as the review of the *Provincial Land Use Policies* can be used either in whole or in part. The use of the conclusions identified in Chapter 5 would, at best, result in the Capital Region of Manitoba becoming a region recognized for its efforts towards sustainable development and "smart growth". At worst, the consideration or implementation of any of the recommendations mentioned in Chapter 5 would provide the regional environment one additional safeguard towards protecting it from the detrimental affects resulting from rural-residential development.

5.0 Potential Policies and Initiatives to Better Direct Future Rural-Residential Development in the Capital Region

It is clearly evident that current rural-residential development trends observed within the Capital Region of Manitoba are not sustainable. To ensure the long-term environmental well being of regional air and water resources, current trends of land consumption must be curtailed. I recommend that future rural-residential developments in the Capital Region incorporate the following directives. I also recommend that – during their current review – the *Provincial Land Use Policies* be strengthened to tighten the control over the subdivision of land for rural-residential uses. Section 5.1 examines how the above mentioned policy initiatives may be adapted to existing planning policy in Manitoba. A brief assessment of how existing policy has contributed to the fragmentation of the rural landscape within the Capital Region is also provided. The following section also considers initial policy revision that would help curb rural-residential growth within the Capital Region and better promote sustainable development.

5.1 Application of Findings to *Provincial Land Use Policy* Review

A review of recent planning literature has identified that large-lot rural-residential development is attributed to producing detrimental impacts on the environment. As mentioned earlier, rural-residential development is often automobile-reliant, wasteful of agricultural land, a cause of soil erosion, and damaging to air quality and the quality of both surface and ground water.

An analysis of development trends in the Capital Region of Manitoba has identified that rural-residential development has been increasing in the Region in recent years. Data has also shown that rural-residential development is occurring in an unsustainable manner in that there is an abundance of undeveloped rural-residential parcels. Unfortunately, unless control over the subdivision of land is strengthened or better enforced, there are not any measures in place to prevent non-sustainable development from continuing to occur in the Capital Region.

Land use control within the Manitoba is guided by the *Provincial Land Use Policies* (Province of Manitoba, 1994) and municipal or district development plans and zoning by-laws. A municipal zoning by-law must generally conform to the development plan that has been adopted by that municipality. A development plan can be created for an individual municipality or for two or more adjacent municipalities as a planning district development plan. Development plans within the Province are reviewed to ensure that they fulfill objectives and intentions of the *Provincial Land Use Policies*.

The *Provincial Land Use Policies* were first approved as a Regulation under *The Planning Act* in 1980, and were revised in 1994. The 1994 revisions were intended to make the Policies less regulatory and more educative. However, critics of the revised *Provincial Land Use Policies* argue that the 1994 Policies weakened control over rural-residential development (Fleming, 2002).

The revised Policies aimed at protecting the environment and encouraging land-use planning that was guided under the principles and objectives of sustainable development. The Policies include ten principles of sustainable development and six fundamental guidelines aimed at directing land use planning and development in a manner that would achieve sustainable development.

Among the principles and guidelines of sustainable development that the Policies acknowledge, the following are especially noteworthy:

- "*Conservation – make wise and efficient use of renewable and non-renewable resources*" (Principle #5, pp. 5);
- "*Enhancement – enhance the long term productive capability, quality and capacity of our natural ecosystems*" (Principle #7, pp. 6); and
- "*Efficient Use of Resources – encourage efficient use of resources and full environmental costing of decisions and developments*" (Guideline #1, pp. 6).

If the above principles and guidelines were strongly enforced and diligently followed during the creation and review of land use planning policy documents in the Province of Manitoba, the amount of land that has been subdivided and developed for rural-residential use in the Capital Region would have been significantly reduced. Developments that are entirely automobile-reliant certainly do not "*make wise and efficient use of...non-renewable resources*". The depletion of the agricultural land base, and the reliance on sewage disposal systems that contaminate local ground and surface water, certainly does not "*enhance the long term productive capability, quality and capacity of our natural ecosystems*" in the Region. Likewise, land that has been subdivided for rural-residential use but remains

undeveloped does not do much to "*encourage efficient use of resources and full environmental costing of decisions and developments*".

Unfortunately, though the Policies intend to direct land use within the Province in an environmentally responsible manner, they also contain a number of lenient policies with questionable intentions regarding rural-residential development. Included within the *Provincial Land Use Policies* are the following statements that particularly lack consistency when measured against the principles and guidelines of sustainable development:

- "*Rural residential (large lot) development...are appropriate land uses in rural areas and shall be encouraged, provided that they:*
  - *...do not impede the orderly expansion of urban centres and do not require piped water and sewer services...; and*
  - *...are of sufficient size to accommodate sustainable on-site sewage disposal rather than piped water and sewer services. Lot densities ...should also be low*" (Policy #1 – General Development, 1.A.17, pp. 26-27).

- "*Rural residential lots shall be planned to accommodate environmentally sound sewage disposal which protects aquifers and surface water...On-site sewage disposal shall be used rather than a common pipe system in order to lessen the demand for urban-size lots*" (Subdivision Policy #4, pp. 53).

It is fundamentally impossible for a land-use policy document to embrace and promote the principles and guidelines of sustainable development, while concurrently encouraging large-lot rural-residential development reliant on on-site sewage disposal. Such development is both wasteful of resources and harmful to the environment. The above policies are also problematic because they do not include a definition for "*environmentally sound on-site sewage disposal*". An open-ended statement of this nature

does nothing to curb the use of environmentally detrimental septic fields and sewage ejectors in floodplain areas with predominantly clay-based soils.

The current version of the *Provincial Land Use Policies* do not ensure that the goals of sustainable development are accomplished. Municipalities essentially have the ability to pick-and-choose from a number of differing policy areas that would all conform to the *Provincial Land Use Policies*. Critics of the lack of regulatory control that the Policies provide claim that municipalities are able to "*meet legal obligations by putting together something that resembles a plan*" because of a lack of "*clear provincial planning guidelines*" (Leo, 2000). In other words, municipalities are able to adopt development plans that comply with the *Provincial Land Use Policies*, yet are contrary to the objectives of sustainable development. The land-use policies that direct development in the Province need to be strengthened and more diligently enforced. A land-use policy document must protect the physical environment without attempting to satisfy all stakeholders. Unfortunately, however, lobbying efforts of various different (often-opposing) interest groups make the task of producing a comprehensive, environmentally responsible, land-use planning policy document very different to accomplish. As the Reeve of the Rural Municipality of Macdonald recently stated, "*the mandate of the Province to do regional planning must not interfere with development opportunities in any of the municipalities of the Region*" (Rodney Burns, RPAC Submission, 22/05/02).

Despite the concerns associated with regional planning initiatives in the Capital Region, current land-use trends cannot continue unchecked. I recommend that the Provincial Land Use Policies incorporate aspects of the following six initiatives to help ensure long-term environmental sustainability within the Capital Region.

5.2 Ecological Footprint Consideration

The Province of Manitoba has recently taken a leading role among Canadian provinces in lobbying to ensure that the guidelines for reducing fossil-fuel emissions, as stated in the Kyoto Protocol, are realized (Province of Manitoba, 2002). It is widely recognized that a decrease in fossil-fuel emissions, would result in local and global benefits to air quality, and likely curb global climate change (Ewing, 1997).

The Province of Manitoba's support of the Kyoto Protocol has been questioned for being opportunistic (by Canadian provinces opposed to legislating guidelines identified in the Kyoto Protocol) (Winnipeg Free Press, 2002(c)). It has been speculated that the primary reason that Manitoba is in support of legislating guidelines established within the Kyoto Protocol, is so that the Province can profit from selling hydro electric power to Canadian provinces more reliant on fossil-fuels (natural gas, oil, coal) as a heating fuel.

It has been identified that, throughout North America, vehicular emissions are a leading contributor to atmospheric greenhouse gases (Ewing, 1997). It has also been identified that as the density of residential development decreases, the amount of vehicular miles traveled greatly

increases (Clean Air Trust, 2002). Low-density developments are essentially impossible to effectively service with public transportation and, as identified earlier, residents of low-density rural-residential developments are often completely reliant on the use of private vehicles.

If the Province of Manitoba is successful with regards towards achieving a reduction in greenhouse gas emissions, improving regional air-quality, and mitigating global climate change, it must enact legislation that would discourage the development of large-lot rural-residential development. Non-compact rural-residential subdivisions increase the demand for – and consumption of – greenhouse gases, in that they are reliant on personal automobile use for the simplest of needs, and essentially impossible to service with public transportation.

An ecological footprint analysis translates the ecological impact associated with different settlement patterns and different consumption rates, and calculates the area of productive land required to support the necessary resource consumption. When defining the ecological footprint of a given population, a calculation is made of the total area of productive land and amount of fresh water that would be required, on a continuous basis, to produce all the resources consumed by that population (Walker and Rees, 1997). It has been identified that Canadians have perhaps the largest ecological footprint of all countries in the world (Walker and Rees, 1997). It has also been argued that Winnipeg and the Capital Region of Manitoba may have among the most wasteful land consumption practices of all major urban

Canadian regions (Lennon and Leo, 2001). When taking these two factors into consideration, the long-term environmental sustainability of the Capital Region of Manitoba does not appear very promising.

If Manitoba is to realize a significant reduction of greenhouse gas emission and fossil fuel consumption it must enact legislation that encourages compact, transit-oriented development. Current development within the Capital Region is wasteful of land and is of a form that produces high amounts of greenhouse gas emission and fossil fuel consumption. Land use within the Region must strive to be environmentally sustainable. If the Province were to enact land-use policy that minimized the ecological footprint 'created' by the Capital Region, it would effectively reduce the detrimental environmental impacts resulting from non-sustainable rural-residential development and realize goals of reducing greenhouse gas emission and fossil fuel consumption.

5.3 Regional Land Use Development Plan

A coordination of municipal development plans, within the framework of a region development plan, would result in a more sustainable use of land in Capital Region municipalities by minimizing inter-municipal competition. A number of authors, as well as the Province of Manitoba, have acknowledged that to achieve long-term regional sustainability, land use planning can not occur solely at the municipal level (Lennon and Leo, 2001; Manitoba Intergovernmental Affairs, 2001; Thomas, 2001, Ackerman, 1999). Without

sound, co-operative, inter-municipal planning, sustainable regional planning is difficult, if not impossible, to achieve (Pendall *et al*, 2002).

Present municipal and planning district development plans within the Capital Region are based entirely on political boundaries rather than the boundaries of natural, environmental systems. If a single development plan were to be established for all Capital Region municipalities, many natural environmental systems (watersheds, habitat corridors) would be encompassed within the scope of the plan. Policies and land use designations could then be made to better direct future land use practices within the Region as a whole.

Often individual municipal development plans fail to consider land use practices outside of the political jurisdiction for which the plan is made. Single municipal or planning district development plans often state that a goal of the plan is to ensure the long-term environmental well being of the area. However, these efforts can be fruitless if neighbouring, downstream, or upwind municipalities do not designate adjacent land uses accordingly. A region-wide designation of land uses would better safeguard fragile environmental ecosystems.

Capital Region municipalities, including the City of Winnipeg, should strive to establish a region-wide land use development plan. A regional development plan would ensure that large-scale environmental systems are protected by appropriately designating land use on a regional scale. The adoption of a regional development plan should be followed by the adoption

of a series of more directed secondary plans and zoning by-laws. Policies and designations within the secondary plans and zoning by-laws would closely mirror objectives and land use designation maps identified in the regional development plan. The establishment of a regional development plan would support the environmental sustainability of the Region by helping to deter inter-municipal competition. Environmental integrity is often sacrificed when municipalities are competing with their neighbours for development activity. A Capital Region Development Plan would help safeguard the environment by abating inter-municipal competition for rural-residential development.

5.4 Density Management

As mentioned earlier, population density is deemed the most important indicator of "Smart Growth" and the most effective measure of environmental affects related to rural-residential development (Smart Growth Network, 2002; Fulton *et al*, 2001; Glaeser and Shapiro, 2001; Avin and Holden, 2000). Numerous environmental benefits, including enhancements to regional air quality, water quality, resource consumption rate, and species biodiversity, have been associated with increasing the density of rural-residential developments (Sustainable Measures Organization, 2001; Walker and Rees, 1997; Breheny and Rookwood, 1993). Tomalty *et al*, 1994(a) have documented how moderate increases in population density have been associated with benefits to regional air quality, agricultural land consumption rates, and enhancement of natural areas in a number of Canadian metropolitan areas.

The bulk of recent planning literature has stated that a more sustainable pattern of urban development, such as development displaying characteristics of "Smart Growth", is largely reliant on high population densities. However, while analyses of recent census and subdivision data have identified that population within the Capital Region of Manitoba is generally increasing in density, the compactness, concentration and centrality of the Region is decreasing. An examination of recent housing start totals has identified that many "rural" Capital Region municipalities are experiencing a relatively high number of new single-family housing starts compared to their urban counterparts.

It is not difficult to imagine how an increase in population density throughout the Capital Region, and particularly rural-residential areas, would benefit the long-term environmental sustainability of the Region. An increase in population density would result in an inversely proportional decline in the amount of agricultural land lost for rural-residential development. The lower the amount of prairie and riparian land lost to rural-residential development, the lower would be the impact of development on regional biodiversity.

An increase in population density of rural-residential subdivisions would also greatly increase the feasibility of servicing these areas with piped water, piped sewer (or an on-site treatment system), and public transportation systems. The provision of these services would result in the Capital Region experiencing benefits to both the regional air and water quality, as a regional increase in population density would reduce the reliance on personal

automobiles, and enable sewage treatment services to be provided to rural-residential areas.

An increase in population density would likely also result in a decrease in the amount of land that is utilized as monocultured lawns for large rural-residential acreages. As mentioned earlier, a decrease in the amount of land utilized for turf or lawn would reduce the rate of soil erosion throughout the Region.

Capital Region municipalities need to ensure that future development throughout the Region occurs in a manner that would increase population density in present and future rural-residential areas to levels that would allow feasible servicing. Current rural-residential development trends and patterns are highly unsustainable. Municipalities within the Capital Region must encourage future rural-residential subdivisions to develop at higher densities than are witnessed presently or promote infill development of existing rural-residential areas. By creating policies encouraging densification in a municipal development plan, existing four-acre parcels could be further subdivided into two-acre parcels. Two-acre parcels could be further subdivided into one or one-half acre parcels. Eventually, these 'infill' rural-residential areas could be feasibly serviced with water, sewer, and public transit infrastructure.

Current rates of population dispersal are not sustainable. Without reform to the manner in which rural-residential subdivisions are developed, and to the trend of population dispersal, the Capital Region of Manitoba will

continue to experience deterioration of regional air, water, and soil quality and degradation of the regional agricultural land base.

5.5 Cluster Zoning / Conservation Subdivisions

Long-term environmental sustainability of the Capital Region could be enhanced if future regional development followed principles identified by advocates of cluster zoning and conservation subdivisions. Cluster zoning differs from contemporary zoning practiced in the Capital Region in that it establishes a cap on the number of dwellings that can be developed on a specified area of land, and establishes a maximum lot size for non-farm, single-family (rural-residential) parcels.

If zoning by-laws within the Capital Region were to identify a maximum parcel size for rural-residential areas of one or two acres, the amount of agricultural land lost to rural-residential development would be greatly reduced. Adopting the principles of cluster zoning in the Capital Region would also help protect ground and surface water. One acre (or less) rural-residential parcels clustered together in relatively close proximity could easily share water and sewage services.

Similar to cluster zoning, the principles of conservation subdivisions are largely based on encouraging developers to build on smaller lots if the developers set land aside for green space. Conservation subdivisions in areas that are largely tree covered often intersperse large-lot parcels with natural areas. However, in an agriculturally productive area such as the Capital Region of Manitoba, conservation subdivisions would cluster smaller

residential parcels to allow a greater amount of agricultural land to remain in production. One example of a plausible method of developing a clustered conservation subdivision would be to require a developer planning to subdivide a 40 acre agricultural parcel (for rural-residential purposes) to "cluster" 20 one-half acre parcels at one end of the holding rather than creating 20 two acres parcels over the entire holding. Adopting the conservation subdivision approach would allow 30 acres of land to remain in agricultural use and enable the 20 rural-residential parcels to utilize common water and sewer services.

A municipal example of the potential effects of promoting clustered or conservation subdivision was discussed earlier (Section 4.2.1) when identifying recent subdivision trends in the rural municipalities of Springfield and Macdonald. If the entire Region were subjected to clustered, conservation subdivision patterns of rural-residential development, the Capital Region of Manitoba could accommodate residential growth and still greatly reduce the amount of agricultural land taken out of production, while ensuring the long-term quality of ground and surface water resources – by eliminating the use of sewage ejectors and septic fields by non-farm, rural-residential parcels.

5.6 Mandatory Servicing

A more resolute method of securing the long-term protection of regional air, land, and water resource bases would be to prohibit new non-farm, rural-residential subdivisions from utilizing septic fields and sewage

ejectors. New rural-residential dwellings in the Capital Region would then be required to rely on holding tanks (and subsequent sewage treatment) or other forms of shared sewage disposal.

It is recognized that a ban on sewage disposal methods, such as fields and ejectors, would likely meet fierce opposition from developers and municipal officials, as well as landowners. It is also recognized that septic fields and sewage ejectors are efficient and effective methods of sewage disposal in many circumstances. For example, it would be unrealistic to expect those agriculturally related dwellings that are far removed from surface watercourses and adjacent property holdings, to remove existing septic fields and sewage ejectors in favour of holding tanks and municipal treatment facilities. However, a prohibition of the above-mentioned forms of sewage disposal in new development would greatly reduce the affect that rural-residential development has on the quality of water resources in the Capital Region of Manitoba (City of Winnipeg Water and Waste Department Engineering Division, 2002; Manitoba Conservation, 2001; Manitoba Environment, 1997).

As mentioned earlier (Section 2.1), much of the soil throughout the Region has a very high clay content, is highly impermeable to liquids and is not a preferred host for septic fields or sewage ejectors. Generally, due to the previously mentioned characteristics of clay based soils, fine-grained soils are at risk of becoming saturated quite rapidly, and may lead to premature surface runoff from septic fields.

If Capital Region municipalities were to prohibit the use of septic fields for new rural-residential developments, the amount of nitrogen and phosphorous entering regional waterways would be reduced significantly. The survival rate and general well being of aquatic species living in surface water bodies within the Region would also be greatly increased. Proscribing the use of septic fields and sewage ejectors would also help reduce the amount of agricultural land taken out of production. To facilitate the efficient servicing of new rural-residential parcels, developers would be more likely to design new rural-residential developments in a more compact manner. As a result, public transportation options would be greatly enhanced, and rates of surface runoff and soil erosion would also be decreased.

Prohibiting the use of septic fields in new rural-residential subdivisions would also encourage developers to consider performing supply and demand analyses for their developments. For economic reasons, developers would likely not be inclined to create an excessive amount of rural-residential parcels if they had to provide piped water and sewer services to parcels that would remain vacant for great lengths of time.

5.7 Supply and Demand Provisions

Strict subdivision control, and reform of the policy and legislation that governs the subdivision of land, is particularly difficult to achieve in regions exhibiting a slow rate of growth (Meck *et al*, 1999). Municipal officials, residents, and developers alike, tend to perceive development of *any* form, as a sign of progress regardless of its impact on environmental sustainability.

This may explain why municipalities within the Capital Region of Manitoba, a region that has displayed a relatively slow rate of growth since the 1950s, seemingly tolerate an overabundance of subdivided land.

As identified earlier, as of November 2001, there were over 4,200 undeveloped parcels in Capital Region municipalities (excluding the City of Winnipeg) under ten acres in size. Though some of these parcels may not be designated for residential purposes, or may be geographically restricted as building sites, this is still a remarkably high number of undeveloped parcels for a region exhibiting a relatively static growth rate.

There are a number of contributing factors as to why so many vacant urban and rural-residential parcels are found in the Capital Region. It is thought that municipal governments approve a large number of subdivisions in anticipation of seeing a likewise increase in the municipal tax base because municipalities "*should be allowed to compete for residents*" (Karen Carey, RPAC Submission, 26/06/02). Some agricultural property owners choose to subdivide portions of their holdings rather than invest in costly agriculturally related equipment. In other words, agricultural landowners see their land holdings as a "*nest-egg for their retirement*" (Leo, 2000). Developers may be optimistically observing recent trends of ex-urban development within the Capital Region and simply overestimating market demand. Small-scale parcel holders may simply be purchasing rural-residential parcels on the speculation that they will rapidly experience an increase in value. Regardless of the reason for the overabundance of urban and rural-residential parcels found

within the Region, it has become apparent that recent subdivision trends cannot continue unchecked without some form of policy change.

One initial method of policy change would be to ensure that prospective developers and subdivision applicants provide supply and demand analyses as a requirement for all subdivision proposals. A supply and demand analysis, followed by signed "intentions to purchase" from prospective buyers of the proposed parcels, would greatly help limit the number of vacant residential parcels in the Region.

Another control that could be placed on recently created residential parcels would be to put a limit on the period of time that a parcel can remain undeveloped. By establishing a predetermined date by which residential construction must occur, the number of property speculators, who have no intentions of developing the parcels that they are purchasing, would likely be reduced.

By including these two controls on land subdivision (supply and demand analyses, and establishing a predetermined requirement for a construction date) within a municipal or regional development plan, the number of undeveloped residential parcels that would be created throughout the Region could be greatly reduced. The above-mentioned subdivision controls would also result in a reduction in the occurrence of 'leap-frog' development, an increase in urban and rural-residential densities, and a significant decrease in the amount of agricultural land unnecessarily taken out of production for residential purposes.

Manitoba Intergovernmental Affairs is currently reviewing the *Provincial Land Use Policies*. It is essential that the review process remove statements that accommodate and "*encourage*" large-lot rural-residential developments that are reliant on on-site sewage disposal systems. Though it is probable that a strengthened series of Provincial Land Use Policies would not receive a warm reception from many municipal councils, administrators, and developers, it is important that the review process provide better protection to the regional environment. Ideally, the review will remove policies that promote rural-residential development and the use of on-site sewage disposal systems. The Policies must 'acknowledge' or 'recognize' large-lot rural-residential development – but certainly not 'encourage' it.

A comprehensive review of the *Provincial Land Use Policies* cannot be accomplished without additional research being conducted. More research is required to enable policy planners to better understand the significance of the impact that on-site sewage disposal systems have on ground water aquifers and surface water bodies in the Region. The literature reviewed in Chapter 2 and the trends revealed in Chapter 4 have identified that a much stronger understanding is required of the environmental impacts of on-site sewage disposal in the Capital Region. As a recent RPAC submission by Harold Taylor points out: "*Some lands are suitable for* (on-site) *sewage disposal, others are not*" (Harold Taylor, RPAC Submission, 25/05/02). It is irresponsible for the *Provincial Land Use Policies* to encourage the use of on-

site disposal systems when a full understanding of their environmental implications does not exist.

More research is also required to better quantify non-farm rural-residential population trends within Capital Region municipalities. A detailed population breakdown for all types of land use – urban, rural, and rural-residential – would aid in anticipating population and land-use trends. A better understanding of rural non-farm residential population trends would enable policy planners to effectively incorporate aspects of density management, cluster zoning/conservation subdivision, and supply and demand provisions into the Policies. It must be recognized that, upon the completion of the current review of the *Provincial Land Use Policies*, they will very likely be used to guide land-use planning within the Capital Region for the next decade. To successfully plan for the future, a better understanding of current population dispersal trends is essential.

Rural-residential development within the Capital Region has been characterized as bearing a likeness to a "*multi-headed 5-acre monster...the tentacles of which are moving slowly down many of the roads in the Capital Region destroying large areas of what was once prime farm land and limiting land use options on thousands of acres of additional land*" (Bruce MacLean, Capital Region Review Panel Submission, 19/01/99). The above analogy casts a ominous future for land-use within the Capital Region. However, if current rural-residential development trends in the Region carry on

unchecked, the "*multi-headed 5-acre monster*" will continue to grow – at the expense of the regional environment.

The Provincial Government must take full advantage of the current review of the *Provincial Land Use Policies.* If the environmental implications of rural-residential are not recognized during the current review of the Policies, the goal of sustainable development for the Province will be impossible to realize especially for the Capital Region of Manitoba.

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7.0 Appendices

Appendix 1: City of Winnipeg Neighbourhood Populations

	1971	1976	1981	1986	1991	1996	% change
City of Winnipeg Total	521,812	547,505	554,912	592,875	614,435	618,575	19%
Pre-Unicity Neighbourhoods	233,175	211,480	198,542	213,195	212,145	207,845	-11%
Non Pre-Unicity Neighbourhoods	288,547	336,025	356,370	379,680	402,290	410,730	42%

Pre-Unicity Neighbourhoods	1971	1976	1981	1986	1991	1996	% change
Armstrong Point	535	470	420	395	360	330	-38%
Assiniboine Park	75	40	60	45	120	125	67%
Broadway - Assiniboine			3,575	3,845	5,340	5,405	51%
Brockville				15	160	140	833%
Burrows - Keewatin	3,645	3,640	3,195	3,135	2,885	2,785	-24%
Burrows Central	6,430	5,520	4,725	4,895	4,850	4,805	-25%
Centennial	3,510	2,865	2,830	2,980	2,740	2,210	-37%
Central River Heights	4,295	3,865	3,580	3,710	3,335	3,225	-25%
Chalmers	11,360	10,905	9,880	10,095	9,810	9,810	-14%
Colony				330	570	660	100%
Crescentwood	3,840	3,670	3,135	2,805	2,880	2,795	-27%
Daniel McIntyre	11,505	10,840	10,470	10,960	10,400	9,885	-14%
Dufferin	3,280	2,520	2,195	2,370	2,370	2,130	-35%
Dufferin Industrial	665	350	170	180	150	135	-80%
Earl Grey	6,330	5,900	5,040	4,920	4,640	4,540	-28%
East Elmwood	4,080	4,005	3,385	3,380	3,635	3,250	-20%
Ebby - Wentworth	1,095	925	795	815	710	715	-35%
Edgeland	780	1,565	1,257	1,495	1,535	1,430	83%
Grant Park	3,215	3,050	2,920	3,075	2,905	2,920	-9%
Inkster - Faraday	5,075	4,430	400	4,095	4,070	4,095	-19%
Inkster Gardens	60	50	185	1,685	3,120	3,270	5350%
Inkster Industrial Park				185	5	5	-97%
J.B. Mitchell	1,775	2,100	2,430	2,320	2,125	1,950	10%
Legislature					55	65	18%
Logan - C.P.R.	1,345	995	500	370	480	435	-68%
Lord Roberts	6,555	5,955	5,620	5,600	5,290	5,200	-21%
Lord Selkirk Park	2,115	1,835	1,680	1,420	1,290	1,100	-48%
Luxton	3,715	3,275	2,905	2,920	2,710	2,660	-28%
Main Street				635	835	475	-25%
Mathers	1,790	2,015	2,650	2,775	2,580	2,485	39%
McMillan	5,735	4,605	3,920	3,875	3,630	3,760	-34%
Minto	7,290	6,330	5,685	5,580	5,475	5,685	-22%
Mynarski	1,905	1,655	1,445	1,350	1,300	1,255	-34%
North Inkster Industrial				10			-100%
North Point Douglas	4,210	3,530	3,170	3,285	3,205	2,895	-31%
North Portage			3,640	4,090	4,365	4,470	23%

North River Heights	7,050	6,610	6,170	6,050	5,760	5,720	-19%
Oak Point Highway	210	25		30	15	30	-86%
Old Financial District				110	205	240	118%
Omands Creek Industrial	55			5	5	5	-91%
Pacific Industrial	40			15	10	30	-25%
Parker	100	85	75	75	5	5	-95%
Polo Park	520	465	320	310	260	280	-46%
River - Osborne	5,465	5,185	1,550	4,715	4,540	4,615	-16%
Riverview	5,875	5,415	4,775	4,565	4,565	4,470	-24%
Robertson	5,960	5,140	4,565	4,205	4,120	4,050	-32%
Rockwood	5,695	4,885	4,345	3,885	4,050	4,045	-29%
Roslyn	3,115	3,210	3,675	4,335	4,170	4,255	37%
Rosser - Old Kildonan	235	255	255	235	430	660	181%
Sargent Park	6,735	6,335	5,915	5,870	5,910	5,905	-12%
Shaughnessy Park	3,160	2,820	2,545	2,445	2,300	2,275	-28%
Sir John Franklin	3,250	2,935	2,660	2,560	2,440	2,530	-22%
South Point Douglas	445	370	265	500	380	395	-11%
South Portage			1,970	2,050	1,930	1,900	-4%
South River Heights	3,650	3,415	3,040	2,895	2,805	2,850	-22%
Spence	6,230	4,980	4,895	5,115	4,870	3,940	-37%
St. James Industrial	60	95		20	35	25	-58%
St. John's	11,030	9,705	8,560	8,740	8,270	8,100	-27%
St. John's Park	830	725	700	620	610	585	-30%
St. Matthews	8,035	7,335	6,710	6,920	6,390	6,365	-21%
Talbot Grey	3,360	2,940	2,680	2,655	2,485	2,370	-29%
The Forks					15		0%
Tyndall Park	435	3,095	7,650	9,880	12,975	13,505	3005%
Wellington Crescent	1,920	1,860	1,730	1,745	1,665	1,615	-16%
West Alexander	6,925	5,605	4,530	4,590	4,755	4,415	-36%
West Broadway	6,745	5,200	5,240	6,545	5,455	5,190	-23%
West Wolseley	240	195	195	180	300	275	15%
Weston	7,560	6,835	5,960	5,985	5,715	5,685	-25%
Weston Shops	35	10	165	20	15	20	-43%
William Whyte	10,005	8,490	6,780	6,895	6,620	6,230	-38%
Wolseley	11,995	10,355	8,760	8,790	8,140	8,165	-32%
Total	**232,640**	**211,010**	**198,122**	**212,800**	**211,785**	**207,515**	**-11%**

Post-Unicity Neighbourhoods	1971	1976	1981	1986	1991	1996	% change
Agassiz	710	675	595	510	630	510	-28%
Airport	560	670	540	540	530	430	-23%
Alpine Place	2,470	2,935	2,985	3,810	3,630	3,500	42%
Amber Trails					130	470	262%
Archwood	1,415	1,135	995	945	950	885	-37%
Assiniboia Downs					10	35	250%
Beaumont	3,350	2,940	2,470	2,545	2,420	2,415	-28%
Betsworth	1,665	2,655	4,000	4,720	4,705	4,585	175%
Birchwood	2,475	2,330	2,125	2,045	1,975	1,910	-23%
Booth	5,985	6,270	6,180	6,125	5,805	5,675	-5%
Brooklands	3,670	2,950	2,580	2,575	2,465	2,435	-34%
Bruce Park	2,730	2,440	2,140	2,215	2,150	2,140	-22%
Buchanan	2,145	3,740	3,715	3,650	3,395	3,230	51%
Buffalo							
Canterbury Park		1,020	2,220	2,950	4,505	4,820	373%
Central St. Boniface	8,960	8,105	7,075	7,075	6,585	6,575	-27%
Chevrier	195	150	90	185	70	65	-67%
Cloutier Drive	45	110	255	220	265	275	511%
Crescent Park	3,100	2,850	2,455	2,305	2,315	2,245	-28%
Crestview	8,440	11,830	11,035	10,545	10,005	9,610	14%
Dakota Crossing	185	745	2,185	1,150	4,580	6,660	3500%
Deer Lodge	5,575	4,835	4,350	4,270	4,130	4,185	-25%
Dufresne	740	605	500	465	445	435	-41%
Dugald	40	35	30	15	20	10	-75%
Eaglemere	125	105	90	270	270	325	160%
Elm Park	2,050	1,945	1,755	1,735	1,675	1,610	-21%
Elmhurst	1,195	1,835	2,400	4,160	4,695	4,900	310%
Eric Coy	2,025	2,340	2,490	2,525	2,650	2,590	28%
Fairfield Park	175	470	95	105	115	95	-46%
Fort Richmond	6,035	10,315	11,890	12,280	12,425	11,825	96%
Garden City	8,050	8,055	7,040	6,485	5,920	5,715	-29%
Glendale	820	920	1,175	1,160	1,050	1,055	29%
Glenwood	5,755	5,045	4,480	4,240	4,035	3,990	-31%
Grassie	110	180	160	245	1,365	1,890	1618%
Griffin				10	5	5	-50%
Heritage Park	2,465	3,740	4,980	5,320	5,320	5,115	108%
Holden	290	270	225	230	210	195	-33%
Island Lake				500	3,115	4,055	711%
Jameswood	2,450	1,955	1,490	1,720	1,595	1,575	-36%
Jefferson	10,075	10,065	9,190	8,755	8,430	8,330	-17%
Kensington	450	360	310	290	280	285	-37%
Kern Park	2,640	2,295	2,000	1,925	1,900	1,765	-33%
Kil-Cona Park	135	380	275	270	260	270	100%

Kildare - Redonda	7,545	9,160	8,440	8,105	7,545	7,115	-6%
Kildonan Crossing	45	30		30	15	10	-78%
Kildonan Drive	5,490	5,960	5,375	5,185	4,820	4,790	-13%
King Edward	7,600	6,350	6,005	5,930	5,760	5,760	-24%
Kingston Crescent	835	760	680	675	645	715	-14%
Kirkfield	2,460	2,830	2,845	3,120	2,855	2,795	14%
La Barriere	30	90	150	100	110	170	467%
Lavalee	900	1,215	1,200	1,190	1,115	1,230	37%
Leila - McPhillips Triangle	110	225	975	1,100	2,700	2,920	2555%
Leila North	105	95	175	185	165	185	76%
Linden Ridge	120	55	35	20	5		-100%
Linden Woods	70	45		1,605	5,530	6,470	9143%
Maginot	2,310	2,120	1,970	1,990	1,765	1,680	-27%
Mandalay			670	3,260	4,490	4,665	596%
Maple Grove Park	65	30	10	10	15	10	-85%
Margaret Park	2,715	2,995	2,765	2,615	2,410	2,290	-16%
Marlton	515	500	650	695	720	725	41%
Maybank	3,620	3,160	2,865	2,605	2,510	2,395	-34%
Mcleod Industrial				5	5	5	0%
Meadowood	355	3,240	3,925	5,715	6,410	6,135	1628%
Meadows			1,055	3,020	4,800	5,145	388%
Melrose	2,125	1,775	1,520	1,505	1,360	1,340	-37%
Minnetonka	1,705	3,955	4,475	4,790	4,940	4,985	192%
Mission Gardens	340	1,320	2,490	2,770	3,315	3,535	940%
Mission Industrial	410	340	200	150	140	120	-71%
Montcalm	1,330	2,920	3,080	3,530	3,765	4,430	233%
Monroe East	9,420	10,380	9,935	9,700	8,525	8,705	-8%
Monroe West	4,140	3,575	3,370	3,285	3,110	3,040	-27%
Murray Industrial Park				10	5	5	-50%
Niakwa Park	985	890	800	735	685	680	-31%
Niakwa Place				2,250	1,975	2,005	-11%
Norberry	1,715	1,560	1,435	1,365	1,295	1,340	-22%
Normand Park	30	60	50	120	555	730	2333%
North St. Boniface	2,585	2,190	1,920	1,855	1,935	1,865	-28%
Norwood East	6,460	5,680	4,915	4,690	4,445	4,380	-32%
Norwood West	4,150	3,825	3,350	3,230	3,095	3,115	-25%
Old Tuxedo	1,030	985	1,105	960	970	930	-10%
Parc La Salle	765	2,160	1,970	1,985	2,230	2,250	194%
Peguis	185	240	235	240	350	430	132%
Pembina Strip	795	2,245	2,225	2,335	3,025	3,020	280%
Perrault	80	55		65	70	70	-13%
Point Road	2,410	2,160	1,985	1,930	1,870	1,855	-23%
Pulberry	4,945	5,280	5,065	4,905	4,855	4,780	-3%
Radisson	5,262	5,100	4,500	4,075	3,740	3,535	-33%
Regent	170	125	85	70	105	70	-59%
Richmond Lakes			540	1,580	1,740	1,825	238%

Richmond West	50	240	1,100	2,995	4,475	5,370	10640%
Ridgedale	415	665	695	680	635	615	48%
Ridgewood South	65	140	105	125	145	185	185%
River East	1,980	4,805	7,780	9,550	9,360	9,150	362%
River Park South	305	435	3,005	8,105	10,750	10,840	3454%
Riverbend	465	450	720	780	2,445	3,070	560%
Rivergrove	330	285	230	235	780	910	176%
Riverwest Park		1,020	1,690	1,715	1,720	1,675	64%
Roblin Park	1,065	1,130	1,020	1,075	1,105	1,075	1%
Rossmere - A	15,005	15,790	14,925	14,440	13,960	13,860	-8%
Rossmere - B	6,330	5,445	4,870	4,460	4,165	4,070	-36%
Royalwood				60	50	340	467%
Saskatchewan North	40			5	10	25	-38%
Seven Oaks	4,110	3,670	3,250	3,105	3,065	3,120	-24%
Silver Heights	7,390	6,610	5,780	5,530	5,265	5,130	-31%
South St. Boniface - A	125	60	125	40	45	330	164%
South St. Boniface - B	45		20	10	10	5	-89%
South Tuxedo	35	85	1,375	2,375	3,170	3,545	10029%
Southboine	295	470	1,255	1,360	1,315	1,520	415%
Southdale	3,170	6,380	8,890	6,745	6,950	7,130	125%
Southland Park				15	355	650	4233%
Springfield North	335	450	1,860	3,660	4,820	5,140	1434%
Springfield South	100	100	1,080	1,490	1,540	1,555	1455%
St. Boniface Industrial	40			10	5	5	-88%
St. George	4,275	3,810	3,310	3,210	2,900	2,875	-33%
St. Norbert	1,585	1,570	1,445	1,375	1,535	1,530	-3%
St. Vital Centre	85	75		5	5	35	-59%
St. Vital Perimeter South	825	950	980	1,165	1,230	1,300	58%
Stock Yards	45			10	20	15	-67%
Sturgeon Creek	3,325	3,870	3,785	3,715	3,495	3,470	4%
Symington Yards							
Templeton -Sinclair	315	210	2,065	3,880	5,195	5,060	1506%
The Maples	500	8,510	13,670	14,030	14,575	14,380	2776%
The Mint							
Tissot	265	265	295	230	165	185	-30%
Transcona North					75	20	-73%
Transcona South	435	560	585	595	640	675	55%
Transcona Yards	55						-100%
Trappistes	125	190	165	215	145	65	-48%
Turnbull Drive	80	95	35	50	80	25	-69%
Tuxedo	3,180	3,745	3,400	3,250	3,075	3,170	0%
Tuxedo Industrial	25	30	10	10	10	145	480%
Tyne - Tees				5	5	5	0%
University	30	40	50	235	265	105	250%
Valhalla	885	2,590	2,770	2,955	2,935	3,145	255%
Valley Gardens	230	6,220	8,445	8,600	9,095	9,085	3850%

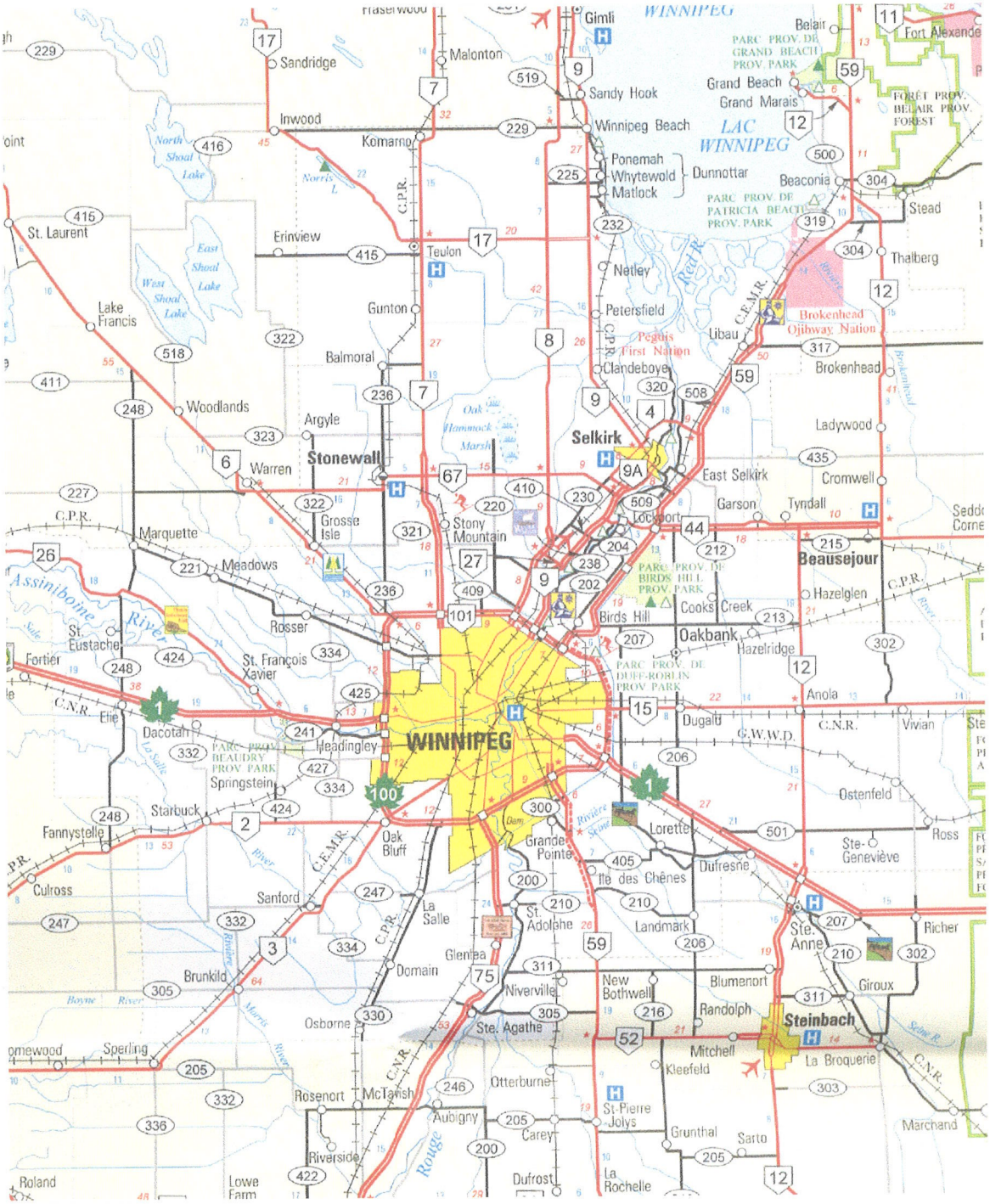
Varennes	1,405	1,240	1,075	1,050	1,060	1,095	-22%
Varsity View	1,575	2,215	2,380	2,410	1,685	2,735	74%
Vialoux	490	1,020	1,055	1,025	980	985	101%
Victoria Crescent	620	745	695	625	595	585	-6%
Victoria West	3,890	3,340	2,970	2,770	2,540	2,545	-35%
Vista	360	1,015	1,360	1,630	1,685	1,625	351%
Waverley Heights		1,050	5,135	5,795	5,695	5,585	432%
Waverley West	75	90	90	60	70	405	440%
West Elmwood	3,320	2,865	2,505	2,550	2,330	2,320	-30%
West Fort Garry Industrial					15	45	200%
West Kildonan Industrial	35	30		5	5	5	-86%
West Perimeter South							
Westdale	2,010	5,320	5,550	5,430	5,260	5,080	153%
Westwood	10,200	10,185	9,570	8,515	7,860	7,505	-26%
Whyte Ridge	125	105		120	2,815	4,445	3456%
Wildwood	1,515	1,300	1,200	1,150	1,125	1,125	-26%
Wilkes South	240	295	285	320	350	355	48%
Windsor Park	14,655	13,805	12,155	11,290	10,795	10,330	-30%
Woodhaven	1,080	1,035	995	910	900	865	-20%
Worthington	3,765	4,430	4,960	5,550	5,420	5,550	47%
Totals	**288,547**	**336,025**	**356,370**	**379,680**	**402,290**	**410,730**	**42%**

* Figures may not sum to total due to random rounding

** For areas that did not have a population count for the 1971 census,
% change is calculated from the first census year showing population.

*** Totals are not exact. Some neighbourhood boundaries have been altered since the formation of Unicity.

Appendix 2: Capital Region of Manitoba - Regional Road Map



Appendix 3: Settlement Centres – Macdonald and Springfield

Rural Municipality of Springfield	
Settlement Centre	**Estimated population**
Anola	250
Cook's Creek	110
Dugald	700
Hazelridge	80
Oakbank	2,300
Vivian	60
Total Municipal Population	12,602
Settlement Centre percentage of Total Population	**27.8%**

Rural Municipality of Macdonald	
Settlement Centre	**Estimated population**
Brunkild	140
La Salle	1,475
Oak Bluff	608
Sanford	758
Starbuck	374
Total Municipal Population	5,320
Settlement Centre percentage of Total Population	**63.1%**

* Population estimates courtesy of Springfield and Macdonald municipal offices – Jan. 7, 2003