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The Process of Urbanization: A Case Study of the Former County of Laprairie

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Masters of Urban Planning, 2002

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McGill University

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A Supervised Research Project submitted
in partial fulfillment of the requirements for the degree of
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Abstract

The purpose of this study is to examine the process of urbanization in the former County of Laprairie, part of the urban-rural fringe of Metropolitan Montreal. It is part of a longitudinal study that commenced in 1964. This study uses Geographic Information Systems (GIS) to create a land use database and corresponding spatial information using 2000 data that is then compared to the 1988, 1976, and 1964 data. The results show increased urbanization and increased land consumption rates when compared to population growth. The increases in urbanization and land consumption rates are caused by factors such as big box developments, residual land uses (quarries, garbage dumps, et cetera), and housing densities. While building densities have increased the residential population density has decreased: the average size of households has fallen from 3.3 (1981) to 2.8 (1996) persons per household. Transitional land uses, such as land that is subdivided but not yet built upon, had diminished in the 1976 to 1988 period. This was widely believed to be due to the introduction of the Act to Preserve Agricultural Land (1978) and the Act Respecting Land Use Planning and Development (1979). However, the net area of subdivided but not yet built upon increased again between 1988 and 2000. The net hectares of abandoned farmland, which is another transitional land use, had diminished between 1988 and 2000: some even returned to agricultural use, suggesting that stable agricultural policy had positive effects.

Résumé

Cette étude a pour but d'examiner le processus d'urbanisation de l'ancien Comté de Laprairie qui fait partie de la périphérie urbaine et rurale de Montréal. Ce comté fait partie d'une étude longitudinale qui a débuté en 1964. L'étude de 2000 utilise le Système d'information géomatique (SIG) pour créer une base de données sur l'utilisation du sol ainsi que leur distribution spatiale en comparant les données de 2000 à celles de 1988, 1976 et 1964. La densification urbaine et les taux d'utilisation du sol sont causés par les facteurs suivants: le développement des grands espaces commerciaux (Reno-Depot, Wal-Mart, Loblaws, etc.), l'utilisation résiduelle du sol (carrières, site d'enfouissement de déchets, etc.) et la densification résidentielle. Alors que la densité de construction s'accroît, elle ne correspond pas à l'accroissement de la population résidentielle. En effet, la taille moyenne des ménages a décru au cours des vingt dernières années passant de 3,3 personnes/ménage en 1981 à 2,8 personnes/ménage en1996. Les usages temporaires du sol tels que les sols subdivisés non-construits, ont diminué au cours de la période 1976-1986. Cela est probablement attribuable à la *Loi sur la protection du territoire agricole* de 1978 et la *Loi sur l'aménagement et l'urbanisme* de 1979. Cependant, les terrains subdivisés principalement non-construits connaissent une croissance de 1988 à 2000. Le taux des terrains en friche a baissé entre 1988 et 2000. Certains lots ont retrouvé leur usage agricole, ce qui laisse entendre que la politique de stabilisation et de protection de l'espace agricole a eu des effets positifs.

Appendix B

Appendix C

Purpose

The purpose of this study is to examine the process of urbanization in the former County of Laprairie, part of the urban-rural fringe of Metropolitan Montreal. It is a continuation of a longitudinal study that commenced in 1964, and has been repeated every 12 years by Masters candidates at the School of Urban Planning of McGill University under the direction of Jeanne M. Wolfe and Jane Matthews Glenn.

The original study was conducted in 1964 by the City of Montreal's Planning Department. Joanabbey Sack (1976), Julie St-Jean (1988) and Gaetane Frenette (1991) have all worked on it. This study, undertaken in 2000, uses Geographic Information Systems (GIS) technology to create the land use activity database and corresponding spatial information[1].

[1] DeMers provides a succinct explanation of the capabilities of GIS technology: "[It] stores data electronically in various layers, each one representing a separate theme or selection of themes (like electronic maps). These digital images can be easily edited, projected or overlaid one on top of the other. The analytical power of a GIS comes from its ability to dissect and relate disparate layers of geographic information. When overlaid, these layers can be analyzed cross-sectorally to determine how the various themes are spatially correlated. This tool is extremely useful for performing area calculations as well as for sorting-out complex spatial relationships" (DeMers, 1997: 11).

Background

Currently there is much attention and debate surrounding topics such as compact cities and smart growth resulting from concern about urban sprawl, the inefficient use of land which has led to encroachment onto agricultural land, and the environmental impacts of urbanization. The hinterland of Montreal, which also happens to be amongst the most fertile lands in Quebec, is in a transition phase where its land is becoming increasingly urbanized.

Urban planners are faced with the reality that plans for the development of communities with a finite supply of land are not being managed properly. This study is the result of such debates and concerns.

Specific Objectives

This 2000 study will be compared with those from previous study years (1988, 1976 & 1964). From this comparative analysis, both theoretical and practical constructs are examined with a focus on:

a) the process of urbanization;
b) how land transformation takes place.

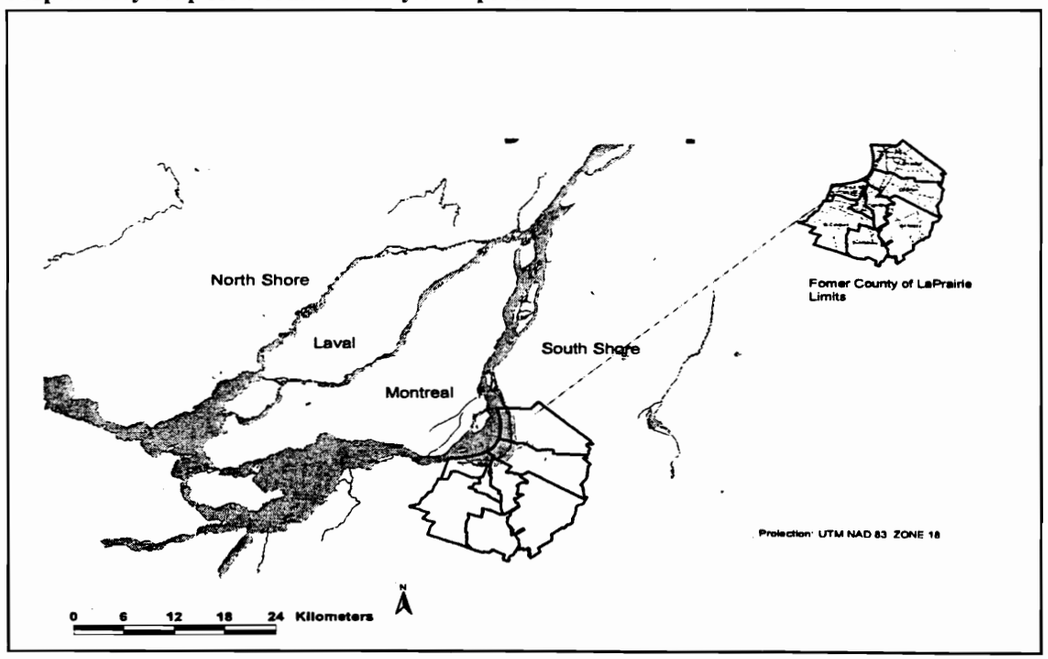
Further objectives of this study are:

a) To see how the Act to Preserve Agricultural Land (1978) and the Act Respecting Land Use Planning & Development (1979) have affected the rate of change of agrarian land being converted to urban purposes on the urban-rural fringe. This will be undertaken by:
    - comparing the 2000 data with the 1988, 1976 and 1964 data
    - establishing to what extent non developed subdivisions in 1988 were developed by 2000
    - establishing whether or not land consumption rates for urban purposes are increasing or decreasing
    - analyzing the extent and spatial distribution of the urbanization process.

b) To attempt to identify factors contributing to and causing wasteful land consumption.

c) To relate findings on development in the study area to concepts of suburban sprawl and sustainable development.
d) To examine possible planning policies and their relevance to the area under study.
e) To demonstrate the utility of digital techniques by transferring all spatial and related land use data to a GIS database.

Map 0.1 Key Map for Former County of Laprairie

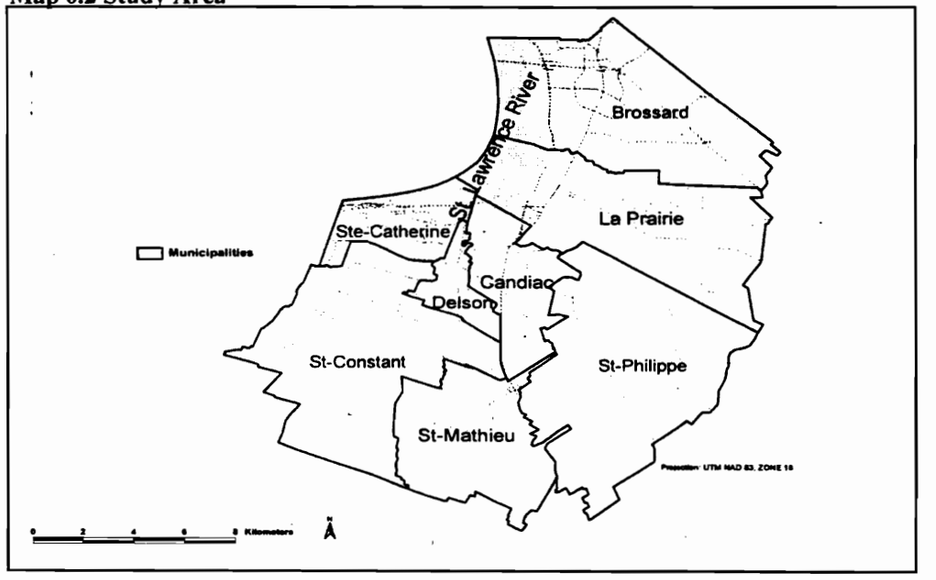


Source: Shoma Murshid, School of Urban Planning, McGill University

The Study Area: Former County of Laprairie

The former County of Laprairie is located on the south shore of the Saint Lawrence River in the Saint Lawrence Lowlands, just south of the Island of Montreal. It is the perfect example of an urban fringe due to its evolution in population, urbanization and density rates, and amount of transitional land. It is composed of eight municipalities, of which six are classified as urban and two as rural. The urban municipalities are Brossard, Candiac, Delson, La Prairie, Sainte Catherine, and Saint Constant. The two rural municipalities are Saint Mathieu and Saint Philippe. Since the introduction of the Regional County Municipalities (RCMs) in the mid-eighties, seven of the municipalities now belong to RCM Roussillon while one, Brossard, is part of RCM Champlain. Another municipality, Notre-Dame, also belonged to the former county and study area but was annexed to Brossard shortly after 1976.[2]

Map 0.2 Study Area



Source: Shoma Murshid, School of Urban Planning, McGill University

[2] For reasons of simplicity, all data depicted in the tables and graphs within this study, values for Notre-Dame before 1976 have been added to Brossard. However, if one would like a breakdown of the numbers for Notre-Dame, please refer to previous studies from 1964, 1976 & 1988.

Outline

Chapter one consists of a review of the literature on urban sprawl, sustainable development for urban regions, the environmental impact of urban development, theories regarding the process of urbanization, pressures on farmland, as well as current farming practices and socio-economic trends in Quebec and Canada.

Chapter two sketches the legal framework of planning in Quebec. It includes a description of the roles of the municipal, regional and provincial governments under the provisions of the Act to Preserve Agricultural Land (1978) and the Act Respecting Land Use Planning and Development (1979).

Chapter three provides the history and outlines for the regional development plans that comprise the former County of Laprairie. Chapter four provides a historical introduction to each municipality within the former County of Laprairie. Chapter five outlines the methodology for this study. Chapter six describes and analyzes the results regarding urban growth. Then chapter seven contains the conclusions for this study.

Chapter 1: Issues

This chapter reviews the issues concerning loss of farmland in the St. Lawrence Lowlands, the need for sustainable development for regions on the urban-rural fringe and urban sprawl.

1.1 Protection of Quality Farmland

Historically, farming was the dominant economic and subsistence activity for the majority of the population that lived in the St. Lawrence Lowlands.[1] However, the advent of the industrial revolution, the agricultural revolution, the onset of the information age in which tertiary sectors are dominant, have all led the majority of the population in the Quebec region and the St. Lawrence Lowlands to secure their livelihood by concentrating in densely urbanized centers. The ratio of urban dwellers to those who grow food has risen remarkably. As populations continue to increase in urban areas, developers and prospective home-owners look to the periphery of the urban centers, that is to the agricultural land, to buy land and build homes. The most productive agricultural lands in Canada are in close proximity to these major urban centers and therefore are strongly influenced by them.[2] The influences range from the direct conversion of farmland to built-up urban area, to the abandonment of agricultural land due to land fragmentation and increased production costs. These influences, along with the mechanization of agriculture and the consolidation of small uneconomic farm units, have resulted, since the 1920s, in a large out-migration from agriculture to a non-farm economy.[3] Because it has become so commonplace in our society we sometimes fail to grasp the magnitude of the migration from agriculture. Economic conditions have had a strong influence on the rate of out-migration from agriculture. One should not conclude immediately that this has been entirely a movement of people from what we generally classify as "the low-income areas" in

[1] The St. Lawrence Lowlands comprise the valley of the St. Lawrence River and are the easterly extension of the Great Lakes-St. Lawrence Lowlands extending through Ontario and Quebec, bounded to the north by the Laurentians and the south by the Appalachians.
[2] Major urban centers in the Great Lakes-St. Lawrence Lowlands: Toronto, Ottawa, Hamilton, Kingston and Montreal.

agriculture. From the decade 1940-1950, the net migration from low–income farming areas was only one-third above that of the higher income areas.[4] Among the generalized low-income farming areas classified by the US Department of Agriculture there were many geographic regions for which the rate of out-migration was below that of medium- and high-income areas.[5] Thus the rate of out-migration from a specific area depends upon complex socioeconomic factors of which relative income level is just one.

According to Higbee and Clawson, concern with adequate production of food and fiber seems to have been displaced by the agricultural overproduction.[6] Ironically overproduction has occurred during the same period as the acreages of farmland have been decreasing. Despite the shrinkage of agricultural lands no food shortage has resulted, due to the introduction of new technologies such as mechanization, irrigation, artificial fertilizers and pesticides as well as genetic improvements, which have significantly increased per acre yields. As farming becomes increasingly mechanized and rationalized, fewer people are needed on the land. On the average, the more urbanized a country, the lower is its rural population density.

Bruce Pond, in his Ph.D. thesis, "Leading Indicators of Rural to Urban Land Conversion: Developing the Latent Image" (1992), explicitly states that the gains in productivity referred to above are unlikely to be maintained into the future since it seems that the points of diminishing return of these agricultural technologies are being reached.[7] Despite lack of empirical evidence of a leveling off[8] of productivity gains, increases in total agricultural output will only be achieved by increases in the amount of land allocated to crop production. The belief that agriculture will require more land in the near future, coupled with a perception that urban areas are wasteful

[3] Hathaway, 1964: 20.
[4] Hathaway, 1964: 19.
[5] Ibid.
[6] For example, in the United States there was a drop of three and one-thirds million hectares of harvested farmland between 1950 and 1978, from 157 to 153.75 million hectares but with an accompanying farm output increase of 67% (Pond, 1992: 8 referring to Higbee and Clawson, 1964).

[7] Pond, 1992:4 referring to Crosson and Brubaker, 1982: 68 & Heady, 1982: 34.
[8] Contemporary Britain, Holland, and Japan, for example, could not maintain their urban population solely from the output of their own farmlands. In 1964, the number of rural inhabitants required to maintain one urban inhabitant was very high – greater than one would imagine from the rural-urban ratio (Davis, 1964: 11). At the start of the 21st century, despite new technologies that have been added, the probability is that the ratio remains the same.

in their consumption of agricultural land, has led to an examination of the process of urban growth.

Furthermore, the loss of farmland to the urbanization process has led international bodies, and local bodies in concertation, to express:

- concern for the maintenance of an adequate land resource for food production;
- recognition of the rural landscape as a recreational resource;
- a wish to preserve a culturally-valued landscape;
- desire for an ordered and economically efficient urban growth.

Consequently, Quebec passed legislation in 1978 and 1979 that can be used to protect agricultural land.[9]

The continued decrease in farmland has been documented for Canada from the census data.[10] According to Bruce Pond, it is a much more crucial problem in Canada than in the United States because the quantity of high-quality agricultural land is much smaller.[11] The most highly urbanized area of Canada, the Windsor-Quebec City axis, comprises less than one-seventh of the settled land area of the country and in 1981 included 44% of the country's urban population[12] and ironically contained 54% of the highest quality agricultural land (Canada Land Inventory (CLI) Class 1 land) and one-fifth of all the good agricultural land (CLI classes 1, 2, and 3).[13] The urban pressure on this land is strong and its value to agriculture is great because of its physical and locational characteristics. Thus, agriculture is affected by expanding urban development in two ways. First, development directly exhausts the agricultural productivity of reallocated tracts. Second, urban development indirectly limits the productive potential of surrounding farms, regardless of ownership. For every tract developed, often many acres of farmland are crippled for agricultural production as a result of conflicts with neighboring residential development. Although some cropland

[9] Act to Preserve Agricultural Land (1978) & Act Respecting Land Use Planning and Development (1979)
[10] Pond, 1992: 3.

[11] Canadian and U.S. situations are not comparable because 51% of Canada's class 1 land is in southwestern Ontario, which is located in a rapidly urbanizing area. Pond, referring to Heimlich and Krupa, liken the Canadian situation to having the population growth of Florida located in the heart of the U.S. cornbelt. (Pond, 1992: 7).
[12] Pond, 1992: 5 referring to Yeates, 1985: 38 & 44.

converted to urban uses can be replaced by forest and rangeland, the agricultural productivity of converted land is lost permanently.

Soils affect types of farming principally because they influence the physical adaptability of crops. Each feature of the soil has a direct bearing on the choice of crops. Recognition of the productivity of the soil and the manner in which the farmer selects crops to make the best use of the soil conditions determine the type of farming. The management of the soil through cropping practices and crop rotation relates to the kind and permanency of the farm type.[14] For example, soil quality and climatic effects on agricultural production have determined that 2.4 hectares of land in the Peace River district would be required to produce the same value of production as that produced by one hectare of Class 1 land in the Windsor-Quebec City axis, where the St. Lawrence Lowlands is located.[15] Due to the level topography and a high percentage of arable land combined with the favorable climate, agriculture in the St. Lawrence Lowlands is generally quite prosperous. Absence of serious crop hazards and the proximity of a large domestic market have a stabilizing effect on farm income. Other production costs and the distribution costs per unit of food produced becomes higher the further the source of food becomes from the market. It is also true that unique production possibilities become entirely lost since some types of crop cannot be grown at all on the replacement land. These factors in combination make it necessary to be concerned with the issues of rural to urban land conversion in the St. Lawrence Lowlands.

One can consider that the Act to Preserve Agricultural Land passed in Quebec (1978) may have fallen short of a fully regional approach to the problems of urban sprawl and preserving prime agricultural lands. For example, according to the most recent figures available (1996), 53.8% of the Montreal census metropolitan area lies within agricultural zones established pursuant to the Act to Preserve Agricultural Land. This is true of 30.1% of the territory of the City of Laval. The portion of Quebec's

[13] Pond, 1992: 5 referring to McCuaig and Manning, 1982: 4.
[14] Hudson, et al., December 1949.
[15] Pond, 1992: 5 referring to Environment Canada, 1985a: 6.

territory that is deemed to be rural encompasses 60 or so more urban service centers, mainly in the 44 RCMs in which there is neither a census metropolitan area (CMA) nor a census agglomeration (CA).[16]

Further reasons that have endangered agricultural lands in areas such as the St. Lawrence Lowlands are:

a) Canadian agriculture today is market-oriented and market-limited. The volume of agricultural output is definitely limited by available markets, and the quantity of resources used in agricultural production is also limited by market demand for agricultural products.
b) For every section of land developed in the agricultural belt, often many hectares of farmland become crippled for agricultural production as a result of conflicts with neighboring residential development.[17]
c) Due to the rise in the market value of these lands, farmers now have an opportunity to sell their land for an amount that would far exceed what they could earn by working it in a lifetime.
d) Alienation due to purchase of farmland by non-farm, individuals or corporations as an investment in real estate. Well-financed professionals are able to hold high-quality agricultural lands in complete idleness because that is their business and they have the capital to buy today for sales that may take place five or ten years from now. This premature expulsion of the farmer from the edge of the city commonly creates a belt of idle land that grows into unsightly weeds and brush between advancing city construction and the outer rim of active farms.
e) There is a rising trend for greenhouse agriculture where one does not utilize the actual soil. The visibility of greenhouse domes is growing in the rural landscape and the cultivation that occurs in these units is not sustained by the prime soil upon which it is located. Long-term non-use can lead to a degradation of the soil's quality and consequently reduce its potential to produce high yields.

1.2 Containment of Urban Area

Despite urban renewal projects that were meant to recapture the exodus of city dwellers who were out-migrating towards the exterior limits of the city's administrative limits, encroachment of growing metropolitan centers onto peripheral agricultural and natural environments became a reality. With the creation of the massive road networks beyond the exterior limits of the city in North America the

[16] Quebec, 2000: 23.
[17] Leo et al., 1998: 201.

exodus continued.[18] The exterior promised new residential developments with more green space and less congestion. Greater numbers of lower density developments[19] started "sprouting" on the outer fringes of the urban centers in the midst of agricultural land. This process, known as "urban sprawl," came into question as it became obvious that this process was not being controlled properly and was affecting the natural balance of the earth that humans did not (and still do not) have a full understanding of yet.[20] What was recognized was that environmental problems were complex and interdependent by nature and that this was disrupting a non-renewable resource, agricultural land.[21] This concern resulted in a new shift in the paradigm of planning.[22] Environmental concerns and sustainable development criteria became synthesized with modern planning. At the same time, political ideologies shifted policy to a market-based stance, so it became clear that planning lacked not only the power, but also the expertise and theoretical knowledge necessary to tackle the environmental problems facing the present populace.[23] Considering population forecasts, which predict that Quebec's population will be virtually the same in 2051 as it is today, plans must be treated cautiously from the standpoint of new infrastructure. Under the circumstances, the public cost of urban sprawl is hard to accept.

[18] Government policies aided the exodus: tax incentives and home-ownership programs, veterans' housing and mortgage insurance programs were all subsidized. Further programs were also made available to prospective developers on the urban fringe (Schoenauer, 1994).

[19] The residential developments in turn attract the clustering of low-density services to maintain the communities, which in turn attracts other low-density services with regard to real estate, communication, tourism, et cetera.

[20] It has been accepted that every activity embarked on by humans has altered, to a greater or lesser degree, the natural balances and processes possessed by the planet. The activity's negative consequences usually have not been foretold and are realized decades later with few quick and easy solutions. Every land-using activity therefore has a classification that ranges from low intensity to high intensity. Therefore, the natural habitat that housed many species, biodiversity, and even areas of higher intensity land use such as agriculture and forestry (classification scale cited in Statistics Canada, 1997: 54), was being depleted at a growing rate. Instead, negative consequences such as air pollution, soil erosion, destruction of biodiversity, destruction of the atmosphere, green house effect are all on the rise in an exponential manner.

[21] Environmentalists oppose urban sprawl on the grounds that it exhausts agricultural land, and disrupts ecosystems, fosters car dependence and related environmental and social disorders, and has adverse effects on human health and safety.

[22] Evans et al., 1997; European Foundation for the Improvement of Living and Working Conditions, 1999; Ave et al., 1997;Hardoy, Mitlin & Satterthwaite, 1992; Rowley & Holmberg, 1992; Saarinen, 1976.

[23] Evans, 1997: 4.

1.2.1 Urban Sprawl

Urban sprawl, as defined by *Urbanisation, 1964*, is:

> The phenomenon of urban expansion taking place in the Montreal Region...new neighbourhoods are being built, suburbs spring up at the edge of the built up area, which spreads out here and there, in bits and patches and in long haphazard strings along the highways, the rivers and the railway lines...and sometimes wherever a development company chooses to build.[24]

A further description is provided by Blumenfeld's memorandum in the same document:

> Most people still misinterpret the modern metropolis as just an overgrown city. But actually there are profound qualitative differences...Not only is its population larger but, as a result of the development of new means of transportation and communication, it is spreading over a vaster and vaster territory. And this territory contains not only the elements of the old city – residences, markets, buildings for government, religion and culture – but extensive areas devoted exclusively to work. It also includes large open areas for recreation... It is, indeed, neither city nor country...No longer can it be identified from the outside by its silhouette, clearly set off from the surrounding fields.[25]

The further the distance from the core (city), the development density decreases. Residential development and all the other services geared that maintain the residential population spread out over vaster pieces of land. This urban sprawl infringes on the agricultural land and creates a disturbance of land uses. Areas directly outside the urbanized area were kept vacant by speculators who hoped for big profits.

> As a result, developers are forced to go beyond the areas of logical development to isolated locations on the urban fringe where they can find land at reasonable

[24] City of Montreal, City Planning Department, February 1968: 2.

[25] City of Montreal, City Planning Department, February 1968: 3.

> prices. This process of leapfrogging creates a "chicken-pox" pattern around the edges of urban areas, a pattern which is aptly characterized as urban sprawl.[26]

Land left in speculation usually becomes a vacant lot here and a dump there. Aesthetically, the result is unpleasing. Other land uses, which are considered to be unwanted or residual, tend to be littered on the outer fringes. According to the 1964 Fringe Analysis (Urbanisation), six categories of non-farmland uses were regarded as problem uses in the fringe: quarries and sand pits, recreation (golf courses and driving ranges), isolated urban residual uses (auto graveyards, industry, hydro sub-stations, dumps), summer cottages, residential estates and cemeteries. Ideally, urbanization that takes place on the outer limits of the city should be controlled in an orderly manner that will produce an economically efficient and personally satisfying environment for all subgroups within a population while maintaining land that may be resourceful in other ways.[27] In the case of the St. Lawrence Lowlands, the land on the outer fringes of the city would be most productive if maintained as undeveloped land saved for production of quality agriculture. An extensive project embarked on by the Real Estate Research Corporation detailing the costs related to urban sprawl, stated that "sprawl" was the most expensive form of residential development in terms of economic costs, environmental costs, natural resource consumption and many types of "personal costs."[28] Installing services and infrastructure for lower density development on the urban fringe with expanses of undeveloped lands in between, is a highly wasteful and economically inefficient practice. Furthermore, the main contributors to low-density suburban development are not residential uses but the non-residential activities such big box developments, strip malls and conventional malls with their huge parking lots, the large industrial and manufacturing districts, hobby farms, golf courses. While suburban residential (net) densities have been increasing in most areas, measured both in population and dwelling units, the

[26] Bosselman, 1968: 5.
[27] Bosselman, 1968: 5.
[28] Real Estate Research Corporation, April 1974: 7.

densities of other uses of urban space, including public-sector uses, have been decreasing.[29]

According to *Municipal Reorganization: Changing Our Ways to Better Serve the Public*:

> Urban sprawl leads to an array of drawbacks, not only a reduction in arable land and increased pollution resulting from longer commuting but also the significant costs engendered by the expansion of the road network, new infrastructure and the under-utilization of existing infrastructure. Various studies conducted outside Quebec have confirmed this assessment. In 1996, the Golden Report estimated that the adoption in the Toronto area of a more concentrated development model would have saved at least $12 billion in infrastructure costs over 25 years, equivalent to 22% of the anticipated investments. While such precise evaluations concerning Quebec are not available, certain indicators suggest similar conditions.[30]

Thus, in many senses, urban sprawl has contributed to unexpected growth-related dilemmas that threaten the long-run viability of participating societies.

1.3 Remedies

> Environmental pollution does not stop at municipal borders. Regulation of the emission of harmful substances, the processing of waste and the conservation or creation of green areas for instance, all demand to be taken up on at least the functional metropolitan level. Of course, some environmental questions (greenhouse effect) are best approached on the world-wide, European or sometimes national scale. However, on the metropolitan level too, the coordination of environmental questions appears necessary. [31]

[29] Bourne, 2001.

[30] Quebec, 2000: 26.

[31] van den Berg, et al., 1997: 6.

Coordination between different levels of government is essential for the proper implementation of sustainable development criteria. As the quote above, from *Metropolitan Organising Capacity: Experiences with Organising Major Projects in European Cities*, clearly shows that environmental problems, though they may have a local source, affect the global community. The importance of implementing and strongly enforcing coordination between different/all levels of government, and providing more political and financial power to the regional level governments so as to solve existing and prevent new environmental problems is further described:

> Joint metropolitan approach to environmental problems is not only required...but also prevents intra-metropolitan inconsistency and inefficiency...a metropolitan approach permits (economic) scale advantages for the design, coordination and implementation of policy.[32]

National and provincial laws may exist that outline the necessity and means of protecting the agricultural resource and environment, but without proper coordination between different levels of government, intra-governmental inconsistency and inefficiency will occur. Therefore, the goal of strongly enforcing the protection of the environment and the agricultural resource will not be realized.

On the other hand, *Metropolitan Organising Capacity: Experiences with Organising Major Projects in European Cities* suggests solutions that not only improve the competitive position of major cities but also contribute to sustainable development. The following is a breakdown of elements that are considered to be crucial for implementing successful strategies while avoiding intra-governmental inconsistency:

- "hardware" – infrastructure, labor and capital;
- "software" – qualitative, intangible, quality of life factors;

[32] van den Berg, et al., 1997: 7.

- "orgware"[33] – a management at the proper functional level that handles 'hardware' and 'software' and all the other remaining factors;
- "finware" – financial arrangements[34] and financing; and 'ecoware' – environmental aspects.

The concepts introduced above, when combined with the framework in the following table enables a region to fully develop and implement strategies that have been successful in terms of sustainable development for European cities (Table 1.1).[35]

Table 1.1 Theoretical Framework for Sustainable Development

Administrative organization	Co-operation of the local levels involved is a necessary condition for the performance of any administrative model.
Strategic networks	Because of the complexity, dynamics and diversity of present society, government on the basis of one-way traffic between public and private actors is no longer satisfactory. In other words: urban management is not just a matter of the formal public administration. Activities related to 'governing efforts' are by definition interaction processes between public actors and public or private target groups or individuals involved. Governing is mainly a process of steering, influencing and balancing these activities.
Leadership	Leadership of key persons within the administrative organization is equally important if not more important than strategic networks.
Spatial economic conditions	The hypothesis is that without the recognition of significant problems in a city or region, the creation of the capacity to develop and implement strategies for sustainable development is more troublesome.
Vision & Strategy	Without vision, efficient organizing capacity is a utopia, an "unguided missile."
Political Support	The elbowroom of public and private actors in urban development is determined in the local political circles and sometimes on a national or even supra-national level.
Societal support	Lack of support of those directly involved or interested, notably the population or specific market (for instance private investors) parties can limit the chances of successful implementation.

Source: van den Berg, et al., 1997.

[33] With 'orgware' representing the handling and exploitation of potentials with respect to the other components.
[34] Economic growth can generate financial resources that can be used for the benefit of the environment and its resources.
[35] van den Berg, et al., 1997: 8-14.

Many of the case-studies, concepts and conclusions in this publication can provide important insights for the Quebec governments to mitigate future intra-governmental inconsistency, thereby providing an effective foundation for the protection of the agricultural lands and the environment.

If future generations are to enjoy the same level of environmental benefits and have the environment supply materials for subsistence, we must safeguard the agricultural base as well as the natural environment from which we extract resources.[36]

It is quite clear that currently some conception of sustainability[37] – or sustainable development - has now become the formal goal of environmental policy, including land use policy in Europe, North America, and the rest of the world. Likewise, environmental planning has incorporated the conception of sustainability into its framework. However, sustainable development is not simply about the environment. It incorporates other indicators of human welfare such as incomes and their distribution, jobs, health, housing, crime levels, et cetera.[38] Sustainable development endeavors to balance the needs of people, the economy and environmental protection. With respect to sustainable development for regions on the urban-rural fringe, it has become commonplace to assert that to prevent any future environmental problems and minimize existing ones, one must plan a sustainable pattern of land use. The problem here, of course, is that there is no agreement as to exactly what a sustainable pattern of land use is. Although studies in *Metropolitan Organising Capacity: Experiences with Organising Major Projects in European Cities* have provided key insights into the framework for implementing and enforcing "sustainable development," the criteria that must be monitored remains vague. Environmental

[36] Furthermore, Canadians now realize that the environment has value beyond its direct use by humans (Statistics Canada, 1997: v). This has led to the Government of Canada in 1990 to ask Statistics Canada to initiate development of an environmental and resource account system that would quantify the links between the environment and the economy. The attempt is to give value that is not usually based on the market value, but rather environmental costs. This report however, is still in the preliminary stages and forms the groundwork for future endeavors (Statistics Canada, 1997).

[37] 'Sustainability' and 'sustainable development' are used interchangeably throughout this particular chapter.

[38] These indicators have been assumed based on the ambiguous definition provided by the famous Brundtland Report: "'sustainable development' is development that meets the needs of the present without compromising the ability of future generations to meet their own needs..." (World Commission for Environment and Development, 1987: 49). Such a definition combined with "[it is] essential to obtain an accurate picture of the true health and wealth of the national economy..." leaves open the criteria with which to monitor sustainable development. Clearly, the 'sustainable development' definition spans a wide range of political positions and its very ambiguity makes it

protection, however, is one of the main concerns from this field. Within the field of sustainable urban planning, land use planning is the oldest instrument of environmental protection. When combined with other tools, such as zoning, subdivision, and licensing and integrating them with sustainable energy policies, waste management, water resource management, pollution control, et cetera, the aim of protecting the environment becomes more well-rounded. Furthermore, for environmental change to occur on the urban-rural fringe, one needs to re-examine the course of low-density development that is present within this belt. Employing existing urban planning tools provided by planning and agricultural laws to create cities that are more 'compact' and higher in density than what presently exists on the urban-rural fringe is the first step towards sustainable development. Over time, the values and criteria can change to incorporate more stringent and effective plans to enhance the beginning of the protection of the environment and its resources.

attractive. It is thus important to ensure that all political positions include a stronger commitment to sustainable development and moreover to the environment above other factors.

What must be recognized is the importance of regional coordination between governments to infuse sustainable development criteria within their agendas. Regional growth management (RGM) has been one avenue explored by many planners, theorists and politicians.[39] The main concern of the article "Is Urban Sprawl Back on the Political Agenda? Local Growth Control, Regional Growth Management, and Politics" is political feasibility of the management of growth at the regional or metropolitan level of government.[40] RGM is a far more ambitious undertaking than local growth control.[41] What must be noted is that RGM's aim is not to stop development, since this is an impossible task. Instead, it accommodates development or urban uses and growth of population where it is occurring while

[39] The list of initiatives using a demanding definition of RGM – includes Oregon, Florida, Washington State, New Jersey, and San Jose and Santa Clara County, California. Politically influential support for RGM has surfaced, among other places, in Michigan, South Carolina, metropolitan Toronto, California, Montreal, Salt Lake City, and Denver, and action has been taken in British Columbia, Maryland, Colorado, Massachusetts, Pennsylvania, and Vermont. To be sure, all this does not mean that RGM is on the way to being achieved. A shifting political balance is not the same as a changed state of affairs (Leo et al., 1998).

[40] Leo et al., 1998.

[41] Agricultural Land Reserves (ALRs) and Habitat Conservation Plans (HCPs) are examples of local growth control that fall short of RGM. The main problems with local growth control plans, such as the aforementioned, are that they may undermine urban considerations in land-use decision-making and

checking its destructive potential in terms of environmental, economic, and social costs.

Other strategies have been used to promote sustainable development principles. They provide a more market-sensitive approach for agricultural land preservation. Two of these strategies are: purchase of development rights (PDR) and transfer development rights (TDR).[42] A TDR approach allows landowners to sell their development rights to a developer. The developer will then use these rights to develop qualified lands at higher densities than allowed under existing zoning laws. This allows local governments to direct development to desirable areas (such as those with sufficient infrastructure) while assuming little financial burden.[43]

Under a similar PDR approach, landowners can sell conservation easements to government agencies or nonprofit organizations. This approach involves the purchase of a deed restriction on qualified farmland that restricts the future use of the land for agricultural or open-space uses. This restriction can be either permanent or temporary. Although the farmer retains the right to sell or transfer the land, it remains subject to the deed restriction constraining future development or activities that may reduce its agricultural viability. An owner of agricultural land may also receive a charitable deduction by donating a conservation easement to a governmental agency or charitable organization.[44]

The feature that distinguishes PDR and TDR approaches from other agricultural land preservation strategies is that they establish property rights over activities on privately owned lands. Both PDR and TDR approaches are market-based and compensate landowners if they surrender their development rights voluntarily. It also has the desired affect to permanently protect agricultural lands through conservation easements. Furthermore, the PDR approach allows for public purchase of an owner's right to convert undeveloped land to a developed use.[45]

also exacerbate urban sprawl by attempting to avoid prime farmland that results in strip and leapfrog developments.

[42] Leo et al., 1998.

[43] (Leo et al., 1998). This is an American strategy that can be incorporated into the Quebec version of land trusts.

[44] Leo et al., 1998.

One of the latest sustainable development and planning strategies that have been embraced by urban planners for the urban-rural fringe are *smart-growth* principles.[46] Each level of government must assume responsibility for realizing a certain set of goals that is within their breadth and scope.

For the metropolitan or regional level, it must[47]:

- establish a long-term urban growth boundary outside of which growth is not permitted and which does not receive urban services;
- designate natural corridors: these are the regional scale elements that serve to preserve ecosystem functioning – e.g. greenways, waterways, and wildlife corridors;
- designate transportation corridors: continuous pedestrian or bike paths, parkways for cars, and rights of way for rail or transit around which future growth can occur;
- integrate regional land use with transportation planning: make sure that new development will be properly served with transit;
- integrate transit services region-wide and with other modes;
- expand alternative transportation modes;
- institute demand management: tempering demand for new infrastructure instead of meeting all demand with new supply;
- establish and strengthen a clear urban structure by establishing priority development areas – around transit stations, rail stops, commercial areas, and redevelopment areas;
- achieve more compact urban patterns by encouraging infill/intensification of existing urban instead of greenfield development and higher density greenfield development where necessary;
- promote regional planning among neighboring communities to develop regional growth strategies and address common issues like the need for affordable housing, integrated transit delivery.

At the local level the following principles must be incorporated[48]:

- create complete communities: mixed-use, mixed-income (and housing type) communities with a wide range of services and amenities;
- create affordability through infill development, alternative housing forms, reducing need for car and increasing access to recreational facilities, development incentives like density bonusing and linkage fees, et cetera;

[45] Leo et al., 1998.
[46] Tomalty, February 1997.
[47] Tomalty, February 1997.
[48] Tomalty, February 1997.

- replace mobility with access: proximity planning, i.e., by bringing uses together in mixed patterns, thereby reducing need to travel;
- provide local transit within walking distance of most homes and make neighborhoods friendly for walking, biking, roller-blading and skateboarding;
- reduce parking standards in order to remove barrier to intensification and to discourage car use;
- preserve green space that promotes clean air, clean water and provides residents with places to walk, play and relax;
- install "green infrastructure:" use biological processes to provide urban services such as wastewater treatment, stormwater drainage and promote the use of local sources of renewable energy: e.g. wind and solar;
- make developers on greenfield sites pay the full costs associated with growth: taking into account not only the public costs of growth, but all the social and environmental costs that might be involved;[49]
- restore a sense of community by fostering citizen involvement in local planning, creating quality public spaces, and employing urban design (e.g., sidewalks, balconies, et cetera);
- enhance economic competitiveness by nurturing a high quality of life that attracts well-trained workers and cutting-edge industries and by promoting the redevelopment of brownfield sites.

Other possible remedies would be:

- increase the percentage of new construction as residential or urban in-fill within the existing urban envelope;[50]
- provide physical infrastructure for housing on more densely-packed streets such as those with thirty-foot lots would be less expensive per dwelling unit than for streets with sixty-foot lots;[51]
- examine the mix of uses and declining non-residential densities, and redress the lack of strategic coordination between housing and other land uses in ways that facilitate service provision, conservation and transit use when residential density on the urban fringe is not the main problem.

[49] Flip side is to give developers who are with the program a financial break. In other words, emphasize and enforce development charges.

[50] Bourne, 2001.

[51] Yet these costs are a relatively small proportion of the costs of new housing and services, particularly in rapidly growing regions. Other local costs, such as those for schools, open space and community facilities, are essentially fixed (Bourne, 2001).

However, focusing on densifying existing urban areas and keeping non-farm activities out of the agricultural belt will not guarantee viable agriculture unless other factors are considered. According to Christopher Bryant:

> One major challenge facing agricultural land preservation is recognizing that farmland preservation cannot be accomplished simply through physical land use planning. Planners and politicians need to recognize that farmland preservation requires a viable farm structure...to incorporate social and economic considerations while working in co-operation with farmer and their families and professional associations.[52]

He goes on to say that identification and pursuit of new opportunities is needed to supply the Canadian urban demand and that the ultimate survival of farmland bordering metropolitan regions will end up depending upon such marketing strategies.[53]

A present trend has been the recognition of value of "peri-urban" agricultural land in the Greater Toronto Area (GTA). A one-year study conducted by Walton and Associates discovered that the area had underestimated the importance of agriculture to the regional economy:

> Agriculture in the GTA is a vibrant, world-class industry of great diversity. The economic analysis confirmed that agriculture in the GTA generates an estimated $1.3 billion dollars per year in annual gross sales. Approximately 35, 000 jobs are supported by GTA agriculture. Despite development pressures, there were still 4621 census farms in the GTA in 1996.[54]

GTA's agricultural land, alongside Quebec's St. Lawrence Lowlands, fall into the limited five per cent of the Canadian land mass that is considered prime farmland.

[52] Bryant, 1994: 51.

[53] Ibid.

[54] Walton, 2000: 4.

This has led various levels of government in the GTA to establish working groups that include members of the agricultural community. The objective of re-establishing agriculture as a significant and critical component of the GTA was achieved and can provide Quebec with a perspective on its own prime agricultural land.

Chapter 2:
The Legal Framework for Local Planning in Quebec

It is widely accepted that local governments in Canada grant property owners and prospective developers approvals regarding land use, and permission for property development. This chapter will lay out the legal framework and context under which the local governments in Quebec exercise their authority regarding land use planning and development.

2.1 Government Responsibilities in Planning

In Canada the division of legislative powers amongst the different levels of government are outlined in Section 91 and Section 92 of the Constitution Act, 1867 (formerly the British North America Act of 1867).

The federal power derives from section 91 of the Constitution Act and provincial power derives from Section 92. This means that legally, the federal government does not control any municipal activities. However, the federal government does affect local conditions due to its many broad powers, such as those over fiscal management (e.g. mortgage rates), and federal infrastructure such as navigation and postal services, trains, airports, major roads, et cetera, and spending power.

Provincial governments are responsible for public lands, property registration and transactions, municipal government, natural resources and the like.

The constitutional position of municipalities, on the other hand, is derivative. Municipalities are the creation of the provinces, and entirely subservient to them. Provincial governments may delegate certain powers to a local authority or government. Municipal institutions in this instance refer to regional and local governments. References to municipal institutions is made in Section 92(8) of the Constitution Act. In some cases where it is explicitly mentioned that the province may delegate its powers or help the local institution are: property and civil rights; organizations of elections, meetings, voting, quorum done by province for municipality; and functions to adopt plans, by-laws, et cetera. The rights and duties of municipalities in Quebec are laid out in the Municipal Code, the Cities & Towns Act as well as the Act Respecting Land Use Planning and Development (1979).

Two acts that have been implemented by the province and are of particular interest to this study are the Act Respecting Land Use Planning and Development (LUPDA) (1979) and the Act to Preserve Agricultural Land (1978). The LUPDA delegates power to Regional County Municipalities (RCMs) and local municipalities. The LUPDA applies to all municipal institutions, unless it is inconsistent with the special acts in a particular municipality. For example, the City of Montreal and the City of Quebec have been exempt from certain parts of this law as they have their own Charters.[1] The only legal body that can modify these Acts and Charters is the provincial government.[2] The province reserves the right to intervene, change and/or modify these laws at any point as prescribed within the laws to protect their own interests.[3] For instance, municipal institutions may not always act in the interest of protecting the environment, or on other issues such as maintaining agricultural land. It is understandable due to the provisions set out in the Act to Preserve Agricultural Lands (1978) why they have not acted in the interest of agricultural land. The jurisdiction for control and protection is beyond their statutory sphere. Instead, local governments may be more interested in increasing their tax base by augmenting the scale of development. The province, therefore, protects its right to affect development plans in a decentralized system, such as the one in Quebec, for cases regarding the environment or agricultural lands, for the sake of conserving resources that can be utilized by future populations.[4]

2.2 Municipal Institutions

The municipal institutions, as have been mentioned before, are made up of two levels of government: regional and local. The clearest examples of articulation between local and regional levels and their plans regarding land use planning and development are outlined in the LUPDA c. A-19.1, subsections 1.1; 3-8; 32-34; and 54-60.[5]

[1] Subsection 252. (Quebec, 7 March 2000).
[2] Currently, there is a municipal reorganization process taking place. It will affect the administrative limits and scope of jurisdiction that has been outlined in this chapter. (For further information please refer to Quebec, 2000).
[3] As outlined in subsections 149-157 (Quebec, 7 March 2000).

[4] Purpose of the Agriculture Act: This is to guarantee "a lasting territorial base for agricultural purposes and to foster the preservation and development of farming activities and farm enterprises in the established agricultural zones, in keeping with" the concept of sustainable development". (Quebec, Commission de protection du territoire agricole du Québec, August 1999).
[5] Subsections 1.1,3,5,6,7,8 & 56-60 (Quebec, 7 March 2000).

2.2.1 Regional Government

RCMs group together local municipalities on a basis of social, economic or physical affinity, for planning and other purposes. RCMs were set up after the passage of the LUPDA in 1979.

RCMs must prepare a development plan that is approved by the provincial minister.[6] Obligatory contents include:[7]

1) general aims of development;
2) policies regarding land use;
3) urban perimeters;
4) zones liable to flood or subject to natural hazards;
5) thoroughfares;
6) areas of special cultural, historic, aesthetic, and/or ecological value;
7) transportation network for terrestrial transport;
8) existing & planned infrastructure;
9) permanent agricultural zones;
10) plan for implementation, along with estimated costs (say for infrastructure, et cetera).

There is also an optional section dealing with private forest preservation, density, inter-municipal development proposals, et cetera.[8] The legal effect of a regional plan is that it binds local municipalities to prepare their own detailed plan within its framework.

The regional councils are constituted by local councils electing their members to the Regional Council. Therefore, the Regional Council's power base is local.

2.2.2 Local Government

Municipal governments are responsible for the preparation and adoption of a local plan. Two years after a regional development plan has been adopted, the local councils of the governments must have had prepared a detailed local development plan that

[6] Subsections 3,5-8,32,47,54,58, & 61-65, (Quebec, 7 March 2000).
[7] Subsection 5 (Quebec, 7 March 2000).
[8] Subsection 6, (Quebec, 7 March 2000).

conforms with the regional plan.[9] This must then be approved by the Regional Council for conformity.

Plans are implemented by the local municipalities through the usual range of land use controls: zoning, building, and subdivision by-laws. They also have the power to expropriate, to undertake special planning programs, and build infrastructure and other projects. A land use by-law, drafted by a local government, must be approved by the RCM. If the RCM rejects a local by-law, it must state its reasons. The local government has the ability to appeal to the Municipal Commission to review the RCMs decision if it feels that the rejection was discriminatory. The local government can also circumvent this path by adopting a by-law that excludes contentious articles. When the local government, an individual, or other property owners, want to modify existing land usage, the procedure outlined in these by-laws must be followed and an approving officer of the local government will then apply their regulatory or discretionary powers to the application.[10] Each tool has a fairly strong content and procedural protection for landowners.[11] The main issue for this study is the extent to which the LUPDA applies in an agricultural zone, outlined in the following section.

[9] Subsection 33, (Quebec, 7 March 2000).

2.3 La Commission de protection du territoire agricole du Québec (CPTAQ)

The CPTAQ is a provincial administrative body and tribunal set up under the Act to Preserve Agricultural Land (1978). Its main functions are set out in subsection 3 of the Act to Preserve Agricultural Land[12]:

> (a) to decide on applications for authorization submitted to it pursuant to the Act in respect of the use, subdivision or alienation of a lot and applications for the inclusion or exclusion of a lot in or from an agricultural zone;

[10] Regulatory - the by-law has been drafted in a way that landowners and any party know exactly what rights one has. No element of subjective decision-making is provided here. A computer can issue it. It spells out what an official must do in terms of land use control; standard applications to all/any situations. Discretionary - This is a by-law that simply sets out the procedure for how a potential owner can apply for a land use change; however, rights are not set out; it is subjective and judgements/decisions are made on a case by case basis; decentralized.

[11] A strong procedural content protects the private person from these laws, depending on how invasive it is on land uses, i.e. licensing has the least protection since it is the least invasive on land.

[12] (Quebec, 1 April 2000).

(b) to issue the operating permits required for the removal of topsoil, in accordance with Division V;

(c) to describe, in cooperation with the local municipality, the agricultural zone in the territory of that local municipality;

(d) to issue a notice in any other case where a matter must be referred to it pursuant to the Act;

(e) to supervise the administration of this Act.

The manner in which the two Acts co-exist in Quebec is that the Act to Preserve Agricultural Land takes precedence over the LUPDA, since the former operates at the provincial level and the latter operates at the regional/local level.

Since the designation of the permanent agricultural zones in the late seventies (they have been amended several times since then), any land use changes that are to occur in designated agricultural zones, whether subdivisions, construction of new buildings, et cetera, are not to be undertaken without the authorization of the Commission. Thus, subdivision approval in rural agricultural areas (permanent agricultural zones) of Quebec cannot be approved by municipal institutions. The CPTAQ reserves the right to approve or reject these applications.

The interrelationship of the two Acts - the Act to Preserve Agricultural Land and the LUPDA - are interesting. The Act to Preserve Agricultural Land effectively sets out the perimeter of urbanization. The Act is administered by a provincial authority within the permanent agricultural zone; the LUPDA is administered locally and essentially deals with development issues within the urban perimeter.

Chapter 3: Current Development Plans for Roussillon and Champlain

The original County of Laprairie was disbanded with the passage of the LUPDA (1979), and parts fell into the new Regional County Municipalities of Roussillon and Champlain. The history and outlines for the regional development plans that comprise the former County of Laprairie will be provided in this chapter. Both RCMs have followed the prescribed planning process in the LUPDA (1979). Each produced a development plan after 1979 (RCM Roussillon, 1986 & RCM Champlain, 1986) within the prescribed seven-year delay, and each has prepared a revised development plan more recently (RCM Roussillon, 2000 & RCM Champlain, 1998) again in conformity with the law.

3.1 COMPREHENSIVE DEVELOPMENT PLAN: ROUSSILLON

The 2000 development plan for RCM Roussillon applies to seven of the eight municipalities that form the former County of Laprairie: Candiac, Delson, La Prairie, Sainte Catherine, Saint Constant, along with Saint Mathieu and Saint Philippe. This chapter provides the basic contents of the plan, which is broken down into three main parts: an introduction, the planning context, and then the detailed development plan.

The development plan contains four major sections. The first addresses procedural matters. The second gives a general description of the RCM, its composition, location, demographic characteristics, and growth in terms of residential development and of economic activities (industry, commerce and agriculture). The third section describes the major orientations of the land use plan, the organization of activities, transportation networks and interventions. The fourth lists the land-use and regulatory controls, including definitions of uses, standards, classifications and the like. Section five treats the capital costs of the projects proposed, while section six deals with the phasing of development (short, medium and long-term). The seventh

section describes the process of public consultation, and an eighth contains various technical appendices.

From the perspective of the present study, the *Schéma d'aménagement* contains useful background information and confirmatory statistics.

3.1.1 Highlights of Urbanization in Roussillon:

The main highlights that pertain to the urbanization process for Roussillon are:

- Following a study of the local municipalities in September 1998, 1488.34 hectares of vacant land was found to be available for residential development within the whole RCM. According to the zoning regulations for densities allowable for certain areas within the urban perimeters, 18, 000 new residential units could be constructed. For the municipalities of the old County of Laprairie, the breakdown of vacant land in hectares is provided in the following table:

Figure 3.1 Breakdown of Vacant Land

Municipality	Candiac	Delson	La Prairie	Saint Constant	Sainte Catherine	Saint Mathieu	Saint Philippe
Vacant Land (ha)	156.88	35.73	225.5	88.85	N/A	N/A	113

Source: MRC de Roussillon , revised second draft on September 2000.

- Average value of housing units for this region was established at $99, 309 in 1996. Candiac ($127, 810) had the highest average and Saint Mathieu ($74, 919) the lowest average.

- The municipalities with the highest number of residential housing starts between 1988-1998 were Sainte Catherine (2767), Saint Constant (2617) and La Prairie (1957). On the other hand, Saint Mathieu (97) had the lowest, as is reflected by the lack of new development infrastructures (sewage, piping, roads, et cetera).[1]

- Among the municipalities, Saint Constant was the one that built the most single-detached houses. Between 1988-1998, 2005 new residences were constructed, which translates to an annual average of more than 200 housing starts.[2] These were mostly in the late 1980s. Since 1995, the number of new housing starts has decreased considerably.

- Sainte Catherine comes in second place with 1729 single-detached housing starts and an annual average of 173 new dwellings. Unlike Saint Constant, we find that the development increases rapidly at the beginning of the 1990's.

- Over the last ten years, Sainte Catherine and La Prairie had the highest number of multi-family housing starts.

[1] MRC de Roussillon, revised second draft on September 2000: 26.

- As a general rule, municipalities that are more urban had a higher proportion of higher density, apartment-type developments while rural municipalities had a higher proportion of single-family detached type of housing.

- Close to 65% of the housing developments of the region were built over the last 30 years, especially for municipalities with an urban character. Rural municipalities, on the other hand, have had their housing developments spread out over time.

- Over three-quarters of the housing is owner occupied (76.3%) while 23.7% is rented. Generally, the urban municipalities shared a higher proportion of rented domiciles: La Prairie – 35.5%; Sainte Catherine – 24.9%; and Delson – 24.8%. Candiac, incidentally, has the highest proportion of owner-occupiers. Rural municipalities had the highest proportion of owners who lived in their dwellings: Saint Mathieu – 88.5%; and Saint Philippe – 84.3%.

[2] MRC de Roussillon, revised second draft on September 2000: 27.

3.1.2 Highlights of Agricultural Land in Roussillon:

The main highlights of the development plan that pertain to the state of agricultural land for Roussillon are:

- Seventy-two percent of the RCM is situated in the permanent agricultural zone due to its soil quality and modern farming techniques and agriculture is thus a very important economic activity for the region. The geographic and climatic conditions of Roussillon provide wide agricultural potential. According to a study by the Minister of Agriculture, Fisheries and Food, 270 farms were registered producers in 1995.[3]

- Since the first development plan, there have been no major modifications to the agricultural zone.

- The presence of different activities in the agricultural zone creates incompatibility problems between each other which is not conducive to long-term viability of agriculture (Example: gravel pits, auto graveyards, junkyards, garbage dumps, et cetera).

[3] This consisted of 3% of the total agricultural farms for Montérégie. Montérégie is on the South Shore of Montreal and consists of 15 RCMs with 225 municipalities over an area of 11 000 km^2.

- The road network tends to attract linear development within the permanent agricultural zone, which is also not conducive to long-term development of agriculture.

3.2 COMPREHENSIVE DEVELOPMENT PLAN: CHAMPLAIN

The development plan for the RCM Champlain applies to only one of the eight municipalities that currently make up the former County of Laprairie: Ville Brossard. It provides a detailed picture of the last municipality under examination in this study. This development plan follows exactly the same order as for Roussillon.

3.2.1 Highlights of Urbanization in Champlain:

The main highlights of this development plan document that pertain to the urbanization process for Champlain are:[4]

- the urban zone represents more than 74% of the total surface area;
- in terms of the urbanized zone, the dominant land use is residential;
- sixty-seven percent of all construction permits in 1991 were for residential uses;
- projected addition to existing population is 51, 000 persons or 20, 000 households by 2011;
- residential taxation revenue ($9.3 billion) accounted for 67% of the total RCM revenue;
- within Brossard, areas of future residential development will be in Sections C, L (in the east) and at the river's edge.

3.2.2 Highlights of Agricultural Land in Champlain:

The main highlights of this development plan document that pertain to the state of agricultural land for Champlain are:

- Twenty-five percent of the RCM is zoned for agriculture.
- Only 30% of the lands in the RCMs agricultural zone are actually being used for agricultural purposes.

[4] MRC de Champlain. "Schéma d'amènagement" website, 2001.

- Agricultural activity takes place on only 20% of the 1520 hectares zoned agriculture in Ville Brossard.
- Urban pressures have had a negative effect on the agricultural lands found in this RCM, as it has on other RCMs. Close to 70% of the agricultural land is in a transitional state, that is, used neither for agricultural nor urban purposes.
- Twenty-six commercial farms in the RCM generate an average revenue of $70, 053 per year and a total of $1.8 million.
- Champlain has the intention to promote operating farms, as opposed to the existing tracts of abandoned lands and has stated explicitly that its urban zone already has ample space to accommodate new urban functions without infringing on the agricultural lands.[5]
- Many areas in the agricultural zone lack proper drainage and care of watercourses.
- Wooded areas/forests cover more than 45% of the agricultural zone in Champlain.
- Wooded areas are a territory of interest not only due to the immense expanse that it covers in this region but also due to its ecological and biodiversity value.
- Land use category "agricultural and recreational" applies to the eastern edge of Brossard where the city, Hydro-Quebec and the Ministry of Transport own most of the land. This portion of land is situated at the extreme south east corner of Champlain, south of Autoroute 10 and west of Autoroute 30. It is mostly wooded and contains a reserve of uncommon trees and other species.

[5] MRC de Champlain, revised in 1998: 37.

Chapter 4:
Municipal Profiles & Statistics

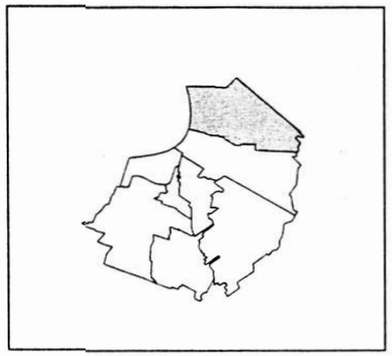
Access from Montreal to the former County of Laprairie is possible across two bridges: Pont Mercier and Pont Champlain. Pont Mercier is located just on the western edge of the former county. Pont Champlain provides direct access into Brossard, which is located on the other extreme end of the study area. One major characteristic in this study area is the outstanding presence of big box developments along the main commercial spine, Taschereau Boulevard (Route 134). Taschereau Boulevard binds all the urban municipalities together. Pont Mercier and Pont Champlain are found on opposite ends of Taschereau Boulevard.

The creation of the bridges brought urbanization to this study area. The first nodes of urbanization occurred around the bases of the bridges. Further creation of the autoroutes and highways that linked with the bridges allowed the urbanization process to spread and densify. Autoroute 30, the latest addition to the network of autoroutes found in the study area, will bring in further development.

This section provides a thumb-nail sketch of each municipality individually.

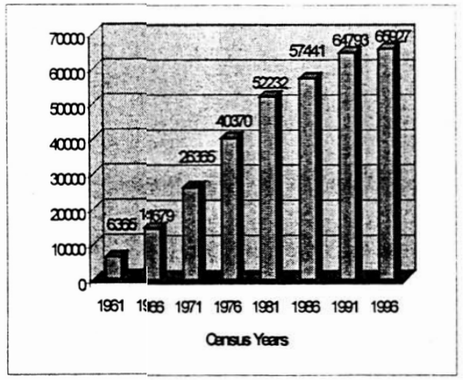
4.1 Ville Brossard

Map 4.1 Brossard



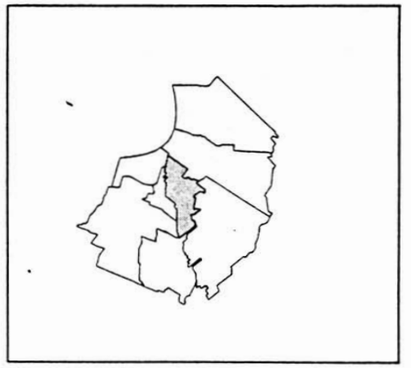
Brossard with a population of 65, 927 is now the largest town in the study area. Back in 1964, when the Champlain Bridge opened, this was the first area to become massively suburbanized. The primary function of this municipality is residential and this is evident by its growth of urban land. Residential dwellings and commercial activities that support residential activities dominate most of this area. The average household income for this municipality is $60, 834.[1] Lands in transition, that can be considered neither urban nor rural, start just before Autoroute 30 and end at the edge of the municipal limits.

Graph 4.1 Population Growth by Census Years from 1961-1996: Brossard



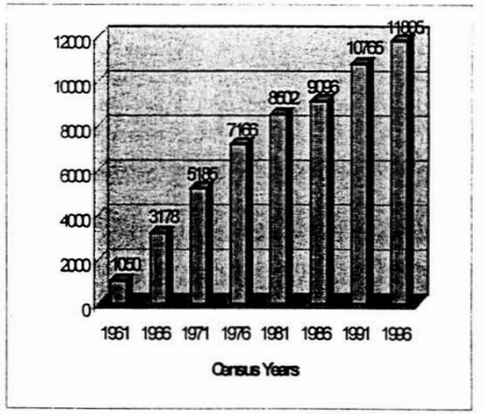
4.2 Ville de Candiac

Map 4.2 Candiac



Candiac was founded as a private-sector speculative development hoping to capitalize on the opening of the St. Lawrence Seaway by becoming an industrial port. After its initial overall plan was drafted, it became incorporated as a town in 1959. Initially it developed a solid industrial base with Iroquois Glass but experienced slow residential growth. Today, the residential density has increased and the average household income for all private households is $67, 635.[2] The main commercial and recreational centers are a strip mall located near the corner of

Graph 4.2 Population Growth by Census Years from 1961-1996: Candiac



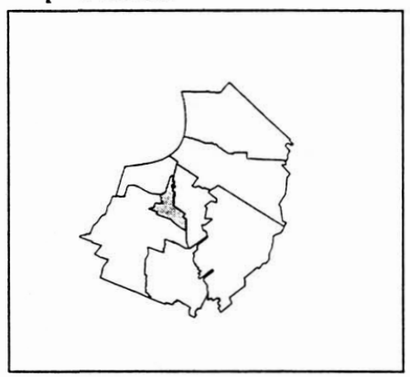
[1] Statistics Canada, 1996.
[2] Statistics Canada, 1996.

Boulevard Montcalm and Chemin Handel and Club de Golf Candiac. The latter comprises approximately seventy hectares or five percent of the total municipality.[3]

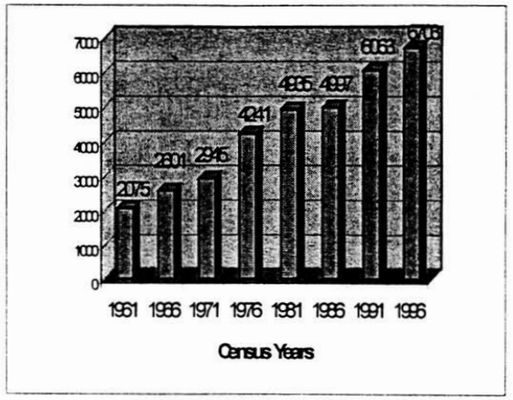
4.3 Delson

Delson is located directly east of Candiac, and historically was an unstructured and unplanned municipality. The CN Rail Museum is located in this municipality. Commercial activity in this area has increased through big box developments located along the major artery, Taschereau Boulevard. One notable development between 1988-2000 is the massive garbage dump located at the southeast corner along Autoroute 15. Today, Delson can be described as an urbanized municipality with abandoned fields scattered in small parcels. There is no evidence of farming in this municipality with one exception: along rue Principale, just north of Route 134, there is a small parcel of land bordering rue Robidoux that is actively cultivated. The average household income for all private households in this municipality is $49, 590.[4]

Map 4.3 Delson



Graph 4.3 Population Growth by Census Years from 1961-1996: Delson

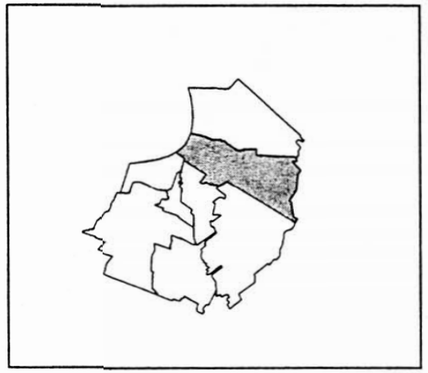


[3] Table 6.5 from Chapter 6 "Results of the 2000 Survey & Comparison to Previous Studies"

4.4 La Prairie

This municipality is located just south of Brossard along the St. Lawrence River. It was originally an independent market town. The old center of La Prairie is over two centuries old and is designated as an historical district. Stemming from the early days of industrialization, it was famous for the Laprairie-Cooksville brickworks. Surrounding this historical district is a new residential waterfront development of mid-rises and multiple-unit dwellings.

Map 4.4 La Prairie

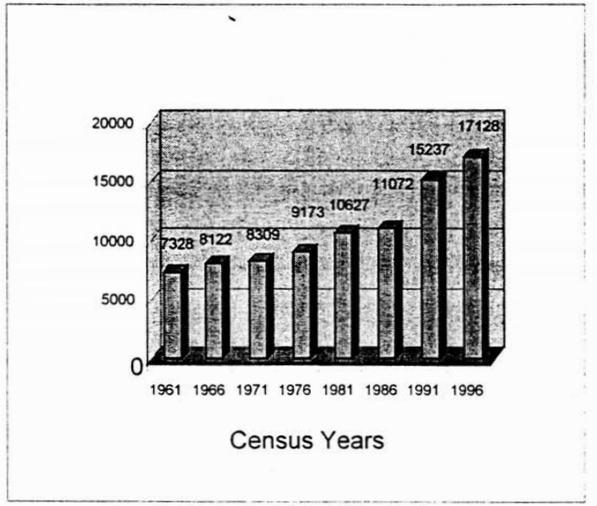


Suburbanization only arrived at this municipality following the extension of autoroutes and highways such as Boulevard Taschereau in the 1970s.

Boulevard Taschereau runs through the center of the urban area and marks the border between the old and new development. Most of the commercial activity is located along Taschereau which weaves in and out of this municipality.

Just east of this artery, along rue Saint-Jean, a new residential community exists due to the GOREDCO project (1972). There is a huge tract of land just southeast of the axes of rue Saint Jean and Taschereau that has been subdivided and prepared for residential purposes. Land near the new Autoroute 30 has been subdivided for commercial purposes; from my field observation, it was being developed for golfing. Just south of Saint Elizabeth and the CN railroad tracks, within the confusing assortment of industry, an active quarry remains.

Graph 4.4 Population Growth by Census Years from 1961-1996: La Prairie

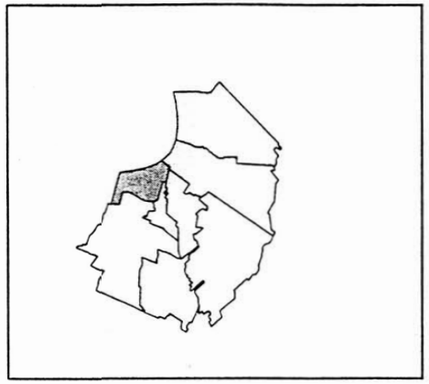


Today, the average household income for all private households is $ 51, 642.[5]

[4] Statistics Canada, 1996.

4.5 Sainte Catherine

Map 4.5 Sainte Catherine

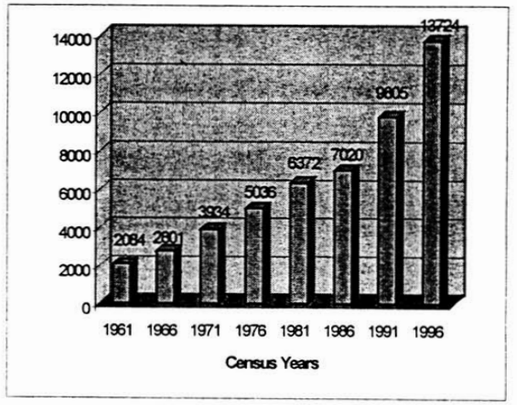


This municipality is located on the extreme northwestern side of the study area. This municipality contains the biggest presence of commerce along the Taschereau corridor. The commercial development is dominated by "power centers" of big box development.

The western portion of this municipality is dominated by industrial activities. Due to the modest size of this municipality, the industrial activity tends to overpower the observer's sense of proportion between residential and development used for other purposes. Along the western edge between Taschereau Boulevard (this boulevard is also known as Route 134) and the waterfront edge scattered development of industry exists between abandoned fields. It is somewhat messy in appearance. Furthermore, within the industrial areas, residential blocks become visible and provide one with a feeling of non-compatibility in use.

Just south of Taschereau along the western edge, a huge piece of land exists as subdivided but not yet built upon and has been reserved for industrial purposes.

Graph 4.5 Population Growth by Census Years from 1961-1996: Sainte Catherine

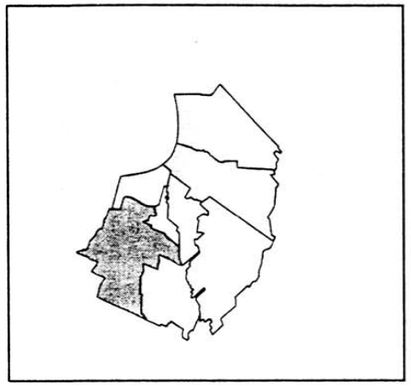


East of this area, planning and compatibility of uses between residential and commercial activities take shape. Most major commercial activities are located along, as aforementioned, along Taschereau, with the exception of some minor activities along rue Saint-Pierre. The average household income for this area for all private households is $48, 527.

[5] Statistics Canada, 1996.

4.6 Saint Constant

Map 4.6 Saint Constant

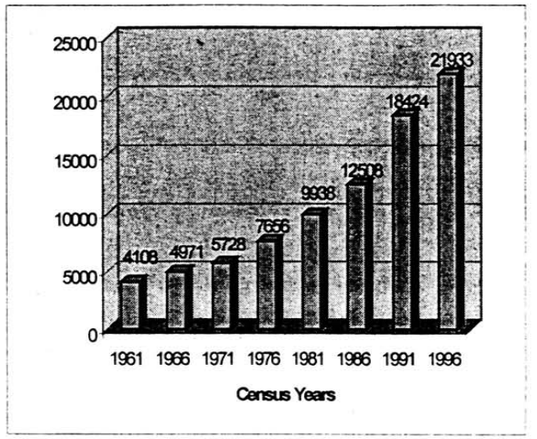


This municipality is located in the southwestern portion of the study area. Along the northern portion of this municipality, urban development predominates. However, just south of this area, about 80% of the land is devoted to rural activities. A transition zone seems to also exist between the urban development (mostly residential in nature) and rural agricultural lands. Within this transition zone, most farmlands are neglected and appear abandoned, with a limited amount of vacant, subdivided land for future use (mostly for residential purposes).

Within the developed urban area, the La Farge Quarries are located along the northeastern edge and have expanded considerably since the last study. Amongst all the municipalities in our study area, this area depicts the largest growth with respect to this extraction related activities since the last study in 1988.

Housing types vary greatly within this sector. For example, a large estate was observed just north of Montée Saint Régis on Chemin Sainte Catherine. Housing types show the diversity of income levels and lifestyles found in this municipality.

Graph 4.6 Population Growth by Census Years from 1961-1996: Saint Constant



The section of the municipality where rural activities seem to dominate has interesting distinguishing characteristics from other municipalities of the study area. This area has an abundance of farms, many cultivating crops for a chain supermarket. Other distinguishing activities in this area are pasture land, agro-farming, orchards, poultry farming, sheep farming, dairy, and greenhouses.

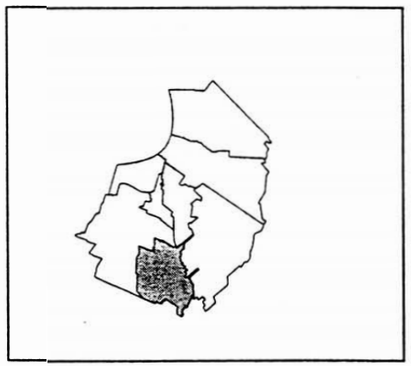
Interestingly, on the southwestern edge of the municipality in the middle of farmland, a parcel of land has been developed into a residential neighborhood between the last study and now.

Furthermore, on the southern edge of the municipality, in the middle of the agricultural belt, a metal processing plant is present with an adjacent junkyard.

The average household income for all private households within this municipality is $52, 811.[6]

4.7 Saint Mathieu

Map 4.7 Saint Mathieu

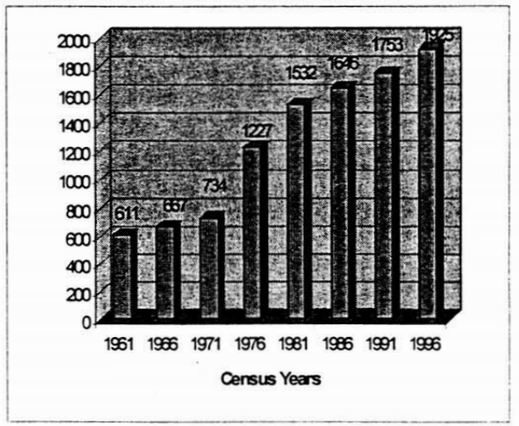


This area is mainly farmland. However, an urban node has developed since the last study at the axes of chemin Saint Edouard and rue Principale. Trailer parks are evident on the northeastern edge of the municipality. Future development seems to be impending between the rangs of Chemin Saint-Pierre and chemin Poissant-Principale where most of the land is currently subdivided for residential development.

Otherwise, this area remains agricultural.

The average household income for private households within this municipality is $43, 023.[7]

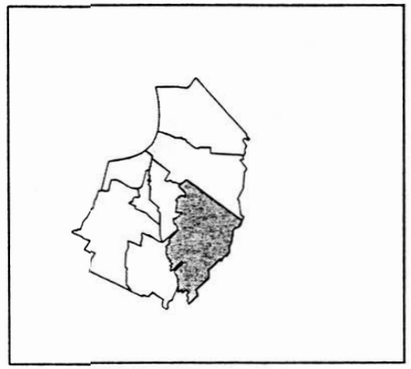
Graph 4.7 Population Growth by Census Years from 1961-1996: Saint Mathieu



[6] Statistics Canada, 1996.

4.8 Saint Philippe

Map 4.8 Saint Philippe



This municipality is rural in landscape with occasional groupings of development that are residential in nature. Trailer parks and mobile homes mark the northwestern edge of this area.

A town center is also apparent in this area between Boulevard Monette and Montée Saint Claude. Commercial activities such as restaurants and a large depanneur are located within this center. Surrounding this nucleus are low-rise apartments. The further one moves from this center, the more the residential structure becomes dominated by single-family dwellings. A auto junkyard is also located in this area, on Boulevard Monette.

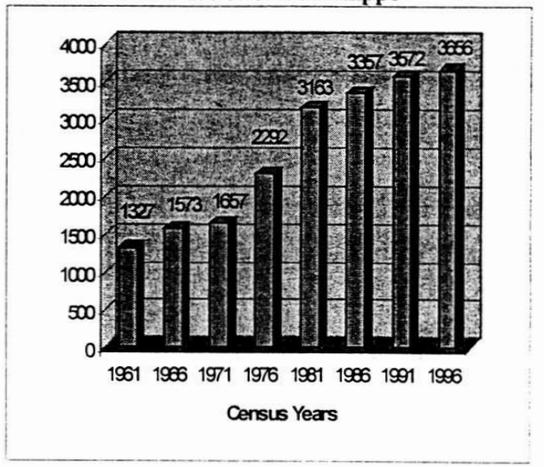
[7] Statistics Canada, 1996.

There are two other distinguishing characteristics for this rural region, campgrounds and horseback riding farms and establishments are abundant.[8]

This municipality also had one large lot of agricultural land completely devoted to pine trees. This nursery probably supplies the region with Christmas trees.

The average household income for this municipality is $43, 680.[9]

Graph 4.8 Population Growth by Census Years from 1961-1996: Saint Philippe



[8] These activities are probably due to the sandy soil quality of this region.
[9] Statistics Canada, 1996.

Chapter 5: Methodology

This project examines the process of urbanization on the fringe of the Montreal metropolitan region. The scope of this study is land use change. The collection of new data for this project has been limited to land-use information gathered in the field and does not include land-market activity (land values and sales) data, land ownership pattern analysis, or socio-economic analysis of the populations. The empirical research consisted of four activities:

1. field survey;
2. GIS mapping;
3. collection of population & other data;
4. GIS analysis.

5.1 Field Surveys

The field survey was undertaken in the summer of 2000, using aerial photographs as a base map (scale: 1:15 000; date: June 1997).

Starting in late July, every cadastral lot within the study area was visited and land use activities were recorded for that time. The record of land use activity is, in essence, a "snap shot" for this particular time.

5.2 Classification Used in this Study

The classification system used in this study replicates the system used in previous studies undertaken by Jeanne Wolfe, Joanne Sack-Abbey and Julie Saint Jean.

Two major groups of land use activity were used for mapping purposes: Urban Land Use Activity and Transitional Land Use Activity.

5.2.1 Urban Land Use

Urban land use includes residential, industrial and commercial development, urban related recreation, such as golf courses and camping grounds, and quarries and roads constructed in built-up areas. Trailer parks, cemeteries, garbage and junkyard dumps are also included in this category. The following are aggregations used in previous studies and in this study:

- Urban Residential (including community facilities, i.e. community centers, recreational paths, community parks, schools, sport centers, et cetera);
- Urban other than Residential (i.e. urban commercial & urban industrial).

5.2.2 Transitional Land Uses

Transitional lands are neither active agricultural or forested lands nor developed land. They are lands that are "in-between." They include lands that are subdivided not built (SNB) for residential, commercial and industrial purposes, as well as lands that are abandoned, such as abandoned farmland, suspected abandoned farmland, and abandoned woodlots. The term 'abandoned' which has been used throughout this study means idle or vacant, and identifies farmland and woodlots that are no longer in use.

- Subdivided not (yet) Built Lands

This type of land was identified by evidence of services installed or obviously planned such as fire hydrants, survey posts, sewer pipes.

Again a distinction was made between subcategories; however, for analysis purposes, industrial and commercial subdivisions were grouped together.

- SNB. Residential
- SNB. Commercial
- SNB. Industrial

⇒ That is, SNB Other (than residential)

- Abandoned Farmland, Farm Fields and Buildings

These are plots of land on which farming is no longer being practiced. This is indicated by growth of weeds, scattered bushes and trees, neglected orchards. No crop or pasture land (except uncultivated hay fields) was classified as abandoned.

- Farms and Woodlots as Suspected Abandoned Land

Farms and woodlots are suspected to be abandoned when apparently not in use. Hay is often cut on land that may be abandoned. Therefore, other indicators are used to identify such lands:

- fences down or in disrepair;
- farm buildings which appear to be unused or dilapidated;
- evidence of preliminary surveying (posts);
- 'For Sale' signs.

- Abandoned Woodlots

Woodlots occupying the backland of abandoned or suspected abandoned farms.

5.2.3 Rural Land Use

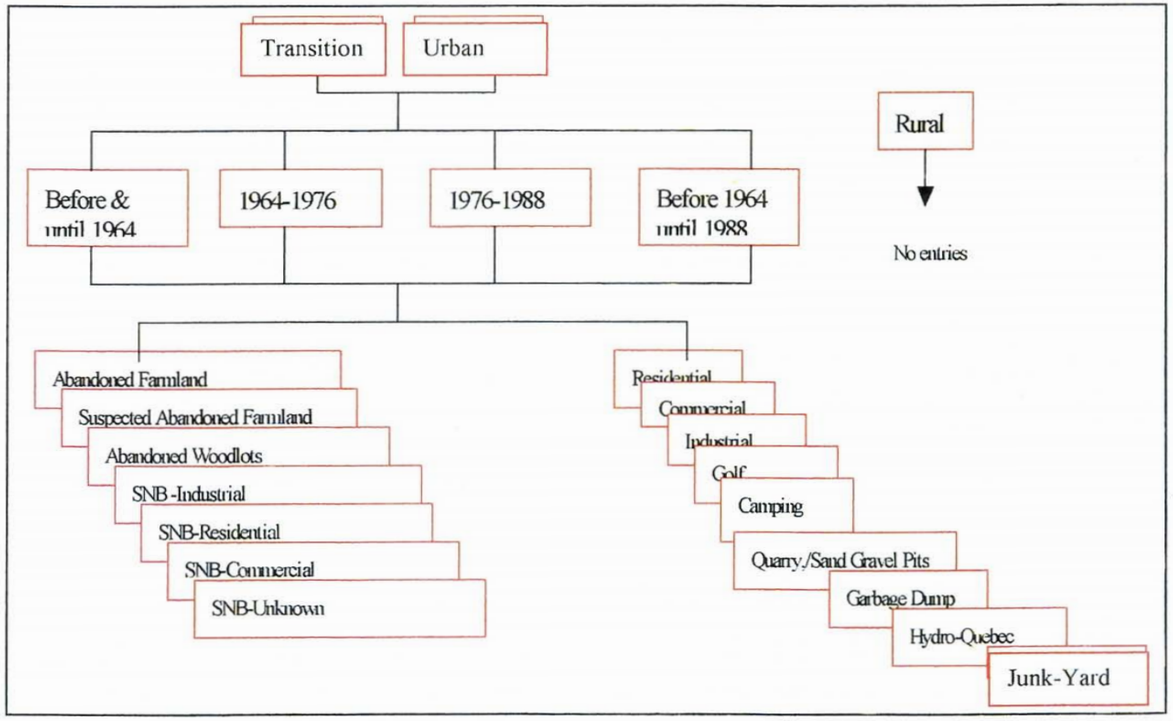
Rural lands are properties that are currently actively farmed or used for farming purposes. Examples include agro-industries, lands used for crops cultivation, as well as lands used for animal husbandry. Rural land also includes forests and natural conservation areas.

In summary, the main categories for this study are Urban Land Use, Transitional Land Uses and a residual Rural Land Use category.

The following sections will further outline the classification system used for this study, as has been recorded in the GIS database. One way to view all the contents of the database is through a tree diagram (Figure 5.1).

The database contains some rural land use entries. For example, conservation areas in the agricultural zone that are identified in comprehensive plans, have been digitized. These are not used for this study but may be used for future research. However, all active, operating farms are not digitized.

Figure 5.1 Tree Diagram for GIS Database



5.3 GIS Mapping

5.3.1 Choice of Procedures to Amalgamate Data

The procedure to amalgamate data that is presented in this work has been multi-fold. Field mapping in the summer of 2000 was digitized to create maps with related databases in GIS. Past studies representing the data for the same region from previous years were also digitized from Julie Saint Jean's 1988 study which contains data from 1964, 1976 and 1988 (12-year intervals).

5.3.2 Techniques & Criteria

Registering Past Data

Many problems were encountered while registering Julie St. Jean's maps (1989) for 1988. The first step was to scan her maps and then open up the unregistered maps/images in ArcView 3.2. The information contained in these maps was then vectorized manually.

Registration of her maps with real-world coordinates was the next step. Ideally, the projection and datum of maps are used during the registration process. Since the maps were hand-drawn, this information was not available. Therefore, they were registered in the same manner as images such as air photos, by associating known points with registered maps and scaling, rotating and stretching the image to correspond with those points. The registered maps used for this process were the enumeration boundaries, provided by Statistics Canada, and a road network coverage file, provided by Natural Resources Canada (NRCan)(Figure 5.3). The error was consequently reduced to 65 meters.

What must be noted is that manipulating the 1988 maps meant warping any errors, which included missing data or data that did not fall into the study zone. The following summary of the cartographic procedure from 1988 shows how this occurs.

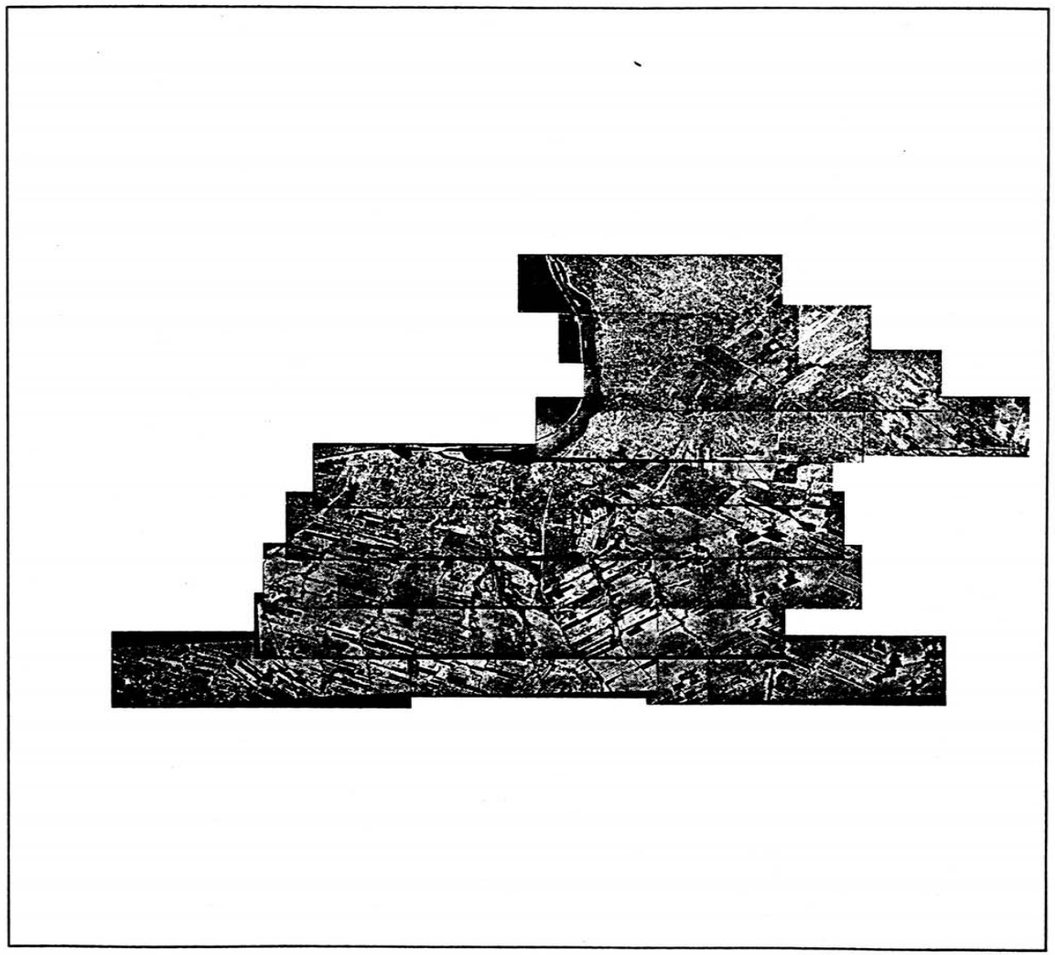
The field mapping project that was completed in 1988 used 1:15 000 orthogonal aerials from 1981. These were photocopied on 12" x 12" paper and pasted together to form a map. Inventories of 1988 activities were made on these photocopies. The original copies of the aerials were reduced to 1:50 000. The 1976 land inventory from Joanne Sack-Abbey's study was then traced and overlaid onto the reduced

colored aerials.[1] Polygons representing the land inventory for 1988 were added to these tracings. Finally, the 1976 land inventory map was traced and super-posed on top of the marked activity changes recorded between '76-'88.

No error calculation was possible for this procedure. Transferring data manually and through photocopies from paper onto differently scaled sheets that can shrink, fade and stretch, may introduce a high level of error into a cartographic procedure when compared to the contemporary standards set by GIS map-making.

Another area where error could have been introduced for the eventual calculation of area for the land use data was during the digitization process. Each millimeter on the 1988 maps represents a 50-meter distance in the real world. I tried to avoid this error by zooming (usually within a 1:1000 scale) within ArcView and by digitizing on the inside of given polygons representing the data. However, a slight aberration in digitizing could yield an error in the process.

Figure 5.2 Aerials Aligned



[1] This land inventory was also reduced and traced onto tracing paper.

Creation of the 2000 Land Use Activity Map & Related Database

The first step when creating a land-use map using GIS software is to have a registered base map. No digital or registered base map was available at the beginning of the study and had to be created. A digital file of the aerial photographs was consequently created and used as the base map. This digital format was given real-world coordinates with the help of different GIS software. This led to the creation of a digitized and geo-registered map. All pictures were joined and aligned to represent the eight municipalities of the study area (Figure 5.2).

Flight Lines and Picture Numbers Used to Represent Area of Study:

Date of pictures: June 1997
Scale: 1:15, 000

FLIGHT LINE	PICTURE NUMBER
31H23 HMQ97-100	54,55,56,57,58
31H22 HMQ97-123	60,59,58,57,56,55
31H21 HMQ97-105	204,205,206,207,208,209,210
31H20 HMQ97-105	100,99,98,97,96,95,94
31H19 HMQ97-104	145,144,143,142,141,140,139,138,137,136,135
31H18 HMQ97-104	13,14,15,16,17,18,19,20,21,22,23,24
31H17 HMQ97-103	182,181,180,179,178,177,176,175,174,173,172, 171,170
31H16 HMQ97-103	48,49,50,51,52,53,54,55,56,57,58
31H15 HMQ97-104	237,238,239,240,241,242,243,244,245,246,247, 248,249,250,251,252,253,254

Each aerial photograph was scanned individually and at the highest permitted resolution possible (300 dots per inch), within the constraints of the software and

space available at the School of Urban Planning. These images were saved as TIFF images.[2] Rotation, scaling and aligning of the images were performed in PhotoShop.

The alignment process is as follows:

One picture was locked into position and every other consequent photo for a particular series/flight line of aerials was then modified and nudged into position with the locked image (starting from left to right). Some problems were encountered during the alignment process. One was due to curvature effect of each photo.[3] These photos were not orthogonal, which means that curvature effect had not been mitigated. Therefore, the least distortion on the picture occurred in the center of each image. The greatest distortion occurred on the top and bottom of each picture and series of photos. The second problem was due to altitude differences between each picture. Even though these aerials have been recorded at one standard altitude (scale), there were slight variations between each picture. Average error in scale between the pictures was approximately 10 meters in real-world distance.

Thus, to minimize errors for the base map, the main issue was to create as close to an orthogonal image as possible within the bounds of the software available.

Steps taken to minimize curvature effect:

- In PhotoShop: 33% was cropped off of each side (top, bottom, left, right) of the picture to reduce distortion due to the photography process.

Steps taken to minimize difference in scale:

- Even though each photograph is recorded at the scale of 1:15 000, the gauge on many aerials indicate that several were taken at different altitudes. Scaling was performed to mitigate the difference in scale between the pictures and allow the mosaic of pictures to line up as accurately as possible between themselves.

Ideally, each picture would have been individually registered. However, there were not enough roads available per photo to register each properly. Instead 5 images per

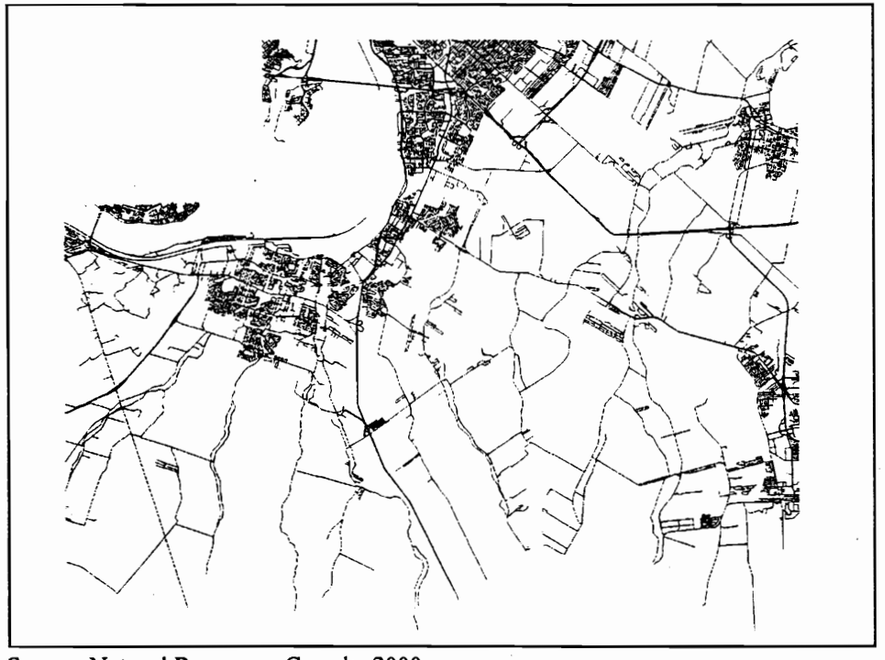
[2] TIFF: Tag Image File Format. This process was deemed to be the best for GIS purposes, as it did not loose detail in ArcView. Standard images and pictures when saved for digital purposes are usually saved as JPEG images. However, JPEGs use compression which leads to a loss of detail.

[3] This can be minimized by special software programs in focal lens and distance and estimate a correction based on lens information on the camera used.

series/flight line were chosen and joined, once again using PhotoShop. This was saved at the highest resolution possible to retain detail.

Arc/Info was then used to register the images (16 series in total that made up 9 flight lines) according to an existing digitized road network file provided by NRCan. This registration process was accepted on the basis that each point during registration fell below RMS of 0.001. This provided each series of pictures with an associated world file (TWF). All images were rectified to ensure that they were aligned with respect to Cartesian coordinates.

Figure 5.3 Natural Resources Road Network File



Source: Natural Resources Canada, 2000

Once the registration and rectification processes were completed, an average of the highest possible error between the image and the NRCan registered road network file was calculated. This was performed by using 454 points, distributed where the most distortion would occur along the mosaic of aerials. The greatest average error obtained was 10.055 m.

Once the air photos were registered within acceptable boundaries for GIS cartography/digitization, the new map was digitized using ArcView. Data was manually digitized onscreen. Any information regarding the data being mapped onscreen was input into an associated database.

The method used for digitizing data was to trace along the outer edges of polygons except when it bordered another polygon or when it bordered municipal limits. The principle of "back of the lot-line to half of the street width in front of the property" was also used in the digitization process. However, in some cases, the polygons did

not cross onto half of the street width where it bordered. This was due to houses not fronting on that particular street, and/or SNB lots that seem to have an internal smaller street network planned and no obvious fronting onto existing streets.

Digitization of land use activity for the year 2000 was made accurate to the level of error provided by the registration and rectification process (10.055m) by making sure that the information digitized did not overlap other digitized data. The tool found in ArcView to 'snap' or abut polygons of information to one another allows the mapper to digitize data without overlapping and therefore introducing new error to the new map. Abutments of data were found where adjacent polygons were neighboring each other closely and did not represent subdivided not built areas (SNB), obvious disruption (i.e. power lines or other land use activity taking place), or did not front and occupy that particular space.

Further detection of errors caused by digitizing was undertaken. This process detected whether any slivers of data overlapped one another, or if the digitized data contained any null polygons (polygons that were created by accident during digitization that contain no value/area or information) or dangles. A script file obtained from ESRI was used to calculate the area of different land use activities within the specification of UTM NAD 83, Zone 18 projection. The output provided by this routine depicted sliver polygons which were then deleted from the database.

Figure 5.4 StatsCan Roads on top of NRCan Roads

The boundaries I had chosen to depict the eight municipal limits within my study area were from 1996 Enumeration Area Digital Cartographic Files from Statistics Canada Geography (based on based on 1996 Census). These geo-referenced files were provided courtesy of the Walter Hitschfeld Geographic Information Centre's website (http://felix.Geog.McGill.CA/heeslib/) (last accessed: August 2000). The enumeration areas were downloadable in Arc/Info Export format (.E00) in Latitude/Longitude projection.

These digital files were chosen to depict the boundaries of the eight municipalities of the study area for the following reasons:

1) enumeration areas always respect higher-level geographic areas such as municipal boundaries. Hence, the enumeration areas once joined would accurately depict municipal limits;
2) the source of these files was federal and therefore accuracy of the digitizing and geo-referencing should be commensurate with GIS cartography standards and consistent with digital files from other sources. Despite the source of these bounds, it became apparent when overlaid on top of the NRCan road network file and the associated geo-referenced base map (air photos), that the boundaries were on average 40 meters off. The enumeration areas from Statistics Canada (StatsCan) were only consistent with the street network file originating from the same source (containing streets, railways and hydrography).

The exact reason why NRCan and StatsCan digitized files do not line up is not clear. One reason may be that the information registered and digitized at each federal department originates from different sources. NRCan obtains most of its data through land surveys while StatsCan uses data from published paper maps ranging in scale from 1:2 000 to 1:50 000. This inconsistency between the two sources used for the database had to be solved. There were two possible ways:

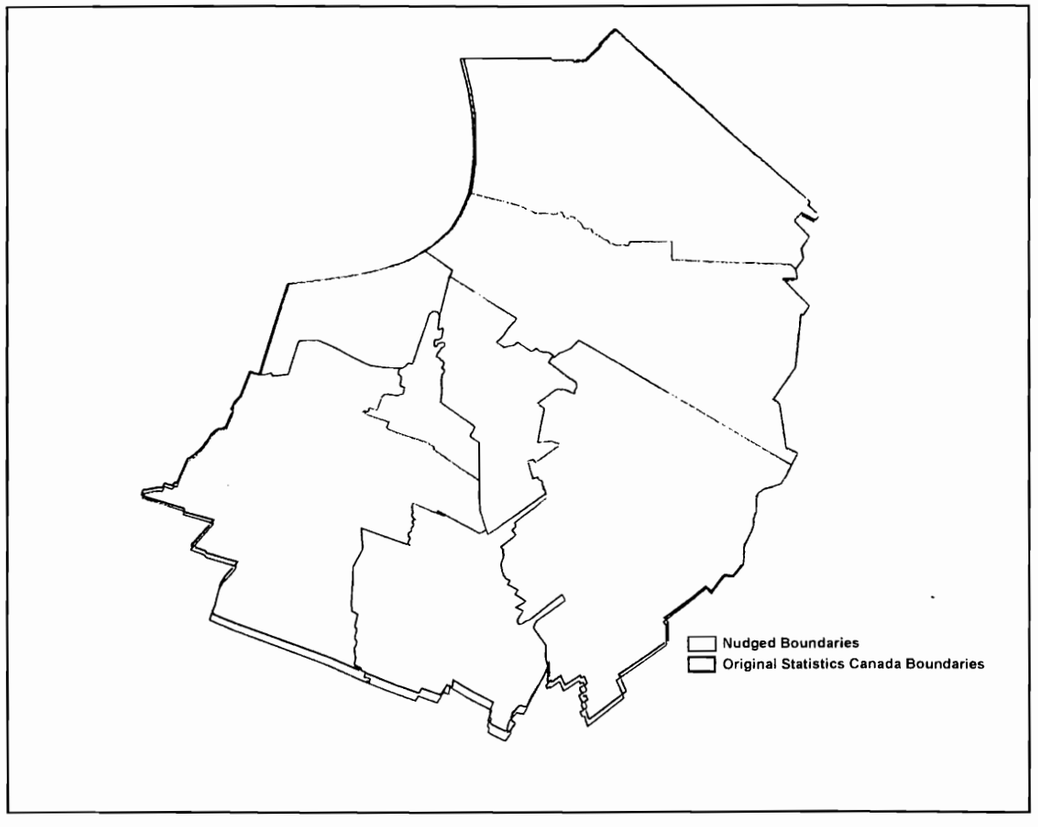
1) re-registering and rectifying the aerials to the Street Network File of StatsCan and proceeding thereon;
2) "nudging" the enumeration areas bounds by means of re-registering and warping to better fit the NRCan road network file. This was performed in the same manner as was done with Julie St. Jean's maps. The enumeration area bounds were combined with the StatsCan street network file and both were re-registered and warped to the known geographic space of the NRCan road network file.

The primary reason that led to discarding the first option was:

- re-registering the base map (mosaic of aerials) to the StatsCan street network file would lead to high errors as the road coverage was not complete for the whole

study area. For example, major and secondary roads were missing for the municipalities of Sainte Catherine, Delson, Saint Constant, Saint Philippe and Saint Mathieu.

Figure 5.5 "Nudged" Enumeration Area Boundaries



Option 2, of nudging the StatsCan enumeration areas (that is, the municipal limits) became the viable solution. After several different tries, the least error obtained between the StatsCan boundaries and the NRCan road network file became 23 meters (Figure 5.5).

Other Constraints to Analytic Procedure

The following were other constraints encountered in the course of this study:

Field Observation Constraints

- during the collection of data on-site (fieldwork), inaccessibility to many interior lots due to lack of trail for car or bike (walking was attempted);
- size of each parcel of activity was an 'educated guess' due to visual estimation during fieldwork/land inventory on-site;
- some lots in rural areas which appear abandoned or are suspected to be abandoned may be subject to crop rotation, et cetera;

GIS Mapping Procedure Constraints

- determining back of lot-line per parcel of activity when digitizing;
- visually determining half of the street width when digitizing at a scale of approximately 1: 2000.

5.4 Population and Other Statistics

This section provides the sources used to complete the analysis that is provided in the upcoming chapter.

2000 population data were obtained from the Institut de la Statistique du Québec.[4]

1988 population data were obtained by extrapolating a 2/5 population change between the 1986-1991 distribution from Census Canada. Table 2's Annex (Table 2 is presented in Chapter 6 of this study) provides a detailed breakdown of this process.[5] All other population data used in this study were obtained from Statistics Canada.

The areas per municipality were verified from Répertoire des Municipalités du Québec, 2000.

Definitions and formula for some terms used in this study:

Densities

Gross density – persons per hectare (total area of the municipality)

Urban density – persons per urban hectare

Residential density – persons per residential hectare (including roads and community facilities)

Rate of Urbanisation

This term refers to the number of newly urbanized hectares of land per 1000 population increase.

Formula:

$$\text{Rate of Urbanization} = \frac{\text{Increase in urbanization (area)}}{\text{Increase in population (in thousands)}}$$

5.5 GIS Analysis

After having completed the digitizing of the land use map using the classification system set up from previous surveys, a tabulation performed by GIS provided the results of the 2000 field survey as well as any information that was digitized from previous surveys. The aim of using GIS for analysis purposes is to increase the accuracy of analysis of land use activity. This analysis, combined with population and other statistical data obtained from the federal and provincial governments,

[4] (1): Institut de la Statistique du Quebec Estimate. Estimate tabulated on July 1. (Institut de la statistique du Quebec web site, Last accessed: July 1, 2001).
[5] Please refer to Appendix B.

provides the most accurate results of all the surveys to date. The following chapters will explain the results of the 2000 field survey as well as make comparisons with the results of the previous studies (1964, 1976 & 1988).

Chapter 6:
Results of the 2000 Survey & Comparison with Previous Studies (1988, 1976, 1964)

This chapter shows the results of the field survey and GIS analysis. The bulk of the information presented is in the form of tables and graphs that represent the results of the 2000 field survey and data from past surveys. Detailed mapping of the information is found in Appendix C (Maps 1-6). It documents the 2000 field survey, and compares the results with those of previous years of study (1964, 1976 & 1988).

The variables addressed are:

- Population Growth
- Population & Density Growth
- Urban Land
- Density of Residential Areas
- Rate of Urbanization
- Rates of Consumption of Land for Urban Purposes
- Subdivided Not Built Lands
- Abandoned Lands

A final section of the chapter addresses agricultural zoning. Again maps referring to this section are found in Appendix C (Maps 7 & 8).

Table 6.1: Population Change by Census Years: 1961-1996

	1961	% Increase	1966	% Increase	1971	% Increase	1976	% Increase	1981	% Increase	1986	% Increase	1991	% Increase	1996
Brossard	6365	130.6	14679	79.6	26365	53.1	40370	29.4	52232	10.0	57441	12.8	64793	1.8	65927
Candiac	1050	202.7	3178	63.0	5185	38.0	7166	19.0	8502	7.0	9096	18.4	10765	9.7	11805
Delson	2075	25.0	2601	13.0	2945	44.0	4241	16.0	4935	1.0	4997	21.3	6063	10.6	6703
La Prairie	7328	11.0	8122	2.0	8309	10.0	9173	16.0	10627	4.0	11072	37.6	15237	12.4	17128
Ste-Catherine	2084	34.0	2801	40.0	3934	28.0	5036	26.0	6372	10.0	7020	39.7	9805	40.0	13724
St-Constant	4108	21.0	4971	15.0	5728	33.0	7656	29.0	9938	25.0	12508	47.3	18424	19.1	21933
St-Mathieu	611	9.0	667	10.0	734	67.0	1227	25.0	1532	7.0	1646	6.5	1753	9.8	1925
St-Philippe	1327	18.0	1573	5.0	1657	38.0	2292	38.0	3169	5.0	3357	6.4	3572	2.4	3656
Total	24948	54.7	38592	42.1	54857	40.7	77161	26.1	97307	10.1	107137	21.7	130412	9.5	142801

Source: Statistics Canada

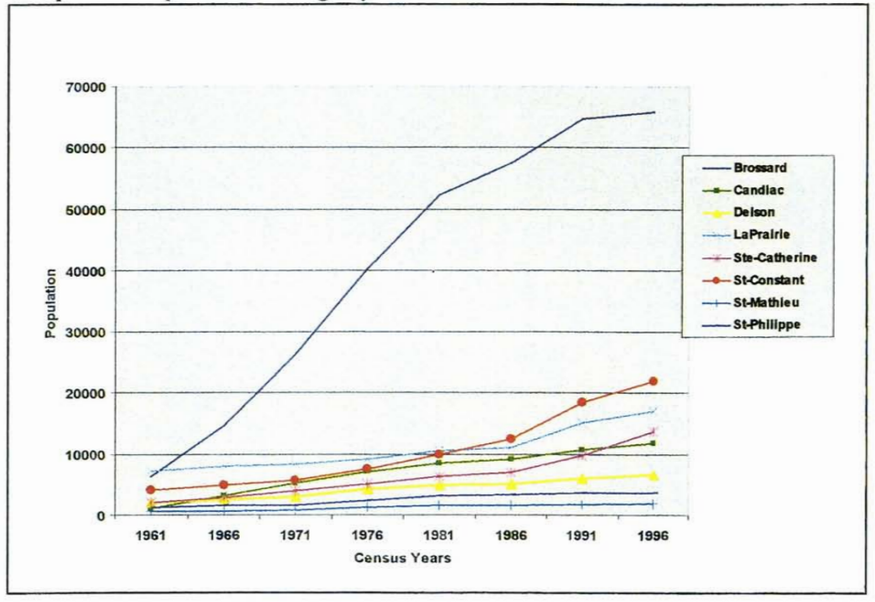
6.1 Population Growth

Table 6.1 presents population evolution for each municipality comprising the former County of Laprairie according to the census years covering the study (Graphs 6.1, 6.2 & 6.3).

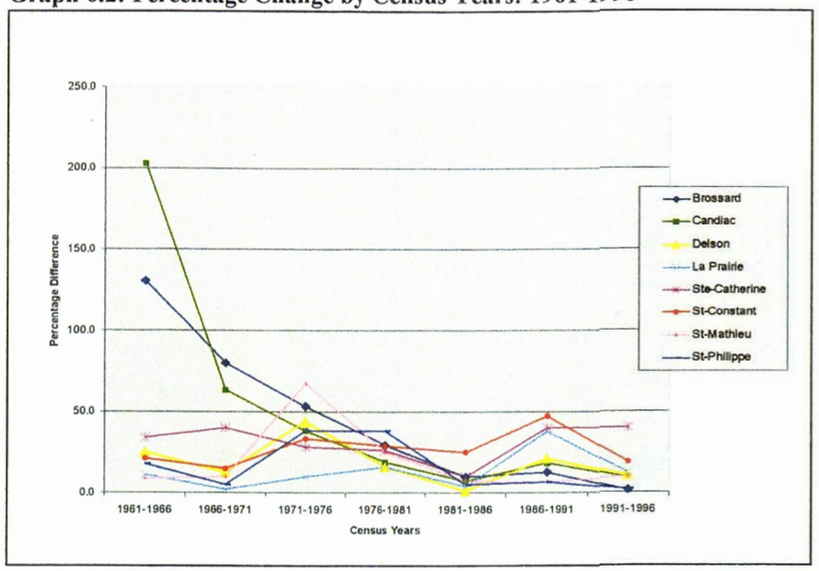
The most recent average population growth for the 1991-1996 period was 9.5%. The municipalities that were above this average were Candiac, Delson, La Prairie, Sainte Catherine, Saint Constant, and Saint Mathieu. Brossard and Saint Philippe fell well below the average growth.

The percentage increase for each municipality between the census years 1961-1996 varied widely. The most extreme percentage differences are Brossard and Candiac,

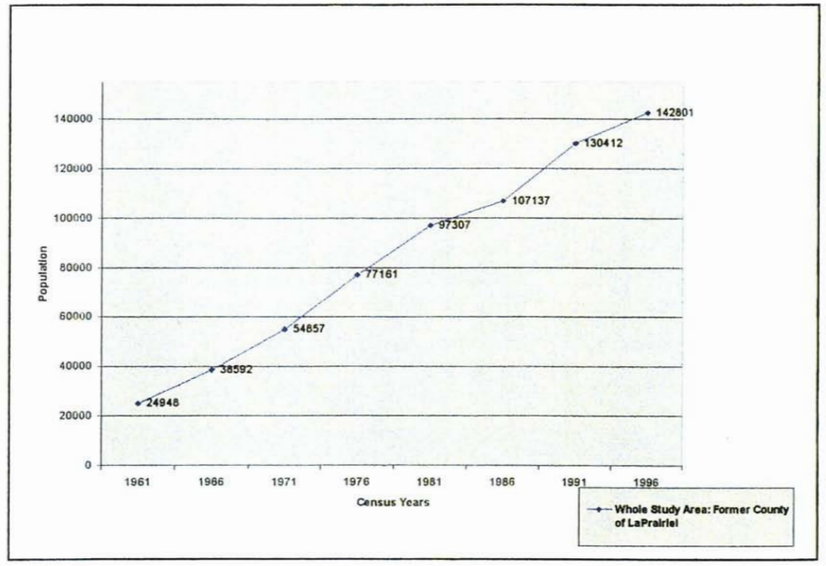
Graph 6.1: Population Change by Census Years: 1961-1996



Graph 6.2: Percentage Change by Census Years: 1961-1996



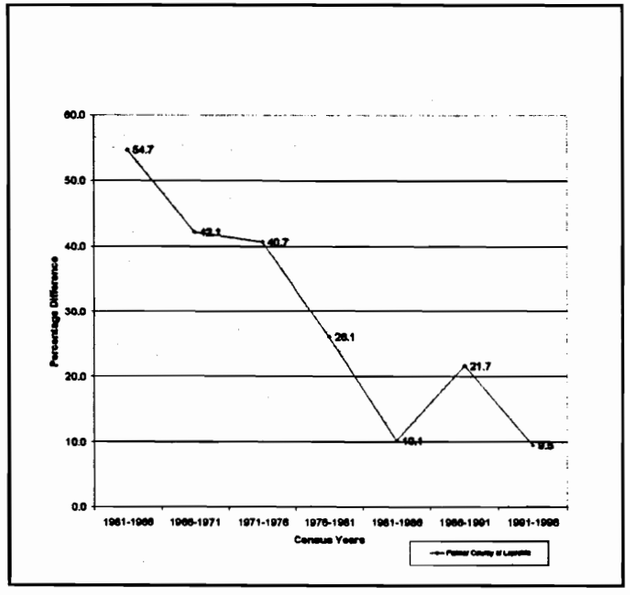
Graph 6.3: Population Change by Census Years for Whole Study Area: 1961-1996



who have dropped from above the hundred per cent mark to below five per cent according to the most recent census. Saint Mathieu and Delson showed a sharp increase from their average between the census years 1971-1976. Saint Philippe showed a sharp increase for the same years and remained at the same level for the next period but then dropped off drastically between the census years of 1981-1986 and continued to decline thereafter. Every municipality, other than Brossard, Candiac and Saint Mathieu, have remained below 50% with respect to its percentage differences since 1961-1996.

The total, depicted in Table 6.1 and Graph 6.3, is the summary for the former County of Laprairie. When compared to the previous census years, the percentage increase for the most recent period (1991-1996) has decreased considerably (Graph 6.4). The general trend depicted by the former County of Laprairie has been that the rate of growth of population has been decreasing overall over the census years. In the 1960s,

Graph 6.4: Percentage Change in Population for Former County of Laprairie by Census Years: 1961-1996



the percentage growth was amongst the highest ever recorded according to the data recorded between 1961-1996. It then reached an all-time low for the census years between 1981-1986. For the consequent census year, it increased but then for the following census years between 1991-1996, it decreased again to 9.5%. Between the last two census years of 1991 and 1996, there was a 12.2 % decrease in the rate of growth for population.

Table 6.2: Population Change by Study Years: 1964-2000

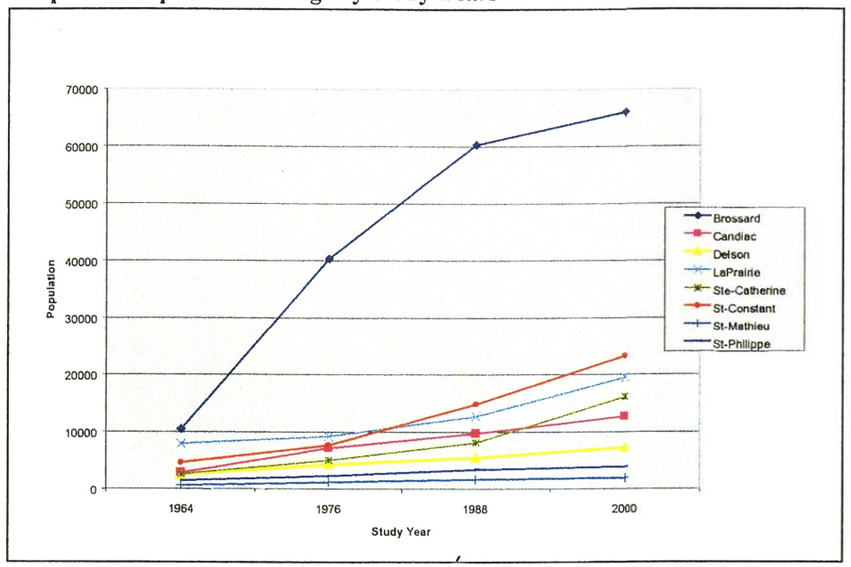
	1964	% Increase	1976	% Increase	1988*	% Increase	2000(1)
Brossard	10500	284.5	40370	49.6	60382	9.486	66110
Candiac	2850	151.0	7166	36.3	9764	29.937	12687
Delson	2450	73.0	4241	27.9	5423	33.174	7222
La Prairie	7900	16.0	9173	38.9	12738	52.952	19483
Ste-Catherine	2570	96.0	5036	61.5	8134	98.279	16128
St-Constant	4590	67.0	7656	94.3	14874	56.454	23271
St-Mathieu	650	89.0	1227	37.7	1689	15.157	1945
St-Philippe	1450	58.0	2292	50.2	3443	12.721	3881
Total	32960	134.1	77161	50.9	116447	29.438	150727

*: Recalculated based on 2/5 population change between 1986-1991Census demographical years. (Appendix 2)
(1): Institut de la Statistique du Quebec Estimate. Estimate tabulated on July 1, 2001.
Source: Population des municipalites>Demographie>Donnees statistiques: http://www.statgouv.qc.ca/
For reasons of simplicity, values for Notre-Dame municipality have been included with Brossard since 1964.

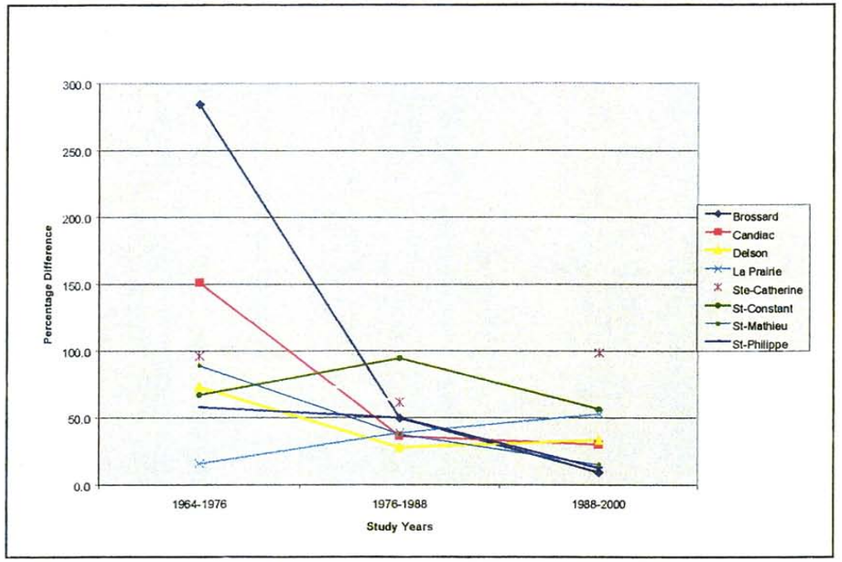
Table 6.2 and its corresponding graphs (Graphs 6.5 & 6.6) depict the population evolution of each municipality for each twelve-year study period until 2000.[1] Both table and graphs reveal municipal populations progressing at varying levels. For 2000, the highest percentage increase amongst the municipalities was for Sainte Catherine at 98.3%. The second highest was Saint Constant at 56.5%. The lowest percentage increase recorded was for Brossard at 9.5%.

[1] Figures for non-census years were interpolated by arithmetic proportion, and for 2000 were taken from the Repertoire des Municipalités.

Graph 6.5: Population Change by Study Years



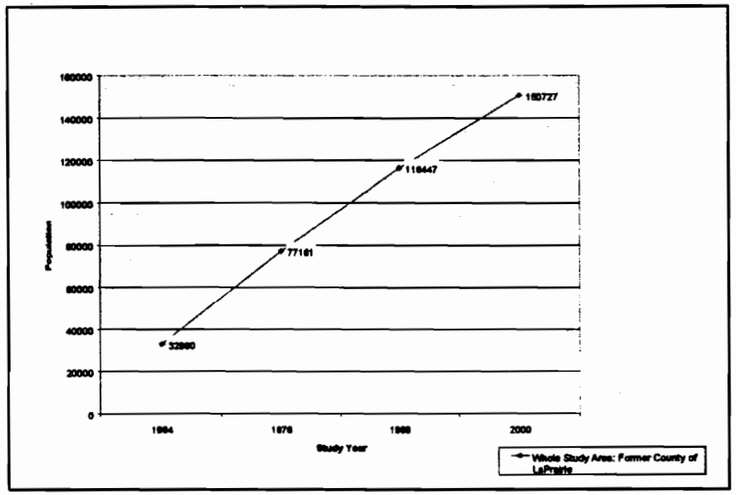
Graph 6.6: Percentage Change of Population between Study Years



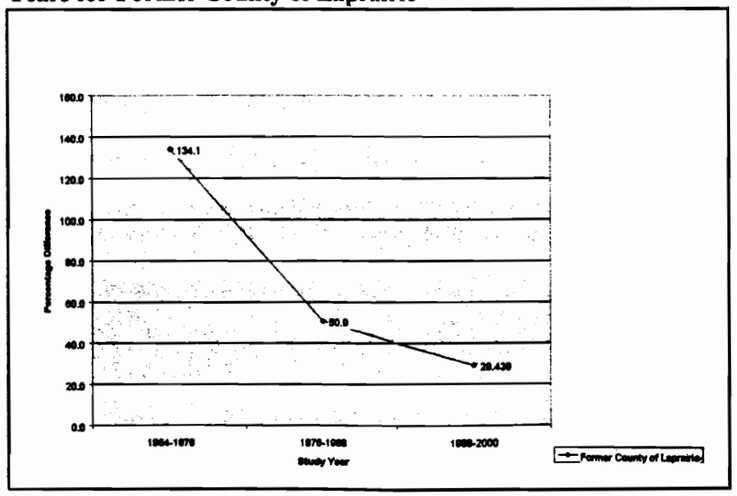
In comparison to previous study years, the most drastic slowing in percentage difference for population was for Brossard. Candiac, which was also amongst the highest in population increases at the beginning of the study, has also declined or plateaued since 1976. One municipality, La Prairie, depicts an almost linear increase in its percentage increase for population. Sainte Catherine, Delson, and Saint Mathieu depict a drop between the study years of 1976-1988 and then a slight increase between 1988-2000. Saint Constant and Saint Philippe depict a slight increase in its population growth between 1976-1988 and then a drop between 1988-2000.

The total in Table 6.2 is a representation of the former County of Laprairie population growth according to each study year (Graphs 6.7 & 6.8). Since the beginning of the study in 1964 until the most recent study in 2000, the percentage growth for population has been decreasing. Between 1964-1976, the percentage growth was 134.4%, between 1976-1988 it was 50.9%, then finally between 1988-2000 it fell to

Graph 6.7: Population Change for Whole Study Area by Study Years



Graph 6.8: Percentage Difference in Population between Study Years for Former County of Laprairie



29.5%. The total population for this area, at the beginning of the study was 32 960. Today, the total population is tabulated at 150 727. Please note that these figures will be used in calculating the rates of urbanization later in this chapter.

6.2 Population & Density Growth

Table 6.3 shows population and gross density changes for every study year from 1964 onwards.[2] (Gross density is calculated as total population per municipality divided by the total area.) Graph 6.9, Density Growth between 1964-2000, shows that Sainte Catherine, Brossard and Delson are the municipalities with the highest gross densities. Sainte Catherine's growth - the municipality with the highest gross density for 2000, at 17.8 persons per hectare - is attributable to the continued growth of multi-family housing between 1988-2000. The municipalities with the lowest gross density are Saint Mathieu and Saint Philippe, since they are largely rural.

[2] Areas of municipalities were taken from Repertoire des Municipalités.

Table 6.3: Population & Density Change: 1964-2000

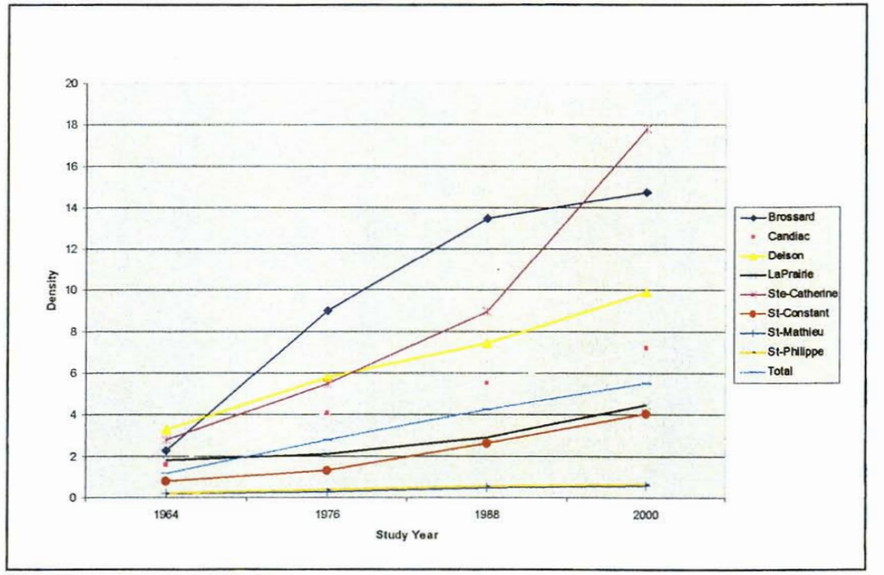
	Total Area (ha)***	% of Total Area	1964		1976		1988		2000	
			Population	Density	Population	Density	Population	Density	Population[4]	Density
Brossard	4477	16.39	10500	2.3	40370	9.0	60382	13.48	66110	14.76
Candiac	1758	6.44	2850	1.6	7166	4.1	9764	5.55	12687	7.22
Delson	730	2.67	2450	3.3	4241	5.8	5423	7.43	7222	9.89
La Prairie	4353	15.93	7900	1.8	9173	2.1	12738	2.93	19483	4.48
Ste-Catherine	906	3.32	2570	2.8	5036	5.5	8134	8.98	16128	17.8
St-Constant	5705	20.85	4590	0.8	7656	1.3	14874	2.61	23271	4.08
St-Mathieu	3227	11.81	650	0.2	1227	0.3	1689	0.52	1945	0.6
St-Philippe	6161	22.55	1450	0.2	2292	0.4	3443	0.56	3881	0.63
Total	27318	100.00	32960	1.2	77161	2.8	116447	4.26	150727	5.52

1: Percentage based on former County of La Prairie's total area

*** Source: La Commission de protection du territoire agricole du Quebec.

[4]: Institut de la Statistique du Quebec Estimate. Estimate tabulated on July 1, 2001.

Graph 6.9: Gross Density Change: 1964-2000



The density growth has been increasing in an almost linear fashion for each municipality except for Brossard, Saint Mathieu and Saint Philippe. Brossard's population density had been increasing markedly until 1988. However, between 1988-2000, the density increase has not been so pronounced. Interestingly, Brossard's gross density remains the second highest in the former County of Laprairie.

Saint Mathieu and Saint Philippe's densities have increased incrementally but have remained below one person per hectare since the beginning of the study period in 1964. The highest gross density for either of these municipality is 0.63 person per hectare. According to Yeates (1975), a municipality is considered to be urban if the gross density is more than 0.184 per hectare. Saint Mathieu and Saint Philippe are the only municipalities of the former County of Laprairie that have a gross density equal to or less than this value.

Gross densities are calculated in order to show the general trend of urbanization in the region.

6.3 Urban Land

This section reports on the changes in area of urbanized land from 1964 to 2000.[3] Maps 1, 2, 5 and 6 in Appendix C further illustrate this growth. Increase in urbanized land is related to population growth, with some qualifications. Residential growth and total urban growth are treated in a parallel manner within this section, in order to show the interrelated patterns.

The overall population for the former County of Laprairie has continued to increase, although at diminishing rates for each twelve-year period: it grew by 134.4% between 1964-1976, by 50.8% between 1976-1988 and by 29.4% between 1988-2000.

Table 6.4 outlines the growth of the residential area for the former County of Laprairie. Between 1964 and 1976, the area more than doubled, (an increase of 113.5%). Between 1976 and 1988, the area was augmented by 60%, and by 4.4% between 1988 and 2000.

Table 6.4: Area for Residential Purposes: 1964-2000 (ha)

	Total 1964	%	Total 1976	%	Total 1988	%	Total 2000	%	Variation 64-76	Variation 76-88	Variation 88-00
Brossard	311.6	6.96	853.6	19.07	1248.6	27.89	1551.1	34.6	173.94	46.27	24.23
Candiac	64	3.60	188	10.70	295	16.70	384.7	28.7	194.00	56.00	30.4
Delson	70	9.60	112	15.30	167	22.80	175.5	24.0	60.00	49.00	5.09
La Prairie	134	3.10	202	4.60	381	8.70	591.5	13.0	51.00	187.00	55.25
Ste-Catherine	87	9.60	124	13.60	179	19.70	422.6	46.6	43.00	44.00	136.09
St-Constant	160	2.70	258	4.50	507	8.80	780.539	13.7	61.00	96.00	53.95
St-Mathieu	4	0.10	7	0.20	33	1.00	93.2	2.9	75.00	371.00	182.42
St-Philippe	14	0.20	59	0.90	75	1.20	167.2	2.7	321.00	27.00	122.93
Total	844.6	3.12	1803.6	6.65	2885.6	10.65	4166.339	15.4	113.54	59.99	44.38

*: Percentage based on total area per municipality

The growth of total urban land for the same three periods is: 87.9 %; 49.2 %; and 65.7%. Since 1988, the growth in each municipality has been different. For Brossard, which recorded the lowest growth of urban land since 1988, the percentage growth is 29.4%. Since the opening of the Champlain Bridge in 1964, Brossard was amongst the municipalities with the highest growth of urban land. However, according to the 2000 data, a definite slowing has occurred.

The three municipalities with the highest growth rates were (in order of highest to lowest) Sainte Catherine, Delson and Saint Constant.

[3] Disaggregated data for the years 1964 to 1976 and 1976 to 1988 is taken from St. Jean (1990). The aggregated data was compiled and measured by the use of GIS. The results are not exactly the same, due to the problems described in section 6.8 (pages 77& 78).

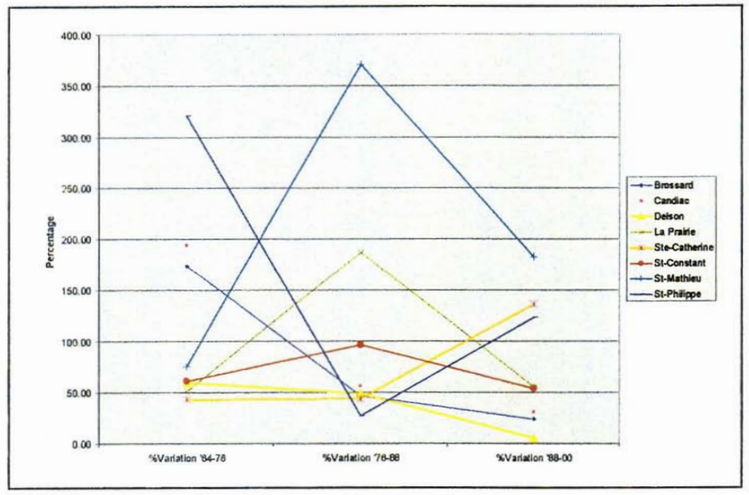
Saint Philippe initially had the highest percentage of growth of urban land between 1964 to 1976 although the areas were relatively minor. However, between 1976 and 1988, this municipality showed the slowest growth in its percentage of urban land. Since 1988, the percentage growth in urban land has increased from the previous study year to 192 %.

When comparing by municipality, the recent trend is that half have increased notably since 1988 with respect to the percentage growth of urban land. However, the other half, Brossard, Saint Constant, La Prairie, and Candiac have either remained the same or decreased slightly in percentage growth with respect to the previous study years.

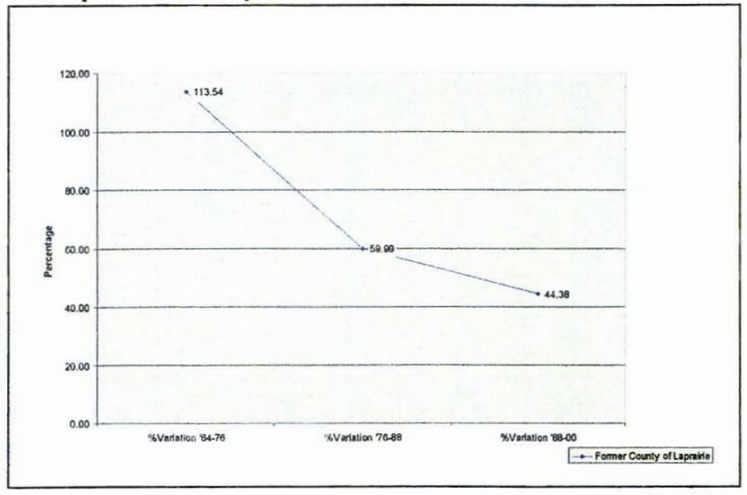
Table 6.4 and Graphs 6.10 and 6.11 depict the percentage growth for residential development purposes between each study period. Between 1964 and 1976, the percentage growth was 113.54%. For 1976 to 1988, the growth was 59.99%. For the final period, the growth was 44.38%.

Delson portrays the lowest percentage increase since 1988 for residential purposes. Brossard represents the second lowest. Candiac then follows in tow. Interestingly, today the percentage based on land converted for urban purposes for all of Candiac

Graph 6.10: Percentage Change of Area Converted for Residential Purposes: 1964-2000



Graph 6.11: Percentage Change of Residential Development for Study Area: 1964-2000



between 1988 to 2000 shows that only 40% is used for residential functions. This is unlike other suburban municipalities whose residential area tends to outweigh non-residential functions. Sixty percent of the urban land is for other purposes, ranging from industrial to commercial-related activities. Single family residences continue to dominate the residential structure.

Saint Mathieu, which has been building an urban center, has the highest percentage increase, amongst all municipalities since 1988, in area diverted from agricultural land to residential development purposes. Sainte Catherine is the second highest and then Saint Philippe.

For the whole former County of Laprairie, a total of 2388.4 hectares were converted to urban use since 1988 (Table 6.5). Of these 2388.4 hectares, 1360.6 hectares (57%) were converted to residential use, while 1027.8 hectares became occupied by industry, commerce, urban roads, junkyards, car cemeteries, golf courses, camping and/or quarries. In other words, 57% of the total urbanized land was for residential development, while 43% was for other purposes. Since the beginning of the study

Table 6.5: Land Converted for Urban Uses: 1964-2000 (ha)

	From 1964 to 1976					From 1976 to 1988					From 1988 to 2000				
	Residential Conversion	%	Other Urban Conversion	%	Total Urban Conversion	Residential Conversion	%	Other Urban Conversion	%	Total Urban Conversion	Residential Conversion	%	Other Urban Conversion	%	Total Urban Conversion
Brossard	542	83	113	17	655	395	66	204	34	599	302.491	62.8	179.093	37.2	481.6
Candiac	124	72	48	28	172	107	52	99	48	206	89.652	40.3	132.88	59.7	222.5
Delson	41	82	9	18	50	55	39	85	61	140	88.46	60.1	58.724	39.9	147.2
La Prairie	68	68	32	32	100	179	60	118	40	297	210.499	54.4	176.517	45.6	387.0
Ste-Catherine	36	73	13	27	49	55	39	87	61	142	243.625	63.0	143.011	37.0	386.6
St-Constant	98	80	25	20	123	249	83	51	17	300	273.539	56.8	207.727	43.2	481.3
St-Mathieu	3	3	110	97	113	26	81	6	19	32	60.19	82.4	12.825	17.6	73.0
St-Philippe	45	43	59	57	104	16	46	19	54	35	92.18	44.1	116.978	55.9	209.2
Total	957	70	409	30	1366	1082	62	669	38	1751	1360.636	57.0	1027.755	43.0	2388.4

*: Source: St. Jean, Julie (1990)
**: Percentage based on land coverted for urban purposes over total area
***: Other urban conversion includes: areas for industrial, commercial, junk-yard, car cemeteries, golf courses, camping, quarries, etc.

period in 1964, land converted for residential purposes has always outweighed land converted for other purposes.

6.4 Density of Residential Areas

Table 6.6 (Graphs 6.12 & 6.13) displays density of residential areas (persons per residential hectare). It shows an increase between 1964 and 1976 (39.0 to 42.8 persons per residential hectare) and then decreases to 40.3 in 1988 and to 36.2 in 2000. According to the 2000 study, the highest density is found in Brossard (42.6 persons per hectare) and the second highest in Delson (41.2). The lowest densities are found in Saint Mathieu and Saint Philippe with 20.9 and 23.2 persons per residential hectare respectively.

Table 6.6: Density of Residential Areas: 1964-2000

	Residential Area (ha)				Population				Density			
	Total 1964	Total 1976	Total 1988	Total 2000	1964	1976	1988*	2000**	1964	1976	1988	2000
Brossard	311.6	853.6	1249.0	1551.1	10500	40370	60382	66110	33.7	47.3	48.3	42.6
Candiac	64.0	188.0	295.0	384.7	2850	7166	9764	12687	44.0	38.0	33.1	33.0
Delson	70.0	112.0	167.0	175.5	2450	4241	5423	7222	35.0	38.0	32.5	41.2
La Prairie	134.0	202.0	381.0	591.5	7900	9173	12738	19483	59.0	45.0	33.4	32.9
Ste-Catherine	87.0	124.0	179.0	422.6	2570	5036	8134	16128	29.5	41.0	45.4	38.2
St-Constant	160.0	258.0	507.0	780.5	4590	7656	14874	23271	28.7	30.0	29.3	29.8
St-Mathieu	4.0	7.0	33.0	93.2	650	1227	1689	1945	162.5	175.0	51.2	20.9
St-Philippe	14.0	59.0	75.0	167.2	1450	2292	3443	3881	103.6	39.0	45.9	23.2
Total	844.6	1803.6	2886.0	4166.3	32960	77161	116447	150727	39.0	42.8	40.3	36.2

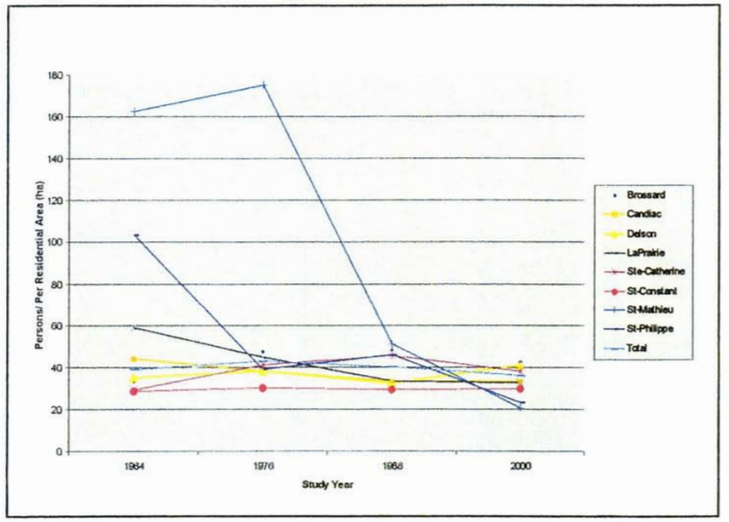
*: Recalculated based on 2/5 population change between 1986-1991Census years; check Appendix 2

**: Institut de la Statistique du Quebec Estimate. Estimate tabulated on July 1, 2001.

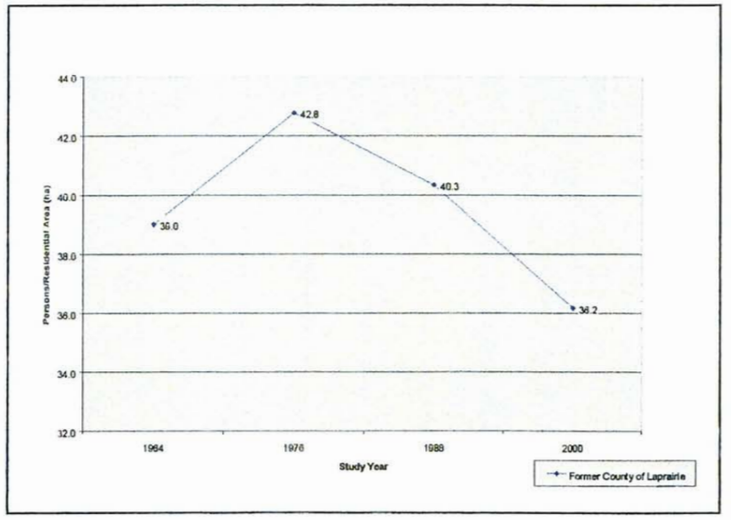
For reasons of simplicity, values for Notre-Dame municipality have been included with Brossard since 1964.

N.B. Annexation of Notre-Dame occurred after 1976.

Graph 6.12: Density Change of Residential Areas: 1964-2000



Graph 6.13: Density of Residential Areas: 1964-2000



It seems that in Brossard, La Prairie, Sainte Catherine, Saint Mathieu and Saint Philippe, the area converted to residential is proportionately greater than the increase in population. That is why the residential density decreases between 1988 and 2000. For example, Saint Mathieu in 1988 used to have 51.2 persons per residential hectare, but in 2000 the density had fallen to 20.9. This illustrates an inefficient use of land, as the residential population spreads out over land converted to urban (in this case, residential) use.

Saint Philippe and Saint Mathieu used to have the highest residential density rates, but as aforementioned, they have become the municipalities with the lowest rates.

Both Saint Philippe and Saint Mathieu are considered to be rural municipalities. A rural municipality seems to imply that the residential density for such areas should be low. However, in these cases, the contrary statement was made clear for 1964, 1976 and 1988. Both had residential densities which were much higher than other municipalities in the county. It has been hard to explain why these densities were formerly high, but one hypothesis has been used in previous studies to explain this phenomenon: it was probably caused because much of the population in these areas lived on the rangs and farmlands as opposed to residential developments or trailer parks prior to 2000.[4] This led to an artificial inflation of the density for areas allotted for residential. From the total population for each municipality, it has not been possible to know how many residents were considered urban (living in residential subdivisions) – that is the urban population. Today, the rates have reversed, which is probably attributable to a dramatic increase in the hectares of land that have been developed for residential purposes while the population for these two municipalities have not substantially increased. The probability is that the majority of the population still lives on the rangs and farmland and leads one to assume that the urban residential population living in these residential areas have larger subdivisions for their homes, when compared to other municipalities within the study area. Therefore, one can consider that the artificial inflation that existed previously has normalized, but not necessarily due to the same principles that apply to all the other urban municipalities of the study area.[5] An examination of the area per residential lot and calculation of the urban population for these two municipalities would be suggested for future studies to ascertain if this will lead to an inefficient growth of urban land.

Saint Constant's density has remained much the same since the beginning of the study. Candiac's rate has dropped slightly since the 1960s, while La Prairie's has dropped by almost 50% since the 1960s. Delson's rate went up incrementally in 1976, then slightly down in 1988 and then went up again with this study. Delson currently has the highest residential density since the beginning of the study in 1964. Both Brossard and Sainte Catherine's densities have increased since the 1960s,

[4] Hypothesis presented in 1988 study (St. Jean, March 1990: 96).

however despite a decrease between 1988-2000, the rate remains higher than in the beginning. The overall density rate has decreased since the 1960s. The peak was recorded in 1976 when it reached 42.8 persons per residential hectare. However, since the study in 1976, the density has been steadily decreasing. In 2000, the average density for the former County of Laprairie was 36.2.

6.5 Rate of Urbanization

Table 6.7 shows the extent to which the former County of Laprairie and its municipalities are urbanized. In 1964, 5.2% of the land in the study area was devoted to urban use. This percentage increased to 9.8% in 1976. Then in 1988, the percentage of land that became urbanized was 14.6. The most recent survey shows that 24.2% of the whole study area is urbanized. This increase in urban land is compared to the increase in population in Table 6.8 (Graph 6.14).

Table 6.7: Growth of Urban Land: 1964-2000 (ha)

	Total (1) 1964	%	Addition 1964-1976	Total 1976	%	Addition 1976-1988	Total 1988	%	Addition 1988-2000	Total 2000	%	Variation 1964-1976	Variation 1976-1988	Variation 1988-2000
Brossard	433.9	9.7	663.7	1097.6	24.5	538.7	1636.3	36.5	481.6	2117.9	47.3	153.0	49.1	29.4
Candiac	185.2	13.8	118.3	303.6	22.7	160.9	464.5	34.7	222.5	687.1	51.3	63.9	53.0	47.9
Delson	192.3	26.3	35.8	228.1	31.2	0.0	228.1	31.2	337.6	565.7	77.5	18.6	0.0	148.0
La Prairie	351.8	7.7	146.8	498.6	11.0	245.9	744.5	16.4	387.0	1131.5	24.9	41.7	49.3	52.0
Ste-Catherine	112.9	12.5	30.4	143.3	15.8	93.4	236.7	26.1	386.6	623.3	68.8	26.9	65.1	163.4
St-Constant	113.6	2.0	124.8	238.4	4.2	225.0	463.3	8.1	482.8	946.2	16.6	109.9	94.4	104.2
St-Mathieu	0.0	0.0	46.6	46.6	1.4	19.7	66.3	2.1	73.0	139.3	4.3	NA	42.4	110.1
St-Philippe	22.7	0.4	74.9	97.6	1.6	22.7	120.3	2.0	231.0	351.3	5.7	330.5	23.2	192.0
Total	1412.4	5.2	1241.3	2653.8	9.8	1306.3	3960.0	14.6	2602.1	6562.3	24.2	87.9	49.2	65.7

*: Percentage based on total area per municipality

**: This table represents GIS generated data.

(1): Saint Jean (1990) maps represented no development prior to 1964 for St-Mathieu

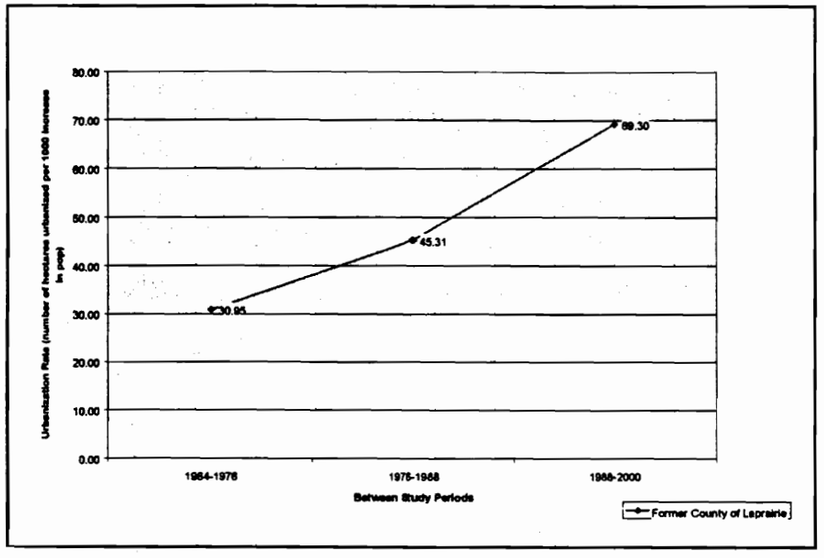
Table 6.8: Rate of Urbanization

	Urbanized Areas (ha)			Population Difference			Urbanisation Rate*		
	1964-1976	1976-1988	1988-2000	1964-1976	1976-1988	1988-2000	1964-1976	1976-1988	1988-2000
Brossard	656.0	599.0	481.6	29870	22741	5728	21.96	26.34	84.08
Candiac	172.0	206.0	222.5	4316	2598	2923	39.85	79.29	76.12
Delson	50.0	140.0	147.2	1791	1182	1799	27.92	118.44	81.82
La Prairie	100.0	297.0	387.0	1273	3565	6745	78.55	83.31	57.38
Ste-Catherine	50.0	141.0	386.6	2466	3098	7994	20.28	45.51	48.36
St-Constant	123.0	300.0	481.3	3066	7218	8397	40.12	41.56	57.32
St-Mathieu	113.0	32.0	60.2	577	462	256	195.84	69.26	235.16
St-Philippe	104.0	35.0	209.2	842	1151	438	123.52	30.41	477.63
Total	1368.0	1780.0	2375.6	44201	39286	34280	30.95	45.31	69.30

*: Urbanisation Rate: Number of hectares urbanised per 1000 increase in population.

[5] This dramatic incraase will affect the urbanization rates within section 6.7.

Graph 6.14: Rate of Urbanization



6.6 Rates of Consumption of Land for Urban Purposes

The rate at which land is consumed in the process of urbanization is expressed as a ratio: hectares of land converted to urban use for every one thousand increase in population.[6] The overall rates for the study area have been increasing: 30.95; 45.31; and 69.30 hectares used per 1000 increase in population.

[6] This figure can be put in perspective if the amount of land devoted to urban uses is obtained for an area at one specific time. (Yeates, 1975.)

For the former County of Laprairie, Graph 6.14 concludes that an alarming 69.3 hectares are becoming urbanized per 1000 increase in population between 1988 to 2000. When comparing the calculation from this study to the data from 1964 to 1976, an increase of 38.35 hectares per 1000 increase in population is recorded. It is apparent that the rates of consumption of land for urban purposes have increased since the inception of the study in 1964. We are using more land per 1000 increase in population today, and the process of urbanization is thus becoming less efficient.

Between 1988 to 2000, the highest urbanization rate for a municipality within the former County of Laprairie was Saint Philippe. The second municipality was Saint Mathieu. Notice that these are the two rural municipalities. These were also the two municipalities that had a sensational increase in the amount of farmland that became used for residential purposes while population growth remained poor. It is impossible for two rural municipalities to have approximately 235 (Saint Mathieu) and 477 (Saint Philippe) hectares of land that are being urbanized for every 1000 increase in population, since they are not at the heart of a high density region that has heightened its intensification process. Instead, the probability that huge residential subdivisions

exist per urban population, coupled with the increase in lands developed for residual uses, have led to exaggerated figures for this area.[7] The implication remains that there is a highly wasteful process of urbanization occurring in this area.

The third municipality was Brossard with 84.08 hectares urbanized for every 1000 increase in its population between 1988-2000. The municipality with the lowest area urbanized for every 1000 increase in its population was Sainte Catherine (48.36). The two rural municipalities within the former County of Laprairie depicted the steepest increase in their urbanization rates from 1976-1988 to 1988-2000.

Rates of urbanization show whether the process of land conversion is becoming more efficient over time. It is clear from Table 6.8 and Graph 6.14 that it is not.[8] However, Delson and La Prairie showed diminishing rates of consumption in the 1988-2000 period, while Candiac and Sainte Catherine remained almost stable. Brossard showed a great change, from 26.34 to 84.08 per 1000 population increase, a change largely attributable to commercial development. Delson and La Prairie do not have a large presence of big box developments in their area, unlike Candiac, Sainte Catherine and Brossard. This has enabled Delson and La Prairie to avoid increasing the amount of hectares consumed as the population increases. However, this would not be enough to explain the diminishing rates, unless it also doubled it with effective and stricter planning controls that guided residential (and other uses) development into more densely packed units due to the decline in the average household size. For example, in Roussillon, the average household size decreased 15% between 1981 (3.3) and 1996 (2.8). Delson's figures from the previously presented Table 6.6 attests that its residential density has indeed increased. Nevertheless, both municipalities exhibit more conscientious and sustainable planning. A further examination of the mix and ratio of uses and the declining growth of non-residential urban land (Other Urban) should be further examined for these two particular

[7] The residual uses that were referred to on page 17 in the first chapter are characteristic of the two rural municipalities and directly affect the urbanization rates for these areas. These same uses were recorded as problems in the 1976 study when their presence directly affected or disrupted the surrounding farmland activity.

[8] It must be noted that the urbanization rate for the former County of Laprairie has been skewed due the highly wasteful urbanization process of its two rural municipalities.

municipalities and considered for the remaining municipalities in the former County of Laprairie.

The next two sections study transitional or fringe lands within the former County of Laprairie and the changes it has incurred over time. Collecting data for transitional lands provides a clearer understanding of the process of urbanization.

6.6 Subdivided Not Yet Built

For the 2000 survey, 870.2 hectares were classified as subdivided not built (SNB) for the former County of Laprairie. Maps 5 and 6 in Appendix C chart the SNB changes from 1976 until 2000. This is 3.21% of the whole area. In Table 6.9, this category is broken down into subdivisions for residential, and subdivisions for other urban activities for all study years starting from 1964 (Graphs 6.15-6.17).

Table 6.10 and Table 6.11 show that 206.2 ha or 29.8 % of the 691.05 hectares subdivided but not built in 1988 remained in the same state in 2000 for the whole county. The situation varies amongst its municipalities though. In Brossard, 18.8% remained the same in 2000, for Candiac, 76.7%, and for Delson, 8.17%. 35.3% of La Prairie's subdivided not built lands from 1988 remained undeveloped, and 20.23% in Sainte Catherine. Only 0.17% remained in Saint Constant and 1.5% remained in Saint Philippe.

According to the 1964 survey, SNB areas covered a total of 0.65% of the whole county. By 1976, this had increased to 3.96%, by 1988 it had declined to 2.53%, but by 2000 increased again to 3.20%. The variation in area reflects these

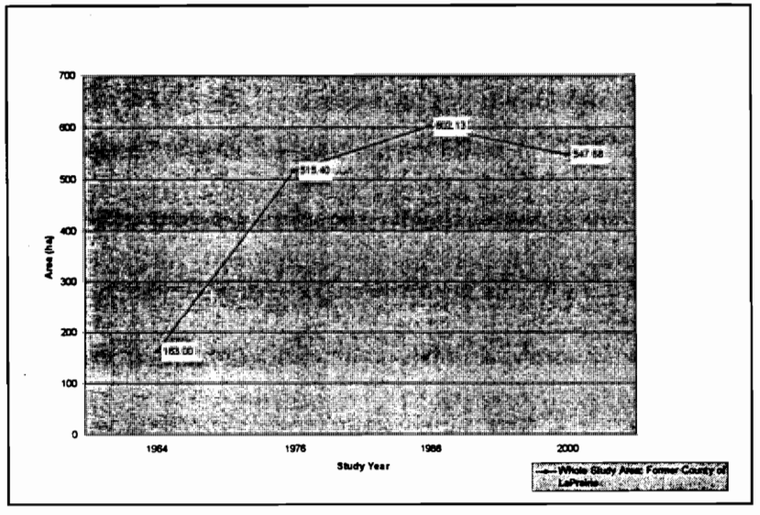
Table 6.9: Area of Subdivided Not Built Lands: 1964-2000 (ha)

	SNB-RESIDENTIAL (ha)								SNB-OTHER URBAN (ha)							
	1964	%	1976	%	1988	%	2000	%	1964	%	1976	%	1988	%	2000	%
Brossard	105.00	2.38	182.00	4.10	208.50	4.66	61.14	1.37	0.00	0.00	149.00	3.38	0.00	0.00	20.09	0.45
Candiac	2.80	0.15	64.00	3.60	38.04	2.84	73.62	5.49	7.00	0.39	132.00	7.50	76.20	5.69	218.17	0.16
Delson	35.00	4.70	11.00	1.50	24.98	3.42	6.81	0.93	0.00	0.00	0.80	0.10	0.00	0.00	9.37	0.01
La Prairie	3.00	0.07	108.00	2.80	167.85	3.69	239.29	5.26	7.00	0.18	263.00	6.80	8.00	0.18	9.88	0.00
Ste-Catherine	7.00	0.77	91.00	10.00	62.29	6.88	30.80	3.40	0.00	0.00	22.00	2.40	4.70	0.52	26.01	0.03
St-Constant	10.00	0.17	53.00	0.90	89.31	1.57	98.35	1.72	0.00	0.00	2.00	0.03	0.00	0.00	39.00	0.01
St-Mathieu	0.00	0.00	0.00	0.00	0.00	0.00	15.51	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
St-Philippe	0.00	0.00	6.40	0.10	11.16	0.18	22.17	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	162.80	0.59	515.40	1.90	602.13	2.22	547.69	2.02	14.00	0.05	569.00	2.08	88.90	0.33	322.53	0.01

	SNB-TOTAL (ha)								Variation %		
	1964	%	1976	%	1988	%	2000	%	1964-76	1976-88	1988-00
Brossard	105.00	2.38	331.00	7.50	208.50	4.66	81.23	1.81	+215	-52	-61.04
Candiac	9.80	0.55	196.00	11.10	114.24	8.53	291.79	21.78	+20	-21	155.42
Delson	35.00	4.79	11.80	1.60	24.98	3.42	16.18	2.22	-66	+187	-35.24
La Prairie	10.00	0.26	371.00	9.60	175.88	3.86	249.17	5.47	+3610	-53	41.67
Ste-Catherine	7.00	0.77	113.00	12.40	66.98	7.39	56.81	6.27	+1514	-59	-15.19
St-Constant	10.00	0.17	55.00	0.90	89.31	1.57	137.35	2.41	+450	+47	53.78
St-Mathieu	0.00	0.00	0.00	0.00	0.00	0.00	15.51	0.48	0	0	0
St-Philippe	0.00	0.00	6.40	0.10	11.16	0.18	22.17	0.36	NA	+25	98.66
Total	177.00	0.65	1084.20	3.60	691.05	2.55	870.21	3.21	+512	-40	25.93

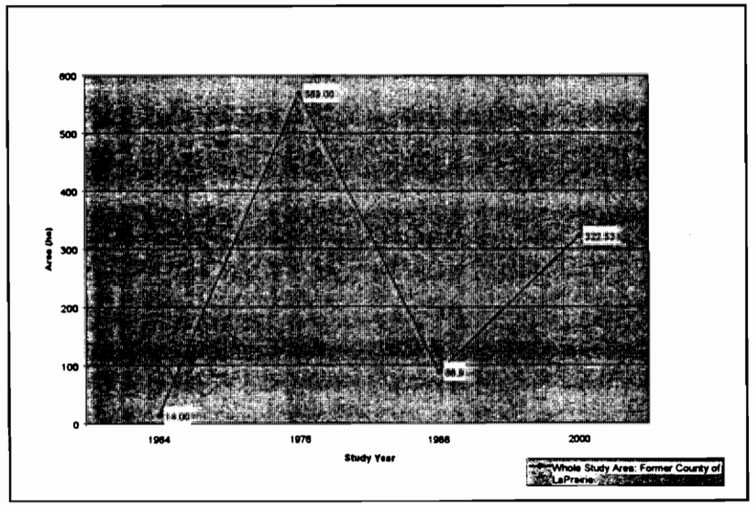
* Percentage calculated based on total area per municipality

Graph 6.15: Evolution of SNB-Residential: 1964-2000



percentages: increases were 512% between 1964 and 1976, a decrease of 40% between 1976 and 1988, then an augmentation of 25.93% between 1988 and 2000. Candiac, La Prairie, Saint Constant and Saint Philippe all showed an increase in subdivided not built lands between 1988 to 2000. Saint Mathieu has shown no growth from its zero ha devoted to subdivided but not built lands between 1964 to 2000. The rest of the municipalities in the county showed a decrease for 2000. The municipality with the highest increase was Candiac. The municipality with the highest decrease was Brossard.

Graph 6.16: Evolution of SNB-Other: 1964-2000



Graph 6.17: Evolution of Total SNB: 1964-2000

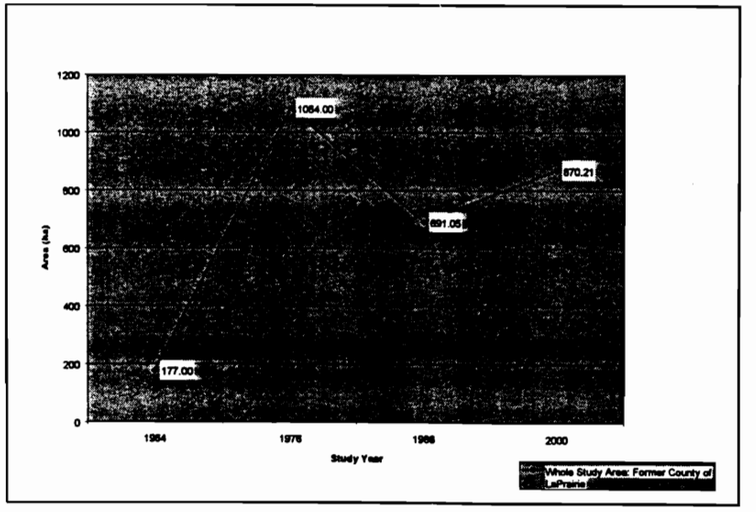


Table 6.10: Transformation of SNB Residential (SNB-R) between 1988-2000

	GIS Total	SNB-R 1988	R 2000	%	AUU 2000	%	SNB-AUU 2000	%	AB 2000	%	F 2000	%	Remained Same	%
Brossard	208.49	136.010	65.24	16.40	7.87	7.47	3.58	9.27	4.45	0.00	0.00		39.34	18.87
Candiac	38.04	19.78	52.00	3.66	9.62	0.00	0.00	2.56	6.72	0.00	0.00		12.04	31.65
Delson	24.98	22.93	91.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		2.04	8.17
La Prairie	167.85	96.30	57.37	0.00	0.00	0.00	0.00	7.34	4.37	0.00	0.00		62.12	37.01
Ste-Catherine	62.29	41.23	66.19	7.51	12.05	0.00	0.00	0.00	0.00	0.00	0.00		13.55	21.75
St-Constant	89.31	85.27	95.48	0.32	0.36	0.00	0.00	3.56	3.99	0.00	0.00		0.15	0.17
St-Mathieu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
St-Philippe	11.16	4.89	43.82	0.00	0.00	0.00	0.00	5.57	49.91	0.00	0.00		0.70	6.27
Total	602.11	406.41	67.50	27.89	4.63	7.47	1.24	28.30	4.70	0.00	0.00		129.94	21.58

SNB-R: Subdivided not built lots for residential purposes
R: Became residential in 2000
AUU: Became used for other urban purposes in 2000
SNB-AUU: Lots subdivided not built for other purposes
*: Percentage of total SNB-R area (ha) from 1988 that became R in 2000
AB: Became abandoned (all categories) in 2000
F: re-became farmland in 2000

Table 6.11: Transformation of Lands Subdivided-Not-Built for Urban Purposes Other than Residential: 1988-2000

	Total SNB-AUU 88	R 2000	%*	AUU 2000	%*	SNB-R 2000	%*	AB 2000	%*	F 2000	%*	Remained Same	%*
Brossard	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Candiac	76.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.26	100
Delson	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
La Prairie	8.00	8.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ste-Catherine	4.70	0.00	0.00	4.70	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
St-Constant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
St-Mathieu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
St-Philippe	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	88.96	8.00	8.99	4.70	5.28	0.00	0.00	0.00	0.00	0.00	0.00	76.26	85.73

SNB-AUU: Lots subdivided not built for other purposes
R: Became residential in 2000
*: Percentage of total SNB-AUU area (ha) from 1988 that became R in 2000
AUU: Became used for other urban purposes in 2000
SNB-R: Subdivided not built lots for residential purposes
AB: Became abandoned (all categories) in 2000
F: re-became farmland in 2000

Brossard is the only municipality in the whole county that has shown a decrease in every study year since 1976 with respect to lands subdivided but not built. The rest vary, some years increasing and some years decreasing.

The results for the study years reflect changing metropolitan growth patterns and real estate markets. Between 1964 and 1976 there was a period of expansion and excessive premature subdivision. However, by 1976 and 1988 agricultural zoning and land use planning legislation were introduced, reining in excessive subdivision. The boom in the real-estate market of the late 1980s and its subsequent crash in the early 1990s may account for the increase in SNB areas in 2000.

6.8 Abandoned Lands

The importance of taking inventory of areas that seem abandoned is because this often represents the first step in the land transfer/transformation phase from its original agricultural use to an urban use.[9] This category is further subdivided into abandoned farmland, suspected abandoned farmland and abandoned woodlots.[10] For the purpose of this study, the breakdown of land classified as abandoned for 1964, 1976, 1988 and 2000 is given in Table 6.12 (Graphs 6.18-6.21) and Table 6.13.

Table 6.12: Summary of Abandoned Land: 1964-2000 (ha)**

	Abandoned Farmland								Suspected Abandoned Farmland							
	1964	%	1976	%	1988	%	2000 (1)	%	1964	%	1976	%	1988	%	2000 (1)	%
Brossard	738.00	16.70	420.00	9.50	522.00	11.60	69.70	1.56	118.00	2.70	240.00	5.40	1.60	0.03	6.23	0.14
Candiac	291.00	16.50	338.00	19.20	329.00	18.70	210.99	15.75	0.00	0.00	12.50	0.70	0.00	0.00	3.63	0.27
Delson	147.00	20.10	156.00	21.30	112.00	15.30	1.60	0.22	5.00	0.70	39.00	5.30	0.00	0.00	0.00	0.00
La Prairie	109.00	2.50	318.00	7.30	160.00	3.60	191.92	4.22	0.00	0.00	150.00	3.40	183.00	4.20	326.19	7.16
Ste-Catherine	123.00	13.50	125.00	13.70	184.00	20.30	0.00	0.00	0.00	0.00	40.00	4.40	0.00	0.00	0.00	0.00
St-Constant	78.00	1.30	261.00	4.50	95.00	1.60	283.79	4.98	0.00	0.00	161.00	2.80	64.00	1.12	0.00	0.00
St-Mathieu	0.00	0.00	10.00	0.30	0.00	0.00	33.03	1.02	0.00	0.00	0.00	0.00	27.00	0.80	0.00	0.00
St-Philippe	0.00	0.00	49.00	0.80	0.00	0.00	111.79	1.81	0.00	0.00	12.00	0.20	25.00	0.40	76.78	1.25
Total	1486.00	5.43	1677.00	6.10	1402.00	5.10	902.82	3.33	123.00	0.40	654.50	2.40	300.60	1.10	412.83	1.52

	Abandoned Woodlots								Total Abandoned							
	1964	%	1976	%	1988	%	2000	%	1964	%	1976	%	1988	%	2000	%
Brossard	183.00	4.10	243.00	5.52	455.00	10.16	273.72	6.11	289.73	6.47	456.44	10.20	1006.64	22.48	349.65	7.81
Candiac	13.00	0.70	8.00	0.45	35.00	1.99	139.92	10.44	36.74	2.74	258.61	19.30	393.37	29.36	354.53	26.46
Delson	18.00	2.50	25.00	3.42	95.50	13.08	63.17	8.65	125.18	17.15	149.41	20.47	155.93	21.36	64.77	8.87
La Prairie	32.00	0.70	68.00	1.56	293.00	6.73	319.13	7.01	215.92	4.74	330.21	7.25	695.86	15.28	510.99	11.22
Ste-Catherine	58.00	6.40	32.00	3.50	58.00	6.40	118.59	13.09	63.06	6.96	120.03	13.25	242.31	26.75	118.59	13.09
St-Constant	0.00	0.00	11.00	0.19	43.00	0.75	256.81	4.50	8.69	0.15	128.41	2.25	232.30	4.07	540.60	9.48
St-Mathieu	0.00	0.00	0.00	0.00	0.00	0.00	2.17	0.07	0.00	0.00	0.00	0.00	30.53	0.95	35.20	1.09
St-Philippe	0.00	0.00	0.00	0.00	0.00	0.00	33.21	0.54	1.24	0.02	0.00	0.00	38.05	0.62	221.77	3.60
Total	304.00	1.10	387.00	1.42	979.50	3.58	1206.72	4.45	740.55	2.73	1443.11	5.32	2794.98	10.31	2196.10	8.10

*: Percentage calculated per municipality's total area

**: This table depicts the following categories: abandoned farmland, suspected abandoned farmland, and abandoned woodlots

Graph 6.18: Evolution of Abandoned Farmland: 1964-2000

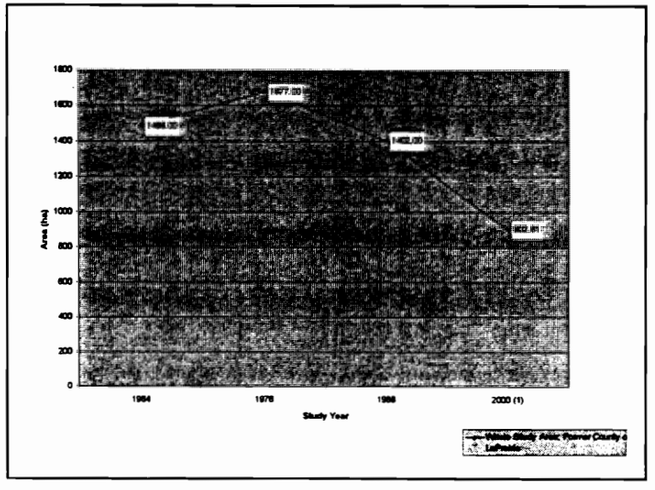
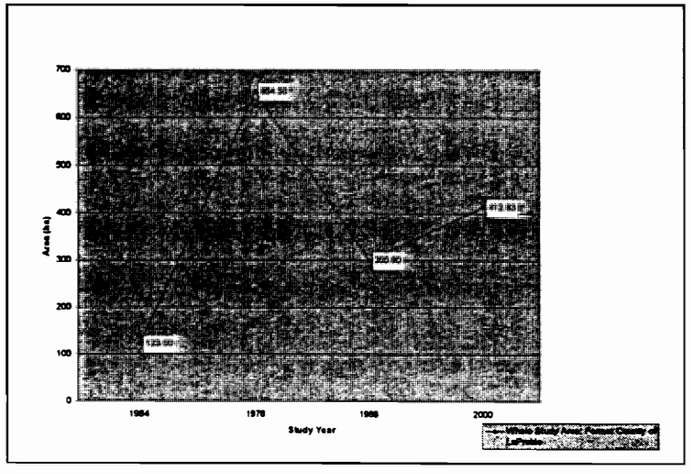


Table 6. 12 and Graph 6.18 show that the amount of abandoned farmland has clearly decreased since 1976. It is hypothesized that this is due to the introduction of agricultural zoning. The situation for suspected abandoned farmland is not so clear, since the data is not so secure (Graph 6.18). Recent increases may be due to the designation of fairly extensive areas by the Agence Métropolitaine de Transport (AMT) for future suburban parking lots for commuters that have yet not been clearly identified to a person collecting land use data on-site. Similarly, Graph 6.20 indicates the evolution of abandoned woodlots, located at the rear of abandoned or suspected abandoned lands. Similarly, the question of abandoned woodlots is unclear. However, Tables 14, 15 and 16 from the last study in 1988 could not be completed for this study, because the mapped data was an amalgamation of the three sub-categories for abandoned lands. In other words, abandoned farmland, suspected abandoned farmland, and abandoned woodlots were all represented by one

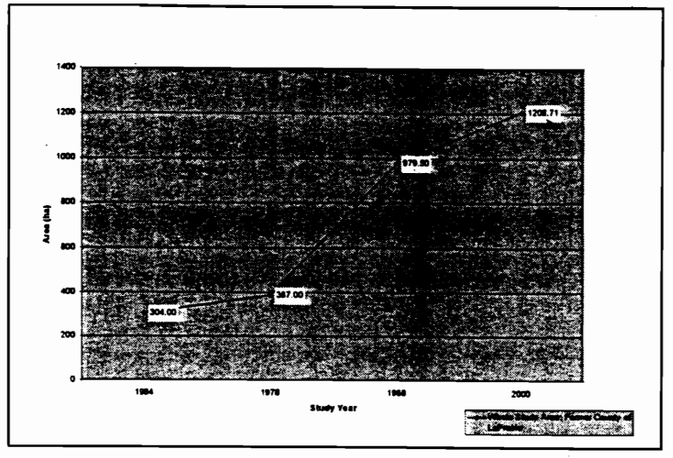
[9] The same land becoming subdivided for urban purposes (refer to section 6.7.) usually represents the second part of the phase. The land becoming transformed into some form of urban use represents the final phase of the land transfer.

[10] The status of land in the last two subcategories is not always clear.

Graph 6.19: Evolution of Suspected Abandoned Farmland: 1964-2000



Graph 6.20: Evolution of Abandoned Woodlots: 1964-2000



classification, "total abandoned lands" on the maps used to digitize and create a database for 1988. Thus, any changes that may have occurred on these lands since 1988 and had been mapped using GIS methods, can only depict changes to the main category. Instead, these tables can be completed in 2012 by the next researcher if they use the same tools for analysis: digitizing data into a GIS database and using the sub-classification from the 2000 survey.

For this study, I am presenting the transformation of abandoned lands from 1988 as one classification, "total abandoned," although the information is available in Table 6.12 and the GIS database.

Table 6.13 depicts the transformation of abandoned lands (total abandoned lands) between 1988 and 2000. The former County of Laprairie had a total of 2794.99 ha of land that was classified as abandoned in 1988. By 2000, 7.37% of this became developed for residential purposes, 10.28% became developed for other urban purposes (AUU classification), 4.08% became subdivided not built for residential

Graph 6.21: Evolution of All Abandoned Lands: 1964-2000

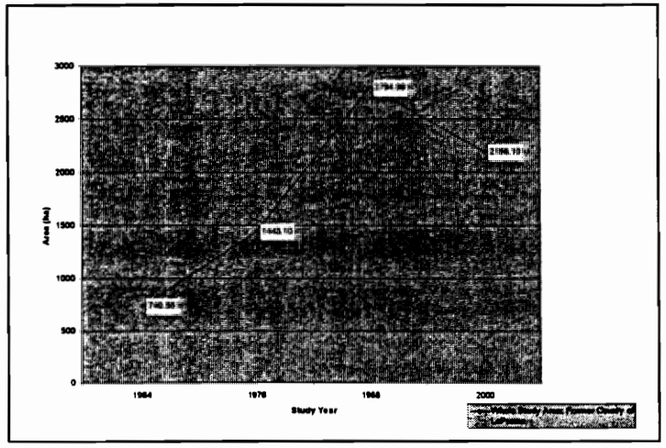


Table 6.13: Transformation of Abandoned Lands between 1988-2000 (ha)

Brossard	1006.64	2.77	0.28	54.97	5.46	16.10	1.60	10.52	1.04	631.19	62.70	241.50	23.99
Candiac	393.37	10.12	2.57	10.98	2.79	11.60	2.95	169.25	43.02	0.00	0.00	191.42	48.66
Delson	155.93	51.37	32.95	70.16	45.00	3.19	2.04	1.59	1.02	0.00	0.00	29.62	19.00
La Prairie	695.86	25.62	3.68	58.74	8.44	44.21	6.35	0.00	0.00	249.62	35.87	317.67	45.65
Ste-Catherine	242.31	51.70	21.34	54.32	22.42	13.70	5.65	20.93	8.64	0.00	0.00	101.66	41.96
St-Constant	232.30	61.32	26.40	13.80	5.94	9.08	3.91	57.88	24.92	19.94	8.58	70.29	30.26
St-Mathieu	30.53	3.16	10.36	6.05	19.83	13.76	45.07	0.00	0.00	0.00	0.00	7.55	24.74
St-Philippe	38.05	0.02	0.05	18.27	48.02	2.46	6.47	0.00	0.00	1.71	4.49	15.59	40.97
Total	2794.99	206.08	7.37	287.31	10.28	114.09	4.08	260.16	9.31	902.46	32.29	975.30	34.89

**: Total of abandoned farms, suspected abandoned farms & abandoned woodlots in 1988
R: Became residential in 2000
*: Percentage of area abandoned in 1988 that became either R, AU, SNB-AU, SNB-R, F or remained same in 2000
AUU: Became other urban uses in 2000
SNB-R: Became subdivided not built for residential purposes in 2000
SNB-AUU: Became subdivided not built for other urban uses in 2000
F: re-became farmland in 2000
***: Remained Same

purposes, 9.31% became SNB for other purposes (AUU classification), 32.29% re-became farmland and 34.89% remained the same (i.e. abandoned).

The total abandoned acreage for the former County of Laprairie increased every study year until the last. In 1964, different forms of abandoned lands covered 2.73% of the whole area. In 1976, they covered 5.32%, by 1988 this was 10.31%, and in 2000, had fallen to 8.10%. The fate of abandoned lands has already been commented upon. An exciting finding was that some abandoned farmland has again become cultivated. This is probably due to the recognition that there is no pressing need to impinge onto the permanent agricultural zone, which is being protected by the Act to Preserve Agricultural Land (1978), when there is sufficient space left for development within the urban perimeter. As aforementioned in previous chapters, land within the urban perimeter is controlled by the Act Respecting Land Use Planning and Development (1979) and has clearer procedures for urban development. On the other hand, the act that protects the permanent agricultural zone is less clear and probably deters big-scale development. and also Maps 3 and 4 in Appendix C provide a spatial illustration for abandoned lands in the former County of Laprairie.

6.9 Comparison of Previous Agricultural Zoning to Current Agricultural Zoning

The area designated as the permanent agricultural zone is shown in Appendix C's Map 7 and Map 8. Map 7 charts the area that was marked off as "permanent agricultural" in 1979, thus defining the perimeter of urbanization, and the area where changes were under debate in 1988. Map 8 of 1990 shows that these were accepted within the perimeter of urbanization and no changes have occurred since. This second map (Map 8) is up-to-date as of 2000.

According to the present study, development has occurred within the boundaries of the "permanent agricultural zone" for the study area. The commission, CPTAQ, and the Act to Preserve Agricultural Land (1978) protect this zone. Urban development, that is any form of activity not deemed to be rural or agricultural, occur in Brossard, La Prairie, Saint Constant, Saint Mathieu and Saint Philippe and total 741.85 hectares.

In Brossard, 62.22 hectares of the land in the permanent agricultural belt is used for urban purposes. Forty-eight and a half percent was urbanized prior to 1988. Thirty-two percent of this land is being used for extraction activities (quarry and sand pit activities) since 1988. Approximately 16 percent is being used for various commercial and other industrial activities.

Figure 6.1: Urban Development in Permanent Agricultural Zone (ha)

Municipalities	Infringements (ha)
Brossard	62.22
Candiac	0
Delson	0
La Prairie	153.46
Ste-Catherine	0
St-Constant	251.07
St-Mathieu	100.79
St-Philippe	174.31
Total	741.85

Source: 2000 Land Use Map Database, Shoma Murshid

In La Prairie, the total amount of land that is used for 'urban purposes' in the permanent agricultural zone is 153.5 hectares. Eighteen percent of this was urban prior to 1988.

Of the rest, 60.9% is being used for various industrial activities other than extraction-related, 7.9% for residential development, 5.6% for commercial-related activities, 7.5% for urban recreational purposes, mainly golfing.

Urban development occurred on 251.1 hectares of Saint Constant's permanent agricultural zone. Sixty-seven percent of this is due to extraction-related activities. Approximately 17.6% of the urban development occurred prior to 1988. The rest has

been developed from its agricultural state for residential and industrial related activities.

Saint Mathieu has a total of 100.8 hectares that are not being used for agricultural purposes in its permanent zone. Within this, the majority of the land (70.7%) was converted for urban purposes prior to 1988. Since 1988, 21.76% has been converted for residential purposes, 4.25% has been converted for extraction-related activities, 0.81% is being used for industrial-related activities other than extraction, 1.66% for commercial purposes, and approximately 1% for a car cemetery.

Saint Philippe has only 75.197 hectares that have been urbanized in the permanent agricultural zone: 3.3% of this land is currently accommodating a car cemetery; 6.39% for camping purposes; and 43.1% was classified as urban prior to 1988. Since 1988, 11.03% has become residential, 7.65% has become used for other industrial-related activities, 18.97% has been used for extraction-related activities, and 9.48% is used by commercial activities.

Chapter 7: Conclusions

7.1. Summary of Analysis

Anyone concerned with optimal utilization of resources that will be needed by future populations, the wasteful use of prime agricultural land, food security, maintaining sustainable development and ecological biodiversity should pay important attention to the conclusions in this section. It is appropriate to bring together the main analyses made within this report. Despite the limited size of the study area, it is possible to draw strong conclusions regarding the current situation of the urbanization process for all regions on the urban/rural fringe of metropolitan Montreal. Upon the opening of the Champlain Bridge an influx occurred during the 1960s and 1970s into the former County of Laprairie. This influx from the urban nucleus of Montreal brought the urbanization process into this once predominantly agricultural county. Today, all along the St. Lawrence shore of the former county, an urbanized ribbon is present and the urbanization process still continues to augment it.

Unlike the previous study (1988) where Brossard had the strongest population growth and growth of urban land, today Sainte Catherine represents this trend. Important factors to consider for this trend are its proximity to the Honoré-Mercier Bridge in Kahnawake, and the boom in the local economy and tertiary sector of this region. Another municipality directly south of Sainte Catherine presents the second highest population growth: Saint Constant. These results from the 2000 land survey mark a shift in the rapid urbanization rates from Brossard, on one end, to the other extreme end of the former county. Currently, the three municipalities with the highest urban coverage are Delson (77.5% of its municipality is urbanized), Sainte Catherine (68.8%) and Candiac (51.3%). Brossard, with 47.3 % of its area currently urbanized, falls in fourth place. Overall, the former County of Laprairie has seen a growth of 9.6% since the last study.

On the other hand, the highest percentage of abandoned lands within a municipality of the former county is found in La Prairie. This inventory of abandoned lands will prove to be an important indicator for the next area representing massive urban growth.

The urbanization rates for the former county conclude that more land is being used per 1000 increase in population today than previously. This is an indication that the urbanization process on the urban/rural fringe is unfortunately becoming less efficient, especially since the last study. Gross density is increasing due to population growth. Urban densities have been decreasing largely because of inefficient growth of big box developments and other non-residential urban uses. Residential densities have also been decreasing: this is very disappointing in light of all the advocacy for sustainable development. In 1964, there were 39.0 persons per hectare; in 1976, this increased to 42.8; and thereafter declined to 40.3 in 1988 and 36.2 in 2000. Most of this is due to a reduction in household size over the last two decades. For example, in 1996, the average household size in the RCM of Roussillon was 2.8, whereas in 1981, it was 3.3, a difference of 0.5 (15%). As was also shown in Toronto, residential subdivisions are becoming denser, while gross population densities are decreasing.[1]

The total area subdivided for residential purposes, but not yet built upon, has varied throughout the study period. To date, 1976 holds the record for the highest proportion of land under this category. This coincides within most intense decade of construction for this area for this former county. Approximately 72% of the land that was subdivided and not built in 1988 became developed for urban purposes by 2000.[2] The remainder (165.71 ha) either remains in the subdivided state (21.58%) or has become abandoned (4.7%). This suggests that premature subdivision is still present, indicating a waste of public resources, but at less severe rates than the past.

The hypothesis that the Act to Preserve Agricultural Land should have increased the efficiency of the urbanization process, halted urban sprawl on the urban/rural fringe, and stringently protected any further development from occurring within the permanent agricultural zone is thus only partially supported. The current agricultural zoning set out by the CPTAQ did not deter certain new development, considered urban within the parameters of this study, to occur. In the twenty odd years since the adoption of the Act to Preserve Agricultural Land and the Land Use Planning and

[1] Bourne, 2001.

Development Act, it is difficult to conclusively demonstrate their effectiveness from the results of this study. There have been some lands classified as abandoned in 1988 which have again become cultivated and productive. This suggests that the stability of the agricultural zoning is an inducement to farm what were formerly considered transitional lands. Between 1988 and 2000, the amount of abandoned land has decreased – again suggesting stability in agriculture. One of the observations made during the field work relates to the ambiguous nature of the concept of sustainability. The AMT is improving public transportation to the island of Montreal, which should clearly reduce automobile use and thus contribute to pollution reduction, a sustainable gesture. At the same time it is building huge parking lots at key terminals, namely in Brossard and Saint Constant, at the edge of the urban fringe, where land is fairly cheap. To amortize its expenditures, it hopes to develop the land around these terminals for housing. In so doing, it pushes the perimeter of urbanization still further outward. A curious paradox.

[2] Please note: urban purposes imply residential and any other urban development.

Urban growth has for the most part occurred within the urban perimeter designated by the agricultural zoning, despite the various exceptions noted. Urban non-residential growth has been exceptionally rapid, largely propelled by peri-urban shopping and industrial centers such as big box stores and the extension of quarries and extractive industries.

7.2. Recommendations for Controlling & Curtailing Inefficient Use of Land & Urban Sprawl

It is fitting to present the issues broached in the 1976 study at this point as they still hold true today. Points of concern that still need to be addressed twenty-four years later are:[3]

- Municipalities tend to approve revenue producing projects rather than conserve farm use with the potential loss of tax revenue due to the strength of urban finance
- Indirect control – Government acquisition of development rights, control of subdivisions, regulation of the transfer of property and the careful planning of transportation networks, are all policies suggested to bring order to the

[3] Sack, November 1976: 117.

urbanization process and to direct development to land specifically reserved for that purpose.[4]

Other recommendations that still have not been applied properly are:

- Provision of progressive land use controls (zoning, development control regulations, subdivision and transfer regulations, and regulation of minimum lot sizes) to keep ahead of developers. For example, since the 1970s, with the size of family units shrinking and the cost of housing escalating, developers repeatedly have identified market opportunities for more compact forms of housing and for neighborhoods where the proximity of stores and public facilities encourage more walking and less driving. However, planning regulations affecting such things as lot sizes, widths of rights-of-way, or separation of uses, has repeatedly thwarted cashing in on this new opportunity. The developers faced with such obstacles are business people, not politicians. Typically, their reaction to regulatory obstacles is to find a profitable way of working within the regulations, rather than try to get them changed. Thus, planning regulations should:
    - Incorporate sustainable development and smart growth principles into current city guidelines.
    - Continue development charges and/or taxation measures designed to provide incentives for cost-effective patterns of urban growth. This would involve raising the relative cost of low density, single-use development at the urban fringe and lowering that of more compact, mixed-use development within the city.
    - Decrease the amount of area allotted for big-box developments and other non-residential urban uses.
    - Increase the percentage of new construction as in-fills within the existing urban perimeter or suburban envelope since there is sufficient land subdivided for foreseeable population growth.[5] This presents no real need to cross the urban perimeter and into the agricultural zone.
- Redirect the movement of economic activity (due to market factors and technological changes) back into the city center. In the urban core, one must provide equitable tax policies, an efficient regulatory process, and timely investment into physical and social infrastructure to create a hospitable environment for businesses and people. This will boost the economic viability of the city-region and attract people to stay within the urban core.

Since this study began, many changes have occurred at the governmental level. The establishment of the Montreal Metropolitan Community in January 2001 has led to amalgamations of local municipalities in and around Montreal Island. Greater

[4] Ibid.

emphasis will be placed on regional governance to boost the urban core's viability. It is too soon to say whether this new form of governance will be successful, however it has the potential to respond to regional planning needs and create greater urban efficiency through the control of infrastructure and transportation planning. The points of concern and recommendations set forth in this research can ensure efficient management of urban growth and create a stronger foundation for agricultural activities.

[5] This is supported by the Regional County Municipal Comprehensive Development Plans

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APPENDIX A

Appendix A: Notes for Future Access to 2000 Land Use Map Database

The database for the general land use map of 2000 has integer columns set per category up which represent different types of information related to that classification. The reason the integer column had to be set up was to lessen the time GIS functions, such as scripts and geoprocessing wizard, would take.

The field "category" in the database is represented by "urban", "transition" or "rural" activity. A similarly named field has been set up with integers. Number 1 represents urban activity and number 2 represents transition activity. Any space that is not digitized within the bounds of the study area will be considered as rural or actively farmed and forested for a specific end that is rural in nature. An interesting caveat are sections of land in the rural zone which may appear abandoned during the field survey but have been designated as conservation areas. Cross-referencing with the regional or city development plans will allow one to deem if the land should be classified as "abandoned" or rural – conservation area.

Category	Integer	Description
Urban	1	Represents any form of urbanization including residential, commercial, industrial, & mixed-use activity. Camping, golfing, cemeteries, dumps, & institutional activities are also included in this category
Transition	2	Represents any form of activity that can be classified as neither rural (active farming or forestry practices) nor urban. This category is reserved for agricultural lands that are now abandoned, suspected abandoned, abandoned woodlots, subdivided not built areas for residential, commercial or industrial purposes.
Rural	3	Whatever is not urban or transitional

The "period" field has numbers, which represent five different time periods within the longitudinal study. Number 1 represents any activity that occurred until 1964. In 1964 the first study and collection of land use activity took place. Number 2 represents the next study cycle where land use activity was once again checked at the end of 1976. Thus, 2

presents 1964-1976. Number 3 depicts the study year between 1976-1988, which is consequently, exactly 12 years later. Number 4 represents any new land use activity that could either be classified as transitional or urban in nature between 1988-2000.

Number 5 represents a region of development in the municipality of Saint Philippe where urbanization took place in spurts since before 1964 until 1988.

Period	Integer	Description
1964 & Before	1	Represents any activity that occurred until 1964
1964-1976	2	Represents any activity that occurred between 1964-1976
1976-1988	3	Represents any activity that occurred between 1976-1988

For the field that represents land use type (lu_type), the following table depicts the activity and its corresponding integer.

Lu_type	Integer	Description
(- '64)	1	Depicts urban and transitional lands until 1964
('64-'76)	2	Depicts urban and transitional lands during 1964- 1976
('76-'88)	3	Depicts urban and transitional during 1976-1988
Residential	4	Urbanized, residential between 1988-2000
Commercial	5	Urbanized for commercial purposes between 1988-2000
Industrial	6	Urbanized for industrial purposes between 1988-2000
Car Cemetery	7	Urbanized between 1988-2000
Quarry/Sand Gravel Pit	8	Urbanized between 1988-2000

Garbage Dump	9	Urbanized between 1988-2000
Hydro-Quebec	10	Urbanized between 1988-2000
Junk-Yard	11	Urbanized between 1988-2000
Abandoned Farmland	12	Farmland that became abandoned between 1988-2000
Abandoned Woodlots	13	Woodlots behind abandoned or suspected abandoned farmland between 1988-2000
Suspected Abandoned Farmland	14	Farmland that is suspected as abandoned between 1988-2000
SNB-Industrial	15	Land subdivided but not built for industry between 1988-2000
SNB-Commercial	16	Land subdivided but not built for commercial purposes between 1988-2000
SNB-Residential	17	Land subdivided but not built for residential purposes between 1988-2000
SNB-Unknown	18	This category exists for areas which are apparently subdivided for development purposes but has remained unidentified between 1988-2000
Golf	19	Golf courses and driving ranges developed between 1988-2000
Camping	20	Campgrounds developed between 1988-2000
('64-'88)	21	Depicts urban lands between 1988-2000- represents a region of development in the municipality of Saint Philippe where urbanization took place in spurts from before 1964 until 1988

APPENDIX B

Appendix B:

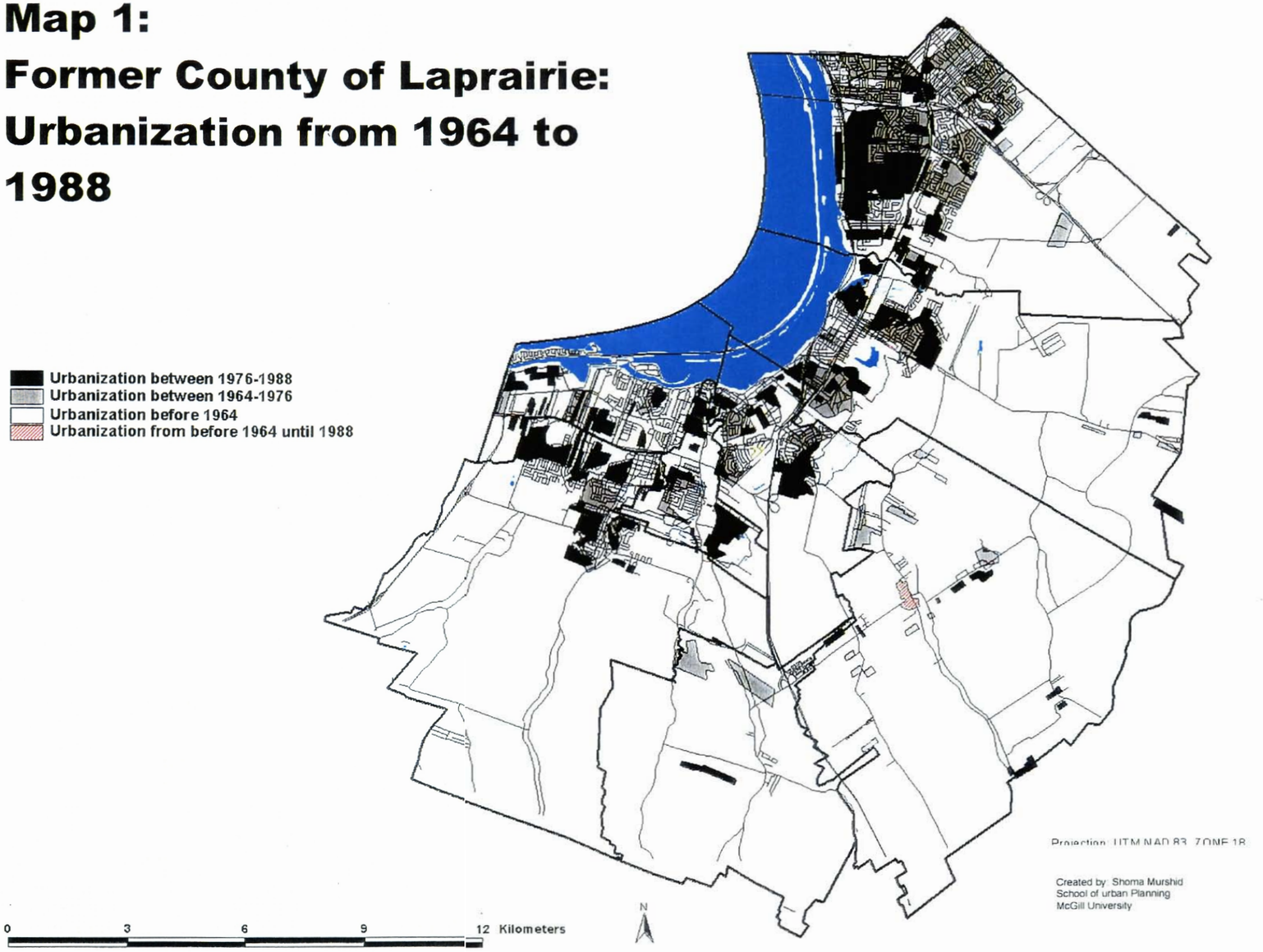
Table 6.2 Annex:

1988 Population was recalculated in 2000 based on this logic:

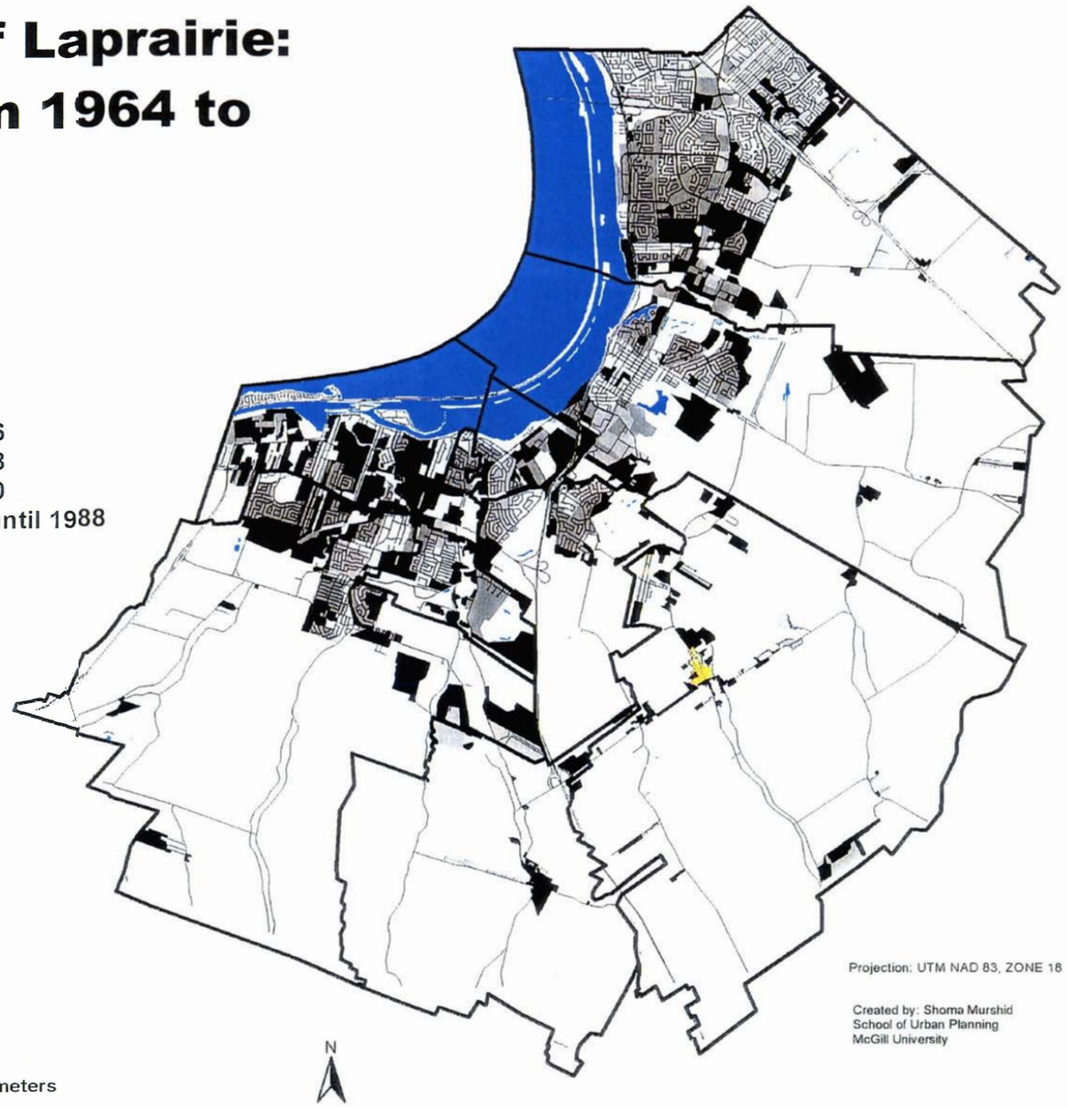
	1986	% Increase	1991	Increase in Pop	Incr in Pop/5	2/5 of 91-86 Change	Recalc Estims of 88 Pop
Brossard	57441	12.8	64793	7352	1470	2941	60382
Candiac	9096	18.4	10765	1669	334	668	9764
Delson	4997	21.3	6063	1066	213	426	5423
La Prairie	11072	37.6	15237	4165	833	1666	12738
Ste-Catherine	7020	39.7	9805	2785	557	1114	8134
St-Constant	12508	47.3	18424	5916	1183	2366	14874
St-Mathieu	1646	6.5	1753	107	21	43	1689
St-Philippe	3357	6.4	3572	215	43	86	3443
Total	107137	21.7	130412	23275	4655	9310	116447

APPENDIX C

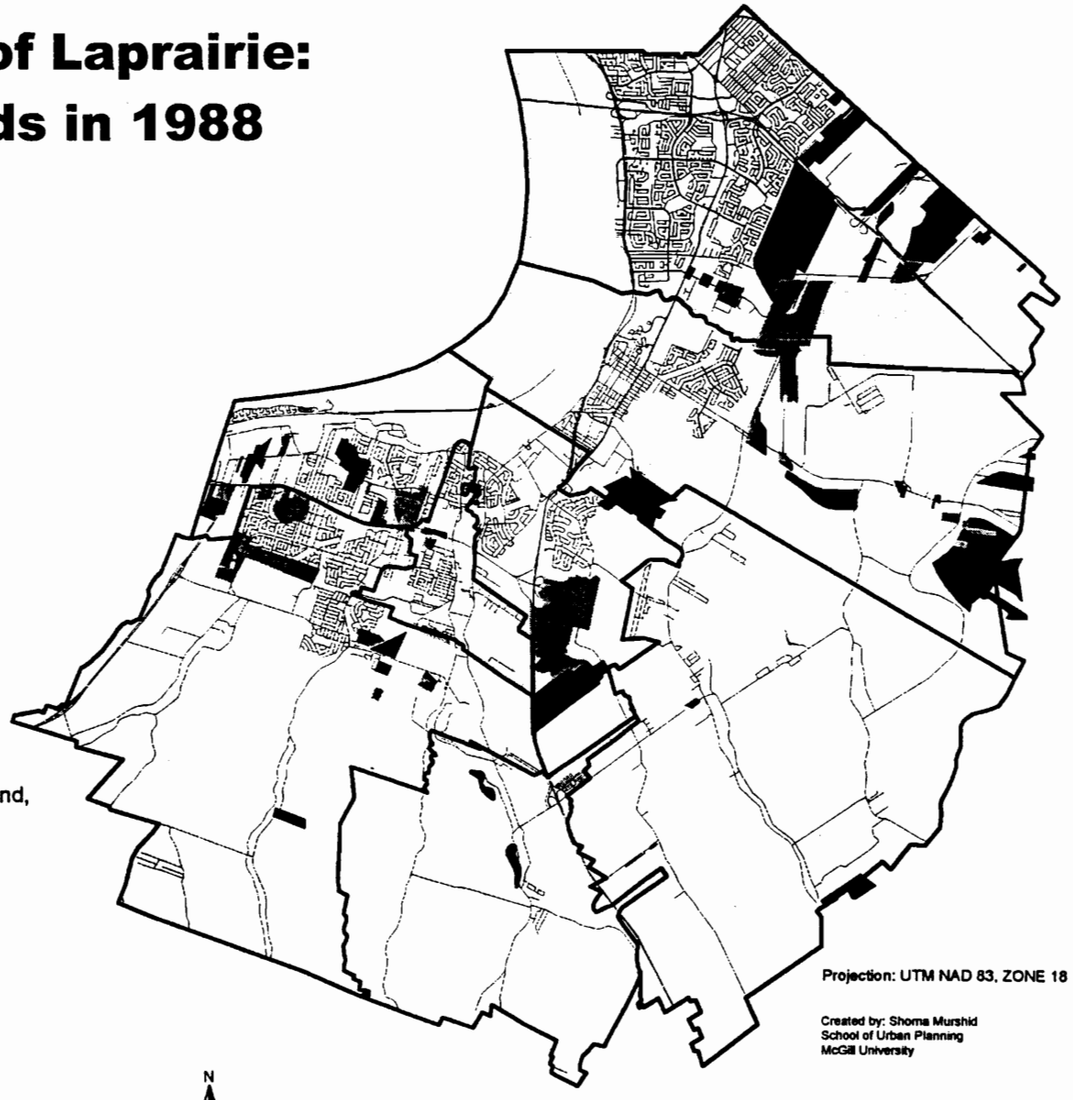
Map 1:
Former County of Laprairie: Urbanization from 1964 to 1988



Map 2:
Former County of Laprairie: Urbanization from 1964 to 2000



Map 3:
Former County of Laprairie:
Abandoned Lands in 1988



Abandoned between 1976-1988
Abandoned between 1964-1976
Abandoned before 1964

Abandoned lands include abandoned farmland, suspected abandoned farmland & abandoned woodlots

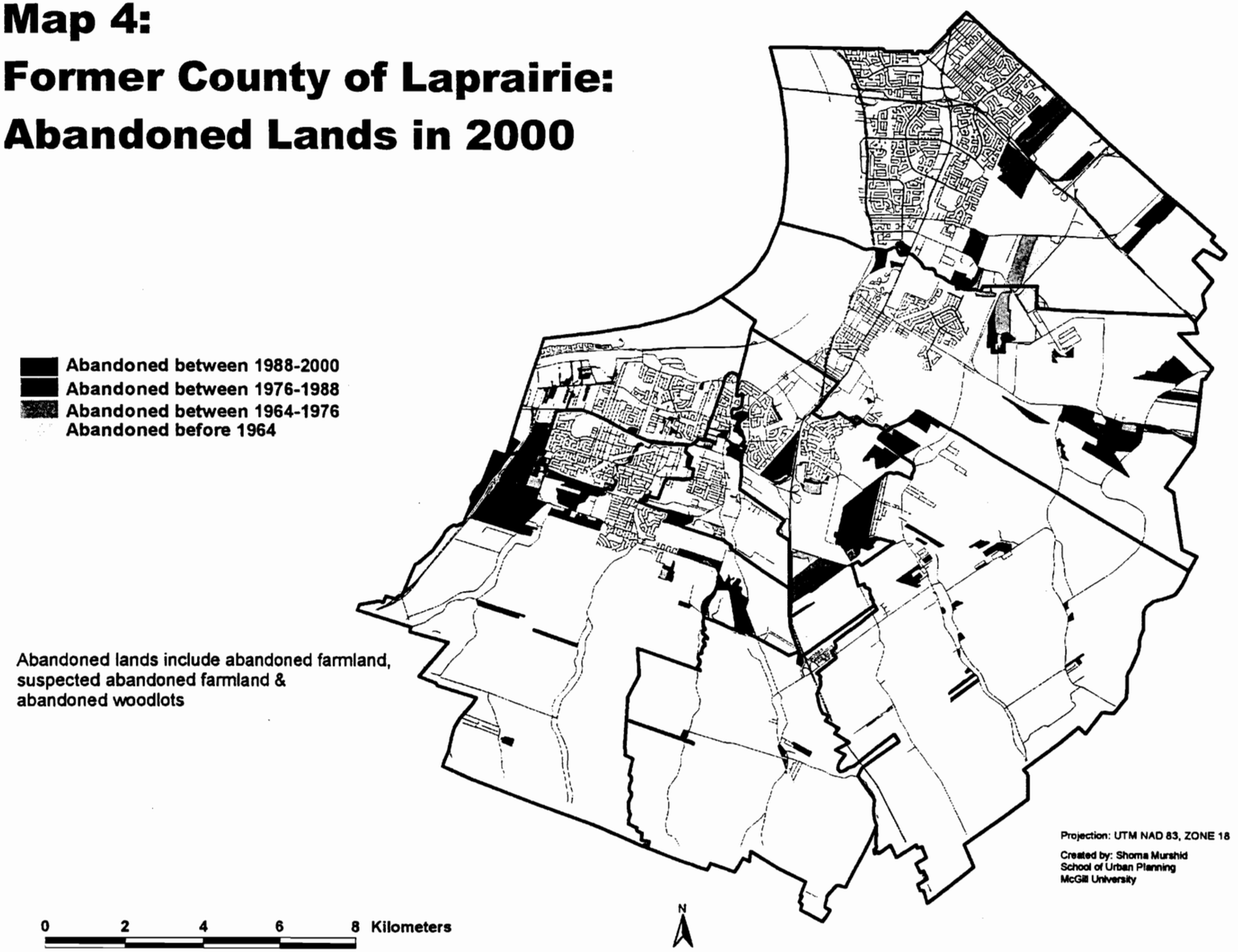
Projection: UTM NAD 83, ZONE 18

Created by: Shoma Murshid
School of Urban Planning
McGill University

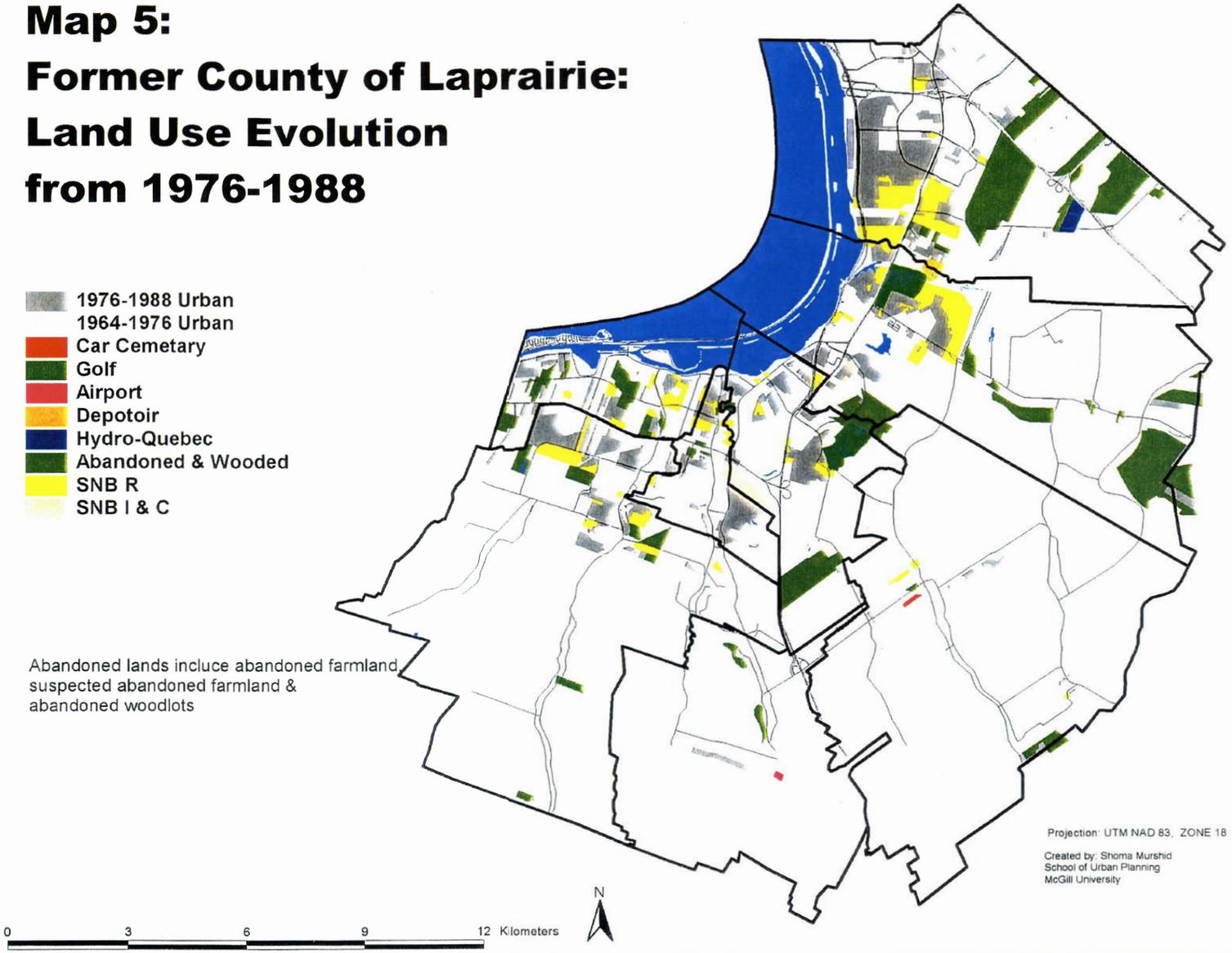
N

0 2 4 6 8 Kilometers

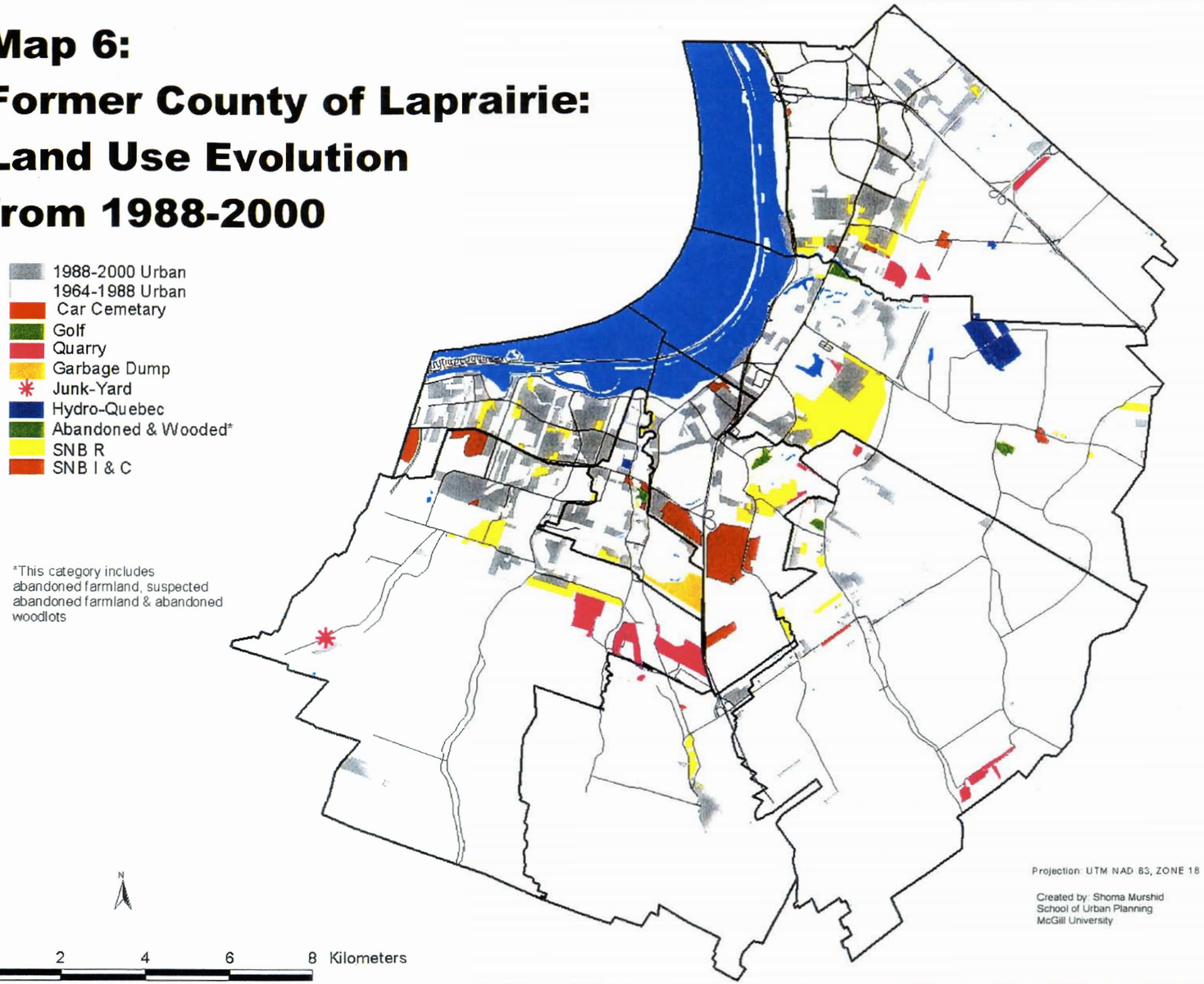
Map 4:
Former County of Laprairie:
Abandoned Lands in 2000



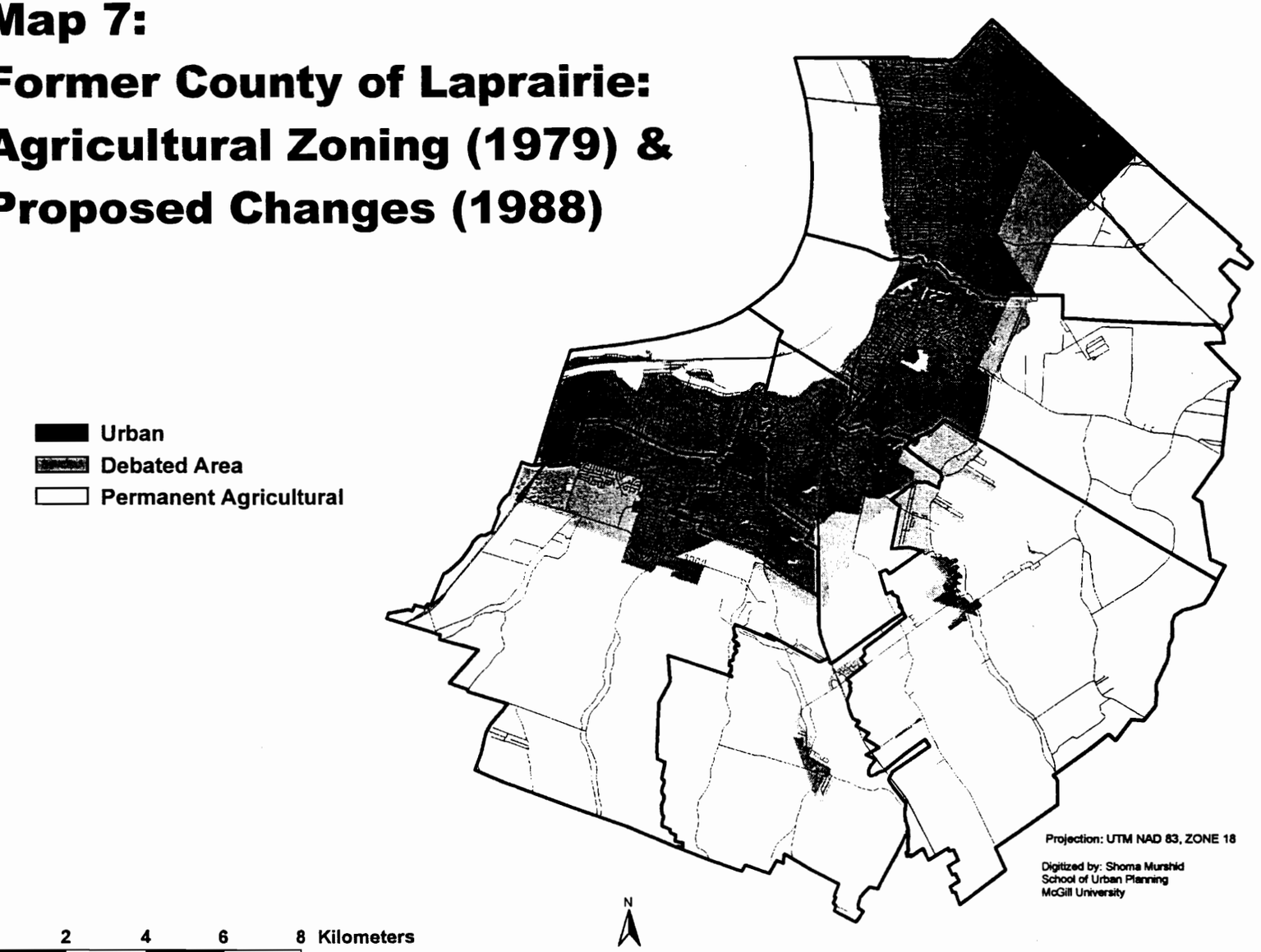
Map 5:
Former County of Laprairie:
Land Use Evolution
from 1976-1988



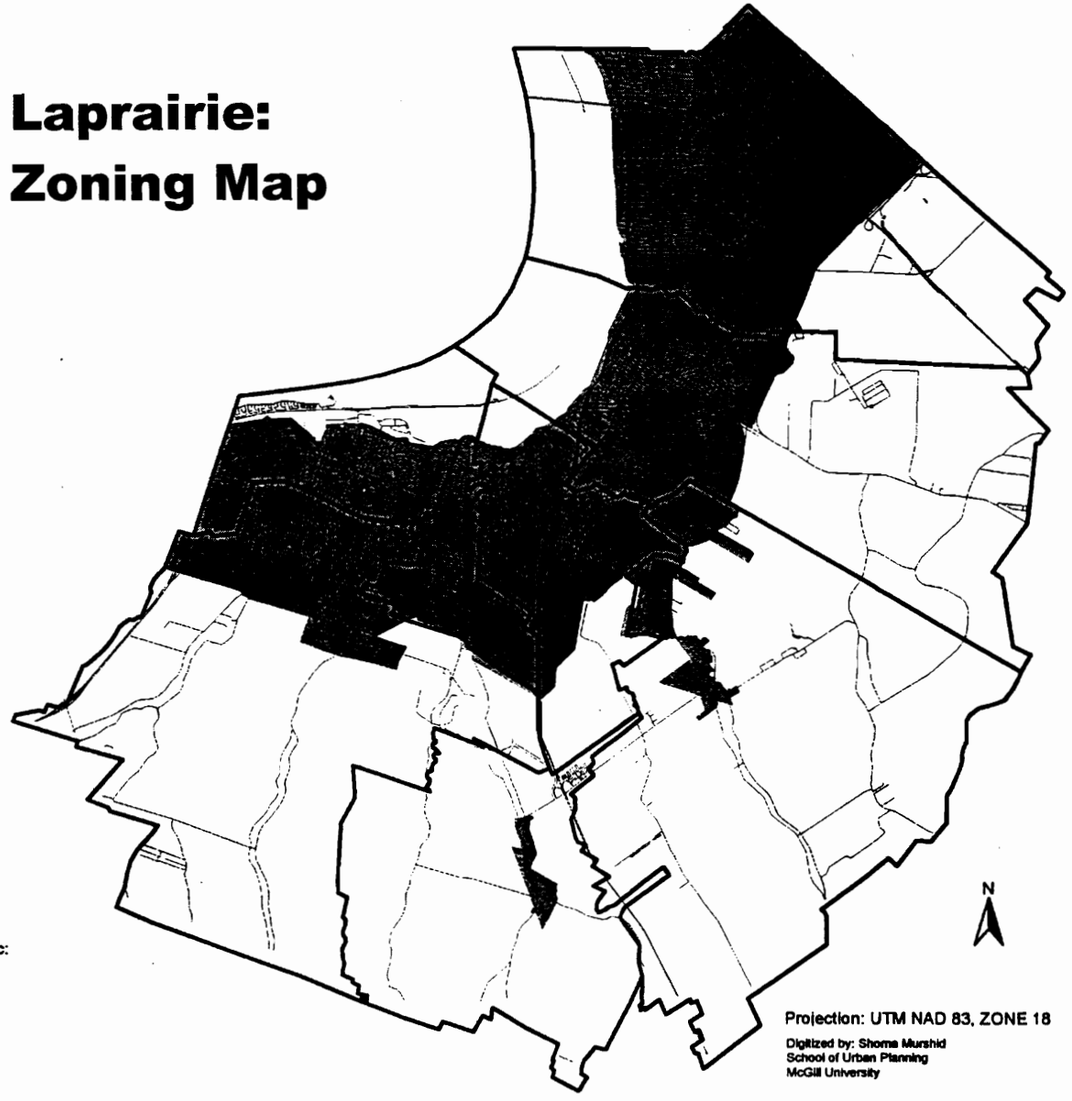
Map 6:
Former County of Laprairie:
Land Use Evolution
from 1988-2000



Map 7:
Former County of Laprairie: Agricultural Zoning (1979) & Proposed Changes (1988)



Map 8:
Former County of Laprairie:
2000 Agricultural Zoning Map



Source of Information:
Commission de Protection du Territoire Agricole du Quebec:
Loi sur la protection du territoire agricole (Carte synthese)

Decrete numero 1314-90-du 1990-09-12
En vigueur le 1990-09-29

Base Topographique: Ministry of Energy and Resources
Base cadastrale: Ministry of Energy and Resources
Cartographie de base: Ministry of Energy and Resources

Realise par la Direction des Services Techiniques
Commission de Protection du Territoire Agricole du Quebec

Projection: UTM NAD 83, ZONE 18

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