Towards Building Compact Cities: Measuring the Outcomes of Winnipeg's Development Plans

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Capstone Report

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Executive Summary

The concept of the compact city is widely regarded as a prominent paradigm of sustainable urbanism in recent years. To promote sustainable development, the City of Winnipeg incorporates compact development policies in plans to serve as a roadmap. This research evaluates compact development policies in Plan Winnipeg 2020 Vision and OurWinnipeg, and the extent to which the policies have been implemented. To examine the policies and measure their extent of implementation, this research adopted content analysis, mapping, and spatial analysis as research methodologies. The content analysis revealed that Plan Winnipeg had a higher percentage (67%) of specific compact development policies compared to OurWinnipeg (24%). OurWinnipeg had more ambiguous language and lacked clearly defined goals. Moreover, having specific policies provides clear guidance for stakeholders to achieve desired development outcomes.

Also, the research found that both Plan Winnipeg and OurWinnipeg contain compact development policies that have influenced compactness and urban sprawl to some extent. Most of the development permits issued between 2013 and 20122 were distributed along the fringes of the city. This demonstrates the extent to which the development plans have influenced urban sprawl considering development applications are reviewed in conformance with the plans. Therefore, planners should evaluate the impacts of regional plans in order to improve the planning process and future development plans. In addition, mapping the rate of change of rural and agricultural land shows that there has been a decline in lands designated as agricultural. This reduction can be attributed to urbanization and political decisions which have led to the conversion of agricultural land for non-agricultural uses. The loss of agricultural land may have adverse environmental consequences and also cause food insecurity. Further, the research revealed that public transit services had improved during the implementation of OurWinnipeg compared to the previous state of the service. This was attributed to the construction of the bus rapid transit system which reduced waiting times and allowed residents in the southwest corridor to reach destinations easily. The study concluded by recommending strategies that could be considered to promote and encourage compact development.

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CEC	Commission of European Communities
COM	Commercial
FAO	Food and Agricultural Organisation
GHGs	Green House Gases
GTFS	General Transit Feed Specification
GIS	Geographic Information System
HDD	High Density Development
IISD	International Institute for Sustainable Development
IPCC	Inter-Governmental Panel on Climate Change
IND	Industrial
INS	Institutional
LDD	Low Density Development
OF	Office
RMU	Residential Multi-use

CHAPTER ONE
INTRODUCTION

1.1 Introduction

Compact development has been widely recognized as a key planning response to the challenges of sustainable development in cities. Evidently, numerous studies have revealed that compact development promotes sustainability by reducing car dependency, decreasing commute time, palliating energy consumption, conserving biodiversity and mitigating pollution (Bibri et al., 2020; Kotharkar et al., 2014; Stevens, 2017). This is substantiated by the fact that compact development emphasizes a mixture of land uses, encourages intensification of development, supports public transportation, and creates urban growth boundaries. Despite the benefits of compact development, there are some studies that are against the concept. According to Bibri et al. (2020), most of the criticisms against compact development are unanticipated and unforeseen effects of compact urban form that is known in the planning literature as "wicked problems". Some of the "wicked problems" include increased housing prices, traffic congestion, reduced green spaces, and limited access to sunlight (Campbell, 2020; Colding et al., 2020; Turnbull & Hoppe, 2019). In addition, the current climate stress and rapid urbanization in cities pose additional challenges in building sustainable urban communities. This implies that growth results in a variety of problems that tend to jeopardize the development of sustainable cities. Therefore, it is essential for urban planners and city authorities to develop effective policies that are geared towards enhancing the sustainability of cities.

Recent reports by Statistics Canada state that the City of Winnipeg is growing in terms of both its geographic footprint and population. Moreover, between 2001 and 2021, the city's growth in land consumption outpaced population growth resulting in nearly 13% decrease in density amid a 6.3% increase in population (Goulet-Kilgour, 2022; Statistics Canada, 2022a). The rate of land expansion is associated with modest population growth which has implications for the expansion of built-up areas as more infrastructure is needed to accommodate the growing population. Besides, the expansion of cities results in encroachment on farmlands, increase in Green House Gas (GHG) emissions, loss of biodiversity, air pollution, road congestion, poor mental health, vehicular accidents, and heat island effects. Due to the implications urban expansion has on cities, it has attracted the attention of urban planning scholars and authorities to devise ways to cope with it. Among these strategies include the promotion of compact development, which has been hailed as one of the best planning responses to the challenges of sustainable development.

To enhance sustainable development, the City of Winnipeg incorporates compact development policies in plans to serve as a roadmap. While these polices are present in all the development plans of the city, there is still urban development in the suburbs. Meanwhile, planners produce plans that are expected to benefit society and stakeholders in the planning process. These plans would seem to have limited value if they are not effective in a political and decision-making environment that calls for transparency and accountability (Guyadeen & Seasons, 2016). Given the trust the public has placed in plans to advance compact development, it is crucial to determine if plans are making progress. Despite the significant emphasis placed on compact development in Plan Winnipeg 2020 Vision and OurWinnipeg, there is insufficient empirical evidence to gauge the extent to which they are actually achieving it.

To improve society and stakeholders' understanding of the context and impacts of plans, this study focuses on evaluating compact development policies in Plan Winnipeg 2020 and OurWinnipeg, and the extent which the policies have been implemented. Notwithstanding the importance of plan evaluation, fewer studies have evaluated plans (Guyadeen, 2018; Guyadeen et al., 2019; Horney et al., 2017; Stevens, 2013) and numerous studies have explored the outcomes of plans based on their principles, goals and strategies (Allred & Chakraborty, 2015; Blatz, 2019; Carnevale et al., 2018; Hossu et al., 2020; R. Lewis & Margerum, 2020; Ramirez, 2019). This research will contribute to the limited literature on plan evaluation and the outcome of long-term development plans. Also, planning practitioners and researchers can use the findings from this research to identify the strengths and weaknesses of Plan Winnipeg and OurWinnipeg which has the potential of improving future plan making in the City of Winnipeg and the Province of Manitoba.

1.2 Research Questions

This study seeks to analyze compact development policies in Plan Winnipeg 2020 and the extent to which these policies have been implemented. Based on that, the following research questions will be addressed:

a) How does Plan Winnipeg 2020 (2001) and OurWinnipeg (2011) address compact development?
b) To what extent has the policy documents led to increased density and supported compact development?
c) Has rural land been maintained for rural and agricultural uses over the planned period?

1.3 Context

The context of the research is influenced by three main factors: first, population growth, second, low density development and lastly automobile dependency.

Winnipeg has experienced steady population growth over the past several decades, which has put pressure on the city to expand outward to accommodate new residents. According to Statistics Canada, the city's population increased from 705,244 in 2016 to 749,607 in 2021, a growth rate of 6.3% over 5 years (see Figure 1). This growth is a little bit more than the national average for urban centres in Canada, which saw a 5.2% increase in population over the same period (Statistics Canada, 2022d, 2022c). Besides, Winnipeg's population growth has been driven by a combination of natural factors and migration. Between 2016 and 2021, non-permanent residents who migrated into Winnipeg accounted for 67.8% of the population growth (Statistics Canada, 2022d).

Another factor that influenced the context of this study is low-density development in the city. Historically, residential development in the City of Winnipeg has been of a low-density suburban nature (City of Winnipeg, 2013). This type of development occupies huge amounts of land contributing to urban sprawl. Despite efforts to promote denser and more sustainable compact development patterns through voluntary regional plans, low density development remains a dominant feature of Winnipeg's urban form. This can be attributed to the availability of excess land for more development. However, expansion of the city has implications for climate change, agriculture and rural land, and the city's budget. Addressing the challenge of low-density development will require a combination of policy changes, cultural shifts, and public education to promote more equitable and sustainable development patterns in Winnipeg.

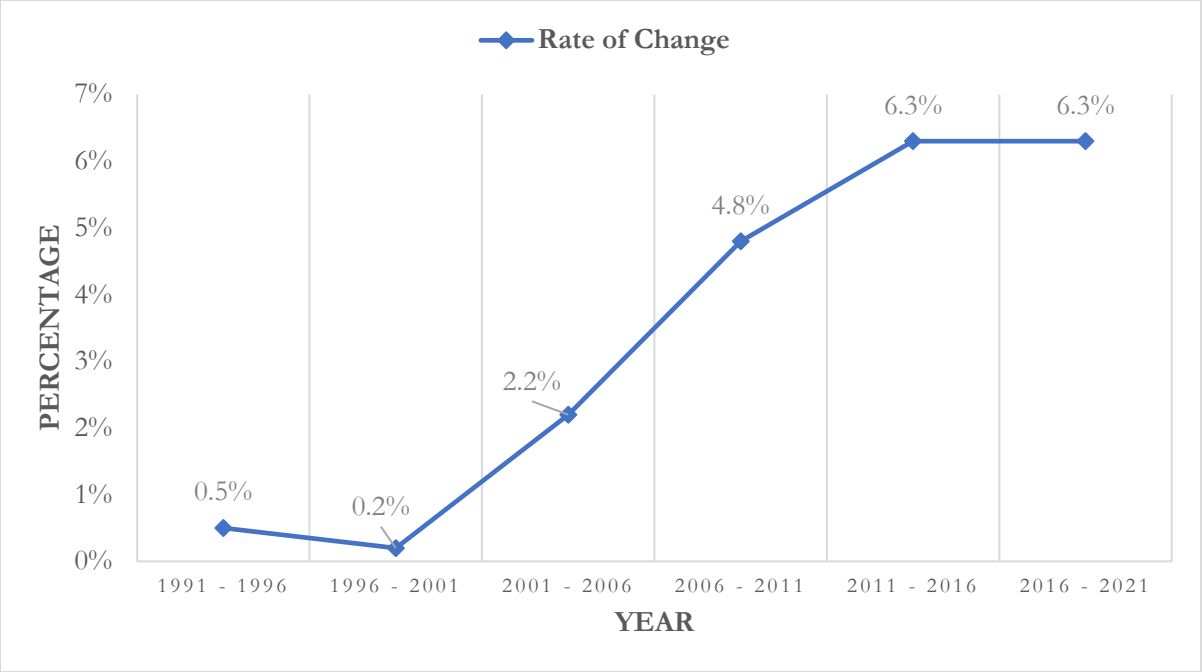

Figure 1: Population change from 1991 to 2021.

Source: Statistics Canada (2022b) and City of Winnipeg (n.d.-a)

Additionally, Winnipeg's transportation system is largely built around private automobiles, which is fueling development of large sprawling suburbs that are difficult to access by public transit or other means of transportation (Bernhardt, 2019). The city's sprawling layout and historically low-density development patterns have contributed to a culture of car dependence, with many residents relying on their cars to travel to work, school, and other destinations. This car-dependent culture has had a number of negative impacts on the city, including increased traffic congestion, air pollution, and increased capital spending. By investing in public transit infrastructure, promoting alternative modes of transportation, and shifting cultural preferences away from cars, the city can create a more sustainable and livable urban environment for all residents.

1.4 Data and Research Methodology

1.4.1 Framework for Content Analysis

To identify the policies in Plan Winnipeg and OurWinnipeg that address compact development, content analysis was adopted to review the policies in the plans. The review of the municipal plans helped in answering the first research question - How does Plan Winnipeg 2020 and OurWinnipeg address compact development?

First, each policy related to compact development was identified in Plan Winnipeg and OurWinnipeg. The policies were selected based on reference to density, design, diversity, destination, and public transit (Figure 2). Second, the policies were classified based on the five common features (Density, Diversity, Design, Destination Accessibility and Distance to Transit) used to assess a compact urban form (Stevens, 2017). In the case where the goal of a policy is related to two or more features, it is categorized as multiple features. Thirdly, based on Berke & Conroy's (2000) methodology of evaluating 30 comprehensive plans, the policies identified were evaluated as suggested and required. This was to identify policy priorities and strengths. Suggested policies included words such as consider, encourage, intend and should. Required policies contained words such as shall, will, require and must.

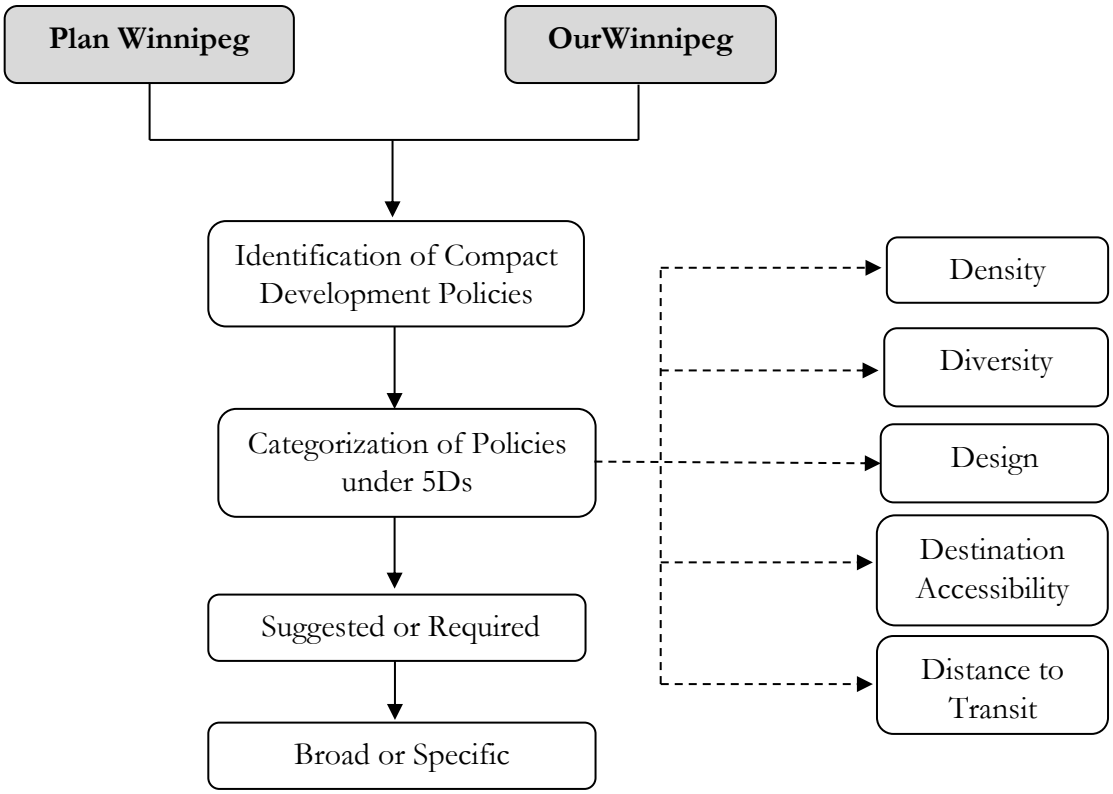

Figure 2: Framework for content analysis

For example, a policy from Plan Winnipeg states that *"The City shall promote compact urban form in support of sustainability by encouraging infilling of vacant lands and the revitalization of existing neighbourhoods to maximize the use of existing infrastructure"* (Plan Winnipeg 2020 Vision, p. 30). The aim of the policy is to support infilling of vacant lands which encourages densification. The policy was categorized under Density as a feature of compact development. The policy is required due to the phrase *"The City shall…"*. Another example is, in OurWinnipeg, a policy states that *"Facilitate the expansion of employment and educational*

opportunities in the Downtown seeking to reinforce Downtown's role as a hub for business, for learning, for government and for commercial activity" (OurWinnipeg, p.34). The policy supports diversification of downtown and was categorized under Diversity as a feature of compact development. The policy is suggestive due to the phrase *"Facilitate the…..".* In addition to Berke & Conroy's (2000) methodology of conducting content analysis, the intention of the policies were also considered in categorizing the policies.

Lastly, the policies were analyzed based on their language. All the policies that were identified and categorized were tallied and summarized to know the features that are most supported by the development plans. Table 1 shows the elements of each feature that was considered in categorizing the policies.

Table 1: Elements for categorizing policies

Feature	Elements
Density	Housing types, population, built-up area, infill, land area
Diversity	Mixture of residential, commercial, and educational development, and different housing types
Design	Pedestrian pathways, vehicle roadways, cycling infrastructure
Destination Accessibility	Downtown, job centres (employment lands), regional mixed-use centres
Distance to Transit	Bus stops, transit routes, rapid transit, public transportation

1.4.2 Mapping density and built form.

Data for mapping the densities of neighborhoods in Winnipeg was obtained from the City of Winnipeg open data portal. The data was then added to ArcGIS Pro and queried to show the years that are relevant for this research. The 2021 population density for the various neighbourhoods in Winnipeg was not available at the time of this study and was therefore excluded.

To know the rate of change of the built form when the plans were adopted, I downloaded the Assessment Parcels data from the City of Winnipeg open data portal. The parcels contain numerous information including the year structures were built, the neighbourhoods, roll numbers, number of rooms, property use code, assessed value for various years and many more (City of Winnipeg, 2023a). Based on the year a particular structure was bult, I created a query for 1870 to 1900, 1901 to 1950,

1950 to 2000, 2001 to 2011, and 2012 to 2022. Although the period of the development for the first three are outliers, the main focus of the study was 2001 to 2011 and 2012 to 2022.

1.4.3 Accessibility to destinations

Accessibility in transportation "denotes the ease with which activities may be reached from a given location using a particular transport system" (Morris et al., 1979, p.91). The study aims to measure accessibility to destinations before and after the implementation of Plan Winnipeg and OurWinnipeg. The data that was used for the analysis was not available between 2001 and 2012. As such, the data for 2013 was used as the basis for comparing with the outcome in 2022.

Accessibility has been measured in many ways in the literature, however, this study measured accessibility to destinations by considering employment lands and residential mixed-use centres as destinations. Employment lands and residential mixed-use data was georeferenced from the urban structure of OurWinnipeg and OurWinnipeg 2045 Development Plan. Data for creating the dataset to be used for the accessibility analysis was first obtained from Open Mobility Data, a database for storing transit data feed (Open Mobility Data, n.d.). The data base hosts transit data in General Transit Feed Specification (GTFS) format. GTFS is a data format that enables public transit agencies such as Winnipeg Transit to share their transit data in a way that can be easily used by a variety of software applications (General Transit Feed Specification, n.d.). GTFS contains a number of data files that have to be converted to support the appropriate analysis in ArcGIS Pro. Table 2 contains the specific files that were used in the accessibility analysis for this study.

Table 2: GTFS Data Files used for Accessibility Analysis

GTFS File	Definition
Stops.txt	Location of every transit stops where passengers board and get off transit
Routes.txt	The path in which transit travel to various destinations. This file contains all transit routes in the city.
Trips.txt	Movement from one destination to another within a route at specific times.
Stop_times.txt	Specific times that vehicles arrive at and depart from each stop during a trip
Calender.txt	Contains the schedule in which transit operates. Specifies when service starts and ends, and the days of the week where service is available

Source: Wiebe (2019) and Google Transit (2022)

After obtaining the GTFS data for the City of Winnipeg, it was used to create the network dataset by converting the *.txt* files into shapefiles *(.shp)* in ArcGIS Pro. Prior to using the data, each GTFS file was examined for accuracy and missing data. Winnipeg's street data was also added to the dataset for

analysis since pedestrians must be able to walk to the transit stops, board the bus, and walk to their destinations. For this study, all streets were categorized as pedestrian friendly, this means pedestrians can easily walk on sidewalks along the streets. The street data (road network) was obtained from the open data portal of the City of Winnipeg (City of Winnipeg, 2022).

To create the network dataset for the analysis, a file geodatabase was created to host the network dataset. The "GTFS To Public Transit Data" Model under the Georeferencing pane was used to convert transit stops, routes, schedules, and trips from GTFS data format. The network dataset was finally created by adding the streets data to the GTFS data that has been converted.

The "Transit Network Analyst" Tool was then used to generate the accessibility matrix with Winnipeg's dissemination blocks as the origin and, employment lands and regional mixed-use centres as the destination. For each origin, the tool counts the number of destinations reachable over the allocated time window. According to Canada's 2021 population census, the commute duration for most people (135,335) is between 15 to 29 minutes. Also, most of the employed labour force aged 15 years and over left for work in the morning between 7am to 8:59 am (Statistics Canada, 2023b). Based on that, the analysis was conducted by considering a generic Wednesday morning between 7am to 9am, when people are commuting to work. The cut off time was set to 30 minutes, which means, the calculation should be based on the number of destinations a resident can get to within 30 minutes in the morning from their house or origin. The dissemination blocks were used as origins since they are the smallest standard geographic areas for census data in Canada and can support pedestrian activity (Statistics Canada, 2023a).

1.4.4 Mapping rural and agricultural land

Data for rural and agricultural land was obtained from Plan Winnipeg 2020 Vision, OurWinnipeg and OurWinnipeg 2045. The areas designated as rural and agricultural land in the urban structure of the plans were georeferenced and digitized in ArcGIS Pro. After the areas were digitized, I then calculated the geometry for each polygon in square kilometers before dividing the total of each year's rural and agricultural area by the total land area of Winnipeg and multiplied it by 100 to get the percentage coverage. For instance, the total rural and agricultural land for 2001 was 136.82 km^2. To find the percentage of coverage, I divided 136.82 Km^2 by 475.2 km^2 (City of Winnipeg area) and multiplied by 100 to get 29 percent.

1.5 Limitations

The main aim of the study is to analyze the intent of compact development policies in Plan Winnipeg and OurWinnipeg, and the extent to which the plans have influenced compact development. Some features such as accessibility to regional mixed-use centres and employment lands were mapped to ascertain the level of accessibility to these destinations. The analyses required GTFS data which was only available from 2013 to date. As such, analyzing the extent to which Plan Winnipeg has influenced accessibility was not conducted.

Another limitation to this research is that only permit data from 2010 to 2023 was available which provides a limited understating of the historical trends of development patterns since 2001. Having access to data from earlier years would have allowed for a more comprehensive analysis of the impact of Plan Winnipeg on development patterns.

Mapping of population density was limited to 2016 instead of 2021. As at the time of this study, the population data for neighbourhoods in the city was not available. This limitation may have affected the accuracy of the findings as population growth and density can change rapidly in certain areas over a short period. Moreover, the unavailability of the most recent population data for the neighbourhoods limited my ability to provide an analysis of the change in population density associated with OurWinnipeg.

1.6 Structure of the Document

The document is organized in five chapters. Chapter one constitutes the introduction about the study and includes subsections such as the research questions, context of the study, limitations, and the research methods employed in the study. The second chapter focuses on a review of related literature considering content related to plan evaluation and measuring compact urban forms. The third chapter describes the trends of the findings of the research. The fourth chapter entails a discussion of the findings in relation to other literature and their policy and planning implications. The last chapter revisits the research questions and how they were answered, suggests some recommendations, provide areas for additional research and the conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

To gain an understanding of the existing literature on plan evaluation and compact development, I reviewed the literature to know the how other researchers have evaluated development plans and the features that have been used to measure a compact city. Findings from the literature review informed my framework for evaluating compact development policies in Plan Winnipeg 2020 Vision and OurWinnipeg. In addition, the features used in this study for measuring the compactness of Winnipeg was derived from the literature review.

The literature review is organized in three main sections. The first section explores the approaches of plan evaluation and the various criteria that has been used in evaluating plans. The second section defines compact development, the various arguments for and against it, and the features that have been used in quantifying the compactness of a city. Lastly, the summary presents the major findings in the literature in connection to this study.

2.2 Plan Evaluation

Plan evaluation is defined as "the systematic acquisition and assessment of plans, planning processes and planning outcomes" (Connell, 2020, p.2). In Laurian et al.'s (2010) view, plan evaluation should not only assess plans but should compare the content of the plan with explicit indicators and standards to ascertain their performance level. Particularly, plan evaluation examines outcomes of plans to determine whether set goals have been achieved or not. The plans that are subject to scrutiny in plan evaluation are outcomes of the planning process. Plans, according to Berke & Godschalk (2006) are long-term policy documents that provide a rationale for development and urban patterns within a local jurisdiction over a period. Referred to as blueprints (Allred & Chakraborty, 2015), plans contain goals, objectives, principles and policies that are translated into physical development patterns.

The concept of plan evaluation is also driven by the growing need for transparency and accountability in decision making by community members and politicians (Bernstein, 2001). Recent studies have deemed evaluation as a legitimate task and a form of good governance (Chouinard, 2013; Dahler-Larsen & Boodhoo, 2019). According to Cousins et al. (2014, p.2), evaluation has major functions: to encourage accountability and to enhance government management. Accountability can be achieved

by keeping the public informed about the advancement and efficacy of policies and programs, as well as their intended and unintended outcomes (Curristine et al., 2007; Leeuw & Furubo, 2008).

2.2.1 Rationale for Plan Evaluation

Plan evaluation is a complex but necessary exercise (Oliveira & Pinho, 2010). It is important for assessing whether policies were implemented as planned or decision makers went contrary. This is relevant for improving decision-making, encouraging participation, and enhancing legitimacy in the planning process. Waldner (2004) notes that planners use public funds and must demonstrate their credibility by producing desirable outcomes. In addition, evaluating plans and sharing the results to the public increases legitimacy and improves the understanding of citizens about the impacts of plans (Oliveira & Pinho, 2010).

Evaluation is an important stage in any planning process, as it provides decision makers with information on whether a plan is (i) accomplishing its stated goals and policies, (ii) recommending appropriate guidance for its successful implementation and (iii) effectively communicating its intentions (Lyles & Stevens, 2014). Additionally, plan evaluation presents an opportunity for planners to examine plans to know how they performed and identify strategies that can be considered to improve future plan making (Guyadeen & Seasons, 2016).

2.2.2 Approaches of Plan Evaluation

The literature on evaluation presents three approaches to plan evaluation (Guyadeen & Seasons, 2016; Laurian et al., 2010; Oliveira & Pinho, 2010). The approaches include a) rational approach b) communicative approach and c) pragmatic integrative approach. These approaches were born out of debates about the best method to evaluate the preparation and implementation of plans. The rational approach to plan evaluation links plans and their actual outcomes (Laurian et al., 2010). Thus, the outcomes of plans must reflect the policies, goals, and principles of the plan. Considered conformance-based, the success of a plan is evaluated based on the degree of conformance with what has been implemented against what is in the plan. Notwithstanding the logical process involved in using the rational approach, it has been criticized of having difficulty defining planning issues, measuring goals and the relationship between plans and their outcomes (Guyadeen & Seasons, 2016). Despite these criticisms, the rational approach to evaluation is still used to guide evaluation in the planning process.

Considered performance-based, the communicative approach to plan evaluation focuses mainly on the planning process. Here, plans are regarded as roadmaps or blueprints that guide development instead of documents that should be strictly adhered to (Laurian et al., 2010). Focusing more on the process, the communicative approach has been criticized of being time consuming and costly (Guyadeen & Seasons, 2016). In addition, while many studies are focusing on the rational approach to plan evaluation, there has been a paradigm shift towards an integrative approach to plan evaluation in recent times (Guyadeen & Seasons, 2016; Hossu et al., 2020). The discourse on using the integrative approach claims that the other approaches when used independently are not feasible considering the complexity of planning issues. For instance, considering only the goal of a project might not feasible since the outcome might not be desirable. Therefore, an integration of both rational and communicative approaches in plan evaluation has the potential of yielding greater understanding of the strengths and weaknesses of plans, which could inform better decision making (Bunnell & Jepson, 2011).

Based on the discussion of the approaches of plan evaluation, a pragmatic integrative approach will be used in this study. This is because the approach allows for an exploration of the linkages between the goals, principles, and policies of a plan against the actual outcome, in which this study is attempting to examine.

2.2.3 Criteria for Plan Evaluation

There are numerous studies on plan evaluation in the planning literature (Allred & Chakraborty, 2015; Baynham & Stevens, 2014; Berke & Conroy, 2000; Blatz, 2019; Connell, 2020; Guyadeen, 2018, 2019b; Hossu et al., 2020; R. Lewis & Margerum, 2020; Ramirez, 2019; Stevens, 2013). Since the scope of the study is in Canada, the focus will be on plan evaluation in North America.

Berke & Conroy (2000) evaluated sustainable development content in 30 plans in the United States of America by developing their own plan evaluation protocol that required three items of information from each policy in the plans. The researchers started the evaluation process by classifying each policy based on the sustainable development principles promoted by the policy. According to Berke & Conroy (2000), the principles were identified based on the objective that was linked to the policy. After that, the development management principle (for instance subdivision and zoning regulations) specified by each policy for encouraging a principle of sustainable development was identified. Lastly, each policy was evaluated as being suggested (score = 1) in the plan or required by the plan (score = 2). Policies in the plan that were "suggested" contained keywords such as *consider, encourage, intend or*

should. Policies in the plan that were "required" contained keywords such as *will, shall, require or must*. To increase the reliability of the protocol in plan evaluation, the protocol was pretested.

Using content analysis, Baynham & Stevens (2014) evaluated adaptation and mitigation content in 39 Official Community Plans (OCP) in British Columbia, Canada. The authors used an evaluation protocol that was established by Tang et al. (2009) to examine the plans. The four general categories included *fact base, goals, policies,* and *implementation*. The same evaluation protocol was used by Stevens & Shoubridge (2015) to assess plans of 20 municipalities in British Columbia. The evaluation protocol used by Stevens & Shoubridge (2015) was informed by Brody (2003) and Godschalk (2009).

Other studies on plan evaluation focus on plan quality evaluation using similar evaluation protocol used in plan evaluation. McCain et al. (2022), Guyadeen et al. (2019), Guyadeen (2019b) and Stevens (2013) used fact base, goals, policies, implementation, monitoring and evaluation - coordination, readability, usability, public participation and presentation as their evaluation criteria during an assessment of plans in British Columbia and Ontario, Canada.

Table 3: Studies on Plan Evaluation

Author	Method	Criteria
Berke & Conroy (2000)	Content Analysis	- Categorized policies according to sustainable development principles - Evaluated policies as being suggested *(consider, encourage, intend or should)* or required *(will, shall, require or must)*
Baynham & Stevens (2014) Stevens & Shoubridge (2015)	Content Analysis	Fact base, goals, policies, and implementation
McCain et al. (2022), Guyadeen et al. (2019), Guyadeen (2019b) and Stevens (2013)	Content Analysis	Fact base, goals, policies, implementation, monitoring and evaluation, coordination, readability, usability, public participation, and presentation

2. 3 Concept of Compact Development (City)

Globally, compact development has become one of the prominent paradigms of sustainable urban development. The concept has been around for a long time and was identified by Jacobs (1961, p. 205) as promoting social benefits, energy advantages and environmental conservation. In addition, the Inter-Governmental Panel on Climate Change (IPCC) in 1990, 1991 and 1995 encouraged the concept as a way of coping with the issues of climate change through efficient pattern of development (Frey, 1999).

There is no specific definition of compact development in the planning literature, but there are several studies that focus on the key elements of sustainable urban form. Notably, compact city, the by-product of compact development is defined by Jenks (2019) as a city that is "spatially contained, environmentally sound, efficient for public transport, socially beneficial, and economically viable" (p. 1). In addition, Jenks (2019) noted that compact settlements have higher densities that are controlled and reduce urban expansion, has a mixture of uses, encourages sustainable modes of transportation (walking, cycling and transit), safeguard farmlands and utilize the existing urban area efficiently. Likewise, Bibri et al. (2020) posits that compact development encourages intensification of growth, emphasizes mixed use development, creates limits for urban growth and focuses on the use of public transit. Having a more compact built environment can encourage people to drive less. This was proven by a meta regression analysis by Stevens (2017), who found that compact urban forms are associated with fewer vehicle miles travelled, based on an exploration of 37 papers on compact development. Contemporary research on compact development and cities suggest that social, economic, and environmental benefits accrue from the promotion of compact development.

Despite the benefits of compact development, there are still arguments surrounding the concept. The concept is said to contradict the concept of the green city (promoted by the Commission of the European Communities (CEC)) which focuses on the conservation of green spaces in cities (CEC, 1990). For instance, the encouragement of compact development will result in the depletion of open spaces, thereby reducing environmental quality of cities. Another argument against the concept is that it neglects rural development. Thus, the concentration of activities threatens rural economic growth (Breheny, 1992, cited in Frey, 1999). This argument is vague since the author did not specify the type of rural economic activities that will be threatened. In addition, with evidence from Calcutta, Cairo and Rio de Janeiro, Brazil, Knight (1996), argues that compact development causes congestion accompanied by pollution and loss of recreational spaces. Other arguments against compact urban

form include social segregation (Valk & Faludi, 1992 cited in Frey, 1999), unexpected population growth (Frey, 1999), expensive growth (Jenks et al., 1996) and decreased local power (McHarg, 1992 cited in Frey, 1999). While the arguments against compact development where mostly in the 90s, 21st century research on the concept shows that only political ideology is consistently associated with opposition to compact urban form (Lewis & Baldassare, 2010).

The discussion of the arguments about compact development shows that the concept is complex and multi-dimensional. Moreover, cities are different in form and structure including topography, size, history, and socio-demographic dimensions. Consequently, some cities may have the potential to be compact and some may not. Therefore, before any arguments are made for or against the concept, the structure, topography, history, socio-demography, size, and form of the geographic area should be considered instead of only focusing on economic, social, and environmental factors.

2.3.1 Measuring Compact Development

Compact development is promoted through national and local plans which serve as blueprints for directing growth. These plans influence changes in the form and structure of cities which can be understood by analyzing the outcomes and progress of plans. Moreover, the spatial expansion of cities in recent years have become more complex and need to be monitored and properly managed to ensure sustainable development. Table 4 shows the features and indicators used to measure compact urban patterns, which will serve as a guide for identifying the features appropriate for this research.

Table 4: Features of compact development

Author (s)	Location	Focus of studies	Features
Ewing et al. (2015)	United States of America	This research used built environment variables to determine the travel outcomes of households in 15 regions. The study found that household trips increase when there is an increase in household size.	Density Diversity Design
Bibri et al. (2020)	Sweden	This study examined how the compact city model can be practiced and justified. The study showed that compact cities contribute to economic, social, and environmental goals of sustainability.	Density Diversity Transportation Mixed land use
Nadeem et al. (2021)	Pakistan	The authors of this study explored the level of compactness of Lahore, Pakistan. The findings showed that Lahore is a semi-compact city with a potential to become a full compact city. Data in this study was analyzed using GIS	Land use and land cover Density Transportation network Accessibility to Transit Mixed use Shape performance
Hamidi & Zandiatashbar (2021)	United States of America	This paper investigated the impacts of compact development on COVID 19 policies. The study found that the challenges of practicing the COVID 19 restrictions in compact areas were not related to minimizing trips	Destination accessibility
Luan & Fuller (2022)	Canada	This study used Bayesian multivariate spatial factor analysis to examine urban compactness for Census Tracts in Canada.	Density Centering Land use Street connectivity

There are various measures of compact urban form in the planning literature that has been developed by researchers. These are focused on different features used to measure compact development but contain common vital features that can be useful for the assessment of compact development in the plans of the City of Winnipeg. Nadeem et al. (2021) and Luan & Fuller (2022) used satellite imagery, digital mapping, and GIS to analyze the built form of Lahore, Pakistan and census tracts in Canada. This technique will be considered in the current research to measure the compactness of the City of Winnipeg after the implementation of the plans.

According to Stevens (2017), there are five features commonly used by researchers to measure compact development. The features are referred to as D-variables and include Density, Diversity, Design, Destination accessibility and Distance to transit. Table 5 contains the definition of the D-variables. Moreover, all the features identified in the literature are related to the D-variables.

Table 5: D-variables for measuring compact urban form

D-Variables	Definition
Density	This refers to the population and jobs per unit area. High densities signify compact development. This measure includes neighbourhoods with multi-family homes that house huge populations.
Diversity	This includes a mixture of land uses in a neighbourhood. Higher diversity indicates less travel and the motivation to use other modes of travel for shorter distances.
Design	This variable evaluates the nature of streets including the distinction between pedestrian pathway and vehicle roadway, and the density of intersections. A well-designed street has the potential of promoting other modes of transportation such as walking and cycling.
Destination accessibility	Measured in relation to distance to downtowns, this variable assesses the easy of accessibility to trip destinations. Accessibility to important destinations could decrease the need for travel and present an opportunity for the exploration of other modes of travel.
Distance to transit	This is measured based on the distance between a house and the nearest transit stop, using the most convenient route. Locating transit stops closer to houses could influence people to live in a compact settlement.

Source: Stevens (2017)

2.4 Summary

The aim of this research is to evaluate compact development policies in Plan Winnipeg 2020 and OurWinnipeg, and the extent to which these policies have been implemented. A review of the literature shows that there is limited research on plan evaluation and quantification of compact development in Canada, particularly, the west. Moreover, the available studies predominantly analyze large scale locations such as the Ontario-Greater Golden Horseshoe (GGH) Region and British Columbia. This research will contribute to bridging the gap on plan evaluation and compact urban form by applying a pragmatic integrative approach to assessing long term plans of the City of Winnipeg.

Furthermore, the literature on plan evaluation and compact development shows that there are various ways of assessing plans and compact development. Similar to the approach used by Berke & Conroy (2000) in evaluating sustainable development content in plans, content analysis will be used to assess compact development policies by setting a criteria with keywords for policies that are suggested and required in the plan. In addition, compact development policies identified in the plan will be categorized under the commonly used features (D-variables) for measuring compact development to know the feature the plan is supporting the most.

CHAPTER THREE

RESULTS

3.1 Introduction

This section presents the findings of the content analysis and the extent of implementation of Plan Winnipeg 2020 Vision and OurWinnipeg. The content analysis is based on Berke & Conroy's (2000) methodology of evaluating principles of sustainable development in 30 comprehensive plans. Compact development policies in the development plans are categorized under the five common features (Stevens, 2017) used to assess compact urban form. A quantification of the urban form of the City of Winnipeg based on the 4 out of the 5 common features used to measure compact development is visualized under this section using maps, graphs, and tables. The last part of the section provides results on how rural and agricultural land has changed over the period of the plans.

3.2 Assessing compact development policies.

3.2.1 Plan Winnipeg 2020

Plan Winnipeg was the City of Winnipeg's long term policy document adopted by Council to guide development from 2001 to 2020. The plan was developed through a participatory process which informed the policies that were formulated. The document is organized in five chapters with a series of numbered statements that are supposed to direct the growth of the city. In addition, the document contains projected scenarios which influenced responses in the form of policies to tackle future concerns. For instance, Plan Winnipeg 2020 forecasts showed that there was going to be an employment growth in the city during the implementation of the plan (Plan Winnipeg Vision, p. 6). This growth was expected to result in labour shortage which will influence migration into the city. As a result of the migration in response to employment needs, the population of the city was expected grow at a modest rate.

The underlying premise of Plan Winnipeg was to "guide Winnipeg into the twenty first century by addressing the broad physical, social, economic, and environmental conditions in the city" (Plan Winnipeg 2020 Vision, p.3). This intent was expected to adhere to six principles which will help shape the policies in the plan. The principles of the plan included sustainability, social consciousness, thoughtful development, partnership and collaboration, healthy living, and local employment.

The plan proposed to have a well-planned urban development by promoting orderly and compact development, guiding land use, urban design, and transportation planning, and investing strategically

in new infrastructure. These strategies were expected to increase infill, transit ridership, bicycle usage and improve residential streets. A land use map, shown in Figure 3, was developed to shape the growth of the city. In addition, the plan proposed to reduce reliance on automobile travel by providing positive incentives and encouraging the use of alternative modes of travel. To achieve this, the city formulated policies to promote compact urban form with mixed land uses to allow people to live and work in their neighbourhoods without the need to travel.

Plan Winnipeg contained a blend of policies and proposed initiatives which were expected to inform decision making. A total of 45 policies in relation to compact development features were identified. The policies were categorized under the five common features for measuring compact development (Density, Diversity, Design, Destination accessibility and Distance to transit) and were further grouped under *"required" or "suggested"* and *"broad" or "specific"* based on their wording and intention. All the policies identified in the plan were categorized and summarized in Table 6.

As shown in Table 6, all the policies identified in the plan were evaluated based on their intention and keywords. Most of the policies identified (16) in the plan integrated all the features used in measuring compact development. The least feature with less policies in the plan was Destination Accessibility. This means there were least policies that focused on improving access to destinations such as downtowns, jobs and mixed used centre. Appendix 1 contains all the policies that were evaluated in Plan Winnipeg in relation to compact development.

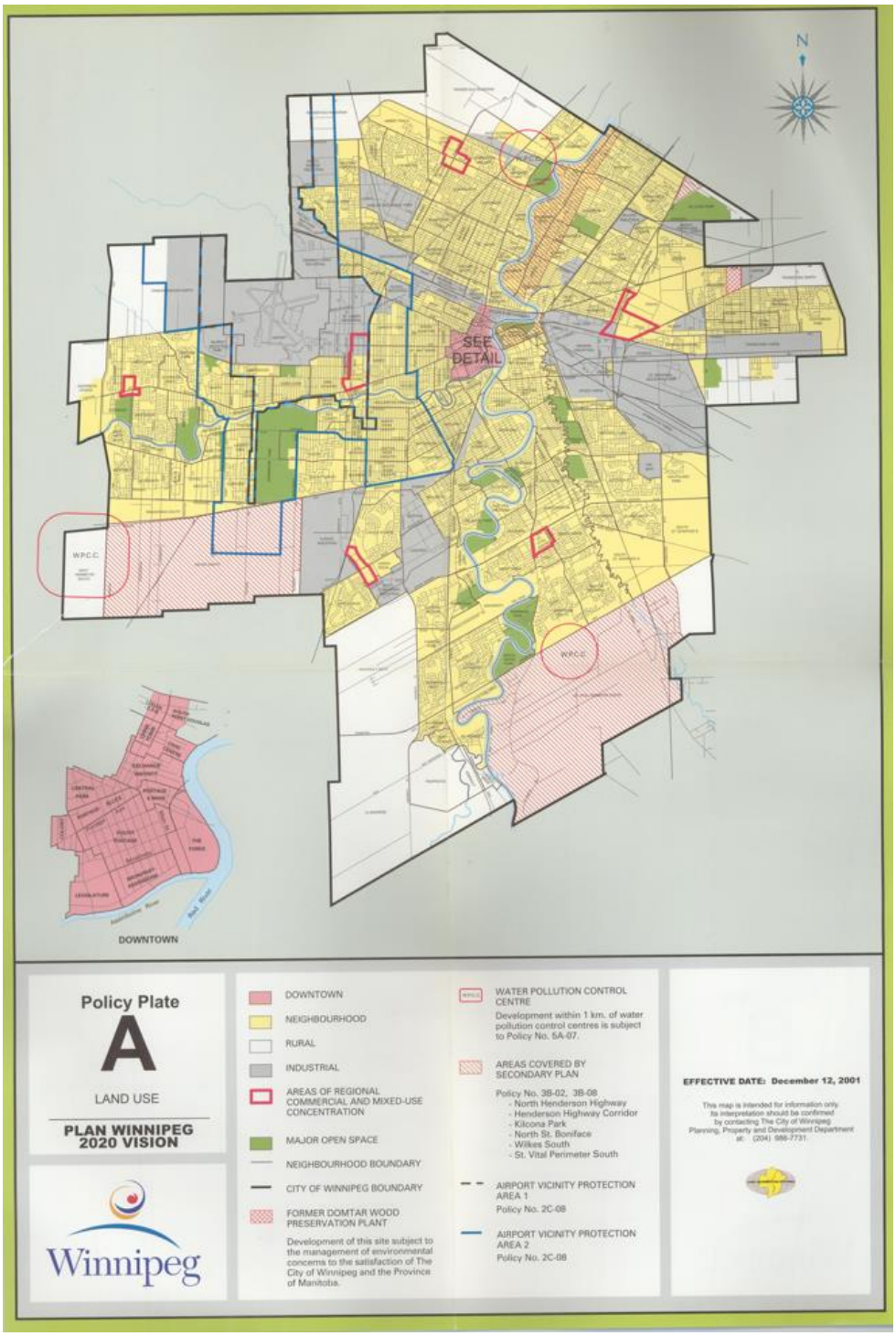

Figure 3: Land Use Map of Winnipeg in 2001

Source: The City of Winnipeg (2001)

Table 6: Policy Classification of Plan Winnipeg 2020 Vision

Features	Total Number of Policies	Language							
		Suggested	%	Required	%	Broad	%	Specific	%
Density	4	3	75	1	25	2	50	2	50
Diversity	11	8	73	3	27	5	45	6	55
Design	7	3	43	4	57	3	43	4	57
Destination Accessibility	2	2	100	0	0	0	0	2	100
Distance to Transit	5	0	0	5	100	1	20	4	80
Multiple Features	16	4	25	12	75	4	25	12	75
Total	**45**	**20**	**44**	**25**	**56**	**15**	**33**	**30**	**67**

Source: Plan Winnipeg (2001)

Overall, 56% of compact development policies outlined in Plan Winnipeg were required to be implemented by planners based on the language used in the policies. In terms the specificity of the policies, the study found that 67% of them provided specific details about what factors should be considered in the implementation process. This means that these policies provided clear guidance on the requirements and considerations that should be taken into account when building a compact city. For instance, a policy in Plan Winnipeg states that *"The City shall promote downtown development to stimulate revitalization and capitalize on existing infrastructure by ensuring its zoning and building by-laws and its administrative procedures support the concepts of mixed land use and compact urban form in the downtown."* This policy was categorized as required and specific because it involves adhering to zoning and building by-laws and specifies the area compact development should be prioritized. Refer to Appendix 1 for more examples of how policies were categorized.

3.2.2 OurWinnipeg

OurWinnipeg was adopted by the City of Winnipeg Council in 2011 to guide growth and development of the city over the next 25 years. The plan provided a framework for decision making on issues such as land use, transportation, and infrastructure. In addition, the plan was supported by three direction strategies (Complete Communities, Sustainable Transportation and Sustainable Water and Waste) which provide specific policies on how various sectors and areas should be developed. Figure 4 shows the Urban Structure of the city which shows how the neighbourhoods are expected to change over the period of the plan. This study focuses on only OurWinnipeg which is the main development plan that informs the rest of the direction strategy documents.

One of the key strategies of OurWinnipeg was to encourage infill development and densification in existing neighbourhoods, rather than sprawling outward. This was done by introducing targeted zoning and land use policies to encourage development in existing neighbourhoods. For example, under the enabling strategies of policy direction 3, the city included policies that allow secondary suites in single family homes. Also, the City created zoning districts that allow for higher density development in certain areas such as Centres and Corridors, and New Communities. These areas were expected to have a variety of different housing types from apartments, to single family homes and townhouses with mixed use facilities around to reduce the need for driving.

Another key strategy outlined in the plan that is relevant for this study is the development of a high-quality public transportation system including rapid transit and active transportation options like cycling and walking. The plan emphasized the development of transit-oriented communities that are located close to public transportation. This was expected to make it easier for people to live in denser, more walkable neighbourhoods without relying on cars. For instance, the policies in the plan suggested that new developments be located close to transit stops to increase accessibility to destinations such as downtown, mixed use centres and job locations.

Additionally, the plan aimed to create complete communities that are vibrant and diverse with a range of housing options, services, and amenities. Complete communities are essential for creating a high quality of life for residents and ensures that everyone has access to resources and services needed to thrive. The plan encouraged the development of mixed-use neighbourhoods which combine residential, commercial, and institutional uses in the same area. This creates more walkable communities and allows residents to access services and amenities within a short distance of their homes.

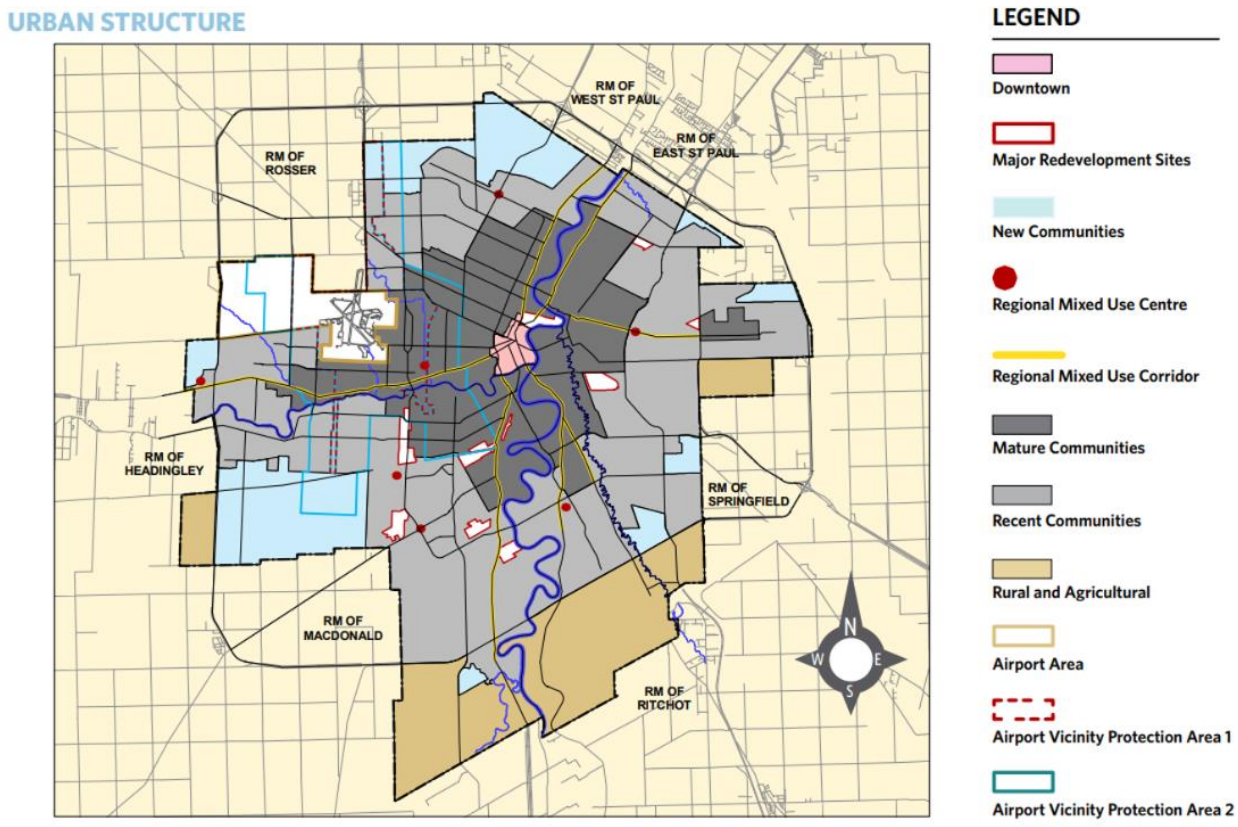

Figure 4: Winnipeg Urban Structure

Source: City of Winnipeg (2011)

The policies in OurWinnipeg are intended to be both suggested and required, depending on the specific policy and its level of importance. Some policies in OurWinnipeg are suggested, meaning that they are recommended but not mandatory. Other policies in the Plan are required, meaning that the policies are mandatory and must be followed by developers and other stakeholders. Overall, the intention of the policies in OurWinnipeg is to provide a comprehensive framework for development in the city that balances the needs of residents and promotes long term sustainability and livability. While some policies are suggested and others are required, all are intended to guide decision making and ensure that development occurs in a responsible and sustainable manner.

Table 7 presents the scores by compact development features and the percentage of policies in OurWinnipeg that are suggested, required, broad or specific. The policies in the plan are spread across each feature used to assess compact urban form with majority of the policies falling under Density. The findings indicate that most of the compact development policies are aimed at increasing the density of the city. For instance, the plan suggested that New Communities will play an important role

in accommodating the projected population growth of the city. None of the policies identified in the plan were directly linked to design. Rather, policies associated with improving the design of the city such as the bike paths and walkways were integrated with other features for holistic infrastructure development. Out of the total number of compact development policies identified in the plan, 45% of them were suggested whiles 55% were required.

Table 7: Policy Classification of OurWinnipeg

Features	Total Number of Policies	Language							
		Suggested	%	Required	%	Broad	%	Specific	%
Density	10	5	50	5	50	6	60	4	40
Diversity	6	4	67	2	33	5	83	1	17
Design	0	0	0	0	0	0	0	0	0
Destination Accessibility	1	1	100	0	0	1	100	0	0
Distance to Transit	2	2	100	0	0	1	50	1	50
Multiple Features	19	5	26	14	74	16	84	3	16
Total	**38**	**17**	**45**	**21**	**55**	**29**	**76**	**9**	**24**

Source: OurWinnipeg (2011)

In terms of the specificity, only 24% of compact development policies were specific with 76% being broad. For instance, a policy such as "support contextually sensitive infill development that builds complete and inclusive communities in Areas of Stability" (OurWinnipeg, p. 55) does not specific the features that make a complete or inclusive community. This gives flexibility to developers to propose characteristics they think could make communities inclusive.

3.3 Distribution of density by neighbourhood

Density and how it is distributed in a geographic area is a fundamental aspect of urban form and is frequently used to assess urban expansion and sprawl. When density decreases over a period of time, it is viewed as a sign of urban sprawl or expansion, which can be used to define the degree of compactness of an urban form (Xu et al., 2020). The density of the various neighbourhoods of Winnipeg was calculated by dividing the land area of the neighbourhoods by the population. Areas such as large parks, industrial areas and open spaces in the neighbourhoods are considered in the calculation of the density. This has the tendency of influencing the density of a particular neighbourhood where there are large parks or open spaces. Areas designated as neighbourhoods

without populations such large parks and industrial areas were exempted. The density of the city in 2001, 2011 and 2016 are examined in this study to know the change in density after the implementation of the plans under examination.

It is observed from mapping the density of the neighbourhoods that the density of the city changed during the period of the plans but not so much. From Figure 5, it can be observed that Roslyn, Broadway-Assiniboine, Central Park, and Alpine Place neighbourhoods had the highest population densities ranging from an average of 8,258 to 15,965 people per square kilometer in 2001. The second most dense neighbourhoods in 2001 included Spence, West Broadway, Daniel McIntyre, St Matthews, Mcmillan and Edgeland neighbourhoods with population densities of approximately 5,394 and 8,258 people per square kilometer. Compared to the densities in 2011, the period after Plan Winnipeg, the neighbourhoods with the highest densities in 2001 changed but not significantly. For instance, the number of people per square kilometre in Roslyn neighbourhood was 13,360 in 2001. This number increased to 13,392 in 2011 signifying an increase in 0.24% over 10 years. Similarly, the population density of Central Park increased by 17.47% between 2001 and 2011. Despite most neighbourhoods experiencing slight change in density from 2001 to 2011, neighbourhoods such as Amber Trails (350%), Brockville (103%), Eaglemere (142%), Rivergrove (125%) and Royalwood (259%) recorded significant increases in their densities during the implementation of Plan Winnipeg.

Furthermore, I observed that the implementation of Plan Winnipeg resulted in the development of new neighbourhoods including Sage Creek, Bridgwater Forest, and South Pointe. Some of these new developments were constructed on lands designated as Rural and Agricultural policy area according to Plan Winnipeg 2020. The original designation of the lands were changed into neighbourhood policy area on January 25, 2005 by City Council to allow for the development of new residential units to meet a supposed housing demand (Sjoberg, 2005, p.6). Despite Plan Winnipeg's intention to maintain rural and agricultural land at the end of the plan period, Waverley West was still redesignated to allow for infrastructure development.

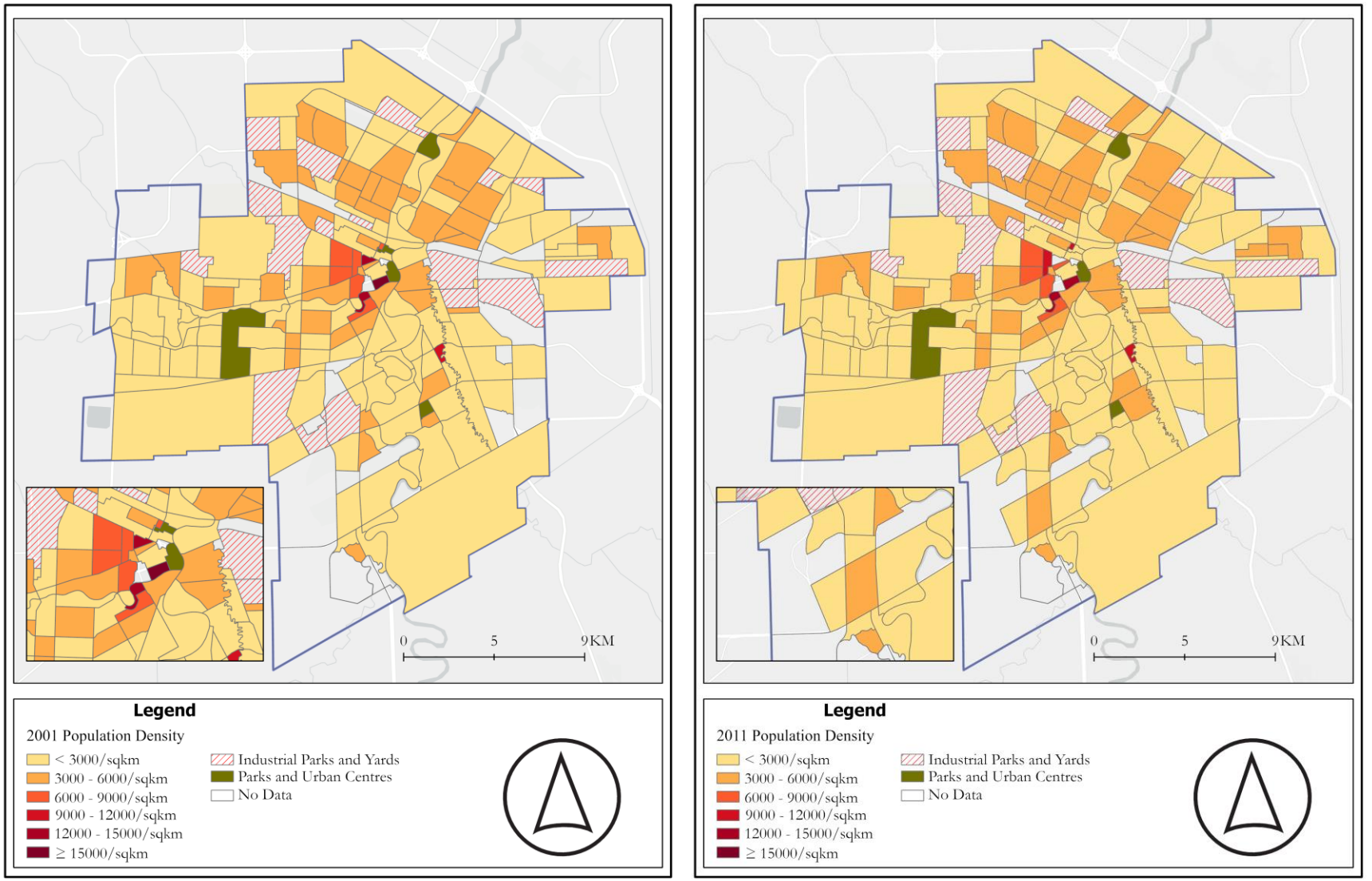

Figure 5: Population Density in the City of Winnipeg by Neighbourhood in 2001 and 2011

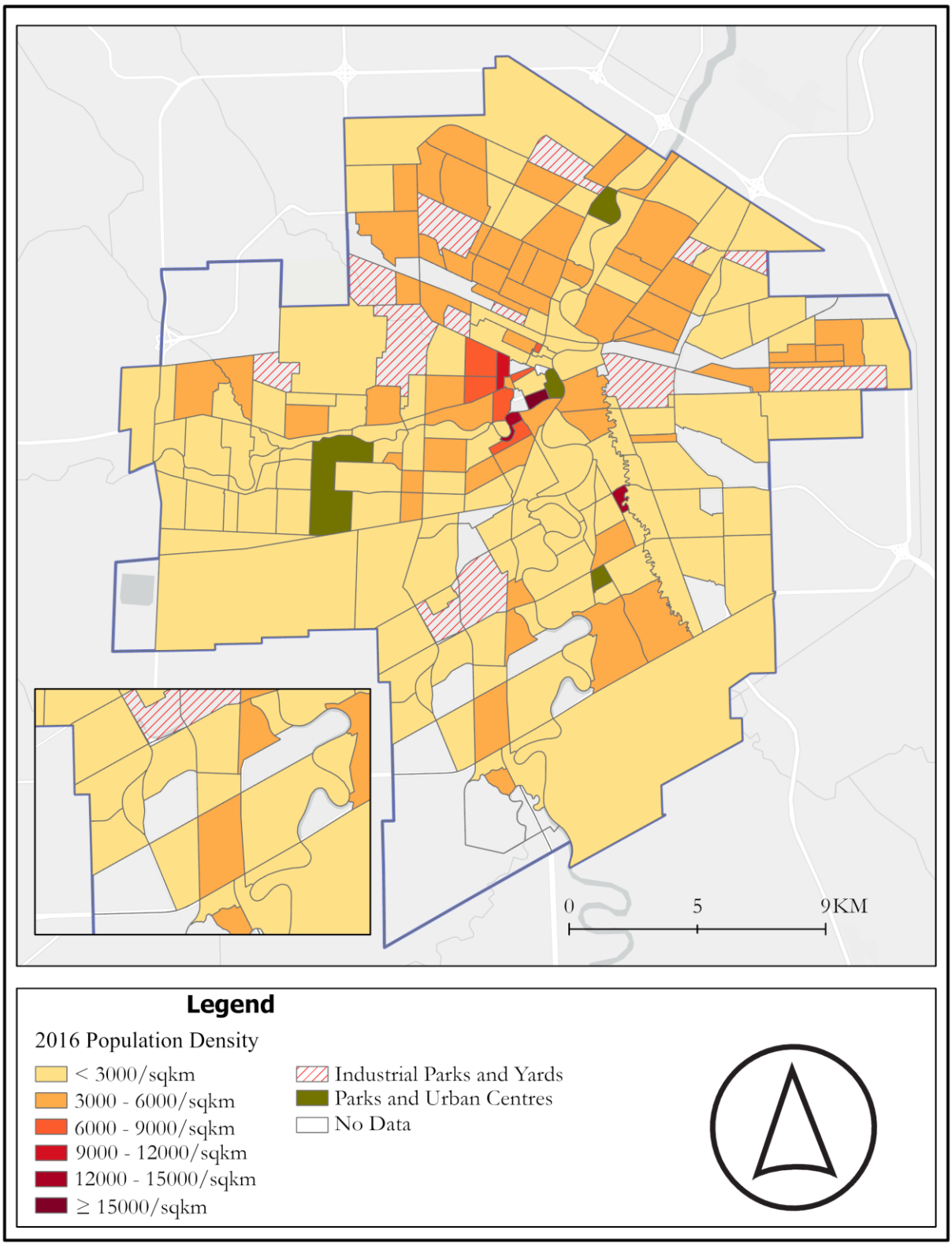

Figure 6: Population Density in the City of Winnipeg by Neighborhood in 2016

Figure 6 shows the distribution of density in the City of Winnipeg in 2016. Although OurWinnipeg was replaced in 2022, the density of the city in 2021 was excluded in this study because the census data for the neighbourhoods in Winnipeg was not available. Further research could be conducted in the future to include the density of the neighbourhoods in 2021 to fully understand how the density has changed between 2011 and 2021. Five years after the adoption of OurWinnipeg resulted in the creation of Bridgwater Centre and Bridgwater Trails neighbourhoods in Waverley West. However, the development of these neighbourhoods cannot be attributed to OurWinnipeg since Waverley West was approved for development during the implementation of Plan Winnipeg between 2001 and 2011. As far as urbanisation and population growth are concerned, the development of Waverly West and Sage Creek was in response to projected population growth in Plan Winnipeg 2020 and OurWinnipeg. The plans projected a positive net migration for Winnipeg which informed the estimated increase in population by 2020 and 2031. More importantly, the projection included growth rates for the years after 2001 and 2011 which is relevant for the preceding years. The projection in Plan Winnipeg indicated that Winnipeg would experience a modest population growth which informed the formulation of policies in Plan Winnipeg to commit to inner city revitalization, sustainable practices, and compact urban form.

Additionally, projections from Plan Winnipeg showed that the city was expected to witness a decline in inner city population over the planned period. The development of new neighbourhoods such as Waverley West can be said to have been the pull factor in depopulating inner neighbourhoods. With clearer understanding of what happened opposed to what was planned, the intentions of the two long range plans influenced a change in density and built-up area which fueled residential development on lands designated as rural and agricultural policy areas.

3.3.1 Change in built form.

The urban growth pattern map of the City of Winnipeg was generated by considering the year in which the infrastructure was built. The results indicate that the city's built-up area has been increasing since 1870 with most of the growth occurring between 1951 to 2000 (Figure 7). Currently, a portion of the rural and agricultural land has been encroached upon and transformed into residential development. However, the city still retains some green areas and open spaces in the form of parks that can serve as nature-based solutions to the adverse impacts of climate change such as urban heat island.

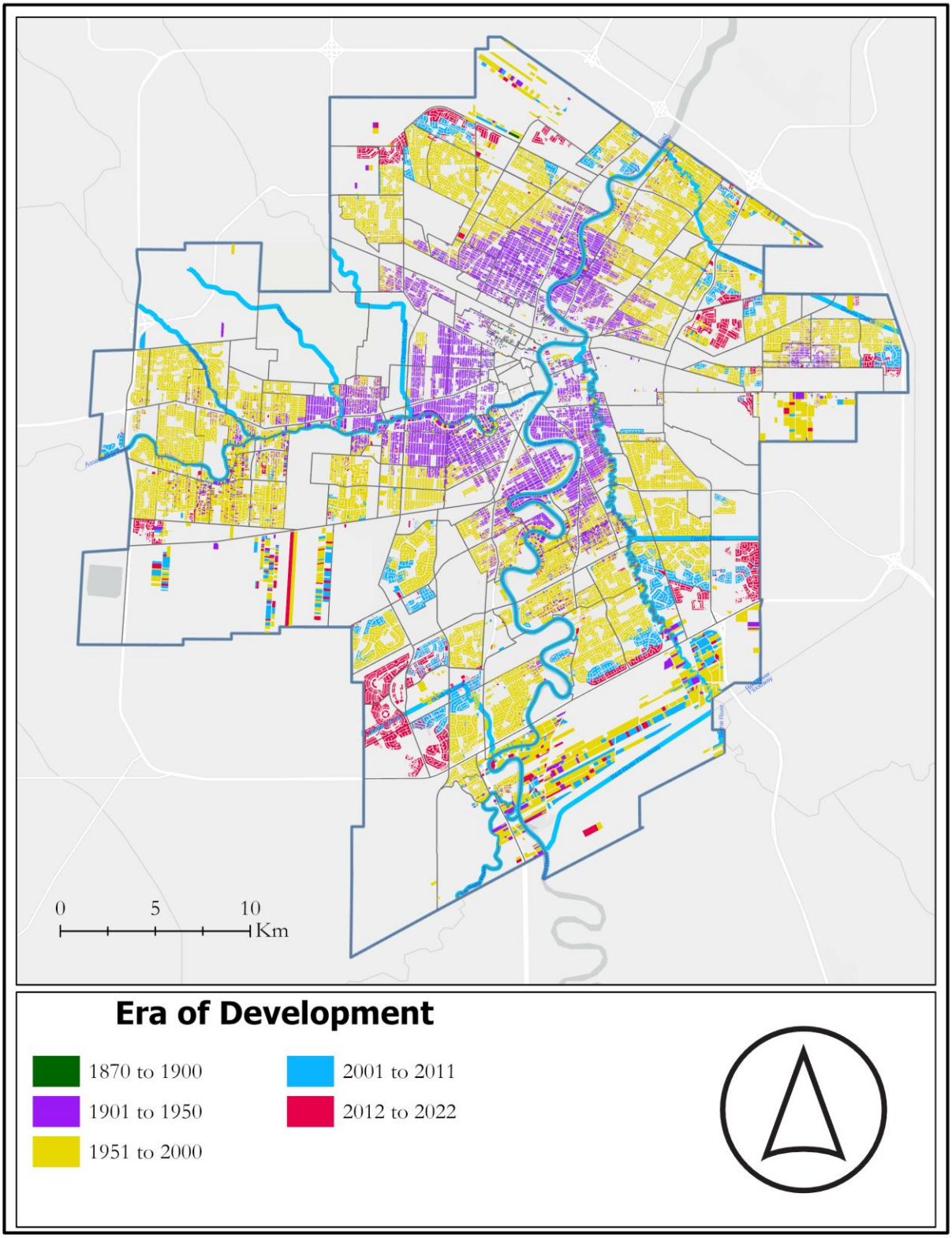

Figure 7: Urban growth pattern of the City of Winnipeg

Notwithstanding the built form of the city increasing every decade, I observed that the new neighbourhoods that are being developed are compact but with mostly single-family homes. This means less people will be living in a particular neighbourhood despite the compact urban form. In addition, most of the new developments during the period of the plans under study are located in the periphery of the city indicating that the city is expanding outward. If this continues, the city is likely to lose all its rural and agricultural land to residential development which will have implications for farming and the climate.

3.4 Diversity

Diversity measures the variety of land uses in a particular area (Stevens, 2017). A higher mixture of land uses in a neighbourhood has the tendency of promoting compact development since retail shops, jobs, and restaurants will be closer to residential developments. Hence, residential development should be accompanied by the development of other land uses which will support future residents.

3.4.1 Distribution of development permits issued from 2012 to 2022.

Using development permit data issued between 2012 and 2022, I filtered the number of residential and non-residential development permits that have been approved for development. The filtration was limited to permits issued for only new constructs (buildings), excluding other permit types such as renewals, repairs, demolitions, change in use, construction addition and structural alteration. Residential development permits included housing while non-residential permits comprised of retail, offices, health and education structures, recreation and entertainment, public infrastructure, manufacturing, personal use, public utility, safety, signs, and accessory structures.

The City of Winnipeg has three categories that indicate the status of a development permit application. This includes; Issued (permit has been issued and all applicable plan review process have been completed, and inspections may have been performed), Closed (permit is closed and required inspections have been completed), Closed with incomplete inspection (permits closed with not final inspection) (City of Winnipeg, n.d.-b). I considered only permits that have been issued over the planned period for this study.

Table 8 provides information on the number of residential and non-residential development permits issued in the various categories from the year 2012 to 2022. The categories include Low Density Developments (LDD), High Density Developments (HDD), Residential Multi-use Developments (RMU), Commercial (COM), Industrial (IND), Institutional (INS), and Office (OFF). The data shows

that the number of residential development permits have increased over the years. In terms of residential categories, Low Density Developments (LDD) have consistently had the highest number of developments, with the highest number being in 2017 (2619) and the lowest in 2020 (1645). High Density Developments (HDD) have also been increasing, with the highest number being in 2019 (55) and the lowest in 2013 and 2014 (21).

Table 8: Development permits issued for new constructs between 2012 and 2022

Year	Residential Developments			Non-residential			
	LDD	**HDD**	**RMU**	**COM**	**IND**	**INS**	**OFF**
2012	2230	25	2	36	4	8	4
2013	1948	21	6	28	6	11	3
2014	1970	38	3	21	9	4	4
2015	1865	32	1	23	4	6	2
2016	2146	34	1	27	4	10	4
2017	2619	46	3	34	21	10	7
2018	1941	31	4	32	12	7	6
2019	1671	55	9	32	11	10	4
2020	1654	37	1	23	10	7	4
2021	2209	51	13	13	9	8	2
2022	1720	32	3	22	21	7	4
LDD – Low Density Developments (Single Family Dwellings, Duplexes, Row Housing)							
HDD – High Density Developments (Apartments)							
RMU – Residential Multi-use Developments							
COM – Commercial							
IND – Industrial							
INS – Institutional							
OFF – Office							

Source: City of Winnipeg (n.d)

Residential Multi-use Developments (RMU) have been relatively consistent, with the highest number being in 2021 (13) and the lowest in 2020, 2016, and 2015 (1). On the other hand, non-residential categories have been more variable, with Commercial (COM) new buildings having the highest number in 2012 (36) and the lowest in 2021 (13). Industrial (IND) new constructs had the highest number of developments in 2017 and 2022 (21) and the lowest in 2015 (4). Institutional (INS) and Office (OFF) developments have both been relatively stable over the years, with the highest number of developments being in 2017 (10 and 7 respectively) and the lowest in 2021 (2 and 4 respectively). Overall, the data indicates that there has been some variability in the number of residential and non-

residential development permits issued over the years, with different categories experiencing different trends.

3.5 Measuring accessibility to destinations

Transportation systems are designed to help people move from one place to another to participate in activities that are distributed in space over time. Accessibility to destinations has implications for compact development since it can influence the need for travel or encourage people to travel by a particular mode of travel. The City of Winnipeg has expanded over the years which means transportation needs to be improved to enable access to important destinations such as shopping malls, grocery shops and job centres. To assess how Plan Winnipeg and OurWinnipeg has contributed to accessibility, Winnipeg Transit GTFS data was downloaded from Open Mobility Data website (Open Mobility Data, n.d.) and used to generate transit network data sets that were used to calculate accessibility to regional mixed-use centres and employment lands.

Although Winnipeg is car centric with approximately 82% of people commuting to work using their personal automobiles (car, truck, van), 9% of the employed labour force travel to work using public transit (Statistics Canada, 2023b). This is evidence that a percentage of people in the city rely on public transit to get to their destinations. Moreover, about 47.8% of the labour force aged 15 years and over who commuted to a fixed workplace daily leave their origins (home) to their destinations (workplace) between 7 am to 8:59 am according to Statistics Canada. In addition, most of the residents (45.6%) who commute to work spend 15 to 29 minutes. Based on the above premise, the accessibility analysis was conducted using a generic Wednesday between 7am to 9am (Statistics Canada, 2023b) and a commute duration of 30 minutes.

3.5.1 Accessibility to regional mixed-use centres

Areas designated as mixed use in the development plans represent large commercial areas in the city with the capacity to support major retail uses, employment, services, and a variety of housing options (OurWinnipeg 2045, p.33). To support access to regional mixed-use centres, the development plans had transit-supportive policies to increase the ability of residents to travel to mixed use centres as a destination. This section uses GIS to analyze and compare the percentage of residents that had access to mixed use centres in 2013 and 2022. Accessibility in this study refers to the ease with which residents can move from one place to another (Morris et al., 1979). GTFS data was limited to 2013 which informed the decision to conduct the analysis using GTFS data in 2013 instead of 2012. Using

accessibility to mixed use centres in 2013 as a baseline, the study explored how public transit service had improved during the time of implementing OurWinnipeg.

Despite not being indicated as a mixed-use centre in the development plans, downtown Winnipeg was included in this study as a mixed-use location to examine the extent of accessibility by public transit. Downtown was purposively selected due to concentration of entertainment facilities and activities that attract residents of the city. The maximum number of destinations a resident can reach in 2013 was 6 and in 2022 was 7. Overall, approximately, 91.84% of the population had access to at least one regional mixed-use centre within 30 minutes in 2013 during morning rush hour when everyone is trying to get to work.

Table 9: Access to regional mixed-use centres between 7am to 9am in 2013

Number of Destinations	1-2	3-4	5-6	No Access
Duration of Trip (Minutes)	30 Min.	30 Min.	30 Min.	30 Min.
Population	526,312	82,831	311	54,163
Percentage of Population	79.31%	12.48%	0.05%	8.16%

On the other hand, 89.8% of the population had access to at least one of the mixed-use centres from 7am to 9am in 2022 indicating a decline from 2013. Neighbourhoods in and around the city centre had the most access to regional mixed-use centres with a travel time of 30 minutes (see Figure 8). Residents in neighbourhoods on the fringes such as Wilkes South, Fort Richmond, Richmond West, St. Norbert and Richmond lakes could not access mixed use centres within 30 minutes during morning rush hour.

Table 10: Access to regional mixed-use centres between 7am to 9am in 2022

Number of Destinations	1-2	3-4	5-7	No Access
Duration of Trip (Minutes)	30 Min.	30 Min.	30 Min.	30 Min.
Population	390,002	263,748	19,902	75,955
Percentage of Population	52.03%	35.18%	2.65%	10.13%

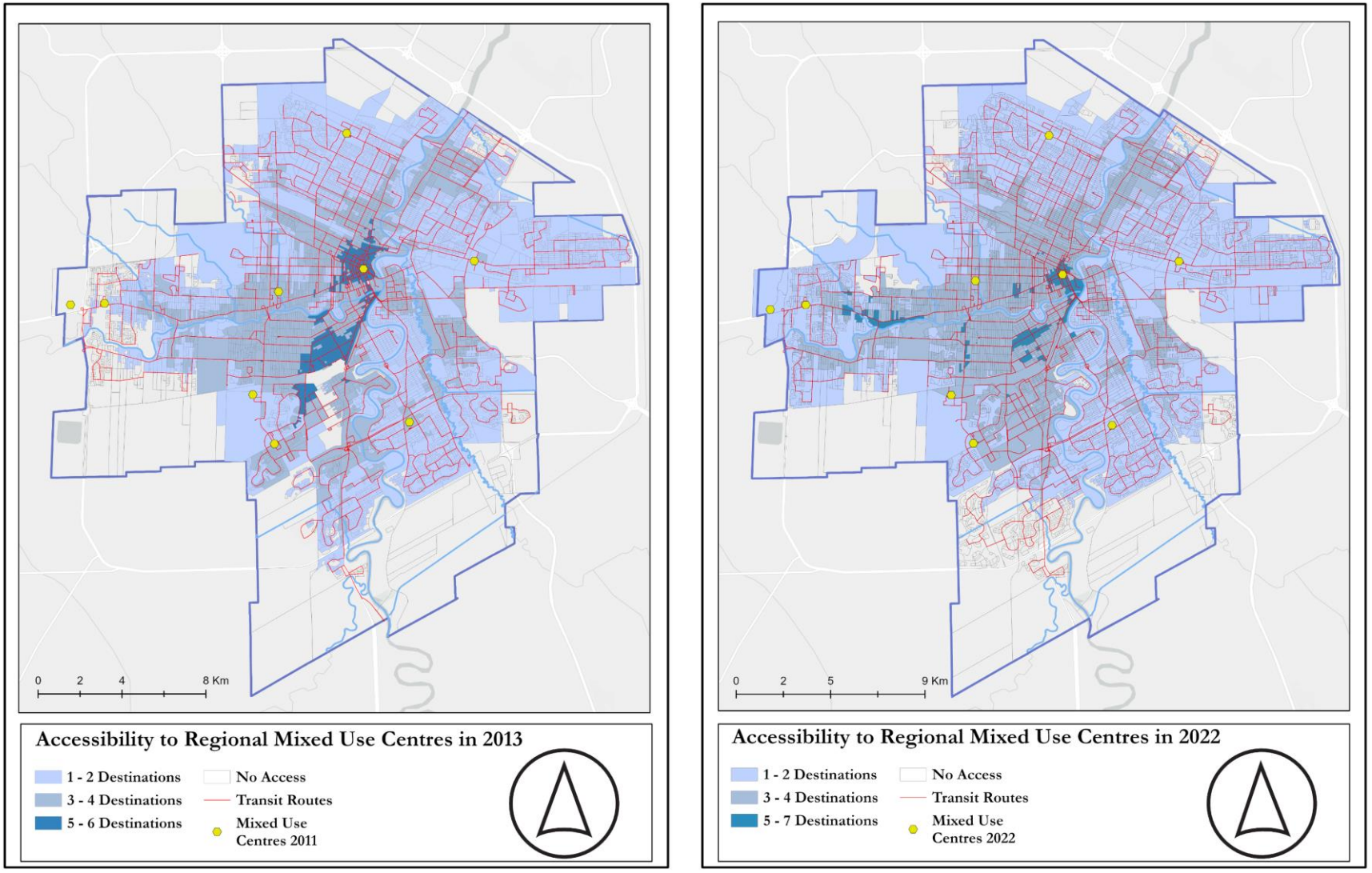

Figure 8: Accessibility to regional mixed-use centres using public transit in 2013 and 2022 (7am to 9am)

3.5.2 Accessibility to employment lands

Employment lands within the urban structure of Winnipeg accommodate economic growth with a wide range of employment opportunities for residents. The urban structure of OurWinnipeg 2045 shows that there are 20 areas that have been identified as employment lands. Employment lands are defined as "lands designated for clusters of business and economic activities including, but not limited to manufacturing, warehousing, offices, institutional uses, and ancillary retail and commercial facilities" (OurWinnipeg 2045, p.46) Figure 8 visualizes the accessibility analysis results for access to employment lands using public transit on a generic Wednesday morning between 7am to 9am within 30 minutes.

Based on Figure 9, it is evident that most neighbourhoods can access at least one employment land during the morning rush hour. However, neighbourhoods in downtown Winnipeg including South Portage, Portage-Ellice, Exchange District, St. Matthews, West Broadway, South Point Douglas, West and Alexander neighbourhoods have access to more than one employment land. This implies that residents within the centre of the city have the most accessibility to employment lands by transit compared to those on the fringes. The high accessibility to destinations in downtown could be due to the greater number of buses that operate from downtown to the rest of the city.

Table 11: Access to employment lands between 7am to 9am (2022)

Number of Destinations	1-2	3-4	5-6	7-9	10-13	No Access
Duration of Trip (Minutes)	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.
Population	270,619	231,311	133,273	66,029	1,346	47,207
Percentage of Population	36.10%	30.83%	17.78	8.81%	0.18%	6.30%

Table 11 presents a summary of the population of Winnipeg that can access employment lands by public transit. Using data from the 2021 Canadian Census, 93.70% of the population of Winnipeg have access to employment lands within 30 minutes by transit and 6.30% do not have access during morning rush hour. A significant percentage (36.10%) of residents have access to at least one employment land when using public transit. From the table, the portion highlighted blue indicates the percentages that have access to employment lands by transit and the red shows no access. The percentage of people that have access to employment lands was computed by using the Census Dissemination Blocks as origins and employment lands as the destination. The analysis considers the closest employment lands to the dissemination blocks within 30 minutes of travel via transit.

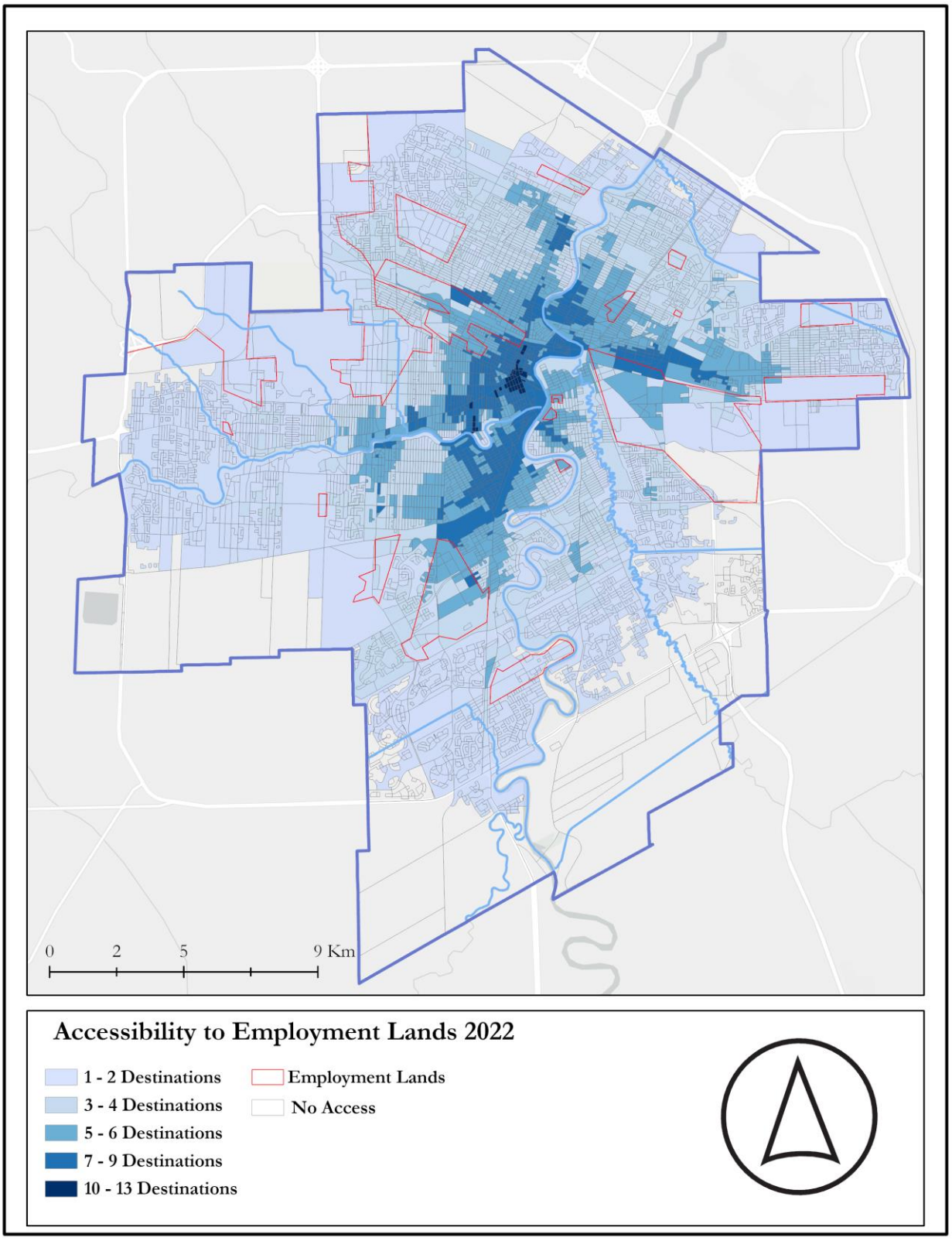

Figure 9: Accessibility to employment lands using transit (7am to 9am)

3.6 Distance to transit

Having access to public transit is crucial for promoting social inclusion and enabling access to important activities such as work, education, healthcare, shopping and social events (Daniels & Mulley, 2013). To help understand the proportion of a population that is served with transit, walking distance to transit stops or stations are calculated. The literature on measuring transit accessibility shows that there are two ways of estimating accessibility to transit (El-Geneidy et al., 2014; Gutiérrez & García-Palomares, 2008; Ritter, 2014). One is using the Euclidean buffers and the other is generating network buffers around a stop or a station. Although Euclidean buffers reveal access to transit, the buffers overestimate the service area as they do not consider how individuals get to the stop. This study considers the two ways of estimating distance to transit stops and how access to a bus stop does not mean one has access to public transit.

3.6.1 Accessibility to transit stops.

Accessibility to transit stops in Winnipeg was measured by creating buffers around transit stops within 500 meters, approximately a 6-minute walk (see Figure 10). This was done by using the buffer tool in ArcGIS Pro. To calculate the percentage of residents within 500 meters, the buffer polygon (a shape created by the buffer tool that outlines the area around each transit stop) was merged with Winnipeg's dissemination blocks for the 2021 census. The results revealed that 98.4% (737,595) of the residents of Winnipeg are within 500 meters from transit stops. This means that the vast majority of Winnipeg residents are within a reasonable walking distance of a transit stop, making public transportation a viable option for a large percentage of the population.

Furthermore, there are approximately 5,588 transit stops in the City of Winnipeg with most of them concentrated in the downtown. The fact that most of these stops are concentrated in the downtown area suggests that this part of the city is well-served by public transportation, with many options available for commuters. However, it is important to note that this concentration may also reflect the fact that the downtown area is a major transit hub, with many different routes converging in this area.

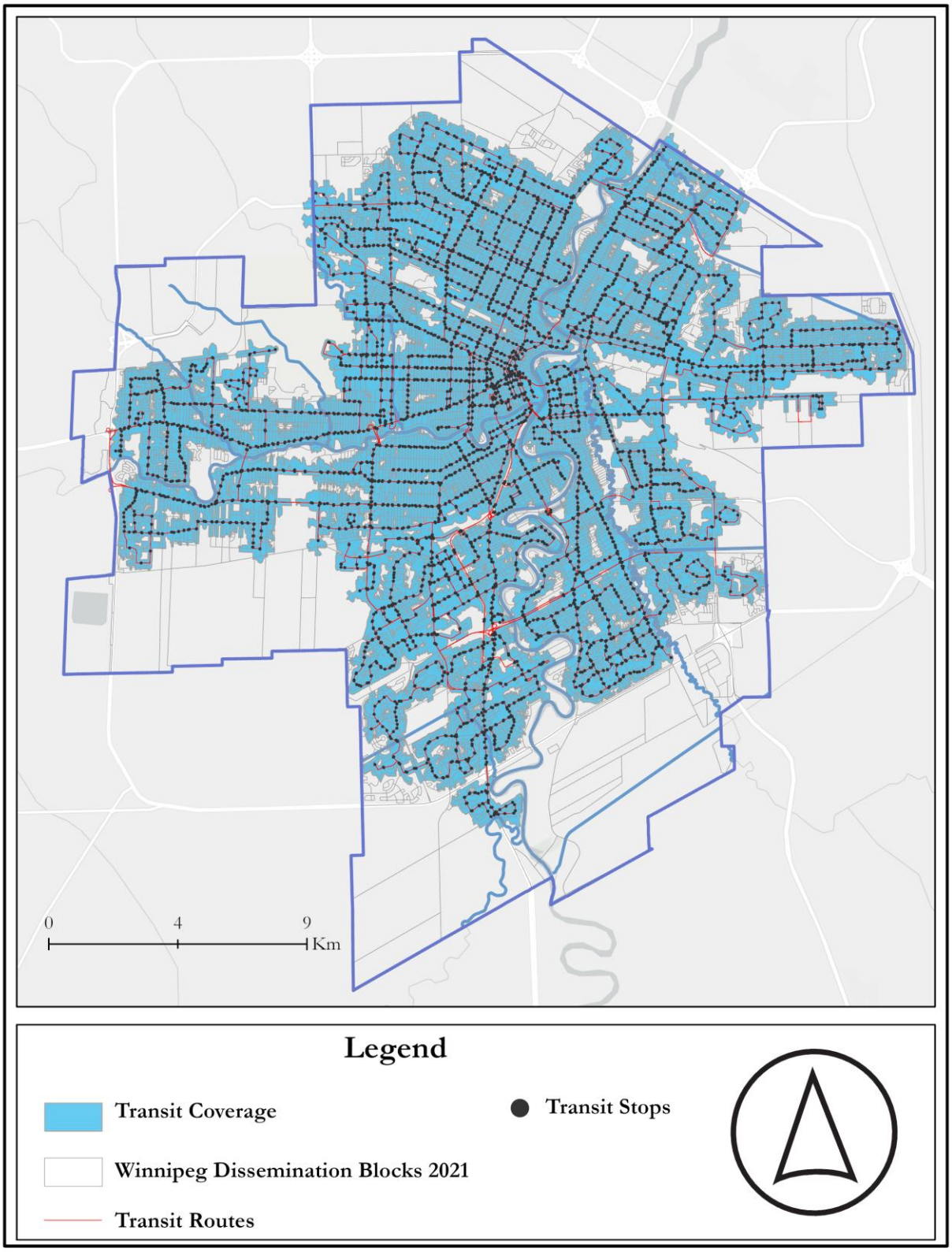

Figure 10: Accessibility to transit stops based on walking time to stop (6am to 8 pm)

3.7 Changes in rural and agricultural land

Rural lands contain vegetation and farmlands that are an essential resource for sustainability and food security (Caldwell et al., 2022; Viana et al., 2022). Rural areas in the urban structure of Plan Winnipeg 2020 and OurWinnipeg are lands dedicated to agriculture and are not fully served by municipal services. The period of the plans has seen changes in rural and agricultural lands as a result of urban expansion and sprawl. Figure 11 shows how rural and agricultural land has changed in 2001, 2011 and 2022. This is based on designations according to the city over the planned period.

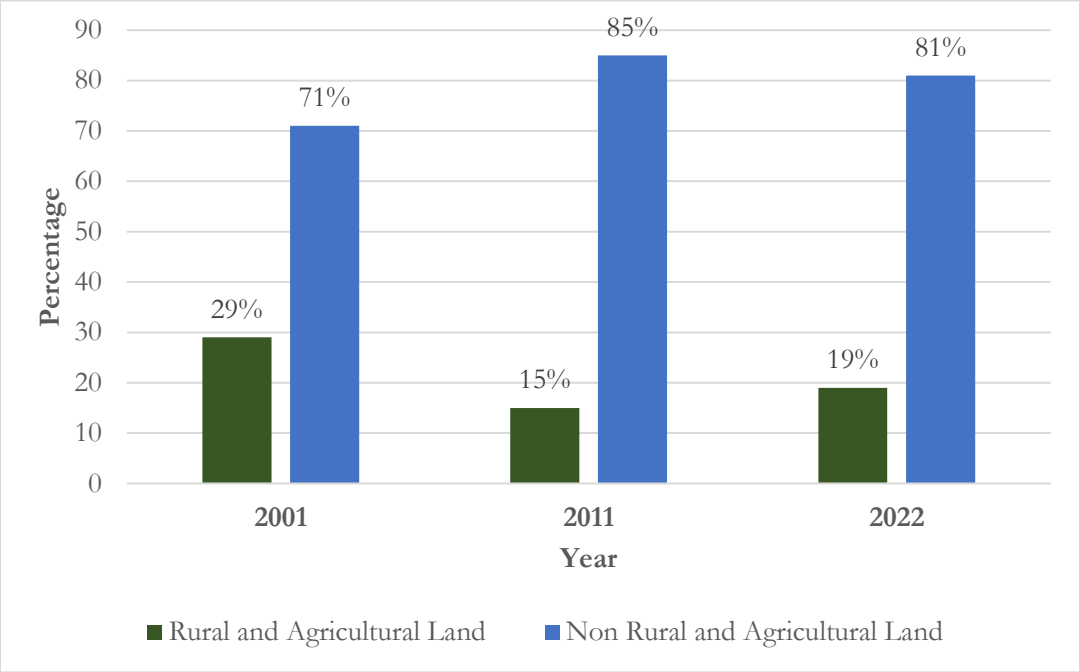

Figure 11: Percentage of Rural and Agricultural Land

Data from the designations in the urban structure of Plan Winnipeg 2020 shows that the city had 29% of rural land in 2001 (Figure 11). This reduced to 15% in 2011 and increased to 19% in 2022. The percentage increase in 2022 is due to the addition of Wilkes South which was previously designated as a New Community policy area under the urban structure of OurWinnipeg. Also, the increase in rural and agricultural land is as a result of the new development plan, OurWinnipeg 2045, which is not being analyzed in this research. Rural areas according to the plans are reserved for future development and can only be approved for new development when there is a need (Plan Winnipeg 2020, p.67, OurWinnipeg, p.101). To regulate development within specific rural areas (such as Wilkes South and St. Vital Perimeter South) until they are redesignated, the City of Winnipeg passed the Wilkes South

Secondary Plan By-law No.6391/94 and the St. Vital Perimeter South Secondary Plan By-law No.175/77 to limit and guide development.

Rural and agricultural lands located in the west (Assiniboia Downs), north (Rosser Old-Kildonan) and northeastern (Kil-Cona Park) part of the map (Figure 12 and 13) were redesignated as new communities in OurWinnipeg. Areas classified as new communities were not fully served by municipal services but were identified as lands for new developments in the future. The redesignation of rural and agricultural lands for urban development by OurWinnipeg demonstrates that the development plan led to the conversion of previously undeveloped or underutilized rural and agricultural land into urbanized areas. While the conversion may have been necessary to accommodate the population growth, it also means that the natural environment, farmlands, and the unique characteristics of these rural areas will be destroyed to make way for urban development.

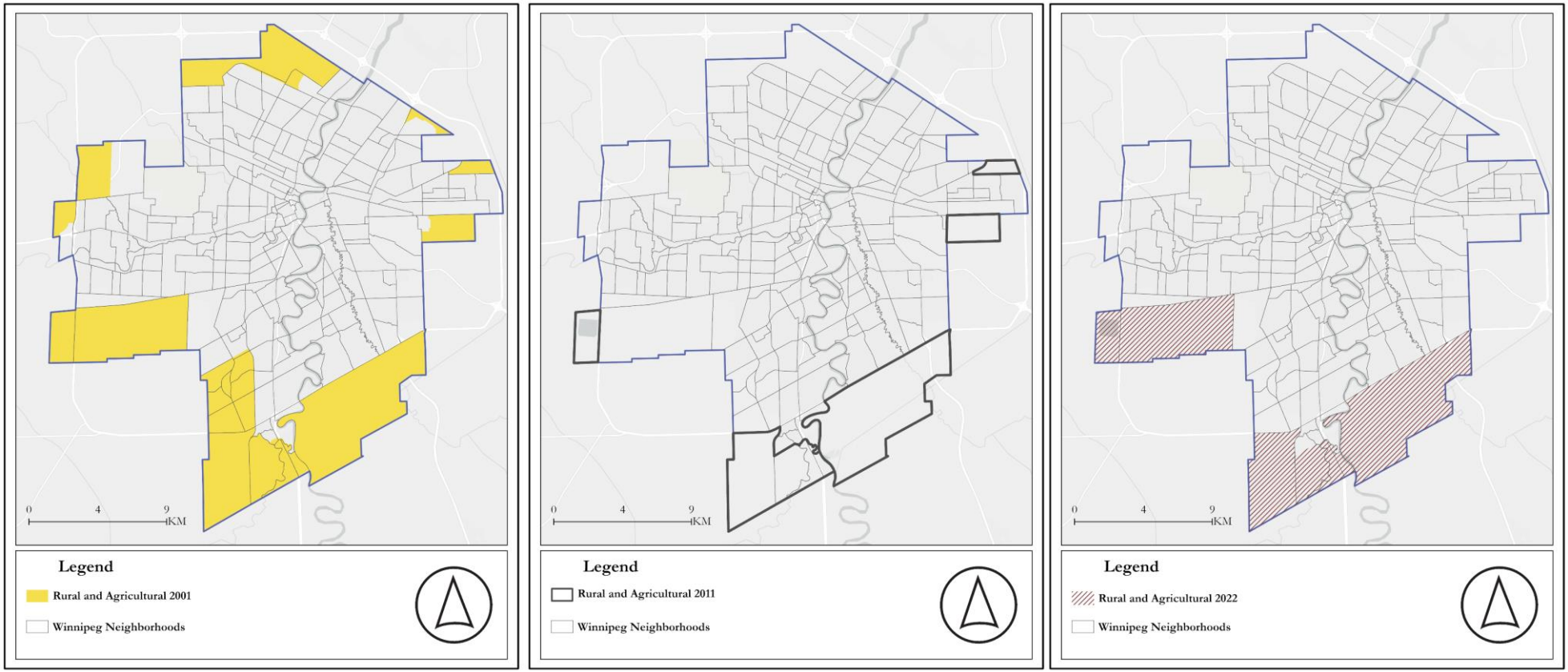

Figure 12: Maps showing rural and agricultural land in 2001, 2011 and 2022

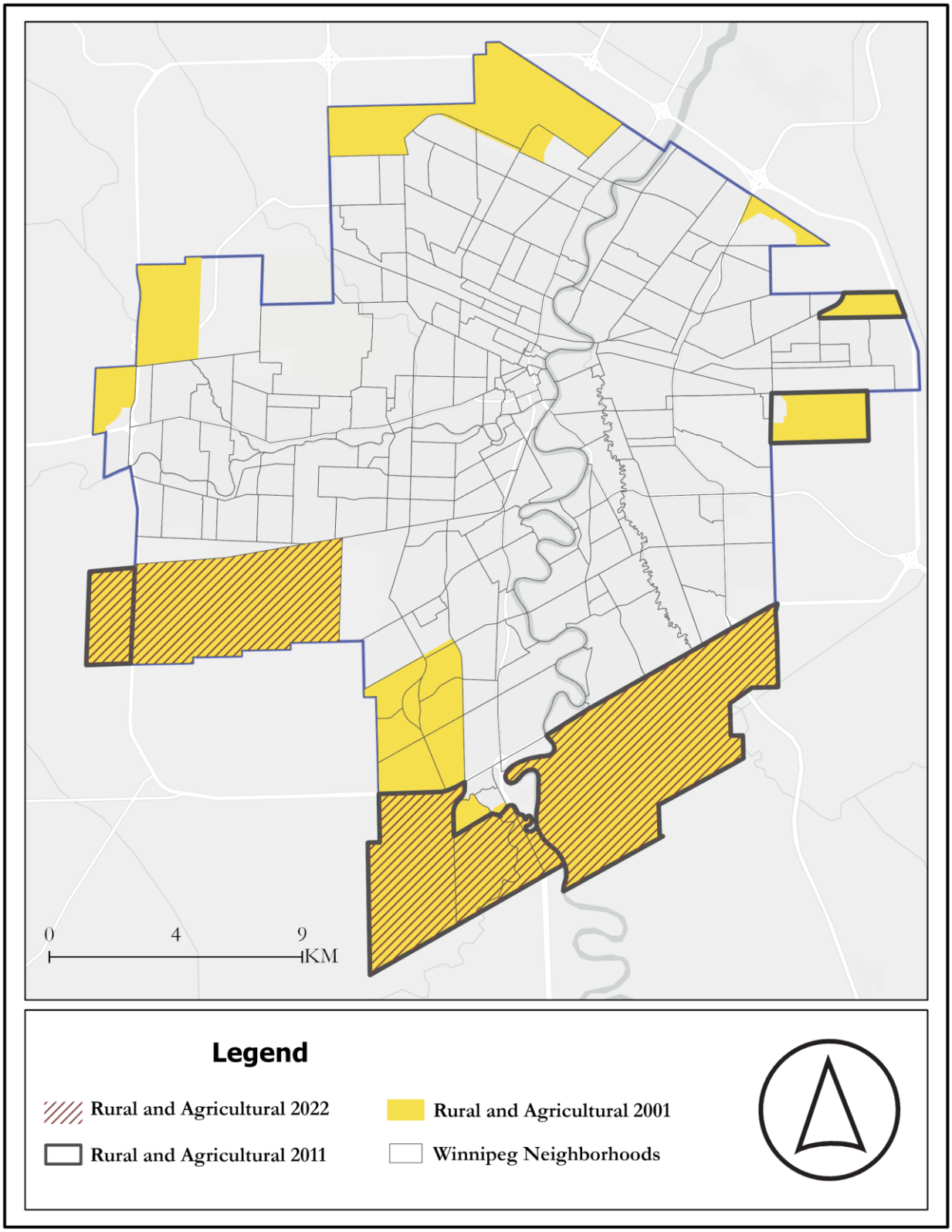

Figure 13: Changes in rural and agricultural land in 2001, 2011 and 2022

CHAPTER FOUR

DISCUSSION

4.1 Introduction

This section discusses the findings in relation to the literature. The discussion covers the implications of major findings and how it can influence policy making. The first subsection explores the intention of compact development policies that have been identified in Plan Winnipeg and OurWinnipeg. The intentions of the policies are further analyzed to know if they were aimed at promoting compact urban form. The second section examines the outcome of the plans in relation to the intentions of the policies. This will help know if the outcomes followed the plans or otherwise. To measure the outcomes of the plans, three neighbourhoods were selected and analysed based on the changes that have occurred during the planned period.

In addition, residential development permit data was mapped to know the neighbourhoods that witnessed the most residential development during the period of the plans. Findings on accessibility to transit are further discussed in this section and compared to the policies in the plans to know if transit has improved or not. Finally, the implications of continuously losing rural and agricultural land are discussed.

4.2 Planning for compact development

4.2.1 Contribution of the development plans to compact urban form.

The results from the content analysis shows that compact development policies have been integrated into Plan Winnipeg 2020 Vision and OurWinnipeg. However, the language in both documents is completely different as Plan Winnipeg specifies the stakeholder that will be involved in the implementation of the policy whiles OurWinnipeg does not. For instance, all the policies in Plan Winnipeg related to compact development start with *"The City shall",* which identifies the City as the implementing organization in terms of reviewing planning and development applications submitted by developers. On the contrary, policies in OurWinnipeg are stated in a way that does not specify who implements the policy. For example, a policy in OurWinnipeg states that *"Ensure land use, transportation and infrastructure planning efforts are aligned to identify where growth will be accommodated and how it will be serviced",* compared to Plan Winnipeg, OurWinnipeg does not specify who will ensure land use, transportation, and infrastructure planning.

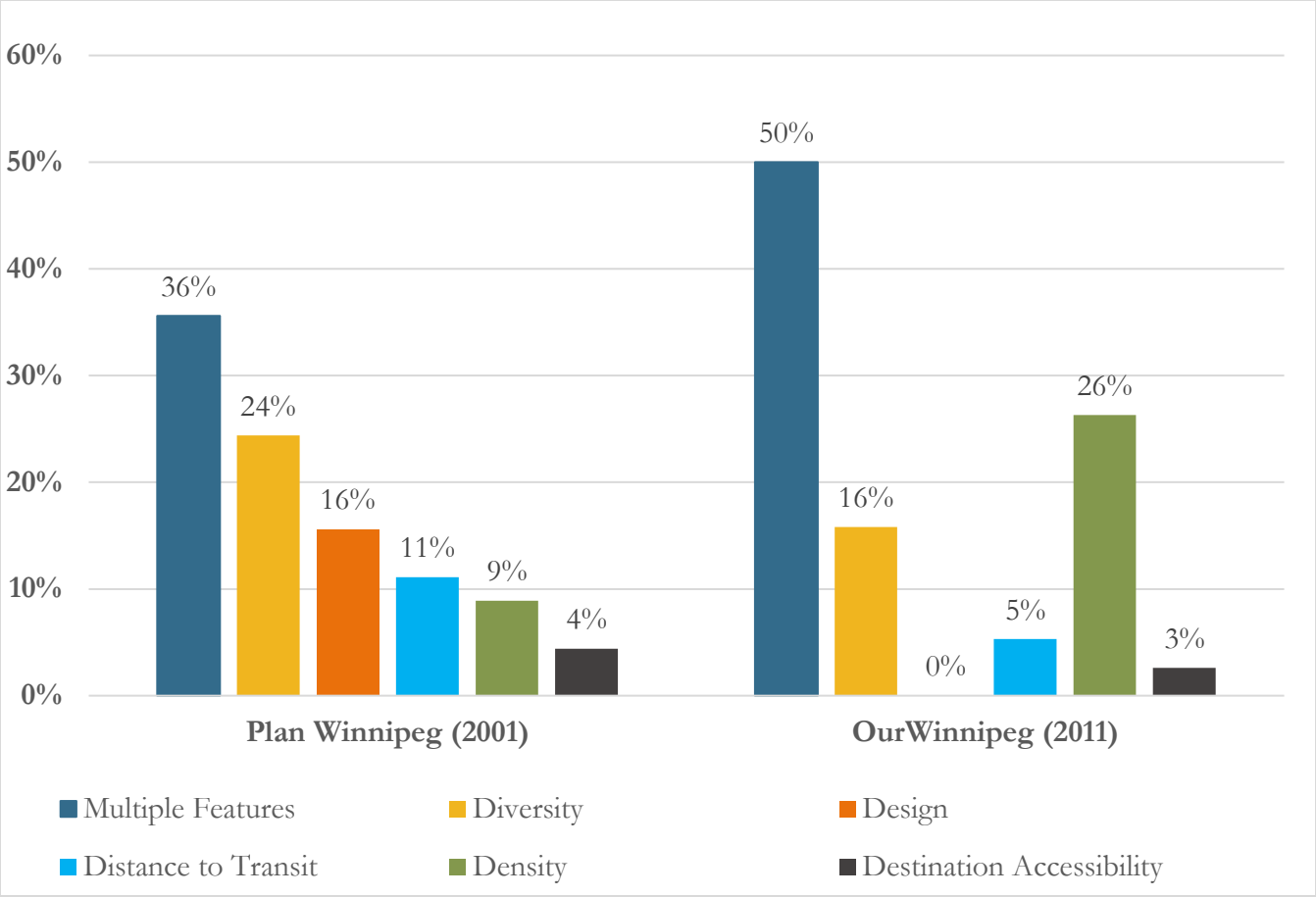

Figure 14: Categorization of Policies under 5Ds

The findings also indicate that both plans are aimed at increasing density as a means of creating compact and sustainable communities (Figure 14). This strategy promotes the development of new housing within existing urban areas, rather than expanding the city's footprint into rural and agricultural lands. Although both plans had policies that focused on increasing density, the content analysis revealed that OurWinnipeg had more policies that focused on increasing density than Plan Winnipeg. This suggests that OurWinnipeg was more focused on creating a compact city by increasing urban density compared to Plan Winnipeg.

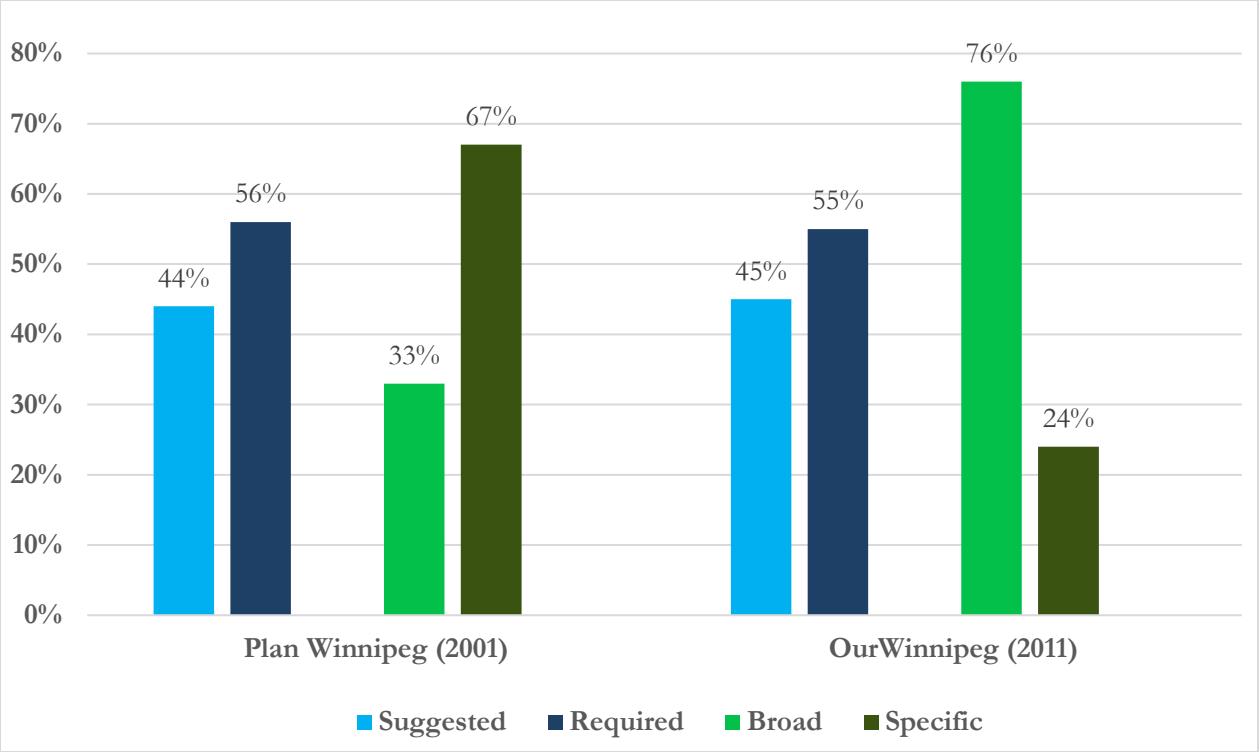

Figure 15: Policy Language in Development Plans

Furthermore, in relation to which plan had broad and specific policies, the content analysis revealed that Plan Winnipeg had more specific compact development policies (67%) than OurWinnipeg (24%) (Figure 15). Wideman & Masuda (2013) in an evaluation of both plans notes that OurWinnipeg "contains planning policies that use more ambiguous language and display a lack of clearly defined goals" (p. 61). Having specific policies provide clear guidance for planners, developers and other stakeholders on how to approach development to achieve a desired outcome. In contrast, broad policies may be less effective because they lack clear policies. Moreover, Plan Winnipeg having more specific compact development policies indicates that it should be more effective in promoting compact development than OurWinnipeg.

4.3 Measuring development outcomes against policies

According to Statistics Canada, urban centres are growing as more people are migrating into the country (Statistics Canada, 2022b). This is fueled by new arrivals into the region with a record high number of immigrants settling in urban centres between 2016 to 2019. Winnipeg is not an exception and has also welcomed a number of immigrants that have influenced population growth. This increase puts pressure on the city to grow by building new communities or accommodating the growth in

existing communities. Efforts to accommodate the growing population are incorporated in development plans such as Plan Winnipeg and OurWinnipeg in the form of policies to guide the growth of the city.

Compared to other cities in Canada which were randomly selected (see Table 12), the change in density of the city is similar to them considering their sizes. Cities such as Vancouver and Montreal with small land areas have more population density than Hamilton and Calgary which have bigger land areas. The City of Winnipeg has experienced a change in density over the planned periods with the most occurring during the implementation of OurWinnipeg. The city witnessed a 7.4% and 13.5% increase in density during the implementation of Plan Winnipeg and OurWinnipeg respectively. But was this increase influenced by the plans? New developments are approved for construction in compliance with development plans and other guiding documents, therefore, to effectively understand the extent to which the plans have influenced a change in density, three neighbourhoods in the City of Winnipeg were selected for analysis to identify the developments that were constructed during the period of the plans.

Table 12: Population and Density of randomly selected cities in Canada

City	Urban Population			Population Density (Residents per Km^2)		
	2001 (Area)	**2011 (Area)**	**2021 (Area)**	**2001**	**2011**	**2021**
Winnipeg	619,544 (465.16 Km^2)	663,617 (464.08 Km^2)	749,607 (461.78 Km^2)	1,331	1,430	1,623
Vancouver	545,671 (114.67 Km^2)	603,502 (114.97 Km^2)	662, 248 (115.18 Km^2)	4,758	5,249.1	5,749
Calgary	874,866 (701.79 Km^2)	1,096,833 (825.29 Km^2)	1,306,784 (820.62 Km^2)	1,252	1,329	1,592
Regina	178,225 (118.66 Km^2)	193,100 (145.45 Km^2)	226,404 (178.81 Km^2)	1,501	1,327	1,266
Montreal	1,039,534 (185.94 Km^2)	1,649,519 (365.13 Km^2)	1,762,949 (364.74 Km^2)	5,590	4,517	4,833
Hamilton	490,268 (1,117.11 Km^2)	519,949 (1,117.23 Km^2)	569,353 (,118.31 Km^2)	438	465	509

Source: Statistics Canada

Additionally, findings from Filipowicz (2018) revealed that Canadian cities have low population densities compared to other international cities such as New York, Charlotte, Denver, and Athens. As shown in Table 12, Vancouver has the highest population density among the randomly selected Canadian cities. However, in 2011, although Athens (664,046) and Vancouver (603,502) had similar population sizes, Athens (39 km^2) occupied only one third of the geographic area that Vancouver

(114.97 km^2) does, resulting in a population density three times higher than that of Vancouver. Similarly, the City of Seattle (737,015) and Winnipeg (749,607) are close in population, but Seattle's land area (217 Km^2) is more than double when compared to Winnipeg (461.78 Km^2). This confirms the findings of Filipowicz (2018) that Canadian cities have relatively low population densities when compared to other cities with similar population. Based on this, it is important for policy makers in Canada, particularly the City of Winnipeg, to understand the various ways neighbourhoods change in the midst of urbanisation. This will encourage city authorities, policy makers and city planners to rethink their perception of urban growth and lean towards promoting and accepting sustainable compact communities.

4.3.1 Case study neighbourhood analysis

To better understand the extent of implementation of the local plans on the city, three case study neighbourhoods across Winnipeg were selected for more detailed analysis. The case study neighbourhoods were selected based on the following criteria:

- Level of population density.
- Represents different parts of the city.
- Represent different periods of development.

4.3.1.1 Roslyn Neighbourhood

Roslyn is one of the densest neighbourhoods in Winnipeg with approximately 14,491 people living per square kilometer. Located in the center of the city, the neighbourhood has evolved over the years and can be classified as compact with mixed use infrastructure. As can be seen from Figure 12, Roslyn is a heavily built-up neighbourhood with varying housing options for residents. The density of the neighbourhood decreased in 2006 (13,201/km^2) and 2011 (13,392/km^2) from 13,360/km^2 in 2001. In 2016, the density increased to approximately 14,491/ km^2 which can be attributed to the population growth within this period.

In relation to the regional plans increasing density, during the implementation of Plan Winnipeg between 2001 and 2011, there were various development and changes in Roslyn neighbourhood. These include the construction of new multi-family homes to accommodate the growing population. Also, a detached single dwelling was constructed during the plan period to diversify the housing choices in the neighbourhood. This is evidence that vacant lands in existing neighbourhoods such as Roslyn benefited from infill during the implementation of Plan Winnipeg. Based on this, it can be said that the development outcome of the neighbourhood followed the policies in Plan Winnipeg which

were aimed at encouraging infilling of vacant lands to maximize the use of existing infrastructure (Plan Winnipeg, p. 30).

An analysis of the trend of development in Roslyn neighbourhood shows that OurWinnipeg did not influence any form of development in the neighbourhood despite the availability of policies in the plan to encourage infill in existing neighbourhoods. Figure 16 shows that Roslyn still has vacant land for residential development and could have been considered for infill during the implementation of OurWinnipeg. Considered an area of stability in OurWinnipeg, neighbourhoods such as Roslyn were supposed to accommodate low to moderate density infill development to support more efficient use of land, infrastructure, and services.

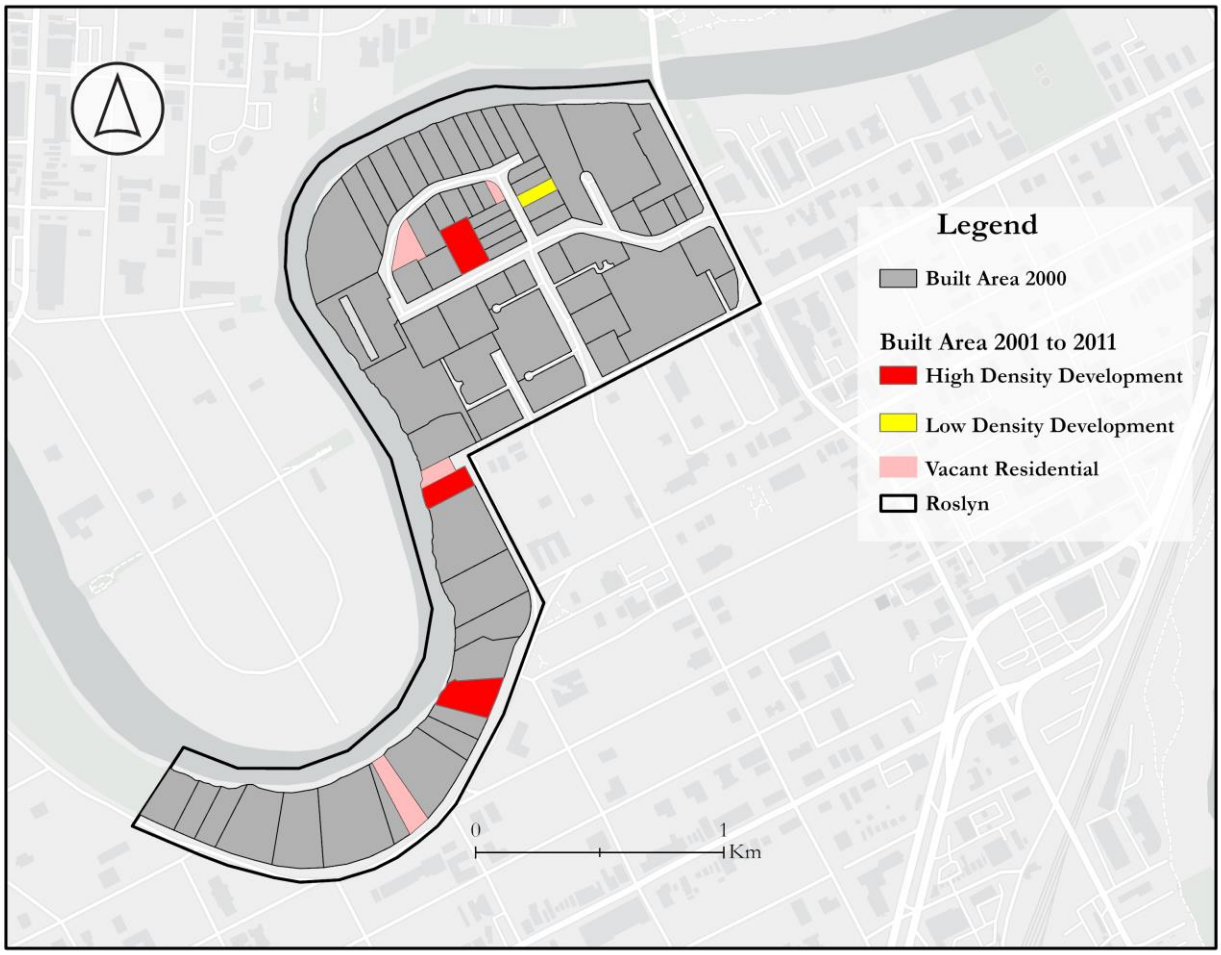

Figure 16: Built Area of Roslyn Neighbourhood

In addition, regional plans should not be blamed entirely for the outcomes of development in communities. For instance, although Plan Winnipeg and OurWinnipeg aimed at increasing density, residents of existing neighbourhoods sometimes oppose to developments with concerns about parking, traffic and change in the neighbourhoods' character. Many cities in North America are confronted with similar issues that result in a push back against high density development in existing neighbourhoods. Faced with a similar issue in trying to infill vacant lots, the City of Kelowna developed a best practice guide as an approach that maximizes infill housing while respecting the character of existing neighbourhoods (City of Kelowna, n.d.).

4.3.1.2 Broadway Assiniboine Neighbourhood

Broadway Assiniboine is recognized as one of the oldest and most densely populated areas of Winnipeg. Located in downtown Winnipeg, the neighbourhood offers convenient access to various office spaces, employment locations, and public transit, enabling easy commuting to other parts of the city, including mixed-use centers and employment lands. Despite these advantages, the neighborhood's population density has been declining since 2001, currently standing at 15,452 people per square kilometer as of 2016. The decrease in density could be attributed to multiple factors such as housing market trends, rise in income levels, demographic shifts, and suburbanization, as noted by (Lennon & Leo, 2001).

According to City of Winnipeg, the proportion of seniors in the neighbourhood has been increasing in recent years, with the population aged 65 and over increasing from 13.3% in 2001 to 14.6% in 2016 (City of Winnipeg, n.d.-a). As older residents may have smaller households or may move to smaller residences, this could also lead to a decrease in population density in the neighborhood. Another factor that could be contributing to the decline in density is urban sprawl. Winnipeg's urban sprawl has resulted in low-density neighborhoods which are attracting residents in the city centre and increasing traffic, pollution, and loss of agricultural land. Findings from the 2021 census shows that the downtowns in Canada are growing faster than before (Statistics Canada, 2022b). In addition, Statistics Canada reported that populations of neighbourhoods in downtown such as Broadway-Assiniboine are growing, but at a slower pace. This study excluded the density of Winnipeg neighbourhoods in 2021 because it was not available. Therefore, based on the findings of Statistics Canada, it is expected that the density of Broadway-Assiniboine should increase in response to the growing city population between 2016 and 2021.

According to Figure 17, there was no significant development activity in the neighbourhood during the implementation of Plan Winnipeg, despite its objective of promoting infill in mature communities. However, after the adoption of OurWinnipeg, a condominium apartment was constructed, indicating that OurWinnipeg contributed somewhat to an increase in residential development in the downtown area (OurWinnipeg, p.57). This serves as evidence that the development outcomes in Broadway Assiniboine followed the policy direction of OurWinnipeg, which emphasized the encouragement of residential development in downtown Winnipeg.

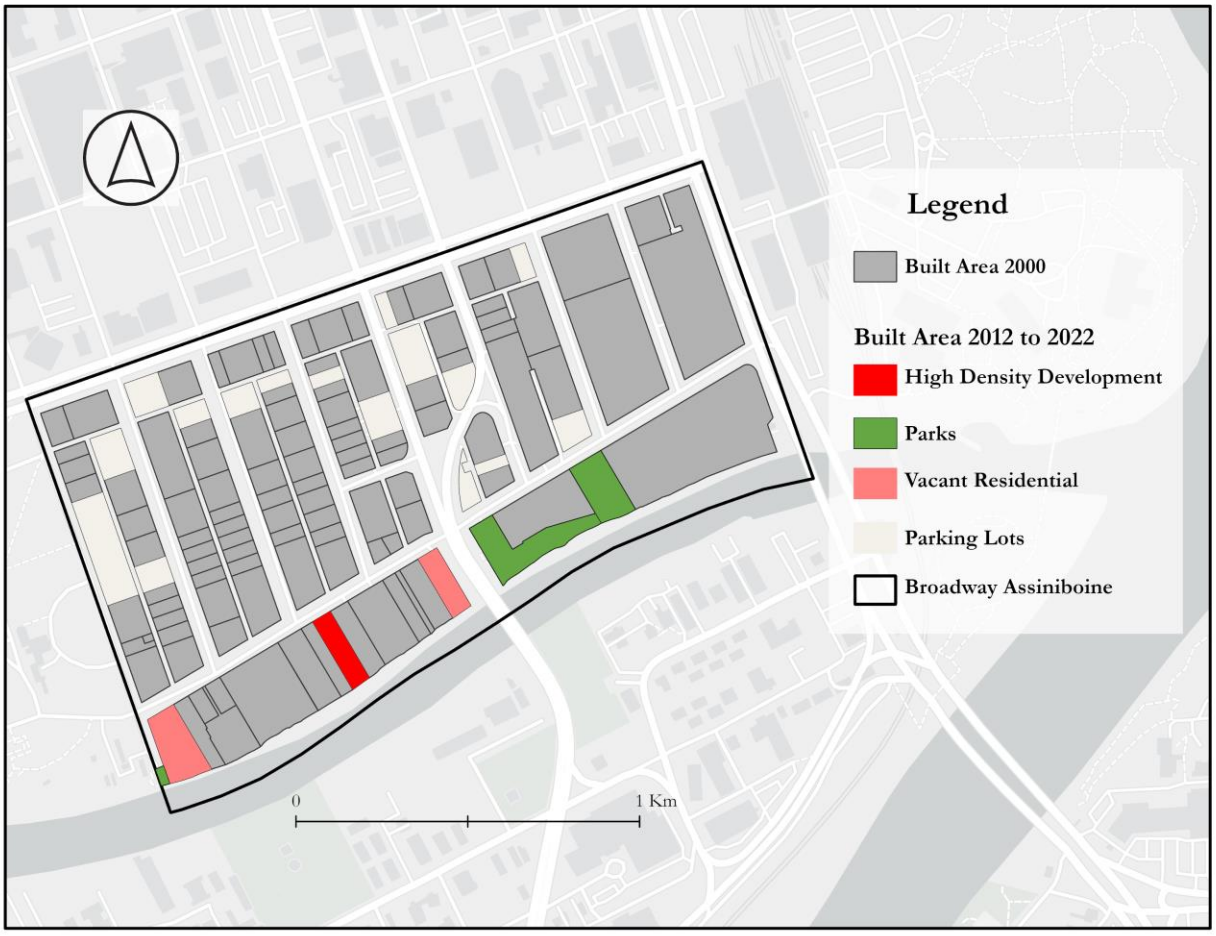

Figure 17: Built Area of Broadway-Assiniboine Neighbourhood

4.3.1.3 Bridgwater Forest Neighbourhood

Formerly a Rural Policy Area under Plan Winnipeg 2020 Vision, Bridgwater Forest is part of the Waverley West lands which were converted into a Neighbourhood Policy Area to allow for new residential development (Sjoberg, 2005). The neighbourhood is concentrated with detached single-family dwellings with fewer condo apartments as can be seen in Figure 18. Built in 2011, Bridgwater

Forest has experienced a significant change over the years including an increase in its density from 822 residents per square kilometre in 2011 to 2,754 residents per square kilometre in 2016, representing a 235% increase in density over 5 years. The neighbourhood was rezoned to an "R1-M" Single Family District and "PR-1" Parks and Recreation District in 2008 to support new residential housing development. The amendment of the zoning by-law implies that development went contrary to the development plan by amending the guiding document to pave way for new development.

ND LEA Engineers and Planners initiated the application for developing the Bridgwater Forest neighbourhood in 2006 on behalf of the Manitoba Housing and Renewal Corporation, who owned the land at the time. Notably, the Planning, Property and Development Department supported the application for development, citing that it aligned with the policies outlined in Plan Winnipeg (City of Winnipeg, 2008). Sjobeg (2005) attributed the development of Bridgwater Forest to three factors: population growth, a need for new housing in the southwest area of Winnipeg, and urban sprawl. While the development did align with Plan Winnipeg by increasing residential construction to support the growing population, it is worth noting that the available space was not utilized efficiently. This is because there was additional land within the Neighbourhood Policy Area outlined in Plan Winnipeg that could have been used to accommodate the growth in a more effective manner.

Urban sprawl has implications for sustainability and the budget of the City of Winnipeg. The development of suburban communities, such as Bridgwater Forest, typically involves the conversion of natural or agricultural land into developed land, which can have negative impacts on the environment. For example, it can lead to the destruction of wetlands, loss of wildlife habitat, and increased air and water pollution due to increased traffic. Furthermore, the development of suburban communities often requires significant investments in infrastructure, such as roads, sewers, and other utilities, which can strain the budget of the City of Winnipeg. This is because suburban communities typically have lower population densities than urban areas, which means that the cost of providing services per capita is higher. This can result in increased taxes for residents of both suburban and urban areas.

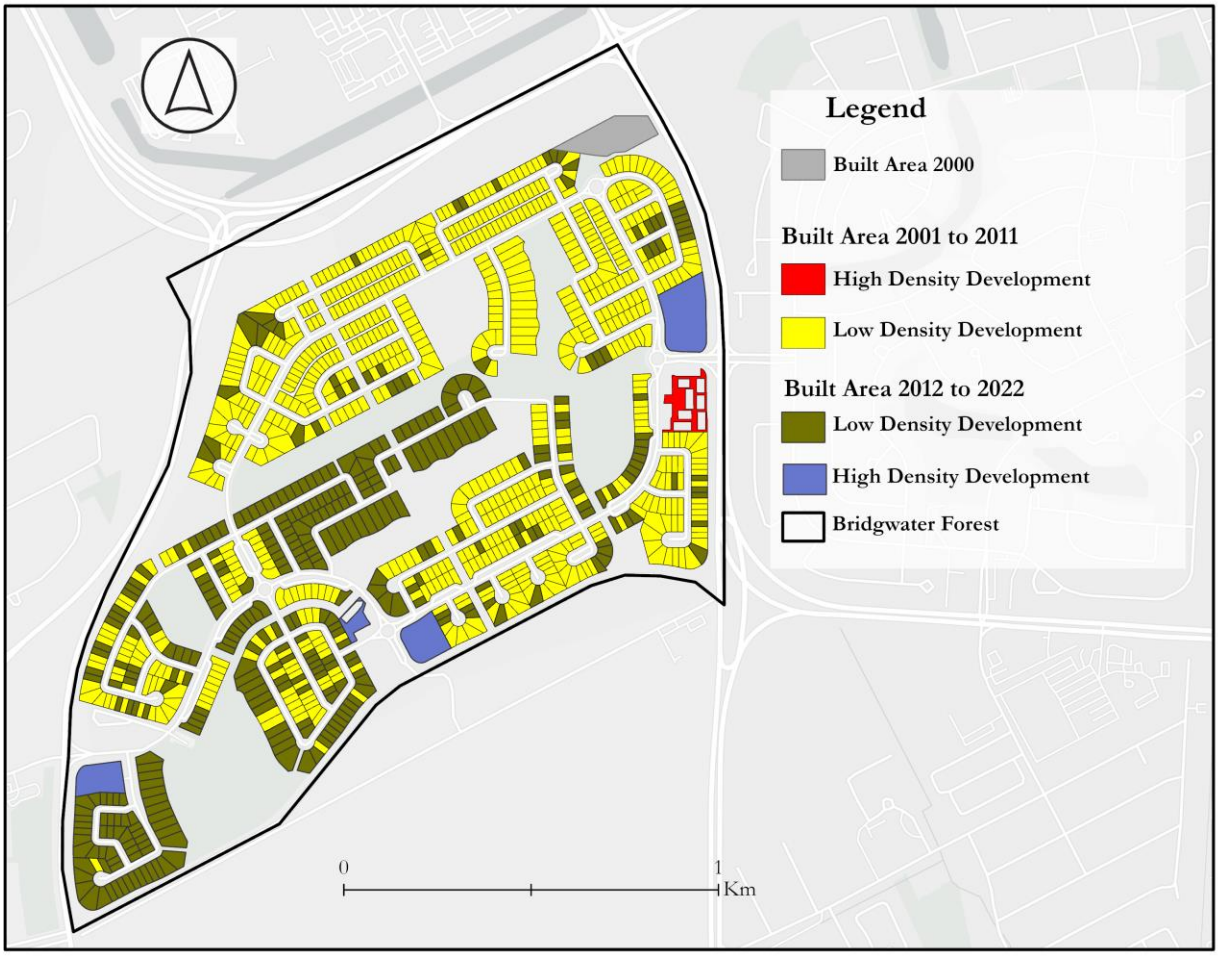

Figure 18: Built Area of Bridgwater Forest Neighbourhood

Prior to the development of the new neighbourhoods in Waverley West, the capital budget of the city stood at $476,489 in 2009 (City of Winnipeg, 2009, p.2-1). This figure reduced to $370,144 in 2011 (City of Winnipeg, 2011a) after the development of Bridgwater Forest and increased to $526,951 in 2022 (City of Winnipeg, 2021) after other phases of Waverley West were completed. The extra funds that are used to provide services in the suburbs could have been used to address other challenges in the city such as, improving active transportation infrastructure to encourage alternative modes of transportation. The development of Waverley West offers an important lesson for policymakers and city authorities regarding the trade-offs that come with urbanization. It underscores the need to follow development plans that aim to promote sustainable development by encouraging a compact urban form that enables residents to live and work within the same neighbourhood. Such plans should also prioritize sustainable transportation options, which can contribute to healthy lifestyle habits. By implementing these measures, cities can reduce the environmental, social, and economic impacts of

urban sprawl, as well as improve the quality of life for their residents. It is important for policymakers and city authorities to carefully consider these factors when making decisions about urban development, in order to ensure the long-term sustainability of the city and its inhabitants.

4.3.2 Residential Development Trends

Results from mapping new residential permits issued between 2012 and 2022 shows an uneven distribution of the permits across Winnipeg's neighbourhoods. Most of the development activity occurred on the fringes of the city as shown in Figure 19. This resonates with Leo's (2016) assertion that developers "cherry pick" lands on the fringes which are relatively cheaper, most convenient to develop and yield more profit (p.7). This is further confirmed by Allred & Chakraborty (2015) who compared the outcomes of development within a specific time frame against regional plans in Sacramento. Extending development to the fringes implies that services and roads will need to be extended to serve the residents in those areas. This comes at a cost as the city will have to spend huge amounts of money to extend water lines, sewage, public transit service and roads. Moreover, these expensive services that are being extended are on lands that generate low levels of taxation compared to developments in the city centre which generate much higher taxes. In addition, after being fully inhabited, developments on the fringes will require additional infrastructure and services such as community centres, libraries and response to emergency services that are equivalent to those in more densely populated neighbourhoods of the city.

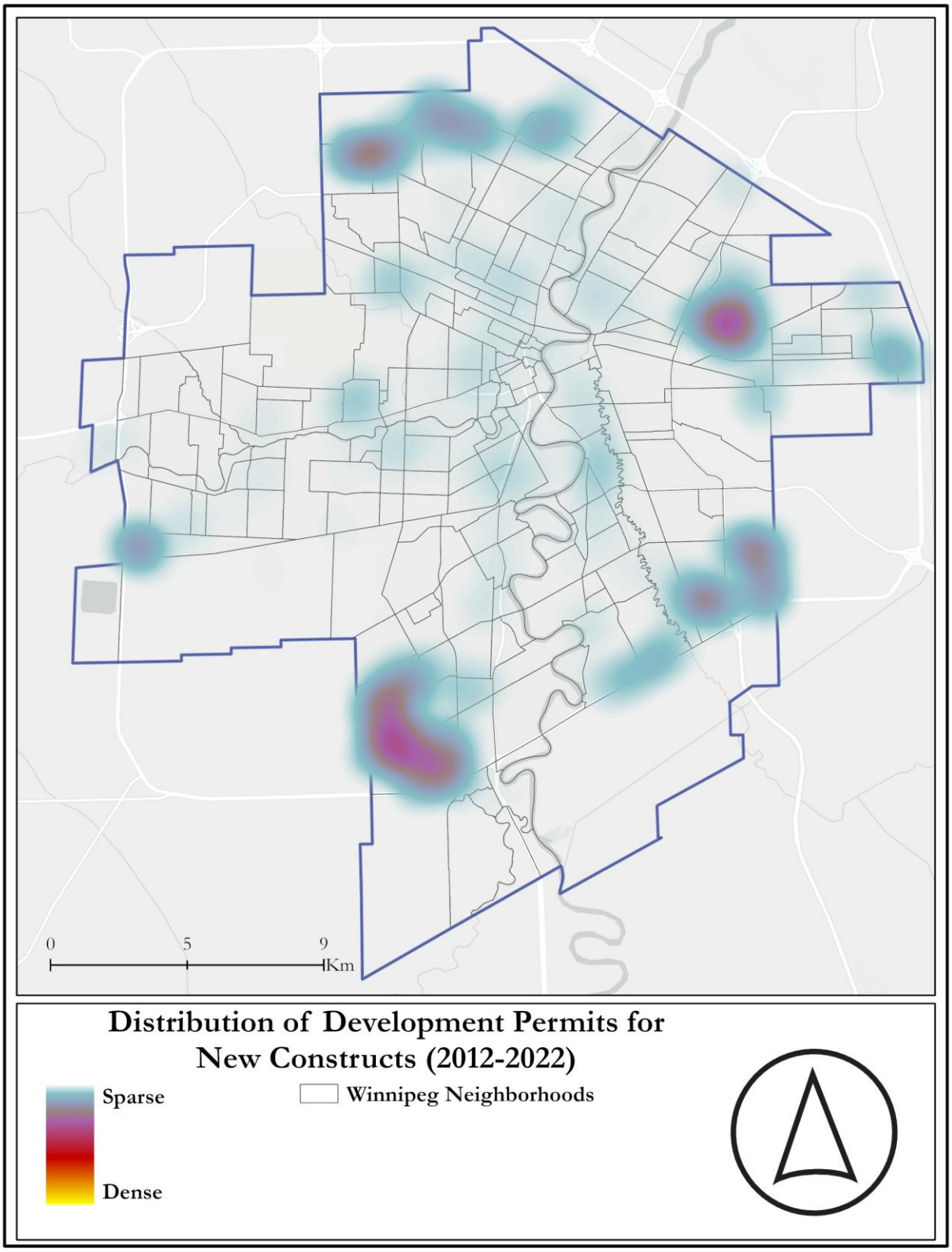

Figure 19: Heat Map showing Residential Development Permits issued from 2012 to 2022.

4.3.3 Measuring convenient access to public transit.

According to Stevens (2017), transit can be measured in relation to compact development by considering the distance from a household to the nearest bus stop, following the shortest route. However, accessibility to a bus stop does not mean one has access to transit. The International Institute for Sustainable Development (IISD) defines convenient access to public transit as "how long you may need to wait at a bus stop before a bus arrives (headway), how many buses come each hour (frequency) and how long that bus will take to get to your destination (duration of trip)" (Wiebe, 2019, p.2). Convenient access to public transit is employed in this research because an individual may live closer to a transit stop but might not have access to public transit due to the frequency of the service. One limitation of this analysis is that the direction of movement of the bus was not considered.

To measure convenient access to public transit in Winnipeg, GTFS data was combined and analysed using the "Calculate Transit Service Frequency" tool in ArcGIS Pro (Figure 20). With Winnipeg's dissemination blocks as the input points of interest, service areas were generated around the transit stops to ascertain the extent of transit coverage. The analysis considered residents living six minutes away from transit stops, approximately 500 metres away from the stops. The time window considered for the research was from 6am to 8pm. This time window was considered because it is assumed that most people use the bus within this period to go to work, shopping, schools, hospitals, and other destinations. Table 13 contains a summary of how long it takes for people living within 6 minutes away from a transit stop to catch a bus.

From table 13, 75.1% of the residents of Winnipeg have convenient access to public transit as per the criteria developed by the International Institute for Sustainable Development (IISD). This means 75.1% of the residents have to wait 15 minutes or less to access transit services. At the neighbourhood scale, Downtown, Roslyn, St. Mathews, and Broadway-Assiniboine are some of the neighbourhoods that have convenient access to transit. According to the 2016 census, 17%, 27% and 29.2% of residents in Roslyn, St. Mathews and Broadway Assiniboine used public transit as their main mode of commute to work. This implies public transit plays a significant role in the transportation needs of these communities.

Compared to similar findings conducted by Wiebe (2018) who found that 53% of the population of Winnipeg had convenient access to public transit in 2018, it can be said that public transit service in the city has improved since 2018. This could be attributed to the completion of the rapid transit corridor which was completed in the second half of 2019 (Strachan, 2020) and launched in April 2020

(Singh et al., 2020). The construction of the blue line resulted in the addition of transit routes and stops which helped to address the shortcomings of the previous transit system and enhanced the performance of the current service by offering fast and efficient services to residents along the Southwest Transitway (Baker & Linovski, 2022).

Table 13: Convenient access to public transit

Convenience	**Convenient access to public transit**			**Inconvenient access to public transit**		**No Access to public transit**
	Very High	**High**	**Moderate**	**Low**	**Very Low**	**No Access**
Average Headway from Stops (500m)	< 6 Min.	6 – 10 Min.	10 – 15 Min.	15 – 30 Min.	30 +	No Access
Population	333,916	132,368	96,626	70,852	37,608	78,237
Percentage of Population	44.5%	17.7%	12.9%	9.5%	5.0%	10.4%

Using isochrones with different time windows, Singh et al. (2020) evaluated accessibility to essential services before and after the implementation of the new bus rapid transit in Winnipeg. The authors revealed that accessibility to essential services increased for residents living near the dedicated lane. This finding resonates with the current findings of this study which found that convenient access to transit had increased since 2018 when a similar study was conducted by staff of the International Institute of Sustainable development using Esri's Better Bus Buffer tool in ArcMap (Wiebe, 2018).

Furthermore, according to the 2021 census, only 9.3% of the population of Winnipeg who are employed and aged 15 years and older commute to work using public transit (Statistics Canada, 2023b). In comparison to the number of people that commuted to work by transit in 2016 (14.9%), the percentage of ridership decreased by 45.7% in 2021. The increase in remote work and closure of schools and businesses, which were implemented as a precautionary measure against the COVID-19 pandemic, may have contributed to this trend. Winnipeg was not the only city that witnessed a decline in transit ridership between 2016 and 2021. Other cities such as Edmonton and Hamilton also witnessed a 54.6%% and 45% decline in transit ridership within the same period of time respectively (Statistics Canada, 2022d, 2022e)

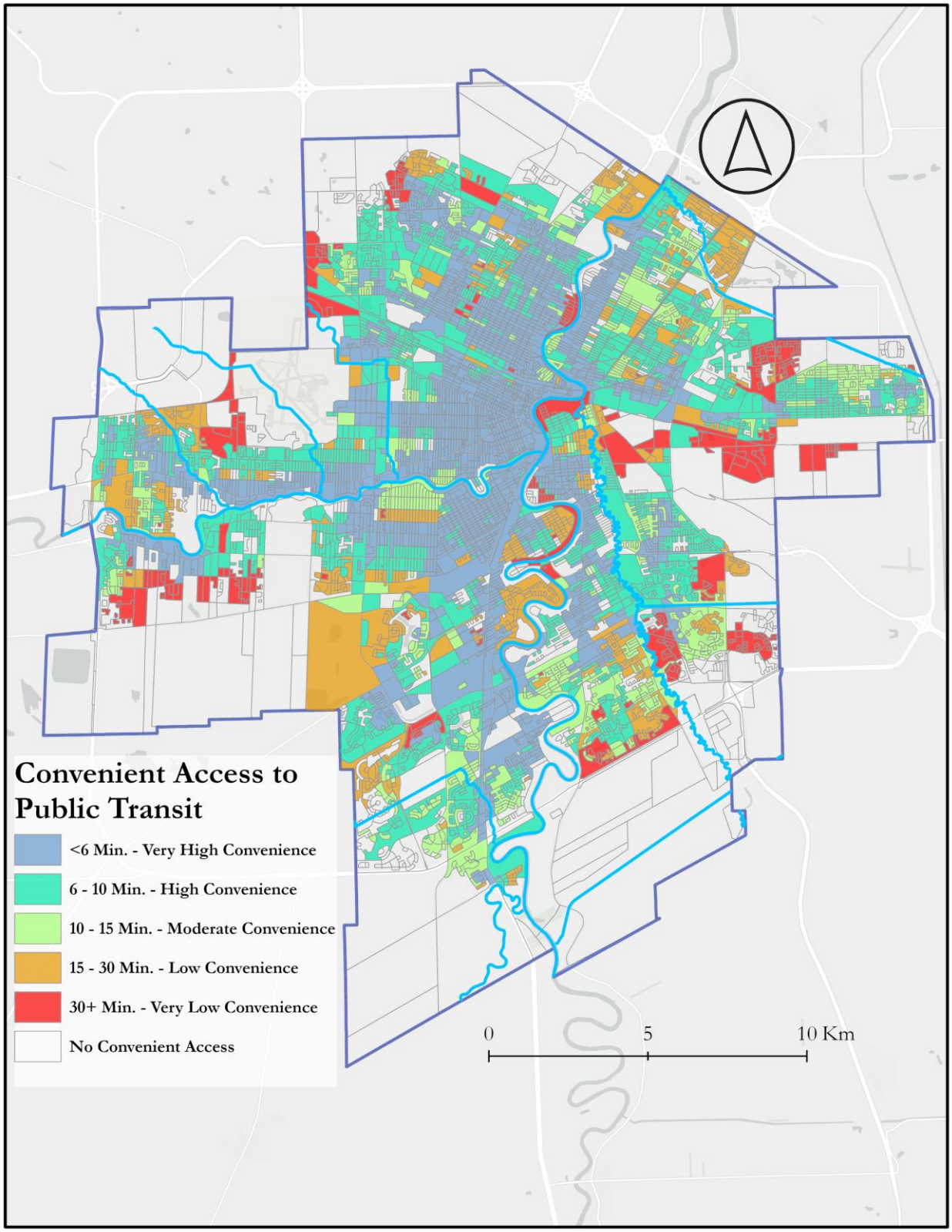

Figure 20: Accessibility to public transit stops based on service frequency (6am to 8pm)

4.3.4 Implications of redesignating rural and agricultural lands

The redesignation of rural and agricultural lands in Winnipeg can have significant implications for the environment, food security, and the social and economic wellbeing of the residents who live and farm on those lands. This section discusses the implications of redesignating rural and agricultural lands, drawing on relevant literature.

Agricultural lands provide a wide range of ecosystem services such as carbon sequestration, water management, and soil conservation (Bengtsson et al., 2019; Power, 2010). Therefore, redesignating rural and agricultural lands could lead to the loss of valuable natural resources which serve as nature-based solutions to the numerous problems that cities face. The services provided by natural resources are essential for maintaining healthy cities and ensuring the sustainability of food production. According to the Food and Agriculture Organization (FAO), the conversion of agricultural land to non-agricultural uses, such as residential development, is a leading cause of environmental degradation, including soil erosion, loss of biodiversity, and greenhouse gas emissions (FAO, 2021, p.8). Thus, the redesignation of rural and agricultural lands may have adverse environmental consequences on the City of Winnipeg.

In addition, the redesignation of rural and agricultural lands can threaten food security. Food security exists when all people have access to sufficient, safe, nutritious food to meet their dietary needs (FAO, 2006). By converting agricultural land to urban uses, the availability of land for food production is reduced, potentially leading to food shortages and increased food prices. Moreover, the displacement of farmers from their land can have significant social and economic impacts, including increased poverty, loss of livelihoods, and migration to urban areas (Coulibaly & Li, 2020; Randell, 2016).

To minimize the negative implications of redesignating rural and agricultural lands, there is a need for effective land use planning and management. Although the City of Winnipeg promotes compact and mixed-use development through its development plans, ensuring the effective implementation of the development plans by denying urban development proposals proposed by developers is relevant for maintaining rural and agricultural lands in Winnipeg.

CHAPTER FIVE

RECOMMENDATIONS, FUTURE RESEARCH AND CONCLUSION

5.1 Introduction

This section revisits the research questions and how they were addressed, provides recommendations on how urban sprawl can be contained in the city, offers direction on future investigations, and concludes by summarizing the findings and analysis that have been presented in this research.

5.2 Revisiting the Research Questions

a) How does Plan Winnipeg 2020 and OurWinnipeg address compact development?

To evaluate the compact development policies in Plan Winnipeg 2020 and OurWinnipeg, a content analysis was conducted. The policies in both plans were identified and sorted into five common categories used to assess compact development: Density, Diversity, Design, Distance to Transit, and Destination Accessibility. The results of the analysis indicated that both plans included compact development policies. However, OurWinnipeg contained more policies related to increasing density, while Plan Winnipeg had more specific policies. Overall, both plans took a comprehensive approach to creating a compact city, as the majority of the policies integrated all the features of a compact urban form.

b) To what extent has the policy documents lead to increased density and supported compact development?

This research question was answered by mapping the density of the various neighbourhoods in the city before and after the implementation of the plans. The results showed that the density of some neighbourhoods had changed over the planned period including the development of new neighbourhoods such as Waverley West and Sage Creek. Also, the built-up area of the city was also mapped to ascertain the additional buildings that were added before and after the implementation of the plans. Three neighbourhoods were further selected due to their density, location and era of development to better understand how the development plans had influenced new developments in existing neighbourhoods and the suburbs. To some extent, the plans influenced new developments including apartments and single-family homes in existing neighborhoods such as Roslyn and Broadway Assiniboine. The study also found that the plans influenced the developments along the periphery in the neighbourhoods such as Bridgewater Forest and South Pointe.

In addition, development permits issued between 2013 and 2022 was mapped to visualize the distribution of permits during the implementation of OurWinnipeg. The results showed that most of the permits issued were located in Inkster Gardens, Amber Trails, Leila North, Canterbury Park, Transcona North, Peguis, Island Lakes, FairPoint, Sage Creek, Waverley West and Ridgewood South. All these neighbourhoods are along the fringes of the city and demonstrates that the city is expanding outwards. While development plan policies encourage infill, they don't prohibit outward expansion.

Accessibility to transit stops and destinations such as regional mixed-use centres and employment lands was also conducted to find out the extent to which the plans had improved transit services. Compared to other studies on transit accessibility in the city, transit services have improved over the years which can be attributed to the construction of the bus rapid transit line which was opened in 2020.

c) Has rural land been maintained for rural and agricultural uses over the planned period?

The urban structure of the City of Winnipeg in the development plans informed how rural and agricultural land had changed over time. Areas designated as rural and agricultural lands in the plans were compared to find out if the lands were maintained to be used for rural and agricultural purposes over the planned periods. The results of the study showed that some of the areas designated as rural and agricultural lands such Waverly West and Transcona South, had been redesignated to support urban development.

5.3 Recommendations

a) **Prioritize Infill Development:** Infill development involves developing vacant or underutilized land including parking lots within the existing urban fabric. This can help reduce urban sprawl, increase housing supply, and promote revitalization of underperforming neighborhoods. Therefore, planners and city authorities should prioritize infill development and provide incentives for property owners and developers to redevelop underutilized properties such as old office spaces.

b) **Invest in Public Transit Services:** A well-functioning public transportation system can encourage people to use alternative modes of transportation, reduce vehicle dependence, and facilitate access to amenities and services. Thus, the City of Winnipeg should invest more in public transit service as a way of discouraging urban expansion. For example, the availability of an effective and efficient public transit system can encourage developers to build mote compact and

mixed-use developments near transit hubs, which can increase housing options and reduce transportation costs for residents.

c) **Introduce taxes and impact fees:** Taxes and fees can be an effective tool for discouraging developers from submitting proposals for development along the fringes and on rural and agricultural lands. For instance, impact fees can be implemented to charge developers for the cost of providing infrastructure and public services to new developments. These fees can act as a deterrent for developers who are considering building in areas that lack adequate infrastructure, such as rural and agricultural lands. Additionally, taxes can be levied on properties in areas designated for development to offset the costs associated with providing services and infrastructure to those areas. This can discourage development on the fringes by making it more expensive for developers to build in those areas.

   Additionally, tax policies can also be used to encourage development in areas that are more suitable for growth and development. For example, city authorities can provide tax credits to developers who build in designated growth areas or who invest in redeveloping existing urban areas or repurposing office spaces to be used for housing. This can incentivize developers to focus on areas that are better served by infrastructure and public services, rather than expanding into rural or agricultural lands.

d) **Increase education about infill development:** Increasing education about infill development is an important strategy for promoting compact development in the City of Winnipeg. The study showed that infill development can sometimes be challenging and often requires significant community engagement and support. To increase education about infill development, a comprehensive outreach strategy should be developed by the city. This could include public information campaigns, community workshops, and targeted educational programs aimed at developers, property owners, and community members. Such campaigns can provide information about the benefits of infill development, how it can be achieved, and the tools available to support it.

e) **Evaluate the impacts of plans:** Effective regional planning requires planners to carefully evaluate the impacts of their plans on neighbourhoods and the region as a whole. By evaluating plan impacts, planners can identify strengths and weaknesses of their plans and make adjustments to improve their effectiveness. By carefully considering the impacts of municipal long-range plans, planners can ensure that their plans align with regional goals, avoid unintended negative consequences, and contribute to the broader understanding of effective planning

5.4 Future research

a) **OurWinnipeg Direction Strategy Documents:** This study evaluated and measured some of the outcomes of OurWinnipeg, excluding its companion documents (Complete Communities, Sustainable Transportation, Sustainable Water and Waste). Future research could be conducted to evaluate OurWinnipeg's companion documents to know which of them influenced compact development more.

b) **Perception of Practicing Planners about Plan Quality:** Development plans in the city are mostly used by practicing planners who refer to policies to guide their decisions and to justify their actions. It is therefore important to conduct research to find out from planners their views about the quality of the plans they have been using. The research could find out if the policies in the plans reflect "good" or "bad" planning. Another focus of the research could find out if the policies in the plans were well developed for easy interpretation. Knowing the perception of planners could help inform the level of involvement of planners in the development of plans in the city.

c) **Factors Contributing to Urban Sprawl:** Although it is easy to assume why people move to the suburbs, conducting research to determine the reason why people move could inform policy making to address issues related to urban sprawl. The research could be done by interviewing people in new neighbourhoods such as Sage Creek to find out their reason for choosing housing in those locations considering that they have to drive to work or other locations all the time.

5.5 Conclusion

Compact development has been hailed as one of the best planning responses to urban sprawl in recent times. This study focused on evaluating compact development policies in two development plans of the City of Winnipeg and the extent to which the policies have been implemented. The results of the research show that the development plans contain compact development policies that have influenced a compact form to some extent. On the other hand, the study also revealed that the plans have contributed to urban sprawl with the approval of development permits for new residential development along the fringes of the city.

Content analysis, mapping and spatial analysis were employed in this study to evaluate compact development policies and the extent to which they have been implemented. First, policies related to compact development were identified and categorized under the five common features used to measure a compact urban form. The policies identified were then summed based on their respective category to determine the features that are mostly influenced by the development plans. Second,

mapping was used to visualize the distribution of density before and after the implementation of the plans. Also, mapping was used to visualize the rate of change of rural and agricultural land, and the distribution of development permits in the city. Finally, spatial analysis was used to measure accessibility to destinations and transit stops in the city.

Overall, the study suggest that infill development should be prioritized in the city as a way of promoting compact development. To encourage the development of a compact urban form, the research suggests that public transit services and active transportation infrastructure be improved to provide alternative modes of transportation and encourage developers to build along transit hubs. Also, to reduce public pressure against infill development, the study recommended education about infill to convince residents to support the compact development policies in the development plans. Planners can support this by educating residents anytime there is an opportunity for them to address the public.

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LIST OF APPENDICES

Appendix 1: Review of Plan Winnipeg 2020 Vison

Page (Objective)	Policy	Language Required /Suggested	Language Broad/ Specific	Features
Goal: 1A. Putting downtown first				
12 (1A-01)	The City shall promote downtown development to stimulate revitalization and capitalize on existing infrastructure by *ensuring its zoning and building by-laws and its administrative procedures support the concepts of mixed land use and compact urban form in the downtown*	Required	Specific	Diversity
12 (1A-02)	The City shall encourage downtown living in existing downtown residential neighbourhoods and elsewhere in the downtown by *providing incentives such as heritage tax credit programs, building code equivalences for heritage buildings, and mixed-use zoning that encourage the provision of housing including warehouse conversions and new construction throughout the downtown*	Required	Specific	Diversity/Density
12 (1A-02)	The City shall encourage downtown living in existing downtown residential neighbourhoods and elsewhere in the downtown by *encouraging mixed-use residential development that integrates retail, service businesses, and institutions needed by downtown residents*	Suggested	Specific	Diversity
12 (1A-02)	The City shall encourage downtown living in existing downtown residential neighbourhoods and elsewhere in the downtown by *supporting the creation of a pedestrian-friendly downtown environment*	Suggested	Broad	Design

12 (1A-01)	The City shall promote a safe downtown by *encouraging more pedestrian activity on downtown streets through support for mixed land use developments and pedestrian-focused transportation planning*	Suggested	Broad	Design/Diversity
14 (1A-06)	The City shall encourage accessibility to and within the downtown by *supporting universal access and proper maintenance of outdoor routes and indoor public walkways for people of all ages and abilities*	Suggested	Specific	Destination Accessibility
14 (1A-06)	The City shall encourage accessibility to and within the downtown by *linking adjacent neighbourhoods to the downtown with attractive transportation routes and access points with an emphasis on pedestrian connections*	Required	Broad	Destination Accessibility/ Design
14 (1A-06)	The City shall encourage accessibility to and within the downtown by *using streets and sidewalks, river corridors, pathways, and green spaces as an interconnected network to integrate the downtown and connect it with the whole city*	Required	Specific	Destination Accessibility/Design
14 (1A-066)	The City shall encourage accessibility to and within the downtown by *supporting cycling and other alternative modes of transportation to and within the downtown*	Suggested	Specific	Destination Accessibility
14 (1A-06)	The City shall encourage accessibility to and within the downtown by *supporting public transit to move people to and within the downtown, including the implementation of measures that reduce travel times between suburban areas and the city centre, the upgrading of waiting areas at major transit stops, and the operation of a downtown shuttle service*	Required	Specific	Distance to transit/ Destination accessibility

14 (1A-06)	The City shall encourage accessibility to and within the downtown by *maintaining with operational, custodial, and security services a weather-protected pedestrian walkway system linked to public transit*	Required	Specific	Distance to transit/ Design
14 (1A-07)	The City shall integrate rivers, parks, and green spaces in the downtown by *enhancing year-round access to the Riverwalk system and to the rivers themselves through the provision of boat launches, docks, the winter River trail system, and other conveniences*	Required	Specific	Design/ Destination accessibility
14 (1A-07)	The City shall integrate rivers, parks, and green spaces in the downtown by *encouraging the private sector to incorporate open space, landscaping, and pedestrian amenities into development projects in the downtown.*	Suggested	Broad	Design
14 (1A-08)	The City shall promote high standards of urban design in the downtown *by ensuring that all projects for which it is responsible reflect exemplary urban design and maintenance*	Required	Broad	Design
Goal: 1B. Creating healthy neighbourhoods				
15 (1B-01)	The City shall support neighbourhood revitalization through efforts that address the physical, social, and economic needs of neighbourhoods giving first priority to Major Improvement Neighbourhoods identified on Policy Plate D and second priority to Rehabilitation Neighbourhoods identified on Policy Plate D by *encouraging targeted private sector investment in neighbourhoods including the provision of infill housing and local services*	Suggested	Broad	Density

17	**Goal: 1C. Addressing housing needs**			
17 (1C-O1)	The City shall facilitate the provision of safe and affordable housing giving first priority to Major Improvement Neighbourhoods identified on Policy Plate D and second priority to Rehabilitation Neighbourhoods identified on Policy Plate D by *proposing tax increment financing and tax credit programs to facilitate affordable infill development and improve housing stock in older neighbourhoods*	Required	Specific	Density
17 (1C-01)	The City shall facilitate the provision of safe and affordable housing giving first priority to Major Improvement Neighbourhoods identified on Policy Plate D and second priority to Rehabilitation Neighbourhoods identified on Policy Plate D by *supporting, in partnership with not-for-profit community housing groups, the acquisition and redevelopment of vacated houses*	Suggested	Specific	Density
22 **Goal: 2B. Ensuring responsible government**				
22 (2B-02)	The City shall commit to the reduction of greenhouse gas emissions by *reducing the need for motorized transport through integrated planning and the promotion of compact urban form and mixed land use*	Required	Broad	Diversity/Distance to transit
26	**Goal: 2C. Providing economic direction and support**			
26 (2C-07)	The City shall partner with the Winnipeg Airports Authority on initiatives which capitalize upon the airport's capacity to generate strategic economic	Required	Specific	Design

	development *by improving street connections, urban design, and signage along a designated route between the airport and the downtown*			
30	**Goal: 3A. Planning for growth and change**			
30 (3A-01)	The City shall promote orderly development through land use designations on Policy Plate A by *considering the Downtown designation to signify a unique multi-functional area, the centre of business and service-oriented activity, government and other institutional operations, major arts and cultural attractions, and some specialty retail and regional recreation, with a large and diverse mix of residential uses and transportation options*	Suggested	Broad	Diversity
30 (3A-01)	The City shall promote orderly development through land use designations on Policy Plate A by *considering the Neighbourhood designation to signify areas of local identity with mutually supportive uses generally including a residential mix together with a variety of educational, recreational, institutional, commercial, and possibly industrial uses, at a scale and density compatible with each other*	Suggested	Broad	Diversity
30 (3A-02)	The City shall promote compact urban form in support of sustainability by *encouraging infilling of vacant lands and the revitalization of existing neighbourhoods to maximize the use of existing infrastructure*	Suggested	Broad	Density
30 (3A-02)	The City shall promote compact urban form in support of sustainability by *supporting new development, which is adjacent to, and compatible with, existing development and which is*	Required	Broad	Density/Diversity

	designed to minimize the spatial use of land.			
31 (3A-03)	The City shall integrate land use, urban design, and transportation planning in a manner consistent with its commitment to compact urban form by *encouraging mixed-use development to minimize travel distances for basic needs*	Suggested	Broad	Diversity
31 (3A-03)	The City shall integrate land use, urban design, and transportation planning in a manner consistent with its commitment to compact urban form by ensuring that all residential development supports the provision of efficient, attractive, and cost-effective transit service through appropriate design considerations	Required	Specific	Distance to transit
31 (3A-03)	The City shall integrate land use, urban design, and transportation planning in a manner consistent with its commitment to compact urban form by *continuing the development of the weather-protected pedestrian system in the downtown and integrating the entry points to the system with the downtown transit network*	Required	Specific	Design/Distance to Transit
31 (3A-04)	The City shall protect traffic flows from significant increases in volume as a result of new developments by *directing new development with high intensity uses to locations that are supported by transit operations*	Required	Broad	Distance to transit
32	**Goal: 3B. Guiding land use**			
32 (3B-01)	The City shall promote vibrant neighbourhoods by encouraging and accommodating within new and existing developments a	Suggested	Specific	Density/Diversity

	variety of compatible mixed uses including: i) low-intensity residential uses; ii) low-intensity ancillary uses such as local commercial, educational, recreational, religious, and institutional uses at a scale and density compatible with, and necessary to support, low-intensity residential development, and in recognition of traffic flows related to these uses; iii) high-intensity residential development and ancillary uses on sites adjacent to major traffic or transit corridors; and iv) light industrial development at industrial park standards as a buffer, where appropriate, between residential development, major traffic arteries or railways, or other incompatible uses.			
33 (3B-04)	The City shall accommodate commercial and retail development by *recognizing and supporting the importance of a strong downtown as the preferred location for concentrating specialty retail, tourist-oriented commercial uses, and office development*	Suggested	Broad	Diversity
33 (3B-04)	The City shall accommodate commercial and retail development by supporting the maintenance and development of neighbourhood main streets that provide a wide range of local services, that enhance neighbourhood character, and that provide for the incremental expansion of commercial uses consistent with the general character of the adjacent neighbourhood	Suggested	Broad	Diversity

33 (3B-04)	The City shall accommodate commercial and retail development by *supporting the maintenance and development of community commercial centres that provide convenient local shopping opportunities and services while minimizing the need for travel beyond the community*	Suggested	Specific	Diversity
33 (3B-04)	The City shall accommodate commercial and retail development by *identifying, generally, the areas of regional commercial and mixed-use concentration on Policy Plate A, to accommodate large scale retail and service space, entertainment space, and suburban office employment of a regional nature.*	Required	Specific	Diversity
33 (3B-04)	The City shall promote commercial densification in a manner consistent with its commitment to compact urban form by *encouraging the redevelopment, infill, and expansion of existing commercial areas as the preferred method of accommodating new commercial development*	Suggested	Specific	Diversity
33 (3B-04)	The City shall promote commercial densification in a manner consistent with its commitment to compact urban form *by approving new locations for commercial development only where significant residential areas are not well served with commercial space, where existing commercial areas cannot accommodate expansion, where the long-term negative impacts on existing regional and commercial centres will be minimal, where additions to the regional street system can be demonstrated to have long-term benefits, and where a full range of municipal infrastructure can be provided in an environmentally-*	Required	Specific	Diversity

	sound, economical, and timely manner			
33 (3B-05)	The City shall promote commercial densification in a manner consistent with its commitment to compact urban form by *ensuring that areas of regional commercial and mixed-use concentration be designed and built as focal points for public transit*	Required	Specific	Diversity/Distance to transit
33 (3B-05)	The City shall promote commercial densification in a manner consistent with its commitment to compact urban form by *giving primary recognition to maintaining and supporting street-level retail in the expansion or redevelopment of the downtown's weather-protected pedestrian walkway system*	Required	Specific	Diversity/Design
35	**Goal: 3C. Integrating Transportation**			
35 (3C-01)	The City shall provide an integrated transportation network that supports its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions by *designing public rights-of-way to encourage pedestrian use through adequate lighting for safety and security, aesthetics, and comfort*	Suggested	Specific	Design
35 (3C-01)	The City shall provide an integrated transportation network that supports its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions by *minimizing walking distances to transit in the planning of new developments and making transit connections quick, easy, and weather-protected*	Required	Specific	Distance to transit
35	The City shall provide an integrated transportation	Required	Specific	Design

(3C-01)	network that supports its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions by *improving cyclist comfort on the arterial street system through the expansion of curb lanes and the establishment of cycle lanes where feasible*			
35 (3C-01)	The City shall provide an integrated transportation network that supports its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions by *establishing a city-wide bicycle and pedestrian pathway system which is segregated where practical and feasible from motorized traffic and which creates links between open space and major destinations*	Required	Specific	Design
35 (3C-01)	The City shall provide an integrated transportation network that supports its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions by *promoting alternative modes of transportation through the inclusion of transit routes and bicycle paths in transportation plans and in the design of new developments*	Suggested	Specific	Distance to transit/Design
35 (3C-01)	The City shall commit to transit improvements to increase ridership by i) making ongoing improvements to service; ii) making transit service easier to use; iii) making transit service more affordable; iv) making transit service more productive; and v) making a commitment to high-speed transit.	Required	Specific	Distance to transit
37	The City shall invest strategically in new	Required	Specific	Distance to transit

(3D-02)	infrastructure by recognizing that investment in transit improvements, facilities that encourage cycling and other alternative modes, and measures to reduce the reliance on the use of automobiles is most consistent with its commitment to sustainability, compact urban form, and the reduction of greenhouse gas emissions			
37 (3D-03)	The City shall direct transit system investment by focusing on those areas where the potential to attract new ridership is greatest, namely, to, from, and within the downtown; along the major radial travel corridors of the city; and to and from major centres of employment, education, health care and shopping	Suggested	Specific	Distance to Transit/Destination Accessibility
37 (3D-03)	The City shall direct transit system investment by initiating a program of on-street transit improvements and rapid transit corridor development as illustrated on Policy Plate B, to significantly improve the speed of transit travel and to support the revitalization of downtown.	Required	Specific	Distance to Transit/Destination Accessibility

Appendix 2: Review of OurWinnipeg

Page	Policy	Language	Language Broad/ Specific	Features
27	**01-1a Ourwinnipeg's Approach to City Building**			
27	Adopt Complete Communities as the City's land use and development guide.	Required	Broad	Density /Diversity/Design/Destination Accessibility/Distance to Transit
27	Endorse Sustainable Transportation as the primary vision for a transportation master plan	Required	Broad	Distance to transit/Destination Accessibility
27	Ensure land use, transportation and infrastructure planning efforts are aligned to identify where growth will be accommodated and how it will be serviced.	Required	Broad	Density /Diversity/Design/Destination Accessibility/Distance to Transit
28	**Direction 2:** Develop and maintain an urban structure planning tool	Required	Broad	Density/Diversity
28	Use the urban structure framework as the basis for integrated transportation and infrastructure planning	Required	Broad	Distance to transit/Destination accessibility
30	**Direction 3:** Promote compact urban form and manage the extension of municipal services for new growth.	Required	Broad	Density/Design/Diversity/Distance to Transit/Destination accessibility
30	Support new developments that are contiguous with existing developments to minimize the spatial use of land and the extension of services	Required	Broad	Density/Diversity

31	01-1b Key Directions for the entire city			
31	Dynamically integrate transportation with land use	Required	Broad	Distance to transit/Diversity/Destination Accessibility
31	Accommodate growth and change in Transformative Areas within the city's built environment including: Mixed Use Centres and Corridors, Major Redevelopment Sites and Downtown	Required	Broad	Density and Diversity
31	Recognize that New Communities will play an important role in accommodating the City's projected population growth.	Required	Broad	Density
31	Ensure that a sufficient supply of developable land emerges at an appropriate pace and that the supply remains well distributed both in terms of geography and scale to ensure a competitive market	Required	Broad	Density/Diversity
32	Create a safe, efficient and equitable transportation system for people, goods and services	Suggested	Broad	Distance to Transit/Destination accessibility
32	Create a transportation system that supports active, accessible, and healthy lifestyle options	Suggested	Specific	Distance to Transit
34	**Downtown**			
34	Promote and enable a mix of residential development options as part of a mixed-use strategy seeking to:	Suggested	Broad	Diversity/Density

	accommodate the residential needs of a large cross section of the population, establish a number of thriving 'complete' communities Downtown, attract additional commerce to the area, leading to active – and safer – Downtown streets.			
34	Facilitate the expansion of employment and educational opportunities in the Downtown seeking to reinforce Downtown's role as a hub for business, for learning, for government and for commercial activity	Suggested	Broad	Diversity
34	Facilitate the movement of people and goods within the Downtown and to it from elsewhere in the city by focusing primarily on an enhanced array of sustainable transportation options.	Suggested	Broad	Destination Accessibility/Distance to Transit
36	**Centres and Corridors**			
36	Focus a significant share of growth to Centres and Corridors in a manner that: provides compact, mixed-use, high-quality urban development, concentrates people and jobs in areas well-served by the primary transit service, located close to transit stops,	Required	Broad	Diversity/Distance to transit/Design

	encourages a built form that supports a pedestrian friendly environment while incorporating climate sensitive site and building design			
36	Address the need for new Regional Mixed-Use Centres by supporting their development as mixed-use, higher density residential, transit-supportive regional destinations	Required	Broad	Diversity/Distance to Transit/Density
36	Promote and guide the transformation of existing regional mixed-use centres through a proactive and collaborative process	Suggested	Broad	Diversity
36	Where appropriate, develop Corridors in accordance with Transit Oriented Development principles.	Suggested	Broad	Distance to transit
37	**Major redevelopment sites**			
37	Major Redevelopment Sites will provide transformative opportunities for the development of complete communities with significant residential and employment densities and attractive urban design, capitalizing on vacant or underutilized sites within the existing urban fabric.	Required	Broad	Density/Diversity

38	**New Communities**			
37	Planning for New Communities will ensure orderly development that will provide opportunities for a mix of uses; higher density residential; parks, places, and open spaces; employment options and transit access within walking distance of diverse residential neighbourhoods.	Required	Specific	Density/Diversity/Design/Distance to transit/Destination accessibility
38	New Communities will be planned with a supporting street network that connects residents, jobs and commercial services through direct and efficient active transportation, transit, and automobile routes.	Required	Specific	Diversity/Destination accessibility/Design/Distance to Transit
38	New Communities will continue to play an important role in accommodating the city's projected population growth.	Required	Broad	Density
39	**Areas of Stability**			
39	Areas of Stability will accommodate low to moderate density infill development to support more efficient use of land, infrastructure and services as well as enhance housing choice and affordability.	Required	Specific	Density
39	Enhance the quality, diversity,	Suggested	Broad	Diversity

	completeness, and sustainability of stable neighbourhoods and expand housing options for Winnipeg's changing population			
54	**Housing**			
54	Direction 1: Support diverse housing options in each neighbourhood or neighbourhood cluster throughout the city	Required	Broad	Diversity
54	Support the creation of a range of sizes, forms and tenures of housing	Required	Broad	Diversity
55	Direction 2: Collaborate with other levels of government and other partners to renew and regenerate Winnipeg's housing stock	Required	Specific	Density
55	Continue to use initiatives to facilitate housing rehabilitation in reinvestment neighbourhoods and infill housing in mature neighbourhoods.	Required	Specific	Density
55	Enhance the reinvestment efforts of existing neighbourhoods by supporting the assembly of strategically located vacant land that can be redeveloped	Suggested	Specific	Density
55	Support contextually sensitive infill development that builds complete and	Required	Broad	Density/Density

	inclusive communities in Areas of Stability.			
56	Direction 3: Establish partnerships with the private sector, not for profit and government sectors to provide affordable housing throughout the city, with a particular focus on locations near a variety of transportation options	Suggested	Broad	Density/Distance to Transit
56	Encourage new and infill development, as well as the redevelopment of existing properties to incorporate affordable housing that is integrated with market housing	Suggested	Broad	Density
56	Encourage the development of mixed-income neighbourhoods, as well as mixed-income multiple-unit projects as part of creating complete communities, guided by the urban structure described in Complete Communities.	Suggested	Specific	Diversity
57	Direction 6: Encourage residential development downtown	Suggested	Broad	Density
57	Improve transportation options to, from, and within the Downtown.	Suggested	Broad	Design/Distance to Transit/Destination accessibility
57	Develop a strong planning framework for Downtown residential development.	Suggested	Broad	Density

57	Promote downtown living with developers and potential residents.	Suggested	Broad	Density

Appendix 3: Change in density of City of Winnipeg Neighbourhoods from 2001 to 2016

Name	Density 2016	Density 2011	Density 2006	Density 2001
Agassiz	614.37	757.44	732.19	715.36
Airport	12.56	21.26	19.81	35.28
Alpine Place	12236.88	11859.88	11043.04	10917.37
Amber Trails	4223.72	2067.94	1071.61	459.26
Archwood	811.61	860.96	855.48	937.74
Armstrong Point	1391.08	1428.67	1353.48	1503.87
Assiniboia Downs	106.04	98.38		
Assiniboine Park				
Beaumont	1915.96	1986.46	1957.43	1982.31
Betsworth	1853.94	1851.65	1936.54	2048.97
Birchwood	2683.62	2467.2	2337.35	2597.05
Booth	2914.38	2935.71	2925.05	2834.39
Bridgwater Centre	384.12			
Bridgwater Forest	2754.33	822.64		
Bridgwater Lakes	1217.04			
Bridgwater Trails	164.12			
Broadway-Assiniboine	15452.19	14572.56	14895.09	15965.31
Brockville	1420.87	1214.84	1001.71	596.76
Brooklands	3395.41	2895.73	2715.12	2781.35
Bruce Park	2424.71	2356.57	2458.78	2458.78
Buchanan	2508.38	2331.62	2373.7	2550.47
Buffalo				
Burrows Central	5057.74	4983.01	4487.98	4413.26
Burrows-Keewatin	4402.26	4073.74	4029.93	4219.75
Canterbury Park	2570.97	2127.75	1737.53	1578.55
Centennial	5312.15	4138.97	4176.51	4476.85
Central Park	16221.91	16178.94	15276.52	13772.51
Central River Heights	2915.31	2797.48	2745.1	2718.92
Central St. Boniface	3128.86	3385.15	3154.23	3045.12
Chalmers	3827.78	3837.69	3756.42	3774.26
Chevrier				
China Town	6364.31	9394.94	9167.64	8258.45
Civic Centre	779.77	804.93		
Cloutier Drive	389.68	328.8	249.64	310.53
Colony	5140.75	5858.07	5698.66	4981.35
Crescent Park	1471.19	1443.44	1399.02	1421.23
Crescentwood	2552.28	2505.28	2542.88	2571.08
Crestview	3047.1	3103.27	3108.53	3213.85

Dakota Crossing	3155.97	2934.36	2676.25	2133.96
Daniel Mcintyre	7904.43	7876.97	7,649.45	7,629.84
Deer Lodge	2551.85	2420.14	2492.58	2413.56
Dufferin	3452.1	3390.87	3199.51	2686.67
Dufferin Industrial				
Dufresne	2334.89	2776.62	2745.07	2681.96
Dugald				
Eaglemere	1923.38	2256.27	1800.08	930.87
Earl Grey	4208.06	4188.3	4356.23	4252.51
East Elmwood	3822.64	3727.77	3471.07	3426.42
Ebby-Wentworth	1995.72	1757.24	1807.44	1832.55
Edgeland	4638.6	5082.13	5248.45	5969.19
Elm Park	1841.99	1815.14	1836.62	1874.21
Elmhurst	2359.02	2487.69	2522.54	2624.41
Eric Coy	1219.13	1189.15	1269.09	1214.13
Exchange District	1972.46	1393.25	1314.97	1080.16
Fairfield Park	2844.18	1833.68	290.83	
Fort Richmond	2557.35	2482.39	2522.59	2555.18
Fraipont				
Garden City	2700.25	2594.48	2486.56	2439.07
Glendale	833.54	801.48	857.59	821.52
Glenelm	2565.96	2679.08	2613.59	2685.03
Glenwood	2383.21	2241.94	2241.94	2278.79
Grant Park	1989.07	1978.12	1970.82	1821.19
Grassie	2060.78	1410.75	871.4	845.24
Griffin				
Heritage Park	3314.8	3431.58	3293.84	3042.31
Holden	1827.67	1726.13	1472.29	1472.29
Inkster Gardens	3115.23	2521.33	2313.65	2386.52
Inkster Industrial Park				
Inkster-Faraday	5417.38	5059.79	4928.68	4732.01
Island Lakes	2997.11	2971.22	2688.44	1983.47
J. B. Mitchell	3878.45	3553.82	3579.45	3690.51
Jameswood	1839.35	1579.44	1666.08	1879.34
Jefferson	3795.71	3692.21	3497.88	3476.76
Kensington	2563.49	2753.38	2421.08	2610.97
Kern Park	3147.53	3120.93	3076.6	2854.94
Kil-Cona Park	116.84	127.3	125.56	97.66
Kildare-Redonda	3059.55	3141.77	3233.95	3311.19
Kildonan Crossing				
Kildonan Drive	2068.81	2066.6	2139.31	2110.67

Kildonan Park				
King Edward	3467.51	3363.96	3351.41	3458.1
Kingston Crescent	1002.52	1030.36	863.28	1009.48
Kirkfield	1402.35	1359.55	1394.8	1372.14
La Barriere				
Lavalee	2339.12	2263.97	2527	2564.57
Legislature				
Leila North	863.96	748.06	526.8	
Leila-Mcphillips Triangle	2847.3	2823.41	2904.62	2880.74
Linden Ridge	2806.54	2119.74	1831.46	
Linden Woods	2685.06	2826.24	2643.54	2100.99
Logan-C.P.R.	225.23	272.16	281.54	281.54
Lord Roberts	2935.87	2885.61	2929.96	2997.96
Lord Selkirk Park	2843.33	2684.33	2553.38	2506.62
Luxton	3969.85	4046.94	3954.43	3969.85
Maginot	3538.43	3698.75	3630.04	3813.26
Mandalay West	3918.57	3973.4	3279.99	3215.49
Maple Grove Park				
Margaret Park	2427.87	2449.84	2367.45	2455.33
Marlton	1123.56	1265.12	1371.28	1273.96
Mathers	3525.37	3545.11	3426.72	3301.75
Maybank	2813.71	2656.14	2628	2594.24
Mcleod Industrial				
Mcmillan	6074.49	6056.86	6030.41	6242
Meadowood	2855.55	3124.28	2998.71	2981.13
Meadows	2686.59	2451.8	2146.37	2204.54
Melrose	3295.89	2948.43	2531.48	2690.32
Minnetonka	1811.49	1830.52	1834.74	1885.47
Minto	3616.27	3537.24	3388.67	3527.76
Mission Gardens	3093.14	2874.64	2451.29	2383.01
Mission Industrial				
Montcalm	4371.19	4189.79	4088.04	3964.16
Munroe East	4193.97	4193.97	4174.24	4302.52
Munroe West	2305.59	2301.76	2313.25	2313.25
Murray Industrial Park				
Mynarski	5022.38	3357.06	3568.53	3396.71
Niakwa Park	945.18	945.18	991.77	1264.68
Niakwa Place	1363.7	1363.7	1411.03	1328.2
Norberry	2279.52	2219.98	2202.97	2194.46
Normand Park	1673.07	1174.5	671.14	690.32

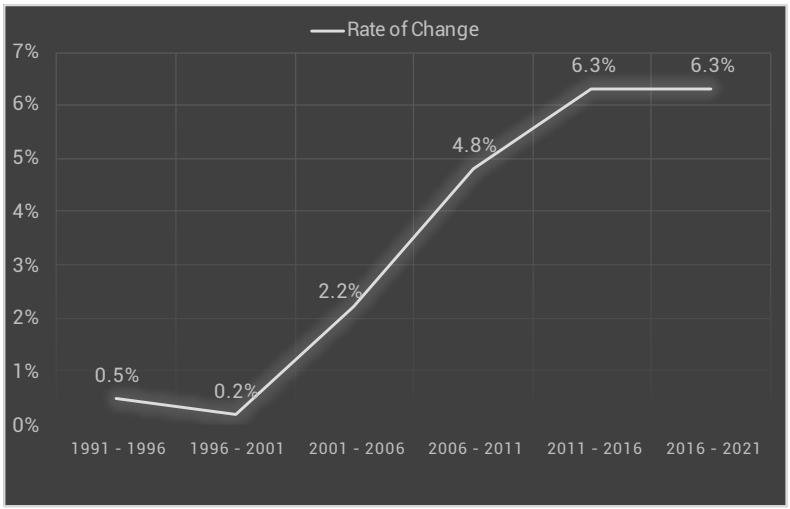
North Inkster Industrial	112.88			
North Point Douglas	1786.26	2086.17	1962.68	1993.55
North River Heights	3253.64	3253.64	3279.72	3305.79
North St. Boniface	1487.32	1308.98	1266.18	1341.08
North Transcona Yards				
Norwood East	3128.8	3151.86	3171.08	3163.39
Norwood West	2224.72	2183.46	2292.25	2371.04
Oak Point Highway				
Old Tuxedo	1198.05	1139.13	1126.04	1008.2
Omand's Creek Industrial				
Pacific Industrial				
Parc La Salle	3464.26	3593.47	3496.57	3633.84
Parker				
Peguis	323.81	121	109.07	63.06
Pembina Strip	4444.31	4430.32	3940.39	3828.41
Perrault				
Point Road	2343.47	2412.4	2437.46	2293.34
Polo Park	271.7	286.52	281.58	276.64
Portage & Main				
Portage-Ellice	6343.27	6579.3	6520.29	5074.61
Prairie Pointe				
Pulberry	1883.53	1841.5	1825.48	1849.5
Radisson	2735.87	2764.75	2768.88	2851.41
Regent				
Richmond Lakes	2506.01	2676.17	2768.99	2606.56
Richmond West	3228.11	3087.44	3074.31	2436.56
Ridgedale	880.92	924.04	1034.93	930.2
Ridgewood South	62.16	60.52	55.62	106.32
River East	2257.7	2314.69	2440.37	2576.27
River Park South	3018.3	2796.82	2445.38	2451.03
River West Park	1937.49	1911.31	1891.68	2094.59
Riverbend	3257.06	3160.32	2764.54	2178.21
Rivergrove	1525.82	1529.1	717.07	677.78
River-Osborne	5434.77	5446.21	5583.51	5394.72
Riverview	1748.37	1783.18	1781.13	1781.13
Robertson	3633.89	3374.33	3074.55	3016.06
Roblin Park	1348.71	1455.75	1398.66	1498.56
Rockwood	4380.24	4313.17	4338.97	4168.71
Roslyn	14491.05	13392.27	13201.18	13360.43
Rosser-Old Kildonan	42.51	17.19	13.75	18.76

Rossmere-A	3348.15	3248.93	3353.17	3366.99
Rossmere-B	3393.33	3206.84	3150.08	3259.54
Royalwood	1721.62	1622.6	986.76	451.69
Sage Creek	1171.74	351.03		
Sargent Park	2976.86	2904.61	2815.5	2875.71
Saskatchewan North				
Seven Oaks	2446.23	2413.61	2340.22	2438.07
Shaughnessy Park	3401.63	3234.34	2831.6	2670.5
Silver Heights	3098.64	3098.64	3074.52	3152.89
Sir John Franklin	2228.63	2076.99	2132.14	2155.11
South Point Douglas	562.6	382.28	331.79	245.23
South Pointe	2194.35	372.97		
South Portage	2823.24	2823.24	2815.67	2565.89
South River Heights	2565.89	2387.28	2302.66	2414.01
South Tuxedo	1642.55	1878.91	1809.67	1697.46
Southboine	1944.34	2037.27	2151.64	1908.6
Southdale	2123.11	2177.42	2208.69	2307.44
Southland Park	441.14	437.5	450.26	326.3
Spence	9125.95	9105.28	8805.56	7751.38
Springfield North	2327.85	2289.85	2097.86	1981.87
Springfield South	2319.29	2319.29	2412.37	2482.19
St. Boniface Industrial Park	274.13			
St. George	2807.3	2807.3	2573.36	2919.19
St. James Industrial				
St. John's	5377.69	5371.23	4987.11	5061.36
St. John's Park	1318.04	1355.34	1429.95	1380.21
St. Matthews	6774.26	6715.55	6803.61	6909.27
St. Norbert	975.52	864.98	712.98	737.86
St. Vital Centre				
St. Vital Perimeter South	49.4	49.4	45.6	39.63
Stock Yards	429.85	336.01	251.25	
Sturgeon Creek	2637.84	2780.67	2869.94	2923.5
Symington Yards				
Talbot-Grey	3874.22	3940.87	3824.23	3849.22
Templeton-Sinclair	3578.02	3542.3	3071.98	2857.65
The Forks				
The Maples	4981.53	4865.76	4540.58	4632.51
The Mint				
Tissot				
Transcona North				

Transcona South	113.11	115.74	126.26	127.14
Transcona Yards				
Trappistes				
Turnbull Drive				
Tuxedo	952.77	1048.25	1024.91	1126.77
Tuxedo Industrial	82.19			
Tyndall Park	4164.14	4329.91	4235.42	4331.57
Tyne-Tees				
University				
Valhalla	4237.27	4333.74	4311.48	4437.63
Valley Gardens	3588.96	3510.2	3512.33	3563.42
Varennes	2618.88	2533.22	2863.64	2643.36
Varsity View	2182.28	2125.38	2113.19	2113.19
Vialoux	1720.39	1693.23	1720.39	1820
Victoria Crescent	687.35	779	805.18	824.82
Victoria West	3184.76	3090.57	3061.14	2955.18
Vista	2966.27	2852.98	2852.98	3172.26
Waverley Heights	2530.18	2505.76	2537.51	2652.3
Waverley West B				
Wellington Crescent	1703	1594.96	1651.55	1564.09
West Alexander	2843.02	2921.8	2864.51	2968.35
West Broadway	7429.44	7733.44	7896.56	7481.34
West Fort Garry Industrial				
West Kildonan Industrial				
West Perimeter South				
West Wolseley	1310.59	1203.16	1117.22	1009.8
Westdale	2696.78	2726.48	2833.4	2848.25
Weston	4345.9	4018.3	4049.67	4032.24
Weston Shops				
Westwood	2559.12	2577.16	2568.14	2663.73
Whyte Ridge	2719.8	2783.47	2675.59	2261.79
Wildwood	885.41	877.58	857.99	861.9
Wilkes South	26.09	29.08	25.45	18.18
William Whyte	5391.15	5386.84	5356.7	4947.63
Windsor Park	2994.52	2997.5	2879.81	2893.22
Wolseley	4508.7	4364.28	4396.05	4523.14
Woodhaven	1496.57	1421.74	1471.63	1363.54
Worthington	3609.53	3646.89	3684.24	3528.04

Appendix 4: Presentation

Reasons for Research



- Population growth
- Low density development
- Automobile dependency

Population change in Winnipeg from 1991 to 2021

2

Research Questions

How does Plan Winnipeg 2020 and OurWinnipeg address compact development?

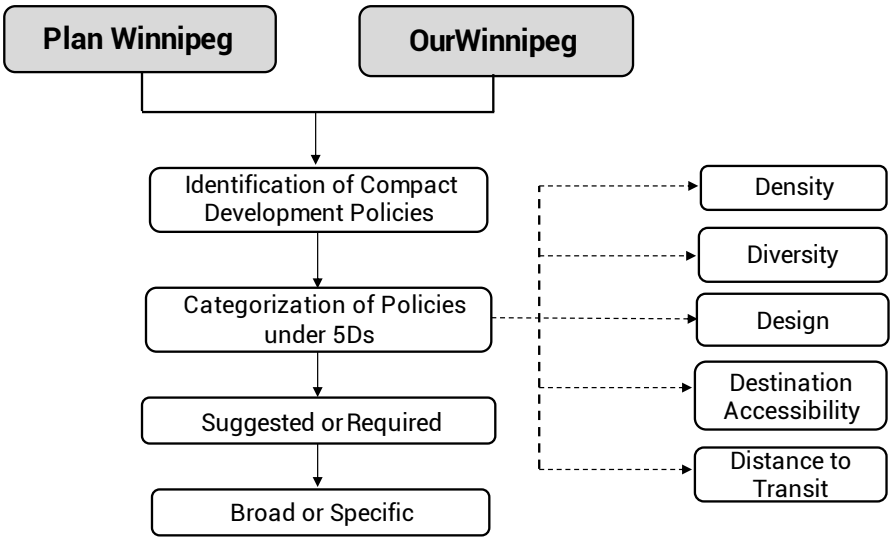
To what extent has the policy documents led to increased density and supported compact development?

Has rural land been maintained for rural and agricultural uses over the planned period?

3

4

Content Analysis



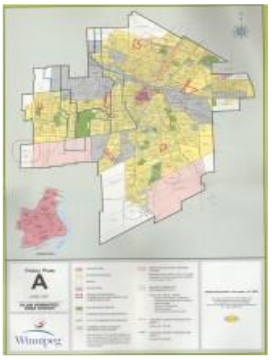
5

Content Analysis Cont.

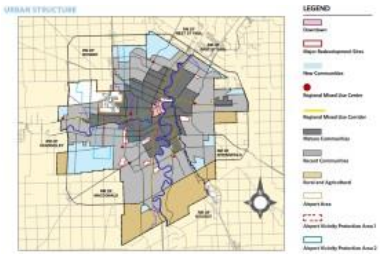
Feature	Elements
Density	Housing types (low and high density development), population, built area, infill, redevelopment of vacated houses
Diversity	Mixture of land uses, and different housing types
Design	Pedestrian pathways, vehicle roadways, cycling infrastructure
Destination Accessibility	Downtown, job centres (employment lands), regional mixed-use centres
Distance to Transit	Bus stops, transit routes, rapid transit, public transportation
Multiple Features	Two or more features in one policy

6

Mapping

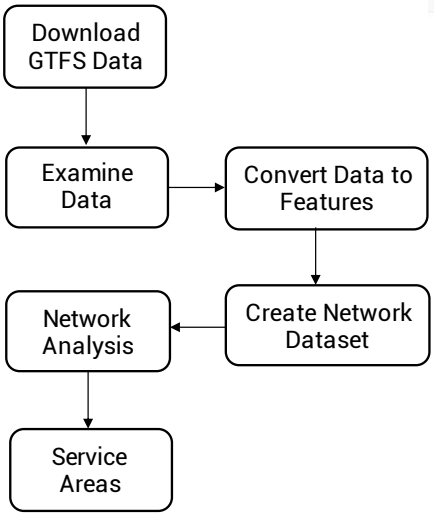


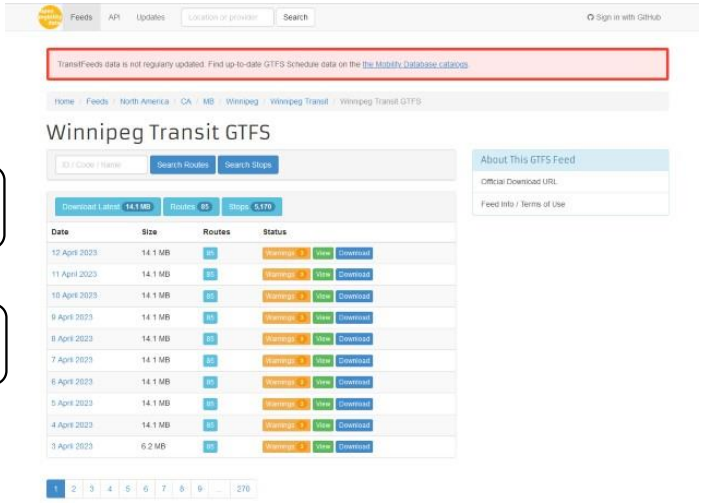
- Density of neighbourhood from City of Winnipeg Open Data Portal
- Winnipeg Assessment Parcels (built area)
- Rural and agricultural land
- Urban structure of development plans
- Georeferenced and digitized



7

Spatial Analysis

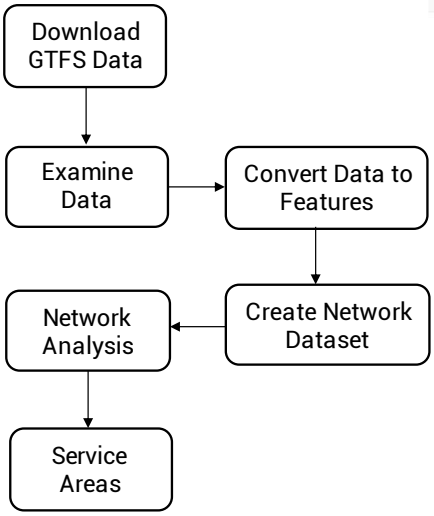


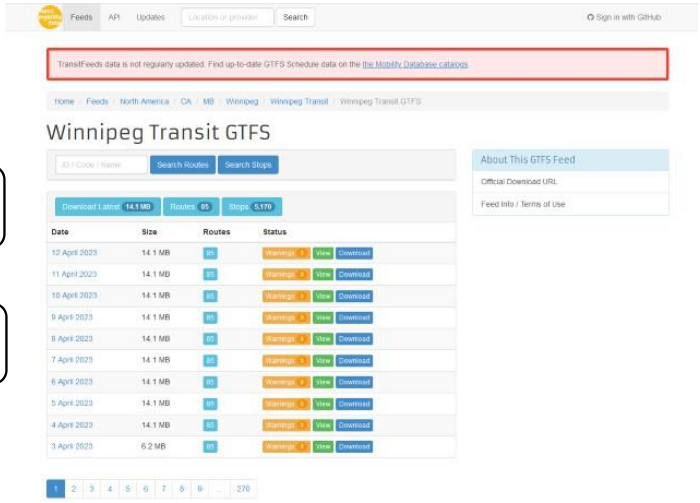


GTFS: General Transit Feed Specification

8

Spatial Analysis





GTFS: General Transit Feed Specification

8

9

Summary of Compact Development Polices

Plan	Feature	No. of Policies	Plan	Feature	No. of Policies
Plan Winnipeg (2001)	Multiple Features	16	OurWinnipeg (2011)	Multiple Features	19
	Diversity	11		Diversity	6
	Design	7		Design	0
	Distance to Transit	5		Distance to Transit	2
	Density	4		Density	10
	Destination Accessibility	2		Destination Accessibility	1
	Total	**45**		**Total**	**38**

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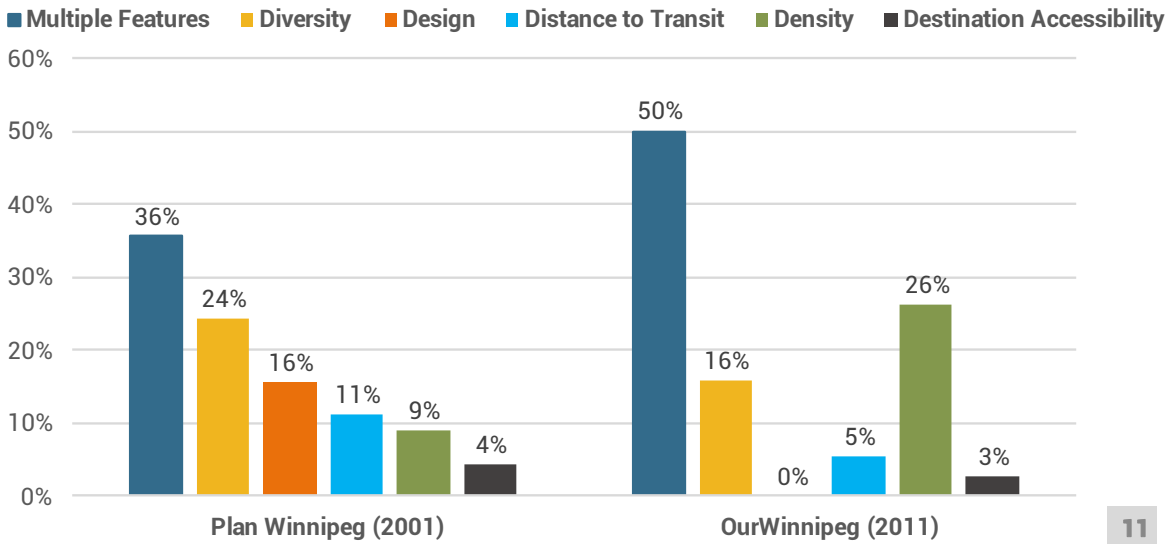
Categorization of Policies under 5Ds



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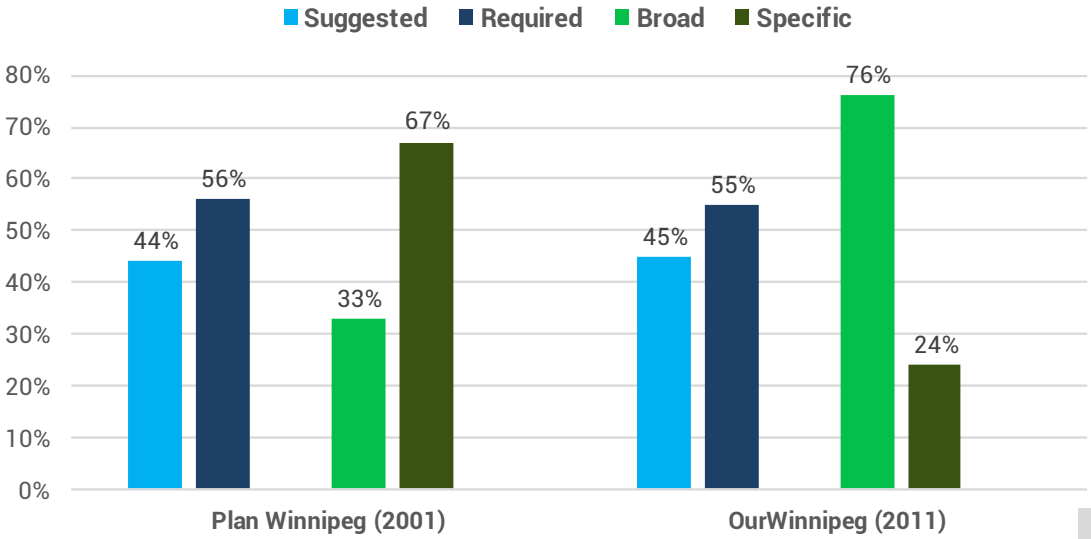
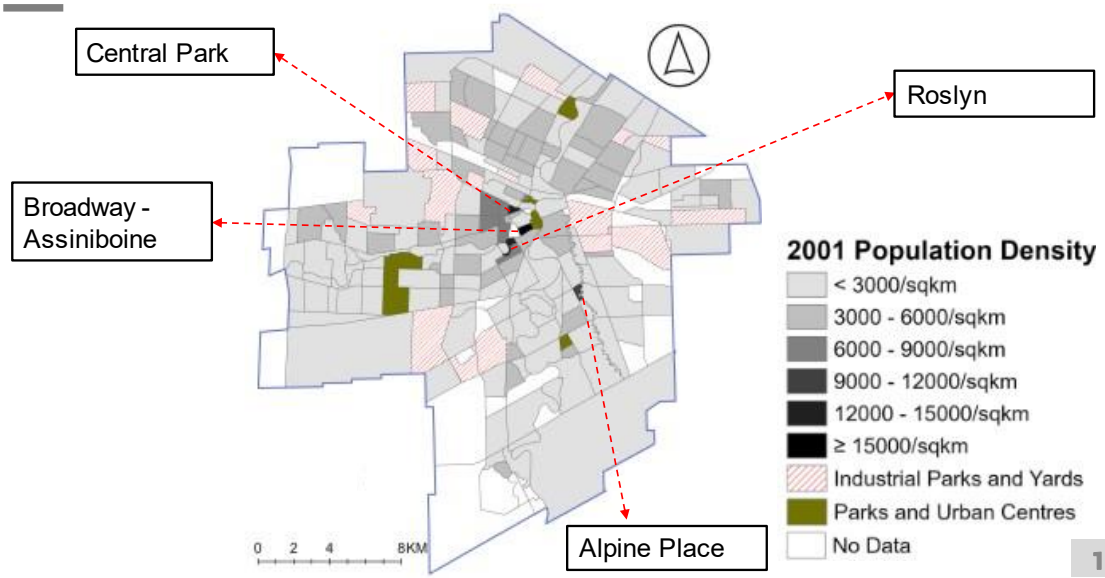
Policy Language in Plans



12

Change in Density 2001



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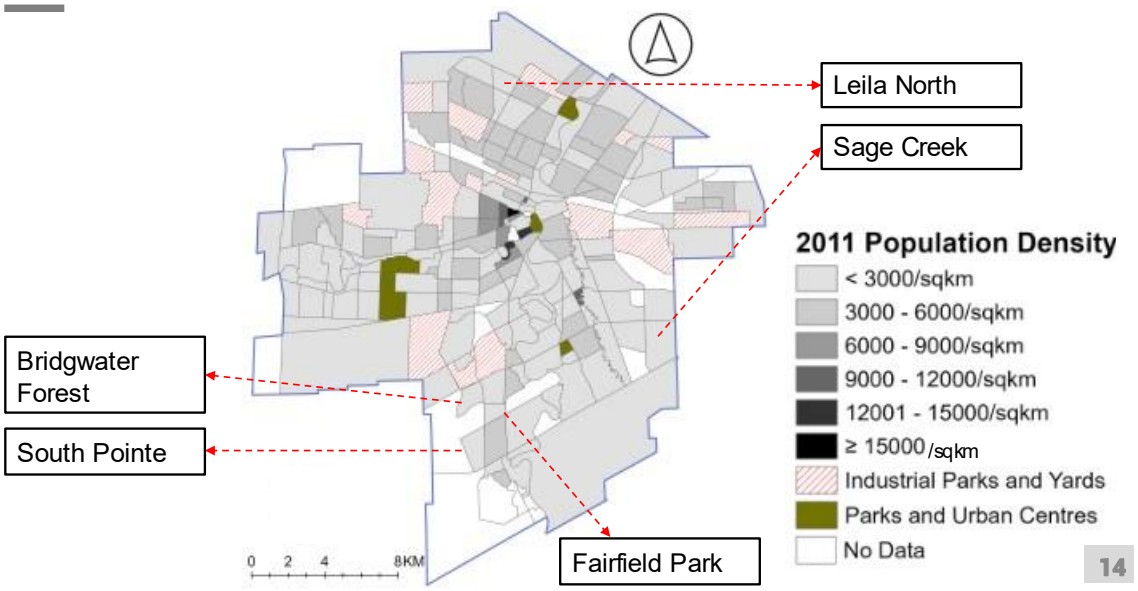
Change in Density 2011



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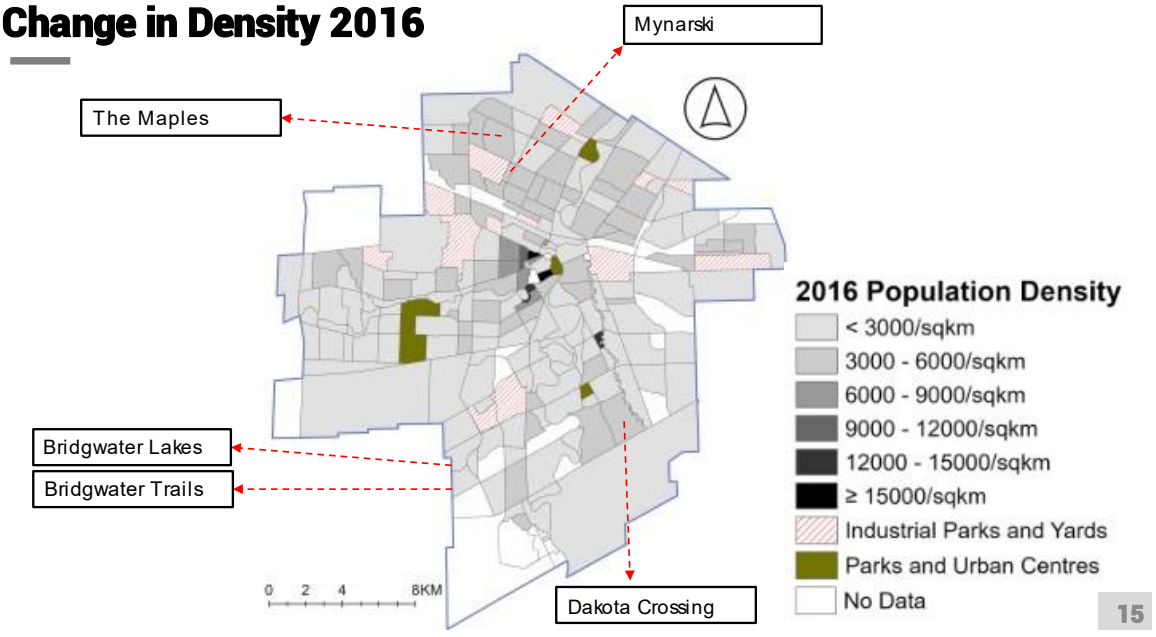
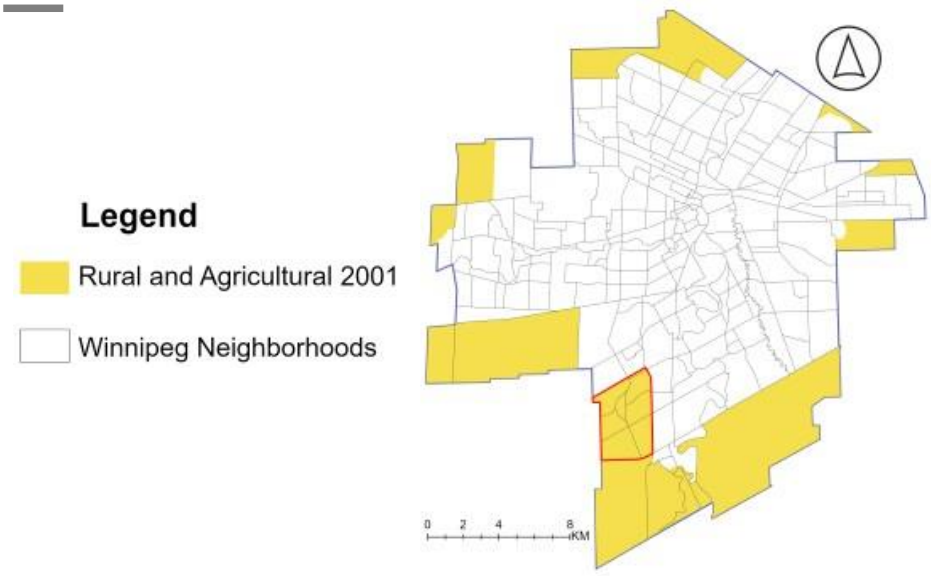
Change in Density 2016



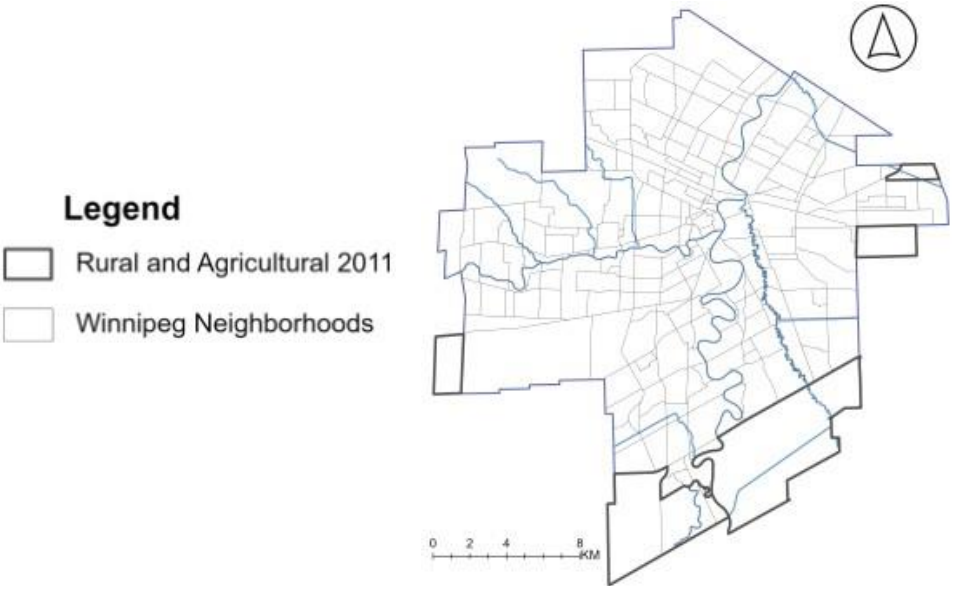
15

Changes in Rural and Agricultural Land (2001)



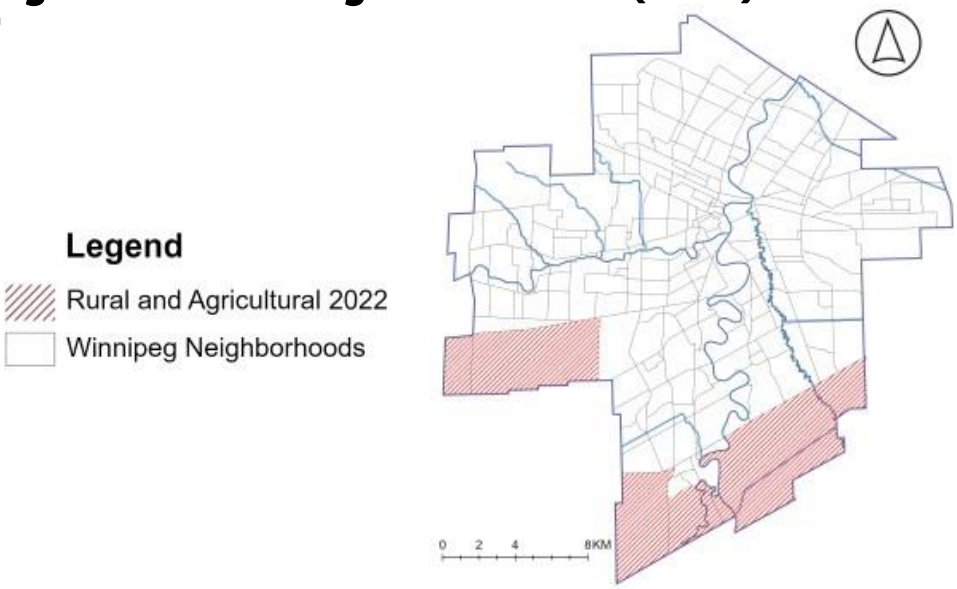
16

Changes in Rural and Agricultural Land (2011) Cont.



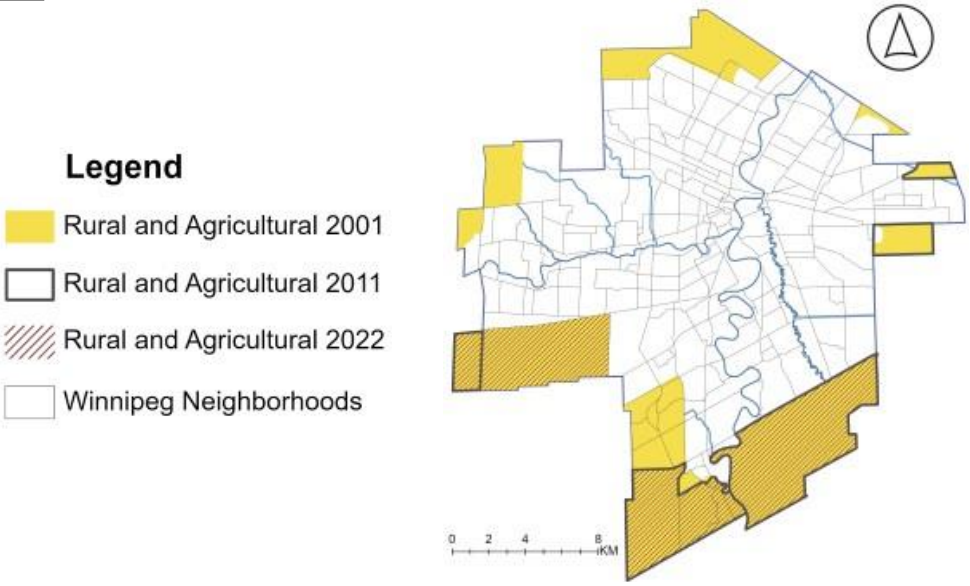
17

Changes in Rural and Agricultural Land (2022) Cont.



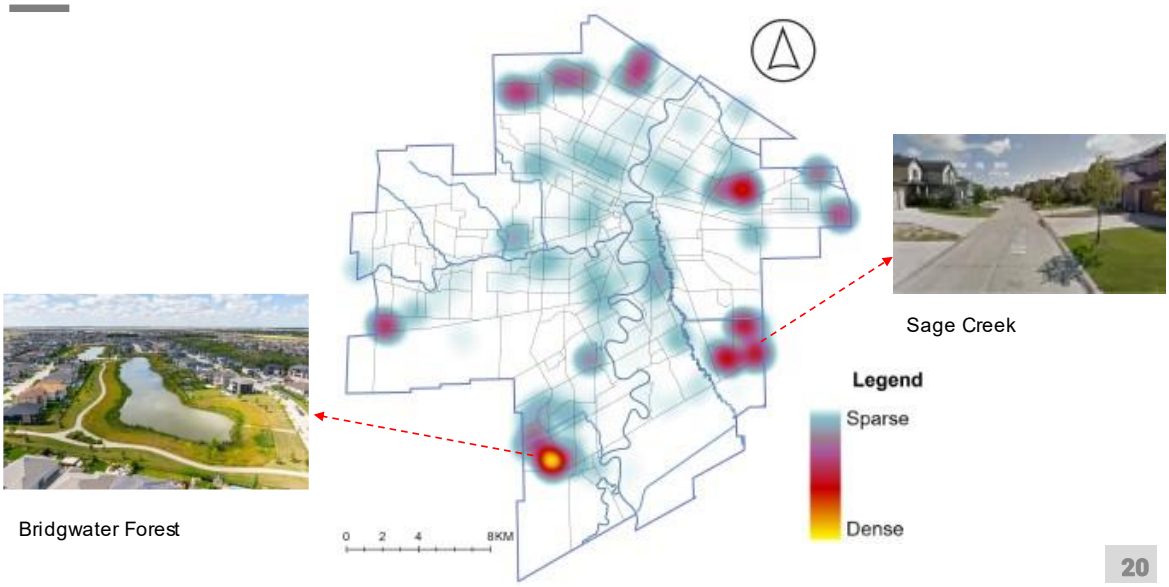
18

Changes in Rural and Agricultural Land Cont.



19

Distribution of Development Permits 2012 - 2022

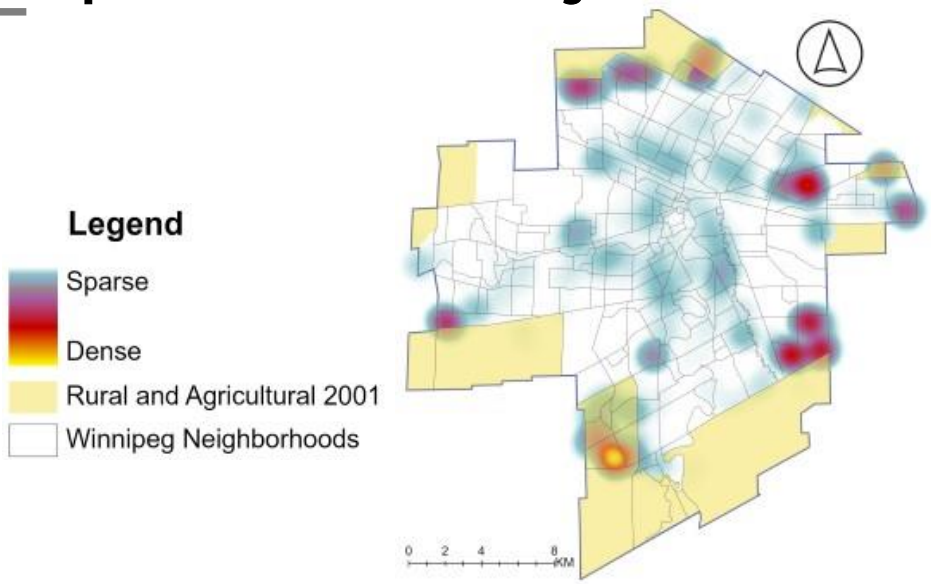


Bridgwater Forest

Sage Creek

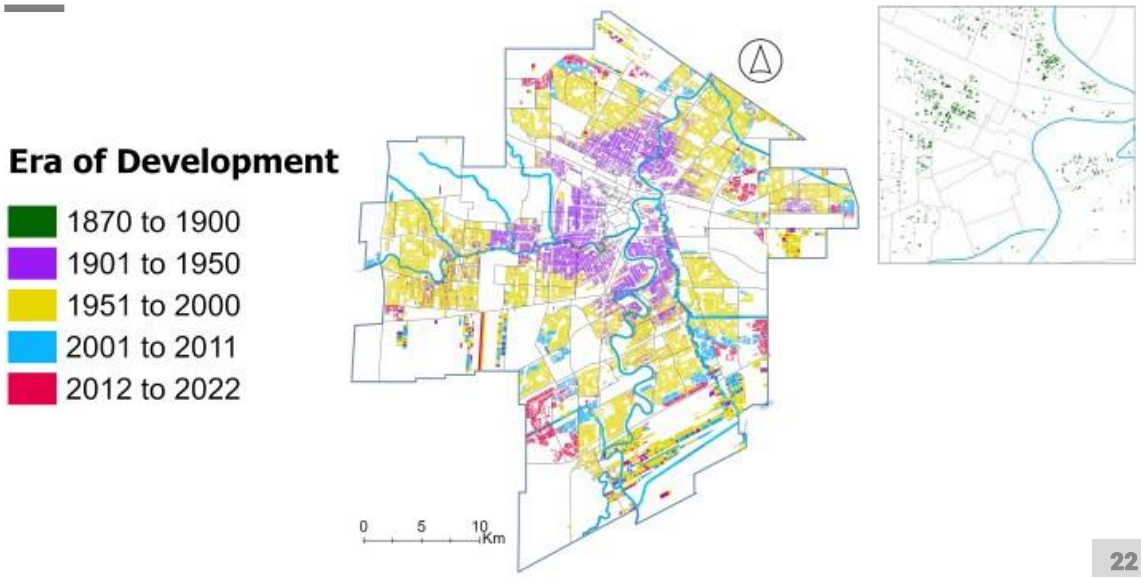
20

Development Permits and 2001 Agricultural Land



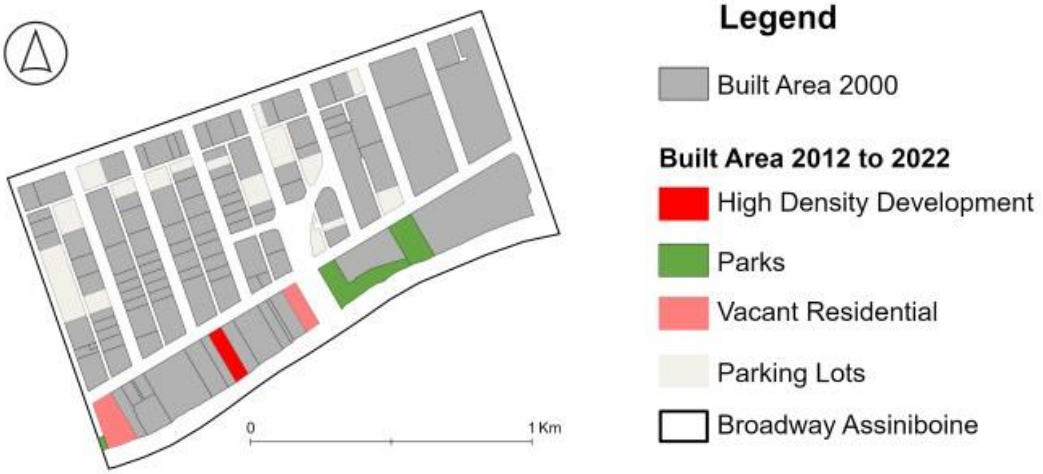
21

Change in Built Form 1870 to 2022



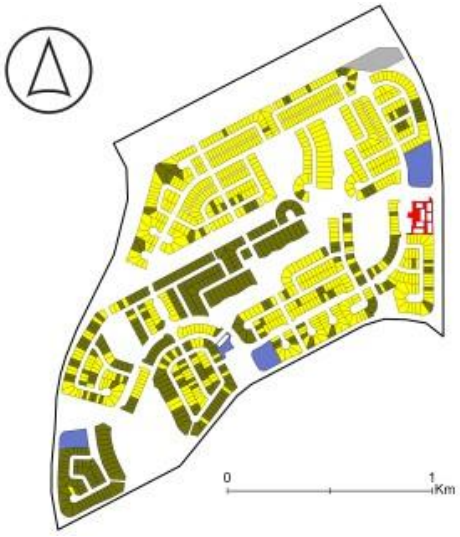
22

Change in Built Form 1870 to 2022 (Broadway Assiniboine)



23

Change in Built Form 1870 to 2022 (Bridgwater Forest)



Legend

Built Area 2000

Built Area 2001 to 2011

High Density Development

Low Density Development

Built Area 2012 to 2022

Low Density Development

High Density Development

Bridgwater Forest

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Convenient Access to Public Transit

Convenient Access to Public Transit

<6 Min. - Very High Convenience

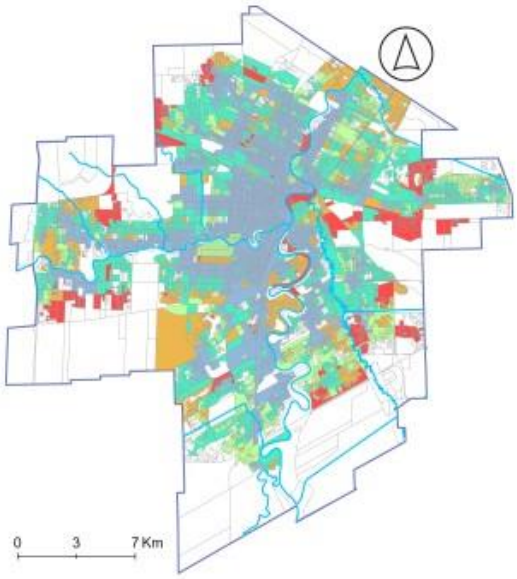
6 - 10 Min. - High Convenience

10 - 15 Min. - Moderate Convenience

15 - 30 Min. - Low Convenience

30+ Min. - Very Low Convenience

No Convenient Access to Public Transit



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Conclusion

- Broad policies result in undesired growth
- Existing neighborhoods did not receive most development
- Policies focused on multiple features of compact urban form
- Reduction in rural and agricultural land

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SCAN ME

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THANK YOU!
28