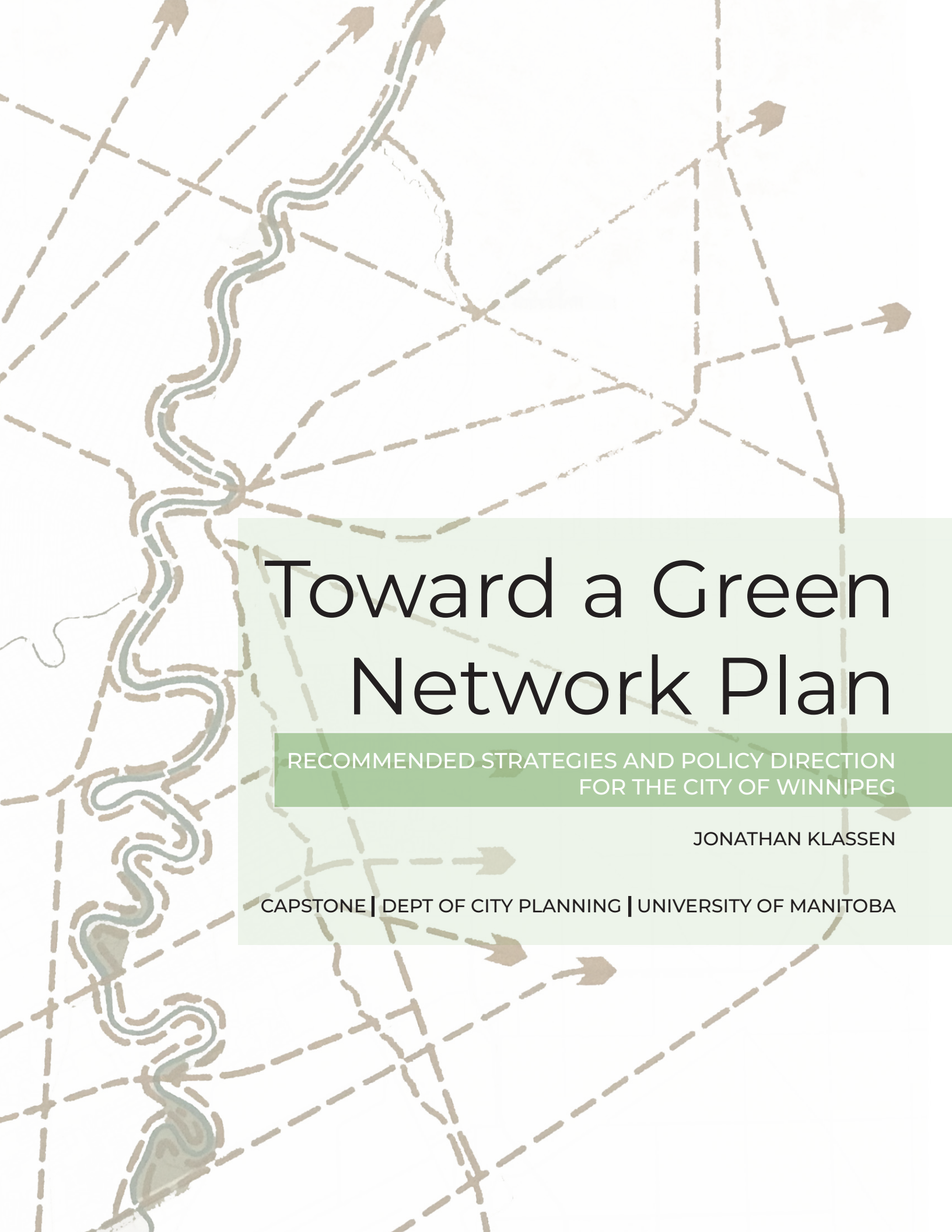

Toward a Green Network Plan

RECOMMENDED STRATEGIES AND POLICY DIRECTION FOR THE CITY OF WINNIPEG

JONATHAN KLASSEN

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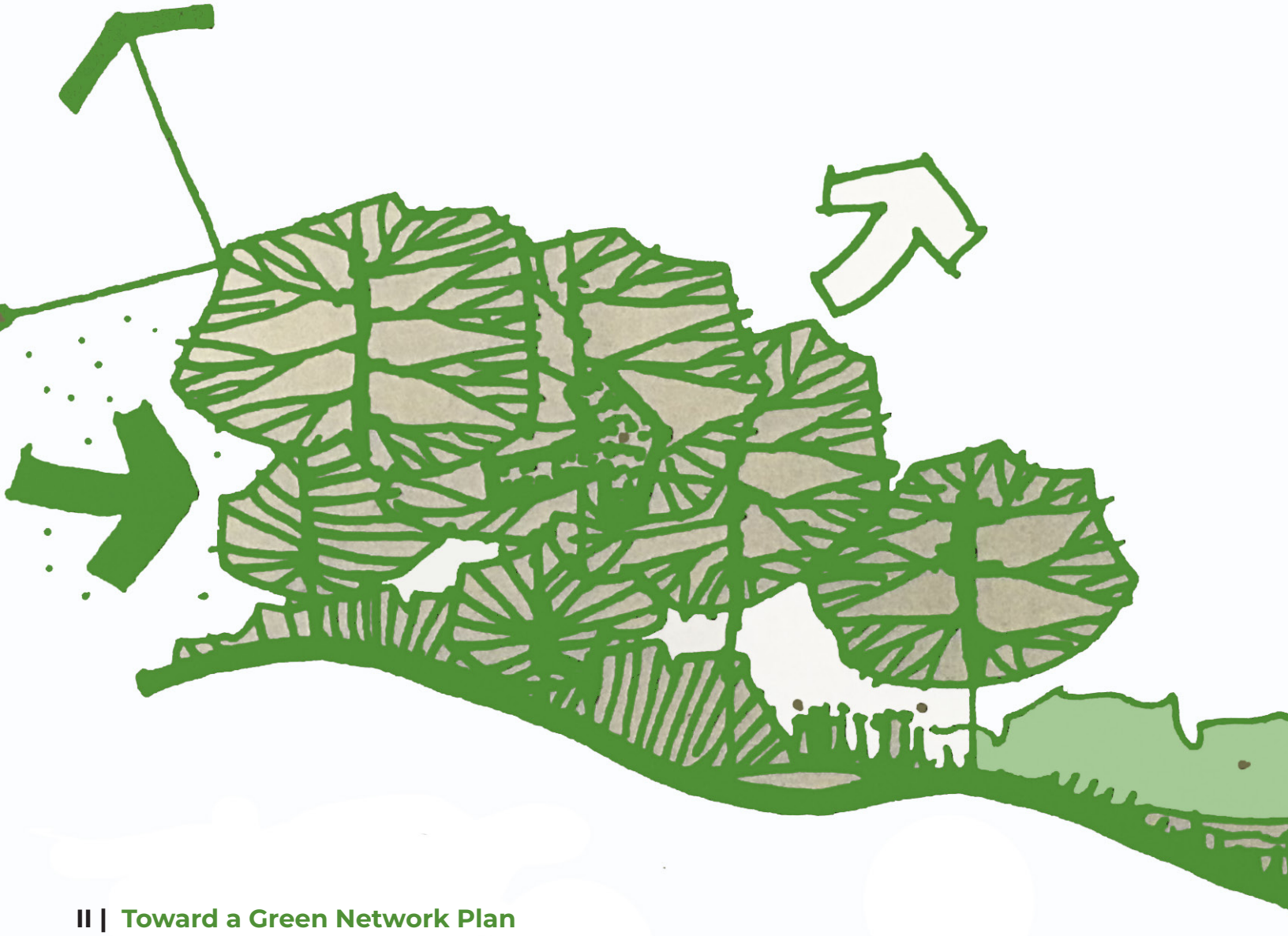

TOWARD A GREEN NETWORK PLAN:
RECOMMENDED STRATEGIES AND POLICY DIRECTION FOR THE CITY OF WINNIPEG

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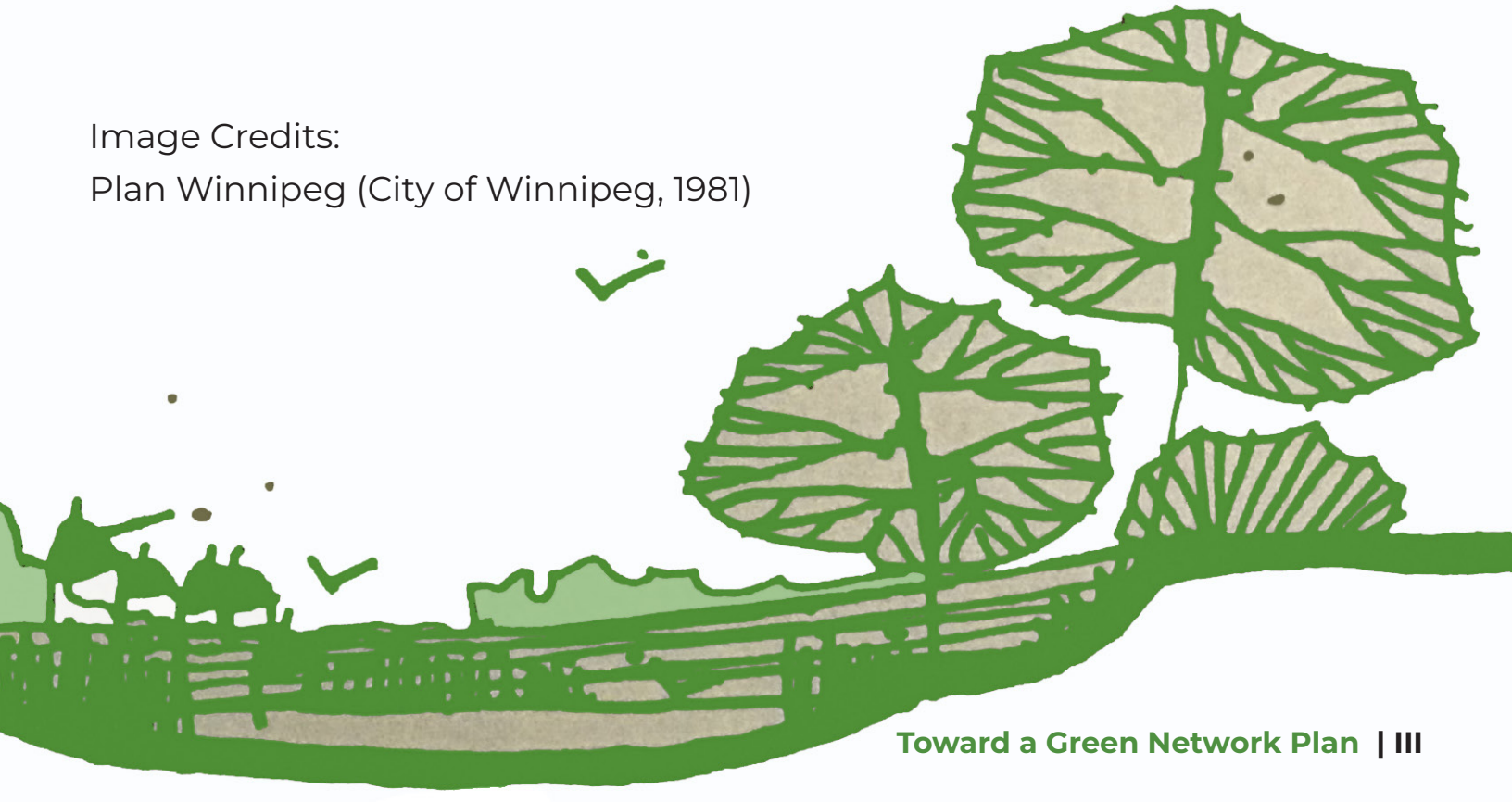
April, 2023

Image Credits:
Plan Winnipeg (City of Winnipeg, 1981)



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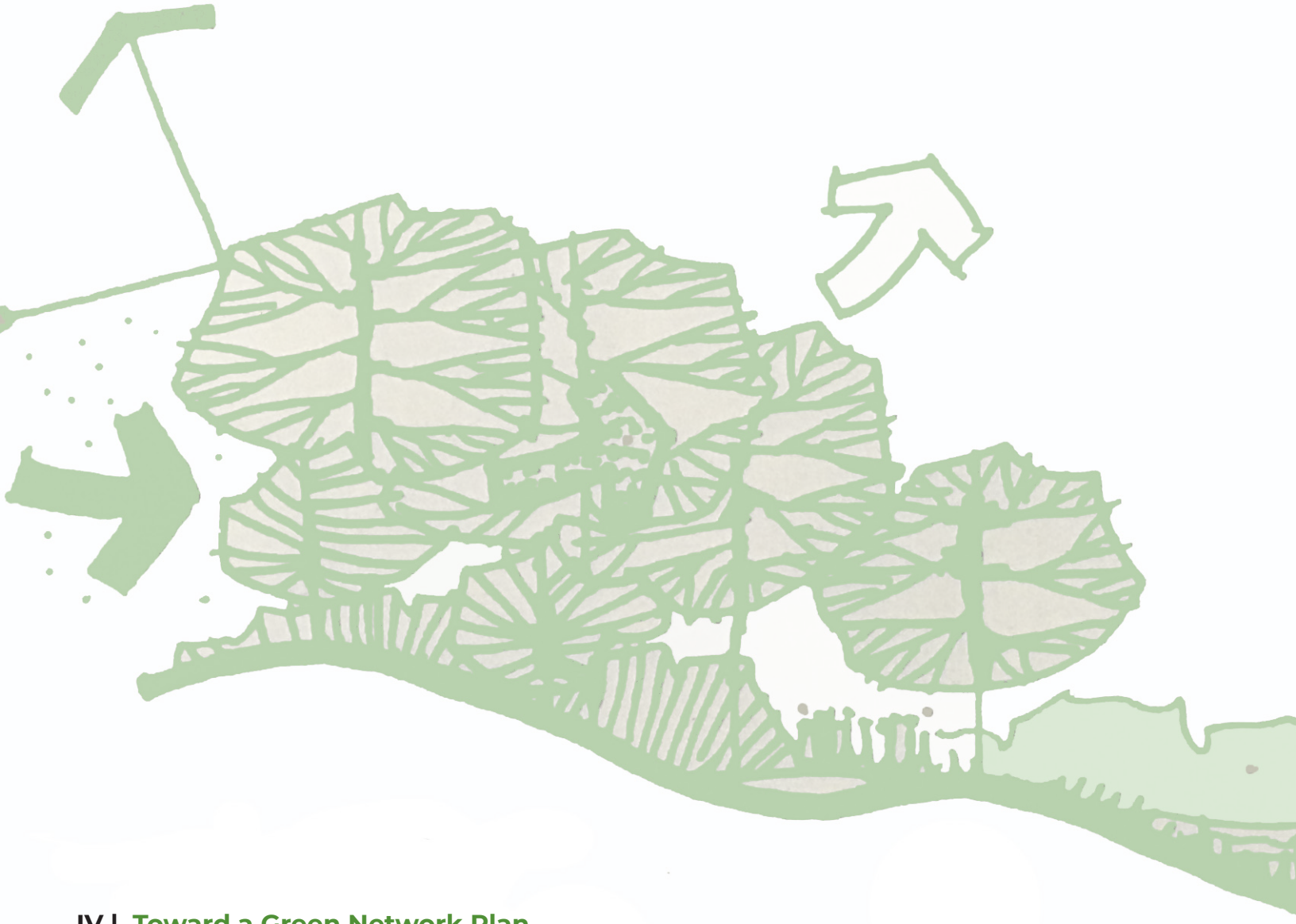


Executive Summary

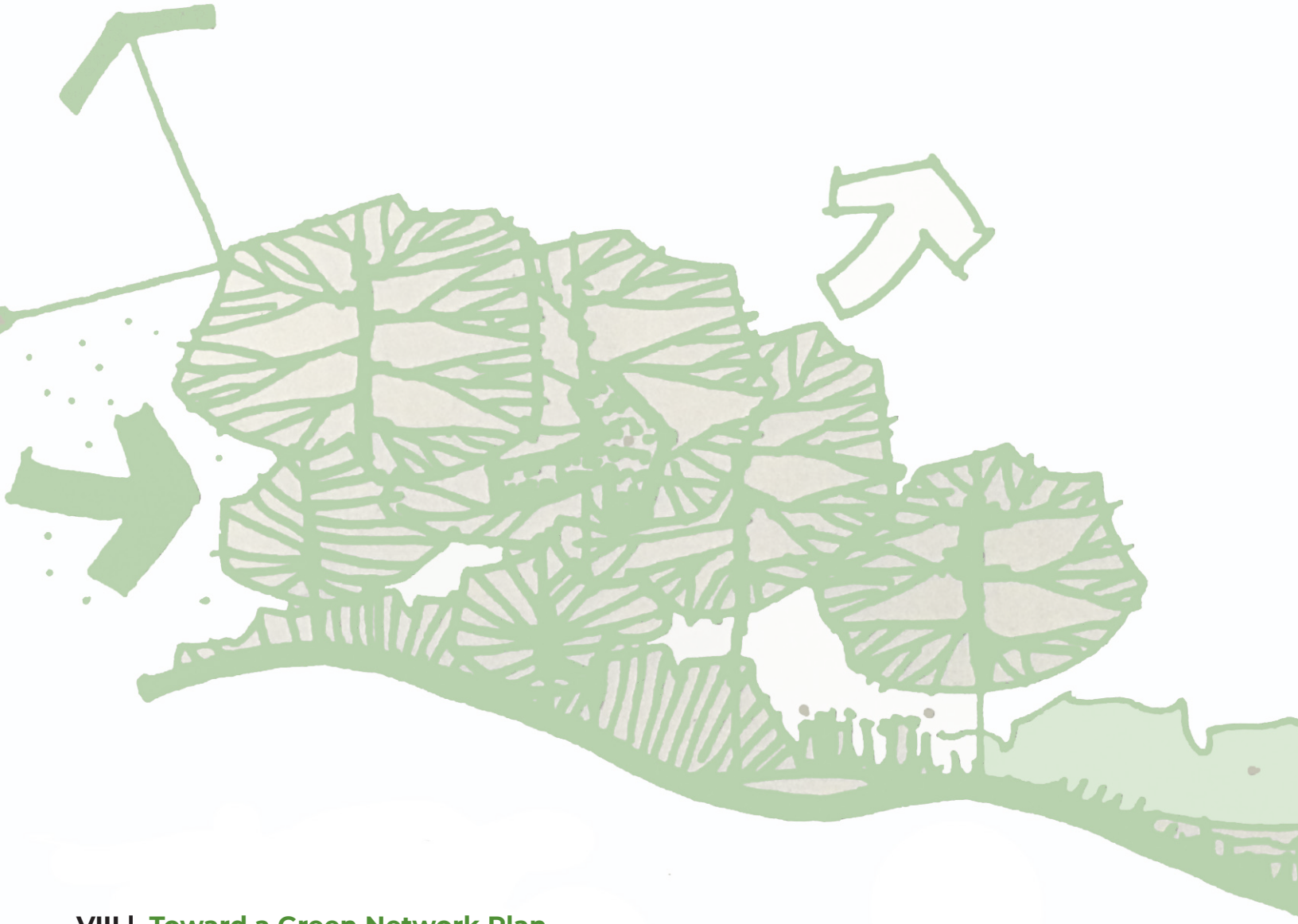
Winnipeg's 25-year development plan, *OurWinnipeg 2045,* directs the City to "create a master green space and natural corridor plan by-law that enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas." This capstone studies planning precedents from Winnipeg's past and recent precedents from elsewhere in Canada to develop recommendations in support of a future master plan by-law. As Winnipeg seeks to strengthen community resilience through its network of green spaces and corridors and ensure a socially, environmentally, and economically sustainable future for citizens, it is vital to understand how the City responded to the changing needs of its communities in the past and to consider ways in which comparable jurisdictions have used green network plans to address similar priorities in our own time effectively. The available existing literature does not address these concerns as they relate to Winnipeg's strategic planning priorities; a gap that this capstone seeks to fill.

The research for my capstone was broadly guided by precedent study, reviewing precedent planning documents to gather data and narrative and analytical synthesis to establish commonalities and themes through a close reading of the planning documents used. The resulting findings reveal that Winnipeg's green network has grown increasingly multi-functional over the course of the 20th century, its form adapting to support active transportation and green infrastructure services in addition to recreational uses and responding to the corridors of the Red and Assiniboine rivers. Additionally, my analysis of green network plans from Halifax, Saskatoon, and Edmonton identifies holistic and sustainable planning approaches as contributing to their effectiveness and notes their active collaboration with Indigenous partners and recognition of cultural landscapes as supportive of reconciliation goals.

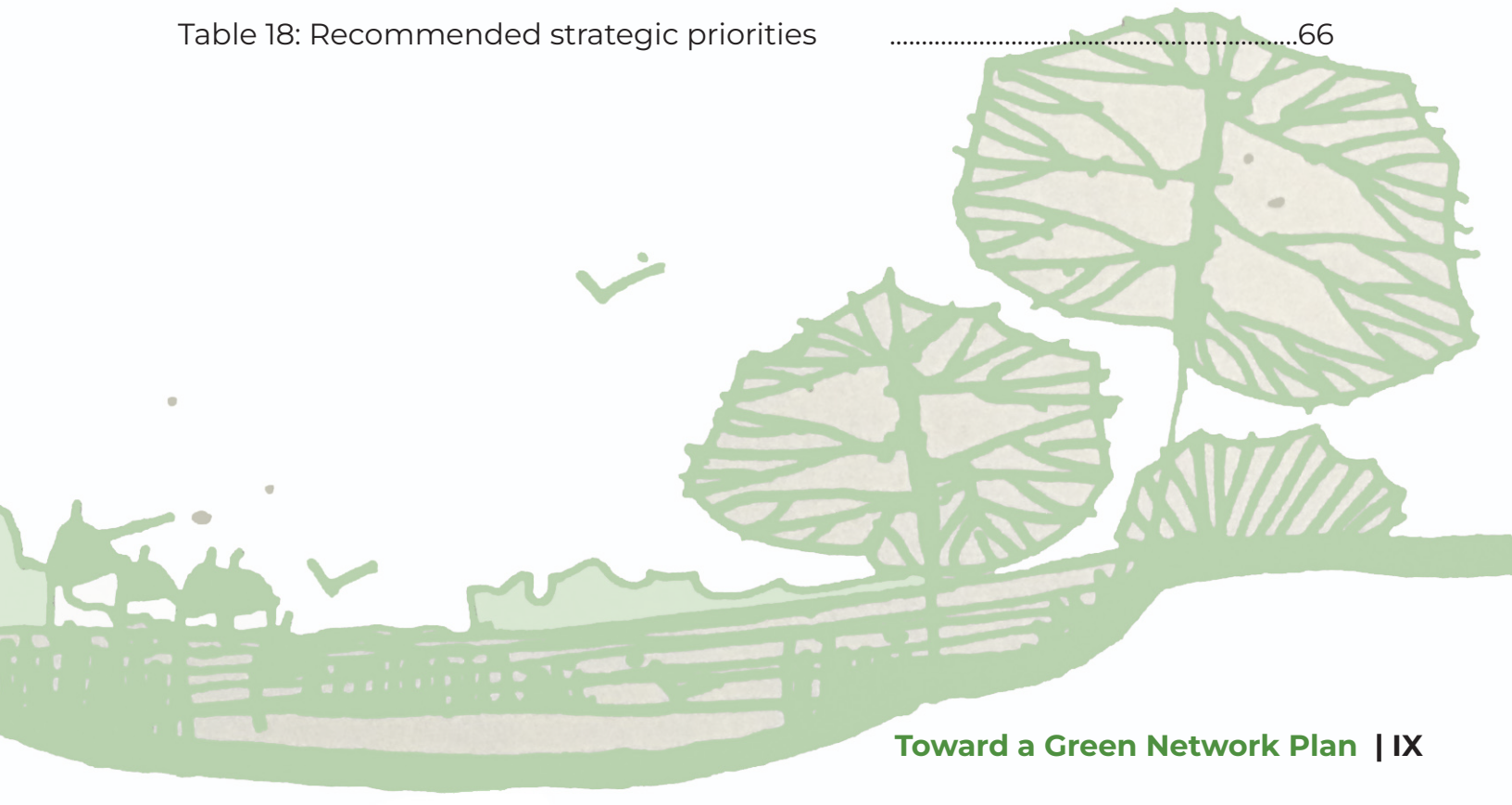
Based on my findings, I recommend eleven strategic priorities and twelve policy directions to the City of Winnipeg to support the development of an effective and successful master green space and natural corridor plan; a plan that reflects the holistic approach identified in green network plans from other Canadian cities, while integrating the lessons from our own past, responding creatively and inclusively to our city's own functional requirements.

Contents

List of Figures



List of Tables



I. Introduction

Cities and regions around the world are re-evaluating their green spaces as they experience rapid urban growth in tandem with climate change and the more extreme and unpredictable weather events it entails. As they do so, the importance of biodiversity for sustainable and resilient urban landscapes is growing increasingly apparent. In response, 21 jurisdictions signed *The Durban Commitment: Local Governments for Biodiversity in 2008*,

> Acknowledge(ing) accountability and responsibility for the health and well-being of our communities through protecting, sustainably utilising and managing biodiversity and recognising its role as the foundation of our existence. (Local Governments for Sustainability (ICLEI), 2008)

Among the signatories and the sole Canadian jurisdiction represented in Durban, South Africa, was Edmonton. In signing the commitment, participating local governments recognized the value of services delivered to their communities by local and regional green corridors and networks that existed, and sometimes persisted against considerable odds, as part of the urban fabric. These services, as enumerated in *The Durban Commitment*,

> Are multi-faceted – including ecological, economic, tourism, recreational, environmental, heritage, stewardship, spiritual, intrinsic, medicinal, nutritional, health, educational, scientific, cultural and social dimensions. (Local Governments for Sustainability (ICLEI), 2008)

While not a signatory to *The Durban Commitment*, the City of Winnipeg is also giving renewed attention to its green network. Winnipeg City Council recently approved an update to its development plan, *OurWinnipeg*, with a policy direction to "create a master green space and natural corridor plan by-law that enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas. [And to] increase quantity of such lands by 1,000 acres that can be accessed for recreation and connection of people with nature, as population growth occurs" (City of Winnipeg, 2022c, p. 23). Further direction in *Complete Communities 2.0*, a city-wide secondary plan, requires, among other things, that a biodiversity policy with accountability modeled on that of *The Durban Commitment* be included in the by-law (City of Winnipeg, 2022b). These new planning priorities align with those of regional authorities like the Winnipeg Metropolitan Region (WMR), whose draft regional plan, *Plan20-50*, includes a commitment to develop a Natural Assets Network Plan to "identify, protect, restore, and enhance" natural systems and use a "holistic approach to foster a multi-functional, integrated network of open space and natural assets"(Winnipeg Metropolitan Region, 2022, pp. 65 & 96). Together, these green network planning priorities indicate a readiness and desire to join cities and regions worldwide in the measures necessary for the urban ecologies upon which our well-being depends.

My capstone responds to *OurWinnipeg 2045*'s policy direction to create a master green space and natural corridor plan and associated direction in *Complete Communities 2.0* and the *Winnipeg Parks Strategy*. While studies supporting the development of new strategic planning documents usually incorporate various forms of research, consultations and similar processes are typically concerned with present-day perceptions and values. Less frequently do they consider perspectives from the last century regarding the desired functions of green spaces and corridors or the forms they should manifest. There are valuable lessons we can learn from the historical analysis of green network planning in Winnipeg, however, that may contribute to the development of more robust policy. Research demonstrates that communities' functional demands influence the design of green spaces and networks (Heckscher, 1977) and that these forms evolve in response to the changing and multiplying expectations assigned to them (Matsuoka & Kaplan, 2008). This capstone considers the historical functions and forms of green corridors and networks in Winnipeg, connecting them to this city's current greenspace and natural corridor planning. It also studies present-day green network strategies adopted by jurisdictions elsewhere in Canada to identify green network planning practices, strategies, and policies relevant to the City of Winnipeg.

Research questions

To structure this inquiry, the following research questions were identified:

- How have the functions of green corridors in Winnipeg changed over time?
- How have the functions of Winnipeg's green corridors influenced their form? and
- How can best practices developed elsewhere in Canada inform Winnipeg's future master green space and natural corridor plan?

Implications of research questions

The City of Winnipeg has experience planning green corridors and networks extending back to recreational leafy drives and parkways conceived in the early 20th century and continuing through schemes and proposals contained in a succession of plans developed and implemented by the Metropolitan Corporation of Greater Winnipeg (Metro) and the City of Winnipeg. Some literature exists that considers the historical forms and functions of green corridors in Winnipeg and their effectiveness in realizing the City's planning objectives in the past and to the present day. This includes reportage and editorials from contemporary news media. Little is available, however, that attempts to broadly analyze the function and form of green corridors and networks in Winnipeg as a whole (MacDonald, 1995), and none of the literature applies this knowledge and experience to the development of the future master green space and natural corridor plan.

Other municipalities in Canada have recently implemented green network plans, notably Edmonton, Saskatoon, and Halifax Regional Municipality, and their applicability to Winnipeg's planning context has not been explored in the existing available literature. They may serve as valuable models, providing best practices to inform the successful development and implementation of a similar plan for Winnipeg.

The study of historical planning precedents from Winnipeg and recent precedents from elsewhere in Canada, jurisdictions that share commonalities with Winnipeg and its surrounding area, is necessary to ensure that a future master green space and natural corridor plan, to which the *OurWinnipeg 2045* commits the City, is effective and successful.

Definitions

For the purposes of this review, the terms "greenspace" and "green spaces" refer to open, vegetated, and natural(ized) areas in otherwise developed landscapes, and "green networks" to systems of green spaces. Green spaces are usually connected by "green corridors" – narrow or elongated linkages facilitating movement (e.g., human, animal, water). In the context of a green network, individual green spaces and corridors serve varied and often overlapping functions and are subject to a range of human influence and use, from minimal to intensive. This usage broadly reflects that of Richard Forman in *Urban Ecology: The Science of Cities* and is compatible with that of the City of Winnipeg's planning documents. The term "natural corridor," also used by the City (City of Winnipeg, 2022c, p. 23), is employed where appropriate as well.

The term "green infrastructure" is used in this review as defined by Benedict and McMahon, namely "natural areas and other open spaces that conserve natural ecosystem values and functions (and) sustain clean air and water" (Benedict & McMahon, 2006, p. 1). Other terms that have been used over time in Winnipeg and other places to describe variations on green corridors and green networks, including "parkway," "greenway," "linkage," "linkage system," and "open space system," are used only when quoting the literature or referring to specific instances or contexts where doing otherwise would be confusing or inappropriate.

Outline

I begin the capstone with a section (II) describing the research methods used to address my research questions; followed by a section (III) reviewing the literature that considers the relationship between greenspace and corridor function and form and that identifies best practices for green network implementation. I continue with a section (IV) outlining the geographical and policy context for planning in Winnipeg; sections (V) describing and (VI) discussing the findings that respond to my first two research questions (*functions of green corridors* and *influence of function on form*), including a review of public expectations of green network functionality

and perceptions of the City's efforts to address expectations through the development of a green network, explored through the analysis of newspaper archives; sections (VII) describing and (VIII) discussing best practices as identified in green network plans from other Canadian jurisdictions.

Finally, following the review of findings from planning precedents and their analysis, I conclude the capstone with a section (IX) providing recommendations supporting the development of the future master green space and natural corridor plan by-law. My recommendations refer to relevant policy direction in *OurWinnipeg 2045*, *Complete Communities 2.0*, and the *Winnipeg Parks Strategy*, and take the form of 11 strategic priorities and 12 policy directions.

II. Research Methods

Process

My research was broadly guided by precedent study, reviewing precedent planning documents from Winnipeg's past and contemporary plans from other Canadian jurisdictions to gather data and address my research questions. I also used newspaper archive analysis to integrate public perceptions and better assess the effectiveness of past Winnipeg plans. To derive meaning from the data I collected, I applied two analytical approaches, narrative synthesis and analytical synthesis, to establish and organize themes through a line-by-line reading of the planning documents used.

Precedent study

My report seeks to make recommendations for the future master green space and natural corridor plan informed by the study of Winnipeg's historical planning context and the broader contemporary Canadian context. With this objective, I chose precedent study as the overall approach best suited to inform the development of Winnipeg's future plan and appropriately flexible to address all three research questions. To undertake my study, I collected data from past Winnipeg planning documents, a digital newspaper archive, and contemporary planning documents from selected Canadian municipalities, analysing the data with synthesis techniques.

The Oxford English Dictionary defines the legal sense of a precedent as "an authoritative example or rule for subsequent analogous cases; a form of a document which has been found valid or useful in the past and can be copied or adapted" ("Precedent, n.," 2023). When applied to research, precedent study is a means of sourcing and considering exemplars that "provide[s] inspiration and help with the justification of an idea" (IGI Global, n.d.). Reliance on available knowledge in this way is an efficient approach to plan development that accommodates a more limited scale and scope of data collection than is typically required for case studies while being more conducive to generalized findings (Howard, 2003; Olmsted, 1871). Weddle and Neveu suggest that while in architectural theory and design precedent studies usually connect existing models, precedent studies also offer the potential to relate current design processes (Weddle & Neveu, 2011).

Newspaper archive analysis

The digital archive of the *Winnipeg Free Press* contains records of the decisions and activities of municipal governments and planning departments relating to the city's green spaces and networks for the past 150 years, and those of *The Winnipeg Tribune* do so for much of that period as well. Both newspapers also record

editorial and public perceptions of Winnipeg's green network while reflecting changes in sentiment over time. Besides straightforward reporting on municipal politics and greenspace planning, Winnipeg's newspapers, accessed through the digital archive *NewspaperArchive.com*, provide nuanced and varied views on these and other municipal concerns. While they are limited in the amount of relevant information they contain, they are significant as being among the few available sources for the history of local greenspace planning initiatives outside of physical government archives. The process of searching through the vast quantity of data in digital newspaper archives is described by Krippendorff as "text mining." The user has a reasonable expectation of obtaining relevant information, even though the "evidence needed to answer a research question is scarce and hidden beneath a huge mountain of irrelevant matter" (2019, p. 16).

Analytical approach

I relied on a document analysis approach for my research, applying two data synthesis techniques, narrative and thematic synthesis, to my subject planning documents. Using a structured format, narrative synthesis organizes planning documents into more homogenous groups (Barnett-Page & Thomas, 2009). This technique is often used to report document characteristics, assess document quality, explain document context, and examine the differences and similarities among planning documents (Lucas et al., 2007). In my capstone, I used narrative synthesis to organize documents by year of publication, jurisdiction, type, and thematic content.

Thematic synthesis is similar to narrative synthesis in that both approaches present the results in text format and, in practice, may lead to similar findings (Lucas et al., 2007). However, while narrative synthesis can reveal "… the scope of existing research and account for the strength of evidence" (Lucas et al. 2007, 1) and "… make transparent heterogeneity between studies" (Barnett-Page & Thomas, 2009, p. 3), thematic synthesis is suitable for identifying commonalities shared by planning documents, generating findings and supporting their evaluation. The strengths of the two methods complemented each other and allowed me to consider the relationship between function and form in Winnipeg's historical planning context, identify commonalities in green network planning approaches in other Canadian contexts, and evaluate my findings to support the development of recommendations for the future master green space and natural corridor plan.

Through the line-by-line reading of planning documents and using thematic synthesis as an analytical approach, I established themes pertaining to my research questions. This approach was in line with that developed by Thomas and Harden and followed three steps: the free line-by-line coding of findings from development plans and other strategic planning documents; the organization of free codes into "descriptive themes;" and the development of "analytical themes" (e.g., inflexibility of form, rivers and greenbelts; or,

holistic approach to planning, sustainability as a central concept, etc.) (2008, p. 4).

Like Thomas and Harden, I also structured codes non-hierarchically, developing a "bank" of codes and adding to it as terminologies changed from one planning document to the next (2008, p. 5). This reflected a coding process that was initially deductive, using codes derived from policy direction in *OurWinnipeg 2045* (e.g., "green space," "corridor," park"), then becoming inductive as I added codes to my bank that were specific to the contexts of the various selected planning documents (e.g., "open space system," "linear park").

Precedent selection

As noted in the Introduction, *OurWinnipeg 2045* directs the City to create a master green space and natural corridor plan by-law that:

> Enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas and systems year-round, to support the environment, advance climate change adaptation and mitigation,… access for recreation, social interaction, active living and connection of people and nature with nature, as population growth occurs. (City of Winnipeg, 2022c, p. 23)

The scope entailed by this policy direction for a future plan is inclusive and broad and suggests an approach to reviewing green space and natural corridor plan precedents that focuses on those operating at the system or network level. Because *OurWinnipeg 2045* also directs that the future plan be statutory, with ostensibly greater authority to guide municipal planning processes (e.g., complementing and filling gaps existing in the development plan, realigning subordinate planning documents), statutory plan precedents are also of particular interest.

For this reason, to respond to my research questions relating to the change in function and form of Winnipeg's green corridors over time, I selected statutory development plans as precedents whenever possible (the by-law status of earlier plans is unclear). Further criteria that I used to establish my selection of past Winnipeg development plans included: status as major multi-year planning initiatives; representation of various planning eras throughout the City's history; and the presence of objectives and policy that pertain directly to green corridors or networks, regardless of function or the terminology used to describe forms. My selection of past Winnipeg planning documents includes those created for the City of Winnipeg, the unincorporated Greater Winnipeg area, and the Metropolitan Corporation of Greater Winnipeg (1961-1971), all of which concern a roughly similar geographical area. All but the earliest *City Plan* were approved by their respective councils and at least partially implemented.

Jurisdiction	Year	Plan	(Component)	Planning authority
City of Winnipeg	1914	*City Plan*		Greater Winnipeg Plan Commission
	1928-1944			Special Committee on Town Planning and Zoning Board
City of Winnipeg; Greater Winnipeg area	1947	*Metropolitan* (or *Comprehensive*) *Plan for Greater Winnipeg* (Comprised of 9 master plan reports published between 1944 and 1949)	*Preliminary Report on Neighbourhoods:* *Part of the Metropolitan Plan for Greater Winnipeg*	Winnipeg Town Planning Commission; Metropolitan Planning Commission of Greater Winnipeg
	1948		*Preliminary Report on City's Appearance:* *Part of the Metropolitan Plan for Greater Winnipeg*	
	1950		*Summary of Recommendations: Comprehensive Plan for Greater Winnipeg*	
Metropolitan Corporation of Greater Winnipeg	1968	*The Metropolitan Development Plan*		Metropolitan Corporation of Greater Winnipeg: Planning Division
City of Winnipeg	1981	*Plan Winnipeg*	*Parks and Recreation Component*	City of Winnipeg: Planning, Property & Development Department
City of Winnipeg	2001	*Plan Winnipeg 2020 Vision*		

Table 1: Precedent Winnipeg development plans.

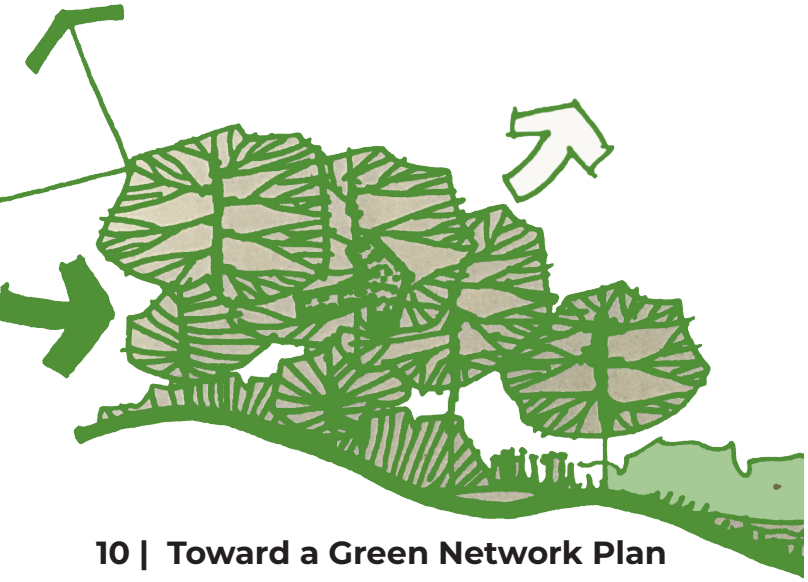
In response to the final research question relating to best practices developed elsewhere in Canada, I selected planning documents from elsewhere in Canada that:

- Plan for green spaces and natural corridors as systems or networks;
- Were developed and implemented by municipalities broadly similar in size and climate to Winnipeg;
- Are current and exist in comparable provincial planning contexts to that of Winnipeg; and
- Approach greenspace and natural corridor planning holistically, integrating ecological, cultural, recreational, and green infrastructure priorities into a single planning framework.

Few planning documents address all these criteria and, unlike the statutory plans selected from Winnipeg's planning context, none are statutory. Nonetheless, the selection, representing strategic plans from Edmonton, Saskatoon, and Halifax, comprises comprehensive plans that provide concrete direction guiding land use and the development of green networks across their respective jurisdictions.

Jurisdiction	Year	Plan	Type
City of Edmonton	2017	*Breathe: Edmonton's Green Network Strategy*	Strategic Plan
Halifax Regional Municipality	2018	*Halifax Green Network Plan*	Municipal Priority Plan
City of Saskatoon	2020	*Saskatoon's Green Infrastructure Strategy: Toward an Interconnected Green Network*	Strategic Plan

Table 2: Precedent Canadian green network plans.



III. Literature Review

The landscape design and urban and regional planning literature from the past century and a half reveals an evolution in the prevalent roles assigned to urban green spaces. 19th-century theorists and designers advocated providing an increasingly urbanized working class with greenspace as a venue for recreation and moral improvement, accessibility being a necessarily associated principle (Howard, 2003; Olmsted, 1871).

To fulfill the functions assigned to them by early practitioners, green spaces were conceived of in the context of green "systems" or networks, facilitating accessibility and mobility. Designed into these networks as requisite connecting elements were linear green spaces. The broad greenspace types represented by networks and corridors have proven resilient over the intervening decades. As forms, they have adapted successfully as outward urban expansion accelerated through the 20th century and the management of sprawl and protection of ecologically sensitive areas became the concerns of those responsible for creating and managing greenspace. They continue to adapt today, even as governments and the public expect increasingly flexible and multi-functional green spaces that respond more effectively and sensitively to the diversity of contemporary society, historical injustices to Indigenous peoples, pandemics, and the effects of climate change.

A review of the relevant literature is beneficial to aid the analysis of historical greenspace planning precedents in Winnipeg and green network best practices from elsewhere in Canada. The review is organized around the following questions:

- How have the functions of green corridors changed over time; and how have these changes influenced their forms?
- How can best practices developed elsewhere inform the future green space and natural corridor plan?

Functions and form

Accessibility to containment

Before the second half of the 19th century, large public green spaces were unusual in Canada and the United States. Frederick Olmsted was a notable early advocate for their establishment in North American cities and among the first to approach their planning as a distinct professional discipline. Olmsted promoted "parks and parkways" as a means to structure a city's growth and predicted that a large park "fairly well managed" near a city would soon become its centre (1871, p. 24). Parkways, informal elongations of the park (often very wide), would radiate from the park, connecting it to existing and future parts of the city and branching in such

a way that everyone in the city would have accessible recreation within a few minutes walk. Many greenspace and corridor types common to Olmsted's designs, like the pleasure drive, addressed public recreation as the primary function, but aesthetic responses to existing natural landscapes also inspired greenspace forms (Walmsley, 1995).

Herbert Hoyt understood green corridors as a necessary expression of the most influential functional demand of the era, as he perceived it. In *The Structure and Growth of Residential Neighbourhoods in American Cities*, he argued that the form of a city, including its open spaces, was primarily determined by the dominant transportation mode at the time of its growth. Around the turn of the 20th century in areas with flat open topography, most growth was therefore axial and adjacent to routes served by street railways. Fashionable neighbourhoods were established in a similar way around carriageways, leading from urban centres to parks via connecting boulevards lined by shade trees. As the decades passed, these green corridors were frequently extended to serve the greater range of automobiles (Hoyt, 1939).

Accessibility and facility of movement remained functional priorities for Ebenezer Howard, but he reasserted public recreation and wellbeing as primary objectives of urban greenspace and added an agricultural role. In *Garden Cities of To-morrow*, he imagined a city of concentric rings that combined the advantages of urban and rural life. The "garden city" was organized around a central park providing recreation and linked to the surrounding regions by tree-lined boulevards. A grand avenue "form[ed] a belt of green, three miles long" (Howard, 2003, p. 105) midway between the central park and the city's edge, where a final ring of garden allotments and dairies constrained the further growth of the garden city.

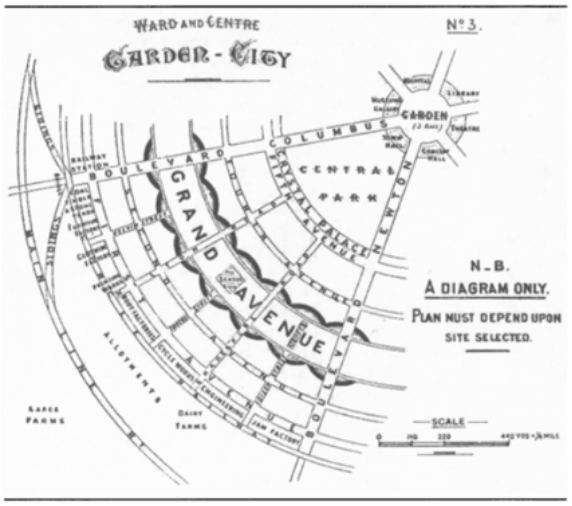


Figure 1: Section of Howard's "Garden City," showing greenspace elements (2003, p.105).

The notion of containment as a primary function of greenspace was later rejected as untenable by urban theorists like William Whyte, especially when apparently arbitrary in form and without reference to natural features or topography. Whyte argued in *The Last Landscape* that greenspace must have a positive function, providing people with something to do or at least something to see. When people are intimately familiar with green spaces and enjoy them, they become invested in them and will advocate for them. Addressing arbitrary greenspace forms, Whyte insisted that they should be "tightly drawn" with boundaries following the idiosyncrasies of the landscape and its waterways to be successful (1968, p. 162). Wasteful land use planning has often resulted in scanty, untidy remnants of natural landscapes, but there is a "good side" to this mess,

according to Whyte. “It is disciplining us to do out of necessity what we have refused to do by choice” (1968, p. 1). Working with a tighter, more constrained pattern of spaces, as is increasingly necessary in developed urban environments, results in more efficient programming of open spaces.

Canadian context

Whyte’s critique of containment as the functional objective of greenspace was confirmed by Gordon and Scott in their case study of Ottawa and the National Capital Greenbelt (NCG), which, like many others, was established to shape urban form and limit the expansion of suburbs. While the NCG had some success at achieving its first objective, it failed at the second, with expansion continuing uncontrolled. Greenbelts, wide green corridors surrounding urban areas, were more successful in Ottawa and else-where in providing extensive, contiguous, and accessible landscapes capable of delivering valuable functions (Gordon & Scott, 2008). Greenbelts have allowed access to recreation and active transportation, supported food security by protecting agricultural landscapes, and encouraged coherent development patterns. Rather than constraining development, however, growth typically leap-frogs protected areas, resulting in longer, polluting commutes (see *Figure 2*). Greenbelts also fail to adequately protect natural features when they ignore the contours of the landscape and interrupt the functioning of ecological systems (Gordon & Scott, 2008).

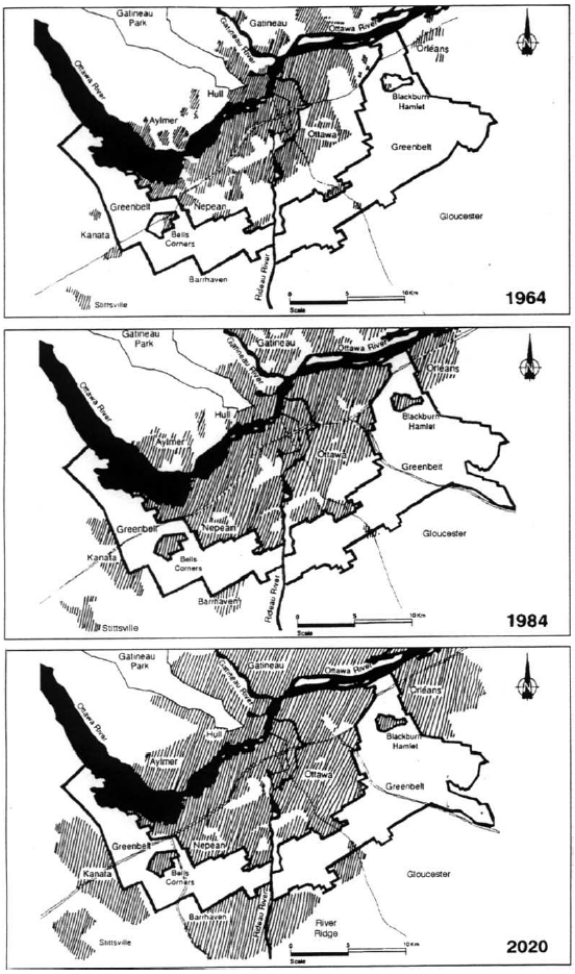


Figure 2: Sequence of maps shows how the National Capital Greenbelt failed to constrain Ottawa’s outward growth (Erickson, 2004, p. 210).

Ottawa’s example is encouraging, Donna Erickson suggests, as it demonstrates that where connected green spaces remain from earlier, less successful greenspace planning schemes, they can be retrofitted. Through a case study of Ottawa that included interviews with planning officials and site visits, she showed how environmental and recreational functions have increasingly been privileged over motorized transportation. Intact ecological corridors and riparian landscapes within the greenbelt have been enhanced and the network of green corridors within the historical urban area has proven adaptable to new priorities, including active transportation and green infrastructure services like water treatment and source protection (Erickson, 2004).

The changing approach to greenspace design in Ottawa reflects a broader trend in Canada, Taylor et al.

suggest. Their case studies of green networks (described as "urban greenway systems") in Calgary, Saskatoon, Ottawa, and Toronto "demonstrate an evolution from an urban design approach that attempted to impose both landscape form and land use function to an ecologically based planning approach that addresses natural factors [and] connections between natural and urban systems" (Taylor et al., 1995, p. 1). Toward the end of the 20th century, green network planning took an increasingly holistic approach, with greater public participation and emphasis on sustainability even as government funding for greenspace decreased and alternatives to direct ownership were sought. Green network forms grew increasingly complex and organic as their intended functions changed and broadened in scope (see *Table 3*).

City	Year	Green corridor/ Network name	Authority	Functions	Form
Ottawa	1950	The National Capital Greenbelt	National Capital Commission	Prevent urban sprawl and development of agricultural land; Reserve building sites for future government and institutional use; and Contain urban growth in an area efficient and affordable to service.	Green belt
Calgary	1976	Fish Creek Provincial Park	Province of Alberta, City of Calgary	Protect environmentally sensitive areas (vegetation, wildlife habitat and movement) and cultural heritage features; and Serve recreational uses.	Green corridor of connecting nodes and links
Saskatoon	1981	The Meewasin Valley	Meewasin Valley Authority	Maintain and upgrade the health of the river and river valley system; and Provide recreation and education opportunities, where appropriate.	Green corridor connecting eight rural and urban nodes
Toronto	1992	Greater Toronto Bioregion greenway concept	Royal Commission proposal - not fully implemented	Support the resilience and sustainability of natural, physical, economic, social, and cultural environments.	Arterial greenways forming a regional network with local community connectors

Table 3: Canadian green corridor and network models (Taylor et al., 1995).

Notwithstanding the examples above, few available academic studies relate function to form in a specifically Canadian context. This absence in the literature raises questions about its general applicability when considering green spaces and networks in Canadian cities, including whether historical and political peculiarities, climate extremes, geographical isolation, or other factors exerted unique influences on Canadian

green networks, causing their forms to diverge from those prevailing elsewhere, particularly in the United States.

Ecological priorities

In *Open Spaces as Context for Urban Life*, August Heckscher claimed to describe cities as they are rather than as abstract concepts, relying for support on numerous case studies of American cities. According to Heckscher, the spatial uniqueness of a city is determined by its pattern of built elements and void. These absences of development, whether parks, woodland, water courses, or otherwise, function as a structural framework toward which neighbourhoods orient. In this model, green spaces provide the context in which all urban functions are performed. As a result, they not only define the city's form but reflect the values and nature of its communities and the compromises that occur as a part of political processes (Heckscher, 1977). Heckscher nevertheless rejected greenspace design that disregarded the integrity of natural landscapes, understanding green networks as the "interpenetration of urban and rural elements." He observed that "respect for topography was one factor leading beyond the traditionally conceived park."

> If the underlying bones of the urban form were to be kept visible, if its natural assets were to be captured for recreation, green was the colour to be applied literally to the map. The green would run along shore and ridges, touch hilltops and the steeper slopes, spill over into wetlands. That evolution tended toward open spaces linked by corridors of green. (Heckscher, 1977, p. 192)

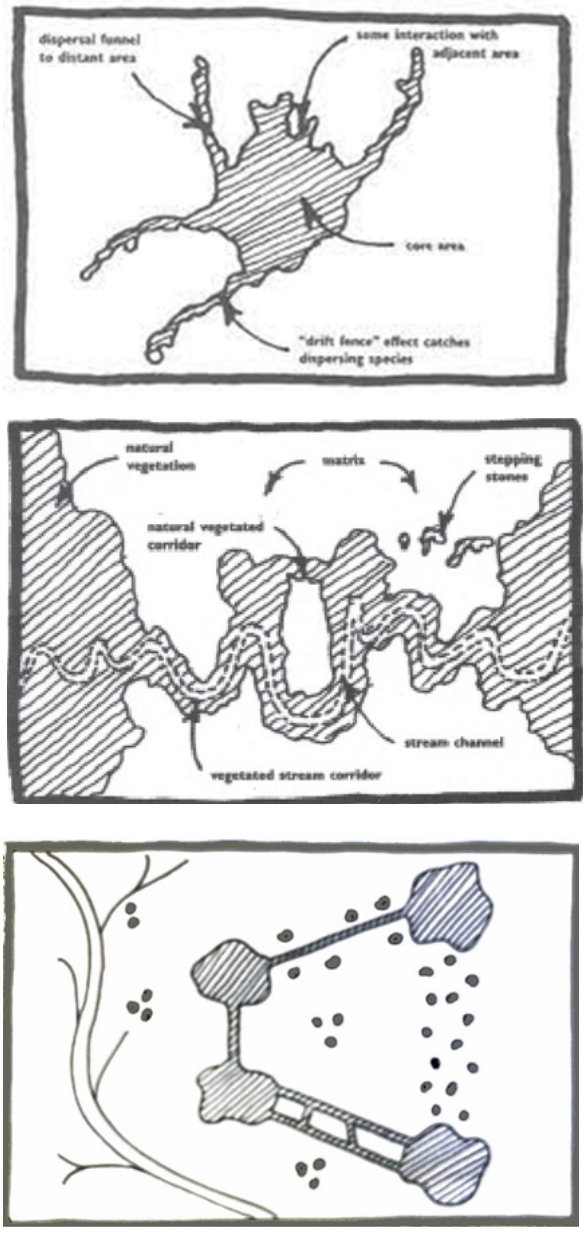


Figure 3: Drawings by Forman illustrating: (Top) Ecologically optimum patch shape; (Middle) Loops and alternative corridors; (Bottom) Patch, corridor, matrix model (Dramstad, et al., 1996).

Two decades later, Michael Hough argued that natural landscapes in urban environments arise in spite of and in contestation with city building, whose forms are guided by economic imperatives rather than environmental or social ones. Contemporary urbanism, according to Hough, is inclined to degrade the uniqueness of natural and cultural landscapes. This makes the "fortuitous products of natural and cultural

forces" that thrive without significant maintenance or attention even more socially valuable (Hough, 2004, p. 2). They may often be less costly than past efforts to shape urban landscapes in North America, as well. In *Cities and Natural Processes*, Hough advocates for greenspace planning that works with natural processes to shape urban environments, representing a new, integrated approach to design that prioritizes environmental and social sustainability. Such an approach would necessarily restore and enhance continuity in the landscape, repairing the disruptions to biodiversity and ecology common in urban environments (Hough, 2004).

Biodiversity and the ecological roles of urban green spaces receive similar attention from Richard Forman, who describes the forms most suitable to effectively fulfill these functions. Forman uses a land mosaic model for analysis, whereby all urban and rural landscapes are understood as mosaic-like compositions of patches—wide areas varying in type and size, distinct from the broader context, or matrix—and corridors, which are narrower, straight or convoluted, and typically supporting movement. Corridors typically form networks, which may be dendritic, tree-like networks, often corresponding to watercourse patterns; rectilinear networks, often formed by roadways; and anastomosing patterns common to trail networks and railways. Patches and corridors alike typically have well-defined edges that constrain and guide movement. Forman argues that the optimal format for a functional green network sustaining relatively high biodiversity is an "emerald network" of large green patches connected by corridors (2014). While representing ideal forms for supporting plant and animal habitats and movements, their ability to accommodate the inevitable human activities of urban landscapes is not always evident. Erickson, in *MetroGreen: Connecting Open Space in North American Cities*, reframes Forman's patch, corridor, and matrix model as one of hubs, sites, and links. This alternative model not only relates green spaces to each other, but also to people, and applies to the varying degrees of naturalness and diverse land use contexts of North American cities. A green network is therefore multi-functional, though the ecological

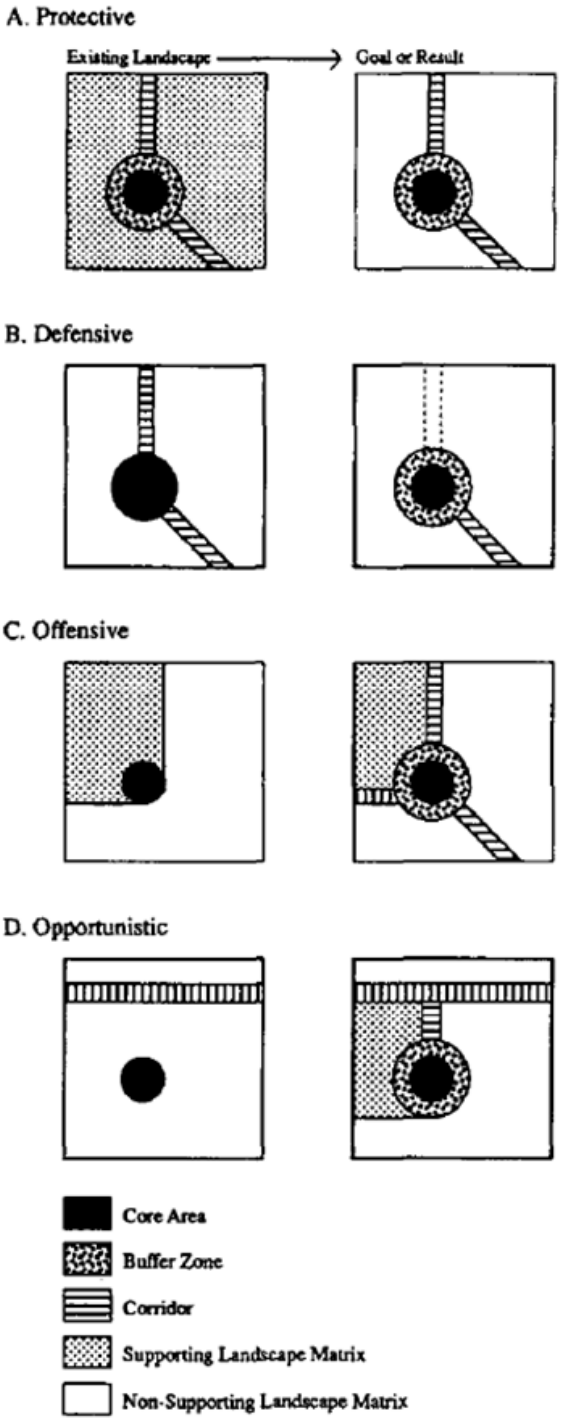


Figure 4: Ecological planning approaches to green networks with associated forms (Ahern, 1995).

framework on which it is based retains precedence (Erickson, 2006).

In “Greenways as a Planning Strategy,” Jack Ahern uses case studies of Dutch and American regions to identify four general approaches to sustainable green network design. All approaches assign new roles, primarily ecological but with associated functions like recreation, to areas outside a green network, re-sulting in new forms (as shown in *Figure 4*). A protective green network planning approach (A) identi-fies and protects desired elements ahead of negative changes. A defensive approach (B) identifies iso-lated landscape elements and secures them with buffer areas, while an offensive approach (C) also es-tablishes a corridor, connecting it to an existing green network and naturalizing previously developed landscapes. Finally, an opportunistic approach (D) relies on existing corridors, possibly rail or utility, to expand the green network (Ahern, 1995, pp. 139–140). Environmentally sustainable green network de-sign, according to Ahern, must retain greater biodiversity as its primary goal. To do so successfully, however, it must also have cultural and social objectives. “Multiple use is central to the greenway con-cept,” as articulated by Ahern (1995, p. 152). Nevertheless, he notes, it remains important to identify and protect significant natural features that are not obviously part of linear green networks or that do not immediately present multiple potential uses.

The elegant greenspace forms represented on paper by theorists like Ahern and Forman are intellectually and visually compelling, but they reduce complex environmental patterns to an abstraction. This raises the question of whether their forms adequately reflect the complexities and account for the diversity of contemporary urban landscapes or the roles they perform.

Re-emphasis of accessibility

In post-pandemic urban environments where many more people work from home and have recent experience with reduced mobility due to lockdowns, green networks usage patterns have changed. So have city-dwellers’ expectations of the functions green spaces should serve, not least relating to accessibility and local mobility (Lennon, 2020). Green networks are well suited to delivering multiple functions when managed effectively, protecting biodiversity and the systems fundamental to life, while also promoting better health and well-being for city-dwellers. Making such spaces accessible and equitable could be an affordable and preventative public health strategy, of particular value in a time of pandemic as Maller presciently recognized nearly twenty years ago (2009).

As Canadian societies grow more aware of the historical injustices done to Indigenous peoples and pursue reconciliation, there is increasing impetus to see Indigenous functional priorities accommodated in green spaces. With little available literature considering the implications of Indigenous culture and values for green network form, more research is clearly needed. It remains to be seen whether forms will continue to adapt

successfully to the functions demanded of them.

Following a review of historical green corridors, or "greenways" in the United States in "Greenways and the Making of Urban Form," Anthony Walmsley concluded that they remain an influential and convincing force in modern city-building. For multi-cultural, multi-mobile societies inhabiting highly varied urban landscapes, greenspace must manifest in the greatest possible range of scale and form, guaranteeing people convenient and appealing options where they live and work. The interpenetration of urban and rural landscapes necessary to achieve this objective is unlikely to be as rigidly defined as in Howard's garden city, Walmsley acknowledges. Rather, it must be "a comprehensive regional green network that joins inner cities to the countryside" (1995, p. 125).

Best practices

To understand the spectrum of needs that outdoor urban environments meet, Matsuoka and Kaplan undertook the qualitative analysis of 90 empirical studies published in the journal *Landscape and Urban Planning*. Their research revealed the remarkable diversity of uses that green spaces and networks serve. "A wide variety of spaces can meet the same needs," they observed, "and a particular setting can meet multiple needs:" (Matsuoka & Kaplan, 2008). As broad as the spectrum of needs met by green networks is, the needs themselves are generally shared across diverse cultural groups. Considering the importance and impactful nature of human experience in these environments, effective planning and design consistent with current best practices are necessary to positively influence the well-being of green network users (Matsuoka & Kaplan, 2008).

In the following review of green network best practices, the literature is categorized according to the primary functions considered. It provides models of actionable policy appropriate to a city like Winnipeg, built around rivers and seeking winter city functionality, greater equitability of access, and climate change resilience; policy areas in which the best practices precedents analysed in *Sections VII* and *VIII* are particularly strong. The best practices identified in this literature review are numbered for reference in *Appendix A*.

Access and equity

In *Green Networks for People*, Moseley, et al. used user surveys and other qualitative data to determine the practical accessibility of a Scottish urban green network. They concluded that the methods by which greenspace access in urban areas were typically calculated significantly overestimated their provision and accessibility and that areas of greater social deprivation were especially susceptible to over-estimation. The authors suggest that **(1)** when assessing the accessibility of greenspace within a green network, planning

authorities must consider factors other than linear distance. These may include the cultural values, physical limitations, and safety concerns of users – factors which require the collection of qualitative data to evaluate. Their evidence also indicated that people who are able will usually travel further to access higher quality greenspace. **(2)** For reasons of equity, quality throughout a green network should be enhanced and maintained to a high standard, ensuring high quality spaces even for those with less mobility (Moseley et al., 2013).

Extending green networks and increasing the availability and accessibility of greenspace offer solutions toward simultaneously addressing environmental and social problems. However, Tozer, et al. warn that doing so can reinforce inequalities and lead to new forms of social exclusion. To avoid creating new barriers, **(3)** culturally relevant perspectives must not be neglected when determining how to make greenspace available to underserved communities, while **(4)** culturally dominant views should be questioned and the value and appropriateness of the green spaces being provided critiqued (Tozer et al., 2020).

Similar concerns to those of Tozer, et al. are expressed by Nesbitt, et al. in "The Dimensions of Urban Equity." The forests supported by urban green networks provide diverse benefits to those who live and work in proximity to them. These include benefits related to health and perception of well-being, as well as recreation. According to research by Nesbitt, et al., however, urban forests and other vegetation are not equitably distributed in many cities, with socioeconomically disadvantaged and racialized communities typically enjoying less access. To ensure greater equity, green network planning must: **(5)** include representation from diverse communities in decision-making; **(6)** provide urban forests in close proximity to all residents; and **(7)** ensure that green networks support a variety of vegetated landscapes, reflecting the preferences of diverse urban communities (Nesbitt et al., 2018).

In many parts of the world, the recent Covid-19 pandemic drew renewed attention to the accessibility of urban green networks and reframed how accessibility was understood. Mick Lennon related the existing literature to the ongoing pandemic context to determine how green network usage patterns were impacted and how access was affected. He observed that during the pandemic, many cities experiencing lockdowns saw increased use of neighbourhood green spaces, while larger, regional scale greenspace was underused. **(8)** Green networks, he recommended, should be decentralized to facilitate the support of a range of functions throughout during periods of lower mobility. Lennon also suggested: **(9)** improving green network connectivity by "nesting" various scaled green spaces to allow greater opportunity for activities for which smaller spaces are inadequate; and **(10)** designing green spaces with discreet areas to support their simultaneous use by a greater number of groups pursuing various activities (Lennon, 2020).

Indigenous participation

Chance Finegan, an academic at the University of Toronto, conducted mini case studies of the Meewasin Valley Authority in the Saskatoon region and an urban park in Portland, Oregon, assessing their ability to promote Indigenous interests and culture in the context of settler societies.

Finegan made the following recommendations based on his case study analysis: **(1)** Support the renewal of ties between Indigenous communities and their traditional lands, partnering with Elders and knowledge-keepers; **(2)** Reserve space for ceremonial, educational, and contemplative uses, as deemed appropriate by Elders and knowledge-keepers; **(3)** Promote Indigenous food sovereignty through the planting of traditional foods and medicine in green corridors; and **(4)** Create opportunities to educate non-Indigenous visitors about the Indigenous heritage of urban landscapes (Finegan, 2021).

Further recommendations are made by American Indigenous educator and planner Ted Jojola in "Indigenous Planning – Toward a Seven Generations Model," including: **(5)** Establish roles for Indigenous peoples in planning processes; **(6)** Support the pursuit of a seven-generations model of planning with its special capacity to bring "clarity and cohesion" to the process (2013, p. 470); and **(7)** Allow Indigenous peoples to assert themselves as stewards of their traditional lands, enabling them to sustain themselves culturally and materially from these urban and natural landscapes (Jojola, 2013).

Active transportation

In "Bicycling Renaissance in North America," Pucher, et al. analysed the results of aggregated studies from North America and Europe and local transportation data. They concluded that there is a positive correlation between the availability of active transportation routes and cycling levels, even when accounting for factors such as city size or climate. Pucher, et al. also conducted case studies of large North American cities that had successfully implemented innovative active transportation programs. Of the programs highlighted, particularly recommended and notable for its success was Portland, Oregon's **(1)** "tightly connected bike network", where bike facilities could be accessed from anywhere in the city within three to six blocks (Pucher et al., 2011).

Schoner and Levinson evaluated bicycle networks in 74 American cities using linear regression models as a part of their study, "The Missing Link." Like Pucher, et al., their analysis revealed that bicycle commuting responded most positively to increases in network density. Schoner and Levinson also emphasized the importance of **(2)** reduced active transportation network fragmentation and **(3)** improvements in network directness and connectivity, which were also associated with higher rates of bicycle commuting. To encourage active commuting via green corridors, they suggested that improvements in these factors should be prioritized,

especially in combination and *before* network size expansion, which was negatively associated with bicycle commuting rates (Schoner & Levinson, 2014).

A primary motive for connecting green spaces is to enable the movement of people across the urban landscape, Donna Erickson argues in *MetroGreen*. Conflict with automobile traffic discourages green corridor use by cyclists and other active users, however, and **(4)** traffic calming measures are necessary to ensure that vulnerable users travelling by diverse modes are accommodated in such green corridors. Erickson recommends that **(5)** green corridors containing active transportation links should be designed with destinations in mind, ensuring that they facilitate connections with mass transit. **(6)** Connections can often be supported by existing linear infrastructure, including rail and utility corridors and roadways, which are often suitable for integration into green networks. Cycling and other active modes can be disruptive to natural environments, Erickson warns, and **(7)** transportation routes should be kept away from those areas that are most sensitive and ecologically significant (2006).

Bergström and Magnusson considered the requirements of effective winter bicycle networks in their study, "Potential of transferring car trips to bicycle during winter," which was based on a questionnaire answered by 1000 employees at companies in two Swedish cities. They concluded that **(8)** active transportation networks should be designed to be adaptable to winter weather and that **(9)** municipalities should ensure consistent, well-defined winter maintenance standards, with frequent clearance of long, continuous routes (Bergström & Magnusson, 2003). Similar responses were elicited from participants in a more recent Swedish study, who participated in interviews and completed travel diaries (Chapman & Larsson, 2021).

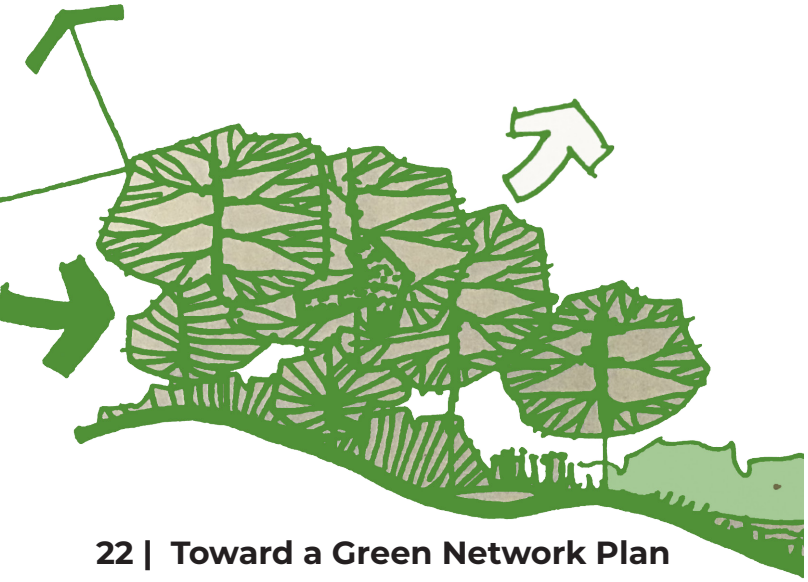
Green infrastructure

In *Planning and Design for Sustainable and Resilient Cities*, Novotny, et al. emphasize the importance of protecting landscapes that provide ecosystem services. By their expansive definition of green infrastructure, these services may be abiotic and biotic services, as well as cultural ones (see *Table 4*). These services should be maintained and enhanced with strategies that emphasize multi-functionality, networks, and adaptability. Novotny, et al. recommend: **(1)** multi-functional green infrastructure (e.g., stormwater wetland *plus* neighbourhood active transportation corridor) for greater spatial and economic efficiency; **(2)** flexible and decentralized green infrastructure networks that respond to local ecosystem opportunities and incorporate redundancy, accommodating the increasingly unpredictable and extreme weather events of the future; and **(3)** communication to green network users of the services provided by green infrastructure to cities and regions, creating awareness of the sustainable and resilient nature of the services delivered (Novotny et al., 2010).

Abiotic services	Biotic services	Cultural/Landscape services
Maintain hydrological regime(s)	Habitat and movement routes for generalist and specialist species	Opportunity for active and passive outdoor recreation
Accommodate disturbance and adaptive response	Support meta-population dynamics in fragmented landscapes	Context for social interaction
Support nutrient cycling, buffering, sequestration	Bioremediation of wastes and toxins	Stimulus for aesthetic expression
Protection from floods	Maintenance of disturbance and successional regimes	Opportunity for environmental education
Stabilizing climate fluctuations	Biomass and food production	Reduce human stress
Filtering and improving air quality	Reservoir of genetic diversity	Supports economic activity (e.g., tourism)
Waste processing, digestion	Support flora-fauna interactions	Access to quiet/solitude

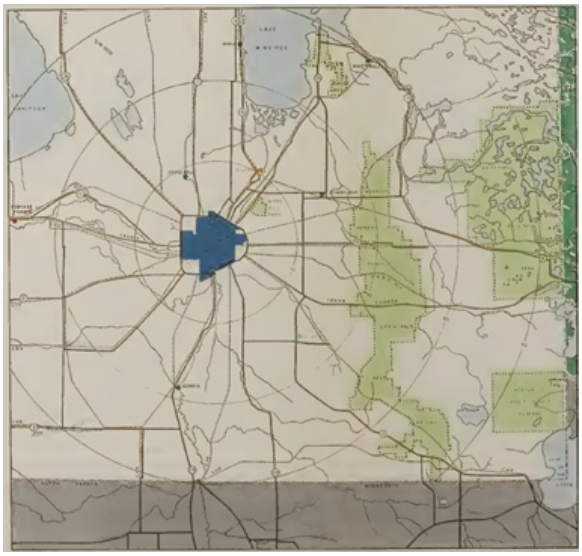
Table 4: "Selected examples of ecosystem services" (Novotny et al., 2010, p. 140).

(4) Forested riparian areas in cities should be especially carefully protected, Beatley emphasizes, due to the remarkable combination of ecological functions they fulfill, including: climate modification, heat island mitigation, water quality protection, carbon sequestration, and sustainable wood production. At the same time, **(5)** constructed elements of green networks should not be neglected as green infrastructure and linear corridors should be designed to collect and treat stormwater (Beatley, 2011).



Geography and planning hierarchy

The City of Winnipeg is the capital and largest municipality in Manitoba, with a population of 749,607 over an area of 462 km2 (Statistics Canada, 2023). The city is located in Treaty One Territory, the home and traditional land of the Anishinaabe, Ininew, and Dakota peoples, and in the homeland of the Red River Métis Nation (City of Winnipeg, 2022a). Winnipeg is situated around the confluence of the Red and Assiniboine rivers. Several smaller watercourses, including the Seine River, La Salle River, and Sturgeon Creek, drain into the Red and Assiniboine within city limits.



The City of Winnipeg was established by the Province of Manitoba in 1971 through the *City of Winnipeg Act*, which amalgamated twelve cities, towns, and rural municipalities, formerly component municipalities of the Metropolitan Corporation of Greater Winnipeg. The metropolitan government was itself created by the Province for the Greater Winnipeg area ten years earlier through the *Metropolitan Winnipeg Act* (City of Winnipeg, 2014). The present-day municipality exercises its authority to plan and enact policies and by-laws through the more recent *City of Winnipeg Charter Act* (City of Winnipeg Charter Act, 2002). Land use in the City of Winnipeg is guided by its development plan, *OurWinnipeg*, updated in 2022 as *OurWinnipeg 2045* (HRM, 2022).

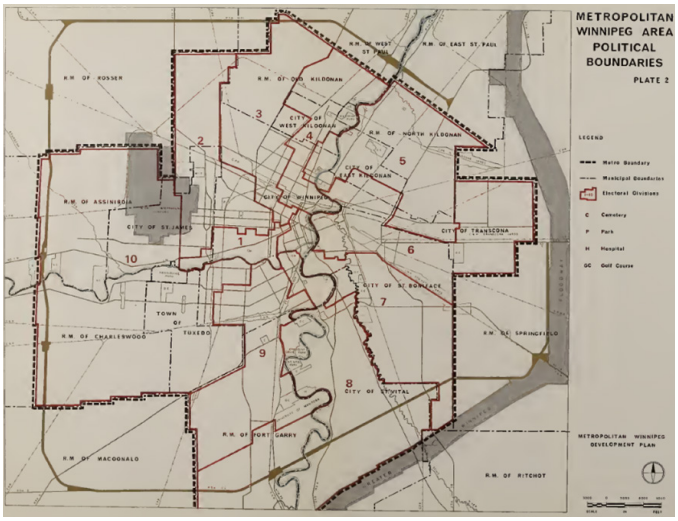


Figure 5: Map showing geographical context of Winnipeg circa 1960s (above); Map showing constituent municipalities of the Metropolitan Corporation of Greater Winnipeg (below) (City of Winnipeg & Metropolitan Corporation of Greater Winnipeg, 1968).

OurWinnipeg 2045

As with other large municipalities and regions, the City of Winnipeg has a well-developed hierarchy of plans. As a creation of the Province, the City is bound by its Charter, which requires it to adopt a development plan. This plan, *OurWinnipeg 2045*, conforms to and fulfills the minimum planning requirements of the Charter,

establishing a vision for the City for the next 25 years and providing goals, objectives, and policies that direct land use in Winnipeg (City of Winnipeg, 2022c).

Many policies in *OurWinnipeg 2045* pertain directly to Winnipeg's green network, including those to "leverage green infrastructure." These direct the City to create a master green space and natural corridor plan, acquire 1000 acres of publicly accessible green space, maintain ecosystem integrity, and use green infrastructure like wetlands and woodlands for stormwater management and other infrastructure services (see *Table 5*). The plan contains other policies that are relevant to the city's green network, including policies related climate resilient growth, regional water resource management, urban soil conservation, and low-impact ecosystem management (City of Winnipeg, 2022c, p. 23).

OurWinnipeg 2045 - Selected policies

2.17 Regional Water Resource Management – Engage in watershed planning that protect waterways, biodiversity and water quality, and addressing the capacity of water systems for stormwater management.

2.19 Leverage Green Infrastructure – Value, protect and integrate green infrastructure solutions within the urban environment, to achieve highest and best use for biodiversity and ecosystem integrity.

2.20 Leverage Green Infrastructure - Create a master green space and natural corridor plan by-law that enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas. Increase quantity of such lands by 1,000 acres that can be accessed for recreation and connection of people with nature, as population growth occurs.

2.21 Leverage Green Infrastructure - Conserve, restore, and enhance the urban forest as a key contributor to, erosion control, stormwater management, improved health and well-being.

Table 5: OurWinnipeg 2045 - Selected policies (City of Winnipeg, 2022c).

Complete Communities 2.0

is a city-wide secondary plan under *OurWinnipeg 2045* that describes the physical characteristics of the city and establishes a framework for its development, including that of its greenspace and natural corridors. Detailed policy in *Complete Communities 2.0* builds on the policy directions contained in *OurWinnipeg 2045*, key among which is that "the City shall accommodate physical development that reflects this Plan's goals and achieves a continuum of complete and connected communities over the lifecycle of the Plan" (City of Winnipeg, 2022c, p. 31). Through the integration of land use, infrastructure, urban design, and other priorities, *Complete*

Complete Communities 2.0: Parks and Recreation - Selected policies

1.3 Plan the recreation and park systems from a city-wide perspective, giving consideration to the differing areas of the Urban Structure, and their respective unique character, configuration, and need.

1.4 Create and designate spaces that increase walking and cycling opportunities and promote active mobility connectivity.

1.4.1 Enhance the linear park system through the acquisition of riverbanks and rail corridors.

2.2 Ensure the high-quality design of park sites, recreation facilities and their amenities that:

a. Are interconnected across neighbourhoods and communities;

b. Facilitate public access to, movement along, and views of public amenities such as other parks or trails, recreation facilities, historic and natural features, other public spaces and other interesting focal points; and

Communities 2.0 seeks "to ensure a socially, environmentally, and economically sustainable future" for Winnipeg and the communities it comprises (City of Winnipeg, 2022b, p. 9).

Complete Communities 2.0 articulates a vision for Winnipeg's green spaces that emphasizes accessibility and sustainability. Through policy, the secondary plan promotes the development of a green network that is interconnected and multi-layered, supporting a range of functions and retaining a dynamic and flexible form that accommodates future functional demands and actively removing barriers to access for under-served populations. The plan also provides some detail about the nature and scope of the future master green space and natural corridor plan, emphasising the importance of a healthy urban ecology "rooted in Indigenous traditional knowledge of land, community, and ecology" and the importance of accountability through transparent reporting on the health of Winnipeg's green network (City of Winnipeg, 2022b, p. 141).

c. Encourage year-round activity while accommodating and celebrating Winnipeg as a winter city.

4.1 Identify, protect, enhance and restore natural and cultural resources recognized as having historical, ecological, or aesthetic value by incorporating them into the park system.

4.1.1 Preserve and conserve habitats designated through the Ecologically Significant Natural Lands Strategy and Policy or habitats that may be susceptible to damage from development, flooding or erosion.

4.1.2 Enhance the sense of place and community by identifying significant landscapes and conserving and celebrating them in meaningful ways.

4.4 Preserve and enhance natural environments by ensuring their harmonious integration into urban development.

4.4.1 Maintain our "ribbons of green" (riverbanks, urbans street trees, greenways and green corridors) and provide a well-managed urban forest that contributes to air quality, water quality, and high environmental and aesthetic standards.

Table 6: Complete Communities 2.0 - Selected policies (City of Winnipeg, 2022b).

Complete Communities 2.0: Green Network and Natural Corridor Plan by-law

4.8 Develop a green space and natural corridor plan by-law that includes:

a. Consideration of municipal golf courses as major nature preserves and green space;

b. A biodiversity policy for Winnipeg that will detail, among other things, an ecological network that is interdependent, reciprocal, healthy, connected, and integrated with the built environment and life on the land; one rooted in Indigenous traditional knowledge of land, community, and ecology. This should include a requirement for an annual report to Council structured in line with The Durban Commitment: Local Governments for Biodiversity;

c. A Corridor Plan to protect and enhance Winnipeg's forests, green spaces, natural environment, and natural area corridors including Winnipeg's connecting riverbank corridors; and

d. Tracking the status of green space and regular reporting to the public and Council.

Table 7: Complete Communities 2.0 - Green network and natural corridor plan by-law (City of Winnipeg, 2022b).

International initiatives

United Nations (UN) Sustainable Development Goals

The UN Sustainable Development Goals (SDGs), in which the *OurWinnipeg 2045* vision is grounded, were

adopted by Canada and other UN member states in 2015 as a part of the *2030 Agenda for Sustainable Development*. The SDGs represent an "urgent call for action" to improve health and education, reduce inequality, encourage economic growth, address climate change, and preserve important natural assets in developed and less developed countries. (United Nations, 2023).

Figure 6: Six goals for Winnipeg localized from the 17 United Nations Sustainable Development Goals (City of Winnipeg, 2022c).

The City of Winnipeg relies on the UN's SDGs to inform the goals, objectives, and policies expressed in *OurWinnipeg 2045* in recognition of the scale of the issues that the city contends with. Many of these issues reflect those of the SDGs and extend beyond the City's jurisdiction and capabilities. To be effectively addressed, they must be considered in a regional and global context. The SDGs also represent internationally recognized standards to which Winnipeg can contribute, if not actually attain on its own.

OurWinnipeg 2045 requires that "all City policy implementation and enforcement tools must be aligned with" the UN's SDGs, related to the local context through six key goals: leadership and good governance, environmental resilience, economic prosperity, good health and well-being, social equity, and city building (see *Figure 6*). When applied locally, the goals are intended, in the words of the development plan, to:

> Strengthen proactive leadership and good governance; build Winnipeg on the foundation of human rights, equity, and reconciliation; and, strengthen civic systems that support community resilience – whether related to the environment, the local economy, healthy built environments, or disaster preparedness. (City of Winnipeg, 2022c, p. 14)

COP 15

Recent international conservation commitments made at the COP15 biodiversity summit are also relevant to greenspace and natural corridor planning policy in Winnipeg, particularly in the context of the City's own commitment to acquire 1000 acres of publicly accessible green space, as directed by *OurWinnipeg 2045* (City of Winnipeg, 2022c). The Kunming-Montreal Biodiversity Framework, a landmark agreement adopted by Canada and other member states at the recent United Nations Biodiversity Conference in Montreal, commits signatories to protecting 30 percent of the world's land and water by 2030 (Government of Canada, 2022b).

Following the signing of the framework, Prime Minister Justin Trudeau further identified a target of 25 percent of land to be conserved by 2025 (Cruickshank, 2022), considerably more than the 13.5 percent that is currently protected nationwide, or the 11 percent that is protected in Manitoba. (Government of Canada, 2022a).

Greenspace in Winnipeg

"We do know for sure that — who wants to be living in a city without a park?" Dave Domke, the City of Winnipeg's manager of parks and open space, observed in a 2016 *Winnipeg Free Press* story. "Parks are just as important as pavement, or underground services, water and waste" (Trachenko, 2016). According to Domke, the amount of publicly accessible greenspace in Winnipeg is increasing, with 102 hectares added between 2011 and 2016. Most of this growth was and continues to be in new neighbourhoods, however, where homebuilders are required to dedicate public land for greenspace as a condition of development (City of Winnipeg, 2021). A different, more inclusive measurement of Winnipeg's green network used by Statistics Canada indicates a concerning trend in greenspace loss.

Statistics Canada uses urban greenness as a measure of the presence and health of an urban area's vegetation in summer and the extensiveness of its green network, factoring in all public and private land in the built-up area. Between 2000 and 2022, urban greenness in Canadian cities declined overall. In Winnipeg, however, the rate of decline was well above that of the country as a whole, reflecting changing land use and climate patterns. Winnipeg's average greenness between 2000 and 2004 was 66 percent, decreasing to an average of 41 percent between 2018 and 2022; a difference of almost 40 percent that represented the second largest decrease among Canadian cities over that period of time (Statistics Canada, 2022).

At the same time as an increasing proportion of Winnipeg's surface area is paved and impermeable, climate change is causing more frequent extreme weather events. In combination, they make the city more susceptible to climate hazards like flooding and intense heatwaves. Winnipeg's more vulnerable populations, many of whom live in core neighbourhoods with limited access to green space, are often most exposed and negatively impacted by these crises (City of Winnipeg, 2018b). Extensive and accessible green networks delivering green infrastructure services like stormwater management and summer urban cooling are advocated for by local planners like Glen Manning, principal at HTFC Planning and Design. "A lot of these technologies are pretty much accepted… [and] required by by-laws in some cities," Manning says, but "in Winnipeg we're not there yet, so we don't have that same kind of urgency to address these things" (Rutgers, 2023).

In the *2018 City Asset Management Plan*, the City of Winnipeg identifies itself as being in the process of assessing the value of its natural assets, including trees and wetlands, recognizing that the services they provide would otherwise demand much greater engineered infrastructure investments. This inventory process

is in line with the City's objectives of reducing its infrastructure deficit and efficiently delivering services and involves identifying and prioritizing natural assets in order to better protect, manage, and improve them (City of Winnipeg, 2018a). If inventory is followed by necessary investments (guided by the *Winnipeg Parks Strategy* and the future master green space and natural corridor plan), a more equitable, high-quality, and sustainable green network is possible for Winnipeg.

Winnipeg Parks Strategy

The *Winnipeg Parks Strategy* (WPS), provides "strategic direction and policy for the ongoing provision, renewal, operations, maintenance, and development of the City of Winnipeg's parks system for the next 25 years" (City of Winnipeg, 2021, p. 3). The WPS was developed in response to an increasing demand for greenspace, arising from an extended period of population growth and urban expansion, and the plan seeks to mitigate climate change and increase resiliency by expanding natural areas. The policies and strategies contained within the WPS are guided by the strategy's vision, articulated as "fostering the wellbeing of individuals, communities, and natural environments by enabling all to engage in meaningful, accessible outdoor experiences and activities" (City of Winnipeg, 2021, p. 17). The WPS is primarily focused on park amenities and access to greenspace, however, and doesn't consider ecological functions like green infrastructure and biodiversity in depth. These absences are to be addressed by the future master green space and natural corridor plan, for which the WPS provides policy direction (see *Table 8*) and which it informs, along with other future strategic plans relating to Winnipeg's green network.

4.2.2.B Develop a Master Greenspace and Natural Corridors Plan By-law to replace, or as a companion to the *Ecologically Significant Natural Lands Strategy and Policy*. The plan and by-law should:

- **i.** Ensure conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas and systems;
- **ii.** Advance climate change adaptation and mitigation;
- **iii.** Increase the quantity of open space for recreation, social interaction, active living, and connection of people with nature as population growth occurs;
- **iv.** Provide a biodiversity framework or policy;
- **v.** Provide a methodology to quantify the value of ecological goods and services and natural assets.

Table 8: Winnipeg Parks Strategy - Green network and natural corridor plan by-law (City of Winnipeg, 2021).

Other strategic planning documents

Other notable strategic planning documents relevant to Winnipeg's green network and the creation of the future master green space and natural corridor plan include:

Winnipeg Climate Action Plan

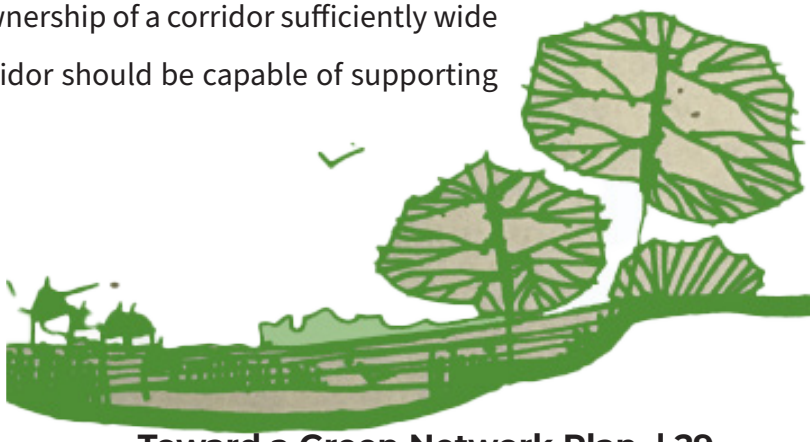
In the *Winnipeg Climate Action Plan: Planning for Climate Change. Acting for People*, the City articulates its commitment to mitigating the effects of climate change and establishes a framework for doing so. As a part of the City's efforts to reduce carbon emissions, the plan acknowledges the importance of "enhance[ing the] connectivity of green spaces and parks throughout Winnipeg to support biodiversity and natural systems" and promotes this objective with high-level actions (City of Winnipeg, 2018b, p. 1). These include joining regional watershed management authorities and conservation districts in recognition of the interconnected nature of wetlands, waterways, and basins and the importance of addressing them at a regional scale.

Ecologically Significant Natural Lands (ESNL) *Strategy*

The *Ecologically Significant Natural Lands* (ESNL) *Strategy and Policy* provides a process for identifying and prioritizing ESNLs in and around Winnipeg that acknowledges the importance of connectivity and multi-functionality and points toward the concept of a green network. The functionality of a greenspace or natural corridor as a connection in a larger network is a factor considered by the City when using the strategy for assessment. Connections, the strategy notes, are of great importance to biodiversity, as well as for other ecological functions and recreational uses (City of Winnipeg, 2007, p. 12). While the ESNL strategy contains policy direction, it lacks clear, strong policy necessary to enforce the protection of vulnerable natural corridors and functions largely as a procedural document in aid of prioritizing land acquisition. The strategy will likely be replaced or updated, possibly together with a biodiversity framework in the future master green space and natural corridor plan by-law, as directed by policy 4.2.2.B in the *Winnipeg Parks Strategy* (City of Winnipeg, 2021).

Seine River Park – Waterway concept

Although more than forty years old, the *Seine River Park policy* remains relevant and continues to successfully enable the purchase of riparian corridors by the City for protection, public access, and land drainage, facilitating the extension of Winnipeg's green network in the current planning context. The Seine River Park policy responds to the importance of the Seine River as a drainage outlet for the southeast part of the city. The policy directs the City to acquire ownership of a corridor sufficiently wide to accommodate potential stormwater flows. The corridor should be capable of supporting a parkway suitable for active and passive recreation and restricting any development that might affect summer storm levels on the river (City of Winnipeg, 1980).



V. Findings – Q 1&2: Form and Function

The Charter of the Winnipeg Parks Board, established in 1893 and modelled on that of Minneapolis, called for the creation of public parks. Unlike Minneapolis, however, Winnipeg did not reserve land along its rivers and streams for linear parks, and its riparian woodland and watercourses were typically encroached upon by development or neglected (Graham, 1984). Most development involved the wholesale removal of vegetation, and 80 percent of Winnipeg's riverbottom forest was cleared in the years following settlement (Latourelle, 1996). Remnants of these natural corridors survived along the city's rivers including at the mouth of Omand's Creek on the Assiniboine, the surroundings of which an alderman described in 1931 as "naturally beautiful and… ideal for a park," ("Relief This Year Has Cost City $480,456," 1931). By this time the form of the pre-settlement green network had long been erased and the rarity of surviving fragments of riparian green corridor made them increasingly desirable.

The applicability of historical planning precedents to the future master green space and natural corridor plan for Winnipeg has not been previously explored in the available literature. In this capstone, I do so through the precedent study of local statutory plans from the past century, applying thematic synthesis to establish analytical themes relating to the evolving functions and forms of green corridors and networks in Winnipeg and relevant to its current green network planning context.

Terminology		
Plan	Green corridor	Green network
Metropolitan Plan for Greater Winnipeg (1947)	Parkways	Parkways system
The Metropolitan Development Plan (1968)		Metropolitan/public parks system
Plan Winnipeg (1981)	Linkage	Open space system; Linkage system
Plan Winnipeg Vision 2020 (2001)		Park system; Linear parkway system

Table 9: Green corridor and network terminology

Functions of green corridors – Functionality to multi-functionality

Conceptions of what functions green corridors could serve broadened as the 20th century progressed in response to greater environmental awareness, decreasing biodiversity, and knowledge of the ecological services provided by natural spaces, including those in urban areas (Hough, 2004). In Winnipeg, this trend was reflected in the progressively greater functional diversity of the green corridors planned and developed by the City, including with Greater Winnipeg area municipalities and the Metropolitan Corporation of Greater Winnipeg (Metro).

In the early *City Plan*, which was interrupted by the First World War and never implemented, emphasis was given to providing opportunities for strolling and other types of active and passive recreation (City of Winnipeg, 1970). Elements of *City Plan* were implemented by City officials in the decades that followed, but as green corridors suitable for motorists (City of Winnipeg, 1970; City of Winnipeg & Greater Winnipeg, 1947). The developing green network became increasingly multi-functional as it accommodated direction to serve social and cultural priorities, including the provision of educational opportunities and the support of community well-being. As the 20th century progressed, ecological functions were identified for Winnipeg's green network. While notions of ecological functionality initially responded largely to aesthetic feelings and a desire for natural landscapes, they eventually matured into an acknowledgement of the fundamental importance of biodiversity in the urban landscape.

Following the earliest manifestations of green corridors in Winnipeg as strolling and pleasure drives, golf courses represented another recreational function that drove the development of the city's green network, if not conceived as such. Golf courses, most of which were situated adjacent to rivers (and several privately owned), were already numerous in the Greater Winnipeg area when the *Metropolitan Plan for Greater Winnipeg* was developed in the late 1940s and, because of their popularity, their retention was a priority for the City and metro region. Along the Seine River, golf courses formed a nearly continuous corridor from Elizabeth Road in the City of St. Boniface to south of Fermor Avenue in the City of St. Vital (City of Winnipeg & Greater Winnipeg, 1947). The functionality of such green corridors was a privileged one, however, with access limited to more affluent Winnipeggers who could afford equipment and green fees (MacDonald, 1995).

Already in the *Metropolitan Plan for Greater Winnipeg*, recommendations were made for the "conservation" of areas of natural beauty, including wooded areas, rolling terrain, and the corridors adjacent to rivers and streams that supported them, with the plan recognizing that several such already existed, especially along the Assiniboine and Seine rivers. Nevertheless, their most important functions were identified as recreational; venues for a range of summer and winter activities like cycling and sledding along the Assiniboine at Omand's Creek or golfing on the several courses along the Seine. (City of Winnipeg & Greater Winnipeg, 1948, p. 15).

Emphases broadened in *The Metropolitan Development Plan*, which recommended that Metro should provide adults and children with nature education opportunities and encouraged the retention of natural landscapes in the regional green network as a means of reducing costs (Metropolitan Corporation of Greater Winnipeg, 1968, p. 64). However, a truly multi-functional planning approach to Winnipeg's green network was not apparent until the development and implementation of *Plan Winnipeg*. The open space system, the plan maintained, should respond "to the recreational needs of Winnipeg's citizens… create a positive image of the city, define the physical structure of the urban form, and define geographic areas such as neighbourhoods." It

must also fulfill other criteria, including: “quality of experience, accessibility, provision of facilities compatible with users, and landscape preservation,” and be achieved within a “finite budget” (City of Winnipeg, 1981, p. 1). *Plan Winnipeg* proposed a “linkage system,” providing new opportunities for community activities like marathons and “bike rallies” and increasing accessibility and active mobility (City of Winnipeg, 1981, p. 35). The plan recommended that the City integrate golf courses into the linkage system, especially along riparian corridors. These would support pedestrian and bicycle trails and open up formerly exclusive green corridors to the public, while giving due consideration to the heritage and cultural significance of river corridors and elements that might require preservation (City of Winnipeg, 1981).

Plan Winnipeg acknowledged the potential conflict of the recreational and community functions of the green network with landscape preservation and, as a result, the necessity of careful planning to negotiate these priorities. The plan suggested, however, that the preservation of natural landscapes could usually be compatible with a range of activities, based on the assessment of their specific carrying capacities, and encouraged functions like outdoor education and “nature-related activities” (City of Winnipeg, 1981, p. 5). Indeed, *Plan Winnipeg* directed the City to preserve “major ecological and geological landscape features” in recognition of the diverse roles they play. Besides affording educational opportunities, these included the “reinforcement of landscape values,” presumably meaning awareness of and respect for the environment. The plan assigned special value to woodlots, recognizing their “ecological productivity” and vulnerability to development and urging their acquisition to be prioritized on these bases. (City of Winnipeg, 1981, pp. 46–47). The plan also recommended the provision of better quality and more diverse habitat for wildlife through the establishment of naturalized edges on storm management basins with rushes, grasses, and shrubs, offering visual interest and less costly maintenance as additional benefits to the green network (City of Winnipeg, 1981). It remained for *Plan Winnipeg Vision 2020* in 2001, however, to direct the maintenance of biodiversity for its own sake in the city’s green network. *Vision 2020* did so by requiring the protection of “important pockets of natural flora and fauna,” in part through the development of a “lands plan” designating ecologically sensitive areas and providing measures for their acquisition and preservation (City of Winnipeg, 2001, p. 52).

Functions of green corridors – Green infrastructure

Winnipeg was slow to appreciate the range of infrastructure services that the woodlands, wetlands, and waterways comprising its green spaces and corridors were capable of delivering. With its very shallow grades, melt and stormwater move slowly in the Red River Valley and wet meadows and marshes once covered much of what is now the City of Winnipeg. While the years immediately following the City’s establishment were relatively dry, a wet period beginning in the late 1870s brought annual flooding to the young city and large scale stormwater diversion schemes were the preferred means of addressing the chronic problem (Graham,

1984). Nevertheless, major floods periodically inundated the city through the mid-20th century, and planners identified vulnerable areas as suitable for public greenspace.

In 1947, the *Metropolitan Plan for Greater Winnipeg* recommended the development of a greenspace on the banks of the "picturesque" Seine River, providing recreational areas for the city and using land subject to annual flooding and of little value for other purposes (City of Winnipeg & Greater Winnipeg, 1947, p. 55).

Urban tree canopy
Boulevard trees and wooded areas adjacent to rivers and streams were valued and their propagation encouraged by the *Metropolitan Plan for Greater Winnipeg* for the protection they afforded from the heat of summer and winter cold (1948).

Table 10: Urban tree canopy (City of Winnipeg & Greater Winnipeg, 1948).

Flood plain zoning regulations pre-existed *The Metropolitan Development Plan*, prohibiting permanent development in areas vulnerable to flooding (Metropolitan Corporation of Greater Winnipeg, 1968). The region's combined sewer system presented an additional flood hazard to Winnipeg and other Metropolitan Corporation of Greater Winnipeg (Metro) municipalities, however. The system was susceptible to overloading and Metro had determined that combined sewers could no longer be connected to its sewage interceptors. *The Metropolitan Development Plan* acknowledged that "expanding urban growth results in increases in roof areas and paved surfaces which reduce the amount of stormwater that can be dissipated by absorption into the ground." (Metropolitan Corporation of Greater Winnipeg, 1968, p. 92). The plan proposed an alternative land drainage system relying on the "valleys" of natural drainage channels. If sufficiently wide to manage spring run-off, the plan suggested, these valleys could also support recreational functions. A precedent for this concept was identified in the Toronto area where green infrastructure was developed and managed in partnership with conservation authorities. *The Metropolitan Development Plan* deemed the Toronto model so successful that it recommended a similar conservation authority be established for Metro. "An authority is needed to deal with water conservation and land drainage in the whole of the catchment basins of the natural watercourses that drain through the urban area into the rivers," improving river valleys as stormwater management areas and as public greenspace. (Metropolitan Corporation of Greater Winnipeg, 1968, p. 93)

As with previous development plans, *Plan Winnipeg* directed that land prone to flooding or obstructing floodwater be reserved as greenspace and, like Metro's plan, recommended similar treatment for stream outlets, marshes, and other sites relating to historical drainage and river flow patterns (City of Winnipeg, 1981). Notably, *Plan Winnipeg* advocated for the maintenance of green spaces as "functional landscapes," delivering green infrastructure services like stormwater storage, water, and air filtration through the protection of flood plains and aquifer recharge zones (City of Winnipeg, 1981, p. 6). Storm retention pond systems, increasingly constructed in subdivisions inland from the rivers as an aid to stormwater drainage in the absence of

other natural drainage features, were identified as offering a potentially "varied and dynamic" network of green spaces in an "otherwise flat prairie landscape." *Plan Winnipeg* called for standards that maximized the recreational potential of these systems and recommended that pond systems be integrated into the broader green network, or "linkage system," along with natural landscape features requiring protection (City of Winnipeg, 1981, p. 51). The plan identified riverbank stability and erosion in its green corridors as an increasingly urgent problem requiring costly intervention and more conscientious future development (City of Winnipeg, 1981).

After the attention given to it in *Plan Winnipeg*, green infrastructure policy is noticeably absent from *Plan Winnipeg Vision 2020*, except for direction to acquire flood plains to prevent development susceptible to property damage (City of Winnipeg, 2001).

Functions of green corridors – The automobile

While the origins of Winnipeg's green network pre-exist the presence of automobiles, their functional influence on the city's green network is manifest in the network of leafy drives, parkways, and scenic routes that, if not established specifically for motoring, were quickly repurposed for that use. In 1947, the perspective of planners for the City of Winnipeg and the surrounding municipalities was thus:

> Automobile ownership… is increasing and will continue to do so at a much more rapid pace than the total population. Thus, the desire for pleasant drives is an expanding one, and a program of development is needed to keep the growth of the parkway system in line with the desire to use it. (City of Winnipeg & Greater Winnipeg, 1947, p. 77)

City Plan, in 1914, proposed a "Park Boulevard Scheme" encircling the city and including in its course the large city-owned parks - Kildonan Park, Kitchener Park (near Inkster Boulevard and Wyatt Road – no longer exists), Tuxedo (Assiniboine) Park – along with other suggested green spaces. The scheme would have served pedestrians, cyclists, and horse-drawn carriages as excursion routes or as pleasant and comfortable routes to access green spaces with more amenities. The extension of Wellington Crescent to Assiniboine Park, forming the city's first river drive of approximately six kilometres, reflected the scheme's partial implementation (City of Winnipeg, 1970). The Special Committee on Town Planning and Zoning Board, active between 1928 and 1944, was responsible for implementing many of the elements of *City Plan* that were ultimately realized, but did so for an urban population that was already becoming automobile reliant and that used automobiles recreationally. In this changed context, the Special Committee planned to expand the developing network of landscaped pleasure drives, with one proposed drive along the north bank of the Assiniboine River from Osborne Bridge to Cornish Avenue, connecting to Wellington Crescent by means of a new Maryland Bridge (City of Winnipeg, 1970).

Ambitions for a parkways system grew in Winnipeg with the popularity of automobiles. In 1947, the *Metropolitan Plan for Greater Winnipeg* proposed a comprehensive network linking together major parks and sites of interest throughout the Greater Winnipeg area with pleasure drives – dual roadways separated by a central park strip and beautified with plantings. The parkway system would provide pleasant alternative routes to more direct thoroughfares, as described by the plan, and planners urged an active program of development for the network in benign recognition of the rapid growth of automobile use and a desire to accommodate it as a recreational function of the urban green network (City of Winnipeg & Greater Winnipeg, 1947). Boulevards laid out before automobiles became dominant, like those along Wellington Crescent and Wolseley Avenue, remained appreciated for their beauty and the opportunities they afforded for a pleasant stroll. More such boulevards were recommended, designed sufficiently wide to allow trees and other plantings to grow properly (City of Winnipeg & Greater Winnipeg, 1948).

By the time *The Metropolitan Development Plan* was developed, near-universal ownership of private automobiles was assumed by planners, who based green network accessibility standards on this assumption and admonished the City to provide adequate parking at access points. The minimum accessibility standard for "metropolitan" green spaces was assessed as half an hour automobile travel time, placing them beyond reach of anyone unfortunate enough not to own a private vehicle (Metropolitan Corporation of Greater Winnipeg, 1968, p. 64). *The Metropolitan Development Plan* acknowledged the vulnerability of pedestrians to fast-moving automobile traffic when separated only by a curb or narrow boulevard, as well as to noxious vehicle emissions. The ideal means of mitigating this, according to the plan, was grade separation, in climate-controlled retail malls where possible. Doing so with a network of protected active transportation routes was not considered, nor were any measures that calmed automobile traffic (Metropolitan Corporation of Greater Winnipeg, 1968).

Plan Winnipeg recognized automobiles as a dominant force in the contemporary urban lifestyle and sought to provide scenic drives as "slower-moving routes that provide a varied and pleasant viewing landscape." Views were to be preserved, recreational opportunities provided, and plantings established. Notably, the plan also suggested that pedestrian and bicycle routes be incorporated into parkways (City of Winnipeg, 1981, p. 45). Reflecting a significant shift in functional priorities, *Plan Winnipeg* also recommended that the City develop a "linkage system" supporting pedestrian and bicycle trails. A network linking neighbourhoods, activities, and destinations through active uses, noted the plan, "provides the resident with a more intimate knowledge of his community and city, an image that often differs vastly from… [that] seen from within a vehicle (City of Winnipeg, 1981, p. 3).

Cycling and walking were assigned an additional role in *Plan Winnipeg Vision 2020* of integrating "urban

fringe parks" outside the city into Winnipeg's green network via trails supported by green corridors. The plan conceived of the city's green network as functional for active mobility year-round, encouraging active river uses through the expansion of winter river trails for skating and skiing and the placement of boat launches (City of Winnipeg, 2001). While recreational automobile use was no longer a primary function of the network, *Vision 2020* continued to identify "scenic drives" as a priority, perpetuating a legacy of automobile centricity that remains an influence in Winnipeg's green network into the 21st century (City of Winnipeg, 2001, p. 55).

Functions of green corridors – Accessibility

Accessibility as a long-standing functional principle of green network planning is apparent in my findings regarding automobile use trends and the increasing multi-functionality of Winnipeg's green spaces and corridors. Certain principles and policy directions not yet mentioned, however, are noteworthy. In 1950, the *Metropolitan Plan for Greater Winnipeg* bluntly proposed locating "new park areas where needed," observing that "a visit to a local park should be a pleasure, not a pilgrimage" (City of Winnipeg & Greater Winnipeg, 1950, p. 14). Ensuring that access to Winnipeg's green network was pleasurable year-round continued to be a challenge acknowledged by the city's planners. *The Metropolitan Development Plan* acknowledged "the influence of severe winter climate on the physical form of the community," noting, "we have not yet faced the fact that we live through weather conditions that… are not exceeded in any community of comparable size in the world except in Siberia," and that doing so demanded the provision of facilities providing comfort and convenience in winter (Metropolitan Corporation of Greater Winnipeg, 1968, pp. 6 & 61).

Plan Winnipeg adopted a broader and more inclusive understanding of accessibility than previous plans, committing to the provision of a service that was non-discriminatory. "All people can participate in any of the many facets of that service" (City of Winnipeg, 1981, p. 1), it asserted, adding that the importance of the green network was not greater than its accessibility to people. Accessibility, according to *Plan Winnipeg*, meant accommodating all ages, ethnic groups, "special populations," and people with disabilities, as well as recognizing that residents of some communities have reduced mobility, making near and convenient proximity of the green network necessary. The plan advised that green network accessibility needed routine assessment and that if elements of the network were underused by some populations, causes for this should be investigated (City of Winnipeg, 1981).

Influence of function on form – Inflexibility of form

Land use patterns, once established, are difficult to alter. Many of the property lines, structures, and infrastructure rights-of-way that define the edges of green spaces and corridors in Winnipeg have retained

essentially the same form for more than a century. As such, they are little less permanent than the rivers with which they combine to shape our city and its green network. The economic and social costs of relocating roadways and communities to expand green spaces or reconnect fragmented green corridors is prohibitive. In already developed areas, the City must opportunistically acquire land for the green network as it becomes obsolete, and proactively protect it on the urban fringe.

That many of Winnipeg's green corridors, the parkways and scenic drives of the early 20th century, are themselves transportation infrastructure is illustrative of their permanence. In some instances, there have been indirect benefits, including the protection and reservation for public use of adjacent land. Following on the direction of the *Metropolitan Plan for Greater Winnipeg*, several proposed parkways for pleasure driving were developed, especially along the Red River. These included Churchill Drive, Lyndale Drive, Crescent Drive, and parkways around the Wildwood Park neighbourhood, all of which had landscaped and planted areas descending from the roadway to the river (City of Winnipeg & Greater Winnipeg, 1947). Later, in *The Metropolitan Development Plan*, similar policy directed that where roadways ran parallel to the river, land between the roadway and river were to be included in the right-of-way (Metropolitan Corporation of Greater Winnipeg, 1968).

Perhaps in response to the challenges arising from inflexible urban forms as well as the obligation to ensure access to greenspace for city-dwellers, *The Metropolitan Development Plan* urged that green spaces should be thought of as a system rather than in isolation, though in this early instance, its priority was their systematic distribution rather than the development of a connected network (Metropolitan Corporation of Greater Winnipeg, 1968). With greater foresight, *Plan Winnipeg* directed that the form of the city's open space system be designed for flexibility so as to accommodate the changing functional needs of the communities it served, seeking to remain relevant in the future as well as the present. This while acknowledging that a "sense of permanence and lasting value" was desirable in many aspects of a green network (City of Winnipeg, 1981, p. 1). The plan expressed concern that at the same time as it was promoting a more flexible and locally relevant green network, public green spaces and the wooded landscapes they supported were vulnerable to being lost, with new residential development being considered for golf courses (City of Winnipeg, 1981).

Recognizing that Winnipeg's growth over preceding decades had curtailed access to many green spaces, *Plan Winnipeg* proposed the creative repurposing of underused and obsolete spaces for a "linkage system." Rights-of-way, utility corridors, and riverbanks would provide pedestrian and bicycle access between residential areas, parks, and other destinations. (City of Winnipeg, 1981, p. 35). Many of these green corridors – the plan identified hydro corridors in particular – could also serve as "commons" suitable for the provision of informal parks services. Such functions, typically initiated by individuals, might include gardening and other

uses that would otherwise be considered inappropriate in a public greenspace. If needed, “commons” uses could be revoked when other land use needs arose (City of Winnipeg, 1981, p. 33). The green network proposed by *Plan Winnipeg* had noticeable gaps in the city’s core areas, however. Its form did not prioritize commuting or employment area destinations and “linkages” to Downtown were largely absent (City of Winnipeg, 1981, p. 36).

Plan Winnipeg Vision 2020 addressed this absence, directing that river corridors and green spaces be used to establish “an interconnected network to integrate the downtown and connect it with the whole city” (City of Winnipeg, 2001, p. 14). *Vision 2020* sought the development of a “comprehensive, integrated park system” through the connection of major green spaces with “linear parkways.” These green corridors would be supported by riverbanks, rail and utility rights-of-way and would include active transportation routes. The plan proposed that, with the cooperation of other municipalities and the Province, corridors could be extended to “urban fringe parks” beyond the city’s boundaries forming a regional green network (City of Winnipeg, 2001, p. 52).

Influence of function on form – Rivers and greenbelts

Green forms were not applied to guide and constrain the development of Winnipeg as they were in other Canadian cities. Perhaps because of slow population growth through much of the 20th century, barriers to urban expansion were sometimes seen as undesirable. Although before the First World War, *City Plan* proposed the creation of a six kilometre-long green corridor comprising both banks of the Seine River (City of Winnipeg, 1970), even Winnipeg’s rivers were occasionally identified as obstacles to be negotiated rather than as a public good and assets around which to form an urban green network.

In recommendation of its proposed chain of parkways connecting major green spaces, the *Metropolitan Plan for Greater Winnipeg* predicted that it would be “an asset and benefit to all the areas through which it passes” (City of Winnipeg & Greater Winnipeg, 1947, p. 79). Nonetheless, the report expressed concern that the proposed parkway system should not interfere with proper neighbourhood development, betraying a concern that the proposed green network might be a potential obstacle rather than a positive influence on future urban growth. Moreover, it warned against allowing the development of an urban form that responded chiefly to the rivers, favouring instead uniform circular expansion as more efficient (City of Winnipeg & Greater Winnipeg, 1947).

A change in attitude regarding rivers is apparent in *The Metropolitan Development Plan*, which established as an objective the securement of riverbanks in the Metropolitan Area for “the use, enjoyment, and benefit of the residents” (Metropolitan Corporation of Greater Winnipeg, 1968, p. 66). The plan identified riverbanks as

a natural asset and amenity worthy of protection and reclamation for public use, directing Metro to prioritize the acquisition of riverbank land for parks and requesting that constituent municipalities institute similar policies. Planners considered Metro's green network in a wider regional context for the provision of a full range of desired greenspace functions, extending it as far as Birds Hill Provincial Park, thirty kilometres northeast of Winnipeg. *The Metropolitan Development Plan* also recommended the re-zoning to "Open Land" use of the periphery beyond the built-up urban area as a means to constrain urban expansion, identifying it as suitable for agriculture and recreation. Greenspace was only expected to represent a small part of the total open land area however, and unlikely to be integrated into Winnipeg's green network (Metropolitan Corporation of Greater Winnipeg, 1968, p. 74).

Plan Winnipeg was more explicit in its intentions that the city's green network or "open space system" be used to mold its form. The network should "offer a sense of structure or organization of Winnipeg and its landscapes," the plan recommended, delineating the boundaries of neighbourhoods and helping to define them by establishing a "sense of place" (City of Winnipeg, 1981, p. 2), adding that notable landscape features should be actively acquired to this end. Green spaces should have open edges, the plan recommended, integrating neighbourhoods with the green network and supporting a desirable sense of place and usage. *Plan Winnipeg Vision 2020* called for similar principles to be extended Downtown, directing the neighbourhood's integration with rivers and greenspace through improved access to the Riverwalk and winter river trails, and by connecting them onward to the wider green network (City of Winnipeg, 2001).

Public perceptions – Functions of green corridors

Newspaper reportage and editorials provide the most readily available accounts of public expectations regarding the functionality of Winnipeg's green spaces and corridors and how those expectations evolved over time. Their analysis through the digital archives of Winnipeg's newspapers represents a means to assess the effectiveness of the City's green network planning strategies in the past century and further establish connections between historical planning precedents and Winnipeg's present strategic planning context.

Local reporting in *The Winnipeg Tribune* and *Winnipeg Free Press* in the years preceding *The* (1968) *Metropolitan Development Plan* reflects growing expectations that Winnipeg's green network should serve diverse and simultaneous functions, among them ecological roles, and also assume a regional scale. Sterling Lyon, Manitoba's Resources Minister, promised fellow members of the legislative assembly (MLAs) that the banks of the Floodway, then under construction, would be naturalized in the future, providing wooded habitat for wildlife, nature trails and other recreational opportunities, in addition to flood hazard management. The Floodway was anticipated to be a greenbelt integrated with Birds Hill Park, forming a green network extending

well into the city's hinterland ("The Floodway Story: Birds, Bees and People," 1964).

Concerns about the ecological health of the local environment and the city's green network grew over the decade that followed, likely reflecting trends that extended beyond Winnipeg. In 1970, near the end of the Metro era, St. Vital City Council was approached by the Seine River project committee, an environmental advocacy group, with a request to co-operate in "cleaning up and retaining the Seine River as a permanent green belt and park," providing recreational benefits as well as environmental ones ("Requests Cleanup Of River," 1970).

Changing attitudes toward automobile use and greenspace were also reflected in the news media in advance of similar shifts in green network planning. Popular columnist Val Werier welcomed a transfer in control over boulevards and the plantings they contained from the transportation department to the Metro Parks Board, complaining that Winnipeg was a city where "there is always a conflict between traffic and trees" (Werier, 1964a). Conflict persisted between automobile traffic and other modes however, and following the amalgamation of Metro municipalities with Winnipeg, planning officials suggested that the City begin to integrate walking and cycling paths into new riverbank green corridors (Bidewell, 1972). This proposal was gradually implemented over the decades that followed and the Riverwalk and river trails eventually maintained seasonally on the Assiniboine River (MacDonald, 1995) were well-received. A *Free Press* reader congratulated the City for its "far-sightedness" in acquiring and demolishing an industrial building next to Bonnycastle Park in Downtown Winnipeg, allowing for the completion of the "green belt" between the Midtown (Donald Street) and Osborne Bridges. The reader called it a dream come true for "generations of Manitobans [who] can meet and stroll undisturbed by traffic." Can you imagine," he continued, "being able, one day, to walk from The Forks all the way to Assiniboine park, with paths for cyclists, wheel-chairs, and pedestrians?"… (Krepps, 1989) A dream of a green corridor that remains incompletely fulfilled.

Public perceptions – Influence of function on form

Inflexibility of form

Early reporting in Winnipeg's newspapers suggests that public access to greenspace was a concern years before plans sought to address it. By 1906, a "driveway" had been constructed on the south side of the Assiniboine River between Winnipeg and the "new public park in St. Charles," later Assiniboine Park. This public access was praised by the unnamed author, who warned that residential development west of Maryland Street, was proceeding quickly. Winnipeg needed to act fast to secure a public right of way or a green corridor north of the Assiniboine River would soon be unattainable, the author continued, complaining that "at the present time the public is practically shut off from the river both within and without the city limits" ("Building and Real Estate," 1906).

Residential development and automobile routes were not alone in constraining possibilities for more greenspace in Winnipeg, or in limiting public access to the rivers. Railway infrastructure, which proliferated in the city in its early years, also contributed to the inflexibility of Winnipeg's urban form. In 1963, Metro Winnipeg sought to acquire land from the Canadian National Railway (CNR) at the junction of the Red and Assiniboine rivers as a part of an ongoing riverbank acquisition program responding to its master development plan. Efforts to clean-up, beautify, and create access to the site failed, however, due to CNR's unwillingness to make accommodations, even over the long term. ("CNR Blocks Riverbank Beautification Program," 1963). Nevertheless, newspapers reported that Winnipeg's planning officials continued to recommend that the City transition its riverbank acquisition program to focus on downtown riverbanks rather than outlaying areas where most acquisitions had so far been made (Bidewell, 1972). Winnipeg's riverbank acquisition program was successful, however. The *Winnipeg Free Press* reported on its ambition and increasing expense in the years following it becoming policy in 1972, noting that purchase prices for a single riverbank property increased five-fold by 1977. Councillor Don Gerrie claimed that the City had found itself with an "'unbelievable' but scattered inventory of riverbank properties" that it could not afford to maintain or develop as public greenspace, forcing it to freeze further acquisitions (Pona, 1978). The inflexibility of the urban form had been partially overcome, but inflated real estate prices were a greater challenge to green network expansion.

Rivers and greenbelts

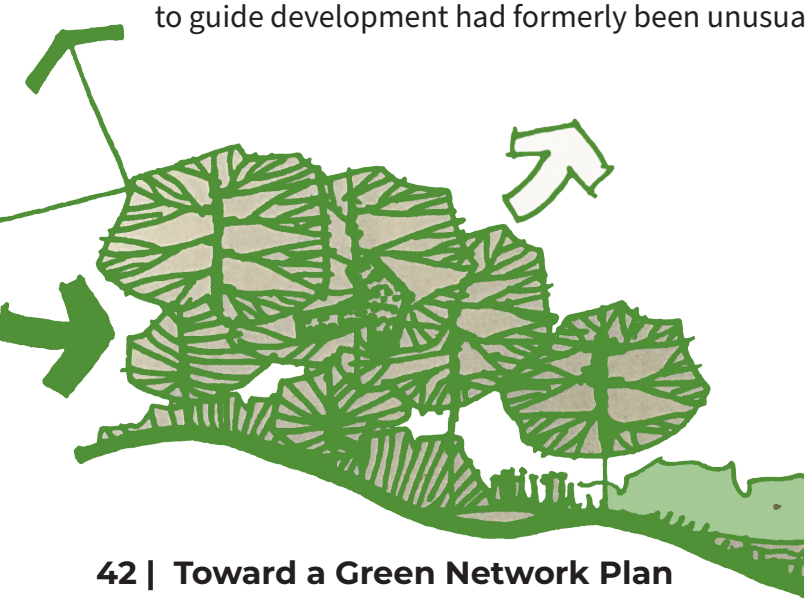
The aesthetic value of rivers early in the city's development was recognized by prescient voices, who decried unrestrained growth and blamed speculators for never taking into consideration "that the river front with a nice driveway, green boulevards and shady trees is far more beautiful than when adorned with stables and other outbuildings" ("Building and Real Estate," 1906). Complaints about the impacts of unconstrained development persisted in the newspapers through the 20th century. "Lands which would be more suitable for greenbelt recreation areas are developed because they are held for investment and feed off other developments" serving few people, Morley Blankstein of historic Winnipeg architecture firm Green Blankstein Russell (GBR) wrote ("Dull Homes 'Serve Only Few People,'" 1961).

Acquisition of riverbank land was in fact a cause dear to the hearts of Winnipeggers, according to Val Werier, and discussed by them for years prior to the City's first efforts to consolidate such green corridors. The author observed outrage whenever development occurred on riverbank land and suggested that this indicated intensifying public interest in the establishment of a green network along the city's rivers and pressure for Metro to take action to preserve what beauty was left (Werier, 1964b). This was echoed by the Winnipeg Chamber of Commerce, which called on City Hall to give serious consideration "to the rehabilitation and reclaiming of river banks for the citizens of Metro Winnipeg" ("Metro Gets First Offer of Riverbank Property,"

1964). Measures that were taken by Metro to reclaim riverbanks and increase public access were praised by Werier, such as its new "open door policy," removing barriers to green spaces and corridors and recognizing the value of informal recreational uses along riverbanks, including the "monkey speedway" bicycle trails along the river near Assiniboine Park (Werier, 1964a).

At the time that it was under construction, the provincial government predicted that the Floodway would serve as a multi-functional greenbelt enclosing Metro Winnipeg. The Floodway's anticipated potential as a greenbelt in a wider green network was never realized ("The Floodway Story: Birds, Bees and People," 1964), but dreams of a "greenbelt" persisted, not least in the form of a green corridor along the Seine River ("Requests Cleanup Of River," 1970). Ideas expressed through the media for such a corridor included the proposal for a linear park adjacent to the Seine River, extending from the Red River to Niakwa Golf Course and, eventually, the Floodway (Bidewell, 1972). In a 1973 resolution, the Midland Community Committee advocated for a similar green corridor along Omand's Creek, protecting "the only remaining creek in the inner city" and retaining its "natural amenities as parkland" (Blanchard, 1979). Development along the creek continued to encroach, however, and Winnipeg persisted in chiefly using Omand's Creek as a stormwater drain.

Eric Stadnyk suggests that public planning in the past has often discouraged people from experiencing Winnipeg's rivers and the natural corridors they support by restricting pedestrian access to them and orienting new development toward roads. Nevertheless, informal trails along many watercourses indicate a persistent desire by residents to access them (Stadnyk, 1999). Investment in enhancing Omand's Creek as a recreational asset was finally planned in the 1980s but discouraged by residents who desired that the green corridor be left alone in a naturalized state. "Don't throw a lot of consultants and money at us," a local man said. "Just leave it as it is and put a walkway from one end to the other" ("Omand's Creek Frills Opposed by Residents," 1986). In the meantime, newspapers reported the ongoing consolidation of extensive green corridors along the Red River in St. Vital and Fort Garry where significant future growth was predicted. This strategic use of greenspace to guide development had formerly been unusual in Winnipeg (Bidewell, 1972).



VI. Discussion – Q 1&2: Form and Function

My findings, drawn from planning precedents from Winnipeg's past and described in the previous section (V), relate to the evolving historical trends in green corridor function and form identifiable through the literature review (*Section III*). They broadly support several of the themes identified including: an early emphasis on accessibility (Olmsted, 1871) that was reasserted as the 20th century progressed (Maller, 2009); axial green network growth supporting recreational automobile use (Hoyt, 1939); a growing awareness of the value of ecological functions (Hough, 2004); and the importance of corridors for maintaining the connectivity on which ecological functions rely (Ahern, 1995; Forman, 2014). In some cases, the integration of these concepts into Winnipeg's planning context occurred decades later than their appearance in the literature. Curiously, Winnipeg differed from other Canadian cities studied in the literature (e.g., Ottawa) in that it did not apply greenbelts and other green network forms to constrain growth (Gordon & Scott, 2008) and interjurisdictional collaboration to preserve public access and the ecological functionality of riparian corridors did not occur as extensively as elsewhere in the Canadian context (Taylor et al., 1995). The unique evolution of green corridor function and form in Winnipeg, sometimes corresponding and sometimes contrasting with broader planning trends, represents a valuable precedent, uniquely suited to inform recommendations supporting the future master green space and natural corridor plan.

Functions of green corridors

The increasingly diverse functionality of Winnipeg's green network over time reflects positively on the flexibility of its form and ability to accommodate new uses as the city's needs evolve.

Experience with frequent flooding has forced Winnipeg to consider its green spaces and corridors as green infrastructure for over a hundred years, capable of managing storm and meltwater. Floodway construction by the Province in the 1960s created a subsequently abandoned opportunity to extend Winnipeg's green network and integrate it with the region by means of green infrastructure, with additional ecological and recreational functions benefitting. However, opportunities remain to collaborate with watershed authorities to the benefit of Winnipeg's green network at a regional level, enhancing the scale and scope of green infrastructure services that the network provides to the region. The provision of green infrastructure benefits from collaborative, well-defined relationships between levels of government and other authorities, a benefit that is further enhanced when legislation and statutory plans articulate and reflect these relationships.

The creation of Ontario-style conservation authorities, as advocated for by *The Metropolitan Development Plan* in 1968 (Metropolitan Corporation of Greater Winnipeg, 1968), would further strengthen the ability to

develop and manage Winnipeg's green network at a regional level. In Ontario, provincial legislation clearly defines expectations for natural asset management at the regional and municipal level (Government of Ontario, 2017). Other legislation empowers conservation authorities like the Toronto and Region Conservation Authority (TRCA) to exert influence in local planning processes, ensuring that healthy watersheds and ecological functionality are considered in decision-making (Conservation Authorities Act, 1990). This governance model promotes collaborative partnerships and supports a regional green network by prioritizing objectives like stormwater management, flood hazard mitigation, and water supply protection, alongside improved biodiversity, and recreational functions. Whatever the governance context, strong and consistent advocacy for green network and watershed priorities should be maintained at the provincial level to ensure that they are considered in planning processes.

As the impacts of a changing climate become more apparent and floods and other climate hazards become more frequent and damaging, Winnipeg's infrastructure systems will depend increasingly on its green network to serve a critical role in mitigating, adapting, and enhancing resilience to climate change. Canada's long-term national infrastructure plan, *Investing in Canada*, emphasizes the potential that ambitious and innovative applications of green infrastructure hold to improve the efficiency and environmental performance of infrastructure systems in the context of a changing climate (Infrastructure Canada, 2018). Winnipeg's future master green space and natural corridor plan should give full consideration to this vital ecological function of urban green networks.

Findings from Winnipeg's past development plans reflect a significant shift in functional priorities for the city's green network. This trend, early enthusiasm followed by gradual de-emphasis of automobile use as the 20th century progressed, led to *Plan Winnipeg* recommending the development of a "linkage system" connecting neighbourhoods, activities, and destinations with pedestrian and bicycle trails (City of Winnipeg, 1981). More than 40 years later, however, these connections remain seasonally dependent and are often not maintained to a level that supports active mobility through the winter. "If you're someone that doesn't have a car, if you are someone that's relying on walking [or] biking… what we've seen in the last few days is where the City prioritizes you, and it's last," Mark Cohoe, Executive Director of Bike Winnipeg said two days after a major winter storm moved through Winnipeg in 2021. "We do a good job at plowing streets for cars, but if we're looking to get more people walking, more people biking… we're nowhere near anywhere where we need to be" (Da Silva, 2021). Wherever possible, green corridors supporting active transportation should be designed and maintained to a universal design standard that encourages year-round use by people of all abilities and using a range of active modes for recreation and commuting. Clear strategic priorities and policy directions supporting these objectives should be included in the future green space and natural corridor plan.

Of course, human-centric green network functions like active transportation and recreation may conflict with ecological functions. Biodiversity, in particular, may be harmed by human activity in proximity to ecologically sensitive areas (Forman, 2014). Careful planning is required to negotiate these priorities, as *Plan Winnipeg* observed, and while the preservation of natural landscapes may be compatible with human activity in some green network contexts, this should be in appropriate relation to the assessed carrying capacity of a given greenspace or corridor (City of Winnipeg, 1981). The principal of multi-functionality should not be rigidly held to where doing so is detrimental to ecological priorities.

Making greenspace more widely available and increasing the accessibility of Winnipeg's green network, where appropriate, offer solutions toward simultaneously addressing environmental and social problems. Doing so can reinforce inequalities, however, and lead to new forms of social exclusion (Tozer et al, 2020, 1). Culturally relevant perspectives about green spaces and natural corridors are often neglected by planners when determining how to make the city's green network available to underserved communities, allowing dominant views to remain unquestioned and reducing the value and appropriateness of what may be provided (Tozer et al., 2020). Winnipeg's future plan should provide clear direction regarding the assessment of the cultural landscape in partnership with Indigenous Elders and organizations, leading to shared stewardship of green spaces and corridors with Indigenous communities and ensuring that Winnipeg's green network is culturally relevant and accessible to all.

Influence of function on form

The tension expressed in *Plan Winnipeg* between flexible green network design that stays relevant to the changing functional needs of the communities it serves, while striving to create green spaces of lasting value remains relevant to green network planning in Winnipeg today (City of Winnipeg, 1981).

In the context of an urban form that is often constraining, Winnipeg should seek chances to extend green corridors and establish connections within the green network opportunistically. Hydro corridors and undeveloped or abandoned rail and road rights-of-way may provide direct connections between neighbourhoods, green spaces, and destinations as green corridors supporting active transportation routes. The same corridors may often simultaneously accommodate "commons" with garden allotments, providing opportunities for outdoor relaxation and urban agriculture that will be increasingly desirable as Winnipeg's urban form grows more dense and private gardens smaller or more rare. Most of all, "In recognition that open space is a scarce asset and that conversion to other land uses is effectively irreversible," Winnipeg's master green space and natural corridor plan should do as Edmonton's and "pursue options to maintain the existing green network intact whenever possible" (City of Edmonton, 2017, pp. 122–123).

Winnipeg has failed to prevent residential development from encroaching on and restricting access to the Red and Assiniboine rivers and smaller streams throughout much of the city. This failure arose in part because of the City's early reluctance to use green spaces and corridors as a means of guiding development. This contrasts with Ottawa's creation of a greenbelt encircling the city and Saskatoon's reservation of the South Saskatchewan River valley for public use, managed since the 1980s by the Meewasin Valley Authority (Gordon & Scott, 2008). Winnipeg's failure also poses challenges for any plans that seek the contiguity of riparian green corridors in the city's green network, as consolidating further parcels depends on private owners' willingness to sell and the City's ability to pay. Nevertheless, Winnipeg's rivers and streams are the lifeblood of the green network and the sustaining and organizing force for its green spaces and corridors. The acquisition of river and stream banks should continue to be actively pursued by the City, whether through fee simple purchase, easements, or other means.

The focus and point of convergence for Winnipeg's green network is near Downtown at the Forks. This reflects the close alignment of *Plan Winnipeg*'s proposed "linkage system" with the city's rivers and streams, which failed, however, to connect Downtown with the network (City of Winnipeg, 1981). Downtown remains undersupplied with greenspace even as its residential population grows and notwithstanding *Plan Winnipeg Vision 2020*'s direction to integrate the neighbourhood with the wider green network (City of Winnipeg, 2001; Rutgers, 2023). The future master green space and natural corridor plan should ensure that Downtown is established as a focus of Winnipeg's green network together with the Forks, providing equitable greenspace access for residents and making the vital connections that would allow all people to commute actively from their neighbourhoods to the city's major employment area in safety and comfort.

Strategic priorities and policy direction

Winnipeg's later plans successfully and clearly articulated strategic priorities and policy direction. *Plan Winnipeg* provided detailed implementation strategies to aid the realization of its objectives and policies, and a Policy/Objective/Implications structure provided clarity regarding intentions and intended actions, strengthened by active verbs and the use of "shall" to provide clear direction (City of Winnipeg, 1981). Time and cost scales provided useful context and encouraged accountability. *Plan Winnipeg Vision 2020* added Key Performance Indicators (KPIs) as another implementation tool (City of Winnipeg, 2001), further encouraging accountability by establishing measurable outcomes against which policy implementation was to be measured. The clear articulation of policy priorities supported by the requisite tools for implementation and monitoring are necessary attributes of an effective future master green space and natural corridor plan.

Assessment of public perceptions

My findings resulting from the analysis of newspaper archives in *Section V* reveal changing public expectations regarding green network functionality over the course of the 20th century and changing perceptions of the City's efforts to address them. The analysis suggests that Winnipeg's green network planning strategies were often successful (Pona, 1978) and responsive to public priorities as they evolved (Krepps, 1989). This is in agreement with the literature, which says that greenspace forms reflect the values and nature of urban communities and the compromises that occur as a part of political processes (Heckscher, 1977), and confirms their relevance as a basis for recommendations supporting the future master green space and natural corridor plan for Winnipeg.

Evolving priorities are evident in the acknowledgement by *The Winnipeg Tribune*'s Val Werier of the conflicting priorities of traffic and greenspace (Werier, 1964a). This reflects the increasingly ambivalent public attitudes toward automobiles over time, as well as the growing environmental awareness that drew Winnipeggers' attention to the health of the city's green corridors and added impetus to the movement to protect them ("Requests Cleanup Of River," 1970). More often, however, reportage and editorials from the past century demonstrate a persistent public concern over issues and priorities that changed remarkably little over time. Public sentiment in Winnipeg has always supported investment in the enhancement and expansion of the city's green network ("Building and Real Estate," 1906). Winnipeggers have long been drawn to the green corridors of the Red and Assiniboine rivers, as well as to smaller streams like the Seine River and Omand's Creek, accessing them through formal and informal green spaces and seeking natural and naturalized spaces where available (Blanchard, 1979). Frequently, Winnipeggers have chosen to experience green corridors away from the mediating influence of automobiles, informally programming them with trails for walking and cycling. Winnipeggers have long been aware of other cities' use of greenbelts and other green network forms to constrain develop and preserve public access to riparian green corridors, and desired that their own leaders do the same ("The Floodway Story: Birds, Bees and People," 1964). The Province's failure to develop the Floodway as a multi-functional space as planned has deprived Winnipeg of very significant recreational, ecological, and green infrastructure functionality, as well as the opportunity to grow its green network to a regional scale including Birds Hill Park.

VII. Findings – Q 3: Best Practices

Cities elsewhere in Canada have recognized the diverse ways in which green spaces and natural corridors contribute to the urban environment. They have also realized the value that a holistic, network-based approach brings to planning these spaces, especially when grounded in sound evidence. The *Halifax Green Network Plan* is a response to the likelihood that the functional value of green spaces will degrade or disappear if their "multiple benefits" are not "well-managed and considered holistically" (Halifax Regional Municipality, 2018, p. 3). *Saskatoon's Green Infrastructure Strategy: Toward an Interconnected Green Network* defines its role and purpose in similar terms (City of Saskatoon, 2020). In addition to establishing strong precedents for a holistic and sustainability-focused approach to the development and management of Winnipeg's green network, these existing plans provide a wealth of actionable policy appropriate to cities built around rivers and waterbodies and seeking winter city functionality, greater equitability of access, and climate change resilience. As of yet, the applicability of these precedents to Winnipeg's planning context has not been explored in the available literature. For my analysis, I relied on a precedent study approach to establish connections between the contemporary Canadian green network planning context and that of Winnipeg, in the process identifying several themes that represent notable strengths common to the green network plans of Halifax, Saskatoon, and Edmonton.

Holistic approach to planning

Halifax

Halifax Regional Municipality (HRM) greenspace planning is notable for the holistic approach that characterizes it. The *Halifax Green Network Plan* (HGNP) recognizes the interconnected and interdependent nature of green spaces and their ability to "offer multiple benefits when they are well-managed and considered holistically" (Halifax Regional Municipality, 2018, p. 3). The green network plan combines elements of greenspace, recreation, sustainable development, and green infrastructure plans, with direction regarding cultural and ecological systems and natural resource and economic development.

Figure 7: Five themes define the importance of open space in HRM (Halifax Regional Municipality, 2018).

HGNP assigns values to greenspace parcels that reflect how effectively they support broad functional categories

or “themes,” identified by HRM planners as Ecology, Working Landscapes, Community Shaping, Outdoor Recreation, and Cultural Landscapes (see *Figure 7*). These are subsequently combined for a total landscape value. This results in land use, infrastructure, and greenspace planning that considers the capacity of land to support a diverse range of uses as a part of the same process rather than independently and in competition. The outcome is a more efficient use of planning resources. For instance, green infrastructure services like stormwater management, water supply protection, and water filtration are considered in a broader and integrated context that accounts for the diverse range of services that water, land, and natural resources provide to HRM (Halifax Regional Municipality, 2018).

Theme (Broad function)	(Sub-)functions
Ecology	Biodiversity; Landscape connectivity (connectivity of habitats and ecological flows); Water management; Climate change adaptation; Climate change mitigation; Air quality; Risk mitigation (slope stabilization, etc.); and Urban forests.
Working landscape	Food production; (Wood) Fibre production; Natural resource production (aggregates, etc.); Tourism; and Waste management.
Community Shaping	Community shaping and identity (guiding forms and patterns of development); Community building and celebration (provision of gathering spaces); Aesthetic quality; and Public comfort and safety (temperature moderation, traffic calming, etc.).
Outdoor recreation	Recreation; Health and well-being; Active transportation; and Learn and play.
Cultural landscape	Cultural and historical significance; and Indigenous significance.

Table 11: HGNP themes and functions (Halifax Regional Municipality, 2018).

Saskatoon

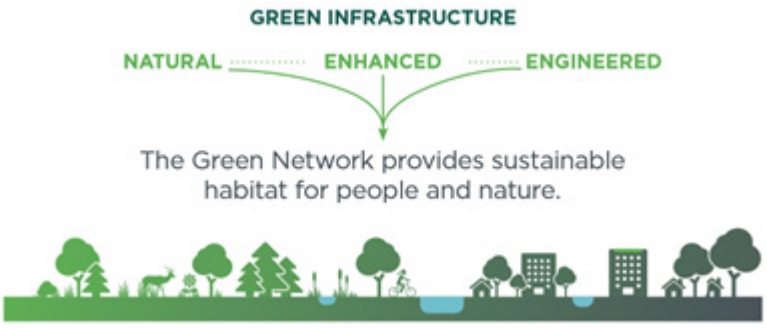


Figure 8: Green infrastructure in Saskatoon, (City of Saskatoon, 2020).

The growth and management of the City of Saskatoon's green network, comprised of public green spaces and green infrastructure functioning at diverse scales, is guided by *Saskatoon's Green Infrastructure Strategy: Toward an Interconnected Green Network* (GIS). The strategic plan is based on the understanding that "when green infrastructure is designed holistically, it becomes an interconnected Green Network that enhances the urban environment and improves quality of life" (City of Saskatoon, 2020, p. 18). In this conceptual context, green infrastructure is understood broadly, extending beyond ecosystem services that sustain water and air to include enhanced and engineered assets, including cultural spaces, trails, and interpretive features, that contribute to a healthy urban ecology, sustaining humans and nature.

The GIS's holistic approach to planning ensures that the diverse ways in which people, green spaces, and ecological functions interact are accounted for and considered as an integrated whole; a "web of interrelationships" that enables the City to provide services more efficiently and equitably. It also draws in diverse communities for input and, "in the spirit of our treaty relationship, provides one opportunity for the many peoples who call Saskatoon home to reaffirm our coexistence on this land" (City of Saskatoon, 2020, pp. 5 & 18).

Green network themes, developed through an analysis of Saskatoon's green spaces and corridors, provide a framework for actions that support a networked response to potential risks and opportunities and realize the City's vision for a green network.

Theme	Inventory and functions
Community	Placing making; Honours culture; Community-led transformation; and Urban Agriculture
Governance	Partnerships; and Triple bottom line (i.e., environmentally, socially, and economically sustainable) solutions
Open Space	Trails and greenways; Interconnected greenspace; and Accessibility
Ecology	Biodiversity; Climate change resilience; and Soil assets
Stormwater	Aquatic assets; and Low Impact Development

Table 12: GIS themes and functions (above) (City of Saskatoon, 2020). *Table 13: Breathe themes and functions (opposite) (City of Edmonton, 2017).*

Edmonton

Breathe: Edmonton's Green Network Strategy uses a network approach to planning the city's green spaces and corridors, accounting for all publicly accessible open spaces, regardless of function, in its conceptualization of the city's green network. The network approach responds to the overlapping, interconnected patterns of greenspace that, as a whole, form an "integrated, multi-functional green network" (City of Edmonton, 2017, p. vi). Through *Breathe*, a broad "systems" lens is applied to green network planning that allows network components to be identified for the benefits they deliver to the whole network, rather than at a strictly local scale where such benefits may be less apparent. This is premised on the assumption that "the whole is greater than the sum of its parts" with individual green spaces and corridors "enhanced by their position in, and connectedness to, broader networks" (City of Edmonton, 2017, pp. 16–17).

Breathe identifies elements of Edmonton's green network and assesses their functionality according to three overarching themes, Ecology, Celebration, and Wellness, which are organized around 15 functions. Based on this assessment, the plan prioritizes support for green spaces and corridors that are multi-functional or that leverage the City's strategic objectives, including objectives relating to land use, active transportation, and drainage. In a context of scarce public land and limited financial resources, *Breathe* acknowledges, "improvements to functionality, connectivity, or access are needed, rather than simply more open space" (City of Edmonton, 2017, p. 16).

Theme	Functions
Ecology Green spaces and corridors that sustain "healthy and resilient ecosystems" supporting the urban environment.	Water Management; Climate Regulation; Biodiversity; Risk Mitigation; Waste Management; and Food Production.
Celebration Green spaces that provide communities with places to "gather and thrive."	Aesthetic Value; Community Building; Public Safety; Heritage; and Destination and Tourism.
Wellness Green spaces and corridors that promote healthy lifestyles.	Recreation; Mental Health and Wellbeing; Active Transportation; and Learn and Play.

Sustainability as a central concept

Halifax

The principle of sustainability is central to Halifax Regional Municipalities' (HRM) planning documents and policies. The *Halifax Green Network Plan* (HGNP) was conceived as an economically and environmentally sustainable strategy for the maintenance and distribution of greenspace in Halifax. Sustainability, as community resilience, is a core concept informing the HGNP and is reflected in its objectives of buffering communities from environmental, economic, and social disruptions and supporting a healthy and sustainable natural ecosystem. HGNP's holistic perspective on sustainable planning is identifiable in its recognition that: working landscapes support economic resilience; and cultural landscapes support community resilience; just as naturalized and biodiverse landscapes are sources of ecological resilience. Often in HGNP, sustainability is realized through multiple functions of the same green network component (Halifax Regional Municipality, 2018).

Saskatoon

The guiding principles and actions in *Saskatoon's Green Infrastructure Strategy* (GIS) are informed by a vision of sustainability. In the strategic plan, the City commits "to provide sustainable habitat for people and nature" by pursuing climate change adaptation and mitigation and ensuring the ecological integrity of its green network (City of Saskatoon, 2020, p. 15). The network approach to green network planning adopted by Saskatoon is aligned with the City's commitment to sustainability. According to the landscape ecology model applied by the City, the network seeks greater contiguity of green corridors, larger green spaces, and spaces situated in close proximity wherever possible, creating a more climate resilient and biodiverse network (City of Saskatoon, 2020). The GIS acknowledges the South Saskatchewan River as a defining feature of Saskatoon. It directs the City to carefully manage the river's watershed to ensure its ongoing health and ability to provide vital green infrastructure services like stormwater management in the future, as well as viable habitats.

A "triple bottom line" framework extends the principles of sustainability to include social equity, cultural inclusion, and economic prosperity, along with ecological integrity. This has implications for communities like First Nations that have been excluded from Saskatoon's green network in the past and that may continue to struggle to access it for cultural and other functions.

Edmonton

Breathe: Edmonton's Green Network Strategy recognizes that the ecological functions supported by Edmonton's green network are vital to the city's environmental sustainability, cleaning air and water, mitigating the effects

of climate change, and providing habitat for plant and animal life. As a result, the strategy acknowledges that green network planning must maintain the "delicate balance between preserving ecological integrity and providing for sustainable human use." With this tension in mind, *Breathe* "establishes policy that addresses issues of environmental degradation, optimizing usage patterns and opportunities for long-term use and preservation" (City of Edmonton, 2017, p. 8).

Clear articulation of policy priorities

The *Halifax Green Network Plan* (HGNP), *Saskatoon's Green Infrastructure Strategy* (GIS), and *Breathe: Edmonton's Green Network Strategy* are similar in using strong, active language in their policy directions, providing clarity and intention that supports their implementation.

Halifax

Green Infrastructure is a repeated theme in the HGNP, which acknowledges green infrastructure and the services it provides as necessary means of addressing climate change and delivering municipal services. The plan recognizes the ecological functions of riparian areas, wetlands, and urban forests in supporting green infrastructure, which it identifies as being critical to ensuring and managing water quality and quantity as climate patterns change (Halifax Regional Municipality, 2018), concerns of no less relevance to Winnipeg.

HGNP promotes the use of naturalized stormwater retention ponds and bioswales, among other green infrastructure types, for the management of stormwater flows, and the application of low-impact development principles in public and private developments. The plan also directs the establishment of 100-metre naturalized buffers around drinking water sources, protecting riparian corridors and wetlands from degradation (Halifax Regional Municipality, 2018).

Saskatoon

Saskatoon's GIS also emphasizes the functionality of the city's green network as infrastructure through policy direction. As climate patterns change and become increasingly unpredictable, Saskatoon, like Winnipeg, is more susceptible to extreme weather events. Its plan addresses this with considerable attention to stormwater management and interventions like low-impact development. The GIS directs the City to consider how the green network can store and slow the flow of water in intense rain events and to rely increasingly on naturalized

Low-impact development
"Low Impact Development (LID) is a design approach that manages stormwater runoff by mimicking natural processes to increase the water's infiltration or evapotranspiration," using tools such as bioswales, green roofs, and rain gardens. – *Saskatoon's Green Network Strategy*

Table 14: Low-impact development (City of Saskatoon, 2020, p. 108).

stormwater ponds, wetlands, and watercourses to do so. The strategy identifies a leadership role for the City in integrating low-impact development into design (See *Table 14*), extending the city's green network further into the built form (City of Saskatoon, 2020).

Edmonton

Notable among Edmonton's strategic priorities and considered repeatedly and in detail throughout *Breathe* is greater accessibility, with particular focuses on: universal access to the city's river and ravine system; winter access to the green network's active transportation routes; and access for Indigenous communities to cultural spaces in the network. All of these priorities are applicable to Winnipeg's green network, which relates closely to its rivers and which struggles to provide adequate access to Indigenous communities or to active users in the winter. Policy in *Breathe* directs Edmonton to expand access to green corridors (especially the city's river valley) for those with reduced mobility, supporting universal access to trails and active transportation routes through the careful application of surfaces, widths, gentle grades, the use of technology, and maintenance conducive to all levels of mobility. The year-round use of the green network is encouraged through the expansion of winter-oriented active transportation infrastructure and through the establishment of a minimum year-round active transportation grid connecting green spaces, corridors, and destinations throughout the city (City of Edmonton, 2017).

In the management and development of the network, *Breathe* directs the City to conduct needs assessments of communities with unique needs, including First Nations, and design spaces in response to their characteristics. This direction acknowledges that if Edmonton's green network seems irrelevant or inhospitable, it will be functionally inaccessible to such communities. The plan also directs the City to communicate effectively with Edmontonians and city employees, including the police, reminding them of the rights to green network use to which Indigenous and marginalized groups are entitled without harassment (City of Edmonton, 2017).

Recognition of cultural landscapes

The green network plans of all three cities recognize the significance of cultural and working landscapes in their urban contexts, especially as they demonstrate in tangible ways the connections between communities and local environments over the course of time. Such landscapes are especially important as they relate to Indigenous history, traditions, and placemaking, due to the history of dispossession experienced by Indigenous peoples in Canada. In many cases, Indigenous uses were actively erased by settler communities in urbanizing areas and places traditionally used for harvesting food and medicine or for cultural activities were lost. As a result, green spaces and corridors in Edmonton, Saskatoon, and Halifax are recognized as opportunities to

partner with Indigenous Elders, knowledge keepers, and communities to re-establish traditional uses and renew connections with the land.

Halifax

The *Halifax Green Network Plan* (HGNP) is notable for the attention it gives to working landscapes, a response in part to the rural nature of much of Halifax Regional Municipality (HRM) and the well-established resource-based and agricultural land uses prevalent throughout the municipality. The plan supports the sustainable pursuit of established and traditional land uses and directs HRM to protect high value agricultural lands where undeveloped. It also encourages small scale urban agriculture including animal husbandry and roadside stands where appropriate. HGNP commits to "preserve and celebrate" cultural landscapes, proactively engaging with historically under-represented communities like Mi'kmaq and African Nova Scotians to identify valued landscape elements, especially where they are vulnerable (Halifax Regional Municipality, 2018, p. 65).

Saskatoon

Saskatoon's Green Infrastructure Strategy (GIS) directs Saskatoon to support a comprehensive assessment of "traditional knowledge systems, food systems, and land uses as they relate to Green Network planning," as recommended by the City's Indigenous Technical Advisory Group (ITAG). This responds to an acknowledged deficit in knowledge relating to the city's cultural landscape, and that of local First Nations in particular (City of Saskatoon, 2020, p. 29). This direction also addresses the difficulty Indigenous communities in Saskatoon have accessing traditional foods and medicines that they formerly cultivated on the local landscape. The GIS directs the City to incorporate traditional food systems and production into its green network.

The GIS also notes, at the recommendation of ITAG, the importance of naming practices, wayfinding, and interpretive features that are relevant to local Indigenous communities, reflecting traditional knowledge and telling their stories. The plan directs the City to partner with these communities to ensure that their traditions and stories are represented in Saskatoon's green network (City of Saskatoon, 2020).

Edmonton

Breathe: Edmonton's Green Network Strategy contains extensive strategy and numerous specific policy actions promoting reconciliation by protecting and maintaining the working and cultural landscapes vital to traditional Indigenous values and practices and celebrating Indigenous culture in the context of Edmonton's green network.

The Edmonton region and the North Saskatchewan River valley have a history as productive working landscapes for Indigenous peoples that pre-dates settlement and is ongoing. *Breathe* directs the City to

support the identification of plant and animal species traditionally used for food, medicine, and other cultural purposes so as to preserve them and ensure their availability to Indigenous communities for harvesting as guaranteed by their Treaty rights. *Breathe* also directs the City to make its green network accessible to Indigenous communities for traditional cultural activities and observances and to ensure that the network be developed and maintained in a manner that is respectful and appropriate to these needs. As such, traditional sacred sites and burial grounds are recognized as requiring protection within the city's green network (City of Edmonton, 2017).

Edmonton is encouraged in *Breathe* to creatively and collaboratively "acknowledge the contributions of Indigenous communities to the history and ongoing story of Edmonton," while "recogniz[ing] the diversity of Indigenous peoples, experiences and narratives in Edmonton" (City of Edmonton, 2017, p. 94). *Breathe* provides policy actions like integrating culturally appropriate programming and educational elements into the city's green network; creating opportunities for cultural celebrations grounded in the landscape; and amending naming policies as means to advance these goals in partnership with Treaty Six Indigenous communities, celebrating the unique relationship they have with the regional landscape.

Collaborative approach to planning

The planning precedents identified in this capstone were developed through extensive community consultation processes and provide their respective jurisdictions with specific strategies for engaging with Indigenous communities, newcomers, and vulnerable populations in meaningful ways.

Halifax

The *Halifax Green Network Plan* (HGNP) identifies stewardship as a guiding principle, grounded in an understanding of the green network as a shared regional asset. As such, the plan directs Halifax Regional Municipality (HRM) to work with First Nations governments and other Indigenous organizations to advance common functional interests in the green network. Mi'kmaq peoples, as well as Afro-Nova Scotians and other minority groups, were engaged in discussions as a part of the development of the HGNP and the plan commits HRM to further work with First Nations to address an acknowledged deficit of Indigenous traditional knowledge in the plan (Halifax Regional Municipality, 2018).

Saskatoon

Green network governance should be cooperative, according to *Saskatoon's Green Infrastructure Strategy* (GIS), and conducted in consultation with conservation bodies and other regional partners and in partnership with Indigenous communities. The GIS directs the City, together with Indigenous partners, to pursue traditional

approaches to land management and governance for its green network, identifying Indigenous Protected and Conserved Areas (IPCAs) as an appropriate partnership framework (see *Table 15*). The plan also directs Saskatoon to collaborate actively with the Meewasin Valley Authority (a regional conservation authority) and the Indigenous-led Wanuskewin Heritage Park Authority (WHPA) in the conservation and naturalization of the city's green network and in the delivery of green infrastructure services (City of Saskatoon, 2020; Meewasin Valley Authority, 2021; Wanuskewin Heritage Park Authority, 2023) (see *Table 16*).

Indigenous Protected and Conserved Areas (IPCAs)

are places in Canada that Indigenous Nations identify for conservation through the Indigenous Leadership Initiative. These lands help sustain Indigenous communities and the health of the world. They are:

- Are Indigenous-led;
- Represent a long-term commitment to conservation; and
- Elevate Indigenous rights and responsibilities.

Table 15: IPCA definition (Indigenous Leadership Initiative, 2023).

The Meewasin Valley Authority

is a Saskatoon region conservation authority established by provincial legislation that provides leadership in the management of resources in the South Saskatchewan River valley and promotes conservation and sustainable development in the valley through various programs and projects.

The Wanuskewin Heritage Park Authority (WHPA)

is an organization established by provincial legislation and "fostering education and respect for the land based on expressions of Indigenous culture, heritage and arts." The heritage park is situated north of Saskatoon in the Saskatchewan River Valley.

Table 16: Saskatoon region conservation bodies (Meewasin Valley Authority, 2021; Wanuskewin Heritage Park Authority, 2023).

Edmonton

Breathe: Edmonton's Green Network Strategy has extensive policy direction regarding collaboration in the development and maintenance of the city's green network. Like Saskatoon's strategy, it gives particular attention to partnership with Indigenous communities, seeking to share stewardship of areas of traditional and cultural significance, incorporating Traditional Ecological Knowledge (TEK) into their management and decision-making processes. Where organizational capacity is lacking, partnerships are intended to build capacity and ensure a greater future role for local Indigenous communities in green network governance. In all collaborative efforts, *Breathe* directs the City to "recognize and respect Indigenous protocols and processes..; honour the contributions, values, wisdom and traditional knowledge of Indigenous peoples; and empower engagement participants to collaborate and co-create solutions and opportunities for everyone" (City of Edmonton, 2017, p. 91).

Cross-jurisdictional partnerships are also encouraged by the plan, where opportunities exist, to work with nearby First Nations, regional conservation authorities, and other municipalities, extending the reach and strengthening Edmonton's green network by restoring and protecting ecologically significant and biodiverse areas beyond the city's boundaries (City of Edmonton, 2017).

Effective and accountable implementation

Halifax

To support implementation, measurable actions accompany each open space theme in the *Halifax Green Network Plan* (HGNP) with timeframes assigned to each action. To compensate for gaps that may exist in Halifax Regional Municipality's (HRM) own capabilities, green network performance monitoring is conducted in partnership with a range of collaborators, including the Province, utilities, research institutions, and non-profits, which may be responsible for determining their own key performance indicators (KPIs) and collecting and interpreting data. Progress on the HGNP is reported to the public annually (Halifax Regional Municipality, 2018).

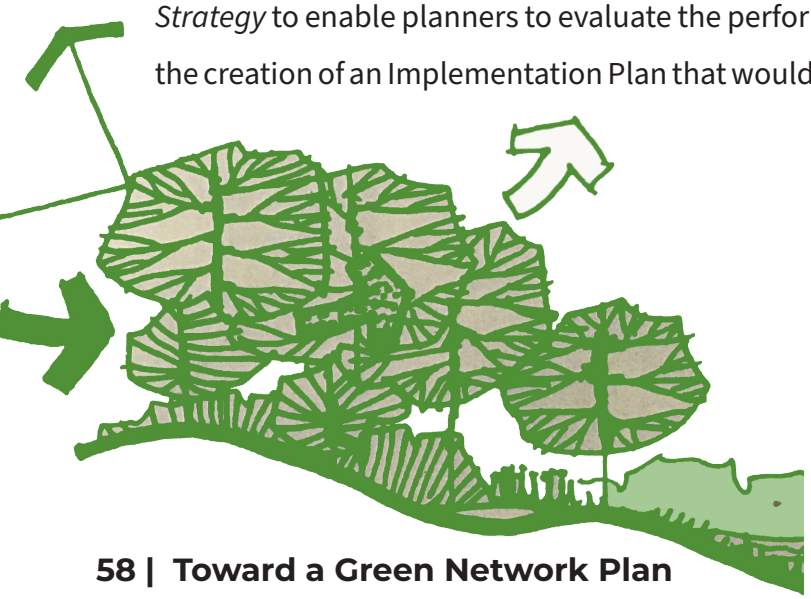
Saskatoon

Actions articulated in *Saskatoon's Green Infrastructure Strategy* (GIS) are designed to be flexible in implementation. While some actions rely on larger capital investments to proceed, others can be implemented on small budgets, as a part of Saskatoon's other strategic objectives, or in collaboration with private landowners and developers (City of Saskatoon, 2020).

KPIs are included in the strategy and every action is assigned an approximate timeframe, primary and secondary departmental responsibility, and partners outside the municipal government. *Pathways for an Integrated Green Network: An Implementation Plan for Saskatoon's Green Infrastructure Strategy* was approved in 2022 as an additional implementation tool for the GIS, phasing actions over the next ten years and providing more detailed KPIs (City of Saskatoon, 2022). Monitoring of green network implementation is described as a continuous process in GIS, with reporting made publicly available online (City of Saskatoon, 2020).

Edmonton

The importance of effective and continuous monitoring is recognized in *Breathe: Edmonton's Green Network Strategy* to enable planners to evaluate the performance of the city's green network. The plan anticipates the creation of an Implementation Plan that would define KPIs, targets, and timelines to aid the evaluation of the network's performance, and which would be publicly reported annually. *Breathe* is meant to be adaptable as a result, and periodically updated in response to ongoing performance evaluations and review, as well as to emerging environmental trends and to routine stakeholder engagement (City of Edmonton, 2017).



VIII. Discussion – Q 3: Best Practices

The findings described in the previous section (VII), drawing from precedent green network plans developed and implemented in Canadian jurisdictions comparable to Winnipeg, relate to best practices identified in the literature in *Section III*. The strategic priorities and policy in the *Halifax Green Network Plan* (HGNP), *Saskatoon's Green Infrastructure Strategy* (GIS), and *Breathe: Edmonton's Green Network Strategy* correspond closely with those relating to: green infrastructure in Beatley (2011) and Novotny, et al. (2010); accessibility in Tozer, et al. (2020); active transportation in Bergström & Magnusson (2003); Indigenous participation in Jojola (2013); and cultural landscapes in Finegan (2021); among others. The clear and consistent alignment of the Canadian precedents with the literature reviewed emphasizes their suitability as models on which to draw recommendations for the future master green space and natural corridor plan for Winnipeg. In the absence of literature relating specifically to this green network planning model, which is apparently particular to Canada and exemplified by the precedent plans I analyse in Section *VII*, the plans' commonalities (e.g., holistic approach to planning, emphases on sustainability and collaboration) establish them as a strong basis for recommendations in their own right.

Holistic approach to planning

Opportunities

Municipal planning that considers green networks holistically benefits the urban ecology in various ways, extending diverse co-benefits to strategic planning priorities. In Halifax Regional Municipality (HRM), Saskatoon, and Edmonton, green spaces and corridors are usefully considered in a broad and inclusive environmental context that acknowledges the varied roles played by the regional landscape and the varied services provided by the green network. The cities achieve this through similar Strategic Plans (Municipal Priorities Plan in HRM) that allow for ecological, cultural, recreational, transportation, and green infrastructure functions to be provided in an integrated manner, while also guiding development and urban growth patterns. The plans facilitate their municipalities' strategic priorities by associating them with co-benefits and, through holistic planning, promote efficiency and avoid redundancy across their green networks and urban forms as a whole.

Challenges

While the *Halifax Green Network Plan* (HGNP) describes open spaces as interconnected and multi-functional, considers their diverse roles and varied impacts, and integrates them into a single green network (Halifax Regional Municipality, 2018), it misses the opportunity to consider them in relation to each other in a detailed way. The co-benefits of Halifax Regional Municipality's (HRM) green networks would be better understood if

HGNP considered the green infrastructure capacities of green spaces and corridors (described as an ecological role) as they relate to working landscapes or explored the opportunities green infrastructure affords to support active transportation and recreation. Naturalized riparian corridors could accommodate new flood resilient multi-use pathways, for instance, while reconstructed wetlands could include themed nature trails educating users on topics like biodiversity, Indigenous cultural landscapes, or even green infrastructure.

Opportunities to integrate green infrastructure functionality into Edmonton's green network planning are limited by the ownership and management of the city's water, wastewater, and drainage infrastructure by EPCOR, a for-profit utility. While municipally-owned, the utility is responsible for planning its infrastructure network (City of Edmonton, 2023), a process that is necessarily independent and isolated from that of the City's green network planning. The divesting of municipal infrastructure is problematic because it limits cities' ability to truly plan holistically, removing elements of their green networks from their effective control. The creative and holistic development of green corridors to enhance and maximize ecological functionality and deliver new green infrastructure services, as done by HRM and Saskatoon, is not feasible in Edmonton.

When considering green spaces and corridors in a holistic manner, tensions and potential conflicts also need to be acknowledged. Principles of sustainability and accessibility may be at odds in the context of sensitive urban environments where human activity could compromise biodiversity or the performance of green infrastructure. Some green corridors may have the capacity to support active transportation routes and even moderate automobile traffic, while sustaining healthy naturalized landscapes. In other corridors, however, public access may need to be prohibited to ensure the survival of fragile habitats. Regardless of the intensity or number of functions supported by an individual green network element, all green spaces and corridors benefit by a holistic approach to planning; an approach that recognizes their interconnected and interdependent nature and their ability to generate "multiple benefits when well-managed and considered holistically" (Halifax Regional Municipality, 2018, p. 3).

Sustainability as central concept

Opportunities

Climate change is addressed by all three green network plans with strategic priorities and policy direction that emphasize sustainable and resilient development and promote investment in green infrastructure in order to accommodate more extreme and unpredictable weather events. In an uncertain future, resilience is a necessary characteristic not only of local and regional ecologies, but also of cities' economies and social fabrics, as existing inequities may otherwise worsen. The triple bottom line lens that *Saskatoon's Green Infrastructure Strategy* (GIS) applies to decision-making is holistic, integrating environmental health, social

equity, and economic prosperity, "producing equitable solutions and avoiding undesirable trade-offs" (City of Saskatoon, 2023b). HRM's similar holistic perspective on sustainable planning acknowledges that working landscapes support economic resilience and cultural landscapes support community resilience just as naturalized and biodiverse landscapes are sources of ecological resilience. With its own challenging and often inequitable urban context in which Indigenous communities are historically marginalized, Winnipeg would also benefit from a triple bottom line lens for green network planning that recognizes the value that working and cultural landscapes bring to the city's green network.

The use of Traditional Land Use and Traditional Knowledge (as identified by GIS) or Traditional Ecological Knowledge (TEK, as in *Breathe: Edmonton's Green Network Strategy*) to approach green network management and decision-making are further notable efforts toward sustainability, especially if applied to the ecological functionality of green networks or to green infrastructure. An absence of roles for Indigenous communities and traditional knowledge in increasing the climate resiliency of HRM's green network, on the other hand, is a negative precedent that should be noted and avoided by Winnipeg as it develops its own master green space and natural corridor plan.

Collaborative approach and recognition of cultural landscapes

Opportunities

Underserved communities, like those of Indigenous peoples, are often difficult to reach. This is a consequence of a lack of trust resulting from the dispossession by urban settler societies of productive Indigenous cultural and working landscapes for the creation of city parks and other greenspace types; a history that has played out in most Canadian cities. Green network plans should make engagement and partnership with Indigenous peoples a priority and include clear strategies and policy direction that enables the rebuilding of trust and a spirit of reconciliation. *Breathe: Edmonton's Green Network Strategy* provides policy precedents for partnering with Indigenous communities that emphasize proactiveness and early-engagement, "honour[ing] the contributions, values, wisdom and traditional knowledge of Indigenous peoples," and respect for Indigenous protocols and processes that are transferrable to Winnipeg's context (City of Edmonton, 2017, p. 91).

Threats

Indigenous involvement in green infrastructure planning processes is largely absent in the *Halifax Green Network Plan* (HGNP), a gap that the plan acknowledges (Halifax Regional Municipality, 2018). Such roles as are defined for First Nations in green network plans should not be limited to tokenistic contributions. Partnerships should entail more than merely representing regional cultural diversity or contributing traditional knowledge

strictly as it relates to cultural landscapes (HRM, 2018), and commitments to future engagement should not be unnecessarily limited or poorly defined. The lack of a strong role for Indigenous peoples in decision-making can deprive cities and regions of valuable sources of knowledge regarding land, water, and natural resources and exclude valuable alternative approaches to green infrastructure implementation. In the context of the historical dispossession of Indigenous peoples' lands throughout Canada and in a spirit of reconciliation, green network planning processes should meaningfully address Indigenous interests and integrate Indigenous knowledge. Where historical greenspace planning processes have excluded non-Indigenous minority groups, these groups should also be collaborated with, ensuring that the services and benefits provided by green networks extend to them in an equitable manner.

Effective and accountable implementation

Opportunities

A rigorous performance measurement regime is essential for monitoring and evaluating regional and municipal green network implementation. Baseline research and reports are necessary to establish priorities and formulate policy, while clear and specific objectives with associated key performance indicators (KPIs) are required to ensure that progress on green network priorities is measurable and outcomes can be assessed. All the precedent plans include strong monitoring and implementation strategies and tools that are transferable to Winnipeg's future master green space and natural corridor plan and worth emulating. These include:

- Extensive and specific KPIs and detailed implementation matrices defining departmental responsibility, likely partners, and phasing for every action in *Saskatoon's Green Infrastructure Strategy* (GIS) and the associated implementation plan;
- Third-party monitoring of *Halifax Green Network Plan* (HGNP) implementation in Halifax Regional Municipality (HRM) by utilities, academic research institutions, and non-profits; and
- Routine evaluations of *Breathe: Edmonton's Green Network Strategy* by stakeholders.

Flexible timeframes for implementation, as provided by the GIS, may be beneficial to cities with limited resources, but may also allow City officials to delay actions unreasonably.

Concerns

In Edmonton, a *Breathe* Implementation Plan was supposed to provide measurable indicators, targets, and timelines to support the monitoring and evaluation of the city's green network performance on an ongoing basis. This has been delayed, however, and reporting is unavailable due to a restructuring of responsibility regarding this file, while approval of a new Municipal Development Plan (*City Plan*) has created further

delays and changed priorities for data acquisition and associated roles and responsibilities. The City expects measurement and monitoring of green network performance to begin sometime in 2023 (L. Butterfield, personal communication, November 24, 2022). Similar delays in reporting pertain in Saskatoon, which commits to publicly available updates and progress reports in its GIS. However, the reporting process for the GIS is on a two-year cycle, and because it is integrated with that for the Implementation Plan, recently passed in June 2022, the first report is not expected until 2024. Limited data related to Saskatoon's green network is published on the City's online Environmental Dashboard, but it is insufficient to determine the success of the GIS's implementation (City of Saskatoon, 2023a).

Without the provision of legally binding objectives and timelines or the clear allocation of responsibilities related to project funding and implementation, the success of green network plan implementation priorities may be impeded, even when supported by strong monitoring and evaluation resources. These are shortcomings for which HRM has also received public criticism (Taplin, 2021). Potentially more troubling, shortcomings that may exist in the implementation of Edmonton's and Saskatoon's strategies remain unidentified, again, because direction relating to reporting is not legally enforceable.

On the positive side and notwithstanding the public criticism noted above, HRM has published green network plan progress reports for each of the years since the plan's implementation. The report for 2021, released last year, indicates that the implementation priorities of the HGNP have been at least partially met and that monitoring is ongoing. Notably, consultations with Indigenous communities to provide direction on the identification, prioritization, and management of cultural landscapes has been proceeding actively. Various projects have also successfully rehabilitated and enhanced green spaces and corridors, improving their ecological functionality and delivering new green infrastructure services (Halifax Regional Municipality, 2022a). Prominent among these is the Sawmill Creek daylighting project, now in its second phase. This stream de-culverting and restoration project is improving stormwater management while re-establishing connections between vital fish habitats and creating new active transportation and recreational opportunities (Halifax Regional Municipality, 2022b); an example of holistic planning successfully delivering multiple co-benefits in an urban green corridor, with positive implications for the whole region.

IX. Limitations

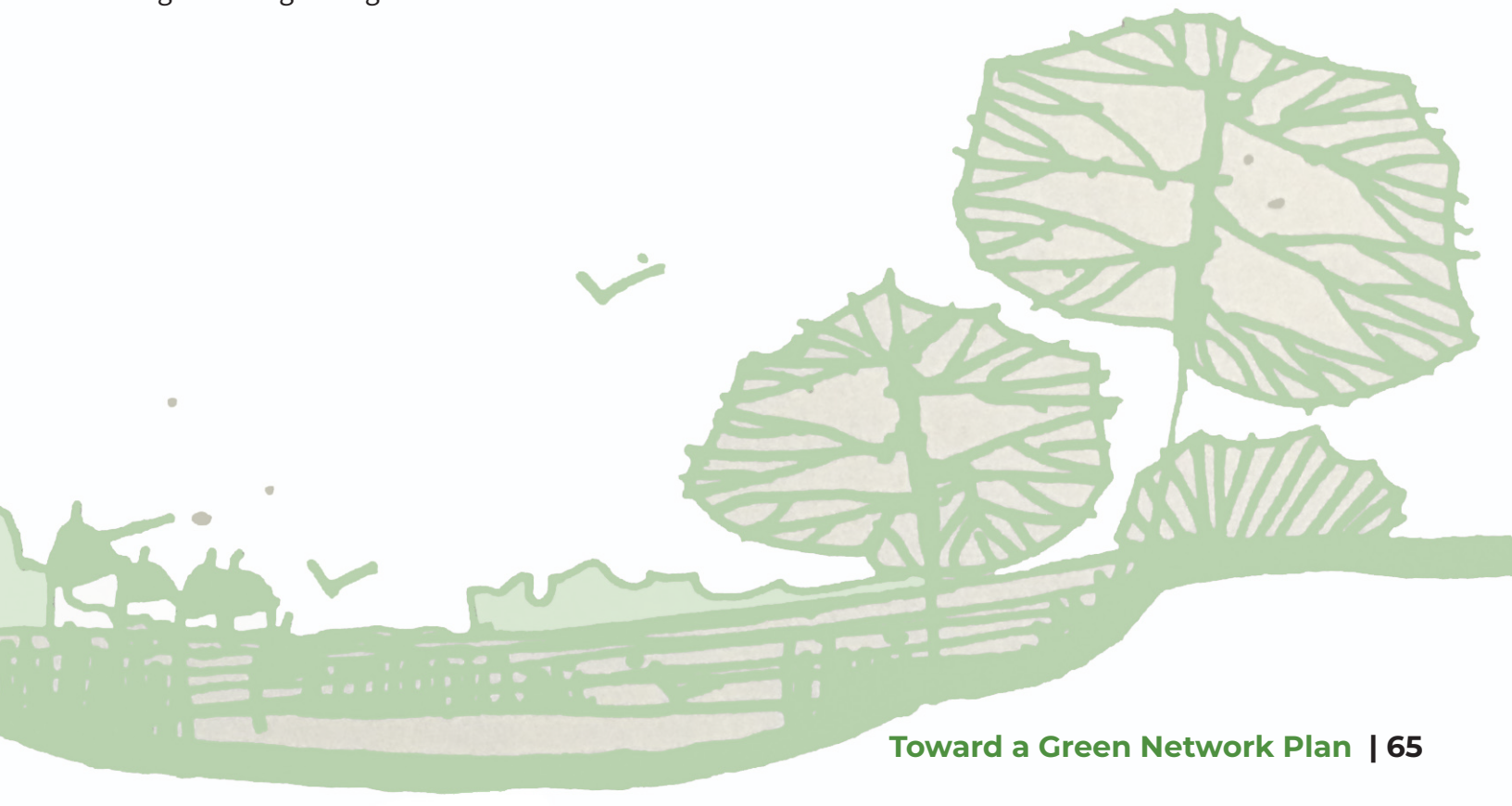
The analytical approach I applied to my research questions was effective in delivering relevant findings to support recommendations for the future master green space and natural corridor plan for Winnipeg. Implicit in this approach, however, were limitations.

The selection criteria I used to identify relevant planning documents restricted them to two limited categories: past Winnipeg multi-year development plans; and current Canadian strategic plans that self-define as green network plans or are similar in scale and scope. My selections necessarily exclude information relevant to green network planning that: may be present in strategic plans and policies from Winnipeg's past that were more limited in scale or scope and harder to access; and various Canadian planning documents that relate tangentially or in a limited way to green networks, but do not respond to them with a specific and holistic planning approach. My capstone also only considered municipal contexts that were similar to those of Winnipeg, while green networks are often regional in scale (especially in their ecological functionality) and unlikely to be limited by jurisdictional boundaries. This is not meant to diminish the importance of green network planning at the regional scale. Rather municipalities should actively collaborate across municipal boundaries to maximize the value and effectiveness of green networks. Finally, I struggled to access municipal reporting on green network monitoring and implementation. This limited my ability to assess the effectiveness of some precedent green network plans.

X. Recommendations

Green networks are "really critical because we can tackle so many problems at once, from a climate perspective to habitats for birds and bees," Mel Marginet of the Green Action Centre told the *Winnipeg Free Press* in January of this year. "We will always be happier and healthier when we work in sync with nature," she continued. "It hasn't taken very long for us to get to this very terrible place. By putting our heads together and following best practices elsewhere, we can get out of it quite quickly" (Rutgers, 2023).

Based on my findings from Winnipeg's history reflecting the pursuit of increasingly diverse functionality through green spaces, corridors, and networks; best practices identified in precedent green network plans from Halifax Regional Municipality, Saskatoon, and Edmonton; as well as best practices identified through the literature review; and in response to *OurWinnipeg 2045*'s direction that the City "create a master green space and natural corridor plan by-law that enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas" (City of Winnipeg, 2022c, p. 23); I propose the following strategic priorities and policy directions. They are intended to serve as recommendations to the City of Winnipeg in support of the future plan's development process and relate to the more detailed policy directions provided in the *Winnipeg Parks Strategy* and *Complete Communities 2.0* (see *Tables 17* & *18*). My recommended strategic priorities and policies also respond to the six goals for Winnipeg localized from the 17 United Nations Sustainable Development Goals, promoting good governance, environmental resilience, economic prosperity, good health and well-being, social equity, and city building through an integrated green network.



Relevant policy directions	
OurWinnipeg 2045 – **2.20**	
Create a master green space and natural corridor plan by-law that enables conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas. Increase quantity of such lands by 1,000 acres that can be accessed for recreation and connection of people with nature, as population growth occurs.	
Winnipeg Parks Strategy – **4.2.2B**	*Complete Communities 2.0* – **4.8**
i. Ensure conservation, management, restoration, and enhancement of the inherent value and ecological functioning of parks, waterways, natural areas and systems;	**a.** Consideration of municipal golf courses as major nature preserves and green space;
ii. Advance climate change adaptation and mitigation;	**b.** A biodiversity policy for Winnipeg that will detail, among other things, an ecological network that is interdependent, reciprocal, healthy, connected, and integrated with the built environment and life on the land; one rooted in Indigenous traditional knowledge of land, community, and ecology. This should include a requirement for an annual report to Council structured in line with *The Durban Commitment: Local Governments for Biodiversity*;
iii. Increase the quantity of open space for recreation, social interaction, active living, and connection of people with nature as population growth occurs;	**c.** A Corridor Plan to protect and enhance Winnipeg's forests, green spaces, natural environment, and natural area corridors including Winnipeg's connecting riverbank corridors; and
iv. Provide a biodiversity framework or policy; and	**d.** Tracking the status of green space and regular reporting to the public and Council.
v. Provide a methodology to quantify the value of ecological goods and services and natural assets.	

Table 17: Policy directions relevant to recommendations (City of Winnipeg, 2022; City of Winnipeg, 2023b).

Recommended strategic priorities – Master green corridor and natural spaces plan by-law		
Category	Strategic priority	Relevant policy direction (see *Table 17*)
Holistic	1. Develop a master green space and natural corridor plan for Winnipeg that is holistic and network-based in its planning approach.	**iv, b**
Network	2. Establish rivers and streams as the vital matrix around which to mold the form of the green network.	**c**
	3. Establish Downtown with the Forks as the focus and point of convergence for the green network.	**c**

Recommended strategic priorities – Master green corridor and natural spaces plan by-law		
Category	Strategic priority	Relevant policy direction (see *Table 17*)
Sustainable	4. Approach planning through a sustainability lens to sustain a healthy and resilient urban environment and society, as called for by the United Nations Sustainable Development Goals.	**i, ii, iv, c**
Green infrastructure	5. Manage and develop the green network as green infrastructure, enhancing its ability to deliver stormwater management, flood mitigation, passive wastewater treatment, and other services wherever possible.	**i, ii**
Accessibility	6. Ensure that, where appropriate and feasible, green corridors provide opportunities for encounters with nature, active transportation, and recreation for all people, regardless of ability.	**iii**
	7. Maintain active transportation infrastructure to a high standard, encouraging year-round use.	**iii**
Collaboration	8. Promote reconciliation by developing and maintaining partnerships with Indigenous communities and organizations.	**v**
	9. Pursue collaborative and well-defined relationships between various levels of government and watershed authorities to enhance and expand the green network.	**iv, v**
Implementation	10. Ensure appropriate and adequate implementation tools are provided with the master green space and natural corridor plan to effectively execute strategic priorities and policy directions.	**b**
	11. Enable effective green network implementation through robust monitoring and evaluation tools.	**b, d**

Table 18: Recommended strategic priorities.

Holistic

1. Develop a master green space and natural corridor plan for Winnipeg that is holistic and network-based in its planning approach.

Network

2. Establish rivers and streams as the vital matrix around which to form the green network.

    2.1 Acquire parcels needed for continuous green corridors along rivers and establish guidelines and standards for green corridor development, maintenance, and level of service delivery.

    2.2 Integrate the Floodway and Birds Hill Park into the green network, working with the Province to develop the Floodway's ecological functionality and opportunities for green infrastructure services and recreation.

3. Establish Downtown with the Forks as the focus and point of convergence for the city's green network.

    3.1 Extend and connect green corridors and spaces Downtown, improving residents' access to the rivers and other destinations.

Sustainable

4. Approach planning through a sustainability lens to sustain a healthy and resilient urban environment and society, as called for by the United Nations Sustainable Development Goals (SDGs).

    4.1 Together with Indigenous Elders and organizations, incorporate Traditional Ecological Knowledge (TEK) into green space and natural corridor management and decision-making.

Green infrastructure

5. Manage and develop the green network as green infrastructure, enhancing its ability to deliver stormwater management, flood mitigation, and passive wastewater treatment, and other services wherever possible.

    5.1 Encourage the incorporation of green infrastructure technologies, including naturalized stormwater retention ponds, bioswales, rain gardens, and green roofs, in public and private developments through the provision of resources and incentives.

Accessibility

6. Ensure that, where appropriate and feasible, green corridors provide opportunities for encounters with nature, active transportation, and recreation for all people, regardless of ability.

    6.1 Design and maintain active transportation routes and trails to allow universal access, eliminating barriers that prevent use by people with visual and mobility impairments, wherever feasible to do so.

7. Maintain active transportation infrastructure to a high standard, encouraging year-round use.

    7.1 Establish and maintain a high standard of ice and snow removal on a minimum year-round network of separated or traffic-calmed active transportation routes.

Collaboration

8. Promote reconciliation by developing and maintaining partnerships with Indigenous communities and organizations.

    8.1 Access TEK relating to the local environment and its ecological functions, conserving and revitalizing green network elements together with Indigenous partners.

8.2 Identify and honour Indigenous cultural landscapes, managing them in co-stewardship with Indigenous communities.

9. Pursue collaborative and well-defined relationships between various levels of government and watershed authorities to enhance and expand the green network.

9.1 Partner with watershed districts (e.g., Seine Rat Roseau Watershed District) to enhance the scale and scope of green infrastructure services and lobby the provincial government for legislation establishing enhanced conservation authorities similar to those in Ontario.

Implementation

10. Ensure appropriate and adequate implementation tools are provided in the master green space and natural corridor plan to effectively execute strategic priorities and policy directions.

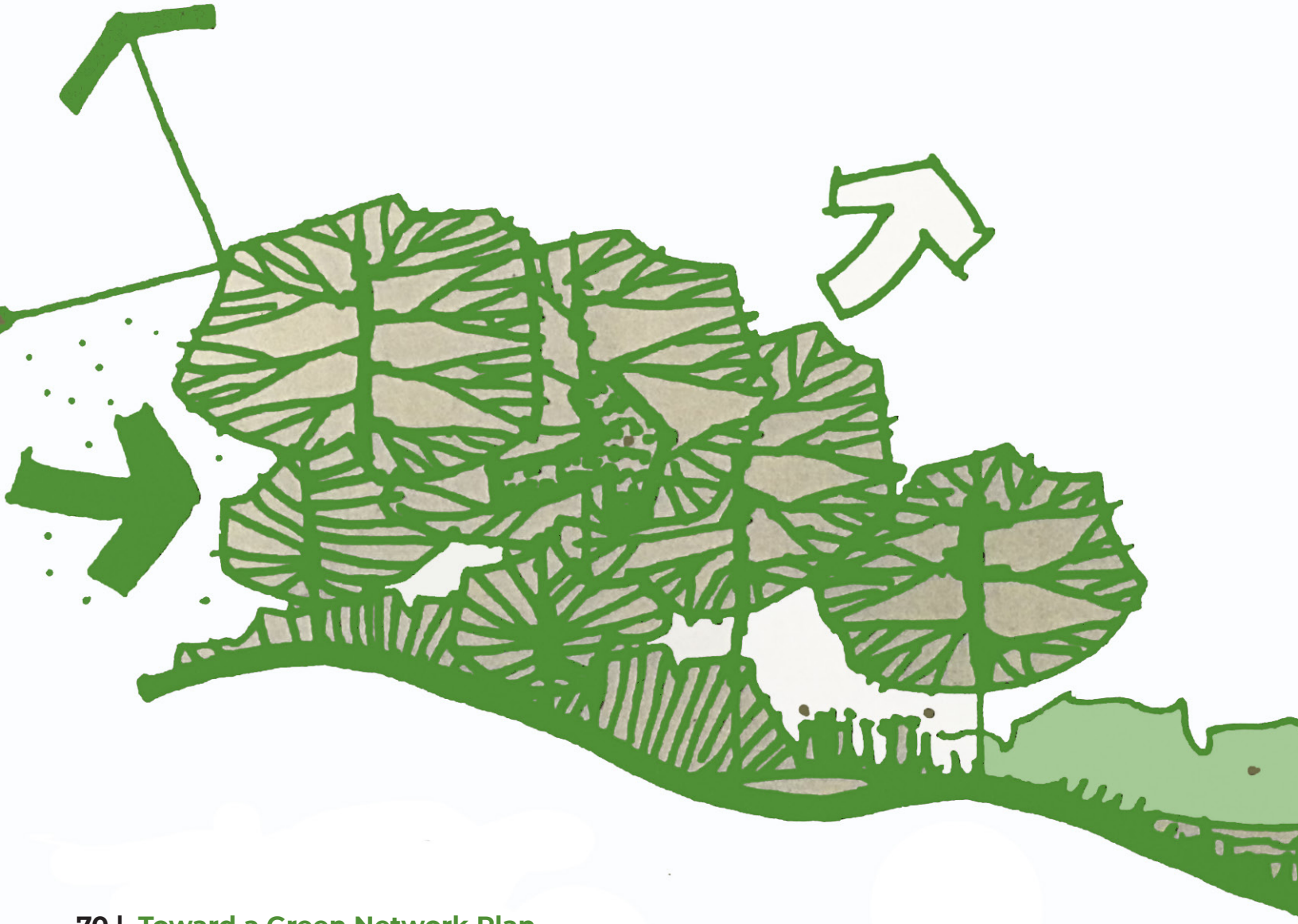
10.1 Use key performance indicators (KPIs), clearly defined timeframes and roles, and legally enforceable targets to support implementation of policy directions.

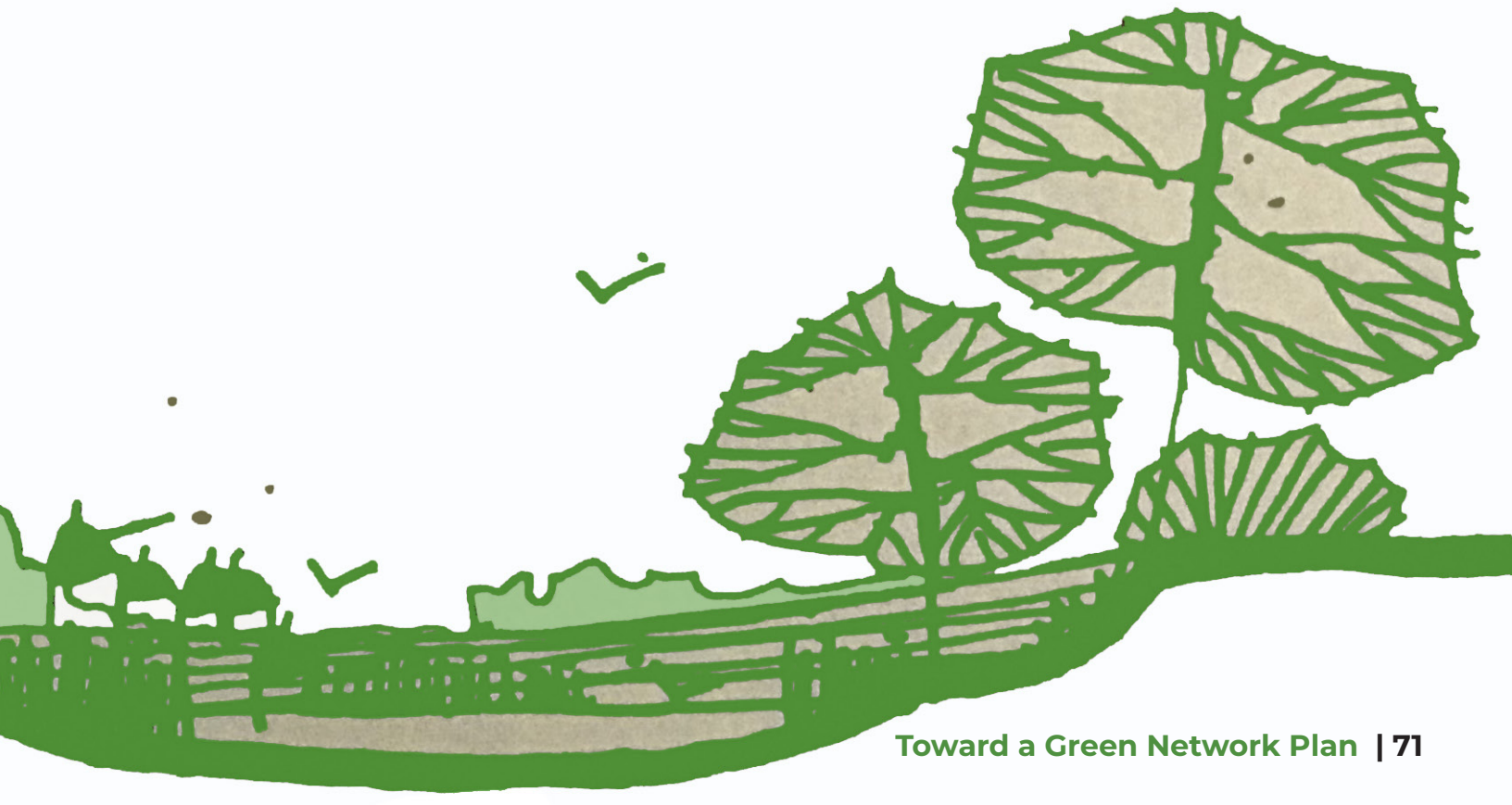
11. Enable effective green network implementation through robust monitoring and evaluation tools.

11.1 Monitor and evaluate green network implementation with the support of third parties, including research institutions and non-governmental organisations, reporting regularly, transparently, and publicly.

XI. Conclusion

More sustainable and holistic planning is necessary to begin to effectively address the considerable planning challenges facing Winnipeg, including unprecedented climate change accompanied by more extreme and unpredictable weather, and social inequity that negatively impacts communities' ability to access and enjoy the city's green network. To address these growing crises successfully, our city requires an approach to greenspace and natural corridor planning that integrates various disciplines and emphasizes the importance of place with a goal of healing both society and ecosystems (Wheeler, 2004). Professional planners and the established planning process must be supported by environmental sciences and knowledge and experience particular to local communities, especially Indigenous communities, generating the holistic change needed to build a more sustainable society and a less fragmented urban environment.





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Appendix A – Selected best practices from literature review

Access & equity	Moseley et al., 2013	p. 18	**1.** Consider a range of factors and not only linear distance when assessing the accessibility of greenspace within a green network. These may include the cultural values, physical limitations, and safety concerns of users, factors which require the collection of qualitative data to evaluate.
		p. 19	**2.** Enhance and maintain the green network to a uniformly high standard, ensuring high quality spaces even for those with less mobility.
	Tozer et al., 2020		**3.** Include culturally relevant perspectives when determining how to make greenspace available to underserved communities.
			4. Question culturally dominant views of greenspace and critique the value and appropriateness of the green spaces being provided.
	Nesbitt et al, 2018		**5.** Include representation from diverse communities in decision-making related to green network planning.
			6. Provide urban forests in close proximity to all residents.
			7. Ensure that green networks support a variety of vegetated landscapes, reflecting the preferences of diverse urban communities.
	Lennon, 2020		**8.** Decentralize green networks to facilitate the support of a range of functions throughout during periods of lower mobility.
			9. Improve green network connectivity by "nesting" various scaled green spaces to allow greater opportunity for activities for which smaller space are inadequate.
			10. Design green spaces with discreet areas to support their simultaneous use by a greater number of groups pursuing various activities.
Indigenous participation	Finegan, 2021	p. 20	**1.** Support the renewal of ties between Indigenous communities and their traditional lands, partnering with Elders and knowledge-keepers.
			2. Reserve space for ceremonial, educational, and contemplative uses, as deemed appropriate by Elders and knowledge-keepers.
			3. Promote Indigenous food sovereignty through the planting of traditional foods and medicine in green corridors.
			4. Create opportunities to educate non-Indigenous visitors about the Indigenous heritage of urban landscapes.
	Jojola, 2013		5. Establish roles for Indigenous peoples in planning processes.
			6. Support the pursuit of a seven-generations model of planning.
			7. Allow Indigenous peoples to assert themselves as stewards of their traditional lands, enabling them to sustain themselves culturally and materially from these urban and natural landscapes.

Active transportation	Pucher, et al., 2020	p. 20	**1.** Develop a tightly connected bike network, where bike facilities can be accessed from anywhere in the city within three to six blocks.
	Schoner & Levinson, 2014		**2.** Reduce active transportation network fragmentation.
			3. Improve network directness and connectivity.
	Erickson, 2006	p. 21	**4.** Employ traffic calming measures to ensure that vulnerable users travelling by diverse modes are accommodated green corridors.
			5. Design green corridors supporting active transportation links with destinations in mind, ensuring that they facilitate connections with mass transit.
			6. Use existing linear infrastructure, including rail and utility corridors and roadways, as green corridors, establishing connections within green networks.
			7. Direct active transportation routes away from areas that are most sensitive and ecologically significant.
	Bergström & Magnusson, 2003		**8.** Active transportation networks should be designed to be adaptable to winter weather.
			9. Ensure consistent, well-defined winter maintenance standards with frequent clearance of long, continuous routes.
Green infrastructure	Novotny et al., 2010		**1.** Enable greater spatial and economic efficiency by developing multi-functional green infrastructure (i.e., stormwater wetland, neighbourhood active transportation corridor).
			2. Incorporate redundancy by responding to local ecosystem opportunities with flexible and decentralized green infrastructure networks.
			3. Create awareness of the sustainable and climate change resilient nature of services delivered by green infrastructure to cities and regions with communication programs for green network users.
	Beatley, 2011	p. 22	**4.** Forested riparian areas in cities should be carefully protected, due to the remarkable combination of valuable ecological functions they fulfill.
			5. Integrate constructed green infrastructure into linear corridors to collect and treat stormwater.

Appendix B – Selected policy from Canadian plan precedents

Halifax	Green infrastructure	4.1.3.3.	Protect riparian corridors and wetlands from degradation, pollution and other threats. • Increase the minimum required riparian buffer around drinking water supply sources
		4.1.3.5.	Coordinate efforts to manage water quality and quantity while expanding the Region's Green Network. • Establish stormwater management guidelines to improve the quality of stormwater runoff. • Promote green infrastructure, such as naturalized stormwater retention ponds and bioswales, as the preferred approach to managing stormwater. • Develop a green infrastructure specification document to guide and promote the use of low-impact design approaches to manage stormwater on private property.
Saskatoon	Green infrastructure	14.1	Incorporate wetlands and natural drainage paths into the stormwater network in greenfield development areas.
		14.2	Identify how green infrastructure can increase the storm system's capacity to respond to intense rain events.
		14.3	Evaluate opportunities to increase naturalization of existing storm ponds to improve water quality and habitat.
		14.4	Consult with affected organizations when designing stormwater infrastructure to mitigate impacts to natural areas and cultural elements within the watershed.
		15.1	Incorporate Low Impact Development pilots into City projects to show leadership.
		15.2	Continue partnering with research institutions and conservation agencies to determine best practices for Low Impact Development.
Edmonton	Accessibility	4.6.1 i)	Ensure that the trail and pathway network provides opportunities for recreation and active transportation for all users, including people with visual or mobility impairments.
		4.1.3 a)	Wherever feasible, trails and pathways should be (re)designed and maintained to ensure universal access. While not every open space will provide accessible trails and pathways (e.g. some natural trails, mountain bike trails), the network as a whole will provide a diverse range of safe, challenging and accessible pathways for recreation and active transportation.
		4.1.3 b)	Develop guidelines for determining where barrier-free pathways (e.g. smooth surfaces and gentle grades) should be provided to enable natural experiences for persons with mobility challenges.
		4.4.3 e)	Use public engagement and other communication initiatives to educate Edmontonians about the rights of open space users, particularly minority or marginalized persons. Ensure that parks employees, by-law enforcement and the Edmonton Police Service are aware of these rights and empowered to confront harassment.
		4.5.1 i)	Community needs assessments should identify the unique characteristics of the neighbourhood or community of interest, including Indigenous communities), and should translate those characteristics to appropriate development and programming outcomes through research and public consultation.

Edmonton	Active transportation	4.9.4 j)	Actively advance reconciliation with Indigenous communities by providing open spaces that respect traditional values, provide spaces for traditional uses and culturally appropriate activities and observances, protect sacred sites and burial grounds, and respond to the needs of present and future Indigenous communities.
		4.2.1 g)	Encourage year-round use of open spaces by… Providing infrastructure and amenities that encourage winter use, including shared-use greenways for walking, cycling, and cross-country skiing.
		4.2.2 n)	Expand and maintain winter-oriented recreational and active transportation infrastructure, including cross-country skiing, snowshoeing and skating trails.
		4.6.1 h)	With the exception of dedicated winter active transportation corridors (e.g. cross country skiing or snowshoeing pathways), increase snow clearing and de-icing efforts on paved pathways and active transportation routes. Establish consistent clearing and winter access priorities for shared-use pathways within and among open spaces to promote winter connectivity throughout the city.
		4.6.3 b)	Develop a minimum grid of year-round active transportation routes (pedestrian, cyclist and other) to connect open spaces and other destinations throughout the city.
Saskatoon	Indigenous participation	1.2	In partnership with the community, complete a Traditional Land Use and Traditional Knowledge assessment to identify cultural elements in the Green Network, and establish ways to conserve, honour, and revitalize these elements.
		5.4	Partner with Indigenous communities and organizations to explore traditional land management and governance models for the Green Network.
Edmonton	Indigenous participation	4.3.3 b)	Recognize and respect Indigenous protocols and processes during engagement. Honour the contributions, values, wisdom and traditional knowledge of Indigenous peoples, and empower engagement participants to collaborate and co-create solutions and opportunities for everyone.
		4.7.1 x)	Form cross-jurisdictional partnerships (i.e., adjacent First Nations) to acquire, secure and restore important biodiversity core areas and linkages outside the administrative limits of the City of Edmonton.
		4.7.2 p)	Collaborate with Indigenous communities in environmental stewardship to identify and protect plant and animal species significant for traditional and cultural uses, and address Treaty rights to harvest in areas where such species are identified as significant.
		4.8.1 l)	Collaborate with local Indigenous communities to gather and preserve traditional ecological knowledge (TEK) about open spaces, and explore ways to incorporate TEK into open space management and decision making in culturally and historically significant areas (e.g. the North Saskatchewan River Valley), as such decisions intersect with Indigenous rights and interests.
		4.9.3 c)	Collaborate with the River Valley Alliance... And Indigenous communities to support the regional connection, expansion, protection and responsible development of the River Valley and Ravine system.
		4.10.4 d)	Build capacity and develop partnerships with Indigenous communities, community groups and other organizations to program open spaces, co-manage or steward open spaces, and assist with maintenance through volunteerism or funding support.