STITCHING THE FABRIC

HUMAN | WILDLIFE

connectivity strategies for identified gaps in Toronto's ravines

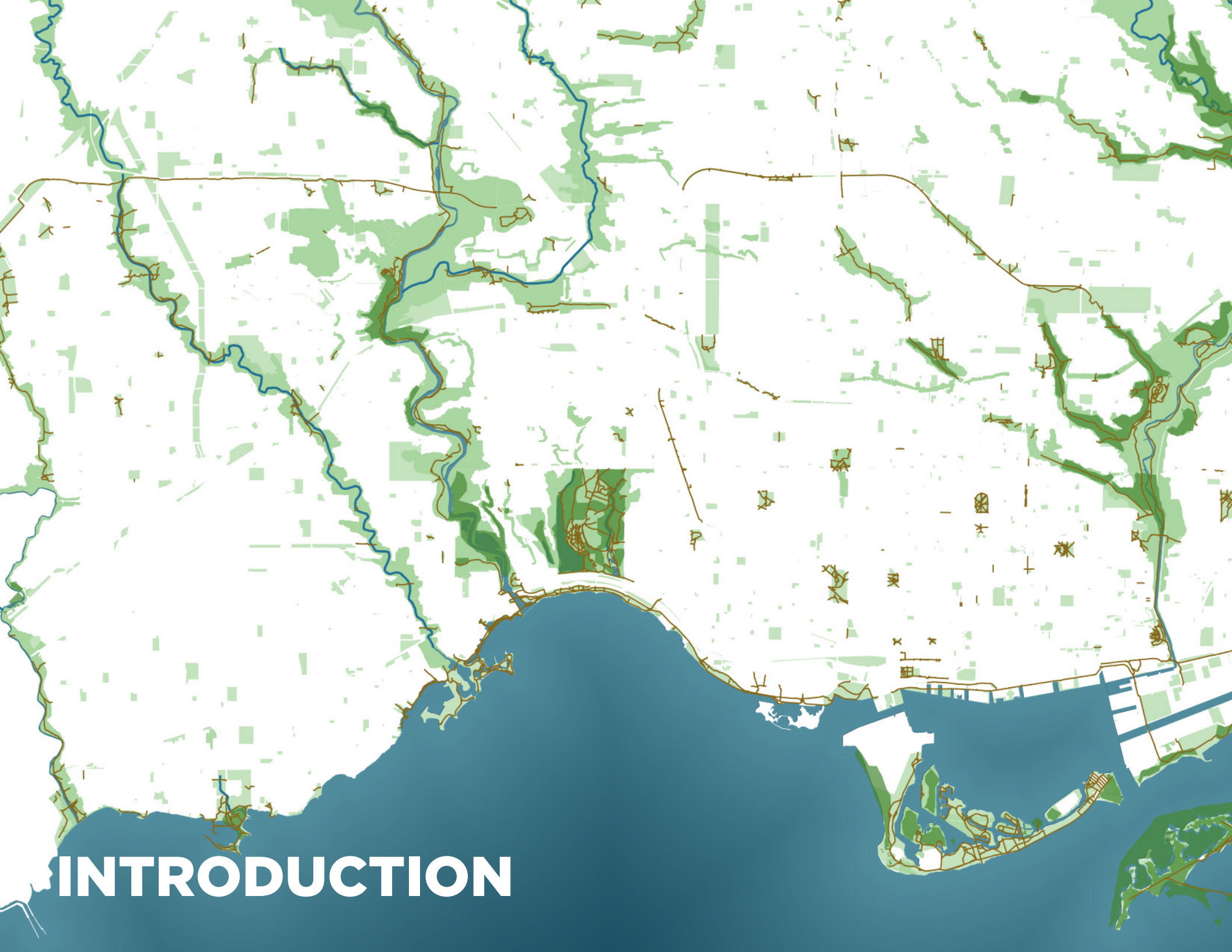
Vincent Racine
Supervisor: Nina-Marie Lister
2nd Reader: Jennifer Kowalski

“The ravines are to Toronto what canals are to Venice and hills are to San Francisco. They are the heart of the city’s emotional geography, and understanding Toronto requires an understanding of the ravines. In the republic of childhood they represent a savage foreign state, a place of adventure and terror. A ravine provides a Torontonian’s first glimpse of something resembling wilderness; often it is also the earliest intimation of nearby danger. A Toronto child usually learns about the ravines from an anxious parent’s warning that evil strangers lurk down there. They can indeed be places of danger, but the act of entering a ravine, often in defiance of parental orders, has for many Torontonians been an essential part of growing up.” (Fulford, p.37, 1995)

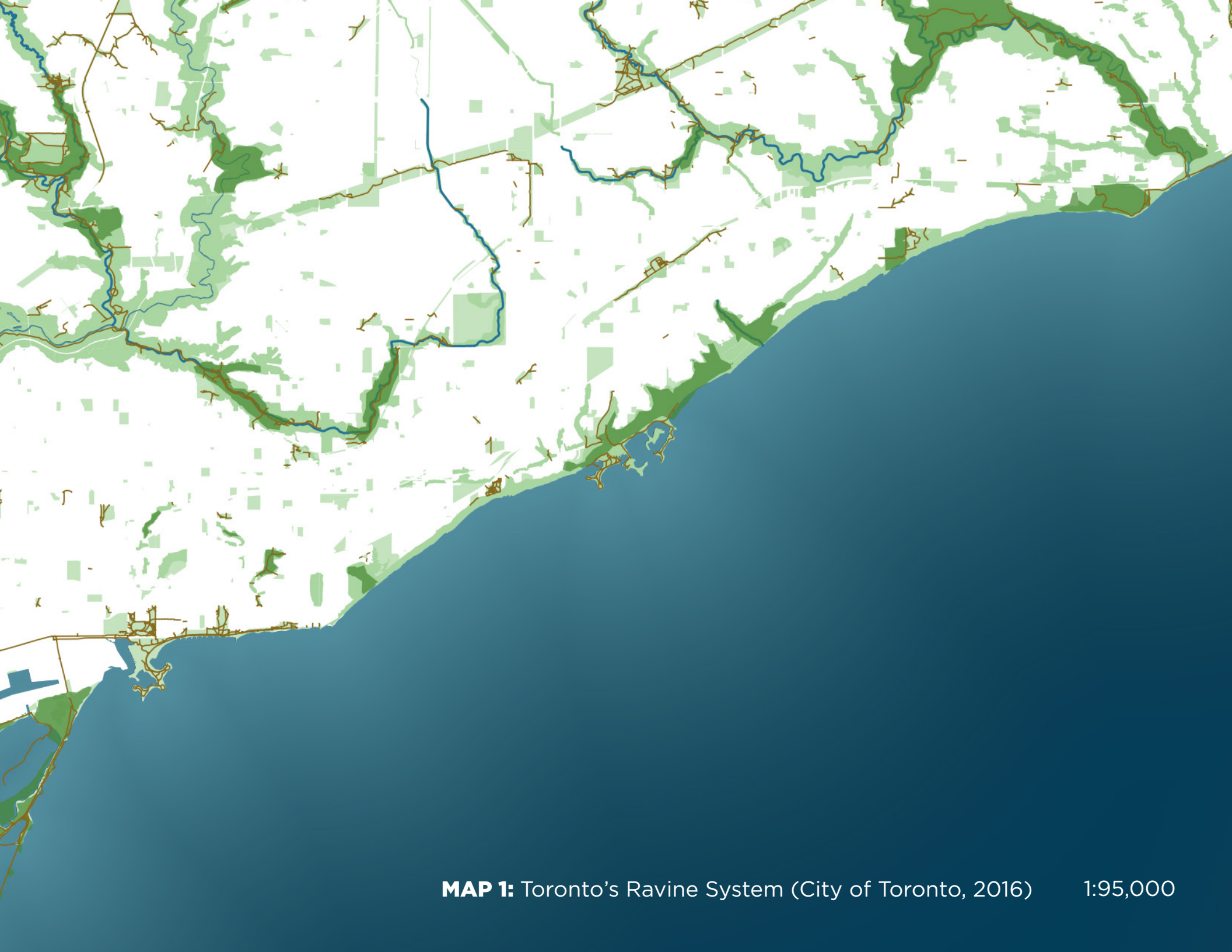
ABSTRACT This Master’s Research Project (MRP) examines landscape connectivity strategies for the ravine system in the City of Toronto, CA. A workshop with natural environment specialists from the City of Toronto was organized to gather practitioner-based information as to which gaps should be prioritized in the ravine system. This GAP Analysis was complemented with a Geographic Information System (GIS) - based buffer analysis looking at connectable green spaces in close proximity to Environmentally Significant Areas (ESAs). Based on both the workshop and GIS analysis, 16 gaps were investigated through which 4 typologies were created. Interviews were then conducted with professionals from comparator cities: Edmonton (CA), Vancouver (CA), Minneapolis (US), Copenhagen (DK), and Stockholm (SW) to compare into how waterfront cities use policies, partnerships and design interventions to connect waterfront public lands. Based on interviews and additional policy scans, connectivity strategies were created for all 4 typologies as a means to improve landscape connectivity in the City of Toronto.

LAND ACKNOWLEDGMENT The land on which I produced this project is the traditional territory of the Haudenosaunee, and most recently, the territory of the Mississaugas of the Credit First Nation. Toronto (from the Haudenosaunee word Tkaronto) is still the home to many Indigenous people from across Turtle Island, and I am grateful to have the opportunity to work in the community, on this territory.

TABLE OF CONTENTS



INTRODUCTION



MAP 1: Toronto's Ravine System (City of Toronto, 2016) 1:95,000

RAVINES

Toronto's landscape is shaped by an extensive yet fragmented ravine system that makes 17% of its total surface (City of Toronto, 2016b). Toronto's ravines represent 400 ha of green space, 300 km of rivers, and 6 km of creeks and tributaries. In terms of human interventions, the ravines contain 316 km of trails and 232 km of roads[1]. A ravine is described as a deep narrow gorge with steep sides hosting or used to host a river.

After the Wisconsin glaciation episode, approximately 80,000 years ago, the receding of the ice-sheet created a unique topography with the gradual appearance of Ontario's Great Lakes. As a point of connection between those great geographical structures, valleys were steadily eroded, dramatically fragmenting the landscape into a ravine-based form that we now know as Toronto (Roots, Heidenreich, & Chant, 1999). The manifestation of this landform has over time shaped the way humans have constructed infrastructures and built form in southern Ontario. Unfortunately, the ecological significance of the ravines has long been invisible to Toronto residents and as a result, the built form has encroached onto the ravines (n.d., 1993).

In 1954, Hurricane Hazel reached Toronto with a 6 metre high flood crest and every creek and river spilled over the banks (n.d., 1993). This not only exaggerated the hydrological significance of the ravines but reinforced its presence as the spine of Toronto. This event caused an unprecedented flooding, as well as property damage, and loss of life. The event opened the eyes of legislators and by-laws were put in place to protect this geographical feature. The ravines were not simply wilderness to be dismissed, but a significant landscape to be protected and embraced. Still, what could have been a continuous connected system was partly privately owned posing obstacles for conservation endeavors.

Over time, both informal and formal trails through the ravines were created. Sections of the ravines were variously turned into parks, industrial areas, and residential areas. Fortunately, some spaces were converted from industrial to ecologically well-thought-out spaces such as with the Evergreen Brickworks. However, this was done on an ad-hoc basis and not comprehensively. The system is lacking consistency both in terms of its trail system, but also in terms of its land use, which in turn affects connectivity between natural systems. With a population that is expected to increase by 32.4% by 2041 (Ontario, 2016), recreational usage of the ravines will increase. This in turn will worsen the already fragmented urban wildlife habitats and so, there is a need to increase connectivity in the ravine system.

This project will explore solutions from comparator cities to develop new solutions to enhance connectivity in Toronto's ravine system.

[1] These values were compiled from a map composed of data collected from the City of Toronto's Open Data Catalogue (City of Toronto, 2016).

biophysical context

Before modern infrastructures were built on this landscape, the ravine system had a long history of change in its morphology, as well as a pre-confederation history of indigenous peoples, that continue to live on these lands. In fact, where Toronto is located is the traditional territory of the Haudenosaunee and the Mississaugas of the Credit First Nation. The territory was the subject of the Dish With One Spoon Wampum Belt Covenant, an agreement between the Iroquois Confederacy and the Ojibwe, and allied nations to peaceably share and care for the resources around the Great Lakes (Roots, Heidenreich, & Chant, 1999).

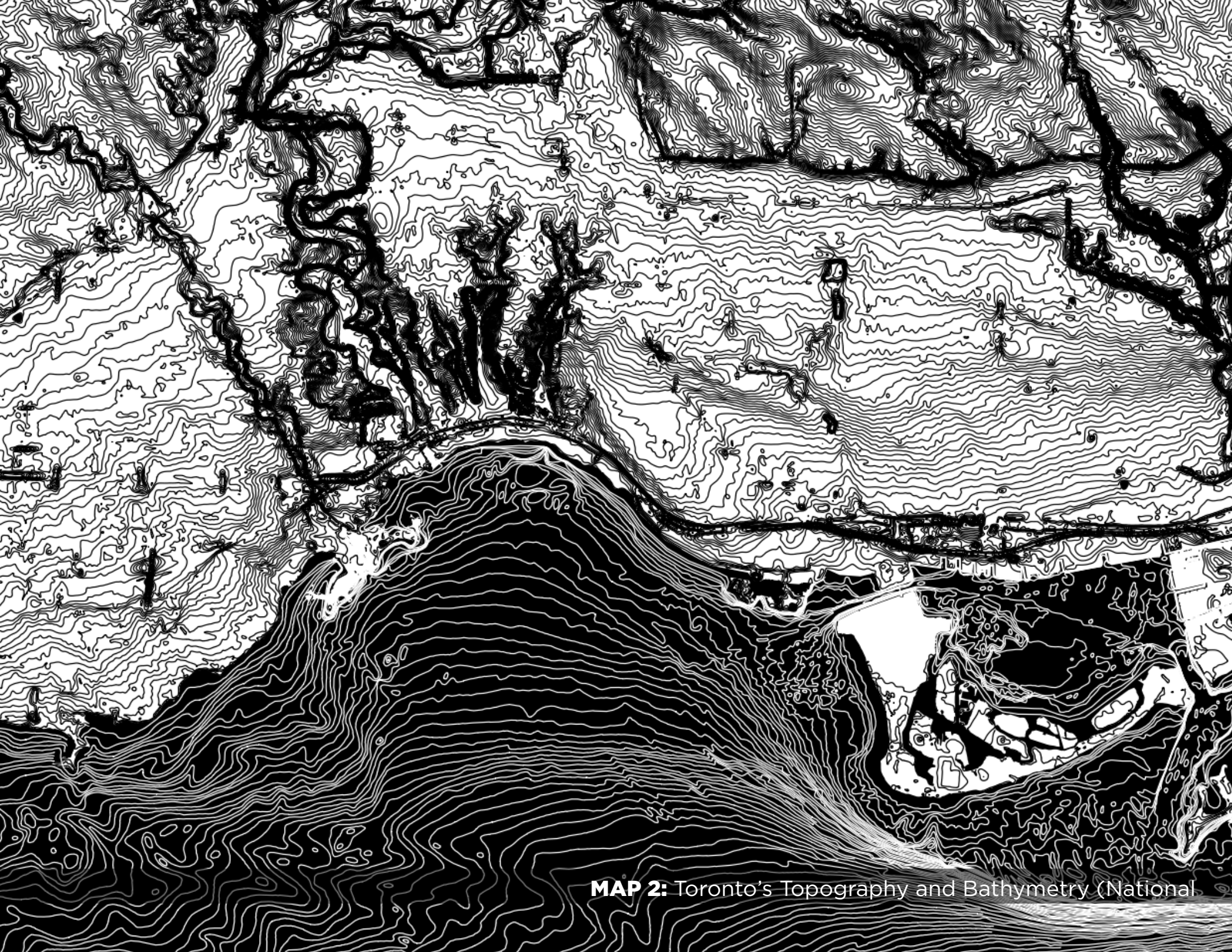
some time ago...

The ravine system in Toronto has a unique topography that is the result of a history of glaciation and erosion. In fact, the surface deposits and associated landforms found on most of the southeastern portion of Ontario relate to the Lake Ontario ice lobe during the last phases of glaciation. 13,000 years ago, this glacier started to migrate and moved towards the Niagara Escarpment to the west and the Lake Simcoe ice lobe to the north leaving till (stones, sand, silt, clay) on the ground. In addition to awarding the region with till deposits such as seen with the Halton Till, the glacier left us with some historical fluted and drumlinized landscape that are still visible today. One of such landform is the popular Oak Ridges Moraine. As these glaciers retreated, the cycle of formation and death of lakes occurred until 10,000 years ago when the glaciers melted leaving extensive deposits of sand and gravel. Then, the regional typography and hydrography started to take shape in the way we see it today (Roots, Heidenreich, & Chant, 1999).

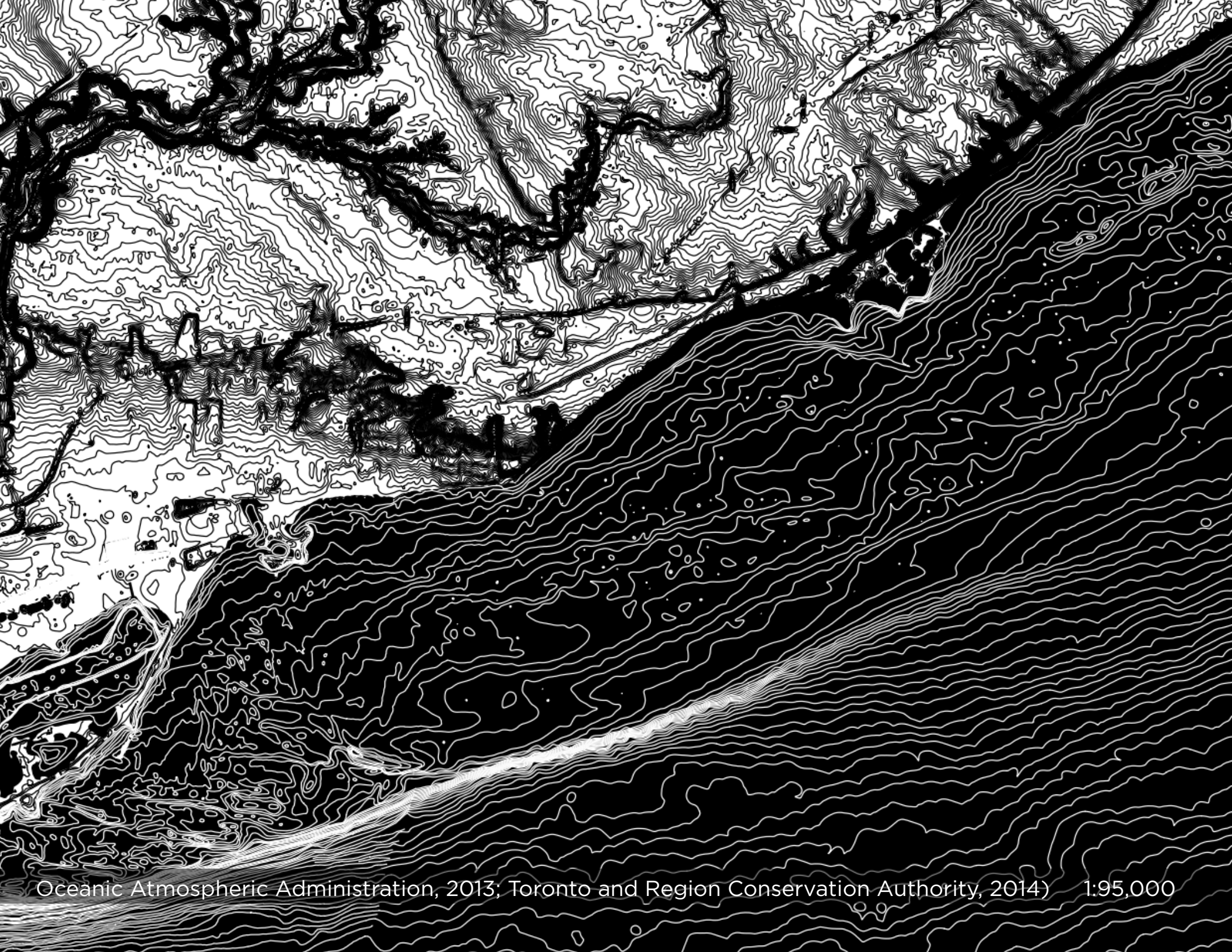
With the melting of the glaciers and the formation of a nutrient-rich landscape, a unique set of ecosystems was created in the region. For thousands of years, the landscape was not disrupted by European settlers and ecosystems developed “old growth” characteristics. An old growth ecosystem refers to:

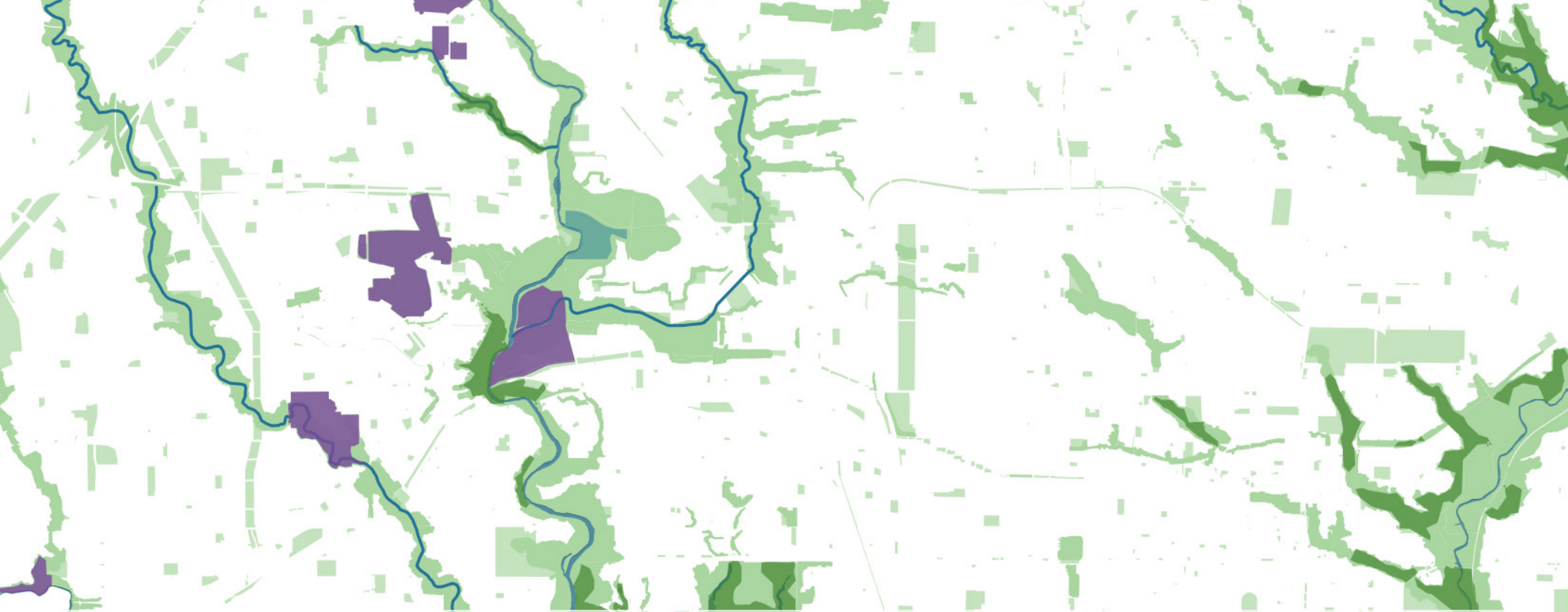
a system with a predominance of trees that were large for the species and the ecological condition of the site, and with unevenly aged trees and a mixed cover varying from patches with multiple canopy layers through no gaps in the canopy that admit sunlight. An ecosystem that is protected from human interference will, over time, acquire old-growth characteristics and especially numerous relatively large and old organisms that represent many species of trees and shrubs, mammals, birds, reptiles, amphibians, fishes, crustaceans, molluscs, and insects. Under old-growth conditions, the shrubs and trees near the streams and wetlands in the valleys of the greater Toronto region were of species that could tolerate ‘getting their feet wet,’ seasonally or permanently. [...] Old-growth ecosystems in the Toronto region were adapted to the natural disturbance regime in which they had evolved. Prior to settlement by Europeans, those ecosystems had accumulated and stored much valuable biological material in several formats. (Roots, Heidenreich, & Chant, p.53, 1999).

However, with European settlement, resource extraction increased significantly and the preferred species from the natural system were over-harvested, contributing to a decline in the quality of the biological material found across Toronto’s landscape. (Roots, Heidenreich, & Chant, 1999).



MAP 2: Toronto's Topography and Bathymetry (National


Oceanic Atmospheric Administration, 2013; Toronto and Region Conservation Authority, 2014) 1:95,000

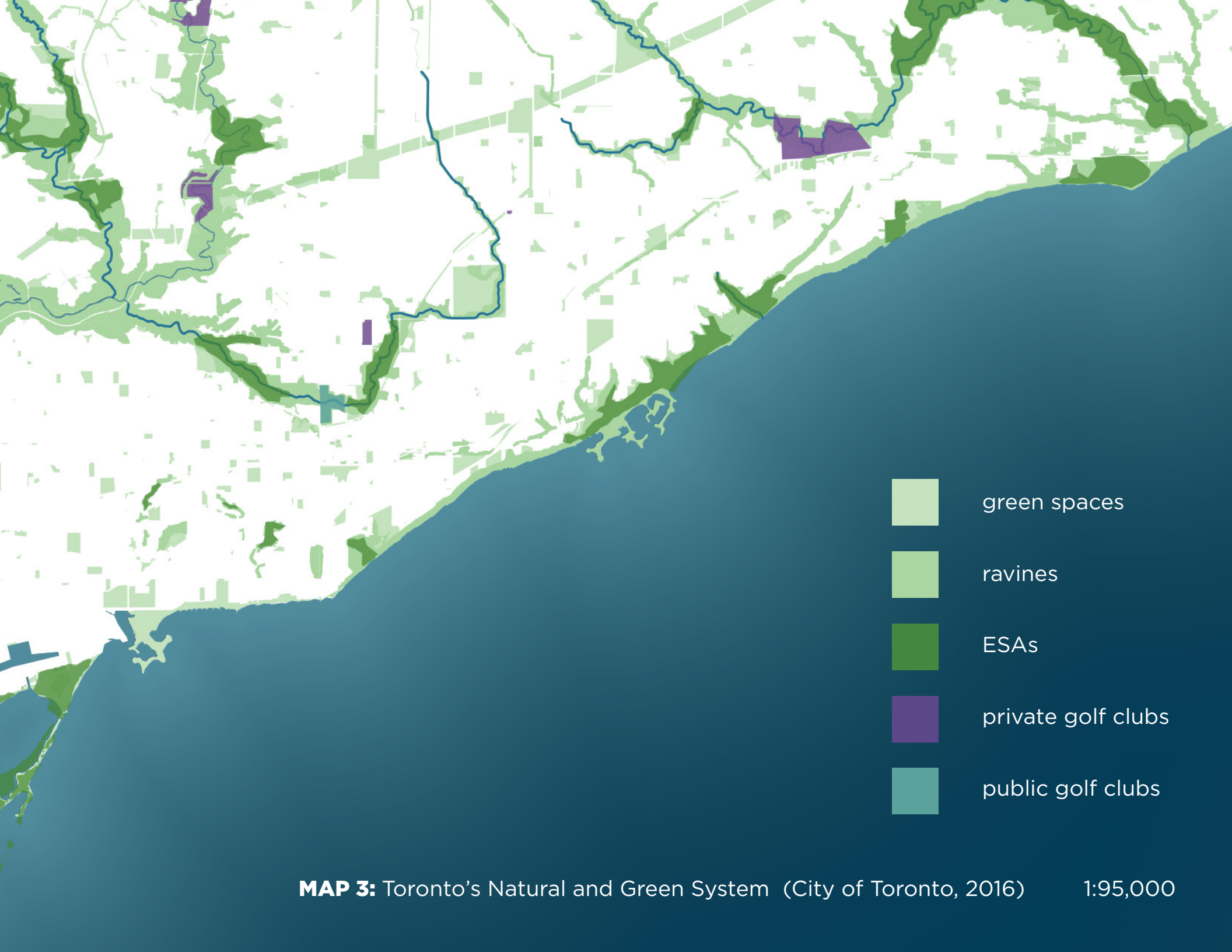


today, we observe....

The ravine system in Toronto, although largely developed in comparison to thousands of years ago, still possess a rich biodiversity. In fact, 87% of Toronto's Environmentally Significant Areas (ESAs) are found within ravines (City of Toronto, 2016b). More specifically, ESAs are defined as follow:

Areas of land or water within the natural heritage system with any of the following characteristics: a) habitats for vulnerable, rare, threatened or endangered plant and/or animal species and communities that are vulnerable, threatened or endangered within the City or the Greater Toronto Area; or b) rare, high quality or unusual landforms created by geomorphological processes within the City or the Greater Toronto Area; or c) habitats or communities of flora and fauna that are of a large size or have an unusually high diversity of otherwise commonly encountered biological communities and associated plants and animals; or d) areas where an ecological function contributes appreciably to the healthy maintenance of a natural ecosystem beyond its boundaries, such as serving as a wildlife migratory stopover or concentration point, or serving as a water storage or recharge area. (City of Toronto, 2012)

In addition, the land adjacent and in the ravines is prone to flooding. As such, the ravine system has its own set of characteristics such as a unique topography with a rich biodiversity and an extensive fluvial system, which make it worth studying, valuing, and protecting.



MAP 3: Toronto's Natural and Green System (City of Toronto, 2016) 1:95,000

WILDLIFE HIGHLIGHTS

Toronto's ravines present a rich biodiversity. This section, based on Roots, Heidenreich, & Chant (1999) and the City of Toronto's Biodiversity Series (n.d.a), showcases key species found across Toronto's landscape.[1]

VASCULAR PLANTS

There are approximately 50 species of native trees, as well as few exotic trees, ferns, horsetails, club mosses, shrubs, and herbaceous plants.

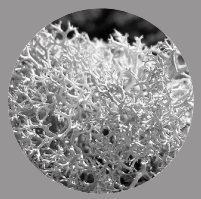
RED-OSIER DOGWOODS

SILVER MAPLE

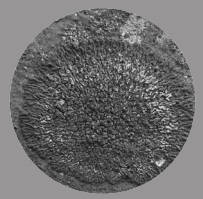
OAK TREE

MOSSES, LIVERWORTS, HORNWORTS & LICHENS

Toronto possesses a great diversity of this category including a total number of 171 liverworts in Ontario.



REINDEER LICHENS



BIRD ROCKS

ROCK TRIPE

FUNGI

Southern Ontario presents a rich range of fungi species such as saprotrophic fungi. Important to mention is the many mutualistic relationships fungi have with vascular plants, especially prominent in our forests.

BITTER BOLETE

FALSE CHANTERELLE

CHICKEN OF THE WOODS

INSECTS

The total amount of insects in the Toronto Region is still unknown but it is approximated that a minimum of 2,400 species cohabit with Torontonians.

MONARCH

ICHNEUMONID WASP

INVERTEBRATES

Over the years, many invertebrate species have been introduced to Toronto. For instance, 14 species of mollusc are known to have invaded the Great Lakes.

DARING JUMPING SPIDER

BLACKFOOTED SAC SPIDER

BOWL AND DOILY WEAVER

FISH

Over time and through the many human activities from sport fishing to dams and channels, fish species have been at risk. Overfishing, lake infill and other practices have caused the degradation of many fish species. Still, with the recent conservation and protection movement, there has been some partial recovery amongst several species.

BROOK TROUT

YELLOW PERCH

JOHNY DARTER

WOOL CARDER BEE

AMPHIBIANS AND REPTILES

In the early 20th century, 11 species of reptiles and 16 species of amphibians were observed in the vicinity of Toronto. Late 20th century, we counted 5 species of salamander, 6 species of frogs and toads, 4 species of turtles and 6 species of snakes.

EASTERN GARTER SNAKE

PAINTED TURTLE

GRAY TREEFROG

BIRDS

The greater Toronto region has few prime spots for migratory birds such as Tommy Thompson Park, Toronto Islands, and High Park. During the late 20th century, 183 species of birds were breeding in the area.

ACADIAN FLYCATCHER

PEREGRINE FALCON

PRAIRIE WARBLER

MAMMALS

In the greater Toronto region, there are 6 species of insectivores, 5 species of bats, 9 species of carnivores, 2 species of rabbits, 16 species of rodents, and 2 species of hoofed mammals such as the white-tailed deer and the domestic horse.

VIRGINIA OPOSSUM

RED FOX

LITTLE BROWN BAT

POLICIES & PROJECTS HIGHLIGHT

Since Hurricane Hazel in 1954, the Government of Ontario, the Toronto and Region Conservation Authority (TRCA), and the City of Toronto have increasingly put policies and plans in place to protect and connect Toronto's ravines.

PROVINCIAL POLICY STATEMENT (PPS)

Under the PPS, the Government of Ontario defines natural heritage systems and discourages development near areas sensitive to natural hazards and areas that are deemed provincially significant by the Ontario Ministry of Natural Resources. The PPS prohibits both development and site alterations in significant wetlands in Ecoregions 6E and 7E of which Toronto's ravines are part (see Appendix D). (Ontario, 2014)

TRCA GREENLANDS ACQUISITION PROJECTS

The TRCA is the conservation authority in the Greater Toronto and Hamilton area and partly owns the lands protected under the Ravine and Natural Feature Protection By-Law. In order to extend the public ownership of the ravine system and ESAs, the conservation authority has an acquisition strategy that identifies parcels of lands that should be acquired for conservation purposes. (TRCA, 2016)

TORONTO OFFICIAL PLAN

Within Toronto's Official Plan, the natural heritage system and ESAs are laid out in maps and are protected through several policies. For instance, policies look at enforcing setbacks and ensuring view corridors onto the ravines through a required building height along the ravines. (City of Toronto, 2015b)

RAVINE AND NATURAL FEATURE PROTECTION BY-LAW

The Ravine and Natural Feature Protection By-Law provides a policy framework for the protection of Toronto's ravines wherever the land is designated as a ravine and natural feature (see Appendix D). The by-law is enforced by the City of Toronto and TRCA and regulates development near the ravine system through limiting building height and setbacks for instance. (City of Toronto, 2016a)

RAVINE STRATEGY

The Ravine Strategy is a city-lead initiative that provides a vision for Toronto's ravines. The strategy embraces the need for both protection and recreation. Within the Draft Principles and Actions booklet, **the strategy repeatedly mentions the need to fill the gaps found within the trail and natural system of the ravines.** (City of Toronto, 2016b)

Overall, the policy documents that provide the policy framework of Toronto's ravines are as follow:

GOVERNMENT OF ONTARIO
Policies: 1) Provincial Policy Statement specifically section 3, 2) Ravine and Natural Feature Protection By-Law, 3) Conservation Authorities Act

TRCA
Policy: TRCA Living City Policies
Initiative: TRCA Greenlands Acquisition Projects

CITY OF TORONTO
Policies: Toronto Official Plan, specifically Section 2.1 Policy 1.k, Section 2.2 Policy 2.i&5.c, Section 2.3.2 Policy 1-10, Section 3.1.1 Policy 3, 4, Section 3.2.3 Policy 1-9, Section 3.4 Policy 1, 3-17, Section 4.3 Policy 1-8, Section 5.1.2 Policy 2.d, Section 5.1.3 Policy 3.e
Initiatives: 1) Ravine Strategy, 2) Parkland Acquisition Strategy, 3) TOcore

policy framework of connectivity

The Greenbelt Belt Act offers the most comprehensive planning tool available in Ontario in terms of protecting and ensuring the connection between green space in the greenbelt region (Ontario Nature, 2014). However, there is no legislation promoting connections among urban park lands and natural systems. This could potentially be due to the lack of funding, the value of real estate, or simply due to the complexity of land tenure and uses within the urban landscape (Lorinc, 2015).

However, as Parks People, a local non-governmental organization, (2015) identified, Toronto has now many opportunities to offer connectivity and the need for policies that could facilitate landscape connectivity is augmented by the difficulty of acquiring lands in Toronto. Under Section 37 of the Planning Act, the City of Toronto can negotiate permitted buildings' heights and density with developers in return for community benefits, which include open and green spaces. In addition, the Official Plan requires developments to dedicate a certain portion of their land to open and green spaces. However, when the land is deemed unsuitable for an open and green space, council may require a cash-in-lieu (City of Toronto, 2015b). The money received from cash-in-lieu of parkland dedication is collected in the Parkland Acquisition and Development Reserve Fund and is directed to land acquisition and park improvements through the City of Toronto Capital Budget. Unfortunately, the Parkland Acquisition and Development Reserve Fund is expected to drop to $221 million by 2017 (City of Toronto, 2015a). In the context of Downtown Toronto where the real estate market for an acre of land varies between $30M to $60M, the fund might not be able to suffice the conventional green space acquisition system (Lorinc, 2015). Hence, the current legislation does not allow for prioritizing connectivity nor does it produce enough funding to secure land for connectivity.

WHY CONNECTIVITY?

Within the Ravine Strategy, the City of Toronto repeatedly mentions the need for better connectivity in the ravine system. Taylor et al. (1993) defines connectivity as *the degree to which the landscape facilitates or impedes movement among resource patches*. This reflects the diversity in species of both wildlife and humans along with the diversity in movements such as walking and biking (Shepard et al., 2008).

In 2006, the City of Toronto identified several areas within its boundaries with low parkland provision (See Appendix D for Map 8B/C of Toronto's Official Plan; City of Toronto, 2015), showing an uneven distribution of parks favouring the waterfront and the ravine valleys (De Sousa, 2003). Moreover, this distribution of parks across Toronto is only going to be exaggerated with the new proposed parks along the waterfront (Mirabelli, 2016). The ravines are and will increasingly become the main source of nature and trails for Toronto residents and tourists. With a forecast population growth of 32.4% by 2041 (Ontario, 2016), increasing pressures will be put on the ravine system with 64% of proposed residential units within 1km buffer around the ravine system[1]. Without proper consideration, ESAs and other green spaces' ecology will be at risk.

a primer on landscape connectivity

Landscape connectivity has a multitude of benefits for both humans and the wildlife contributing to both resiliency and health.

From an ecological perspective, connectivity is important due to the impact of reduced mobility and hard edges on the wildlife's capacity for resiliency. In fact, the lack of mobility reduces the chances of a specie to breed, feed, and find a shelter. Over time, the reduction in breeding frequency creates a weaker set of genetic materials that varies from one patch to the other (Lister et al., 2015). Without proper adaptation, species can become endangered by changes in the surrounding environment. The consequences of fragmentation are reinforced when the size of the "patches" are of smaller size. Studies have shown that genetic robustness correlates with the size of an area. Altogether, species that are found in a fragmented environment are less likely to survive external changes, which happens continuously in the urban environment (Lister et al., 2015). Moreover, wildlife survival in the urban environment is degraded due to the presence of hard edges surrounding "natural" patches. Hard edges are defined as an abrupt difference in land use and naturalization and are found at the boundary between private properties and natural areas, as well as between roads and natural areas (Yahner, 1988). With more than a quarter of its total landscape being dedicated to roadway (City of Toronto, 2017), Toronto presents many opportunities for wildlife-vehicles collisions with little opportunities for wildlife crossing. From a behavioral perspective, wildlife species were found to purposely avoid crossing roads resulting in individuals not breeding (Lister et al., 2015). This behavioral adaptation reinforces the loss of genetic diversity across the overall landscape (Shepard et al., 2008).

[1]These statistics were compiled from a map composed of data collected from the City of Toronto's Open Data Catalogue (City of Toronto, 2016)

The need for improved wildlife is augmented by climate change. In fact, climate change has been incrementally putting pressure on the wildlife. As the climate will change over the upcoming years, species will increasingly require connectivity in order to migrate to warmer and/or better fitted spaces. Species that have historically adapted to the urban environment will likely adapt to new climates, but the survival of sensitive species will require mobility. Hence, the impact of habitat fragmentation on the wildlife is expected to worsen (Lister et al., 2015).

On the brighter side, cities across Canada such as Edmonton have started to tackle the issue of habitat fragmentation. Similarly, Bennett (2003) emphasizes the need to assist animals to cross local barriers, and to help maintain local movements through enhancing environments that are ecologically inhospitable. As a means to assist animals in safely crossing roadways, animal crossing infrastructures are used across Banff, AB, as well as across many locations in Europe, and have eradicated up to 95% of wildlife-vehicles collisions (Lister et al., 2015). Yuan (2014) looked at increasing animal crossing in the City of Toronto, reporting many missed opportunities due to poor coordination and misplacement of the city's transportation department, indicating the political complexity in implementing conservation-based solutions to fragmented ecological habitats in the urban landscape.

Although potentially difficult to implement, a connected system has many advantages such as promoting a wider vegetative richness, an increase in ecosystem services, and better access to communal spaces. In fact, connectors in a green network such as animal crossing infrastructures often contain extensive amounts of vegetation, which contribute in adding biophysical materials to the land while connecting existent biophysical materials. This creates a richer network that can provide more functions to the ecosystem. An increase in vegetation richness inevitably improves ecosystem services, which have been shown to reduce anxiety and increase longevity of local residents (Kuo & Sullivan, 2001). Moreover, an increase in vegetation provides an opportunity for enhancing human accessibility to green and open spaces, which contributes to bringing people together (Erickson, 2006). This is reinforced by the cultural, emotional attachment to nature. In fact, nature-related attributes are the most appreciated characteristics when residents discuss open spaces. These attributes are especially important in dense urban areas where there is a perceived notion that greenery is lacking. Moreover, the perception of a lack of green space is reinforced when there is deficient visual accessibility to vegetative material (Gobster & Westphal, 2004).

In terms of financial considerations, in 1995, a group of ecologists and economists identified 17 types of ecosystem services around the world estimating a total value of $33 trillion. At the time of the study, this was equivalent to twice the gross national product of all the countries around the world (Roots, Heidenreich, & Chant, 1999). Since then, land use changes have resulted in a loss of ecosystem services worldwide that range in value from $4.3T to $20.2T per year (Costanza et al., 2014). Hence, enhanced ecosystem services in a connected natural system would prohibit the loss of the financial value of the land. In addition, a connected system could reduce the need and maintenance costs of grey infrastructure. In fact, Toronto's natural system, acting as blue-green infrastructure, has the potential to alleviate pressure on our sewage system through the reduction of stormwater runoff and nonpoint source pollution (Wang, Eckelman, & Zimmerman, 2013).

Overall, connectivity should be considered a priority in addressing a fragmented landscape, as it adds to the health of both humans and wildlife while providing financial benefits.

CONNECTIVITY: HOW?

Toronto's ravine system has many unique characteristics and is critical to the health and well-being of people and wildlife. Yet, currently the system and the overall landscape are fragmented thus not realizing their full potential. Gaps are found across the system both in terms of trail and natural systems due to several factors including road infrastructures, private properties, and others. As the City of Toronto is aiming for an increasing usage of its ravines, there is a need for both wildlife and humans to move more organically through this complex system. In order to "stitch the fabric", the City of Toronto should undertake a more holistic and bold approach to landscape connectivity. This requires further thinking and further action beyond simply increasing parkland acquisition.

research question

What are strategies to reconnect the gaps found in the ravine system in the City of Toronto?

1. What are areas across Toronto's ravines where there is a gap on publicly-owned land in either the trail system and/or the natural system and where there is a potential for better connectivity?
2. How are global cities with similar density, seasons, and/or landscape using innovative strategies to connect waterfront public land?
3. What connectivity strategies can be used in the context of the City of Toronto to better connect publicly-owned land in the ravine system?

A pipe culvert connecting the water from Ellesmere Ravine across Ellesmere Road (2017, V. Racine)

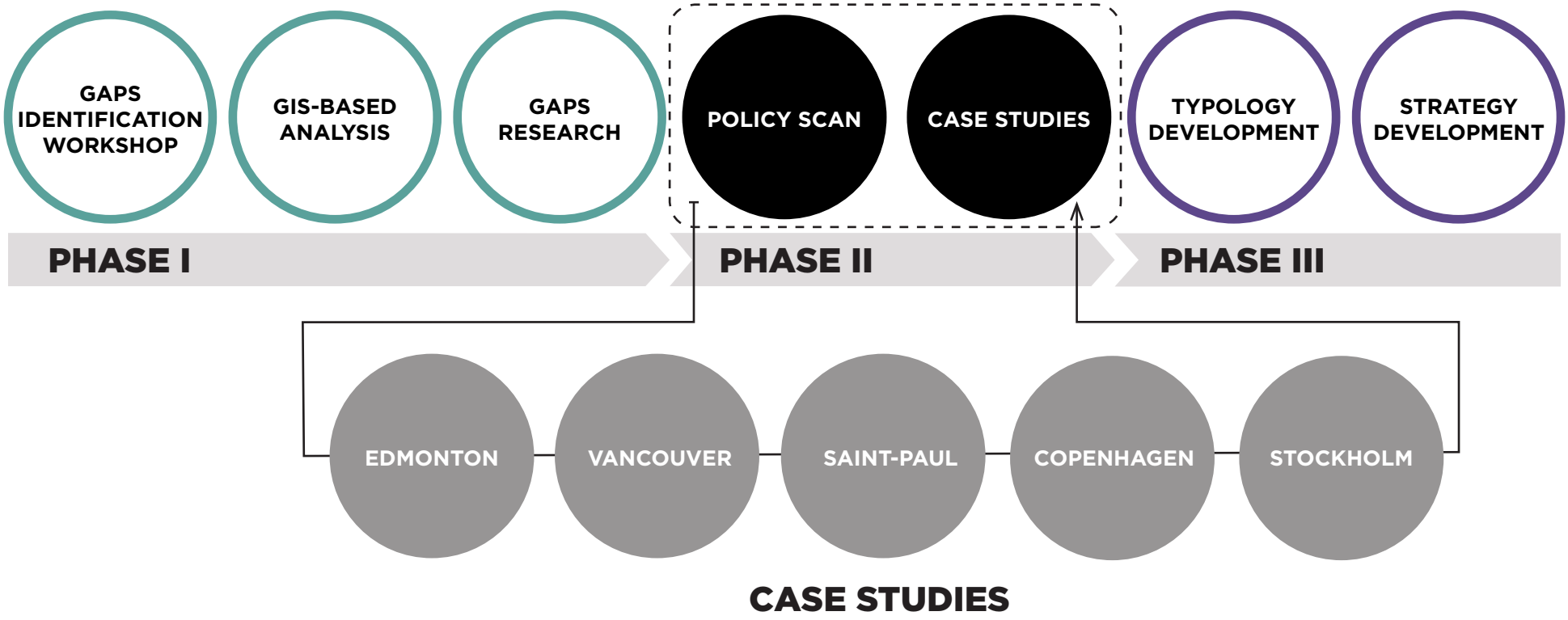
METHODS

A box culvert connecting the water from the East Highland Creek across the Ontario Highway 401 (2017, V. Racine)

To answer the three research questions, the research design was based on a mixed method model where questions were looked at from both a quantitative and qualitative standpoint. Specifically, a mixed method approach allows for both meaning and quantity to be incorporated into a project (Morse, 2010). Hence, the research design aims to unite the practitioner's knowledge to the geographical data. Although the research design is outlined below, it has organically evolved and changed throughout this iterative project.

This project was conducted and designed to inform the City of Toronto and so, was designed for the political, ecological, and physical context of Toronto. To insure the appropriateness of the research, meetings with the City of Toronto's Program Standards & Development Officer, Jennifer Kowalski, were organized throughout each phase.

The research design was divided into three phases: Gaps Analysis, Connectivity Best Practices, and Strategy Development.



PHASE I: GAP ANALYSIS

The goal of this phase was to identify the physical gaps both in terms of trail and natural systems present in the ravine system from both professionals working in Toronto's ravines and a GIS-based analysis. This phase was divided into three sections: Gaps Identification Workshop, GIS Site Identification, and Gap Research.

gap identification workshop

The goal of this workshop was to identify a list of gaps in the ravines both in terms of trail and natural systems. The workshop was opened to 8 natural environment specialists at the City of Toronto who have done extensive work in Toronto's ravines. The workshop occurred on November 15th 2016 at the Evergreen Brick Works Urban Forestry office. Throughout the workshop, the natural environment specialists contributed their extensive experience in the ravine system and provided insights as to which gaps should be prioritized. In order to foster an understanding of the geophysical relationships at play in the ravines, GIS-based visuals had to be made (Tashakkori & Teddlie, 2010). Hence, a map of Toronto's ravines was made illustrating the variables of interest: green spaces, the ravines, and the trail system. The visuals had to be well-constructed and properly labeled in order for the research purposes to be clear (Tashakkori & Teddlie, 2010) to the specialists.

Natural environment specialists are discussing the most important gaps in Toronto's ravines (2016, V. Racine)

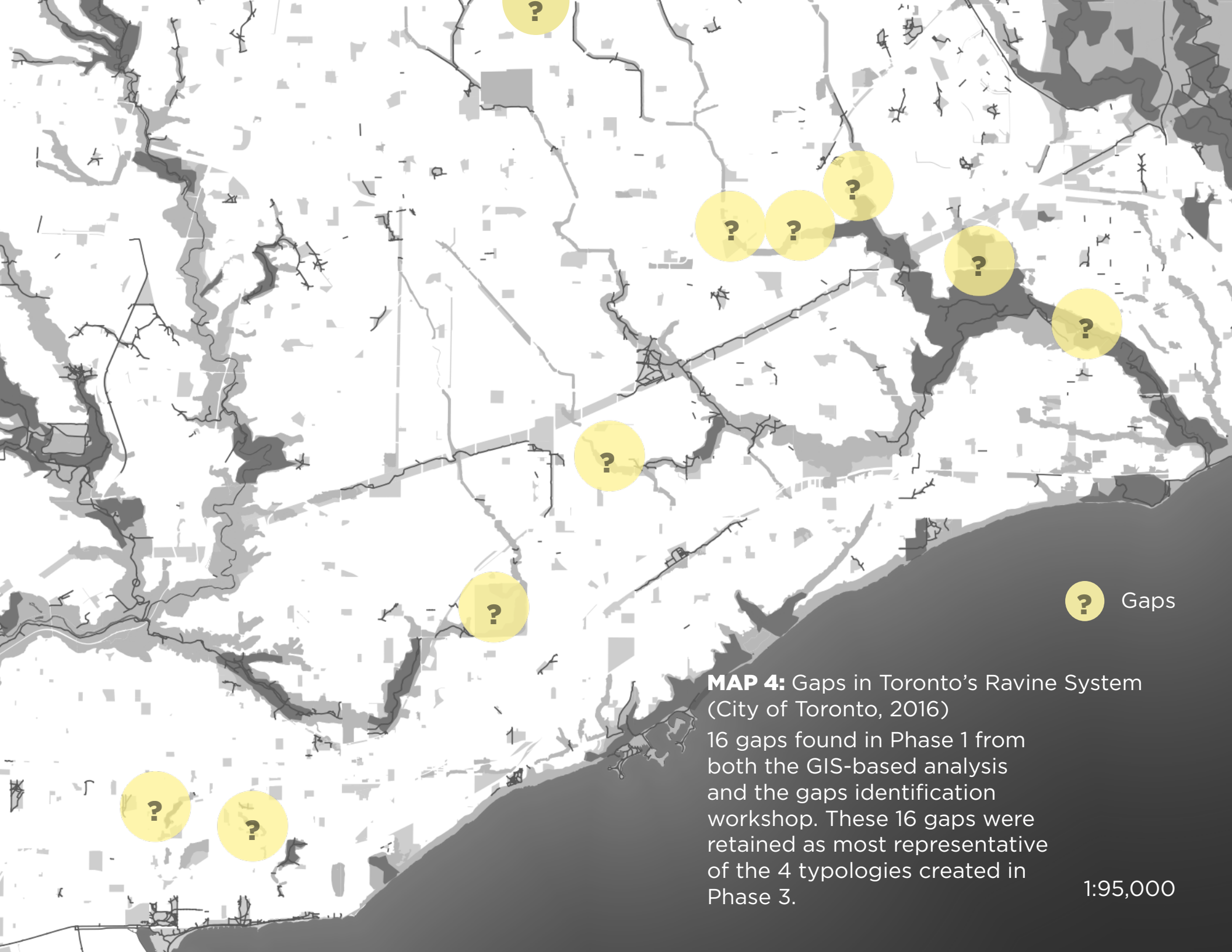
Natural environment specialists identified multiple gaps in Toronto's ravines (2016, V. Racine)

GIS site identification

This section supports the gaps identification workshop and looks into ecological connectivity opportunities alongside ESAs. Green spaces were identified through a buffer analysis of 100m radius around ESAs using data from the City of Toronto Open Data Catalogue. Areas dividing identified green patches and ESAs were defined as gaps. These gaps showed potential for enhanced connectivity for wildlife movement.

gap research

After the workshop and GIS site identification, the gaps identified were digitized. In doing so the ownership context and zoning were explored. Thereafter, each gap identified was discussed with Jennifer Kowalski, Program Standards & Development Officer for the Parks, Forestry & Recreation division at the City of Toronto. A portrait of each gap was then created illustrating the gaps' spatial, environmental, and policy context. A on-site visit was undertaken to complement the analysis with experiential knowledge of the gaps.



MAP 4: Gaps in Toronto's Ravine System (City of Toronto, 2016)

16 gaps found in Phase 1 from both the GIS-based analysis and the gaps identification workshop. These 16 gaps were retained as most representative of the 4 typologies created in Phase 3.

1:95,000

PHASE II: CONNECTIVITY BEST PRACTICES

The goal of this phase was to explore cities internationally that have extensive waterways and comparable populations, seasons, and landscape. Specifically, this phase aimed at understanding waterfront public land connectivity best practices from North American and European cities. The chosen cities have a range of ecologically significant areas, urbanization, as well as waterways with publicly-owned lands crossing their urban core: Edmonton (CA), Vancouver (CA), Stockholm (SW), Copenhagen (DK), and Saint-Paul (US). This phase was divided into two sections: Policy Scan and Interview-Based Case Studies.

policy scan
A policy scan of the chosen cities was conducted. Strategies pertaining to green space connectivity and acquisition were examined and analyzed.

interview-based case studies
To complement the findings from the previous section, academics and professionals in the fields of urban planning and/or landscape architecture from the selected cities were interviewed (see Appendix E for complete list). The goal of this process parallels the goal of the gap identification workshop: to understand connectivity and gaps from a practitioner standpoint. Policies, partnerships and design interventions pertaining to waterfront public lands connectivity were identified through the interviews. Prior to this undertaking, I obtained research ethics board approval through the Ethics Submission and Review System short form protocol at Ryerson University (see Appendix C).

PHASE III: STRATEGY DEVELOPMENT

The goal of this phase was to summarize the workshop and best practice findings into typology-based connectivity strategies for gaps filling efforts. This section represents a tool usable for the City of Toronto when aiming to improve connectivity in gaps. This final phase is divided into two sections: Development of Gaps' Typologies and Connectivity Strategy Development.

typology development
The goal of typology development was to help visualize and understand the context of existing gaps. In total, four typologies were created based on the type of system that is fragmented (natural or trail) and ownership context of the gap (public or private). Each typology assembled a series of 4 gaps previously identified.

strategy development
The final phase aimed at creating an appropriate connectivity strategy for each typology developed in the previous step. To this end, knowledge from the case studies and meetings with the staff at the City of Toronto was applied to each typology depending on the respective context.

FINDINGS

The East Highland Creek contains a rich set of vegetative materials that provides a habitat for several bird species (2017, V. Racine)

The workshop provided insights on 28 gaps in Toronto's ravines (2016, V. Racine)

GAP IDENTIFICATION WORKSHOP

Through the workshop with natural environment specialists, 28 gaps in both the trail and natural system were identified. These gaps varied in different ways.

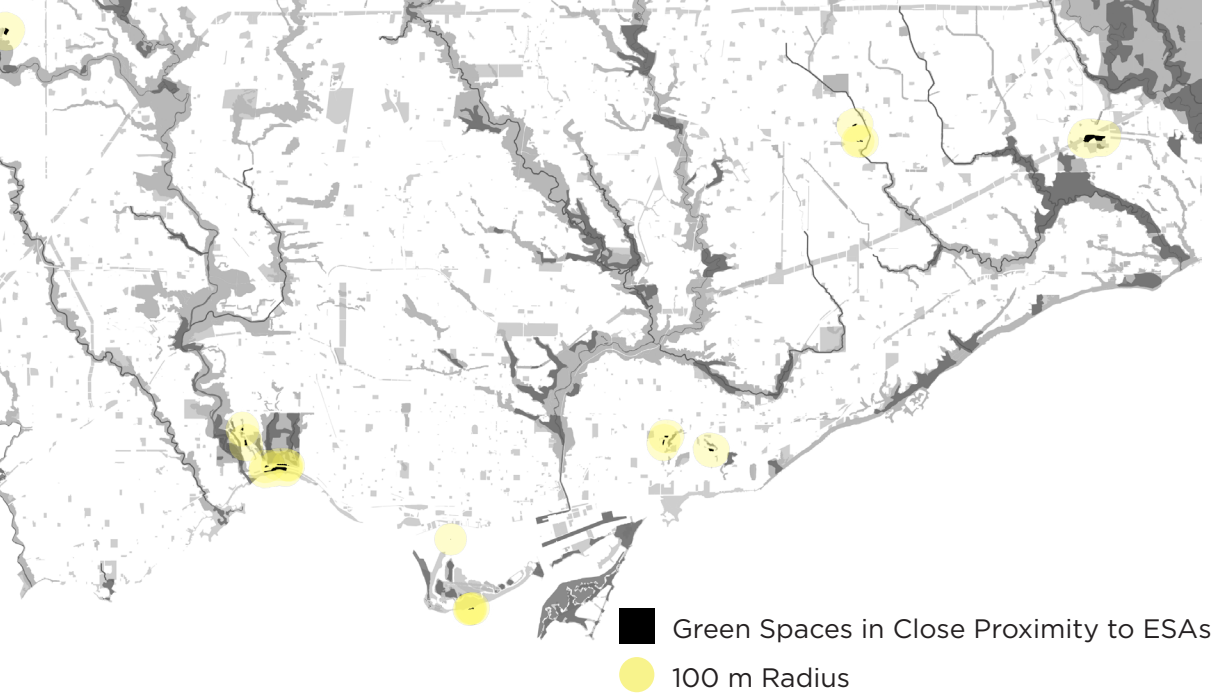
location
The gaps were primarily focused within the Don Watershed. There was also a fair representation in the Humber Watershed and the Highland Watershed.

impeded movement
The gaps were overwhelmingly focused on the trail system with 23 gaps in comparison to 5 gaps that were pertaining to connectivity between natural systems.

physical composition
The gaps found in the workshop varied in the physical composition of the fragmentation. Some gaps were composed of roads, electricity transportation corridors, informal infrastructure, private infrastructure or sometimes gaps lacked infrastructure.

ownership
17 of the gaps identified were on publicly-owned land in comparison to 11 gaps that were found on privately-owned land. The ownership of public lands varied from municipal, regional, and provincial. In fact, where the City of Toronto owns the local transportation corridors, golf courses, and park lands, the TRCA owns areas protected under the Ravine and Natural Feature Protection By-law, and the Ministry of Transportation owns specific parcels of land, highways and electricity transmission corridors.

In terms of private ownership, the gaps varied between residential properties to privately-owned golf courses. Such ownership impacted connectivity between either the trail and natural system and the site causing the disconnect.



Map 5: Gaps in Toronto's Ravine System Found through Buffer Analysis (City of Toronto, 2016) 1:350,000

GIS SITE IDENTIFICATION

The GIS-based buffer analysis undertaken identified 20 green patches that were within 100 m radius of an ESA. The areas between the identified green patches and the ESAs (herein referred to as gaps) have the potential to create greater connectivity between ESAs and their surrounding for the wildlife specifically.

location
As seen on the map, gaps are mostly concentrated on the south portion of Toronto. Whereas some gaps are situated in residential neighbourhoods, some gaps are situated directly adjacent to a highway or situated in water.

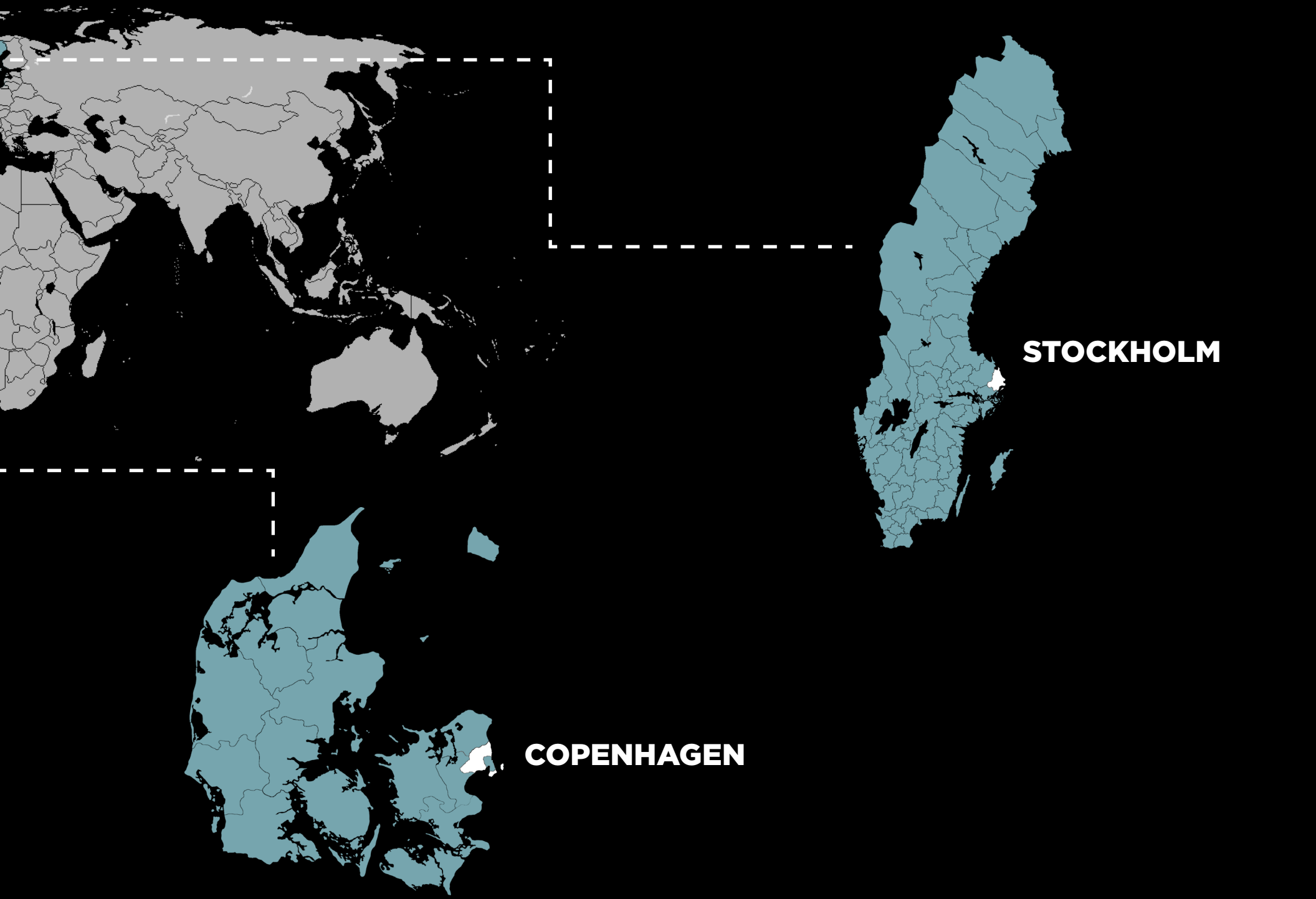
impeded movement
The GIS-based buffer analysis had a primary focus on wildlife connectivity and so, focused entirely on gaps dividing natural systems. This was due to the overemphasis on trail systems in the workshop.

physical composition
The gaps through the buffer analysis varied in the physical composition of the fragmentation. Some gaps were composed of houses, roads, or water.

ownership
The gaps were primarily focused in residential neighbourhoods and so, were mainly composed of privately-owned properties. In less prevalent cases, some gaps were composed of utility corridors with both electricity transmission corridors and roads. The different ownerships promoted inconsistency in the natural system due to different maintenance practice between land owners. For instance, the potential of utility corridors' greenscape is reduced to lawn in contrast to naturalized biodiverse spaces in close proximity to waterways.

BEST PRACTICES HIGHLIGHTS

A policy scan and interviews with professionals were conducted with all 5 cities. Both the literature and professionals provided insights on how these cities are combating habitat and trail fragmentation from both a wildlife and human standpoint.


STOCKHOLM
COPENHAGEN

VANCOUVER

Population: 631,486 | Area: 115 km²

MAP 6: Vancouver's Built Form (City of Vancouver, 2016)

TORO

Population: 2,731,571

MAP 7: Toronto's Built Form

EDMONTON

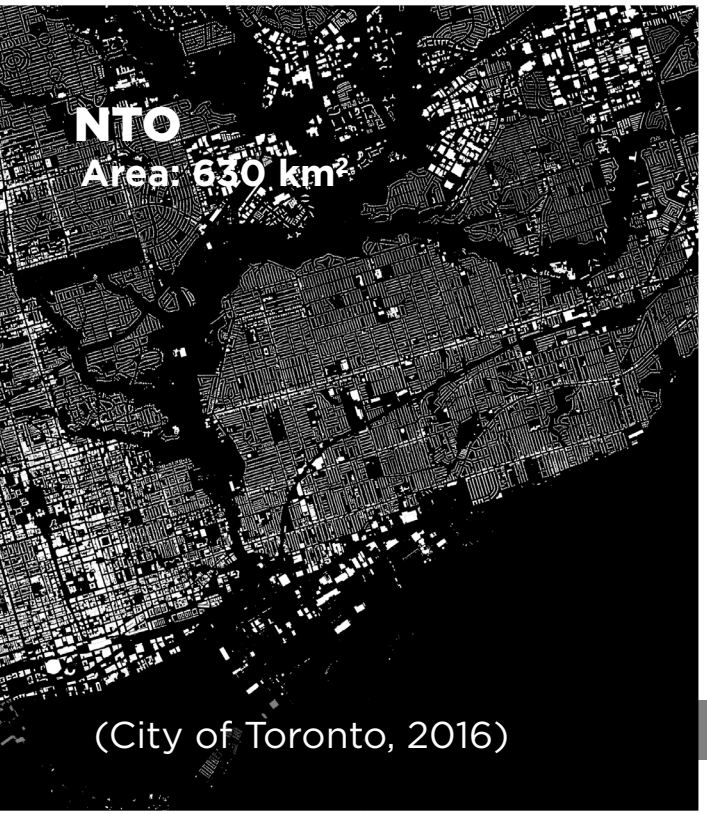
Population: 932,546 | Area: 685 km²

MAP 9: Edmonton's Built Form (City of Edmonton, 2016)

SAINT-

Population: 300,851

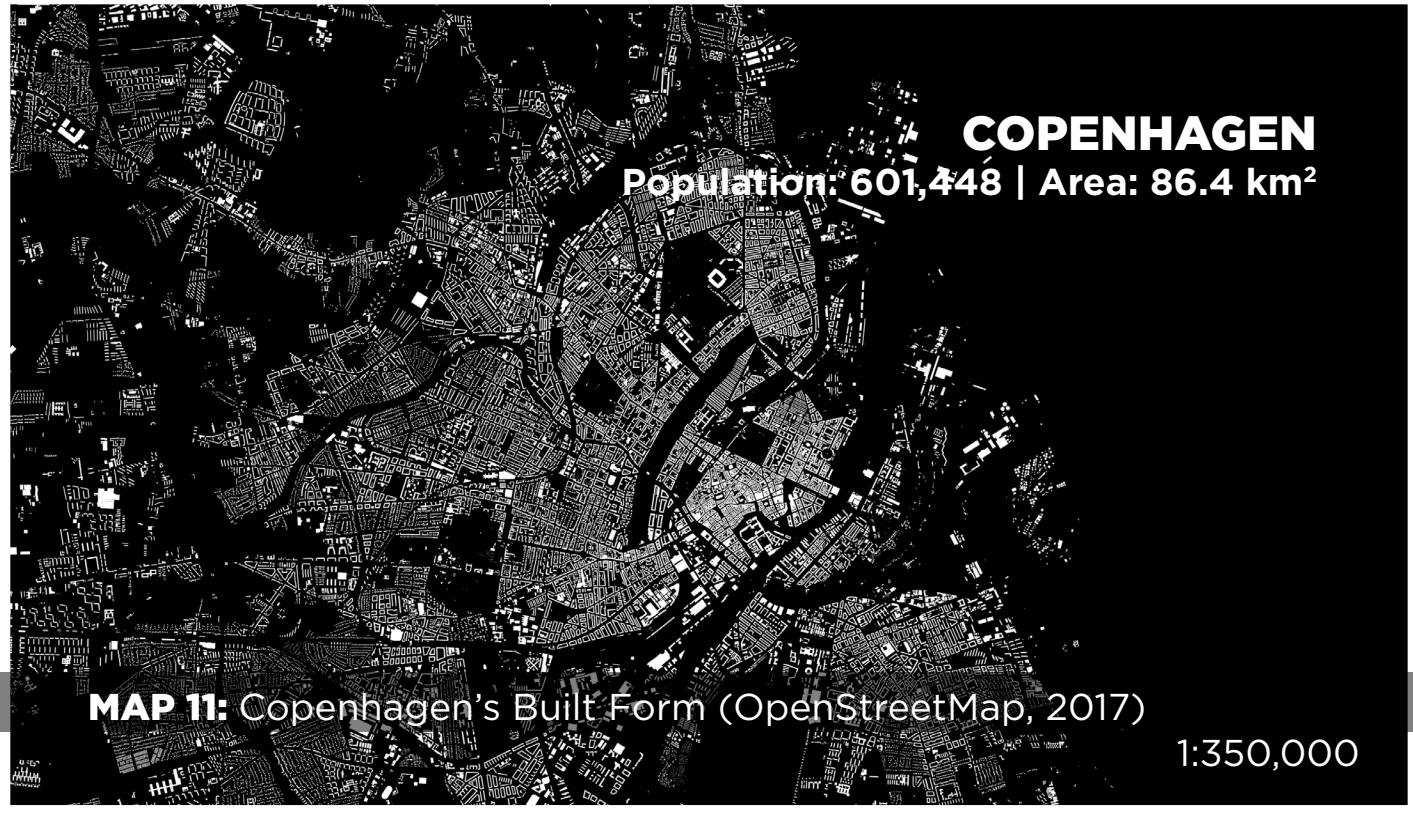
MAP 10: Saint-Paul's Built Form



(City of Toronto, 2016)

MAP 8: Stockholm's Built Form (OpenStreetMap, 2017)

(OpenStreetMap, 2017)



MAP 11: Copenhagen's Built Form (OpenStreetMap, 2017)

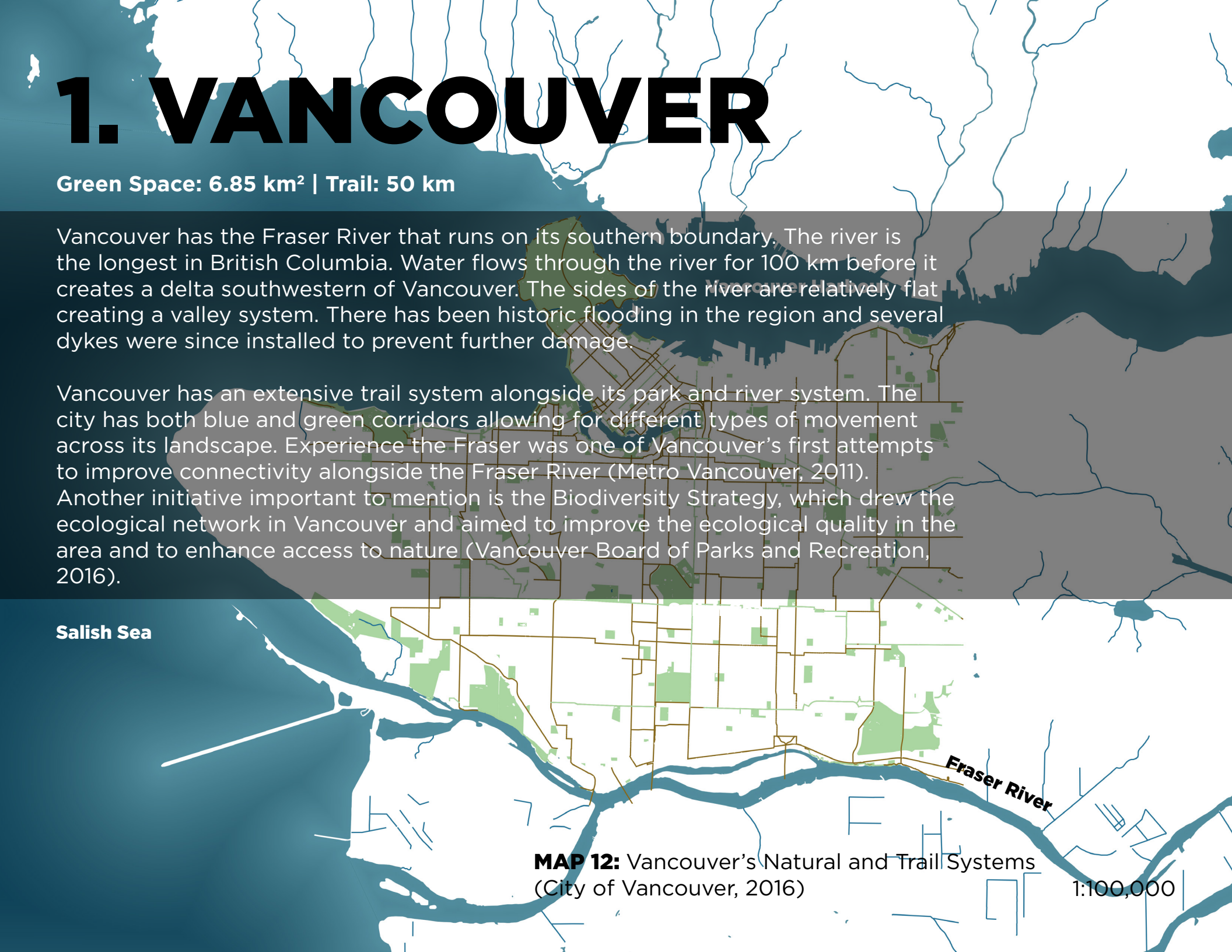
1:350,000

1. VANCOUVER

Green Space: 6.85 km² | Trail: 50 km

Vancouver has the Fraser River that runs on its southern boundary. The river is the longest in British Columbia. Water flows through the river for 100 km before it creates a delta southwestern of Vancouver. The sides of the river are relatively flat creating a valley system. There has been historic flooding in the region and several dykes were since installed to prevent further damage.

Vancouver has an extensive trail system alongside its park and river system. The city has both blue and green corridors allowing for different types of movement across its landscape. Experience the Fraser was one of Vancouver's first attempts to improve connectivity alongside the Fraser River (Metro Vancouver, 2011). Another initiative important to mention is the Biodiversity Strategy, which drew the ecological network in Vancouver and aimed to improve the ecological quality in the area and to enhance access to nature (Vancouver Board of Parks and Recreation, 2016).



MAP 12: Vancouver's Natural and Trail Systems (City of Vancouver, 2016) 1:100,000

NOTABLE PRACTICES IN LANDSCAPE AND TRAIL CONNECTIVITY

density bonuses and provincial requirements

When reviewing a development application, the City of Vancouver provides density bonuses in return for greater setbacks. The goal is to increase the top-bank width to 15-30m of natural space to further contribute to restoration of the vegetation that is part of that corridors: It is now a provincial requirement within the Ministry of Environment's land development guidelines. The Ministry of Environment states that redevelopments on land with creeks running through must adhere to new setback requirements for the ecosystem services to be accommodated (K. Connery, personal communication, February 14, 2017).

right-of-way agreement

When receiving a redevelopment or development application, the City of Vancouver is providing more leniency to developers in return for recreational trails and naturalization of riparian ecosystems on their property. Through a right-of-way agreement, the City of Vancouver puts an obligation onto the land, which protects it from future development. Similar to density bonuses, this is tool where the City puts legal stature over a portion of the land without acquiring it. This is an example of a cost-effective way the City of Vancouver can connect and restore natural and trail systems in a context where lands are expensive to acquire (K. Connery, personal communication, February 14, 2017).

third party purchasing

Organizations such as Ducks Unlimited Canada conserve, restore and manage privately-owned ecologically sensitive areas. The City of Richmond worked with the organization to acquire and protect the Grauer Lands, a 51 hectares tidal wetland (K. Connery, personal communication, February 14, 2017).

ecological gifts program

During the purchase of the Grauer Lands, the City of Richmond used the federal Ecological Gifts Program to acquire the piece of wetlands. The program provides "significant tax benefits to landowners who donate land or a partial interest in land to a qualified recipient" when the piece of land in question is deemed ecologically sensitive. Here, the City used this program to reduce the price of the land (K. Connery, personal communication, February 14, 2017).

regional acknowledgment of ecosystem functions

Metro Vancouver has provided regional goals for sustainable watershed practices. This has in turn fostered cooperation between municipalities when improving connectivity and ecological health in green infrastructures across jurisdictions. Here, a regional authority overseeing municipalities prioritizing conservation of ecosystem services helped with connectivity efforts (K. Connery, personal communication, February 14, 2017).

hedgerows treatment and lease agreement

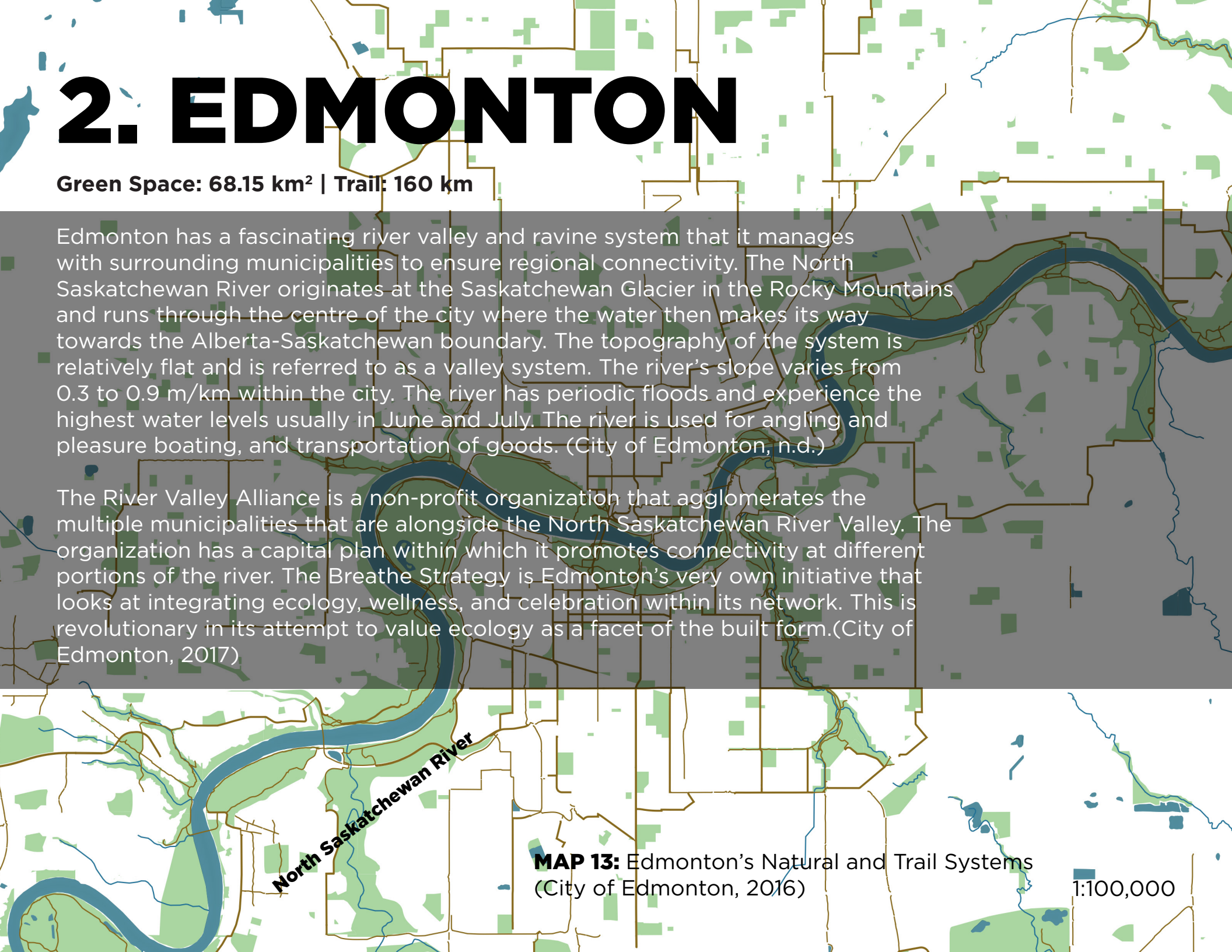
Organizations such as Delta Farmland & Wetland Trust work on leasing the hedgerows of private properties to restore natural habitats and help with the edge-effect of private properties backing onto private properties. Specifically, this firm leases the edge of a farmland and establish a hedgerows treatment and restore ecosystems (K. Connery, personal communication, February 14, 2017).

2. EDMONTON

Green Space: 68.15 km² | Trail: 160 km

Edmonton has a fascinating river valley and ravine system that it manages with surrounding municipalities to ensure regional connectivity. The North Saskatchewan River originates at the Saskatchewan Glacier in the Rocky Mountains and runs through the centre of the city where the water then makes its way towards the Alberta-Saskatchewan boundary. The topography of the system is relatively flat and is referred to as a valley system. The river's slope varies from 0.3 to 0.9 m/km within the city. The river has periodic floods and experience the highest water levels usually in June and July. The river is used for angling and pleasure boating, and transportation of goods. (City of Edmonton, n.d.)

The River Valley Alliance is a non-profit organization that agglomerates the multiple municipalities that are alongside the North Saskatchewan River Valley. The organization has a capital plan within which it promotes connectivity at different portions of the river. The Breathe Strategy is Edmonton's very own initiative that looks at integrating ecology, wellness, and celebration within its network. This is revolutionary in its attempt to value ecology as a facet of the built form.(City of Edmonton, 2017)



MAP 13: Edmonton's Natural and Trail Systems (City of Edmonton, 2016)

1:100,000

NOTABLE PRACTICES IN LANDSCAPE AND TRAIL CONNECTIVITY

multi-department approach

For the past decade, the Transportation and Parks Departments have increasingly partnered on several projects revolving around greenways and ecological connectivity. Most recently, the Parks, Transportation, and Drainage Planning functions of the City have been merged under a new City Planning Branch to ensure future planning decisions, including the maintenance of wildlife passage and ecological connectivity, are undertaken in a multidisciplinary fashion (C. Shier, personal communication, March 7, 2017).

restoration plan

As committed in the City's Environmental Strategic Plan (The Way We Green), work is underway to initiate a City-wide restoration plan. The first stage of work was completed in 2017 which saw the mapping of biophysical assets, threats and constraints across the City. These factors were combined into an environmental sensitivity score, with environmental sensitivity classes then linked to management recommendations. The mapped sites will inform both long-term planning and development decision-making (C. Shier, personal communication, March 7, 2017).

public access agreement

The city has long done public access agreements with landowners to continue trails onto privately-owned lands (C. Shier, personal communication, March 7, 2017).

breathe strategy

The Breathe Strategy was created to create a Green Network, which is formed by the Ecology Network, Celebration Network, Wellness Network, and Urban Infrastructure Network. Specifically, the Ecology Network was framed around identified natural or near natural vegetated patches and corridors. The patches are viewed as providers of ecological functions such as the flow of species, energy, nutrients, and water. Through a set of proposed policies, the City of Edmonton reinforces the need for connectivity between patches and the need to minimize residents' interference with the ecological functions at play[1] (City of Edmonton, 2017).

ecological network report

As directed by Edmonton's Natural Area Systems Policy (C531), ecological information is required to support planning and development applications accepted by the City. This is accomplished at the Area and Neighbourhood Structure Plan stage through the submission of Ecological Network Reports which is to "*describ[e] and assess the structure, function and integrity of the ecological network existing within the plan area*." Ecological Network Reports provides insightful information for connectivity endeavors. (City of Edmonton, 2014).

wildlife passage engineering design guidelines

The City of Edmonton has built numerous wildlife passages ranging from moose underpasses to simple curb modifications to allow for amphibian crossing. In 2010, the City of Edmonton created a technical wildlife passage design guideline. The goal of the document is to "*provide transportation designers and decision makers with recommendations that will incorporate the needs of wildlife into transportation projects*". The document translates ecological needs in technical language appropriate for transportation technicians (City of Edmonton, 2010).

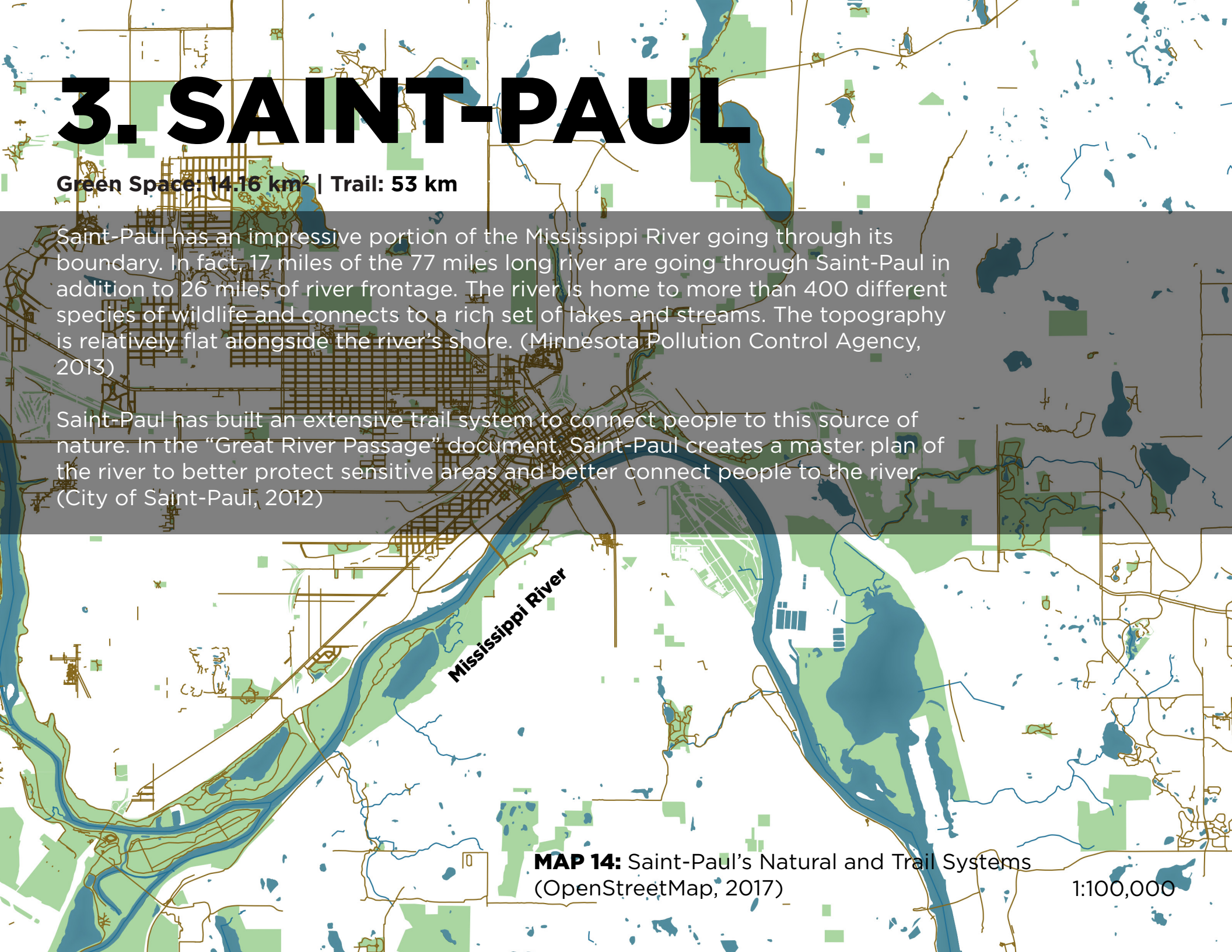
[1]see full report at https://www.edmonton.ca/city_government/initiatives_innovation/breathe.aspx

3. SAINT-PAUL

Green Space: 14.16 km² | Trail: 53 km

Saint-Paul has an impressive portion of the Mississippi River going through its boundary. In fact, 17 miles of the 77 miles long river are going through Saint-Paul in addition to 26 miles of river frontage. The river is home to more than 400 different species of wildlife and connects to a rich set of lakes and streams. The topography is relatively flat alongside the river's shore. (Minnesota Pollution Control Agency, 2013)

Saint-Paul has built an extensive trail system to connect people to this source of nature. In the "Great River Passage" document, Saint-Paul creates a master plan of the river to better protect sensitive areas and better connect people to the river. (City of Saint-Paul, 2012)



MAP 14: Saint-Paul's Natural and Trail Systems (OpenStreetMap, 2017) 1:100,000

NOTABLE PRACTICES iN LANDSCAPE AND TRAIL CONNECTIVITY

landscape-based approach

In the Great River Passage report, Saint-Paul created a master plan for its portion of the Mississippi River. In the document, the City of Saint-Paul divided the Mississippi River in 17 precinct areas. Each area was defined by a unique set of built infrastructure, vegetation, density and varied levels of accessibility. Actions were then based on existing assets and based on a gap-analysis (City of Saint-Paul, 2012; T. Griffin, personal communication, March 9, 2017). Objectives worth quoting:

- Require green connections as part of redevelopment and green infrastructure as means to establish natural corridors.

- Acquire or Otherwise Protect Existing Natural Areas to Create a Continuously Connected Network.

river-oriented development areas

Targeted redevelopment sites in proximity to the river should be "river-oriented". Such redevelopment follows several criteria such as appropriate building scale and mass and green architecture. The redevelopment should enhance walkability of the neighbourhood and improve walking and bicycling access to the river (City of Saint-Paul, 2012).

green connections

In the Great River Passage report, Saint-Paul recommends the establishment of green corridors on streets that provide accessibility to the river. The corridors "*provide connective tissue between neighborhoods and the river."* They can be either publicly or privately managed, but are meant to provide access to the river while adding value to the ecology through stormwater treatment and open spaces (City of Saint-Paul, 2012; T. Griffin, personal communication, March 9, 2017).

more natural, more urban, more connected

Saint-Paul has approached the planning of its portion of the Mississippi River through the lenses of conservation, recreation, and connectivity. Significant to this research is the emphasis to reconnect and enhance corridor habitats, reestablish pre-settlement vegetation patterns, enhance the habitat potential ponds, lakes, and the river's edge, and focus on completing Saint-Paul's Bicycle Network (City of Saint-Paul, 2012; T. Griffin, personal communication, March 9, 2017).

collaborative approach

In acknowledging the limit of public funds, the City of Saint-Paul has shaped the redevelopment of the river passage with a great focus on collaboration. In the master plan of the river passage, the City has identified partnerships with non-profit organization, as well as profit-driven organization. Similarly, the redevelopment is rooted in environmental stewardship. Hence, the city offers many opportunities for residents to engage with connecting the river (City of Saint-Paul, 2012; T. Griffin, personal communication, March 9, 2017).

4. COPENHAGEN

Green Space: 14.69 km² | Trail: 350 km

Copenhagen has extensive waterways running through its city with Øresund to the east, which separates Denmark from Sweden. Although the city has built dyking systems, it has experienced flooding through 100-year rainfall events (i.e. cloudburst) such as 3 within the last 5 years. In terms of forest cover, less than 1% of Copenhagen is covered by trees and vegetation (Nielsen et al., 2016), but has increasingly built green infrastructure to complement its green deficit and be more resilient to climate change.

Copenhagen has one of the most impressive connected trail systems in the world. The below-grade city has built a series of impressive interventions to connect better with its environment.

MAP 15: Copenhagen's Natural and Trail Systems (OpenStreetMap, 2017) 1:100,000

NOTABLE PRACTICES iN LANDSCAPE AND TRAIL CONNECTIVITY

biophysical functions

Copenhagen has incrementally deepened the meaning of what is a green space and now incorporates ecosystem functions through the terminology “biophysical functions”. Before, green spaces were assessed based on carbon neutrality and recreational benefits only. Now, Copenhagen assesses the quality of natural systems based on extensive ecological relationships (A. S. Olaffson & N. Gulsrud, personal communication, March 1, 2017).

partnership tree program

This program provides free trees to residents. The purpose here is for residents to contribute to climate resiliency and create stewardship. Although residents may plant the tree in their backyard, they are encouraged to contribute to the tree canopy of the public realm (A. S. Olaffson & N. Gulsrud, personal communication, March 1, 2017).

green space branding

Denmark has long promoted itself as a leader in sustainable practices. Through the renewal of the city, Copenhagen has also been promoting itself as a leader with its urban green spaces and became the European Green Capital of 2014. Green space branding acts as a means to increase tourism, foreign investment, but also, as a means to encourage more national effort in maintaining “the brand” in the environmental planning field. This type of branding can also be applied to private industries and can encourage sustainable behaviors (Gulsrud, 2015).

green cloudburst streets

Streets in Copenhagen are being designated as green cloudburst streets. That is, streets are redesigned to absorb and support high precipitation events (i.e. cloudburst event). Through a partnership between Copenhagen, utility companies and the private landowner’s associations, these streets will be naturalized to add more urban nature in the city. This will enhance biodiversity and recreation (City of Copenhagen, 2012).

biofactors in development application

Upcoming developments within the next 20 years in Copenhagen will be assessed on the ecological robustness of their project. A biofactor will be attributed to the land prior to the development and the development will be criticized on how it contributes to it (A. S. Olaffson & N. Gulsrud, personal communication, March 1, 2017).

utility companies

Utility companies in Copenhagen have the funds and enthusiasm to contribute to nature-based climate resilient projects. Over time, the city has created partnerships with utility companies to fund environmental projects (A. S. Olaffson & N. Gulsrud, personal communication, March 1, 2017).

multi-functional golf courses

Golf courses in Copenhagen are private. A research project looked into the multi-functionality of golf courses. Their ecological value is embraced and reinforced through partnerships with the city. (Wissman et al., 2016)

5. STOCKHOLM

Green Space: 84.98 km²

Stockholm is shaped by many islands with extensive waterways. It is situated in the Riddarfjärden Bay. The City is rich in natural spaces. In fact, the City has over 30% of its total area dedicated to waterways and another 30% dedicated to green spaces.

The City was one of the first cities in the world to have a park situated within its boundary designated as urban park. Specifically, the Royal National City Park is protected by the state parliament as an article in the Environmental Act. The designation was agreed upon all three municipalities that share the park, as well as the biggest landowners (Lofvenhaft et al., 2002). Overall, Stockholm provides an extensive trail system that allows visitors and residents to move organically across the landscape and connect to all islands.

MAP 16: Stockholm's Natural and Trail Systems
(U. Egerö, 2017)

1:100,000

NOTABLE PRACTICES IN LANDSCAPE AND TRAIL CONNECTIVITY

city-owned lands

Already in the beginning of the 1900s the City bought almost all land inside the border of the city, and some land in the nearest municipalities. The land was bought for both making built-up areas and protecting green spaces for outdoor life. Moreover, the City owns all the undeveloped areas, even the golf courses and the cemeteries (U. Egerö, personal communication, January 26 - April 3, 2017).

strategic parks planning

Stockholm constantly tries to improve the ecological infrastructure. For example, the City places parks in new-built areas plants trees on lawns and streets, and creates and restores wetlands in strategic places in the city (U. Egerö, personal communication, January 26 - April 3, 2017).

in-depth study of social and ecological functions of green spaces

In the two last decades, Stockholm has mapped and analyzed the social and ecological functions of all green spaces carefully. This informs which areas can be built upon without losing very important functions and natural areas. Former industrial and harbor areas are also prioritized for the new parks (U. Egerö, personal communication, January 26 - April 3, 2017).

natural spaces as the priority of city planning

The dominance of natural areas in Stockholm is due to the fact that city planners have used the protection of natural spaces as the main focus in developing the land. During the big suburban expansion in the 40's and 50's the park structure was planned mostly to maintain natural areas, with playgrounds, allotment gardens and sport fields, integrated within the suburbs (U. Egerö, personal communication, January 26 - April 3, 2017).

ecopark movement

The ecopark movement formed by 60 civil-society organizations with approximately 10 000 members has helped the protection of the Royal National City Park in Stockholm. This movement exemplified the power of organized civil society in face of need for conservation in comparison to legislative power lead by governments. The political actions made by the movement gave an identity to the Royal National City Park and shaped the transformational change of the park leading to its legal protection in 1995 (Ernstson et al., 2008).

right of public access

In Sweden, residents have The Right of Public Access, which means people can walk anywhere in the forests, cultural landscapes and parks at the exception of crops, regardless who the owner is (U. Egerö, personal communication, January 26 - April 3, 2017). Hence, there is no defined boundary for pedestrians whether on public or private land.

TYPOLOGIES

The gaps found within this study varied in location, physical composition, ownership, and/or type of impeded movement. These differences are important as they will inform the appropriate response by the City of Toronto. For instance, the location might impact the potential for improved movements. The physical composition might impact the design interventions needed and the policy required. The ownership might impact the types of approach the City of Toronto might have to connectivity, whether prescriptive or collaborative. Finally, the type of impeded movement will impact the design intervention or required policy, but also will require a different approach where wildlife movement might require an educational component within the connectivity strategy for instance.

Approaches to connectivity will vary but it is necessary that the City of Toronto approaches fragmentation holistically through a better understanding of social and ecological movements across its landscape. Although not the focus of this research, a regional approach is required, such as through the Ravine Strategy, before tackling gaps that are unique in their characteristics as illustrated above.

As a means to facilitate connectivity endeavors in Toronto's ravine system, typologies were developed based on existing patterns. As above-mentioned, gaps varied in their location, physical composition, ownership and type of impeded movements. Patterns that were prevalent amongst the gaps were as follows:

private | public
More than half of the gaps were found on publicly-owned lands. This informs a particular approach and opportunity for the City of Toronto. In fact, in such cases, the City has the power to engage in connectivity conversations internally and with other levels of jurisdiction and create change. On the other hand, gaps that are privately-owned have the potential to shift our thinking in terms of collaboration and partnership. Trends have been that acquisition is the best practice for connectivity, but based on explored case studies in this research, other options might be available.

human | wildlife movement
Another pattern was the difference in types of movement considered when delineating a gap. The majority of the gaps found in the workshop focused on human movement. This is not only revelatory in the way wildlife movement is put secondary, but is a great opportunity to challenge the role of the wildlife in the urban fabric and reconsider the need for more in depth ecological knowledge.

Based on patterns found across the gaps identified within this research, four typologies were developed:

PUBLIC ANTHRO|fragment: gap found in the trail system that is prohibiting human movement and that is caused by a public asset

PRIVATE ANTHRO|fragment: gap found in the trail system that is prohibiting human movement and that is caused by a private asset

PUBLIC ECO|fragment: gap found in the natural heritage system that is prohibiting wildlife movement and that is caused by a public asset

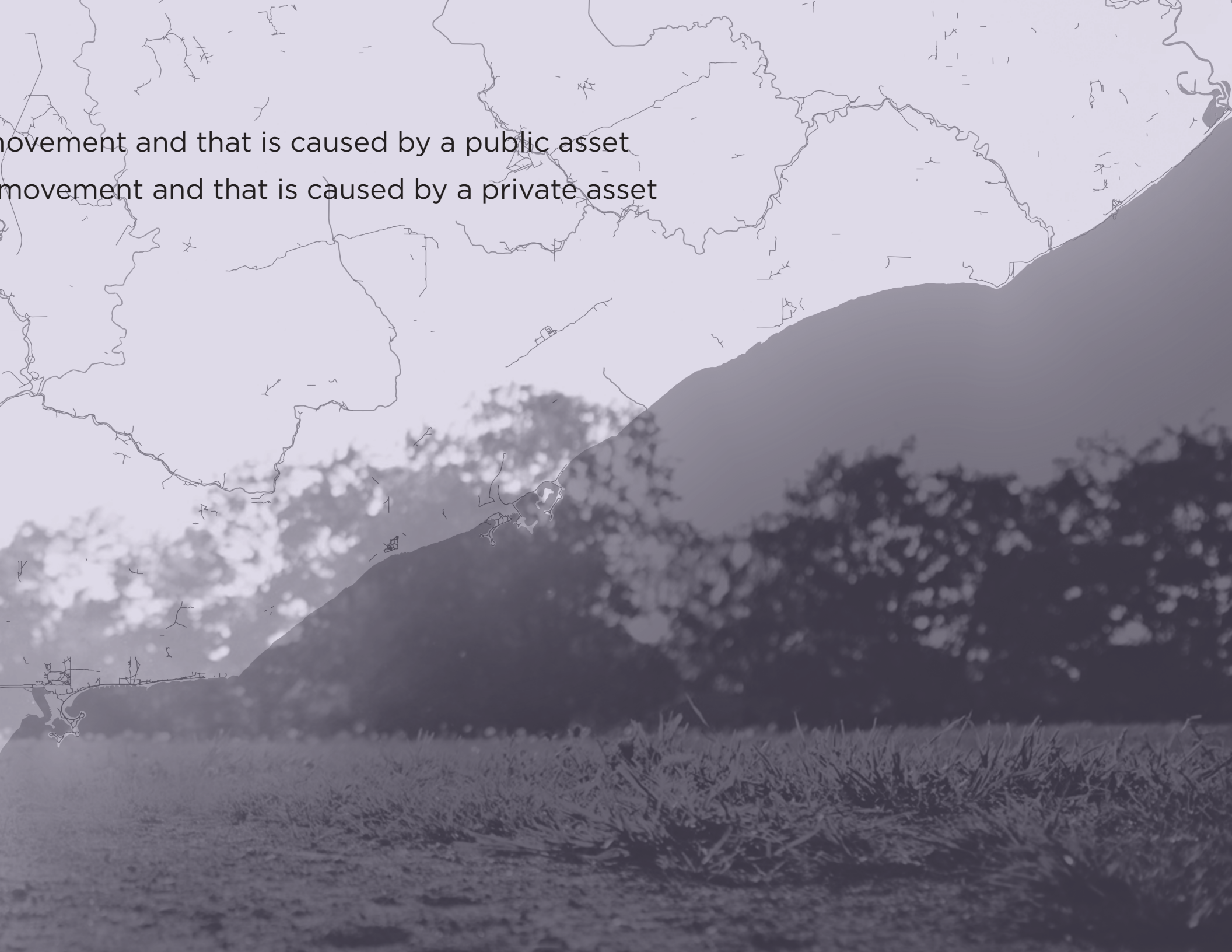
PRIVATE ECO|fragment: gap found in the natural heritage system that is prohibiting wildlife movement and that is caused by a private asset

The next section will further define and explore the four typologies through an in-depth examination of associated gaps and each case study will inform a connectivity strategy for each typology. The gaps were reduced in number from 48 (i.e. 28 gaps found through the Gap Identification Workshop and 20 gaps found through the GIS Site Identification) to 16 gaps to give an equal representation to the four typologies.

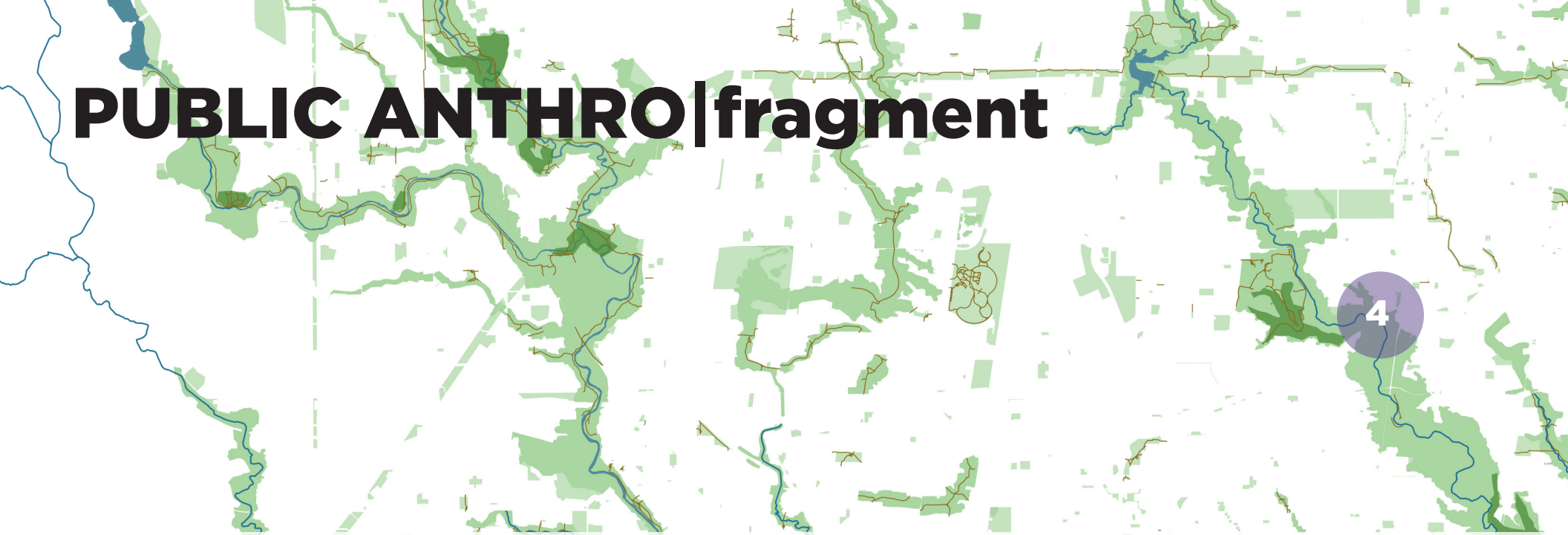
HUMAN MOVEMENT

PUBLIC ANTHRO|fragment gap found in the trail system that is prohibiting human m

PRIVATE ANTHRO|fragment gap found in the trail system that is prohibiting human


movement and that is caused by a public asset
movement and that is caused by a private asset

PUBLIC ANTHRO|fragment

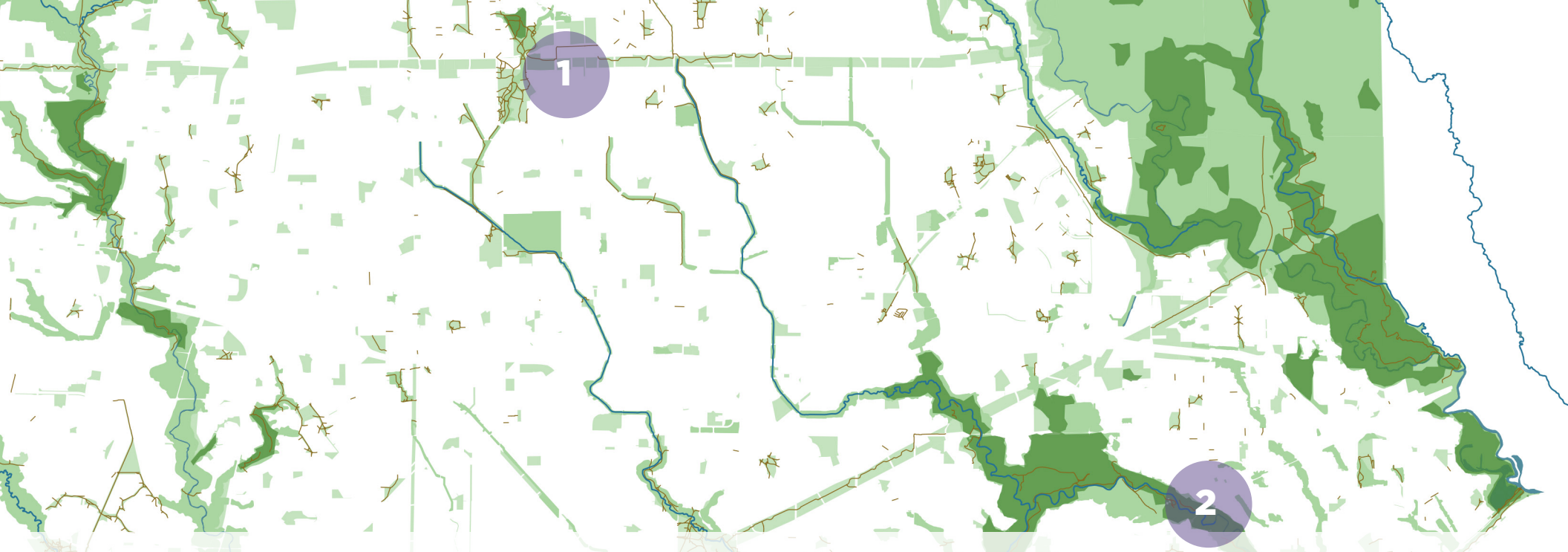


Description and Conditions

This category of gaps looks at human movement that is prohibited by the presence of public assets. Public assets responsible for the fragmentation of natural habitats include roads and other transportation corridors, publicly-owned golf courses, and provincially and federally owned lands.

Legal Framework

The legal framework of each gap depends on the ownership of the trail that is fragmented, as well as the ownership of the asset that is associated with the fragmentation. With 40% of the ravines privately-owned, a large amount of informal trails were created over time. Trails that are “formalized” are on land that is owned by either the City of Toronto or TRCA or are built through a right-of-way agreement between the City and the property owner. This research will look specifically at formal trails. Transportation Services is responsible for creating and managing trails. Parks, Forestry & Recreation is responsible for maintaining trails that are within parks and natural areas. In terms of “public fragmentors”, most transportation corridors in the City of Toronto are owned by the City and operated by the Transportation division. Transmission corridor lands are owned by the provincial government. Rail corridors are also varying in ownership. In fact rail corridors are either publicly-owned by Metrolinx and the City of Toronto or privately-owned by Canadian National Railway and Canadian Pacific Railway. In terms of publicly-owned golf courses, the City of Toronto owns five golf courses: Dentonia Park, Don Valley, Humber Valley, Scarlett Woods, and Tam O’Shanter. These are operated by the Parks, Forestry & Recreation division. Finally, Both the federal and provincial government owns parcels of lands across the City. For instance, the Ministry of Transportation owns lands for its department.



Solution Proposed

The proposed solution for PUBLIC ANTHRO|fragments is based on the cooperation between different levels of governments and between different departments within one level of government, as well as partnerships with utility companies.

REGIONAL MANDATE First and foremost, parcels of land that present a potential for trail connectivity should be regarded as utmost priority. This should be achieved through a regional mandate for landscape connectivity such as seen with Metro Vancouver. Where land is owned by other levels of government, the City of Toronto should engage in conversations to have the land transferred or leased out entirely or partially to allow for trail connectivity.

MULTI-DEPARTMENT APPROACH The City of Toronto should require all departments with infrastructure in Toronto's ravines to prioritize connectivity in their mandate. As seen in Edmonton, a multi-department approach to landscape connectivity makes efforts to connect the land more efficient. Together with the Transportation Services division at the City of Toronto, the Ravine Strategy should mandate that there be a process in place to facilitate and ease connectivity amongst Toronto's trail system between different departments.

PUBLICLY GOLF COURSES In the case where a publicly-owned golf course does not allow for connectivity with the trail system, Parks, Forestry & Recreation should mandate for all public assets owned by the division to connect organically and holistically for cyclists and pedestrian to enjoy a continuous experience of Toronto's ravines.

UTILITY COMPANIES The City of Toronto has extensive land dedicated to transmission corridors. There should be a discussion around creating public-private partnerships with utility companies such as seen in Copenhagen.

Public ANTHRO|fragment

MAP 17: Public ANTHRO|fragment (City of Toronto, 2016) 1:107,000

GAP 1

location
The trail system is disconnected between Kennedy Road and Silver Star Boulevard.

physical context
The trail system is fragmented with a piece of a hydro corridor and is diverted onto McNicoll Avenue, which prohibits a direct connection.

policy context
The area is zoned as Utility and Transportation. The land is owned by the provincial government. Any additional usage to transmission corridor lands is subject to planning review by provincial government agencies, technical review by the hydro authority, and municipal land-use regulations.

solution
The trail system should be extended across the transmission corridor land. The City of Toronto has numerous precedents of such second usage of transmission corridor land.

GAP 2

location
Military Trail is fragmented at Old Kingston Road.

physical context
The fragmentation requires cyclists and pedestrian to cross the street to reconnect with the trail on the other side.

policy context
The road is owned and managed by the Transportation Services division at the City of Toronto.

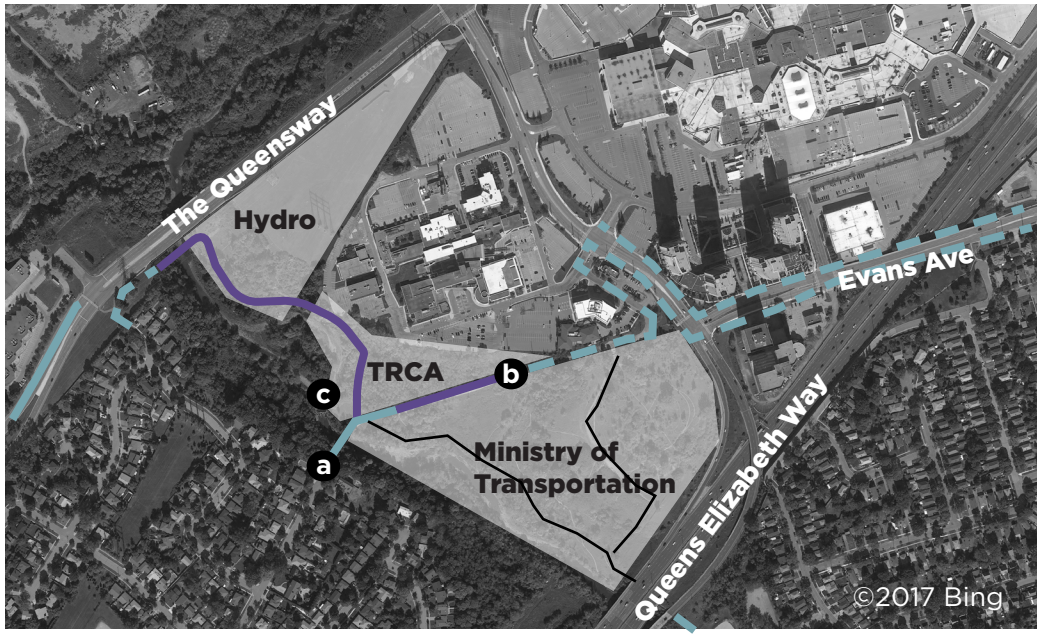
solution
A bridge should be built across the ravine to connect the Military Trail over Highland Creek.

GAP 3

location
The Etobicoke Creek Trail breaks at the Queen Elizabeth Way (QEW).

physical context
Onto the Ministry of Transportation's land, there is a series of informal trails that connect to the Etobicoke Creek Trail. However, it stops before the TRCA owned land. There are also fragments of formalized trails around the three public lands.

policy context
The most left parcel is owned by HydroOne, the middle is owned by TRCA and the southern parcel is owned by the Ministry of Transportation.



solution
Etobicoke Creek Trail should connect across the three parcels of land to connect to the Queensway. Depending on the sensitivity of the ecosystems present, especially onto the TRCA land, gravel should be considered while formalizing the paths.

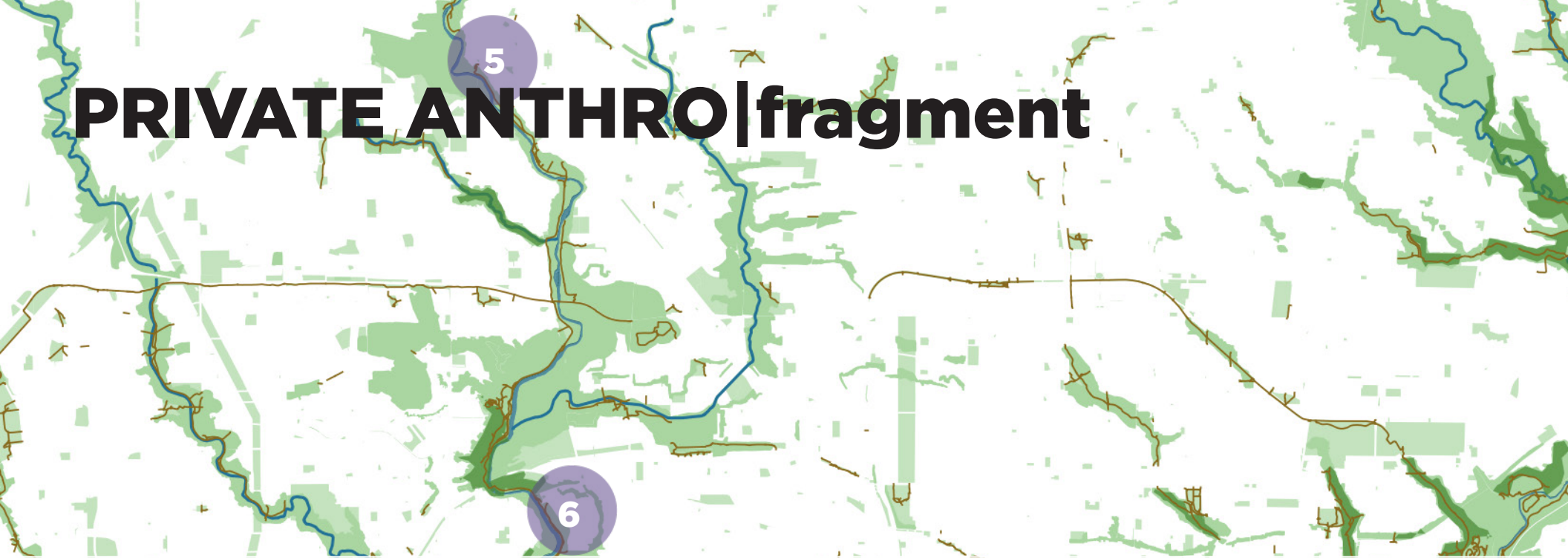
GAP 4

location
The trail system is fragmented by the Don Valley Golf Course next to the Ontario 401 Expressway.

physical context
The trail system is disconnected and does not have any formalized detours for cyclists and pedestrians to go around the golf course.

policy context
The Don Valley Golf Course is a publicly-owned golf courses and is owned and managed by the Parks, Forestry & Recreation division.

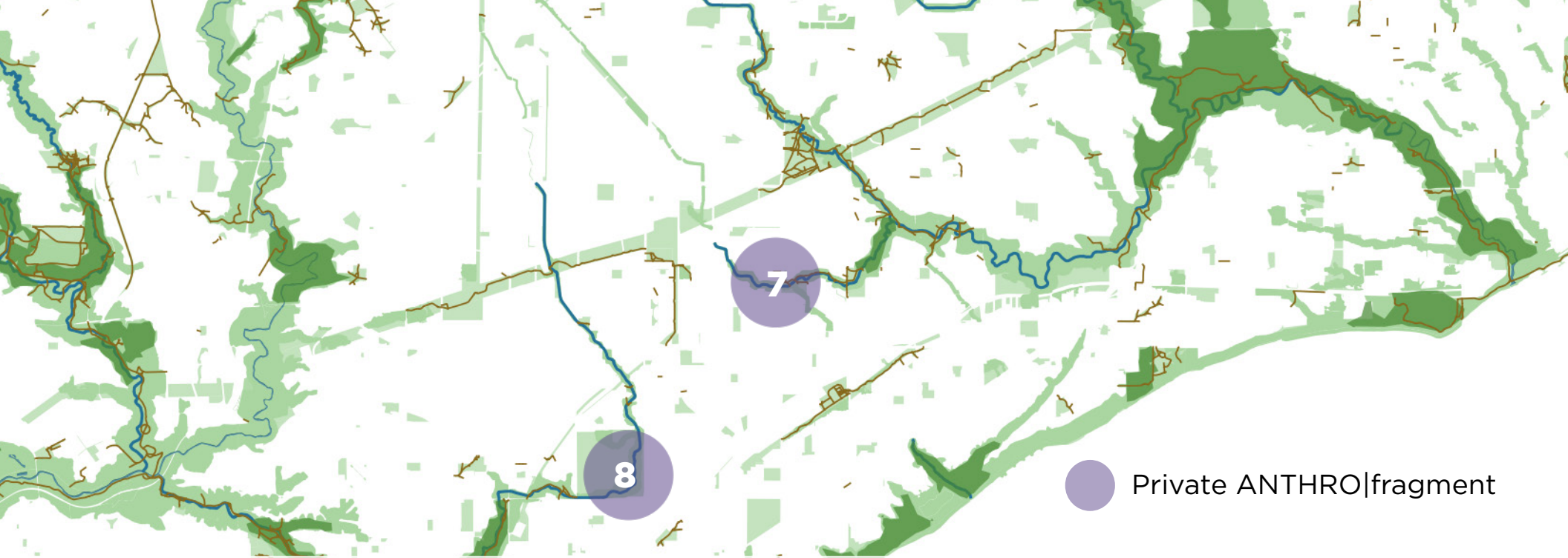
solution
The trail system should be formally extended across the Don Valley Golf Course to provide a continuous experience to pedestrians and cyclists.



PRIVATE ANTHRO|fragment

Description and Conditions
This category of gaps looks at human movement prohibited by the presence of private assets. Private assets responsible for the fragmentation of trail systems include private residential single home properties and private commercial/ industrial properties. This typology is important as 40% of Toronto's ravines is privately-owned.

Legal Framework
Transportation Services is responsible for creating and managing trails. Parks, Forestry & Recreation is responsible for cleaning trails that are within parks and natural areas. In terms of private "fragmentors", the legal framework of private properties in Toronto depends upon the location of the property. Different property standards are expected from property owners depending on the close proximity to a ravine or the presence of a heritage conservation district amongst other conditions. The properties that are promoting PRIVATE ANTHRO|fragments in the ravines are mostly subject to the Ravine and Natural Feature Protection By-Law.



Solution Proposed

The proposed solution for PRIVATE ANTHRO|fragments is dependent upon agreements, acquisition, negotiation, and/or collaboration.

RIGHT-OF-WAY AGREEMENT Trail connectivity on private properties can happen through right-of-way agreements. Such agreements can happen with an existent property owner or through the land redevelopment process. Here, the City of Toronto would use the opportunity to negotiate the connection of a trail system onto a private lot such as seen with both the City of Vancouver and the City of Edmonton. Such agreement would provide legal stature to the extension of the trail system over a private land.

DENSITY BONUSES As seen in Vancouver, the city could also use density bonuses and section 37 to either acquire or create a right-of-way agreement on the portion of the site that would enhance trail connectivity.

ACQUISITION Where there is no redevelopment and cooperative residents, the City of Toronto should consider acquiring the parcel that would allow for connectivity. This should be funded by Transportation Services, Parks, Forestry & Recreation's acquisition fund, and/or TRCA.

RIGHT OF PUBLIC ACCESS Trail connectivity could also be achieved through a Right of Public Access type legislation. As seen in the City of Stockholm, such legislation allows residents to move freely across the landscape regardless of the ownership of the land. Through such legislation, the City of Toronto could collaborate with land owners to build trails without the need for legal stature on the portion of the trail. This would also provide a framework for enhanced collaboration with residents.

MAP 18: Private Anthro|fragment (City of Toronto, 2016) 1:105,000

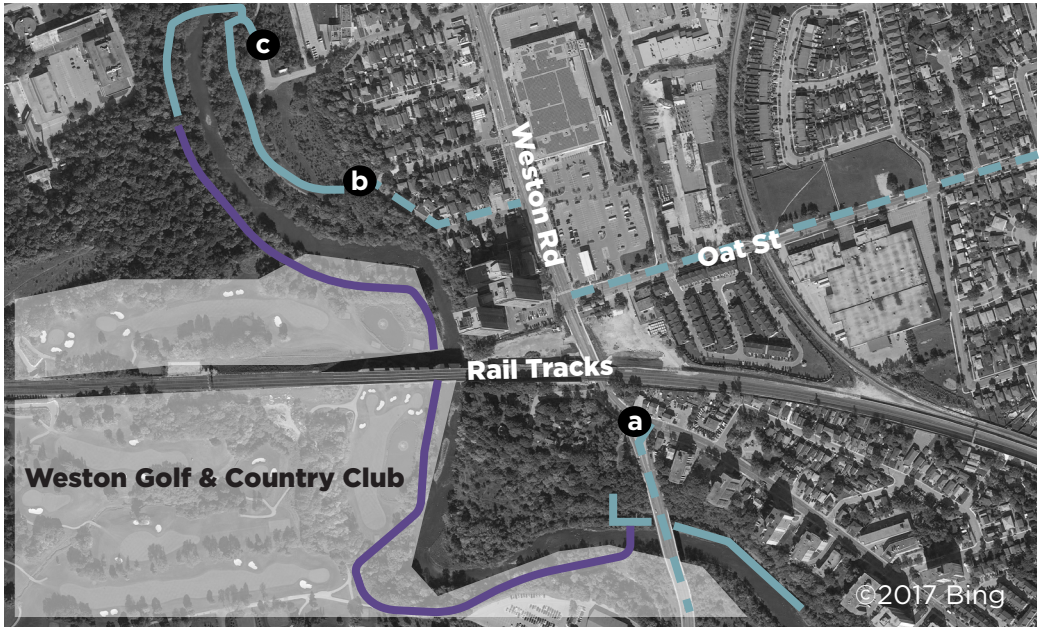
GAP 5

location
The Humber Recreational Trail is fragmented when intersected by Weston Road.

physical context
The trail system is fragmented by the Weston Golf & Country Club and requires users to use Weston Road to reconnect north of Oat Street.

policy context
The Weston Golf & Country Club is privately-owned.

solution
The Humber Recreational Trail should connect to the already-built trails on the property of the Weston Golf & Country Club. This can be done through a right-of-way agreement or a lease agreement of the hedgerow such as seen in the City of Vancouver and the City of Edmonton. In the longer term, the City should prioritize this golf course for acquisition.

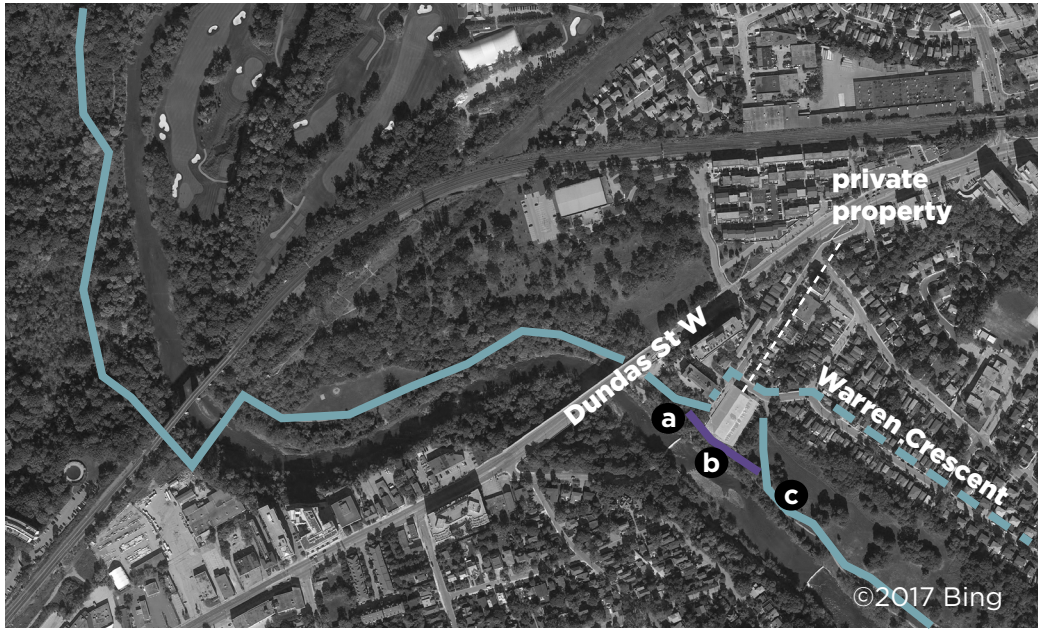


GAP 6

location
The Humber Recreational Trail is fragmented in close proximity to its intersection with Warren Crescent.

physical context
The trail system is fragmented with a private property. There is an informal trail that goes onto the property.

solution
Through a right-of-way agreement or a lease agreement, the City of Toronto should formalize the connection and provide a continuous experience for pedestrian and cyclists across the Humber River.



GAP 7

location
The Gatineau Hydro Corridor Trail stops at the Jack Goodlad Park.

physical context
The ravine west of Midland Avenue and the St. Albert Separate School separates the Gatineau Hydro Corridor Trail and the trail system found in Knob Hill Park.

policy context
Most of the properties backing onto the ravine west of Midland Avenue are privately-owned. St. Albert Separate School is a public school.

solution
The City of Toronto should extend the Gatineau Hydro Corridor Trail across the ravine and connect with the Knob Hill Park's trail. As a multi-used trail might not be appropriate because of the ravine's width, a foot trail is encouraged. Similar to the *Multi-Department Approach* inspired by the City of Edmonton for PUBLIC ANTHRO|fragments, schools in close proximity to Toronto's ravines should be mandated to improve landscape connectivity on their land if said appropriate by the City of Toronto. Specifically to private properties, a prescriptive approach through right-of-way or lease agreement or a collaborative approach through a Right of Public Access legislation are encouraged.

GAP 8

location
The trail system stops at Pine Hills Cemetery.

physical context
The cemetery has built-in trails that could connect.

policy context
The cemetery privately-owned.

solution
The City of Toronto should connect the trail system to the Pine Hills Cemetery through either a right-of-way or lease agreement with the cemetery. Privately-owned cemeteries are a great example of properties that could easily provide public access year long as the trail infrastructure is already in place. Also, as seen in Stockholm, a Right of Public Access would allow pedestrians to connect with the cemetery's trail and easily access the north-east corner of the cemetery.

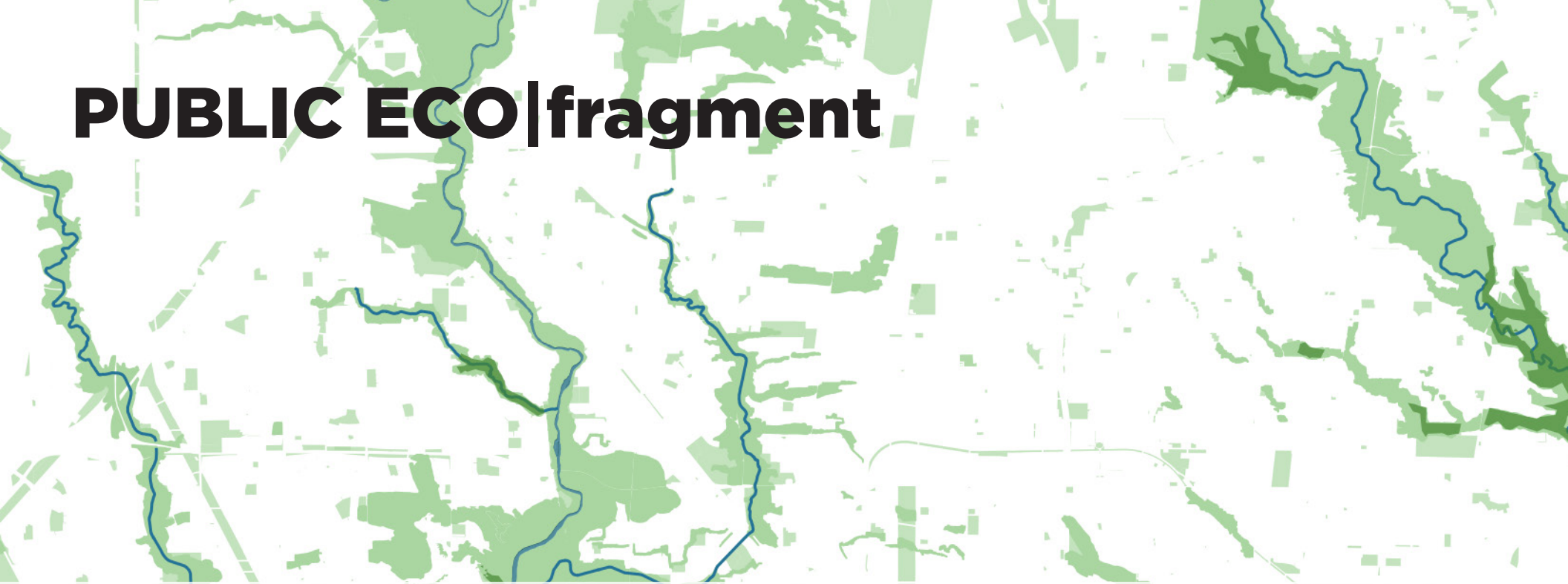
WILDLIFE MOVEMENT

PUBLIC ECO|fragment gap found in the natural heritage system that is prohibiting w

PRIVATE ECO|fragment gap found in the natural heritage system that is prohibiting w

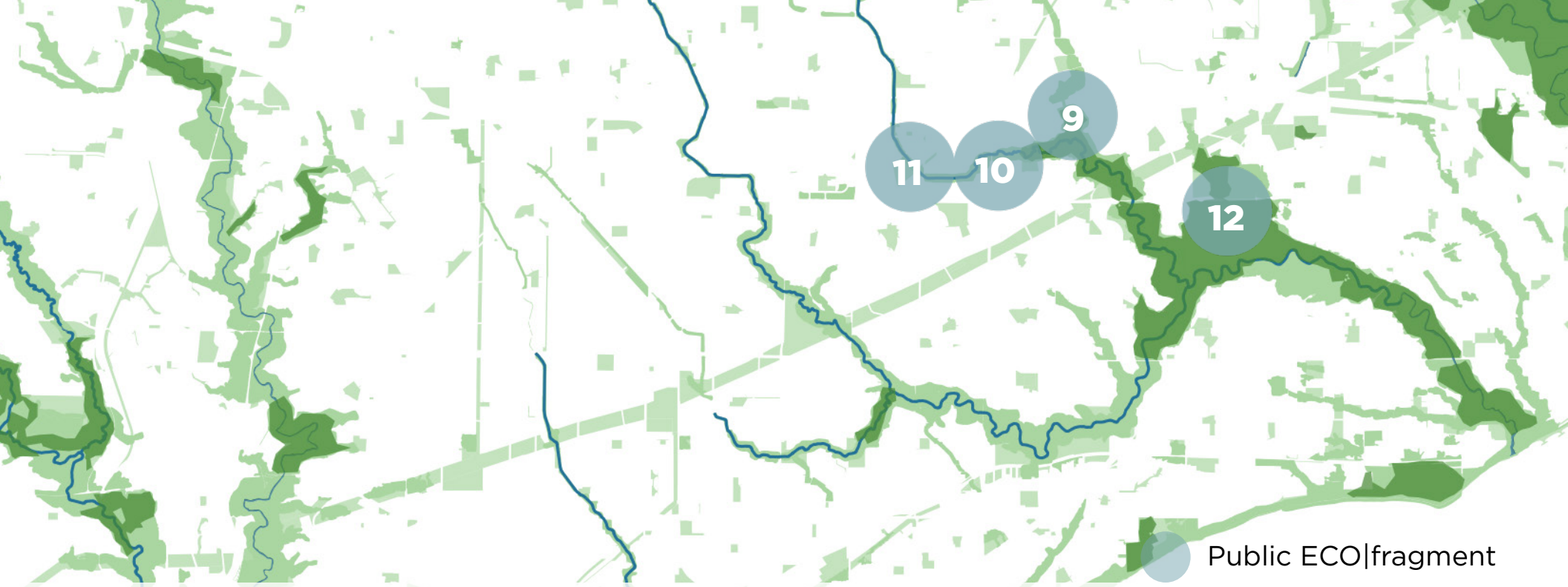

ildlife movement and that is caused by a public asset
wildlife movement and that is caused by a private asset

PUBLIC ECO|fragment



Description and Conditions
This category of gaps looks at wildlife movement prohibited by the presence of public assets. Gaps that were identified within this category were in close proximity to ESAs. Public assets responsible for the fragmentation of natural habitats include roads and other transportation corridors, publicly-owned golf courses, and provincially and federally owned lands.

Legal Framework
The legal framework of each gap depends on the ownership of the natural asset that is fragmented, as well as the ownership of the asset that is causing the fragmentation. First and foremost, ESAs are defined by Toronto's Official Plan. They are protected under the latter document, as well as the Ravine and Natural Feature Protection By-Law. Within this research, ESAs are assumed to have the richest biodiversity in the City of Toronto. Then, most transportation corridors in the City of Toronto are owned by the city and operated by the Transportation division. Transmission corridor lands are owned by the provincial government. Rail corridors are either publicly-owned by Metrolinx and the City of Toronto or privately-owned by Canadian National Railway and Canadian Pacific Railway. In terms of publicly-owned golf courses, the City of Toronto owns five golf courses: Dentonia Park, Don Valley, Humber Valley, Scarlett Woods, and Tam O'Shanter. These are operated by the Parks, Forestry & Recreation division. Finally, Both the federal and provincial government owns parcels of lands across the City. For instance, the Ministry of Transportation owns lands for office space.



Solution Proposed

The proposed solution for PUBLIC ECO|fragments is twofold: physical and political.

ANIMAL CROSSING INFRASTRUCTURES Gaps found in this category require physical connections through the building of animal crossing infrastructures such as either overpasses or underpasses. These interventions should be contextualized with the specific ecosystems. It is important to note that increased connectivity might bring undesirable results such as invasive species.

MULTI-DEPARTMENT APPROACH These physical interventions require a cross-disciplinary approach and require large investments. Hence, in order to have a successful implementation of wildlife crossings across the Toronto's landscape, there must be coordination between all concerned departments at the City of Toronto. Similar to Edmonton, Parks, Forestry & Recreation should collaborate with Transportation Services at the City of Toronto and create a wildlife passage engineering guideline alongside a City-wide restoration plan. Such plan would include the mapping of biophysical assets, threats and constraints across the City, as well as an environmental sensitivity scoring system to inform management recommendations. This parallels the work from the City of Stockholm, which has been informed since the last two decades from an in-depth knowledge of social and ecological functions of green spaces.

BIOPHYSICAL FUNCTIONS A wildlife centric approach necessary for PUBLIC ECO|fragments also requires the City of Toronto to act through the lens of nature-based solutions. Hence, the focus should not be on residents' benefits but rather on the ecology as seen in Copenhagen when enhancing landscape connectivity for wildlife movement.

MAP 19: Public ECO|fragment (City of Toronto, 2016) 1:105,000

GAP 9

location
Morningside Park is fragmented at the Ontario Highway 401.

physical context
Morningside Park, an ESAs does not have natural connections across the Ontario Highway 401 outside of a pipe connector.

policy context
The highway is owned and managed by the Ontario Ministry of Transportation.

Proposed Underpass or Overpass

solution
An animal crossing infrastructure should be created across the Ontario Highway 401 to allow for proper wildlife passage. As seen in the draft Biodiversity, Natural Heritage & Archeology map created for the Ravine Strategy (See Appendix D), Morningside Park has forest interior migrant birds, frogs, and snakes. In addition, many species such as the White-tailed Deer, skunks, squirrels, and other mammals are very common within the City of Toronto (City of Toronto, 2012). Hence, such biodiversity should inform either an overpass or an underpass.

GAP 10

location
East Highland Creek is fragmented by Markham Road.

physical context
The East Highland Creek is fragmented by Markham Road with no connectivity. The area is in close proximity to an ESA.

policy context
The road is owned and managed by the Transportation Services division at the City of Toronto

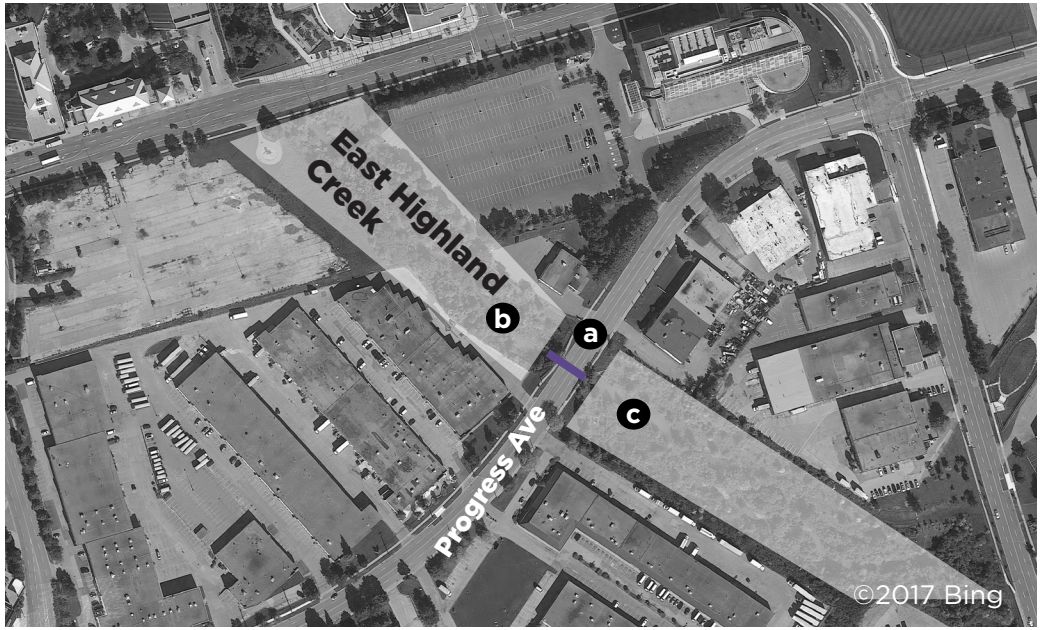
solution
An animal crossing infrastructure should be created across Markham Road to allow for proper wildlife passage. As seen in the draft Biodiversity, Natural Heritage & Archeology map created for the Ravine Strategy (See Appendix D), Morningside Park has forest interior migrant birds, frogs, and snakes. In addition, many species such as the White-tailed Deer, skunks, squirrels, and other mammals are very common within the City of Toronto (City of Toronto, 2012). Hence, such biodiversity should inform either an overpass or an underpass.

GAP 11

location
East Highland Creek is fragmented by Progress Avenue.

physical context
The East Highland Creek is fragmented by Progress Avenue with no connectivity. The area is in close proximity to an ESA.

policy context
The road is owned and managed by the Transportation Services division at the City of Toronto.



Proposed Underpass or Overpass

solution
An animal crossing infrastructure should be created across Progress Avenue to allow for proper wildlife passage. As seen in the draft Biodiversity, Natural Heritage & Archeology map created for the Ravine Strategy (See Appendix D), Morningside Park has forest interior migrant birds, frogs, and snakes. In addition, many species such as the White-tailed Deer, skunks, squirrels, and other mammals are very common within the City of Toronto (City of Toronto, 2012). Hence, such biodiversity should inform either an overpass or an underpass.

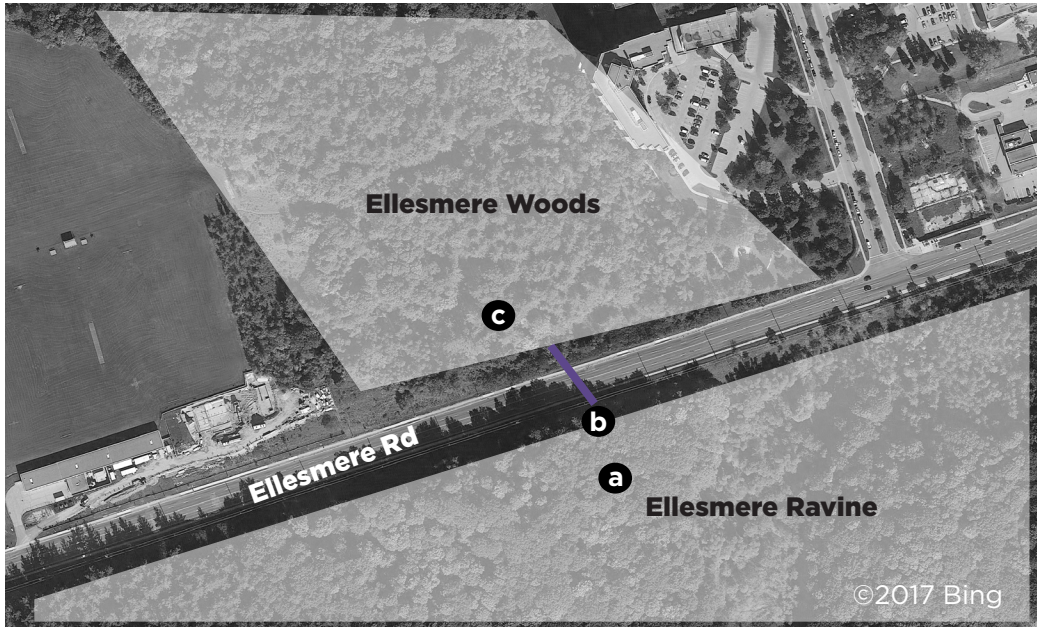
GAP 12

location
Ellesmere Ravine is fragmented by Ellemeres Road.

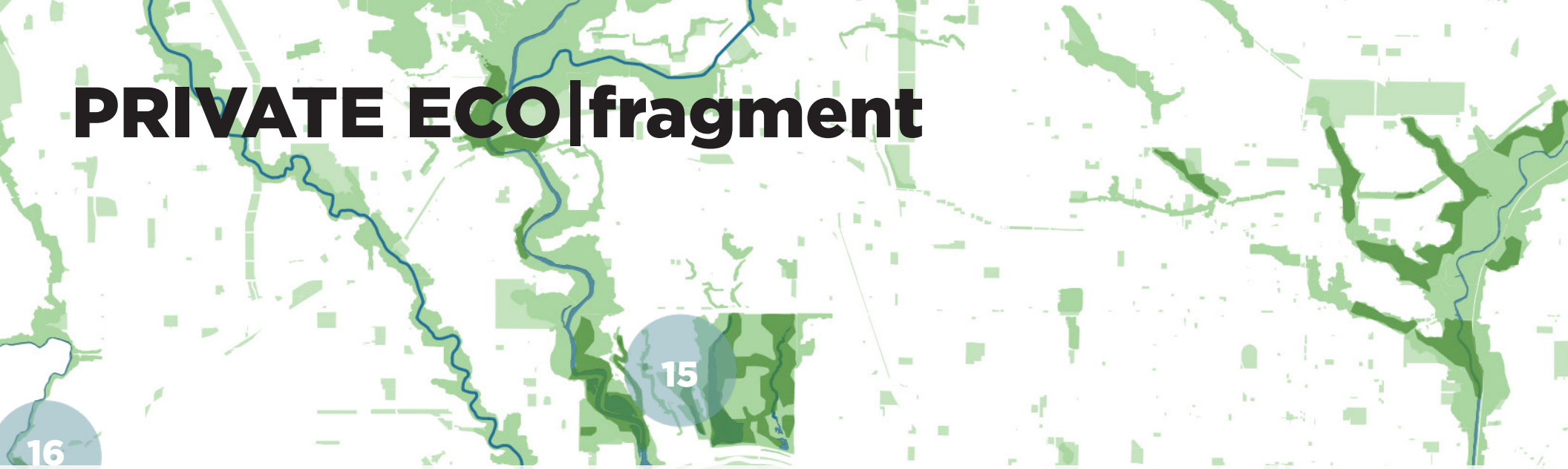
physical context
Morningside Park is an ESA.

policy context
The road is owned and managed by the Transportation Services division at the City of Toronto

solution
An animal crossing infrastructure should be created across Ellesmere Road to allow for proper wildlife passage. As seen in the draft Biodiversity, Natural Heritage & Archeology map created for the Ravine Strategy (See Appendix D), Morningside Park has forest interior migrant birds, frogs, and snakes. In addition, many species such as the White-tailed Deer, skunks, squirrels, and other mammals are very common within the City of Toronto (City of Toronto, 2012). Ellesmere Woods is especially rich in American Toads and Wood Frogs. Hence, such biodiversity should inform either an overpass or an underpass.



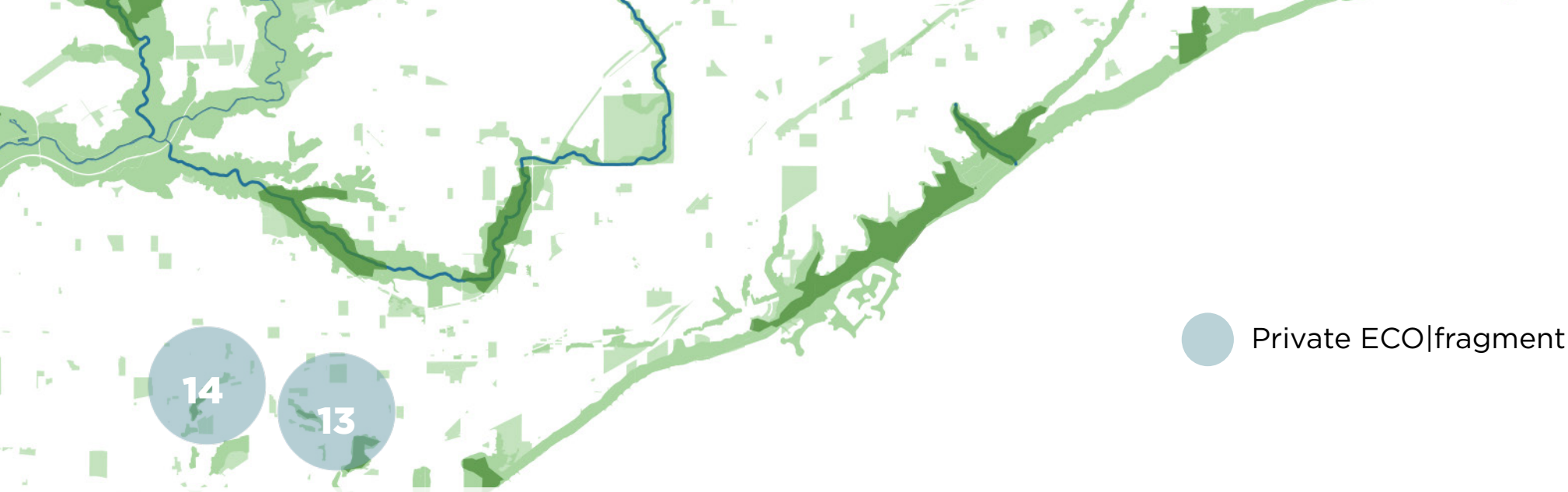
PRIVATE ECO|fragment



Description and Conditions
This category of gaps looks at wildlife movement prohibited by the presence of private assets. Gaps that were identified within this category were in close proximity to ESAs. Private assets responsible for the fragmentation of natural habitats include private residential single home properties and private commercial/industrial properties. Whereas other categories of gaps looked at a local scale, this category looks at the need to enhance connectivity to ESAs in specific neighborhoods. Here, ECO|region is defined as an area including an ESA with green spaces that could better connect altogether as a system.

Legal Framework
The legal framework of private properties in Toronto depends upon the location of the property. Different property standards are expected from property owners depending on the close proximity to a ravine or the presence of a heritage conservation district amongst other conditions. The properties that are promoting PRIVATE ECO|fragments are mostly subject to the Ravine and Natural Feature Protection By-Law. In addition, both the TRCA and the City of Toronto, through their official documents, encourage environmental stewardship with residents and organizations.

Solution Proposed
The proposed solution for PRIVATE ECO|fragments requires a multi-stakeholders approach to connectivity. Each case should be contextualized to ensure soundness and relevancy to local residents and wildlife. The approach here is incremental, flexible and rooted in stewardship.
STEWARDSHIP PROGRAM The city is encouraged to develop a stewardship program to encourage naturalization of hedgerows on private properties within ECO|region. Such stewardship programs should be inspired from the Cloudburst Street Program and the Tree Partnership Program in Copenhagen. The program should be created based on partnerships with non-profit organizations and local companies such as seen in the City of Stockholm with the Ecopark Movement and the collaborative approach as seen in Saint-Paul.



HEDGEROW TREATMENT The city should create a fund from which it could lease ravines' hedgerows such as seen in Vancouver and ensure a proper ecological gradient between the ravines and the private property to reduce the edge effect.

ACQUISITION In the case of an uncooperative resident or a site with high ecological value, the City of Toronto should consider acquiring the parcel of land in question. Similar to Vancouver and due to the high market value of land in Toronto, the City should consider creating public-private partnerships such as with Ducks Unlimited Canada to acquire land with high ecological value. In addition, the Ecological Gift Program should be used to provide tax incentive for land owner in return of a reduction in the land price.

DEVELOPMENT PROCESS The City should use the development and re-development process to provide more ecologically-driven development. Indeed, in the case where a site is being redeveloped or acquired within an ECO|region, the City should use section 37 and density bonuses to negotiate and allow for the city to extend the setback away from the waterway. This could also be achieved by requiring an Ecological Network Report when redeveloping a piece of land such as in Edmonton. Such report would assess the ecological network on-site. Another similar tool would be the inclusion of "bio-factors" in the development process whereby building proposals would be assessed based on the ecological value before and after the proposed building. Finally, ECO|regions should be built and rebuilt following river-oriented development design guideline such as seen in Saint-Paul.

SUSTAINABLE PRACTICES Finally, the City of Toronto should promote green certifications amongst private organizations that are part of the natural heritage system, especially when identified in the ECO|regions. Examples of such certifications are the "Standard Environmental Management Practices" or the SITES initiative, which both provide a score based on the quality of sustainable and ecological maintenance of the land (Sustainable SITES Initiatives, n.d.).

MAP 20: Private ECO|fragment (City of Toronto, 2016) 1:105,000

GAP 13

location
There is potential for better connectivity amongst the natural spaces in close proximity to the intersection of Kingston Road and Main Street.

physical context
The ESA at the above-mentioned intersection is in close proximity to city-owned green spaces (i.e. Love Crescent Parkette, Cassels Avenue Playground, and Norwood Park)

policy context
The lots dividing the 4 green spaces are privately-owned.

Proposed ECO|region

solution
The City of Toronto should develop a stewardship program within the proposed ECO|region and either acquire and/or lease when necessary.

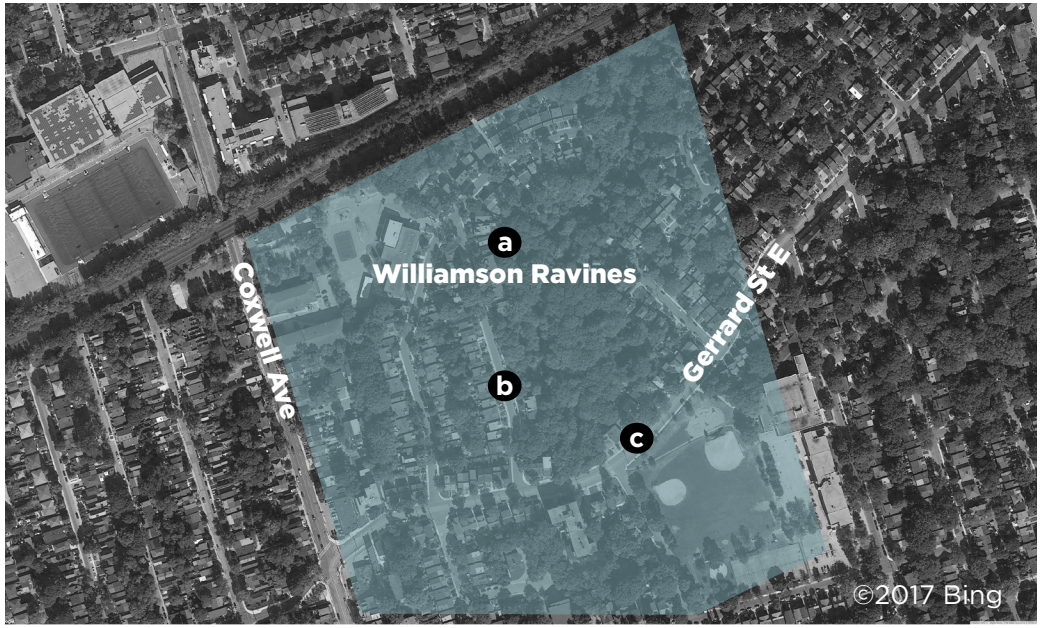
GAP 14

location
There is a potential for better connectivity between Williamson Ravine and the surrounding green spaces.

physical context
Williamson Ravine is bounded by private property and is in close proximity to Fairmount Park and Coxwell Avenue Parkette

policy context
The properties are all privately-owned.

solution
The City of Toronto should develop a stewardship program and either acquire and/or lease when necessary.



Proposed ECO|region

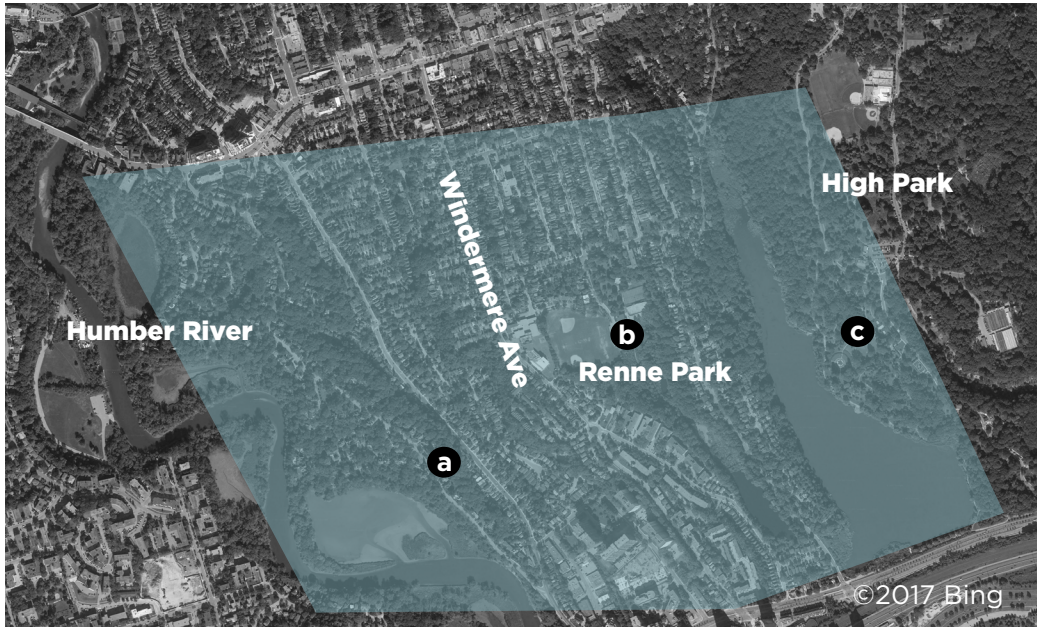
GAP 15

location
There is potential for better connectivity amongst the humber river and High Park.

physical context
Renne Park presents an opportunity to connect natural systems from High Park to the Humber River.

policy context
Most of the properties are privately-owned

solution
The City of Toronto should develop a stewardship program and either acquire and/or lease when necessary.



Proposed ECO|region

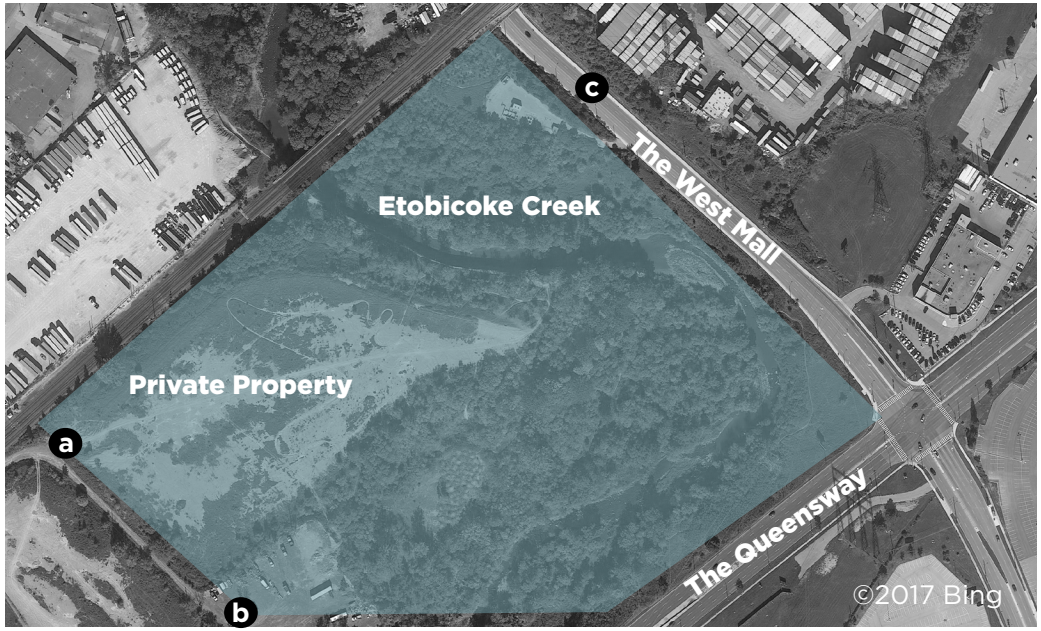
GAP 16

location
The Etobicoke Creek faces anthropocentric pressure at the intersection of the West Mall and the Queensway.

physical context
At the intersection, the Etobicoke Creek becomes environmentally significant but is bounded by a private institution lacking an ecological buffer.

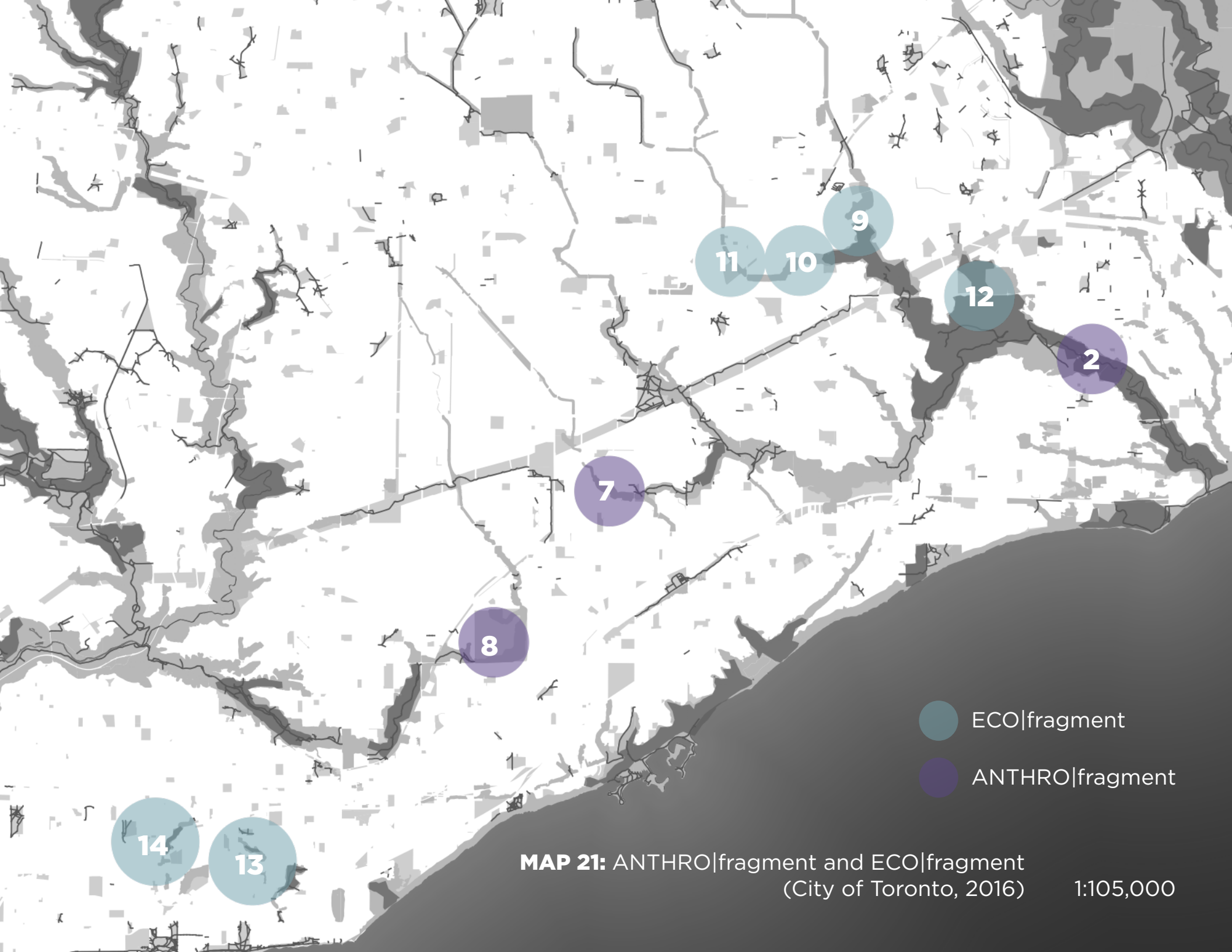
policy context
The property by the creek is privately-owned.

solution
The City of Toronto and City of Mississauga should engage with the owner of the land to ensure ecological gradient between the private property and the ESA. Green certifications should be promoted.



Proposed ECO|region

PROJECTION



MAP 21: ANTHRO|fragment and ECO|fragment
(City of Toronto, 2016) 1:105,000

CONNECTED TORONTO

The literature has consistently shown the benefits and importance of landscape connectivity to both humans and wildlife. A connected Toronto would be beneficial for existing and future populations. This project looked into connectivity strategies for the gaps found in Toronto's ravine system. In "stitching the fabric", a connected Toronto would provide many benefits to both human and wildlife.

Torontonians & Physical Connectivity
Toronto's ravines organically fragment the city's landscape and acts as the spine for this urban city. With increasing population growth, it is critical to offer accessibility to nature. If planned for properly, a connected Toronto could offer active transportation options through a wide range of green corridors on both axis: North-South and West-East. Toronto is rather a large city offering potential for long and continuous corridors for movements. For instance, a North-South trail connection could offer approximately 18 km worth of trails for cyclists and pedestrian to explore Toronto. This would add to the rich trail network already in place. Both increase access to nature and active transportation options would contribute to the health of the communities living in this city.

Torontonians & Spiritual Connectivity
The physical connectivity would influence spiritual connectivity; people's relationship to the ravines. As Fulford (1995) defended, the ravines are a hidden gem for many Torontonians and their secrecy shaped people's childhoods. However, this piece of nature has a potential to be part of Toronto's shared identity and shape everyone's memories. Toronto is unique in being an urban city with such topography and biodiversity rooted in our ravine system. We should use this opportunity to connect people to their ecology.

Torontonians & Wildlife
An acknowledgment of Toronto's biodiversity would enhance people's connection with the landscape. The City of Toronto created a series of booklet informing Toronto's residents about the local ecology (City of Toronto, n.d.a). Similarly, the City is currently creating a Biodiversity Strategy (City of Toronto, 2016c), which will hopefully address issues with fragmentation and habitat destruction. Increasing opportunities for people to connect to nature inherently increases opportunities for education. This in turn will contribute to a rethinking of the environment as part of the urban life and the wildlife as neighbours rather than nuisance or a reality portrayed in the "urban wild".

Wildlife & Physical Connectivity
Through enhanced connectivity, Toronto's ecology would benefit. A connected system would create a more resilient flora and fauna amongst the urban fabric of this city. Continuous corridors of natural system would permit migratory birds and other mammals to move freely and organically across Toronto's landscape. More connectivity across green patches would allow for native plants to spread seeds across the landscape more easily, while reducing the impact of habitat fragmentation and wildlife-vehicle collisions.

OPPORTUNITIES TO IMPLEMENTATION

In this project, connectivity opportunities in Toronto's ravines were investigated. Throughout the case studies, several themes emerged. Before "stitching the fabric", it is important to recognize the barriers that the City of Toronto is facing.

Departments' Mandate
As previously mentioned, most of the gaps explored in the workshop were found on publicly-owned land. This is a great opportunity for the City of Toronto to foster change. A barrier prevalent in most cities looked at within this research was the dichotomy between departments' mandate and agenda. In fact, the protection of natural habitats or the provision of open spaces tended to go against the mandate of other departments to provide engineering sound solutions. This in turn caused obstacles when planning for connectivity as connecting systems requires working with assets managed by different departments.

In Toronto, connectivity is a theme laid out in the Official Plan, as well as within the mandate of Transportation Services and Parks, Forestry & Recreation. However, connectivity, whether trail or natural spaces connectivity, happens on an underlaying basis of ecology. Hence, connectivity should be explicitly planned alongside an understanding and prioritizing of the ecosystem services and functions. Ecosystem services and functions should be part of the mandate of all departments. Edmonton has done strong and exemplary work with an ongoing collaboration between its Parks and Transportation Departments and through the creation of a new branch focusing on Parks, Transportation, and Drainage Planning functions ensuring a multidisciplinary approach to the maintenance of wildlife passage and ecological connectivity. Specifically important to mention is the work on animal crossings. Similarly, through the City's ecology network analysis, the City has identified gaps and has identified prime spots to connect natural and trail systems.

The City of Toronto has recently released its Complete Streets Guideline within which it mentions that "*Streets should improve the city's environmental sustainability by enhancing the tree canopy and landscaping, reducing urban heat island effects, reducing stormwater runoff, reducing energy consumption and reducing greenhouse gas emissions*". Within the document, it proposes that streets should "*Protect and enhance natural heritage and environmentally sensitive areas*". This is important as it links two ideas: conservation and mobility.

Public-Private Partnership
In Toronto, the market value of land is expensive, making the acquisition of land for recreation and conservation purposes difficult. Public-private partnerships have been undertaken in the city within the last decade to create privately-owned public spaces. This was an opportunity for open spaces to be added to some of the most expensive areas of Toronto, such as in Downtown Toronto. Such partnerships, whether with profit-driven organizations or non-profit organizations, could help foster funds to connect both trail and natural systems in Toronto.

A strong example of such partnership occurred between the City of Richmond and Ducks Unlimited Canada, where the City and the organization together decided to acquire the Grauer Lands.

Ecosystem Services

As seen in Copenhagen, the terminology "biophysical function" is often used to refer to the relationships happening in the ecology. This terminology incorporates the relationships prevalent between the physical and biological materials in several ecosystems. In North American cities, the terminology often used is "ecosystem services", which defines the relationships that benefit humans. Hence, our approach to nature in our policies has been anthropocentric. This in itself poses an ethical question: Should we protect nature because it is good for us or should it be protected because it is inherently important to protect?

Throughout this research, we have examined ECO|fragments that are rooted in a disconnect between mobility, settlements, and conservation. In order to "stitch the fabric", there must be a first and foremost understanding of the relationships that are at play in the disconnected ecosystems beyond what brings value to humans. Arguably, humans benefit from every biophysical functions and therefore, every biophysical functions can indirectly/directly be referred to as ecosystem services. However, there is a need to disassociate humans from the ecology in the ecological language professionals are using. Additionally, the development process should be improved through the addition of either "bio-factors" or Ecological Network Reports to ensure the ecology is respected through an in-depth analysis of the wildlife and ecological functions on-site.

Ecological & Environmental Stewardship

Stewardship is important in meaningfully having residents participate in a city's endeavors. It is a tool by which residents can voice their concern and be part of the change. Stewardship in conservation and landscape connectivity is important as it brings people into, what is otherwise a technical field. It is an opportunity to engage residents at every step of connecting both our trail and natural system. It is also a useful tool to educate residents on the need for more connectivity. Stewardship was also a basic assumption in the enactment of the Ravine and Natural Feature Protection By-Law. In reviewing the Natural Parklands Report from 1960, the City of Toronto mentions that: "*It was felt that owners of ravine properties would be willing to preserve the ravines from building if their rights to privacy and quiet and respected*" (City of Toronto, 1973). This sense of belonging should be reinforced through a stewardship program. As seen in Copenhagen, environmental awareness can provide support for big infrastructural projects such with the city's extensive trail system that provides sustainable transportation options to residents. Hence, such awareness leads to more support for environmental and ecological endeavors. Extensive awareness and education also open the opportunity to fill the knowledge gap regarding our urban ecosystems such as with the use of the terminology "biophysical function". Such terminology would allow residents to value the ecology for what it is rather than for what benefits it provide. Hence, in Toronto, the city should harness the potential of stewardship at every stage of a connectivity plan.

Concluding Thoughts

In conclusion, it is hoped that the typologies investigated within this project will foster conversations with the City of Toronto. Although a regional approach to landscape connectivity is important, it is crucial to understand the local context of Toronto's gaps and establish a series of integrated connectivity strategies. Each typology illustrated its own set of characteristics that required a site specific approach. This is important for both existing gaps, as well as gaps that may be created due to future development. The cities looked at within this project provided insights on ways for a city to plan accordingly for its river and use creative approaches to deal with local-specific gaps. While Toronto is just now developing a strategy for its ravine system, the City is facing very similar challenges to global cities and should use this opportunity to learn from them.

ACKNOWLEDGMENT I would like to thank my supervisor Dr. Nina-Marie Lister, as well as my second reader Jennifer Kowalski for their ongoing and meaningful support. Their guidance has helped providing depth to this research and I will be forever grateful. I would also like to thank the natural environment specialists who helped me better understand Toronto's ravines and the many professionals from both North American and European cities who helped me understanding landscape connectivity best practices including Kevin Connery, Anton Stahl Olafsson, Natalie Marie Gulsrud, Angela Hobson, Catherine Shier, Michelle Bernuy, Tim Griffin, and Ulrika Egerö. Finally, I would like to thank my wonderful husband who has been supporting me since the first day we met and has been inspiring me to push myself continuously as both a human being and an upcoming professional in the field of community building.

APPENDICES

The Don Valley Golf Course includes a rich network of trails that connects both sides of the Ontario Highway 401 (2017, V. Racine)

APPENDIX A | PRACTITIONER INTERVIEW GUIDE (semi-structured questions)

ECOLOGY-FOCUS DESIGN & CONNECTIVITY

What regulations and design interventions are in place to allow animal passage throughout your city?
What regulations are in place to protect and restore sensitive ecosystems in your city?
Is there any plan in place that aims at connecting green spaces on a city-wide level across your city?
Are there any parts of the city that are prone to flooding? If so, how does your city manages tourism in flood-sensitive areas?

HUMAN-FOCUS DESIGN & CONNECTIVITY

How would you describe the connectedness of the trail system within waterfront green spaces? Have there been policies to help connecting it?
How would you describe the provision of human-focus infrastructures (washroom facilities, playground, etc..) in the urban park and other parks across your city? And in ecologically-sensitive and flood-sensitive areas?

ACQUISITION & CONNECTIVITY

How have the urban parks and other major green infrastructures been evolving through time? Have there been any policies to help expanding the park system?
Are there any acquisition strategies to expand the many park systems in your city?
What are the tools used for the government to acquire land to connect and protect green infrastructures (e.g. with golf courses, cemetery, etc..)?
Are there any partnerships with other levels of jurisdiction (local-regional-state-national) or with the private sector (e.g. golf course, universities) to permit connectivity on land that is not publicly & locally owned?
For instance, a trail system might be blocked by a golf course and a partnership might be needed in order to allow for a continuous and connected trail system

GOVERNANCE STRUCTURE & CONNECTIVITY

Who is responsible for managing and acquiring green spaces in your city?
Are there any conservation authorities in the area? How involved are they?
Are there any other partners either from the non-for-profit sector or private sector that are involved in managing and acquiring green spaces in your city?
Are there any opportunities for the public to get involved in connecting green infrastructures in your city?

APPENDIX B | LITERATURE CITED

literature

Bennett, A.F. (1998, 2003). Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation. IUCN, Gland, Switzerland and Cambridge, UK. xiv +254 pp.

City of Copenhagen. (2012). Cloudburst Management Plan 2012.

City of Edmonton. (n.d.) River Recreation Guide – North Saskatchewan River.

City of Edmonton. (2007). Natural Area Systems.

City of Edmonton. (2010). Wildlife Passage Engineering Design Guidelines.

City of Edmonton. (2014). Phase II Ecological Network Report: Terms of Reference.

City of Edmonton. (2017). Breathe: Edmonton's Green Network Strategy Strategic Plan.

City of Saint-Paul. (2012). Great River Passage.

City of Toronto. (n.d.a). Biodiversity in the City.

City of Toronto. (n.d.b). TOcore - Planning Toronto's Downtown.

City of Toronto. (1973). Report on Designation of Ravine Lands in the City's Official Plan.

City of Toronto. (2002). Toronto Official Plan.

City of Toronto. (2012). Environmentally Significant Areas (ESAs) in the City of Toronto.

City of Toronto. (2015a). 2015 OPERATING BUDGET BRIEFING NOTE: Contributions to and Withdrawals from Reserves/Reserve Funds.

City of Toronto. (2015b). Toronto Official Plan.

City of Toronto. (2016a). Toronto Municipal Code Chapter 658, Ravine and Natural Feature Protection.

City of Toronto. (2016b). Toronto Ravine Strategy: Draft Principles and Actions.

City of Toronto. (2016c). Bee City Affiliation and Pollinator Protection Strategy Update.

City of Toronto. (2017). Toronto Complete Streets Guidelines.

Costanza, R., De Groot, R., Sutton, P., Van Der Ploeg, S., Anderson, S. J., Kubiszewski, I., . . . Turner, R. K. (2014). Changes in the global value of ecosystem services. Global Environment Change, 26, 152-158

De Sousa, C. (2003). Turning brownfields into green space in the City of Toronto. Landscape and Urban Planning, 62, 181-198.

Erickson, D. L. (2006). Metrogreen: Connecting Open Space in North American Cities. Washington, DC: Island Press.

Ernstson, H., S. Sörlin, and T. Elmqvist. 2008. Social movements and ecosystem services–the role of social network structure in protecting and managing urban green areas in Stockholm. Ecology and Society 13(2): 39.

Florida Department of Environmental Protection. (n.d.). Florida Greenways & Trails System Plan 2013-2017.

Fulford, R. (1995). Accidental City: The Transformation of Toronto. Toronto (ON.): MacFarlane Walter & Ross.

Gobster, P.H. & Westphal, L.M. (2004). The human dimensions of urban greenways: planning for the recreation and related experiences. Landscape and Urban Planning, 68, 147-165.

Gulsrud, N.M. (2015). The Role of Green Space in City Branding: An Urban Governance Perspective.

Harnik, P. (2010). Urban Green: Innovative Space for Resurgent Cities.Washington, DC: Island Press.

Kuo, F.E. & Sullivan, W. 2001. VEGETATION AND CRIME ENVIRONMENT AND CRIME IN THE INNER CITY: Does Vegetation Reduce Crime? Environment and Behavior, 33, 343-367.

Lister, N.M., Brocki, M., & Ament, R. (2015). Integrated adaptive design for wildlife movement under climate change. Frontiers in Ecology and the Environment, 13, 493-502.

Lorinc, J. (2015). Parks in Crisis Part 1-6. Spacing Toronto.

Lofvenhaft, K., Bjorn, C., & Ihse M. (2002). Biotope Patterns in Urban Areas: a Conceptual Model Integrating Biodiversity Issues in Spatial Planning. Landscape and Urban Planning 58: 223-240

Metro Vancouver. (2011). Experience the Fraser: Lower Fraser River Corridor Project Concept Plan.
Ministry of Finance. (2014). Ontario Population Projections, 2013-2041.
Minnesota Pollution Control Agency. (2013). Mississippi River-Twin Cities Watershed Monitoring and Assessment Report.
Mirabelli, J. (2016, March 31). Growth to Watch For in 2016: Toronto's Central Waterfront. Urban Toronto.
Morse, J.M. (2010). Simultaneous and Sequential Qualitative Mixed Method Designs. Qualitative Inquiry 16(6) 483–491
N.d. (1993). Sunken treasures: The ice age carved toronto's network of ravines, but it was hurricane hazel that came to their rescue. (1993, 08). Toronto Life, 27, 29-30+.
Nielsen, A.B., Hedblom, M., Olafsson, A.S., & Wistrom B. (2016). Spatial Configurations of urban forest in different landscape and socio-political contexts: identifying patterns for green infrastructure planning.
Ontario. (2014). Provincial Policy Statement.
Ontario. (2016). Ontario Population Projections Update.
Ontario Nature. (2014). Best Practices Guide to Natural Heritage Systems Planning.
Park People. (2015). Making Connections.
Pennsylvania Greenways Partnership Commission. (2001). Pennsylvania Greenways: An Action Plan for Creating Connections.
Roots, B. I., Heidenreich, C. E., & Chant, D. A. (1999). Special Places: The Changing Ecosystems of the Toronto Region. Vancouver (B.C.): UBC Press.
San Francisco Planning Department. (n.d.). Green Connections. Seymour, M. (2000). Toronto's Ravines: Walking the Hidden Country. The Boston Mills Press. Ontario, Canada.
Shepard, D.B., Kuhns, A.R., Dreslik, M.J., & Phillips, C.A. (2008). Roads as barriers to animal movement in fragmented landscapes. Animal Conservation, 11, 288-296.
Sustainable SITE Initiatives. (n.d.). Retrieved from: http://www.sustainablesites.org/
Tashakkori, A., Teddlie, C. (2010). Visual Displays for Mixed Methods Findings in SAGE Handbook of Mixed Methods in Social & Behavioral Research.
Taylor, P.D., Fahrig, L., Henein, K. and Merriam, G. (1993). Connectivity is a vital element of landscape structure. Oikos 68: 571–573.
Toronto and Region Conservation Authority. (2016). Greenlands Acquisition Project.
Vancouver Board of Parks and Recreation. (2016). Biodiversity Strategy.
Wang, R., Eckelman, M. J., & Zimmerman, J. B. (2013). Consequential Environmental and Economic Life Cycle Assessment of Green and Gray Stormwater Infrastructures for Combined Sewer Systems. Environmental Science & Technology, 47, 11189-11198
Wissman, J. et al. (2016). Multifunctional Golf Courses.
Yahner, R.H. (1988). Changes in Wildlife Communities Near Edges. Conservation Biology: 2: 333-339
Yuan, J. (2014). City of Toronto Wildlife Crossing Protocol: An Integrated Planning Approach to Amphibian and Reptile Ecopassages. Prepared for the City of Toronto.

images

Acadian Flycatcher [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://www.allaboutbirds.org/guide/PHOTO/LARGE/acad.jpg
Black Footed Spider Michigan [Online Image]. (2010). Retrieved March 1st, 2017 from: https://www.whatsthatbug.com/wp-content/uploads/2010/12/black_footed_spider_michigan.jpg
Brook Trout [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://www.adirondackexplorer.org/wp-content/uploads/2015/04/Brook-trout.jpg
Bur Oak Tree [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://www1.toronto.ca/City%20Of%20Toronto/Parks%20Forestry%20&%20Recreation/03Trees%20and%20Ravines/Files/images/Tree%20Species%20Factsheet%20images/bur%20oak%20tree.jpg
Chicken of the Woods [Online Image]. (2012). Retrieved March 1st, 2017 from: https://virginiawildflowers.files.wordpress.com/2012/09/img_0575.jpg
Daring Jumping Spider [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://s-media-cache-ak0.pinimg.com/564x/52/18/e1/5218e17595e8e55218d4d08d832a2a60.jpg

Eastern Garter Snake [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://www.virginiaherpetologicalsociety.com/reptiles/snakes/eastern-gartersnake/sp_eastern%20garter%20snake292.JPG
Gilled Mushroom Caps [Online Image]. (2013). Retrieved March 1st, 2017 from: http://thepaintedpost.com/wordpress/wp-content/uploads/2013/01/gilled-mushroom-caps.jpg
Hollerich, S. (n.d.). Gray Tree Frog [Online Image]. Retrieved March 1st, 2017 from: http://www.nhptv.org/wild/images/graytreefrogusfwsaraHollerich.jpg
Johny Darter (Etheostoma nigrum) [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://fishesofboneyardcreek.weebly.com/uploads/1/3/5/6/13567119/1554011_orig.jpg
Little Brown Bat [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://www.nhptv.org/wild/images/littlebrownbatforestryusda.jpg
Male Frontinella Pyramitela [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/thumb/f/fe/Male_Frontinella_pyramitela.jpg/250px-Male_Frontinella_pyramitela.jpg
Megarhyssa Macrurus Female [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/c/cc/Megarhyssa_macrurus_female.jpg
Monarch [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://monarchwebwork.com/rw_common/images/monarch.png
Opossum [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/2/27/Opossum_2.jpg
Peregrine Falcon [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://www.allaboutbirds.org/guide/PHOTO/LARGE/peregrine_falcon_3.jpg
Prairie Warbler [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://www.allaboutbirds.org/guide/PHOTO/LARGE/Prairie_KennethColeSchneider.JPG
Reindeer Moss [Online Image]. (2012). Retrieved March 1st, 2017 from: http://infofiles.net/wp-content/uploads/2012/11/reindeer-moss.jpg
Red-osier Dogwood [Online Image]. (2009). Retrieved March 1st, 2017 from: http://3.bp.blogspot.com/-FUjs9jTtGvI/UzAz85znMNI/AAAAAAAAGIY/G3nQVMxS-tU/s1600/Chinese+dogwood+Cornus+kousa+var+Chinensis+bracts+by+garden+muses-a+Toronto+gardening+blog.JPG
Silver Maple [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://www1.toronto.ca/City%20Of%20Toronto/Parks%20Forestry%20&%20Recreation/03Trees%20and%20Ravines/Files/images/Tree%20Species%20Factsheet%20images/silver%20maple%20full.jpg
Southern Painted Turtle [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/1/1b/A3_Southern_painted_turtle.jpg
Umbilicaria Vellea [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://www.biopix.com/photos/jcs-umbilicaria-vellea-58674.jpg
Tylopilus Felleus [Online Image]. (2006). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/e/e3/2006-09-14_Tylopilus_felleus_crop.jpg
Wood Bee [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://images.sunlive.co.nz/images/woodbee.jpg
Xanthoria Elegans [Online Image]. (n.d.). Retrieved March 1st, 2017 from: https://upload.wikimedia.org/wikipedia/commons/e/eb/Xanthoria_elegans_97571_wb1.jpg
Yellow Perch [Online Image]. (n.d.). Retrieved March 1st, 2017 from: http://animalia-life.club/data_images/yellow-perch/yellow-perch3.jpg

maps

Map 1: Toronto's Ravine System. Scale 1:95,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 2: Toronto's Topography and Bathymetry. Scale 1:95,000. Scholars GeoPortal. ON: Ontario Council of University Librairies. Using: National Oceanic Atmospheric Administration, 2013; Toronto and Region Conservation Authority, 2014. Using: QGIS. Version 2.18.2.

Map 3: Toronto's Natural and Green System. Scale 1:95,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 4: Gaps in Toronto's Ravine System. Scale 1:95,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 5: Gaps in Toronto's Ravine System Found through Buffer Analysis. Scale 1:350,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 6: Vancouver's Built Form. Scale 1:350,000. City of Vancouver Open Data Catalogue. Vancouver, BC: City of Vancouver, 2017. Using: QGIS. Version 2.18.2.

Map 7: Toronto's Built Form. Scale 1:350,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 8: Stockholm's Built Form. Scale 1:350,000. OpenStreetMap. N.d.: OpenStreetMap, 2017. Using: QGIS. Version 2.18.2.

Map 9: Edmonton's Built Form. Scale 1:350,000. City of Edmonton Open Data Portal. Edmonton, AB: City of Edmonton, 2017. Using: QGIS. Version 2.18.2.

Map 10: Saint-Paul's Built Form. Scale 1:350,000. OpenStreetMap. N.d.: OpenStreetMap, 2017. Using: QGIS. Version 2.18.2.

Map 11: Copenhagen's Built Form. Scale 1:350,000. OpenStreetMap. N.d.: OpenStreetMap, 2017. Using: QGIS. Version 2.18.2.

Map 12: Vancouver's Natural and Trail Systems. Scale 1:100,000. City of Vancouver Open Data Catalogue. Vancouver, BC: City of Vancouver, 2017. Using: QGIS. Version 2.18.2.

Maps 13: Edmonton's Natural and Trail Systems. Scale 1:100,000. City of Edmonton Open Data Portal. Edmonton, AB: City of Edmonton, 2017. Using: QGIS. Version 2.18.2.

Map 14: Saint-Paul's Natural and Trail Systems. Scale 1:100,000. OpenStreetMap. N.d.: OpenStreetMap, 2017. Using: Author. Using: QGIS. Version 2.18.2.

Map 15: Copenhagen's Natural and Trail Systems. Scale 1:100,000. OpenStreetMap. N.d.: OpenStreetMap, 2017. Using: Author. Using: QGIS. Version 2.18.2.

Map 16: U. Egerö. (2017). Stockholm's Natural and Trail Systems.

Map 17: Public ANTHRO|fragment. Scale 1:107,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 18: Private ANTHRO|fragment. Scale 1:105,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 19: Public ECO|fragment. Scale 1:105,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 20: Private ECO|fragment. Scale 1:105,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

Map 21: ECO|fragment and ANTHRO|fragment. Scale 1:95,000. City of Toronto Open Data Catalogue. Toronto, ON: City of Toronto. Using: Using: QGIS. Version 2.18.2.

toronto-specific data

City of Toronto. 75m Buffer Herp. Toronto, ON: City of Toronto, 2017.

City of Toronto. Bird Migrant. Toronto, ON: City of Toronto, 2017.

City of Toronto. Bird Viewing Spots. Toronto, ON: City of Toronto, 2017.

City of Toronto. Forecasted Residential Projects. Toronto, ON: City of Toronto, 2017.

City of Toronto. Golf Course Grounds (city own). Toronto, ON: City of Toronto, 2017.

City of Toronto. Private Golf and Cemetery. Toronto, ON: City of Toronto, 2017.

City of Toronto. Ravine Bylaw. Toronto, ON: City of Toronto, 2017.

City of Toronto. Toronto Centreline (TCL). Toronto, ON: City of Toronto, 2017.

J.D. Barnes First Base Solutions. TRCA Contour Lines (1 metre). Toronto, ON: J.D. Barnes First Base Solutions, 2013.

Nash, S. Environmentally Significant Areas. Toronto, ON: Nash, S, 2017.

National Oceanic and Atmospheric Administration (NOAA). ESRI Great Lakes Bathymetry Contours. Canada: NOAA, 2013.

Statistics Canada. Ecume Hydrography (Major Internal Lakes) Reference Layer, 2011 Census. Canada: Statistics Canada, 2012.

APPENDIX C | ETHICS SUBMISSION AND REVIEW SYSTEM SHORT FORM PROTOCOL

Ryerson University

Protocol View

APPLICATION CHECKLIST

Protocol Submitted By: vracine

Submission Status: Does not require REB approval

REB: 2016-408

Title of Research Proposal
Connecting the Dots: Acquisition in City of Toronto's Ravine System

SECTION - COMMENTS TO CHAIR

Comments to Chair

Dear Chair, The purposes of the proposed research are to (1) provide insights into best practices relating to acquisitions in ecologically sensitive areas? and (2) develop a set of typologies for the gaps found in the ravine system in the City of Toronto. The questions in the interview will focus on factual information, historical context, and professional expertise? as such we anticipate that full research ethics board review will not be necessary as our protocol requires professional practice interviews based upon fact checking. According to Chapter 2, pg 16 of the Ethical Conduct for Research Involving Humans policy statement: "research may involve interaction with individuals who are not themselves the focus of the research in order to obtain information. For example, one may collect information from authorized personnel to release information or data in the ordinary course of their employment about organizations, policies, procedures, professional practices, or statistical reports". Please find attached our interview guide as we believe it adheres to the requirements of this policy. Thank you for your attention and consideration,Vincent Racine

SECTION - INTRODUCTION & INVESTIGATORS

Principal Investigator

First Name: Vincent
Last Name: Racine
Institution: Ryerson University
Academic Title:
Department/Office: Urban and Regional Planning
Email: vracine@ryerson.ca
Telephone Number: 647-975-2413
Type: GS

Supervisor's First Name:	Nina-Marie
Supervisor's Last Name:	Lister
Department:	Urban and Regional Planning
E-mail:	nm.lister@ryerson.ca
Phone extension:	6769
Blackboard Matrix ID:	nm.lister

I have completed the TCPS on-line tutorial:

✓ YES

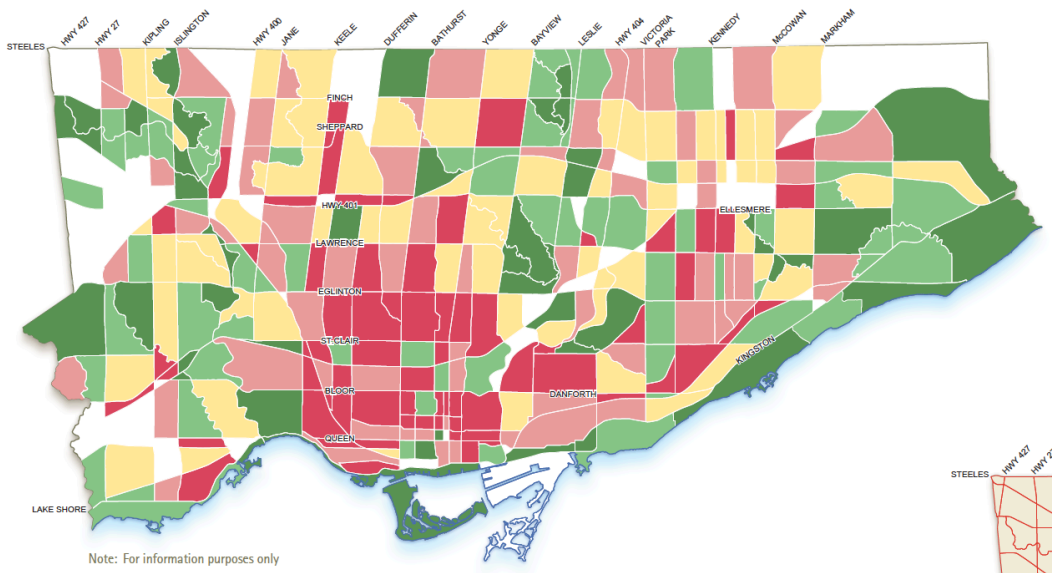
Investigator Experience

Please provide a brief summary of the investigator's relevant research experience/training (there is no need to include a curriculum vitae). If the principal investigator is a graduate student and the research is being conducted for a thesis or dissertation project, also include a brief summary of the faculty member who is supervising the research.

Vincent Racine is a graduate student of Ryerson University's Urban Development Master of Planning program. His previous academic and professional experience as a research assistant in the City Building

APPENDIX D | EXTERNAL CITED MAPS

City Parkland Maps (City of Toronto, 2015b)



Note: For information purposes only

Local Parkland Provision - Map B

Hectares of local parkland per 1,000 people

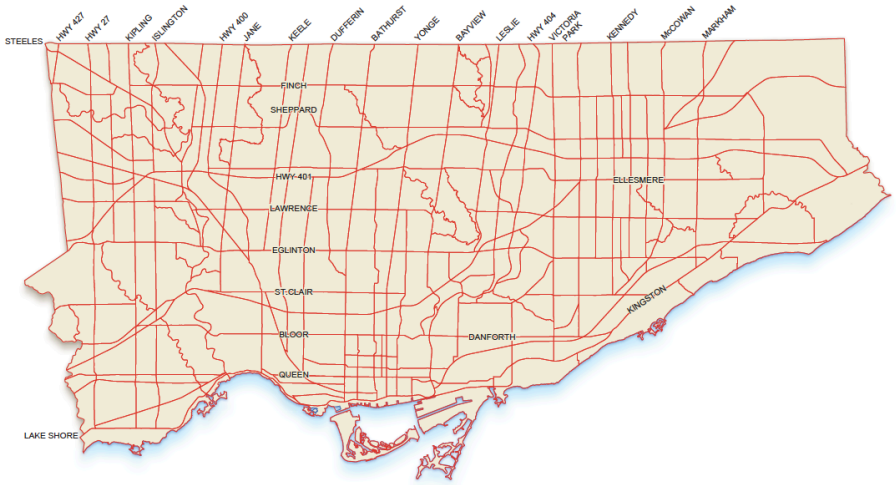
- 0 to 0.42
- 0.43 to 0.79
- 0.80 to 1.56
- 1.57 to 2.99
- 3.00 +
- Areas with less than 300 people

There are five colours on Map 8(B) excluding the white areas. Each of the colours covers an area that is equal to 20 percent of the geographic park planning areas of the City. The colours are used to represent the level of parkland provision in each local park planning area.

Map B shows local parkland provision across the City, indicating relative per capita provision levels. The map shows areas whose boundaries are based primarily on physical barriers relating to safe and convenient pedestrian access to parks.

Local parks are one of several park categories that comprise the public parkland within the City of Toronto. While all categories of municipal parkland make a contribution to meeting the needs of residents, access to Local parkland is important in meeting community park needs.

In its portrayal of Local parkland provision levels across the City, Map B takes into consideration the contribution of all categories of municipal parkland, as shown on Map A. It was developed as part of the Parkland Acquisition Strategic Directions Report that was endorsed by City Council in January 2002.



Local Park Planning Boundaries - Map C

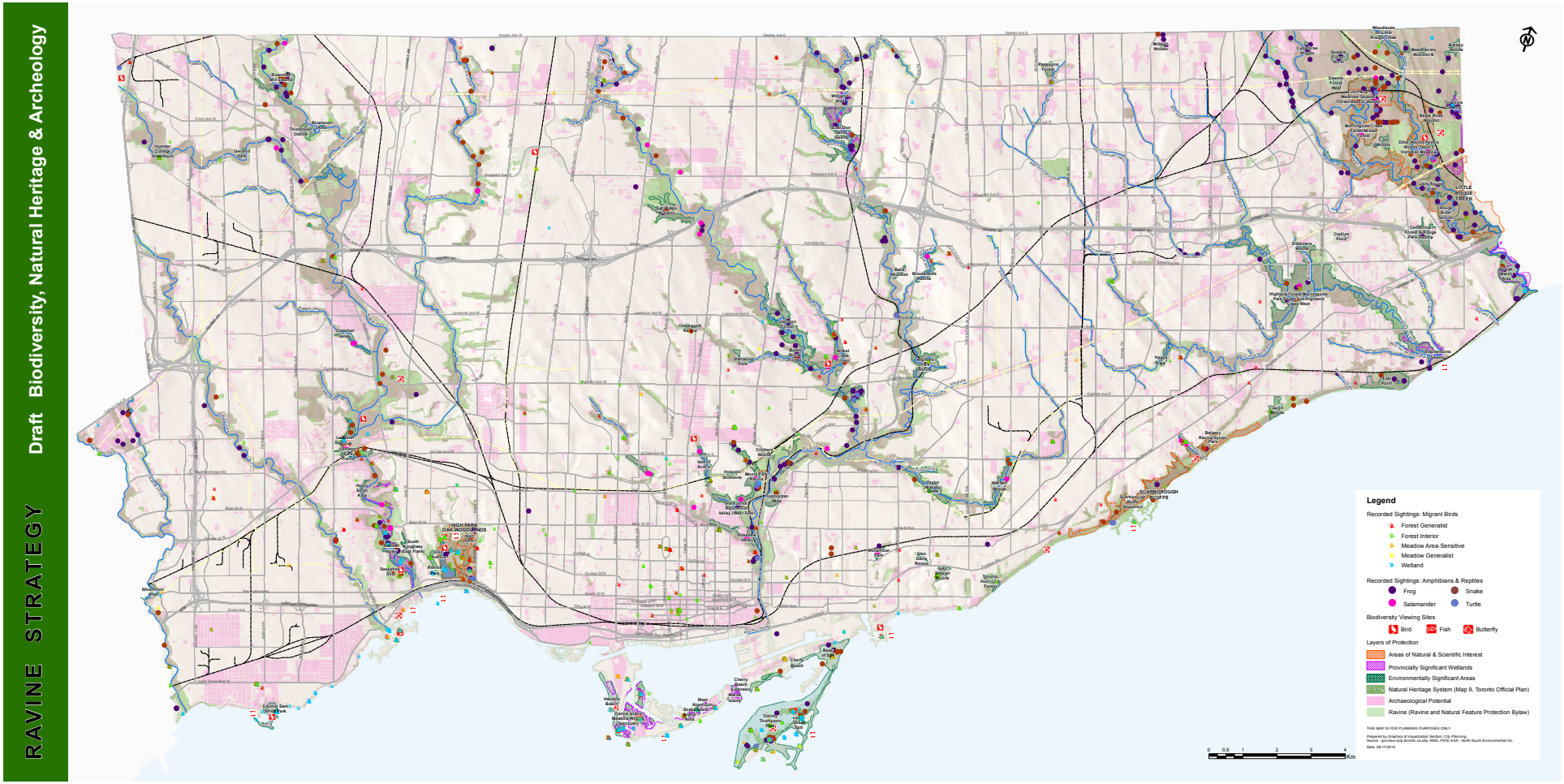
TORONTO City Planning Division

Not to Scale

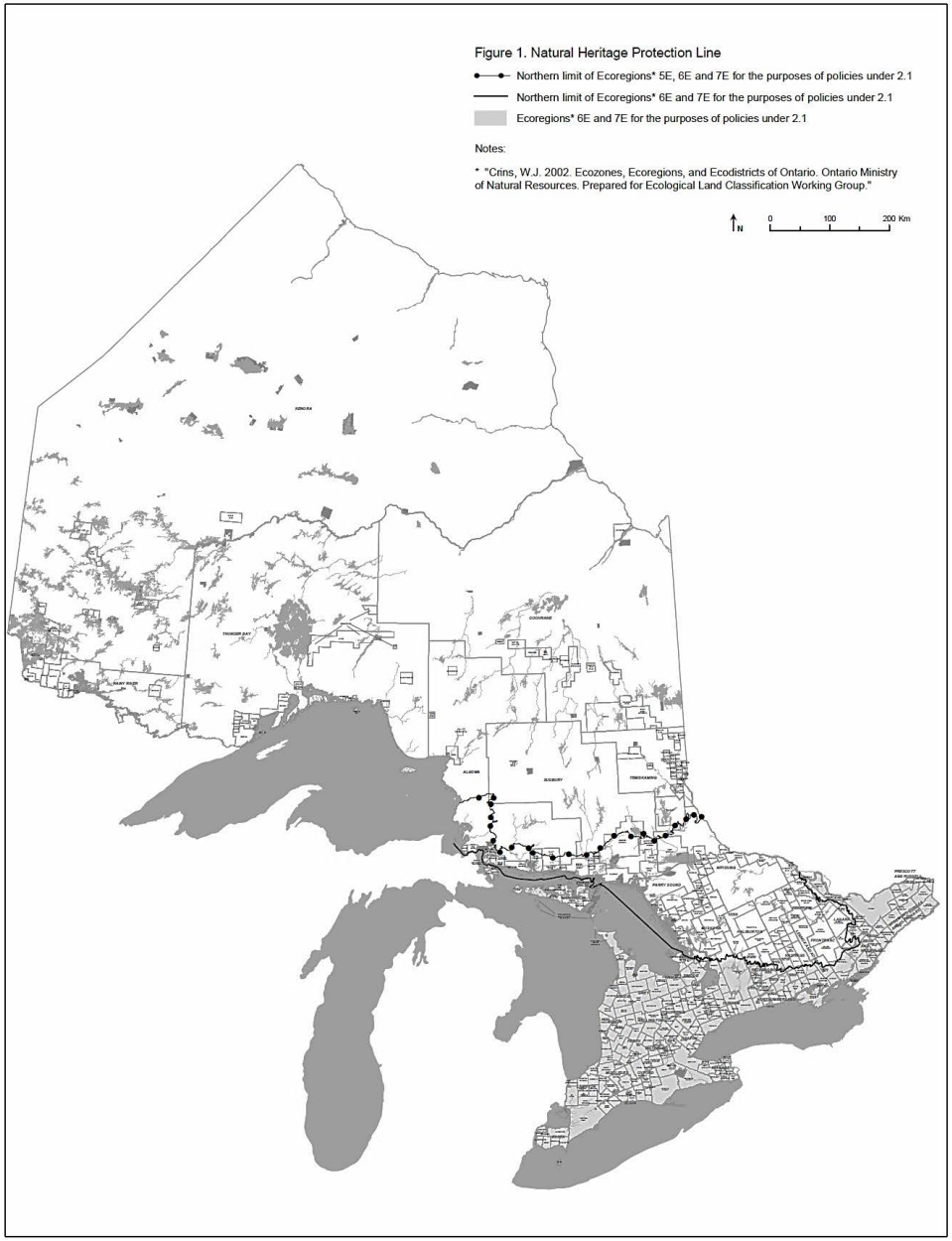
TORONTO OFFICIAL PLAN City Parkland

MAP 8B/C June 2006

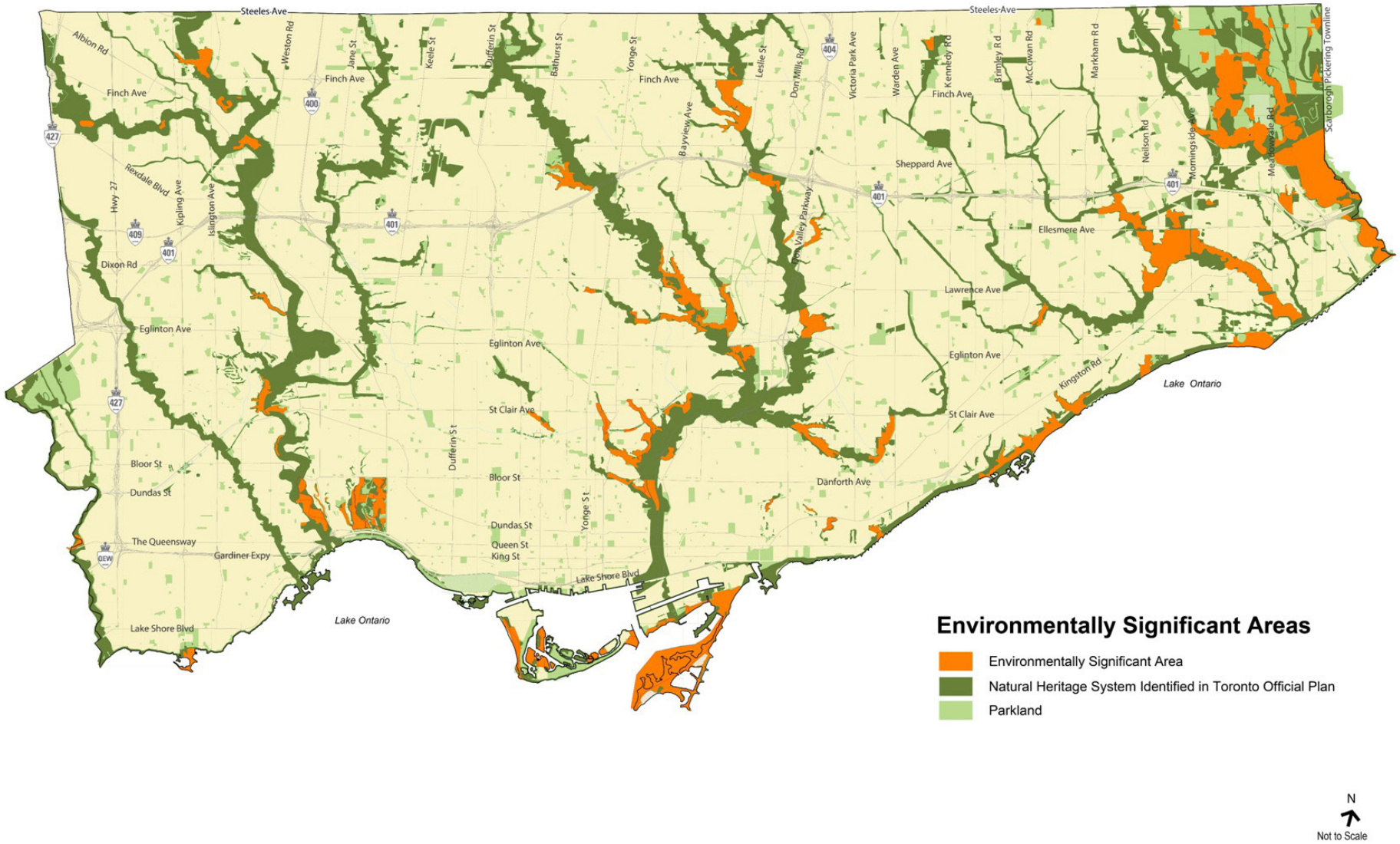
Draft Biodiversity, Natural Heritage & Archeology (Retrieved from [Toronto Ravine Strategy])



Natural Heritage Protection Line (Ontario, 2014)



Environmentally Significant Areas (Retrieved from [Environmentally Significant Areas])



APPENDIX E | LIST OF PROFESSIONALS INTERVIEWED

CITY OF VANCOUVER
Kevin Connery, Landscape Architect for the Arbutus Greenway Project at the City of Vancouver

CITY OF EDMONTON
Michelle Bernuy, Parks Planner for the City Planning division of the City of Edmonton
Angela Hobson, Ecological Planner for the City Planning division of the City of Edmonton
Catherine Shier, Principal Ecological Planner for the City Planning division of the City of Edmonton
Geoff Smith, Senior Planner for the City Planning division at the City of Edmonton

COPENHAGEN
Natalie Marie Gulsrud, Assistant Professor for the Department of Earth Science and Nature Management at the University of Copenhagen
Anton Stahl Olafsson , Postdoc for the Forest and Landscape College at the University of Copenhagen

SAINT-PAUL
Timothy J. Griffin, Senior Research Fellow for the Minnesota Design Center

CITY OF STOCKHOLM
Ulrika Egerö, Overview Planner in the City Planning division of the City of Stockholm