ODONATA PARK: A wetland park for downtown Winnipeg

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ODONATA PARK: A wetland park for downtown Winnipeg

A Practicum Submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of

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Abstract

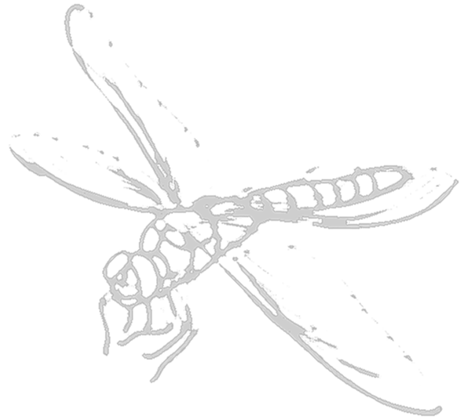
Odonata Park: A wetland park for downtown Winnipeg, is a practicum project that has allowed me to test the boundaries of what is possible for urban habitat, stormwater management, and placemaking in the uniquely harsh context of downtown Winnipeg.

Human pollution and climate change are having detrimental effects on nature and people. Pollution stemming from human activity poisons freshwater ecosystems throughout the province. The concrete blanket of urban development is further esasperating the problem. The pavment heats up the landscape to the point where it is becoming a health risk. The destruction of natural habitats such as wetlands only compounds these issues, as they are nature's way of filtering pollutants from water and air.

A key function of this design is to capture, manage, and purify stormwater in downtown Winnipeg. The focal point is on a specified site, but the hope is that this project can capture water from a more expansive area. This would lessen the burden on Winnipeg's sewer system and reduce pollution in natural water bodies.

While focusing on the technical requirements of stormwater management, another goal will be to reuse the captured water to facilitate a viable wetland habitat. To accomplish this, the project incorporates a group of indicator species, in this case, dragonflies of the order Odonata. These species live in and around wetlands, and their numbers are often linked to the health of these environments. Therefore, designing an environment to meet their needs will result in a healthy habitat, not only for Odonata but a wide range of wetland species.

Equally important to designing a place for habitat is making a space for downtown Winnipeg. This practicum aims to reveal more potential for downtown, providing a new space for visitors and residents. This practicum comes with an opportunity to demonstrate a holistic design approach that combines sustainability, habitat, and place.





Chapter 1:
Introduction

The Issue

Manitoba is home to some of the largest freshwater reserves on the planet. These water bodies offer numerous benefits to people living in Manitoba and beyond. They provide a safe and accessible source of drinking water, agriculture irrigation, endless recreational opportunities, and much more. These freshwater bodies are also habitat for countless species that rely on them to avoid extinction. Today, these environments are increasingly at risk due to pollution and climate change.

This pollution is largely rooted in urban centers, such as Winnipeg, and comes in the form of Eutrophication. This form of pollution is a result of a massive influx of pollutants, nutrients, and other substances that are dumped into nearby water bodies. In the case of Winnipeg, these water bodies include the Red River and the Assiniboine River.

Eutrophication is among the greatest threats to Manitoba's freshwater ecosystems. It is the result of excess nutrients and pollutants contaminating freshwater systems. The most common form of these substances comes in the form of Nitrogen(N) and Phosphorus (P). Both are important substances in nature, but the massive influx of these pollutants coming from human waste is proving to be destructive to natural systems.

In nature, Nitrogen and Phosphorus are essential to the growth of vegetation, especially algae, but they are only found in smaller doses. Human pollution, often in the form of sewage, carries these substances and feed a rapid influx of algae and similar vegitation. Herein lies the issue as this excess growth of saps water systems of resources and oxygen. The result is large-scale habitat destruction as water bodies are left uninhabitable.

Compounding this issue is the effect that human development has had on destroying nature's ability to adapt and deal with this excess pollution. Namely, human development has displaced wetland ecosystems in favor of cities and urban development.

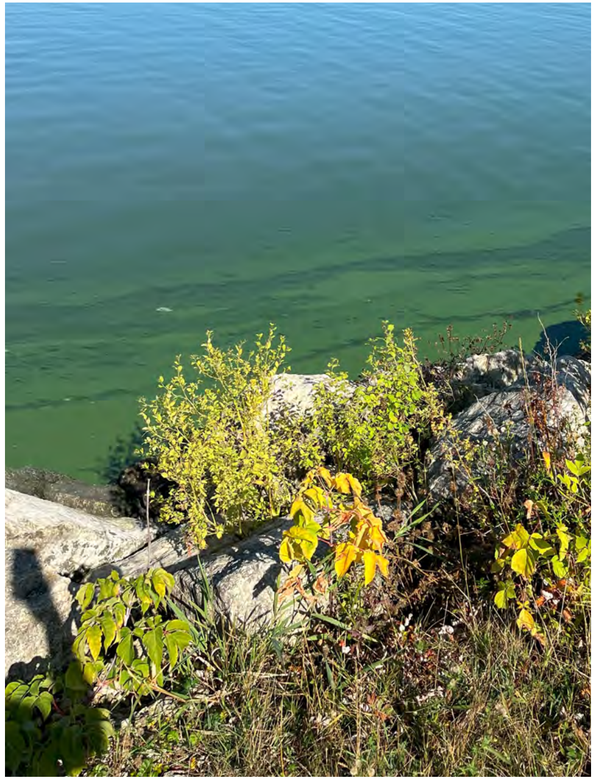




Fig 1. Eutrophication - Photos found in nature of freshwater bodies contaminated by excess pollutants origninating from human activity.

Urban water cycle

The natural water cycle is the sequence that leads up to and follows precipitation events. It begins with a storm event, typically in the form of rain or snow. As this water lands on the ground it soaks into the soil where much of it is absorbed by vegetation. This process called infiltration. This step can also helps replenish groundwater stores. This is an important aspect of the water cycle because groundwater stores can help provide an additional level of resilience against events such as drought. Eventually, groundwater stores are full, and soils are saturated. The excess water becomes surface runoff and makes its way to nearby waterbodies.

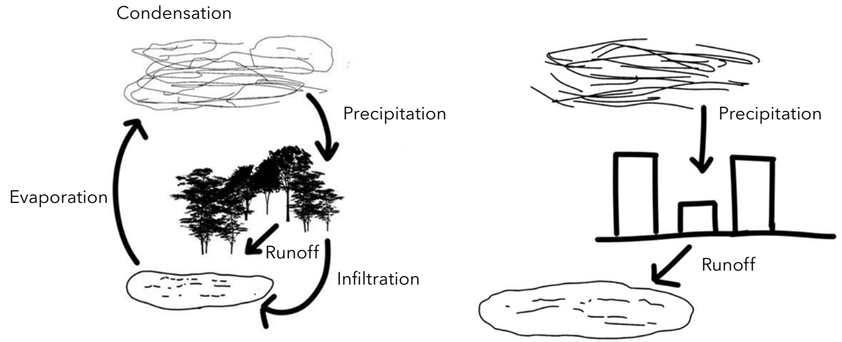
In urban environments, which cities such as Winnipeg are prime examples of, this natural cycle is disrupted which leads to environmental damage[1]. The disruption of this system leads to urban pollutants being exposed to natural water bodies. This can be seen when comparing what the cycle of water looks like in nature vs a typical urban environment.

The landscape in cities is dominated by concrete paved surfaces, making them largely impermeable. This means that a majority of precipitation that lands here turns directly into runoff. Which must then be quickly dealt with to avoid costly damage to properties and infrastructure. The solution that the City of Winnipeg offers is to send rainwater into a combined sewer system. This is a common system for many cities including larger ones such as New York.

The combined sewer system revolves around one single sewer network that contains both wastewater from human activity (i.e sewage) and stormwater[2] This system benefits cities such as Winnipeg by quickly draining waste and stormwater away from urban settings. However, this system comes with a significant shortcoming.

The combined system is susceptible to overloading because of heavy storm events or snowmelt. In these instances, the quick influx of water mixes with sewage and is sent directly into the river systems through emergency outflows.

These events can be detrimental to surrounding environments in various capacities. For one, this outflow risks raising water levels and increasing the risk of floods, severely damaging properties along these rivers[3] . This system is also extremely damaging to freshwater ecosystems. The chemicals, sediments, sewage, and other pollutants that are caught up in this overflow are now exposed to the river. The influx of pollutants occurs too quickly for natural processes to deal with them, and the rivers then take these pollutants to larger waterbodies, such as Lake Winnipeg.



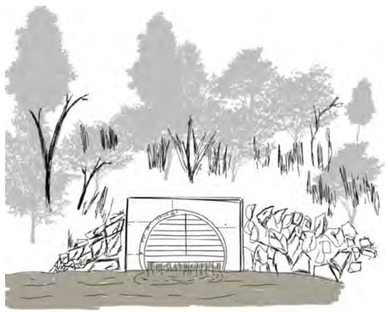


Fig 2. The water cycle - The difference between a natural environment and urban cycle (above) illustrates where most of the water runs off directly into nearby water bodies. (Image reproduced with permission.)
The water is introduced to rivers by various outflows, built into the riverbanks nearby urban development (left).

Stormwater managment stratagies

Issues stemming from the limitations of conventional water management strategies, such as combined sewer systems, have inspired many in the world of Landscape Architecture to find innovative solutions to these issues. The multi-disciplinary outlook of Landscape Architecture provides the potential for a creative solution to these issues. Through design, Landscape architecture includes an understanding of technical requirements as well as how places function both for people and as habitats.

The cost of replacing Winnipeg's entire combined sewer network would make it an inconceivable idea. Instead, this project will look to provide a strategy that targets stormwater specifically. While the pollution is caused by wastewater, it is only released into the river system as a result of its inability to properly manage stormwater.

This practicum will look to nature as inspiration, specifically wetlands, to deal with this issue. Wetlands found in nature provide a natural way to filter pollutants and excess nutrients from stormwater through the processes of infiltration. The naturally occurring vegetation in and around these environments plays a role in filtering out pollution from water and the air. This natural process means that water flowing to rivers and lakes does not contain damaging levels of pollutants.

Nature-inspired solutions to manage stormwater are becoming more common in design. Many of which also share qualities held by wetlands, due to their powerful ability to improve water quality. Wetland environments also provide essential habitat for a wide range of species that cannot survive anywhere else on the planet. The loss of these habitats due to human development only compounds the damage done by urban pollution.

Prioratizing the use of naturalized stormwater strategies has the additional benefit of creating habitat for wildlife. Returning some version of these ecosystems to urban areas could provide a range of benefits toward creating a more environmentally sustainable city.

There are a wide range of nature-inspired strategies that have been used around the world to manage stormwater. A few examples that could be used effectively to an urban site include: biotopes, rain gardens, and retention ponds[4].

The considerations required to capture stormwater in an urban context come with significant limitations. Whether that is climate, limited space, or human traffic. When choosing the best methods to apply to this urban project the considerations included; how successful they are at managing stormwater, do they utilize natural processes to sustainably reduce pollutants, is habitat created for native species, and whether it aesthetically fits within the chosen context.

Biotopes

This stormwater strategy utilizes naturally occurring processes to manage and filter stormwater. This is done through the specific application of vegetation and sometimes wildlife, to create a healthy ecosystem[5]. The resulting process provides natural filtration of pollutants, improves water quality, and can provide an appealing aesthetic for people if designed accordingly[6].

Rain gardens

Rain gardens provide a method to assist with stormwater management in a wide range of contexts. Their flexibility makes them common in urban environments, such as around parking lots, buildings, and along streets.[7] Functionally these gardens are designed as small trenches or infiltration zones that quickly drain water[8]. These gardens typically incorporate species that can handle moist environments as well as aid in water filtration as it moves toward the drains.

Retention ponds

Retention ponds can come in a variety of forms, some not even having permanent surface water. They tend to be larger basins designed to capture and hold rainwater from a more substantial area, such as a park or neighborhood[9]. These ponds also can provide an important aesthetic or even a recreational park to developed areas.

Case Studies

A range of different projects were studied to provide insight and inspiration for the design of Odonata Park. These studies provided an introduction to stratagies used in other areas to deal with capturing and treating stormwater in an urban context. Additionally, these studies hope to provide an aesthetic inspiration for how you can create an attractive place for people in conjunction with the technical goals.

Two projects stood out in these regards. *Sherbourne Commons* is a project that takes an innovative approach to dealing with stormwater within an urban park setting. While *The Quiet Esplanade* is an iconic public space that creates a desirable destination in downtown Montreal.

Projects

Sherbourne Commons - Toronto, Ontario

The Quiet Esplanade - Montreal, Quebec





Sherbourne Commons

Fig 3. Sherbourne Commons render - illustrates an aerial perspective of the waterfront park, highighting the building, canal and urban forest. Used with permission.

Location: Toronto, Ontario

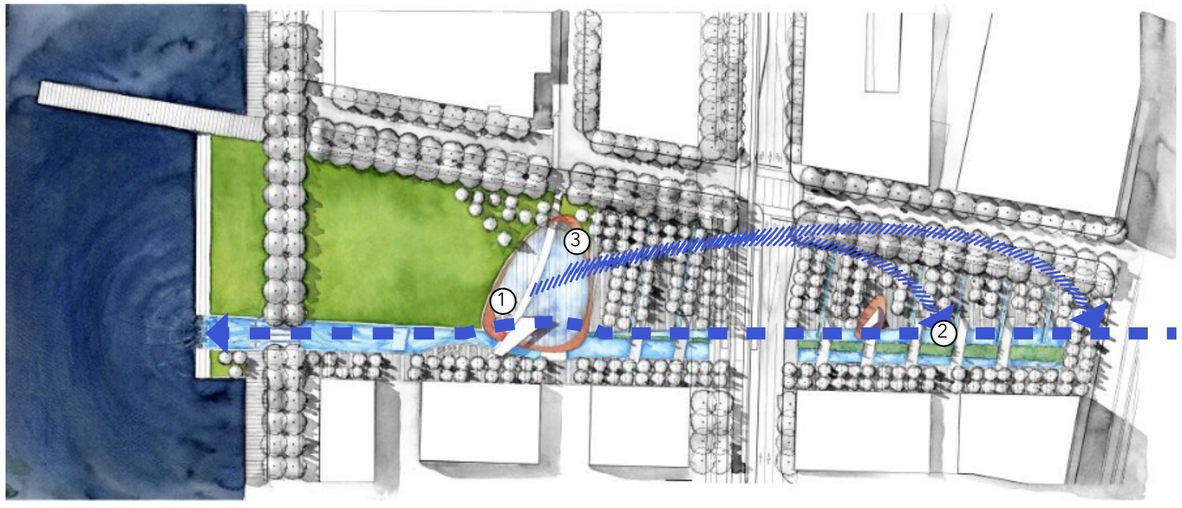
Designer: PFS Studio

Date: 2011

Area: 3.6 Acres

Sherboune Commons is a renovation project that turns what was previously a brownfield site into an exemplary park space along Toronto's waterfront district. The park connects with the sites historical context and the surrounding Canadian landscape. Those areas being designated as the woods, the green, and the water[10]. The design of the park revolves around an intricately designed stormwater management system that includes bioretention features, and the first UV filtration facility of its kind in Canada[11]. This system came about to reduce the pollution that has been running off of Toronto's paved shoreline and contributing to polluting Lake Ontario.

Overall the park seamlessly combines these services with the densely urbanized environment of Toronto, bringing people closer to nature while creating an important point of connection between the waterfront and the lake.



Design stratagy

The design of this park uses a geometric language that builds off the surrounding roadways and buildings. This is especially evident in the linear tree plantings throughout the park. This strategy was chosen to help the park blend in better with the urban fabric. The choice of materials also helps build on this connection. The design leans into non-organic materials such as concrete and metal for many of the key aspects of the design. These include the building, planting beds, and fountains. These choices, mixed with the geometric tree planting patterns, help create a bridge between the man-made and natural environment.

Fig 4. Sherbourne Commons - The plan of the park (above) illustrates the different areas throughout the park and where each step of the stormwater sequence takes place (right). Used with permission.

Stormwater management stratagy



① UV filtration building

The first step of stormwater filtration involves the water being sent to a pavilion building. This building provides a shelter for park visitors but the basement houses UV filtration units.



②Biofiltration

Once the UV filtration process is completed, the water is directed to planting beds via large sculpture-like fountains. The vegetation in these beds provides a final level of biofiltration which clears it of any remaining pollutants.



③ Canal

The purified water falls from the biofiltration beds into a concrete channel spanning over 200 meters long[12]. This channel transports the now purified water back into Lake Ontario.



Fig 5. Biofiltration bed and fountains - Photograph of the large fountains responsible for dropping water into the biofiltration planting beds. Used with permission.



Fig 6. Skating rink - Photograph of the skating rink around the Pavillion building during the winter time. Used with permission.

This park is revolutionary in Canada when it comes to stormwater management and water purification. It provides a precedent for how nature and technology can be creatively implemented not just for filtering the water, but for making a beautiful place for people as well.
Its design allows various levels of interaction between people and the processes of the park. The beautiful fountains stand out, especially when the sun begins to fall. People can walk past the running water as it falls from the fountains, planting beds, and along the canal.

Even more interesting is how some of this filtered stormwater is reused for recreational activity. The park's public splash pad provides a place for children to play in the summer, reusing the captured stormwater to do so. This programming even extends to the winter, where reused stormwater is used to create a recreational ice rink[13]. Overall this project provides a park that is both a recreational hotspot and is part of a larger holistic approach to making Toronto more environmentally sustainable.



Fig 7. The Quiet Esplanade Aerial - photograph. Used with permission.

The Quiet Esplanade

Location: Montreal, Quebec

Landscape Architect: Fauteux et Associés

Architect: FABG Architects

Date: 2011

Area: 0.5 Acres

The Quiet Esplanade is an iconic project in the heart of downtown Montreal, specifically at the intersection of Saint-Laurent Boulevard and Sainte-Catherine Street. The site is a large plaza that works in tandem with a building facade that borders it. The name pays homage to the Library Tranquille, which was located in this space previously[14].

The dynamic space provides a range of programming year-round, especially in the winter when the plaza is converted to a recreational ice skating using the refrigeration technology built into the ground. The connection between the building and the plaza is extremely significant. With a specifically designed facade providing a visual connection between the interior and exterior environments. The site is a destination point for people far beyond the surrounding neighborhood, but especially for the residents of closely placed residential apartment buildings.





The exterior public space contains elements that make the space appealing year-round. The area contains a range of furniture, fences, and planters, both movable and permanent. This allows the site to be programmable to accommodate differing events. Chairs and a staging area make the area an excellent place for concerts and festivals that take place during the year. With movable seating areas and tables, providing spaces for people to have coffee or take a break from work. The movable furniture elements are stored in the basement of the building when not being used.

The materials used in the design of the Esplanade further help create connections between the building and exterior space. White concrete, granite pavers, and specifically designed street lamps help to mark out differing spaces throughout the site.

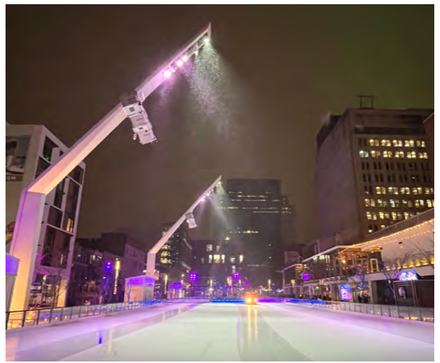
The building provides a range of programming within it. Including a restaurant, cafe, and library. The facade that faces the plaza is largely glass, with alternating balconies on the upper floor. This provides the people in the building with a closer connection between these environments.

During summer, the glass windows at the base level of the building can be entirely removed, further blending the indoor and outdoor environments. The building also houses green roofs and high-end materials in the facade that benefit create a more sustainable structure. The plantings there also grow food that can be used by the restaurant below.



Fig 8. The Quiet Esplanade Photographs - Photos illustrate the connetions betweeen the exterior public space and the interior buildings. Used with permission





The Quiet Esplanade transitions to a public skating surface during the winter months. The massive projector lights illuminate the ice surface with interactive animation, such as schools of fish that disperse around skaters. The recreational skating is free of charge, making the plaza that much more attractive for people. The building and plaza continue to benefit each other this season. Restaurants and lounge areas in the building provide a warm respite from the outdoors while still overlooking the scene. The main floor also contains lockers and a skate rental program. They offer good quality gear that is constantly resharpened to provide the best possible experience for visitors.

The skating rink uses refrigeration technology to help create a well-maintained and smooth ice surface. With the implementation of this technology, the ice surface can remain in good skating condition in temperatures up to 10 degrees Celsius[15]. The technology used in this project involved an innovation that avoids the use of gases such as ammonia, which are harmful to the ozone layer[16]. Mechanical engineer Claude Dumas, who worked for the city, was largely responsible for this new strategy that made creating outdoor rinks more environmentally sustainable[17].



Fig 9. The Quiet Esplanade Winter - The various photographs were taken during the winter months when the plaza is converted to a recreational skating surface.

City of Winnipeg: Constructed wetlands

Retention ponds, or Constructed wetlands, are man-made water bodies that are designed specifically to manage and store precipitation that runs off from surrounding development[18]. These waterbodies typically, but not always, include a specific level of permanent surface water, while including additional capacity for larger storm events. The purpose of this strategy is to capture stormwater using processes inspired by nature to reduce the load on Winnipeg's combined sewer system[19].

Retention ponds are designed using a variety of approaches. The differences between pond designs can be attributed to a variety of factors. These factors could relate to the site context, aesthetics, or scale.

The design of these ponds are often inspired by nature's natural ability to deal with stormwater, especially wetlands. Similar to natural wetlands, constructed ones often plant emergent species of vegetation, often cattails, due to their ability to filter pollutants out of the water.

These ponds can provide additional benefits for communities that go beyond stormwater management. They provide recreational opportunities for people, creating beautiful park spaces. This would also help to boost property value for places with views over them. They can also provide habitat for a wide range of wildlife, such as birds, insects, and even amphibians.

The city of Winnipeg lists 3 differing types of designed retention ponds used throughout the city, those being: traditional, natural, and dry[20].



Fig 10. Urban retention pond - photograph of a retention pond in the Winnipeg city limits. This pond exhibits qualitites of both traditional and naturalized ponds.

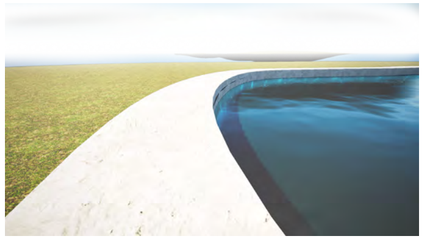






Fig 11. Retention pond types - rendered images showing the typical aesthetic quality of the most common retention pond styles used in Winnipeg.

Traditional

Traditional ponds are often designed to provide stormwater storage, ornamental value, and reduce maintenance. This form of retention pond is typically defined by a border of concrete or stone. Surrounding this landscape is a typical lawn grass. These are the elements that make these ponds easier to maintain. Workers can reach the water edge without being hindered by dense wetland vegetation or overgrowth. Additionally, the lawn can easily be mowed.

Naturalized

Naturalized retention ponds are designed to function similar to natural wetlands. They typically have a gradual slope planted with a range of wetland vegetation and native grasses. The goal with many of these ponds is to take advantage of natural processes to filter pollutants out of the water. They are provide habitat for species of birds and insects. However, these ponds must be regularly inspected and maintained. They have the potential to overgrow or become home to invasive species.

Dry

Dry retention ponds are inspired by natural processes as well, however unlike other ponds this strategy does not include a permanent level of standing water. Instead, they appear to be more meadow than pond. They rely on natural processes such as infiltration from dense vegetation to absorb stormwater. When heavy precipitation or snowmelt occurs the soil can become fully saturated, which may leave them with a temporary level of surface water.

Retention pond vs natural wetland

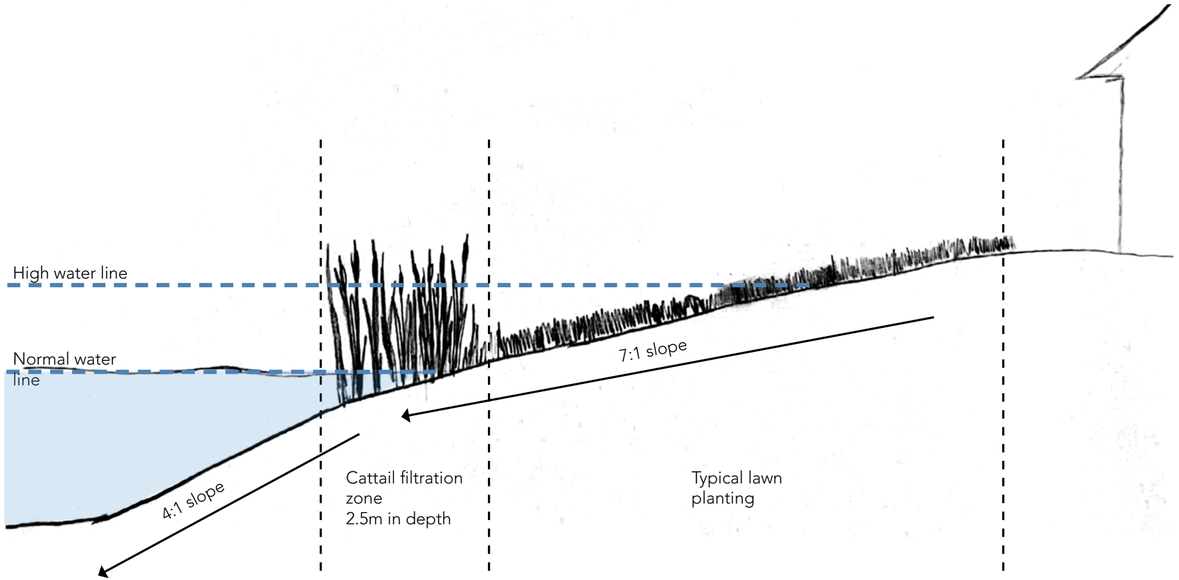


Fig 12. Retention pond standard - The sketch illustrates a standard retention pond design used by the City of Winnipeg.

Winnipeg's standard design strategy for retention ponds provide a general template for many ponds throughout the city. They often begin with the typical lawn grass plantings gently sloping away from people's property. Past those property lines, the site slope becomes steeper as it approaches the pond. The edges of ponds often abruptly transition into a zone of emergent vegetation, most often using species like cattails. The slope in and around these ponds is also standardized. The pond's surroundings have a modest slope of 1:7, which is required for planting the specified vegetation. As you approach the water level, the slope drops dramatically. This strategy is used to maximize the storage capacity within these ponds. The storage calculations are made by engineers for specific potential storm events. Functionally, these ponds do a good job of providing the necessary storage space to deal with significant storm events, but there are concerns as to how well they function as a habitat.

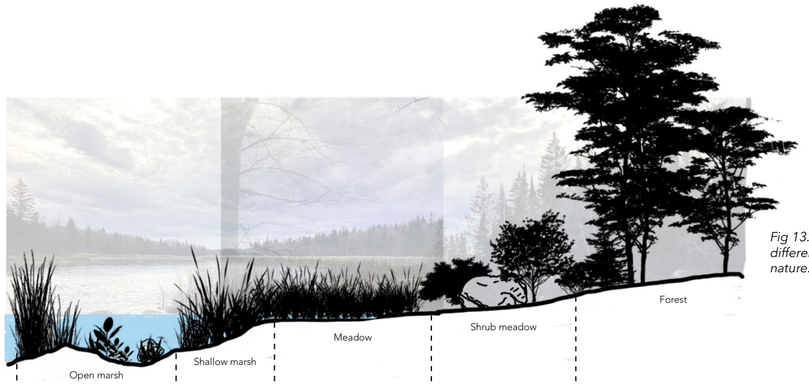


Fig 13. Wetland sketch - The sketch provides an example of the many different vegetation zones that exist in around wetlands found in nature.

Looking at a sketch of a natural wetland environment against Winnipeg's standard retention pond displays substantial differences that may reduce their effectivness as habitat. For one, wetlands found in nature are surrounded by varying zones of vegetation. Throughout these zones, there are unique conditions that benefit specific species. These conditions often stem from varying levels of moisture and nutrients that pool in these areas. These conditions then provide habitat for wildlife who benefit from the resulting zones.

This is where Winnipeg's urban solutions may fall flat. Lawn grasses that surround these environments are consistently mowed, and potentially even sprayed with chemicals to eliminate weeds. This is due to property design codes, and create an "acceptable" aesthetic for people. The result is a minimal level of biodiversity, which may not even include native species, hence the lawn grass.

Wetlands are nature's way of filtering pollutants and excess nutrients from water. The specific species planted around these ponds are chosen too help filter pollutants. Species such as cattails are especially potent at sapping excess nutrients from submerged environments. For this reason, they are a popular choice around constructed wetlands.

What constructed wetlands may not account for is how much time it takes for this vegetation to sap out pollutants. Or how many different species contribute to the final result. The limited space and species used in constructed wetlands may not provide the same level of biofiltration as a natural wetland. The result are ponds with poor water quality, which could make the water unsuitable for many animals to inhabit.

This argument extends to the ecosystems that exist beneath the surface of the water in even more ways. The sudden and steep slope used in constructed wetlands beneath the water may provide more stormwater storage, but the caveat is that it doesn't seem to be suitable for the growth of submerged and floating plant species. This of course has a snowball effect on wildlife, reducing habitat, cover, food, and other essential elements. Overall this results in a reduced level of species that may normally be found in wetlands.

Wetlands are diverse and complex ecosystems that provide habitat to countless species. The ecosystem services they provide extend beyond this as their ability to manage and treat stormwater is why people attempt to use them in water management strategies.
The discrepancies between natural wetlands and retention ponds begs the question of how can they be improved to not only manage stormwater but provide healthier habitat as well.

Dragonflies



Fig 14. Dragonfly photograph

Why Dragonflies?

Dragonflies belong to an insect group called Odonata, which includes orders such as darners, and damselflies. These insects have existed for over 250 million years, and remain relatively unchanged[21]. While not being considered a keystone species, these insects are closely tied to the health of aquatic ecosystems. This is because they require specific environmental conditions to go through their lifecycle stages, making their populations an excellent indicator of the health of these wetlands.

In nature they feed on pests such as mosquitos and midges, both in the aquatic environment and in the air. They are formidible aquatic predators as well, potentially even a top predator in wetland environments that cannot contain larger fish[22].

Concerns over the true ability of Winnipegs constructed wetlands ability to replicate habitat have inspired a proposal that includes a greater focus on creating a healthy ecosystem. To do this a general understanding of the lifecycle and environmental conditions required to support Odonata Due to Odonata's connection with wetlands, it is also theorized that creating habitat for them would create habitat for a greater range of species as well.

Lifecycle

The beautiful and elegant flying form of the Dragonfly is easily recognizable for their streamlined body and large wings. However, despite this form being most commonly attributed to the insects, their lives begin in the water. After mating, Dragonflies perch on either a floating lilypad or other floating debris, and lay their eggs in the water. The eggs that hatch give way to the nymph, which is an entirely aquatic form. While in in the form of a Nymph, they are just as formidable if not more so than the flying adults. They feed on virtually anything they can reach including mosquito larvae, fish, and amphibians[23]. When the Nymph reaches maturity, it will climb out of the water, often on emergent wetland grasses, and shed its skin to reveal the adult form.

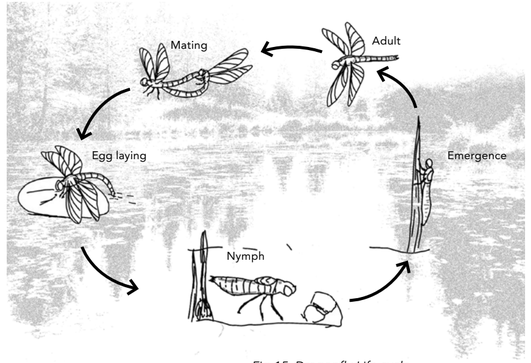


Fig 15. Dragonfly Life cycle

The duration of time that Odonata remains as a nymph varies. Some species can hatch from an egg and go through the process of metamorphosis within a single summer. However, many can take multiple years to go through this process[24].

In the form of an adult, Dragonflies are dominant predators of the insect world. Among the most efficient fliers, they can reach speeds of almost 50km/h[25]. With an ability to pivot at near 90-degree angles making them not just faster but more agile than their prey.

Despite their prowess as hunters, Odonata are also an important food source to many species of birds and bats[26]. They are an important part of the natural food chain, with their populations then being linked to the healthy ecosystems in nature.

Benefit of Dragonfly ponds

As mentioned, Dragonflies and Odonata in general, play an important role in the health of wetland ecosystems. However, further increases in human development and climate change have made viable habitats sparse. Wetlands have largely been displaced by agriculture and cities, leaving remaining habitats isolated[27]. These breaks in habitat also reduce the ability of populations to spread to new areas. Moreover, with the influx of human activity, there is no guarantee that these areas are even viable habitats for Odonata.

A greater focus on a naturalized stratagies to combat issues such as stormwater retention can also create habitat islands, allowing species to move through cities[28]. Furthermore, this benefits more than just Odonata. As their population connects with species up and down the food chain, expanding on their habitat could bring substantial levels of biodiversity with them.

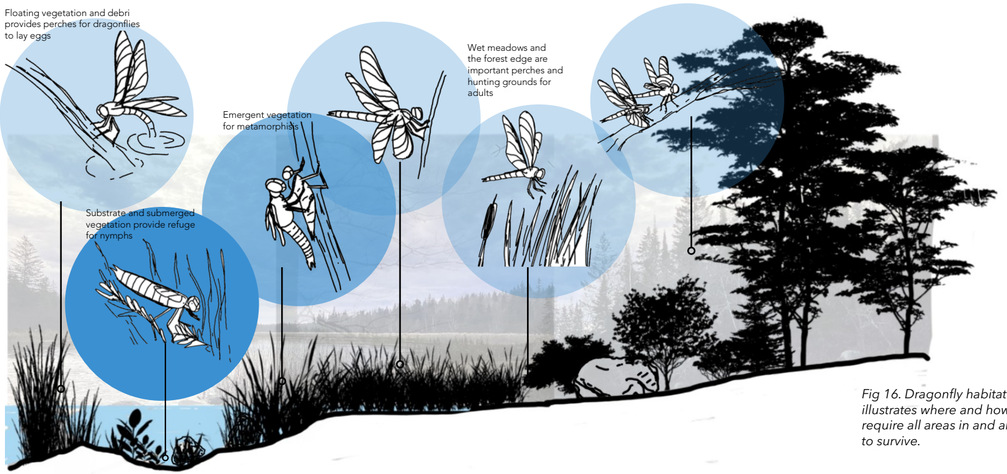


Fig 16. Dragonfly habitat - This sketch illustrates where and how Dragonflies require all areas in and around wetland to survive.

How to design habitat for Dragonflies

When designing habitat for Dragonflies, the key focus will revolve around simulating the conditions of wetlands found in nature. Not only this, but the designed environment must also be resilient to the harshness of the local climate. Including resiliencey to everything from, pollutants, droughts and winters that can drop to -40 degrees celcius.

All Odonata share the same key requirments for a viable wetland habitat. These elements provide them with the areas needed to go through their lifecycle. Important considerations include high levels of water purity, vegitation for cover or perches, and a regular food source[29]. It is important to look at how these species live in and around wetland environments to help understand the necessary relations a designed pond must provide.

The reason Dragonflies are so linked with wetland habitats is that almost every aspect of these environments plays a key role within their lifecycle. Beginning with subtle factors, such as floating vegitation providing the perch where adult dragonflies can lay their eggs. Submerged and floating vegitation provide the space for Nymphs to hide from predators, regulate body temperature, and hunt for food. The emergent vegitation along the shorelines are where they crawl from the water and spread their wings to fly away. Even the surrounding meadows and forests are the areas where adults continue to need perches and hunting grounds.

Designing a Dragonfly pond

Odonata are capable of surviving in habitats ranging in size but require a minimum of 4 square meters[30]. However, smaller areas do make it more difficult, so larger ponds tend to be more attractive and create healthier populations. Whether the shape of of a pond is organic or geometric is largely irrelevant. It is more important that it supplies the depths and vegetation to simulate a natural wetland.

While the size and shape is flexible, the depth is an essential consideration when designing a habitat. The minimum pond depth required is 30cm[31], but this would only benefit the few species that go through their entire lifecycle in the summer. The species that hibernate over the winter time must have a depth that keeps them out of winter frost line. A depth of 70cm can provide resilience to a mild winter. A more robust design would provide depths of 1-2 meters, which provides more resilience to harsher winters[32]. Providing different depths in a single pond is also important to simulate the natural environment[33]. This also creates differing micro-climates within a single pond, which is important for nymphs to regulate their body temperature.

The vegetation in and around wetlands can make or break it for the Odonata habitat. On the topic of temperature regulation, ponds should not be placed near trees. The shade they create might cool the pond too much. Falling leaves and debris may also contaminate the water as they decompose[34].

Emergent vegetation on the edges of wetlands is important as perches and areas for nymphs to crawl out of. However, what is often missed in larger stormwater retention ponds is the submerged and floating vegetation. Nymphs live their lives hiding in between submerged and floating vegetation. Without it, they have little defense from predators and the elements.

The areas around wetlands are also important for attracting Odonata and other species. The vegetation around these areas, often in the form of meadows, is the hunting ground for adult Dragonflies. These areas can be made up of a range of prairie grasses, shrubs, and wildflowers. Not only do these environments provide grounds for Odonata, but they also bring a wide range of species, including birds and pollinators. The arrival of this helps build biodiversity and create a healthier ecosystem.

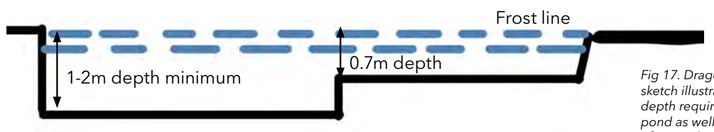


Fig 17. Dragonfly pond depth - sketch illustrates the minimum depth required for a sustainable pond as well as providing a variety of water depths.

Maintenance

Establishing a new habitat will require maintenance while the new vegetation matures. This is especially important in the early stages of the pond's development. It takes time for the planted vegetation to establish itself, and before that happens, the pond is susceptible to algae and pests such as mosquitoes. An influx of nutrients causes algae growth, and newly planted vegetation will not be able to filter these pollutants out yet. As they mature, the algae will be reduced, but in the meantime,it would have to be removed manually. A similar sentiment is shared for dealing with mosquitoes. As vegetation is maturing, Odonata are less attracted to these ponds, resulting in an overabundance of mosquito larvae. There are bio-friendly substances available that can reduce their numbers, but as time goes on, the nymphs will control those numbers.

An established pond will continue to require maintenance and regular upkeep. This is necessary to keep an eye on potential invasive species or debris that builds up in the area. Natural wetland vegetation may also overgrow, taking over unwanted areas and reducing habitat. This must also be regulated, either by taking out the overgrowth or placing the vegetation in specified planters to begin with.

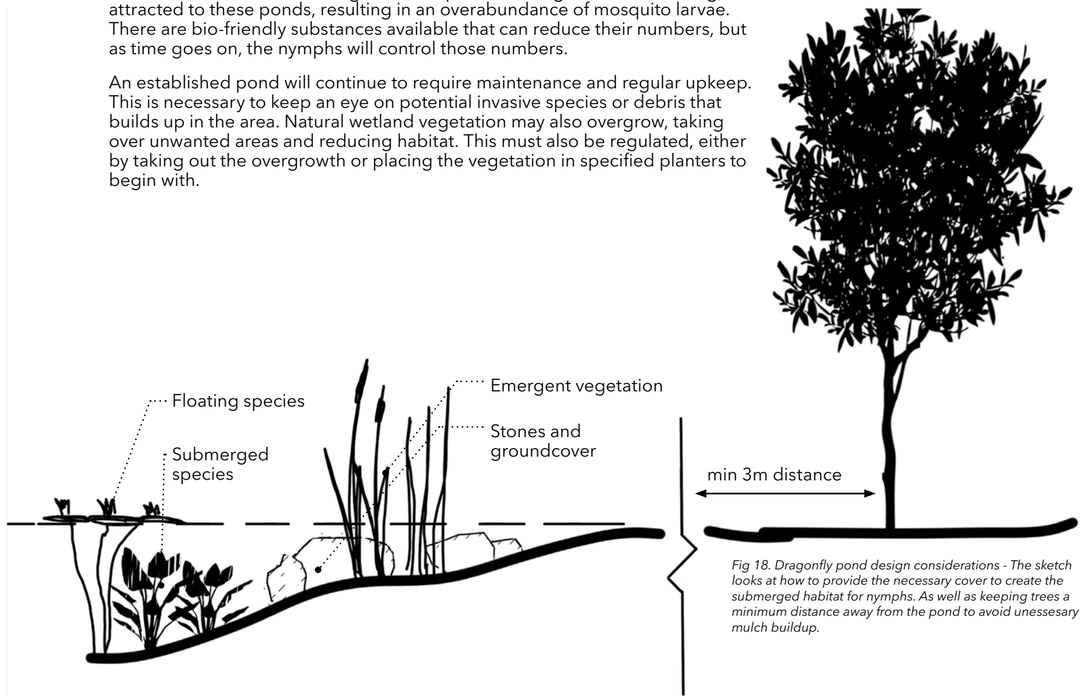


Fig 18. Dragonfly pond design considerations - The sketch looks at how to provide the necessary cover to create the submerged habitat for nymphs. As well as keeping trees a minimum distance away from the pond to avoid unessesary mulch buildup.



Chapter 2:
Inventory & Analysis



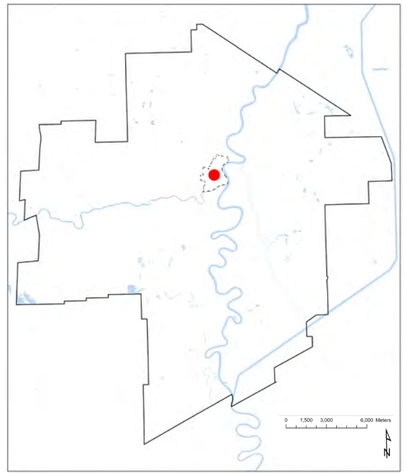
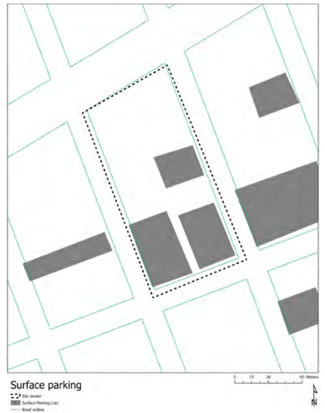


Fig 19. Existing site aerial (above)
Fig 20. Winnipeg site boundary (right)

Site location

The site location for this project is an urban block of downtown Winnipeg. It is located in the multi-use sector, mainly used for workers but with some residential in the area. The block is framed by Portage Avenue to the north, Graham Avenue to the south. Garry Street and Smith street sit to the east and west.





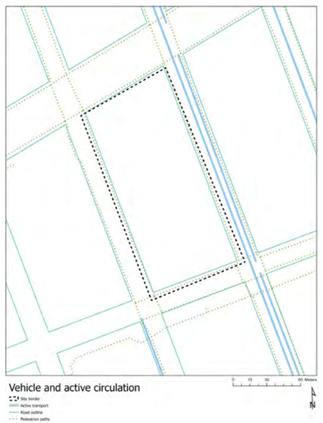




Fig 21. Landuse maps

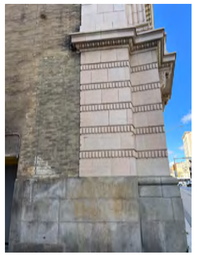
Landuse

This site provides a typical look at most city blocks of downtown. The site is made up primarily of buildings and surface parking. The buildings that sit within the site are primarily for workers and businesses, some of which include a bar/restaurant, hair salon, cafe, and office space.

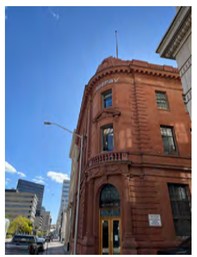
As is typical of downtown, significant space is dedicated to surface parking. The blocks around the space are similar, despite there being regular street parking and a parkade nearby.

Pedestrians are provided with sidewalks that border the city blocks, with crossings located at the intersections. There is a cycling route located on the far side of Garry Street.

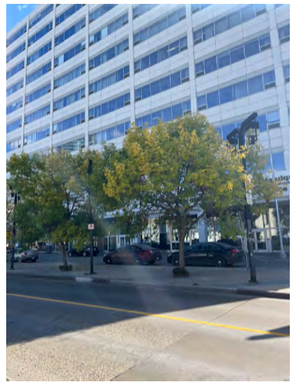
There are a few street trees on site, situated primarily along Graham Avenue to the South. There are a few planters along Portage Avenue to the North, but those trees appear to be struggling in those conditions.













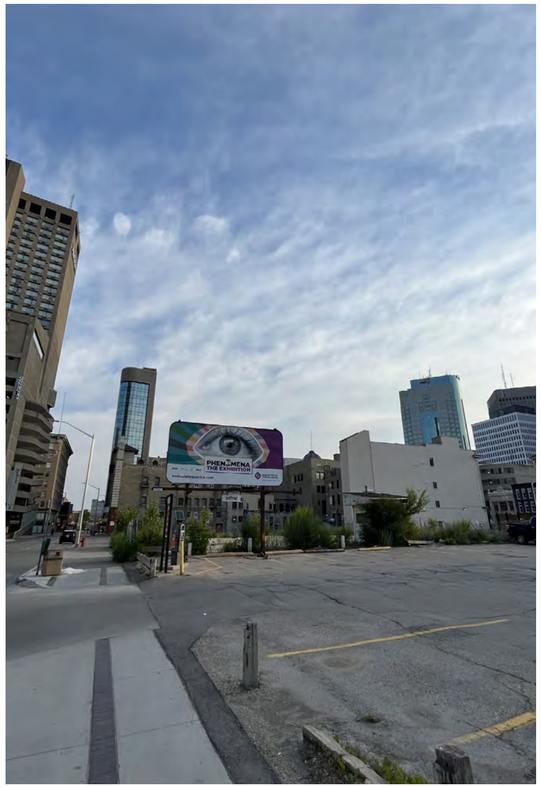
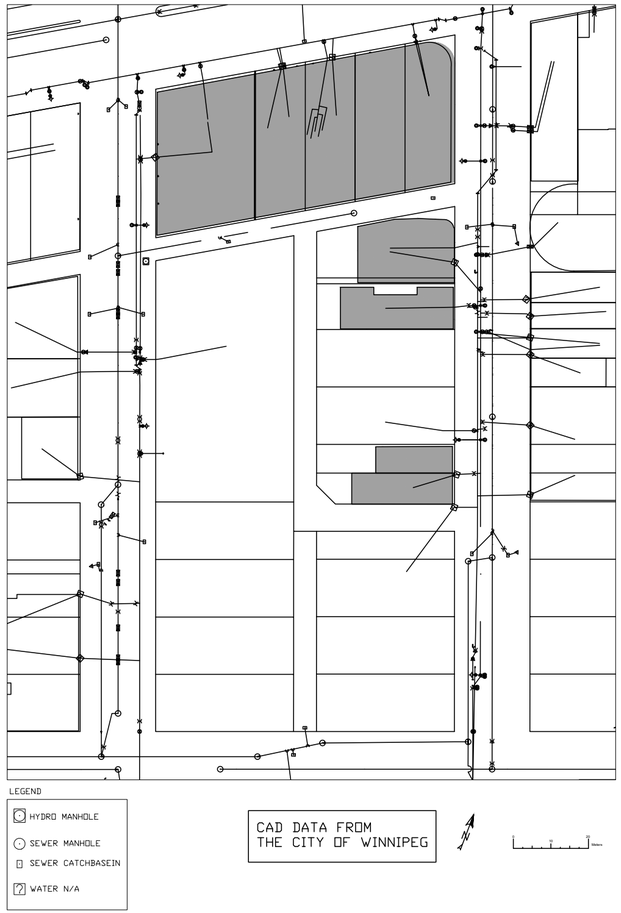
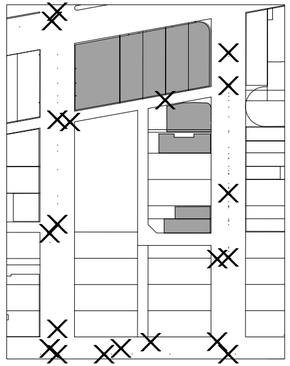
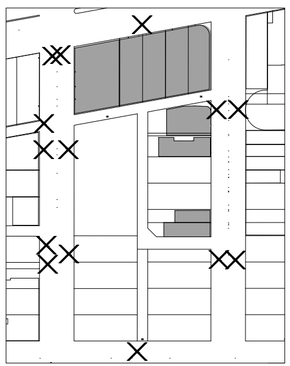


Fig 22. Site Photographs - Photographs from the sites existing conditions illustrate the various characteristics. The buildings on site bring some heritage-type aesthetics through a variety of architectural styles and use of materials. The photos also highlight the dominant surface parking, or the gravel lot, which remains entirely unused.





Manhole cover locations



Catchbasin locations





Fig 23. Site area drainage - Sourced from the City of Winnipeg, the detailed drawing of the site area illustrates the undergound drainage system of the area. Used with permission. Photographs (above) illustrate what the surface drains look like

Drainage

Stormwater and snowmelt is sent directly into the combined sewer system on this site, and most city blocks in downtown. Water runoff originating from rooftops, surface parking, main roadways and service roads are captured via manholes and catch basins. These drains are located primarily on the roadways especially at intersections.



Fig 24. Image of current downtown Winnipeg, Graham Avenue

Graham Ave Redesign 2050

Centerplan 2050 has developed a proposed redevelopment of Graham Avenue which would turn what was a bus only road into a pedestrian corridor.This development would help to create a pedestrian hub for events, concerts, and sports. This new pedestrian corridor would come with enhanced potential for new residential developments.

The re-imagining of Graham Avenue would divide the road in 3 new zones: Shared Zone, Green Zone, and Celebration Zone[35]. These zones have yet to be exactly located. Each of the proposed zones would have its own character and focus.

- The Celebration Zone would focus on events, such as the NHL playoff Whiteout parties.[36]
- The Green Zone would focus on increasing tree canopy, planting and recration activities[37].
- The Shared Zone would be a shared street, where cars would be allowed, but the site would still be prioratize pedestrians[38].



Fig 25. Graham Avenue Renovation - The redevelopment of Graham has already begun as of July 2025. Painting of the streetscale, boulders, planters and street furniture cut of vehicular traffic and promote the pedestrian experiance.

Climate and Precipitation

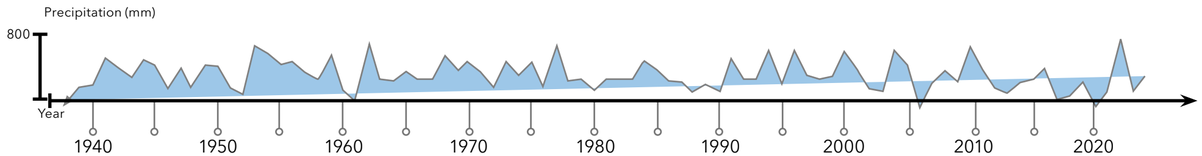


Fig 26. Winnipeg's precipitation history - Winnipeg's precipitation data spans back to January 1st, 1938. This data displays the total precipitation levels per year. Over this span the annual average precipitation is: 521.1mm
The high being; 766.4mm in 2022
The low being: 266.9mm in 2006

Winnipeg's annual precipitation levels can range drastically from year to year, which is illustrated by looking through data compiled since the late 1930's. Understanding these tendencies may provide insight to what you can expect a stormwater management system could have to deal with. The data can also be used to understand climatic patterns, revealing how these precipitation numbers may change in the future.

The graph used to display Winnipeg's precipitation levels provides a few key patterns that could impact the design strategy. Firstly, the graph shows the annual rainfall in millimeters (mm). When looking at this data over this period you can extract average precipitation values (shown in blue on the graph). As you approach the modern day, there seems to be a greater variance from year to year. Essentially one year there are more dramatic storm events than normal, and the next is a drought. These values also seem to be increasing in severity as time goes on as record high and low precipitation levels both occur after the year 2000.

These numbers provide insight as to how global climate change may be altering the precipitation patterns over Winnipeg and Southern Manitoba. The increasing severity of drought specifically, is having a detrimental impact on the environment. Significant changes in temperature result in an increased frequency of wildfires throughout the province. On the other note, extreme precipitation events and thunderstorms have the potential to create flood events that threaten existing infrastructure, such as Winnipeg's combined sewer

Climate Projection

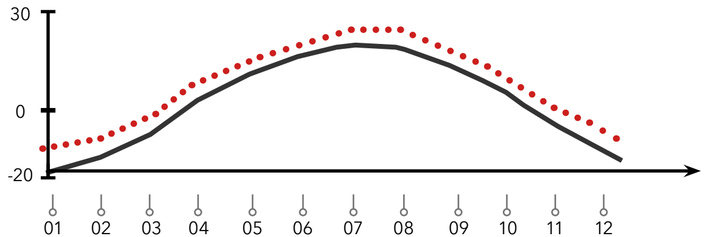


Fig 27. Winnipeg projected future climate - Graph displays Winnipeg's current median temperatures throughout the year compared with the projected future median by the period 2050-2080

system. These flash events could also then lead to flooding that damages built infrastructure.

As the climate continues to warm, extreme events including droughts and storms become a more continuous occurrence. Temperatures will also continue to rise as displayed in the above graph. Where the dotted line displays the average temperature values from 1976 - 2005. The solid line displays the projected climate for the years between 2051-2080.

These future climate projections and significant storm events would further create challenges for urban environments and infrastructure. Therefore this data reveals a necessity for new stormwater management strategies to have a level of flexibility. On top of the necessary ecological considerations, any new strategy must be resilient to more extreme drought and storm events.

Stormwater calculation

Researching the existing and future climate provides an understanding of the environmental context around the chosen site area. However, creating a successful stormwater management system does not require designing for the entirety of annual stormwater. Instead, the newly designed system must be able to withstand the water from specific storm events. The reason for this is that these individual events are what overwhelm Winnipeg's sewer systems. Precipitation that sporadically lands throughout the year can typically be handled and flushed through the system without overloading it.

These specific events that are used as the standard for stormwater management strategies are organized by approximate frequency and intensity. The most common examples used in Winnipeg are storms that occur either once in 5 years or once in 25 years[39]. Larger events such as the 1-in-25 events are used when dealing with significant areas, such as when designing a new suburban neighborhood. Given the compact space available in the chosen site, it was determined that designing for the 1-in-5-year storm makes the most sense. Designing for this event is theorized to provide a greater level of flexibility within the park. Therefore the design of the site can bring a greater focus on the experience for people, creating habitat, and still meet the technical requirements.

Equation

The calculation used to determine the combined stormwater that lands on and around the site will be as follows:

$$Q = A \times I \times C$$

"Q" refers to the total stormwater runoff in meters cubed

"A" is site area in square meters

"I" refers to the amount of rainfall in L

"C" is the runoff coefficient. It can be described as the percentage of water that lands on a surface and becomes runoff without infiltration into the ground.

Finding the numbers for "A" and "C" are fairly straightforward. The area will is the total capture area in square meters. The runoff coefficients are constant numbers that differ depending on materials. Finding "I" requires a seperate equation:

$$I = \frac{100}{t + 18}$$ [40]

In this case "t" represents the duration of the event in minutes. The duration for this designed event will be over a 48 your period, or 2880 minutes.

$$I = \frac{100}{2880 + 18} = 0.034$$

The resulting value is plugged into the initial equation, which will provide the ability to calculate the amount of runoff that lands on the project area.

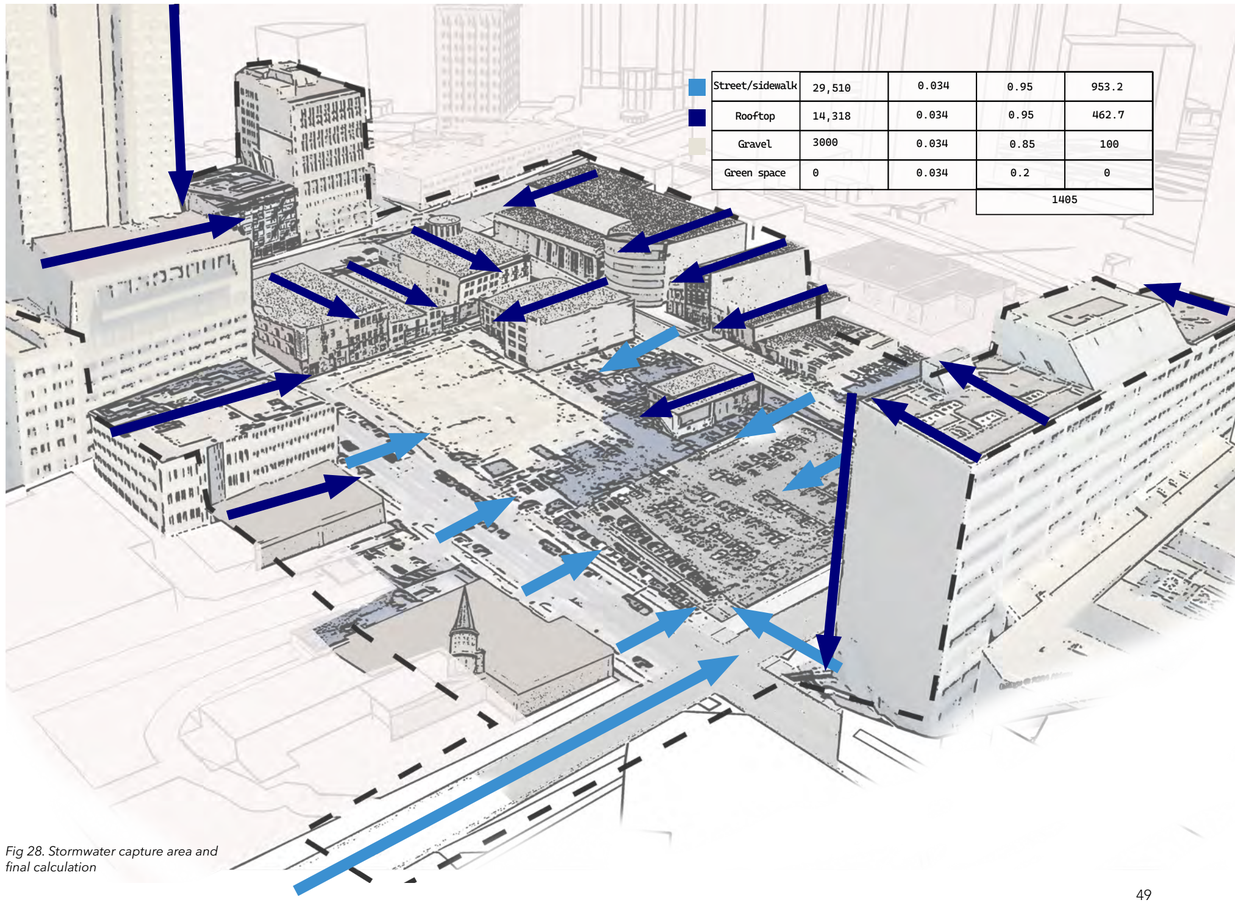


Fig 28. Stormwater capture area and final calculation



Chapter 3:
Design

Fig 29. Photograph of wetland in the Whiteshell Provincial Park

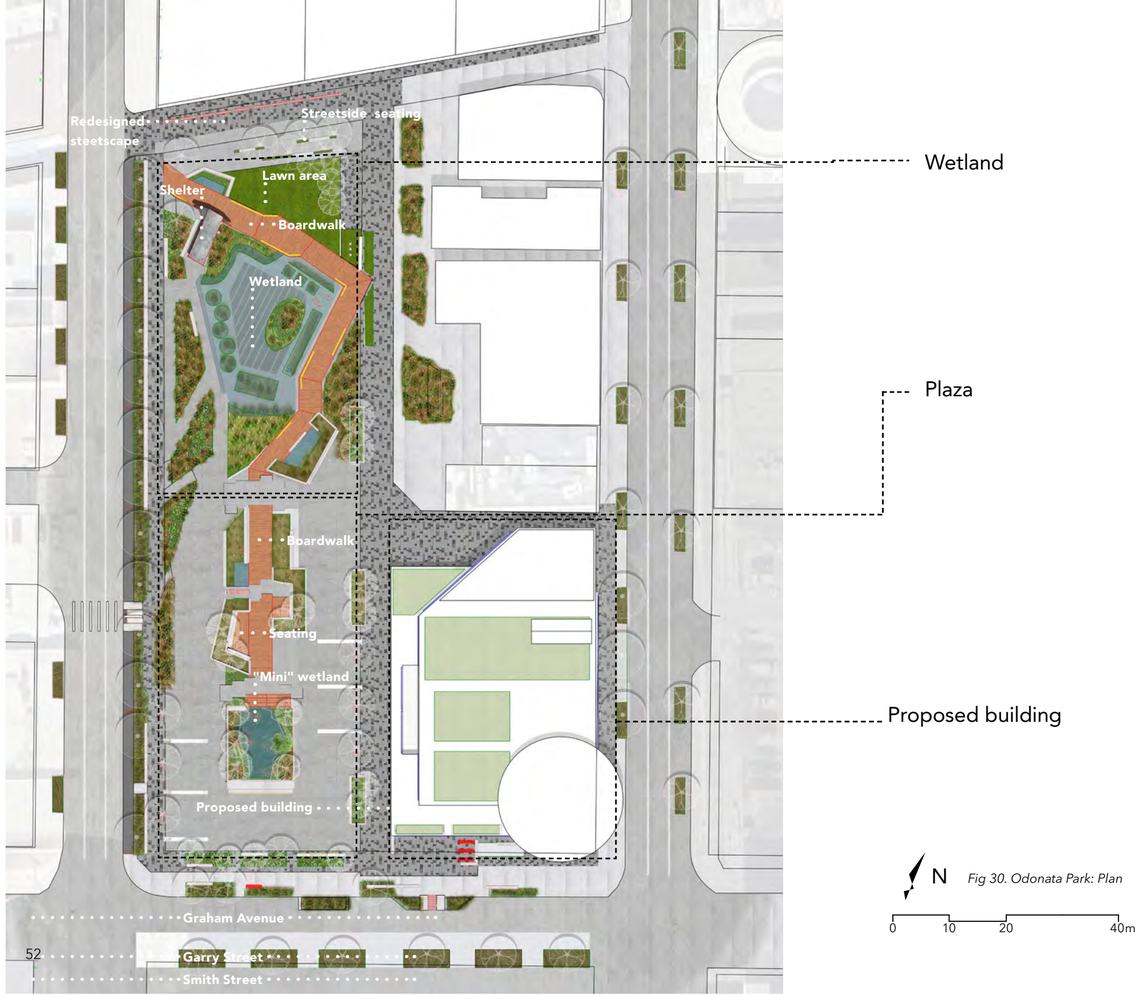


Fig 30. Odonata Park: Plan

Odonata Park

Odonata Park: A wetland park for downtown Winnipeg, was designed to holistically combine the ability to manage stormwater, create a habitat for native Odonata, and provide a destination for people in downtown. The design scheme focuses on 3 areas, the wetland, the plaza, and the proposed buildings.

The wetland serves as the focal point of the project, providing not only the primary stormwater container but also a healthy habitat. To the south of the wetland is the plaza. This area plays a role in stormwater filtration, as well as providing programming for people. The proposal of two separate multi-use buildings to replace the surface parking along Garry Street to the east. Together these buildings create a continuous facade that helps to frame the park. The building at the intersection of Graham Avenue and Garry Street has a more important role in the programming of the site and a role in stormwater management.

Overall the park design brings together previous research and analysis to improve urban sustainability, create a healthy habitat, and provide a destination for people in the heart of downtown Winnipeg.

Stormwater capture sequence

Researching urban retention ponds and Odonata habitat revealed a need to provide high levels of water quality to sustain habitat. Many urban ponds tend to rely on the small amount of planted vegetation around their edges to filter out pollutants. However, this method takes time and significant areas of vegetation, which are often not provided. Largely due to limited available space within urban environments. So to provide the necessary water quality means a greater focus on eliminating pollutants as quickly as possible.

Therefore to accomplish the goal of capturing stormwater and creating habitat the design must look beyond the typical means of water capture and filtration. Instead this project creates a more expanded sequence of stormwater capture. This would send captured water through different steps, each helping to reduce pollutants quickly within a confined area, with the final result being water quality that is pure enough to create habitat.

The stormwater sequence begins with

1. Stormwater capture
2. UV filtration and storage
3. Biofiltration
4. Wetland habitat
5. Overflow

Fig 31. Stormwater capture - The diagrams illustrate how and where each step of the stormwater capture sequence works within the park.



Stormwater capture

When precipitation events occur, the stormwater is initially directed toward a network of interconnected rain gardens. This network captures water from the site, roadways, and building rooftops.

UV filtration and storage

The raingarden network is followed by UV filtration technology, housed in the basement of the proposed building. This reduces pollutants drastically and when this process is complete, water is directed into an underground storage cistern.

Biofiltration

The storage cistern then proceeds to send the water into various planting beds, using the process of biofiltration to eliminate any remaining pollutants before the water replenishes the wetland.

Wetland habitat

The wetland is the focal stormwater storage unit on site. The water at this point is filtered of pollutants and alongg with the necessary planting scheme, becomes a viable habitat for Odonata, with the hope a wide range of species follows them.

Overflow

In the case of extraordinary precipitation events, the wetland is designed to overflow. Excess water gently flows north of the site and into the overflow drains at either corner of the boardwalk. This system sends water back towards the underground cistern. This excess water is stored for later use, or slowly drained back into the combined sewer system, now filtered of pollutants.

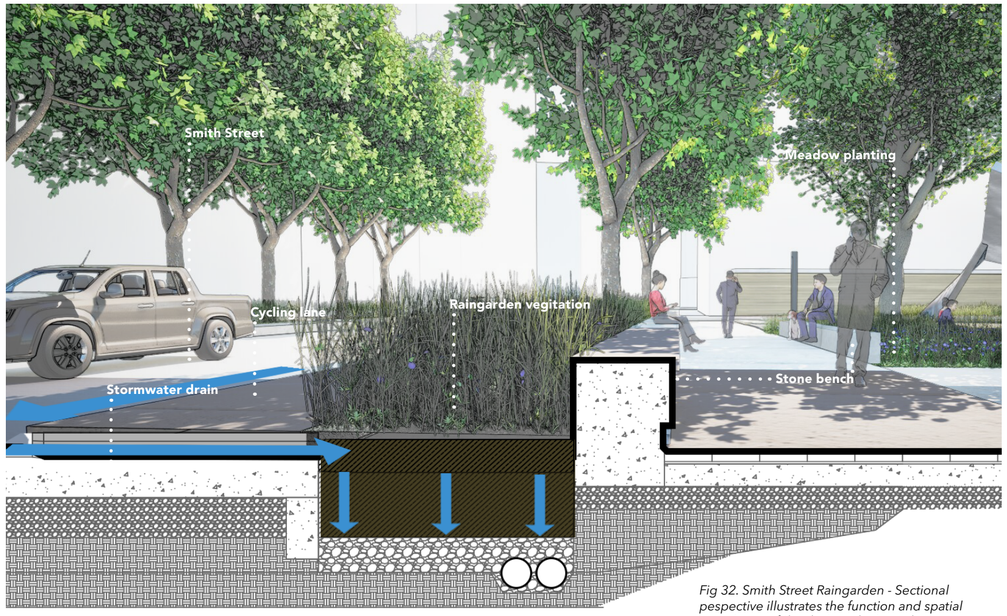
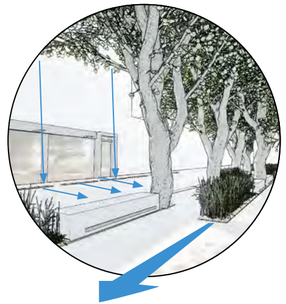


Fig 32. Smith Street Raingarden - Sectional pespective illustrates the function and spatial experiance of the designed raingardens.

Smith Street Rain gardens

The rain gardens that line the city streetscape are essential to help Odonata Park create habitat. Runoff from the buildings and streetscape picks up more than vehicle pollutants. The high levels of sediment and salt laid out by the city to combat slippage in the winter can prove devastating to natural habitats. These rain gardens are the first line of defense for the wetland, helping to capture some of these substances, but also provide a network that directs it away from the habitat.

This raingarden is bordered by a cycling lane and a sidewalk path. The cycling lane faces Smith Street and contains drains to send stormwater toward the planting. A continuous stone bench edges the sidewalk and provides an additional physical barrier that continues to impede splashing pollutants from infiltrating the habitat area. This also separates people from the streetscape and directs them towards the designed wetland.



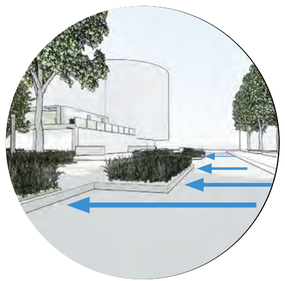
Redesigned Service road

The service road to the North of the site is to be redesigned to create a more pedestrian-friendly space. The buildings will be renovated with a facade and entrance facing towards the park. A seating area enveloped in trees is also placed alongside this road. The planting beds next to the benches are designed to be a part of the larger network of raingardens. These gardens help capture stormwater from this streetscape and the nearby buildings.



Garry Street

Garry Street is the road nearest to the proposed buildings, which means this environment is visually separated from the parking space. It is also a busy vehicular roadway meaning that providing areas for parking is important. The rain garden strategy along this road hopes to enhance the pedestrian experience while still keeping vehicle accessibility. The gardens provide a buffer between the road and the expanded sidewalk while encouraging people to interact with the newly designed buildings. The gardens also provide space between them to accommodate vehicle parking.



Graham Avenue

The raingardens placed along Graham Avenue are more sporadic and playful. Being a part of the newly designed pedestrian corridor allows this scheme to be less concerned with vehicular traffic. Having alternating gardens that extend out into the roadway also helps encourage people to move between them, possibly directing them towards the park. These gardens also provide the possibility of being extended further along Graham Ave, helping to expand the reach of Odonata Park further into the city.

Fig 33. Various Raingardens - Renders of the different raingarden beds illustrate how their forms vary in response to different contexts.

In nature, the vast meadows of reed grasses found in and around wetlands play a key role in the reduction of toxins and providing habitat. The challenge for Odonata Park is to create this environment within the confines of a single city block. Due to these restrictions, there likely isn't enough space available on-site to successfully filter pollutants using only vegetation. For this reason, the park incorporates a technological strategy to make up for the difference.

Proposed building

The proposed building in the SE of Odonata Park plays a crucial role in this step of the process. Given the urban context and limited open space, it is important to make use of the space provided by buildings in an effort to maximize the efficiency of the design. This strategy allows the building to serve a multitude of uses that enhance the park. Firstly, the building itself provides an opportunity for programming that helps bring people to the site. Within the building is space for proposed restaurants, cafes, storage, and other amenities. The design itself provides a multi-level open glass facade directed towards the park. A balcony on the second story continues this language providing an additional visitation point with a view over the site. This facade allows the interior space to seamlessly become part of the design.

UV filtration

The building also provides the necessary conditions to implement UV filtration technology to purify captured stormwater. UV filters need regulated temperatures to work, so the basement of the building provides the necessary conditions. The park would look to the technology used in Sherbourne Commons to filter water in this project as well. These units would easily be able to handle the amount of water this site is exposed to. They would also need to be located in the building to provide the regulated temperatures required for them to run.

Underground cistern

An underground storage cistern provides an additional level of storage for the park. The cistern is built 2.4 meters below ground level to keep it away from the winter frost line. The idea is that this cistern would help pump water toward the next step of the stormwater sequence. However, it also plays an important role in the resiliency of the park. Excess water not needed for habitat would be stored here, and function similar to that of groundwater stores in nature. The excess water stored here would be used to replenish the wetland should levels drop due to natural evaporation or drought.

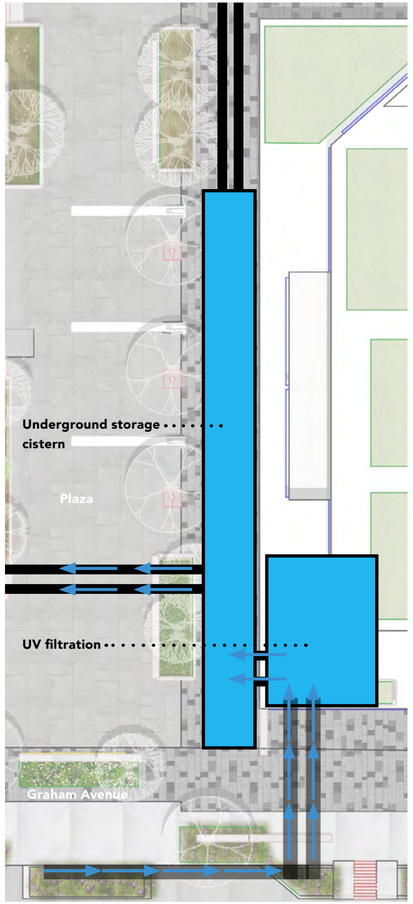


Fig 34. UV filtration and Storage Diagram - Illustrates the location of the UV filtration room and storage cistern in relation to the proposed building.

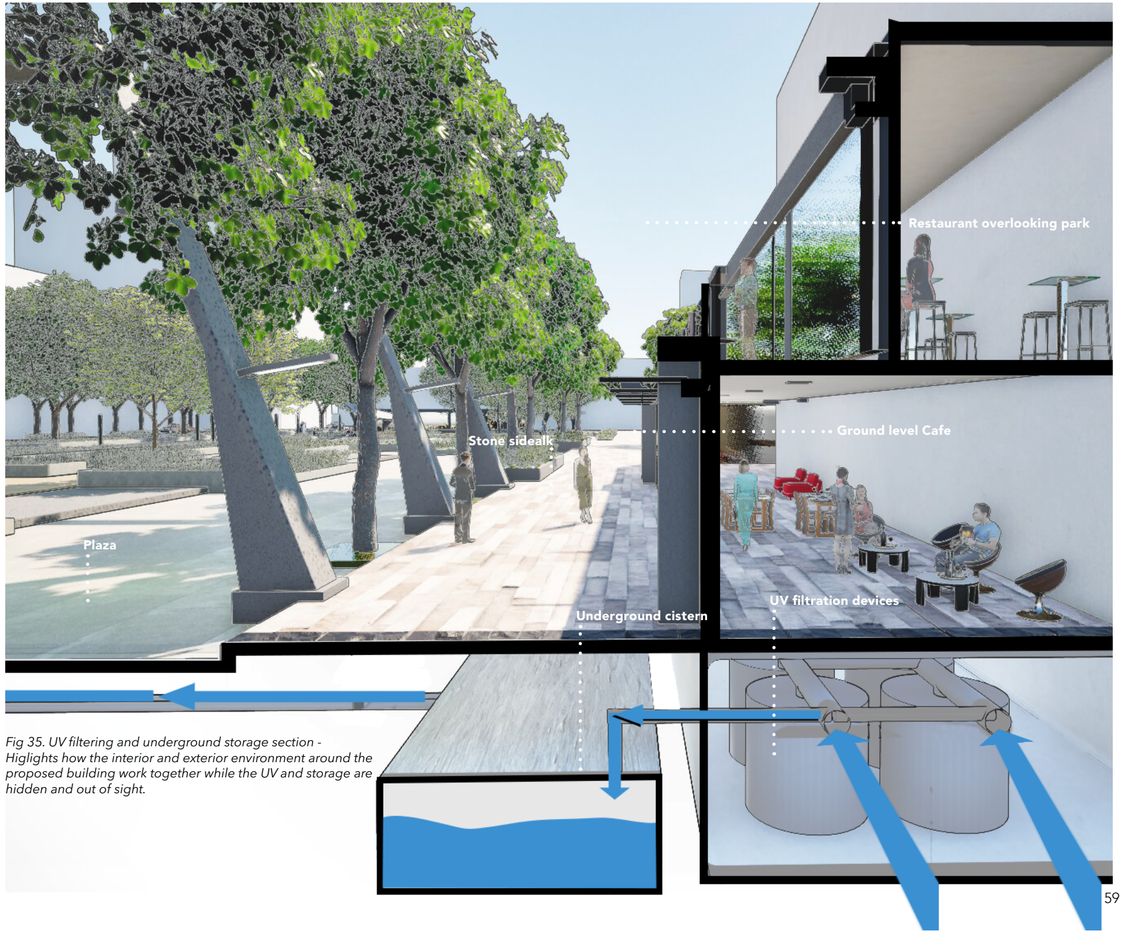


Fig 35. UV filtering and underground storage section - Higlights how the interior and exterior environment around the proposed building work together while the UV and storage are hidden and out of sight.



Fig 36. The Plaza - a programmable space for people while playing an important role in stormwater filtration, eliminating remaining pollutants to create a healthy wetland habitat.

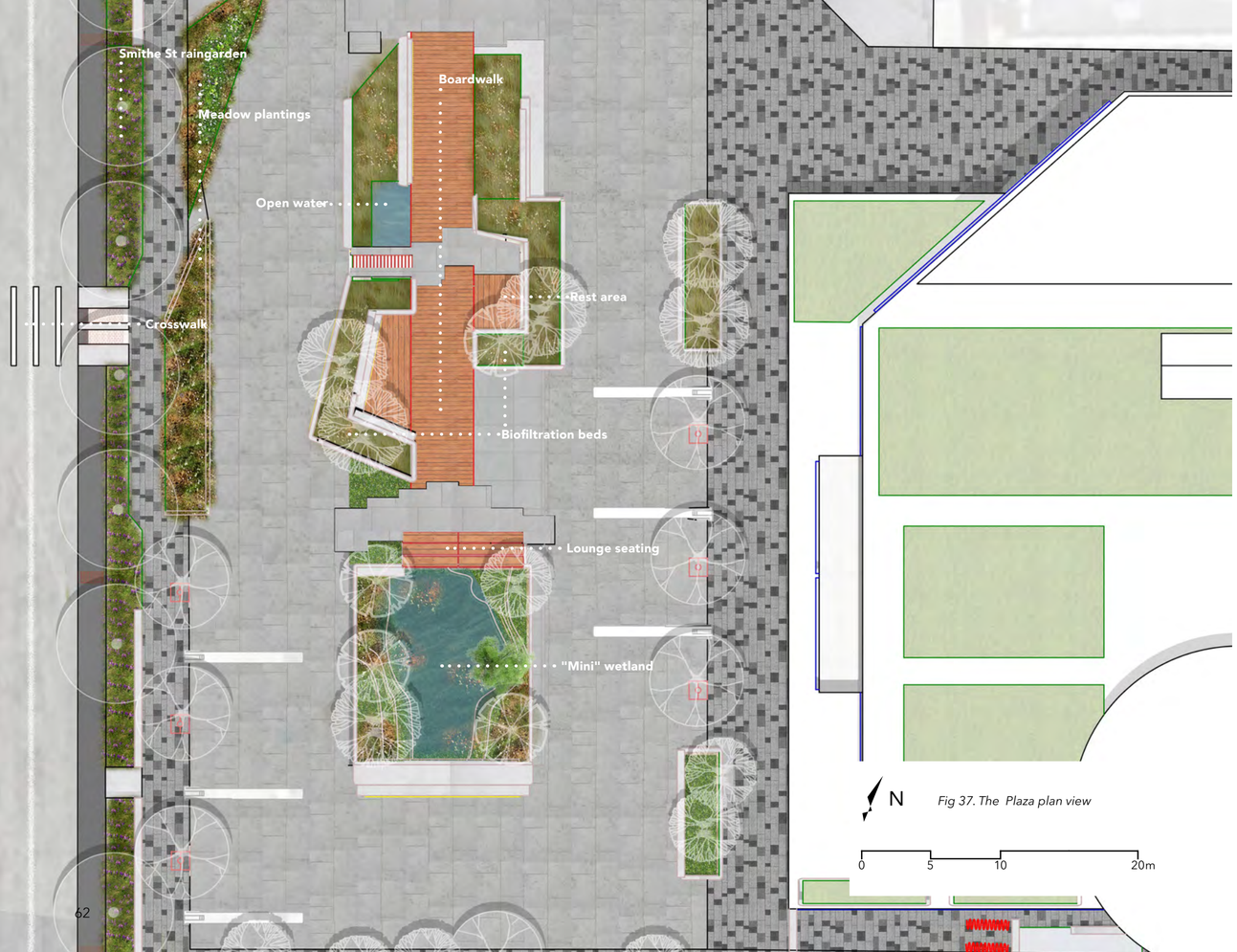


Fig 37. The Plaza plan view

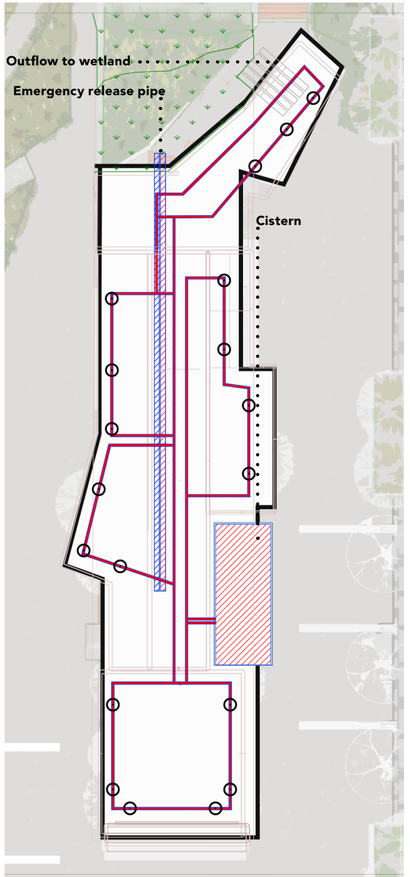
The Plaza

The plaza is designed to provide an open space for the people of downtown Winnipeg. Open spaces where people can gather offer a range of opportunities in a downtown context. They can provide a place for workers to have lunch or a venue for festivals.

The proposed building is an additional level that is designed to bring this space together. The building plays a role through providing space for cafes, restaurants, and storage. The interior of the building provides ample visual connection to the exterior space. Promoting people not only to visit the building but to experience the plaza as well.

The plaza also plays an important role in the larger goal of creating habitat and managing stormwater. The central planting beds that stem from the boardwalk are designed to provide a final level of biofiltration for stormwater.

This path becoming embedded between these planting beds not only provides a beautiful place for people to sit but also brings people closer to the processes of the site. These beds are made up of species that specifically help to reduce pollutants that remain in the stormwater, hence despite differing aesthetics, still play an important role in the stormwater process.



Biofiltration and seating area

The design of Odonata Park initially revolved around one all-encompassing storage unit. This single unit would contain the wetland, biofiltration beds, and the entirety of the 1-in-5 storm event. Throughout the design process, additional underground storage and UV filtration units were added. This was in response to the spatial limitations and the harsh climate. To handle this change, it was determined that the biofiltration area would not be able to store water through the winter as initially planned. Therefore it must be emptied before the frost arrives. The underground storage provided the backup plan and could hold excess water through the winter.

With that aside, the biofiltration occuring here remains an important step in eliminating pollutants before the water reaches the wetland. The filtration process occurs when the stormwater is transported from the underground cistern through a network of pipes beneath this area. The pipes move this water and disperse it into the various planting beds through small surface sprinklers. As the water is soaked up by the soil and vegetation the remaining pollutants are captured with it.

Once the water undergoes this process it remains in the storage area until it reaches a specified capacity. When this capacity is reached the now purified stormwater is directed through an outflow and into the wetland.

Surface sprinklers

Total Storage Capacity: 600 cubed meters

Fig 38. Pipe network diagram - Beneath the plaza, a pipe network circulates stormwater underneath ground level and disperses the water through small surface sprinklers. The overall system is used both to filter remaining pollutants as well as provide additional stormwater storage. The area provides an addition 600 cubed meters of space, and allows stormwater to flow gently into the wetland.

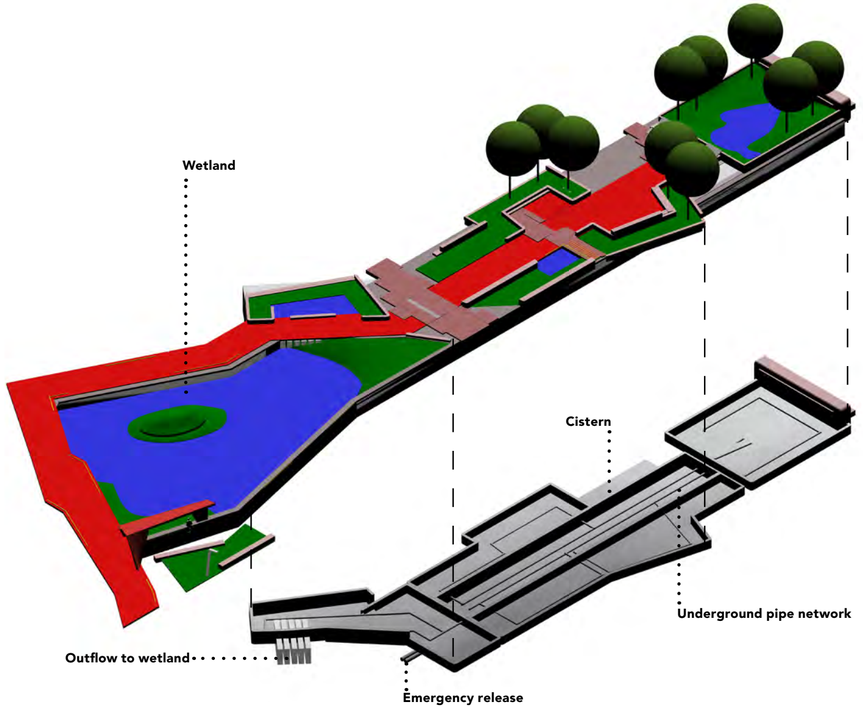
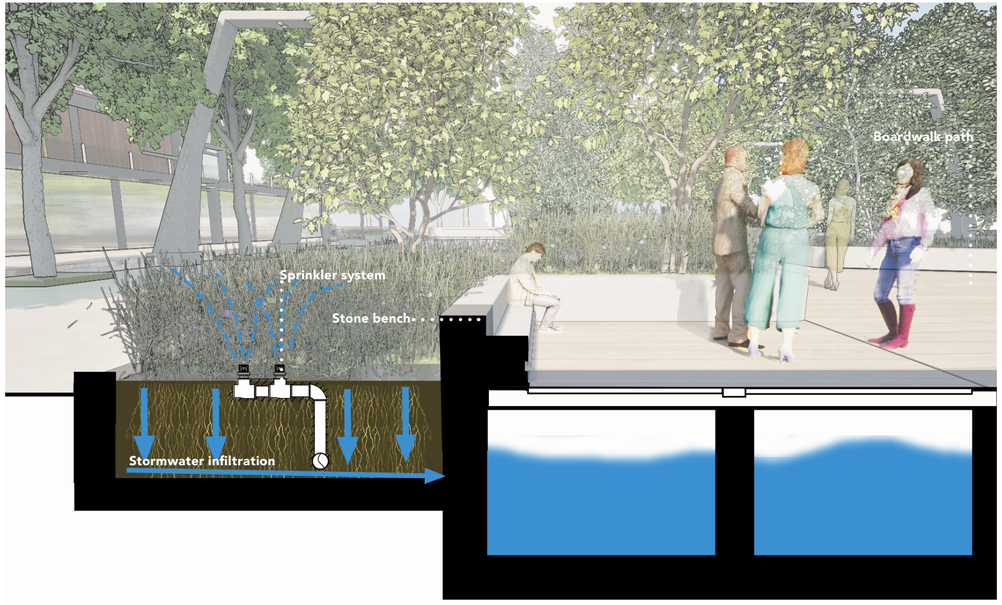


Fig 39. 3D model of Odonata park storage - Above displays how the wetland and biofiltration network designed as one continuous element.



Biofiltration and seating area

The biofiltration occurs close to visitors of the site. with the intention to connect people to the processes taking place. This part of the design intends to connect with peoples senses in various ways, including sight and sound. Visitors are able to see where the sprinkler system disperses the water in the planting beds, where it slowly infiltrates through the ground and into the central storage space. As the water enters the storage space, the sound can be heard through the planks of the boardwalk. This allows people to hear the flow of water as they sit in these areas. The sounds may bring a heightened sense of relaxation, as well as create an acoustic connection tying the plaza to the wetland.

Fig 40. Biofiltration section - The biofiltration beds envelope the boardwalk path as it enters the plaza area.





Fig 41. Plaza to building view - The space outside of the central boardwalk purposefully uses open concrete plaza allowing for a more programmable space for downtown.

Plaza programming

The area surrounding the biofiltration zone provides an open public plaza. This space is designed in conjunction to the proposed building next to it. The multi-level building includes a glass facade and balcony creating direct visual connections to the plaza, enhancing the sightlines from the building, and promoting the inside-outside connection.

The building also provides storage space for temporary elements such as seating and tables that can help make this plaza a nice outdoor place to have lunch during the day. This also builds a level of programmability to the site. This means that plaza can be organized to support any kind of event throughout the year. Whether the tables are placed for people to have lunch during the weekdays. Or seating for small public performances. The site could also conceivably springboard off the nearby Hockey rink and provide a space for outdoor viewing parties.

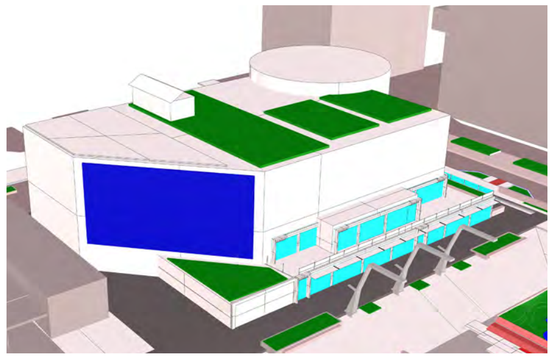


Fig 42. Building Model - During the conceptual development of the building it including various green roofs, glass facades, solar panels and even a rooftop farm. The building would be able to absorb stormwater through the roofs, while the rooftop farm could grow the food used in the restaurants on the lower floors.



Fig 43. The Wetland - the focal point of Odonata Park. The wetland goes beyond being a simple stormwater storage unit. It reuses the captured water inconjunction with the necessary design decisions to make this a viable habitat for Odonata and all the wildlife that follows.

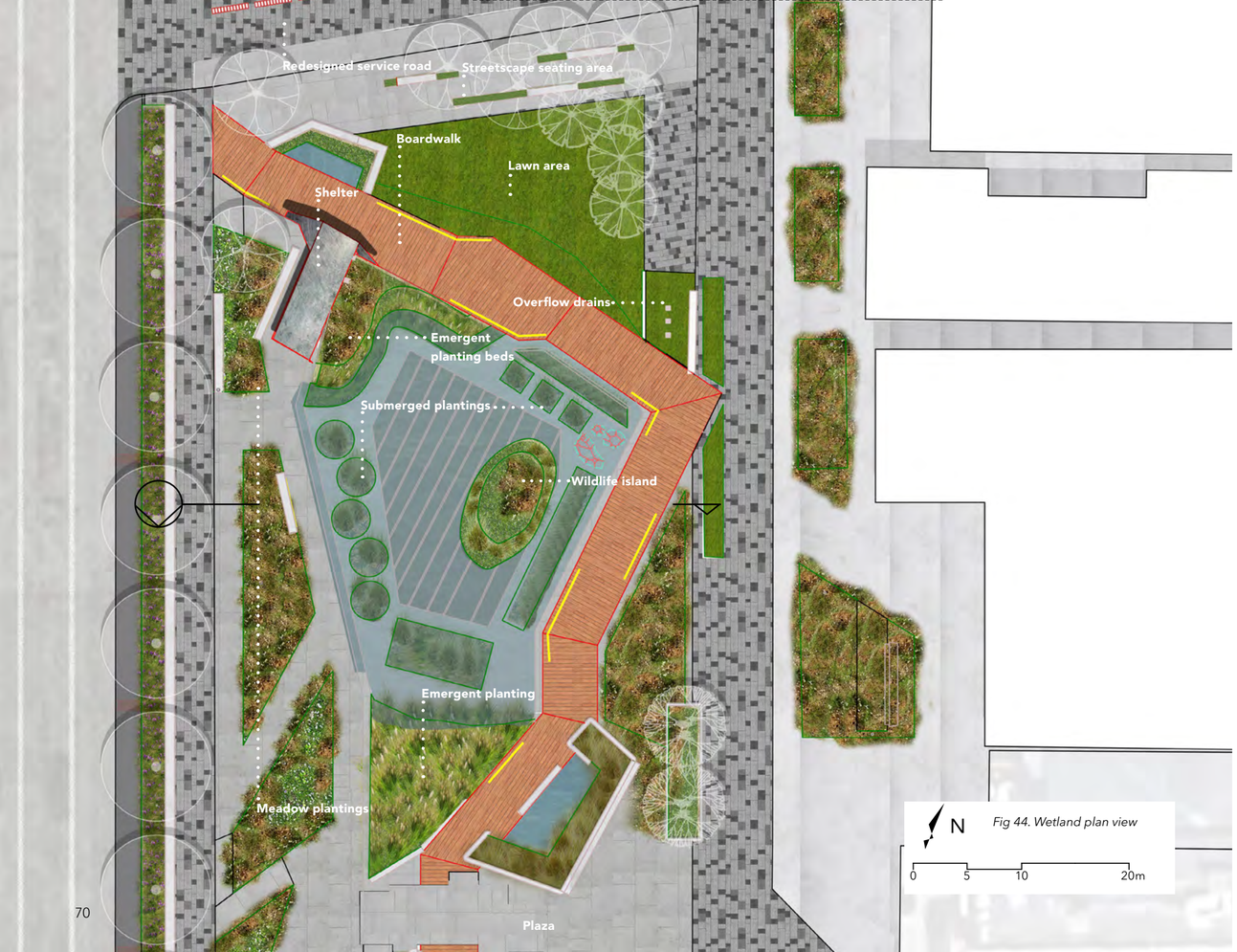


Fig 44. Wetland plan view

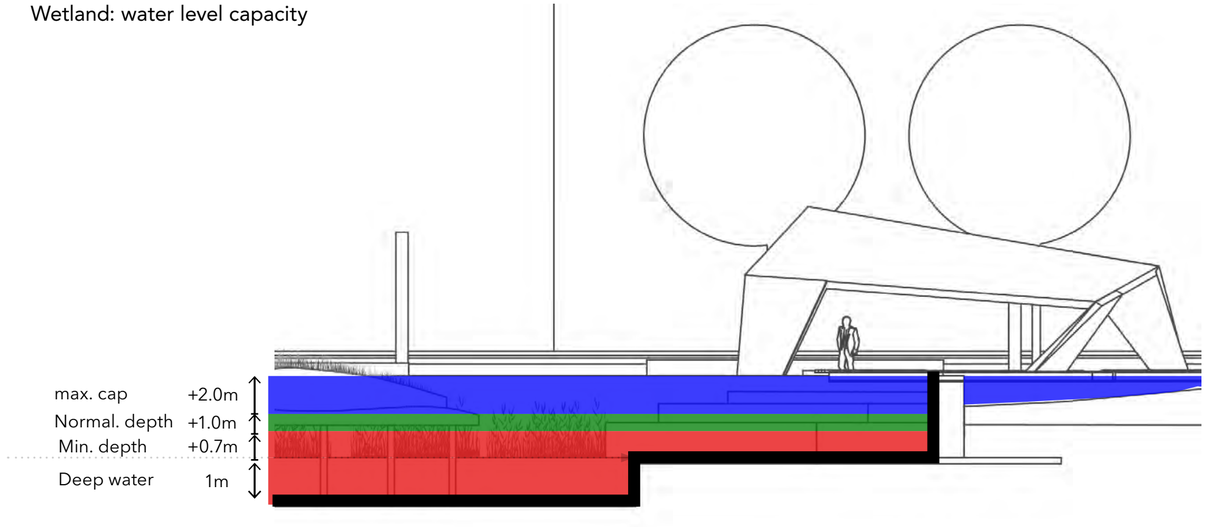
The Wetland

The wetland section of Odonata Park is where you can find the central stormwater storage and habitat. The wetland contains substantial storage and holds a set permanent level of stormwater. Within this wetland are the considerations needed to create a habitat for Odonata as well. The design sports a variety of differing submerged planting beds containing native vegetation to help create a healthy aquatic ecosystem. The wetland also provides emergent zones at specific points to create a naturalistic transition from land to water. The surrounding area contains ground-level planting beds of native meadow species that help recreate the kinds of landscapes that surround wetlands in nature. A floating island is an additional element that may provide a landing spot for wildlife that allows species to keep their distance from people.

The North-West corner of the site provides a kind of entrance condition to the park. At this point, visitors are introduced to a boardwalk pathway that wraps around the wetland and serves as the central of the park. Various other amenities are scattered throughout this area which also makes the space more inviting for people. There is a roofed structure near the entrance of the boardwalk, offering a sheltered place to view the wetland. Stone benches akin to the rain gardens on Smith Street provide resting or viewing points throughout the area.

North of the wetland there is an open lawn area. This open space provides a location for people to sit, relax, and have picnics in an informal manner. Beyond this lawn sits another seating area, here stone benches are placed within tree plantings and rain gardens. This area provides an additional resting area as well as a transition between the newly developed streetscape and the park.

Wetland: water level capacity

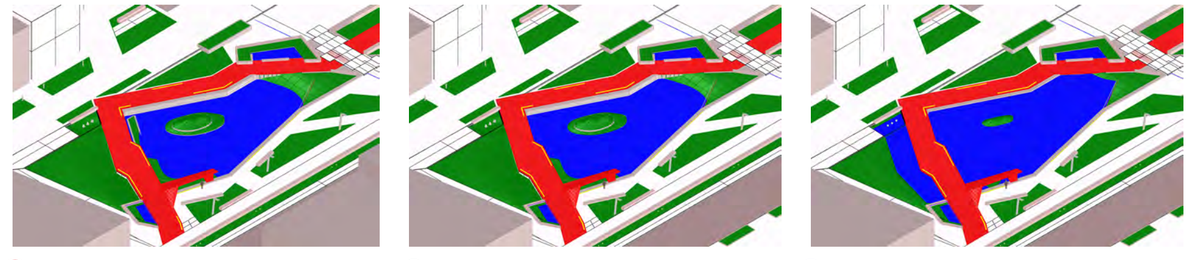


When designing the wetland, providing stormwater capacity is only part of the challenge. To create habitat, the pond must also provide a significant depth and a minimum level of permanent water to sustain aquatic wildlife, especially through the winter. In response to this consideration, the depth was pushed to a maximum of 3 meters at its lowest point. The pond is stepped, including a sharp dropoff of 2 meters from ground level, then a central section of the area drops another meter in depth to reach 3m. Following these measurements, the design must establish a minimum water level, a normal level, max capacity, and an overflow system.

The minimum water level (shown in red) is the baseline for the wetland park. This depth sits at 70 cm above the wetland base, not including the deeper step, which adds 1 meter of depth. This depth of 0.7m provides the necessary depth for Odonata nymphs to be able to hibernate under the frostline. The deep area provides an additional safety zone, but was not fully relied on as the minimum level. This is due to it being a more condensed area, but should temperatures drop to extreme levels, this extra depth could provide a small additional area that could help species withstand the winter.

The Normal depth (green) sits at 1m above the base, which provides an additional level of security for nymphs looking to survive the winter. This is an ideal depth to provide habitat while still leaving space to accommodate larger rainstorms to be stored.

Fig 45. Water level diagram - Diagrams displaying a section of the designed water depths (above) and what each simulated water level looks like using the 3D model (right).



Minimum capacity

456 (depth of 0.70m)+ 195 (deep water area) =

651 M3 of permanent water

802 M3 of stormwater storage

Normal water level

629 (depth of 1.00m) + 195 (deep water area) =

824 M3 of permenant water

576 M3 of stormwater storage

Maximum capacity

The wetlands maxium volume is would in clude a 2m depth, or 3m at the deepest point.

At this point the wetlands full capacity it holds 1500 m3.

In the event of extreme storms, the wetland is designed to fill to its maximum capacity, which is 1500 cubic meters of water. This depth does not include the water already stored within the wetland, which means, in this case, there is potential for the wetland to expand past this capacity.

This overflow would only occur if both the biofiltration zone (600 cubic meters) and the wetland (from Normal depth - another 600 cubic meters) reach capacity. As the stormwater overflows to the north of the wetland, the excess water seeps towards a drain on either end of the boardwalk. This overflow is directed back towards the underground storage cistern located at the proposed building. This overflow system is helps improve the resiliency of the habitat as the excess water can help balance the water during drought. At maximum capacity, the park could hold 2800 cubic meters of water at once.

The water captured here is helps reduce strain to the combined system. The underground storage would also be programmed to slowly release some of the stored water once the storm events have passed. While being able to reuse the remaining water could be reused on site.

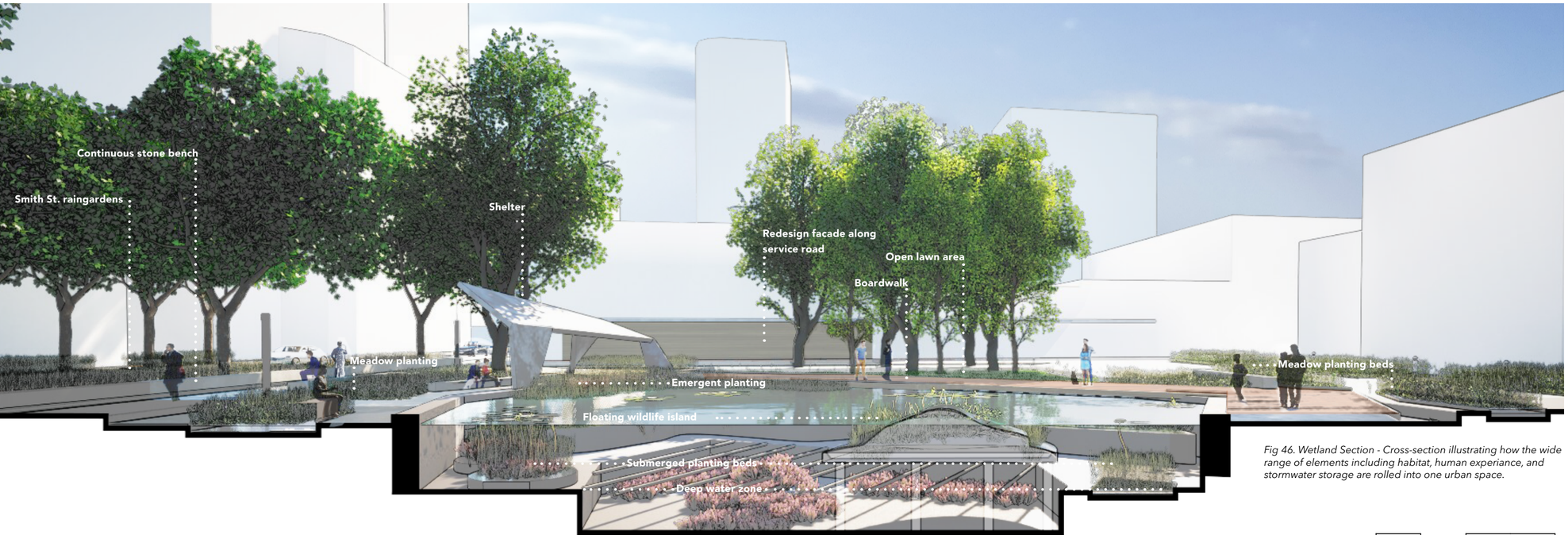


Fig 46. Wetland Section - Cross-section illustrating how the wide range of elements including habitat, human experiance, and stormwater storage are rolled into one urban space.

Wetland design

Odonata Park required a range of specific design decisions to create the desired outcome of a space for both people and wildlife. Interventions, including the extended boardwalk, roofed shelter, and various seating points, provide unique experiences and views of the wetland.

The use of a boardwalk was a design decision made to help reinforce the wetland feeling of the space. This kind of pathway is so commonly associated with wetland parks throughout the world. Even locally, you can look at Fort Whyte Alive and Oak Hammock Marsh, to name a few. The boardwalk is placed along the wetland's edge, and at points it overlaps the water. This helps create a closer connection between people and the water. It also provides a glimpse at the ecosystem beneath their feet. The view towards the wetland reveals a diversity of submerged, floating, and emergent wetland vegetation, which helps facilitate this ecosystem. The small island also provides a perch for species visiting the site that also wish to avoid people.

The vegetation within the wetland is contained within specified beds, which will be seeded as the park is constructed. The strategy of using planting beds instead of a more naturalized continuous soil bed plays off the geometric aesthetic of the park. They also benefit the park long-term, as vegetation would not be able to overgrow. This reduces the required maintenance and helps the habitat remain healthy.

The overall design hopes to provide an authentic feeling wetland despite the geometric form of this wetland. The wetland would be within a concrete shell, with the geometry not only creating the necessary storage space but also using a geometry that blends in better with the surrounding urban fabric.

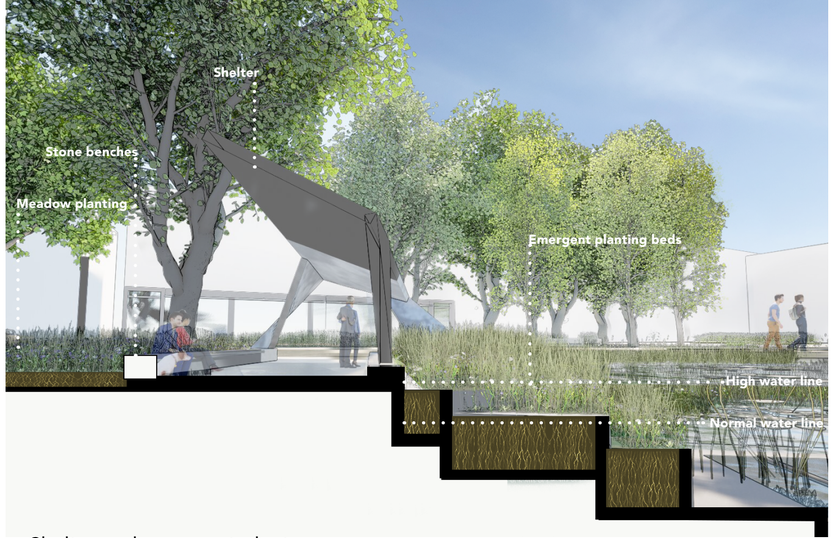


Fig 47. Wetland planters - Multi-leveled planterslong shoreline help enhance the view over the wetland from the perspective of visitors sitting underneath the roof.

0 2 4m

Shelter and emergent planters

An example of how the design accommodates both the needs of stormwater storage and vegetated area can be seen in these emergent planting beds. They are located in the wetland near the roofed shelter. This vegetation is embedded in a multi-leveled planter along the edge of the wetland.

Within these planters are native emergent species that are an important part of a wetland habitat. As per the standards listed by the City of Winnipeg, vegetation in this zone typically needs a specified slope to be successful. However, if this slope were continuous, it would push deep into the already limited storage space. Using these planters allows each level to keep this ideal slope for the plantings to grow healthily. While the edges function as retaining walls, cutting the slope off, and allowing the site to balance storage space and natural vegetation.

Aesthetically, each wall is low enough that the density of vegetation would also mask the retaining walls. The result is a naturalistic-looking emergent shoreline. To further enhance the habitat aspect, debris such as logs or stones could be placed in the area to provide further cover for wildlife.

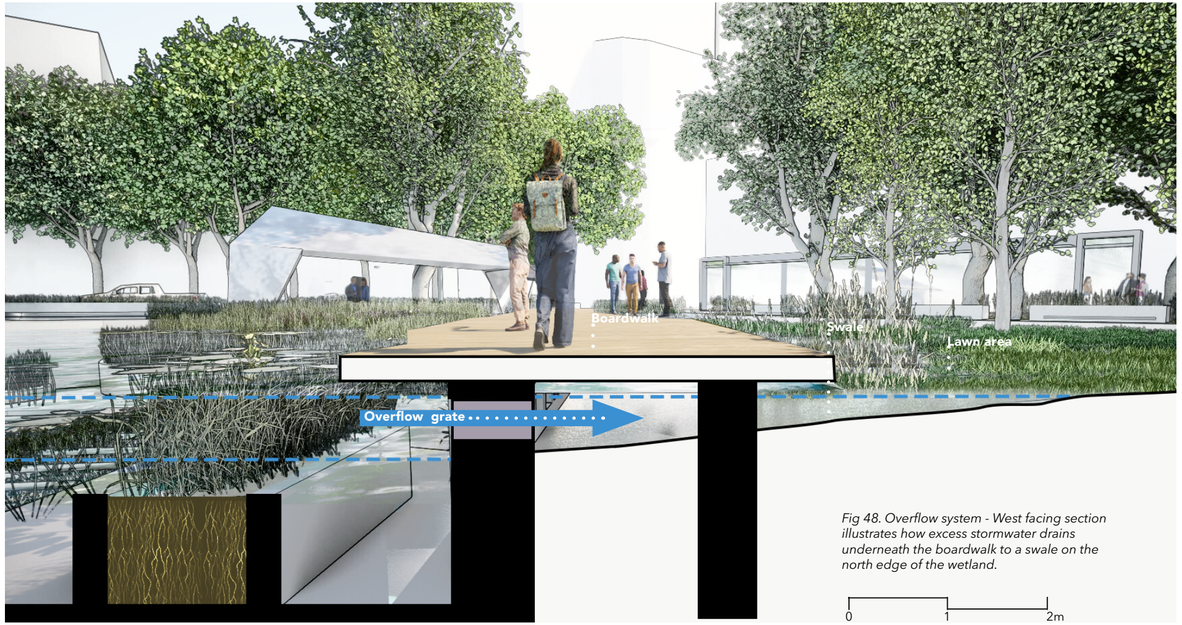


Fig 48. Overflow system - West facing section illustrates how excess stormwater drains underneath the boardwalk to a swale on the north edge of the wetland.

0 1 2m

Overflow system

In the event of the wetland exceeding its maximum storage capacity, the park is designed to gradually release overflow without causing any damage to the wetland or the surrounding area. The overflowing water would escape the wetland through a grate underneath the northern section of the boardwalk. As this happens, the water follows a swale that runs underneath the boardwalk and along the open lawn area. At either end of this swale, additional surface drains direct water into a separate pipe network. This network then directs this water back into the underground storage cistern.

During this process, visitors are provided the temporary experience of water submerging both sides of the boardwalk. This instance becomes a unique condition that helps immerse people in the wetland atmosphere. This could even make the site an attractive place to visit following heavy rainstorms.

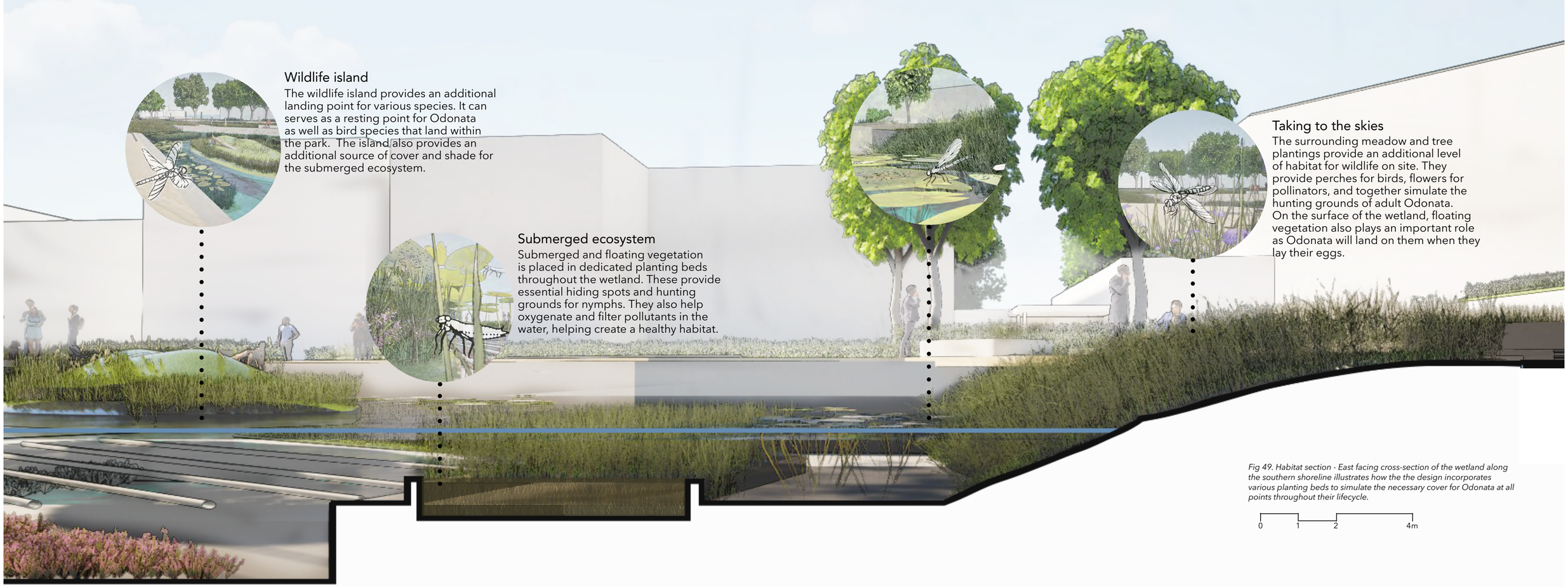


Fig 49. Habitat section - East facing cross-section of the wetland along the southern shoreline illustrates how the the design incorporates various planting beds to simulate the necessary cover for Odonata at all points throughout their lifecycle.

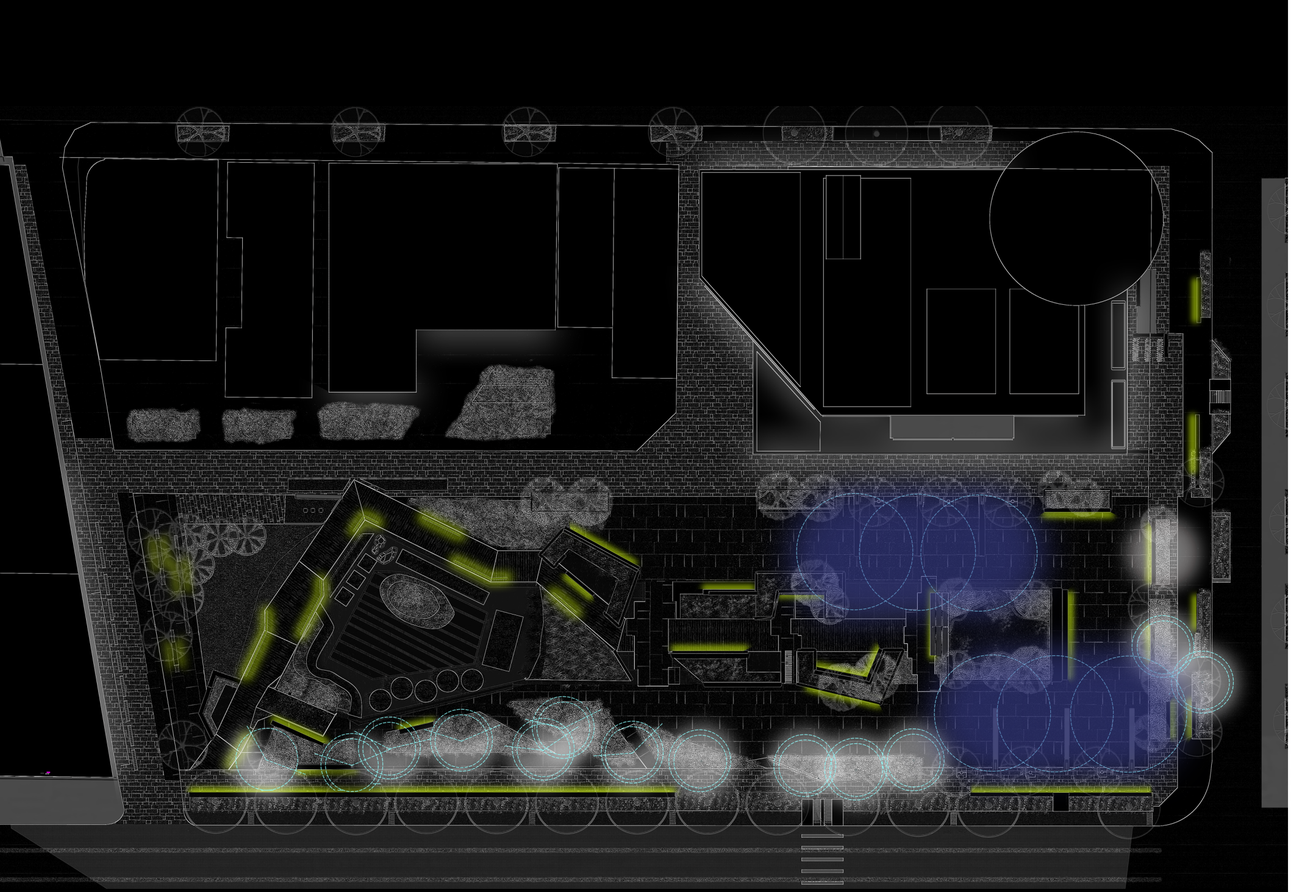
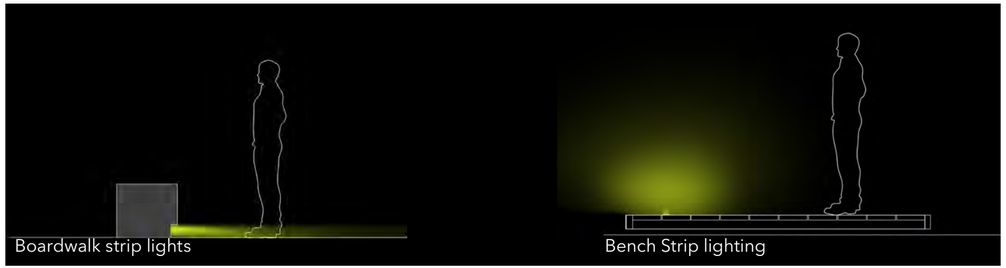
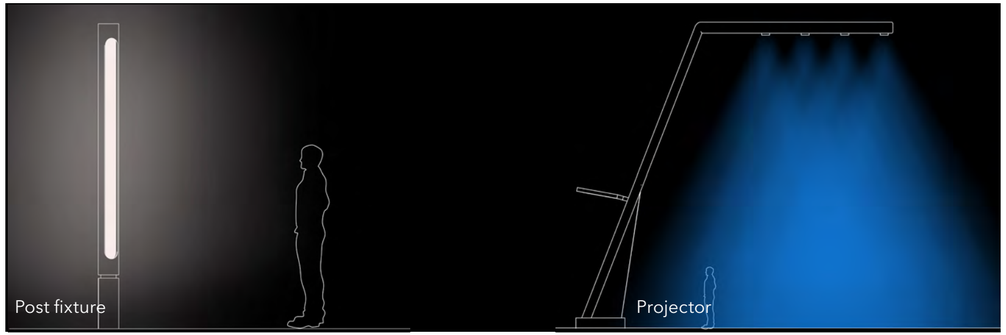


Fig 50. Lighting plan (above) - illustrates the how the specified lighting fixtures (right) illuminates various areas throughout Odonata Park.





Lighting

The design of Odonata Park includes a variety of lighting types. Each type is assigned to specific areas to create an attractive space for people after sundown, without causing a significant disturbance to wildlife.

The lighting types include Post-fixtures, designed with a higher lumen LED. They are primarily used in high-traffic areas such as the sidewalk, providing ample visibility for people walking past the park during the night.

Softer strip lights are embedded in the stone benches as well as the boardwalk to help the visibility of the edges of both. Directing people towards the seating or revealing the edges of the boardwalk.

The projector lights are only located in the plaza. They create a dazzling atmosphere through interactive designs projected onto the plaza surface. This is used to great effect in the wintertime as well, going along with a skating rink conversion.



Fig 51. Sidewalk lighting - The post fixtures help illuminate the pedestrian walkway along the edges of Odonata Park. The fixtures are placed sporadically within the Meadow planting beds. Placing them in these beds provides an additional sculptural aesthetic as well as keeps them away from snow-clearing equipment during the winter.



Fig 52. Boardwalk lighting - Strip lights are placed along important edges and turns along the boardwalk. This lighting strategy helps direct visitors along the path and avoid falling. The strip lights also offer a softer lighting source, which hopes to reduce light pollution directed towards the submerged habitat.



Fig 53. Lighting transition - The directional post lighting provides ample visibility towards the sidewalk while keeping the direct glare away from the habitat. Instead, strip lights along benches and edges provide a more subtle way for people to see where they are going while reducing the light pollution in the wetland.

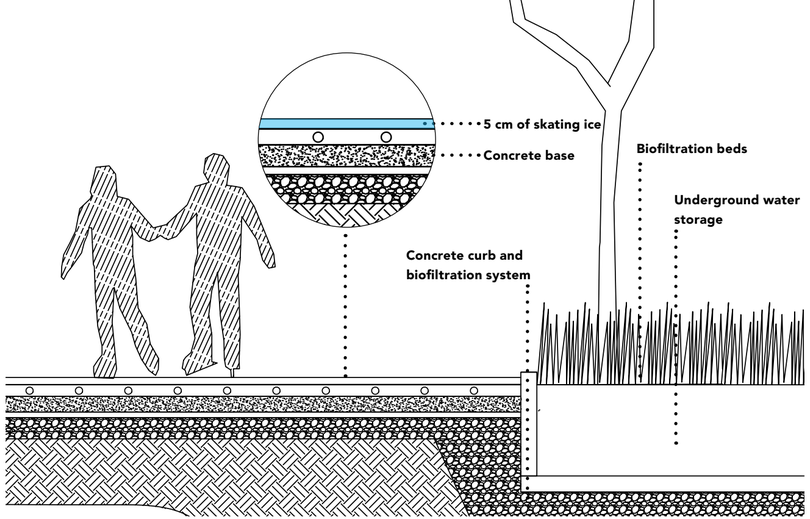


Fig 54. Ice rink detail - Illustrates the plaza design and technogly embedded in the surface of the plaza. The ice rink itself could pull water from the storage cistern located nearby the proposed building.

Winter Skating rink

To successfully design a space for the people of Downtown Winnipeg, it is essential to think about how the space transitions to winter for more than just the submerged nymphs. Winnipeg has to deal with a harsher winter than most. However, this does not mean Winnipeggers aren't able to enjoy time outside when given the means. The plaza of Odonata Park utilizes technology inspired by The Quiet Esplanade in Montreal. Using specifically designed concrete pavers that run cooling pipes through the surface, the space can turn into a recreational skating rink. While the climate can reach temperatures of -35 degrees C, it can still fluctuate and reduce ice quality. The technology used provides the means to maintain a better quality of ice throughout the winter. The proximity to the NHL ice rink means a large number of people could be exposed to a space like this. The large projectors that illuminate the ice surface would provide another level of interest and uniqueness to the space. The proposed building would provide rental skates, equipment, as well as a place to warm up.

Fig 55. Plaza during winter - illustrates the experiance for visitors during the winter, incuding the interactive projector lights enhancing the ice surface.



Conclusion

As a profession, Landscape Architecture is a unique discipline where creativity is your greatest asset. This creativity is used to help solve issues found in our surrounding environment in the hopes of creating a better world. Through this creative process also comes exposure to a wider range of fields and perspectives. All of which provide the necessary information that could translate into a more successful outcome.

Odonata Park: A wetland park for downtown Winnipeg is a project that has blended creative problem solving with designing space. Throughout this project, I have been able to explore more of what Landscape Architecture offers as a field. It has also offered an opportunity to build on what I have learned throughout my education. The extended timeline of this project has allowed me to expand on the technical details required to deal with stormwater. Offering an important tool and perspective that can be carried forward into my design career.

I strongly believe that Landscape Architecture can help bridge the divide between man and nature. Successful designs could use natural processes to help deal with larger issues such as climate change, while at the same time returning habitat to species that have since lost their homes. The hope is that projects such as Odonata Park can inspire a greater focus on these connections. Which could bring humankind and nature closer together, creating a sustainable future.

Fig 56. Odonata Park aerial - illustrates the experiance for visitors during the winter, incuding the interactive projector lights enhancing the ice surface.

Endnotes

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Figure List

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Derksen, Marty. Hand sketches. 2025.

Fig 1. Derksen, Marty. Eutrophication. photograph.

Fig 2. Derksen, Marty. *Sketch of natural vs urbanwater cycle*. Based on diagram in Water Sensitive Urban Design by Jacqueline Hoyer et al., 42. June 2025. Unpublished.

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