Wildlife Wetland Park

Restoring Natural Habitat Through Stormwater Management

& Public Recreation Along The FM Diversion

Sawyer Delp

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WILDLIFE WETLAND PARK

Restoring Natural Habitat Through Stormwater Management & Public Recreation Along the FM Diversion

A Design Thesis Submitted to the
Department of Landscape Architecture
of North Dakota State University

By

Sawyer Delp

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Primary Thesis Advisor
Mathew Kirkwood, PLA, BLA, M.Des., ASLA

Secondary Thesis Advisor
Jason Kost, PLA, MLA, MUD

Department Chair
Dominic Fischer, PLA, MLA, ASLA

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Table of Contents

04 List of Tables and Figures
05 Thesis Abstract
06 Thesis Narrative
07 Typological Precedents & Research
  08 Precedent I
  09 Precedent II
  10 Precedent III
11 Major Project Elements
12 The User
13 The Site
14 Project Emphasis
15 Thesis Goals
16 Site Analysis
17 Application of Results
18 Performance Criteria
19 Design Concept Statement
20 Schematic Design
21 Design Development
-
32 Design Development
33 Detail Drawings
34 Project Conclusion
35 Appendix

List of Tables and Figures

Thesis Abstract

Urban stormwater runoff is at an increasing rate due to climate change causing harmful chemicals and pollutants to drain into rivers and bodies of water. These pollutants are extremely harmful to the environment destroying habitat and biodiversity.

This study will focus on strategies to mitigate the urban runoff flow that comes from streets, leading into rivers and bodies of water. The idea is to restore/implement an ecological infrastructure by constructing a wetland restoration park. Sustainable runoff management practices will allow for habitat restoration and stormwater management, meanwhile providing spaces for humans to connect with the land.

Thesis Narrative

Wetlands are among the most important ecosystems on earth, providing multiple ecological functions for humans and wildlife. These critical ecosystems help create green infrastructure that is sustainable by providing habitat, food, and flood protection. As the affects of climate change progressively get worse, we must begin thinking of solutions through design that will help mitigate these negative environmental issues by restoring habitat.

My project is building off the current construction of Fargo/Moorhead Diversion project where flooding has had a significant affect to residences in Fargo/Moorhead area. The current construction of the flood diversion project will direct water from the Red River, caused by storm events This project is designed to give back to the environment by restoring wetlands.

This thesis proposal aims to restore and revitalize habitat for a 50-acre site along the Wild Rice River in connection with the FM Diversion. Design strategies through stormwater management and habitat restoration will create a shared landscape for people and ecosystems.

Typological Precedents & Research

Environmental Remediation

The project seeks to improve the ecological infrastructure by providing habitat zones and allowing flood waters to populate wetlands through all seasons, creating an oasis for wildlife and connecting people through functional spaces for activity.

Connecting people from Fargo/Moorhead Area

The Mingu Wetland Park

The Mingu Wetland Park is a ecological infrastructure project located in Liupanshui, China with a size of 222 acres. This project aims to transform and restore a river channel that has many issues regarding water pollution, flooding, and a lack of pedestrian connection while being densely populated. The architect, Turenscape, has programmed the site with terraced wetlands and retention ponds that were created to better regulate water flows during seasonal rainfall. These wetlands are designed to retain water using a series of elevated surfaces that can withhold and slow high amounts of water during flood events. The native vegetation selected improves the rate at which nutrients are removed from the water resulting in a rapid growing habitat zone that is filtrated from pollutants. Bordering these wetlands are a variety of pedestrian paths and bicycle routes connecting the entire park for an exceptional experience. Due to the inclining population, the city has become overly dense and these pathways allow people to escape the city. Within the park, seating areas, pavilions, viewing towers, and an iconic bridge are integrated, providing a learning aspect to the site while also creating a aesthetic landscape experience for visitors.

In terms of ecological infrastructure, this case can be seen as a very common project when flooding and water pollution is the primary issue. This case is different from other cases because of the overall size and magnitude of the project.

The project responds to the given site by environmentally improving the ecological infrastructure, restoring wetlands, eliminating pollution, and creating habitat. Socially this project attracts visitors which allows an escape from the densely populated city that is rapidly growing. Culturally, this project was designed to cleanse the polluted wasteland making it fit the surrounding environment.

The Mingu Wetland Park provides factual design solutions that respond to major issues within a city. Restoring wetlands has many beneficial elements that greatly improve the ecological infrastructure while also giving back to the people.

This case study contributes to our understanding of theoretical premise by proving that wetland restoration does improve and eliminate major issues that a city faces resulting in a healthy environment for both wildlife and the people.

Hoosic River Flood Chute Naturalization

The Hoosic River Flood Chute Naturalization is a ecological infrastructure revitalization project located in North Adams, Massachusetts with a size of 1.5 miles long. This project aims to revitalize a once thriving industrial center that has separated itself from ecology and pedestrian connection due to the construction of concrete walls that prevent flooding from two major rivers. After many years of disconnection it was time to restore the river which would enhance the publics access to water and repair the riparian habitat allowing for an improved flood protection. The historic floodplain was critically in need for a revitalization that would be easily maintained reducing long-term costs. Developing a system that would enhance habitat, water quality, and river connectivity was design goal.

In terms of ecological infrastructure revitalization, this case is very similar to other cases addressing issues with flooding and disconnection. What sets this case to be different from others is the historical context that the city has and how it can be re-imagined.

The project responds to the given site by environmentally restoring a historic floodplain while simultaneously expanding the opportunities for recreational activities. Socially, the project provides areas for public engagement through active and passive uses with boardwalks for connectivity. Culturally, this project was designed to restore the historic floodplain and allow for a environment that was once thriving.

The Hoosic River Flood Chute Naturalization project has become a ecologically friendly design that brings the city together, removing the sense of disconnection and improving all aspects of habitat. The historical floodplain no longer has to be seen as a worthless disconnection, but a re-imagined space returning elements the city needs to thrive.

This case study contributes to our understanding of theoretical premise through its history and restoration journey, allowing a city's infrastructure to be sustainable.

FM Area Diversion

The FM Diversion is a stormwater management project is located in Fargo/Moorhead, ND with consisting of a 30 mile long flood diversion channel. This project aims to protect the cities by creating a diversion channel that will allow high flood waters from the Red River to overflow into the channel, protecting the city from catastrophic flooding that currently raises a major issue. Some of the major elements that are designed to help mitigate flow rates are flood gates/levees and channel embankments. During storm events, the flood gates will be able to control the amount of water that is released into the channel allowing more control over large amounts of water. By doing so, this will also limit the amount of water that flows directly into the Red River which splits the Fargo/Moorhead area. Embankments will serve as a protection wall when water reaches above 18 feet where it will then be diverted into the channel, safely routing around town, leaving the city will no flood damage. Retention areas are located after the embankment that will serve as mitigation design. This process will save and protect the citizens from future flood waters which has been an issue for years because the current design protection cannot withstand the high flows during storm events. This project is funded by federal, state, and local sponsors allowing the project to be constructed
.

In terms of stormwater management, this case can be seen as a unique project but also uses techniques that are common. Flooding is a popular issue in many cities but the ability to channel water for 30 miles around makes it unique. This case is different from other cases because of length of the diversion channel and how water can be directed elsewhere still having access to the Red River.

The project responds to the given site by environmentally protecting the city from catastrophic flooding during storm events. Socially, this project allows citizens to utilize funds elsewhere, rather than funding to cleanup and reconstruct after disastrous floods. Culturally, this project will provide an improved infrastructure and also ecologically provide habitat.

This case study contributes to our understanding of theoretical premise by providing factual design solutions that improve and protect cities for a 100 year flood.

Major Project Elements

The initial design program is intended to make wildlife flourish year-round in an environment that is protected by terraced vegetative marshes filtering river pollutants, abundant habitat space for wildlife, and a trail system connecting people to the environment.

The key elements that will create this restoration project are a ser ies of reconstructed natural wetlands that provide a filter for pollutants caused by stormwater runoff. A series of plants, grasses, and flowers will consume the space providing habitat while also filtering runoff through a series of small dams. Boardwalks and elevated paths.

- Visitor Center
- Parking
- Riparian Zones
- ADA accessible trail
- All-terrain trail
- Elevated boardwalk
- Bridge
- Fishing dock
- Viewing tower
- Shelter

User/Client

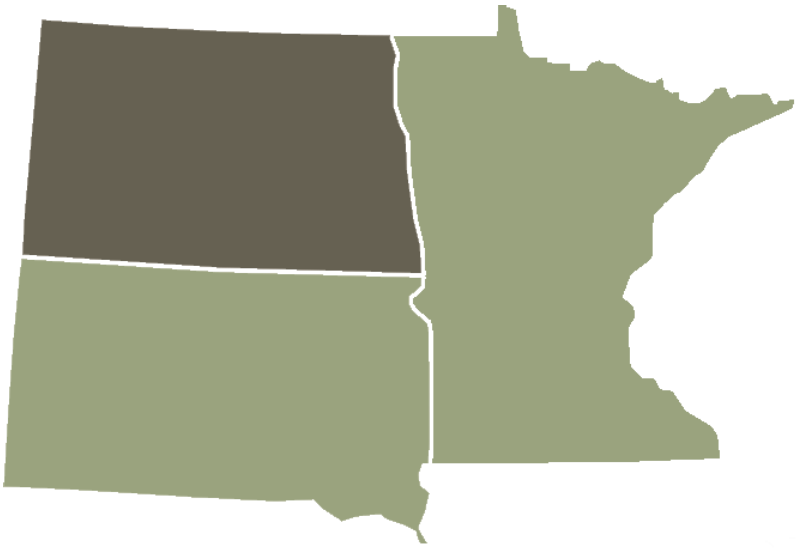
The user/audience this project is directed towards is the public people in the nearby neighborhood searching for an escape to the natural environment. Familes that are searching for an area to explore and adventure following the all terrain trail system. People with disabilities with have the opportunity to have access to the same amenities as everyone else. The site will offer many habitat zones that are restored and provide a exciting and interesting landscape.

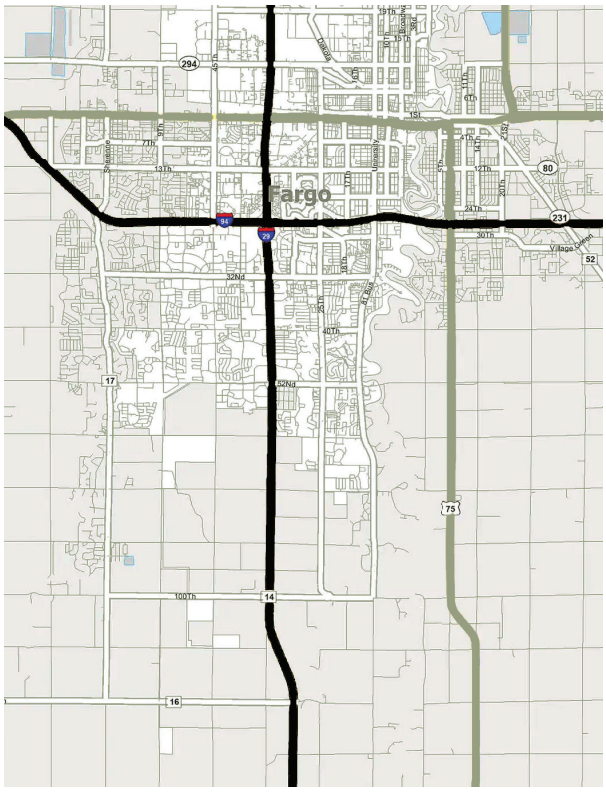
The Site

This project of restoration/creation of wetlands will be in conjunction with the current development of the Fargo/Moorhead Diversion Project.

Site Location:

- South of St. Benedict 1.5 miles
- West of I-29 Interstate 0.5 miles
- Along Wild Rice River
- Approximately 100 acres





Project Emphasis

1. Habitat for wildlife
   Creating grasslands and terraced marshes that can withstand high flow rates allowing for a diverse ecology and restoration process.

2. Integrate sediment filtration
   Harmful chemicals and sediments flowing from the river will be filtered through a series of vegetative elements and soil creating a healthy environment for habitat.

3. Restoration and conservation of wetlands
   Protect and restore the ecological environment by providing a several wetland zones with multiple elevation changes allowing for a safe fluctuating peak flows.

Thesis Goals

(1) Protect- Implement stormwater management practices to allow for flood zones that benefit habitat vs destroy.

(2) Restore- Implement Restoration practices that benefit bird, fish, and mammal habitat along riparian zones.

(3) Interact- Create opportunities for site interaction through passive and active recreation.

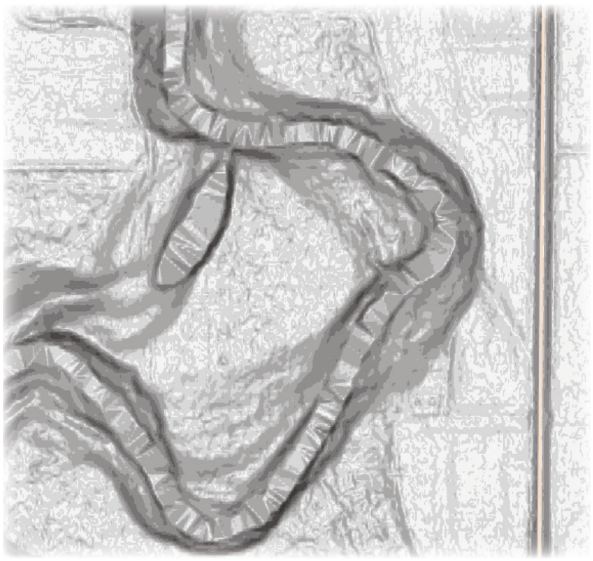
Site Analysis

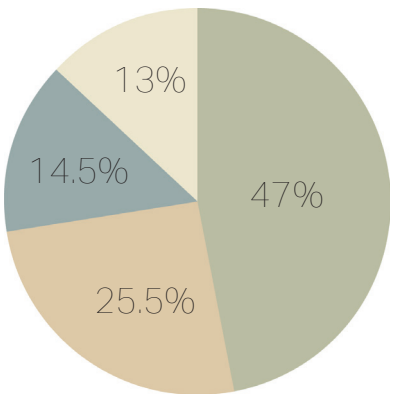
- Stormwater Management
- Land Cover

Flood Level: 26ft

Flood Level: 30ft

Slope: Flat---> Steep





Application of Results

Minghu Wetland Park / Turenscape

1. **Project Type:** Ecological infrastructure project
2. **Location:** Liupanshui City, China
3. **Size:** 222 Acres
4. **Characteristics:** Deteriorated wetlands, abandoned fish ponds, polluted waters
5. **Program Elements:** Terraced wetlands, retention ponds, native vegetation zones, pedestrian paths, viewing towers, and pavilions

Hoosic River Flood Chute Naturalization

1. **Project Type:** Ecological infrastructure revitalization
2. **Location:** North Adams, MA
3. **Size:** 1.5 Miles long
4. **Characteristics:** Flooding from two major rivers resulting in tall concrete walls separating ecology and the city's residents.
5. **Program Elements:** Overlook, boardwalks, fishing, beach area, recreation space, and an urban orchard.

FM Diversion Project

1. **Project Type:** Stormwater management
2. **Location:** Fargo, North Dakota
3. **Size:** 30 miles long
4. **Characteristics:** River control structures with in-town protection channeling high flood water around Fargo.
5. **Program Elements:** Flood gates, flood walls, levees, flood embankments, diver

Performance Criteria

1. Space Allocation:
The amount of space necessary for a wetland to provide habitat through vegetation, water, and man-made features such as roads/pathways. The units involved in this measurement would be the square footage of each as well as the volume of water and the flow rates. These measures will be obtained through ArcGis analysis and recent studies from the FM Diversion project. Modeling and the use of data in ArcGis will help generate these measures. The performance criteria will be met when the desired amount of vegetation can provide adequate habitat along with the desired amount of water volume/flow that comes through the site.

2. Behavioral Performance (usage patterns):
Behavioral performance such as animal patterns and how water rises/decreases over time. The units of data involved will be the type of animal and how they react with the space given along with volume of water in cubic feet. I will obtain this measure from models and studying current ecosystems, deciding how they interact with a similar space. I will have met the criteria by allowing habitat to survive and thrive with the wetland environment created. Also, how much water is available year-round allowing habitat to live and feel a sense of home.

3. Psychological Impact (aesthetics, sensory experiences):
The aesthetics and sensory experiences can be measured by understanding the correct environment that is needed by selecting vegetation that is most beneficial for wetland habitat. The type of vegetation and the soil that best fits the zoning requirement will allow for the wetland to survive year-round. I can obtain these measures through ND plant zoning and soil requirements by doing analysis on ArcGis. I will have met the performance criteria by correctly selecting plants that are hardy to ND weather along with the type of soil that is most suitable for my location.

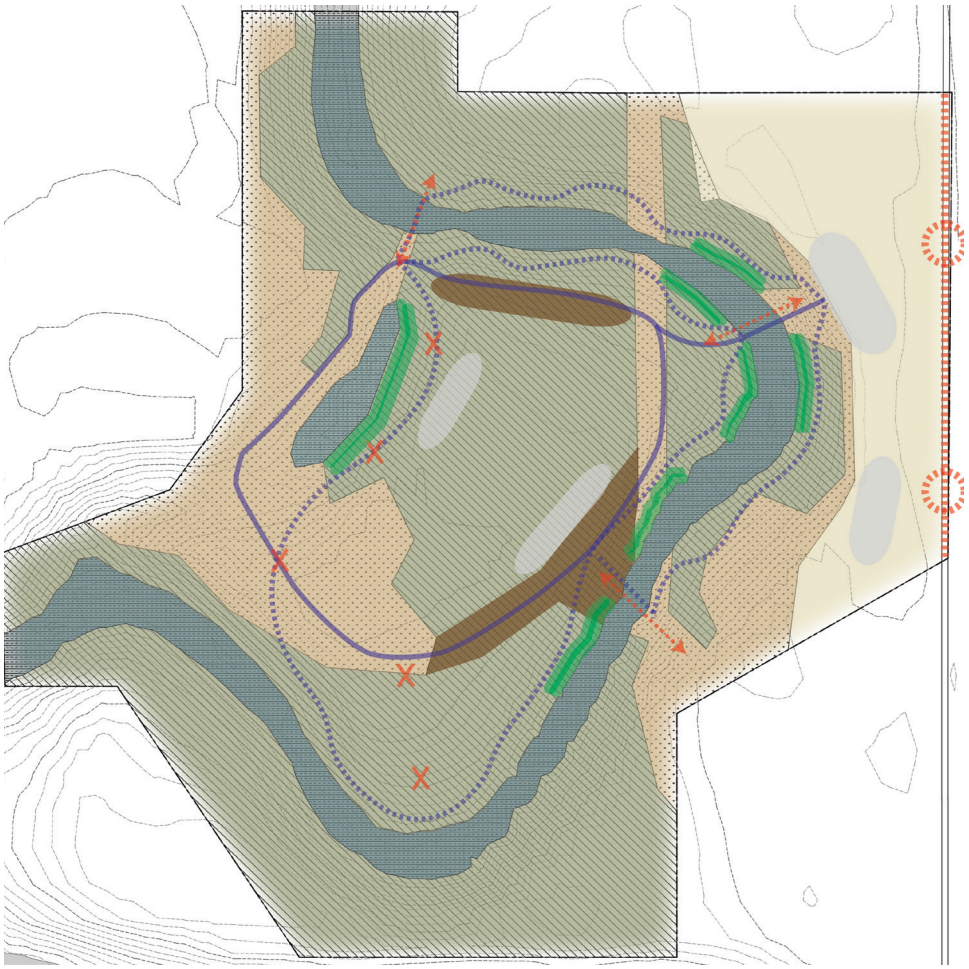
4. Environmental Impact:
The environmental impact that the wetland restoration has can be measured by the output data of number of species active in my space. Also, how water can be retained in my site for a 10- and 20-year outlook. I can obtain this information through generated models and ArcGis suitability analysis studies. I will have met the performance criteria by reaching a desired goal for the number of species in my site for a 10- and 20-year outlook. Understanding how the environment I created can withstand cold winters and spring flooding will be necessary.

Design Concept Statement

Schematic Design

Concept

- Water
- Canopy
- Grassland
- Farmland
- Proposed connection
- Views to protect
- Ada accessible (5% slope max)
- Rugid terrain (slope varies, no limit)
- High runoff
- Prairie expansion
- Access
- Least elevation change

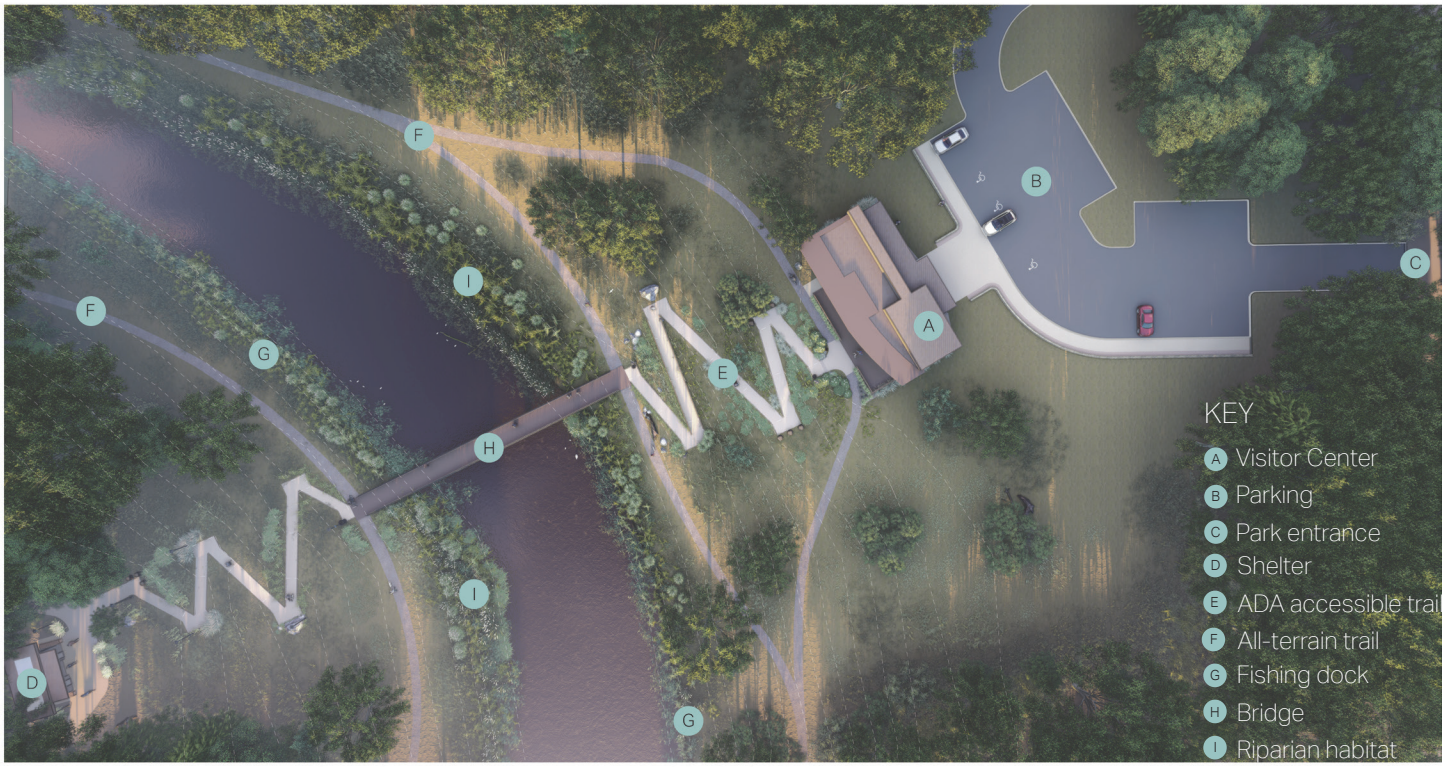


Design Development

Masterplan Scale 1" = 80'

Design Development

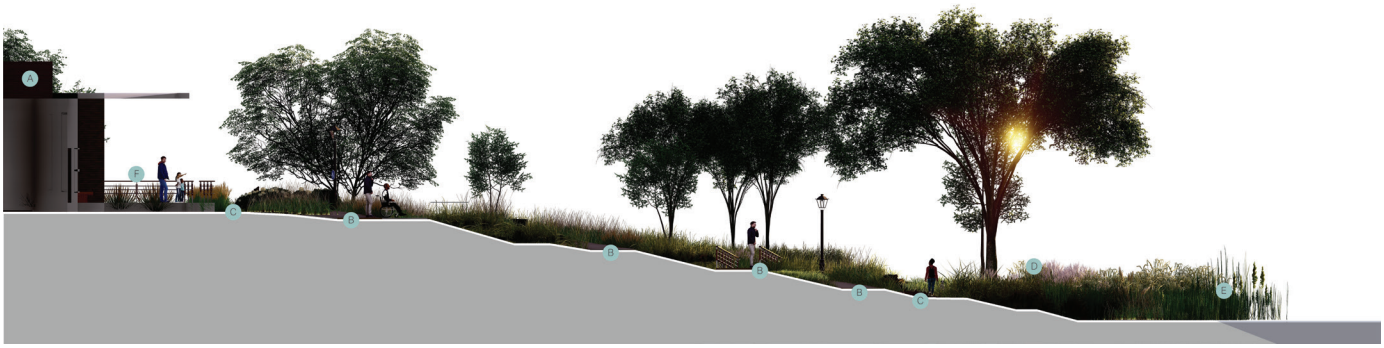
Site Plan I | Visitor Center & Trail Connection
Scale 1" - 30'



Design Development

Section I | ADA accessible trail
Scale 1″ - 5′

- A Visitor Center
- B ADA accessible trail
- C All-terrain trail
- D Fishing dock
- E Riparian habitat
- F Deck Overlook



Design Development

Perspective I | Visitor Center

Design Development

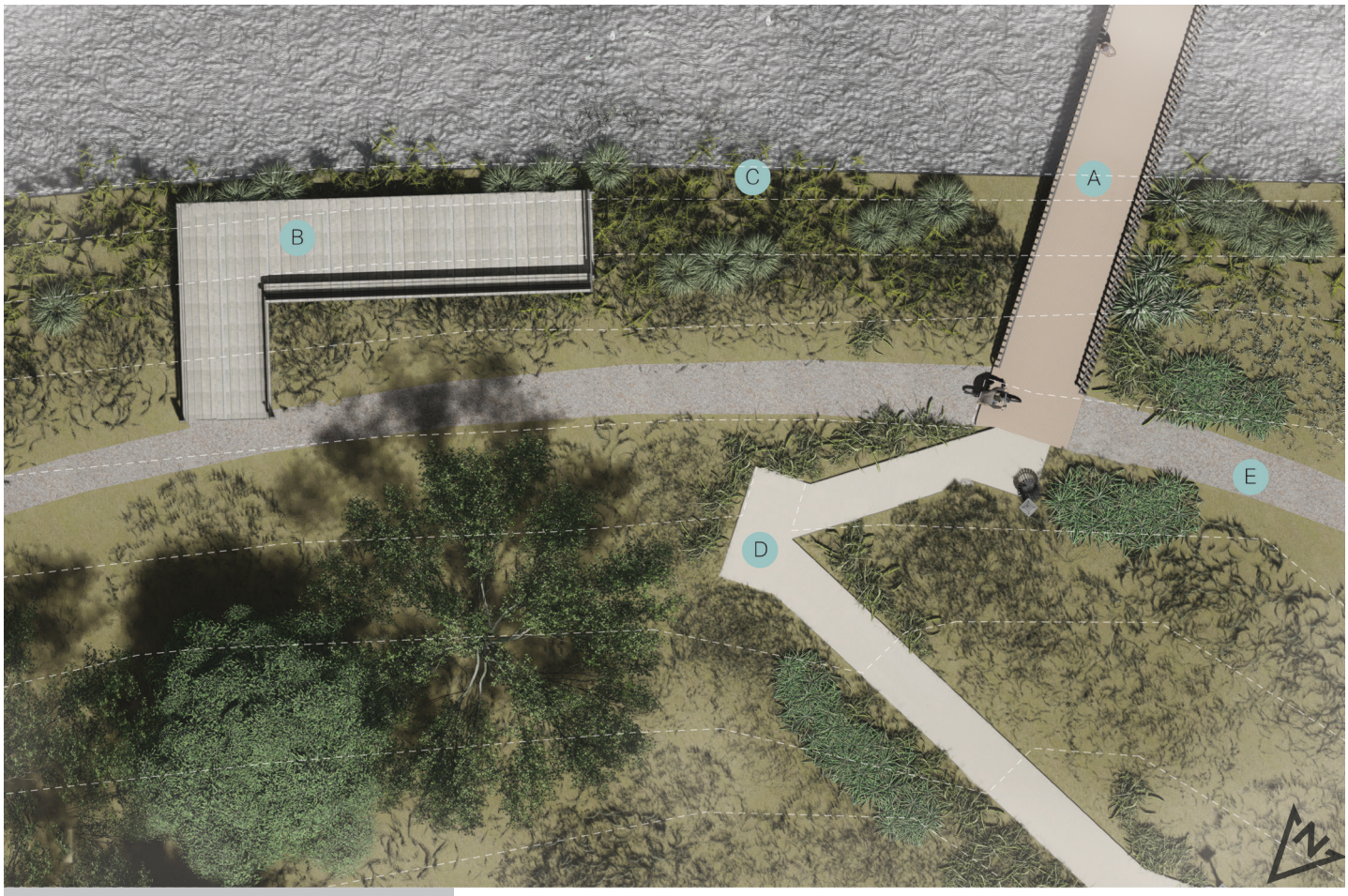
Perspective I | ADA accessible trail & Bridge

Design Development

Perspective II | Shelter

Design Development

Site Plan II | Fishing Dock
Scale 1" - 10'



KEY

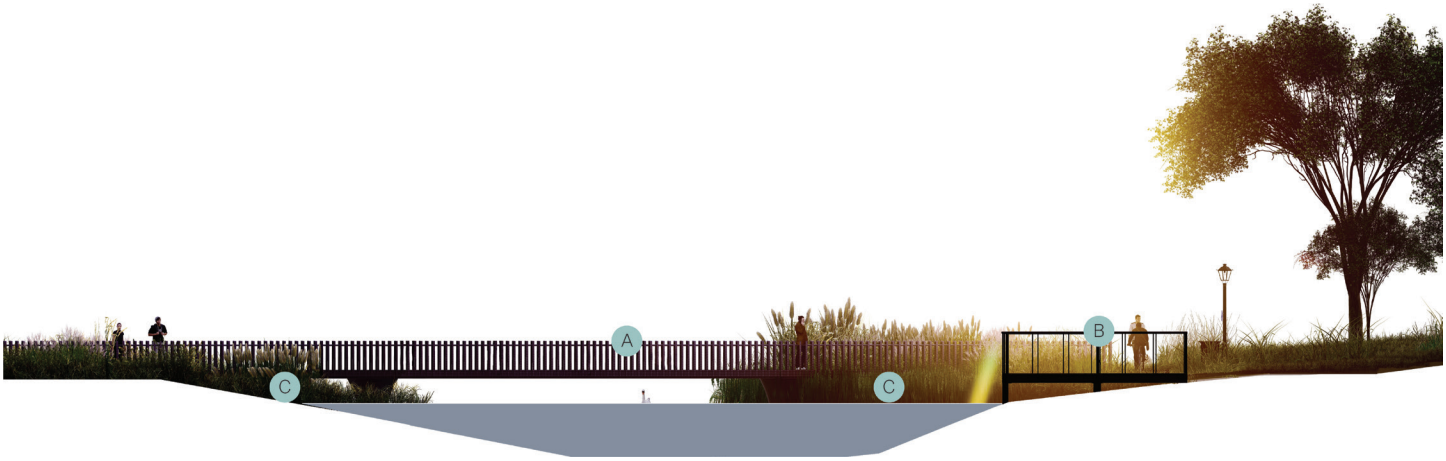
- A Bridge
- B Fishing dock
- C Riparian
- D ADA accessible trail
- E All-terrain trail

Design Development

Section II | Fishing Dock & Bridge
Scale 1" - 10'

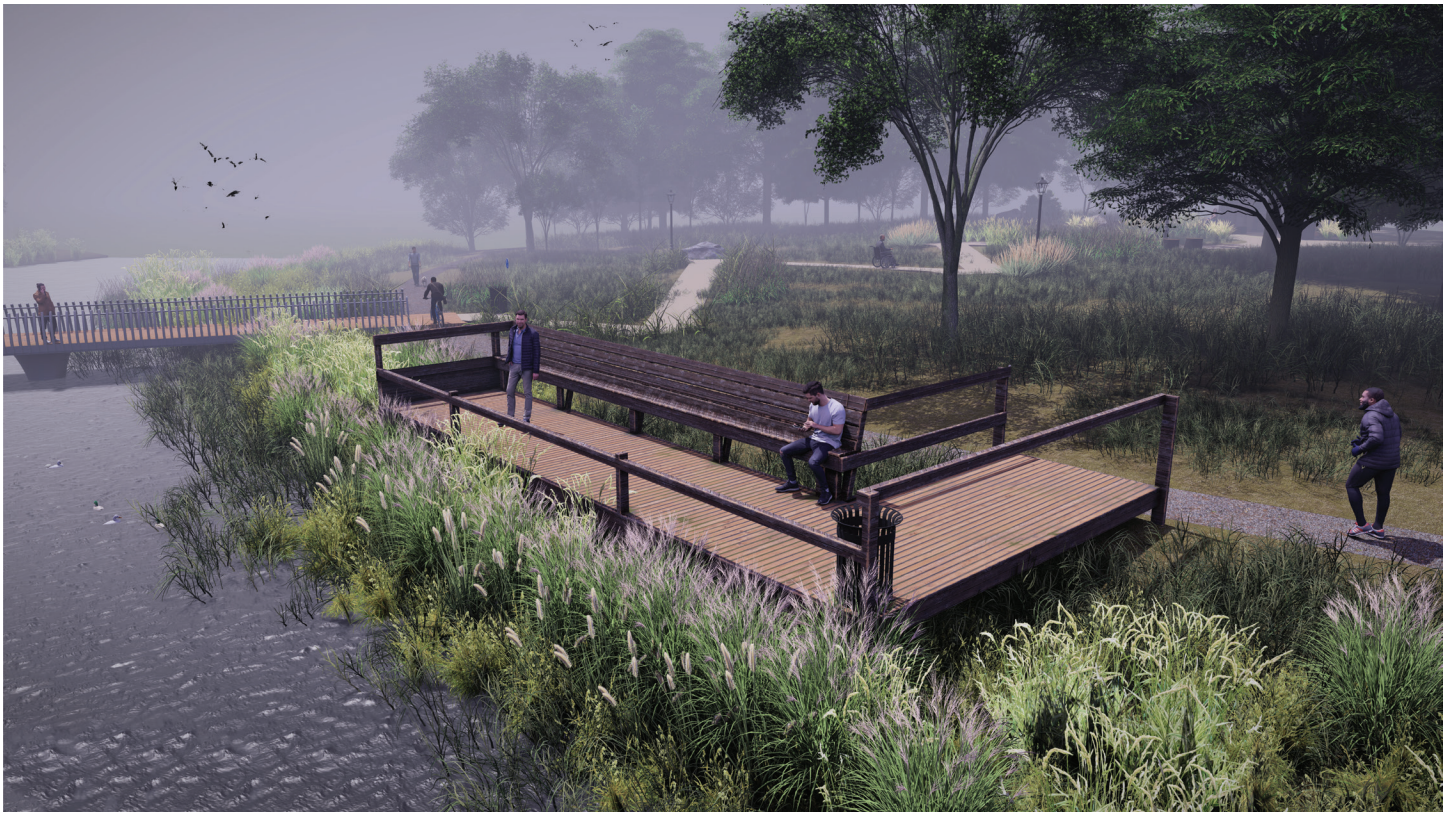
KEY

- A Bridge
- B Fishing dock
- C Riparian
- D ADA accessible trail
- E All-terrain trail



Design Development

Perspective IV | Fishing Dock

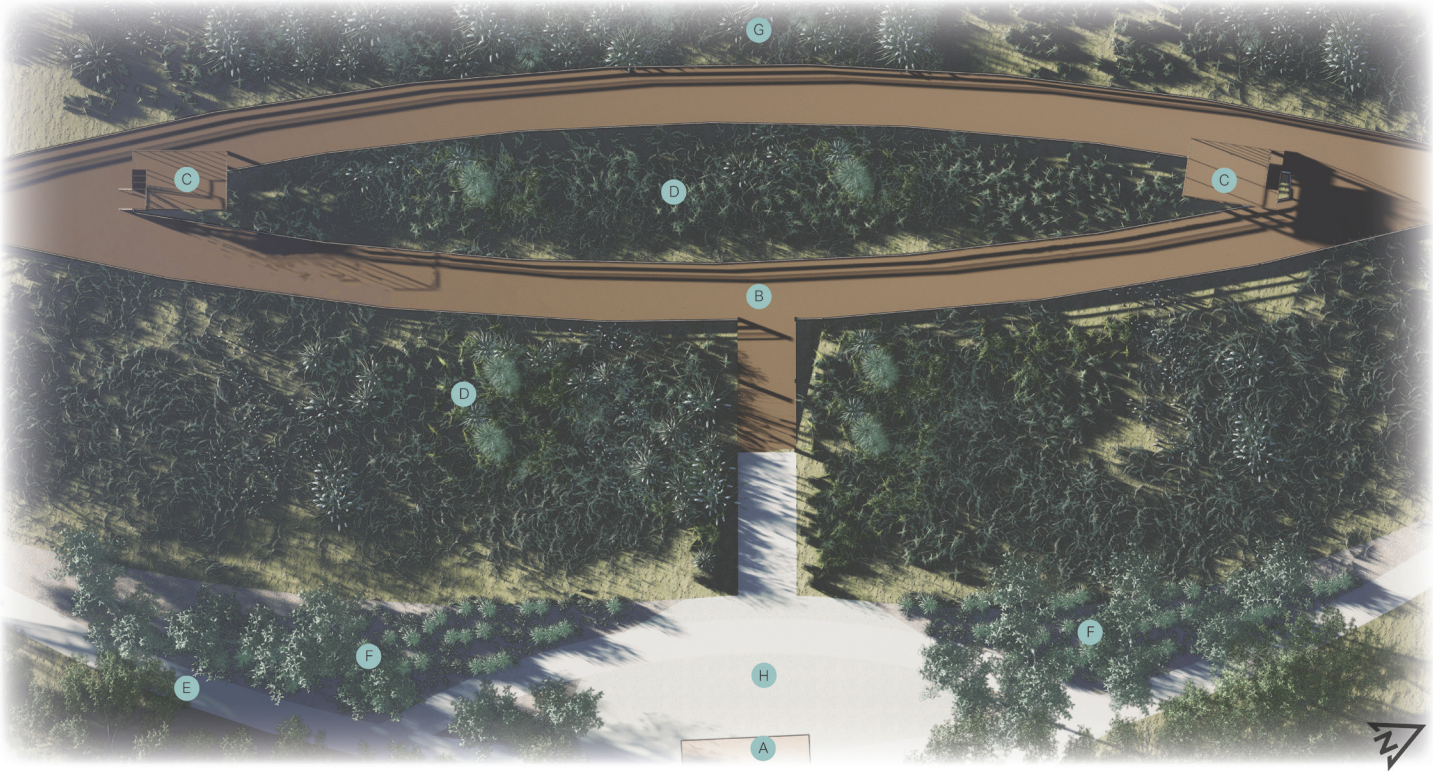


Design Development

Site Plan III | Elevated Boardwalk
Scale 1" - 10'

KEY

- A Shelter
- B Elevated boardwalk
- C Viewing tower
- D Riparian
- E ADA accessible trail
- F Plantings
- G Wetland
- H Plaza

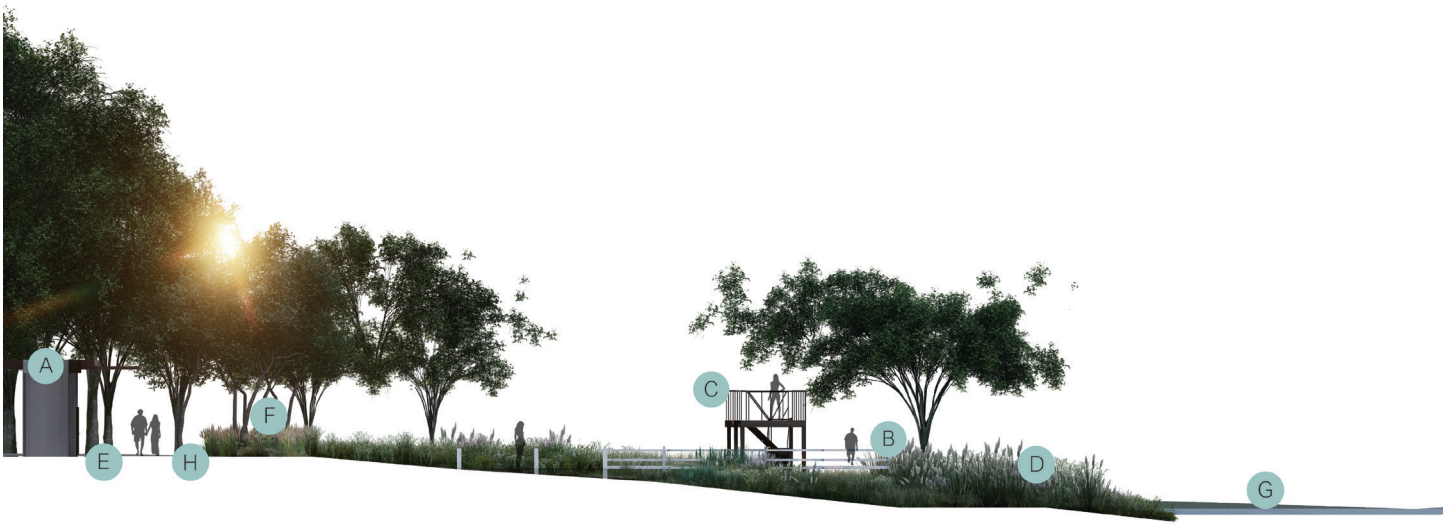


Design Development

Section III | Elevated Boardwalk
Scale 1" - 10'

KEY

- A Shelter
- B Elevated boardwalk
- C Viewing tower
- D Riparian
- E ADA accessible trail
- F Plantings
- G Wetland
- H Plaza

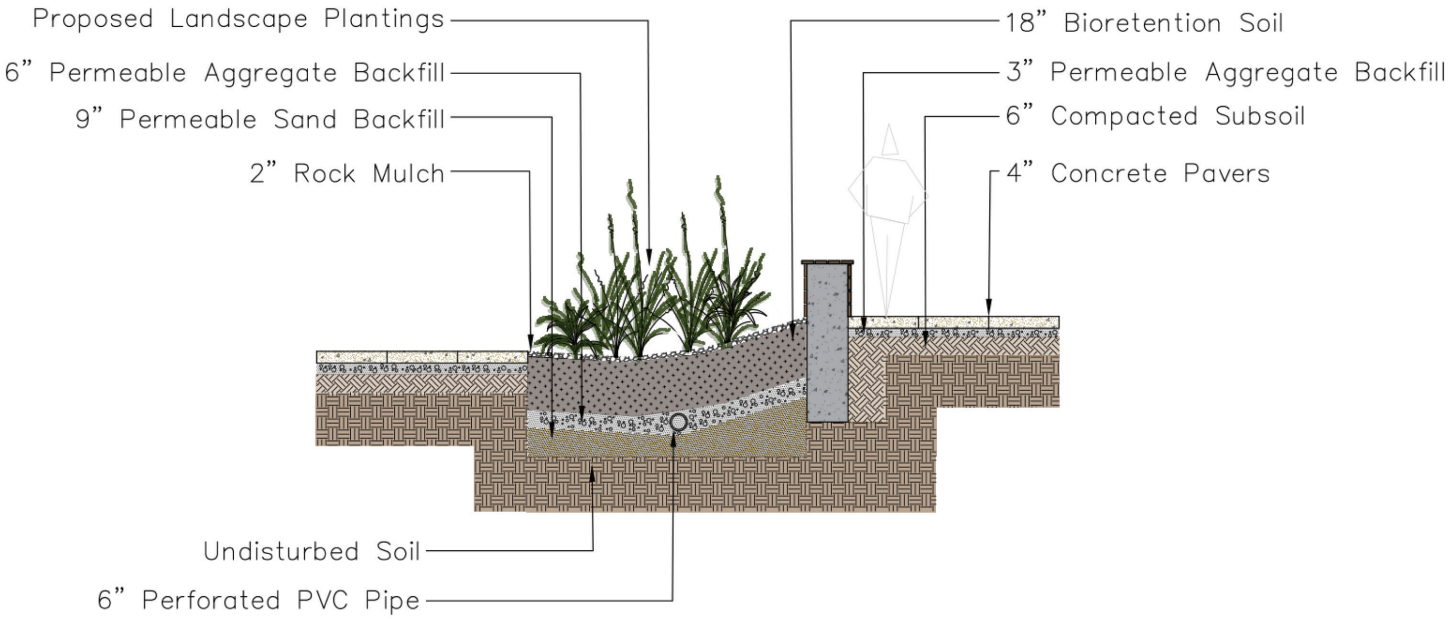


Design Development

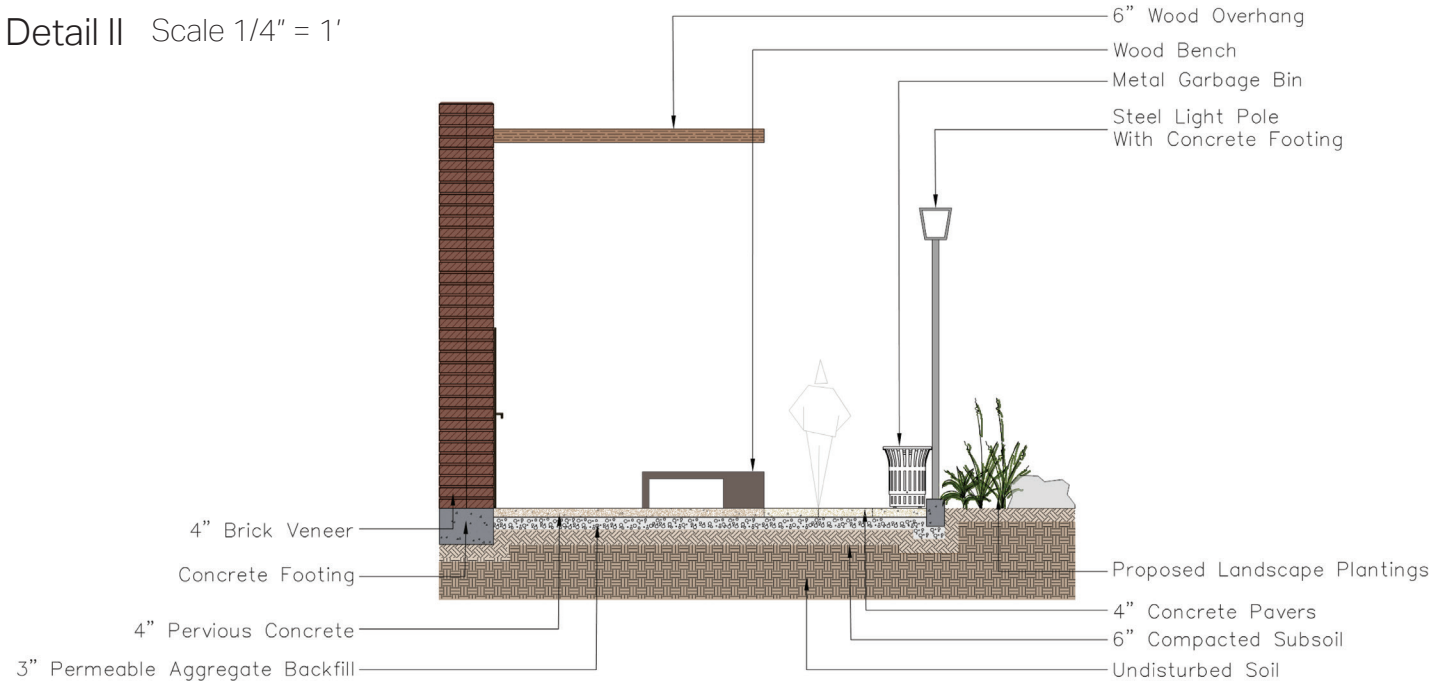
Perspective III | Elevated Boardwalk

Detail Drawings

Detail I Scale 1/4" = 1'



Detail II Scale 1/4" = 1'



Project Conclusion

Discussion & Limitations

After completing my thesis project, I have learned many things about the design proccess. Some major ideas that I soon realized after starting this project was the importance of finding a site with adequate information that was available.

Objectives that I struggled with was choosing a site and sticking with it. This was my main issue and becasue of it, I was not able to obtain the base plans/topogrpahy necessary in order to begin site analysis. This resulted in a project relocation, setting me back with where I should have been. This also created issues with connecting my research to the project design. I think learning this as I went was alot to handle but it allows me to realize the importance of defining the site location, well before the design proccess starts. This is something I can take forward into future projects as a learning objective.

Objectives that worked throughout my project was my perseverance to finish strong and not give up. I created a timeline that would allow me to focus on things that were most important. Creating my base plans was the first step and the most difficult step. One thing that helped with this process was understanding what my site looked like three-dimensional. Taking my plans into sketchup was an eye-opener because I was able to get a completely different perspective and ideas started to flow. Another important objective that worked for me was spending more time in class during the spring semester. This was a big motivater and made me realize how important classmates are when getting feeback and new ideas. I think learning this first hand allowed me to push through and encourgaed me to finish strong regardless of my situation.

Overall, this thesis project had many stuggles but also many things that worked. Understanding that struggles come with any project is my main takeaway and that communicating with people is the solution. Sometimes we get stuck in our own thoguhts and need a different perspective. I have learned that this is critcial and will help me throughout my career as a landscape architect.

Appendix