

From Line to Zone:

Transforming the Miami River & Canal
into Urban Landscape Infrastructure

Xudong Zhang



From Line to Zone:
Transforming the Miami River & Canal
into Urban Landscape Infrastructure

MSc Architecture, Urbanism and Building Sciences
Landscape Architecture Track
Graduation Report

Xudong Zhang

First Mentor: Steffen Nijhuis
Second Mentor: Lei Qu

Miami Lab, Flowscape Studio
Landscape Architecture, Urbanism Department
Faculty of Architecture and the Built Environment
Delft University of Technology

Abstract

The research context is based on the problematic situations of urban riparian area (Miami River & Canal). With research by design as the main method, the research aims to retransform the riparian area from an isolated line into a closely connected urban zone through designing the river & canal as urban landscape infrastructure and improving urban ecosystem services. By relieving the flooding pressure and improving water quality, it provides a healthier water system and new systematic green public space in the condition of complex riparian land use. The research supplies a framework transforming the waterline from an object into a system by organizing participation of diverse stakeholders, which has significant practical and academic relevance.

Content

1 Introduction

- 1.1 South Florida & The Miami River
- 1.2 Miami River: From Zone to Line
- 1.3 Hypothesis: Miami River as Urban Landscape Infrastructure
- 1.4 Research Objective & Questions
 - 1.4.1 Research Objective
 - 1.4.2 Research Question
- 1.5 Methods
- 1.6 Relevance
- 1.7 Report Structure

2 Research Approaches

- 2.1 Theoretical Background
 - 2.1.1 Urban Landscape Infrastructure
 - 2.1.2 Ecosystem Services
 - 2.1.3 Understanding Systems
- 2.2 Method
 - 2.2.1 Site Analysis
 - 2.2.1.1 Historical Evolution Analysis
 - 2.2.1.2 Assessment of Current Conditions and Potentials
 - 2.2.2 Precedent Study of Successful Projects
 - 2.2.3 Research by Design

3 Miami River & Canal: Challenge & Opportunity

- 3.1 Urban Context
 - 3.1.1 Historical Development and Contemporary Context
 - 3.1.2 Typical Sections and Prototypes
- 3.2 The Issues of the Miami River & Canal
 - 3.2.1 River and Natural System
 - 3.2.2 River and Water Management
 - 3.2.3 River and Infrastructure
 - 3.2.4 River and Urban Structure
 - 3.2.5 River and Space
 - 3.2.6 River and Accessibility
- 3.3 Issue Conclusion and Future Outlook
 - 3.3.1 Problem Summary
 - 3.3.2 Potential Opportunities of the Riverfront Area

4 Design Strategies & Principles

- 4.1 Precedent Study
 - 4.1.1 Regeneration of a Historical River: Cheonggyecheon Stream (Seoul)
 - 4.1.2 Industrial Waterfront Transformation :Chicago Riverwalk Project (Chicago)
 - 4.1.3 Overcoming Restriction of Land Utilization: *Jardins de la Rambla de Sants* Elevated Park (Barcelona)
- 4.2 Design Strategies
- 4.3 Design Principles

5 Explorations: New Urban Landscape Infrastructure

- 5.1 Vision
- 5.2 Strategic Plan
- 5.3 Systemic Design
- 5.4 Design Toolkit
- 5.5 Strategic Areas
 - 5.5.1 Mining Lake Area
 - 5.5.2 Industrial Area
 - 5.5.3 Downtown Area
- 5.6 Urban Landscape Infrastructure as Spatial Backbone
- 5.7 Urban Development Over Time
- 5.8 Governance & Related Stakeholders

6 Synthesis

- 6.1 Discussion & Conclusions
 - 6.1.1 Critical Reflection on the Study
 - 6.1.2 Lessons Learned
- 6.2 Outlook

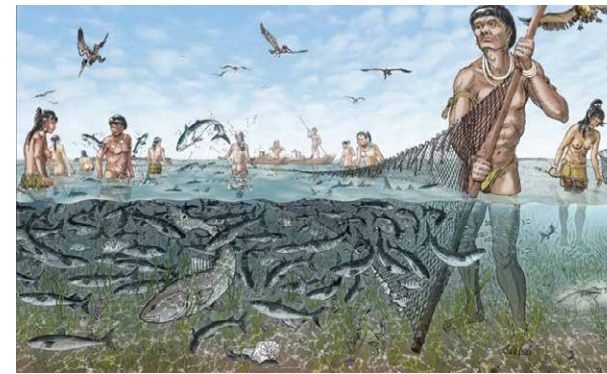
CHAPTER 1

Introduction

1.1 South Florida & the Miami River

Miami is located at South Florida which owns a glorious and ancient history^[1] of diverse and unique ecosystems, including Cypress, the Everglades, Tropical Hardwood Hammocks, etc. In particular, The Miami River is the oldest natural landmark and the earliest settlement area of Southeast Florida in history^[2], evolving over thousands of years. It connected the Biscayne Bay and the Everglades in history, providing essential natural resources for the locals to live as well as the ecological migrating corridor and habitat space. The native Indians regarded the river as important public space for recreation and food and water provision. People used boats to move across the river freely.

However, due to the impact of current issues of environmental risks and sustainable development, the city should think how they should treat their history and face the changes. With the rapid speed of urbanization, the ancient ecosystems decreased dramatically and the Miami River became a complete working river, changed from a zone to a line. As the reinforced concrete and grey infrastructure occupied the waterfront which made the river a spatial barrier, the river lost its ability of integrating the surrounding urban space. Many parts of the riparian area turn its back to the river. The river now acts as a boundary isolating the both river sides. No interaction happens between the industrial and neighborhood area. What role does infrastructure play and what can we do to make the improvement?

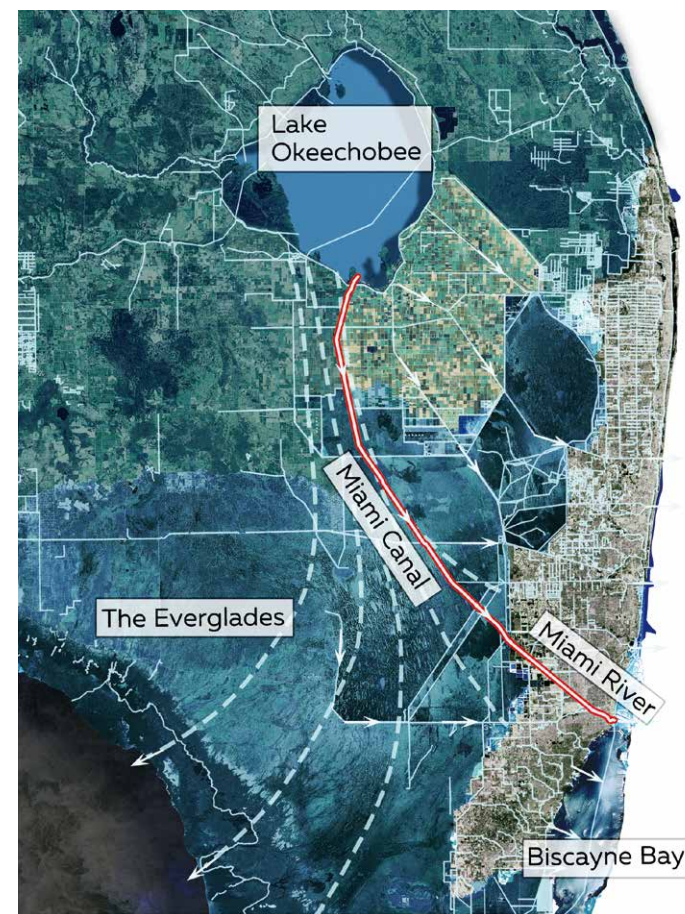
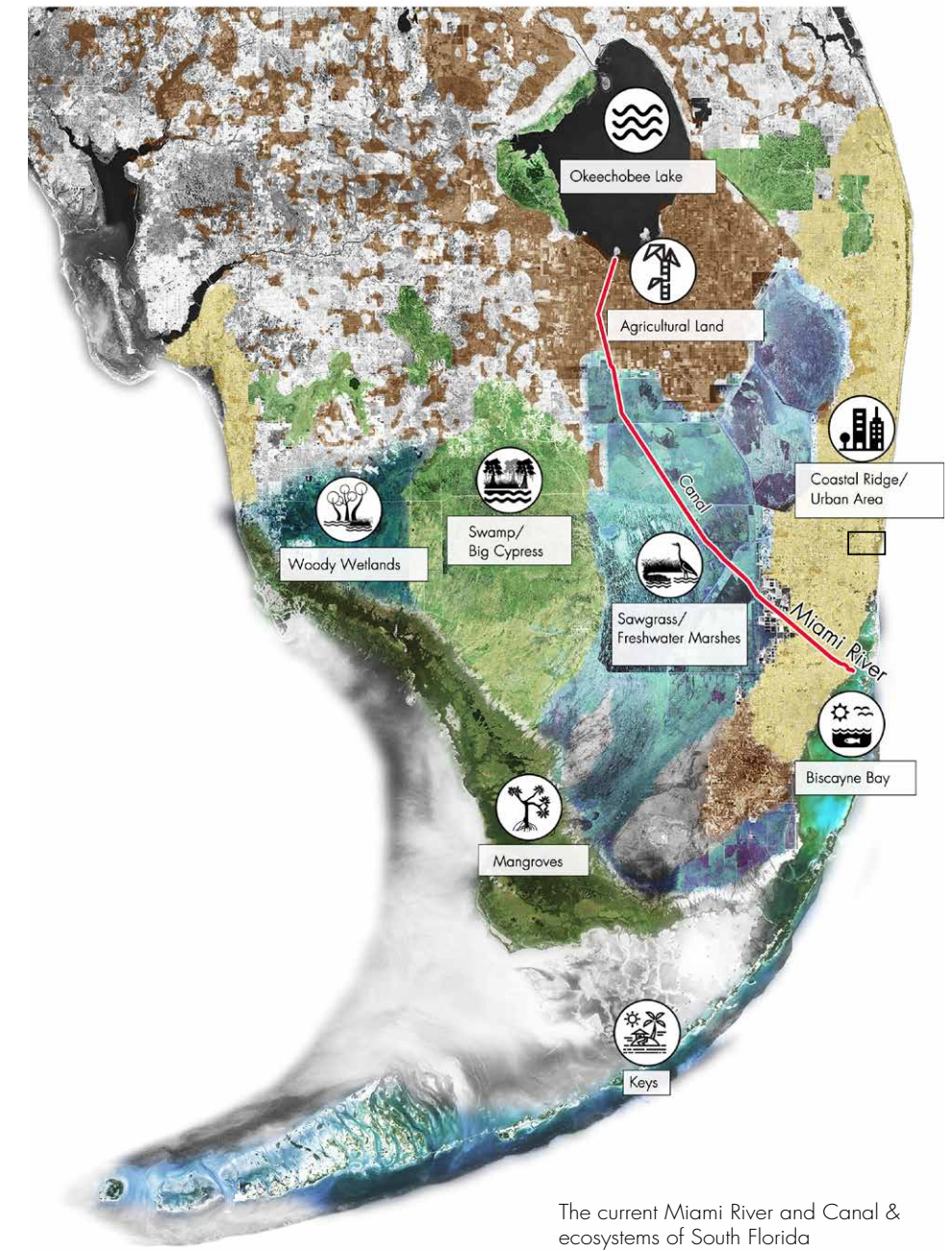


Tequesta Indians settled around Miami River

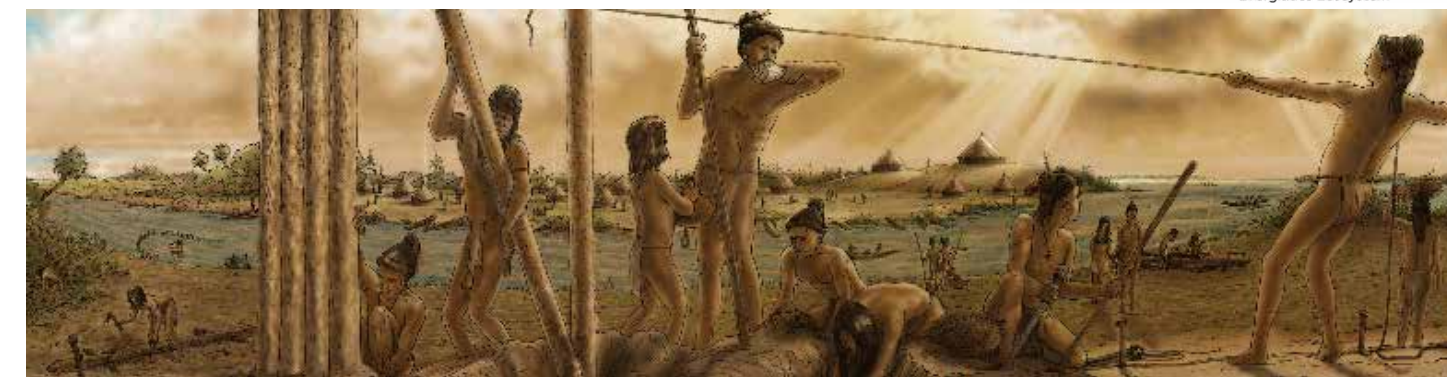
1.2 Miami River: From Zone to Line

Having been losing the ancient environmental traditions of South Florida during the past century, the urbanized Miami is armed with heavy grey infrastructure, especially the Miami river waterfront. As a natural river with broad eco-flourishing land over a century ago, the current river is just a canalized hard line with few connection to surrounding land. The local industry and urban construction have been making Miami city isolated from the vast everglades and devouring its traditional city identity. The ecosystem memory is fading away from the city.

Lost enough interactions with the urban surroundings, the river changed from a integrated and sustainable zone to a hardened line, faced with serious environmental and urban issues. The Miami River becomes a flooding zone with severe pollution problem without self-adaption ability. Many riparian urban areas are turning back to this important river. It is regarded as tools of shipping and sewage discharge^[3]. Resulting from the neglect of traditional ecosystems, the urban ecosystem services are not strong enough to provide the city with safe and sustainable environment to develop. It is essential to do a self-reflection that how should people review their tradition and the urban infrastructure, and how to integrate the river with its urban context again to lead a sustainable development.



- Original Ecosystem Services
- Fresh Water Supplying
 - Fishing for Food
 - Boating for Transportation
 - Water Recreation
 - Flood Regulation
 - Agriculture Water Use
 - Wildlife Habitats
 - Animal Migration



Equesta community near the ancient Miami River
source: Miami History Mesuem



"Rock Lake" Limestone Mining Pollution



Contamination Spread resulted from Frequent Storm Surge & Flooding



Threatened Water Quality made by Nuclear Plant Leak Pollution

Now the Miami River becomes a flooding zone with severe pollution problem. Many riparian urban areas are turning back to this important river which is regarded as tools of shipping and sewage discharge. Resulting from the neglect of ecosystems, the urban ecosystem services are not strong enough to provide the city with safe and sustainable environment to develop. It is essential to do a self-reflection that how should people review their tradition and the urban infrastructure.



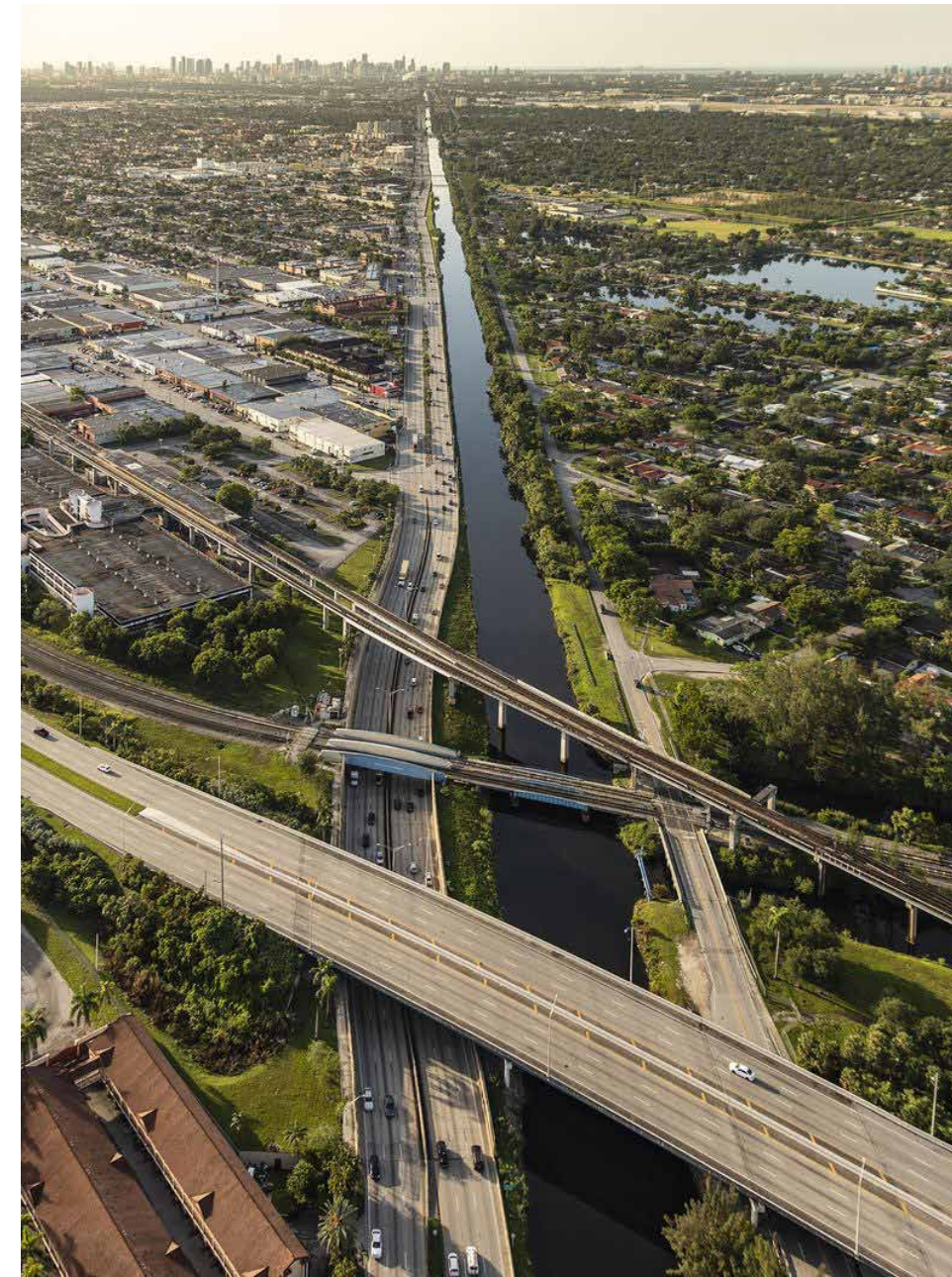
Drinking Water Problem Due to Saltwater Intrusion



Pollution of Biscayne Aquifer by Septic Tank due to Sea Level Rise



Toxic Water Due to Algae Bloom



1.3 Hypothesis: Miami River & Canal as Urban Landscape Infrastructure

As a main backbone in both urban tissue and historical context, Miami River has great potential to transform the grey linear area into a new resilient urban waterfront zone providing ecosystem services. The river itself has strong potential to become landscape infrastructure to face the environmental and urban challenges. Then what can be the possible spatial and functional characteristics of it?

The new landscape infrastructure, the Miami River, provides new public space with main functions such as water purification, flooding regulation and environmental engagement and public education. In order to achieve that, the pattern of the landscape infrastructure will be defined according to the current important urban morphology and public space. The native habitats as well as artificial habitats will be restored and to alleviate the ecological pressure and develop a new urban ecosystem with multiple and adaptive functions related to flood regulation, water purification and protection.

On the other hand, cultural service is an important clue to define the landscape infrastructure. New path system will help people understand the environmental context and how river and city history are connected. Ecological education is especially meaningful along urban rivers because most of the original forms of ecosystems have been damaged. Raising awareness of public about rivers and their natural systems will provide a sense of stewardship and connection to the history of rivers.^[4] With the new infrastructure, Miami River will give full play to the value of its ecosystem services through its rich human and natural history. The added values of it will strengthen the city identity and create a new ecological and social-economical zone.



The state officials even don't know why the canals existed in history. What they do now is just to face the water issues.

Robert V. Sobczak, Hydrologist Big Cypress National Preserve



The problem that Miami people are facing is "non-tradition". With climate change and sea level rise, it is important to think how local people face the changes."

Allan Shulman, Associate professor at the University of Miami School of Architecture, Chief Designer of Shulman + Associates



1.4 Research Objective & Questions

The research objective is to transform the Miami River and Canal into urban landscape infrastructure that establishes new ecological and social-economic urban public space with high urban vitality and sustainable development.

The study will identify and test design strategies and principles to achieve the river transformation from a hardened line to a closely-connected zone with ecosystem services?

In order to do that, the following questions need to be answered:

1.How does the Miami River functions in its contemporary urban context? What are the main challenges and potentials?

2.What are the possibilities to integrate the Miami River in the urban context from a spatial, ecological and functional perspective?

3.How can the river transform from a infrastructure to a landscape infrastructure?

4.What are the lessons learned from Miami River relevant to similar urban rivers elsewhere?

1.5 Methods

The questions will be answered by applying the following method: site analysis, principles from precedent study and application through design experiments at multiple scales. Based on the site analysis indicating the crucial urban and natural issues, the initial research reveals the problem of the systems. With an integration of the problematic aspects, it is essential to learn significant design principles through precedent study of successful cases. With those principles as tools, the design explorations give possibilities in different urban scenarios providing strong proposals. The design at multiple scales illustrates the relations and significance of the strategic areas in the whole system.

Research by design is the main methodology which provides a platform to explore the spatial possibilities of future urban development. After making it clear of the research objectives, design process can help go deeper to the final study target with the help of doing the problematic and opportunity mappings. The design scenarios can help to explore the possibilities of design and make sure that the more suitable plan can be chosen as the final application. Also, the assessment of the current use of the river is useful, providing practical and essential information of what kind of intervention really meet the locals' needs.

1.6 Relevance

Academic Relevance:

This study has referential value to the revitalization of other urban rivers. Firstly, it is important to understand the historical role during the urban development process which helps designers to give an accurate orientation for defining the urban river. Secondly, concerning urban ecosystem services as important principles for designing the infrastructure can promise the comprehensive functions of a sustainable urban river. Also, exploring the approaches of achieving the equitable ecosystem services is a crucial aspect in order to maximize the value of a urban river and to contribute to human well-being with adequate public benefits. Landscape infrastructure acts as significant platform and bridge to hold the mentioned contents, and finally present them in a spatial way. The whole framework can be regarded as a general process of treating a urban river.

Societal Relevance:

Firstly, as the study area exists in complex social environment with mixture of migrants and diversity of races, the research can integrate the social interactions of the Miami people. The river with fascinating environment can serve as new spatial and social bonds. Secondly, The framework of the planning and design is significant to balance the benefits of the stakeholders especially the owners of the waterfront land due to the complicated situations about private and public land use in Miami. Miami city can catch a new economic development through such planning framework and design.

1.7 Report Structure

The introduction shows the overview of the research with basic study background, giving the general framework of the research objective. Chapter 2 illustrates the theoretical framework employing three important theories or lenses in order to build the instructing structure. In chapter 3, the analysis of the contemporary urban context and the challenges and opportunities indicate the concerning orientation. Then the chapter 4 sets the design strategies and principles which act as the core design instructions contributing to specific contexts. Those strategies are based on the precedent study of successful projects. Next, chapter 5 is mainly about design explorations at multiple scales with some scenarios discussion to show design possibilities. The last chapter is the synthesis part expressing reflection and outlooks of the research.

Reference of Chapter 1

- [1] Website: Trail of Florida's Indian Heritage.
<https://www.trailoffloridasindianheritage.org/miami-circle-3>
- [2] Website of Miami River Commission.
<https://miamirivercommission.org/river3.htm>
- [3] Website: Miami Herald.
<https://www.miamiherald.com/news/local/community/miami-dade/article144121814.html>
- [4] Bülent Cengiz. Urban River Landscapes[D]. p561. Book Citation Index in Web of Science™ Core Collection (BKCI) 2017(7)

CHAPTER 2

Theoretical Framework

The theoretical framework introduces the methodological and theoretical frameworks: the basis of this research with urban landscape infrastructure and ecosystem services. The layers approach act as an important way to understand the urban systems and include both of the current situations and the design explorations.

2.1 Theoretical Background

The two main theoretical principles for the research is urban landscape infrastructure and ecosystem services. Urban landscape infrastructure is the core design approach and provides an spatial basis for the whole research design that integrate all the natural and urban element in a systematic and logical framework. Ecosystem services are the instructing and evaluating principles which indicates the orientation of urban landscape infrastructure design.

2.1.1 Urban Landscape Infrastructure

Then what is urban landscape infrastructure? It can be regarded as a methodology that expands the performance parameters of a designed landscape to a multifunctional, high performance system, including those systems originally ascribed to traditional infrastructure^[1]. Urban design based on principles of landscape infrastructure is focused on landscape-based integration of the built and natural environments—seeking out innovative opportunities for building nature and public amenities into the infrastructure of a city. It is an evolutionary approach to strategizing economically and environmentally sustainable multipurpose infrastructure systems, reversing urban sprawl and regenerating our invaluable natural resources^[2].

The world is having an urgent need for new and repaired infrastructure systems. The design and planning professionals have the crucial opportunity to re-imagine networks that support multiple uses and functions. Multipurpose infrastructure conserves land, shares the financial load of its development, restores previously overlooked or damaged natural ecology, reinforces healthy transit options, and provides public access to much needed open space.

As important design theory of the research, considering them as armatures for the development of urban systems and which facilitate social and ecological interactions. It seeks to redefine infrastructural design as interdisciplinary design effort to establish a local identity that has tangible relationships to the region^[2]. Urban landscape infrastructures can thereby be used as a vehicle to re-establish the role of design as integrating practice.

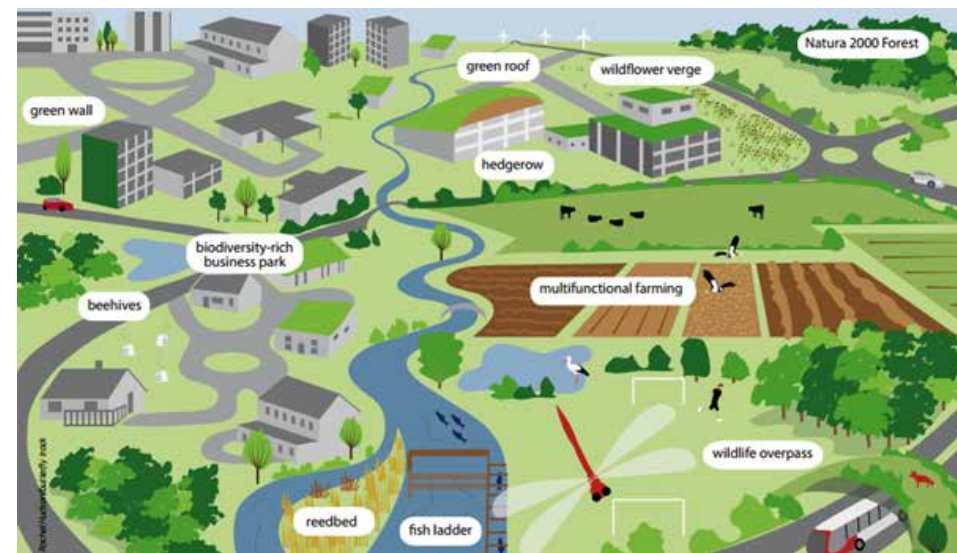


Image of Landscape Infrastructure.
Source: European Commission, 2013.
Building a Green Infrastructure for Europe.



Highline Park.
source: <https://www.introducingnewyork.com/high-line>



Buffalo Bayou Promenade project
picture source: SWA Group

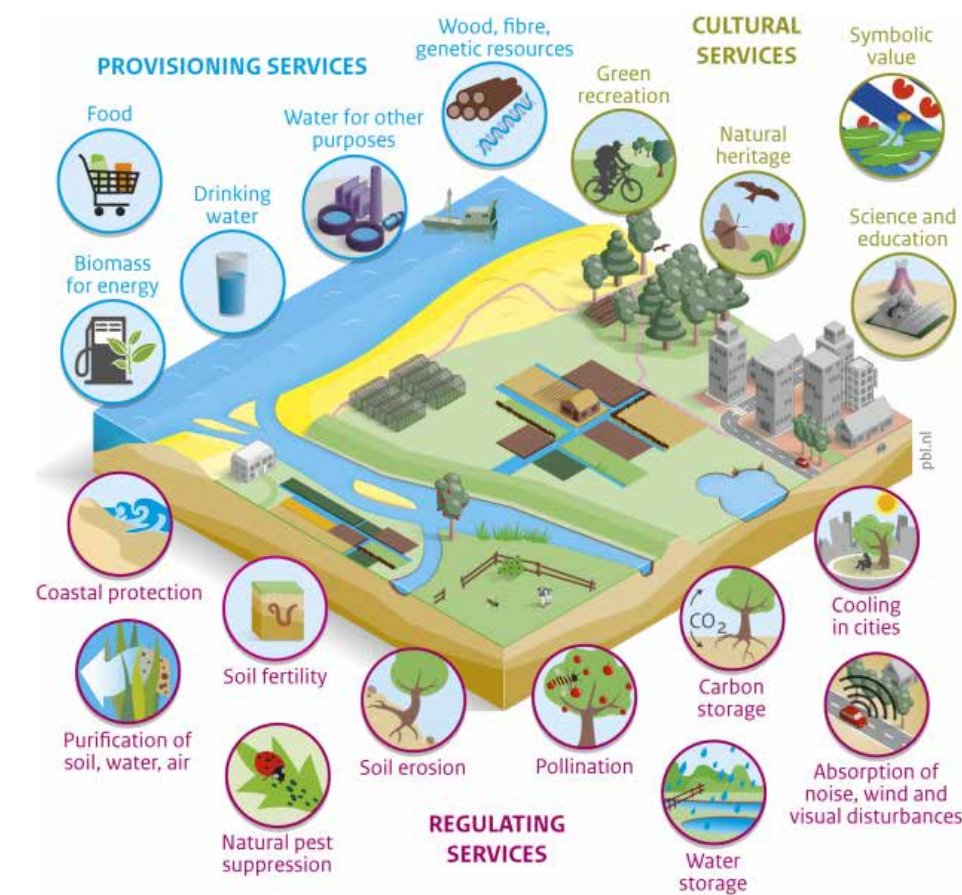
2.1.2 Ecosystem Services

Ecosystem services are the varied benefits that humans freely gain from the natural environment and from properly-functioning ecosystems. They compose a strategically planned and managed network of different types of natural spaces (parks, ecological corridors, river, lake, forest, etc.) that conserve the values and functions of a natural ecosystem and provide associated benefits to human populations^[3].

The ecosystem services act as the crucial indicator for the design which gives significant orientation of the designed urban green space and new green infrastructure. The eco-functions would be more clear and reasonable under such theory. For this research, the regulating and cultural services are the two most important factors concerning climate change risks and the improper development of urban space.

Ecosystem Services:

- Supporting services
- Provisioning services
- Regulating services
- Cultural services



Source: PBL, WUR, CICES 2014

source: PBL, WUR, CICES 2014

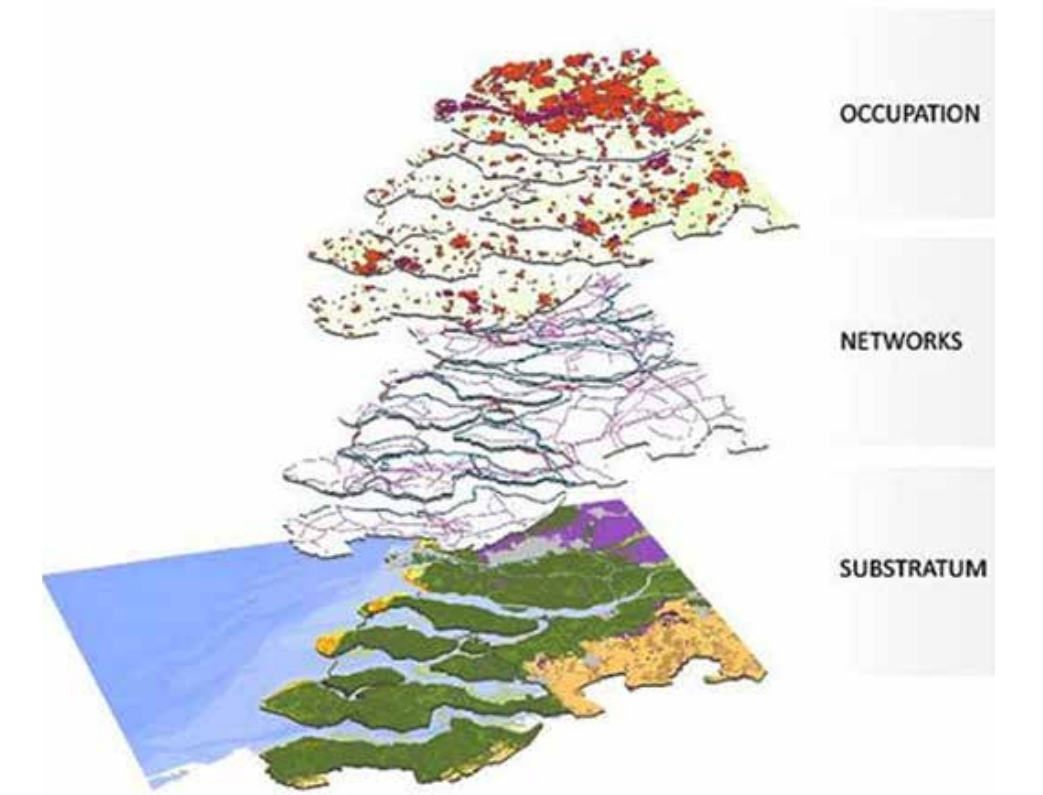
2.1.3 Understanding Systems

On account of the complex systems of urban and natural aspects of Miami, the research is based on the theory of layer approach to analyze the interrelated elements of different layers and to make planning and design proposals. As a historical river, the Miami River possesses the changed natural systems, highly-controlled water management, huge grey infrastructure of surroundings, restricted public space and low accessibility for pedestrians. The layer approach would help to figure out the relations of systems and give the proper urban landscape pathology.

The layer approach understands the landscape as a system of three layers, each with its own attribute of dynamics. The basic layers are natural environment layer, infrastructure layer and urban composition^[4]. As far as the research is concerned, it is of significance to strip the different layers of the whole system. With nature and urban interwoven together, the layer approach would help clarify the complex system and the inner relations through both of temporal and spatial dimensions. The relationships between environmental conditions and human

responses and interventions can be explored by decomposing the landscape in different layers, stratifying them according to the level of influence and dynamics of change^[5].

This lens can guide clearing framework thinking of the urban landscape infrastructure and ecosystem services as each of them possesses complex and interactive aspects. With layer approach as a tool, it is significant to do research by design through explicit theoretical principles.



Picture Source:
H.Meyer, S.Nijhuis.Delta urbanism: planning and design in urbanized deltas – comparing the Dutch delta with the Mississippi River delta. 2013.

2.2 Methods

2.2.1 Site Analysis

2.2.1.1 Historical Development Analysis

As is illustrated, historical development process is important for this research. From history studying, it would be easier to understand the transformation that the river has been changed from a ecological zone to a hardened line. The historical process of the river shows how the ecosystem services changed from the ancient time till now. It gives a very clear clue through comparing different historical stages like ecosystem functions, human lifestyle and social development to guide the research in an definite direction. The basic context builds a strong argument to make the discussion and exploration more significant.

2.2.1.2 Assessment of Current Situations

The current conditions of the river also act as important role providing the basic reference for setting future development strategy. Regarding the urban linear area as a integration of diverse systems, the future development tendency and possibilities are uncertain and there exist many potentials which could be in good or bad situation. The design strategy should take the ability of self-adaption and self-organization into consideration arming with flexibility. In this sense, the study of current conditions work as the basis for exploring open-ended strategies.

2.2.2 Precedent Study of Successful Projects

As the research concerns urban area with diverse characteristics of systems, the precedent study of some successful design projects which have similar backgrounds in international contexts. For instance, the downtown area on highly urbanized level requires different strategy compared with the rural mining lake area. However, the proposed design strategies should integrate different areas into a coherent system.

The significance of precedent study is to extract the helpful aspects of each of the projects and conclude the design strategy and principles. In this sense, the research would be more practical based on a theoretical framework.

2.2.3 Research by Design

The main method is research by design through making design explorations to discuss the possible future spatial configurations. From the design explorations part, different future possibilities are shown by scenarios which also reveal the possible temporal natural and urban processes. Moreover, the thinking of layer approach also work as useful instrument for the possibilities discussion, reflected in how the intervention of different layer interact with each other leading to various conceivable and feasible results. The method is aiming at modelling in the future: knowledge based design (design research) of place, space image and program resulting in a landscape composition^[6]. Using the power of design is an approach to make the research convincing and persuading to academics and societal development proposal.

Historical Sites of Miami



Fort Dallas was a military base during the Seminole Wars, located on the banks of the Miami River in what is now downtown, Miami



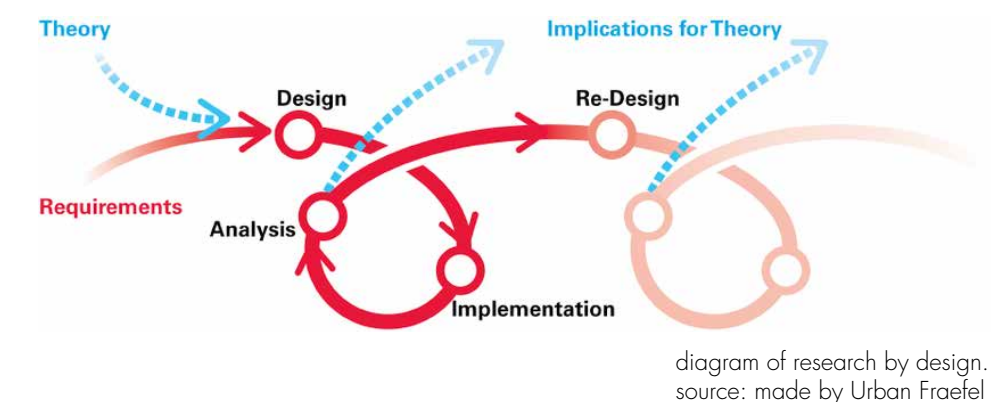
Built in 1855 by one of Miami's earliest pioneer settlers, the William Wagner Homestead is the only known house that remains from the early days of settlement along the Miami River.



Miami FL Lummus Park HD plantation slave qtrs01



Miami Circle, a site sacred to the Tequesta Indians, the first settlers of Miami



Reference of Chapter 2

- [1] SWA Group. Landscape Infrastructure—A Tool for Making our Cities Better. http://swacdn.s3.amazonaws.com/1/d281f914_swadesignbriefing-landscapeinfrastructure.pdf
- [2] S. Nijhuis, D. Jauslin. Urban landscape infrastructures. Designing operative landscape structures for the built environment. *Research In Urbanism Series*, 3(1), 13-34
- [3] Website of Wikipedia, ecosystem services: https://en.wikipedia.org/wiki/Ecosystem_services
- [4] H. Meyer, S. Nijhuis. Delta urbanism: planning and design in urbanized deltas—comparing the Dutch delta with the Mississippi River delta. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*. 2013(6).
- [5] S.Nijhuis, M.Pouderoijen. Mapping Urbanized Deltas. *Urbanized deltas in transition*. Publisher: *Techné Press*. 2014.
- [6] S.Nijhuis, I.Bobbink. Design-related research in landscape architecture. *J of Design Research* 10(4):239 - 257. 2012

CHAPTER 3

Miami River & Canal: Challenge & Opportunity

Chapter 3 addresses research question 1, exploring how the Miami River functions in the current urban context. It elaborates the natural/urban system and identifies the main challenge and potentials. Through understanding its historical development and the relation between the river and the city, the analysis gives strong argument for the development strategy and design explorations.



Historical Development of South Florida

3.1 Urban Context

3.1.1 Historical Development and Contemporary Context

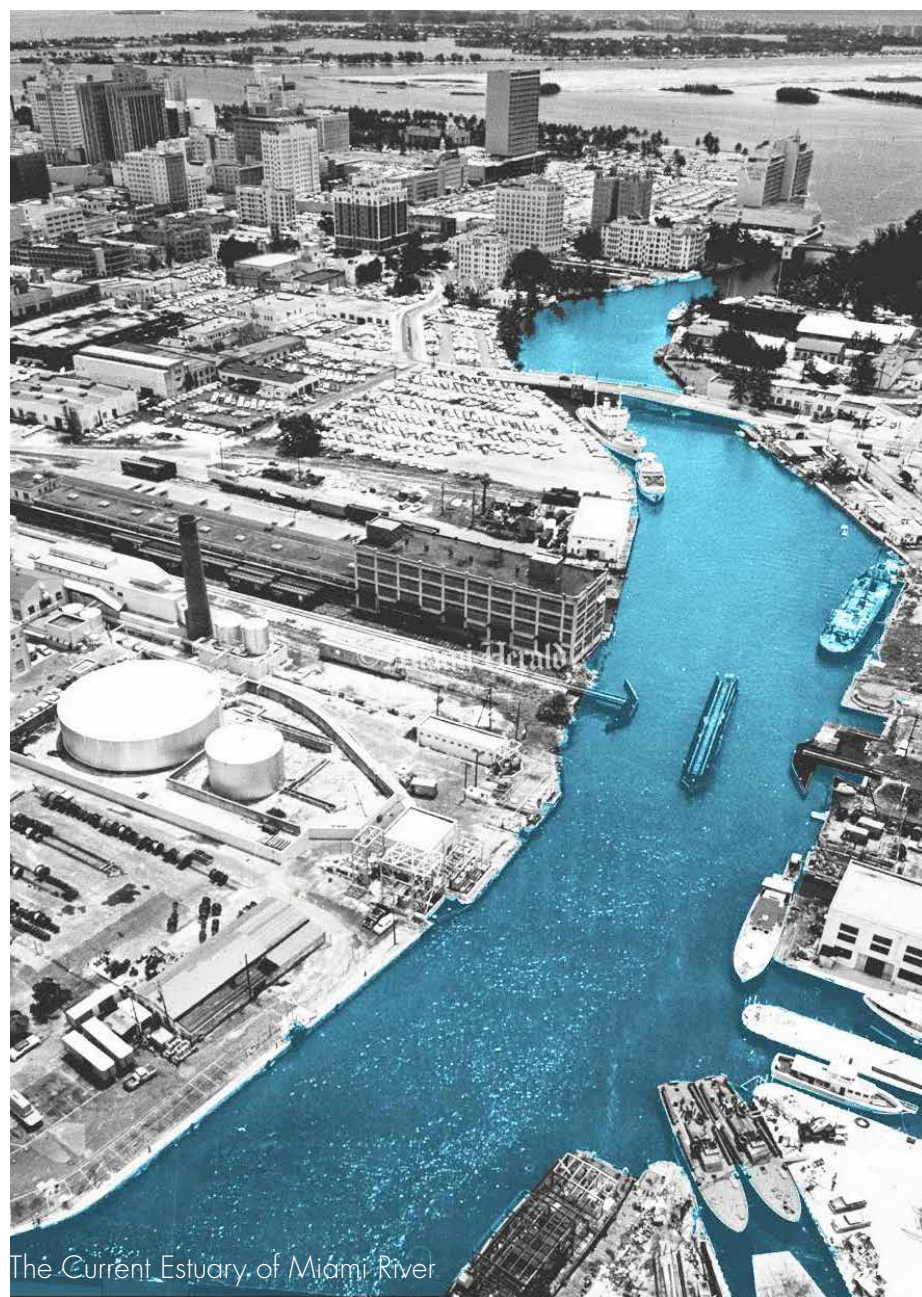
The development of Miami River has experienced a long process and dramatic change. In the ancient time, it was in the original natural form with flooding plain and flourishing ecosystems. The local alligator and manatee were the most typical species living in the river. The earliest settlement of South Florida was located to the south of the estuary part of the river. The Miami River has a special meaning to the region that it gave birth to Miami city. The word "Miami" which is from local Indian language means "sweet water"^[1].

However, as time goes by, people started to construct the river due to shipping demands. Then it began the process of canalization. When the Eastern South Florida Railway extended to Miami city, the urban district experienced a rapid growth during the 20th century. From 1908 people decided to extend the river with a connected canal to the Lake Okeechobee in the north in order to drain the arable land. At the same time, the river value of shipping was excavated dramatically^[1].

The river was dug deeper and wider for higher capability of carrying big ships with products. The construction destroyed the original ecosystems and made the river from eco-harmonious to human-controlled. The Miami River and the new canal part became wider than before while the hydrological system lost the capability of adjusting seasonal water level change in a flexible way. Nevertheless, what made the situation worse was that people tended to regard the river just as a channel for shipping and a drainage for discharging sewer. So far, the Miami River has become a working river, with the fading-away role in history.

Few people concern the original value of it so that parts of the urban area just turn it back to the river for development. The Hammock and Pinelands do not exist in the original area any more but only can be found in the Everglades National Park.

In addition, The river was isolated from the surrounding urban context leading to less related urban industry with low spatial quality. The discontinuous urban environment is the main issue of Miami.



The Current Estuary of Miami River

The overview of the river changing process shows the fading away phenomenon of the urban ecosystems. With the urban development, the sprawling city occupied the waterfront and make the ecological area which is the most precious treasure of the district disappear.



1500s
First settlers of native Indians
Settling around the Miami River mouth
Fishing for a living
Building Miami Canal connecting with Lake Okeechobee



1894
Before Florida railway was built
Miami River not exploited
Natural river bank & vegetation



1909
A working river: shipping, industry, entertainment
Canalized: hard river bank
Settlement with low rise houses along the downstream river



1922
Increasing shipping infrastructure
Fast growth of buildings along river
Green space declined substantially

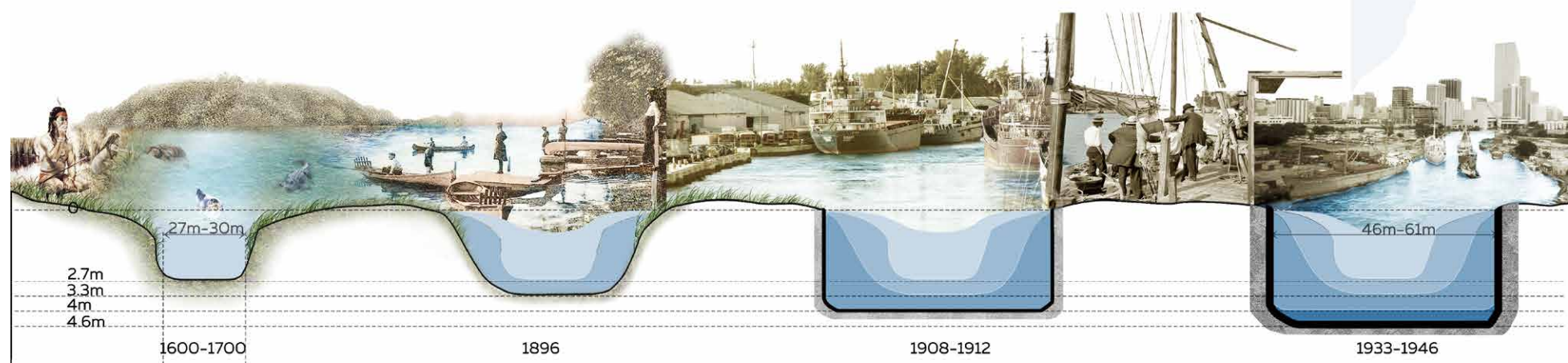
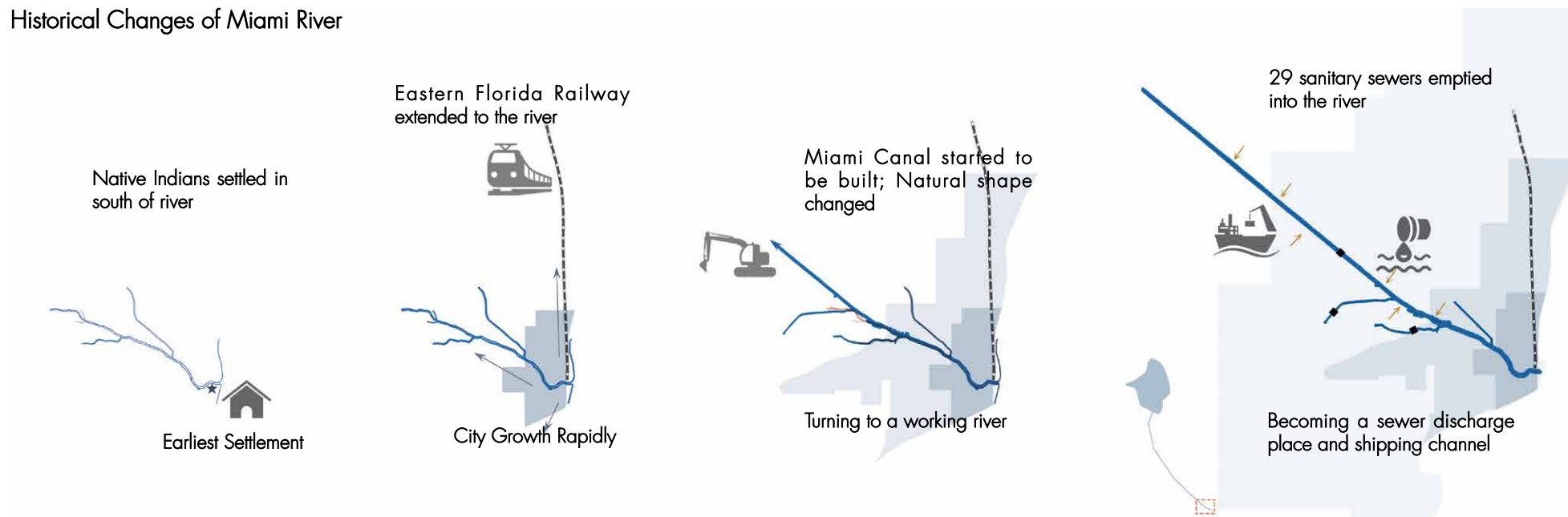


1970s
Fewer public space accessible to the river
Many alien settlers went to riverside neighborhood
The downtown formed near the downstream river

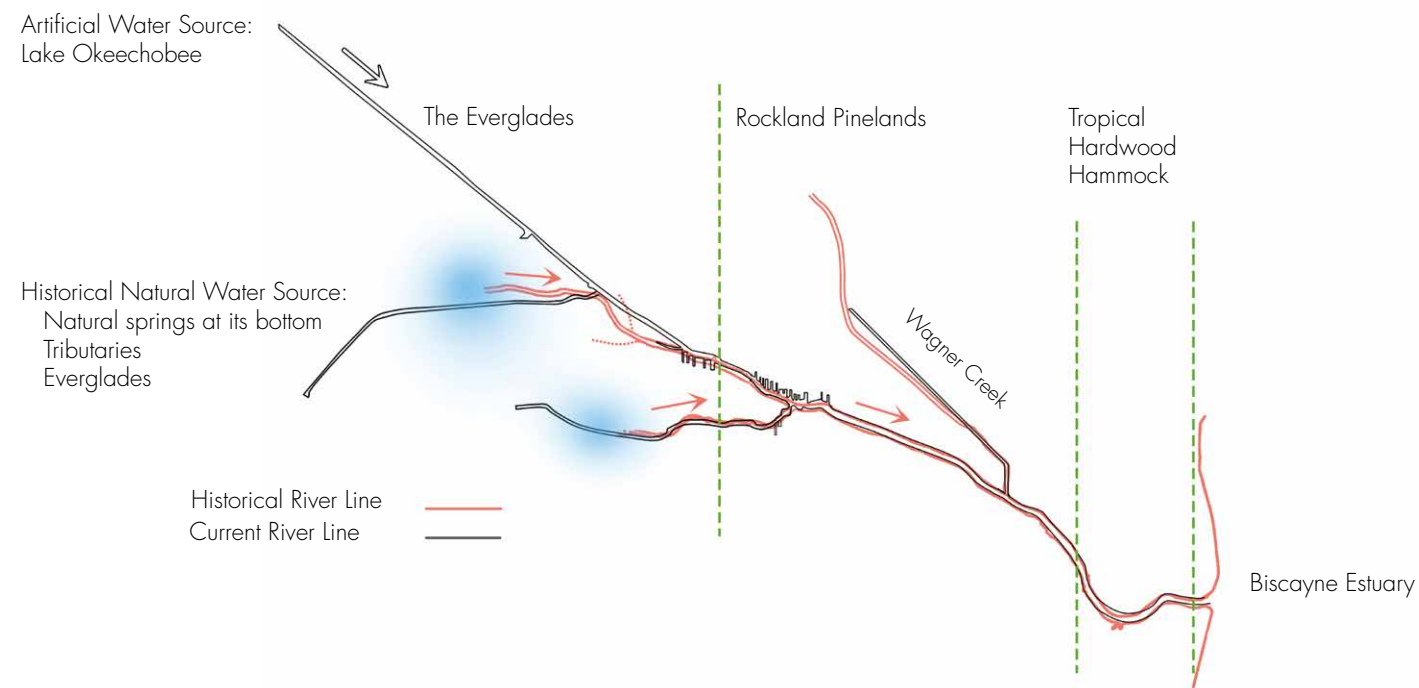


Now
The river is losing its historical and city identity

Historical Changes of Miami River



Change of the River Form & Shape



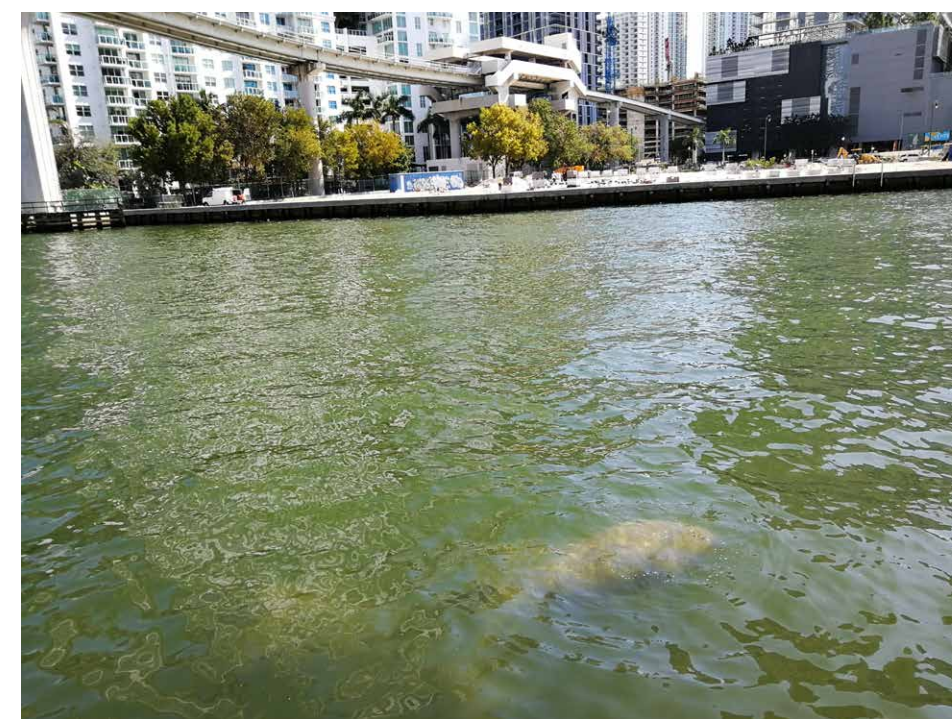
The conceptual sections shows the historical changes of the Miami River. It is obvious that the canalization happened through the hundreds years making the river lose its resilient public space. The river is treated as a sewer discharge place leading to serious pollution problem especially the Wagner Creek^[2]. Redundant shipping activities affect the local species including manatees.

Pacing along the Miami River and the canal part, it is difficult to feel the water culture of the area with an ancient history. Freight industry takes up the riparian space causing spatial mess. For many parts of the river, they just works as a boundary of the city. The natural form changed due to human construction in the 20th century. The historical water body was reshaped and extended to a straight line. The natural water source disappeared with urban sprawl.

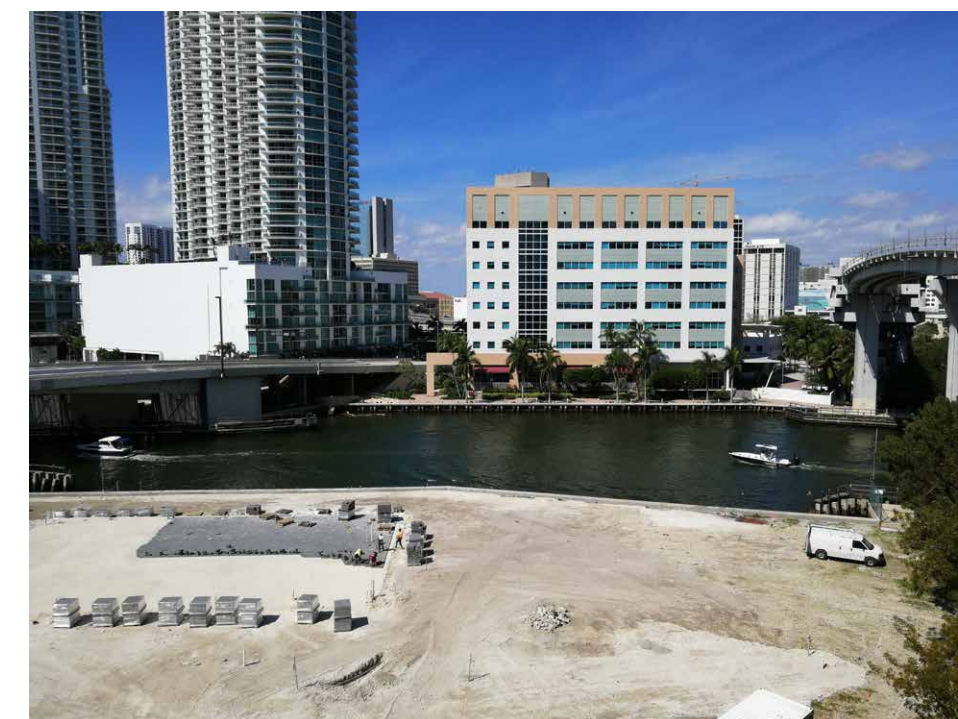
As is mentioned, ecoflourishing environmental tradition has been disappearing during the past a hundred years. There were three typical ecosystems near the historical area of Miami River: tropical hardwood hammock, rockland pinelands and the everglades. The native alligator and manatee lived in this vast land with rich natural treasure. When the Anthropocene era came, the original ecosystem was fading away and taken up by the human-built environment gradually. The ancient ecosystem changed into different types of urban component.

The ancient river interwove the surrounding land through its ability of adapting to environmental changes in a resilient way, including flooding regulation, hydrological purification and circulation, wildlife habitat provision, nutrients provision, recreation and spiritual cultivation for humans. In other words, the altered ancient ecosystem services led to the degradation of the river and the city.

Now the manatee has to live between the cracks of concrete and the ships in the river. There is no resilient buffer zone for flood adjustment and contaminate purification. Few riparian public space exists along the river.



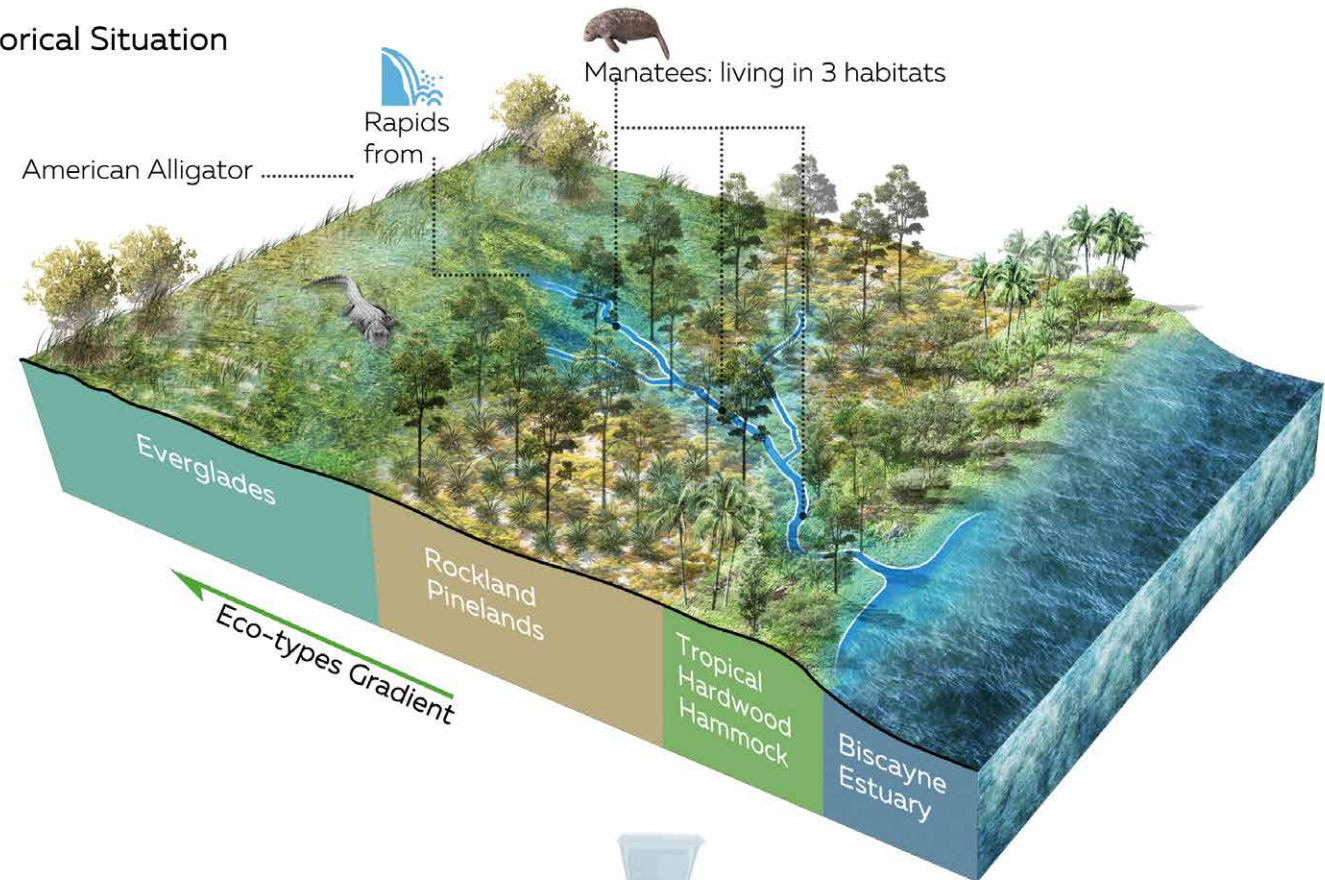
manatee in Miami River photographed by X. Zhang



riparian area in downtown photographed by X. Zhang

Change of the Urban Environment

Historical Situation



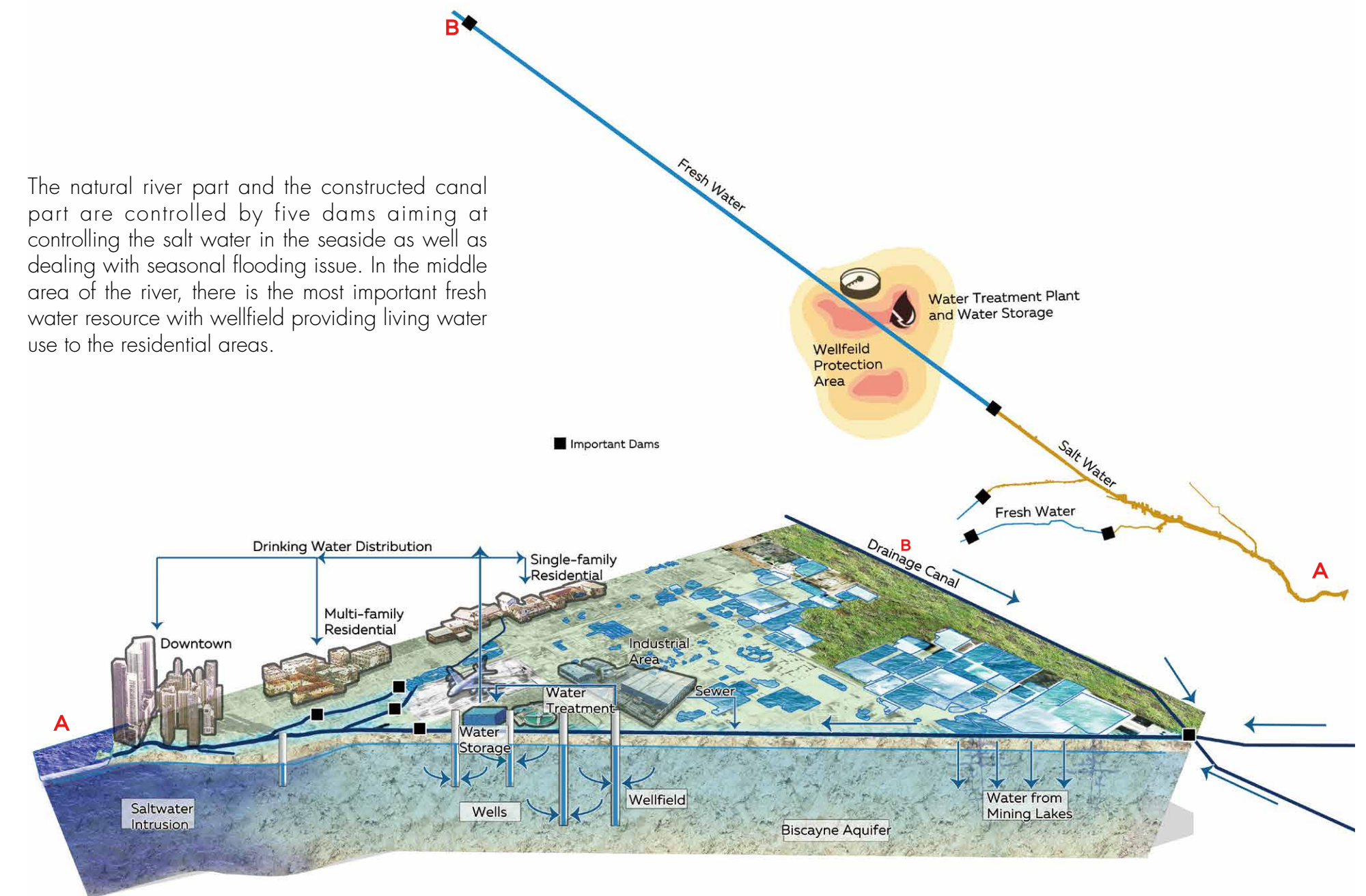
Current Situation



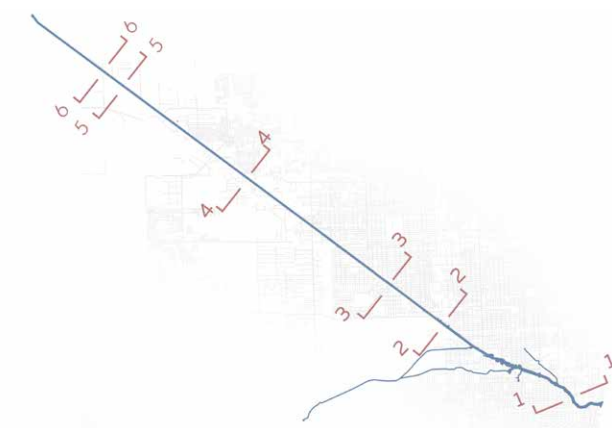
Rich Ecosystems Diminished

Current Water Management of Miami River & Canal

The natural river part and the constructed canal part are controlled by five dams aiming at controlling the salt water in the seaside as well as dealing with seasonal flooding issue. In the middle area of the river, there is the most important fresh water resource with wellfield providing living water use to the residential areas.

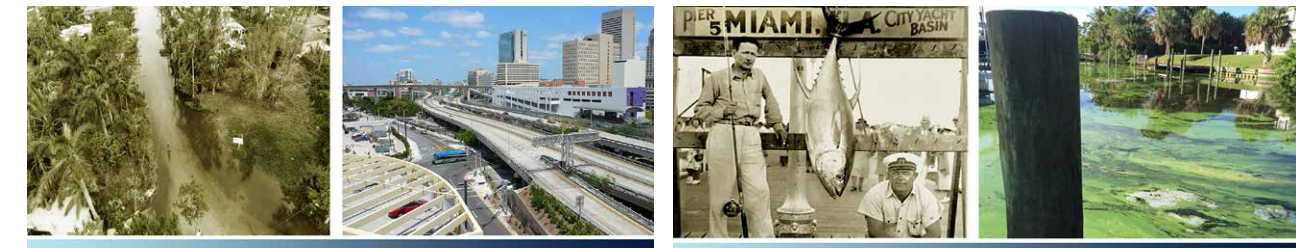


However, the whole water management system is facing with big problem. The salt water intrusion comes through underground due to the dry and vacant subsoil structure resulted from too much water drainage. The fresh water resource is threatened by such intrusion issue. The mining lake in the upstream causes a great deal of pollution with toxic mineral materials leaking into the Biscayne aquifer.



Fishing

Shipping



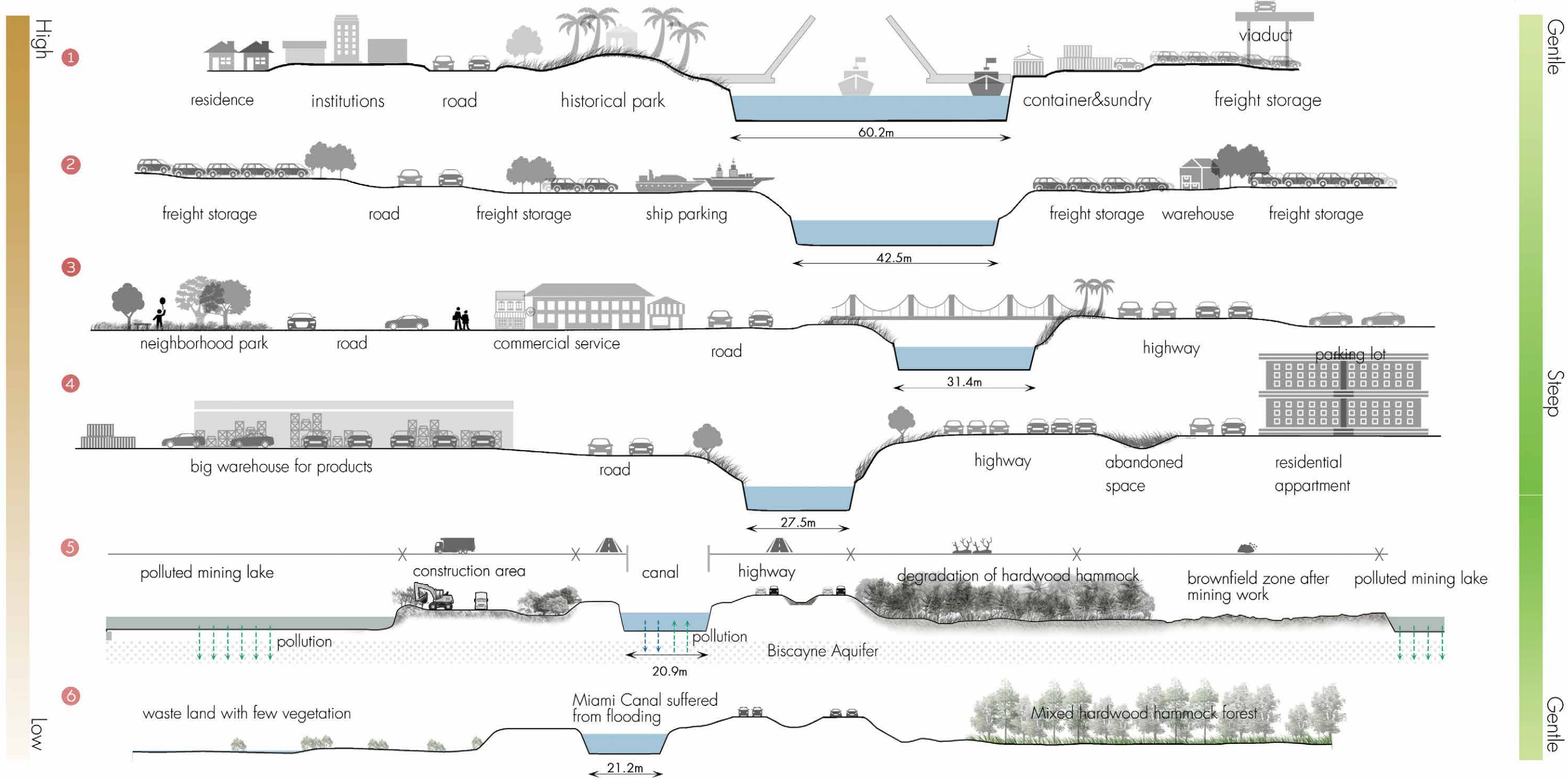
Natural Land

Water Quality

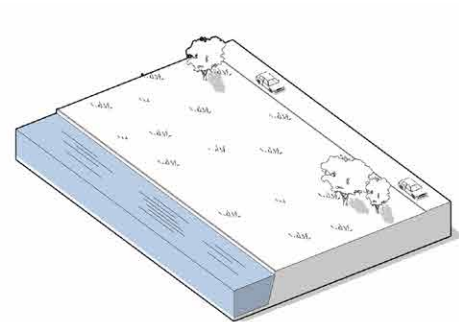


Recreation

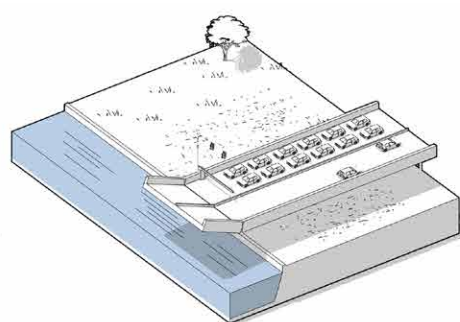
Land Utilization Rate;



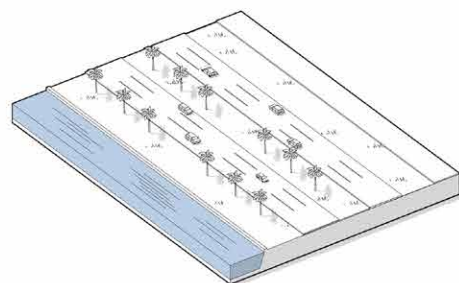
Current Waterfront Typology



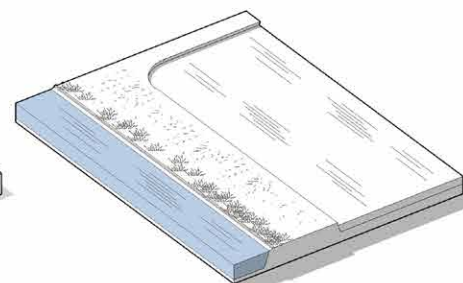
Monotonous Lawn
Unutilized Waterfront Space



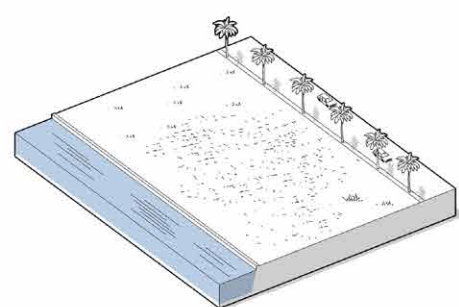
Bridge only for Vehicles;
Brownfield without
Maintenance;
Lawn with Few Activity & Wildlife



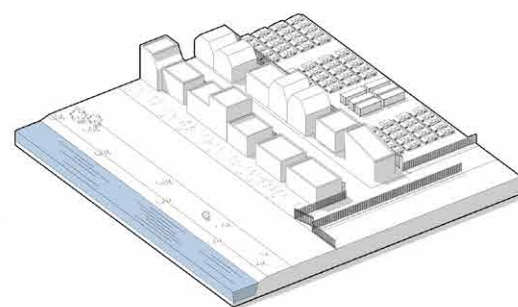
Decorative Greening;
Incompact Highway



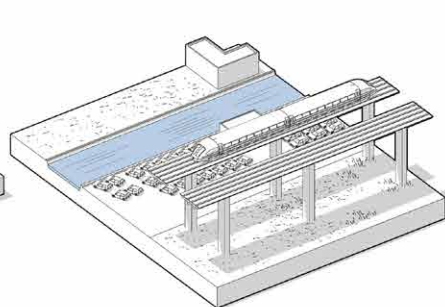
Polluted Mining Lake;
Ecosystem to be Repaired



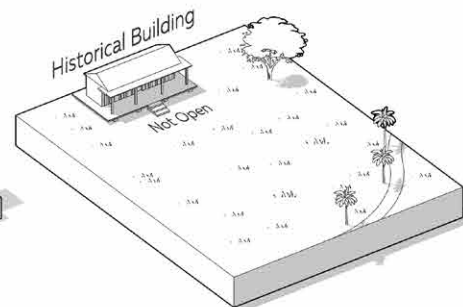
Brownfield without Maintenance;
Decorative Street Greening;



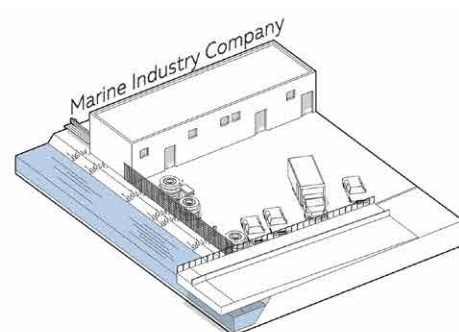
Shabby Infrastructure;
Ignored River Landscape;
Freight Storage;
Enclosed Industrial Roads



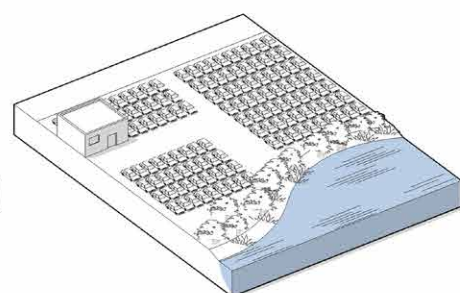
Waterfront Taken up by Freight Storage;
Run-down Space below Metrorail;
Shabby Waterfront Space



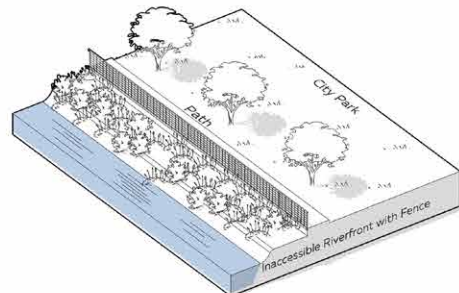
Monotonous Lawn; Joyless Path;
Park without Appealing Conditions;
Lack of Public Activities



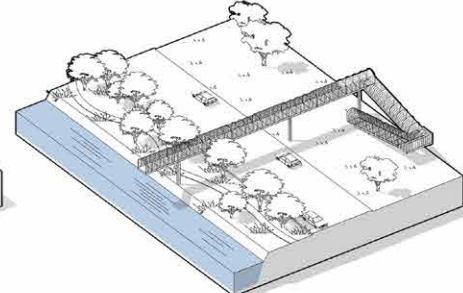
Enclosed Riverbank;
Unreasonable Use of Public Space;



Vehicle Storage along the Waterfront;
Palmer Lake with High Landscape Quality



City Park;
Inaccessible Riverfront with Fence



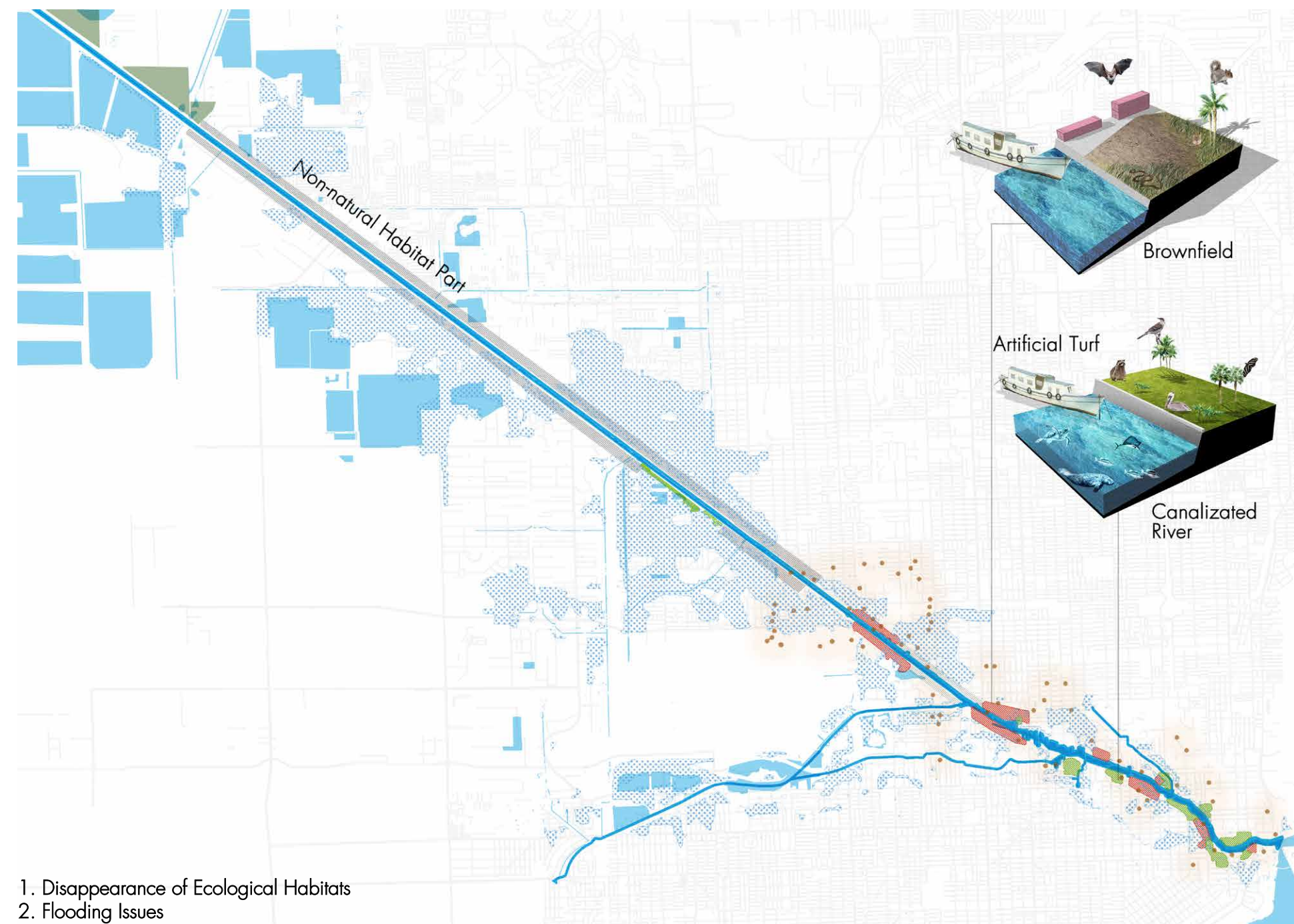
Lack of Organic Connection between Riverfront and
Neighborhood Park;
Neighborhood Park with Simple Greening;
Existing Connection Structure

3.2 The Issues of the Miami River & Canal

3.2.1 River and Natural System

With a unsuitable use of the river, the Miami River is facing with many environmental issues. Flooding and pollution are serious problems which are affecting each other. Under the sea-level rise background, Miami city is quite sensitive to water because its specific location and soil type. Pollution are from the mining lakes, residential waste water discharge and brownfield in the downstream part.

As the dynamics of flooding, contamination will spread excessively causing worse urban environment. In addition, the habitats for local species have been damaged so that few proper ecosystem can be found along the river. The manatee live the estuary part with huge impact by shipping.

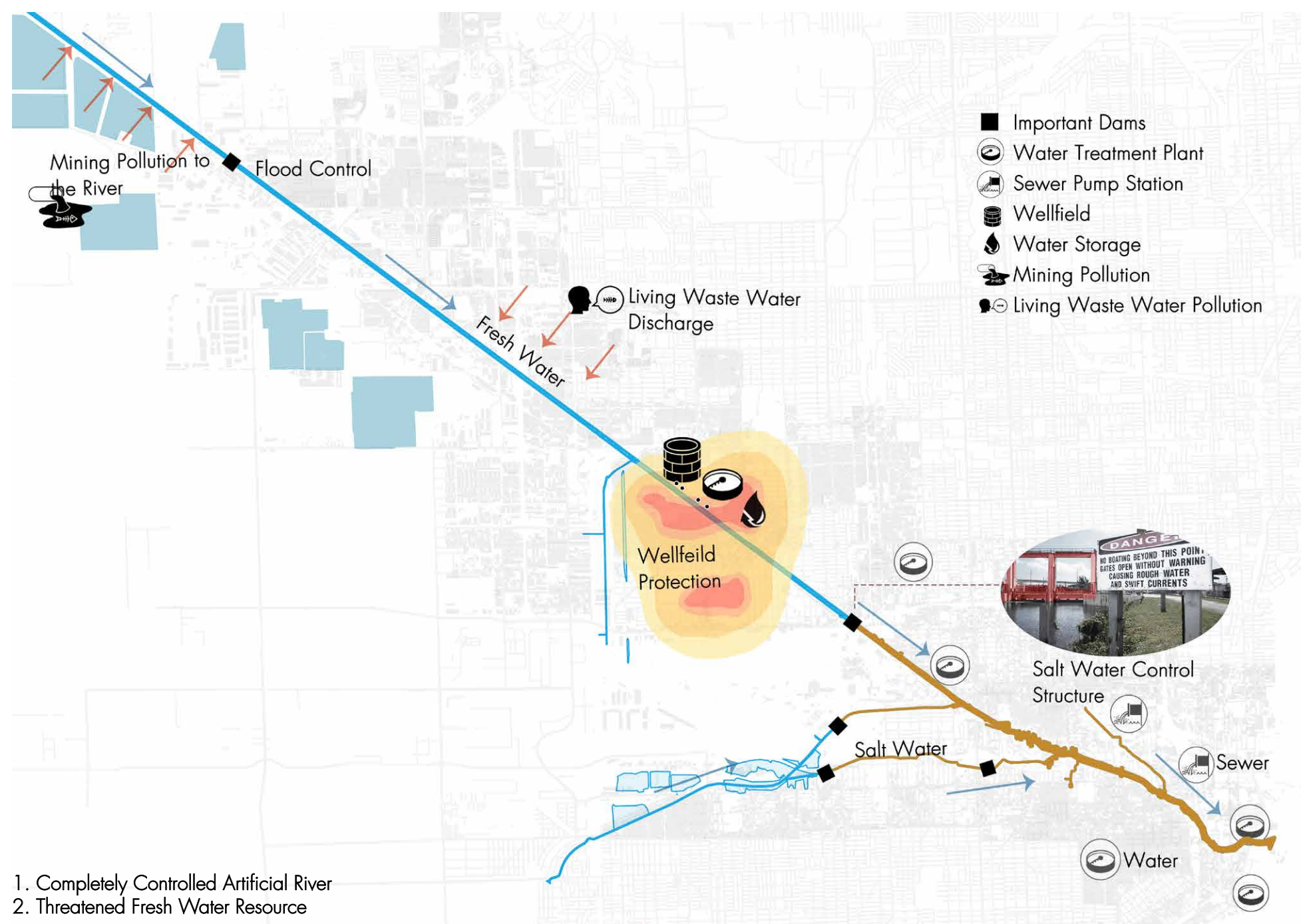


- 1. Disappearance of Ecological Habitats
- 2. Flooding Issues
- 3. Brownfield Pollution

3.2.2 River and Water Management

The water flows from northwest to southeast. The water source are derived from the everglades and Lake Okeechobee. As is shown in diagram 7, five main dams control the river especially the S26 structure for dividing fresh and salt water, and the one in most western for flooding control.

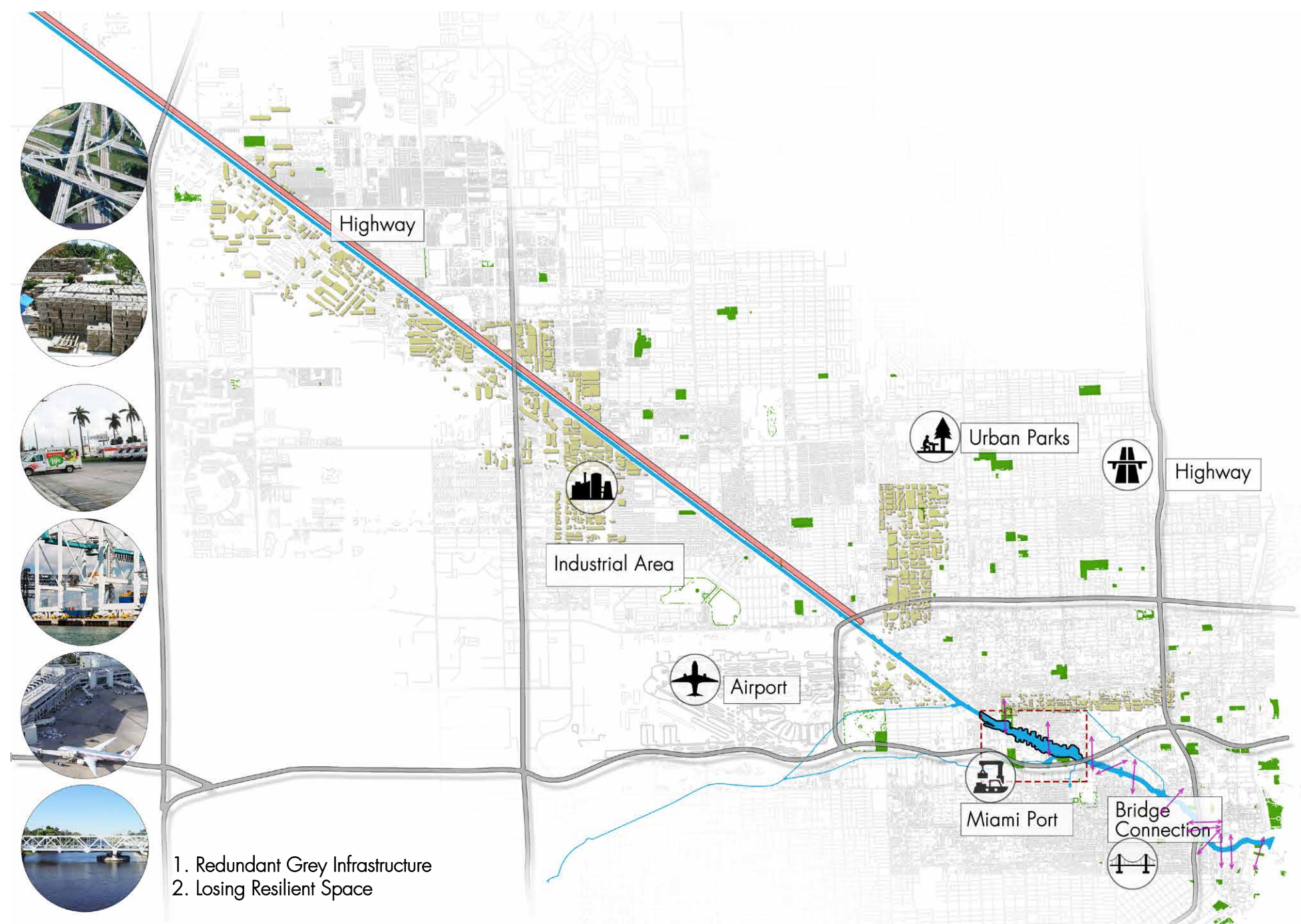
It needs to be emphasized that the middle part is the well field zone with precious fresh water resource for neighborhood water delivery. With the problem of salt water intrusion from the sea, the aquifer is threatened by pollution of the fresh water resource. However, the river and the urban ecosystem lacks the ability of adjusting water quality.



3.2.3 River and Infrastructure

The huge grey infrastructure is imposed on the whole riparian area. The redundant transportation infrastructure leads to a low spatial quality. A long highway closely next to the river obstructs the connection with the surrounding urban area.

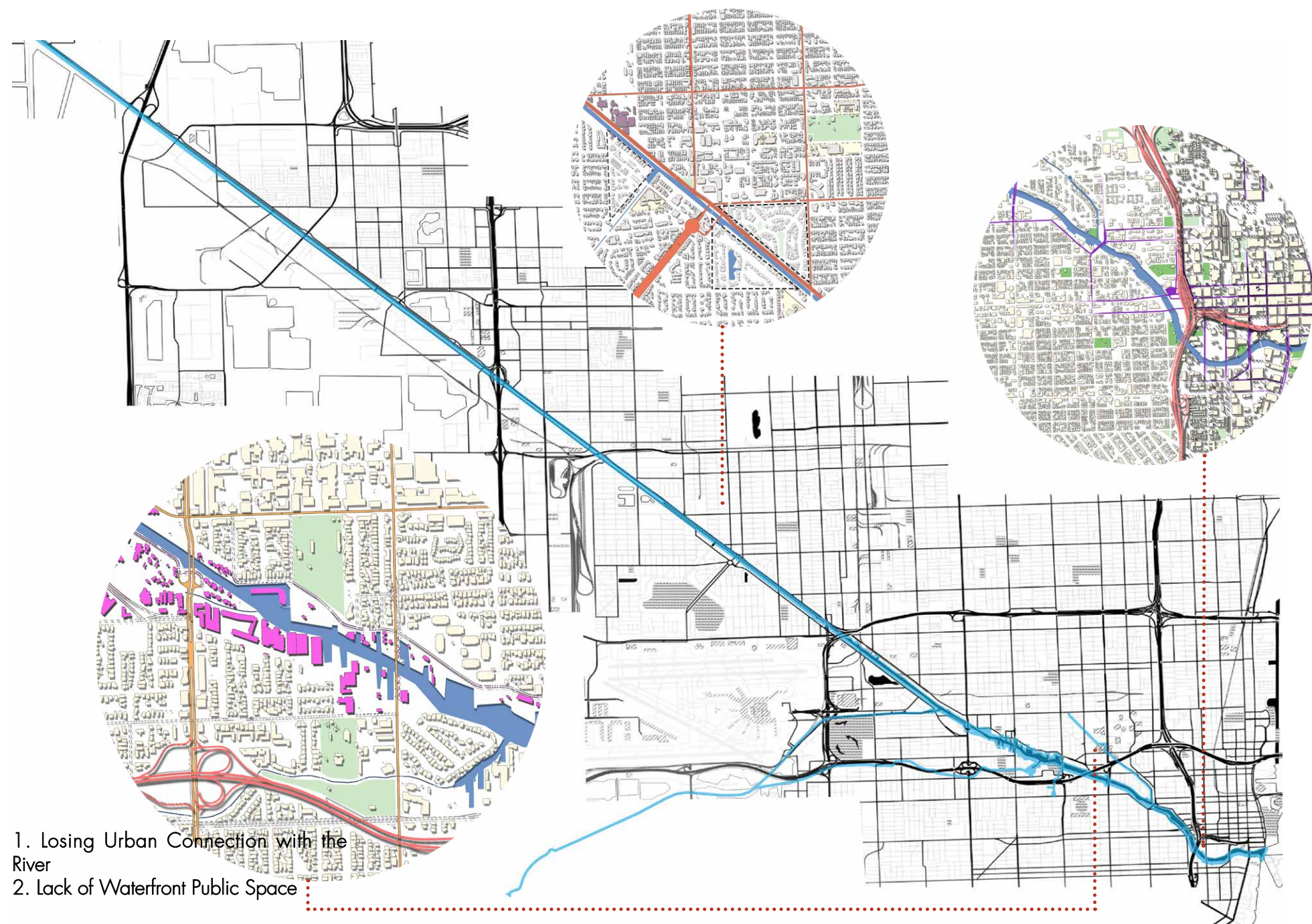
As for the downstream, the port of the river causes mess with freight storage and sundries. A great deal of public space was taken up by non-water related utilization.



3.2.4 River and Urban Structure

The city context does not have much logical relations with the river which is especially obvious in the midstream and upstream. The river acts a boundary isolating the connection of surroundings and hindering urban development.

In this condition it is difficult to promote public activities and stimulate social-economic development of the city.

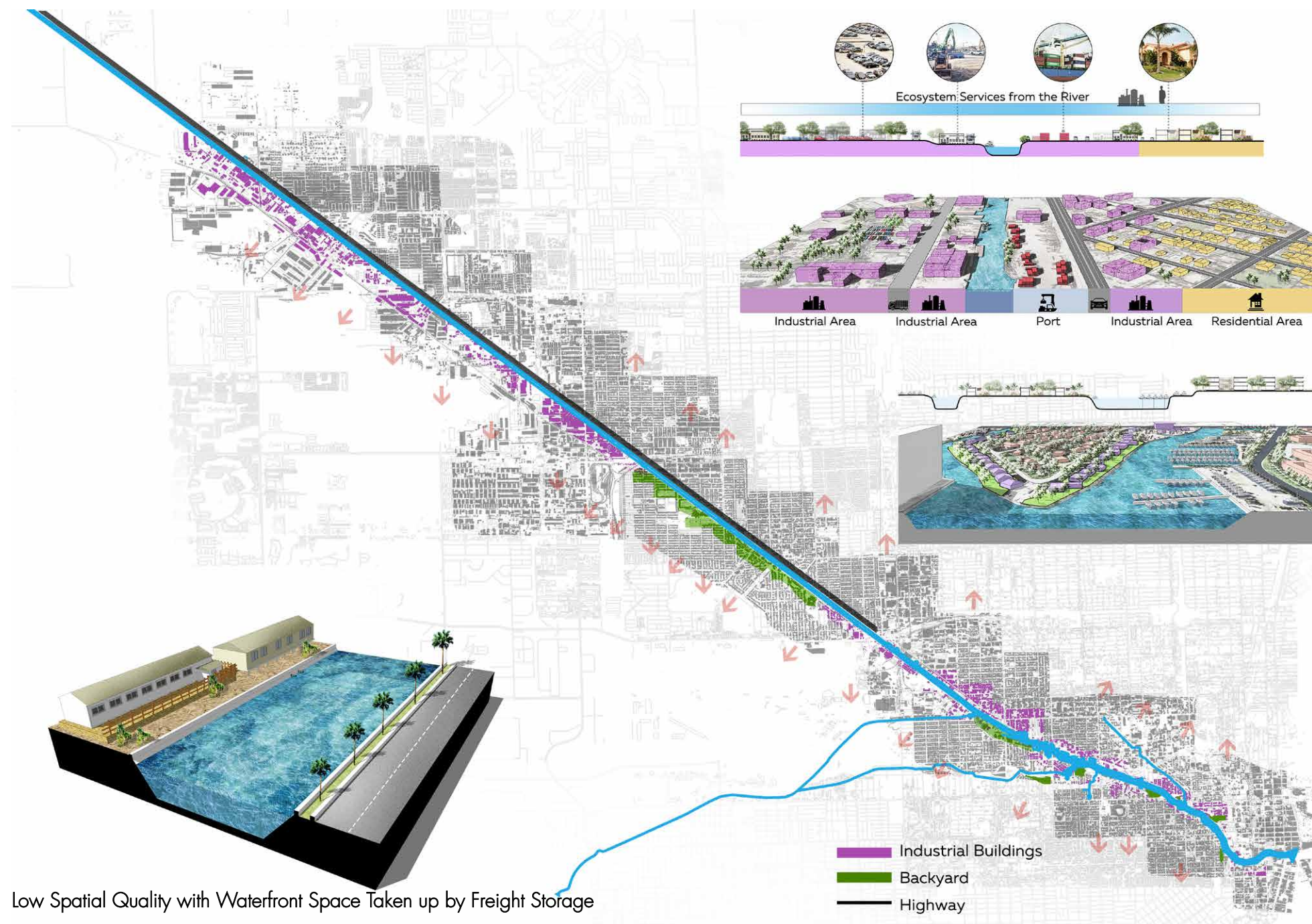


- 1. Losing Urban Connection with the River
- 2. Lack of Waterfront Public Space

3.2.5 River and Space

The riparian space is still under great potential of being adjusted into the situation with more urban vitality. The main issues are that neighborhoods take the waterfront as their backyard and that the riverfront is taken up by cargo. The space shows monotonous and uninteresting characteristics attracting few people and activities. There is no systematic green public space along the whole riparian area, including the historical natural river and the constructed canal. All kinds of public space like pedestrian path, street green land, community parks and city parks are compressed by extensive form of "marine industry", of which the essence is logistic industry with large vehicles and ships.

The urban structure of public space is quite narrow and small. The invasion of industrial land use restrict the future possible and potential development of Miami. It is emergent to reflect what roles do the industrial and public space play of the city. If Miami city needs development, it is necessary to consider what could be the most potential and feasible approaches of making adjustment of the urban space especially the Miami River area.



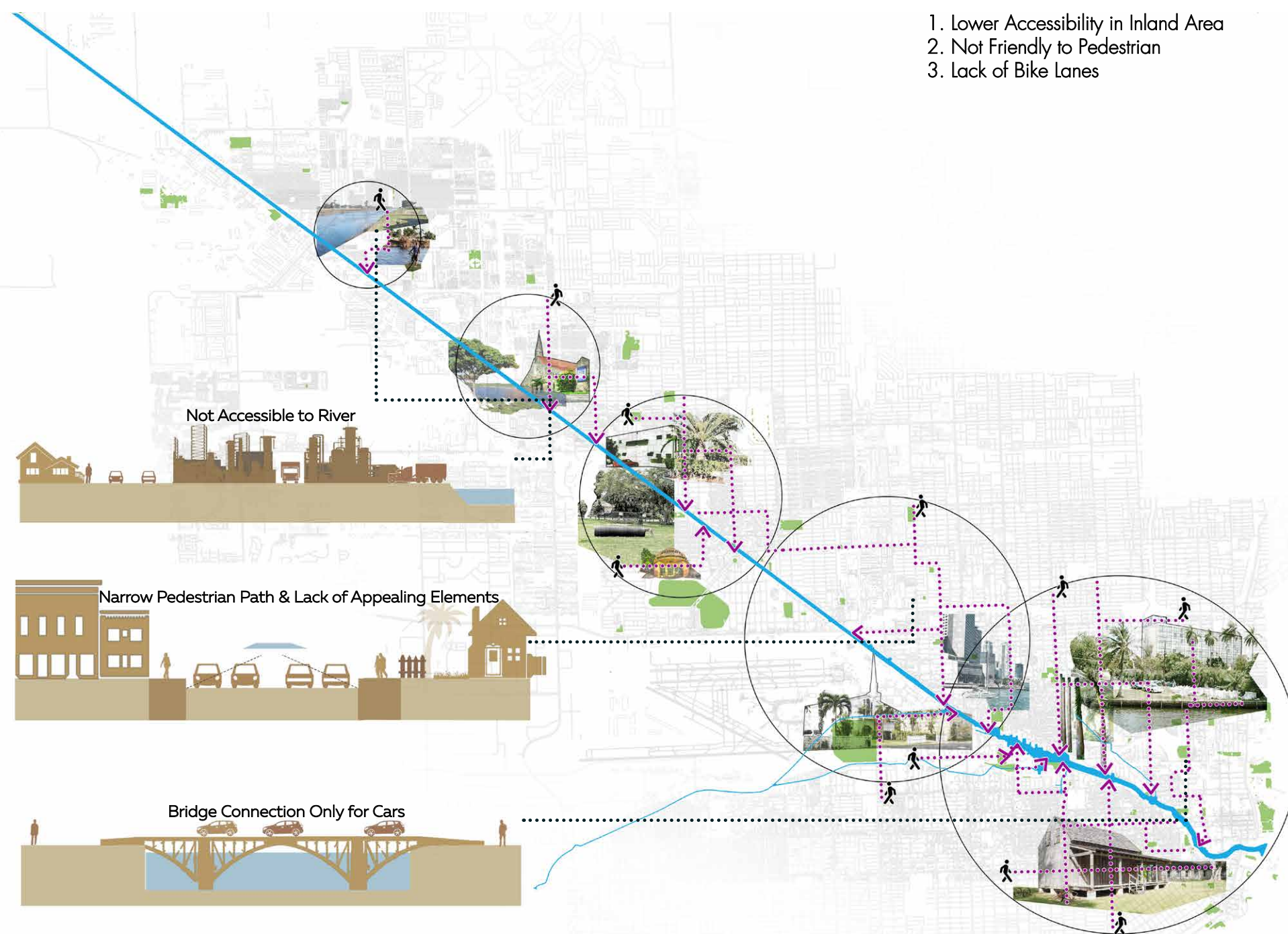
Low Spatial Quality with Waterfront Space Taken up by Freight Storage

3.2.6 River and Accessibility

The accessibility for pedestrian along the river is not in a good situation. The transportation in Miami was planned more for vehicles leading to coarse urban environment without complete comfortable or pleasant pedestrian path system. Due to the logistic industry of Miami city, the According to the current land use, many access to the river is blocked by freight storage, car parking or other kinds of private use. It is difficult to appreciate the river even visually.

The public accessible waterfront space is not continuous lacking spatial connections. From experimental experience, it is found that people have to walk around 20-30 minutes from one public access point to the next without enough shading space near the midstream area. The routing is in very low spatial quality with strong sun exposure and traffic air and noise pollution.

1. Lower Accessibility in Inland Area
2. Not Friendly to Pedestrian
3. Lack of Bike Lanes

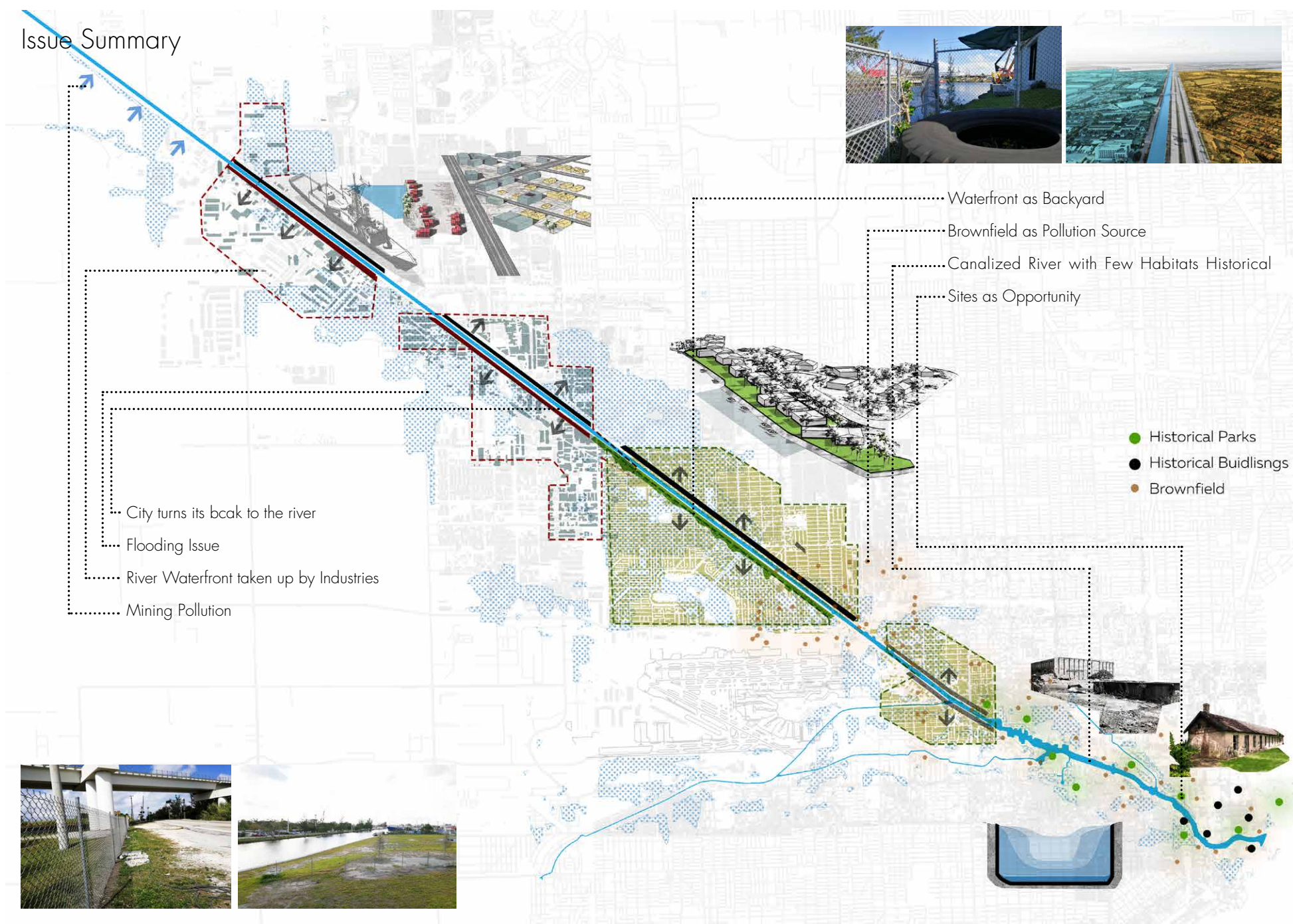


3.3 Issue Conclusion and Future Outlook

3.3.1 Problem Summary

The Miami River now is facing with both urban and environmental issues. On the one hand, the riparian area is not being used properly in the situation that a great deal of space is taken up by logistic storage causing messy space. The value of waterfront area is under exploited. The river is gradually breaking away from the urban context, being treated as shipping channel and sewer discharge. Although the downstream part is furnished with necessary pedestrian viewing path, there is still great potentials to be developed.

The midstream and upstream are tremendously impacted by the huge transportation infrastructure providing few green space for people and ecological habitats for the protection of local species. On the other hand, the contamination and flooding issues are aggravating the ecosystem disservice. The constructed river loses the capability of adapting to environmental changes.



3.3.2 Opportunities of the Riverfront Area

Although faced with so many urban issues, the Miami city still possesses many opportunities and urban potentials which would be the starting point of future framework optimization. The opportunities are divided into four aspects.

1. Water

As is known, Miami is famous for its water-related environment, including the river and canals, the everglades wetland and the bay area. The ecosystem services from Miami hydrology refer to fresh water resource provision for the inhabitants, water storage and adjustment especially during the rainstorm season. In addition, the water environment offers the water identity to the city supplying water landscape for recreational activities. These are the most essential potentials to be developed.

2. Ecological Habitat and Green Space

The green structure provides crucial living space for both human and wildlife. The Miami river still act as important urban eco-habitat for all the species. Along the river, the existing parks would be regarded as valuable urban public space supporting the integration of the green lands. The valuable ecosystems in suburban area would be significant to the improvement of urban ecology.

3. Urban Composition

There are existing industry of commercial service like retails and hotels which drive higher spatial quality of the surrounding urban public space. In this sense, the river value act as a urban motor to stimulate the development. New connection near the riparian area will be created, combining the built environment organically.

4. Public Activity

The river has oppportunities to provide more diversified activities for the public based on the cultural ecosystem services restoration.

Reference of Chapter 3

[1] Website of Miami River Commission.

<https://miamirivercommission.org/river3.htm>

[2] Website: Miami Herald.

<https://www.miamiherald.com/news/local/community/miami-dade/article144121814.html>



CHAPTER 4

4 Design Strategies & Principles

This chapter deals with research question 2. Through precedent study of three successful projects, design strategies and principles are extracted that serve as important basis for addressing the challenges and opportunities of Miami River. It identifies the spatial, ecological and functional principles of integrating the river in its contemporary urban context.

4.1 Precedent Study

In the precedent study part, it is significant to study some examples about water-related projects concerning history, industrial transformation and land use aspects.

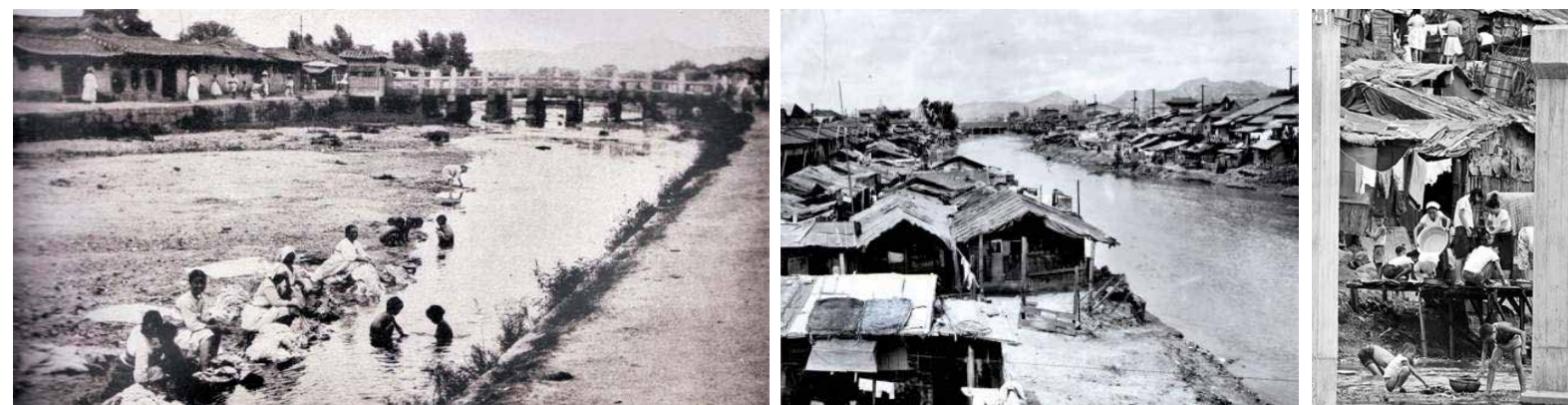
4.1.1 Regeneration of a Historical River: Cheonggyecheon Stream (Seoul)

The Cheonggyecheon Stream has a similar background to that of Miami River due to both of them are historical rivers. The Cheonggyecheon Stream conducted crucial ecosystem functions for the local residents, providing necessary drinking water resource and daily community activities. However according to some sanitation problems, people decided to cover the river in 1958 and built huge transportation infrastructure upon it afterwards in order to deal with traffic jam issues and guide future development. Then the river became a culvert and was buried underneath a 12 lane highway¹¹.

However, the situations got worse: the grey infrastructure made the CBD development get into a stagnation causing severe degradation of the surrounding area. In addition, the urban water quality became poor. The urban ecosystem had been impacted dramatically with decreasing quality of natural environment and lack of vegetation and wildlife.

The river restoration project then was to dismantle the highway and excavate the former river channel. The whole stream was designed with three themed parts: history, urban and culture, nature in the middle of the city. The river was transformed into new landscape infrastructure, offering opportunities to the city center. The downtown has been regenerated with the new activated linear public space with high quality of ecological environment.

Historical Background



Important Living River for Residence

Sanitation Problem



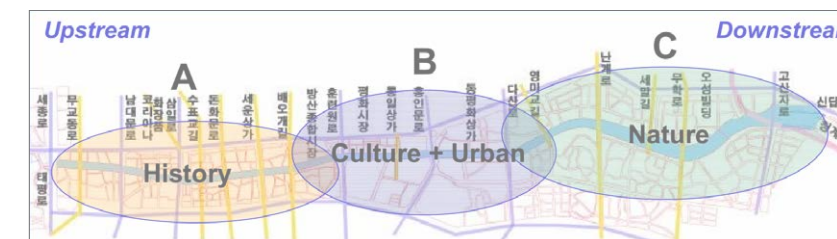
River Covering

River Covering

Cheonggye Highway

Urban Problem

1. CBD redevelopment stopped where the Cheonggye Expressway started
2. Population and employment reduced
3. Business headquarters moved to Gangnam (new sub-center)
4. Industries in CBD lost competitiveness



picture source: Dr In-Keun LEE

Extracted Lesson:

1. The historical natural system should be respected.
2. Urban river or canal shows large potential to lead a sustainable development when designed as urban landscape infrastructure.
3. The added values of a urban river is high to interweave and affect the urban context.
4. Ecological value is important for public space.



Significance:

Regenerated City Center
Improved Spatial Quality
Restored History
Raised Public Awareness

Improved Slow Motion System
Regulated Waste Water
Optimized Comprehensive Infrastructure

Green and Blue Corridor
Restored Ecological Habitats
Promoted Ecological Networks



photo source: <https://photos.com/featured/seoul-cheonggyecheon-stream-south-korea-mlenny.html>

4.1.2 Industrial Waterfront Transformation : Chicago Riverwalk Project

The Main Branch of the Chicago River also has a long and storied history that in many ways mirrors the development of Chicago itself. Once a meandering marshy stream, the river first became an engineered channel to support the industrial transformation of the city. A new civic vision of riverside promenades was introduced with the addition of the viaduct. Over the last decade, the role of the river has been evolving with the Chicago Riverwalk project—an initiative to reclaim the Chicago River for the ecological, recreational and economic benefit of the city^[3].

An integral link to the streets above is provided at the River Theater, a block-wide set of stairs that connects the city with the river and the river with the city. A fully accessible path is geometrically woven into the stairs to become a central circulation feature. These variety of “rooms” create a series of diverse new opportunities along Chicago’s downtown riverfront, ranging from unique dining options, to expansive public event programming, to new amenities for human-powered craft^[5].



Extracted Lesson:

Making use of the urban waterfront in order to create coherent public space is helpful to offer the city more urban vitality to stimulate the social-economic development.

source: <https://cellcode.us/quotes/large-chicago-riverwalk.html>

An integral link to the streets above is provided at the River Theater, a block-wide set of stairs that connects the city with the river and the river with the city. A fully accessible path is geometrically woven into the stairs to become a central circulation feature. These variety of “rooms” create a series of diverse new opportunities along Chicago’s downtown riverfront, ranging from unique dining options, to expansive public event programming, to new amenities for human-powered craft.

The significant reference to Miami River is that this project also includes a process of transformation from a industrial context to ecological-economic benefited situation. The optimized riverfront environment shows a strong power of driving the surrounding urban area into a sustainable development.



4.1.3 Overcoming Restriction of Land Utilization: Jardins de la Rambla de Sants Elevated Park (Barcelona)

This elevated park project shows an approach of how to create new public space when there is some restriction of the urban land utilization. Miami River waterfront is also facing such problem that too much freight storage land take up the precious potential public space with high quality. Due to the specific situation of land ownership in the US, the idea of creating elevated park is promising to deal with the issue in mid-short term^[7].

The visitors enter the park at plaza de sants, where the scheme starts to slope upwards, offering elevated views across the city. The promenade hosts a range of different public amenities. Completed after a decade of development, the park is situated on a raised structure that covers existing railway lines below.



the park contains over 160 trees and 85,000 plants and shrubs (image by adrià goulà)

Deemed too costly to move ground level, this project effectively encloses a corridor of six railway lines and provides a plant-filled urban space in a congested area next to the city’s main train station, affording views of the passing trains from ground level^[8]. There is a man-made ecosystem in the park with large area of flowers and other herbaceous plants ornamental all the seasons. A lot of butterflies can be watched in the park.



over 650 meters of climbing plants have already started to ascend the concrete structure (image by adrià goulà)



Extracted Lesson:

Elevated green space is a smart approach to make use of the complex urban land use with more flexibility. It is also a good way to create new urban ecosystems.

4.2 Design Strategies

With the precedent study, it is significant to learn that the idea of urban landscape infrastructure has strong power of transforming a neglected urban riparian area into a closely connected zone. Also, the riverfront space and elevated green space give important proposals of making smart use of different kind of land use.

In addition, according to the classification of the current problematic situation, the core spatial design strategies are as following in order to deal with the related issues:

- 1) **Creating healthy water system to promote urban sustainability**
- 2) **Adjusting urban green pattern with related ecosystem services**
- 3) **Regarding spatial quality improvement as basic condition in order to transform riverfront land use model.**
- 4) **Building temporal interactions between ecosystem restoration and waterfront space optimization.**
- 5) **Integrating public environmental engagement into the long-term urban dynamic process.**

It is essential to explore the design possibilities as the content of strategy. It is known to all that urban development is in a long-term period with uncertain changes. Discussing scenarios and refining them as the design toolkit is a main approach to building the planning and design framework providing more flexible adjustment.

4.3 Design Principles

According to the analysis, the problematic aspects on Miami River can be classified as four main topics which is helpful to guide the spatial design principles and strategies:

Problems Classification:

- 1) Unreasonable utilization of waterfront space
- 2) Low accessibility of pedestrian & cycling
- 3) River / canal as boundary line
- 4) Destruction of urban ecosystem along the river

The respective specific problems for each of the category are as the following statement:

- 1) The waterfront space are massively taken up by freight storage (vehicles, sundries, etc.) ; Some areas which are non-related to water (power plant, brownfield, etc.) occupy the riverfront space in downtown; Too much private land including residential area and marine industry companies blocks the public access to river.
- 2) The former transportation system was designed mainly for vehicles ignoring slow traffic; The pedestrian path system is incomplete including broken path; The walking experience is with unsafe and uncomfortable feelings; No independent cycling path system; Lack of enough connection crossing the river.
- 3) The river splits different neighborhoods offering no significance of social connection; The middle-up stream part is next to a highway without any public space or public access; The hardened river line attracting few people restricts new urban development and evolution of the industrial area.
- 4) Overload of the working river destroys masses of ecosystems and habitats for local species; Lack of effective protection zone for local manatees; Sewage from residential area makes low water quality; Mining work in the upstream discharges toxic and contaminated materials into the river; Ecological destruction of artificial mining lakes; Lack of buffer zone for flooding resilience.

The design principles indicated the application approach of design interventions which concerns the research objectives and strategies. The core idea is to activate the waterfront public space in the condition of restoring the ecosystem services of the river which is fading away gradually.

Design Principles:

- A. Intensified Land Use of Public Green Space**
- B. Improved River Connection Network**
- C. Creation of River Buffer Zone**
- D. Restored Riparian Ecosystem**

According to the mentioned design principles, there comes the corresponding intervention approaches which indicates the specific spatial measurement concerning different spatial attributes and temporal stages.

A. Intensified Land Use of the Public Green Space

One main spatial problem of Miami is the extensive land use of the industrial zone which takes up too much space of the riparian area. If the value of the river intends to be improved, it is necessary to give a new order to the urban riverfront space. The industrial land use should be intensified. However, it is known that because of the complex ownership of private land, the strategy of achieving such high efficient and intensified land use is supposed to be diverse in order to adapt to different scenarios.

1) Replanning of the industrial and waterfront land use.

The existing industrial space for freight storage or car parking without buildings is needed to turn integration. The incompact form is going to be transformed into grouping sharing form with more compact pattern. Several buildings or companies making up a unit share the storage space. The main purpose is intended to make room for the waterfront space and to create more riparian parks and ecological buffer zone.

2) Creating elevated park upon the industrial area

In this condition, it is difficult to do any change of the land ownership. The idea of elevated park is a compromise among the stakeholders. The ground is still used in original way. But for the area which possesses large potential to facilitate the river value dramatically, building elevated parks to create more public space for viewing the landscape of river and promoting more urban activities is an effective approach after successful ownership negotiation. The elevated parks tend to work as important urban and landscape nodes attracting people and providing ecosystem services for the public.

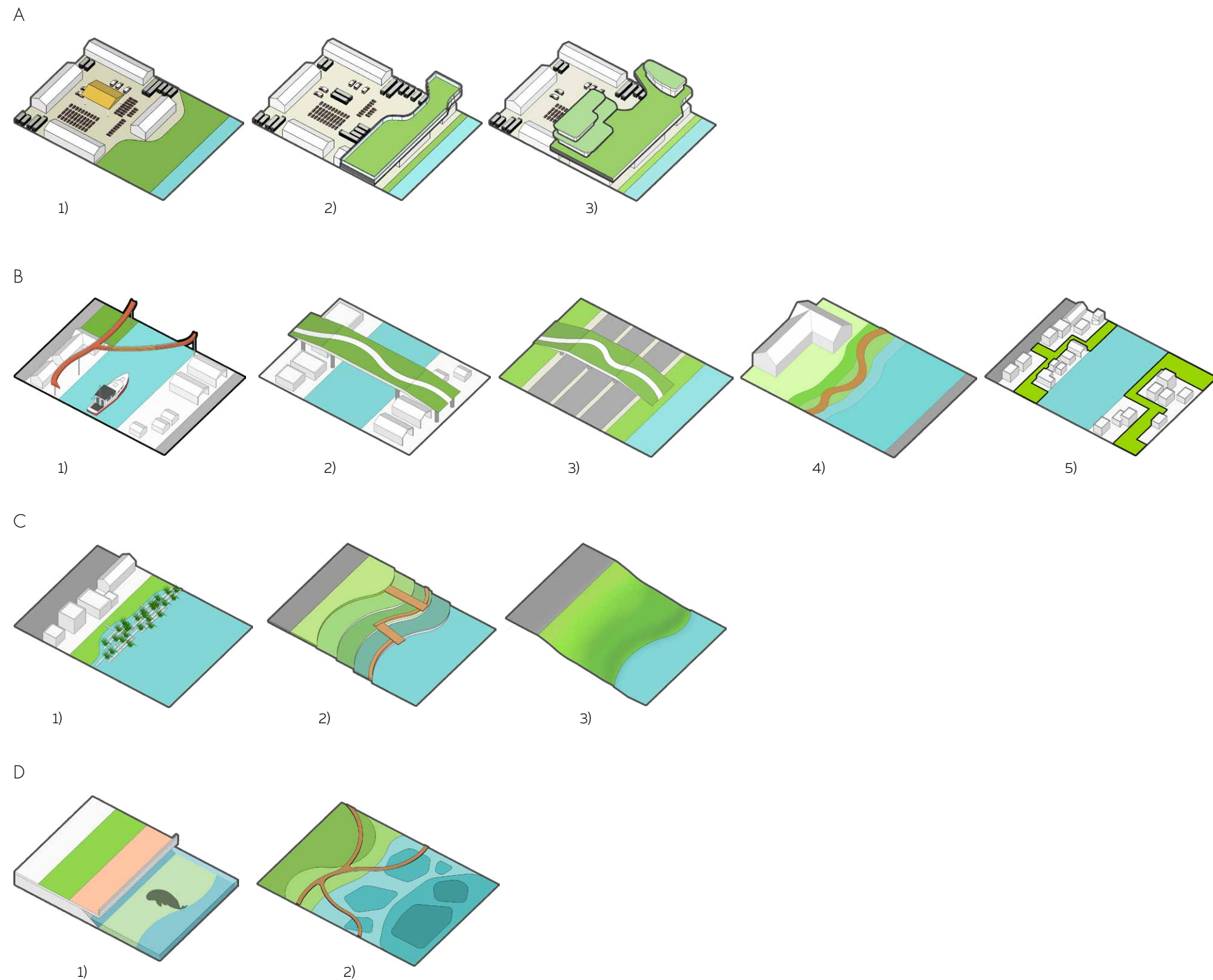
3) Creating urban green complex upon the industrial area

Such strategy could be employed in very urban district, offering more urban functions, especially in the downtown area of the future city center in zoning. It is in the form of the hybrids of green park and commercial-service buildings which provides a new recreational and commercial zone connecting with the river. The elevated zone offers river-viewing perspectives of high quality.

B. Composition Elements of the River Connection Network

The river connection network mainly concerns slow traffic for pedestrian and bicycles. The design orientation is considering the connectivity along the river, across the river and combining both the above.

- 1) Elevated bicycle lane
- 2) River bridge park
- 3) Highway bridge park
- 4) Riparian boardwalk
- 5) Pedestrian parkway system



C. Resilient Space for River with Buffer Zone

As the historical river part has been canalized tremendously and there is lack of organic connection between the canal part and the surrounding area, the river does not take the responsibility to interweave the urban context as well as to relieve the pressure of flooding and contamination. The intervention of new river buffer zone would be employed to support both of the regulating services and culture services. First of all, the buffer zone concerns the sensitive urban river or canal to distinct seasonal water table changes. There would be new room for the fluctuating water volume of the river in order to intensify the ability of self-adjustment to floods. On the other hand, the buffer zone provides a platform as new public space. It is not only for recreation, but also for raising the environmental awareness through facilitating public environmental engagement. The temporal landscape changes works as outdoor natural education classroom. The related design typology are as follows:

- 1) Ecological terraced-form riverbank
- 2) Natural-form riverbank
- 3) Water purification infrastructure; wildlife habitat

D. Improved Riparian Ecosystem

The ecosystem decline is a serious problem of Miami. The comprehensive ecosystem restoration acts as an environmental basis for the whole urban regeneration project. The main issues focuses on the habitats or shelter for the aquatic wildlife of the river like the local manatee and fishes, the polluted mining lake and the damaged brownfield. Those are challenges as well as opportunities. The improved ecosystem would facilitate the river renewal. In addition, as the restoration process would be in a long term, the process itself also promotes public environmental awareness. The viewing infrastructure of those restoration parks would be constructed firstly in order to attract people to experience the open landscape and ecosystem transformation process.

- 1) Aquatic wildlife habitat restoration
- 2) Brownfield restoration
- 3) Mining lake restoration

Reference of Chapter 4

- [1] <https://www.landscapeperformance.org/case-study-briefs/cheonggyecheon-stream-restoration>
- [2] <https://globaldesigningcities.org/publication/global-street-design-guide/streets/special-conditions/elevated-structure-removal/case-study-cheonggyecheon-seoul-korea/>
- [3] website of archdaily <https://www.archdaily.com/780307/chicago-riverwalk-chicago-department-of-transportation-plus-ross-barney-architects-plus-sasaki-associates-plus-jacobs-ryan-associates-plus-alfred-benesch-and-company>
- [4] <https://www.gooood.cn/chicago-riverwalk.htm>
- [5] <https://www.arc-magazine.com/chicago-riverwalk-usa/>
- [6] <https://planning.org/events/activity/9109208/>
- [7] <http://www.landezine.com/index.php/2016/12/rambla-de-sants-by-sergi-godia-and-ana-molino/>
- [8] <https://www.wallpaper.com/architecture/barcelona-jardins-de-la-rambla-de-Sants-recalls-new-york-high-line>

CHAPTER 5

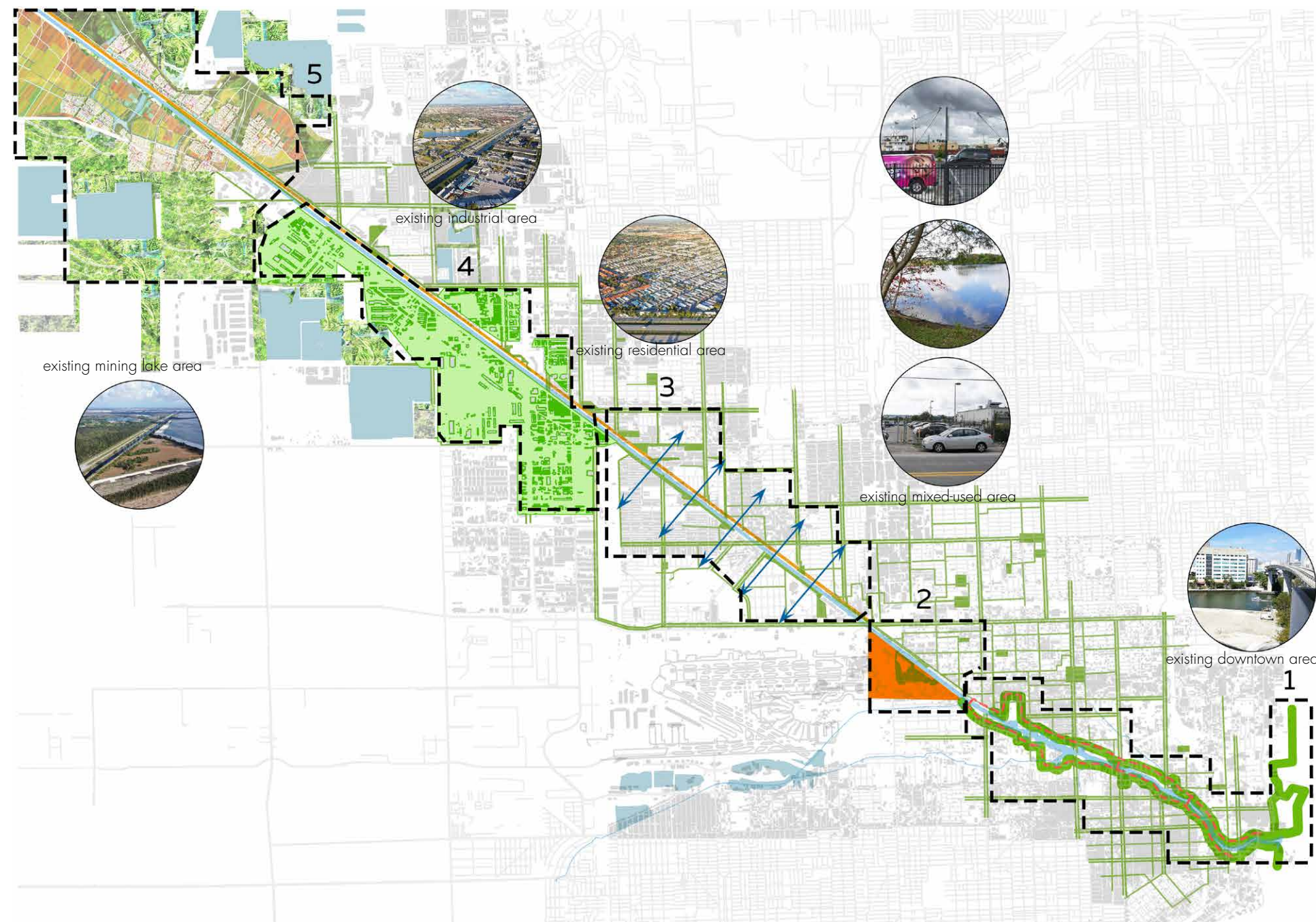
Explorations: New Urban Landscape Infrastructure

This chapter explores the strategy and principles which can be applied to develop the river & canal into a landscape infrastructure. The strategic plan indicates the main design assignments and actions at the regional scale. The system design shows different layers of the complex system. It addresses the Miami River as part of the urban system and the urban context as part of the water system. Three strategic areas including mining lake area, commercial-industrial area and downtown area showcase how the strategies are translated into physical structures. The design elaborates and illustrates how the river can provide new functions and interacts with its context.

5.1 Vision

After the site analysis and proposing design strategies and principles, the research integrates all the conclusions and interpret them into spatial dimension by mapping the vision. Based on the urban context, the vision map shows different urban areas with different functions and expectations. It gives the initial spatial framework for developing the strategic map.

The vision gives initial ideas of the general planning and design assignment indication based on the strategies and principles. The rough spatial structure identifies the assignment framework. Based on the vision, more detailing and specific actions of design are discussed.



Goal under the Design Principles:

Urban Landscape Infrastructure:
weaving urban surroundings;
transitional linking through city and nature;
ecological-social backbone structure

Ecosystem Services:

Cultural Services
city identity and memory
public recreational activity;
enhanced social-economic added values;
public environmental awareness

Regulating Services:

urban ecological quality improvement
flooding & pollution management
ecosystem restoration with higher biodiversity

Vision of the Urban Landscape Infrastructure

- 1 Green walking and cycling system
- 2 New eco-district development area
- 3 New neighborhood connection across the river
- 4 Spatial Quality Improvement of the industrial area
- 5 New ecological restoration park

5.2 Strategic Plan

The strategic plan show the main planning and design spatial framework through dividing the whole region into five crucial areas driving the urban and natural processes.

Herein, the intervention of upstream located at northwest area concerns principally on ecological restoration and river water management by creating new flooding buffer zones and mining retention ponds. Then the vast canal part running through industrial and residential district is intervened by elevated green parks or bridges in order to eliminate the negative effect of the river boundary.

The water value of the future city center is increased to improve spatial quality and drive new urbanization. In downtown area which is also the historical part of the river and the city, the intervention focuses mainly on the public space connection along and across the river. In addition, the historical parks are optimized to provides more recreational activities. A new artificial manatee habitat combined with tidal park is built to protect native species.

The project is in a long-term strategy. The urban and natural processes take place during the next decades with interaction of each of the strategic areas.



5.3 Systemic Design

The systems are divided as water management system, green network system, transportation system and urban composition layer.

1) Water Management System

As is illustrated, the water system of the river is under the problem of pollution and flooding, of which the essence is losing the capability of adapting to environmental changes and threaten due to the over-controlled water management. The optimization focuses on environmental self-adaption and resilience.

First of all, the mining lake area which is with great pollution situation in rural district needs to have a ecological restoration. Then the isolated lakes with clear boundary is integrated to get a more natural and dynamic form. The promotion of water cycles can accelerate the improvement of water quality with the aid of purification vegetation and ecological community reestablishment with pioneer plants. The bioswale with diverse depth is created to provide more fauna living shelter, spawning space and habitats.

2) Green Network System

The green network system exhibits obvious gradients, from natural to urban. For the western district, there is a large area of green space used for ecosystem restoration and environmental-resilience space with seasonal submerged zone. Towards the southeastern district, the green space exhibits in meshy form, of which the aim is to promote systematic public accessibility to the river.

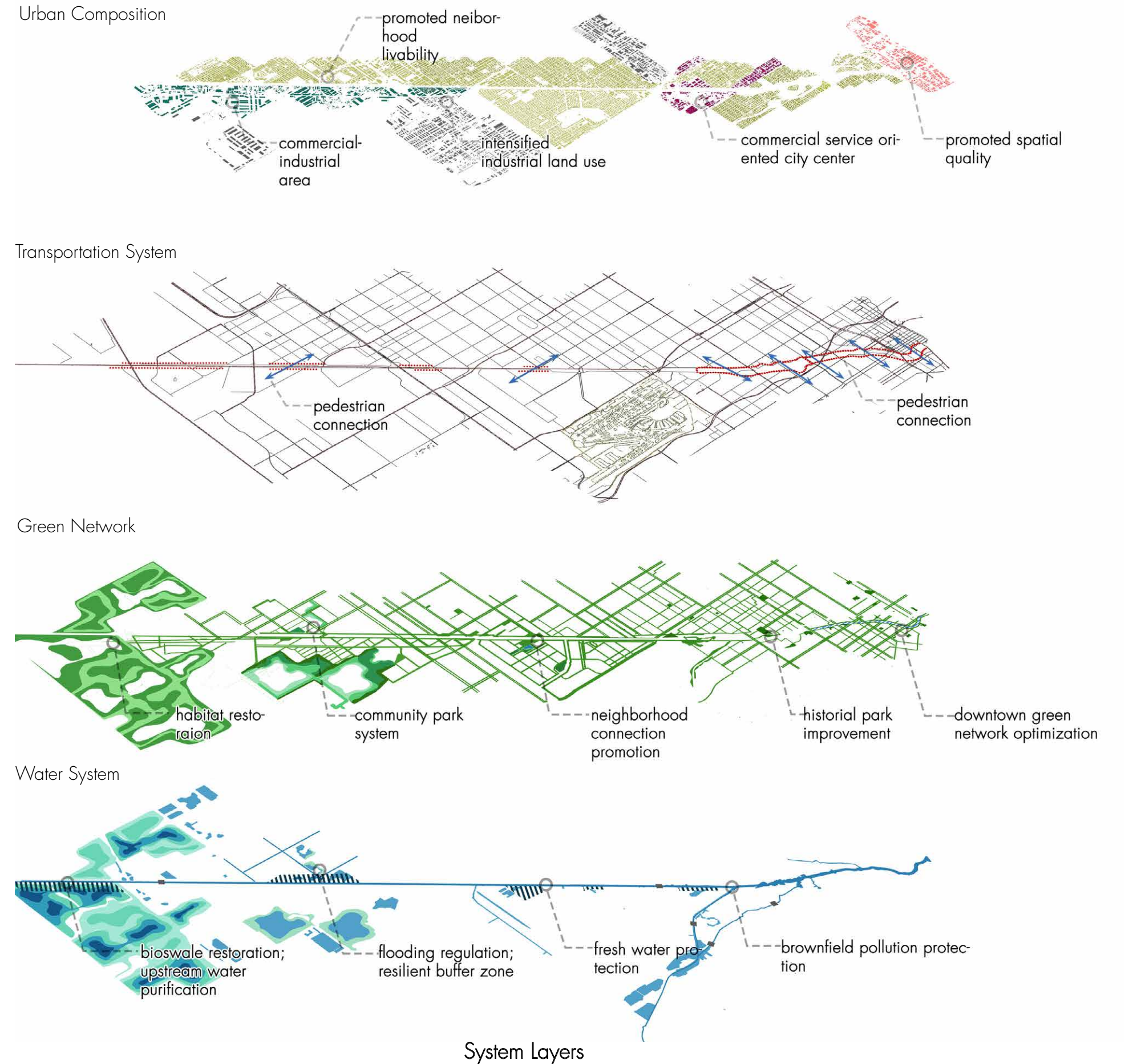
The ecological habitat system is based on a long-term ecosystem restoration process interacting with the intervention constructions of the other layers. The most two strategic areas are the mining lake district and the downtown manatee protection area.

3) Infrastructural Network

The intervention is to integrate new pedestrian and bicycle path into the existing traffic system supplying more complete mobility infrastructure. Such intervention is combined with the green network system to create ecological slow-traffic infrastructure.

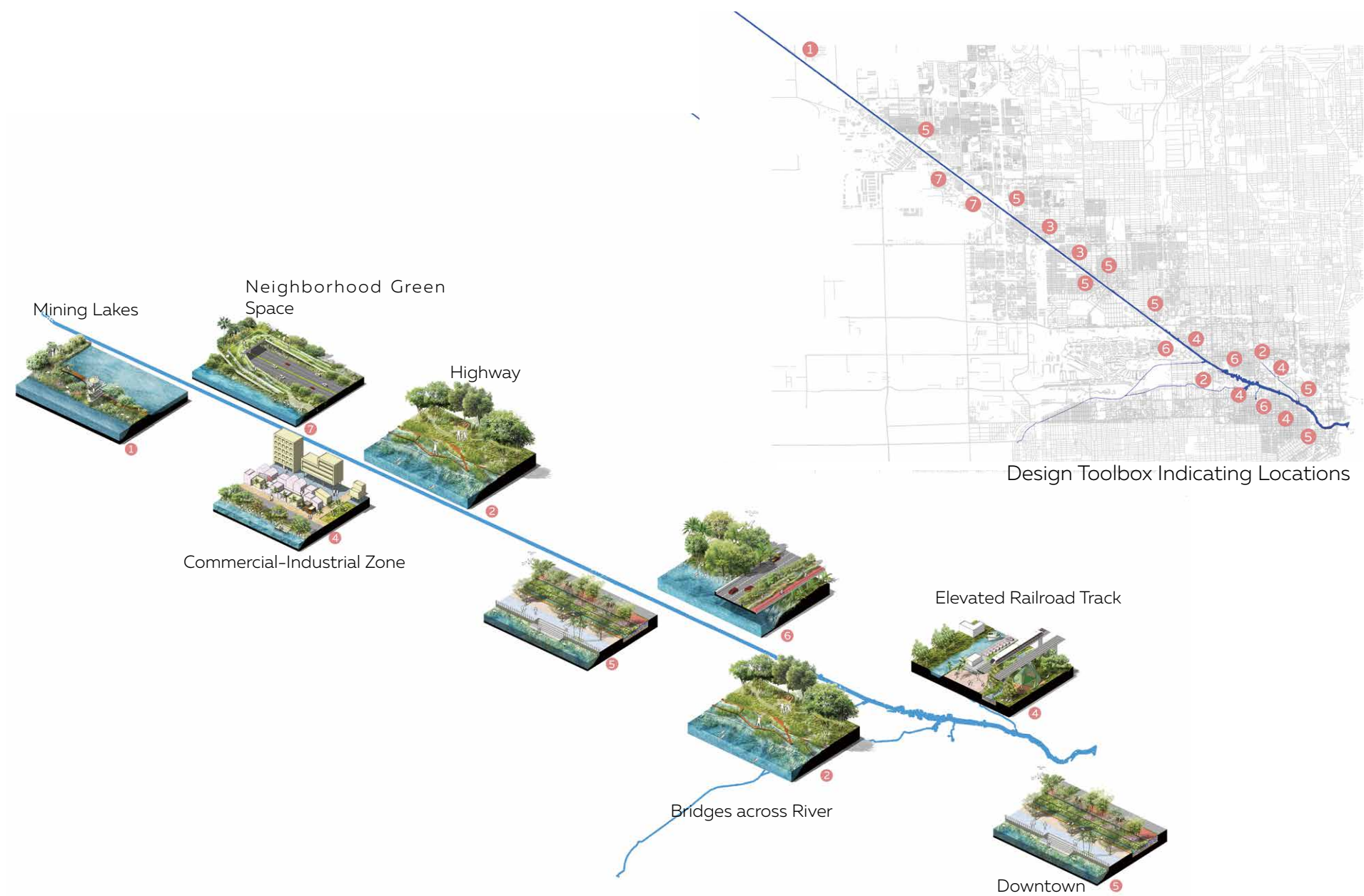
4) Urban Composition

The river as urban landscape infrastructure will drive new development through the improvement of green and blue structure and the optimization of infrastuctual framework. The mining lake area will serve as wilderness park offering new urban functions of recreation and eco-tourism. The industrial area will be transformed into commercial - industrial area with necessary services to the local residence as well as tourists. With a higher connectivity in the downstream area, this part will absorb more public activities and build a new city identity of Miami.

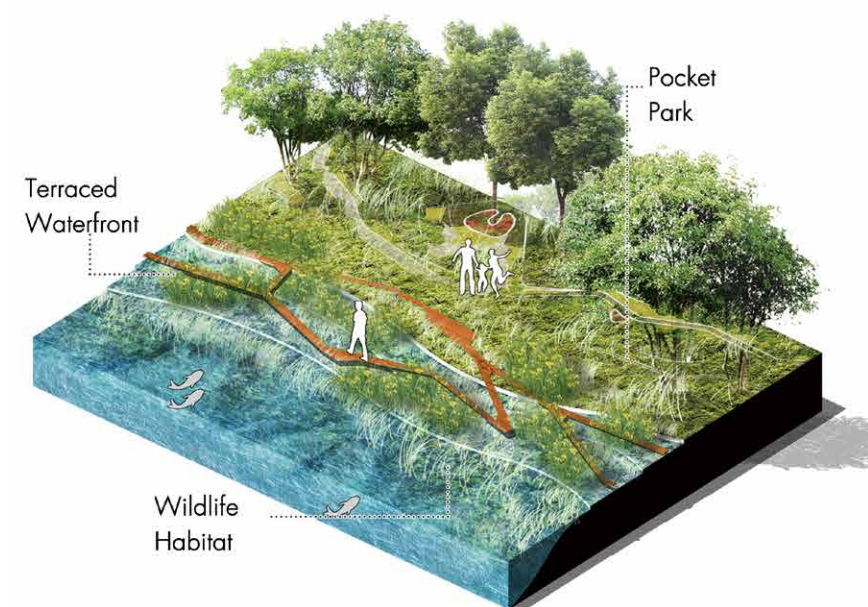


5.4 Design Toolkit

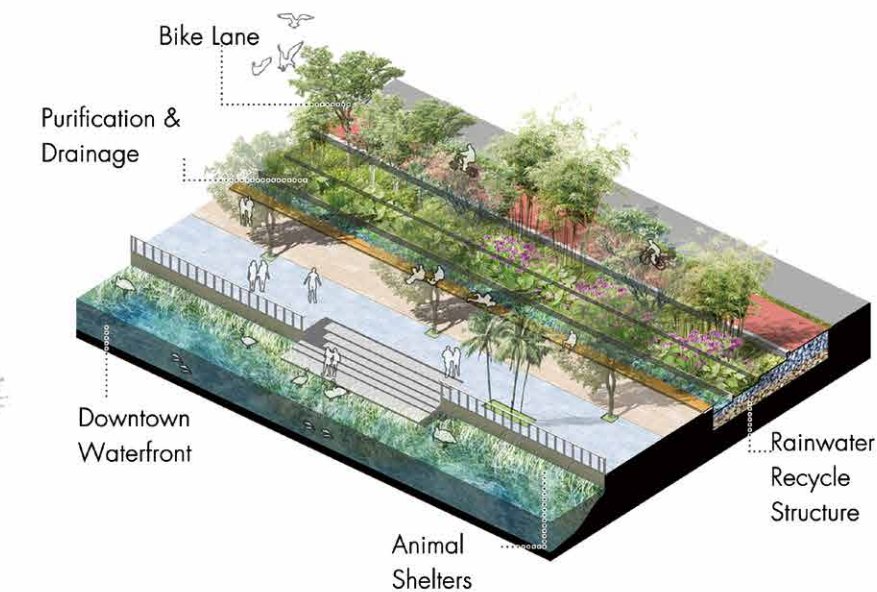
Following the design strategies and principles, the idea of design toolkit is used to express more details with spatial quality of crucial scenes along the river. Deepening to the design principles, more information about the anticipatory design elements including vegetation, materials, forms of structures and spatial atmosphere are showed. The design toolkit serves as typical and standard reference spatial model offering proper design possibilities for practice instruction and future flexibility.



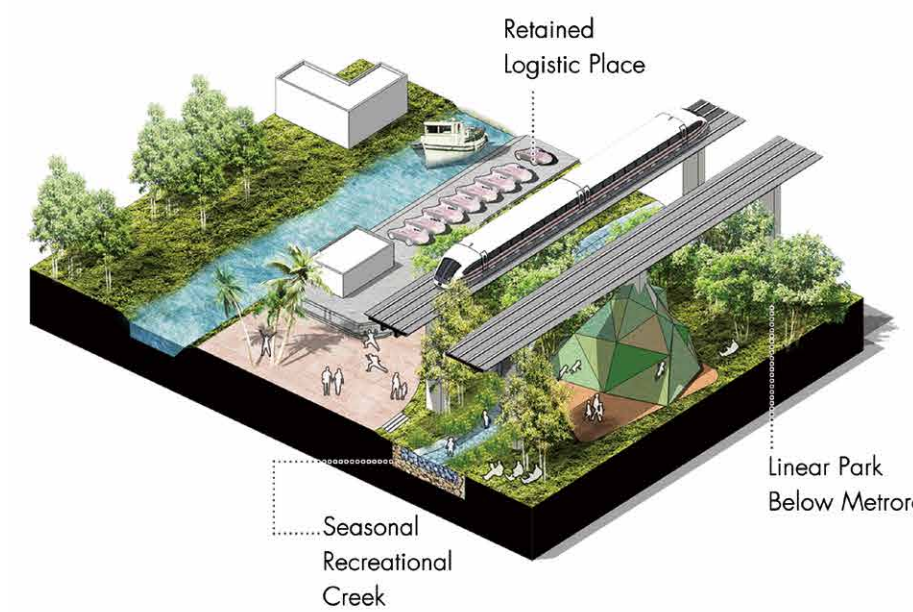
Green Public Space in Urban Area



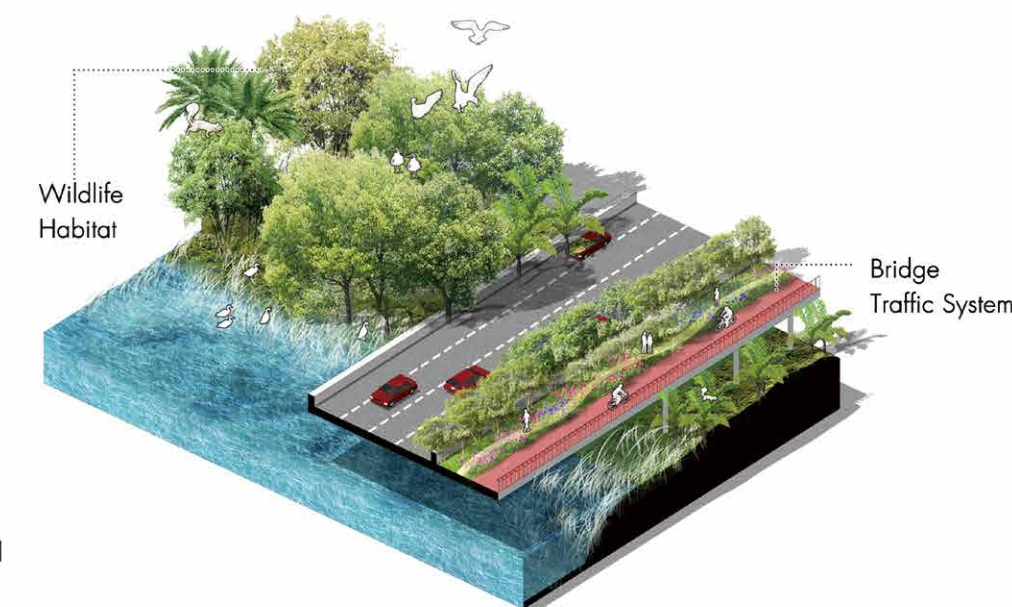
Canal in Neighborhood District



River in Downtown District

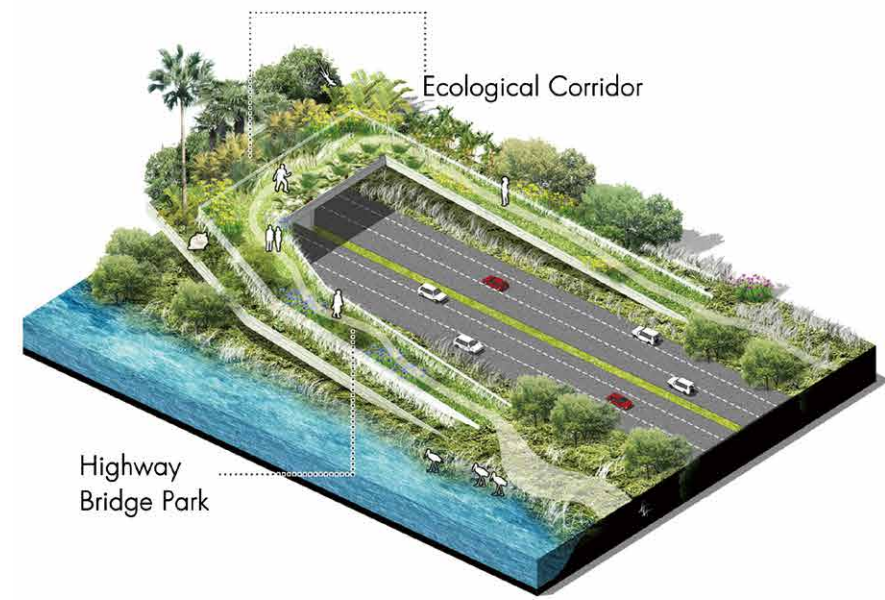


Tributary River in Mixed-used District



River in Downtown District

Green Public Space in Suburban Area



Highway Bridge Park

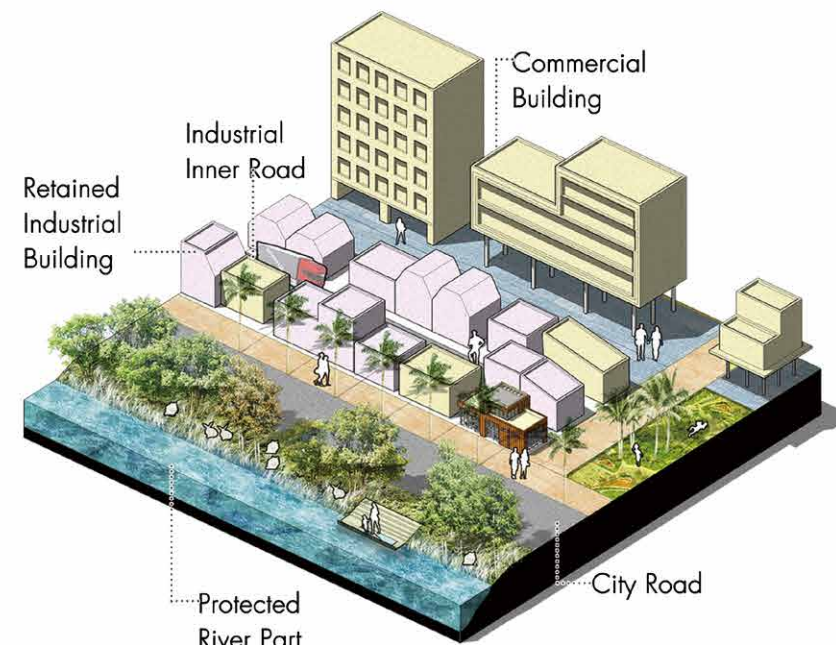
Ecological Corridor

Canal in Industrial District



Mining Lake Ecological Restoration Parks

Canal in Mining Lake District



Canal in Industrial District

5.5 Strategic Areas

According to the regional design, there are five strategic areas as representation in total included in each of the strategic districts: historical area of downtown, future city center area, residential area, commercial-industrial area and ecological restoration park area. However, there are three more representative and crucial parts prior to the others. As is analyzed, the **mining lake restoration wetland** district evolving from wilderness park towards ecological-agricultural areas with some recreational functions. Its values of purification and flooding adjustment are high of the whole system.

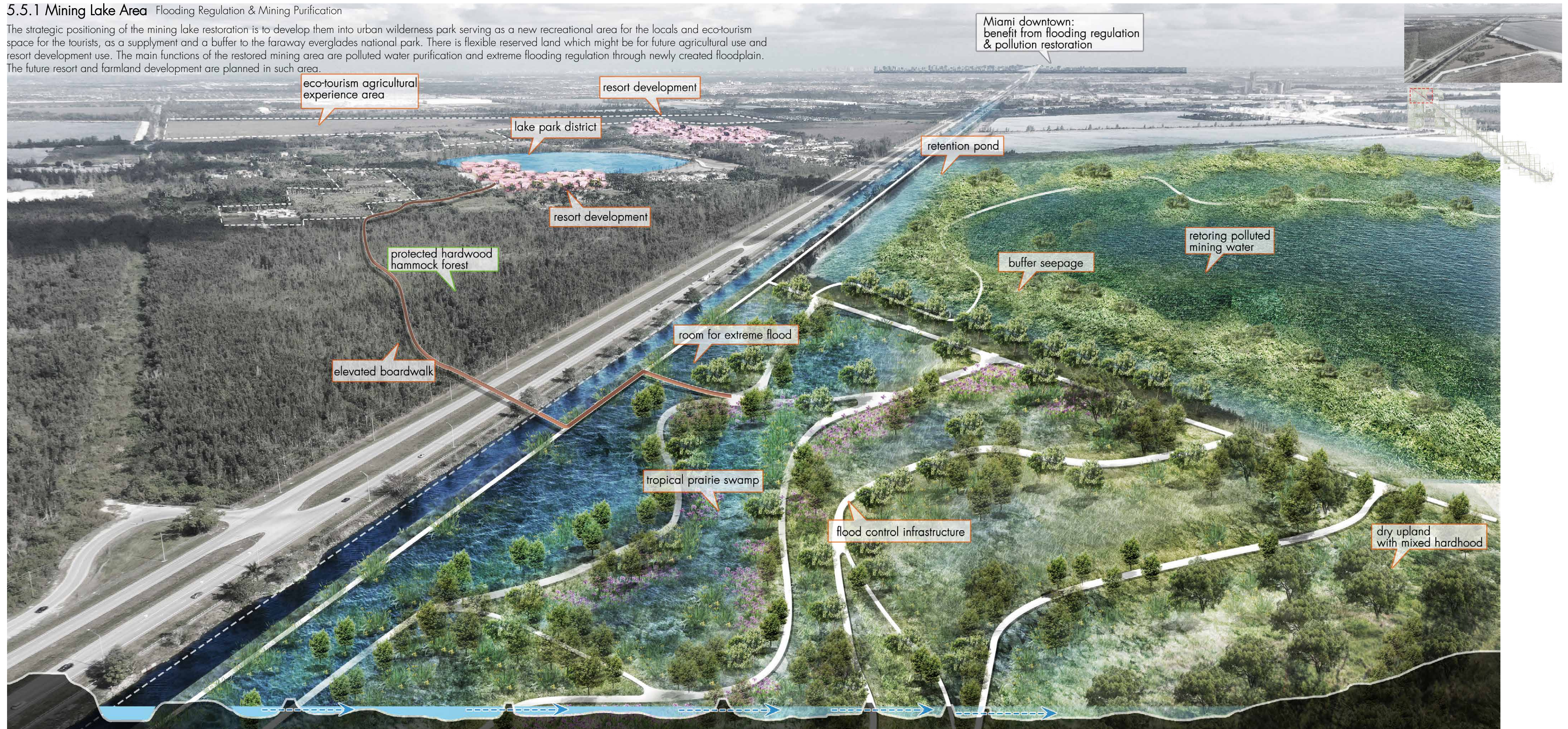
The **commercial-industrial area** are under spatial and industrial transformation process. It is significant to set smart strategy and make good use of power of design to achieve healthy and sustainable urban environment.

The **historical downtown area** owns precious heritage as developing opportunity as well as the manatee habitats with high ecological values. Then the following assignment is the neighborhood areas with optimized community connection and public space.

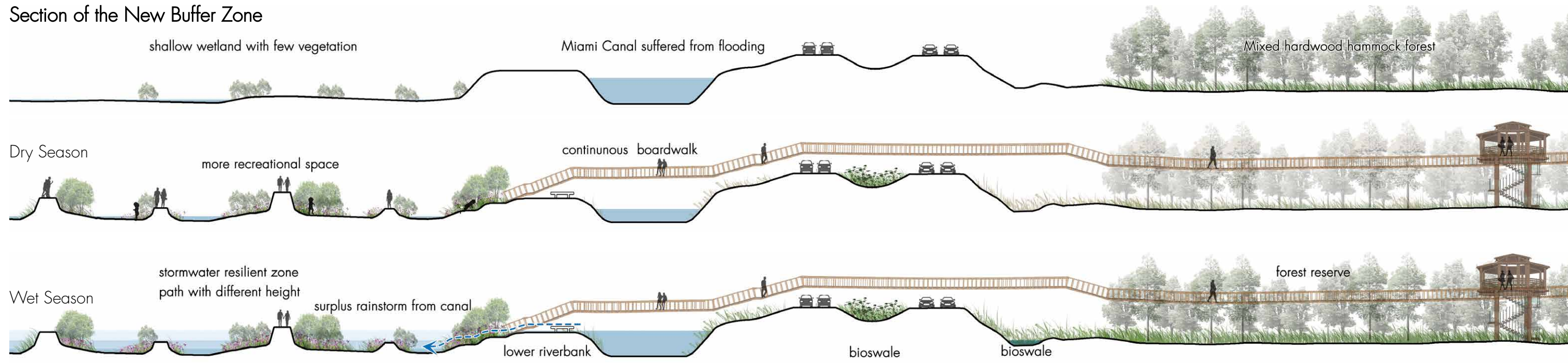


5.5.1 Mining Lake Area Flooding Regulation & Mining Purification

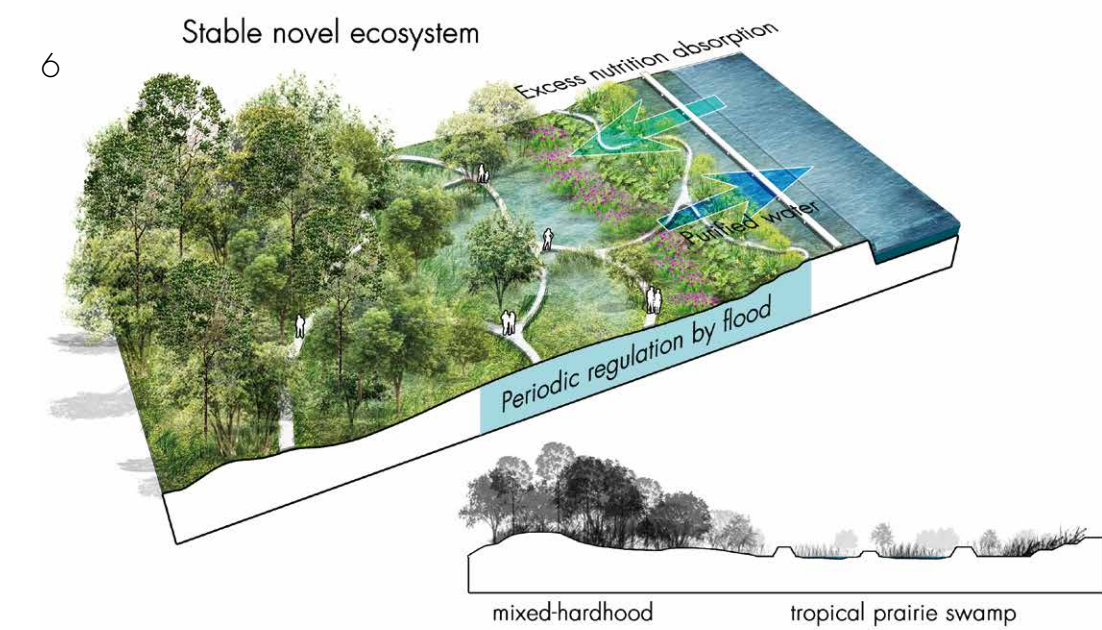
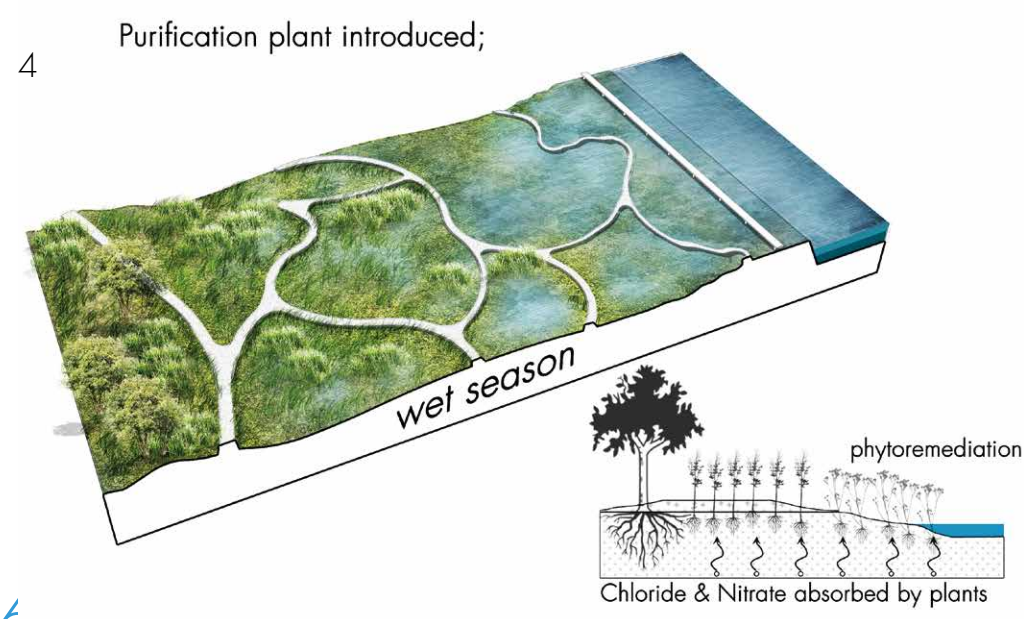
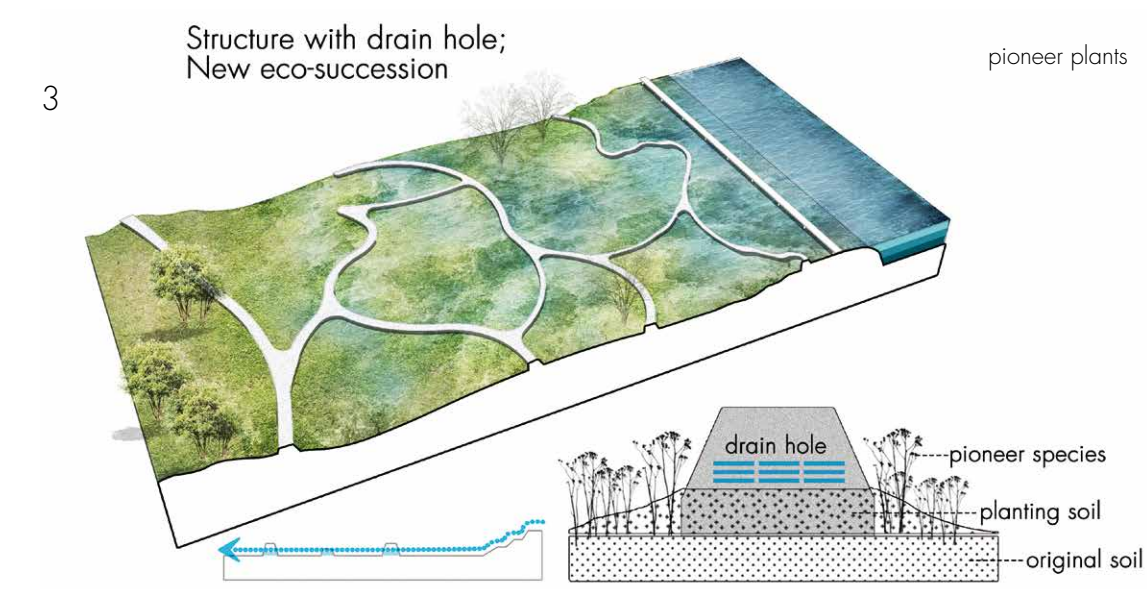
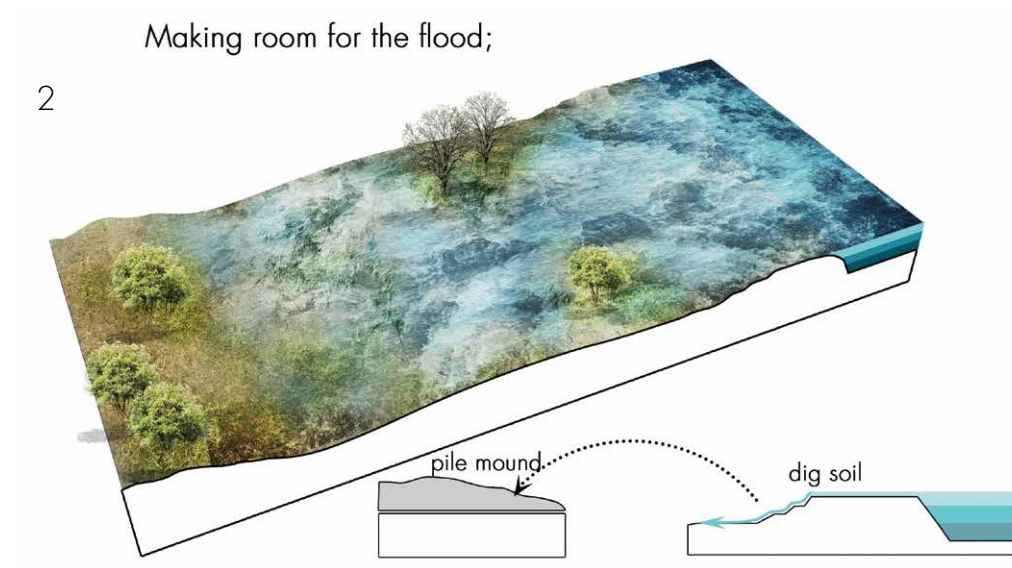
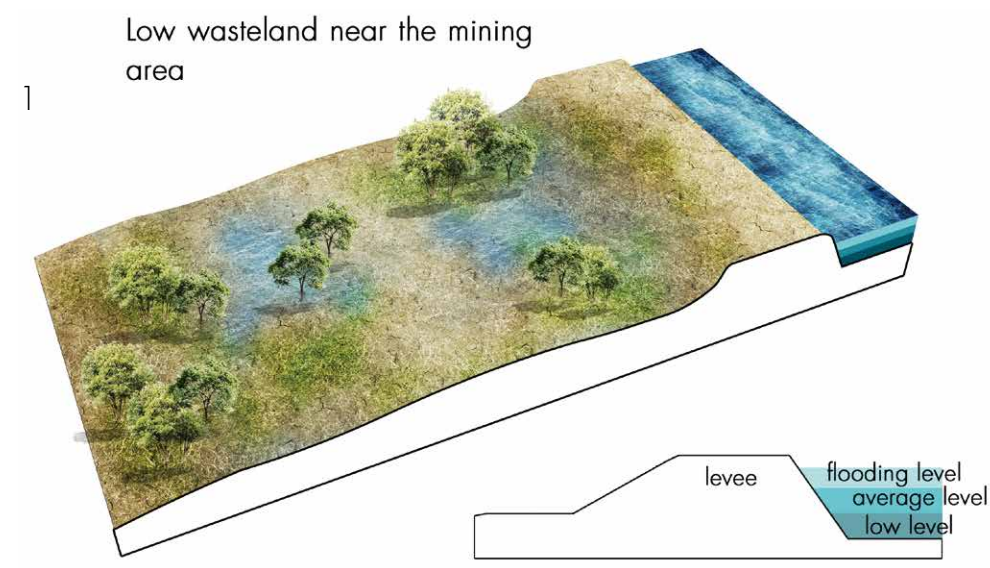
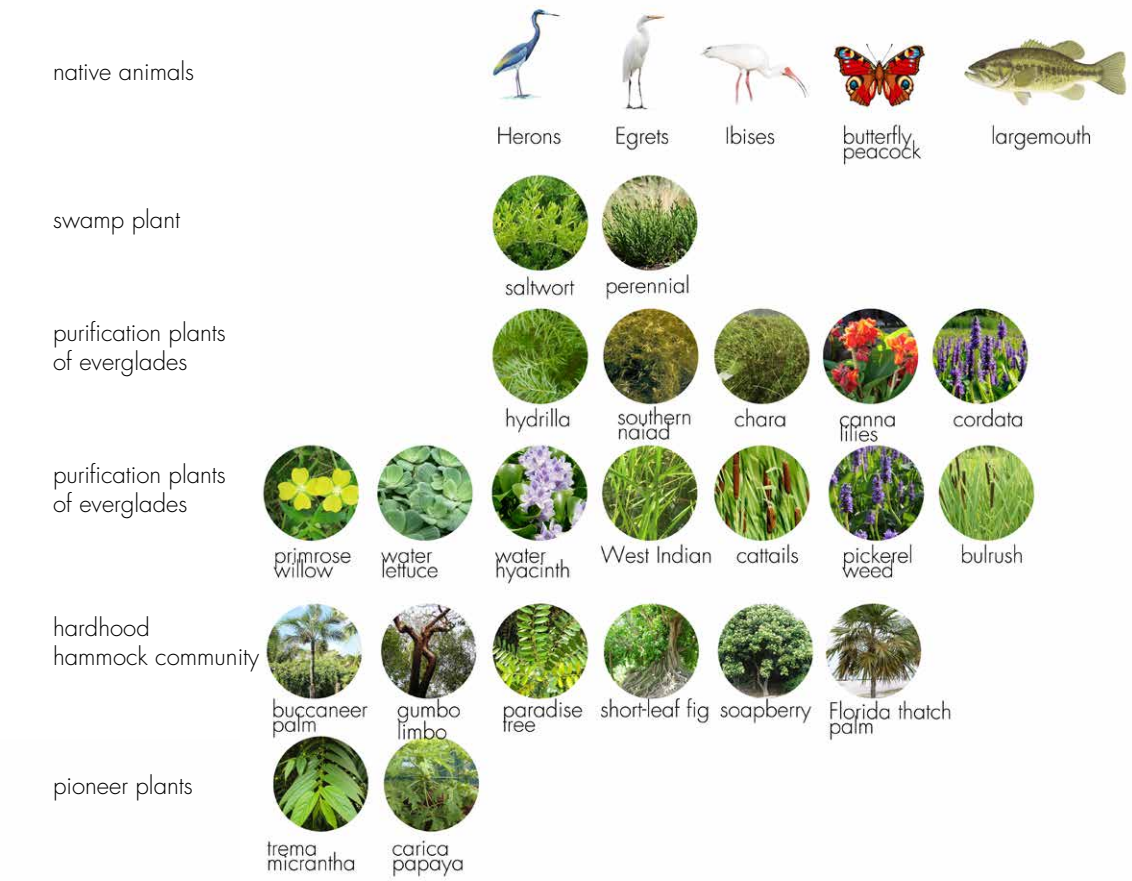
The strategic positioning of the mining lake restoration is to develop them into urban wilderness park serving as a new recreational area for the locals and eco-tourism space for the tourists, as a supplyment and a buffer to the faraway everglades national park. There is flexible reserved land which might be for future agricultural use and resort development use. The main functions of the restored mining area are polluted water purification and extreme flooding regulation through newly created floodplain. The future resort and farmland development are planned in such area.



Section of the New Buffer Zone

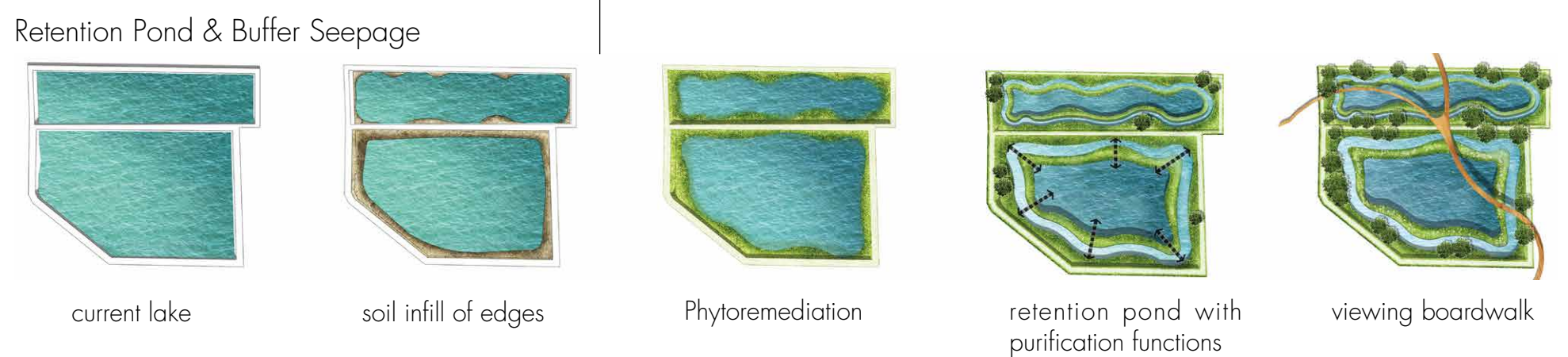
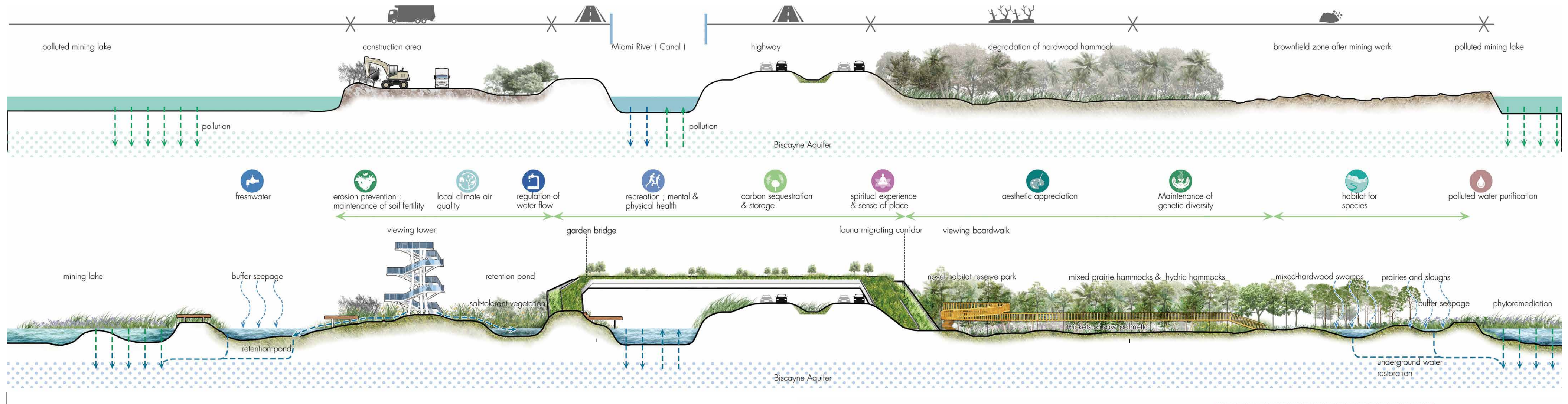


Species of the Ecosystem



The new buffer zone acts as flooding plain. Some soil of the riverbank is digged only allowing the extreme seasonal flood to come into the buffer zone. Such intervention makes the water system less dependent on the artificial dams. The design make the Miami river (canal) regain the ability of self-adjustment and self-adaption to environmental risks.

Ecological Restoration of Mining Pollution



The ecological restoration is an essential part of this area. Firstly, there are retention ponds built next to the polluted lakes. Some of them are reclaimed from the lake edge and some of them are newly excavated. Rainfall would be collected in the retention pond in order to promote water cycle for purification. The tropical hardwood hammock forest would be improved and designed into habitat preserve area. The elevated boardwalk composes the main path system for protection of the ecosystem. It provides an area for people to experience the local characteristics of nature. Viewing tower is important sightseeing platform for enjoying the wild landscapes.

Conclusions: The restoration serves as environmental basis for more improvement of spatial quality. It makes the water system healthier and less dependent on dams. Purification and rainwater storage benefit much to the Biscayne aquifer, as well as benefit to the downstream area.

5.5.2 Industrial Area

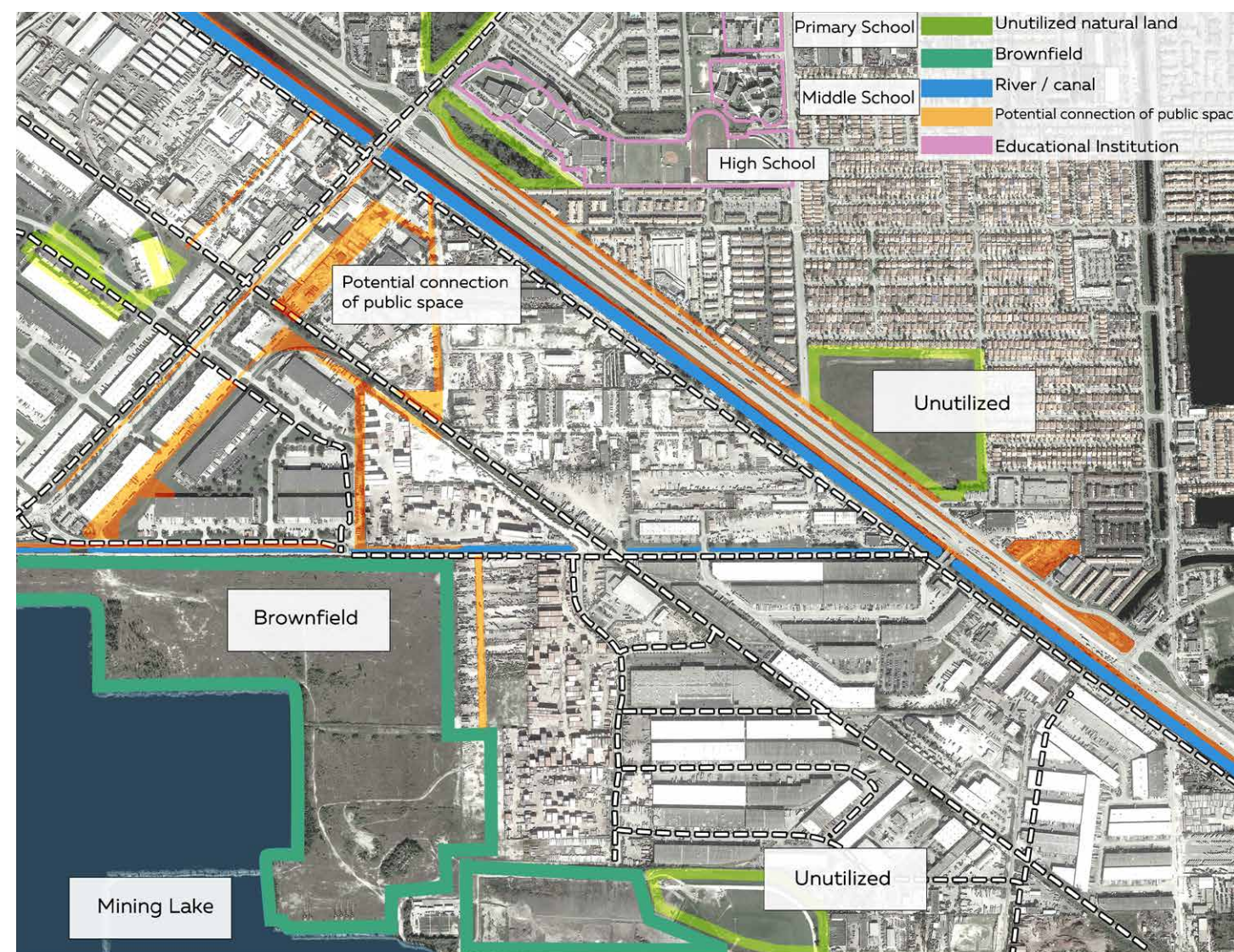
The strategic area is located at the commercial-industrial zone, surrounding by residential and industrial area. The opportunity is that there are mining lakes of which the mining work would come to an end. In addition, the high and primary school institution next to the river also makes the site significant for environmental public education and public activities.

Since for a long time, the industrial area has caused the isolation situation. The industrial land mainly used for freight storage and construction occupies the waterfront without any public access. There is no complete pedestrian path system. The "vehicle town" almost blocks this district only utilized in a mechanical way. In this area, there is no relation between the industry and the canal because the main transporting tool is trucks and there is no pier for ships. Even though, the industry still takes up the valuable riverfront area.

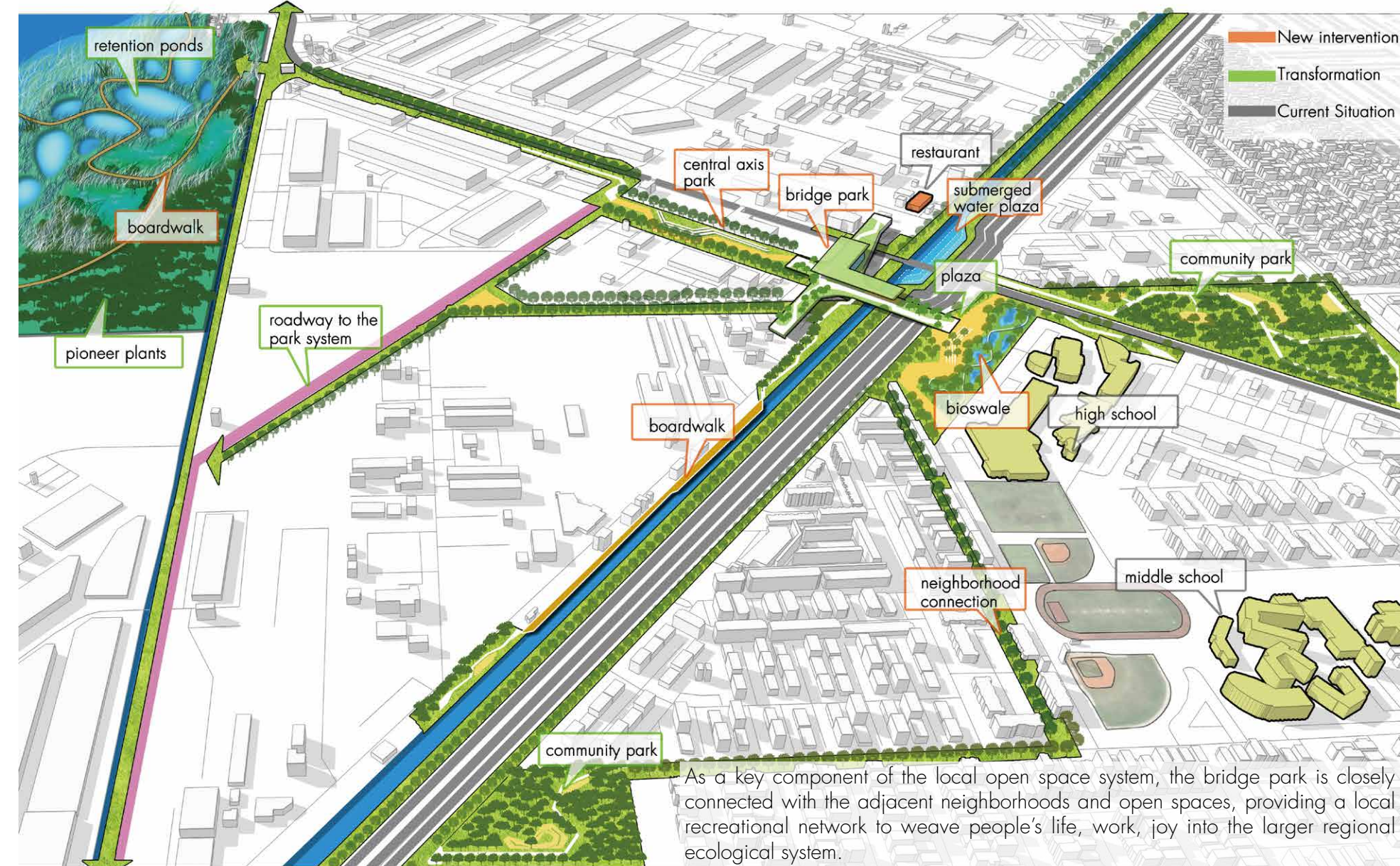
On the other hand, the highway with three lane takes much space and interdicts the connection between both sides of the river. There are large potentials of people from the great neighborhood area and children from schools. The river serves as a boundary with no spatial and cultural values.



Strategic Area 1
Problem and Opportunity Analysis



Basic intervention (first step)



The intervention will be divided into two parts: basic intervention and developing scenarios. The basic intervention which is shown in the following drawing, indicating the necessary green structure and connection. They serve as the basic drive promoting the spatial quality to gain more developing opportunities.

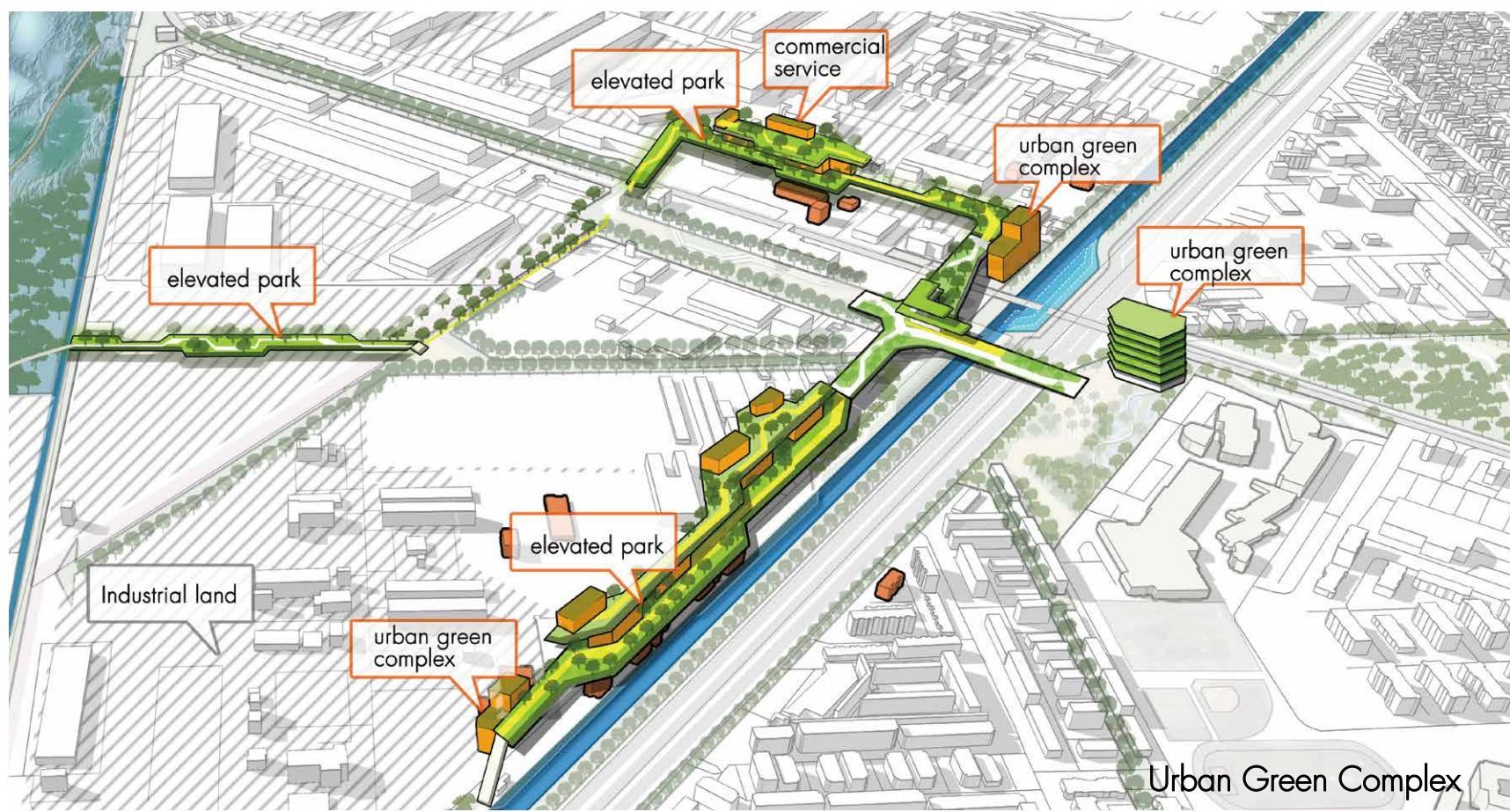
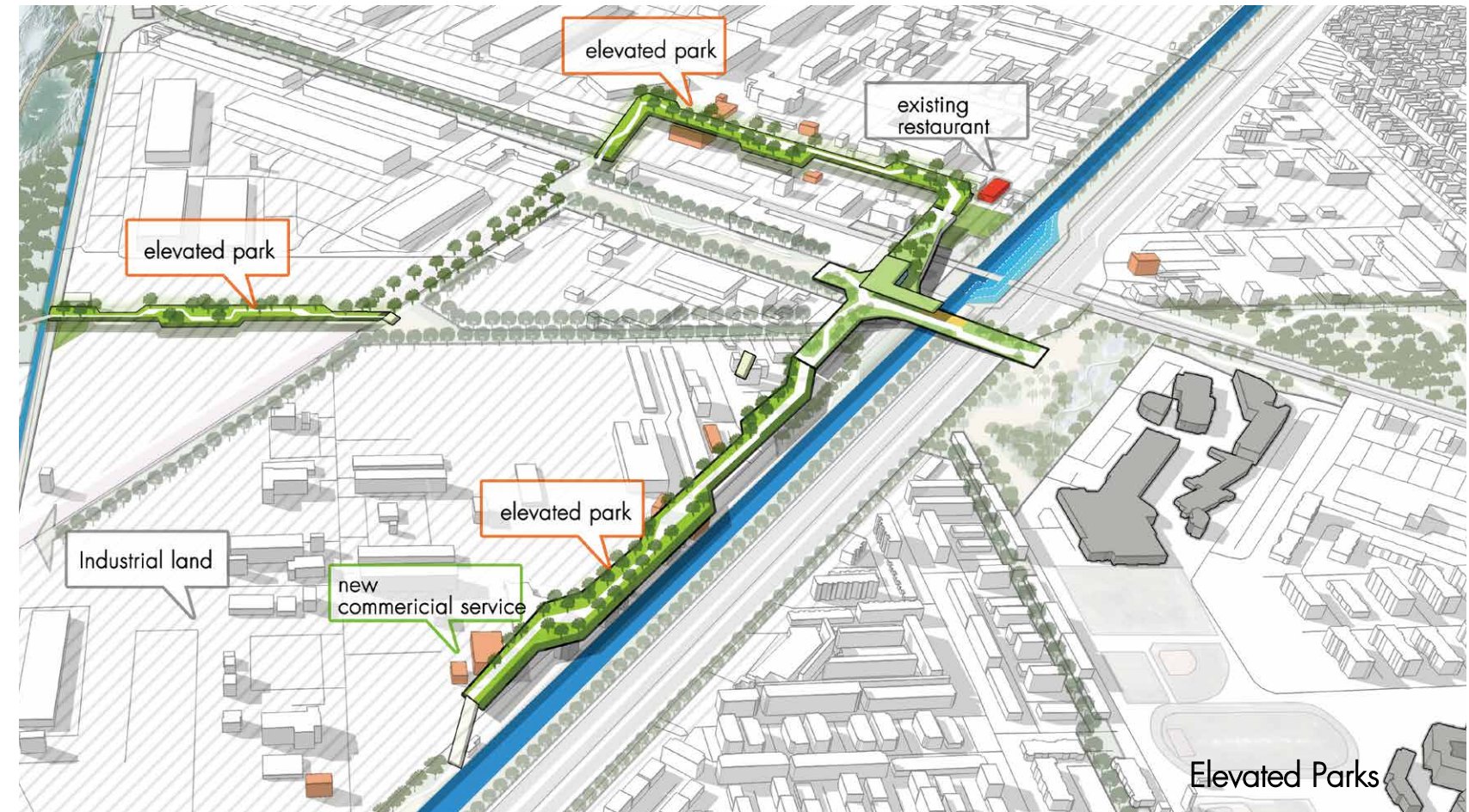
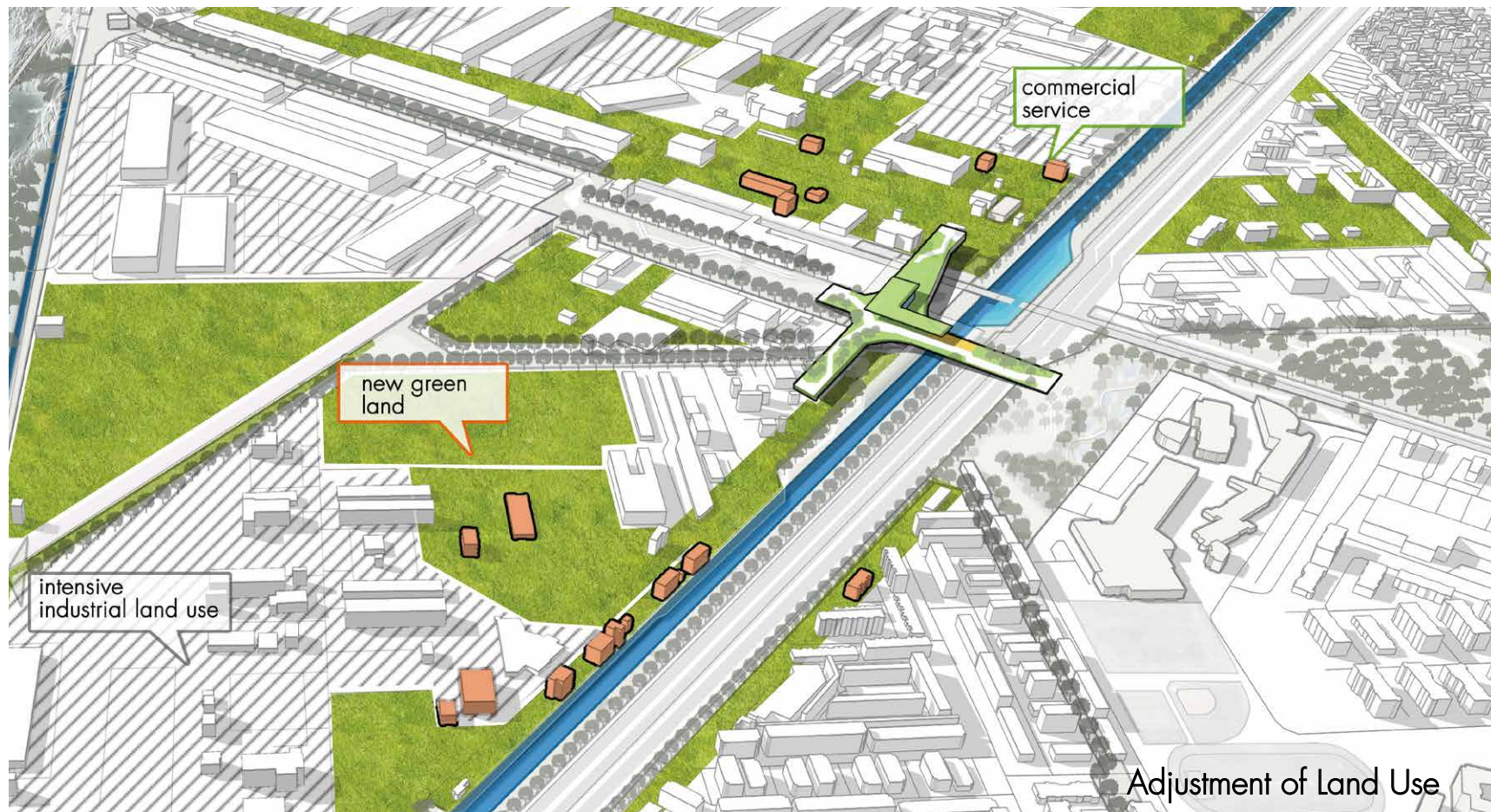
Following this thinking, urban green complex which would supply more commercial services like cafe, restaurant and retail would be another design choice for the elevated green space. The strengthened urban functions for the inhabitants offer vitality to the area through improving the quality of public space. The idea of the urban green complex should be based on a more developed and advanced stage of this area. It is the future possibility under the first intervention of this area.

At the next stage, different possibilities are discussed under the mentioned design principles exhibiting various spatial characteristics. The first scenario is that there would be successful negotiation among the stakeholders agreeing on the land use adjustment. The ideal scheme of intensified industrial land use is accepted making more space for public use.

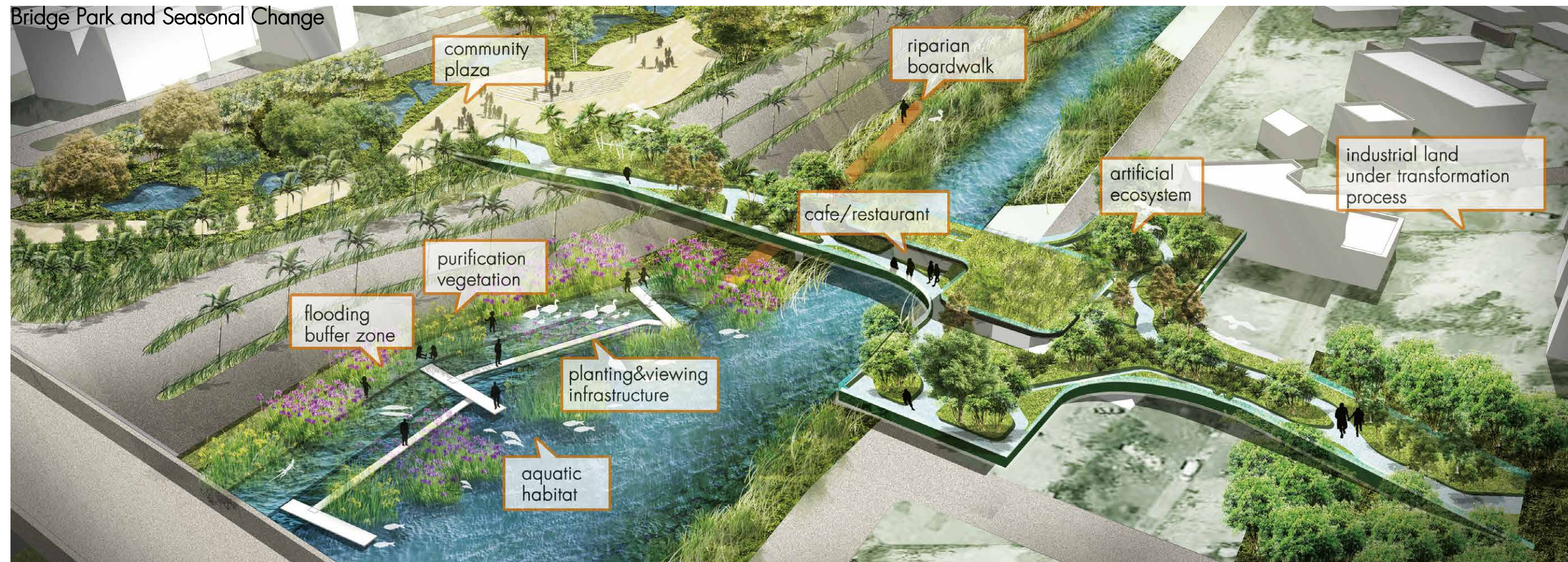
Last but not least, the synthesis shows the comprehensive design result of the scenario discussions. The elevated park would make up the shortage of the mess of the industrial land use. The urban green space on the ground would serve as connecting space which would make the whole green structure systematic and functional.

However, the more realistic situation would be that it is difficult to make the private ownership compromise on the plan. Then another solution would be building elevated park in this area. The project like Highline gives a good example of driving the urban transformation and development. The elevated park is able to stimulate a new urban development in the industrial area with more public services. The urban green space would be integrated as a

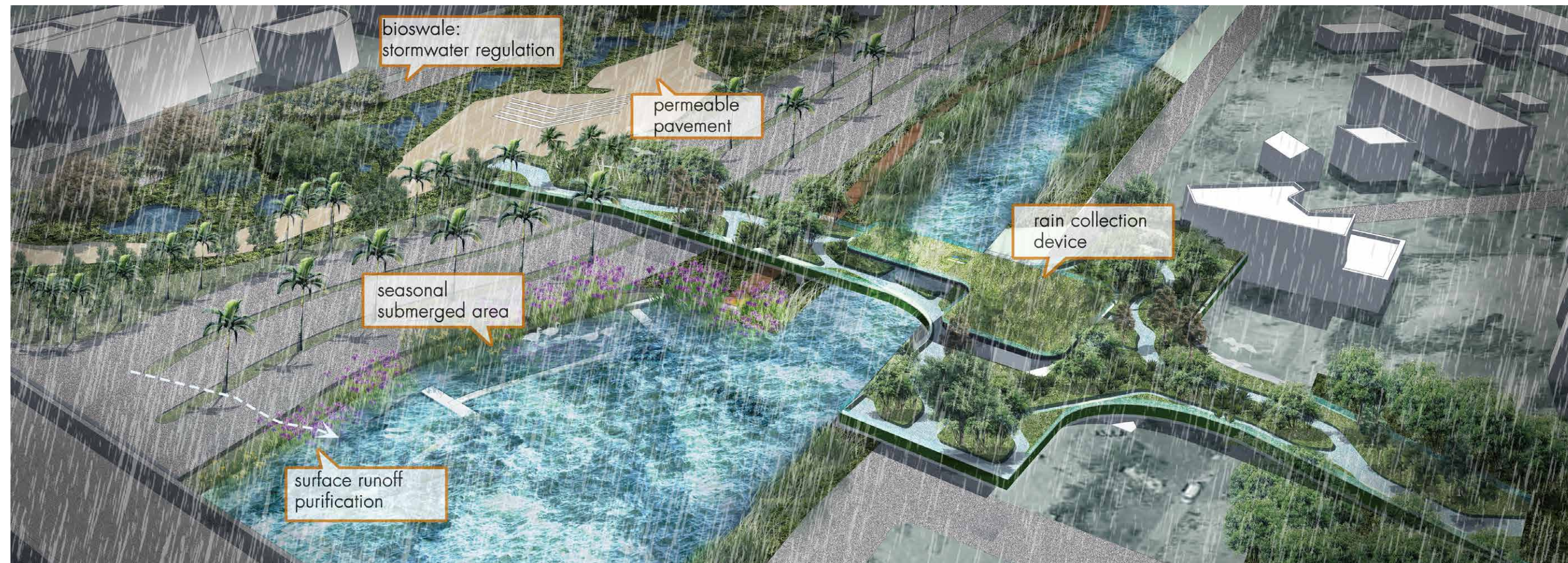
Development Scenarios: Commercial - Industrial Transformation



Bridge Park and Seasonal Change



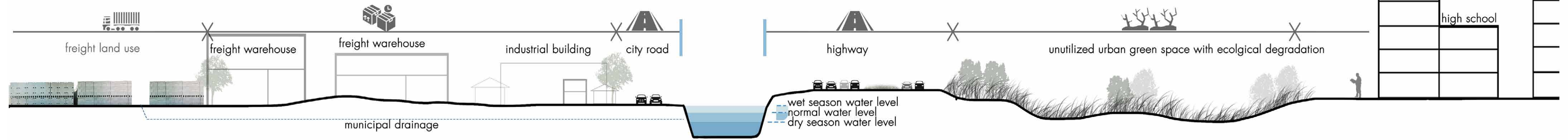
The design of the (elevated) bridge park is not only about urban greening, but integrating novel ecosystems into the artificial built environment. The ecological community concerns the habitats of the native species and creates seasonal landscapes.



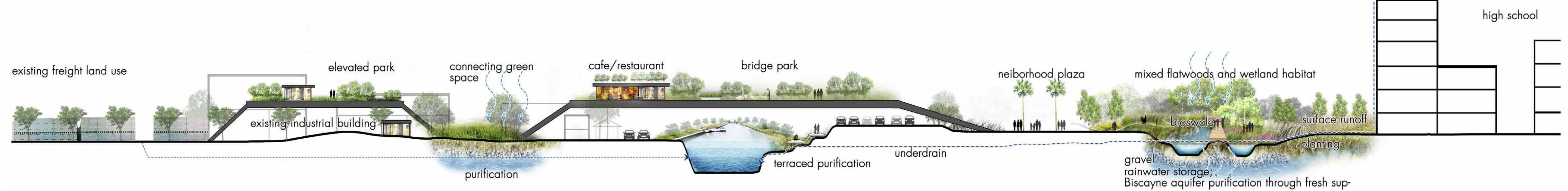
The river buffer zone provides a public recreational space as well as flooding-resilience room. The aquatic habitat for the local species is designed in this area attracting animals and purifying the water as well. During the summer rainy season, the concrete viewing platform would be submerged. The structure also serve as shelter zone for the aquatic animals.

Green Connection of Canal

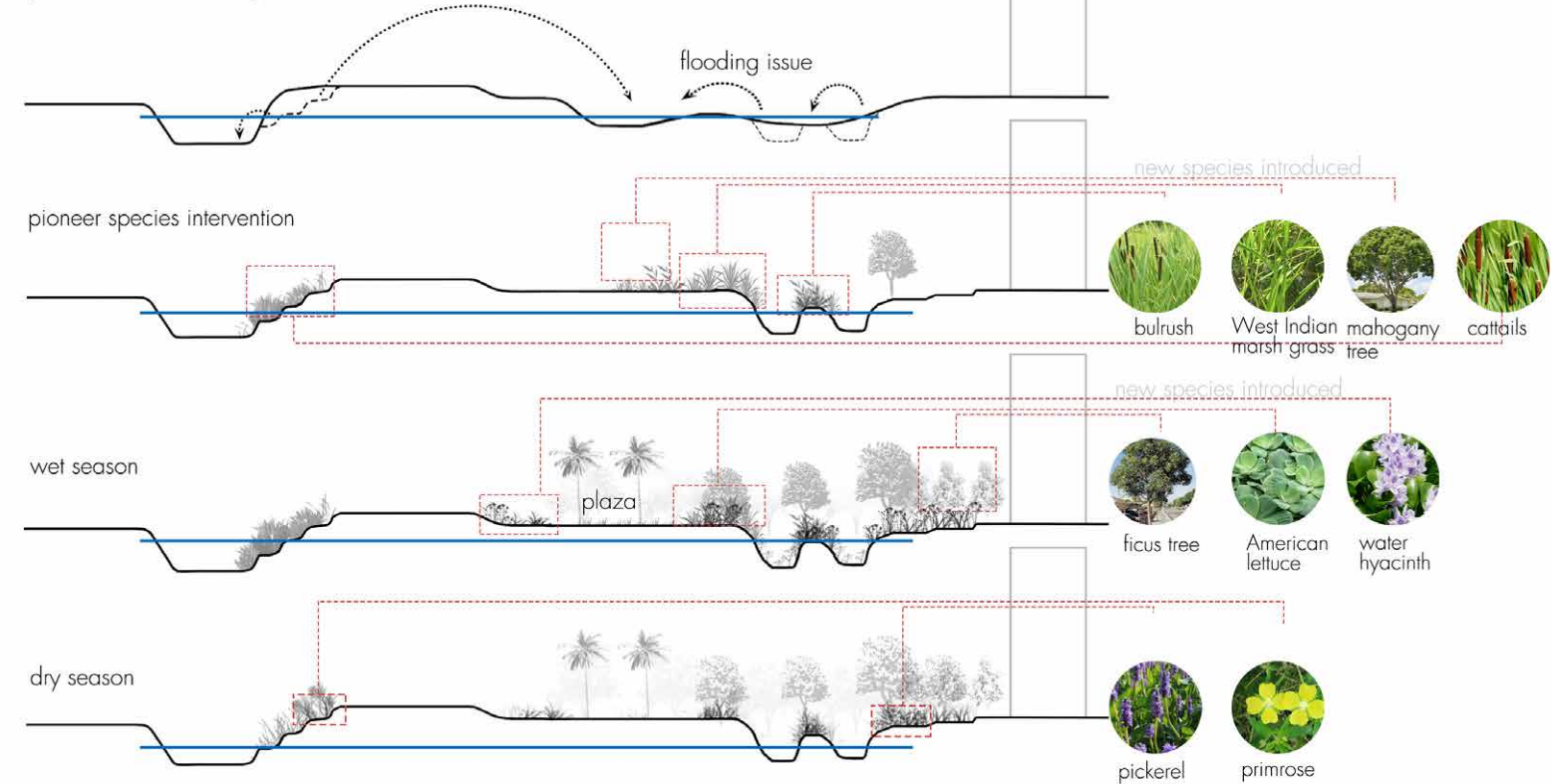
current situation



designed situation



suburban area: lack of connecting public space
plaza & bioswale design



The section shows the coherent urban public space clearly. With green space in the industrial area, bridge park and the novel urban wetland park, the riparian zone is connected into a synthesis. The ecological succession happens in the human-intervened wetland park through the approach of terrain adjustment and phytoremediation.

Firstly, the land with low terrain is dug to create ditch and slot. The rest soil is used for making minor mounds. The main idea is to create diverse ecosystems and habitats in order to accommodate more native species to accelerate the ecological succession.

Secondly the pioneer plants are employed to restore the ecosystem rapidly. The novel creek and bioswale act as resilient land to deal with seasonal flooding and the increasing risk of high water table. Next the vegetation with water purification function is used. The land would help to store rainwater in wet seasons and purify the Biscayne aquifer. The redundant and purified stormwater would be discharged into the Miami River to supply fresh water to mitigate pollution issue.

Conclusion: Through the aid of integrated green public space, the industrial area is transformed from a messy district into a commercial - industrial area with more urban functions with sustainability.

5.5.3 Downtown Area

The design exploration of downtown area is based on spatial analysis of the current issues and opportunities due to the complex land use of a dense urban area. The space barrier problem should be solved by new public connections with transportation function for pedestrian and bicycles. The historical parks are integrated with the newly design urban green space such as tidal parks and manatee habitat parks. The optimization of the downtown green area has higher capability to provide a more active city with public activities.



4 Historical Building & Park



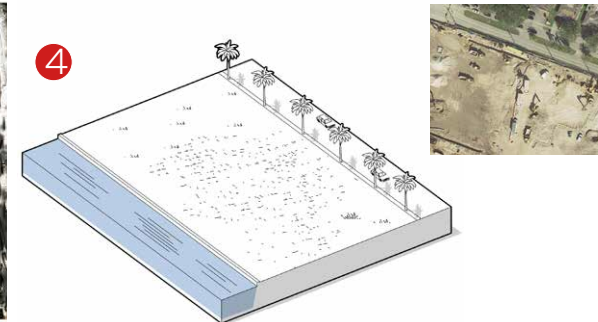
5 Unutilized land to be developed



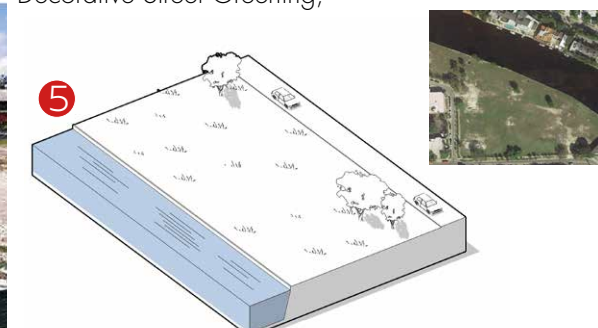
6 Good view of the river from bridge



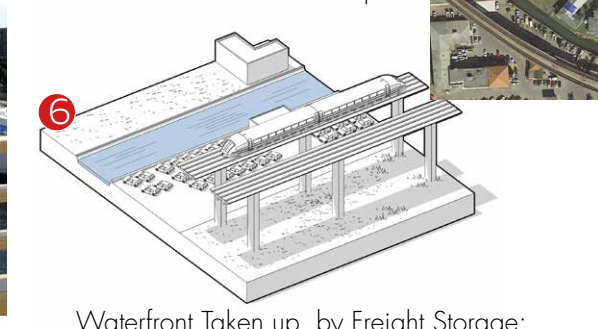
7 Manatee near the estuary



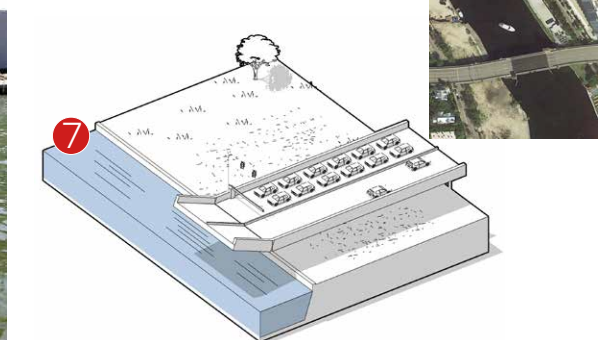
4 Brownfield without Maintenance; Decorative Street Greening;



5 Monotonous Lawn Unutilized Waterfront Space



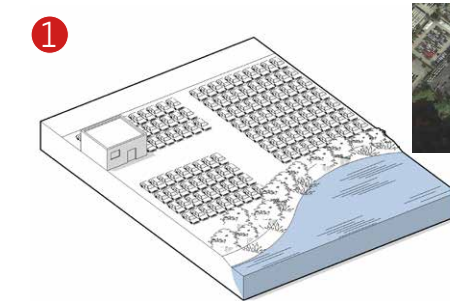
6 Waterfront Taken up by Freight Storage; Run-down Space below Metrorail;



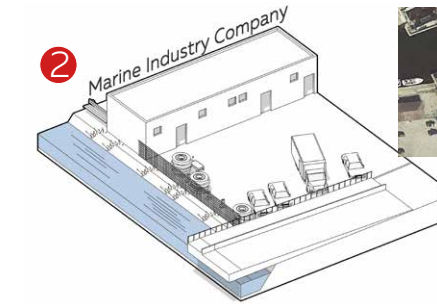
7 Bridge only for Vehicles; Brownfield without Maintenance; Lawn with Few Activity & Wildlife

Issue Summary:
 Waterfront space taken up by freight storage dramatically;
 Brownfield with low spatial quality & maintenance;
 Redundant transportation infrastructure with low spatial quality;
 Low mobility & accessibility of waterfront area for pedestrian;
 Historical sites with few attraction

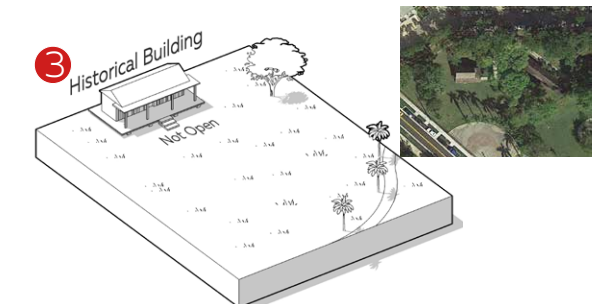
Opportunity & Potential Analysis



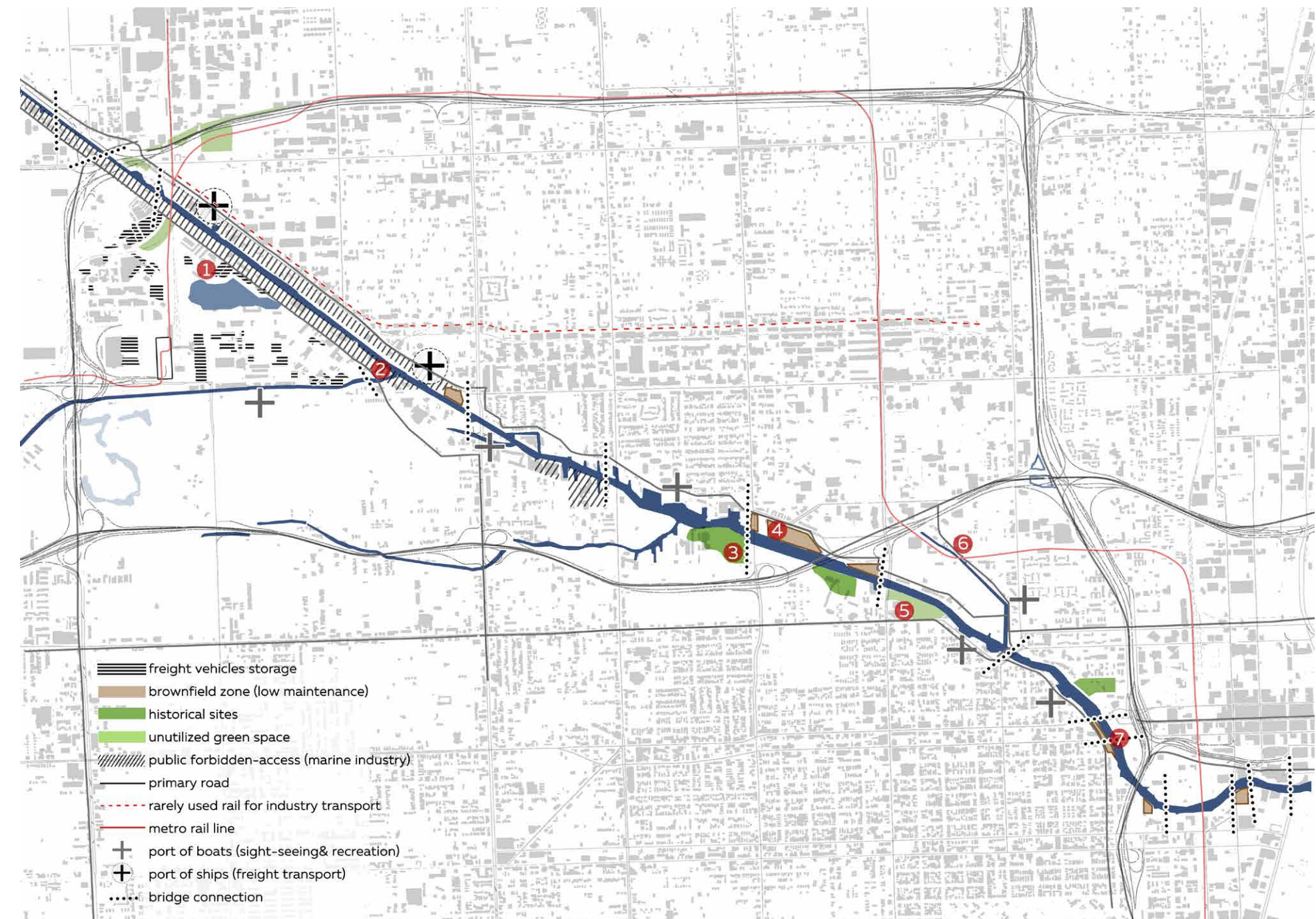
1 Vehicle Storage along the Waterfront; Palmer Lake with High Landscape Quality



2 Enclosed Riverbank; Unreasonable Use of Public Space;



3 Monotonous Lawn; Joyless Path; Park without Appealing Conditions Lack of Public Activities



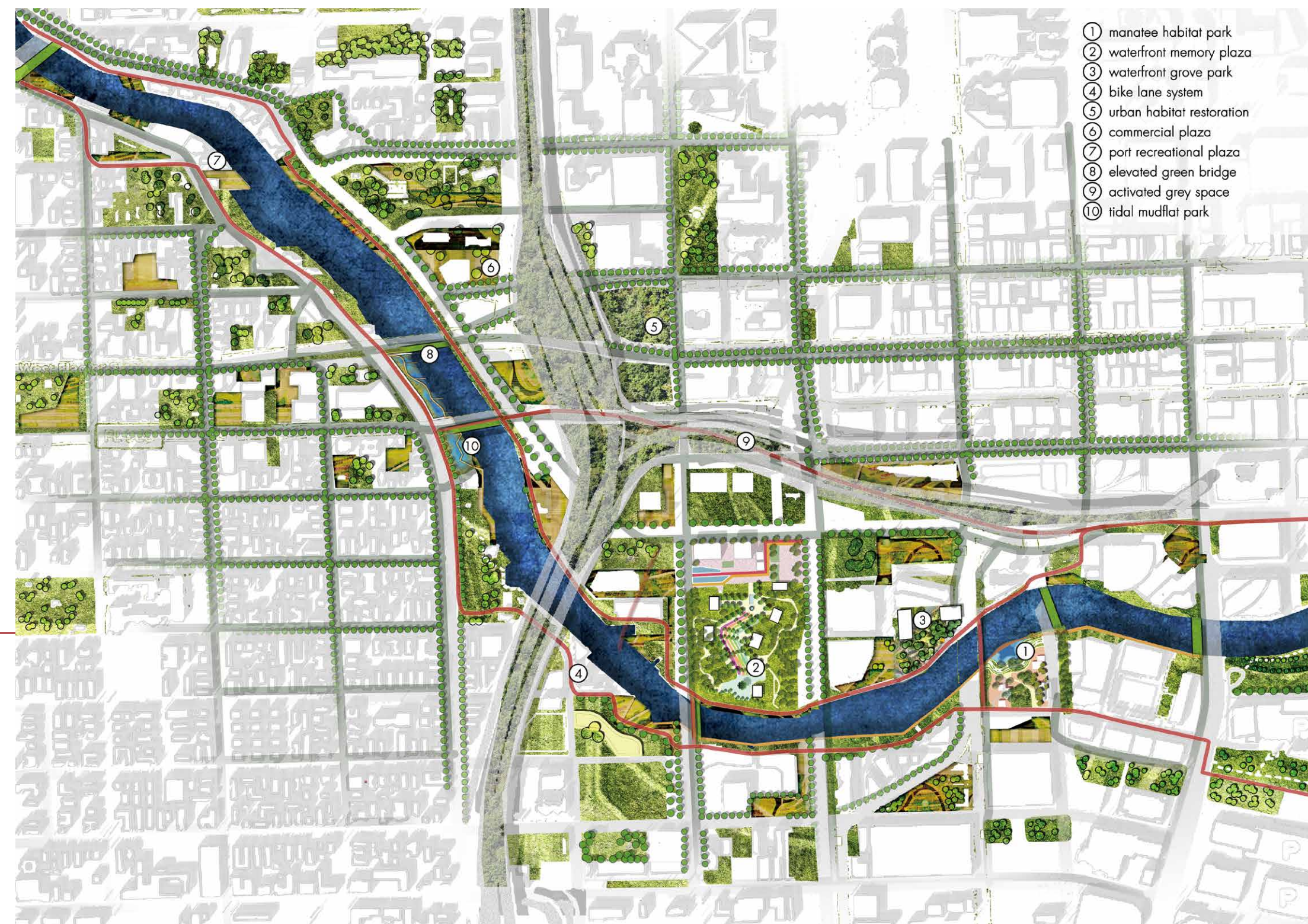


The redesign of the two existing utilized urban land and a power plant to be moved creates new public zones. The planned bicycle path system integrates the area by slow traffic infrastructure. The bicycle lane is elevated as a new bridge for moving across the river. As there are still big ships passing through the existing bridges which requires the bridge to rotate and open for them, the bike path system is also rotatable.

The moved power plant is designed into a plaza with new commercial building development in the surroundings. The outer space is park area providing recreation and mental health functions to the public.

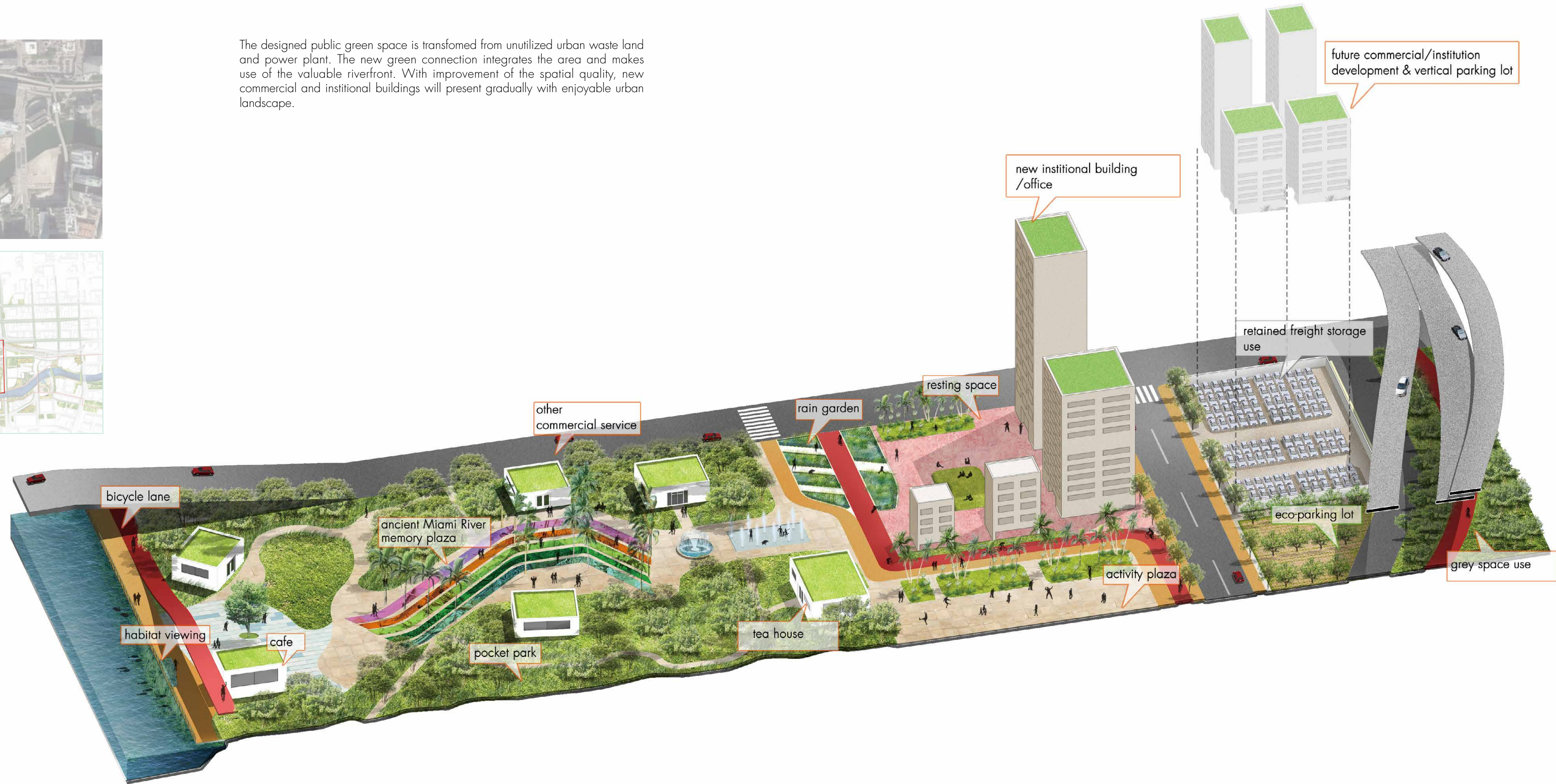
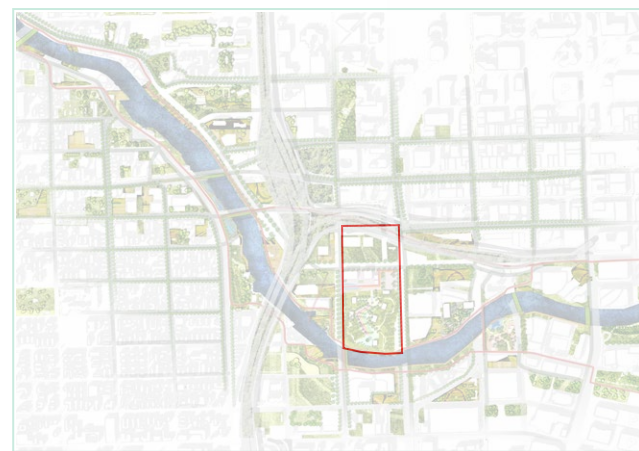
The manatee habitat park is a public space combined with native species protection and environmental engagement. The artificial small bay area creates a shelter for the manatees to avoid the negative effect from the busy shipping industry. The habitat is also a tidal park with terraced sub-submerged landscape. It is an open classroom of ecological education for the public.

The master plan of downtown area of Miami River shows the green networks and urban green space for activating the city. Memory elements of the ancient Miami are integrated with many parks and plazas. The riparian space is connected and composes a slow traffic system. Grey space under the viaducts is utilized properly.



Waterfront Plaza

The designed public green space is transformed from unutilized urban waste land and power plant. The new green connection integrates the area and makes use of the valuable riverfront. With improvement of the spatial quality, new commercial and institutional buildings will present gradually with enjoyable urban landscape.

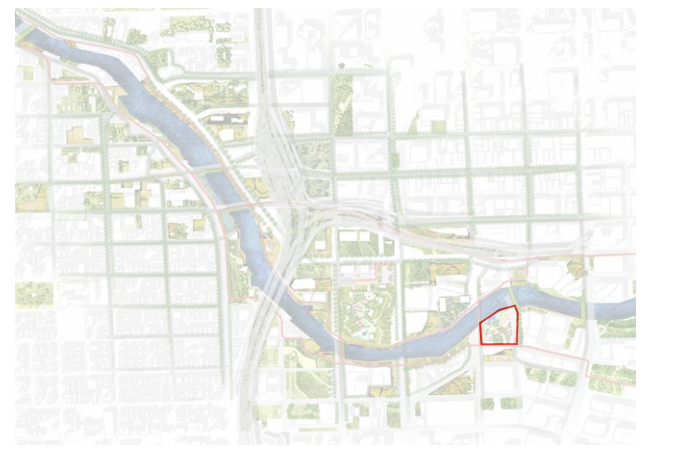


Manatee Habitat Park

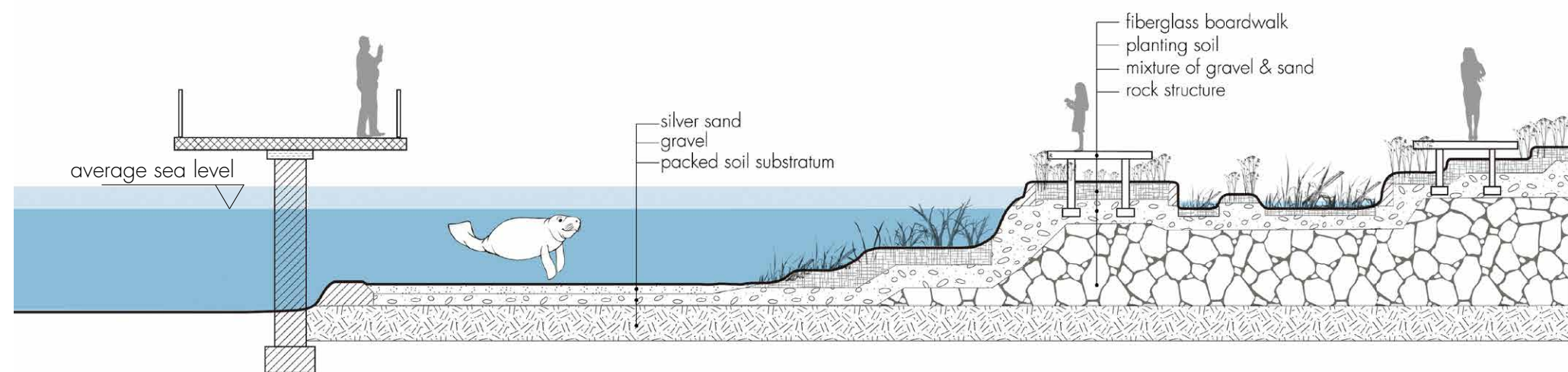


The silver sand and seagrass community compose the habitat of manatee to provide warm living circumstance and their food. The shallow area is the interactive area for the public to experience nature. The emphasis of manatee protection shapes a city identity of ancient ecosystem heritage.

Conclusion: The downtown is activated by the optimization of existing urban green space, connecting green networks and newly designed habitat and tidal parks. It strengthens the city identity and reintroducing the ancient ecosystem memory to the city.



Technical Section of the Manatee Habitat Park



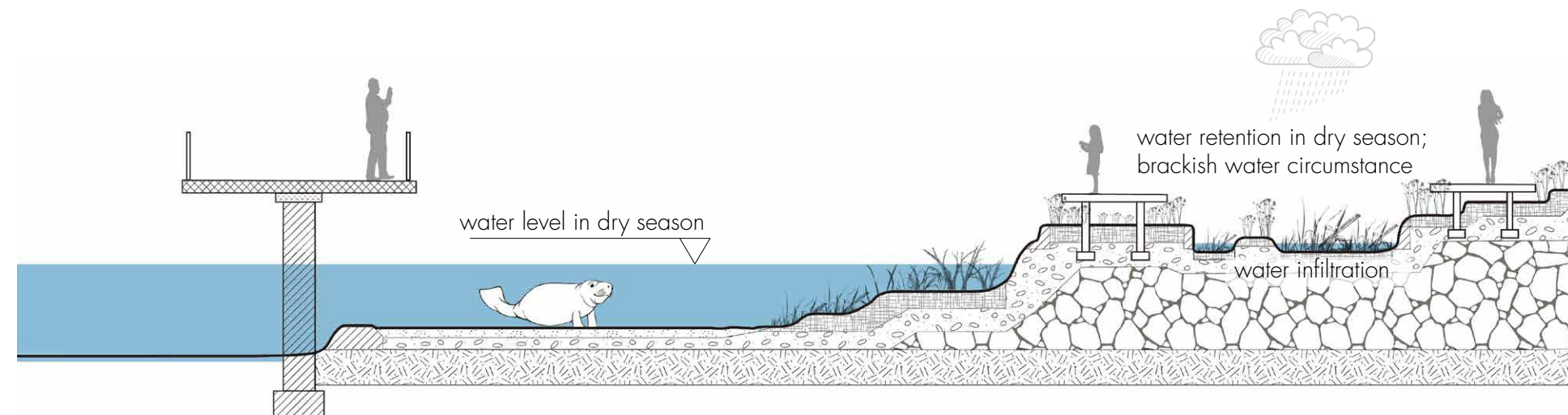
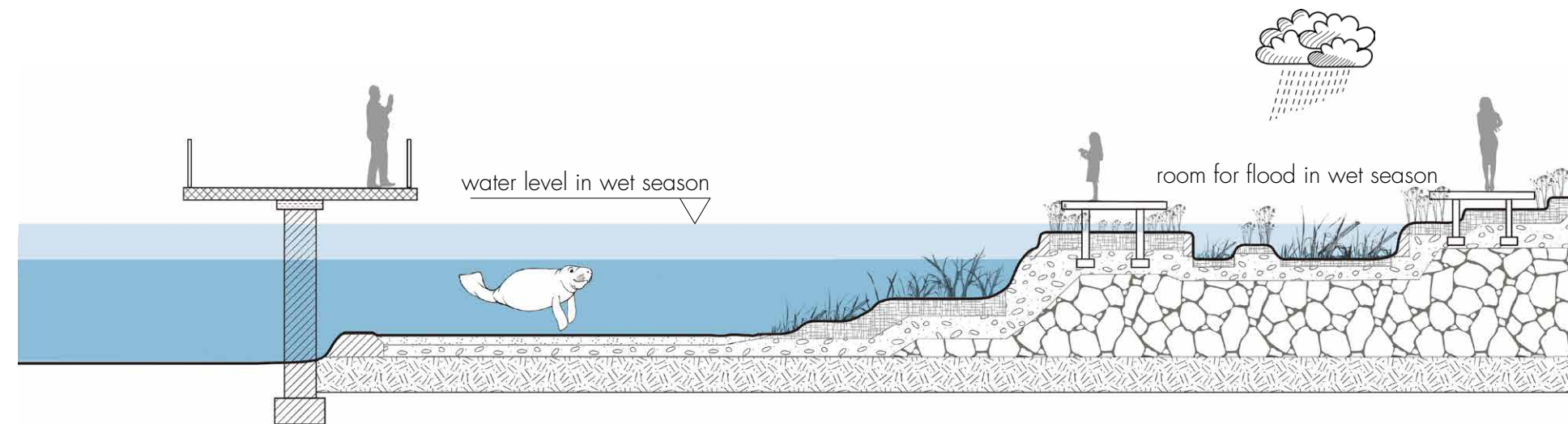
Boardwalk structure protects the manatee from negative effects of shipping

Silver sand provides a warmer and peaceful circumstance which is manatee's favorite habitat

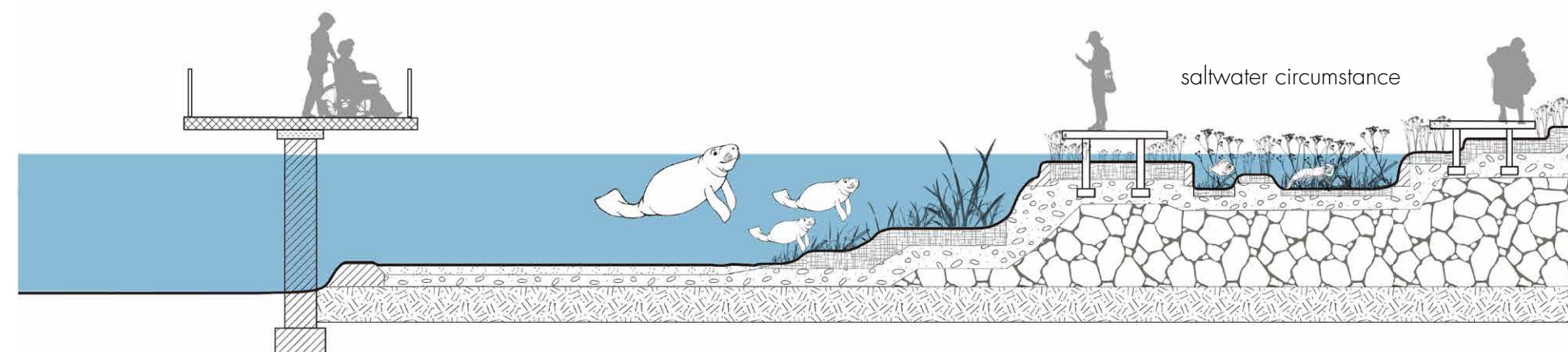
Seagrass planting offers manatee's food

A seasonal bioswale

The manatee habitat park does not only serve as home for animals, but also a tidal park dealing with sea level rise problem. The pond of bioswale acts as seasonal dynamic ecosystem. Affected from sea water and rain water, it is in a brackish environment playing a role of sponge land. With sea level rising, the bioswale will change into permanent submerged circumstance. It has different functions in different temporal stages and reserves adaptive space for the future



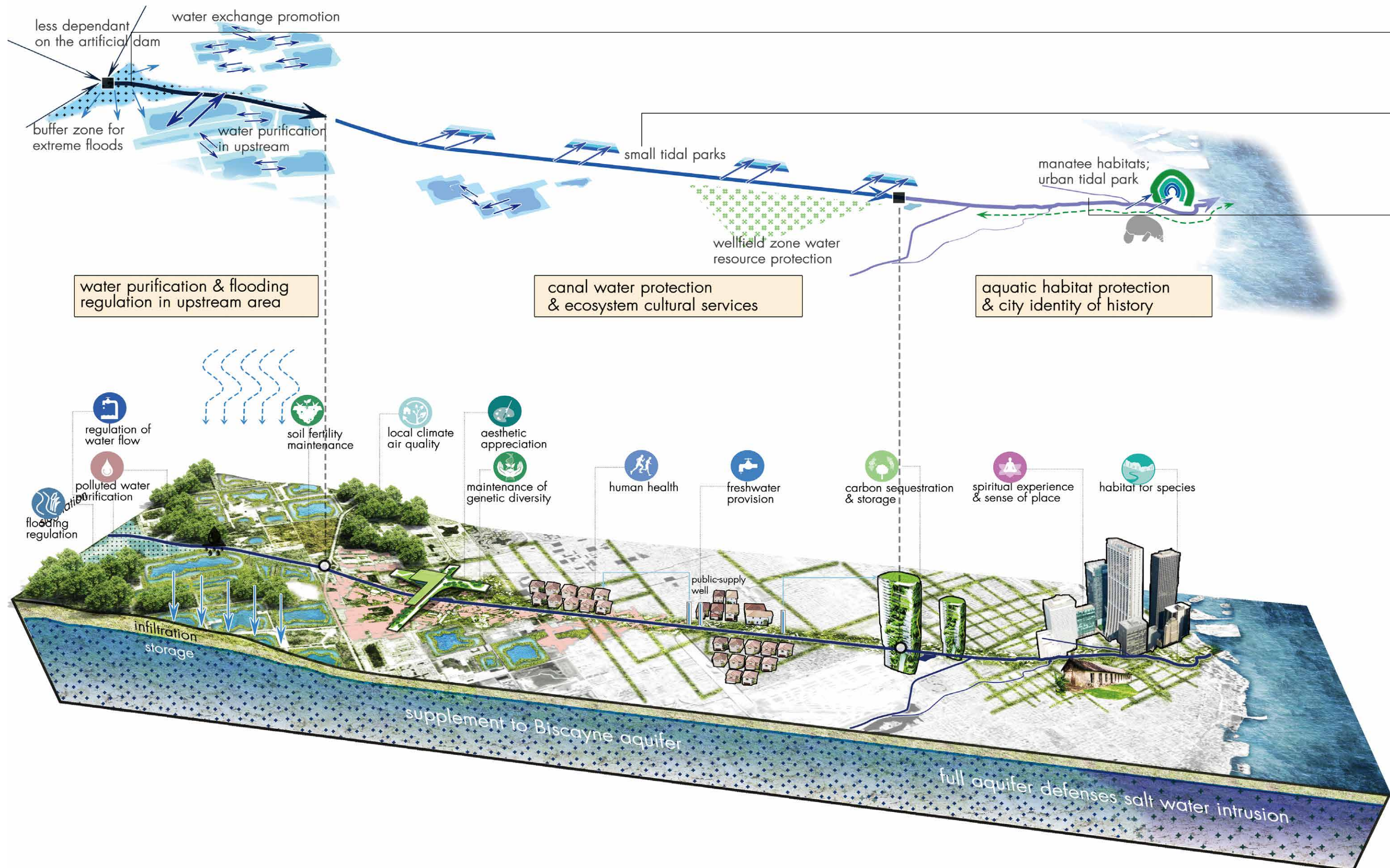
by 2060, sea level rises 60cm



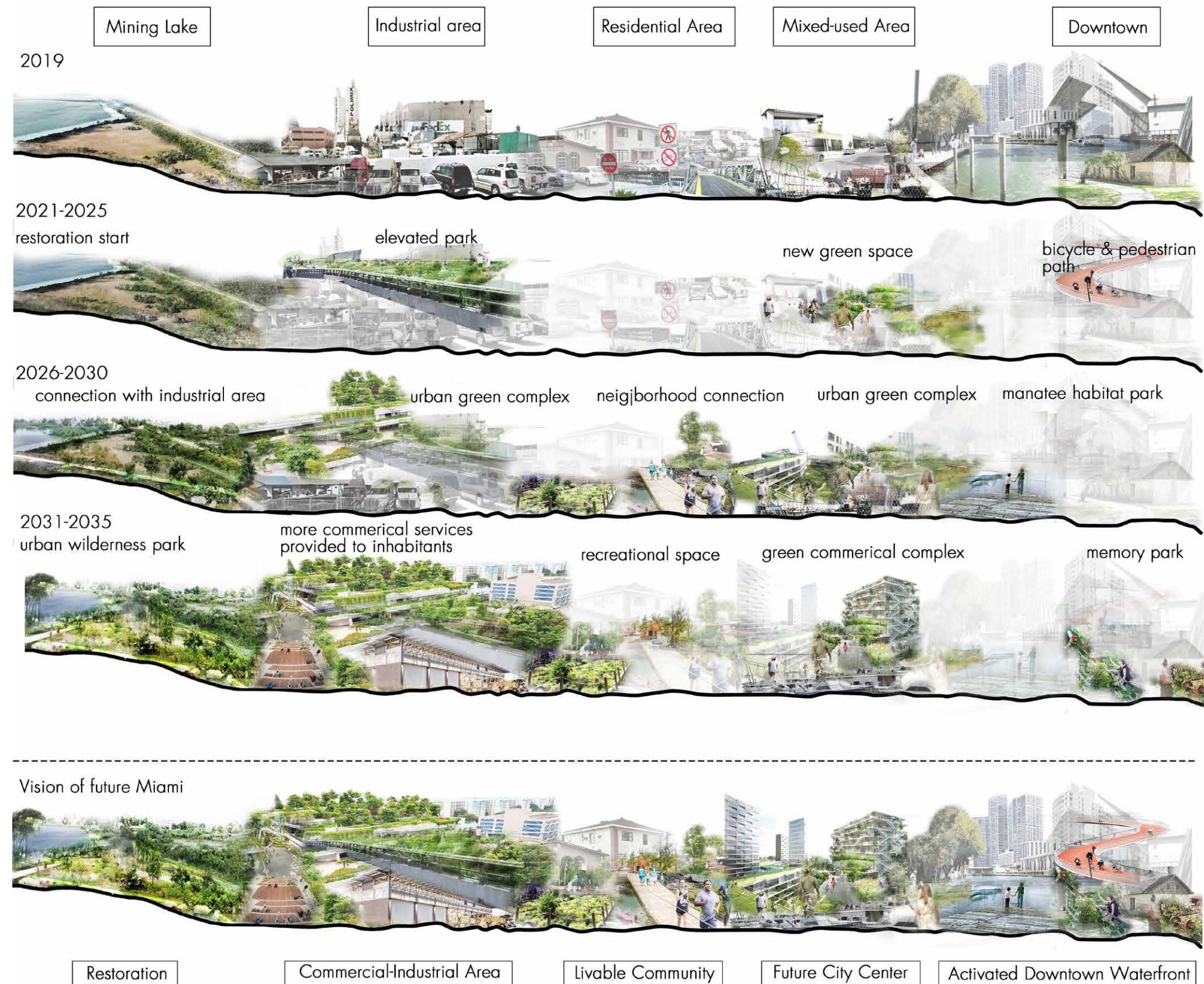
5.6 Urban Landscape Infrastructure as Spatial Backbone

The water system acts an essential role of the whole urban region. The river is divided into three parts according to their functional characteristics:

1. The wetland restoration area which would purify the water in the upstream, as well as making room for the seasonal or extreme flooding. The restored ecological area makes the river less dependant on the artificial dams to control floods.
2. The long canal parts running through industrial and residential area do not serve as a boundary any more. New green connections across the river bring more urban vitality to the district, driving new urbanization of the existing industrial area. In addition, several storm water buffer zones help to relieve the flooding pressure and to provide new recreational urban space.
3. The historical river part connects to the Biscayne Bay working as important habitat of the manatees. With the salt water and the created artificial manatee shelter and viewing place, the downtown river shows stronger capability of interweaving the urban surroundings and integrating social and natural resources. The historical parks with new systematic green paths links the whole urban green space effectively and connects the river closely.



5.7 Urban Development Over Time



5.8 Governance & Related Stakeholders

As the whole program is composed of numerous projects concerning different stakeholders, it is essential to point out the common interests of those stakeholders. The comprehensive revitalization program requires large funding, which means the government needs more social investment to support it. The organization framework is defined according to the five strategic districts.

Mining Lake District: Wilderness Park Districts & Eco-tourism Resort

The basic hydrological adjustment and management are regulated by the Miami-Dade County (MDC) and the South Florida Water Management District (SFWMD), mainly focusing on the earthwork and maintenance of the new ecological zone. In addition, the general ecosystem restoration especially the mining lake pollution restoration will be funded by both of the government and some private investor commonly.

For the government investment, the MDC, the Florida State and the federal government are proposed to undertake the investment jointly. Although the mining lake district is under the administrative range of MDC, it is a boundary between the national park area and the urban area. As an important buffer zone of protecting the ecological reserve district which is managed by the federal government, the upper administration is supposed to support such projects which aid to alleviate the environmental pressure.

On the other hand, the development of the eco-tourism resort is aimed at attracting private finance in order to keep the program operated well. The resort district is intended to be implemented as high-end business resort. The district has large ecological resource with rich flora and fauna. It is a good chance to stimulate the potential of the natural land. With the private investment, the social benefits and economic benefits are developed into the maximum.

Industrial District: Commercial - Industrial Function

The most obvious characteristic of this district is the complex land use and the interests of the land owners, the neighborhood and the government. Its development is mainly market-driven, based on the improvement of the spatial quality. The construction of elevated green structure will be conducted by MDC and private investors who intend to run commercial services. Herein, the private investors include the existing land owner of the industrial area and new investors. A trade-off agreement will be negotiated among the land owners, which is mainly about compensation of land occupation in order to facilitate the implementation.

Residential District: Integrated Communities

The projects of the large neighborhood area are mainly about the connections of public space across the canal and about more community parks as green infrastructure to protect the underground water. The primary finance is from the administration of Miami Springs, Hialeah and Hialeah Garden. At the same time, the planned community public space is combined with more public and commercial services in order to promote the livability and economic progress.

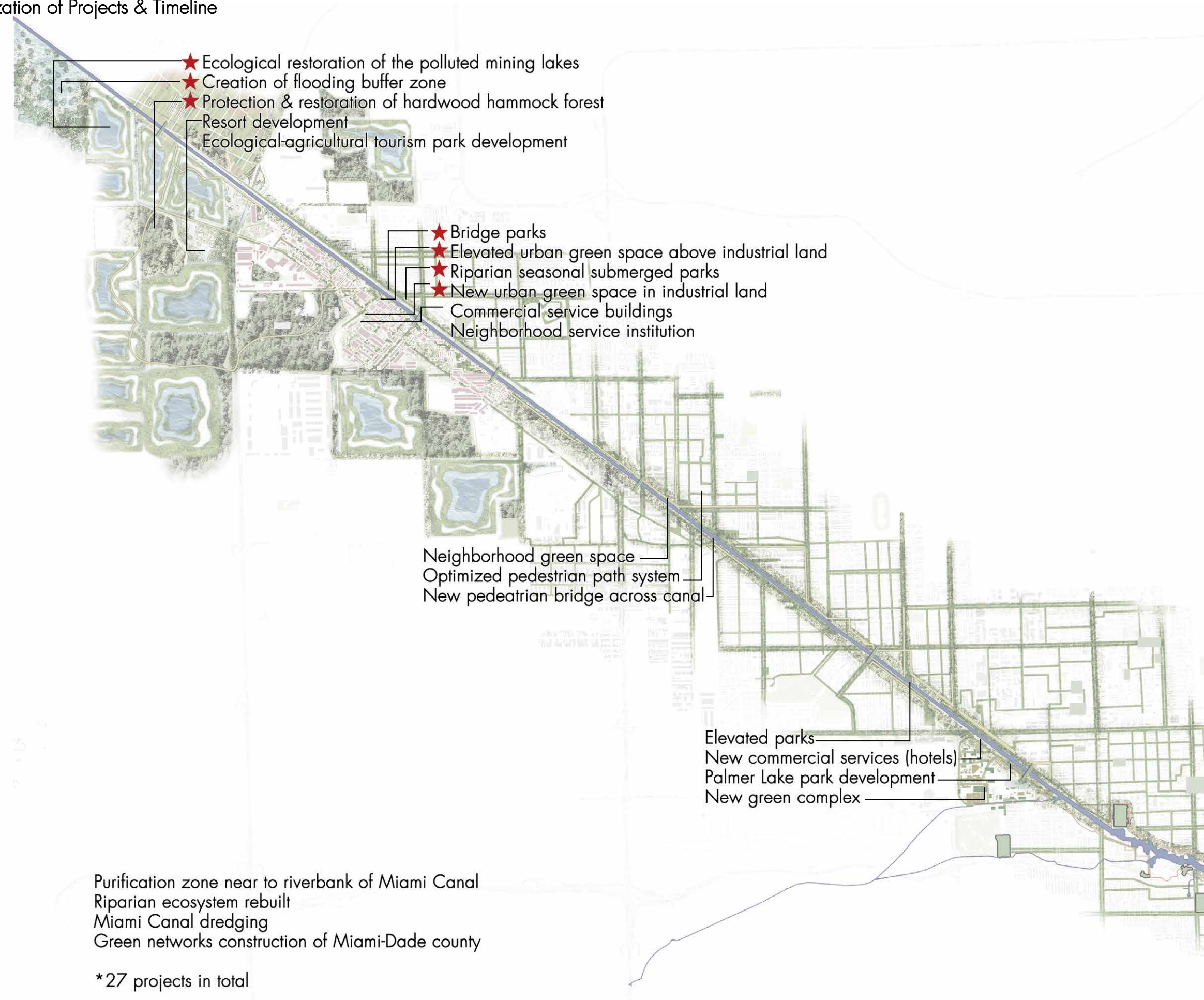
Mixed-used District: Commercial Transformation

This district shows similar situation to the industrial district. However, its urbanizing level is much higher and still in a rapid development process. Mixed with freight industry and commercial services like hotels, the urban area is in dynamic hybrids. Private investors are responsible for not only the construction of their own land, but also for the surrounding urban spatial quality improvement.

Downtown District: Reshaped City Identity with more Social Investment

The downtown district is with high concentration of capital. Making proper use of the existing unutilized urban land is able to inject new vitality to it. The reshaped city identity will absorb more social investment of new constructs. The MDC conducts most of the construction cost of the public amenities. More tourists resource will be gathered from the Miami Beach City (another city on the other side of the Biscayne Bay, which owns most of the Miami tourists) due to the development of urban environment. The stimulated and facilitated economy will offer increasing commercial services. Private investors will benefit economically much from the urban spatial improvement.

Organization of Projects & Timeline



- ★ Ecological restoration of the polluted mining lakes
- ★ Creation of flooding buffer zone
- ★ Protection & restoration of hardwood hammock forest
- Resort development
- Ecological-agricultural tourism park development

- ★ Bridge parks
- ★ Elevated urban green space above industrial land
- ★ Riparian seasonal submerged parks
- ★ New urban green space in industrial land
- Commercial service buildings
- Neighborhood service institution

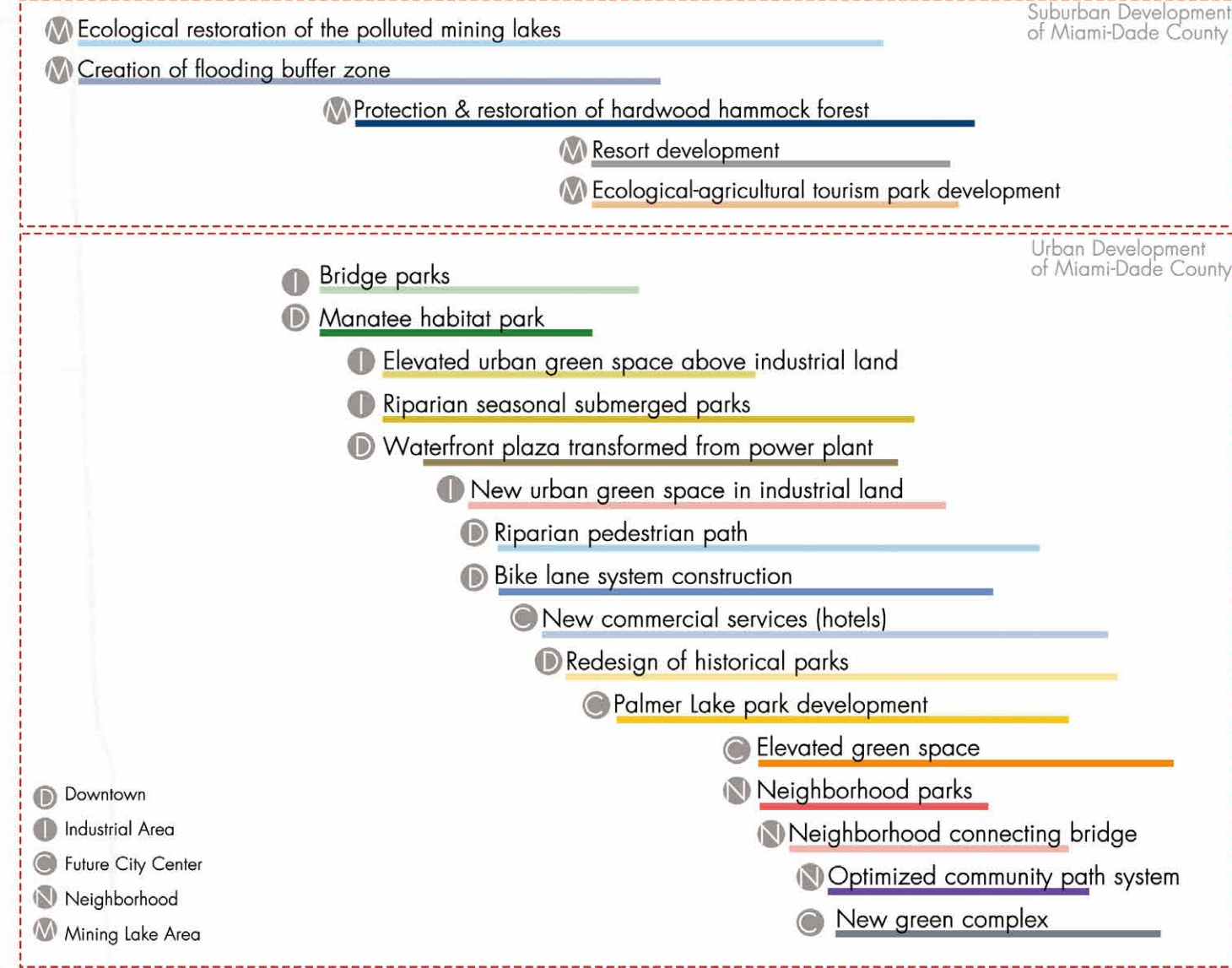
- Neighborhood green space
- Optimized pedestrian path system
- New pedestrian bridge across canal

- Elevated parks
- New commercial services (hotels)
- Palmer Lake park development
- New green complex

- Purification zone near to riverbank of Miami Canal
- Riparian ecosystem rebuilt
- Miami Canal dredging
- Green networks construction of Miami-Dade county

*27 projects in total

Project Agenda



- Suburban Development of Miami-Dade County
- M Ecological restoration of the polluted mining lakes
 - M Creation of flooding buffer zone
 - M Protection & restoration of hardwood hammock forest
 - M Resort development
 - M Ecological-agricultural tourism park development

- Urban Development of Miami-Dade County
- I Bridge parks
 - D Manatee habitat park
 - I Elevated urban green space above industrial land
 - I Riparian seasonal submerged parks
 - D Waterfront plaza transformed from power plant
 - I New urban green space in industrial land
 - D Riparian pedestrian path
 - D Bike lane system construction
 - C New commercial services (hotels)
 - D Redesign of historical parks
 - C Palmer Lake park development
 - C Elevated green space
 - N Neighborhood parks
 - N Neighborhood connecting bridge
 - N Optimized community path system
 - C New green complex

- D Downtown
- I Industrial Area
- C Future City Center
- N Neighborhood
- M Mining Lake Area

- ★ Waterfront plaza transformed from power plant.
- ★ Manatee habitat park
- Riparian pedestrian path
- Bike lane system construction
- Redesign of historical parks

CHAPTER 6

Synthesis

This chapter reflects on the findings of the project and the value of the methodological framework. The outlook shows the most potential parts of the study which deserve further and deeper research.

6.1 Discussion & Conclusions

The "from line to zone" program is a comprehensive urban transformation dealing with complex situations of the context. Through the research design, it's found that it is important to explore the possibilities by discussing different scenarios in order to make more persuading and stronger design framework. It is crucial that the design explorations are powerful enough to show the ideas of a promising future in order to have effective discussion with the stakeholders. The flexibility of the designs is conveyed by supplying reasonable design possibilities to the publics, the private land owners and the government institutions.

6.1.1 Critical Reflection on the Study

The structure and argument of the study is coherent and clear. Firstly, from the perspective of academic research, the research framework is rigorous, built on the research questions and exploring and answering them respectively. The context study including problems and opportunities plays an important part in revealing the most crucial demand indicating the possible interventions. From the perspective of designer, the design exploration makes good use of the existing situations and conditions of the linear riparian area without making too much dramatic changes of the environment. The strategic areas are successfully defined, which play a crucial role in interacting with each other and contributing to the whole system. Even in a limited range, the series of interventions still show strong capability of influencing the designed "zone". The design proposals keep a balance between practical and forward-looking sections.

However, as the designed scale is large and refers to quite different and complex circumstances, there are still numerous aspects needed to be discussed and studied further. These can be summarized in three aspects: spatial and functional design of the system, public space development with complex ownership, and temporal dimension interacting with the program.

6.1.1.1 Reflection on the Method & Theory

1) Methodological Framework

The research is built on the argumentation of designing an urban river (canal) into urban landscape infrastructure. Based on the contemporary urban context of Miami city, the proposed design shows a strong instrument for driving the linear riparian zone towards a sustainable and healthy development orientation. The essence of urban landscape infrastructure is interpreted, illustrated and unfolded through specific and concrete spatial, ecological and functional interventions at different levels with planning schemes and detailed designs.

2) Relation Between Research & Design

Design exploration serves as the core content of the research. But the significance is more than just a practical design scheme of Miami. The research sets a rigorous theoretical framework to lead the design explorations. It is exhibited that the design acts as a tool for discussing the future possibilities and proper proposals to promote the negotiation with the public, government and the land owners. The research framework guides the design orientation, and in turn, the design exploration optimizes the framework continually. The framework promises proper direction of study and makes the exploration more convincing through studying based on theories and precedent study. Also, the research-based design has more relevance to other design projects which have the similar context as Miami River & Canal.

3) Understanding Urban Landscape Infrastructure

The essence of ULI design is to redefine all the systems of a city through the perspective of landscape. It is not only about landscape design or urban design, but a synthesis of the built environment of a city towards sustainability.

6.1.1.2 Reflection on the Design Content

1) Spatial and Functional Design of the System

It is important to reflect whether the intervention on natural and infrastructural aspects work properly under the proposed program.

Water System:

For the canal part, the proposed intervention of water system and hydrology is mainly about providing buffer zones and purification functions by ecological infrastructure. What has been planned now is just partial improvement and upgrading mainly about the riverbank. The current design seems more practical. Although there would be new serious problems if the way of water management is altered, the design proposals need to be checked. Does the current intervention plan have strong capability to transform the river from an artificial canal into a closely connected riparian area providing highly effective ecosystem services? It is important to reflect whether there is any smarter approach to improve the water system.

Green and Ecology:

As far as the design idea is concerned, the program tries to restore the local ecosystems through creating more green space composed of local ecological communities. Although it is admitted generally that ecological restoration is not just trying to simulate the ecological conditions in a historical stage, it is important to reflect that whether it is an appropriate definition of the ecosystem improvement plan. An ecosystem combined with its ancient environmental memory is more helpful for shaping a good city identity for the locals. The eco-design should exhibit the native and unique ecosystem characteristics but not just general ecology. The program still has potentials to be developed in terms of this section.

2) Public Space Development with Complex Land Use

The elevated green public space strategy aims at the complex land use. The industrial area and some other privately used land are preserved for the current stage. The idea suits the contemporary situation, supplying potential space for new connection and urbanization. However, the problem is that such intervention is under risks because it might be hard to be accepted by the private land owners even though they will be benefited a lot economically from the spatial changes. The practice depends on the specific implementation schemes affected by many factors including construction agenda, the orientation and location of new commercial services, and the governance compensation mode, etc. The program needs the aid of other disciplines to set a more thorough and considerate framework.

3) Temporal Dimension Interacting with the Program

The spatial development strategy is related with the temporal processes. The strategic areas own different priority to execute. For instance, the mining lake restoration needs to take a long time with slow but great benefits from environmental improvement. As a rural district, its construction cost could not be very high. It is smart to make good use of the self-adjustment ability of natural environment. In this sense, the restoration should start at the very beginning. The construction of the new green public connection interacts with the restoration process. The necessary infrastructure such as viewing parkway and boardwalk starts to be built when there is some obvious improvement of the restored ecosystems. It provides a platform for the public to experience the change of natural landscape during several years or even decades.

The natural ecosystem restoration is easier to predict. However, the urbanization process such as the transformation from industrial into commercial-industrial district is hard to have an accurate expectation. For the portion which is not controllable, it is supposed to have more adaptive ability to face future changes. In this sense, a bottom-up strategy is more suitable to the program. Improving spatial quality of the targeted area is the foundation of achieving the goals.

6.1.1.3 Reflection on the Program Framework & Stakeholders

The "From Zone to Line" program includes 27 projects in total. The cooperation among private investors and governments of different levels is significant for financing so as to implement such an ambitious program. From the governance perspective, the environmental or ecological restoration and urban green space improvement present great social benefits to the public. From the perspective of other investors, the promoted spatial quality provides more commercial values and economic benefits. In this sense, defining appropriate common interests plays an essential role in integrating social capital and achieving the same goal. Private capital is still able to contribute tremendous benefits to public services and facilities in the condition of getting enough revenue.

6.1.2 Generic Value of the Research

1) It provides a new perspective of how the historical (ecosystem) values could be employed for sustainable development of the current rapidly growing cities.

2) Through presenting a more powerful role of landscape infrastructure in integrating urban systems and leading urban development, the research proposes an effective approach of dealing with urbanism issues from landscape perspective.

3) The research interprets how to redefine infrastructural design as an interdisciplinary design effort in a specific and vivid way.

4) It illustrates how ecosystem services are connected with landscape infrastructure, as well as how ES helps to explore infrastructural design orientation.

6.1.3 Lessons Learned

The research helps to build a complete academic study with strong argument. The educating significance is that it tells the role of design is not just to give a design result, but by employing design exploration as a tool to do attempt of future possibilities. Clear research objectives and questions are important for helping to keep the designer in a right and clear research track. With the instruction of the research questions, the design assignment can be in obvious direction. The clear objective defines the main clue and other sections at the service of the core design goal.

The design is supposed to illustrate how the system functions and how the interventions contribute to the system. The design at different scale aims at interpreting the inner operations of the system.

6.2 Outlook

The research of designing Miami River as urban landscape infrastructure is promising, providing new perspective of urban development of Miami. In order to achieve the potential powerful value of such study, there is still much work to continue.

Firstly, more accurate current situation of the site should be investigated with useful big data, for example, the soil condition of different areas and the hydrology indicators. Secondly, the research has an ambitious target needing the help of experts from diverse backgrounds such as architecture, urban planning, engineering, ecology, hydrology and botany. In addition, as ecosystem services are important theoretical background, there should be more scientific quantitative research on ecosystem services as design indicators. Last but not least, the specific spatial design morphology still needs to be optimized to implement a more practical program and related projects.

Acknowledgement

I'm really thankful to the people who help me with my graduation study during the whole year, especially my two mentors, Dr. Steffen Nijhuis and Dr. Lei Qu. In addition, thanks for all the colleagues from Miami group who spent time with me during two fantastic trips in South Florida. The one-year study impressed me with forgettable memory including academic achievement and life experience. Also, I feel grateful of all the professionals in the University of Miami especially Prof. Jean-Francois Lejeune that provide reception when the group was in field trip.

As my first mentor, Steffen always proposes quite clear and logical research structure as well as practical graphic expression techniques. I'm really appreciate his inspirational guidance, wisdom and patience. Our meetings were always so efficient and effective. His profound knowledge and expertise in urban landscape infrastructure has inspired me to shape my research ideas, method and empirical studies. His rigorous logic influences me most. Besides, I would give my special thanks to my second mentor Lei who is always so kind to provide help on my academic study and personal life. Her sharp perception about spatial planning and design offers numerous inspiring design ideas. The proposed idea of considering governance helps me to think in a new perspective through urbanism which really open my mind. Many of her critical thinking prompts me to review my design ideas and then to improve the research constantly. I have harvested a lot and feel so fortunate to be a student of them during my graduation year of TU Delft.

I would give my sincere best wishes to all the people mentioned above and hope happiness and health will accompany them during the lifetime.