



A (NEW) FUTURE FOR MIAMI BEACH

A landscape architecture graduation work, dealing with drastic change in an urban area facing the risk of a major disruption, which calls for adaptive solutions for resilience. From adaptability theory two forces are derived that guide an analysis towards a solution for an urban environment challenged by sea level rise; the revolt, the force demanding a change, and the remember, the force of processes within a city, offering resistance.

Miami Beach has a low threshold for the effects of rising sea level. The remember force here is focused on spatio-cultural dynamic, related to the identity of the water and the way water has shaped society. The revolt, in this case, is climate change. Along these two lines the analysis is directed to see how the two influence and conflict with each other. It touches upon how the urgency to resist and the current response to the risk may cause a detachment from the culture evolving around water.

The posed solution is a coastal strategy on the Biscayne Bay, stressing the importance of integral long-term thinking through time, understanding history, current culture and accepting an uncertain trajectory by thinking in scenarios. The design combines use of mangroves as an adaptable coastal defense, with inclusive public spaces to create new cultural and ecological qualities along a densely built up, complex, privatized coastline.

A (NEW) FUTURE FOR MIAMI BEACH

Flowscapes
MSc Landscape Architecture
Graduation Programme TU Delft

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With most sincere gratitude to my mentors, Denise Piccinini for the
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INTRODUCTION

PROBLEMATIQUE

Miami Beach is facing a drastic change in spatial and cultural character since it is globally one of the highest- risk areas in terms of coastal flooding. The problematique of sealevel rise, however go beyond the issue of flood. It's a highly urbanized metropolitan region. Built upon specific porous limestone Miami Oolite, which means that there is Saltwater intrusion from underground.

Besides this, climate change is being denied by the government. There is no governmental support for solving climate change-related problems: no subsidies or an overall plan for coastal protection. This causes the coastal defense to be fragmented with interventions between private-public sectors.

The measures against flood, that are taken so far don't consider the existing architectural- and landscape qualities and their potentials for the future. The current investment is huge, without calculating uncertainty in the solution and no guarantee it will be sufficient for a perdurable future.

On the other hand, there is a boom in real estate development and a trend of rapid urban expansion. So, because of the complexity of the task, the lack of governmental control, climate change adaptation measures risk to be fragmented, suboptimal and not taking in account issues related to spatial and cultural character and qualities of the site. It is clear that something must be done for long term functioning, to give the city a future. This might be something strongly changing the current character of the city.

RESEARCH QUESTIONS

How can Miami Beach, adapt itself to a changing climate and in what way can this process be used to create new spatial configurations and generate new landscape qualities in the scale of Biscayne Bay, taking into consideration the existing spatial-cultural dynamic of the city in relation to water?

- How does the land-water continuum in the region and city work? And how does a changing climate influence that?
- How was the spatial-cultural character of the city in relation to water shaped?
- What are the coastal defenses now?
- Which are the possible interventions dealing with changing climate and which are most fitting to the existing spatial dynamic, culture of Miami Beach and the natural system of the Biscayne Bay?
- What new opportunities does an integral redevelopment of the coastal front create for the quality of the City of Miami Beach?
- How can we deal with the fragmentation of the coast and involvement of different actors in time to realize an integral coastal strategy?

METHODOLOGY

The objective of the project is generating new inclusive landscape qualities for Biscayne Bay and South Beach, through adaptation to the uncertain trajectory of sealevelrise caused by climate change, fitting in the spatial-cultural dynamic of the city in relation to water.

The key of the research is looking at it from the perspective of drastic change. The design assignment will be based on adaptability theory, especially two forces; the revolt and the remember. The remember is the slow working processes and identity of the city, the spatio-cultural dynamics relating to water and the revolt is the drastic change, the possible apocalyptic force to the system; the sealevelrise, to which the remember offers resistance. Within the analysis the two forces, the revolt and remember will have to be understood and opposed to each other, to research the worst-case scenario. From the remember analysis clues will be drawn to deal with the problem of sealevel rise in a more nuanced way. Evaluating and valuing the identity, to find a fitting long term solution for the flooding, while prioritizing in keeping the character and culture of the place. The aim is to understand how the two forces work separately and after find the relation and at the tipping point the potential clash between the two forces.

The remember analysis is divided into categories:

1. Physical: understanding of the geomorphology, and existing systems and processes.
2. Cultural/historical: The biography of the place will be told in the narrative of drastic change and in relation to water, dragged from historical

literature, maps and old photographs. Showing the growth of Miami with disruption as a catalyst. And the growth of Miami beach, shown through the way water was used in culture.

The revolt is the force that has impacts as the landscape as *longue durée*, of which the effects should be understood on the landscape as a complex system, composed of different layers, characterized by different time frames and different levels of uncertainty. For the revolt analysis it is crucial to understand the sealevelrise. Showing the impacts sealevelrise has on Miami beach as a complex system, through different scenarios of sealevelrise, anticipation of sealevelrise, and showing the influence of sealevelrise on the relation between culture and water.

EXPECTED ENDRESULTS

Because uncertainty and unpredictability are important elements in the project, as response to the research, the intervention should lead to a strategic framework, creating conditions for adaptability to uncertainty to change, in this case sea-level rise, fitting the evaluation of the current identity. The project will be implied in the landscape as *longue durée*, differentiating strong structures with flexibility, focusing on differences between fast developments, like land use and urban development, to slow development, focusing on climate and ecosystems in which the strategic framework is placed. In the case of Miami Beach, the project will result in a coastal strategy for the west coast of the municipality, that fits within the ecosystem of the Biscayne Bay area. The strategy will be based on creating new spatial configurations and new opportunities for qualitative, inclusive landscapes in the regional- as well as on the small neighbourhood scale, respecting the cultural relation of users with water and identification of water as a major attracting element for all user groups. The strategy will be elaborated through public and private scale and through time, always looking at ways the different scenarios of sea level rise would influence the framework.

THEORY OF DRASTIC CHANGE

CHANGE, ADAPTABILITY AND RESILIENCE

Our metropolis work as a progressive ecological system. According to adaptivity theory a healthy working system or society is always flexible to small changes. According to the theory the system is divided into 4 stages; the Growth(r), Conservation (k), Release (ohm) and Reorganization (alpha).

The system is built up in a constructive way, so that with change (Release phase), there is room for reorganization, and with that improvement. This dynamic equilibrium works in a certain timespan, in which factors in the system have time to adapt to the change (Allen, Angeler, Garmestani, Gunderson, Holling, 2014).

Change can have different levels on impact depending on its magnitude, the rate of change and the reversibility.

Within the era of the anthropocene, the release phases have followed each other up so fast and so drastically that other factors don't always have enough time to respond to the change. Causing the severity of the threat to increase and making for a bigger challenge. An important element in the process cycle of change is the moment that makes the change drastic: the tipping point, it is the threshold for change and can be seen as a point of no return – or very slow return (Clayton, 2016).

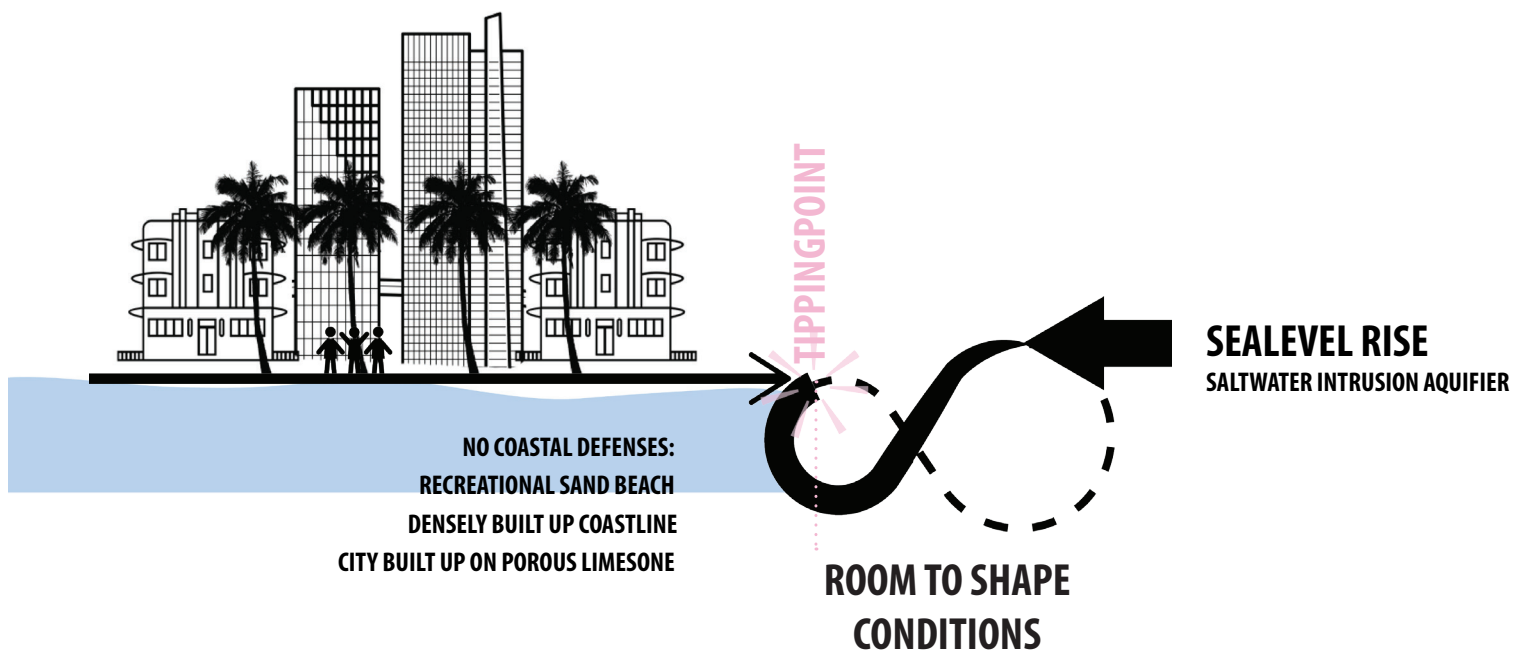
In the aftermath of these drastic changes we can expect unforeseen responses like conflicts, environmental catastrophes, socio-political uproar and with that reduction of civil rights, throughout the globe, that ask for well-educated guidance and solutions.

Clayton (2016, p.88) states that vulnerability to a threat depends on three factors. One is exposure, the level in which the force will affect the subject, this might depend on geophysical location. The second factor is sensitivity, the populations measure of response or non response to the problem. The third element is the adaptive capacity, the ability to adjust to the problem or to cope with the problem. This coping with can be by accommodating to new conditions or changing living patterns to keep up with new conditions (Clayton, 2016 p. 88). So in a system in which a species has high exposure, high sensitivity but low adaptability it is the most vulnerable.

Adaptability is the ability to adapt to changes in ecosystem dynamic that occur in every cycle of living systems. In an actor based cycle it is the ability to manage the resilience of an ecosystem or community, by intervening in or altering a context in its current state to postpone tipping points.

Resilience shows the absorbability of an ecosystem or community to withstand drastic change, while maintaining its structures and functions. In the reorganization phase of the adaptable cycle, resilience stands for the transformative capacity, in which the system's structures and functions turn into a new steady state. Resilience is a balance between stability and disruption, and steadiness and change. (After Folke et al. (2010), Gunderson & Holling (2002), Holling (1973,1978, 1996) and Lister (1998,2008). In Projective Ecologies, p. 277).

Discharges leading from this up-building misbalance lead to big shifts from the equilibrium and an era of risk and uncertainty. This arouses the acknowledgement of risks locally, nationally and even transnationally. Risk is not the same as catastrophe; it is the anticipation of catastrophe (Beck, 2006). It is important to understand risk; as Beck (2006) says, “Whoever believes in not-knowing, increases danger of climate catastrophe”. Anticipation on - and dealing with risk causes the urban development to be shaped along a particular chosen line of defense against the posed risk. In this report the incremental approach that is implemented into Miami Beach is challenged, by stating that it will cause a disruption in Miami’s culture in relation to water



REVOLT VERSUS REMEMBER

As explained the theory of change is based on forces managing to keep a system into a certain equilibrium. This analysis will be based on two forces from this theory, the revolt versus the remember.

The revolt is a progressive force, initiating change and move from the equilibrium to crisis. While remember is a slower, larger force within the organization. Within a notion of change it is the force of resistance, helping to keep the stability. On the other hand, revolt also facilitates the organization to change and, respond to crisis, while remember keeps balance (Redman & Kinzig, 2003). Within the theory, the drastic change is the revolt and the place and its working systems is the remember force.

To put this into relation to the context; in the research of the case of Miami the remember force is focused around the existing spatio-cultural dynamic relating to water. The way the city is shaped around the water and in that way water is, culturally, a part of daily life, for locals as well as for tourists. The revolt force here is the threat that water poses, with the possible cataclystic effect of sea level rise.

The remember

The remember in the case of the city is perceived as the city's identity, its essence and reality. Identity here, is defined as the uniqueness of the place, the values and characteristics that make it different from other places; geographically, culturally and historically. Within this rootedness there is a spectrum of familiarity to different spaces. In the cases of Miami Beach the familiarity can be based on two groups, the local community

and the tourists, of which the first is more connected to spaces for daily use while the latter is expected to have a less profound connection to smaller spaces, but a stronger connection to strong key elements like the ocean and eye catchers (Ujang and Zakariya, 2017).

To understand “remember” of the city; the way the city is and was used will be placed into the theory of landscape as a palimpsest, narrated as a landscape biography. The idea of the landscape as a palimpsest is the notion that any existing landscape results from various different processes, naturally and spontaneously as well as culturally organized with differences in cultural habits throughout different eras in time. These processes all always leave traces in the landscape on which other dynamics are superimposed; this is explained as a palimpsest (Corboz, 1983).

It's crucial to understand the lines' development as a narrative that connects found heritage and traces of cultural patterns and current spatial dynamics to history in which it has been shaped (Roymans, Gerritsen, Van Der Heijden, Bosma, Kolen, 1998). The 'layerdness' of the palimpsest on the landscape, is caused by a constantly changing character and identity of the past. In the current day situation it should be seen how these layers of the past are validated by individuals and user groups and how they make use of them (Roymans, Gerritsen, Van Der Heijden, Bosma, Kolen, 1998).

The remember, lies on the one hand, in the physical context, the understanding of the geomorphological history and the existing systems and natural processes that shape the landscape of

Miami Beach and the Biscayne Bay. On the other side it is shaped by the cultural/historical context of the place and the cultural processes that gave space to the urban context as we know it.

To tackle this idea the analysis is presented as a biography. Exploring the long line in history from the discovery until today, through cultural, social and economic dynamics, understanding how the landscape plays a part in shaping culture and identity of the community by remembering and forgetting eras and understanding that having a grip on the past is inevitable for dealing with the present in the sense that they are connected (Meyer and Nijhuis, 2016). An interesting part of the biography of the context of Miami lies in the narrative of drastic change in relation to water; dragged from more personal, explorative, analysis through historical literature, personal stories, maps and old photographs, this will show how the identity and use of water changes over time.

The Revolt

The force demanding change in the context of Miami beach is sea level rise due to climate change. It is the force that has impacts as the landscape as *longue durée*, of which the effects should be understood on the landscape as a complex system. By seeing the landscape in the *longue durée*, a distinction is made between fast impacts on urban processes and longer scale impacts on climate and landscape scale (Meyer & Nijhuis, 2016).

This force in this case is the anticipated sea level rise, calculated through time and based on a certain degree of uncertainty. This line of analysis shows the impacts climate change has on Miami Beach, on its geomorphology and urban structure, through different scenarios of sea-level rise on the context of the city of Miami Beach. As well as the influences the anticipation of sea level rise can have for the built environment

The Relation

To fit resilience into an urban design it is necessary to understand what the maximum disruptions are before the system can no longer recover, in which case the system needs to adapt. This moment is described as the tipping point (Van Veelen, 2016). The aim in working with these two forces of change is first to understand how they work separately, after this, as a conclusion, the two forces are related to each other, looking for places where the forces interrelate or, even more important, conflict into a tipping point.

Risk and uncertainty call for adaptable solutions for resilience. Resilience is defined as the capacity to absorb disruption as well as to reorganize while changing, still working to keep the same identity within the structure (Van Veelen, 2016, p.70). Adaptability is the capacity to adjust itself to the dynamics of a system in change. It can manage the resilience of a system by directing it around a brink of change (Holling, 1973).

By relating the remember to the revolt, respectively the culture in relation to water to the effects that climate change has on the coastline, the point in which the contrast between the cultural use of the water and the lack of coastal defence is so big that the system cannot maintain the situation like it is, will become visible. In this point the identity of the water may shift from potential, recreational and positive part of culture to threatening and a risk. Changes will have to be made before this moment to stretch out the durability of the existing socio-spatial dynamics of the landscape in a shorter timescale, before finding solutions for the landscape in the longer term. In the design assignment a balance should be found, accommodating the cultural wish to relate to water with a good defence against flooding. Because of the uncertain nature of climate change, this has to be an adaptable framework, in which there is room for flexibility for variations of the impact of the sea level rise.

Relating the two lines of research to each other, will indicate that there is a point at which Revolt and Remember work together in history, presence and future, and in which they influence each other in a line developing the future identity. From that, key elements in dealing with change, in this case sea level-rise, can be dragged to find the characteristic solutions that are embedded within the palimpsest of the location, or question if there is a need for something drastically different.

REMEMBER

MIAMI AND THE SEA: DISRUPTION AS A CATALYST FOR URBAN GROWTH

Throughout all of its history, Miami has shown to be resilient when it comes to major world events and natural catastrophes. The development and growth of the city we know now is a storyline of flourishing developments and rapid crash; every disruption has been taken as an opportunity to grow stronger. With water always being a strong narrator, shaping the development and culture.

In 1513, native Caribbean's tricked European conquistador Ponce de Leon into leaving by telling him he should go to a new land, where they have heard he could find the fountain of youth. When he made his landfall there, instead of the fountain, he found friendly natives, a lot of water and marshlands covered in flowers. He called the land Florida.

The origin of the strong water related culture is visible from the Tequesta-natives that lived from water and dealt with constant flooding with heightened houses in the marshes. As well as the appeal of Biscayne Bay to the "mother of Miami" Julia Tuttle, and the seminole wars fought around the Miami river for the power over the stretch of land. It's notable in the he dredging of half of the everglades to create room for a city and even to real-estate investors building the coast up higher and denser for attraction. Water has always played an important role in the development, construction and culture of Miami.

In the post-war history of Miami it is best seen how the city has grown and shaped itself from the disasters and disruptions that it has faced.

After all the threats from war, missile crisis and other hostile forces overseas, bringing in a lot of

immigrants years and years after, the city became a transnational city, with a big part of its residents having their roots in Latin America. There came a new input that affected Miami greatly. The positivity of its effects for the city is disputable, but Miami became a cocaine hub and main attraction for drug cartels, mainly because of its location as big port-city between the Americas.

Drugs were part of daily life, to the point where research showed that every inhabitant of Miami, young and old, could find cocaine traces on their hands from the money that they were using.¹ The safety in the city deteriorated as crime-rates went up. But at the same time, drug money brought in a lot of investments into the city. Biscayne Bay waters were filled with speedboats, recreational elements and its coastlines were starting to get shape with Brickell downtown developing its skyline and the city starting to thrive.

Meanwhile, upcoming television series Miami Vice, took all the elements of this unfortunate city and unexpectedly changed its character, to a dangerous, but also cool, multi-cultural, exciting place, with a charm that had an impact so big, it brought in tourists and visitors by the masses. The character of the city in Miami Vice as this tropical, pastel-coloured, laid back place enhanced the importance of the protection of the typical South Beach art-deco buildings, pushing investors to renovate the already exhausted art-deco buildings from the '30s, that were initially supposed to be torn down.²

At this time the city of Miami is facing another big challenge, it has a drastic change to look forward

to. The city is globally one of the highest risk areas in terms of coastal flooding, with limited solutions because of geomorphological and spatial context, lack of governmental support and fragmentation of the densely built up coastline. While, on the other hand, there is a boom in real estate development and a trend of rapid urban expansion like never before, that will show cast the way we deal with the risk of climate change in this era in the city of the future.

Because of the complexity of the problem, many are pessimistic about the future of Miami as we know it now. But they are forgetting the strength the city has gained from all that it has endured. Looking forward, with integral planning and accepting water as an element of vitality in the city, the urban growth of Miami is bound to become stimulating and something to pay close attention to.

Ponce de Leon might not have been tricked; the fountain of youth might still be found in Florida. But instead of the classic interpretation, its secret of immortality may lie in the water that gives the city the strength to deal with disaster and re-arise stronger from its ruins.

Drugs on everyone's hands. Miami Herald, 16

January 1985

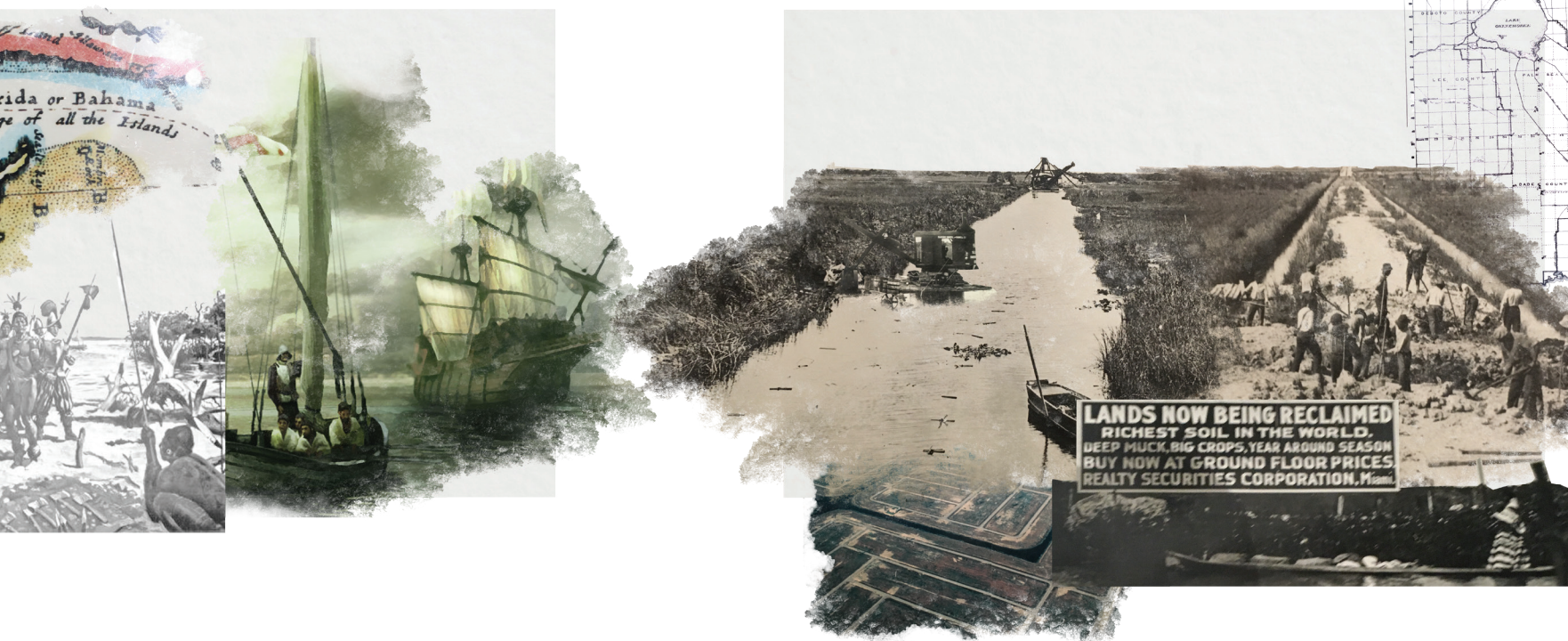
2. Allman, T., D. (1988) *Miami, City of the future.*

University press Florida

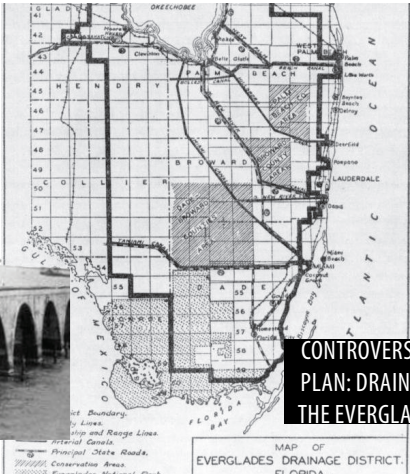
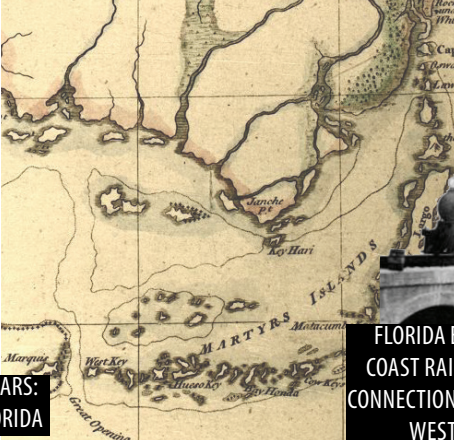
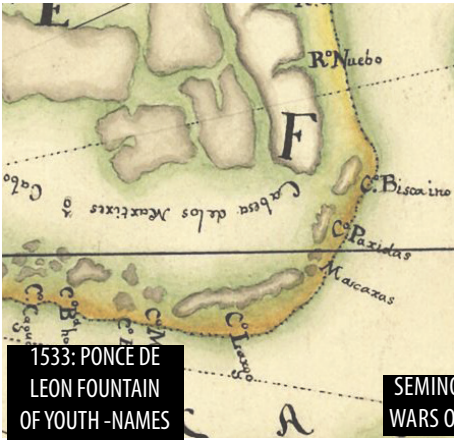


SOUTH BEACH PANORAMIC VIEW ON BISCAYNE BAY

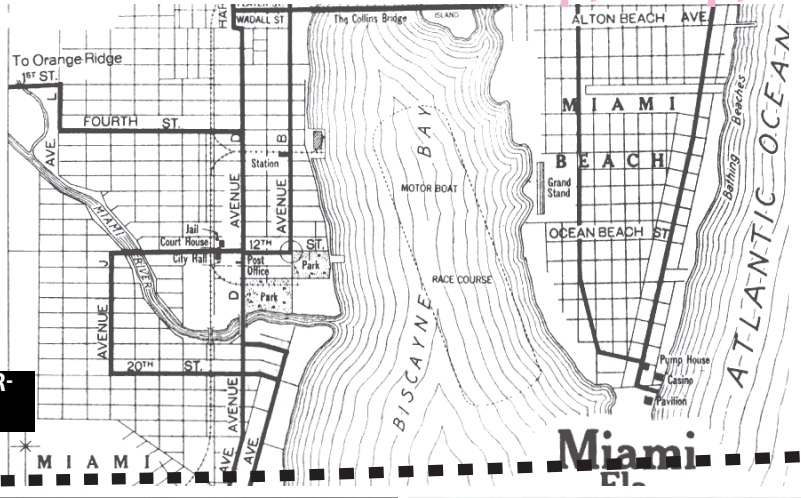
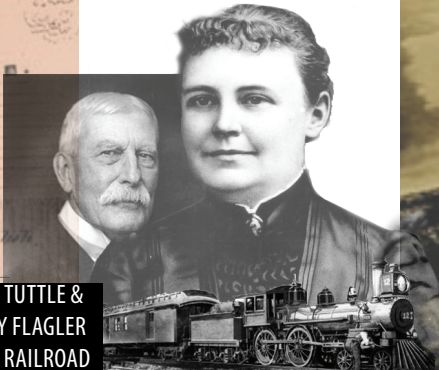
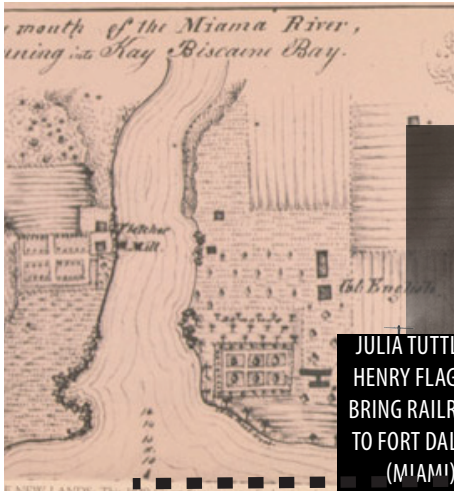
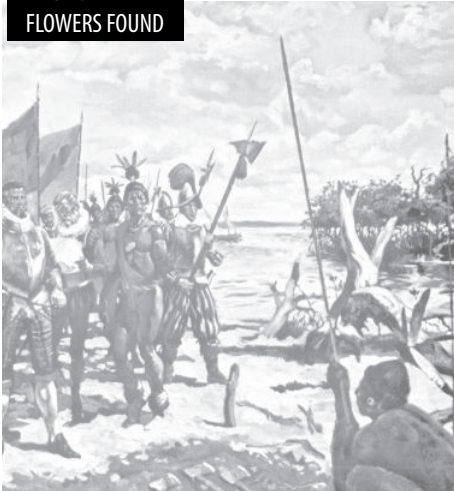




SOUTH FLORIDA



MIAMI



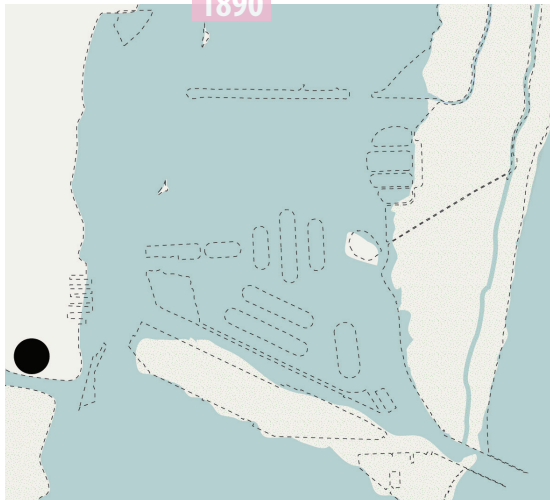
MIAMI BEACH



RECOVERING FROM DEPRESSION: MIAMI SHOULD BE YEAR ROUND TOURIST DESTINATION

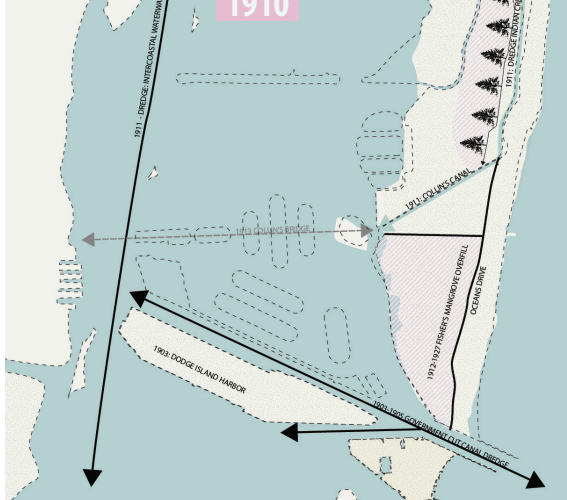
GROWTH MIAMI BEACH

1880



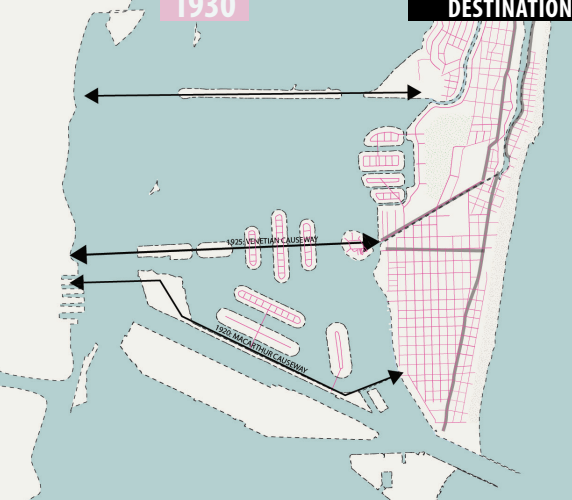
1890

1900



1910

1920



1930

CONQUERING THE WILD

DISCOVERING THE DREDGE & FILL

DEVELOPMENT AND CRASH

ART DECO BOOM



EVERGLADES
NATURE PRES-
ERVATION



FLORIDA MARCH 15, 2018 4:00 PM
In Florida, officials ban term 'climate change'

WASH. POST
State environmental officials ordered not to use the terms "climate change" or "global warming" in any government communications, emails, or reports.

Donald J. Trump
The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.

CLIMATE CHANGE DENIAL



2,496,435

BUILDING BOOM

DRUGS MONEY
INFLUX
URBAN EXPAN-
SION

LIBERTY CITY
RIOTS

ATTRACTIVITY:
CHRISTO AND
JEANNE-CLAUDE

MIAMI VICE

PEDRO PAN
1400 CUBAN
CHILDREN



HURRICANE ANDREW

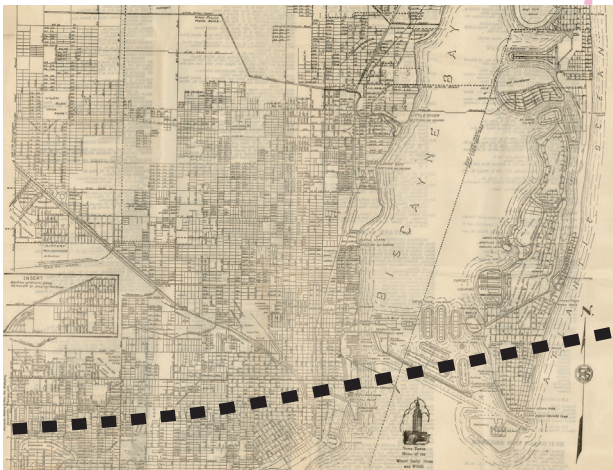


HURRICANE IRMA

91,732

2000

2010



WWII

1940



MISSILE CRISIS

1950



1960

1970



1980

1990

WAR AND TENSION

RESTORING TOURISM

MIAMI VICE & HURRICANE ANDREW

URBAN GROWTH & UNCERTAINTY



MIAMI AND THE SEA: ATTRACTIVITY OF THE COAST

Public spaces

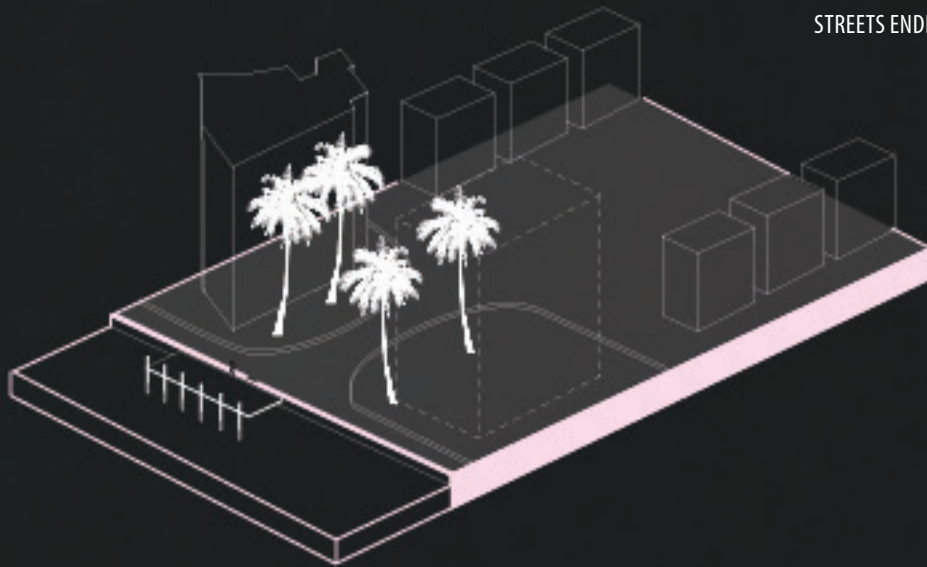
As water has triggered Miami Beach to grow out to the city it is now, it has always been a strong point of attraction, either for tourist as for locals. The Biscayne Bay is lined up with Marinas, yachts, jet skis, speedboats, paddle boarders.

In the city itself you can also clearly notice the attractivity of the water. Most of Miami Beach's recreational public life takes part along or in the water. The city's lack of public space inside of the urban fabric is compensated with boulevards, parks, public squares and beaches around the coast. All being used in their own way.

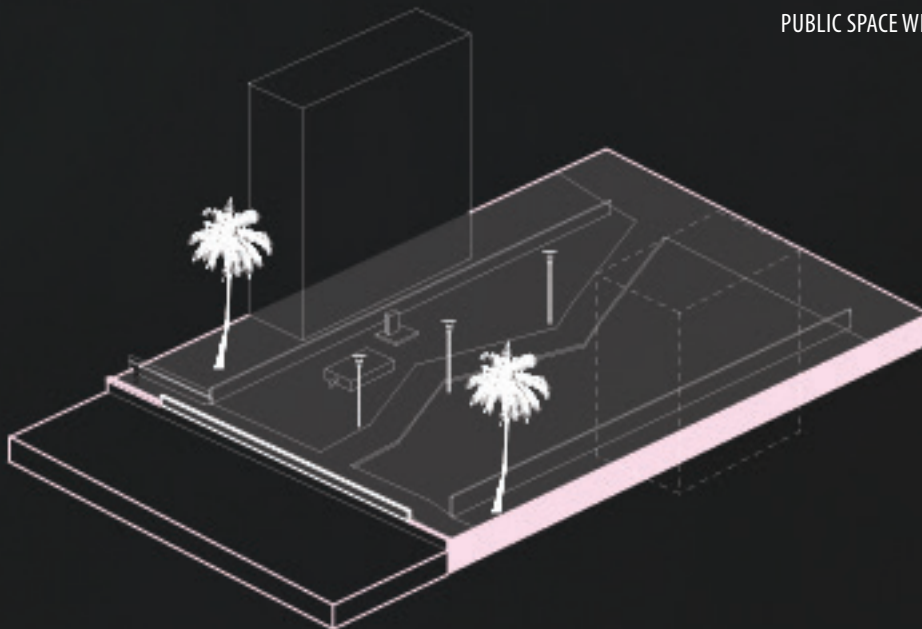
Private investments

The allure of the water to the private sector can be seen in the value of the coastline. The estates along the west coast of South Beach are usually dense high rise buildings, condo complexes or hotels. The attractivity of this coastal real estate is visible in its property value. Also, as the buildings are directly placed on an unprotected coast, most buildings are attached to FEMA coastal building legislation, which commissions the inclusion of a flood protection in the construction of the building, this is again accompanied with higher building expenses.

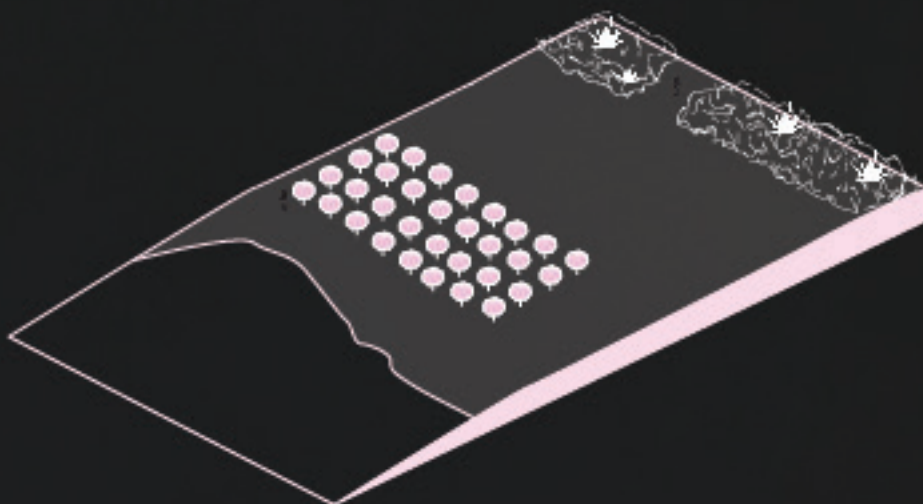
STREETS ENDING ON THE COAST LINE



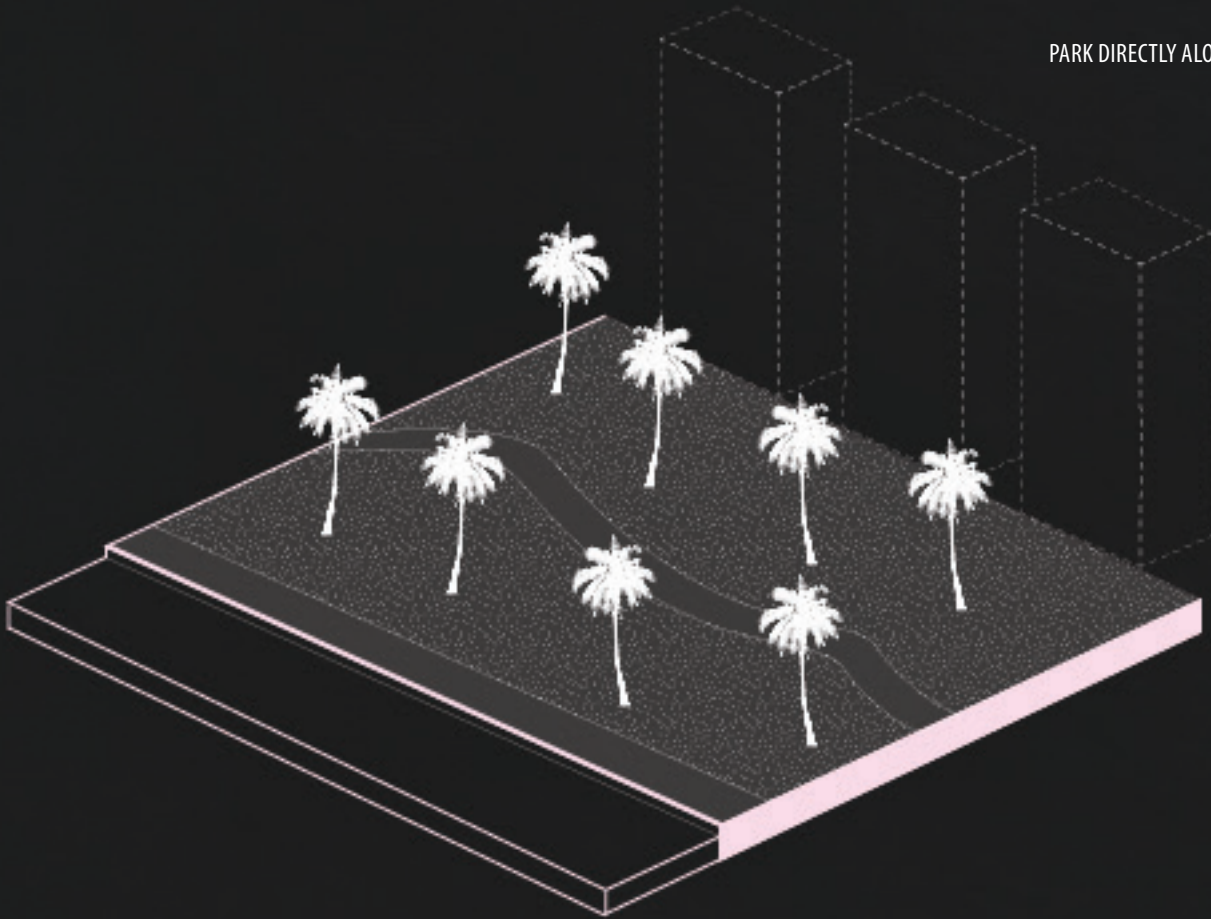
PUBLIC SPACE WITH PUMPING SYSTEM



BEACH

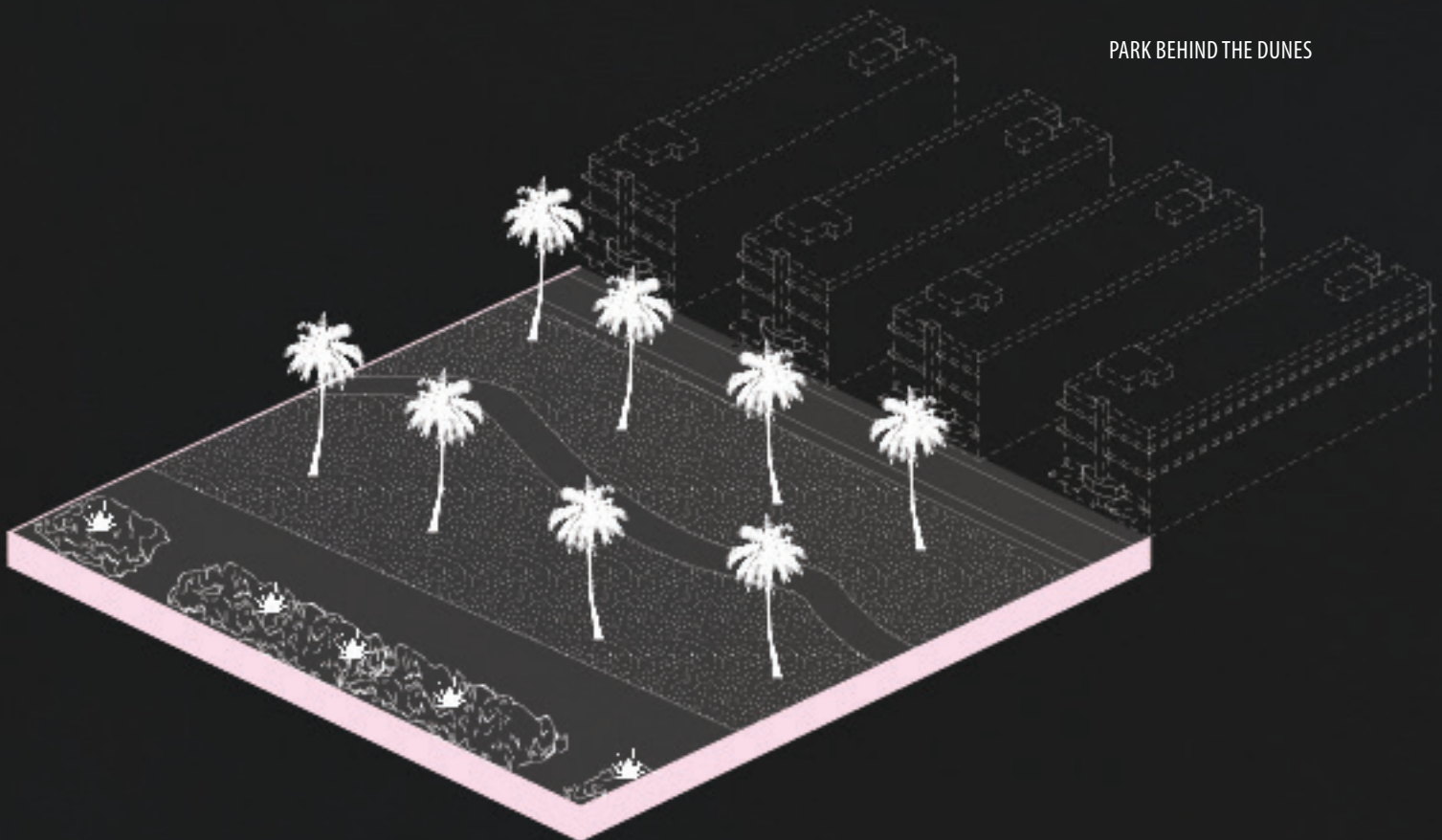


PARK DIRECTLY ALONG THE COAST



REMEMBER: VARIETY OF THE COAST

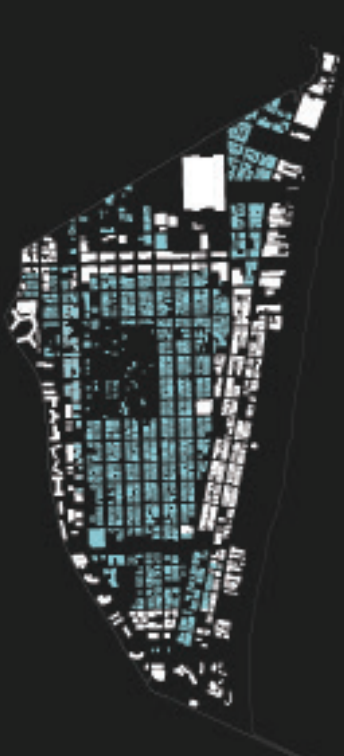
PARK BEHIND THE DUNES



TYPES OF PUBLIC SPACES ALONG THE COAST



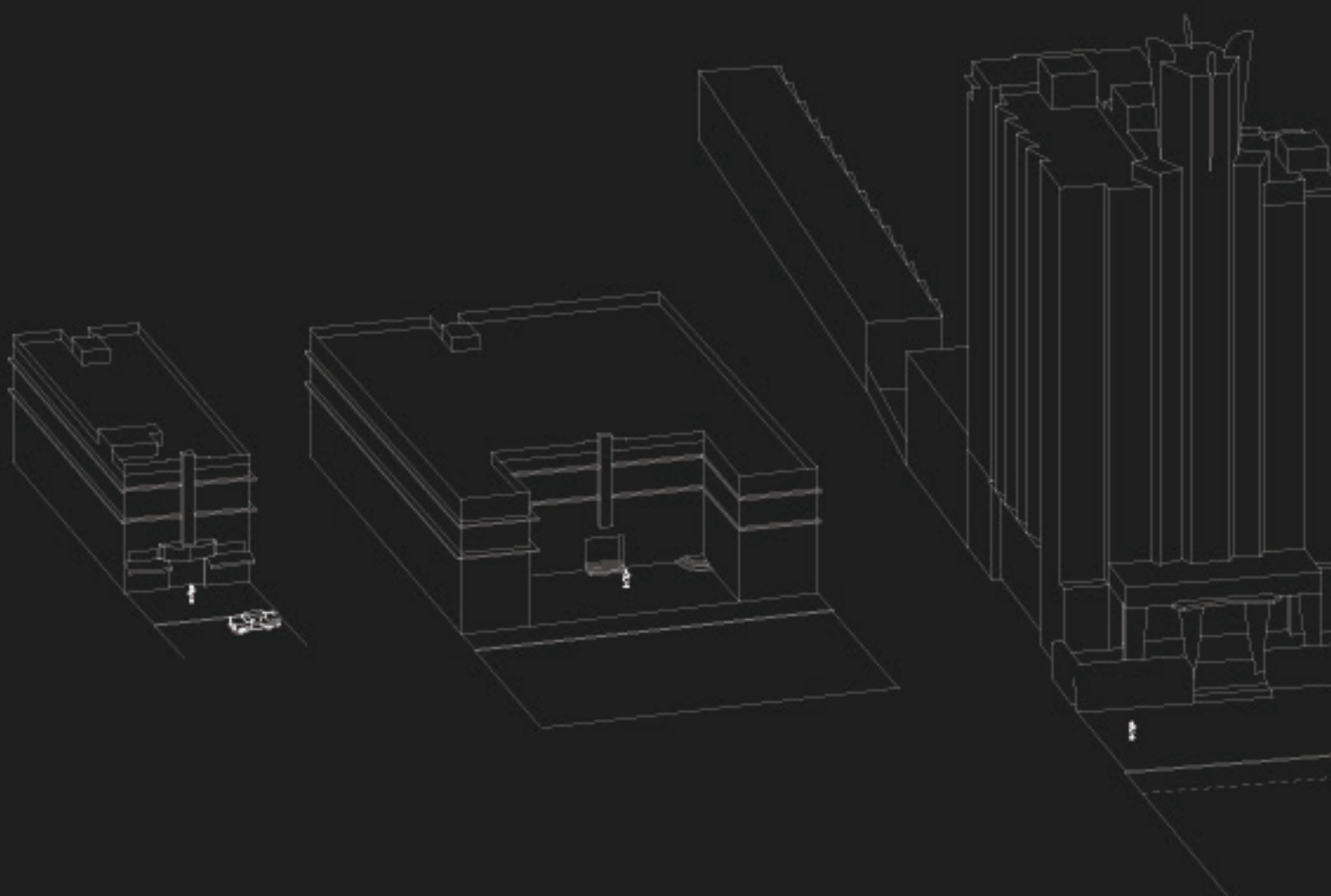
ORIGINAL ART DECO HOTELS
1925-1935
± 2 LEVELS



MIXED HOUSING
1940-2016
2-4 LEVELS

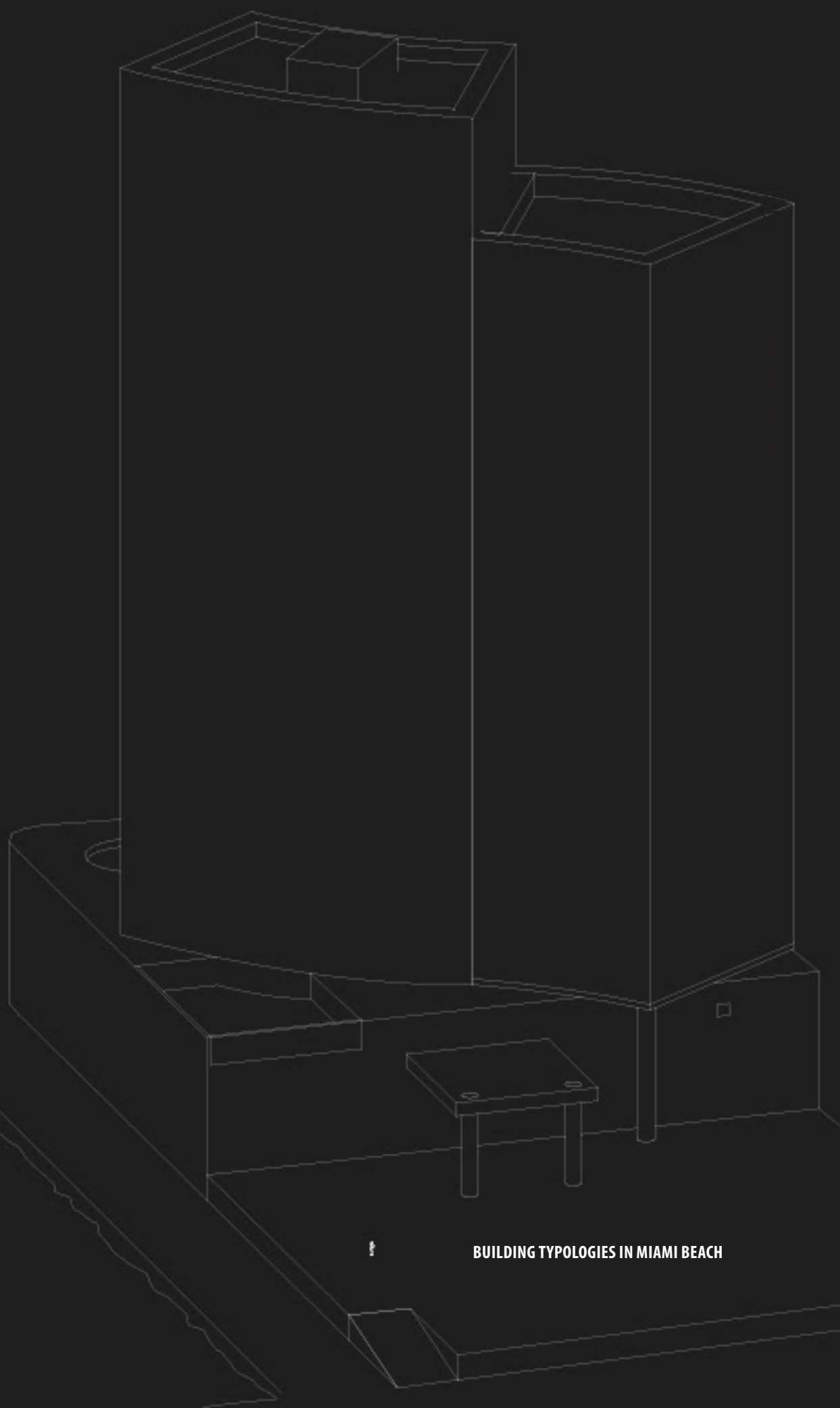


ART DECO HIGHRISE
1940-1995
<20 LEVELS

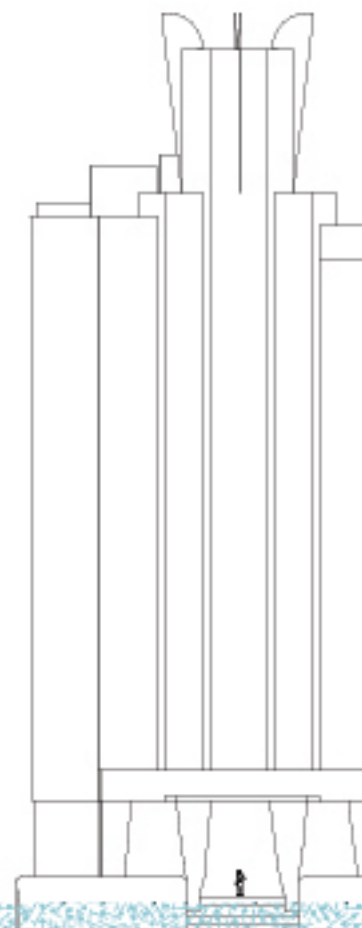
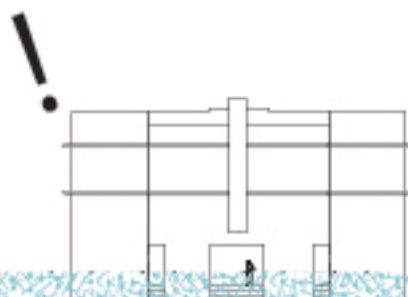




CONTEMPORARY HIGHRISE
1995-2016
10-50 LEVELS



	MONUMENTAL ART-DECO	ECLECTIC	MONUMENTAL
Age	90 years	40-1 years	60 years
Monumental status	Heritage	Mixed styles, no monumental status	Heritage
Flexibility	○ ○ ○ ○ ○	● ● ● ● ○	● ● ○ ○ ○
Zone	Commercial: MXE Mixed use entertainment	Residential multifamily, low /medium intensity	Commercial: MX entertainment
Median household income	\$25,035	\$24,701	\$25,035
Median Listing price	\$443,750	\$265,354	\$509,709



ART-DECO

CONTEMPORARY HIGHRISE

10-0 years

No monumental status



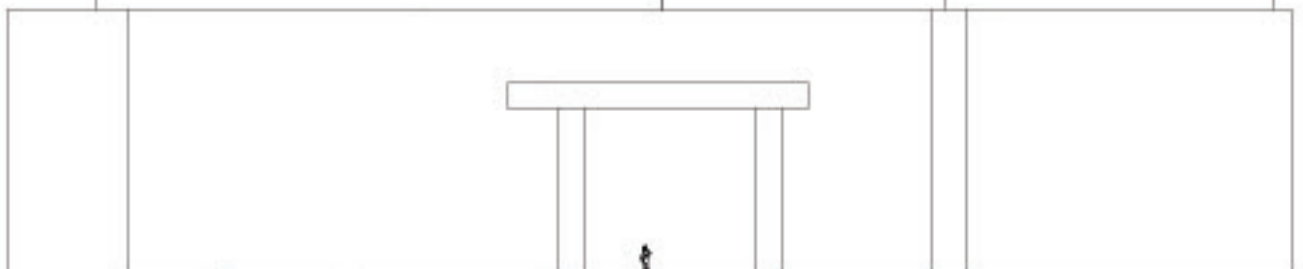
E Mixed use

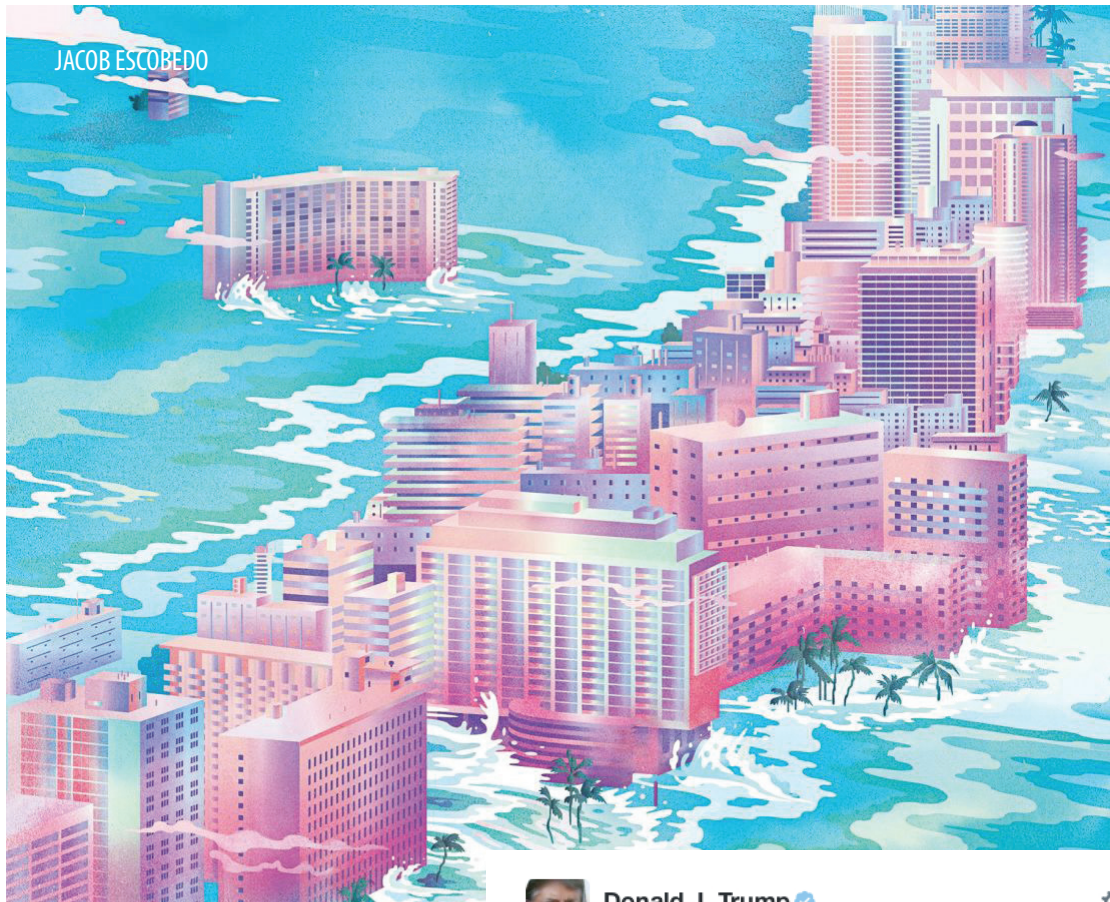
Residential multifamily, medium/
high intensity / Commercial bayside.

\$143,750

\$1,476,875

REMEMBER // ATTRACTIVITY OF THE COAST





FLORIDA

MARCH 8, 2015 4:00 AM

In Florida, officials ban term 'climate change'

HIGHLIGHTS

State environmental officials ordered not to use the terms "climate change" or "global warming" in any government communications, emails



Donald J. Trump

@realDonaldTrump



Follow

The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.

REPLIES

76

FAVORITES

2,800



AM - 6 Nov 2012



UNCERTAINTY AND DENIAL OF CLIMATE CHANGE

Currently there is a strong contrast in two important views on the future. As the term “Building like there’s no tomorrow” describes very well: the city’s, especially coastal, real estate sector is booming, while there is no certainty in how the sealevel will progress and if the city will be able to keep up.

For the creation of a good coastal defense, an integral design is desirable, however, the current governing authorities are not willing to recognize the problem of sealevel rise. Any mediation to the problem of flood is being solved by smaller organizations or mediated by FEMA legislations. With so many actors, and with regard to the importance of the problem, safeguarding this issue will be complex.

To create an effective defense, another goal should be to create a qualitative, inclusive public space. Not only fighting flood but also providing for a fruitful investment environment for smaller organizations, Florida Environmental organizations, individual municipalities and neighborhoods and private investors.

SEALEVELRISE IN FLORIDA

As mentioned before, Florida is one of the verge to become one of the biggest victims of climate and its associated force of sealevelrise. This is mostly because it is an ocean state; one of the last continental states in the USA that have emerged from the sea, and stayed low in elevation and relief. It's the flattest state with its highest point reaching 105 m above sea level, 1300 square kilometers of less than one meter higher than the high tide level and almost 13000 kilometers less than two meters high (Clayton, 2016).

As for it's underground layers, Florida has a porous limestone subsurface on top of the Florida bedrock platform. This massive layer of rock is relatively stable, which causes Florida's sea level change to generally track global trends. It also means that the underground is very porous, and stores big amounts of underground freshwater. These freshwater aquifers are connected through streams, and open up into caves and springs. Salt water enters the reservoirs in coastal openings along the ocean.

With its location in the Caribbean and tropical climate Florida is very prone to disastrous storms, either coming in from the Atlantic Ocean or from the Gulf of Mexico. Few storms, like the Miami Hurricane of 1926, hurricane Andrew in 1992, or and Hurricane Irma in 2017 have strongly damaged coastal zones and cost a lot of lives. The storm surge of 2017 hurricane Irma has shown Miami's weak points when it comes to coastal flooding and a lack of integrated planning.

The state has a relatively shallow underground water table, this is the reasons many Miami houses don't have basements and poorly built garages of-

ten flood. The water fluctuates in the rock or sediment underlayer but is usually 0,3 to 3m below ground. In Miami, sunny day floods are caused by this fluctuation of underground water. Sea level rise tends to elevate the coastal water tables.

With more than 13000 km of shoreline and over 5000 square kilometers of Estuaries and bays it has more of tidal shoreland than any other US State. The entire state is a peninsula, so almost every place in Florida is in close proximity to a sea.

The population of the state has grown an average of 25% per decade, to 20,61 milion inhabitants today, and with the building boom, this growth is expected to be higher in the future. Four out of five major Florida counties are located on the sea, with a densely built up coastline. With a low threshold for change and a large amount of property at stake, this makes the area very vulnerable for damage from rising seas.

Natural consequences that are paired with these geophysical characteristics threatened by the rising sea might be seen in the near future. Flooding, short-term submersion of land during extremely high tides.

Inundation: long-term submersion and even conversion of dry land to wetlands or water. Saltwater intrusion in the aquifers and in fresh surface water. Water table elevation, lifting coastal water tables and sediment redistribution (Clayton, 2016).

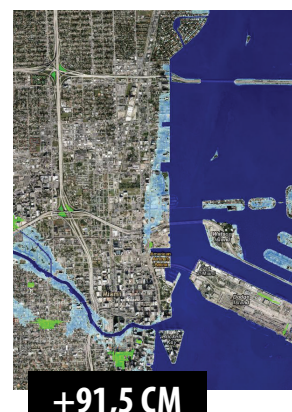
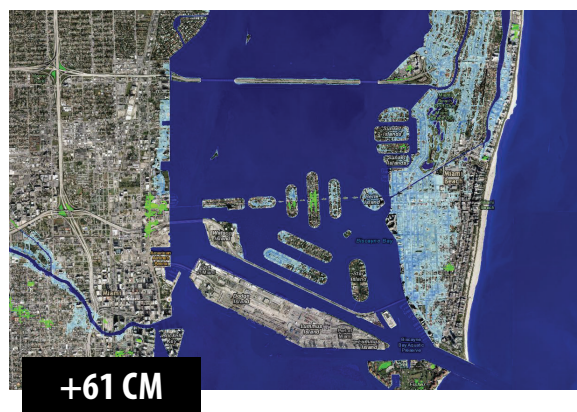
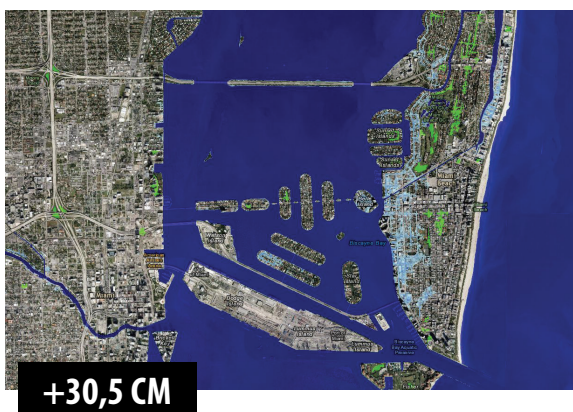


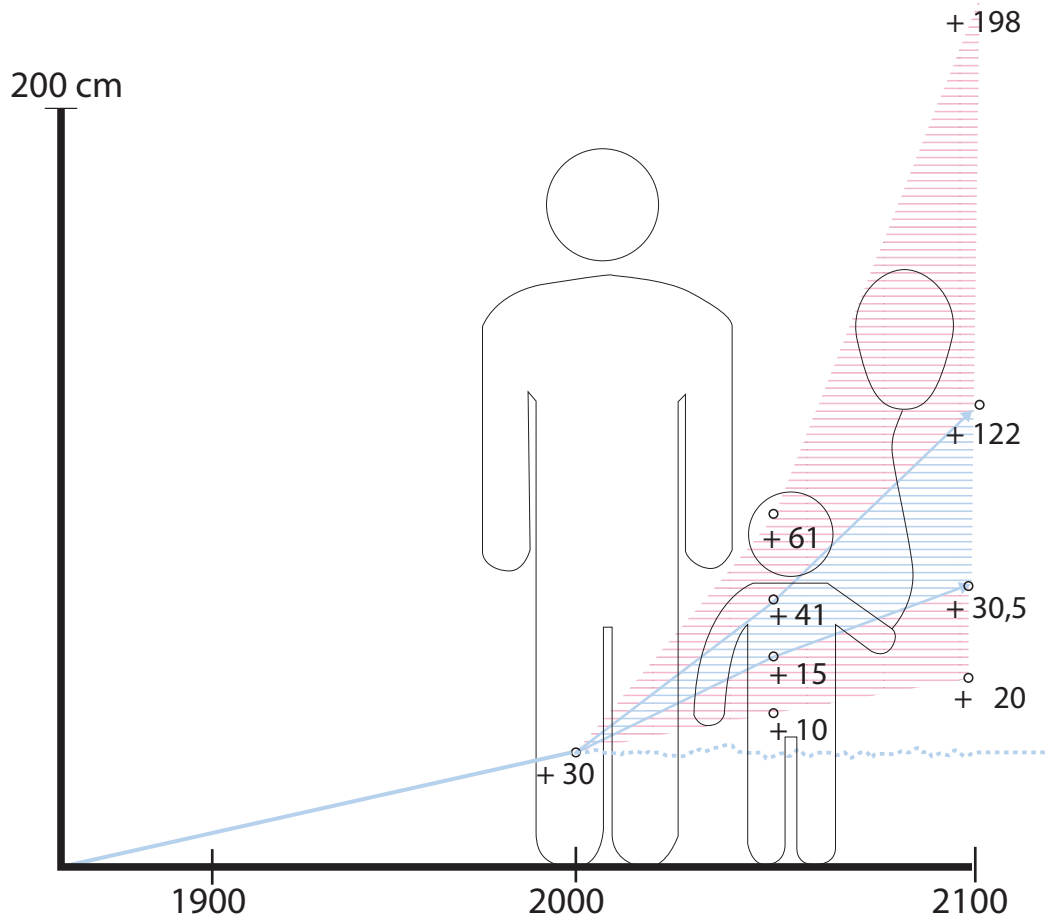
FLOOD ON BISCAINE BAY CAUSED BY HURRICANE IRMA STORMSURGE

THE CASE OF MIAMI BEACH

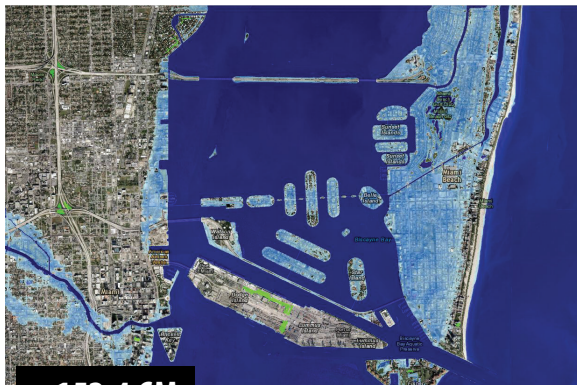
When projected on Miami Beach, the defense of the east coast shows to be of no threat to the rest of the city, as the sand dunes provide enough height to provide a stable defense against sea level rise, the flood comes into the city from the west side. As mentioned before, this stretch of coast has a fragmented private and public coast it is built directly at sea level or has a small wall of 20 cm.

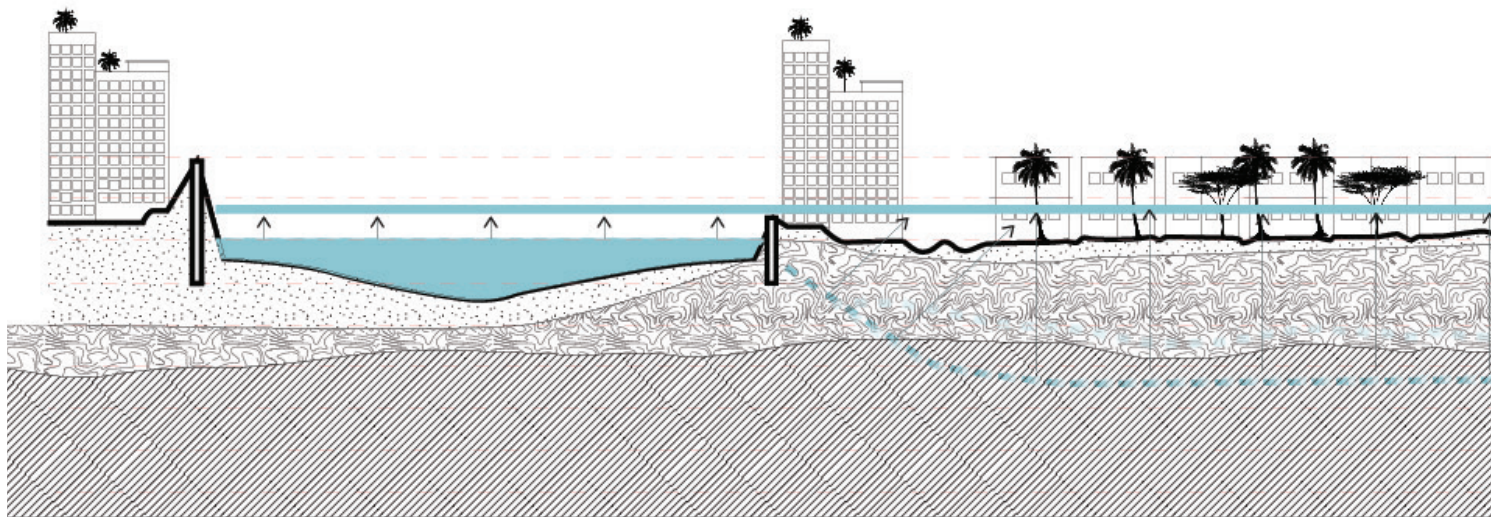
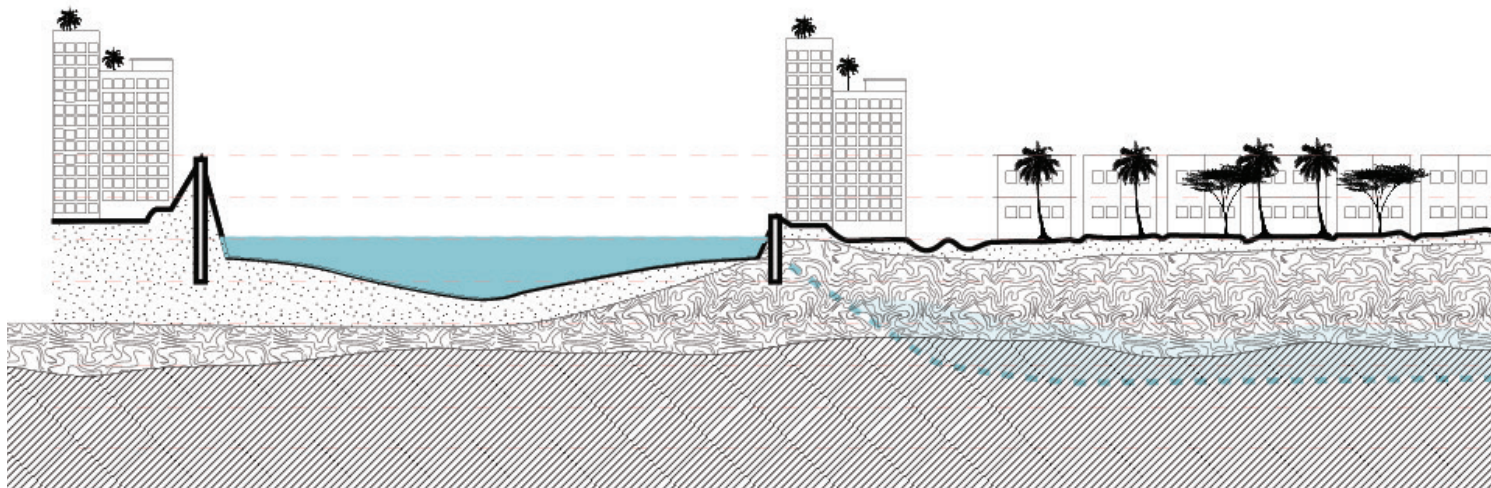
Quite soon in the progression of sealevel the water reaches deep into the neighborhood.

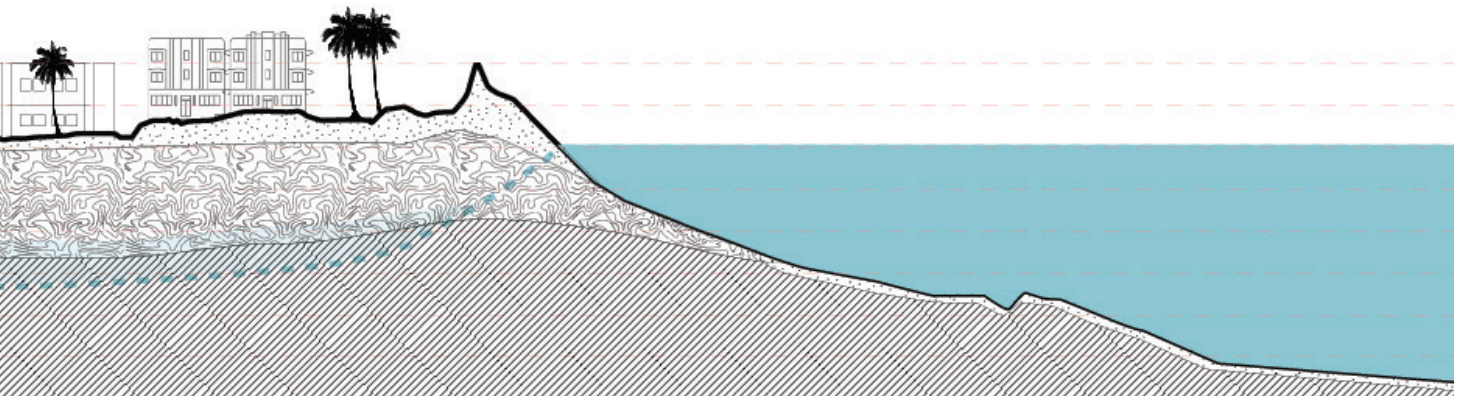




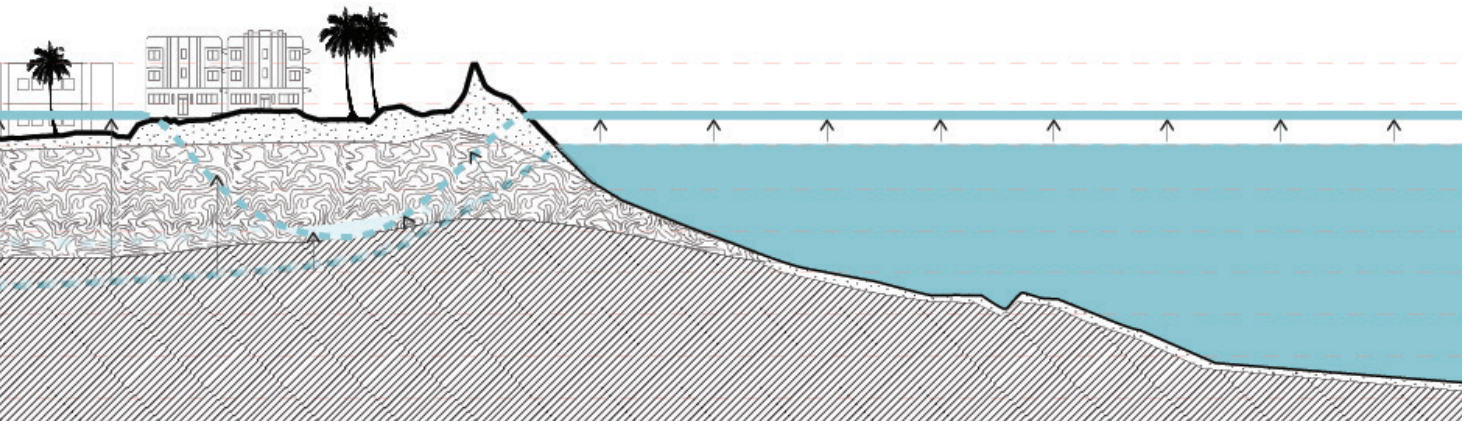
Statistics: ucsusa.org/sealevelrise



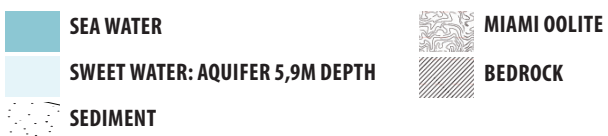




1:2000 SCHEMATIC REPRESENTATION CURRENT SITUATION



1:2000 EFFECTS SEALEVELRISE ON FRESH GROUNDWATER






PUBLIC DEFENSE

PRIVATE DEFENSE

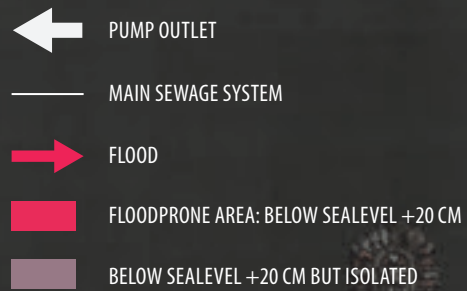
1/40

An aerial photograph of Miami Beach, Florida, overlaid with a pink line representing projected sea level rise. The line starts in the upper left, follows the coastline, and then curves inland towards the bottom right. Several building footprints are highlighted in blue, showing their proximity to the projected water. The background is a dark, textured aerial view of the city and beach.

Projecting the sealevel rise onto Miami Beach, we can clearly see the treath coming from the Biscayne bay. Along the east coast, adjacent to the beach, there is a dune formation of 2 meters in height, serving as a public defense for the city. The water flows into the city from the east side, the Biscayne Bay coast, that is densely built up with very valuable high rise, coastal properties. It is densely populated and has a fragmented coastal defense, in which some private properties are part of the protection for the neighborhood of South Beach in total. This causes the defense from this side to be very unreliable.

WATER THREATS INSIDE VS OUTSIDE

Another threat that Miami Beach is dealing with is the flooding from the inside. This means sunny day flooding from the underground, congestion of rain water, and saturated street water runoff systems. In the last year a new plan is implemented wherein pumps pump out streetwater runoff into the Biscayne Bay. The system claims to filter the dirty streetwater but in emergency cases, high water and necessity of fast drainage this filtration system has shown to sometimes lack in filtration, pumping unfiltered water into the bay and threatening existing ecosystems.





REVOLT // WATER THREATS INSIDE VS OUTSIDE

An aerial photograph of a coastal city, likely Miami, showing a large body of water (Biscayne Bay) and several islands. The city's grid-like street pattern is visible on the left and bottom, while the water and islands dominate the right and top. The title 'THE CLASH' is overlaid on a black bar in the top left.

THE CLASH

There are some areas in which the tipping point is lower than 20 cm sealevel rise, where the flood from the outside and the ability to pump out water from the inside clash. These are the critical points of defense.

The critical connections are necessary connections to accomodate and transport water from the lower laying areas into the Biscayne Bay in an organized manner. Taking the pressure away from upcoming underground water in these areas.






PUBLIC DEFENSE

PRIVATE DEFENSE

WALKING ROUTE

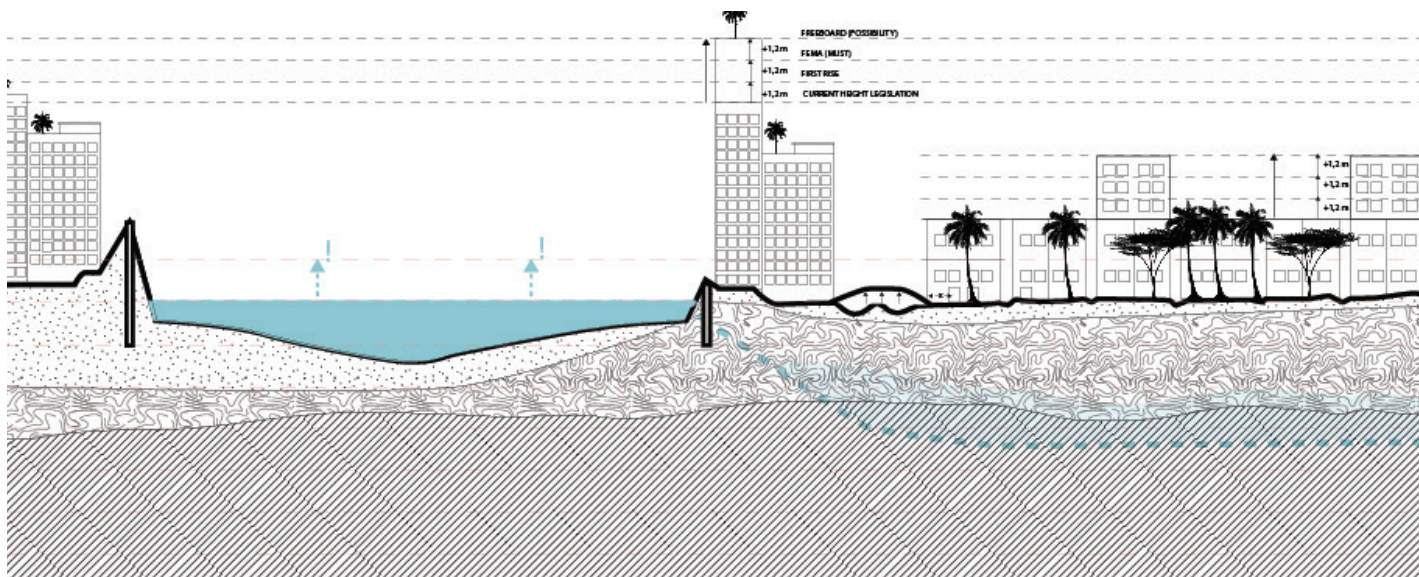


As stated before, Miami's main recreational public spaces are located along the water. This means that there is a strong relation between a coastal defense, and the ability to stay close to and enjoy the water. A lot of the critical points of the defense are related to the public spaces along the Biscayne bay or the spots at which the street connects to the coast. By understanding the current interventions in the public space it is understandable why these solutions are not desirable in these water related public spaces, and therefore lack in defense.

CURRENT INTERVENTIONS AND INCREMENTAL SOLUTIONS

The city of Miami Beach has invested around 500 million dollars in heightening streets, and building seawalls. Miami Herald writes on October 23, 2015: “The foundation for Miami Beach’s future is actually a complicated and expensive experiment: As much as \$500 million to install 80 pumps and raise roads and seawalls across the city. A first phase appears to be working, at least for now. But just one year into a massive public works project that could take six more, it’s way too soon to say whether and for how long it can keep the staggeringly valuable real estate of an international tourist mecca dry.”¹

The mayor of Miami Beach, Philip Levine, has often tried to comfort his people saying they will build walls, even up until two meters if they have to, to protect the city. While trying to be comforting, this statement is actually very worrying. With this uncertainty of rise and the instances just responding directly and incrementally to recent rises and floods, Miami Beach might become a walled city and lose its connection to- and positive relation with the water.

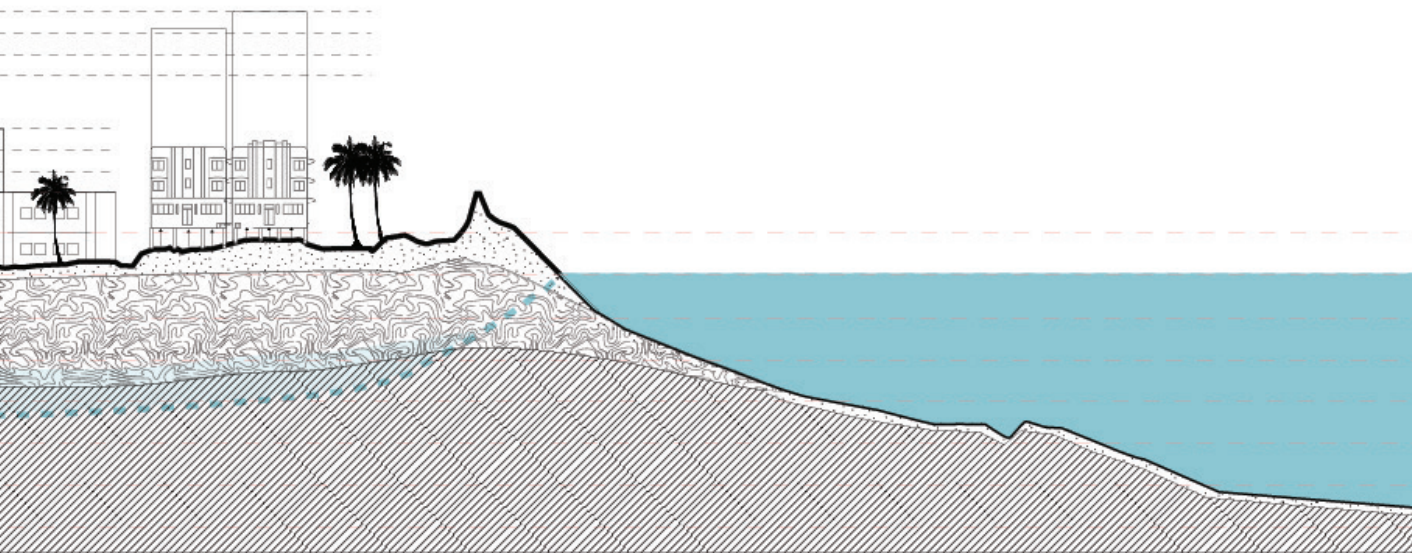
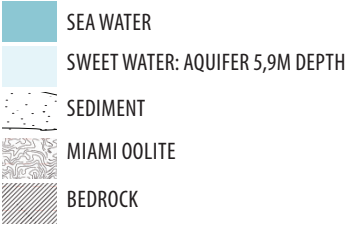


NOW

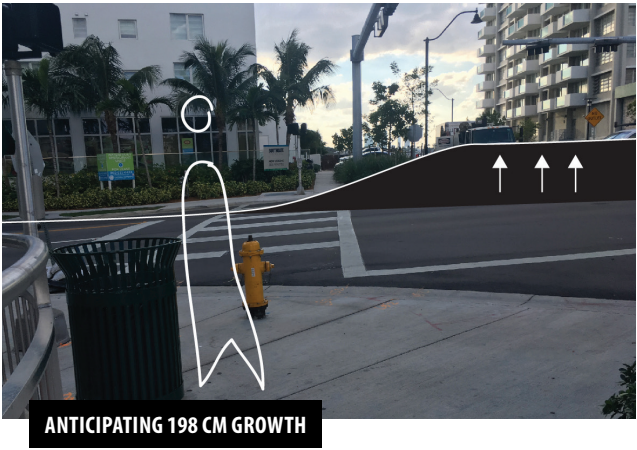
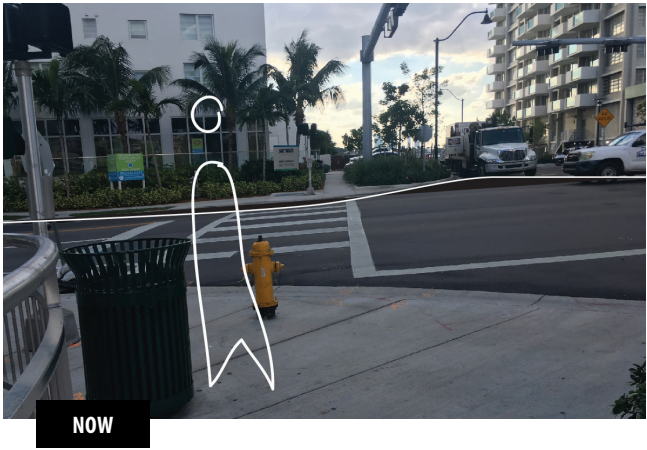


ANTICIPATING 198 CM GROWTH

1. *Miami Beach's battle to stem rising tides.* Miami
Herald, 23 October 2015



1:2000 EFFECTS ANTICIPATION SEALEVELRISE ON BUILT ENVIRONMENT

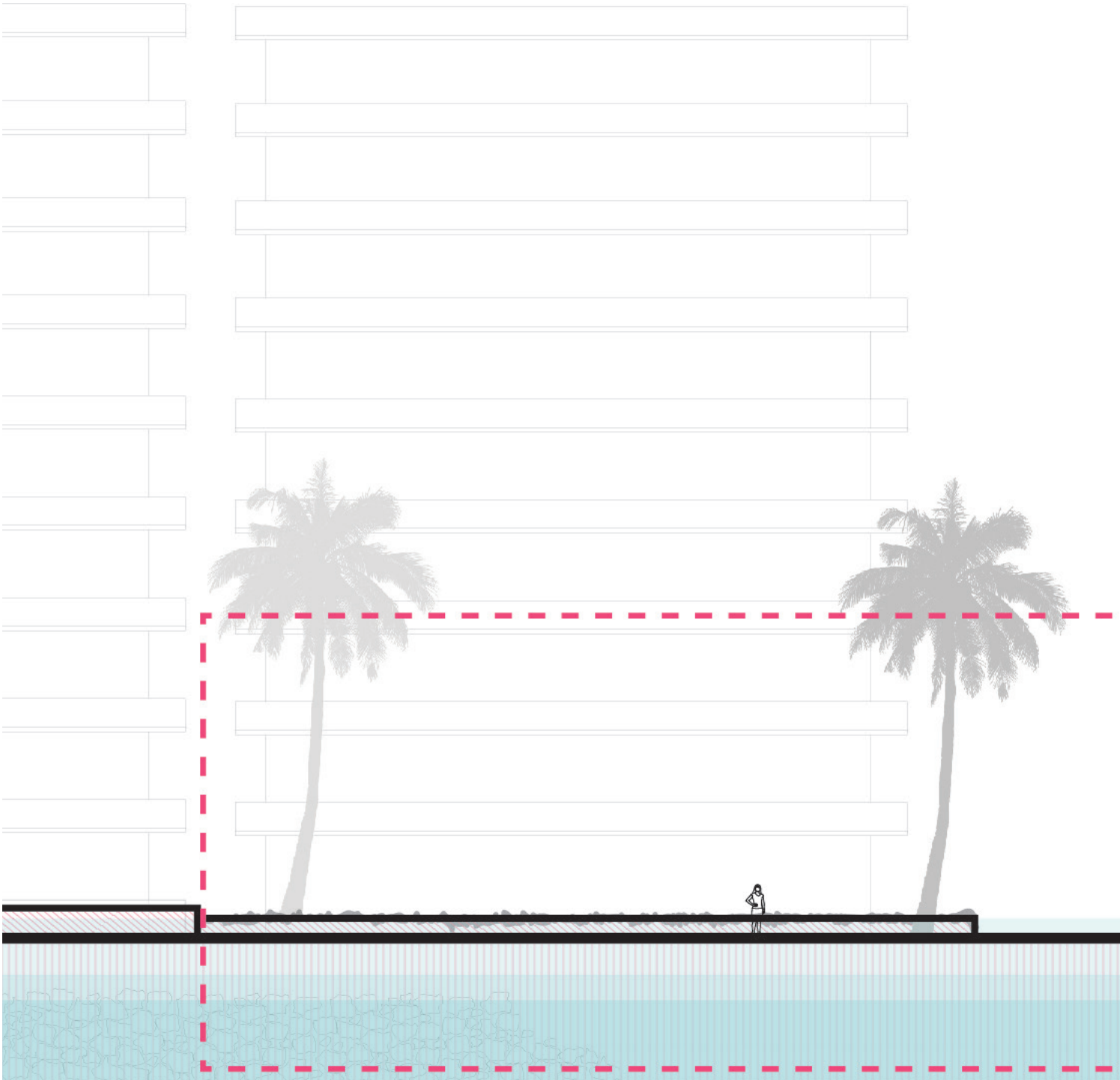




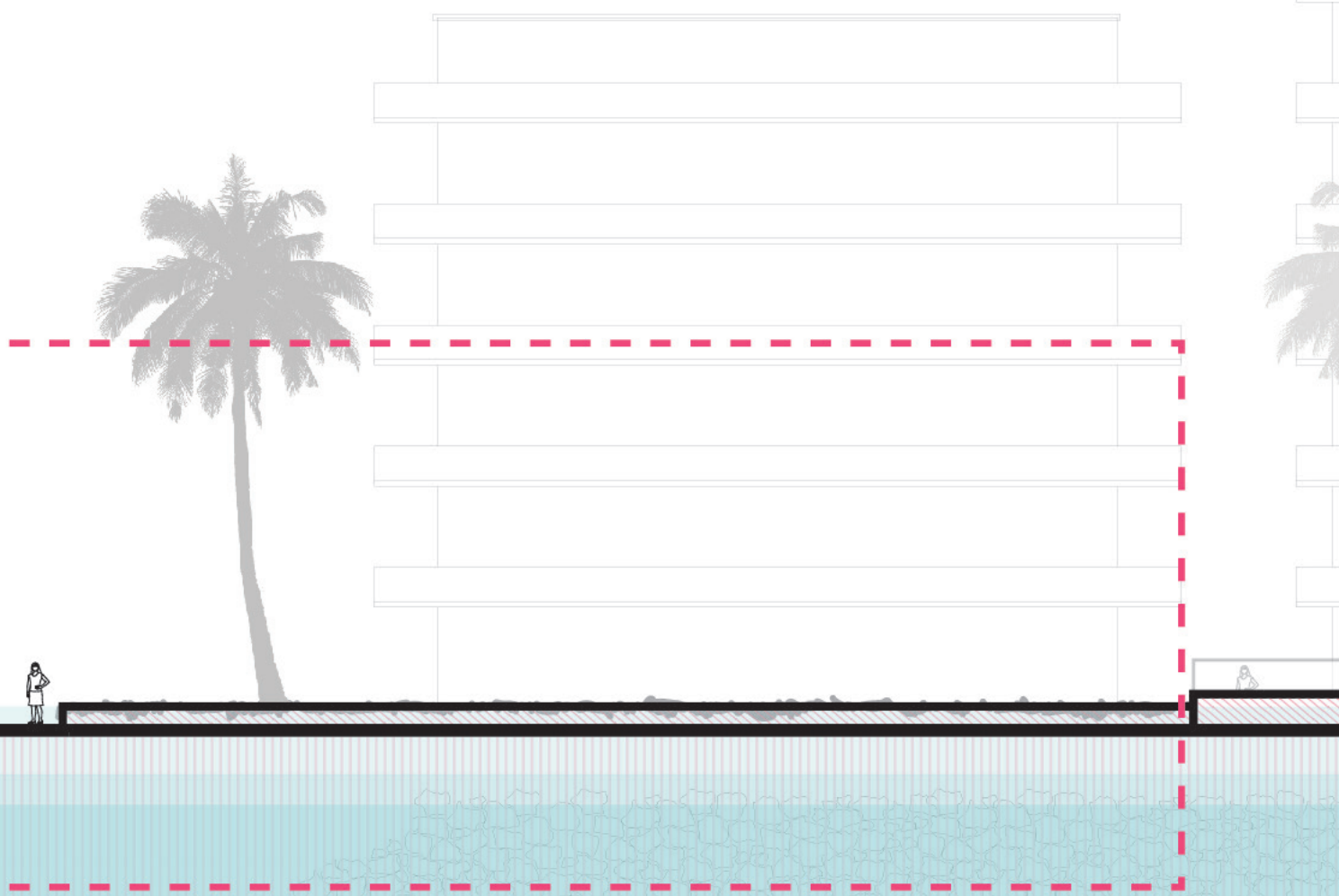


These critical points in the defense are areas in which the public and private sector intersect or interrelate. This shows the urgency for an integral protection strategy.

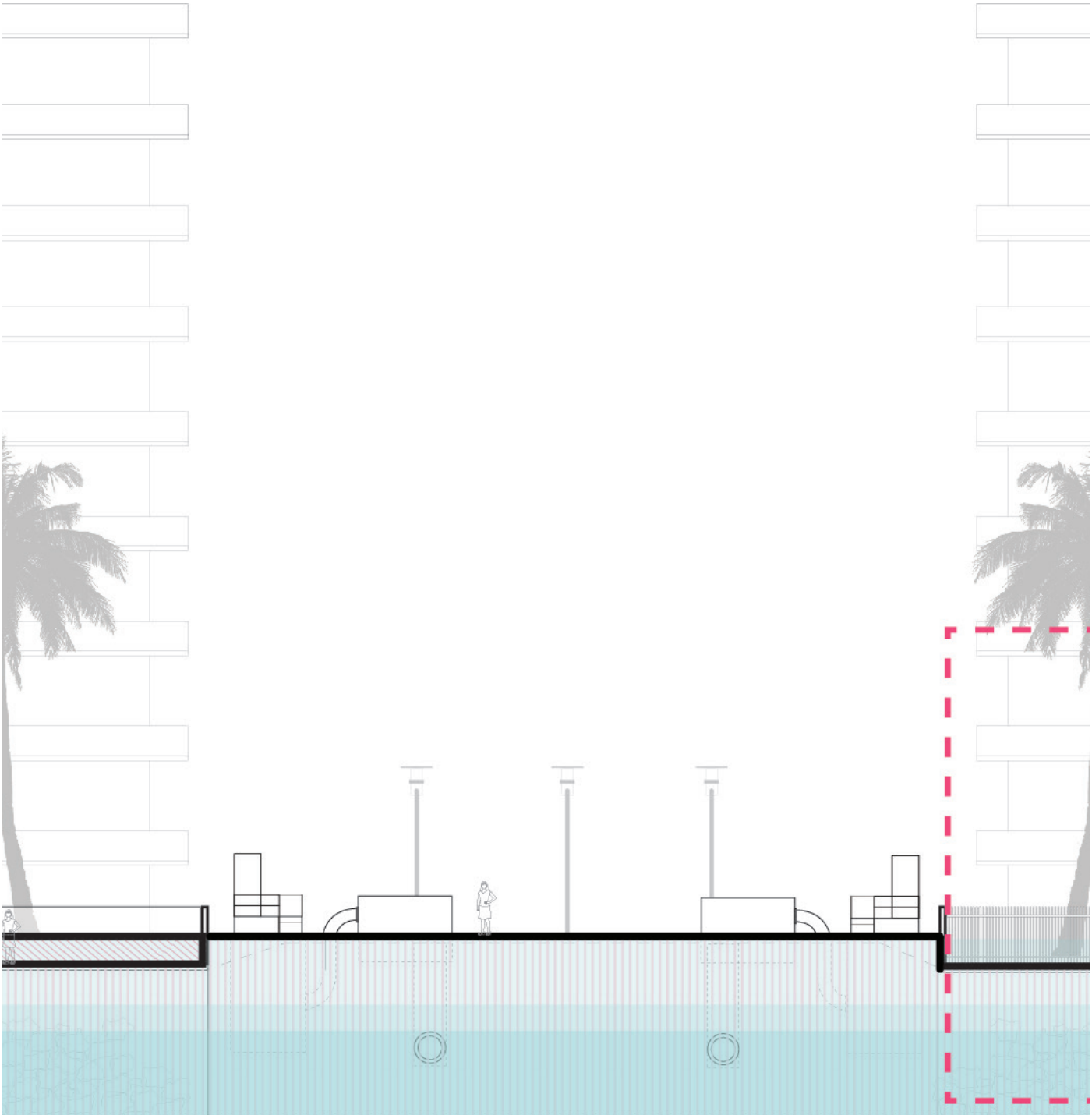
LINCOLN TERRACE



PRIVATE 
PUBLIC 

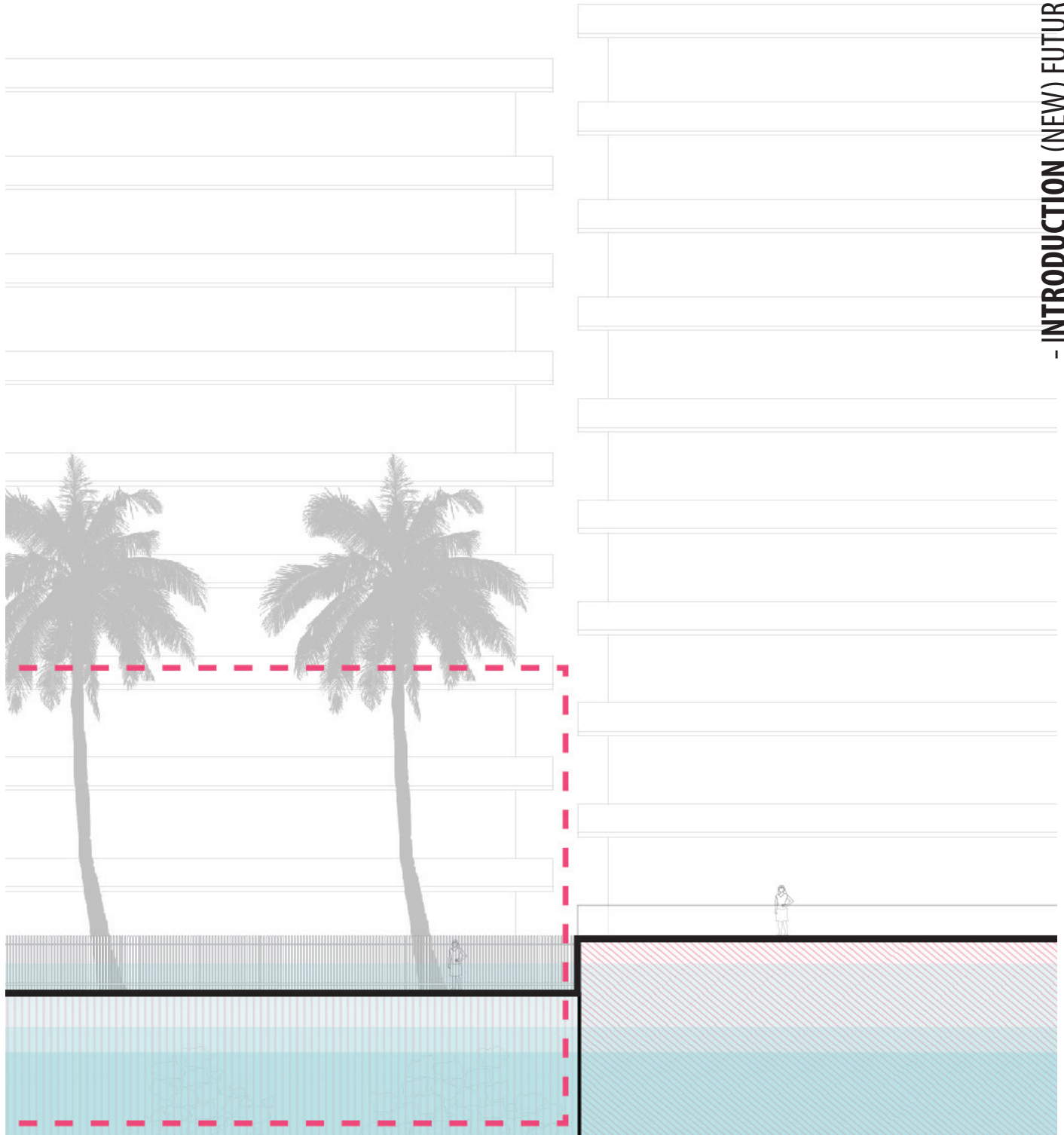


14TH STREET



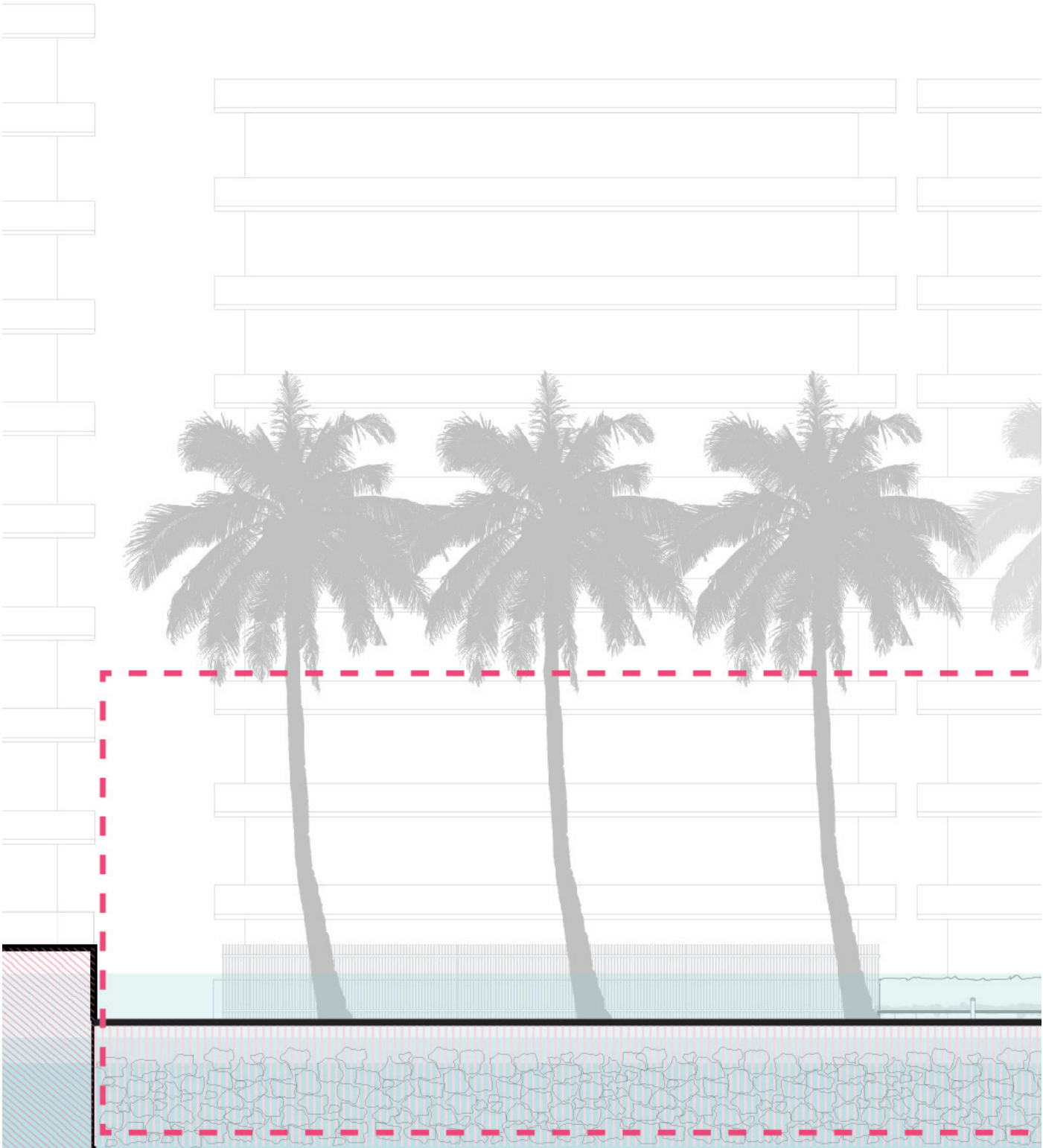
PRIVATE 
PUBLIC 

13-11TH STREET



- INTRODUCTION (NEW) FUTURE FOR MIAMI BEACH

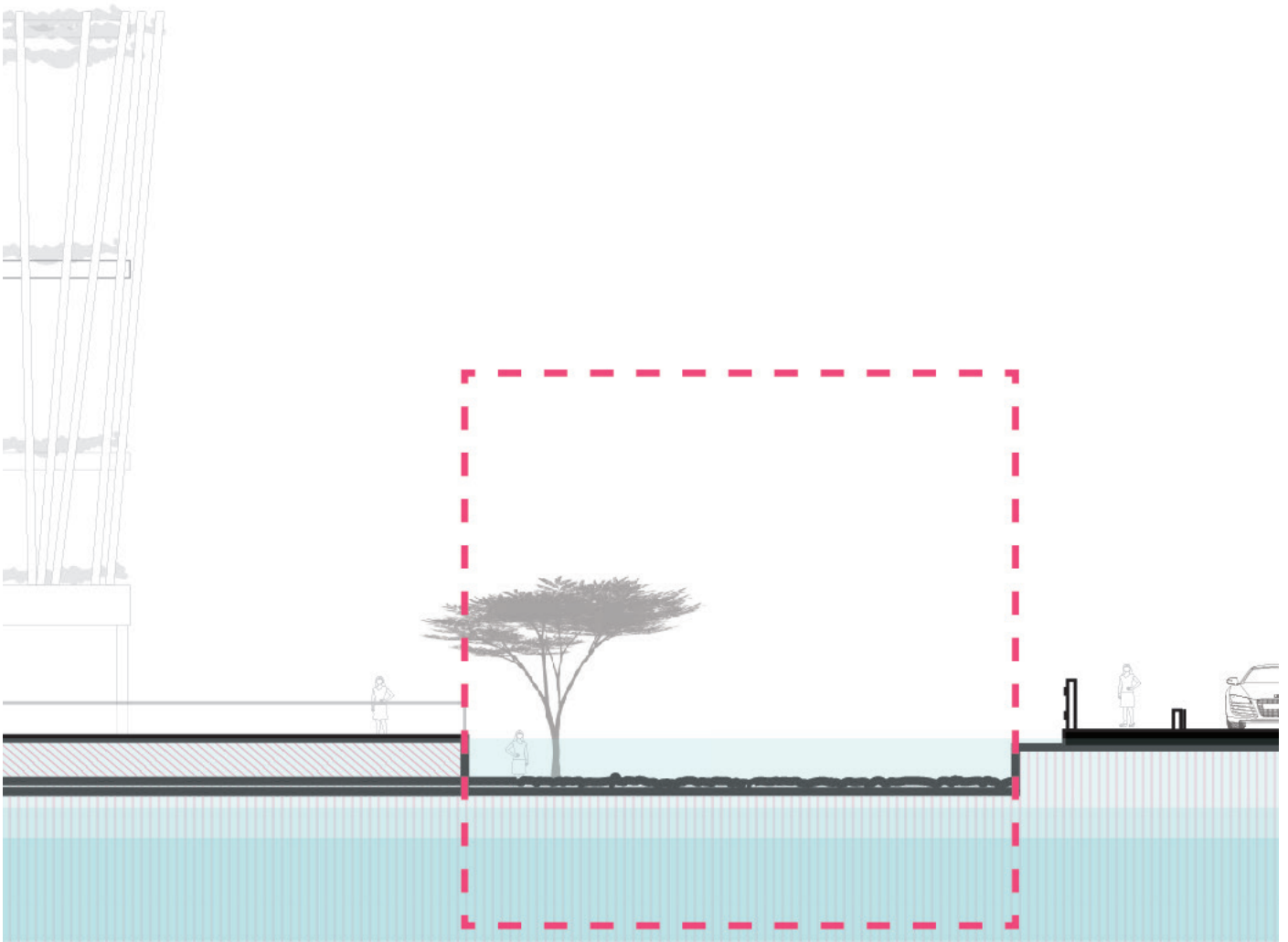
BISCAYNE BAY PATH



PRIVATE 
PUBLIC 

MACARTHUR CAUSEWAY

- **INTRODUCTION** (NEW) FUTURE FOR MIAMI BEACH



CONCLUSION COMPLEXITY PUBLIC-PRIVATE SECTOR

A notable observation in the context of Biscayne Bay is the amount of privatized coast and private defense. As mentioned before, the coast of South Beach is fragmentized, part of the coast is public boulevard, part is built up until the water edge, and as a new layer of complexity, part of the coast is only semi public. While the coast line in front of the property is public, some private estates have appropriated the adjacent public space as private property, controlling when it is accessible to public. The owners of these properties are paying fines in the Millions of dollars per year to the city of Miami Beach¹, and continue to close the gates for the public after a certain hour.

This complexity of the coastal division makes it very difficult to intervene directly on the existing coast. The incremental solutions, that are being implemented now, have shown to cause a disruption in the way the wateredge is used.

To create a uniform, low maintainance, integral defense system another solution should be found that also leaves room for public life. The tipping point of the system is as low as 20 cm in some critical areas. These areas should be heightened for at least a meter, to stretch out the treshold of change, to give more time to a solution over a longer time span and with a longer duration.



1. From a meeting with UMSOA professor
Jean-Francois Lejeune, July 4th 2017.



THE DESIGN

SOLUTIONS FOUND IN REMEMBER

LIVING WITH WATER



POSSIBILITY FOR DEVELOPMENT



FIND IDENTITY IN WATER



RECREATION AND ATTRACTION IN WATER



NATIVE ECOSYSTEM RESTAURATION: MANGROVE SWAMP

DREDGE & FILL

IDENTITY IN SEALEVELRISE

INCLUSIVE QUALITATIVE PUBLIC SPACE

ENGINEERED MANGROVE FORESTS

Reduce Storm damage

Natural growth: increase in soil volume through inflow of sedimentation and own organic matter, creating deep peaty soils.

Water purification: can deal with healthier streetwater run off and contribute to the ecosystem in Biscayne Bay

Good contact neighborhood and water

ATTACHING STRETCH OF LAND

Soil from dredging out government cut and other canals can be used.

Faster solution : more manageable in dealing with rapid sealevelrise

Creates public space

PRIVATE DEFENSE: SEAWALLS

Fast solution

Investment from private sector



DESIGN INTRODUCTION // SOLUTIONS FROM REMEMBER

COASTAL PLAN

CITY PL



◉ RELATION MIAMI BEACH WITH MIAMI

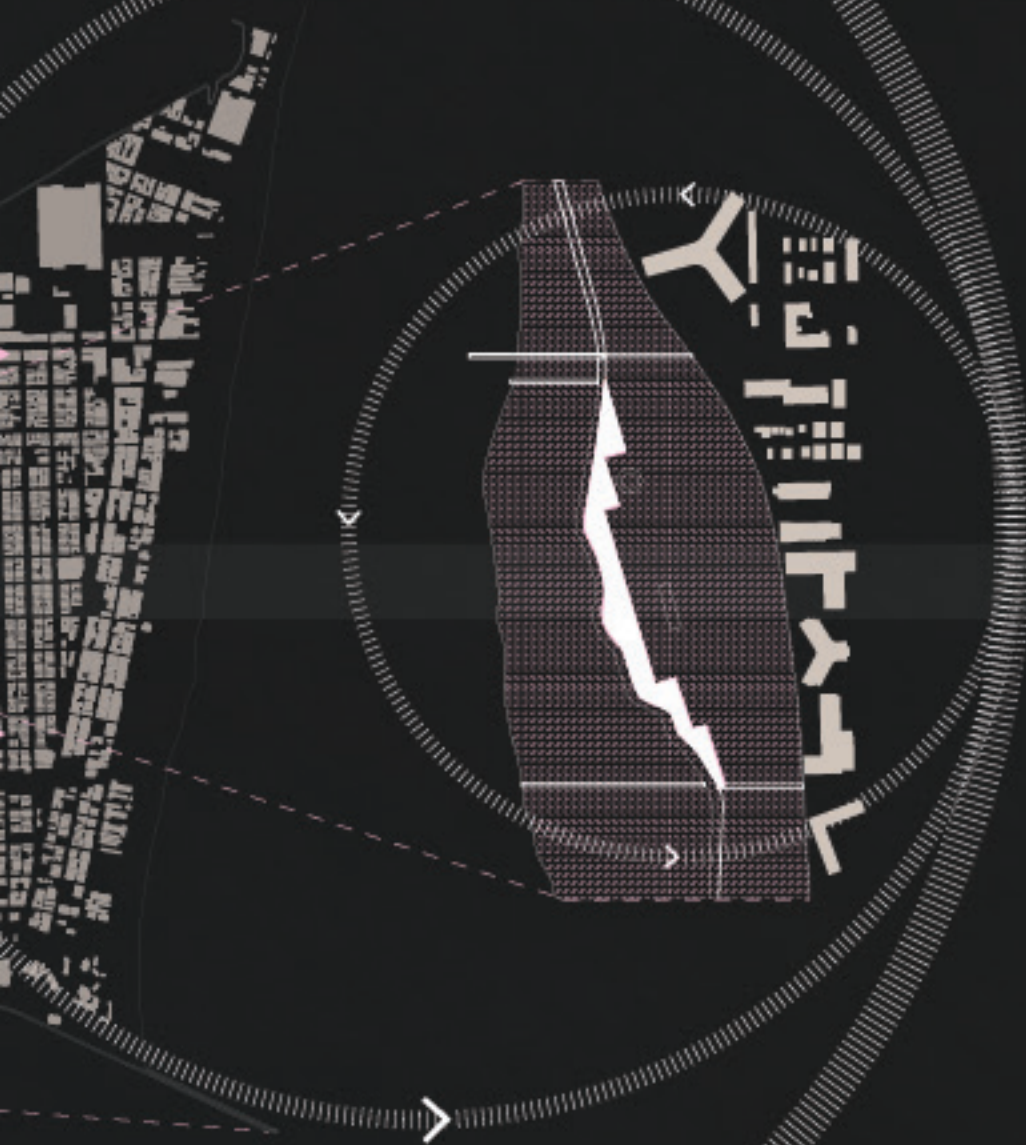
◉ RELATION N

◉ CONTRIBUTING TO A HEALTHY ECOSYSTEM OF
BISCAYNE BAY

◉ WATER RUN

AN

NEIGHBORHOOD PLAN



TIME

SCALE

NEIGHBORHOOD BISCAYNE BAY

○ CREATE A QUALITATIVE AND INCLUSIVE PUBLIC SPACE

-OFF VS SEA LEVEL DEFENSE



SCALE BISCAYNE BAY

The design proposal is a heightened stretch of land attached to the west coast of Miami Beach, creating a natural mangrove edge for the Biscayne Bay. The design on the scale of Biscayne entails some key framework principles.

Coastal Protection

With flood as the most important problem, the hinterland of Miami Beach should be protected by, on one hand a 2,40 m high dike (the highest assumption of sealevelrise in 100 years), and on the other a growing mangrove forest.

Between the dike and Miami Beach a buffer of water remains to catch street water to ensure good filtration before entering the bay, openings and pumps in the system should enable the flush of stored water out of the buffer area.

Restoration of Biscayne Bay's Natural Coastline

With the implementation of mangrove swamp, a natural habitat is reintroduced into this part of the bay. This attracts more wildlife to this area and the green space acts like a lineair connection to different ecosystems around the bay and the inner city.

New Qualitative Inclusive Public Coast

Since there is a lack of public space around the coast on this area, a new qualitative public space should be introduced, to attract people to this area and to better experience the growing mangroves.

Adding on to the Coastal Boulevard

It also completes the existing boulevard along the east- and southcoast along Miami Beach, that was cut off in this area.

Opportunity to attach to Causeways in Time

There should be an opportunity to attach to the Causeways connecting to Miami, this can be included in the restauration of the causeways in time. By connecting these systems not only is there an infrastructural connection with Miami, but also an opportunity to make the causeways more green and provide a wider ecosystem network. The causeways can be a part of the watersystem by acting as sluices and creating zones between different buffers.

Maintaining current systems of the Bay

This intervention is mainly chosen because it has a solely positive impact for the Biscayne Bay and does not intervene in its existing functions. Florida has a strong ecological diversity and the entire stretch of Biscayne Bay is left as an open system for the movement of species. The bay should keep its current qualities. For the placement and openings of the proposed stretch, boat traffic, the relief of the underground, the water current, inner waterways and the culture of dredging are kept into consideration.





CURRENTS DIRECTION AND STRENGTH



DREDGED CANAL



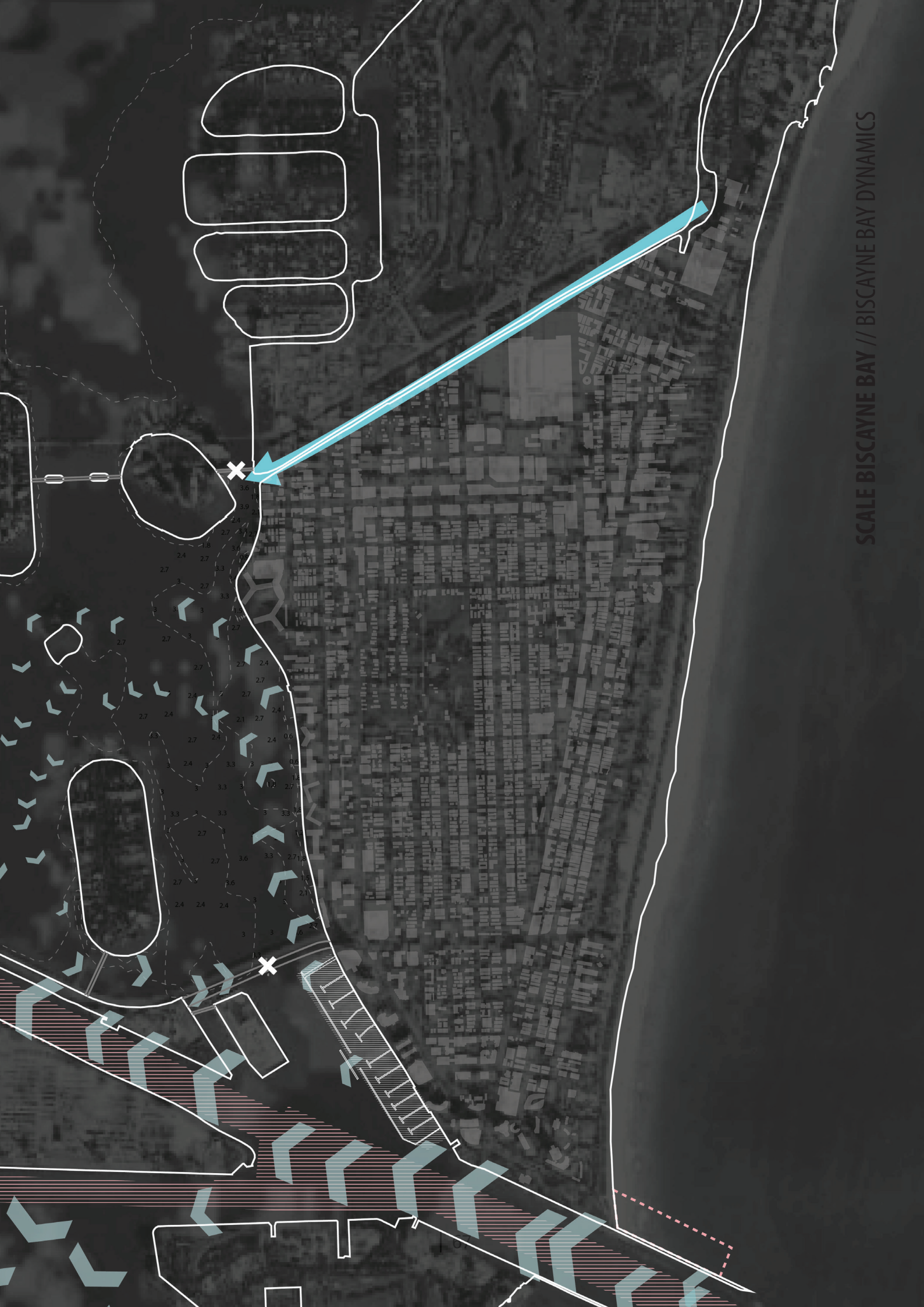
RECREATIONAL AREA: MARINA



BOAT TRAFFIC OPENING



BISCAYNE BAY BOTTOM DEPTH LINE



MANGROVES RESTORING BISCAYNE BAY'S NATURAL COASTLINE

Cultural value

Before the urbanization of the coast of the Biscayne bay, it had the same coastal edge as other, less urbanized South Florida Barrier Islands now: an intertidal mangrove swamp.

Throughout history this swamp has been used by native inhabitants in their way of life. The Tequesta tribe that lived on the Biscayne bay before the beginning of Christianity. They lived close to bodies of water, rivers, streams, barrier Islands like Miami Beach and the Keys, depending on the season. During mosquito season they moved from mainland village on to the barrier Islands. The location and resources of the Biscayne Bay was enough to live a non agricultural existence, they lived from fishing, hunting and gathering fruit, the water was their main source of life. While Tequesta's lived in the intertidal flats on mounds, Seminoles, in other parts of Florida, conquered the tidal fluctuations and life in mangrove swamps by building chickees: houses on stilts, some even 3 stories high.

Ecological Significance

The term mangrove is a collective word describing several trees, not specifically related to each other, that are able to withstand salty environments. Some are able to block the salt entering their roots, while others give off the salt from their leaves.

The mangrove forests of Biscayne Bay are very characteristic, wild places. The tree trunks that are floating above the water, give clarity to the chaos of tangled roots underneath, reaching in every direction. The trees grow out from a flower in the water, growing towards oxygen and sun, to

a system of deep tangled roots, those branches that are able to catch air eventually grow an emerald green crown. The impervious root system keep waters clean and clear, and slow down the current enabling sediment to settle. The mangrove ecosystem provide shelter for a wide variety of marine organisms. The branches and roots provide for a pleasant breeding and nesting environment for birds, including pelicans.

After years of negligence, recently mangroves are again regarded as highly productive ecosystems with key roles in the endurance of some tropical coastal regions. For one the mangrove roots catch sediment and contribute to soil formation, and stabilization of coastlines. Moreover, the complexity of the system makes acts as a filter for run off water. The mangrove ecosystem serves as habitat for vulnerable wildlife, like small birds, reptiles, fish, crabs, oysters and other invertebrates. And at last leaves fall from mangrove branches year round they break down and become food for other marine organisms, so they contribute to the productivity in offshore waters by their large amount of detritus production.

Recreational Significance

As for human life in these regions, mangroves also play a key element in the endurance. The forests serve as protection for coastal communities against storms and hurricanes. Mangroves provide shelter for marine organism that are of commercial value. Areas in which the mangroves are decline usually also experience a decline in fisheries. The areas are attractive in terms of aesthetic and tourism. Many people come to the areas for fishing, canoeing, bird watching, paddle boarding or snorkeling for example.

Technical implementation

The circulation of water in Biscayne Bay is stable, tidally driven. With a semidiurnal tidal fluctuation of 90 centimeters at the Miami harbor, and a gray, shelly, muddy sand soil surface (Wanless, 1969). This, together with the tropical climate are the conditions in which mangroves grow. To grow mangroves, a slope of 30 degrees is necessary.

When planting mangroves the first step is the most crucial, in the first phase of growth, the most fragile flower needs time to root. Although the context of the Biscayne Bay is very mild and growth of mangroves is expected to happen al-

most naturally, by placing some planted flowers in constructions there is more chance for it to succeed. The seeds of the trees float naturally in the bay, and when dropping (after 4 months to a year) in a favorable area they grow out to become full grown mangrove trees.

In the region three types of mangroves can be specified, starting from the water going inland first red, black and then white mangroves can be found.

The red mangrove (*Rhizophora mangle*), was once found all along Florida's coastline. The tree thrives on muddy coastlines towards the sea until



90 cm deep. The tree has stilt like roots, that grow entangled in a mass, that makes them impenetrable.

The black Mangrove (*Avicennia germinans*), resides in salty, silty soils found along the tidal shoreline, more than the red mangrove, it prefers higher and dryer soils. The tree is characterized by its reverse roots, reaching for air and sticking out of the soil all around the trunk. These roots extend out of the soil, to catch oxygen even when the high tide comes in.

White mangroves (*Laguncularia racemosa*) is normally found most inland, the leaves of the plant get rid of the excess salt, and while all the mangrove species do not thrive in cold environments, the white mangrove is the least cold tolerant of the three.

Experience

The context of the mangrove forest will never make it entirely natural. The location so close to a touristic destination will probably ensure that the recreational side of the mangroves will be used. However, with a stretch of 150 m dense forest it is a good exclusion from the city. When passing through the mangroves one can at one moment find himself deep in this historical landscape, while at the other moment being reminded of its location and the ever growing skyline of Miami in the background.





SCALE BISCAYNE BAY // MANMADE VS NATURAL: MANGROVES

EXPERIENCE OF THE MANGROVES IN RELATION TO THE CITY.

MAKING A MANGROVE ISLAND

Dredge and Fill

Florida has a history of Dredging and Filling. It could even be said that it is the main reason why the city of Miami Beach exists how it does today.

Even today dredging is still part of the culture as a lot of the canals in the Biscayne Bay are being dredged, for boat safety. This dredging, however, meets a lot of opposition from ecologists, because by displacing soil, often in the wrong place, ecosystems get affected strongly.

The recent dredge of the Governor's Cut in 2016 for example, has caused a horrific ecological havoc. By dropping the dredged sediment off coast, not taking into account the current the current of the sea, the sediment drifted away, killing off coral off the coast.

By using this existing activity to build a coastal defense from dredged material of surrounding canals not only could ecosystems be saved, the costs of transportations of soil could be kept to a minimum. Moreover, the material dredged from the Bay is the same, as the one on the design location.

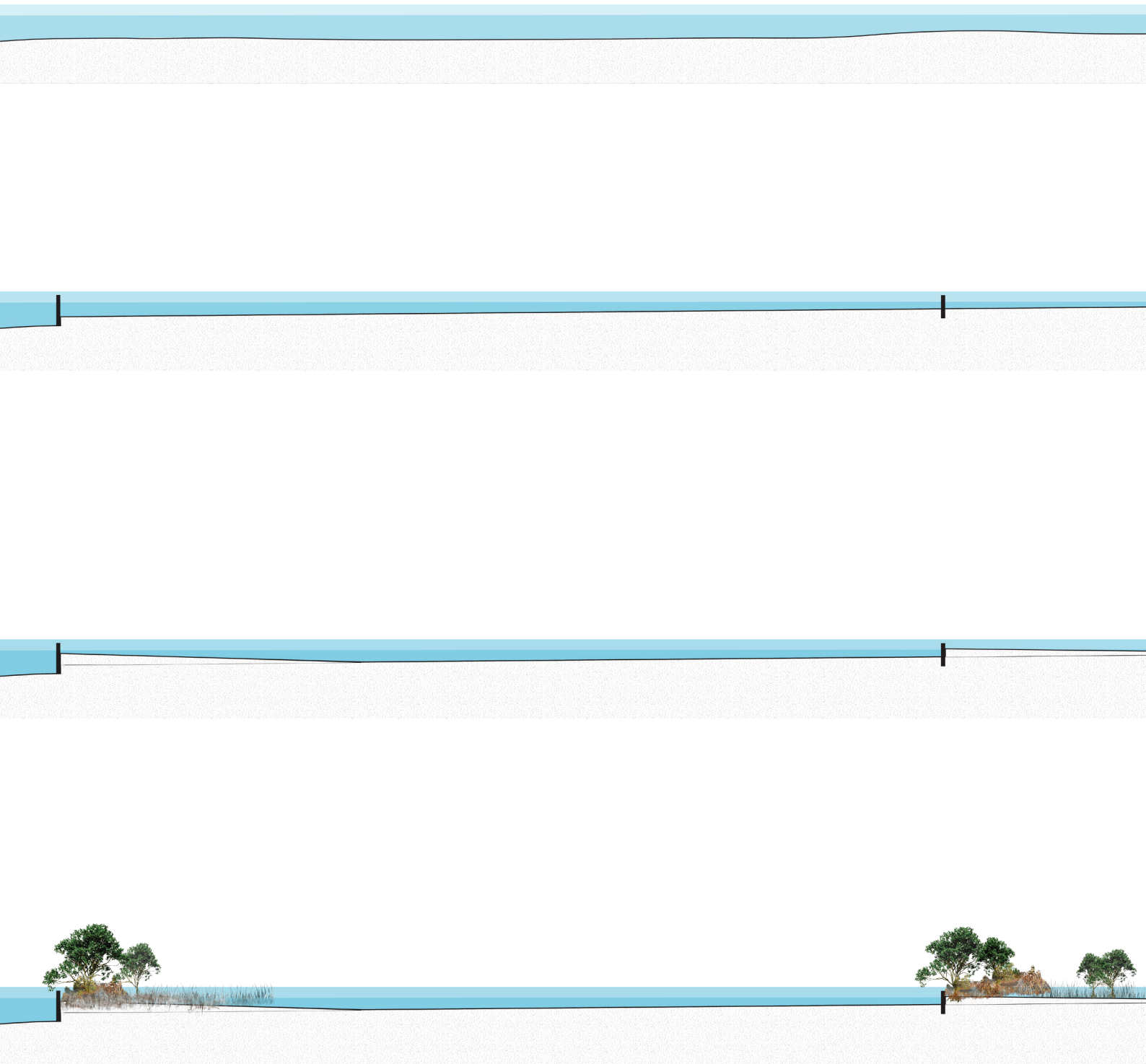
The main defense, which is a long stretch of islands, will be man made, created by dredged material.

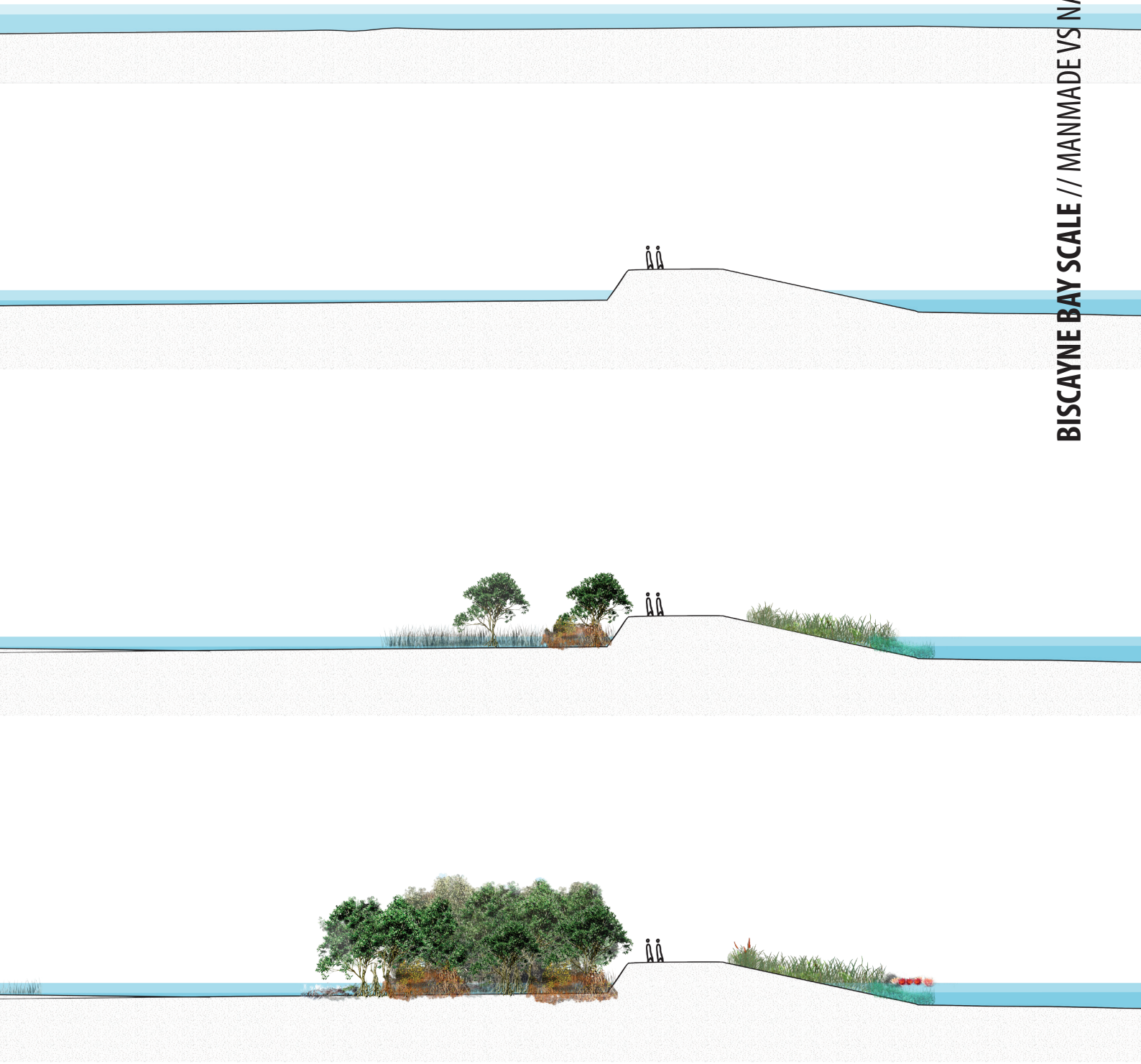
Catching Sediment

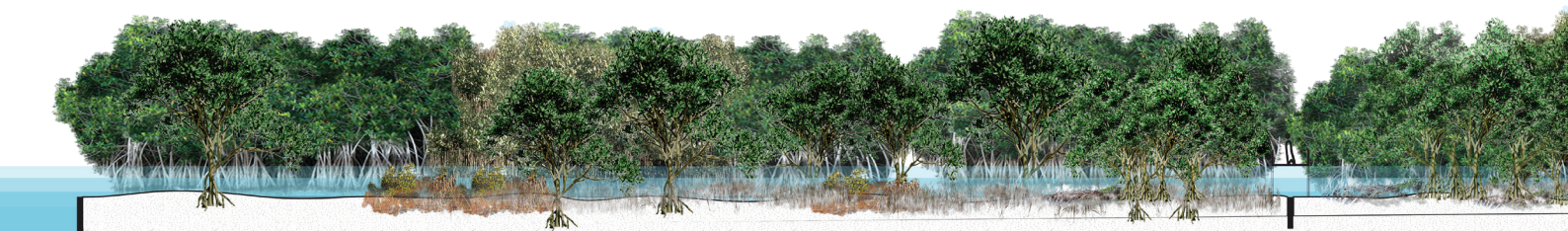
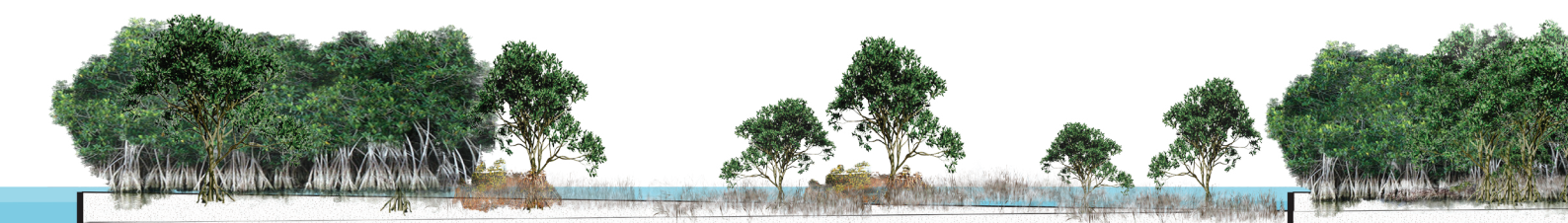
An underwater boxed structure is made, in a slope of 30 degrees that creates conditions to catch soil from the tidal fluctuations and current flow. The box will collect sediment until it reaches up to the current sealevel height. Meanwhile mangroves will grow on top, collecting even more soil between their roots, making the plan resilient to sea level rise, the stretch of mangroves grows with the sea level rise.

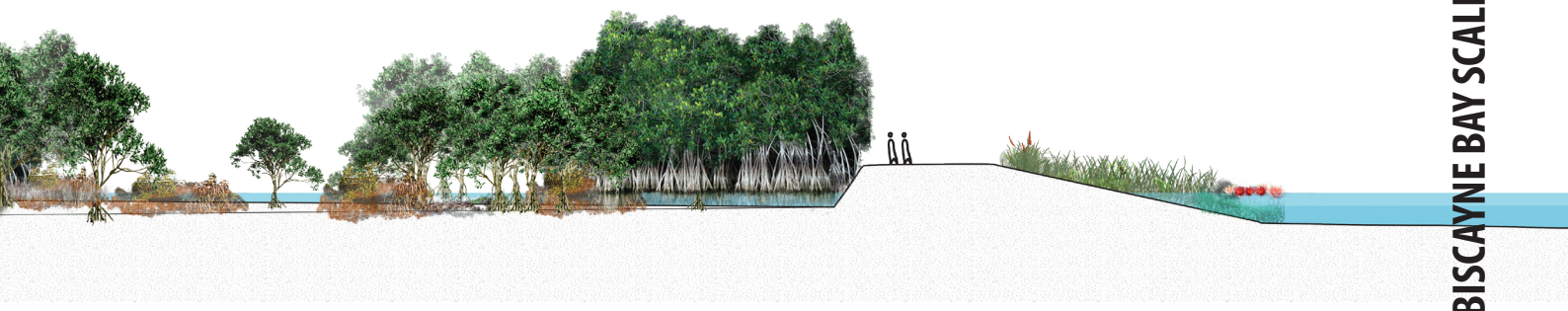
This slow growth of a landscape will be part of the experience of the place, the manmade intervention will be placed into a dynamic of change through the years, so the landscape will be experienced differently at the beginning of the intervention as in the full grown stage.

COMBINING NATURAL AND MAN MADE MAKING AN ISLAND

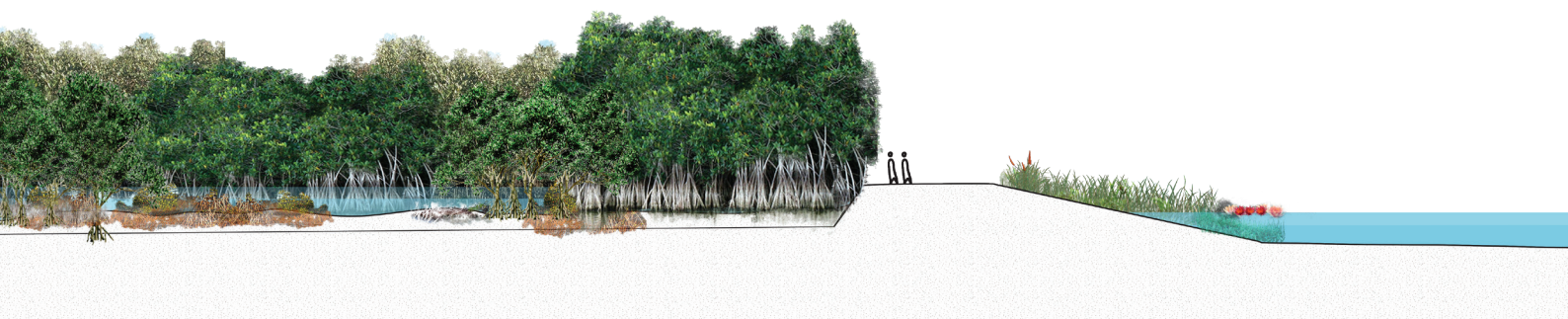
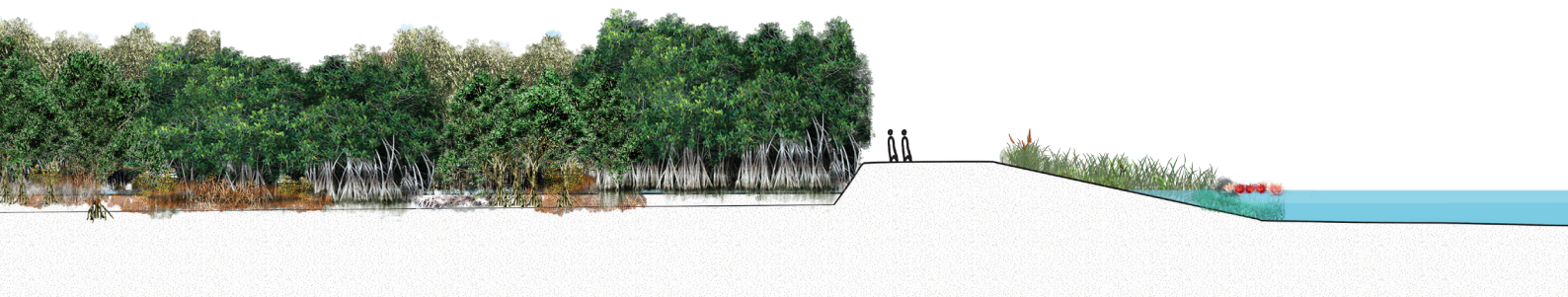








BISCAYNE BAY SCALE // MANMADE VS NATURAL PROCESS



SCALE SOUTH BEACH

The big strategy projected on South Beach manifests itself in a heightened boulevard, moving through different experiences in the area.

It starts at the extension of Lincoln Road Mall, over the heightened Boulevard lined with mangrove along different public spaces and connects to the existing coastal boulevard at the Miami Beach Marina.

System of water and canals

To mediate the inner flood, canals connect the flood prone inland to the buffer zone, all the while filtering the streetwater. A watersystem is design to keep the waterlevel in balance, with the bridges forming sluices creating 3 zone's in the design that can function as water buffer in cases of storm. The watersystem should be experienced on the location.

Connection to the city

From the extension of these canals, bridges are built to cross the buffer and to link the intervention to the urban fabric. Other piers are placed on an extension of the streets to create viewlines from the city, and from the dike towards Miami's skyline.

Zones of experience

The bridges divide the area into different zones of experience. The first, most northern part connects to the Lincoln road mall that is to be developed. Since this street can not be used for phytoremediation, as the other canals, the buffer zone will give a special place to display this system of reed, reedmace, small waterbodies and palm tree grids.

The middle area, between the bridges on 14th and 10th street, is the cultural area in which recreation

gets priority. The public space is designed as a stretched out park on the water with different functions, including a watchtower/jumping deck, a water theater, places for flexible for events and foodtrucks and dex for relaxing or sunbathing. Since it is the area with the opening in the system, this is the place where recreational boats are able to dock in front of the hotels.

The third bufferzone is left as an experimental nature zone. Since the opening and closing of the floodgates under the Macarthur Causeway, on its southern boundary strongly affect the water salinity and with that the vegetation, the course of the sealevel will have affect on the way this area will bloom.

There is a possibility to connect to the Macarthur Causeway to the South in the Future. Now the bridge functions as a sluice for extreme weather.

Experiencing the mangroves

The mangrove and growth of mangroves can be experienced in several ways. The piers that extend from the dike are all built in height related to a predicted sealevel rise, so that in 100 years, most of the lower ones are under water, leaving a straight canal. Until this time the pier is used as a walk way from which you can see the mangroves grow through the years, after that it can be used as a waterway. This system is invented to make people aware of the uncertainty of the trajectory of sea level rise. Another way to experience the area is from the elevated walk way through the mangroves, built on the sediment construction of the area after the mangroves are fully grown, these two paths cross to give the visitors a view towards the city.

1
PHYTOREMEDIATION ZONE:
FILTERING LINCOLN ROAD RUNOFF
WATER: REEDS, REEDMACE, SMALL
LAKES AND PALM TREES

2
3
WATER PUMP OUT AREA,
SHOWING THE PUMPINGSYSTEM IN
THE PUBLIC SPACE

4
FUNCTIONAL ZONE: WATCHTOWER
AND WATER PAVILIONS ALLOW
WATER ACTIVITIES AND OPEN AIR
THEATER, SMALL PRIVATE PORTS -
BOATING ALLOWED.

5
FULL GROWN MANGROVE FOREST
AS COASTAL DEFENSE AND
RECREATION AREA, SHOWCASTING
THE UNCERTAINTY OF SEALEVEL-
RISE THROUGH TIME

ZONE FOR NEW ECOLOGY: SOFT
BANKS, BRACKISH WATER PLANTS,
SHOWING SLIGHT DIFFERENCES
BETWEEN SALTY, BRACKISH AND
FRESH ENVIRONMENTS

CANAL'S CONNECTING AREAS PRONE
TO WATERSEAPAGECOLLECTING,
FILTERING AND TRANSPORTING
RUNOFF AND SEAPAGE WATER TO
THE BUFFER LAGUNA

POSSIBLE CONNECTION TO MACAR-
THUR CAUSEWAY, CONNECTING THE
AREA TO MIAMI MAINLAND, IN
INFRASTRUCTURE AND ECOLOGY.

IN THE FUTURE A CONNECTION TO
THE MARINA IS POSSIBLE. IF THE
HEIGHT OF THE SEALEVEL DISRUPTS
THE CURRENT FUNCTION

ADDING TO AND COMPLETING COASTAL
BOULEVARD SURROUNDING SOUTH
BEACH PASSING THROUGH DIFFERENT
QUALITATIVE PUBLIC SPACES AND
ATMOSPHERES

THE INTERVENTION CONNECTS TO
THE NEWLY REDESIGNED LINCOLN
ROAD PEDESTRIAN MALL AS PART
OF A NETWORK OF DIFFERENT
PUBLIC SPACES

WATER STORING AND FILTERING
CANALS FUNCTION AS GREEN
NETWORK CONNECTING IMPORT-
ANT ECOLOGICAL ZONES TO
INTERVENTION ZONE

THE PARK PARTIALLY TAKES UP
FUNCTION AS A WATERBUFFER IN
EXTREME SCENARIOS. SPORT
FACILITIES REMAIN

ATMOSPHERES IN T=0

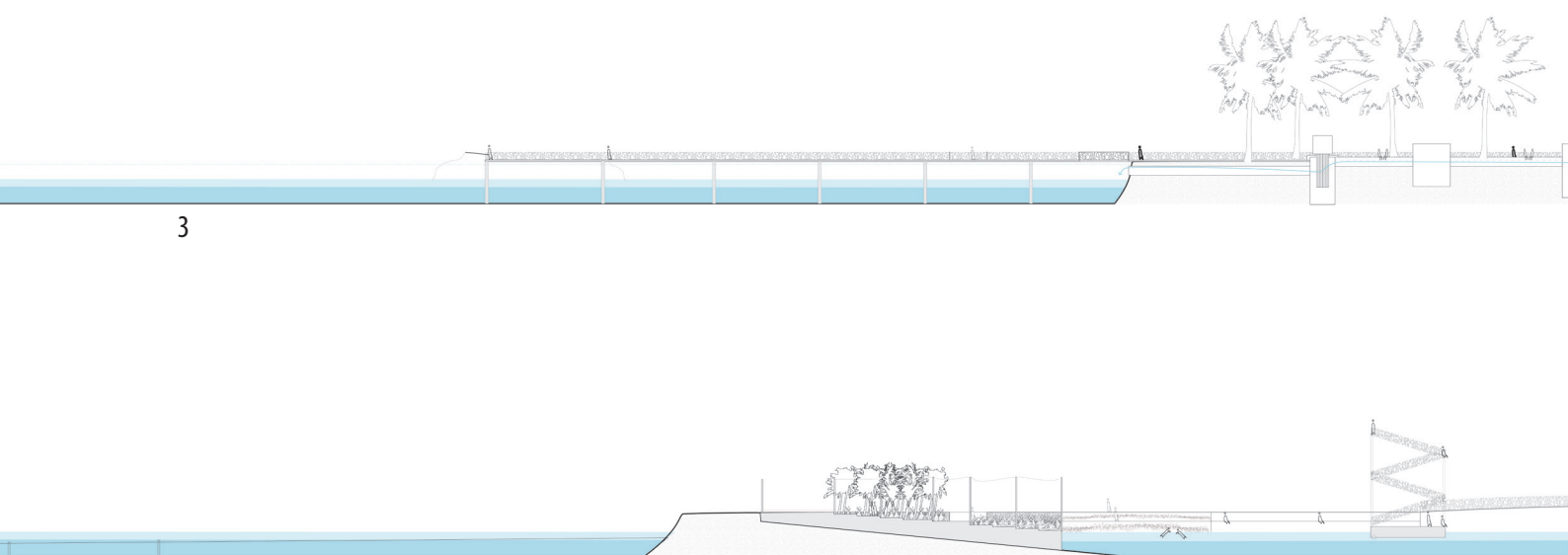
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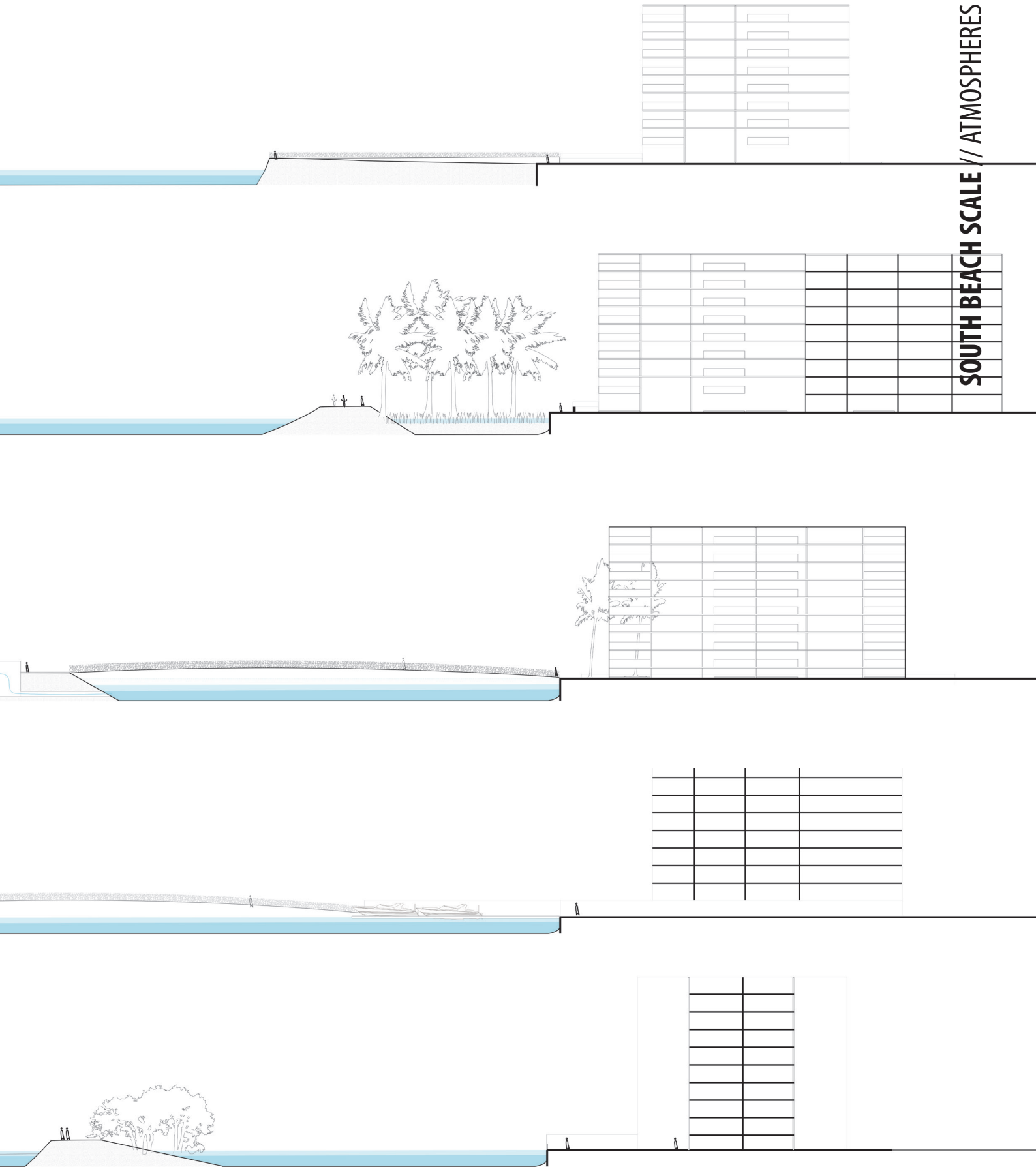
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SOUTH BEACH SCALE // ATMOSPHERE T=0

ATMOSPHERES IN 2050

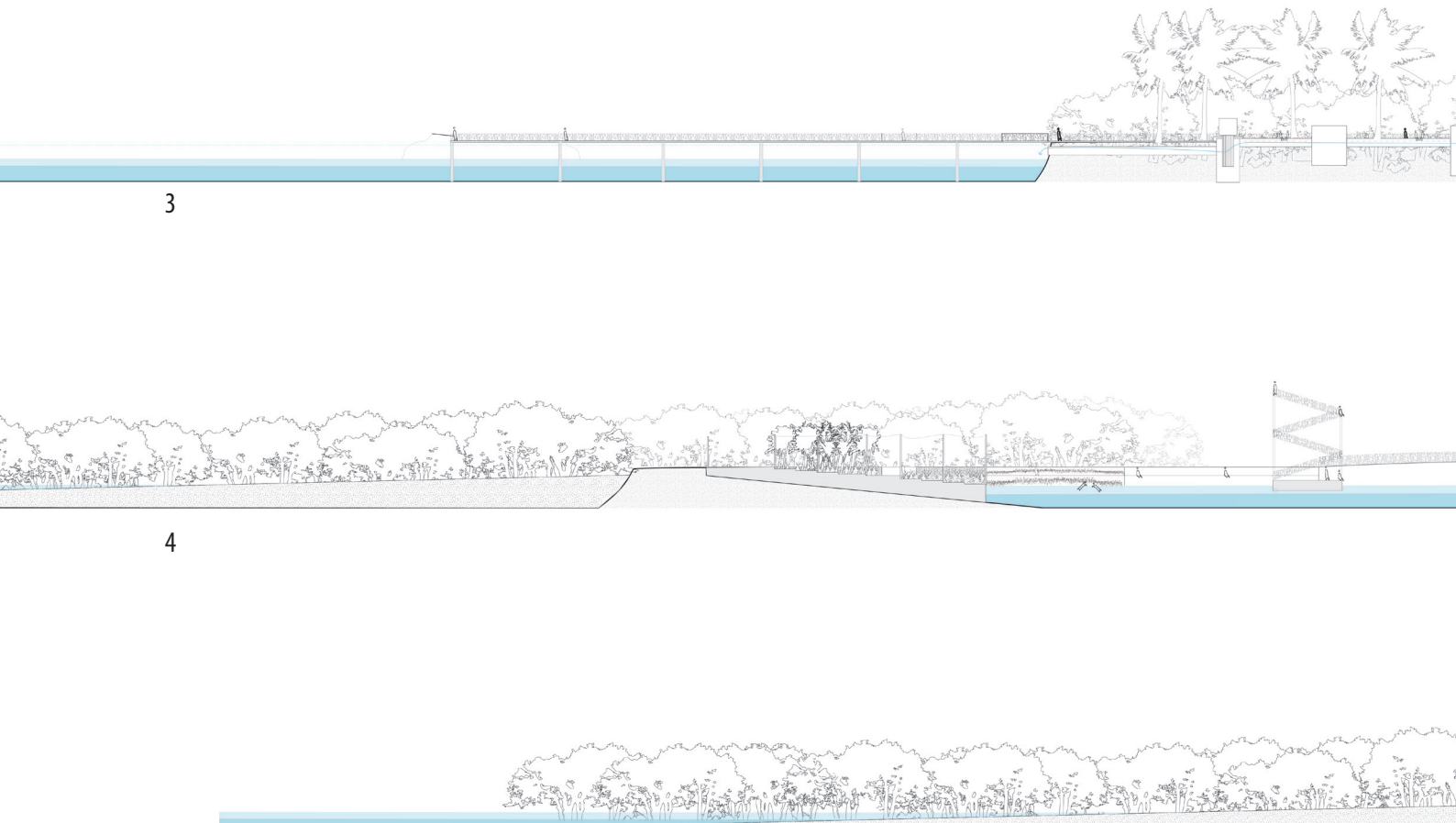
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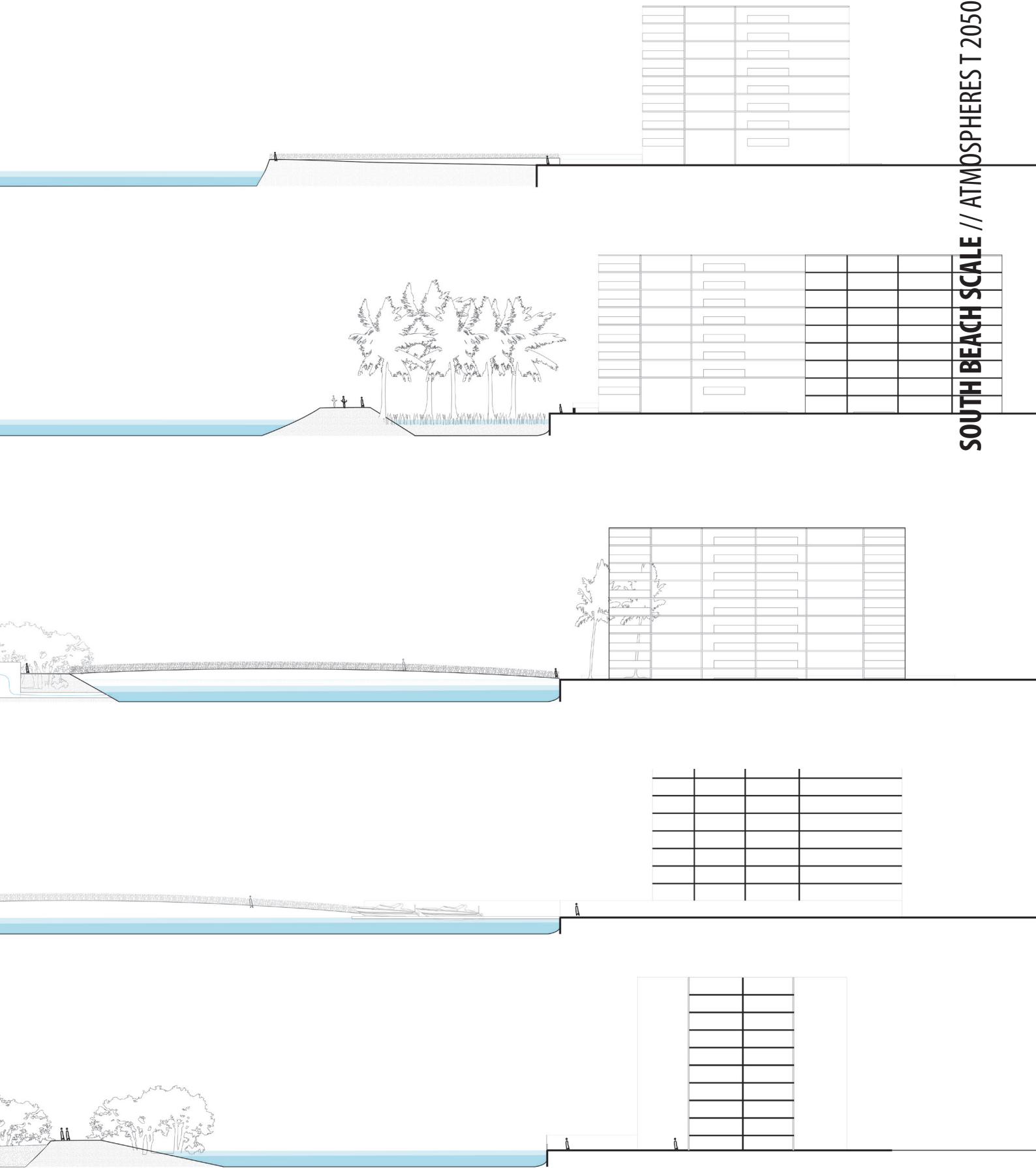
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SOUTH BEACH SCALE // ATMOSPHERES T 2050

WATERSYSTEM

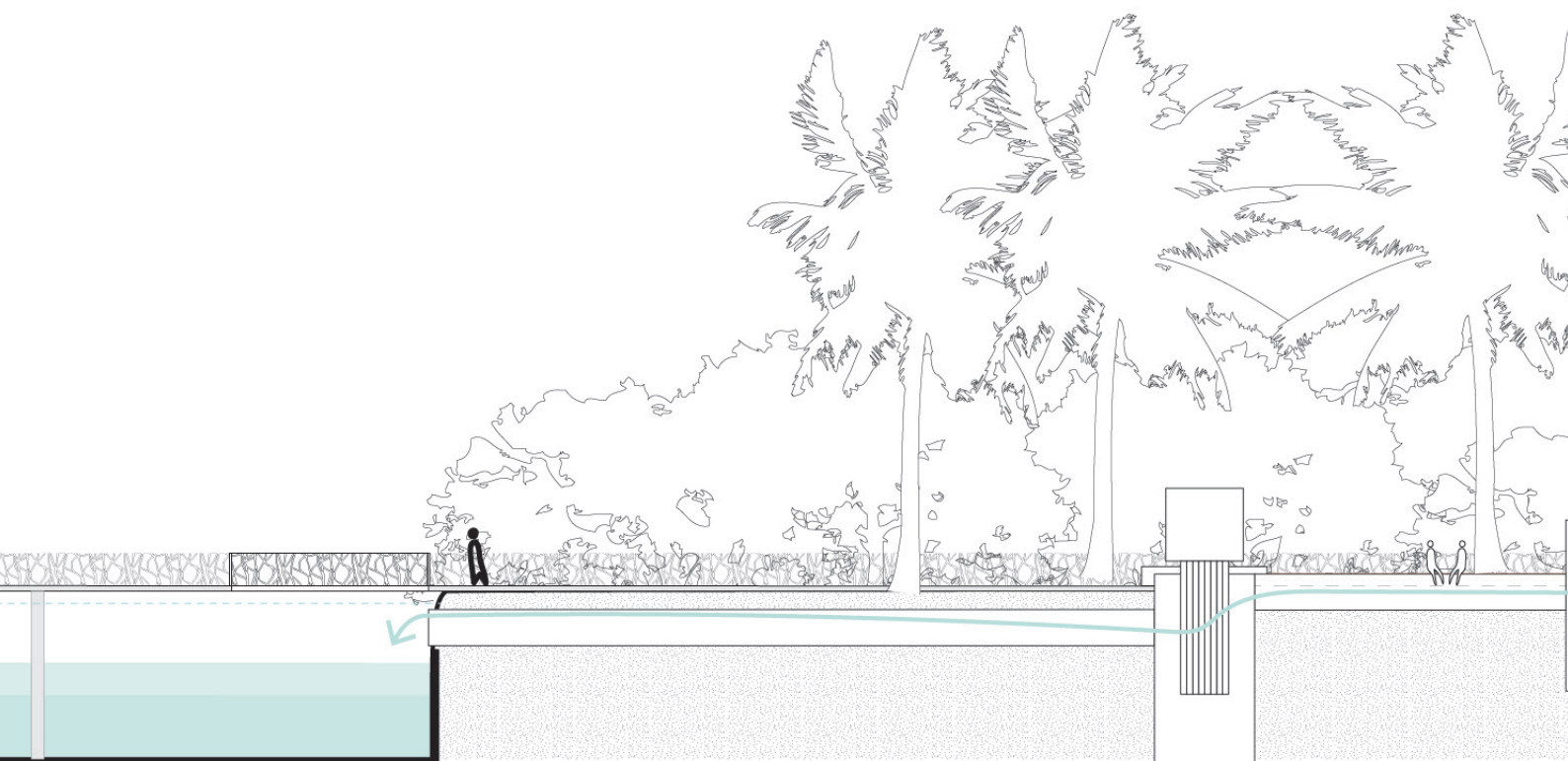
The watersystem is based on canals leading the accumulated street water run off through a phytoremediation process in the streets of South Beach, to the newly created Buffer.

The buffer is aesthetically important, since it maintains a direct connection to the water for the properties on the existing coastline, it keeps the coastal boulevard in relation to water and allows for water related recreativity functions to stay closer to the coast. Moreover, its biggest importance is that it functions as a buffer, stores water from the streets where necessary, and pumps out the water cleaner into the Biscayne Bay.

In the first scenario of lowest sea level rise the water system remains in an open connection with the

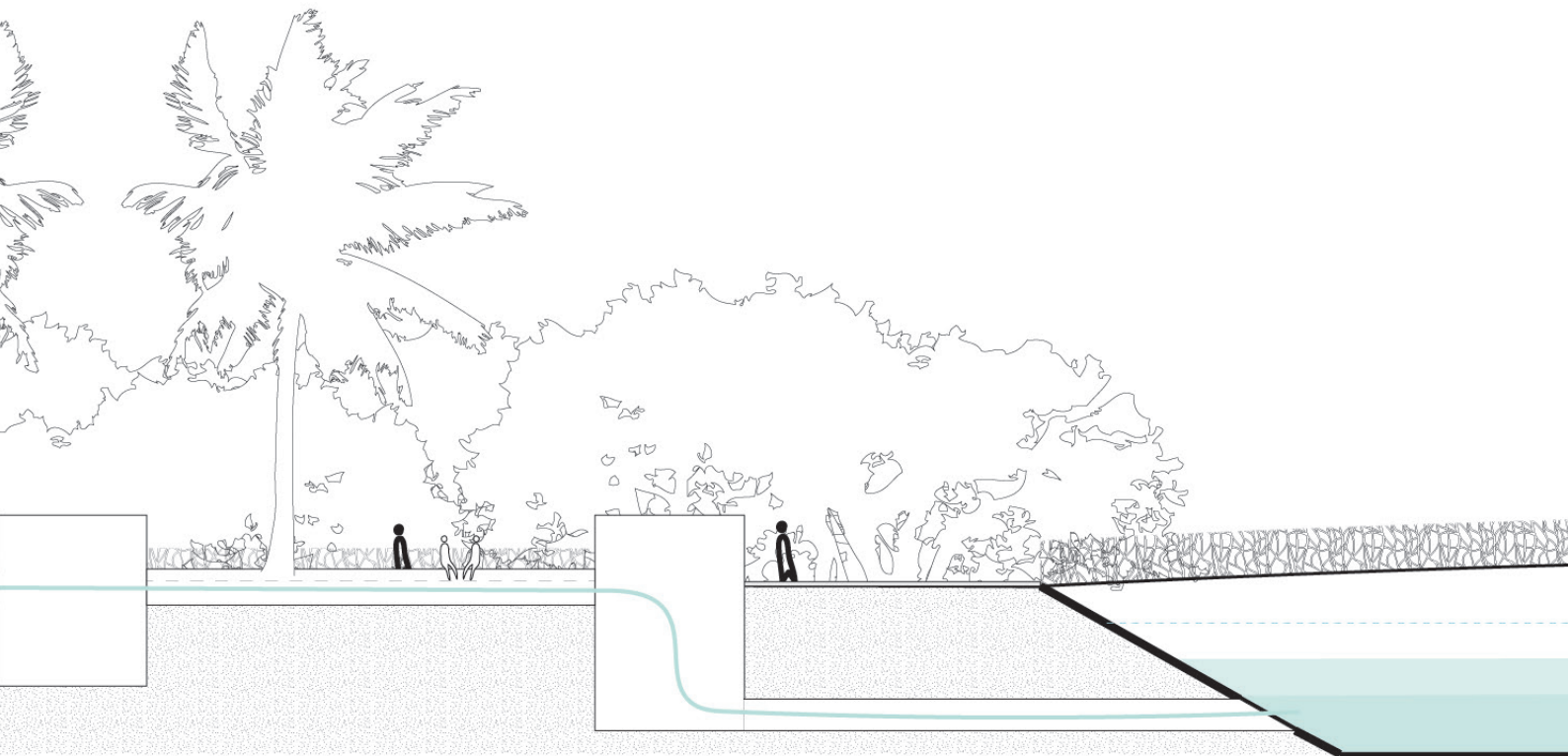
Biscayne Bay, the filtered water from the city gets pumped out here and flows naturally into the bay.

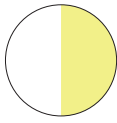
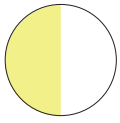
In cases of median (highest probability) and high sea level rise scenarios, the system will be closed off, being kept at a balance of 1,20 rise (tipping point) from the current sea level, so that with low tide in the bay the buffer system can be flushed out. But with high water in the bay and approaching storm the water can be pumped out to the bay to facilitate the water of Miami Beach as a storage, with a total capacity of 96,2 milion Liters with a pump out until 60 cm beforehand. Pumping out to a level of 0 (current sealevel) means that there is a waterstorage capacity of 192,4 milion liters in the buffer.



Meaning that with two pumps out into the bidirectional tidal fluctuation of the bay, the system can facilitate extreme Miami rainfall, as the one in June 2017 in which 482 mm of rain fell in Miami in a total of 7 days. On South Beach's surface of 4384122,68 m², this means that 300 million liter fell in Miami beach a day.

The pumping system should be visible as a useable part of the public space, the tubes could be used as public seats, the storage's stick out of the ground and can be made of transparent material, showing the water being filtered. In the end, when the water is pumped out in the Biscayne Bay, there is an opening in the deck, in which visitors can see and hear the water falling. So the visitor experiences the watersystem in the public space.





BISCAYNE BAY

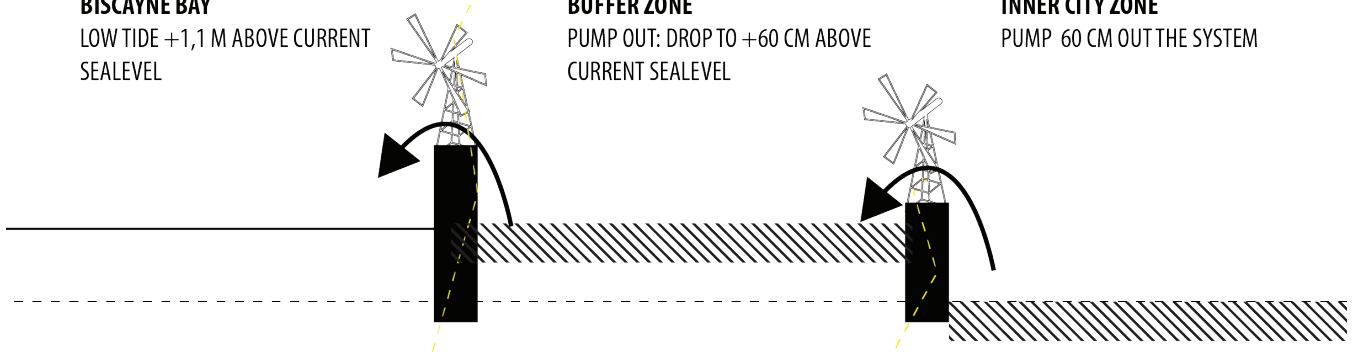
LOW TIDE +1,1 M ABOVE CURRENT SEALEVEL

BUFFER ZONE

PUMP OUT: DROP TO +60 CM ABOVE CURRENT SEALEVEL

INNER CITY ZONE

PUMP 60 CM OUT THE SYSTEM



BISCAYNE BAY

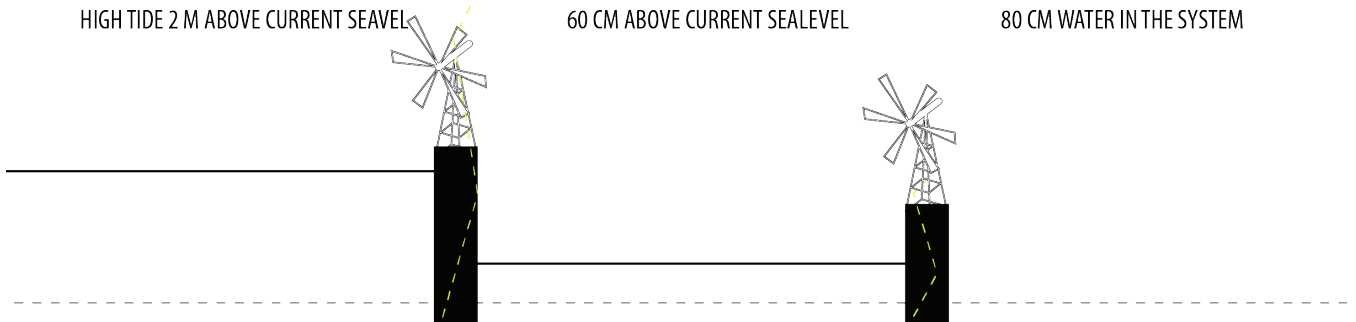
HIGH TIDE 2 M ABOVE CURRENT SEALEVEL

BUFFER ZONE

60 CM ABOVE CURRENT SEALEVEL

INNER CITY ZONE

80 CM WATER IN THE SYSTEM



BISCAYNE BAY

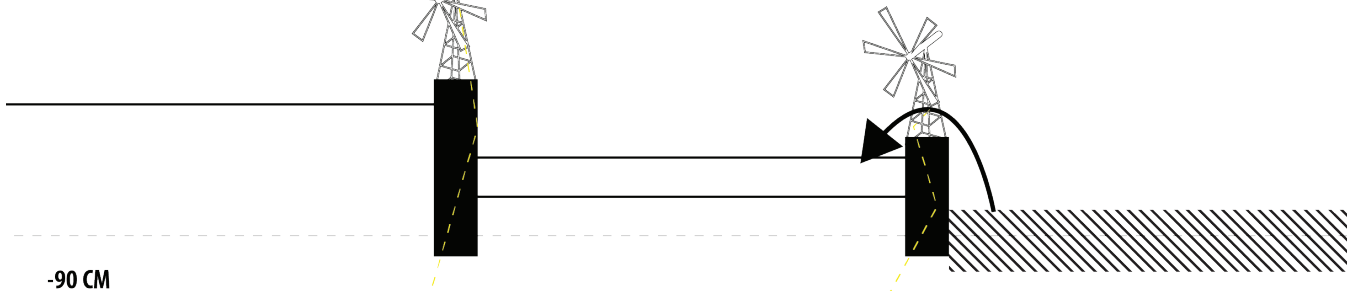
HIGH TIDE 2 M ABOVE CURRENT SEALEVEL

BUFFER ZONE

BACK TO +1,2 M ABOVE CURRENT SEALEVEL

INNER CITY ZONE

PUMP OUT EXCESSIVE WATER FROM HEAVY STORM



-90 CM

BISCAYNE BAY

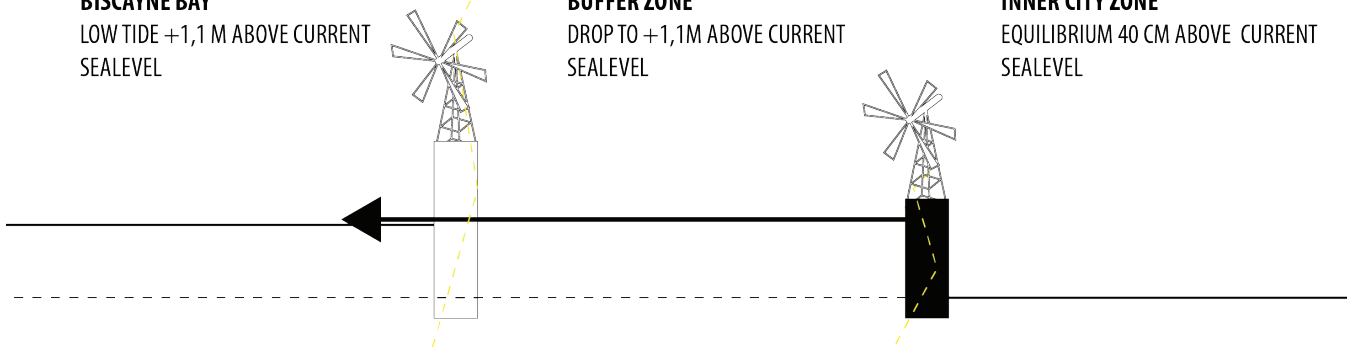
LOW TIDE +1,1 M ABOVE CURRENT SEALEVEL

BUFFER ZONE

DROP TO +1,1M ABOVE CURRENT SEALEVEL

INNER CITY ZONE

EQUILIBRIUM 40 CM ABOVE CURRENT SEALEVEL



SCALE 10-14TH STREET

CURRENT SEALEVEL

The shape of the area is a game of rectangular and flowing lines that will shift through time and sealevelrise.

It is designed on 3 levels, and focused on different relations to water through time.

The highest area is the one of the dike 2,40, the middle platform is a 1,20 walkroute and sometimes platform. And with the current sealevel there is a lowest level that is built on curent mean sealevel. The transition to the water is different per zone with the route of 1,20 stringing everything together.

In the zoning of green every zone's green area depicts different Florida landscape's, from low to high.

The functions of the area are left flexible but with an idea of use in mind. During the day they can be used for swimming and sunbathing. There is one circular pavilion that functions on the one hand as a watchtower to get an overview over the system and as swimming/ jumping facility, and one floating theater that can be usead as sun deck during the day





SCALE 10-14TH STREET // PLAN



NEW EQUILIBRIUM: BALANCE OF 1,20 M RISE

Since 1,20 m is the new equilibrium after it becomes a closed system, everything above will be safe and this platform will in some areas be the water edge.

The “lost” inundated green spaces reference Florida’s most fragile landscapes to sealevelrise. They represent the most endangered ecosystems and should rise awareness to the urgency of the problem.

The inundated accomodational spaces is made of gradual steps downward of 20 cm, so they can still be used as shallow water to walk through or sit in. With the 60 or even 120 cm fluctuation of the bufferwater steps will reappear and dissappear again, displaying the watersystem in the area.

The park is designed in a way that the accomodating spaces still remain useable after the 1,20 m rise.



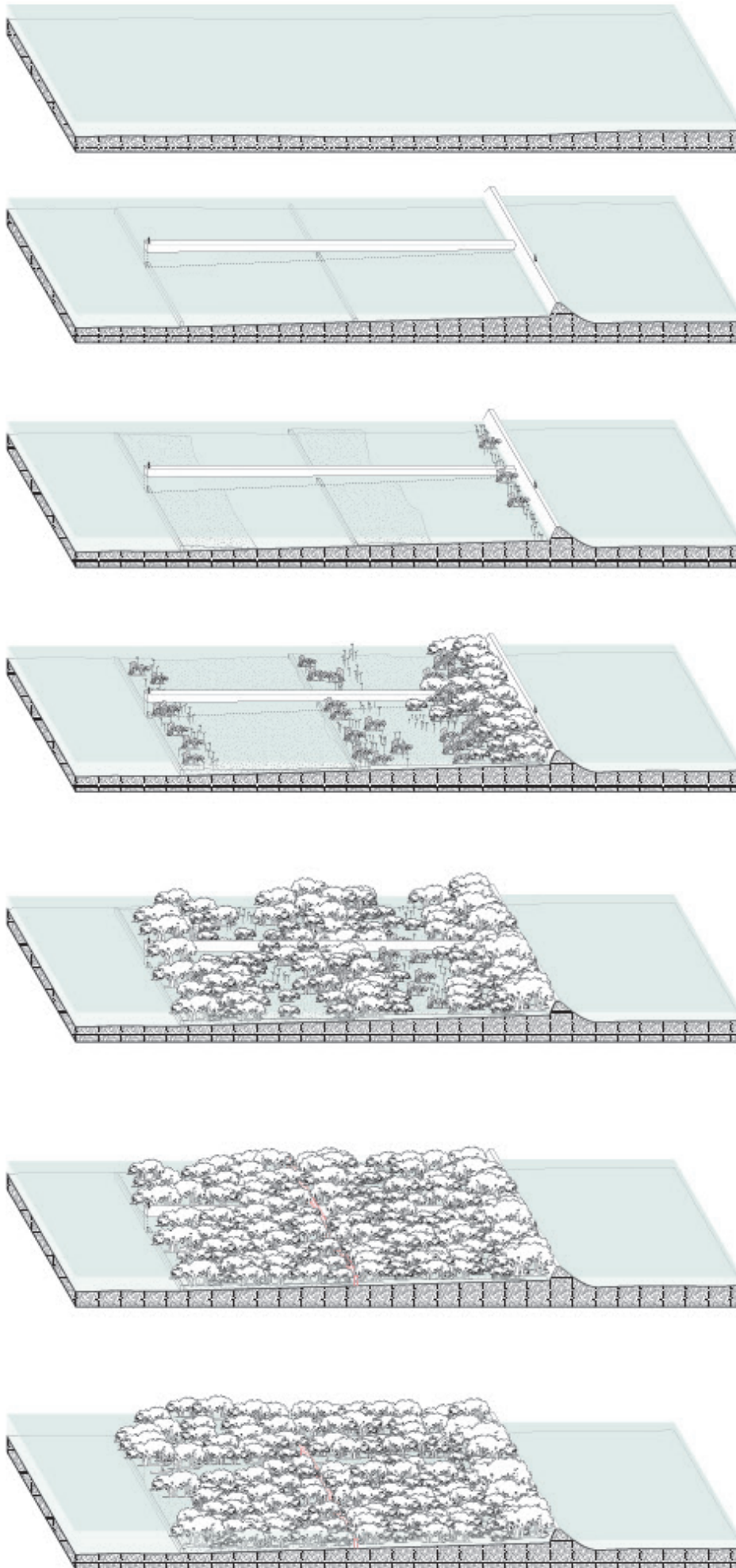
SCALE 10-14TH STREET // PLAN

ADAPTABILITY NATURAL

The landscape transition is adaptable as the system grows with the sea level rise. In the design this is showcased in the experience of the place. Piers are placed orthagonally on the dike, in different heights, following the different scenarios of sea-level. They are accessible from the beginning, so the visitor can experience the transition of the area from open sea into a mangrove forest.

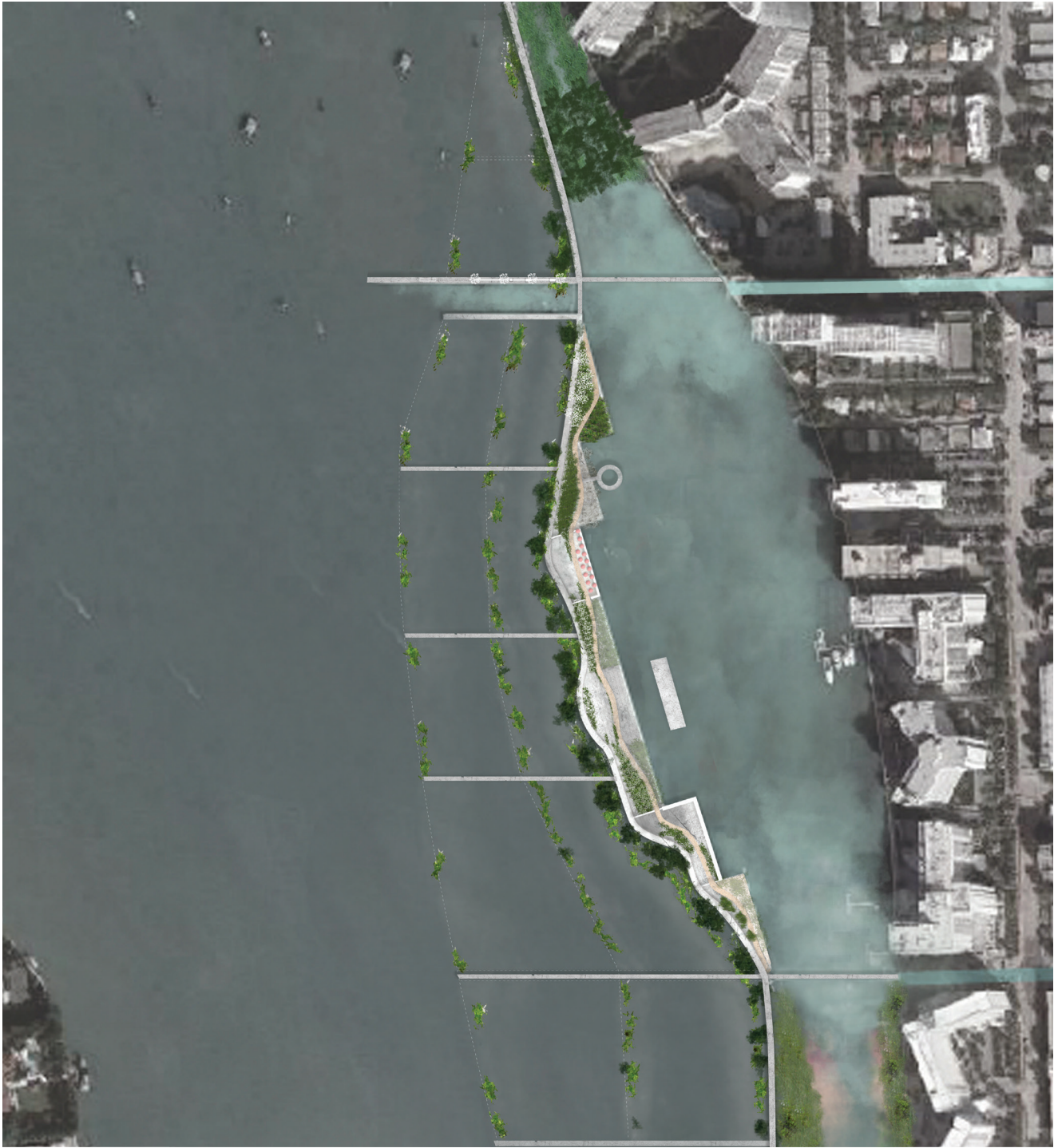
As time progresses and the forest starts to take shape, the structure of the sediment construction will be used as a directional point for a floating route through the mangroves.

While as the sea level rises, the piers gradually dissapear until only the highest ones are left, creating canals that function as sight lines from the dike towards the Biscayne Bay.





PHASE_1



PHASE_2

SCALE 10-14TH STREET // ADAPTABILITY



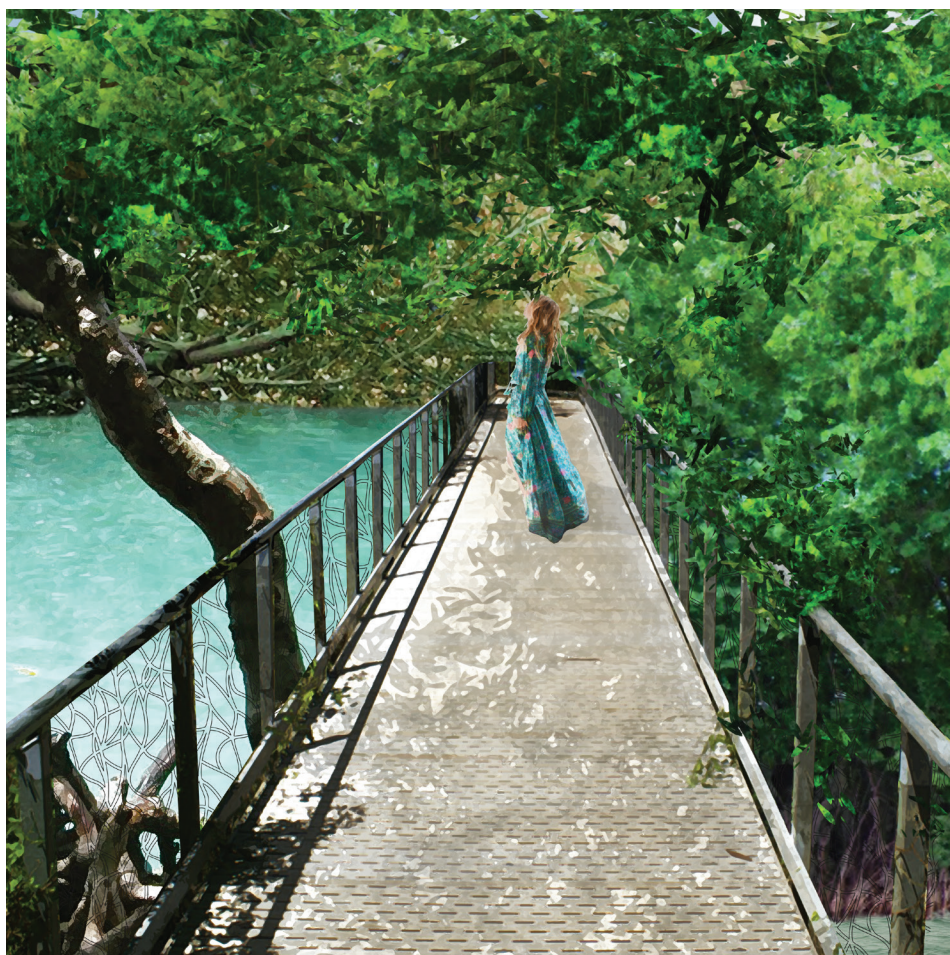
PHASE_3



PHASE_4

SCALE 10-14TH STREET // ADAPTABILITY





SCALE 10-14TH STREET // ADAPTABILITY

WAYS TO EXPERIENCE THE MANGROVES

ADAPTABILITY CULTURAL

The area is designed as a flexible public space according to the needs of the city today. The accommodating spaces are designed in the way that they can be used flexibly for different functions. In the daytime they can be used as sunbathing decks, or swimming facilities, and on occasion they can function as foodplaza's or respectively outdoor water theaters or expo places.

In the future there might be a need for new development. In the design two locations are assigned where high rise development can take place, granted that the development has somewhat of a public function, like an hotel with a public restaurant, bar or theater, this can bring more life into the park and add an extra layer of function.



The assigned places are located in the ends, so that the traffic and crowd does not necessarily enter the more tranquil place in the center. The northern location has privilege since the height can function as a landmark in the area, as envisioned and implemented in form of the watchtower.



FLEXIBLE ACCOMODATING SPACE



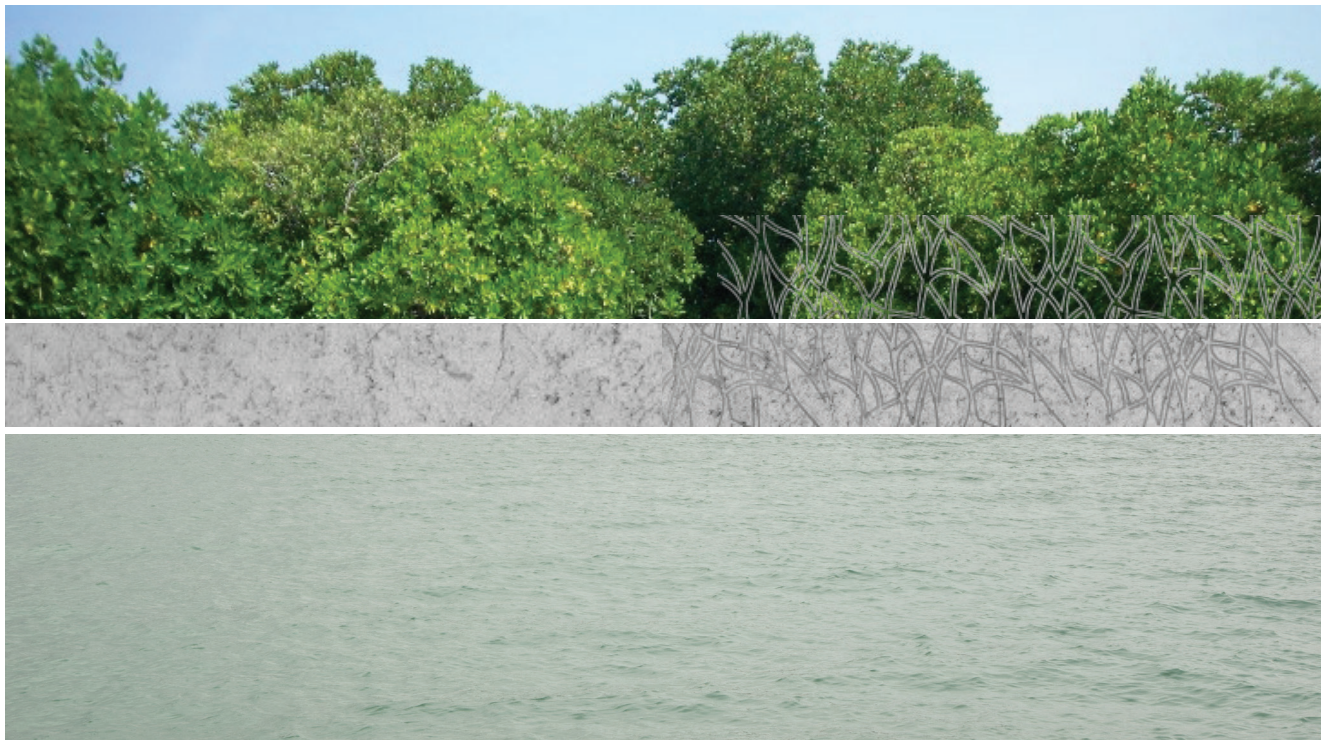
PLACE FOR POSSIBLE HIGH RISE DEVELOPMENT IN THE FUTURE



IMPLEMENTATION OF C.F. MØLLER'S GEYSER IN THE LOCATION



SCALE 10-14TH STREET // ADAPTABILITY



MATERIAL PALET USE OF MANGROVE REFERENCE IN DETAILS OF THE PLAN



COASTAL SCRUB

Saw & Bluestem palmetto, Seagrass (coccothraux uvifera), Prickly-pear cactus, Cocoplum (Chrysobalanus icaco), Shrub Verbena, Beach sunflower, Coontie, Nickerbean, Yucca.



HARDWOOD HAMMOCKS

Strangler fig, Gumbo-Limbo, Live-Oak, Mastic, Busic, Lancewood, Ironwood, Poisonwood, Pigeon plum, Jamaica dogwood, Bahama lysiloma, Mahogany, Thatch palms and Manchineel.



SABAL PALM HAMMOCK

Sabal palm. Under-story plants include vines, grasses, ferns and various herbaceous plants, which are determined primarily by the type of soil and available moisture.

REPRESENTATION OF FLORIDA'S LANDSCAPE AND HEIGHT IN THE PLAN



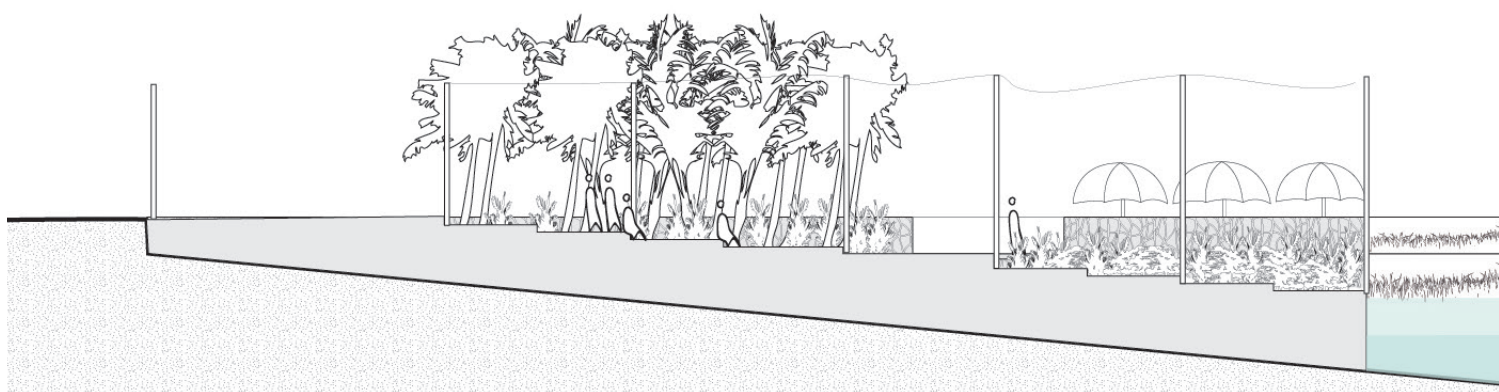
FLORIDA MARL PRAIRIE

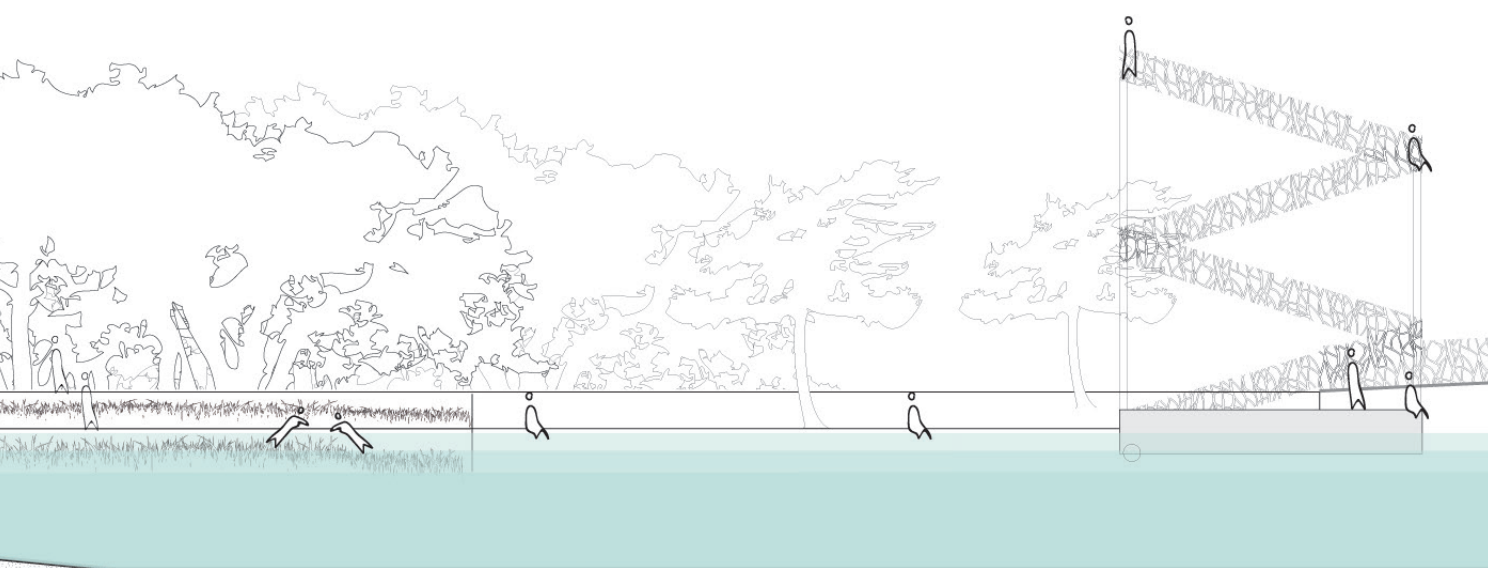
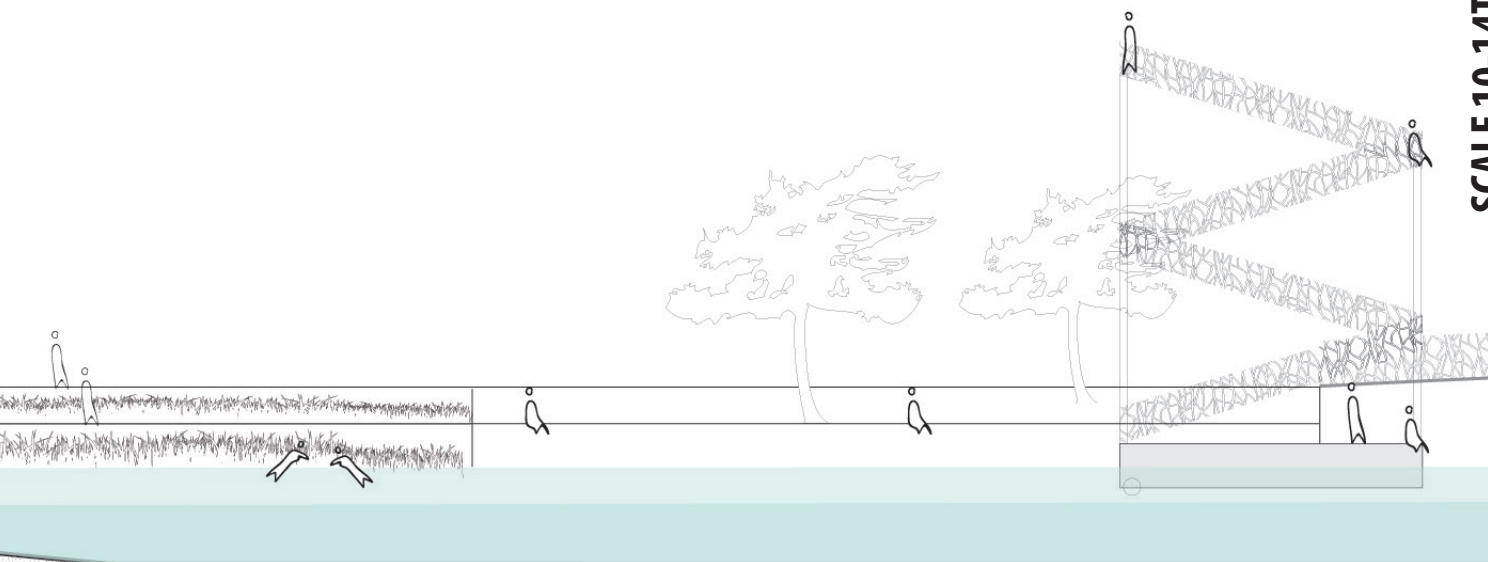
Saw palmetto, Wire grass, Fetterbush, Tarflower, Gallberry, Blueberry, Broomsedge, Wax myrtle and St. Johnswort are a few of the many plants common to various Pine flatwoods habitats.



FLORIDA PINE FLATWOODS

Saw palmetto, Wire grass, Fetterbush, Tarflower, Gallberry, Blueberry, Broomsedge, Wax myrtle and St. Johnswort are a few of the many plants common to various Pine flatwoods habitats.





SCALE 10-14TH STREET // ATMOSPHERIC EXPERIENCE





SCALE 10-14TH STREET // ATMOSPHERIC EXPERIENCE THROUGH CHANGE





SCALE 10-14TH STREET // ATMOSPHERIC EXPERIENCE THROUGH CHANGE

CULTURAL FLEXIBILITY





WATER FLUCTUATION

SCALE 10-14TH STREET // ATMOSPHERIC EXPERIENCE THROUGH CHANGE

REFLECTION

A (NEW) FUTURE FOR MIAMI BEACH

“How can Miami Beach adapt itself to a changing climate and in what way can this process be used to create new spatial configurations and generate new landscape qualities in the scale of Biscayne Bay, taking into consideration the existing spatial-cultural dynamic of the city in relation to water?”

The posed solution is a coastal strategy on the Biscayne Bay, stressing the importance of integral long-term thinking through time, combining fast, solid, solutions of building a dike with slow, adaptable processes like growing a mangrove forest. Combined, the two offer resistance to the uncertain trajectory of sea level rise. By thinking in scenarios a place is made for direct use, while thinking about the future.

The relationship between the theme of the graduation lab and the subject

The graduation studio Flowscales views landscapes as facilitative and integral. The landscapes are infrastructure in its own way, and relate natural and human systems to one another (Nijhuis, Jausling, Van der Hoeven, 2015). While this part of the USA does not (yet) have a culture of integral landscape planning and planning for rising seas, dealing with the problem of sea level rise in Miami, Florida could create opportunities to integrate different systems together and solve other problems, like in this case, lack of inclusive public space.

In this proposal a solution for sealevelrise is created that can facilitate other networks and systems, like the integration of a water storage and a street water filter system, or improving ecological quality of the bay and creating a new recreative quality on this side of the coast. While respecting and using systems that are in place, like the use of dredge to create the initial dike and conserving the current

recreational use of the bay and ensuring the maintenance of an open ecological system.

The relationship between the project and the wider social context

The project is an exemplary solution to integral coastal defense planning in densely populated tropical coastal areas affected by sealevelrise. A balance has been found between the direct contact with water, the restauration of the mangrove ecosystem and the defense against flood. The design could be operationalized in other contexts, if implementing it correctly under the right circumstances. In the case of the Biscayne Bay a big study of the underground typology, soil and sediment flows has been done prior to deciding the shape and feasibility of the idea.

When implementing the solution in another scenario, an important characteristic of the project is that the water defense is multi functional, as the research states that mono functionality may cause a detachment from the culture evolving around water. By adding a layer of functionality it can respond to the necessities and problems in the adjacent area. In Miami Beach this results in inclusive coastal public space and ecological zone, while in other areas or locations there might be a possibility to offer space for private development, business or leisure functions. In the design itself it has shown that in time, the adaptable character of the project allows for an opportunity to invest in this area, therefore responding to future needs.

The unpredictable putting it in perspective

While the project was developing, Hurricane Irma hit Florida and put the project in perspective. It showed almost unbeatable forces of nature, and storm surges flooding the streets, turning them into rivers. Even if the project was based on another type of change, the longer term, the question coming to mind then was if the project could sustain these extreme forces now, with storm surges reaching up to 3 meters off coast. The answer would be: in the first stage probably not, while a lot of the impact is absorbed by the intervention of the seadike, the project and the mangrove defense is a slow process and the dike only would not be sufficient to deal with these forces in the first stage. When in its fully grown stage however, the mangrove forest can withstand and protect the hinterland from storm surge, that happen to be a threat coming from the direction of the bay.

Designing for this annual 1% rate extreme case scenario in the usual context would be difficult since that would mean, following way the problem is treated now, a solid boundary between the public space and the sea. But in the proposed design there is space for growth to aid in this problem, if the probability of these extreme case scenarios increases in the coming years.

Moreover another idea for the use of the intervention in case of these extreme scenarios came to mind, as they are heightened elements, connected to the main arteries of Biscayne Bay's infrastructure, the Causeways, the intervention can be used as emergency exits in cases of traffic congestion due to evacuations in the city. This added another layer to the design.

The relationship between research and design

The theory of change has been implicated in the design process. Not only technically, by finding the tipping point and intervening to prolongue the treshold of change and responding to probabilities, but also by using it as an inspiration for the experience of the place, through time and uncertainty and by showcasing the change. First in the growth of the mangrove ecosystem, in the rise of the sealevel, and in the fluctuating water of the watersystem.

Through research of the revolt versus the remember, the intervention is always being placed in the long line of history relating the city with the water, to safeguard that neither sea level rise, nor the threat of sea level rise and the intervention breaks this strong culture. An important objective was to always have water as a strong element of the experience, either by passing by, staying at, using, or viewing from the coastal real estate on the bay. As the city is characterized and built up from its moments of disruption. The goal was to give Miami a new, more positive identity in relation to water. From the city that is fighting and losing the battle to sea level rise, to the city that embraces it, learns to live with it and even improves from it. Sealevel rise is brought to awareness through the elaboration of the project and change is embraced and emphasized in the experience.



BIBLIOGRAPHY

- Allen, C. R., Angeler, D. G., Garmestani, A. S., Gunderson, L. H.; and Holling, C. S., (2014). *Panarchy: Theory and Application*. Nebraska Cooperative Fish & Wildlife Research Unit -- Staff Publications. Paper 127. <http://digitalcommons.unl.edu/ncfwrustaff/127>
- Allman, T. D. (2013). *Miami: City of the Future*. Gainesville: University Press of Florida.
- Becks, U. (2006). *Living in the world risk society*. Economy and Society Volume 35 Number 3 August 2006: 329- 345.
- Corboz, A. (1983). *The land as palimpsest*. Zürich: École polytechnique fédérale.
- Hine, A. C., Chambers, D. P., Clayton, T. D., Hafen M. R. & Mitchum G. T. (2016). *Sea Level Rise in Florida: Science, Impacts and Options*. Gainesville: University Press of Florida
- Holling CS (1973). Resilience and Stability of Ecological Systems, Annual Review of Ecology and Systematics Vol. 4: 1-23 (Volume publication date November 1973) DOI: 10.1146/annurev.es.04.110173.000245.
- Meyer, H., Nijhuis, S. (2016). *Designing for Different Dynamics: The Search for a New Practice of Planning and Design in the Dutch Delta*. Complexity, Cognition, Urban Planning and Design Part of the series Springer Proceedings in Complexity pp 293-312.
- Nijhuis, S., Jauslin, D., Van Der Hoeven, F. (2015). *Flowscales. Designing infrastructure as landscape*. Research in Urbanism Series (RiUS) Vol. 3 E-ISSN 1879-8217.
- Redman, C., L. & Kinzig, A. P. (2003). *Resilience of Past Landscapes: Resilience Theory, Society, and the Longue Durée*. Conservation Ecology 7(1): 14. <http://www.consecol.org/vol7/iss1/art14>
- Reed, C. & Lister, N. M. (2014). *Projective Ecologies*. Cambridge: ACTAR, Harvard Graduate School of Design.
- Roymans, N., Gerritsen, F., Van Der Heijden, C. , Bosma, K., Kolen, J. (1998). *Landscape Biography as research strategy: The case of the South Netherlands project*. Philadelphia: University of Pennsylvania Press, pp 67-77 and 143-149
- Ujang, N., Zakariya, K. (2014). *The Notion of Place, Place Meaning and Identity in Urban Regeneration*. Procedia - Social and Behavioral Sciences 170 (2015) 709 – 717

Van Veelen, P., C. (2016). *Adaptive planning for resilient coastal waterfronts. Linking flood risk reduction with urban development in Rotterdam and in New York city*. Delft: Delft University of Technology, Faculty of Architecture and Urbanism

Wanless, H., R. (1969). *Sediments of Biscayne Bay - Distribution and Depositional History*. Miami: University of Miami, RSMAS Technical Reports.

