THE POROUS LANDSCAPE

Booklet
Viviana Avila

The porous landscape

A man-made landscape with porous qualities that create multi-purpose spaces to contribute to relieving the storm flood in Santa Marta, Colombia

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Content

Pre-diploma

Diploma

"All material unless otherwise stated, is by the author."

Diploma
Acknowledgement

Professional

I would like to thank my supervisor Karin Helms, who was strongly involved during the whole diploma process. Whose expertise was invaluable, especially your guidance on planting.
For encouraging autonomy with reflective thinking. For lifting up my confidence. For letting always a positive feeling after every meeting.

Personal

Words will never be enough to thank my parents, Gabriel Avila, and Claudia Castañeda. Who always encourages me to dream, build and create. For being brave, resilient, and persistent. For the infinite love, for the sacrifices. For making possible the impossible.

Have been a long journey to arrive at this point. Everything started in my home country, Colombia. A place with an amazing nature but with big inequalities, I grow up with the desire to contribute to improving peoples quality of living, I got into the university when I was 16 years old, persuading a bachelor in Architecture, as soon as I finish it, I started to work in different offices in Bogota, but I had to spend 4 hours in traffic every day, many times down the heavy rain, finding it bothering and without a real understanding of the workings of the water in the city.

I wanted to live in a smaller city, where traffic was not an issue, a city with the perfect weather, with the sun every day. And that opportunity just cross in front of me, I got a job offer in Santa Marta to work as a junior architect. Oh! how lucky I felt at that moment. I have been to Santa Marta before for holidays, In my mind, it was the perfect place, a coastal city with the Caribbean sea, surrounded by one of the most biodiverse natural parks in the Country and with the sun every day.
What a big surprise when after being there a couple of months with no more than intense sun every day, suddenly it transforms into heavy rains for a long time.
I was living just five minutes walking from the office and in front of the beach by the city center. But during the rainy days, the whole city center in Santa Marta get flooded, and even if I was only five minutes away from my destination it was impossible to move between places.

Soon I discovered that the water of the affluents that overflood, the rainwater, and the sewage water go all mixed in the same pipe system. When rains in Santa Marta the city stops. Thousands of people are affected by this, The people located illegally next to the river are the most affected ones, losing their homes and sometimes their lives when the river grows taking back land that before belongs to it.

On a site visit. Photography by Maria Camila Diaz, Santa Marta 2018

After a month of rain everything went back to the sunny tropical paradise I was thinking Santa Marta was.

Working there as an architect was fascinating, a lot of the projects we were developing were closely related to unique ecosystems. We were designing between different scales, housing, and some commercial projects, but most of the projects were public spaces, parks, plazas, promenades, and ecotourism projects.

I realize that architecture can have a big impact in improving people's quality of life, but public space projects, landscape-related projects are the ones that impact the most amount of people. A building may be used for a restricted amount of people depending on its program. But public space can be used by everyone in the city, it creates community, interactions between the people, but it can be also the place where we learn about the natural working of the world. In my opinion, public spaces should be linked to the blue and green structure of the cities. They can also be one of the tools that we use to build equality.

I found myself very passionate about designing spaces for everyone in the city, but I felt that as an architect something was missing, at the office, we were all architects designing projects in very special and unique ecosystems. I was missing not only landscape architecture knowlange but landscape sensibility. Not founding a master's in Landscape architecture in Colombia I start to look for a master's abroad.

When living in Bogota I completely ignore what Flooding problems Santa Marta has. What will I discover when studying in Norway? What could I learn in Norway that I can adapt to solve some of the problems in Colombia?

It has been two and a half years of living in Oslo, and I realize Oslo also has some flooding problems, most of the cities in the world have to address this topic, and some of them had some successful study cases.

I still have a long path to go and I hope through my professional life to be able to design spaces that improve the life quality of living beings, not only humans but other species as well. This diploma project is the first attempt at it.

On a site visit. Photography by Maria Camila Diaz, Santa Marta 2018

On Pre-diploma the project was title Sponge playscapes. A brief analysis of the city shown that there is lack of playgrounds in Santa Marta, the few spaces that exist nowdays are constructed with not porous materials.

The concern of designing spaces that adress flood issues was still present, I looked into references in Netherlands like Warerplein Benthemplein by De Urbanisten where the project adapts to the weather and let some areas to get flooded with rainwater. At that moment I believed that something like that was what Santa Marta needed.
At the same time the research focused on history of playgrounds and studied other references as Noguchi concept of the play mountain and the specific case of Moerenuma Park in Japan.

The reseach on playgrouns took me to the conclution that:

> *The concern for designing safe and controlled play spaces has generated a standardization of the play elements, leaving playgrounds made of plastic, with strict activities to be carried out that leave no room for children's exploration and creativity.*
> *Playground through history has been a play between scale up and scale down elements in our environment, but at the beginning of play spaces, we were doing an abstraction of natural elements, in the last interventions we have been doing an abstraction of urban and man-made elements, letting these spaces isolated from the green and blue structures of the cities, creating completely artificial spaces unrelated to nature.*
>
> *For better development of creativity and life skills in children, the role of nature in play is important, it is necessary to design spaces that bring nature back to the playgrounds. And at the same time respond to the environmental variables of each city, creating a system that is coherent to the needs of a specific place and society instead of being the result of standardization.*

But when I stardet to develop Diploma, I keep analysing Santa Marta deeply, realizing that the stormflood problem was more complex that what I tought at the begining. That playgrounds and stormflood in Santa Marta were not a good combination. The flooding in the city would not get solve for instalign some dry basins in the few existing playgrounds in the city.

The research took the focus on watermanagement, the creation of an adaptive landscape that works in different scales.

It was needed to take and step back and reformulate the project. To look the big picture and to formulate a solution from the city scale to the local scale.

"The city should be good for water, but water can also be good for the city"
Tjallingii.

Topic description
City and water

When we as human species decide to settle in a place, we make sure that is a land with all the resurces we need to survive. Water is the key element for living, not only for us but for all species, without water we cannot grow food, without it we cannot satisfade all living needs.

But if from the begining of the times we aknowlgae the importance of it. In which moment of history we lost the connecton to it?

Our ego exploted at the same time that city expantions, acelerate urbanization and industrialization took the main focus on cities. We start to urbanize spaces that have belong to water for centuries. We changed the natural porous ground for asphalt, concrete, plastic, and endless artifitial impermeable surfaces. We create space for the build elements and reduce the space for nature, for green, for blue, for other species. We build cities as fortres, isolated of the real working of the world. We have acelerate climate change and as resoult every year we face extreme weather conditions, every year new records appear on the dryest conditions, on new levels of flooding all around the world.
We paid now the price of our behaivor, and climate conditions will only get even more extream. We need to face reality and work by the hand with nature.

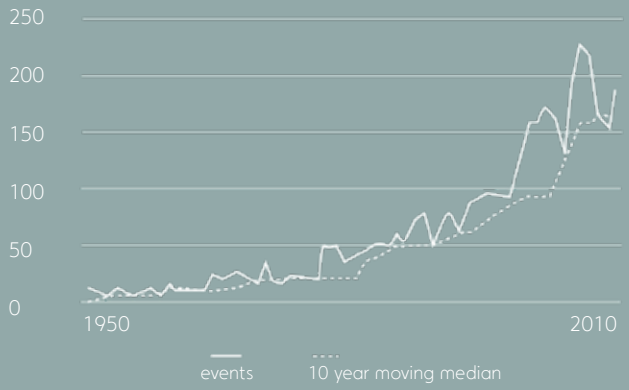
We need to link the blue and green structure of the cities, to create adaptive landscapes, dinamic spaces, resiliante to changes. We as landscape arquitects must understand the working of the ecosystems where we design and make it evident in the projects.

Use floods as an oportunity to create new ecosystems, to build a humble society that is educated in urban ecology.

Topic description
City and water

Water cannot keep been a mistery, as most of the cities that manage the rainwater by centralized pipe systems, getting rid of the water as soon as possible, trying to take it away without seen it, without interaction.

Flooding is a serius issue that affect us globaly. Is the natural desaster with the most frequent amounts of ocurrence.



We have the power to transform cities into a descentralized system that manage water on site, absorb it, filter it and give it back cleaner to the system. At the same time to attract other species to the places that belong to them in the past.

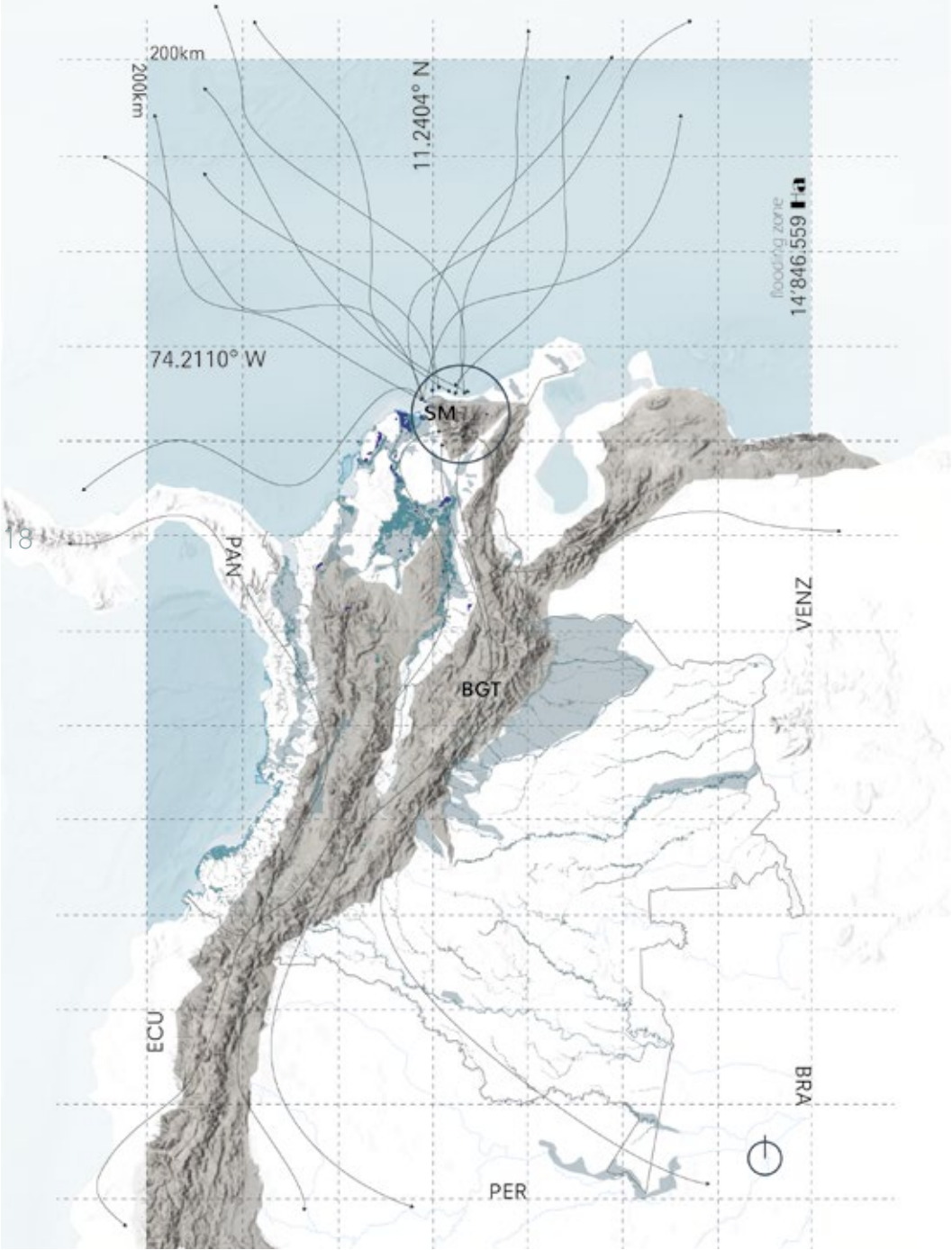
https://openknowledge.worldbank.org/handle/10986/2241

Site analysis
Location
Santa Marta, Colombia

Site analysis

Location

Santa Marta, Colombia



The project is located in Santa Marta, Colombia.

11° 14' 31'' N, 74° 12' 19'' W

Urban area: 55.10 km2

City area: 2,393.65 km2

Population at 2018: 499,192

Density : 210/ Km2

https://www.amazon.com/Bilipala-Decorative-Netting-Decorations-Mediterranean/dp/B01LY840BP

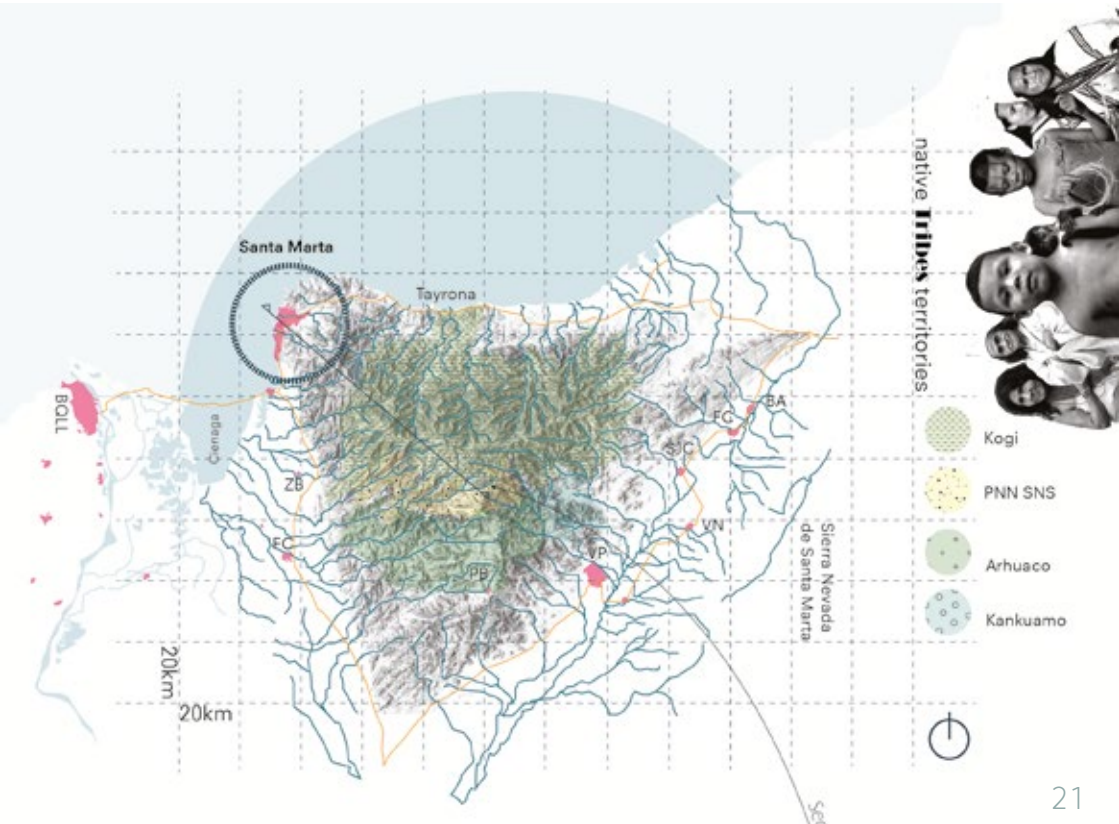
Location

Santa Marta, Colombia

The project is located in Santa Marta, Colombia by the foothills of Sierra Nevada of Santa Marta, the heist coastal mountain in the world, goes from 0 m to 5.000 m above sea level, and is the source of 36 rivers.

Santa Marta is highly biodiverse, with numerous endemic species of fauna and flora.

Before the arrival of Europeans, Santa Marta was the home of diverse native tribes who developed their own architectural and landscape techniques. A small group still remains high up in the SNSM



Section


Pyrrhura viridicata


Chlorostilbon russatus


Cranioleuca hellmayri


Myioborus flavivertex


Atlapetes melanocephalus

635 species of birds
50 species of amphibians
17 endemic
189 species of mammals
90 species of fish
92 species of reptiles

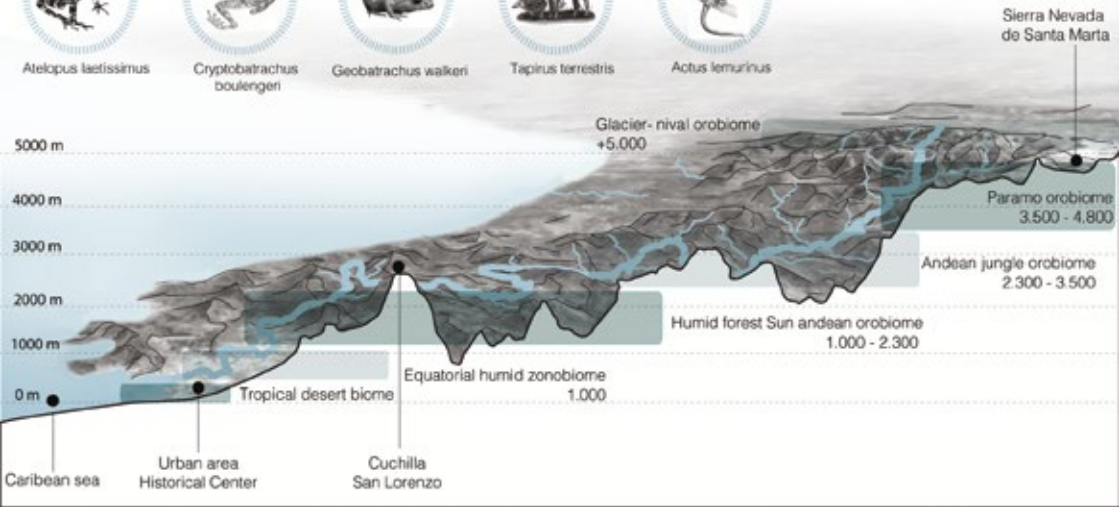

Atelopus laetissimus


Cryptobatrachus boulengeri

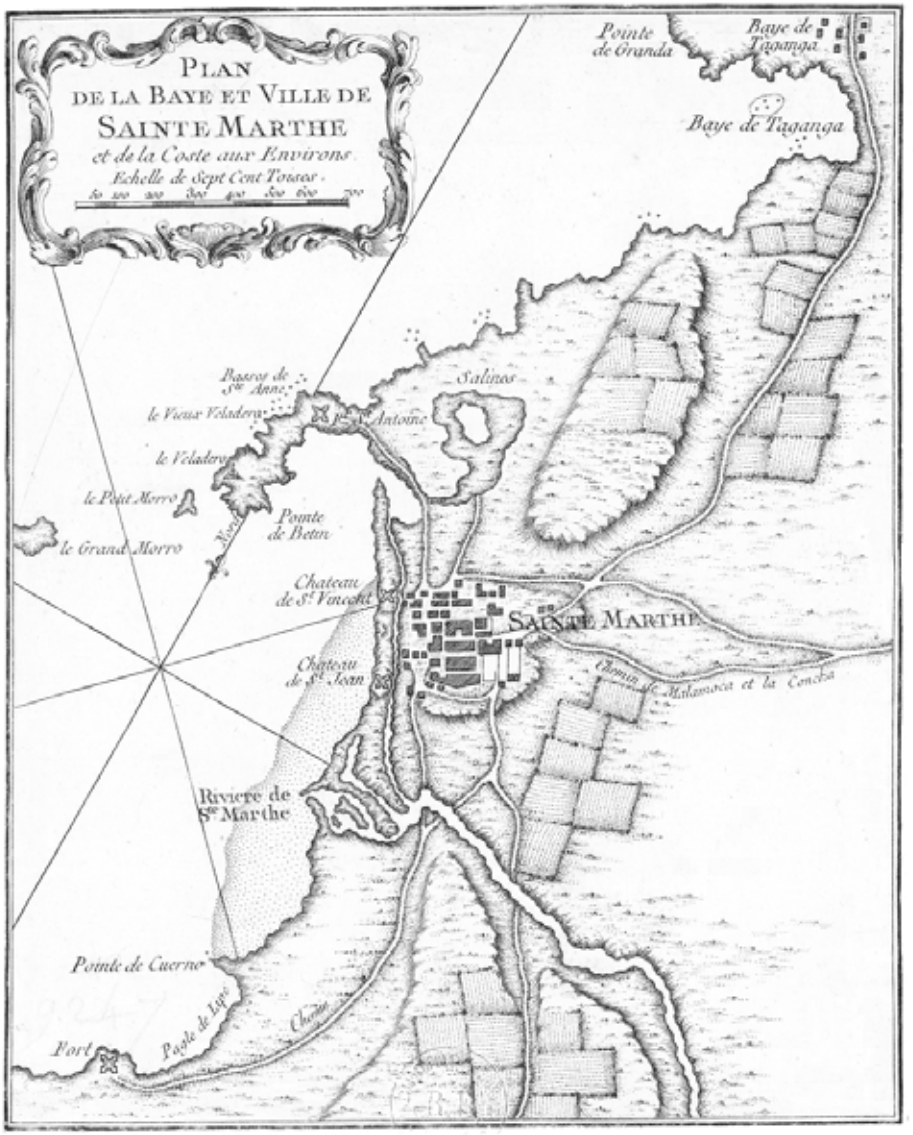

Geobatrachus walkeri


Tapirus terrestris


Actus lemurinus



The first cartography of the city is from 1525, where we can see the relationship be-tween land, ocean, river, and its delta. As the city was growing and developing, the space for water got reduced, reclaiming land and modifying the natural curse of the river. In the pre-Columbian time, native communities developed cities high up in the mountain, their landscape interventions were based on terracing created with stone and cover by porous surfaces. As the city was growing on the floodplain, the course of the river was modified, the space of water got reduced, spaces occupied before by water, vegetation, and other species are now the location of constructed ele-ments with non-porous materials. The city has a disconnection between the green and blue structures.


Plan
de la Baye et Ville de
Sainte Marthe
et de la Coste aux Environs
Echelle de Sept Cent Toises
Pointe de Granda
Baye de Taganga
Baye de Taganga
Salinas
Bassin de Ste Anne
le Vieux Veladero
le Veladero
le Petit Morro
le Grand Morro
Pointe de Betin
Chateau de St Vincent
Sainte Marthe
Chemin de Malamoca et la Concha
Chateau de St Jean
Riviere de Ste Marthe
Pointe de Cuerno
Port
Chemin

History, city growing and flooding

5th century b.C.

Pre-Columbian
Taironas, native community developed cities in the SNSM, connected with stone paths. Society based on agriculture and fishing.

1.501

Spanish arrive to Bay of SM, start to develop a urban center. Took native people as prisoners and looted the territory.

1.525

First city founded in South America, next to Manzanares river.

1.600

Spanish soldiers murder 70 native leaders, enslaved native population and took over their land.

1810-1824

Independence of Colombia.

1.850

Spanish soldiers murder 70 native leaders, enslaved native population and took over their land.

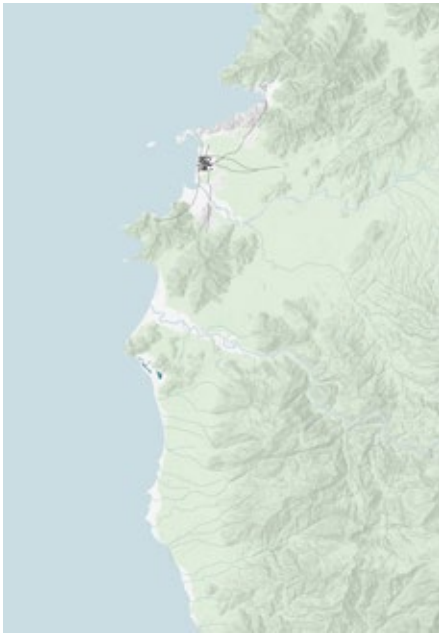
1980

First register event of flood in the city doe to Manzanares river.

1.999 - 2.013

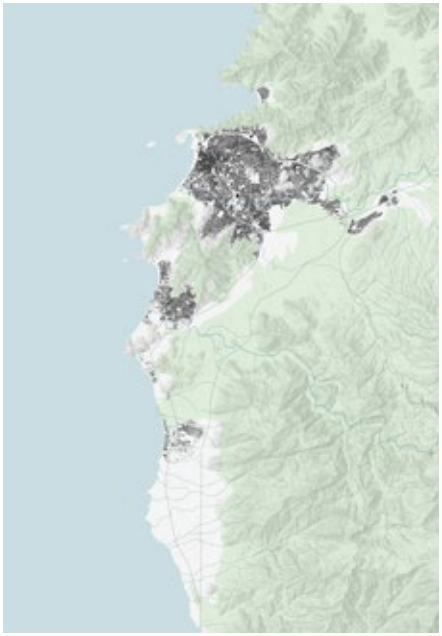
62 Flood events register in Santa Marta.

Own elaboration based on the information of the POT Diagnostic document annexed environmental dimension pag 162.

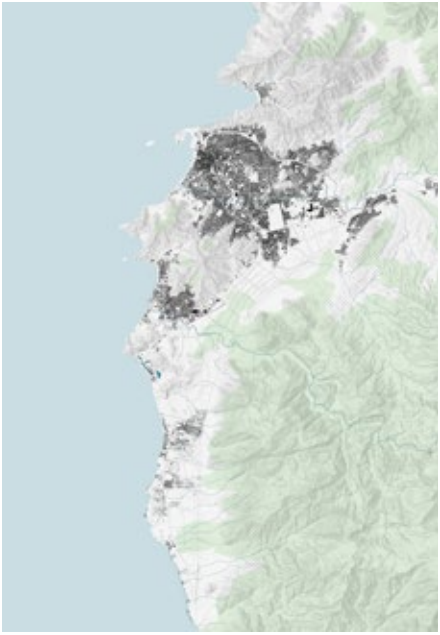


1.525

1.793

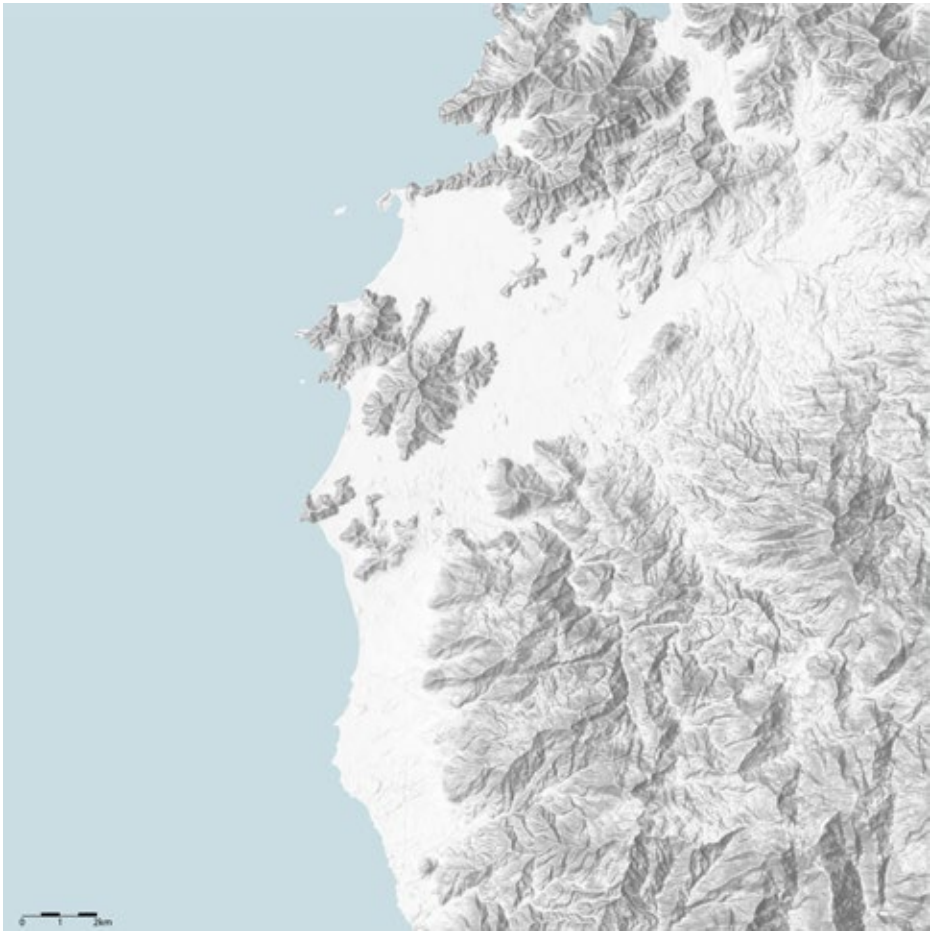


1.970



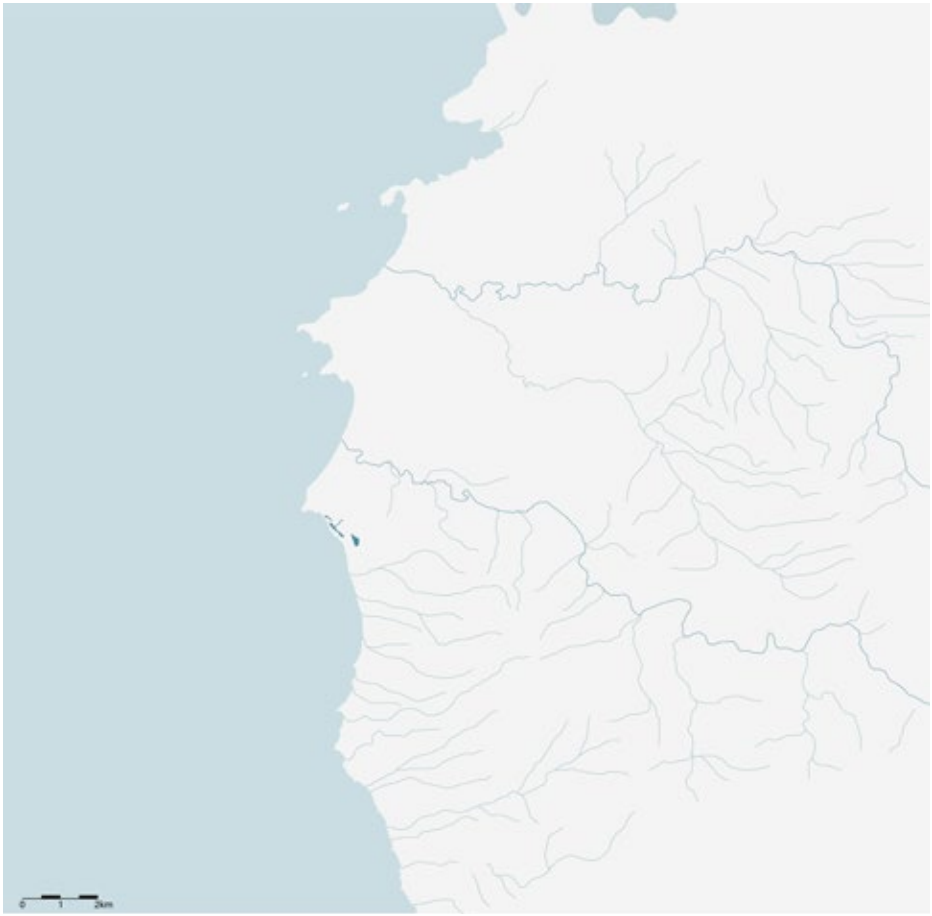
2.021

Topography



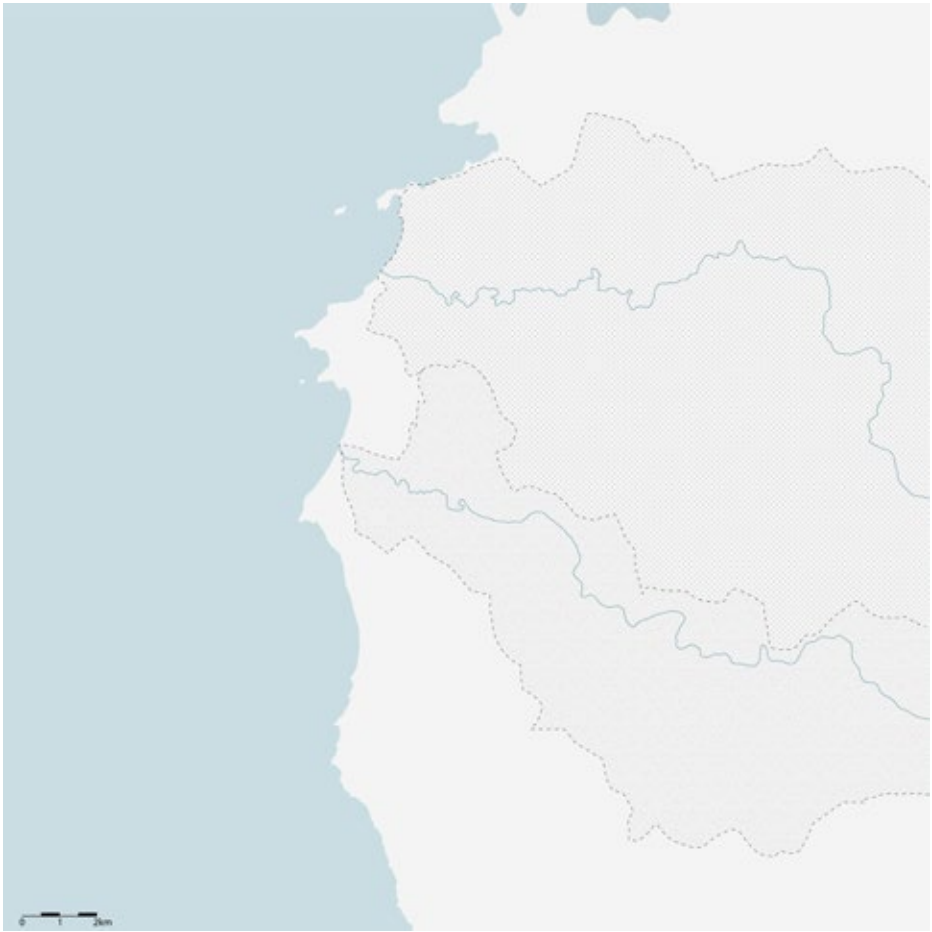
City hights goes from 2m als to almost 5.000 m als.

Rivers, streams and wetlands



Manzanares river 202.2 km2
Gaira river 113.8 km2
Wetlands

Catchment areas

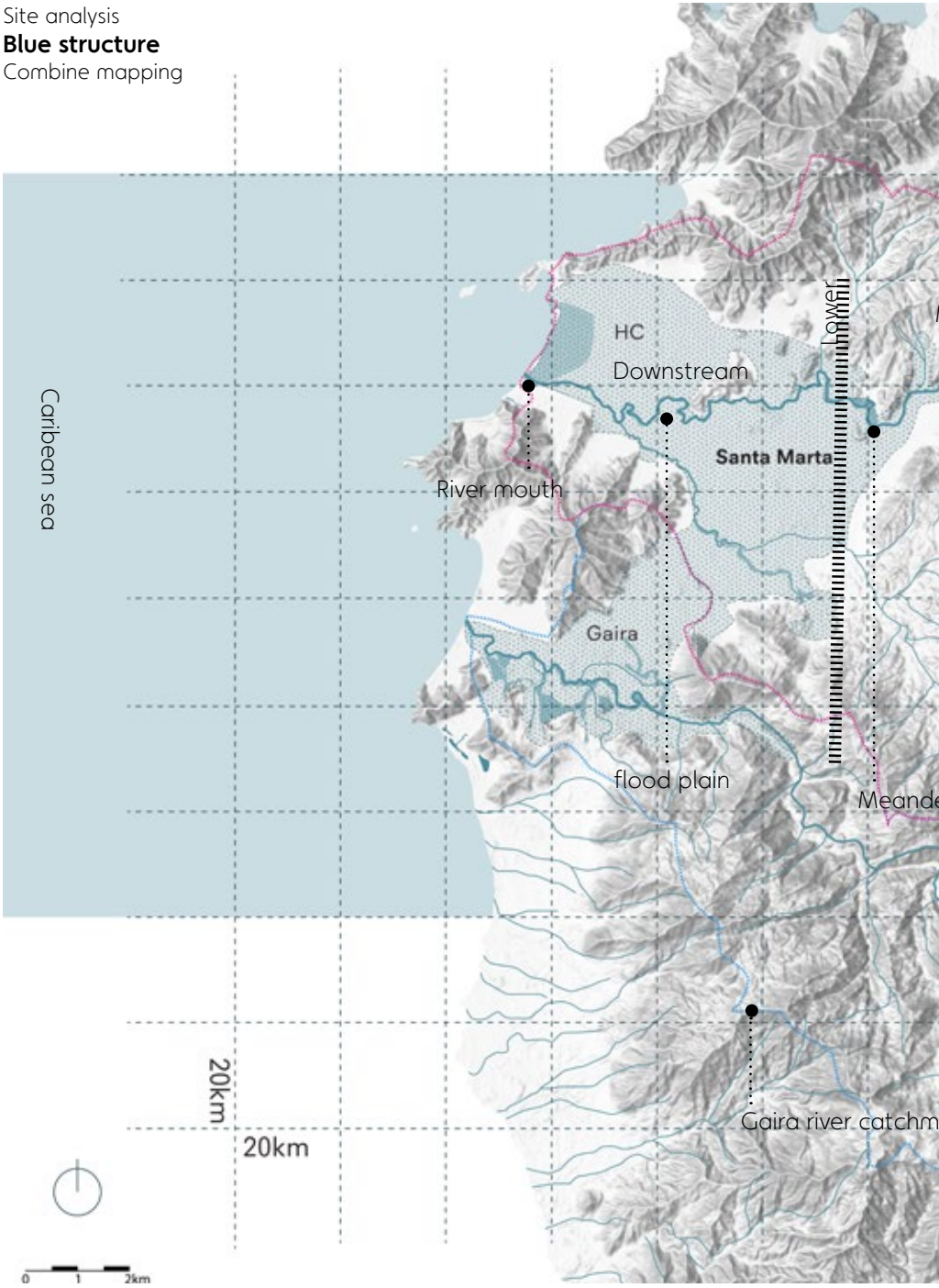


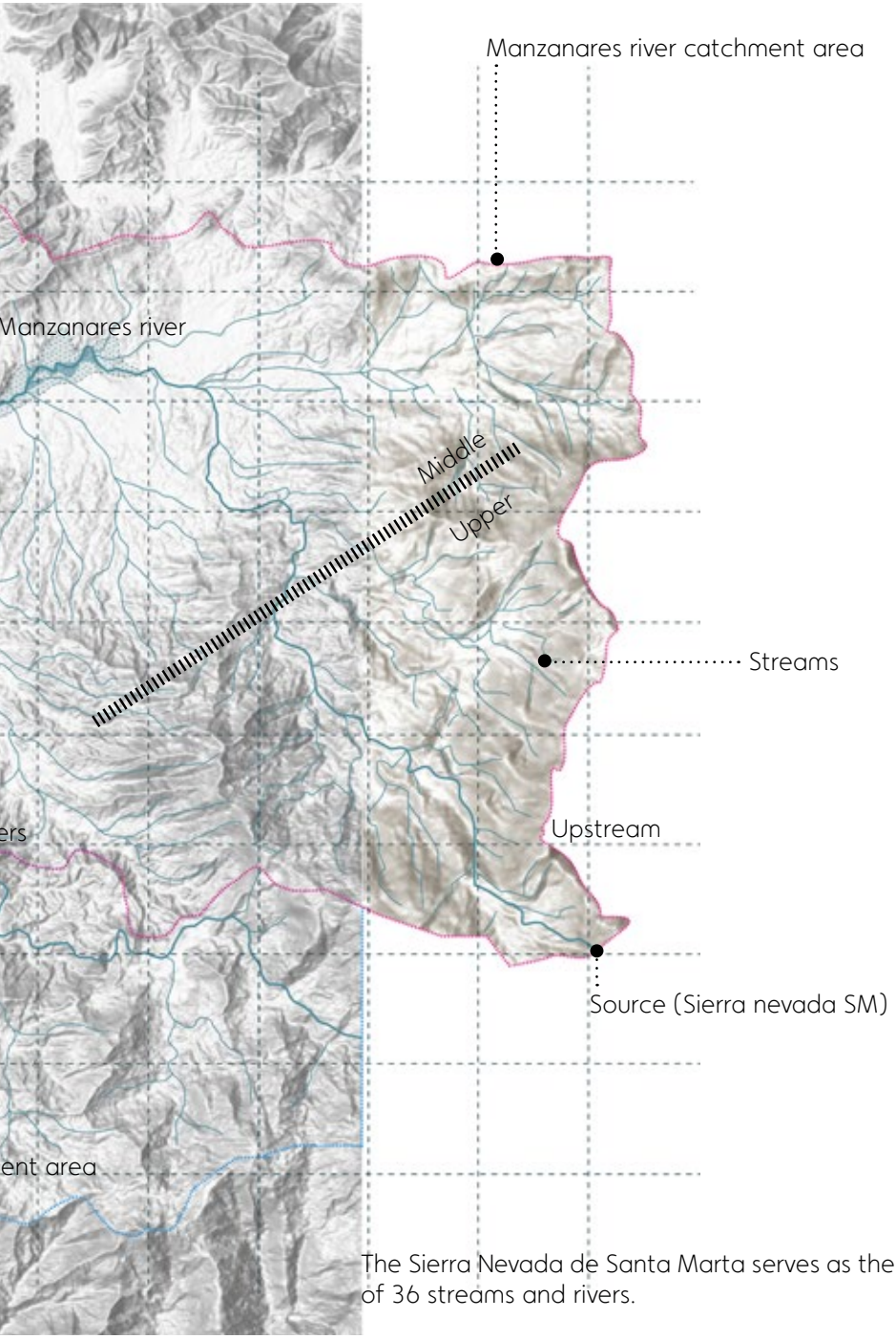
Catchment area Manzanares r.
Catchment area Gaira river

Storm floods

Susceptibility to flooding in Manzanares and Gaira rivers basin

Aquifer recharge zone
Flood risk zones

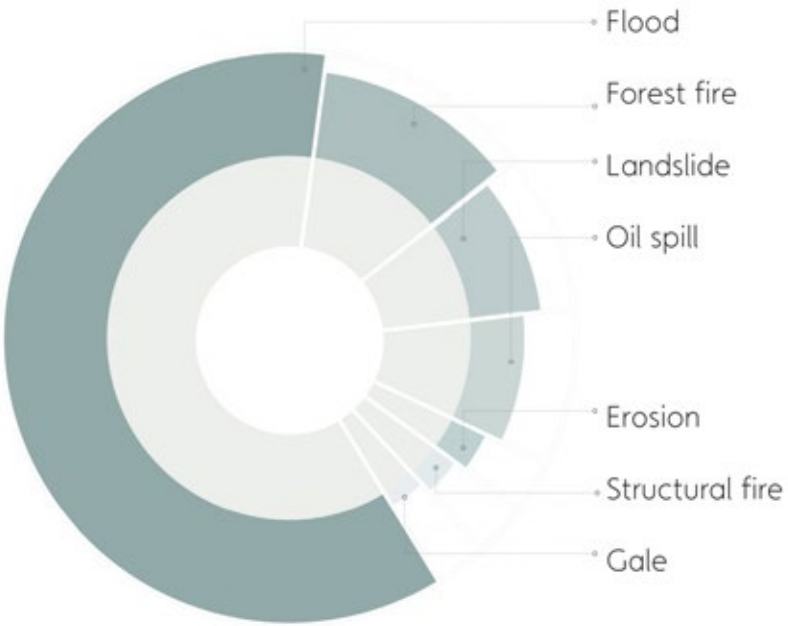

Caribean sea
HC
Downstream
Lower
Santa Marta
River mouth
Gaira
flood plain
Meande
Gaira river catchm
20km
20km
0
1
2km



The Sierra Nevada de Santa Marta serves as the source of 36 streams and rivers.

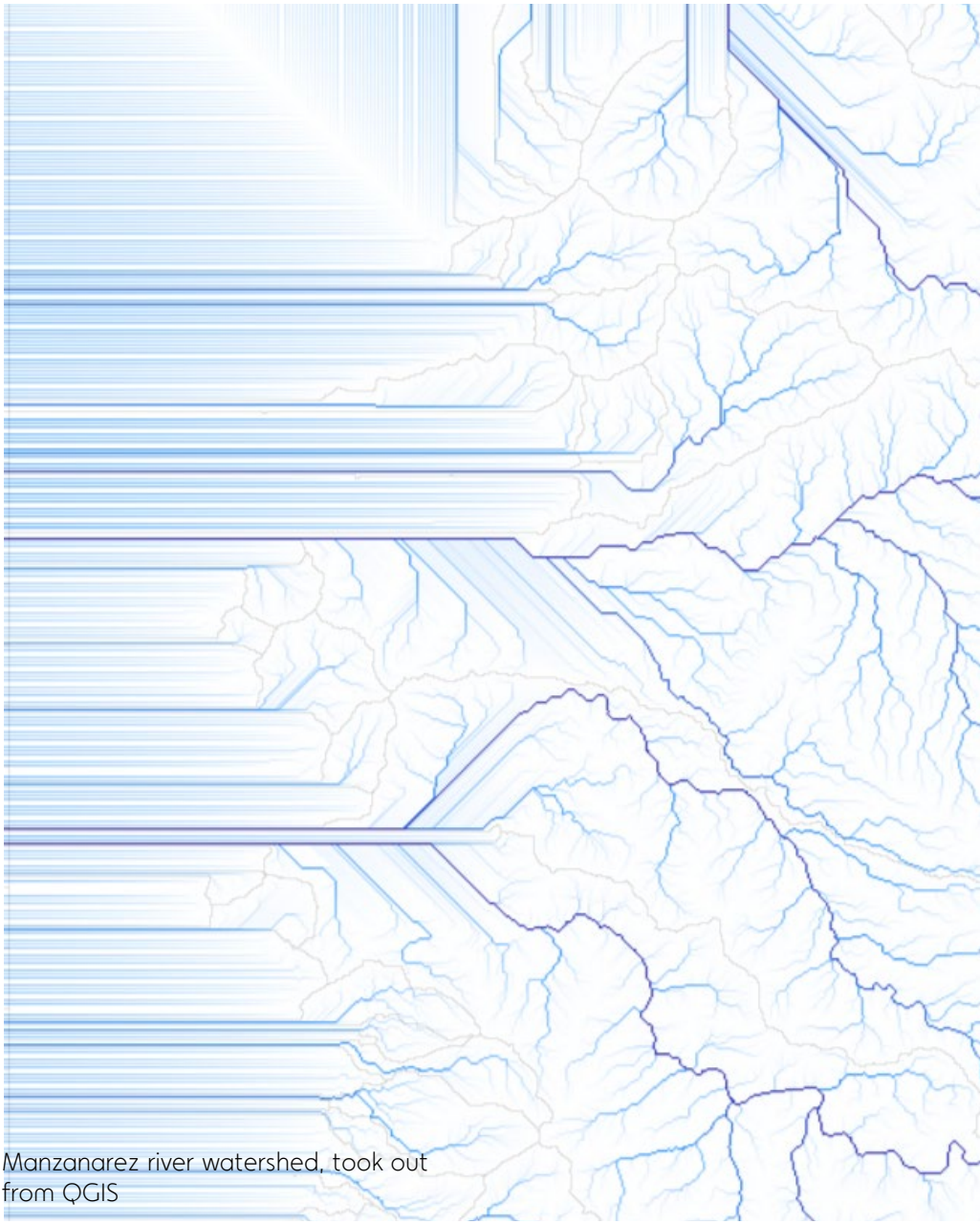
	Temperature	Rain	
Jan	25.1°C	4 mm	0,5
Feb	25.3°C	3 mm	1
Mar	25.5°C	6 mm	1
Apr	25.6°C	38 mm	3
May	25.5°C	132 mm	8
Jun	25.8°C	99 mm	9
Jul	25.8°C	80 mm	7
Aug	25.7°C	88 mm	9
Sep	25.2°C	148 mm	12
Oct	24.8°C	213 mm	15
Nov	24.9°C	141 mm	10
Dec	25.2°C	25 mm	3

Wind Rose

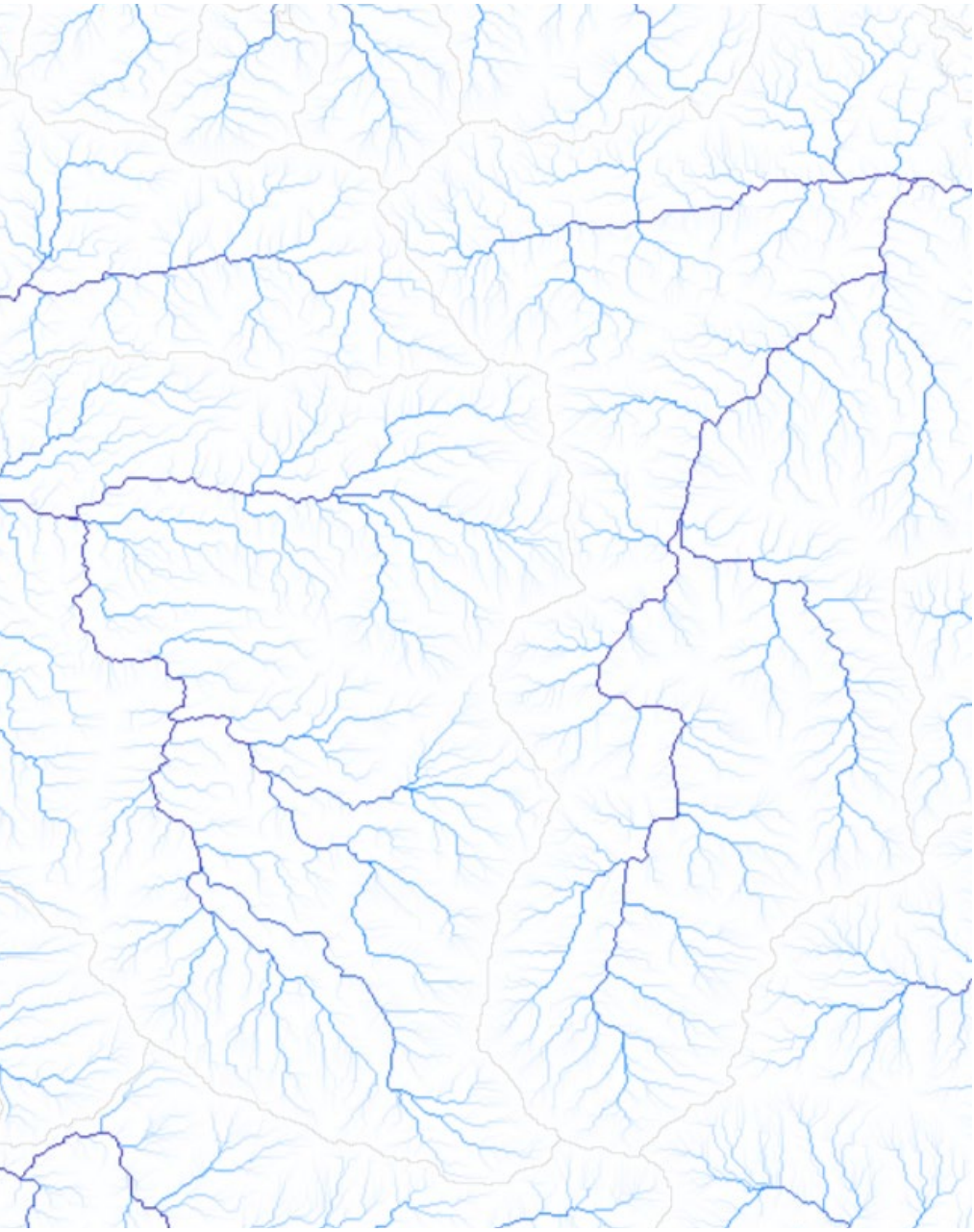


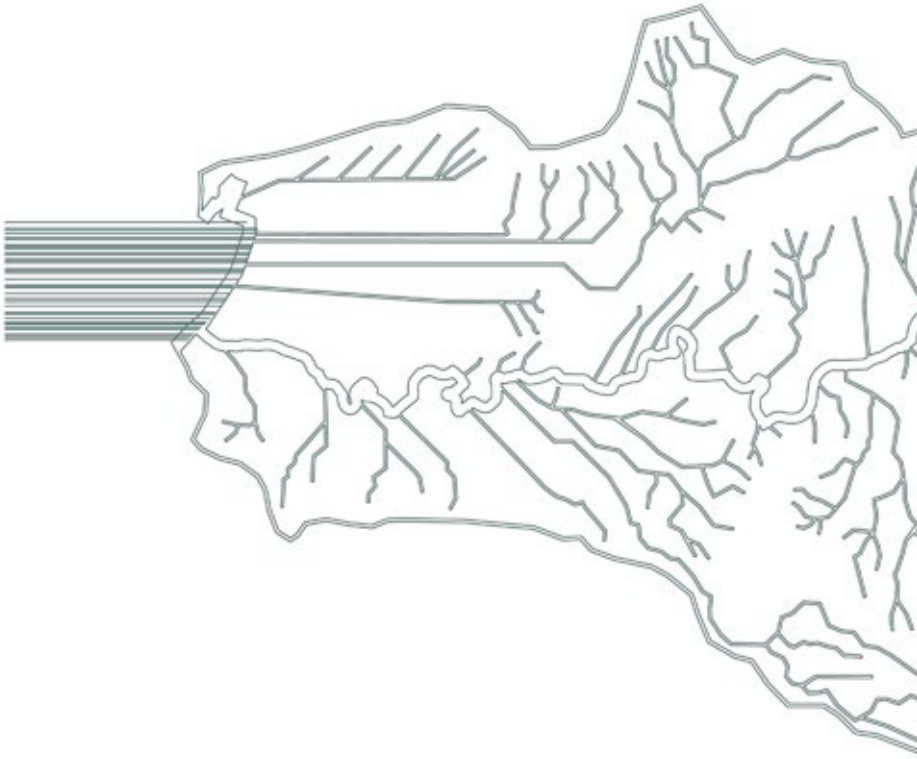
Santa Marta is a city of contras characterized by a very dry weather during the first months of the year and a heavy monsoon season with the high peak on October when the city suffers of flooding events. Stormfloods represent the 65 percent of risk events every year.

Site analysis
Blue structure
Watershed frim QGIS



Manzanarez river watershed, took out from QGIS





Manzanarez river watershed, reconstructed on rhino, to get a better understanding of the tributaries and the dainage system

Paper lace of Manzanarez river watershed scale 1:100.000

Site analysis

Blue structure

Santa Marta, 100 Tr flood events

River

Streams

Areas at low risk of flooding due to rains, coastal erosion

Areas at medium risk of flooding due to rains, coastal erosion

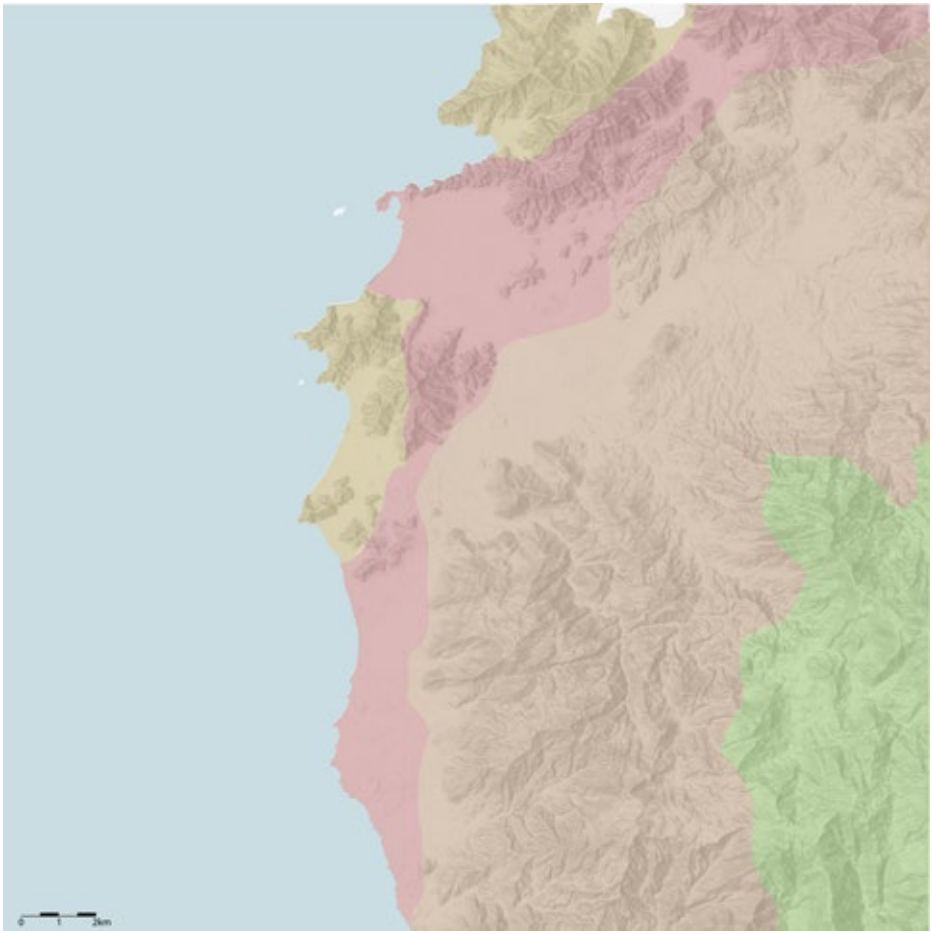
Areas at high risk of flooding due to rains, coastal erosion

Caribean sea

150m 500m

50m 300m

Zonobiomes in the city



- Tropical desert zonobiome
- Tropical xerophytic zonobiome
- Alternate-hydrogen tropical zonobiome
- Equatorial humid zonobiome

Z1 Tropical desert zonobiome

Little annual precipitation and up to ten months without rainfall during the year. The vegetation cover, under these conditions, can be low forest or xerophytic scrub.

Z2 Tropical xerophytic zonombiome

Forests or thickets of the isomegatermic floor, in areas where the season without rain is longer, reaching nine months a year. Under these conditions the most common plants show xeromorphic adaptations.

Z3 Alternate-hydrogen tropical zonobiome

Dry period that can last up to six months, during which time most of their trees lose their foliage. In the remaining months of the year there is no water deficit and the plants replenish their foliage, acquiring an appearance similar to that of an evergreen rainforest. It is found on the northern slopes, in the extreme northeast.

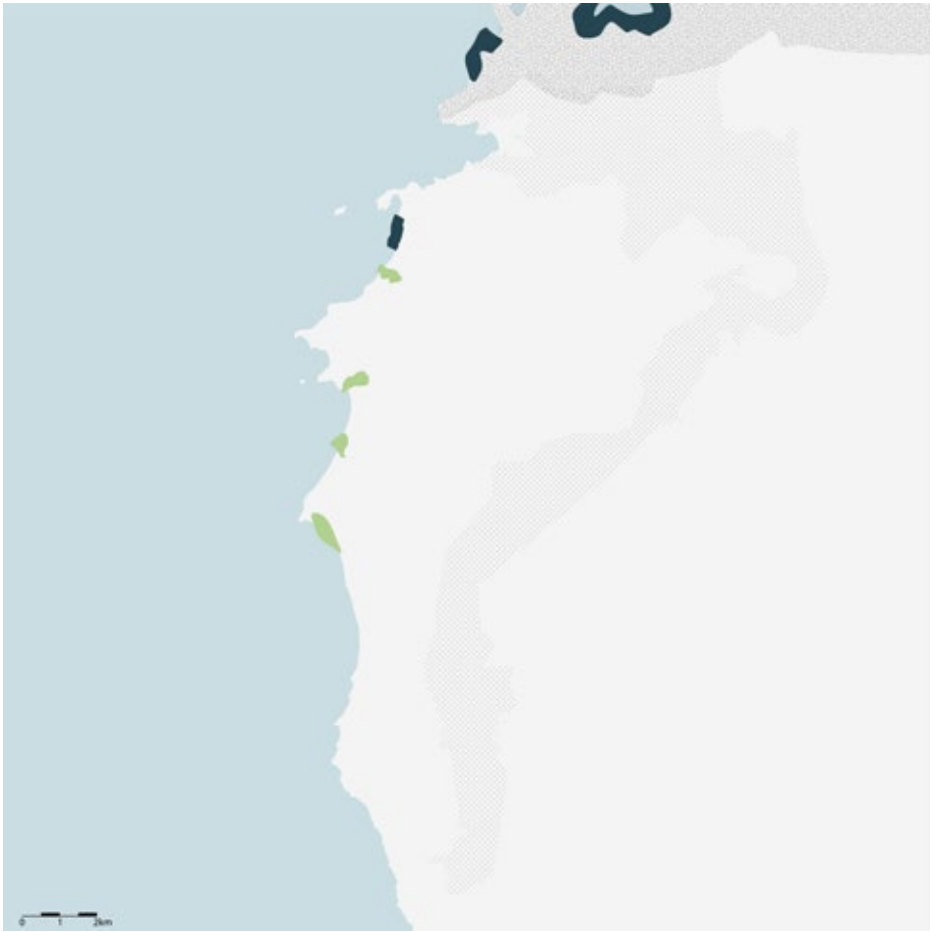
Z4 Equatorial humid zonobiome

Rainforests, evergreen foliage in most woody plants. It is found mainly on the north slope, between the Palomino and Mendihuaca rivers up to approximately 1,000 meters above sea level.

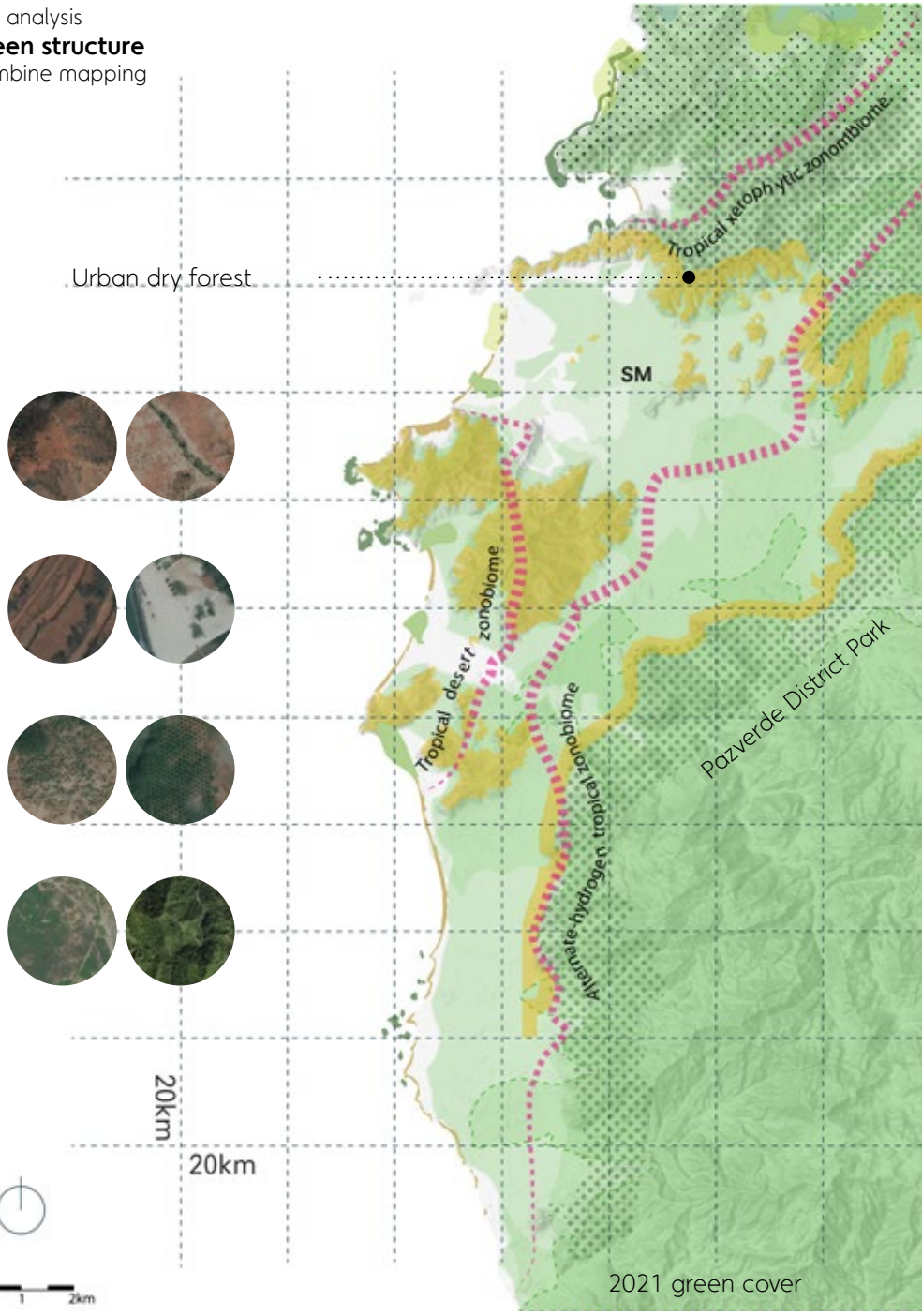
Ecosystems

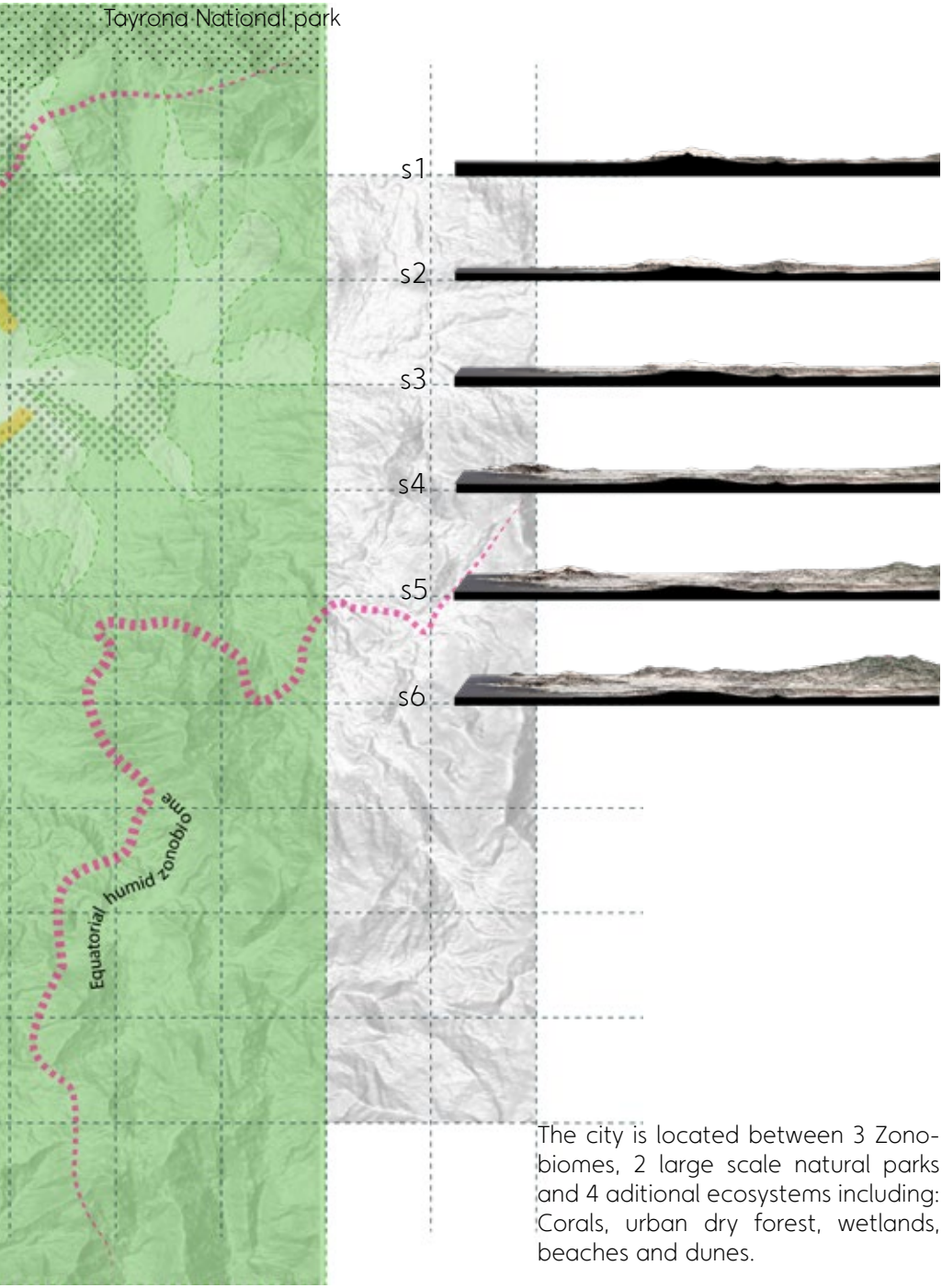
- Corals
- Urban dry forest
- Wetlands
- Beaches and dunes, 92 Ha

Mangroves, seagrass, and national parks



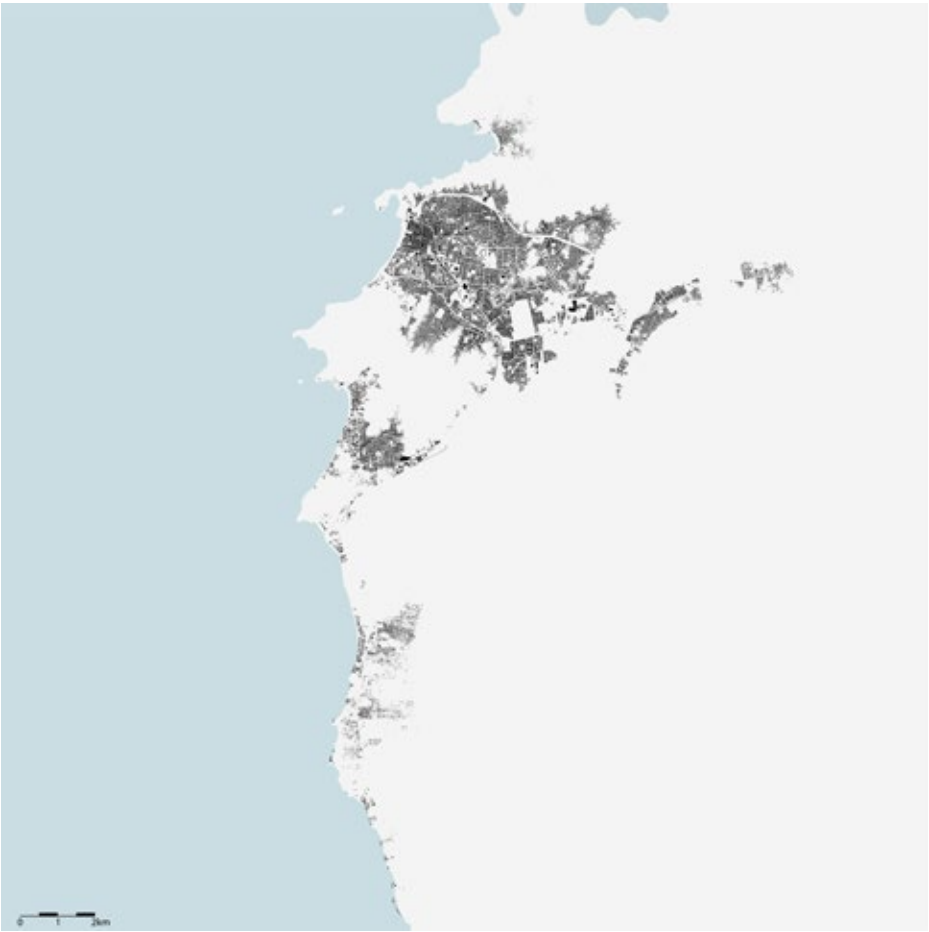
Mangroves
Seagrass, 264 Ha
Pazverde District Park
Tayrona National Park


Urban dry forest
Tropical xerophytic zonobiome
SM
Tropical desert zonobiome
Alternate-hydrogen tropical zonobiome
Pazverde District Park
20km
20km
0
1
2km
2021 green cover

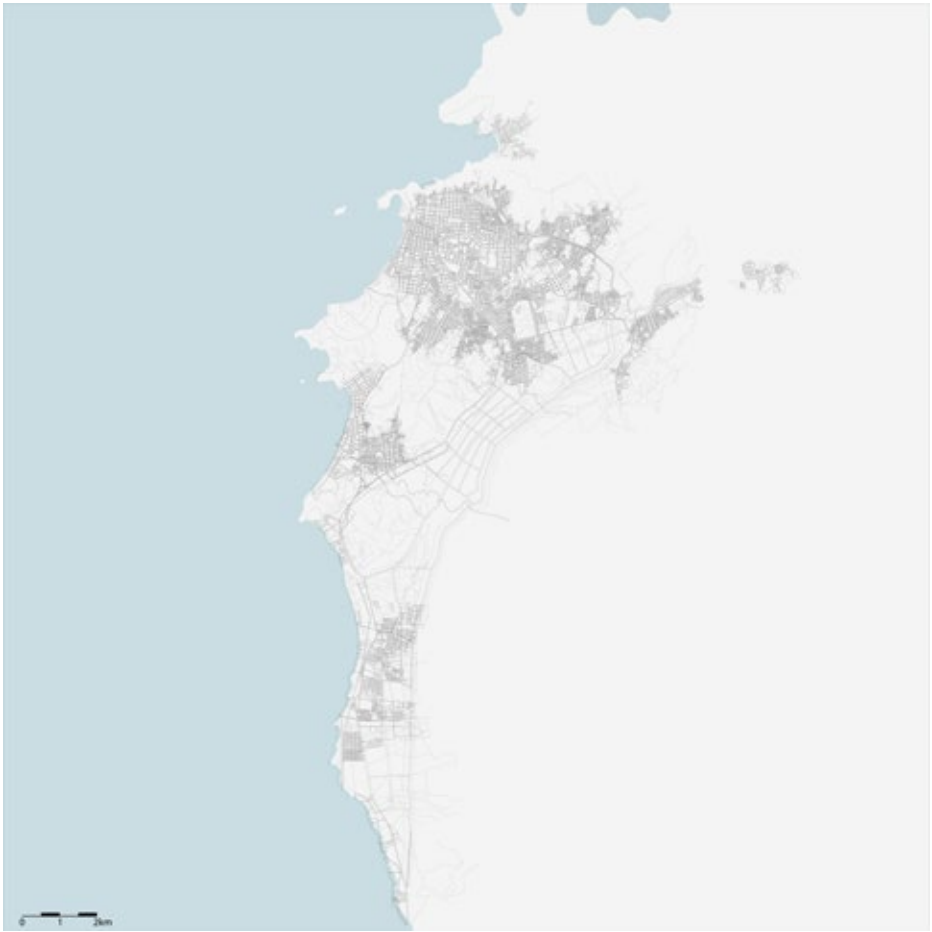


The city is located between 3 Zonobiomes, 2 large scale natural parks and 4 aditional ecosystems including: Corals, urban dry forest, wetlands, beaches and dunes.

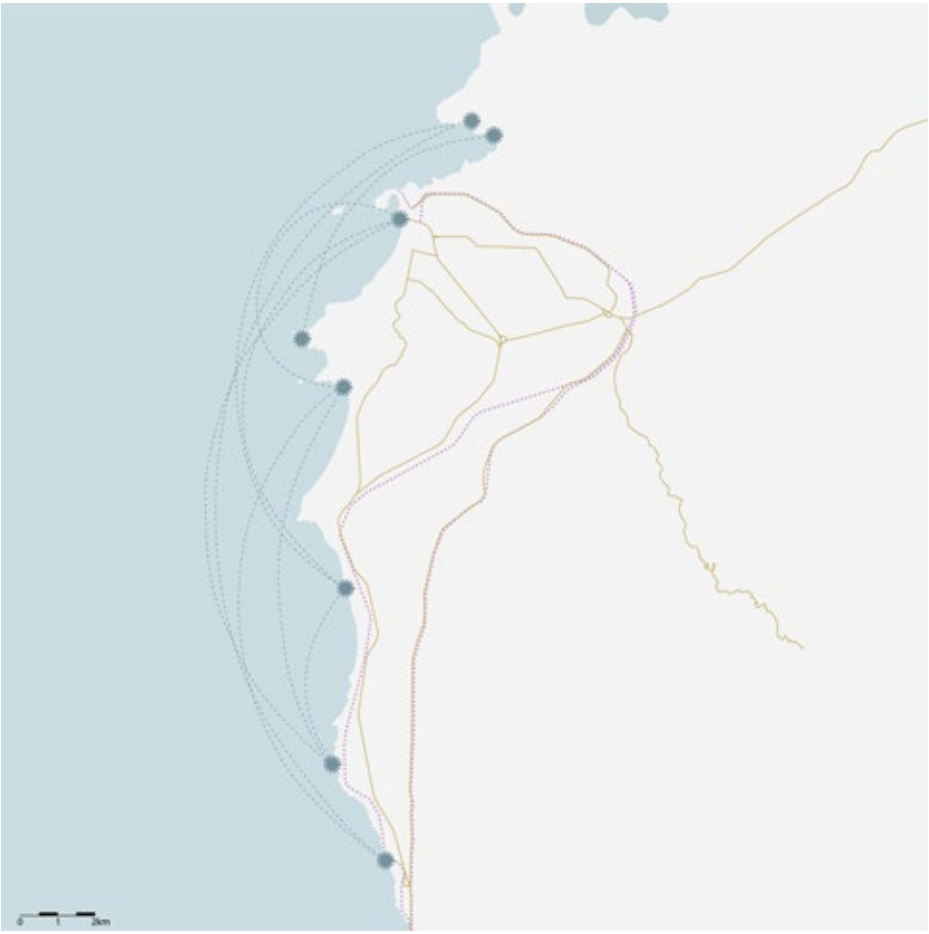
Solid-void



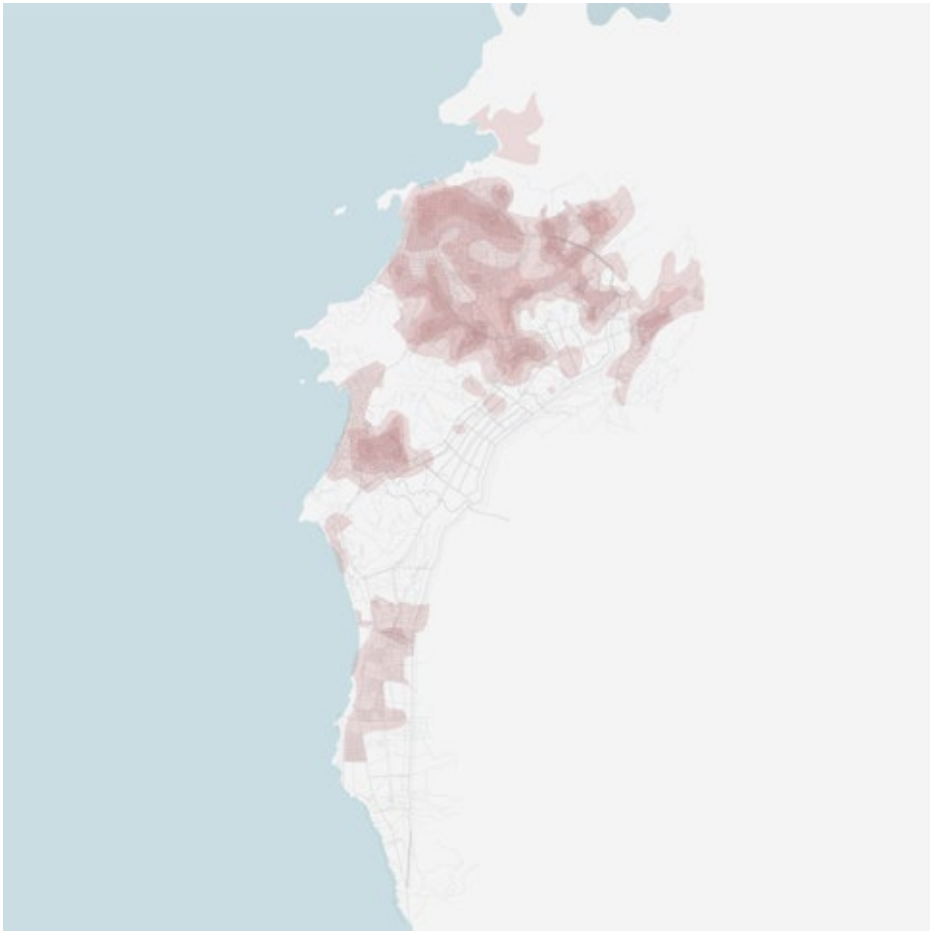
Infrastructure

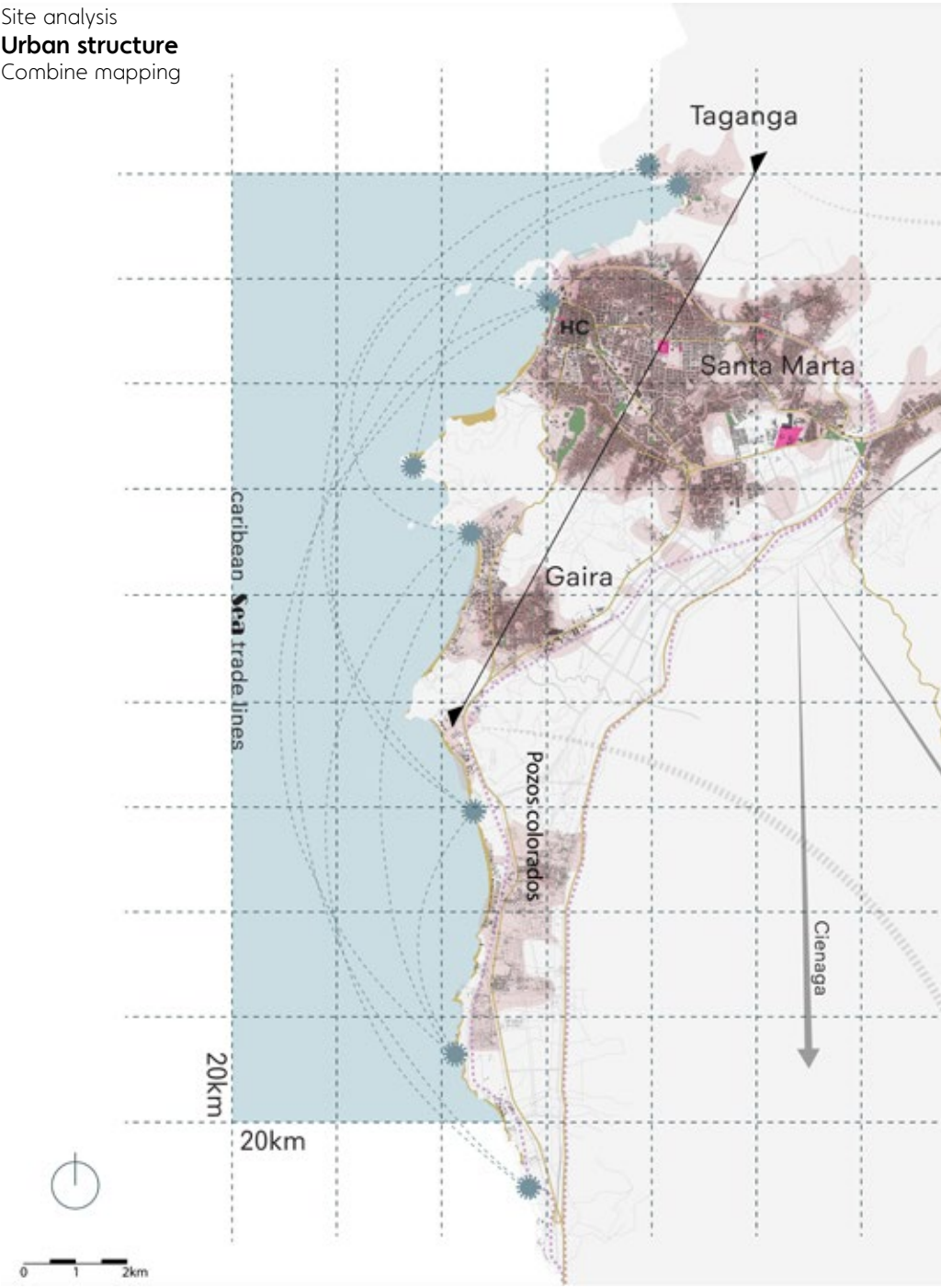


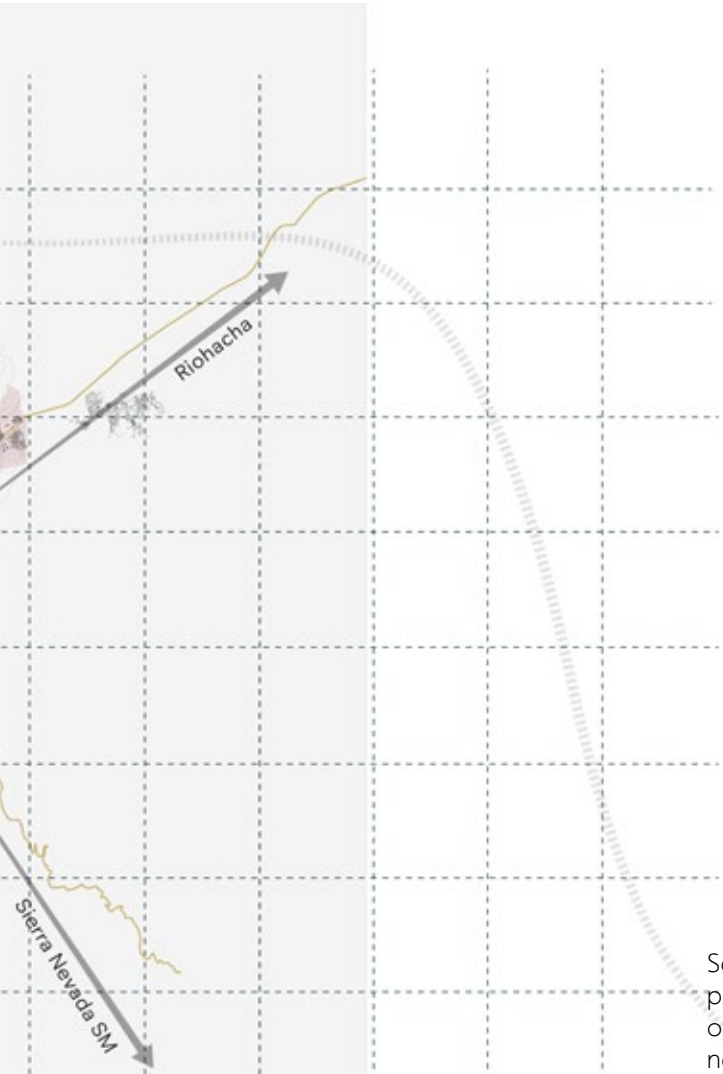
Ports



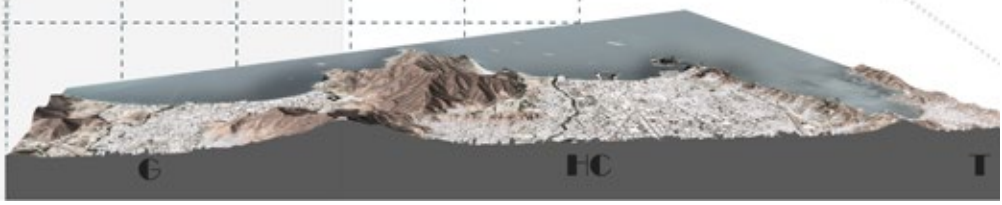
Population density




Taganga
HC
Santa Marta
Gaira
caribean sea trade lines
Pozos colorados
Cienaga
20km
20km
0
1
2km



Santa Marta has a lack of public space. The existing ones present a desert a non-porous characteristic.



Seguimiento (2018) Picture of Flooding in Santa Marta. Figure 5. https://seguimiento.co/la-sa-maria/galeria-asi-quedo-santa-marta-tras-la-lluvia-de-este-jueves-15431

Conclusion

The areas most affected by storm floods are the city center and along the Manzanares river.

In addition to a lack of public space, the city expansion produced a disconnection between the green and blue structures in the city.

It is necessary to design a system that, allowing the natural flow of the water through permeable surfaces, stoping the water before it arrives at the most affected areas. That recognize the climate change conditions and that makes friends with water.

El Informador (2019) Storm Flood Santa Marta. Figure 7. https://www.elinformador.com.co/index.php/el-magdalena/81-distrito/210750-torrencial-aguacero-en-santa-marta

Presedents
Pre-Diploma

Sanya Mangrove Park

Qunli Stormwater Park

The Floating Gardens

Ningbo Eastern New Town Ecological Corridor

Sponge city references. https://www.turenscape.com/en/project/index/4.html

Qian'an Sanlihe River Ecological Corridor

Tianjin Qiaoyuan Wetland Park

How other cities have adress flooding problems?

In China has been developed the concept of Sponge city. Where cities are designed to passively absorb, clean and use rainwater, allowing the natural flow of the water through permeable surfaces that catch in some cases the 70% of rainwater.

"The Sponge City indicates a particular type of city that does not act like an impermeable system not allowing any water to filter through the ground, but, more like a sponge, actually absorbs the rain water, which is then naturally filtered by the soil and allowed to reach into the urban aquifers. This allows for the extraction of water from the ground through urban or peri-urban wells. This water can be easily treated and used for the city water supply. "

https://www.worldfuturecouncil.org/sponge-cities-what-is-it-all-about/

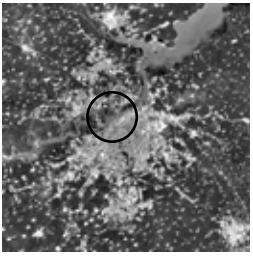
How to manage stormwater in the city?

Precedent analysis

Qunli Stormwater Park by Turenscape

Location

34Ha



Harbin,China

Qunli Stormwater Park

Designed in 2009 by Turenscape in Harbin city, China. The park area is 30 Ha. Developed with the idea of been part of a sponge city.

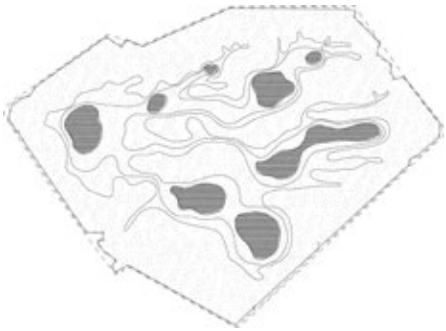
"A sponge city is a city designed to passively absorb, clean, and use rainwater. Cities designed to allow the natural flow of the water to go back using a wetland system to retain and keeps the water instead of draining away." Kongjian Yu

This project presents a stormwater park that acts as a green sponge, cleansing and storing urban stormwater, which can be integrated with other ecosystem services including the protection of native habitats, aquifer recharge, recreational use and aesthetic experience, thus fostering urban development.

The park have ecofriendly terraces were land and water can meet depending on different levels of flood :

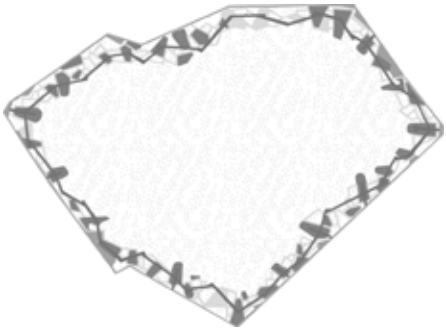
Dry season = Park for everyday use
Monsoon season = Flood terraces

80% of permeable floor that collects 70% of rainwater.

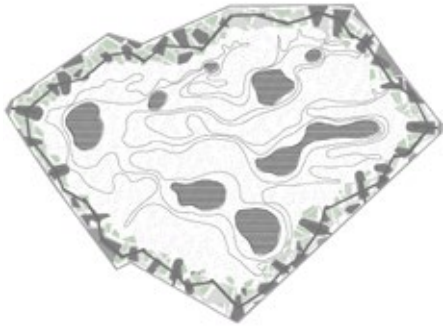


1.Leave the nature core wetland alone for the natural process of water storage.

2. Cut and fill, crearte ring of ponds working as water filters.



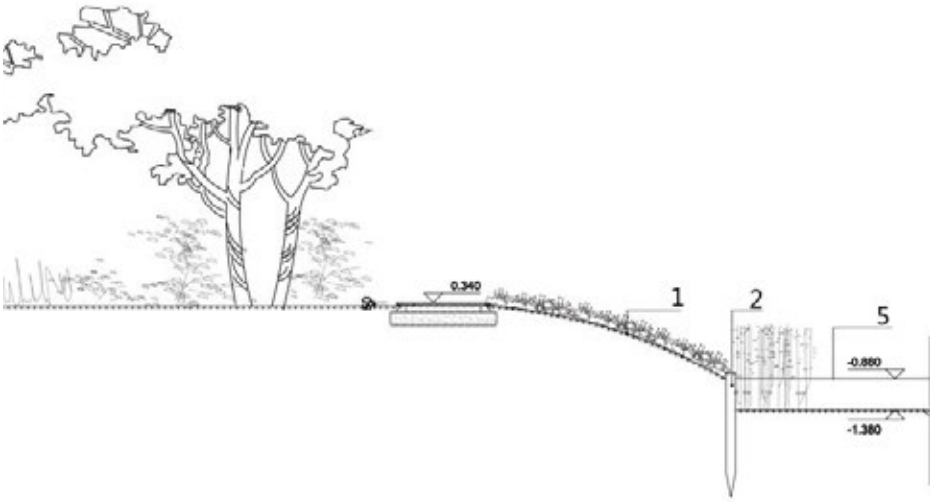
3. Path network in between ponds and mound bringing people close to nature.



4. Platforms, pavillions and viewing towers connected by an skywalk.

Section

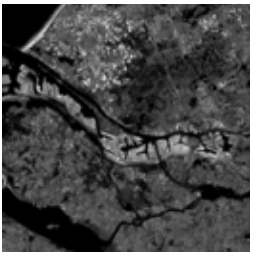
Zoom in Section



https://landezine.com/qunli-national-urban-wetland-by-turenscape/

Location

10Ha



Rotterdam, Neterlands

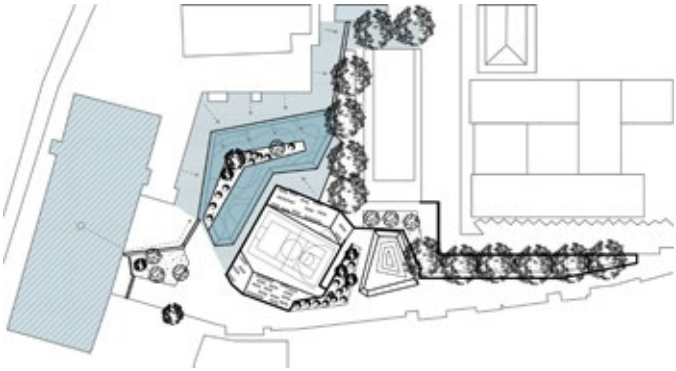
Waterplein
Benthemplein

Designed in 2011 by De Urbanisten, the project works as a square to stormwater storage, in dry time-space is use for play and lingering, in rainy time is used as a water collector. The square area is 9,500 m2.

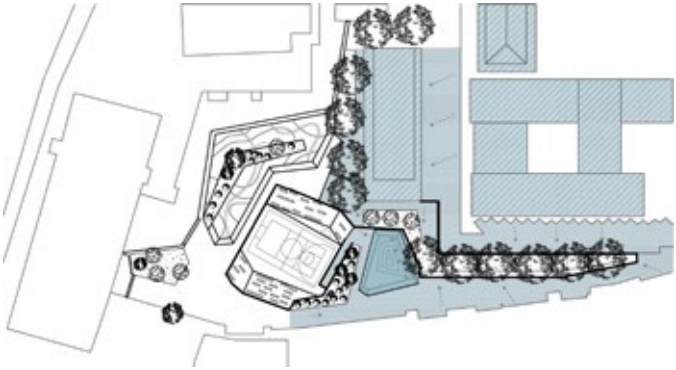
Three basins collect rain water: two undeep basins for the immediate surroundings will receive water whenever it rains, one deeper basin receives water only when it consistently keeps raining. Here the water is collected from the larger area around the square.

Rainwater that falls on the square runs via large stainless steel gutters over it, into the basins. When its dry, these places are fit for everybody on wheels and whoever wants to watch them doing their thing. The deep basin is a true sports pit, as well as a theatre to see and be seen. All that can flood is painted in shades of blue. All that transports water is shiny stainless steel.

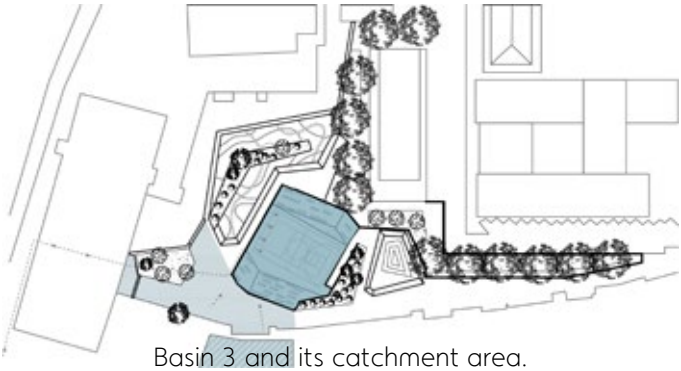
The space is gently defined and subdivided by a green structure of high grasses, colorful flowers and the existing large trees.



Basin 1 and its catchment area.



Basin 2 and its catchment area.



Basin 3 and its catchment area.

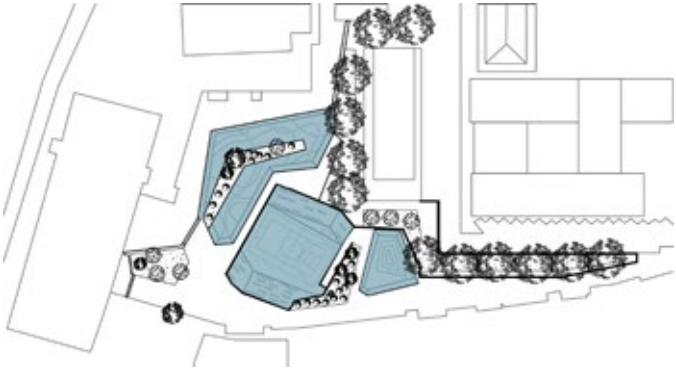
How to manage stormwater in the city?

Precedent analysis

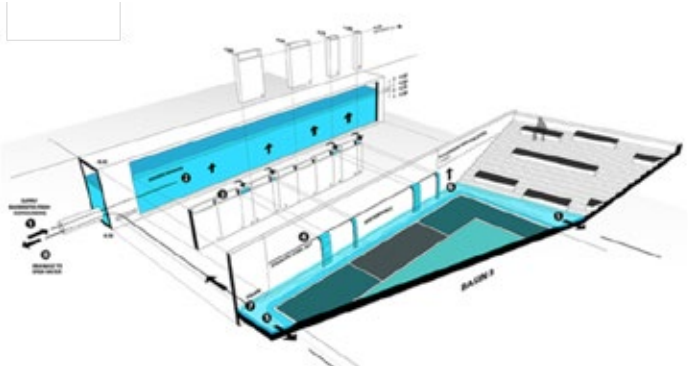
Waterplein Benthemplein by De Urbanisten

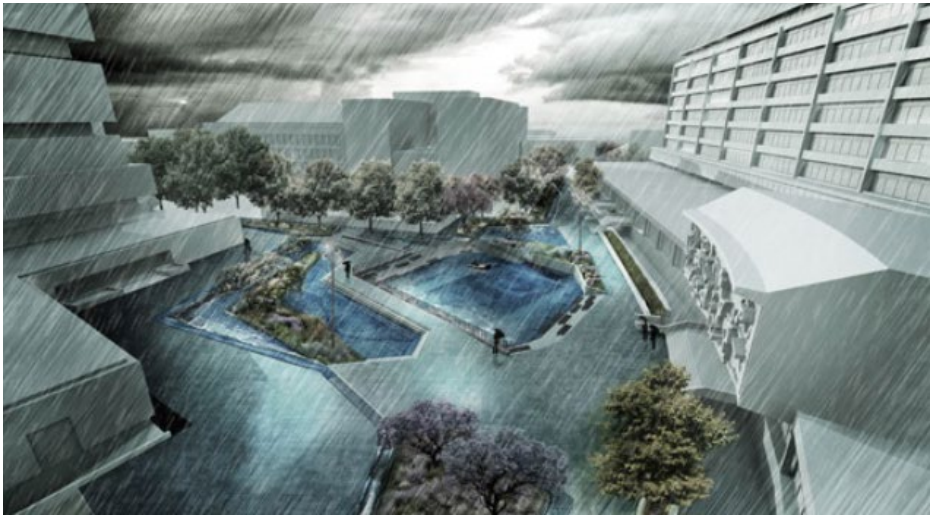
Dry condition

Flood condition



Section



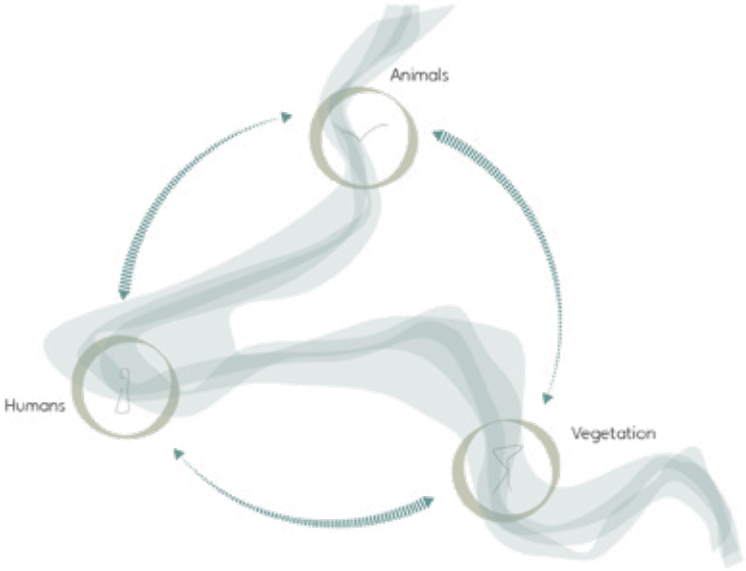


http://www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein

THE Project Diploma

Objective of the project:

The project objective is to connect the blue and green structures in the city to use stormwater as a creator of new dynamics. By transforming the city into a sponge, with a decentralized system. Stormwater is managed locally on-site, creating new recreational areas in an adaptive landscape that gives identity, and creates new ecosystems not only use for humans but also for other species.



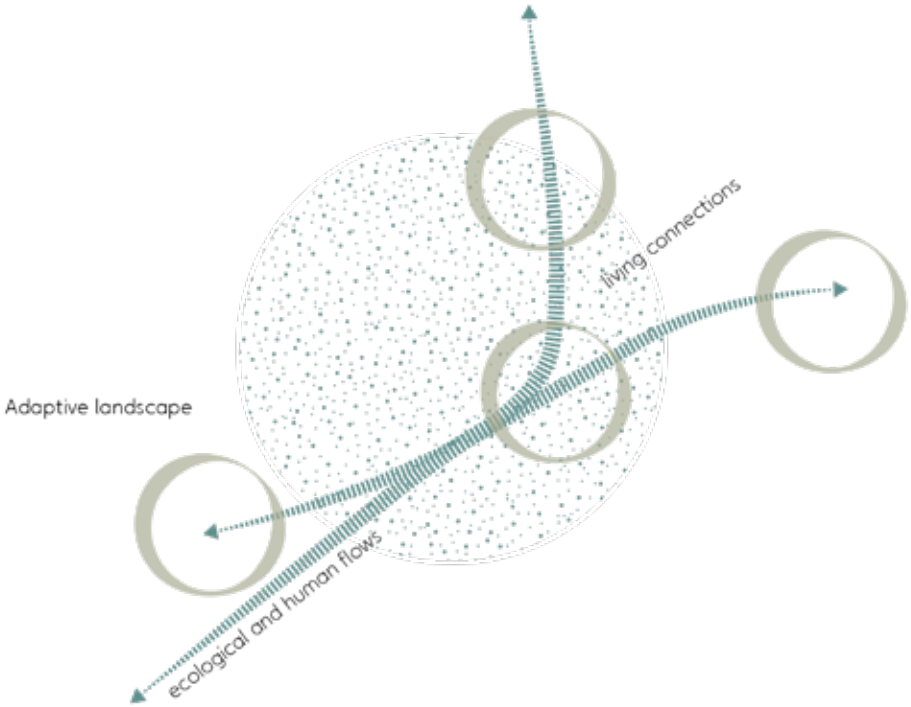
Audience of the project:

As Naoto Fukusawa says "Great design is a multi-layered relationship between human life and its environment."

The project recognizes the need of creating spaces not only for humans but also for animals, spaces that understand
and highlight the natural working of the world.
The porous park is designed as a connector element, part of a bigger network that integrates different users in the same place. Gives space for water that fertilizes the soil and allows the growing of vegetation. Frutal trees and water are an attractor for different bird species, the project work as a stepping stone for them, a space to eat, to rest, and to be between the Sierra Nevada de Santa Marta and the sea.

Shadow trees and topography that protect from the strong wind create a comfortable space for people to practice sports or to enjoy a man-made nature in the middle of the city.

Concept of the project



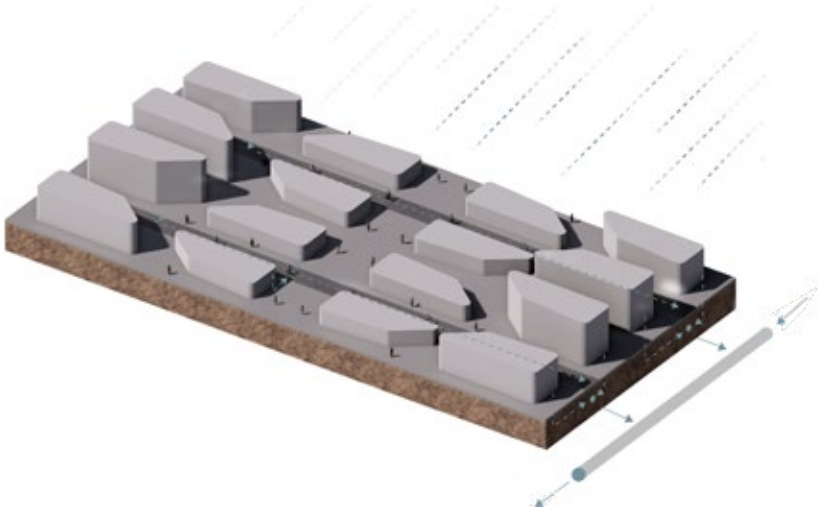
The project is base on create a porous landscape.
Pore: Is a small opening in a surface that let liquids to go trough. To pore is to flow continously and rapidly from one site to the other.

That is how the green and blue systems in the city should work, in a fluid and dynamic relation, with openings that allow the interaction between ecosystems, landscapes and users.

The porous system in the city works as a space composed of smaller elements that work toghether to create a bigger object, and at the same time interact to each other in an addaptative landscape.

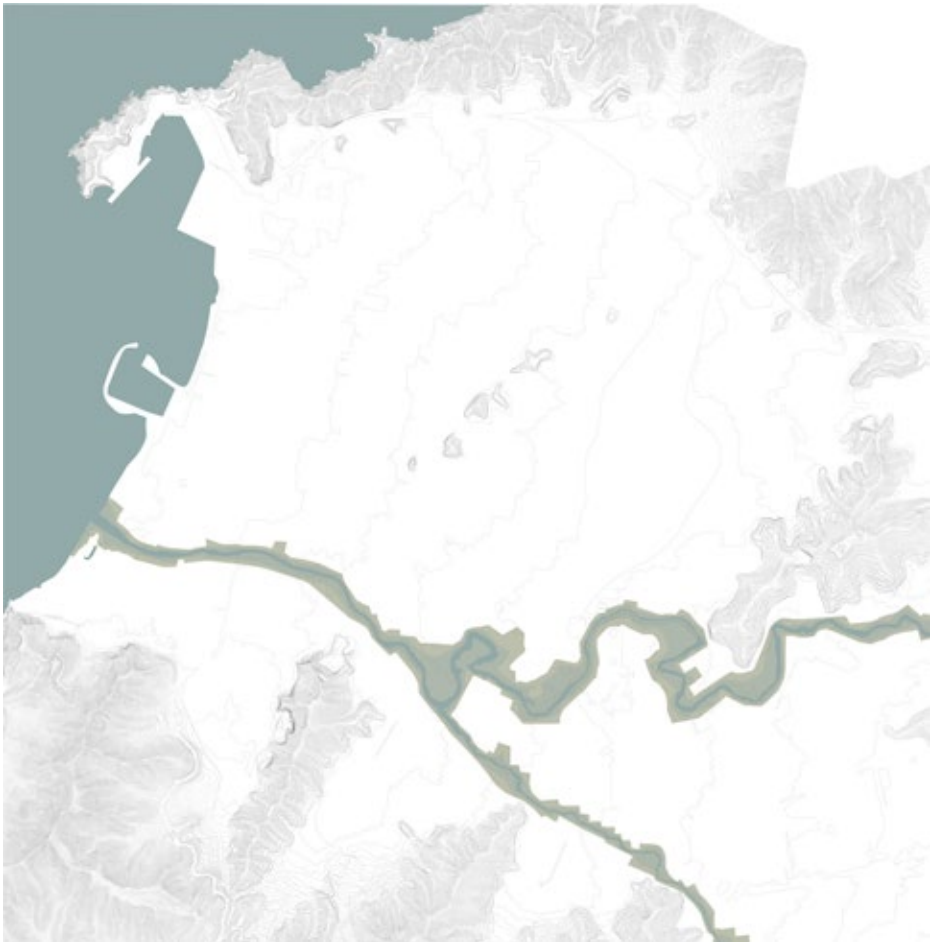
Principle of stomwater management

Centralized system



Decentralized system

Currently, the city manages stormwater by a pipe system, it is centralized, does not allow to increase its capacity. Centralized systems focus on getting rid of water as soon as possible.



1. Create a flooding buffer area (relocate illegal housing at safe areas) and give space to the river to grow during monsoon season in a safe area

2. Recover all the tributaries. Give space to the natural streams on the surface. Make visible the natural working of the water

3. Insert wet basins to filter and storage storm water and dry basins to increase system capacity at extreme flooding events.

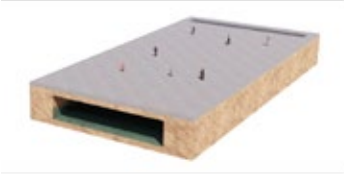
4. Porous system based on runoff reduction elements incorporated on public spaces that work to relieve the flood in the city, creates identity, new ecosystems and integrates comunities.

Diploma

Toolbox of runoff reduction elements

Catchment elements

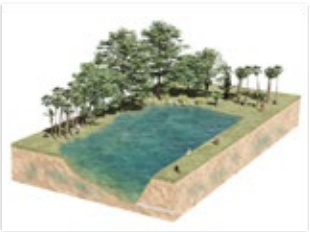
Porous pavement with detention tank



Porous ground, allow aquifer recharge

Green roofs

Storage elements

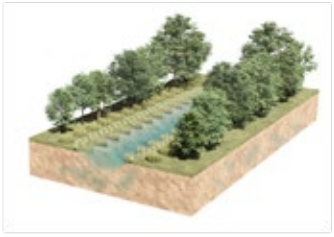


Dry pond, detention basin. Located where 2 afluents meet

Wet pond, retention basin. Located in the course of a stream

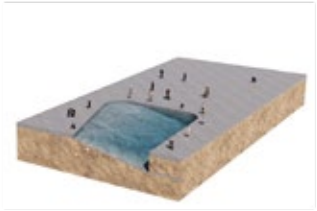
Connecting the system

Bioswale



Open water channel

Pipe



Rain garden, located alow the highways

Water feature. Located in plazas

A project by itself wonts solve the flood problems in the city, but a porous city system will help to relieve the flood in the most critical areas.

The system needs different elements to work, located across the city are catchment elements, connecting elements, and basins, these elements are interconnected and work together to allow control floods on public spaces in spread areas.

They work together to transform the city into a sponge, a permeable and porous city that wors down the principle of a decentralized system.

Diploma
Santa Marta Vision 2050

Diploma
Intermidate scale, urban connection

Flood 100 Tr

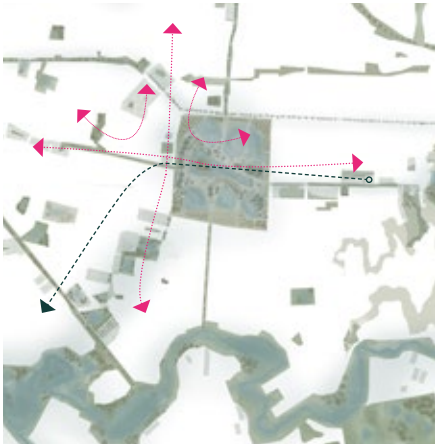
Topography

Green structure

Spread spaces for water

Diploma
Intermidate scale, urban connection

Slow movement network



Urban connections

The porous park

The park integrates into the porous city network, its objective is to be a multipurpose space, to create recreational spaces, and at the same time to regulate water. Reduces the flood in the historical center by managing the water on site.

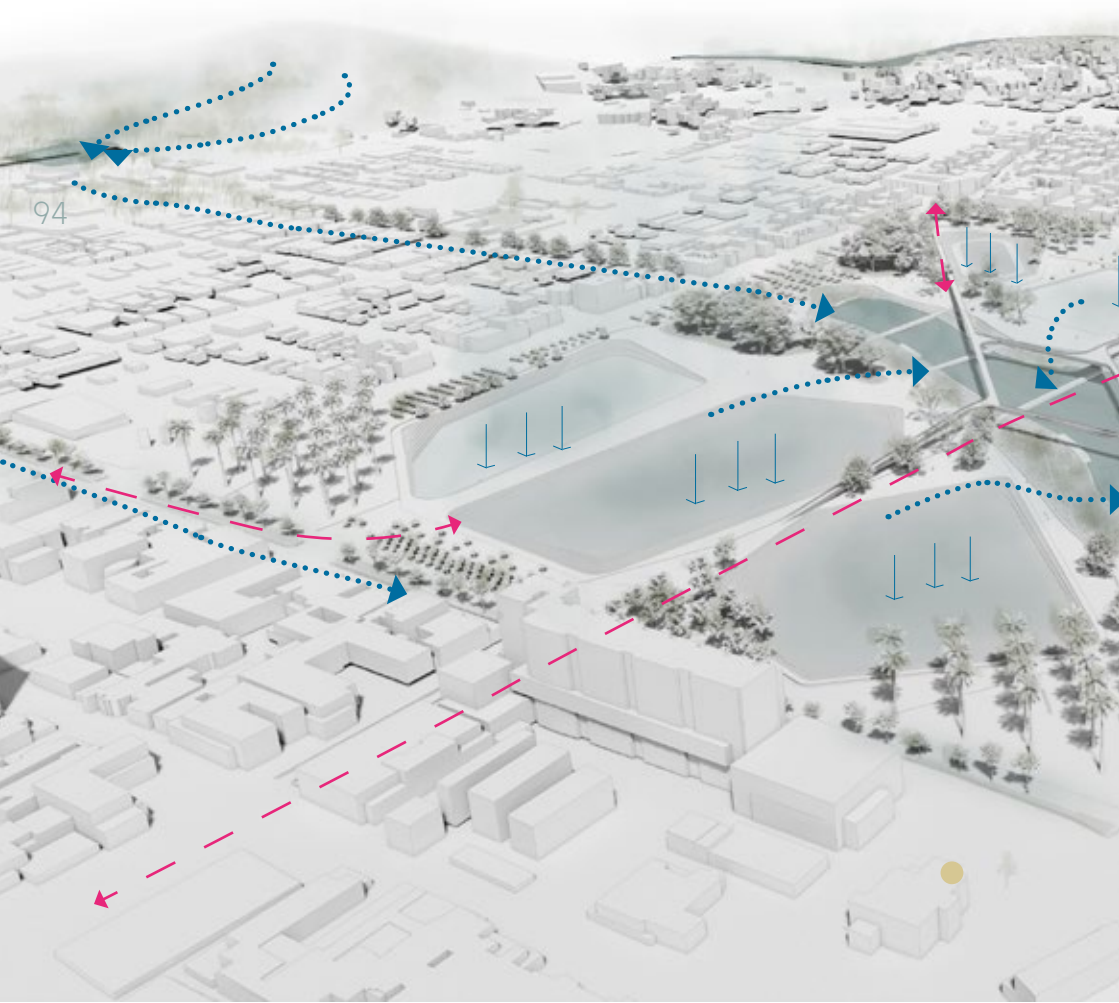
The inflow comes from the stream running from the hill at the east, the water flows through terraces with native submerged aquatics and emerging plants from the wet ground that clean the water before it arrives at the wet basin.

Diploma

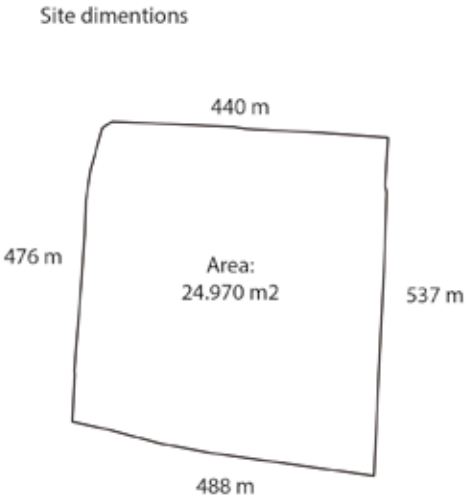
Intermidate scale, urban connection

In moments of high floods, the system increases its flooding capacity with a combination of dry and wet basins.

Dry basins work as sports fields in dry conditions, in addition, 80% of the park is located 0.20 m lower than the pedestrian ecotone, which allows flooding the whole area in an extreme flood event. A pedestrian bridge connects the ecotone and allows the normal flow of people, even when the whole park is under an extreme flood condition.




Pedestrian connections (urban porosity)
Water Flow
Bus stops



Stream
Flooding 100 TR
Contourlines 0,2 m
Residential and commercial buildings
Existing trees

Sport facilities

1. Stadium Eduardo Santos
2. Besiball stadium
3. Sport center
4. Softball stadium
5. Rugby field
6. Tennis court
7. Skate ring
8. Olimpic pool
9. Sport arena

Diploma
The porous park, local intervention
Actual situation

Diploma

The porous park, local intervention

Actual situation

The stadium has been abandoned, the structure is failing and falling apart. There are plans to dem\olige it.

The space in between the other sports facilities is desertic, arid, and don't give any identity to the city, do not connect with the green or blue structure and is not attractor for people.

Diploma
The porous park, local intervention
Actual situation

Diploma
The porous park, local intervention
Inspiration

Inspired on ancestral communities, specially its building techniques, materiality and quality of the space the project will use terracing in a different scale and not going up as the picture shows but in contrast of it, will do a negative terracing on the ground to make space for the water, at the same time that introduces stone as the construction material of the terraces.

https://ciudadperdida.co/arquitectura

Reorganize sport facilities

Giving space to water - opening the stream - Cut and fill

Introduce wet basins and filtrating terraces

Microtopography to directionates the water, protect the sport facilities from the wind

Introduce a 0.20m lowel level to work under emergency events

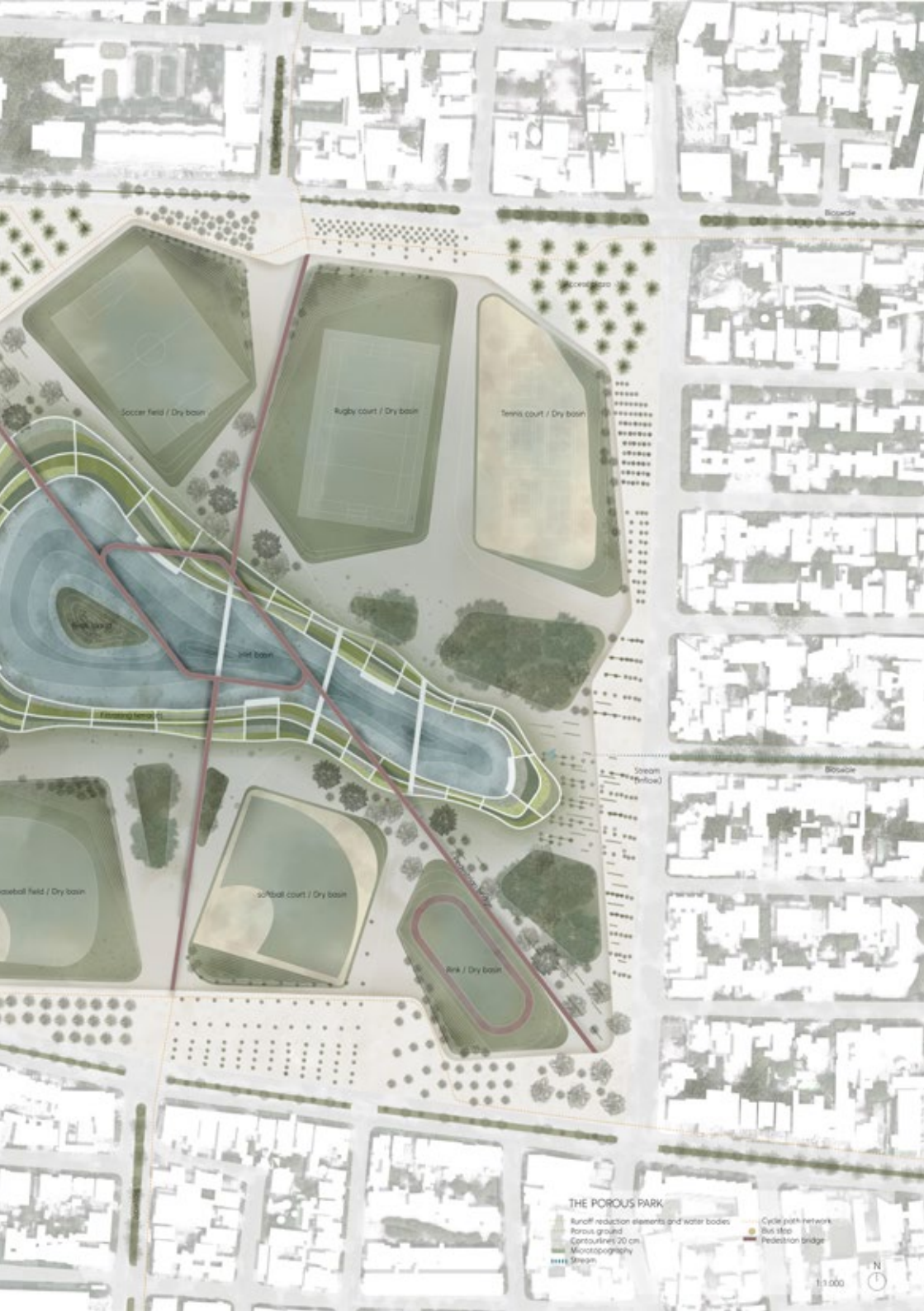
Pedestrian ecotone and urban connections

The porous park

The park integrates into the porous city network, its objective is to be a multipurpose space, to create recreational spaces, and at the same time to regulate water. Reduces the flood in the historical center by managing the water on site.

The inflow comes from the stream running from the hill at the east, the water flows through terraces with native submerged aquatics and emerging plants from the wet ground that clean the water before it arrives at the wet basin.

Diploma
The porous park, local intervention
Site Plan

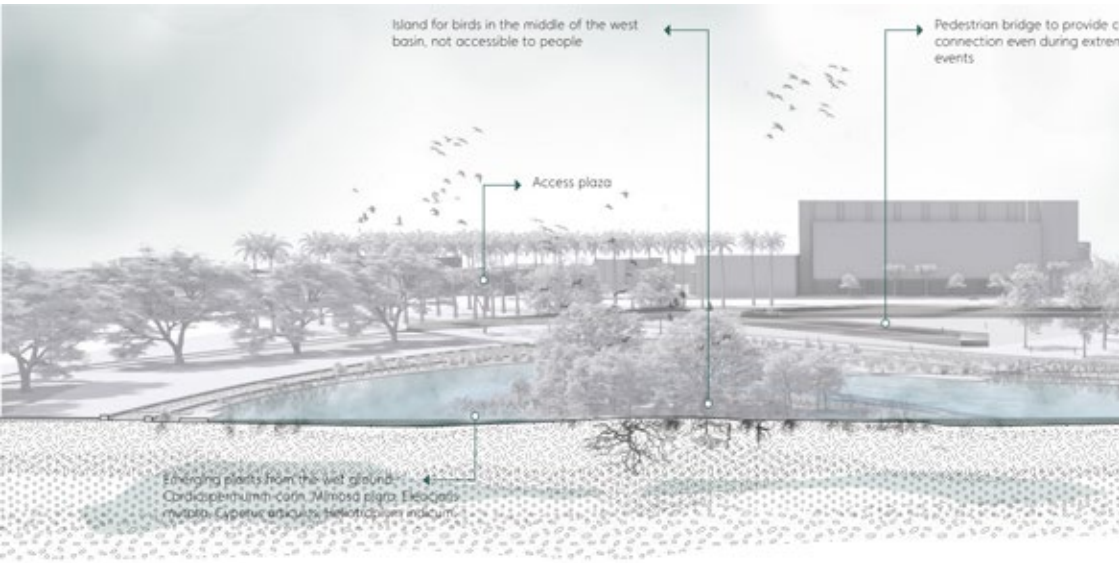

Soccer field / Dry basin
Rugby court / Dry basin
Tennis court / Dry basin
Joint basin
Stream (below)
softball court / Dry basin
Rink / Dry basin
THE POROUS PARK
Runoff reduction elements and water bodies
Porous ground
Contourlines 20 cm
Microtopography
Stream
Cycle path network
Bus stop
Pedestrian bridge
N
1:1.000

Diploma
The porous park, local intervention
Site Plan zoom

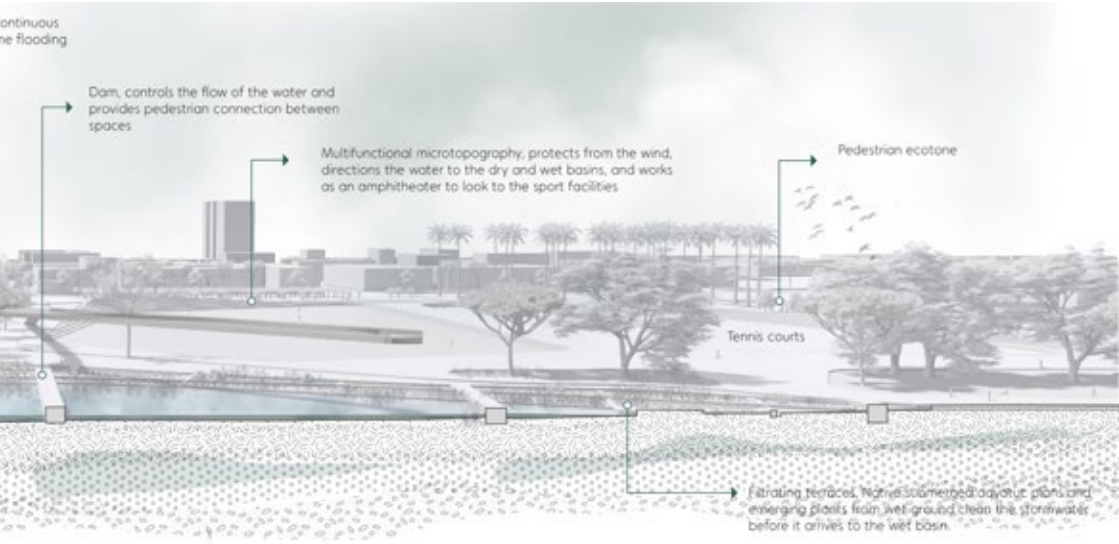
Diploma

The porous park, local intervention

Longitudinal sectional perspective

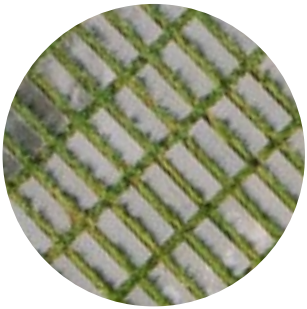


Wet basins are designed to store water in a spread way instead of a deep way. The spread management of the water allows to fertilize the soil and to keep safe deep of the water bodies.


ontinuous
he flooding
Dam, controls the flow of the water and provides pedestrian connection between spaces
Multifunctional microtopography, protects from the wind, directions the water to the dry and wet basins, and works as an amphitheater to look to the sport facilities
Pedestrian ecotone
Tennis courts
Filtrating terraces. Native submerged aquatic plants and emerging plants from wet ground clean the stormwater before it arrives to the wet basin.

Pavers 100% density

Pavers 75% density with pebbles



Pavers 75% density with grass

Crushed brick (recycled material)

Tree bark

Sand

The material selection is based on getting the most permeable materials possible to have a permeable ground to allow aquifer recharge.

In addition, all pavers are with local stone and go with different densities, from 100% density on the pedestrian ecotone to a 75% density mix with pebbles and grass, then transition from hard to soft, from dry to wet, from the exterior to the interior of the park.

Flooding on site

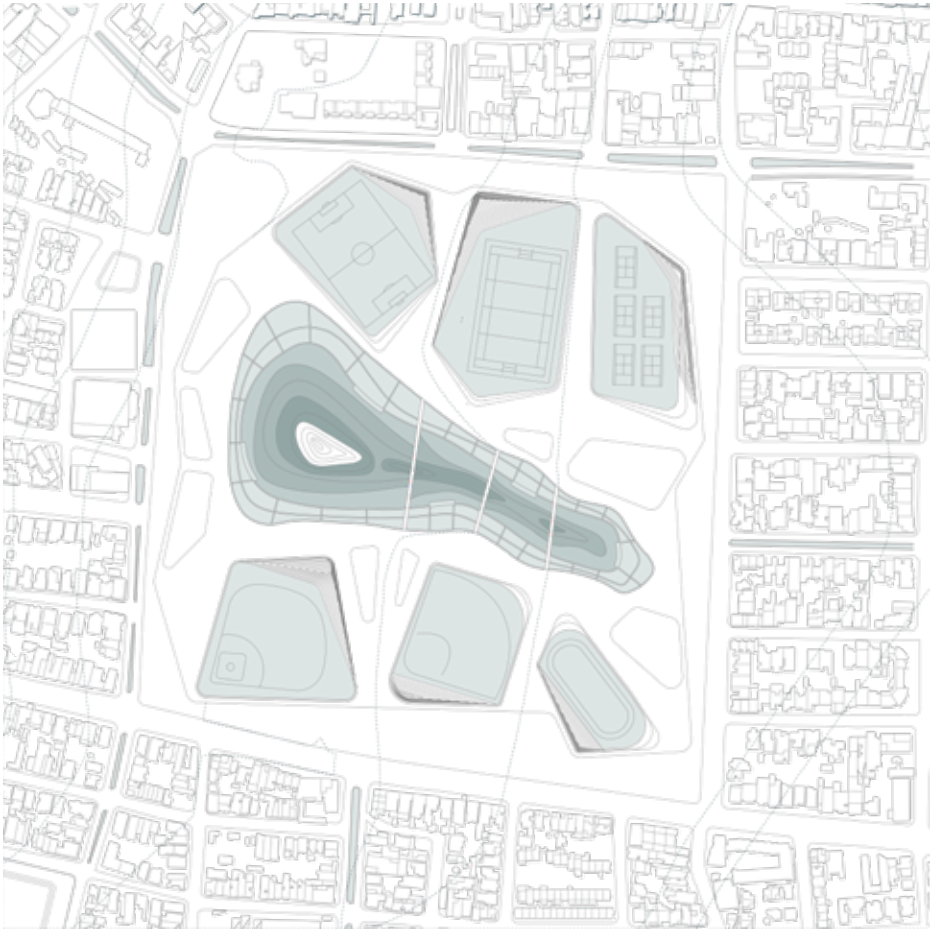
Actual situation

Flooding in an adaptive landscape

Dry condition

Jn F M

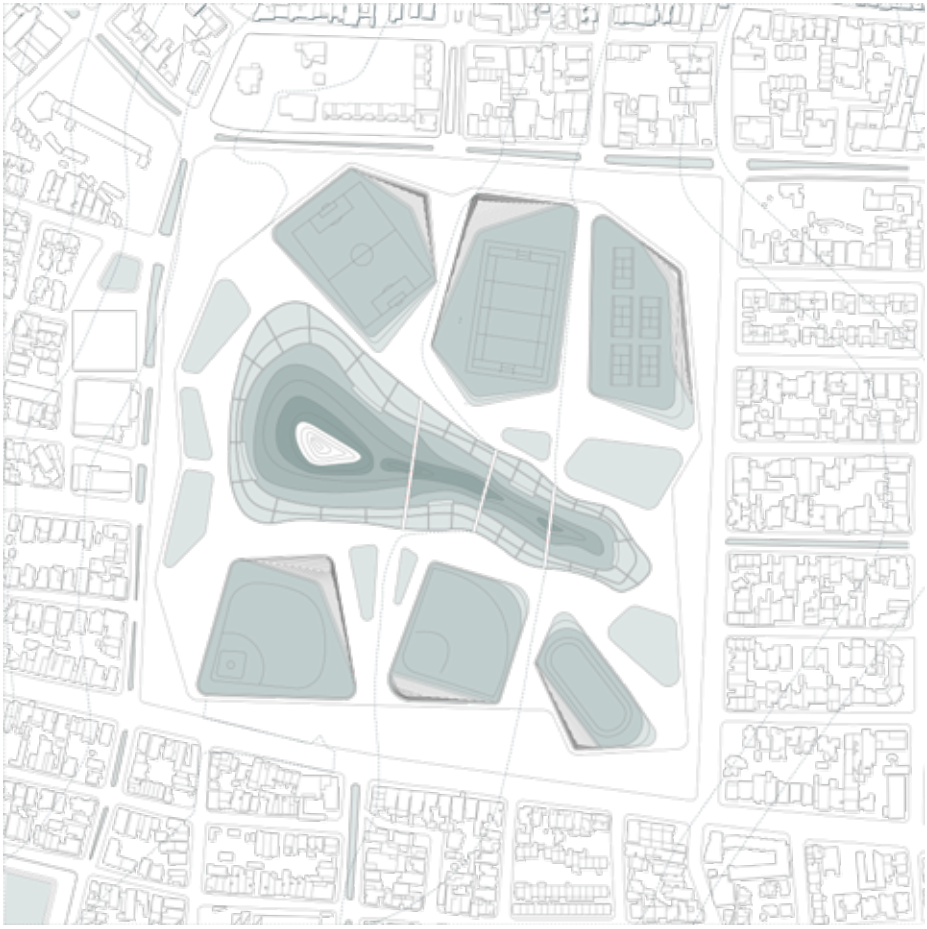
Flooding in an adaptive landscape



Moderate flood condition

Ap Jn Jl Au D

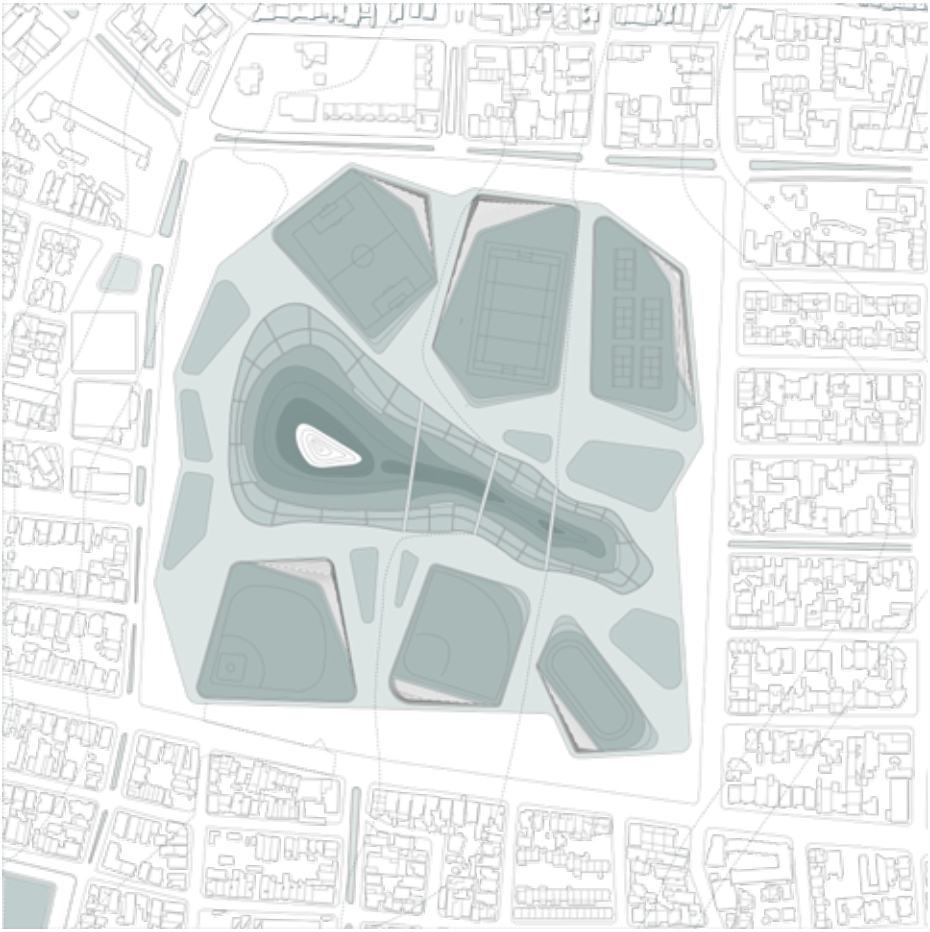
Flooding in an adaptive landscape



High flood condition

M S N O

Flooding in an adaptive landscape



Extreme flood condition

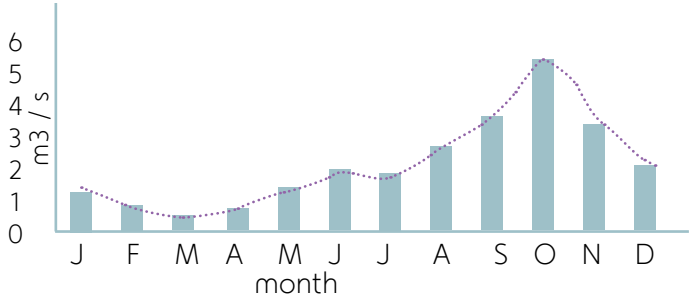
The inflow comes from the stream running from the hill at the east, the water flows through terraces with native submerged aquatics and emerging plants from the wet ground that clean the water before it arrives at the wet basin.

In moments of high floods, the system increases its flooding capacity with a combination of dry and wet basins. Dry basins work as sports fields in dry conditions, in addition, 80% of the park is located 0.20 m lower than the pedestrian ecotone, which allows flooding the whole area in an extreme flood event.

A pedestrian bridge connects the ecotone and allows the normal flow of people, even when the whole park is under an extreme flood condition.

Data to determine the Unit Hydrograph of the Manzanares River Basin

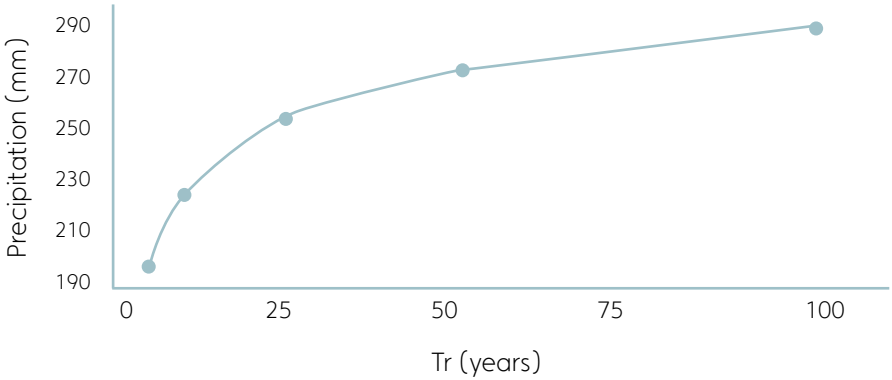
L	33,5 km
CN	73,66
J	0,079 m/m
A	174,54 km2
Lc	29,19 km
Wc	5,98 km
Lc/wc	4,88
K	0,86 hrs
tp	2,20 hrs
tp/Km	2,57 hrs
n	12,14
B	300
Up	9,7m3/sec
to	2,86 hrs
t1	4,58 hrs



Diploma

The porous park, local intervention

System capacity, Modified Rational Method



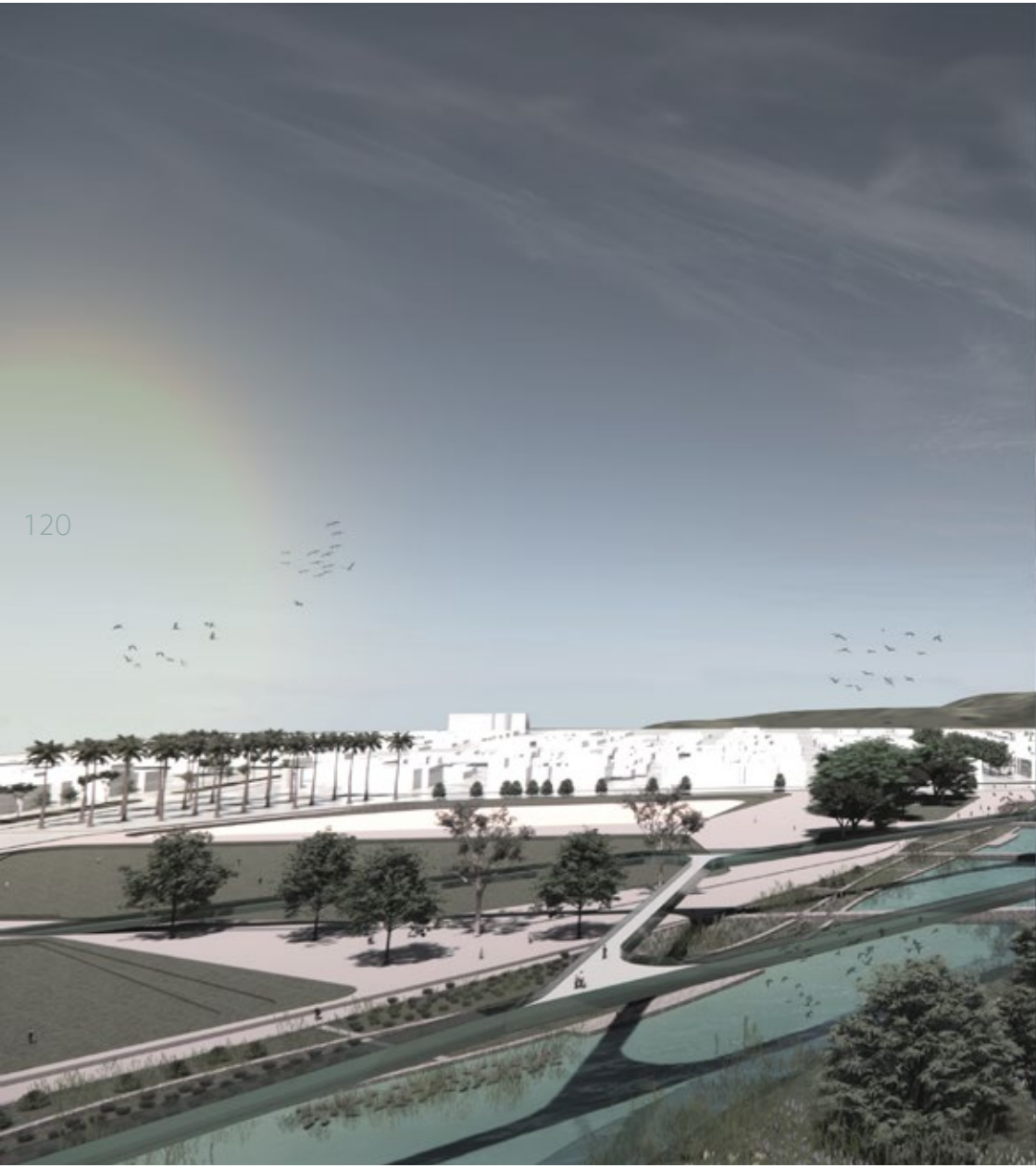
q max = 0,86 * 1,25 * 5,5 (mm/h) * 2,4970 (Ha)

q max = 14,19 m3/ s

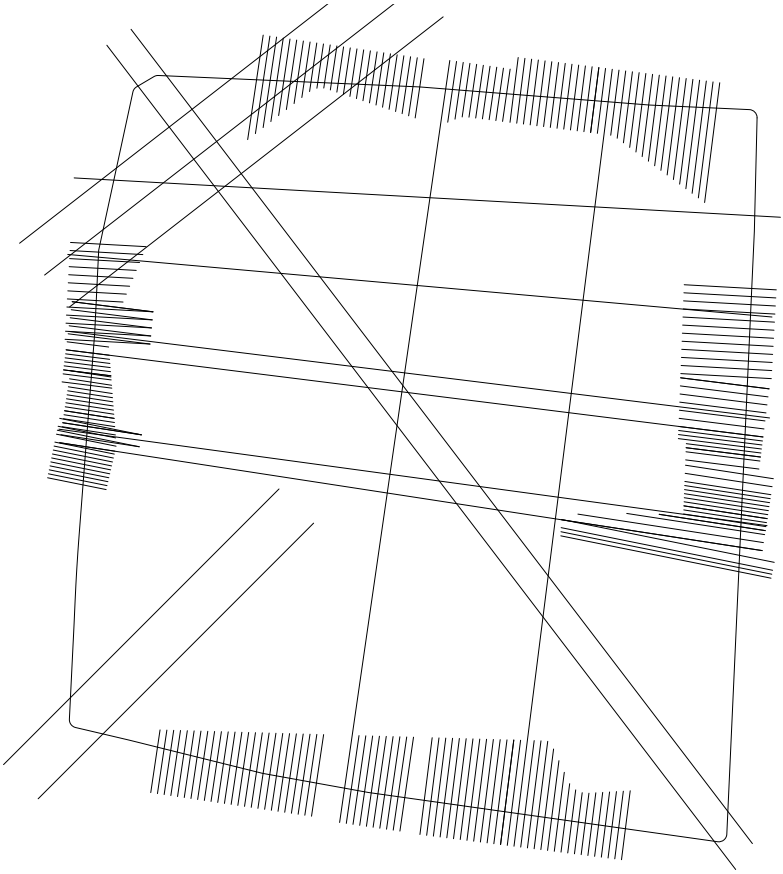
Diploma

The porous park, local intervention

An adaptive landscape

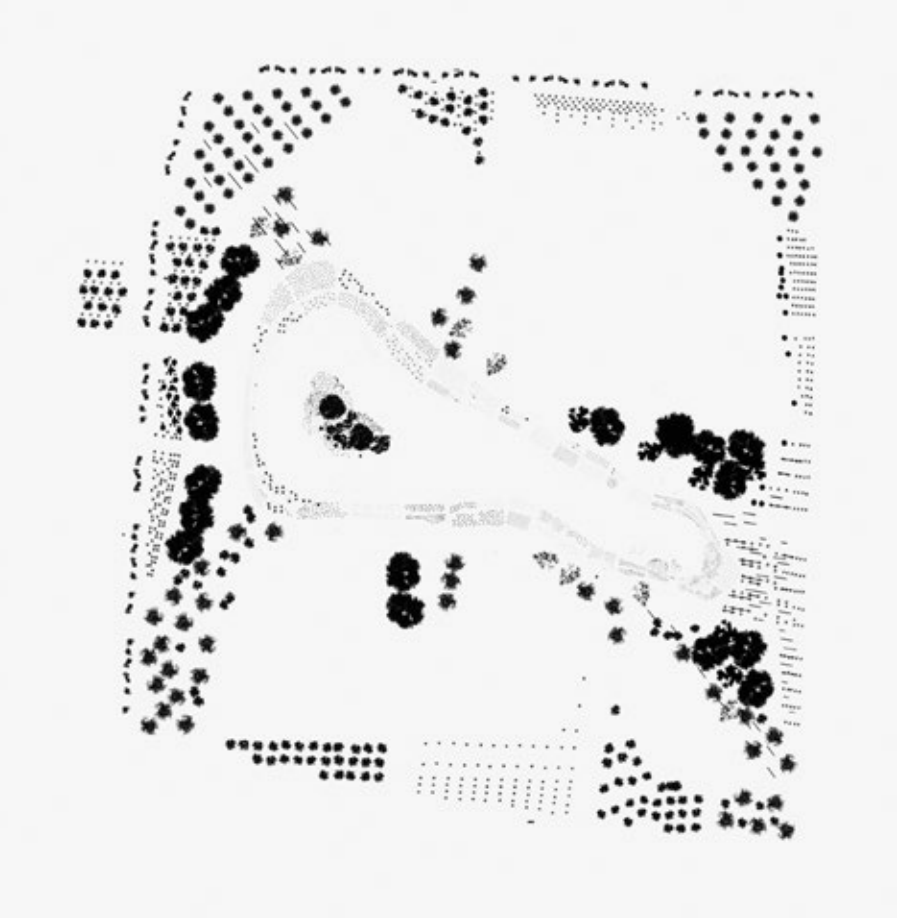


Planting grid, main axis



The location of the planting is defined by a series of grids, that look for a geometrical connection, relation, and tension with the urban fabric, the natural flow of the people, and the natural flow of the water.

Planting plan



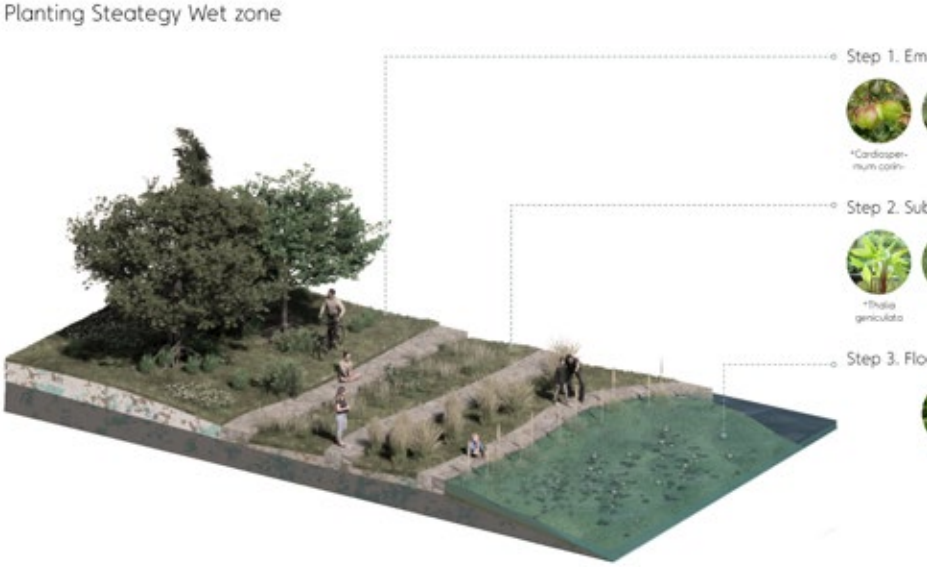
At access plazas, the vegetation continues with the diagonality connecting with the principal people flow. At the border, the planting is related to the immediate context. On the east side, the vegetation recognizes the flow of the water and makes it evident with the strips of vegetation that lets water go in between.

The ecotone planting is characterized by 3 layers of vegetation. Tall trees, medium-sized trees, and low vegetation. The access plazas are a combination of palm trees that highlight the desertic zonobiome that surrounds the area, give a clear path to follow, and are combined with fruit trees that attract different bird species.


zzas - Dry tropical type
Cocos nucifera
Hight: 30m
Wide: 10m
*Albizia niopoides
Hight: 10-30m
Wide: 14m
Aspidosperma polyneuron
Hight: 15m
Wide: 5m
atractive for birds - frutal
Aichiote
Hight: 4m
Wide: 2m
Aromo
Hight: 7m
Wide: 5m
Ipomoea carnea
Hight: 2.5m
Wide: 1.5m
ation - flowering plants
Pleurothallis
Hight: 0.6 m
Wide: 0.4m
Cyperus articulatus
Hight: 80m
Wide: 10m
*Dichea pendula
Long: 1.6 m
Wide: 0.1 m
* Native species

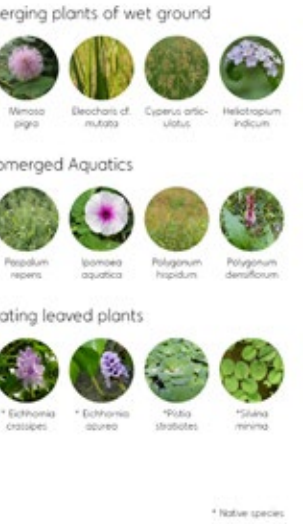
The average temperature in Santa Marta is 31 c with a max register of 41 c.
It is necessary to introduce native trees with high shadow production to provide climatic comfort for people, an promote all-day function of the park.

* Native species



A series of plants between emerging, submerged and flooring has been selected on a color range of green with purple flowering. These plants are located along with the permanent water bodies and have been chosen for their ability to clean the water of heavy minerals, they filter the water before it arrives at the basin and performs well even when the stormwater has been mixed with the sewage water.

Diploma
The porous park, local intervention
Planting strategy

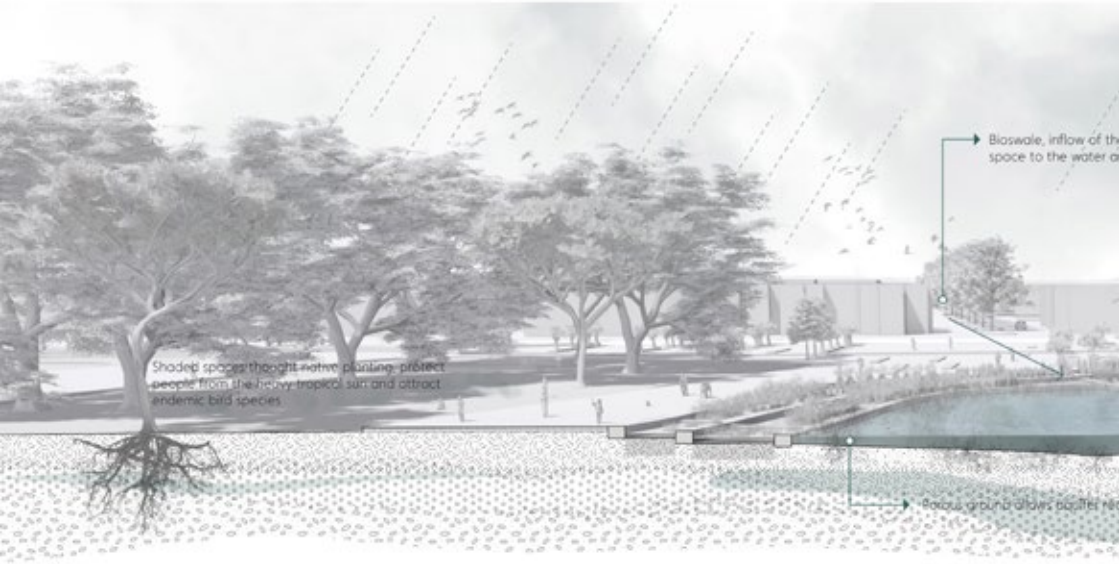


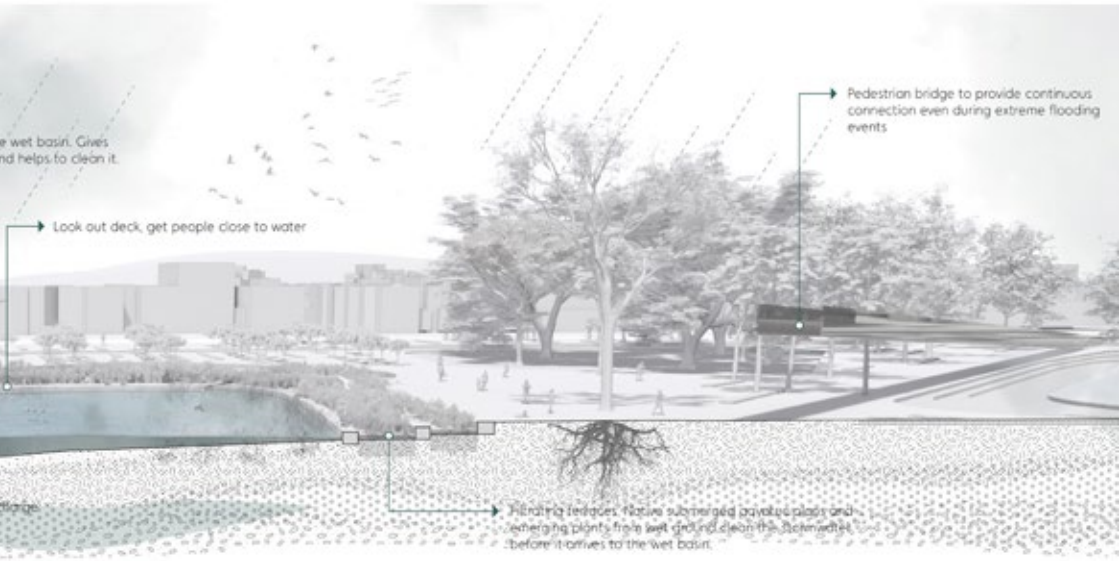
Diploma

The porous park, local intervention

Transversal sectional perspective

Species attracted by the fruit trees, the water, and the birds island




e wet basin. Gives
nd helps to clean it.
Look out deck, get people close to water
Pedestrian bridge to provide continuous connection even during extreme flooding events
Planting terraces (native submerged aquatic plants and emerging plants from wet land) clean the stormwater before it arrives to the wet basin.

Diploma

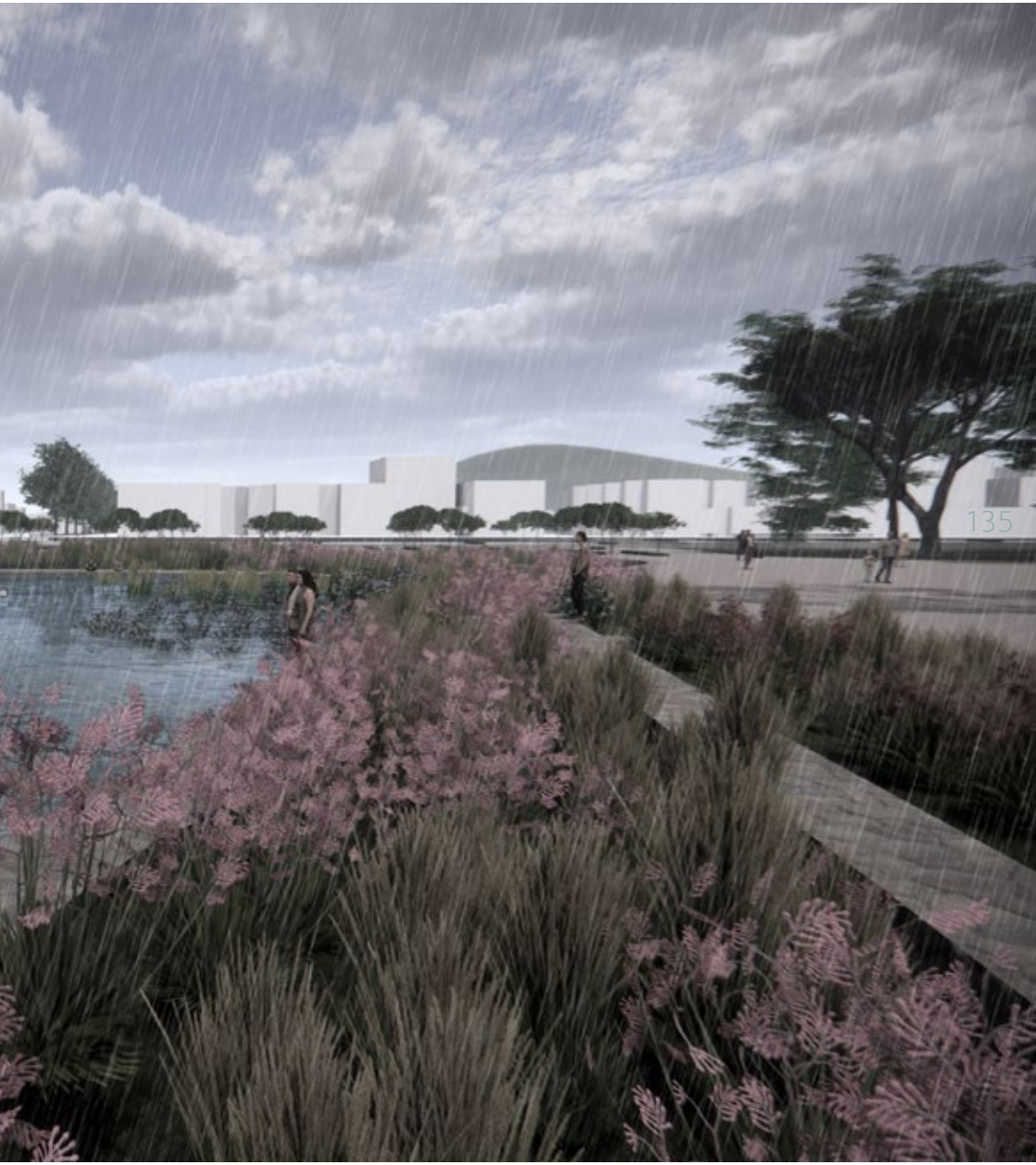
The porous park, local intervention

The user experience, Dry condition

Diploma

The porous park, local intervention

The user experience, Rain condition



Diploma

The porous park, local intervention

Physical model scale 1:1000

Diploma

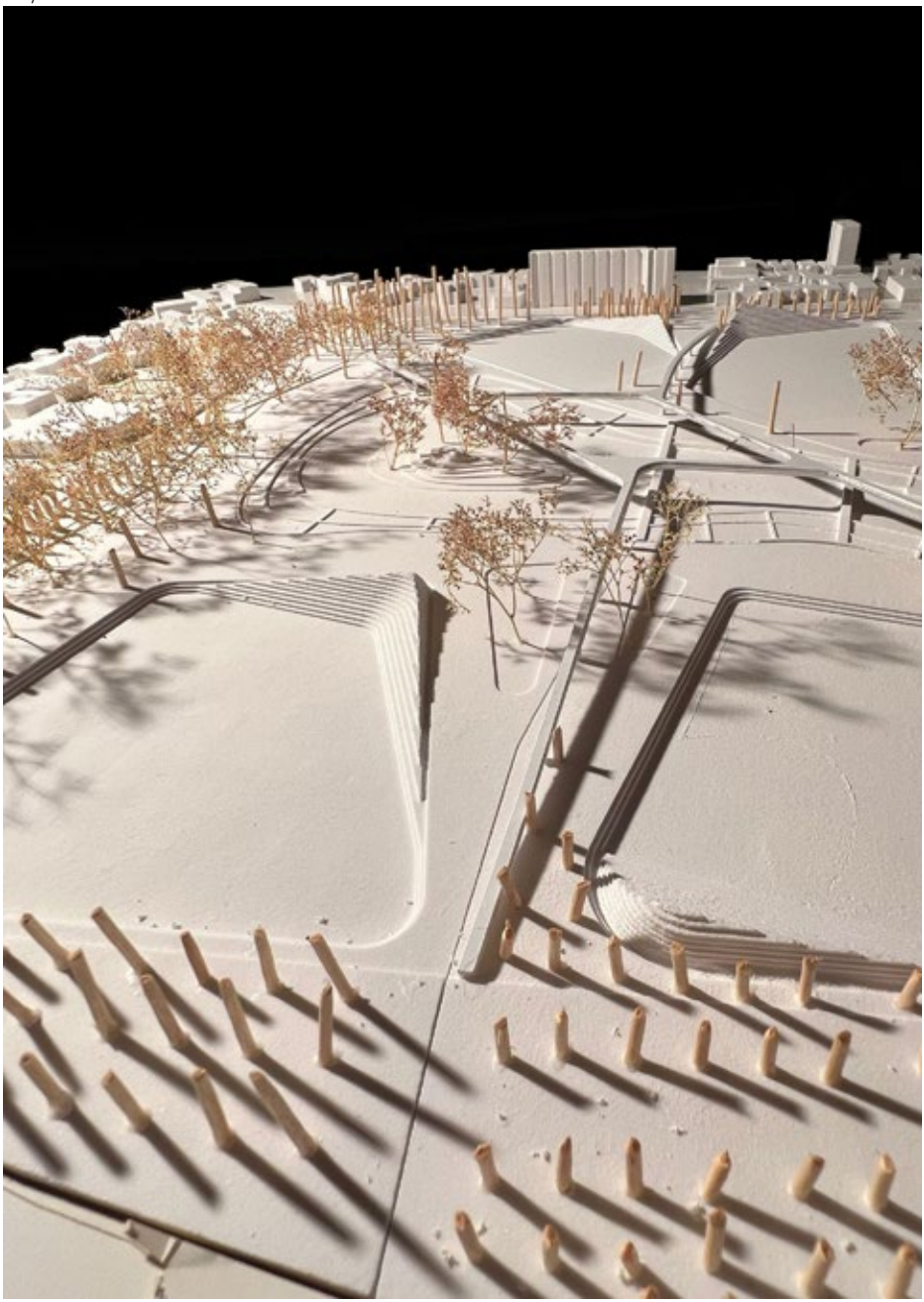
The porous park, local intervention

Physical model scale 1:1000

Diploma

The porous park, local intervention

Physical model scale 1:1000



Diploma

The porous park, local intervention

Physical model scale 1:1000

Diploma

The porous park, local intervention

Physical model scale 1:1000

Bibliography

Literature

Abnas K Jha, Robin Block, Jessica Lamond.(2011) Cities and flooding. A guide to Integrate Urban Flood risk management for the 21st century.

Forman, R.T.T. (1990) Ecologically Sustainable Landscapes The Role of Spatial Configuration, in Changing Landscape: An Ecological Perspective

Picon, A. (2005) Constructing landscape by engineering water, Landscape Architecture in Mutation ETHZurich

Tjallingii, S. (2015) Planning with water and traffic networks. Carrying structures of the urban landscape.

Antoine Picon, "Constructing Landscape by Engineering Water", in A. Berrizbeitia (ed.), Urban Landscape: Critical Concepts in the Built Environment, vol. 1, London: Routledge, 2015

Bobbink I. And Leon S. (2013) "Water inSight : an exploration into landscape architectonic transformations of polder water", Delft, Netherlands:TU Delf

Websites

https://www.worldfuturecouncil.org/sponge-cities-what-is-it-all-about/

https://www.turenscape.com/en/project/index/4.html

http://www.urbanisten.nl/wp/?page_id=47

https://www.plataformaarquitectura.cl/cl/02-341167/primer-lugar-concurso-plaza-de-les-glories-barcelona-espana

Bibliography

Websites

https://www.researchgate.net/profile/Rene-Lopez-Camacho-2/publication/326882449_100_plantas_del_Caribe_Usar_para_conservar_aprendiendo_de_los_habitantes_del_bosque_seco/links/5b6a274845851546c9f6b5c1/100-plantas-del-Caribe-Usar-para-conservar-aprendiendo-de-los-habitantes-del-bosque-seco.pdf

https://www.researchgate.net/publication/282264861_Vegetacion_acuatica_y_de_pantano_de_las_cienagas_del_departamento_de_Cesar_Colombia

https://landezine.com/landscape-architects/zt-studio/

https://ostengen-bergo.no/

https://grindaker.no/

https://www.ibtimes.co.uk/scenes-flooding-cali-after-freak-wet-weather-hits-colombia-1622097

https://storymaps.arcgis.com/stories/27dde19405b-242c8bb0043c13360d718

https://core.ac.uk/download/pdf/198275409.pdf

https://worldlandscapearchitect.com/forest-and-sports-park-guangming-china/

https://worldlandscapearchitect.com/tacubaya-medium-scale-hydric-district-mexico-city-mexico-oru/#.YbV5lr3MJaR

https://ndma.gov.in/Natural-Hazards/Urban-Floods