

Waterfront metropolitan borders

Reshaping the waterfront of the City of Buenos Aires



Andrea Lisa Bril

Tutors: Eduardo Bru Bisturías & Xavier Llober i Ribeiro

2020_2021
MBArch
ETSAB_UPC

Universidad Politécnica de Cataluña
Escuela Técnica Superior de Arquitectura de Barcelona
Máster Universitario en Estudios Avanzados en Arquitectura-Barcelona

Trabajo de fin de máster. Master thesis
Curso: 2020 / 2021
Autor: Andrea Lisa Brill
Tutores: Eduardo Bru Bisturíes & Xavier Llober i Ribeiro

_Table of contents

_Abstract	_ 6
_Keywords	_ 7
_Introduction	8
_Research Proposal	9
_Research Aim, Questions and Objectives	10
_Research methodology	11
_ 1: Evolution of the waterfront of the City of Buenos Aires	12
1.1 History of urban development of the City of Buenos Aires	14
1.2 Large scale urban projects and territorial transformations	17
1.3 Public spaces on the waterfront	23
1.4 Change of paradigm	26
_ 2: Reinventing Buenos Aires waterfront	30
2.1 Site actuality	32
2.2 Opportunities	33
2.3 Connectivity dimension	34
2.4 Morphological dimension	40
2.5 Environmental dimension	44
_ 3: Worldwide waterfront transformations	56
3.1 Waterfront regenerations	58
3.2 Reshaping infrastructures: Barcelona, Spain	62
3.3 Revitalizing heritage: Hamburg, Germany	68
3.4 Restructuring through environmental strategies: New York, USA	78
Chapter 4: Conclusion	84
Bibliography	90
List of figures	92

Waterfront metropolitan borders

Reshaping the waterfront of the City of Buenos Aires

Abstract

Waterfront transformations represent key urban design strategies regarding metropolitan regeneration projects. Throughout history, the waterfront borders have been transformed mainly from industrial spaces to leisure, open and green areas. By analyzing different case studies and their criteria regarding the decision on morphological, environmental and urban aspects this research establishes what are the concepts that can be taken into account when reshaping public spaces in relation to the coastal border of the City of Buenos Aires.

Keywords

waterfront; metropolitan border; regeneration of public spaces; urbanism; connectivity; open space

INTRODUCTION

METROPOLIS | WATERFRONT | BORDER

Research proposal

Metropolitan cities that have coastal areas have the opportunity of having a direct contact between nature and humans. According to the United Nations, there is about 40% of the worldwide population living near or at waterfront areas; cities have a key role in guaranteeing that the connection between people, nature and the built environment is inclusive, diverse and sustainable. Through the course of the industrial times, coastal areas have changed drastically in order to provide with the new infrastructure and technologies needed but nowadays a vast amount of areas have become empty or in disuse due to further changes in transport and commerce. Reshaping the public space on waterfront metropolitan borders is an opportunity to regain or improve the interaction between the city's layout with its waterfront areas.

Cities benefit from the connection between the grid and the natural environment and should advocate for public spaces that take into account the changing environmental demands, the need for green areas, inclusive amenities and diverse sustainable infrastructures. By understanding the full potential of a shoreline it can contribute to the well-being of citizens and incorporate ecological measures.

The motivations on this research come from living my entire life in the City of Buenos Aires and comparing the reality it has to other cities worldwide regarding how they take advantage of the connection between city and water. In the case of Buenos Aires, having a large border facing a river can be understood as having the opportunity to integrate the city with natural environments.

The urban waterfront of Buenos Aires has changed dramatically into a totally alienated place. Private properties, large transport infrastructures and a lack of public spaces generate a disconnection between the city and water. Since 2018 the government has been implementing possible measures that could improve the space throughout competitions and studies and so it can be seen that there is an intention of revitalizing the relationship between the city and the water. Therefore, taken into account this recent events, this research is done to interiorize into how Buenos Aires has a potential to regain its historic relationship with the river, be better connected to its surroundings and discover a new possible interaction between grid and shoreline.

Research Aim, Questions and Objectives

The aim of this research is to reflect on how the City of Buenos Aires could profit from its close encounter to the river and gain valuable public spaces for the people by understanding how cities around the world decide to intervene and regenerate coastlines for the benefit of the cities layout, connection, public spaces and the well-being of its citizens.

The study starts from the following questions:

- What is the actual reality of the coastline of the City of Buenos Aires?
- Does the City of Buenos Aires have the potential of having an integrated waterfront?
- How the City of Buenos Aires can transform the actual disconnection with the river to an integrated urban layout?
- How are cities addressing the regeneration of coastlines?
- How did the paradigm of urban waterfront renewals shifted over the years?
- Are there common strategies around the world regarding interventions in waterfronts?

The objectives are to analyze the actual reality of the City of Buenos Aires regarding its transport structure, infrastructures, public spaces and green areas and understand which are the opportunities that this site has in relation to the potential the area has to modify and discover a possible way of improving its disconnection.

Hypothesis

The urban waterfront is a space that has the uniqueness of being the connection between the built and natural environment. It can benefit the quality of life in social, cultural and economic aspects, it has the potential of improving the natural environment by taking into account the changes in climate, flora and fauna of the area. It is a space that becomes the connection between citizens and the environment and can respond to a more people-place oriented public space.

Research methodology

This research is developed in three parts. First, by analyzing and interiorizing how the waterfront of the City of Buenos Aires changed throughout the years and which large scale projects were done. I will consult documents and books to interiorize the search in relation to the theories and methods that were made in the place's development of the waterfront throughout the years.

Secondly, by using a research by design method I will elaborate a project on the new waterfront of the City of Buenos Aires in order to understand which opportunities the site has and therefore develop public spaces that integrate and connect to the waterfront.

Furthermore, the research will continue on a comparative analysis of case studies (Barcelona, Hamburg, New York) as a tool to study cross-border strategies in a macroscale and microscale projects made to improve the quality of public space and the connection to cities with their waterfront areas. The case studies were chosen to showcase a variety of strategies throughout the last 40 years; they all are part of metropolitan areas, portray a variety of scales of interventions and different main concerns that needed to be changed. Furthermore, the research will be done in order to establish a conceptual framework of strategies and compare on how the project of Buenos Aires answers to the main concerns of grid disconnection and lack of public spaces.

_1

EVOLUTION OF THE WATERFRONT
OF THE CITY OF BUENOS AIRES

History of urban development of the City of Buenos Aires

The De la Plata river is the estuary of the Uruguay and Paraná rivers, with 221km it is the widest river of the world (Stewart et al., 2014). Buenos Aires's direct relation with the river guided its layout from its beginning.

It can be said that the city started from the river, from its geographical location and logistical position. It was founded on two occasions, the first one by Pedro de Mendoza in 1532 and the second by Juan de Garay in 1580. With a rigged distribution of a grid of 144 blocks Buenos Aires continued its expansion alongside the river and into the North, South and West from its original foundation. Since its located in the estuary of de De la Plata River, it had a strategic position to function as a control for the navigation. This allowed the city to become an economic force but also guarantee a secure settlement due to the shallow of the estuary that generated ships to have a difficulty to reach the shore. Therefore the first settlements were located on the upper part of the hill in order to guarantee a secure place.

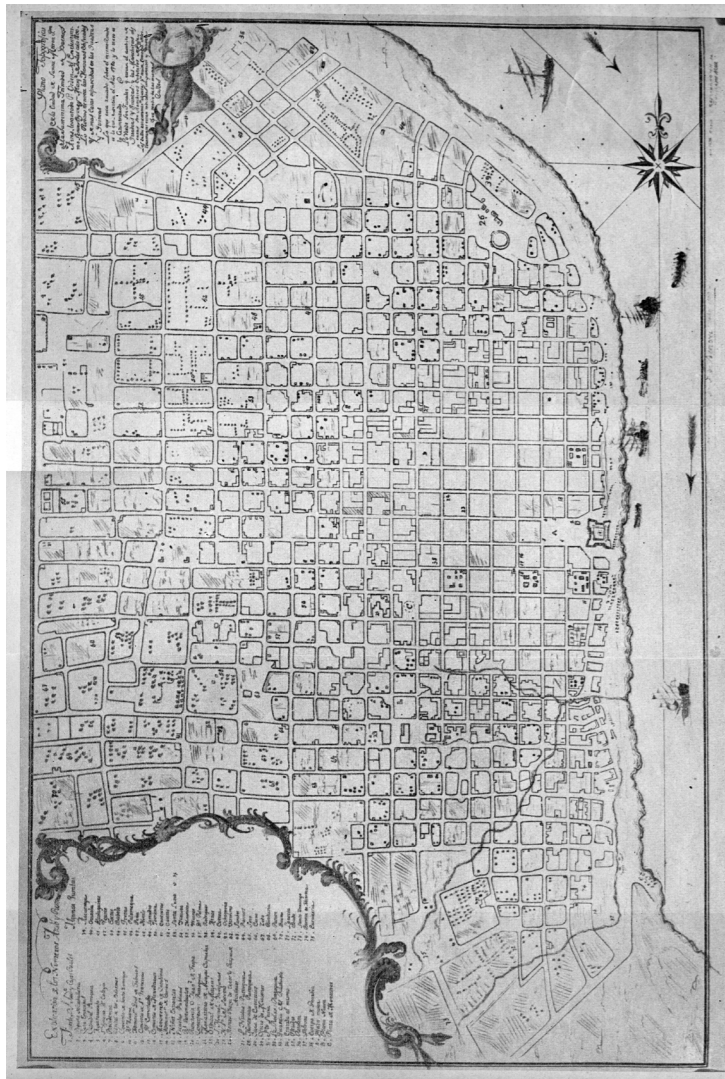


Fig 01: Topographic map of the City of Buenos Aires (1800). © Alfredo Taillard



Fig 2: Expansion of the City of Buenos Aires. © By author.

2 km

After two centuries, the colonial times ended in 1810 with the creation of the Republic; the city grew due to its commercial activity and immigration, always in relation to the transport infrastructure, it expanded north, west and south of its original settlement. It was not until the end of the XIX century that the city gained land to the river. The main event was the construction of the port from 1886 to 1899 (Della Paolera, 1999).

The city grew by prioritizing the economic desires such as trade and transport. The landmaking of the coast showcases how these decisions gradually molded the area by gaining land towards the river and disrupting the natural environment. Nowadays is the largest and densest city of Argentina. With a surface of 200km² located in the northeast of the province of Buenos Aires is the home of 2.890.151 inhabitants and one of the biggest metropolis of South America. It represents an urban hub, an important port and a valuable rich in social life city.

Large scale urban projects and territorial transformations

As a result of the development of the industry in the nineteenth and twentieth centuries, the city needed new infrastructure which accompanies this growth. By using the remains and rubble from urban projects it progressively gained territory over the De la Plata River and slowly transformed from having a direct connection to the river to be more isolated and disconnected from its natural environment. Several large transport and commercial infrastructures were placed along the waterfront that overall changed drastically its land profile by gaining more than 2 kilometers of land towards the river. These new infrastructures were the port, railways, airport and highways. Also, other projects that gained land to the river were the former sport city, the ecological reserve, Costanera Norte (a private concession) and the campus of the University of Buenos Aires.

Overall, the natural environment of the waterfront is lost, the original hills that seduced the colonization to be placed there due to its geography is now hidden within the city's grid. The relationship between the city and the river is characterized by being sparse, there are no good accesses for pedestrians, there are large infrastructures that divide the space and prevent a direct relationship from being generated. Furthermore, the privatization of the coast over the years gradually caused public spaces to be lost.

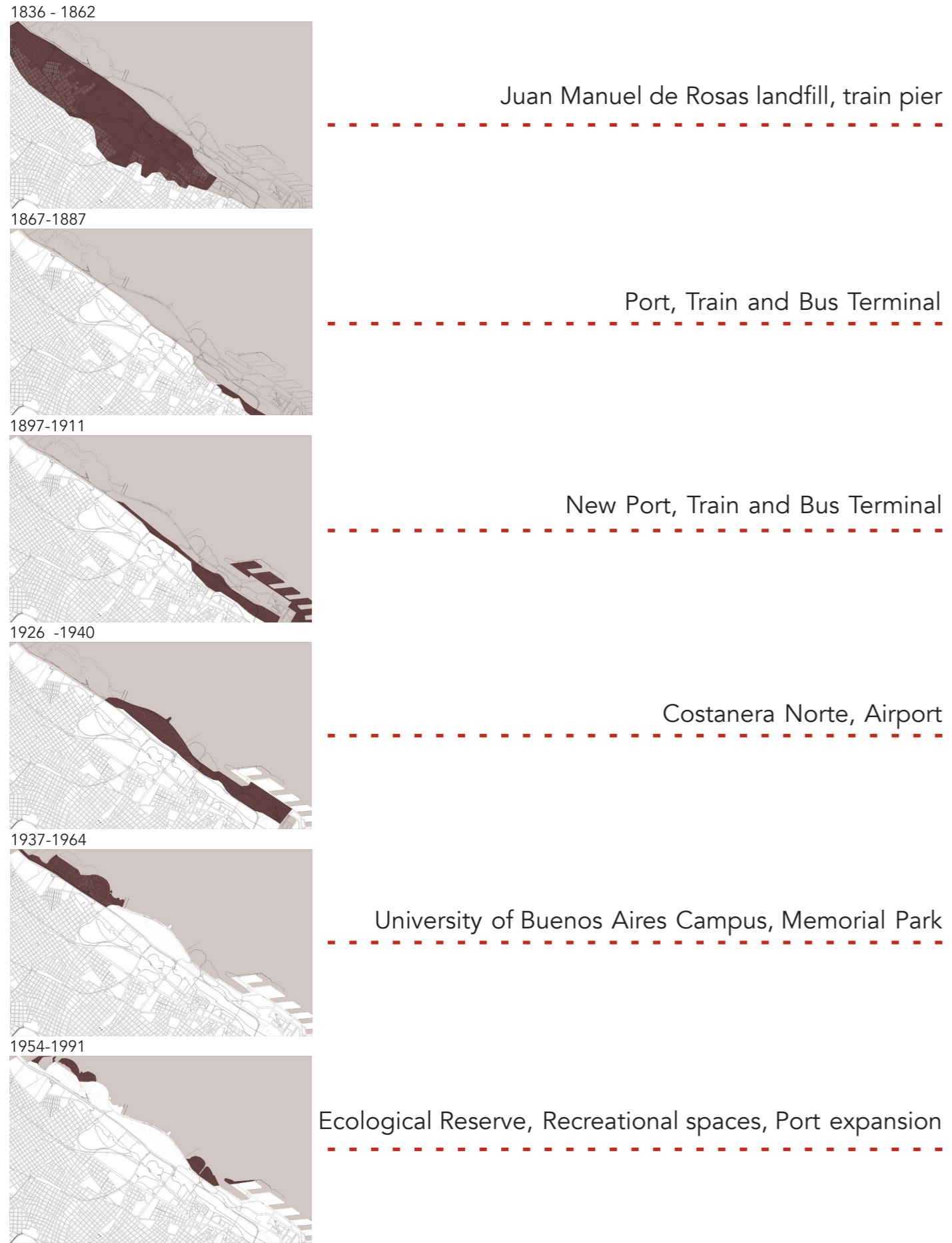


Fig 03: Evolution of the coast of the City of Buenos Aires. © By author



Fig 04: Buenos Aires highway and avenues © By author



Fig 05: Buenos Aires metro lines. © By author



Fig 06: Buenos Aires bicycle lanes © By author

Public spaces on the waterfront of Buenos Aires

"Talking about urban waterfronts and port areas, landscape and public space are key notions in a contemporary debate about cities. The waterfront is a liminal urban area, an extraordinary gateway between artifice and nature, where the city traditionally represents itself on the edge between land and water." (Russo, 2016, 31)

Public spaces are a key element in urbanism, they provide the city with a variety of areas that articulate public activities, open spaces, nature and allow people to create connections now only between themselves but with the environment. When they have a good connection with the urban grid, are livable, green and incorporate sustainable measures in transport or with nature, they become areas that can have an impact in the well being of citizens and also with the natural ecosystem.

Public spaces have been transforming into spaces with much more protagonism in urban transformations. Due to the notion of environmental issues such as climate change, they have become areas that incorporate ways to help mitigate the problem by adding more green areas and increasing the absorbent soil. Also, the shift of paradigm in the overall conception of open spaces that should be more designed in order to respond to a better people oriented strategies has allowed cities worldwide to incorporate measures that take into consideration citizens as a key element in the designing process. Not only by establishing projects that take into account the person as a primary concern but also by including citizens in the design process of these areas. For example in the decision making of the waterfront makeover of Manhattan, or the superblocks in Barcelona.

In the case of the City of Buenos Aires, the coast has become a space where public spaces lost predominance over large infrastructures and private sectors and therefore majorly becoming passing through space. The few spaces that are left for public use do not showcase a good nature of what these areas should be. Firstly, the scarce amount there are make the waterfront to desire the need for citizens for livable and inviting spaces.

Furthermore, the characteristics of the existent areas do not showcase a variety of possible uses and therefore limit the opportunity of exploring the relation between land and water. But 70 years ago, the shoreline had a very different reality. The city had baths along its coastlines, on what is now one of the ecological reserves, allowing the citizens to have a direct relation with the water. But due to contamination, changes in infrastructures and the gaining of more land over the river, these spaces changed drastically to what the coast looks nowadays.



Fig 07: Buenos Aires infrastructures. © By author



Fig 08: Municipal Baths 1949. © Atlas Archivo



Fig 09: Municipal Baths. © AGN

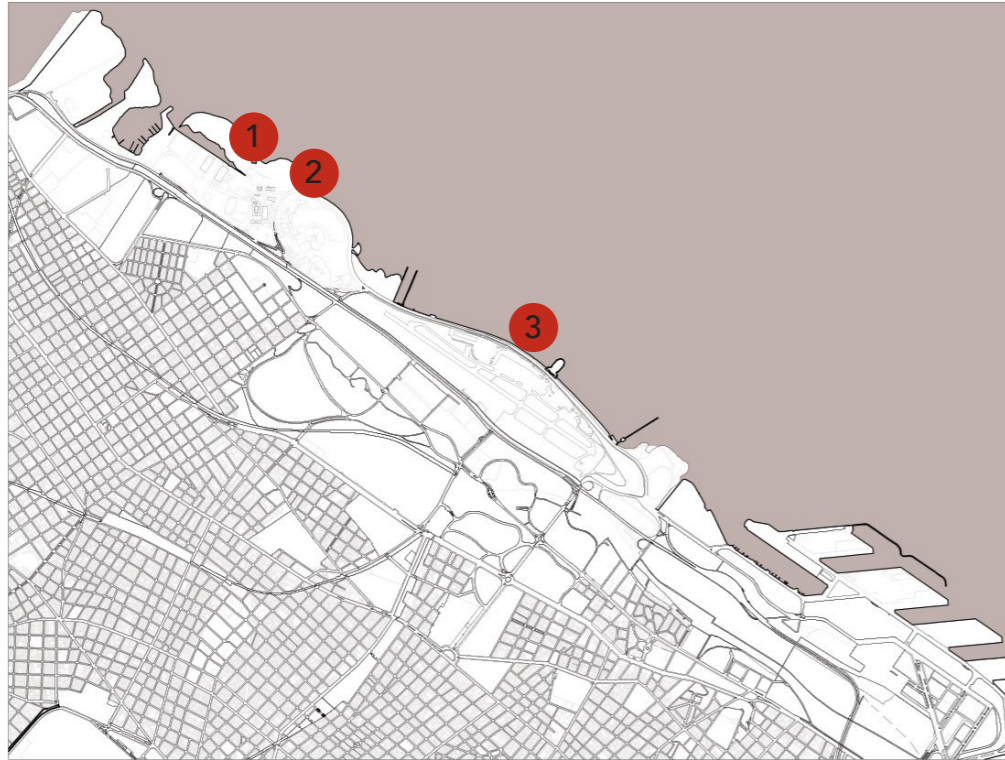


Fig 10: Buenos Aires public spaces along the waterfront. © By author

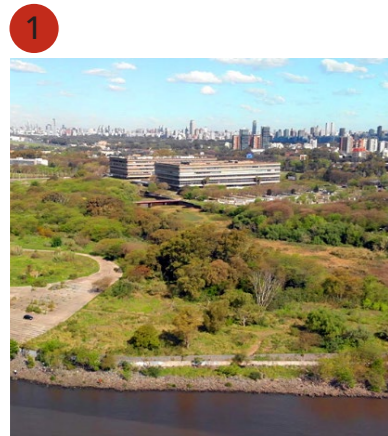
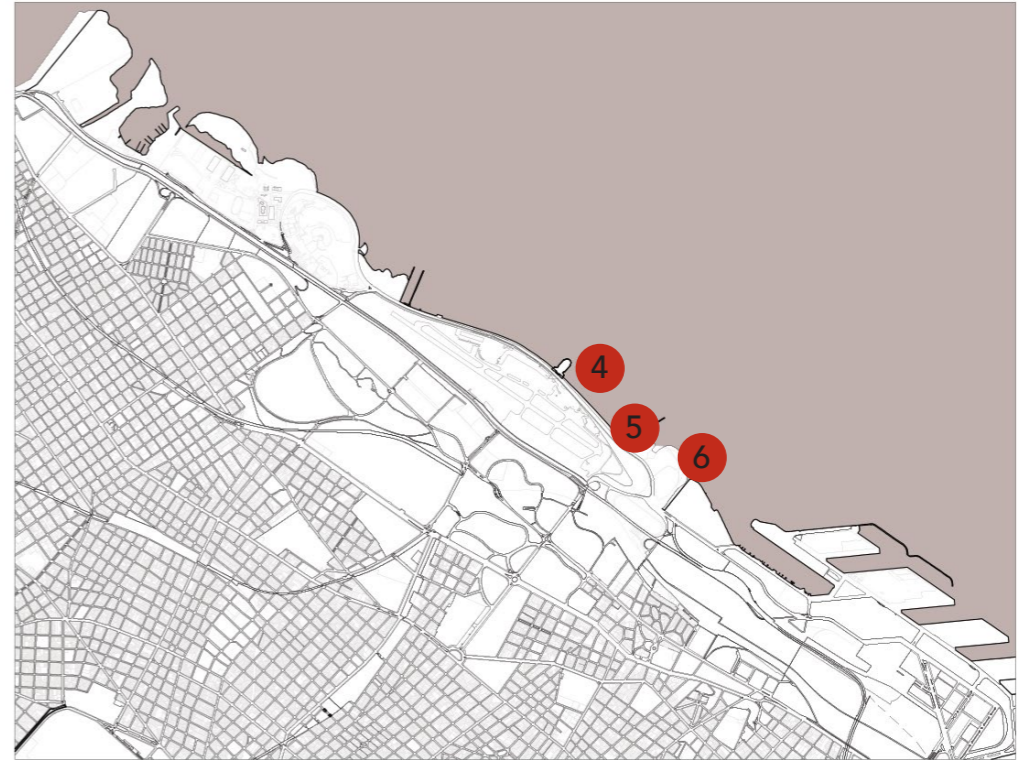


Fig 11: Ecological reserve of the University of Buenos Aires Campus. © RECU-CN

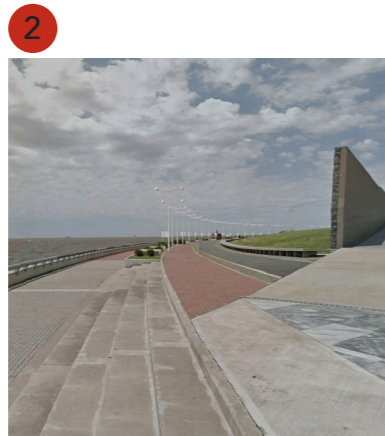


Fig 12: Monument to the Victims of State Terrorism. © Google Maps

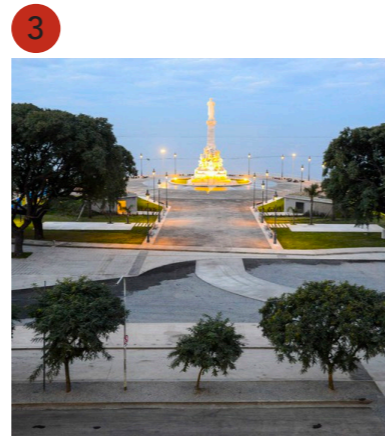


Fig 13: Pedestrian walk on Costanera Norte. © Rafael Mario Quinteros

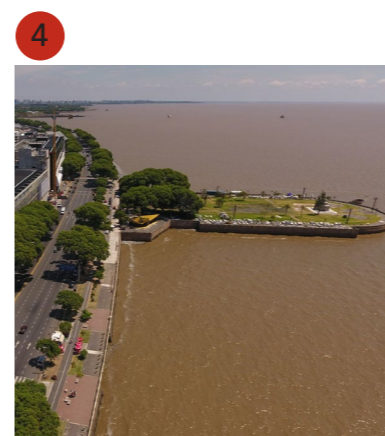


Fig 14: Aerial view waterfront pathway. © Google Maps



Fig 15: Pedestrian walk on Costanera Norte. © Google Maps

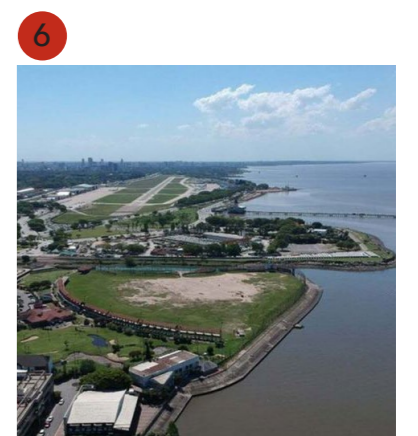


Fig 16: Aerial view Costanera Norte. © Google Maps

Change of paradigm

Delimitation of the site

The City of Buenos Aires has the controversy of being structured by not facing the river. This controversy makes the waterfront area to be alienated, restricted and not inviting for recreational uses.

The site chosen for this research is part of what is called "Costanera Norte" or North Coast. This area comprises from the port to the North part of the city. It has mainly private infrastructures, the campus of the University of Buenos Aires, sport clubs and the largest barrier, the airport. The airport becomes an inaccessible area that divides half of the area of the North Coast and creates a physical barrier between city-river. Therefore, taken into account the opportunities that the large area occupied now by the airport holds, the project proposes what could happen if it was integrated into the city's grid.

Since 2018 the government has launched several measures to start to revert or improve this current reality in order to restore the relationship with the river. By creating a new space called "Youth District" this area will become a space that incorporates parks, new and improved transport connections, gastronomic and recreational spaces. This area has the capacity of becoming an inviting space, a place to relax and enjoy, a large green area that breaks with the concept of being a passing through zone where there are few to none activities that take place.

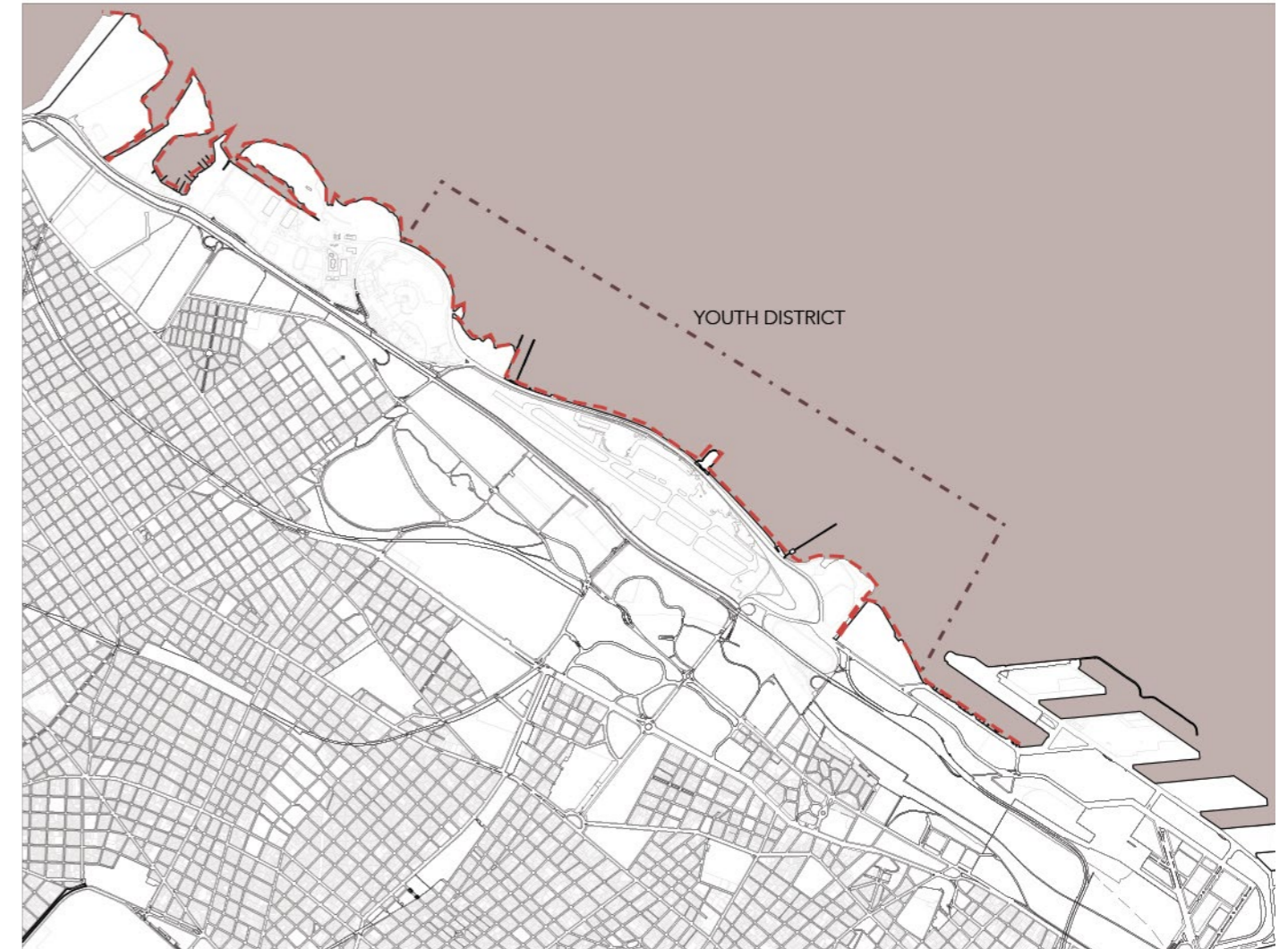


Fig 17: North Coast and Youth District. © By author

1:50000

What would happen if the airport was part of the city's grid?

The project will take into account the area of the airport and the pathway of 2.5km in front of it. This area has an overall area of 157 hectares. The concept is to generate a piece of city that will have the opportunity to be the only place of the entire coastline of the city that connects the grid with the river without any physical or natural barrier that separates them.

before

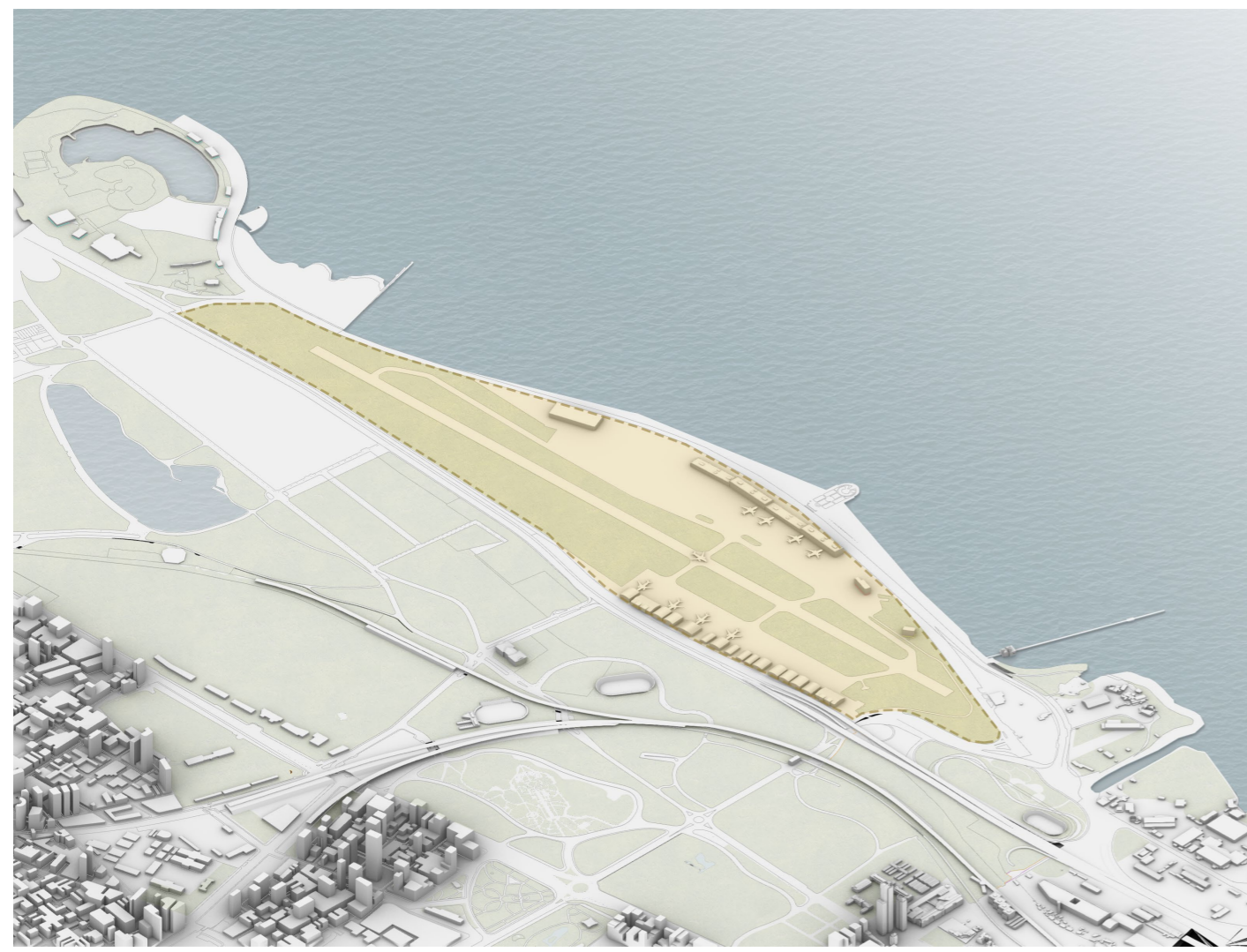


Fig 18: Site. © By author

after



Fig 19: Site. © By author

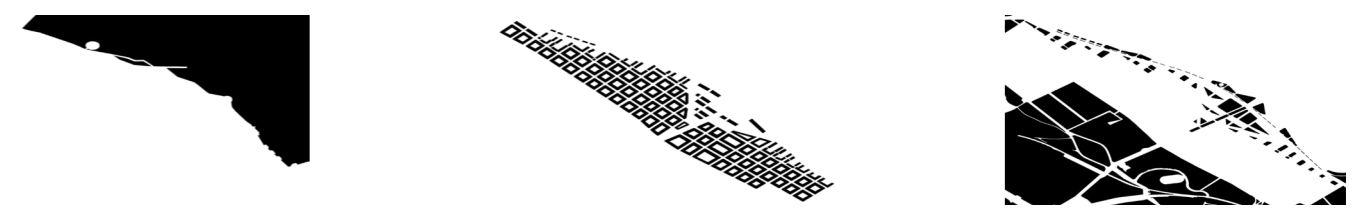


Fig 20: Diagrams of the urban development of the project of reconfiguration on the waterfront. © By author

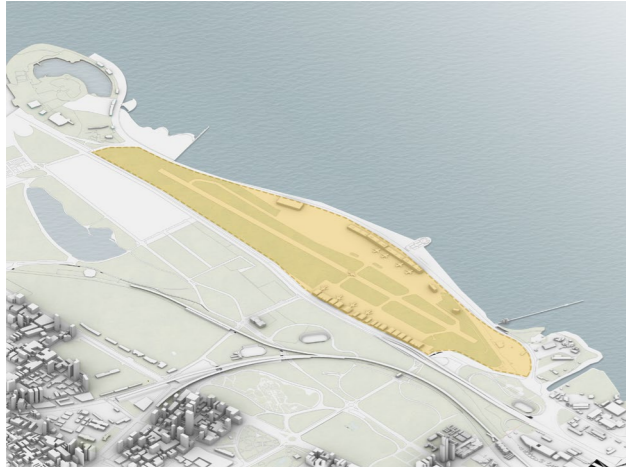
_2

REINVENTING
WATERFRONT

BUENOS

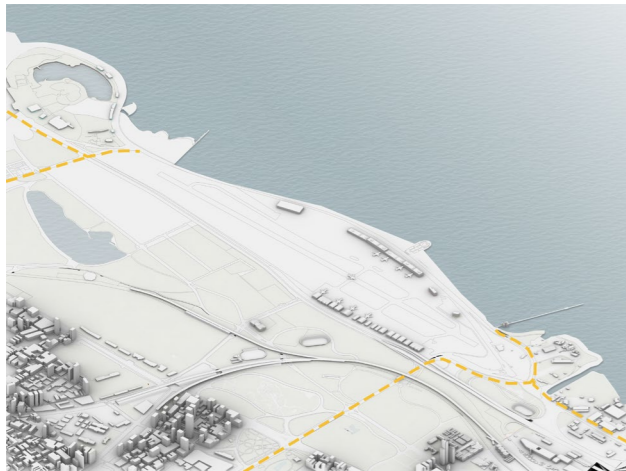
AIRES

Site actuality



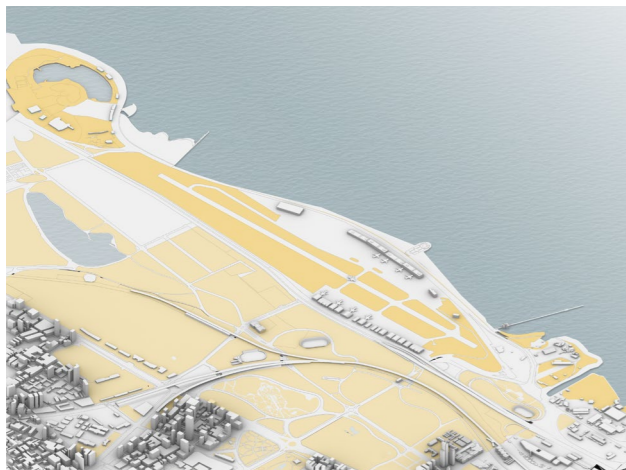
Urban barrier

The area has very rigid barriers that breaks any possible connection between the city and the river. The transport infrastructure such as the highway and the train rails are placed near the waterfront, but the strongest urban barrier is the airport, with a total footprint of 1.45 km² generates an enclosed space that does not allow any possible crossing and cuts the area generating a frontier to the river.



Poor accessibility

The infrastructure barriers mentioned generate a poor accessibility. The access to the waterfront is restricted to connections of both extremes of the airport.



Lack of attractive and green public spaces

Even though the airport has large green areas, all of the space is private. Because of this barrier, the beautiful green areas that the city has on the other side of the highway cannot integrate with a waterfront system of open spaces. Furthermore, the pathway along the shoreline lacks from attractive and inviting uses.

Opportunities

Buenos Aires has become a dense metropolitan area that still seeks its lost relation to the water. The city emerged giving a backside to the natural environment. This allowed the space to locate infrastructures along the coastline and not giving it the necessary attention to become an inviting, high quality public space. Even though Buenos Aires has the privilege of having a border directly connected to nature, it hasn't been able to fully take advantage of this peculiar situation.

The city has attractive green spaces designed by the French-Argentine landscape architect Carlos Thays, but these are all located inside the grid of the city. Currently, Buenos Aires sees its waterfront as a limit, a border and not a space for interaction, recreation and connection between people and the De la Plata river. There are very few spaces that relate directly to the water: the ecological reserve and the sidewalk along the airports waterfront.

Nowadays it has less than 6 square meters of per inhabitant, while the WHO (World Health Organization) established that there must be at least 10. Overall there is an evident lack of green spaces, therefore the incorporation of a new waterfront park can contribute to increasing public spaces, which will benefit the public health and restore the lost relationship between city and water.

During this COVID-19 pandemic times, green spaces have taken an important role in our lives. They serve as spaces to where one can enjoy of nature or gather with friends, they have become a resourceful place to mitigate the restrictions of not being able to meet people on closed spaces. Therefore, to accompany this changing reality the project has to take into account this events as an opportunity to enhance and increase the green areas of cities. (Michèle Laruë-Charlus, 2020) The way in which people appropriate public spaces has become a clear understanding of the need of more open spaces inside the metropolitan area.

The opportunities that this site has are:

- Increase and intensify the mix use
- Balance the natural and urban environment
- Restore the identity of the place
- Introduce sustainable habits

Fig 21: Buenos Aires - site actuality. © By author

Connectivity dimension

Cities function as a network, the connections are the way it is connected through the links-roads and nodes-intersections. (Nel et al., 2018) A wider choice of roads in a city is a positive quality, by having a broader offer of routes from one place to another gives the people different opportunities such as to travel through a preferred route or to run errands while going to a destination. Also, an increase in the number of roads usually means an increase in pedestrian paths and therefore contribute to the possibility of walking to a destination instead of having to use other forms of transport that pollute more the environment.

The connectivity in a city has a direct effect in the way people perceive the space. Having a better connected area and therefore providing a larger amount of routes, that people can navigate through by non-mechanical transport, can have a relation on the possibility of improving and increasing the amount of public space, mixtivity of use and quality of life.

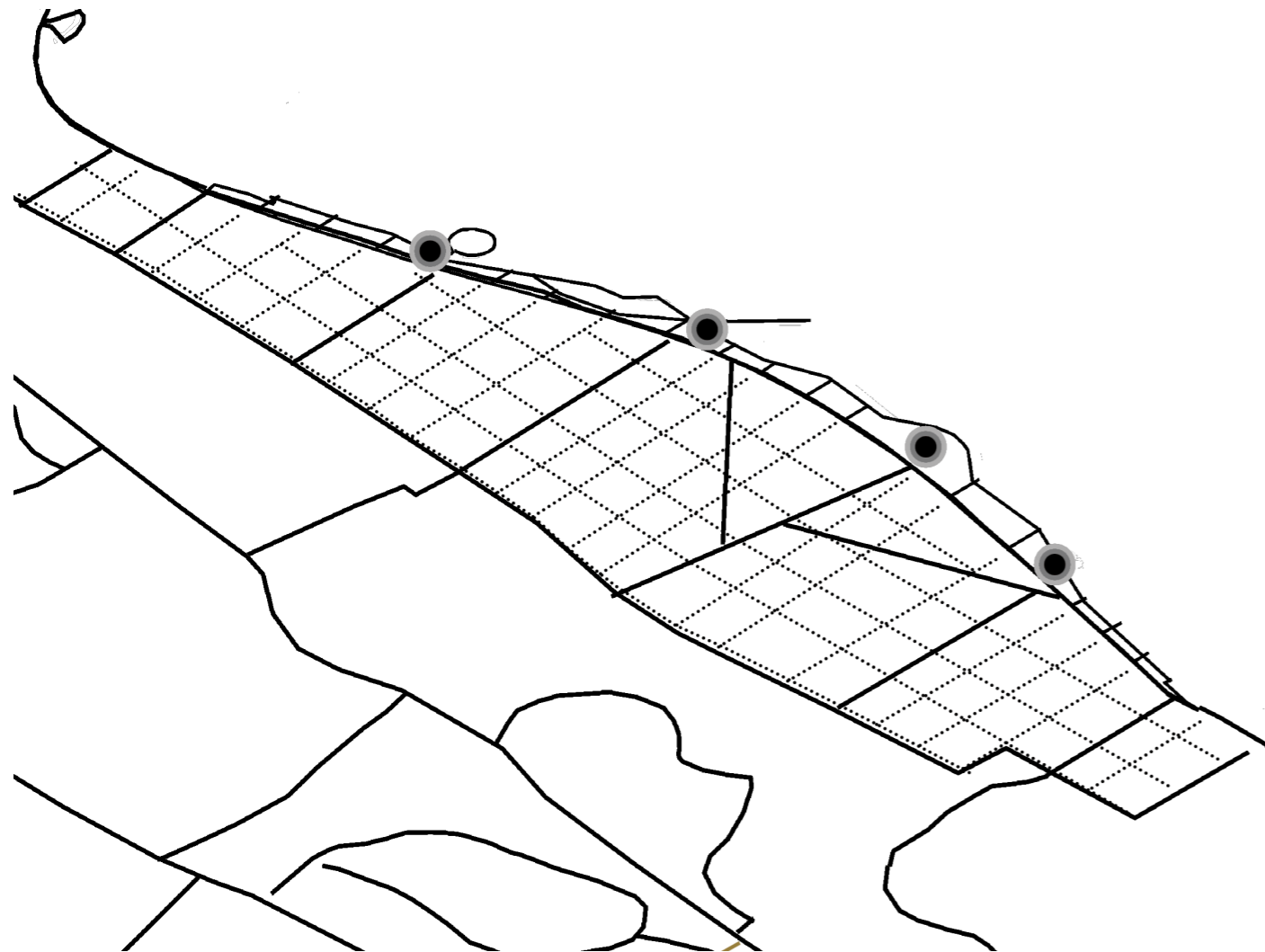


Fig 22: Buenos Aires - connectivity diagram. © By author

How to reconnect the city to the waterfront?

In order to make use of the existent conditions of the space such as the strategical position of the site regarding the city's layout, the concept of transforming this area from a private infrastructure, the airport, into an area that responds to the mixtivity of uses of buildings and public spaces it leads to create a space that generates an interaction between the built environment, the user and nature.

By taking into account the existent grid and extending it to the waterfront, the new urban space integrates naturally to its surrounding. This grid defines the organization of the blocks and structures the space to respect the current rhythm and module. By doing so, it allows the opening of connections between the city to the waterfront in an integrated system.

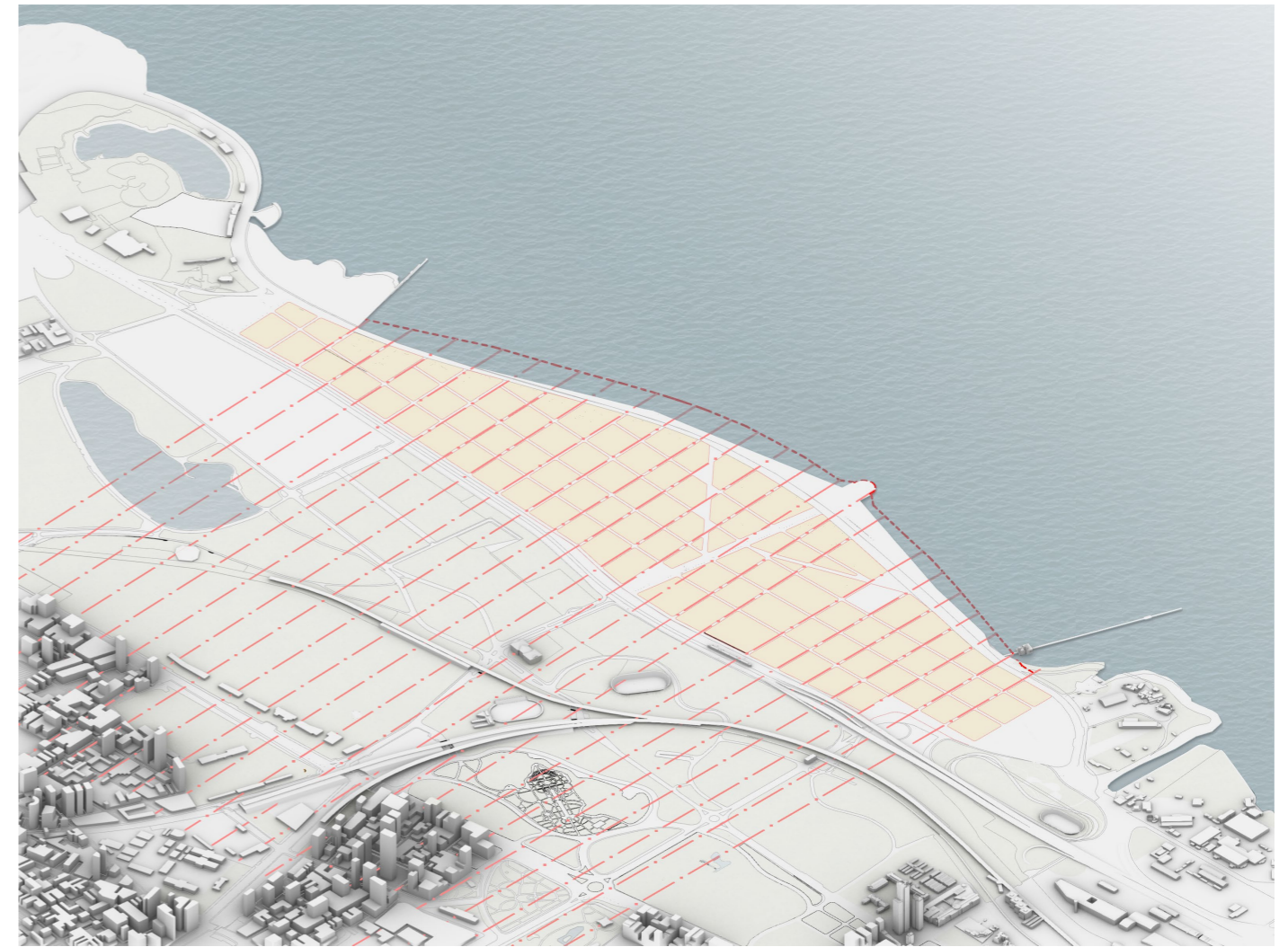


Fig 23: Buenos Aires - connectivity: grid and blocks of the new neighborhood. © By author

Connections

By taking advantage of the given features of the area the idea is to open five crossings from the city's grid into the new urbanization. These connections will allow the area to have a more direct contact between both sides of the site, city and water. This transversal connection lets the urban layout to open access to the river and generate new crossings that will shorten the long existent distance that people need to travel in order to reach the shoreline.

With a central axis, the opening reaches the middle part of the new waterfront park. The other four connections will enable the coastline to foment new programs in order to activate and revitalize the area. Functioning as the new waterfront doors, these connections will empower the area by connecting the so long desired contact.

Furthermore, the new urban grid will be structured with a variety of streets that will prioritize a slower transit, the pedestrian and bicycle movement. By doing so, the project will respond to the worldwide changing paradigm of cities of restricting the car use in order to prioritize the greener forms of transit and accompany the reduction of CO₂ emissions and noise pollution.



Fig 24: Buenos Aires - connectivity: new connections to the waterfront. © By author

Urban structure

The idea to strengthen the urban connection between the city and the water is made by connecting transversally the grid up to the shoreline. By differentiating the different types of mobility and where they could move along, the project establishes a characterization of avenues that function as the main arteries of the connectivity connected with the rest of the space by smaller size streets.

Nowadays, the waterfront avenue serves mainly as a pass through space due to having the airport as a barrier. But by removing this infrastructure and opening transversally the area this coastline avenue will serve as complement in the urban structure of the new urban hub.

Another characteristic to take into account is the accessibility by pedestrianizing the area and allowing bicycle lanes to connect from point to point the different sections of the urban development.

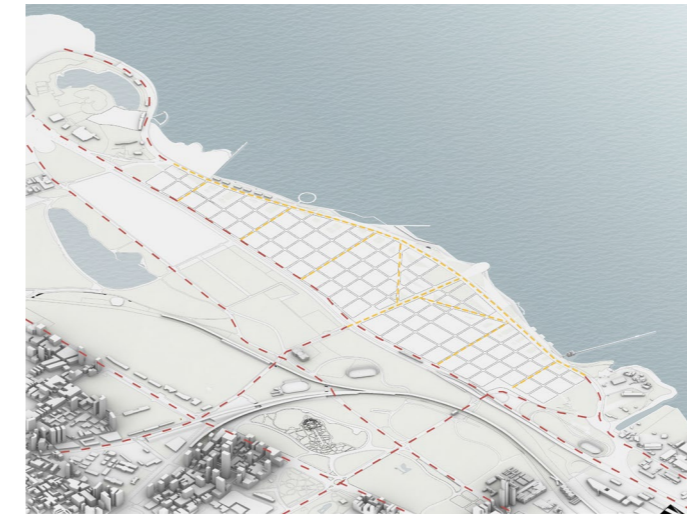


Fig 25: Buenos Aires - connectivity: avenues. © By author

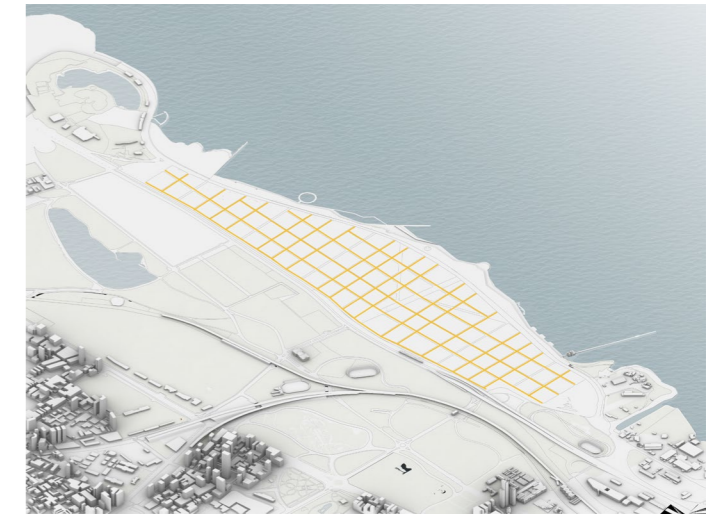


Fig 26: Buenos Aires - connectivity: streets. © By author

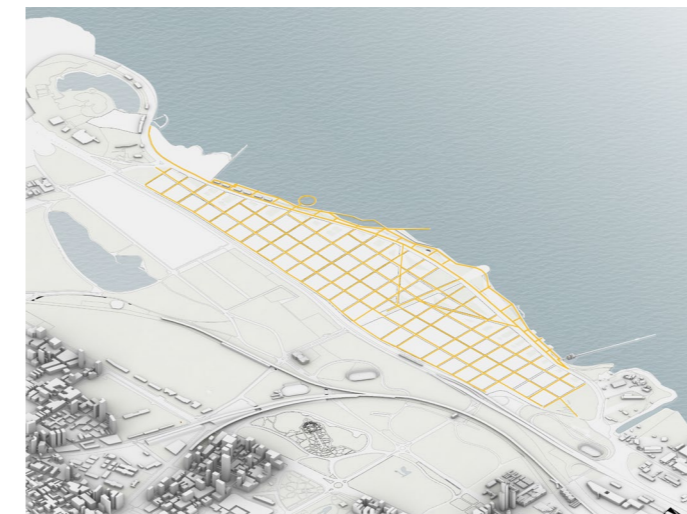


Fig 27: Buenos Aires - connectivity: pedestrian. © By author



Fig 28: Buenos Aires - connectivity: bicycle lanes. © By author

Nodes

"Nodes are the strategic foci into which the observer can enter, typically either junctions of paths, or concentrations of some characteristic." (Lynch, 1960, p.12)

Taking into consideration Kevin Lynch's concept on nodes, the idea to establish a hierarchy of spaces, the circulation from the city to the waterfront culminates in nodes that generate a variety of scenarios. The nodes in relation to the connectivity mean the centralization of an area according to transport and uses. By doing so, the area creates a dynamism that directs people towards these spaces and helps organize the waterfront into different spaces.

The four nodes respond to the main arteries of the project in which different waterfront scenarios take place: circular dock, cove and a convergence open space and floating pathway are the areas in which the visitors can experience different views towards the river and generate a variety in the circulation of the waterfront pathway. These spaces articulate the circulation, morphology and rhythm of the shoreline.

1 – This is the junction of the gastronomic area and the circular dock.

2 – Where the diagonal avenue meets the waterfront there is the pier.

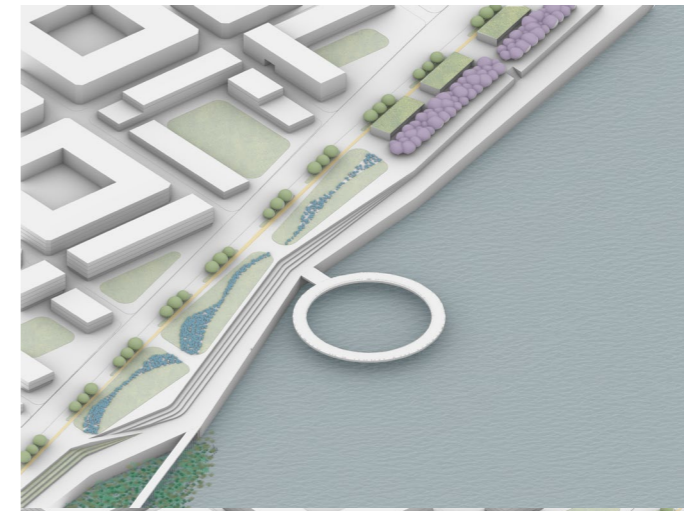
3 – This is the main axis of the urbanization, where the central avenue reaches the waterfront and culminates in the monument of Colon. It signifies an urban convergence space.

4 – This area is the end of the other diagonal avenue. In this space there is the ludic area of the waterfront, with sport facilities and a water garden.



Fig 29: Buenos Aires - connectivity: nodes. © By author

1



2



3



4



Fig 30: Buenos Aires - connectivity: details of the four different nodes in the waterfront area. © By author

Morphological dimension

In terms of morphology, cities structure their parts through the thorough use of elements. These elements can be understood from a large urban scale to a smaller one. In a first approach towards understanding how cities articulate their spaces, an urban view of the way the grid interferes with the environment leads to a better understanding of the variation of possibilities that buildings can provide metropolitan areas. The way in which cities articulate their neighborhoods with infrastructure and the natural environment serves as a way of analyzing the urban structure. Also, looking into a smaller scale, the way in which buildings articulate between themselves in relation not only to their scale but also to the ground floor, makes the morphological approach of analysis to break the two dimensional thinking and consider how the built environment affects continuously the pedestrian overview. Furthermore, the study of the programmatic organization of cities between sectors and in the building scale allows us to comprehend how the cities articulate the space and provide with the needed mixtivity that urban metropolis aspire.

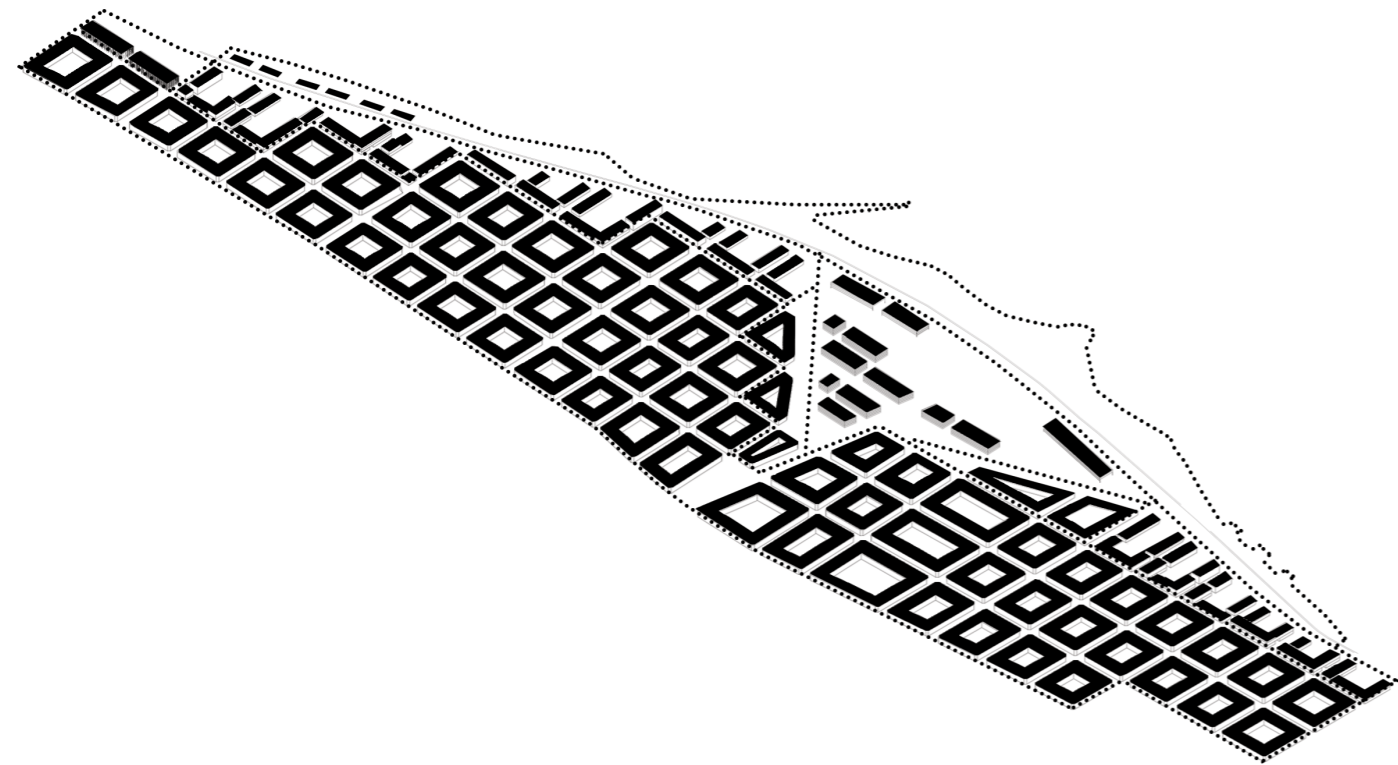


Fig 31: Buenos Aires - morphology diagram. © By author

Urban structure

1. Sections

The project divides the area into five different sectors. Each part responds to different characteristics, approaches, needs and outcome.

- _ District 1: The waterfront park
- _ District 2: The gate from the urban space to the park. Hosts large green open spaces and mix use buildings for services and gastronomic activities.
- _ District 3: Cultural and iconic buildings
- _ District 4: Mix use buildings of commercial, gastronomic, services and residential uses.
- _ District 5: Is mainly residential and serves as the link between the existent urban structure on the other side of the green parks. Also, in this area is where the new five connections take place in order to be able to communicate the new urban structure to the waterfront and back to the city's grid.

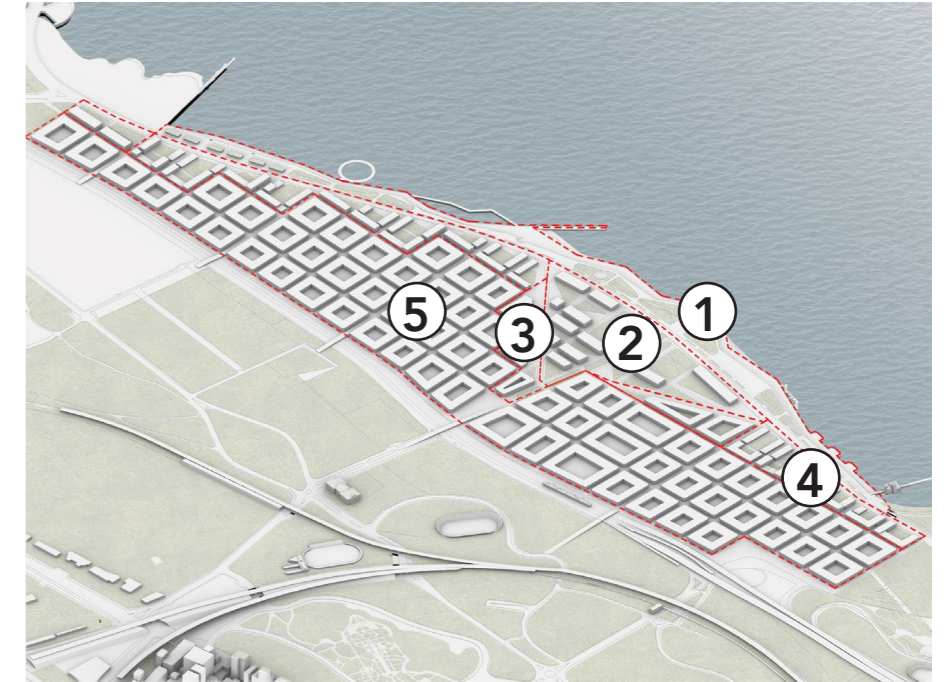


Fig 32: Buenos Aires - morphological: sectors. © By author

2. Buildings

Taking into account the way in which the new urbanization is separated into districts in order to generate an architectural diversity in the project and contribute to the possibility of having a better mix use environment, the buildings in each part have different characteristics. They configurate a variety of different blocks that go from enclosed, semi public, linear and isolated buildings.

The relationship between the back part of the urban morphology towards the buildings along the waterfront change in order to allow the public space of the shoreline to fuse with the urban grid open areas. Therefore the park and built environment work as a whole integrated system.

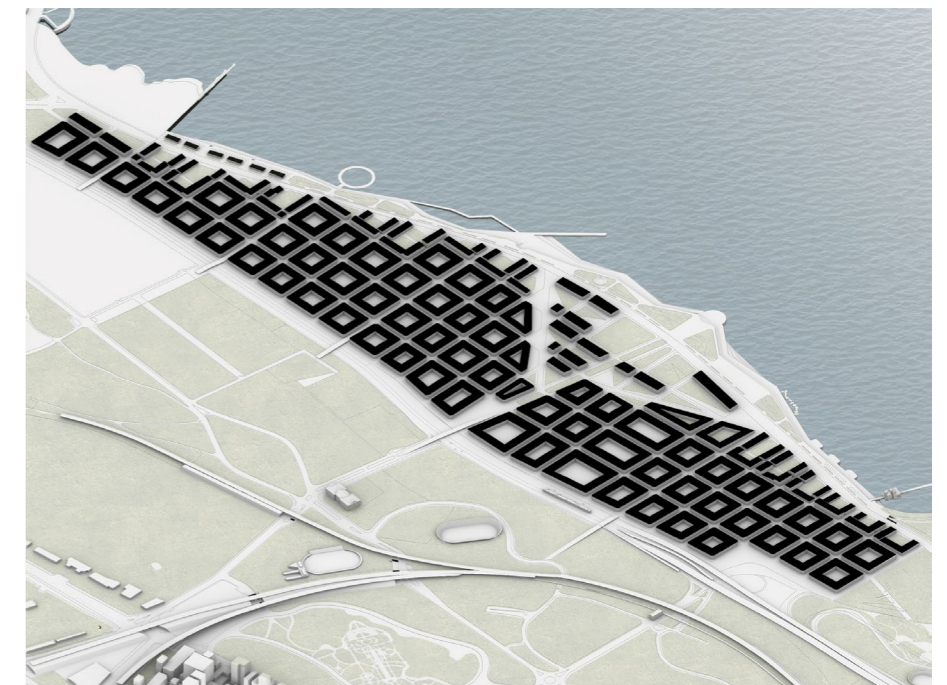


Fig 33: Buenos Aires - morphological: buildings. © By author

3. Program

As mentioned previously, the urbanization will be divided into four different districts. The diverse uses will take part into the creation of a new urban space that fuses the concept of working, living and enjoying leisure activities throughout a masterplan that involves the public spaces as a key element in the layout of the buildings. By incorporating large areas dedicated to the public space, the city regains not only the access to the waterfront but also an opportunity to generate various approaches between the built ground floor, the open space and the waterfront.

The categories implemented are mainly to distinguish in a large scale the different types of buildings such as residential, offices, cultural, educational, gastronomic and services.

The ground floor will prioritize public uses and combines them with the more private part of the urban grid by providing it of the needed services. These services will be mainly located along the new avenues that cut through transversally the project. By distinguishing this section as an opportunity to bring the city towards the waterfront, the new urban space ensures that the new area can become an integrated part of the city. In relation to the top floors, the program will change to a more private use, with a majority of dwellings and offices.

On other hand, along the two diagonals there will be five buildings dedicated mainly to cultural endeavors. Cultural uses involve a variety of different approaches such as buildings dedicated to arts, music, history or knowledge. By adding this type of unique buildings in the project it can incorporate attractive mobility towards this area and provoke a go to destination. These buildings will serve as iconic structures in the city's

grid and enforce the concept of bringing the waterfront back to the people by providing with spaces that enlighten this idea of culture and public spaces.

The waterfront park serves as a new hub for social interactions, it combines the large gained public space with small scale buildings. As well as the buildings in the new urban development, the waterfront also hosts a variety of activities and qualities of spaces that make the area attractive. This area provides the city with diverse opportunities to interact with the waterfront. From spaces to relax with benches, to sport activities such as the basketball and football courts, leisure spots like the viewpoints or the floating islands, medium gastronomic infrastructures and large green areas that altogether conform a revitalize promenade that strengthens the relation between the city and the river.

The main idea is to intensify the different uses of the park by situating them strategically to generate nodes of activities along the coastline. To emphasize in the capability of waterfront areas being spaces that can be integrated into the urban environment, the waterfront park and new urban development are thought as a whole; merging the strategies and enforcing that a good relation between city and water is possible when there is a bonding notion of connectivity and integration and when the project includes a mix use environment that can assure that people can work, live and enjoy recreational activities within a nearby environment.

Residential Office Culture Gastronomic and services Educational

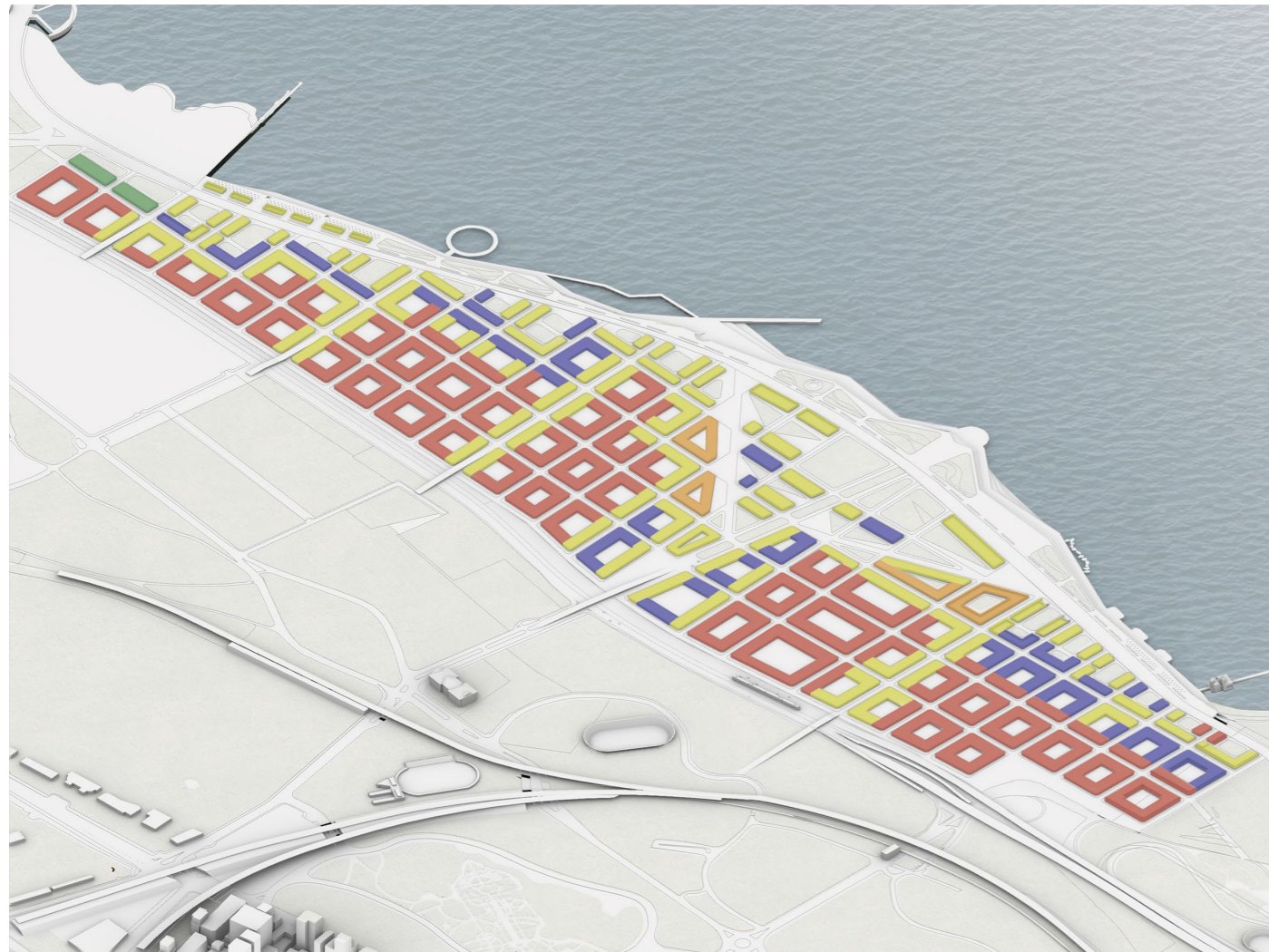


Fig 34: Buenos Aires - morphological: ground floor uses. © By author

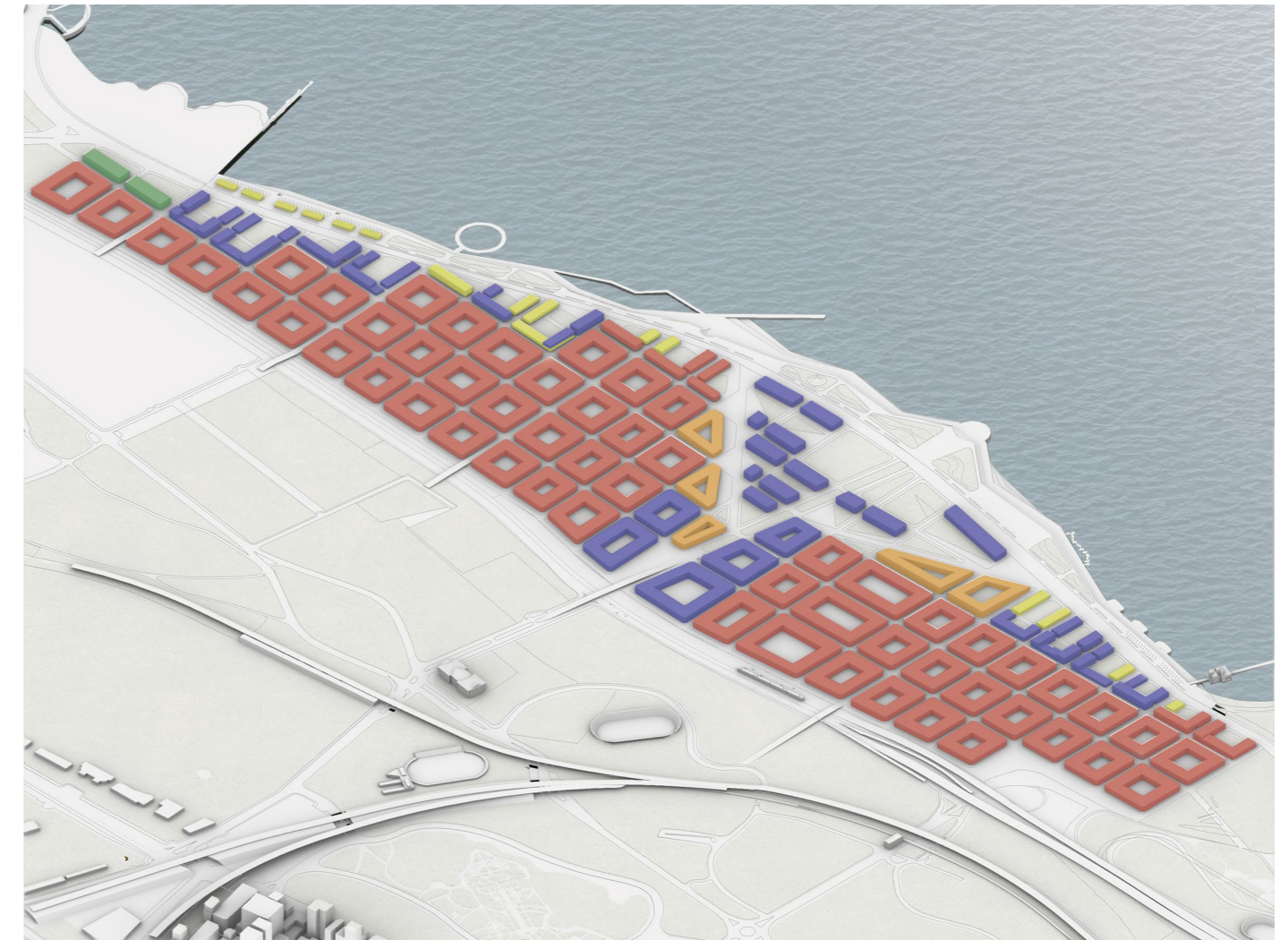


Fig 35: Buenos Aires - Morphological: top floors uses. © By author

Environmental dimension

The use of natural resources as a tool for design allows cities to have a variety of different scenarios that change in relation to the environment, place and time.

Furthermore, during current pandemic times, where public spaces have gained a larger prominence, the understanding of how important good quality public spaces are in the social and healthy life of citizens is a key element to use to be able to generate areas that respond to current problems. For leisure, entertainment or as an escape to times where the exterior spaces were forbidden, public spaces have the ability to provide cities with diverse, welcoming and green environments. By taking into consideration natural resources and evaluating their benefits regarding ecological and social aspects, it can be understood that the way in which a city relates to nature can provide healthier atmospheres, better social interactions and improve the environment.

On the other hand, environmental decisions also relate to the way in which design benefits the ecosystem. By protecting natural environments and using native trees, flowers and shrubs it has a direct positive effect in the way in which the ecological surrounding can grow and persist in time.

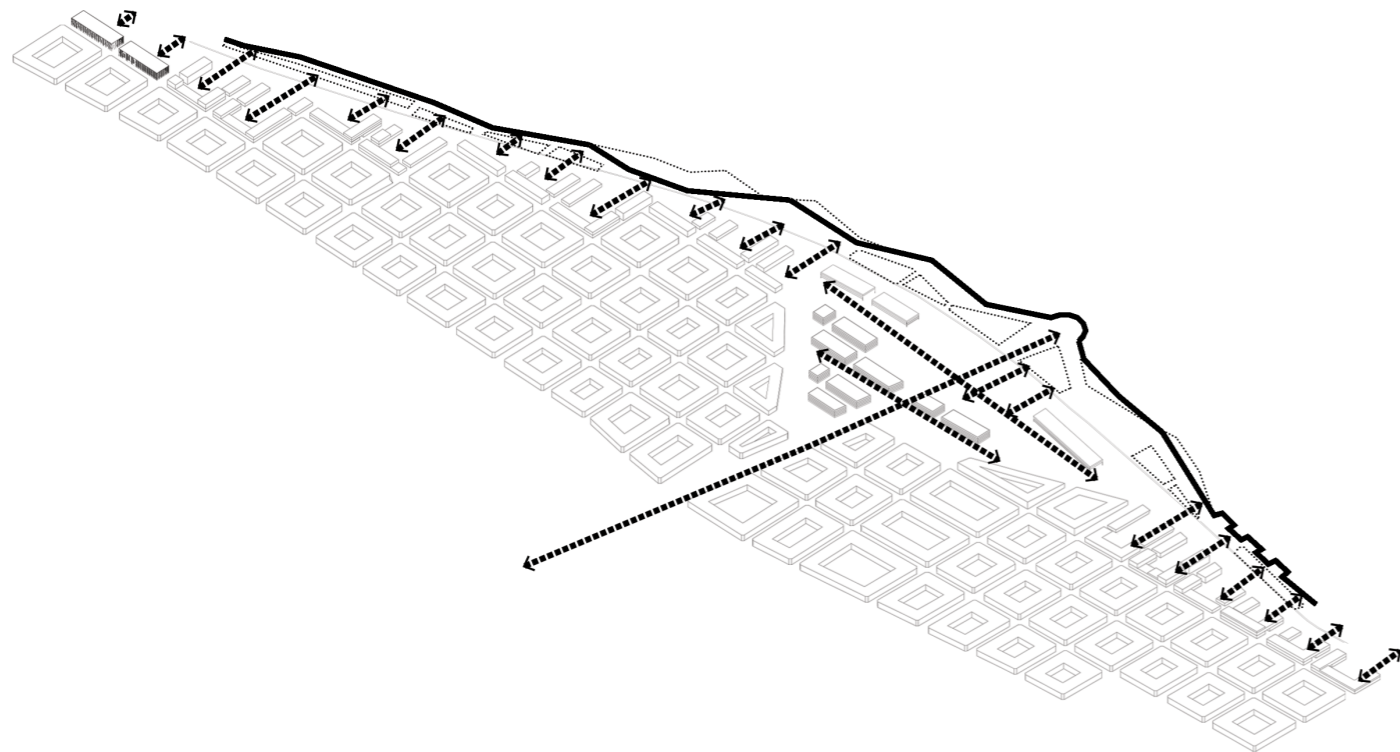


Fig 36: Buenos Aires - environmental diagram. © By author

Green areas

In order to provide the city with more public green open spaces, the project presents a variety of scenarios that will boost the relation with the natural environment. Besides being a benefit to the environment, green areas also improve the urban structure with lighter and cleaner air spaces. The concept of integration of spaces in relation of the public spaces allow green areas to generate a connection between the existent green parks towards the main avenue of the urbanization into the central green parks that serve as a connection to the waterfront green pathway. The green infrastructure serves as a link between the new urban scenario and the coastline; by opening the front line blocks towards the river and allowing green areas to merge into the grid. These connector parks between waterfront and urban space will serve as public open areas with pathways, areas to rest and shaded green loans.

In the case of the waterfront area, the project incorporates an already used strategy of providing along the main avenue native Tipa trees that will generate shadow along the sidewalk generating a pleasant pathway in the shadow. Furthermore, the waterfront park features a variety of spaces that are categorized into: the flower gardens, wetlands, ceibo amphitheater and two jacaranda forests.

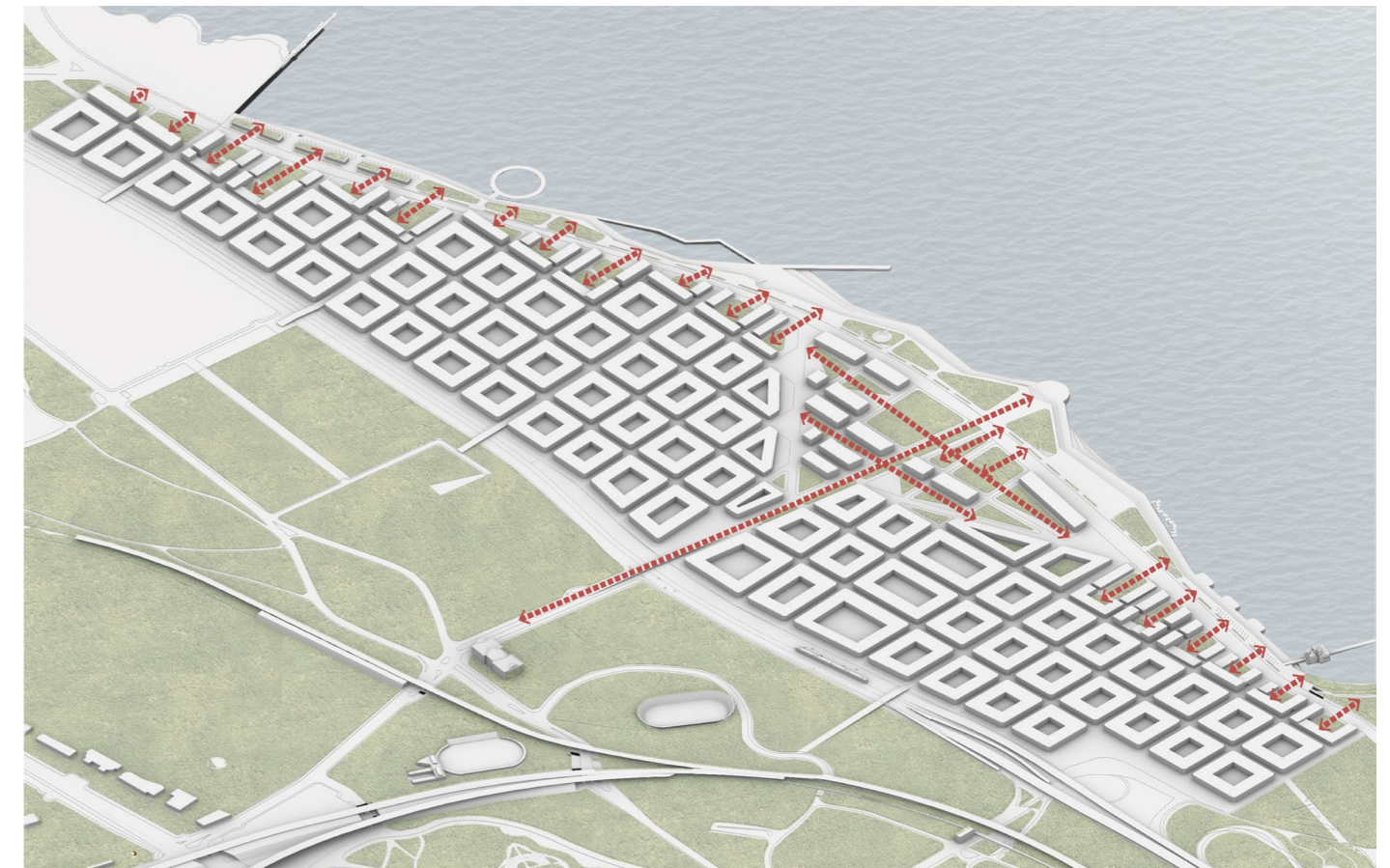
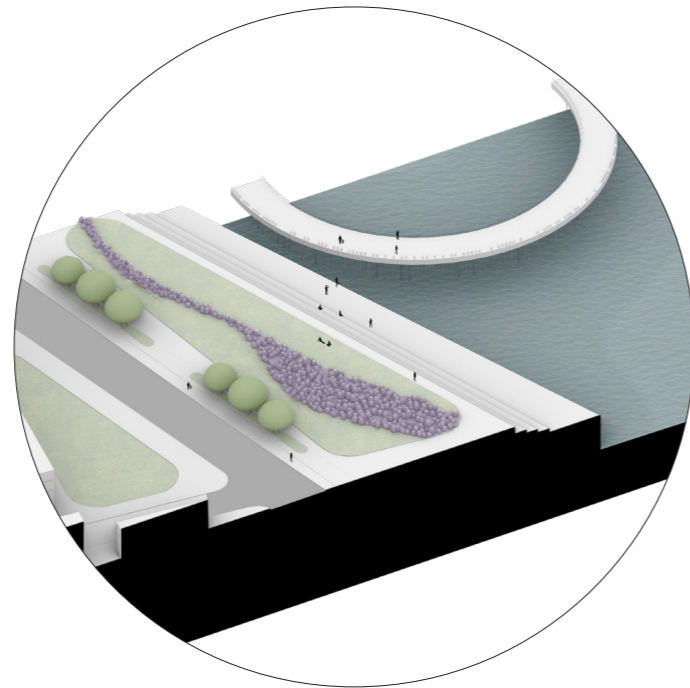


Fig 37: Buenos Aires - environmental: green connections. © By author

Flower gardens



Fig 38: Buenos Aires - environmental: flower gardens.
© By author



The flower gardens have a reminiscence to one of the best green spaces in the City of Buenos Aires, the Rosedal. The large roses garden in the neighborhood of Palermo was constructed in the year 1914 by Benito Carrasco and hosts over 93 different types of roses. This creates a unique setting when they bloom and fill the area with boosts of colors. With this concept in mind, the different flower gardens are spaces to which by an organic form in the land provide the area with colorful and native flowers combined with different grasses that will create a unique scenario all along the waterfront park.

In relation to the types of flora implemented, the native ones are prioritized in order to foment the revitalization of the environment and increase the local biodiversity. Grasses such as Pennisetum Setaceum Rubrum or the Nasella Tenuissima accompany the violet flowers of the Agapanthus Umbellatus. These types of flora create a dynamic surrounding due to their size and shape.



Fig 40.
© Stan Schebs



Fig 41.
© Mokkie

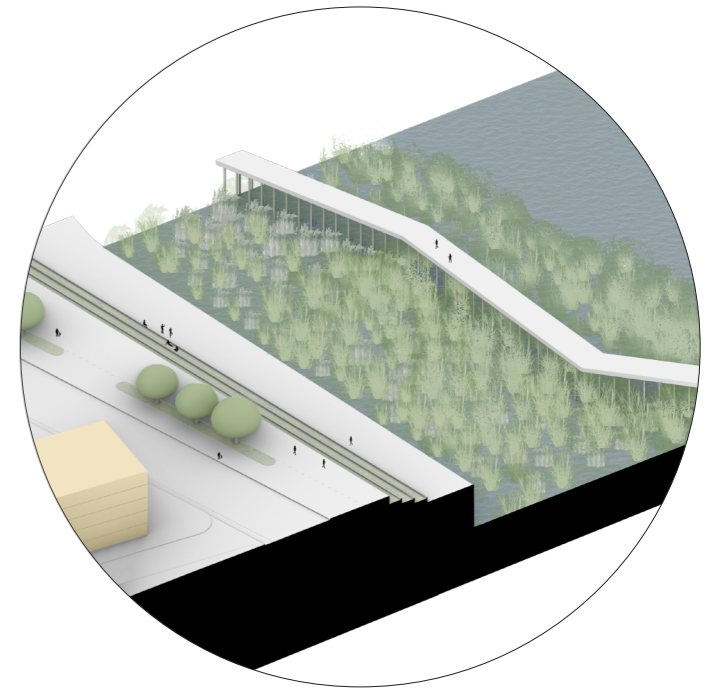


Fig 42.
© Wikimedia Commons

Wetlands



Fig 43: Buenos Aires - environmental: wetlands.
© By author



In the soft edge of the waterfront the marsh allows herbaceous plants to flow with the moving tides and therefore slow the incoming tides. This type of green areas accompanied by the wetland pathway generate a new different scenery in the shoreline. Plants such as the Schoenoplectus Californicus grow in the water and serve as a buffer of storm or high tides. Also they allow the area to increase its biodiversity by becoming an inviting space for birds and fishes to go to. By implementing first the wetlands in this sector of the shoreline, it can provoke the possible expansion of the plants towards other sites of the coast. By doing so it increases the "sponge effect" of marshes and becomes a much more soft edge.

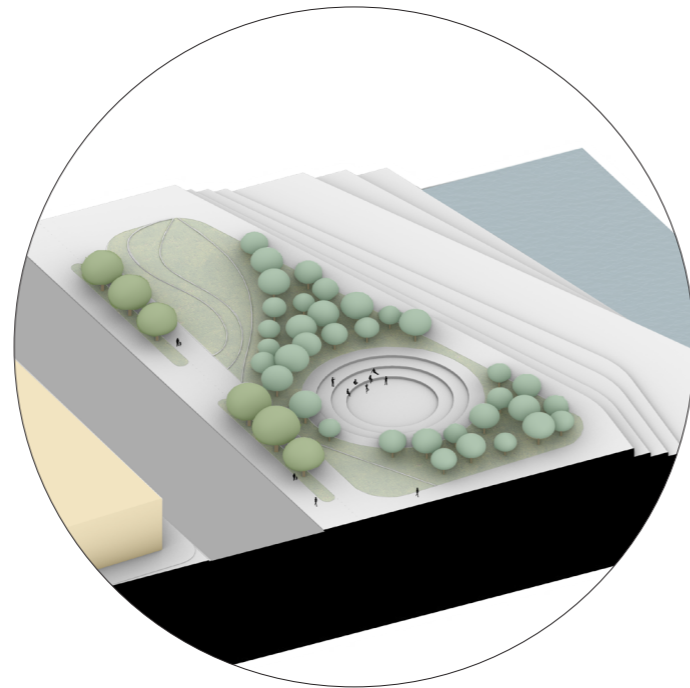


Fig 45.
© B e r n d Haynold

Ceibo amphitheater



Fig 46: Buenos Aires - environmental: Ceibo amphitheater.
© By author



The incorporation of trees into the design structure in the waterfront allows areas such as the Ceibo amphitheater to be a space surrounded by Erythrina Crista Galli (Ceibo) trees. A particular characteristic of this tree is that the flower is the national flower of Argentina. The red flowers of the tree will combine with the flower gardens nearby into bringing color to the surrounding.

Erythrina Crista Galli
(Ceibo)

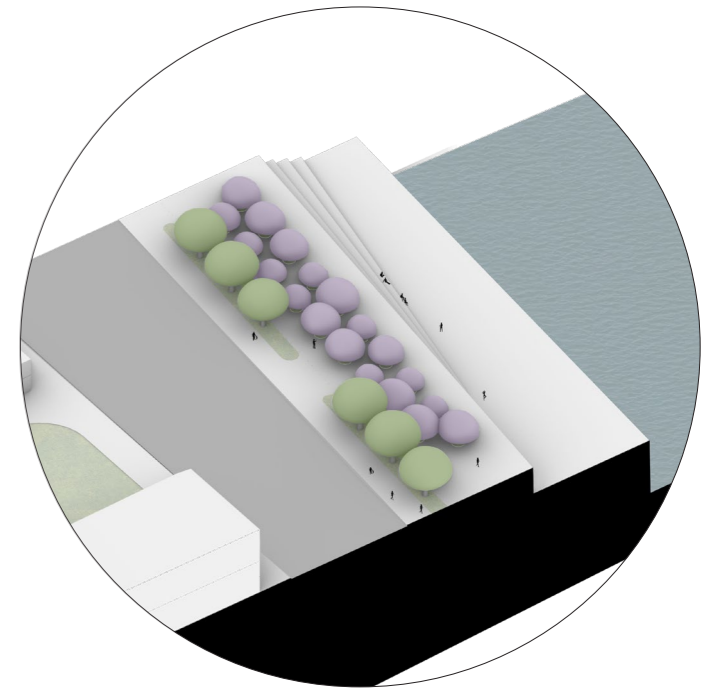


Fig 48.
© Wikipedia

Jacaranda forests



Fig 49: Buenos Aires - environmental: Jacarandá forests.
© By author



The Jacaranda forests are located in both extremes of the waterfront park. The placement of this trees links together the new green spaces with the city's already green structure. It is very characteristic of the main avenues of the City of Buenos Aires and therefore it will merge together neatly into the environment. Even though this tree was not native of this site since it was brought from the Northern part of the country by the architect and landscape urbanist Carlos Thays, when he created the unique green infrastructure of the city, nowadays it has become an iconic part of the greenery since it adapted perfectly to the lower temperatures of Buenos Aires. This tree gives a particular violet color flower that creates a unique spectacle during spring. The placing of these trees along a linear structure will create a forest like ambience that due to its large foliage gives shadow and will contribute to the environmental strategies of creating a space that respects, strengthens and boosts the green structure of the city.

v



Fig 51.
© Wikipedia

Waterfront edges

When intervening in the waterfront, the notion of edge becomes a crucial role in the design strategies. The relationship between land and water is one of the key elements to respond in a strategic and logical way in order to tackle the specificities of the area. Water edges have the capacity to combine the hard edge of the city with the molding environment and showcase a diverse connection between man-made environment and the natural habitat.

In the case of the coastline of the City of Buenos Aires, the current monotony edge becomes a distinctive and attractive space with a variety of activities that accompany the strategies made in relation to environmental approaches.

The use of levels in the shoreline allows the area to have a resiliency towards possible drastic changes in the environment. Nowadays climate change has shifted the focus of the approach towards edges into the reconfiguration of spaces in an integrated environmental way. The effects of the shifting environment produce an increase in the sea level and has a negative correlation with high tides and stronger storms.

In order to address the different possibilities of approach towards the waterfront edge, the strategies are divided according to: hard, adaptive and soft edges.



Fig 52: Buenos Aires - environmental: edges. © By author

Hard edge

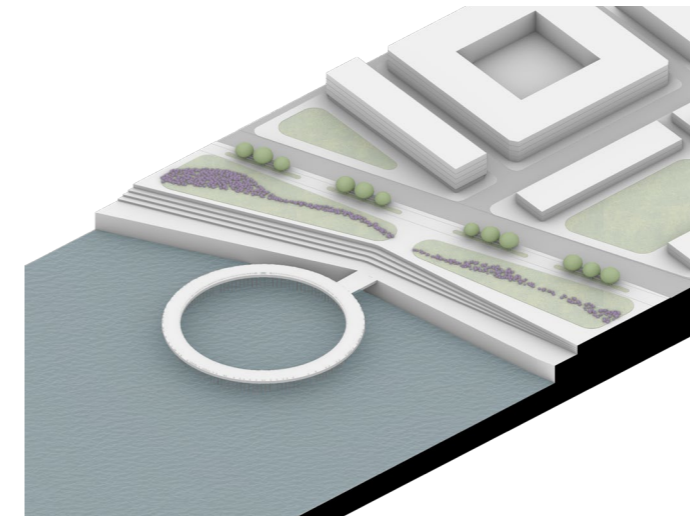


Fig 53: Buenos Aires - Environmental: hard edges. © By author



"Gray solutions, often developed by civil and environmental engineers, are flood protection structures that are (almost always) permanent. Hard solutions focus on controlling flooding and sea level rise. Examples of hard solutions are seawalls, floodwalls, and revetments. The downside of these projects is their disruption of ecological systems. They are generally expensive and require maintenance."
(AI, 2018, p.12)

The hard edge strategies englobe all the systems that require a strong protection towards high sea level rising or environmental disasters. It is the most common strategy used since it is the most permanent and resistant type. These strategies involve large engineer and infrastructural approaches concerning the waterfront edge. Some of these strategies involve bulkheads, seawalls, dikes, and revetments; they showcase some diversity between each other. For example, revetments are made of blocks made of concrete, or wooden planks that help mitigate the incoming tides. This strategy is less effective towards storm surge but it usually involves a lower investment than seawalls or bulkheads.

In the project, the seawall is used as a hard edge strategy along the waterfront line. But this seawall is integrated into the system by expanding its footprint and generating a 15m promenade along the coast. This vertical strategies are robust and expensive but very durable and can be integrated into the design by functioning as a multi-purpose strategy.

Adaptive edge

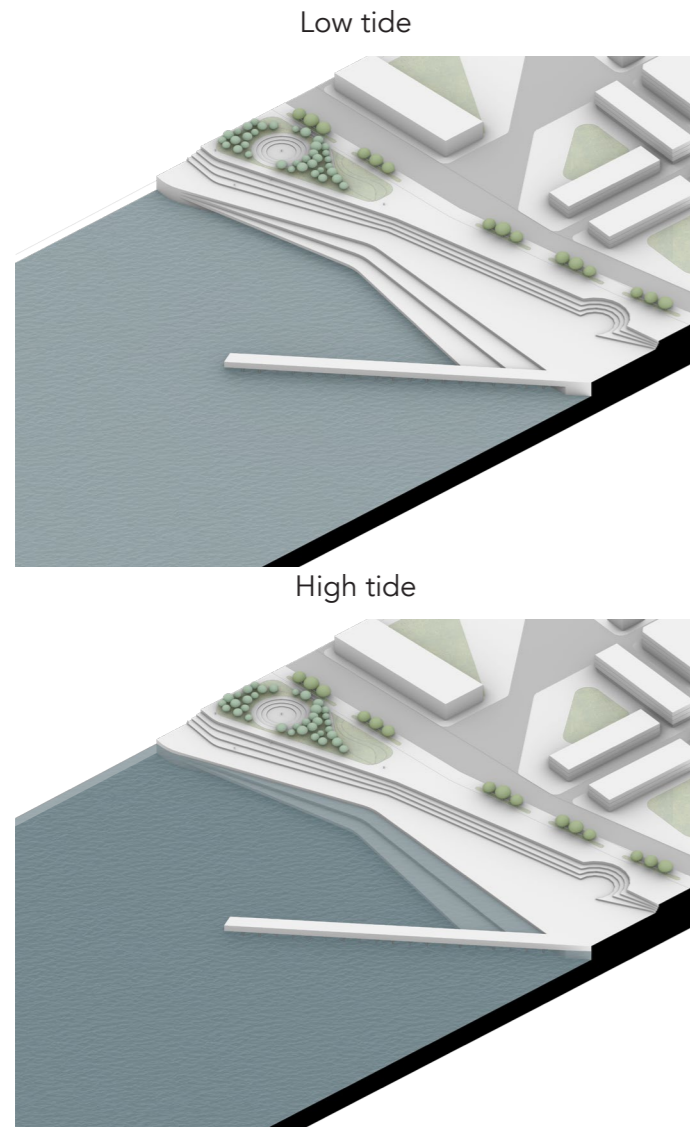
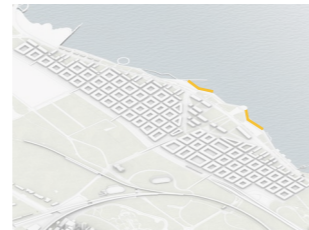


Fig 54: Buenos Aires - Environmental: adaptive edges. © By author

The adaptive edges involve the in-between strategies. These approaches are a mixture of having hard edge infrastructures but allowing the natural environment to fuse with it creating a relationship between hard and soft strategies. Some of these strategies involve green dikes and terraced seawalls. Adaptive waterfronts are very receptive towards the involvement of urban design in merging these flood protections into the urban layout in order to combine the system of man-made and natural environments. To adapt is to recognize the resiliency needed to confront the present and future problems towards the effects of climate change and integrate the protection strategies with innovative design approaches.

The project includes terraced seawalls in the shoreline as a way of incorporating a front line that shifts with the tides and helps reduce the possible risk of high tides. The changing land profile refers to the possibility of having hybrid systems in the waterfront of cities. The natural environment becomes part of the design process of the shoreline with a direct contact to the man-made strategies.



Soft edge

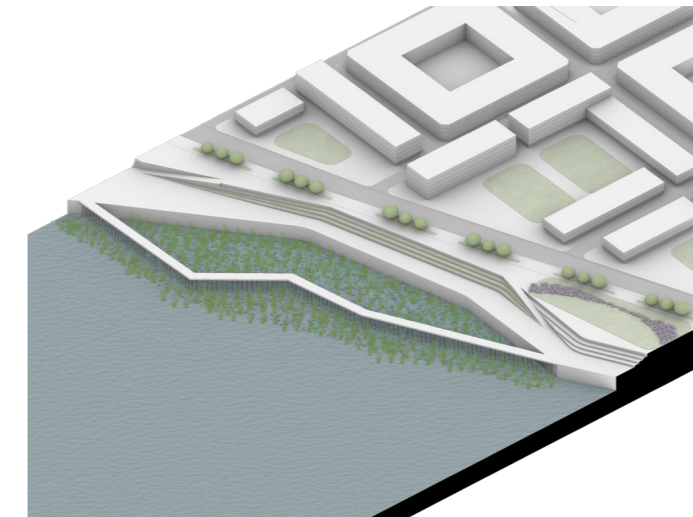


Fig 55: Buenos Aires - Environmental: soft edge. © By author

"Green solutions utilize ecological and environmental principles and practices to provide flood protection, as well as reduce erosion and stabilize shorelines, while also enhancing habitats and improving aesthetics (as compared to hard solutions). Often, soft solutions are less expensive than hard solutions and lower in maintenance, but they are not permanent and are subject to erosion." (AI, 2018, p.13)

Soft strategies are based on the use of natural resources to create a shoreline that battles the possible sea level rise effects. Some of this strategies are wetlands, dunes and floating islands. These approaches allow the border line to become diffuse and therefore integrate the natural environment into the creation of waterfront spaces. These systems generate an indefinite scenario since the environmental conditions are the ones responsible to develop the area. Another characteristic is the benefit for the ecosystem since they encourage the biodiversity of the area; birds, animals and insects become more attractive to these shorelines since they find spaces to breed or feed from.

The wetland is used as a soft strategy of waterfront edge by which the environmental approach reduces the shoreline erosion, helps to mitigate the storm surge and generates a unique scenario that connects hard edge strategies into becoming a hybrid edge system. This type of strategy is commonly used in moderate to low risk flooding areas since is not as strong as harder infrastructures such as dikes or bulkheads. In the project, the wetlands go along with the elevated pathway; this allows people to interact with the environment some meters away from the shoreline and also get a completely different viewpoint of the waterfront. Another soft strategy are the recreational floating islands that create a ludic pathway from the revetment towards the river. These floating structures can also be seen implemented in other cities as green sponges. By adding plants into these structures they become natural buffers of strong tides while involving the natural habitat into the process.



Passive strategies

In order to improve the ecological reality of the waterfront the project includes different nature-based solutions:

_ The incorporation of absorbent pavement is used as a strategy to help protect the area and prevent possible flooding by absorbing excessive rain water and prevent runoff.

_ In relation to the previous strategy but visioned from a natural based approach, the incorporation of large green surfaces into the project allows the area to absorb more water and mitigate the grey waterproof surfaces that cities tend to have.

_ Green roofs are implemented as soft strategies that increase the amount of absorbent soil in the urban grid. Besides of providing an aesthetical scenario, they can also benefit the ecosystem by increasing the possibility of biodiversity and reduce the temperature of buildings which would directly affect the energy consumption and foment a better environment.

_ The respect of the native flora benefits the ecosystem by boosting the environment using plants and trees that will ensure the longevity of the green spaces. The incorporation of trees such as Erythrina Crista Galli (Ceibo) or the Tipuana Tipu (Tipa) guarantee that the environment will be able to proliferate.

_ Marshes in the soft edge of the waterfront line offer a type of coastline that mitigates possible floods while using natural resources.



Fig 56: Aerial view of the project of waterfront regeneration. © By author

_3

WORLDWIDE
TRANSFORMATIONS

WATERFRONT

Waterfront regenerations

Waterfront regenerations have been part of port cities from its beginnings. At the end of the 20th century cities started to transform their waterfronts due to economic reconfiguration of ports and changes in technologies implemented that led to the constant transformation of coastlines in order to adapt to new technologies and requirements. (Stevens, 2021) In port cities, large infrastructures tend to separate areas of the coastline with the city and become physical barriers. When technologies or demands require bigger spaces, port displacements take place leaving obsolete areas. Several cities such as Hamburg or Barcelona reinvent these spaces and generate approachable, attractive and inviting places for people to reconnect with the waterfront.

In order to comprehend the various strategies done over the past 40 years regarding waterfront transformations, I chose to analyze three different cities where these transformations led to major reconfigurations of the relationship between cities and their coastlines. The case studies were chosen to showcase different history times, scales and changes in paradigm.

In relation to the time framework of the projects, the oldest one will be Barcelona, starting from the 80s decade to transform its waterfront, following by Hamburg and the major masterplan of Hafencity and finalizing with the last decade renovations on the waterfront of Manhattan in New York.

Connectivity

- Accessibility
 - Public transportation accessibility
 - Bicycle lanes
 - Walkable paths
 - Neighbourhood connectivity
- Infrastructure
 - Good public transport system
 - Sustainable mobility

Morphological

- Scale
 - Scale of intervention
- Public Space
 - Vivable green open spaces
 - Urban parks
 - Revitalization of industrial heritage
 - Urban furniture
- Land Use
 - Mixed use
 - Residential
 - Commercial
 - Leisure
 - Essential services
 - Urban parks
 - Revitalization of industrial heritage

Environmental

- Pollution Levels
 - Air, land, water, noise pollution
- Natural elements
- Resiliency strategies

Time framework and scale

1983

waterfront 2.10 km

CONNECTIVITY DIMENSION

2000

waterfront 13 km

MORPHOLOGICAL DIMENSION

2004

waterfront 16 km

ENVIRONMENTAL DIMENSION

2021

waterfront 2.7 km

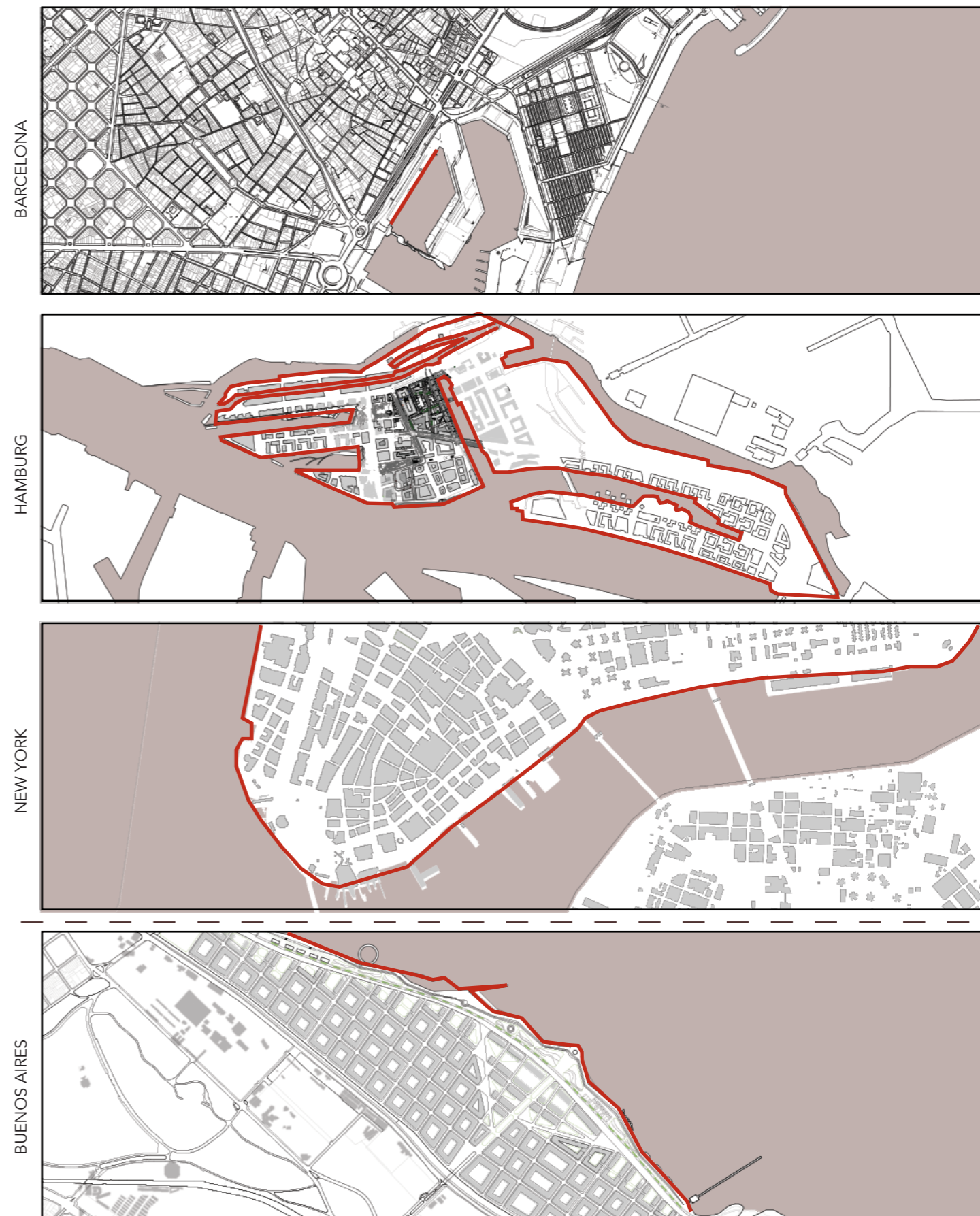


Fig 57: Comparison of the waterfront areas. © By author

1:25000

Connectivity dimension

Urban waterfront regenerations can be determined by the infrastructure of its surroundings. By taking into consideration how the transport has been changing through time, one can understand the shifting needs of a changing urban paradigm. Transport has been a synonym of progress in the layout of a city; ports, highways, avenues, train and bus stations have been altering the urban landscape. Usually these infrastructures have been placed strategically responding to specific needs in those times. But as it can be seen in the beginning of what has been considered the waterfront regeneration concept – post-industrial times – large transport infrastructures can become obsolete and therefore leave large empty spaces that have great opportunities to reconfigure and mutate into something new.

The recovery of these spaces showcase how a city can adjust former transport systems into the city's grid and public spaces. On other cases, the shift in infrastructures does not mean the total removal of it but the improvement in order to adapt to new needs. Nowadays the transport in a city has been prioritizing mainly sustainable or pedestrian mobilizations. This explains once more how the constant changes in an urban milieu can incorporate new paradigms.

Another important aspect of connectivity is the accessibility. The accessibility to coastlines has been a well desired aspect in city's since the post-industrial empty spaces have become an ideal area to intervene and regain a connection between land and water. Depending on how accessible a place is it affects directly the way in which people interact with the space.

Reshaping infrastructures: Barcelona, Spain



Fig 58: Barcelona. © By author

Moll de la Fusta



Fig 59: Barcelona Port, 1981. © Julio Cunill



Fig 60: Moll de la Fusta, 1988. © Julio Cunill

Barcelona has become over the past 40 years a city that transformed its waterfront drastically to respond to port changes, changing infrastructures and the connection with the natural environment. Throughout the colonization of the water, the sea front expanded to host the port, infrastructure and leisure activities. Its urban waterfront, infrastructure and public spaces have been regenerated to accompany the former industry-based economic system. (Busquets, 2004)

This city is an example of how fragmented interventions restructure the coastline of the old harbor. With one of the main concerns being regaining contact between city-water, it has overcome several renovations to be able to achieve this contact between the built and natural environment. The urban renewal of abandoned or remanent spaces in the case of Barcelona meant the transformations on large scale infrastructures to improve the overall quality of the space. There were taken into consideration transport, social life and connectivity, bringing back the shoreline to a dialogue with the city's layout.

The first transformations that took place in the old commercial port become part of a series of projects to restructure the Port Vell space into an urban port and provide the area with accessible public spaces. (Seaman Cuevas, 2012). The needed open public areas forced the projects to make large scale transformations in order to bring back this part of the city to the people.

The first project that enabled a series of transformations on the waterfront is the renovation of the first port space of Barcelona, the Moll de la Fusta. This area, situated between the Ciutat Vella and the water, identified the opportunity to regain the connection between the old city and the waterfront by transforming the section of large scale infrastructures of transport. The area underwent a renovation from being industrial to a touristic, social and open space. The project began in 1983, by the architect Manuel de Solà-Morales who developed a large infrastructural reconfiguration strategy which consisted in stratifying the layers of transport, he hid in



Fig 61: Moll de la Fusta. © Barcelona.cat

an underground highway the car and bus traffic to give the city a large esplanade for social and gastronomic use. This project addresses the idea of transport as the main axis of waterfront renovations. In times where car use was the primary form of transport, where it was prioritized over other more sustainable, but then uncommon ways of moving, the Moll de la Fusta showcases this approach of returning the city a direct relationship to the water.

Transport structures

The disconnection in the area was mainly due to transport infrastructures along the coastline. In relation to its surroundings, even though the city's layout is very rigid and narrow due to its medieval structure, it has a closeness contact to the shoreline. These quarters are the first urban line of the city in relation to the old commercial port area and therefore they presented an opportunity to take advantage of the nearness to the waterfront in order to reestablish the need of public spaces that link the built environment with the water.

The Moll de la Fusta emphasizes on the importance of bringing the relationship city-water back to the people. By prioritizing pedestrian mobility and hiding part of the large transport infrastructure that generated a barrier, it regain the contact to the shoreline. By restructuring the circulation of transport infrastructures the public spaces become accessible and gained not only space but predominance above the rigid barrier structures (Seaman Cuevas, 2012). The project established the importance that public space has in an urban grid and how it can be treated with transport infrastructures in order to restore the space.

By working with the section of the area, Manuel de Solà-Morales develops the stratification of the different types of mobilities. The Ronda Litoral is displaced to an underground level leaving the private car mobility and the public transport system above. Nevertheless, the main prioritization is the pedestrian access which gained a 65 meter wide esplanade of public amenities in order to reach the waterfront.

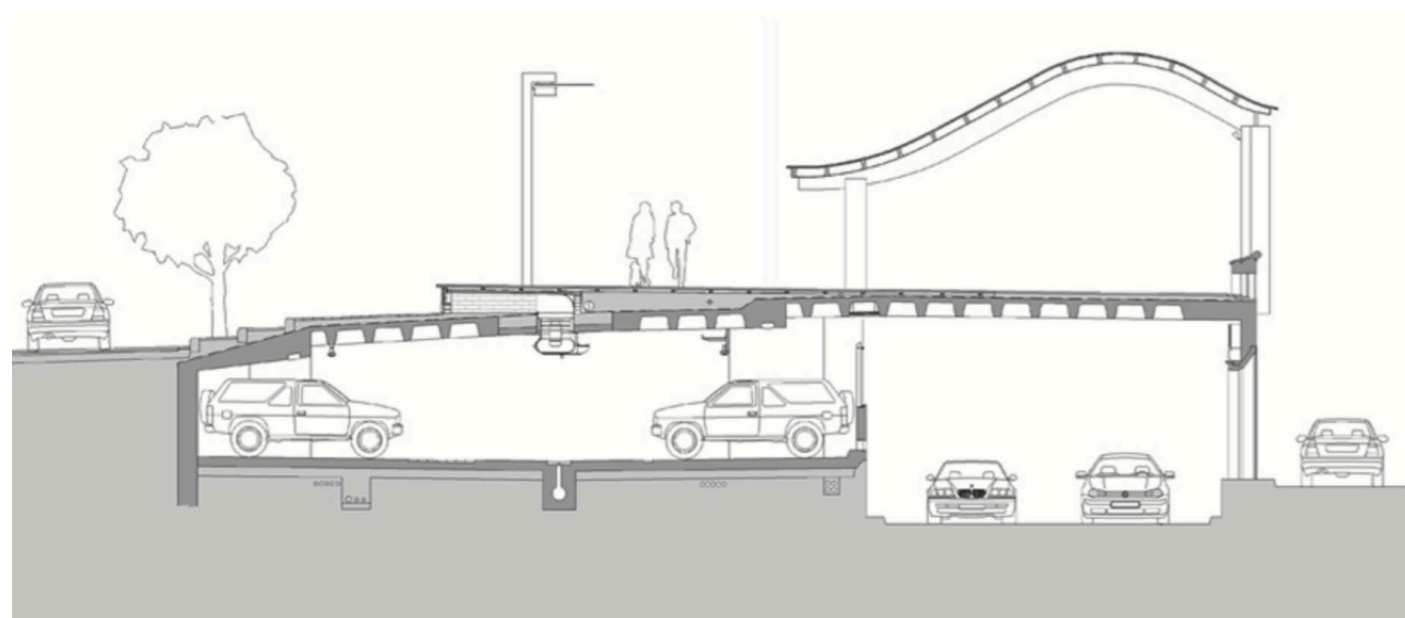


Fig 62: Moll de la Fusta section © Manuel de Solà-Morales

Public spaces

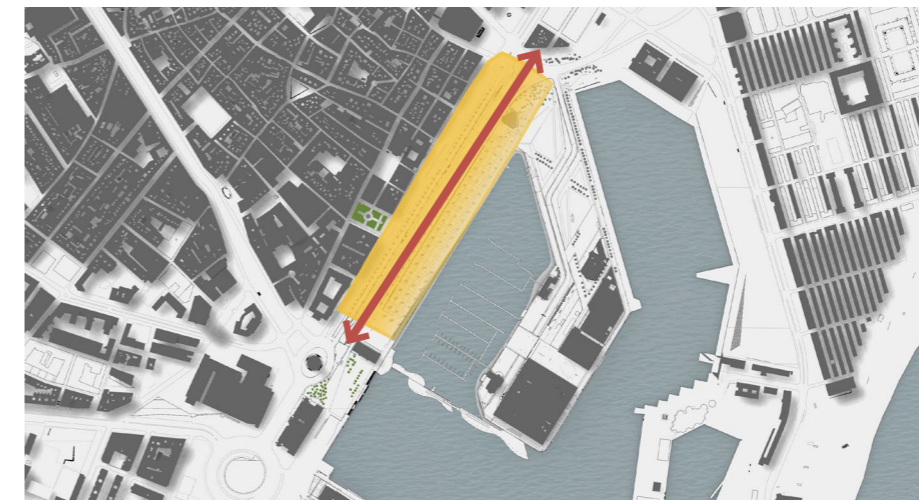
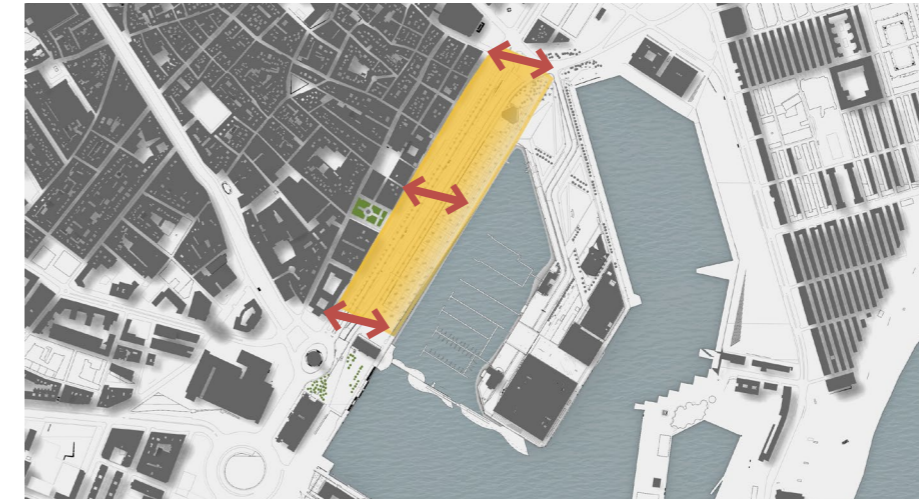


Fig 63: Moll de la Fusta longitudinal and transversal connections. © By author

The public space becomes an integral element of the urban grid. The Moll de la Fusta is characterized by having a clear massing module of 156m that can be subdivided to generate a rhythm and help organize the different layers of the project. (Clos, 1988) There is a clear division of three main public areas: the Passeig de Colom, the balcony and the Moll de la Fusta platform.

Firstly, the Passeig de Colom is the direct relation between these new public spaces and the urban grid. It has a circulation of private mobility and public transport but does not interrupt the scenery. Following is the balcony; this area is the main reconfiguration of transport and where the pedestrian was prioritize by having a 25 meter wide balcony that overlooks the waterfront above the hidden large transport infrastructures. This terrace has a direct visual connection with the Moll de la Fusta pathway. Finally, the largest public space of the project is the large esplanade that welcomes the public and allows the city to gain a large open space for conglomerations, as seen when the Olympics games took place and the area was flooded by people gathering around this area.

The project differentiates the uses by structuring urban elements such as the trees, benches, lightning and materials that articulate each part of the project into spaces for rest, leisure and transit.

The project not only relates to changes in transport infrastructure and how they affect the public space but also has a strong notion of large urban scale discontinuity that needed to be addressed. The public space along the coastline is what links not only city-water transversally but also connects along the water the different neighborhoods.

Morphological dimension

When urban transformations take place they affect several aspects of a city's layout. The configuration of spaces changes in relation to its morphological composition. This can be seen not only regarding the building environment but also the configuration of public spaces and how they interact with the city's grid and natural surroundings.

Waterfront regenerations can generate great impacts towards the morphology of spaces. By being in direct contact with a nature, the changes affect both the natural and built environment. Different scales of interventions can take place to accomplish successful waterfront renewals. Large and medium scales of interventions can relate to the urban reconfigurations of spaces, the incorporation of a variety of mix uses or the revitalization of unused industrial settings. In terms of micro scale, the materials, lightning and urban elements contribute to the overall new configuration of spaces.

Revitalizing heritage: Hamburg, Germany



Fig 64: Hafencity, Hamburg. © By author

Hafencity



Fig 65: Hamburg before revitalization. © City of Hamburg



Fig 66: Hamburg today. © Andreas Vallbracht

The city of Hamburg, former Hanseatic city, is the second largest city of Germany after Berlin. It has an overall size of 755 square meters and connects both the Elbe and Alster rivers. The particular location of Hamburg allowed it to be one of the largest ports in Europe (Garcia Ferrari & Smith ,2012). This city is another reference of how cities are transformed according to the changes of port industries and technologies. Hamburg experienced a process of decentralization of the port area leaving a space in total dereliction. The basis of the project of Hafencity started from the need to enlarge the city center by 40%. This total area occupies 157 hectares with an 10.5km long waterfront. The idea to rediscover a waterfront presents an opportunity that the city took advantage to revitalize old harbor buildings, create new mix-use areas, large open green spaces and generate an overall new urban development without having to create large amount of landfills, it uses what is already there, the obsolete old port, and takes the opportunity to revitalizes it into a new realm by making the city-building process as a whole integrated system. (Smith, 2012) The masterplan becomes a total regeneration not only in physical terms, but also to increase economic activity, improve social activities and create an area that merges the unused space with innovative and sustainable strategies that generate an inviting, integrated and diverse new environment. The masterplan is divided into ten quarters that allow the implementation to be done by phases and respond to different needs in time and characteristics. What makes this area very unique is the concept of creating a new urban area in a

preexistent land but where nobody lived there before. By being close to the city center it presents good qualities to be connected to the existent infrastructure.

Therefore, the project of Hafencity arises from these dilemmas in need and presents a long-term masterplan that includes urban, infrastructural and environmental notions in order to integrate the new urban space to its surroundings, provide with resilience design strategies to accompany the shifting environment and revitalize the area into becoming a new high quality urban hub.

Urban structure

1. Land profile

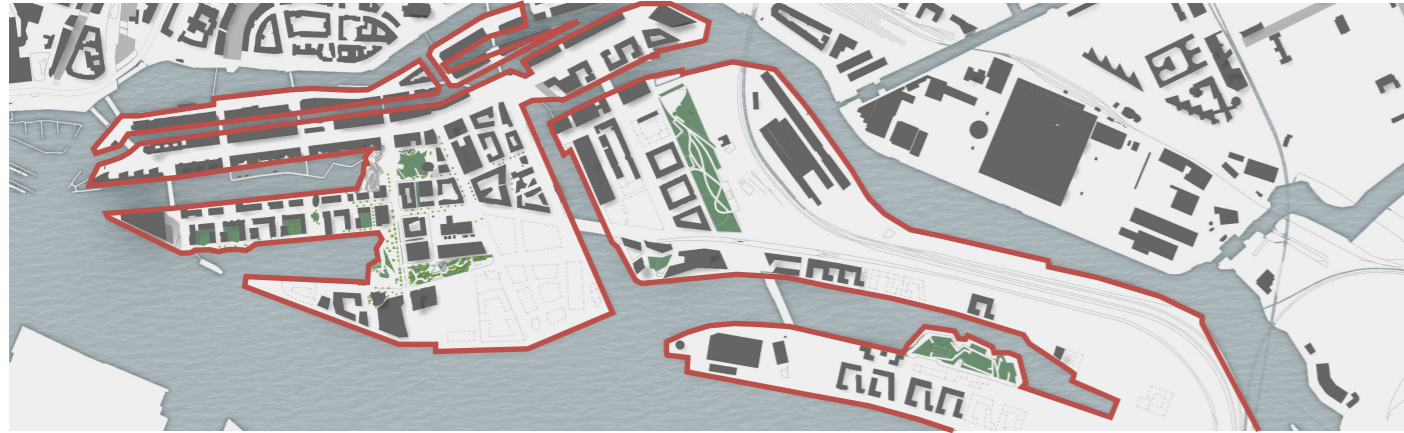


Fig 67: Hafencity land profile. © By author

The land profile of Hafencity disrupts the concept of a waterfront as the limit between land and water. It breaks the notion of frontier by merging the spaces through the form of the land. The profile is varied and very defined but yet lets the water to navigate throughout its silhouette. The edges accompany each sector of the masterplan in order to respond to different uses and characteristics. It generates a juxtaposition of strong linear and diagonal waterfronts that altogether articulate a complex urban design. The overall area was already there, the old port left the ground area of the dikes that became integrated into the new urban layout.

Firstly, the profile in relation to buildings has neat and simple lines, it responds to the morphology of the constructions. This rigid and delimited line breaks with the articulation of the public spaces that generate a dynamism in the form of the shoreline by incorporating a variety of diagonals and curves and generating a unique layout. The project done by the architectural studio EMBT presents a multiplicity of different approaches between land and water. It has a topographic and diverse profile, with curves and planes that intersect creating singular situations and allowing the user to relate to the water in different experiences.

This relation between land and water portrays an environmental approach, even though the city seeks to incorporate the natural environment into the urban grid, it has to maintain the strong and hard edge towards the water due to the climate change effects on the sea level rise that compromises a more direct relationship with the water and places the built environment in a higher level.

2. Levels

The urban mass of land of Hafencity is structured in three different levels. This sectorization serves mainly as a resilience strategy against possible flooding due to the rise of sea level. By stratifying the different components of the masterplan into levels the program is subdivided.

The lower level corresponds to the floating waterside areas, where piers cut through the waterfront into the water like branches of trees. Following, in a level situated four and a half meters up from the shoreline is the water edge. This space is the old port level that now becomes the first borderline between the city and water. It is organized in terraces which are connected through ramps and stairs that create a fluid continuity of circulation. Finally the city level, constructed above the existent ground, is over seven and a half meters high and is where the buildings and streets are located. By being various meters above sea level it ensures that it would not flood. This level is what serves the urban configuration the permeability to go from the city center and connect through the bridges the new urban hub to the water.

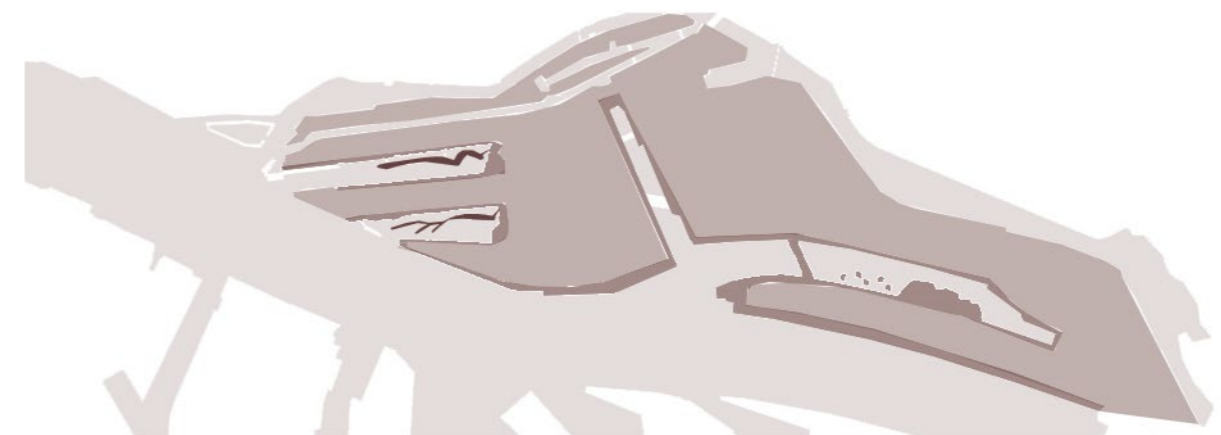


Fig 68: Hafencity levels. © By author

3. Public spaces

Public spaces in Hafencity play a key role in the configuration of the spaces. These spaces become one of the elements of the masterplan that helps articulate buildings and programs between each other. The idea of "Complementary spaces" showcases how each individual part of an urban plan fits into the idea thought as a whole. (Busquets, 2006) Public spaces become the gear, they articulate, push, merge and benefit the urban process of reconfiguration of spaces to help integrate the city center to this new waterfront hub. In an overall analysis, public spaces take more ground floor area than the built environment; streets, piers, terraces, parks and promenades are entangled around the buildings allowing the area to be entirely connected from point to point and with an easy access to public areas.

The public spaces are designed by seven different landscape, architectural and urban studios in order to respond to the different characteristics needed and make the transition between the new Warft level of buildings and the Elbe River. In the Western and central part of Hafencity, the architectural studio EMBT, designed a variety of strategies that connect the higher built environment level with the water level in a terraced and unique way. The two distinct terraced plazas located at the heads of the harbors, Magellan and Marco Polo, create the connection between the two levels in a playful and interesting way; they allow the people to experience the difference in height by incorporating ramps and steps that create areas for enjoyment and leisure.

The variety of promenades and parks accompany the building configuration by providing with good quality and diverse activities. The Eastern part of the masterplan stands out from the central and western by incorporating larger green areas such as Lohsepark. This central piece of green space was designed by the Zurich based landscape architects, Vogt. As the designers describe, the park connects water to water since it crosses transversally the masterplan. Therefore it generates a large unique environment surrounded by buildings that benefit of this close encounter with green areas. As it crosses all three levels, the park is subdivided into different tiers responding to their specific height and use and hiding the flood protection strategies along its emplacement. On the extreme Eastern part of Hafencity, Baakenpark arises in a still in development area. This park designed by Atelier Loidl lies upon a man-made peninsula that configures a space of topographic scenery combined with ludic and sport activities. In this case, the difference in level for flood protection is utilized to sectorize the space. The lower level incorporates seating and playground areas, the central plateau hosts the different sport uses such as football and basketball courts and running lanes. The most remarkable part is the Himmelsberg, a 15 meter high viewpoint that will enable visitors a unique opportunity to overview the Hamburg basin.

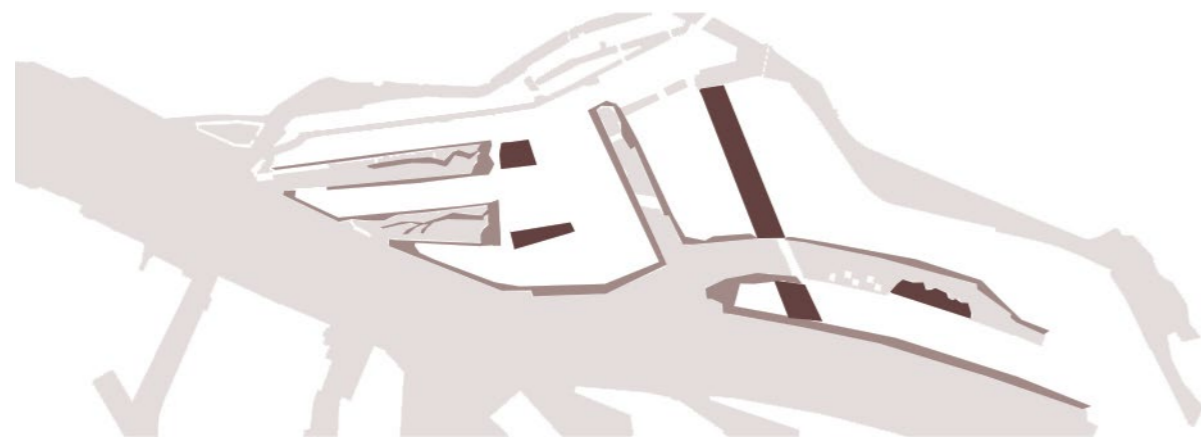


Fig 69: Hafencity public spaces: parks and promenades. © By author

1_ Sandtorpark



Fig 70: Hafencity public spaces: Sandtorpark © EMBT

2_ Magellan



Fig 71: Hafencity public spaces: Magellan terraces. © EMBT

3_ Dalmannkai treppen



Fig 72: Hafencity public spaces: Dalmannkai treppen © EMBT

4_ Marco Polo



Fig 73: Hafencity public spaces: Marco Polo terraces. © EMBT

5_ Lohsepark



Fig 74: Hafencity public spaces: Lohsepark. © Giuseppe Micciché

6_ Baakenpark



Fig 75: Hafencity public spaces: Baakenpark. © Mark Pflueger

4. Buildings

Typologies

The expansion of 40% of the city of Hamburg involves the construction of a variety of different types of buildings. But in order to connect the new urban area to its surroundings, the buildings respect the overall height of the city with the exception of a few iconic landmark buildings such as the Elbphilharmonie. By doing so, the urban morphological concepts of form and scale play a crucial role in determining some guidelines of the new buildings in order to adapt to the given features, not by copying but by understanding the qualities and use them in favor of the design process. This allows the existent area of Hafencity, Speicherstadt, to fuse with the new urban structure. There can be identified diverse typologies of buildings from enclosed, semi open to linear differentiating between their placement in relation to the waterfront and the quartier they are placed. This variation in typology allows the masterplan to be able to host a variety of programs all around the area.

Furthermore, the concept elaborated by the architect Kees Christiaanse in relation to placing iconic buildings at the extremes of the docks, takes the user into being attracted to every part of the branch-like structure of the masterplan. This generates points of attraction that vitalize and guarantees a constant flow of people towards these places.

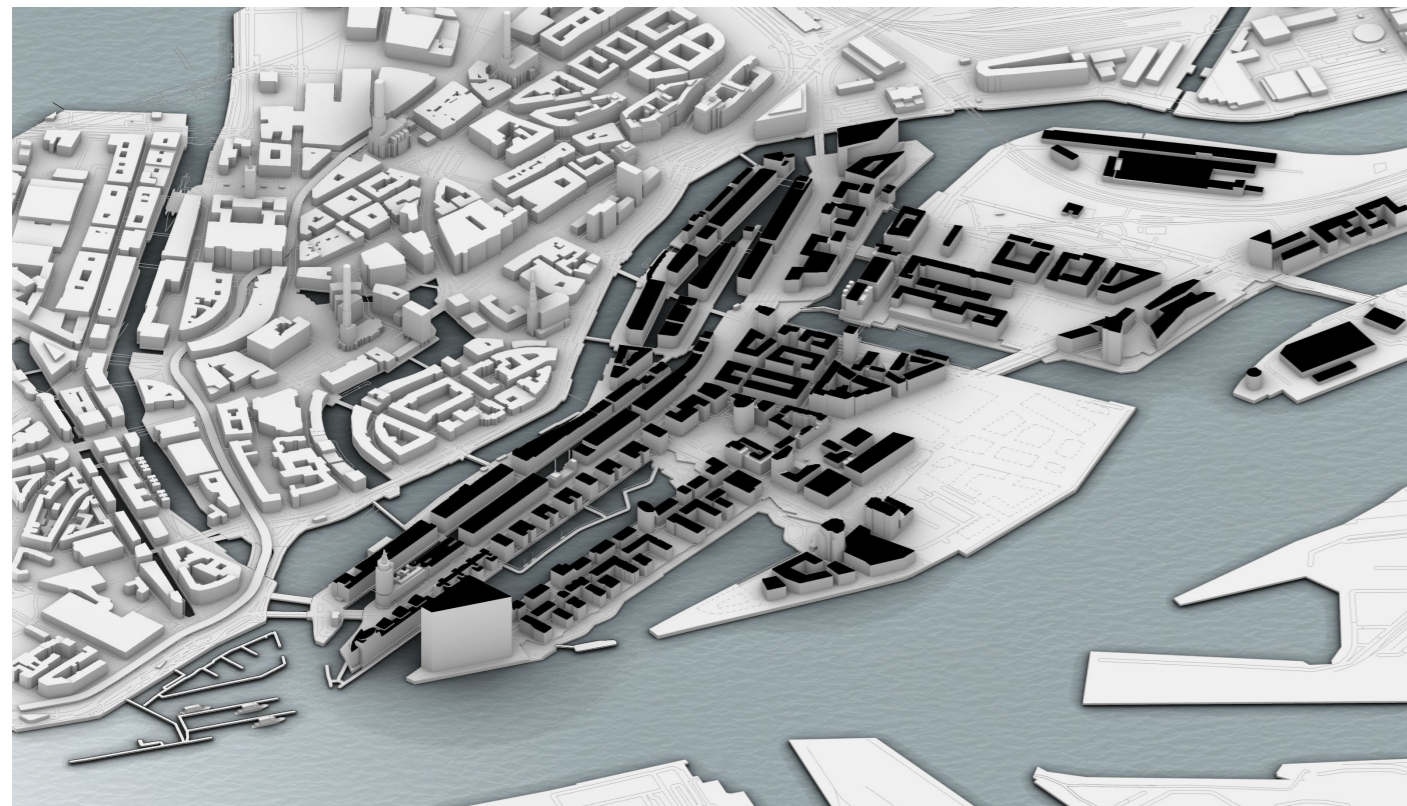


Fig 76: Aerial view of Hamburg and Hafencity. © By author

Program

In relation to the program, the main concern is how to address a new urbanity and provide it with a mix use environment that fuses with public open spaces. The project consists of a variety of mix use buildings that allow the space to fill with lively infrastructures. From residential, offices, corporate institutions, public facilities and entertainment hubs, each of the ten neighborhoods of the masterplan incorporates different uses with scales and sizes of buildings that generate in the overall image a diverse setting. This allows people to live and work nearby while having the opportunity of enjoying recreational and cultural activities in a close environment.

In the ground floor there are mainly public uses, commercial, services and gastronomic uses leaving the more private ones in the upper floors. By doing so the ground floor becomes a lively space that invites people in different times of the day, guarantees the area to have a dynamic use and merges the cultural and social uses of buildings with public spaces.

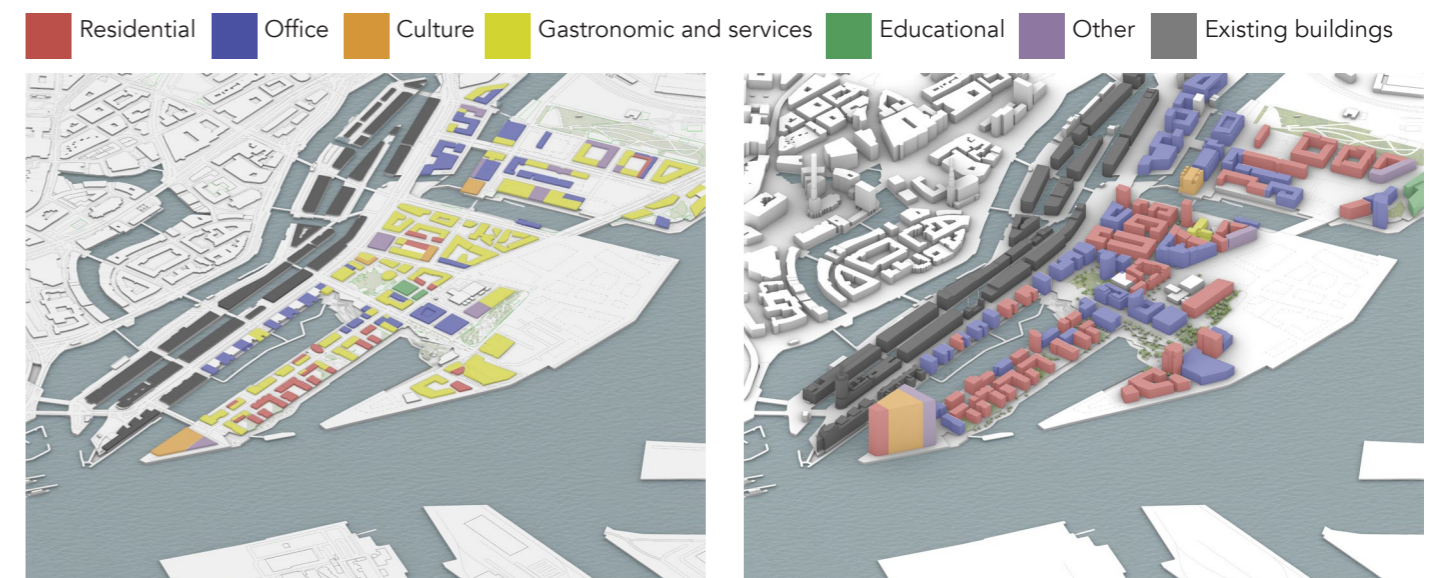


Fig 77: Hafencity: ground floor. © By author

Fig 78: Hafencity: top floors. © By author

Environmental dimension

“Building city resilience is no longer about the protection of urban waterfront edges with hard- engineered structures that aim to divide water from land. Cities worldwide are starting to see the community and economic benefit of adopting a more sustainable systems approach to water management.” (Westerhof, 2018, p. xi).

Over the past 40 years the concern on environmental issues has taken a bigger predominance in the decision making of urban reconfigurations. Climate change has been affecting coastlines in such extent that the result from strong thunderstorms or the rise on sea level it is being seen as a topic to take into account. Water is regaining predominance over the built environment; this change of the natural force over manmade scenarios not only affects how we must make decisions regarding protection but also understand the effect that it will have in future urbanism. Man has manipulated land and water for its own benefit, but in present times cities must adapt to guarantee that they will exist in the shifting environment where the relationship between the built and the natural must be understood in a common denominator in order to assure its continuity.

Furthermore, another environmental point of view is sustainability. This can also mean the way in which passive methods are being implemented when designing urban spaces. The use of low carbon transports such as bicycle lanes and pathways or the incorporation of green areas to mitigate the possibility of flooding are strategies that are seen much more these days than in the end of the XXI century.

In relation to waterfront transformations, environmental decisions have a direct relation since are spaces that have direct contact with a natural surrounding. Therefore these areas have both the opportunity of working with nature but and the need to respect and embrace it since they are in the first line of defense.

Restructuring through environmental strategies: New York, USA



Fig 79: Manhattan, New York. © By author

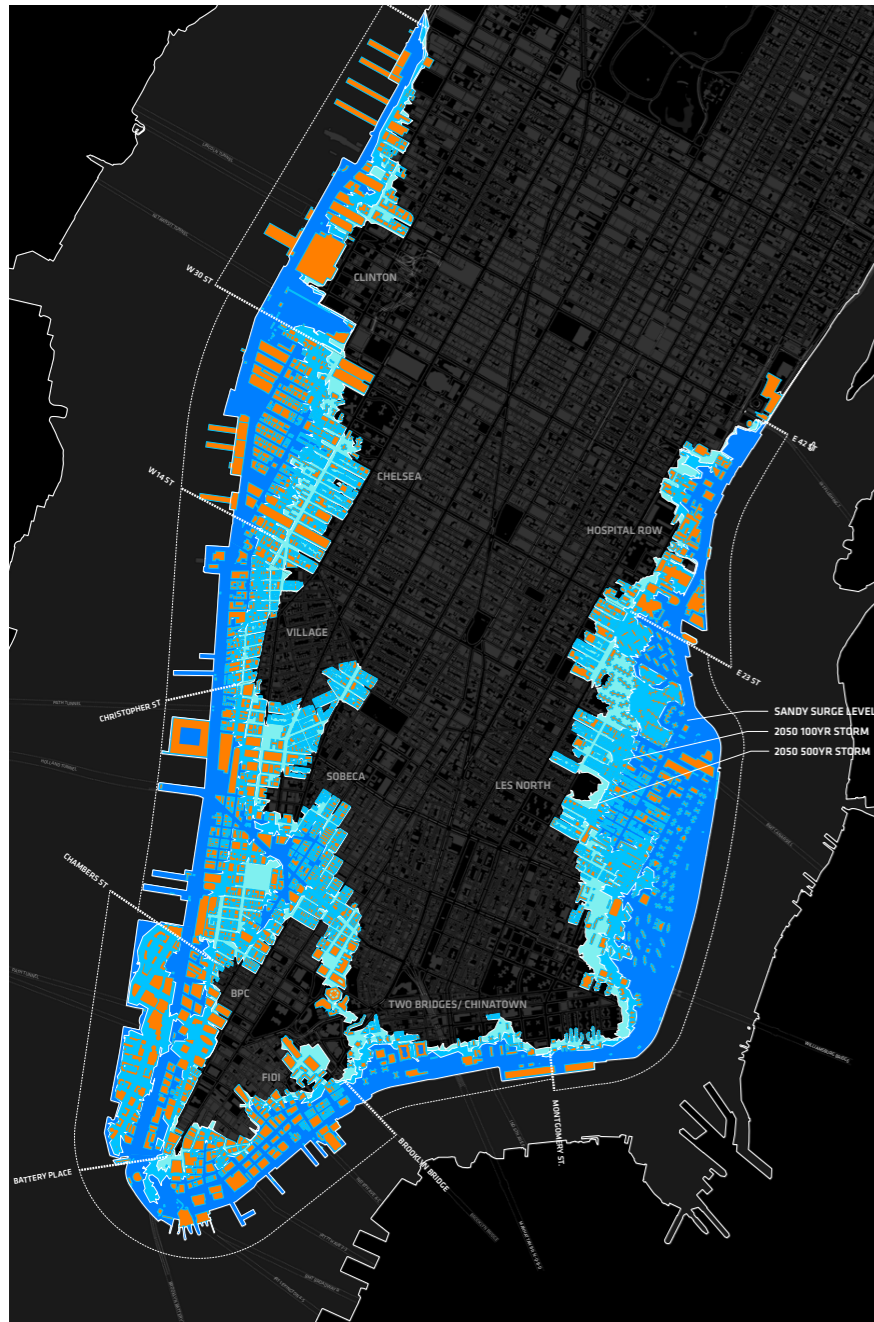


Fig 80: The Big U: Future risk of flooding . © BIG

New York, one of the densest cities of United States, has had a diverse relationship with its waterfront. With a coastline of more than 800km, it has an industrial past that marked the coastal development. From 1992 it started to regain the lost connection and the "New York City Comprehensive Waterfront Plan" was created with an aim to reestablish public spaces, commercial, residential and productive uses. After more than 15 years from the beginning of this plan, New York took another step into revising it and consider new issues such as environmental concerns that where having a negative effect on the waterfront area. Due to the Superstorm Sandy in 2012, New York suffered an enormous damage to infrastructure, public spaces, buildings, economy and the loss of people. Therefore, the city enforced the need to incorporate measures in order to mitigate and prevent the possible effects of climate change in relation to sea level rise. The plan "Vision 2020" contemplates how climate change has been producing high rises of the sea level and stronger storms which led to floods and major destructions in order to reconfigure these vulnerable spaces.

Taking into consideration what Vision 2020 established, Manhattan, launched a competition from the concept of "rebuild by design" to develop its waterfront area. BIG architects, the Danish architectural studio, won the commission and presented a project that tackles the shoreline all the way around. Called "The Big U" it goes from West 57th street, to The Battery and up along the coast to East 42nd street. The project is mainly focused on how sustainable and infrastructural measures protect the city from flooding while enhancing public spaces and guaranteeing the area to be livable before and after storms. The project includes a variety of different scale strategies in order to reconfigure the 10 mile shoreline into a long term plan that will evolve



Fig 81: The Big U: proposal in the C3 area - Battery Park . © BIG

in stages. The restructuring plan involves from governmental entities to small communities all in favor to battle the rising of the sea level where the complexity of the problem to resolve is thought as a system that will ensure the city to sustain in time.

In order to achieve a better understanding of the opportunities, difficulties and needs of each area, the research done was divided into West, Lower and East side. In first place, the West side goes from West 57th street down to Chambers street; this area is the reminiscence of past industrial times and hosts a variety of strong infrastructure barriers such as piers and the highway but also has a green area, the Hudson River Park. The concept of the project is to take into consideration the existent characteristics and use them in favor or combining them with resilience strategies. Following the West side is the lower part of Manhattan; this area stretches from Battery Park to the Brooklyn Bridge. This area in comparison to the previous one is completely man made land. Along the years, Manhattan has gained land towards the river; this flood plain suffered during the Sandy Storm due to its low height in relation to the river. This infilled land hosts mainly green areas and further into the city is the heart of the economic area. Finally, the East side goes from the Brooklyn Bridge up to East 42nd street and hosts the largest floodplain, a transport infrastructure barrier, the FDR Drive Highway, and many high density buildings.

Each presents different characteristics but the East side is the most vulnerable area since there are more high risk people involved. The nearby hospitals, public housing and the largest size of flood plain make this space the starting point of the implementation of the project strategies.

Waterfront edges

The main concern in the project is the way in which the edge of the waterfront is dealt with. The shoreline presents different characteristics that obliges the masterplan to adjust according to the specific needs of the area. The waterfront area is already a very strong delimited site, with constrained characteristics that go from large green areas such as Hudson River Park, Battery Park and East River Park, piers, large transport infrastructure such as the highways (New York State Route 9A and the FDR Drive Highway) and bulkheads in the upper West side. The basis of the idea is to combine the edge of the flood plane with a barrier that will not only serve as an infrastructural support against the rising sea level but also merge into becoming part of a green infrastructure and host activities along the way. By doing so, this needed infrastructure becomes integrated into the scenario or completely hidden; its shifts from being a seen barrier to part of the system of the city.

The border in this case is not the exact normal shoreline but the edge up to which the sea level could reach. This is where the different resilience solutions are placed such as bulkheads, berms or deployables. It will become a second shoreline that mitigates, prevents and reduces the risk of flooding while also providing with social activities, large green areas, commercial and cultural uses. The innovative concept in this masterplan is to merge what flood prevention infrastructures are with green and social infrastructures.

This resiliency strategies need of large infrastructure developments. The loss provoked by Sandy Storm and the continuous climate change effects on sea level determine that Manhattan and the entire waterfront of New York should take action immediately in order to prevent possible risks. In this case, the strategies needed are large-scale, there is no place for soft edge waterfronts since the risk is too high. Therefore the hard edge strategies are combined with adaptable approaches in order to generate a strong hybrid system.



Fig 82: Resilience strategies along the waterfront of The BIG U © BIG

Green areas

The strategies proposed mainly focus on preventing the water to reach the city and provoke massive economical and infrastructural losses. But since the barriers will prevent the water to get inland, there would be a vast amount of water that is raining in the city that would need to be alleviated in order to not aggravate the proposed plan. Therefore along with the waterfront measures there will also be other strategies that will help mitigate the possible flooding such as the implementation of bioswales or rain gardens.

These green infrastructures will allow the rain water to be drained and stored and prevent an overflow of water towards the closed barriers to the shoreline.

Also, another characteristic to take into account when planning green infrastructures is the notion of these spaces as buffers for the city. Since the waterfront hosts large transport infrastructures that provoke not only CO2 gases but also generate noise pollution, having large green areas help absorb the annoying noises and reduce the amount of greenhouse gases. Furthermore, green areas also contribute to the decrease in heat temperature since they generate shadows.

The plan encourages the use of native flora and also salt-tolerant trees. By doing so it contributes to the increase in flora but also could provoke the increase in biodiversity.



Fig 83: Manhattan East Side resiliency design © BIG

_4

CONCLUSION

Conclusion of strategies

The idea of urban regeneration along coastlines has changed to accompany the commitment of cities of becoming mixed, greener, sustainable and more people oriented. The strategies chosen to lead the decision-making showcase how cities have been displacing the concept of large scale urban transformations, of a car oriented city and of fragmented projects towards ideas and concepts that relate to how urban planners, architects, governments and everyone involved in the process to have the responsibility of creating spaces that adjust to this XXI world, this being cities that take into account people as a primary guideline and where human scale is revalued (Stevens, 2021).

On other hand, the realization of understanding how waterfronts were regenerated throughout the past forty years reinforces the concept of waterfronts not only as a limit between land and water but also as a resource. Waterfronts used to be thought mainly as an infrastructure asset, not prioritizing the opportunity of people-nature-city connection. Green areas have become places with multiple uses and purposes and advocate to foment the desired open, green and accessible spaces. This shift in paradigm brings into debate the idea that this space has the capacity of becoming an area that connects people between each other but also to nature. In globalized cities, nature has become an asset that citizens aspire to recover. They benefit the ecosystem by incorporating vegetation that helps reduce noise pollution, increases CO2 absorption and helps control temperature peaks. Also, these spaces have a direct effect on people, citizens benefit by having areas that provide of spaces that foment social connections.

By analyzing the cities of Barcelona, Hamburg and New York, I can establish the following conclusions:

- _The change of paradigm from a car-oriented city towards sustainable and zero-carbon city proves that the differentiation between what were urban based design strategies related to large transport infrastructures have changed to respond to more environmentally friendly decisions regarding waterfront regenerations.
- _The recovering of heritage returns to the cities the past memories and helps to reconnect to the sense of place
- _ Climate change and pollution are issues that need to be considered when transforming a waterfront area so that in the future these areas can guarantee that the environment is taken into account and respected.
- _ Waterfront areas need to be accessible to everyone. This being accessible through mobility and also through the uses that need to be inviting, varied and promote the approach of people towards these areas.
- _ Public and sustainable transport mobilities should be prioritized over cars.
- _ Public spaces must be diverse, attractive and inviting. These spaces must provide different activities that distinguish between active and passive situations.
- _ Regaining and preserving natural coasts provides benefits for the environment and the society.

Therefore, after analyzing and concluding which strategies have had a better effect, implementation and result I've established the following attributes that waterfront regeneration projects must take into account:

Morphological

Scale

Scale of intervention

Public Space

Vivable green open spaces

Urban parks

Revitalization of industrial heritage

Urban furniture

Land Use

Mixed use

Residential

Commercial

Leisure

Essential services

Urban parks

Revitalization of industrial heritage

Connectivity

Accessibility

Public transportation accessibility

Bicycle lanes

Walkable paths

Neighbourhood connectivity

Environmental

Pollution Levels

Air, land, water, noise pollution

Landscape

Urban parks

Overall waterfronts have become spaces that mutate and adapt in order to respond to the present needs. But as it can be seen by studying worldwide cases and investigating how to implement macro and micro scale strategies in the coast of Buenos Aires, these areas must always have the ability to adapt to future paradigms in relation to connectivity, usability and environmental conditions.

The reconfiguration of waterfront areas needs to be taken as a complex system of decisions between social, economic, cultural and environmental strategies combined. In relation to the connectivity of the shoreline with the city it needs to be taken as a whole and not isolate the problem of disconnection with the immediate contact. Also, it can be seen that having mix use spaces in close contact with the shoreline can benefit the city into providing better livable areas that interconnect the grid with the natural surrounding.

Furthermore, the transformation of coastal areas that are prone to suffer from the effects of sea level rise and storm surge should include into the resiliency decisions strategies that merge nature and the ecosystem with the human built environment. The path is not to restrict the environment in order to prevent flooding but the capacity to adapt to the changing world and be able to prevent possible incidents.

Waterfront areas used to relate to infrastructural transport systems, now are considered a desired space for leisure and living. This bring the final question of, what are going to be waterfront strategies in 100 years from now? I hope that these areas assured their persistence through the climatic effects and are spaces that promote a healthier approach between the built and natural environment.

BIBLIOGRAPHY

Aerts, J. C. J. H., Botzen, W. J. W., Emanuel, K., Lin, N., de Moel, H., & Michel-Kerjan, E. O. (2014). Climate adaptation. Evaluating flood resilience strategies for coastal megacities. *Science (American Association for the Advancement of Science)*, 344(6183), 473–475. <https://doi.org/10.1126/science.1248222>

Al, S., & Westerhof, E. (2018). *Adapting cities to sea level rise: Green and gray strategies*. Island Press.

Augé, M. (2009). *Los no lugares: espacios de anonimato*. Gedisa.

Arpa, J. Fernández Per, A. (2008). *The Public Chance: New Urban Landscapes*. Spain: a+t.

Arrese, A. D. (2002). Buenos Aires and de la Plata Riverfront: design concept for restructuring the urban core. *Publikatieburo Bouwkunde*.

Busquets, J. (2006). El diseño del conjunto o de las partes. *Visions*, (5), 48-57.

Carta, M., & Ronsivalle, D. (2016). The fluid city paradigm: Waterfront regeneration as an urban renewal strategy / Maurizio Carta, Daniele Ronsivalle, editors.

Charlesworth, E. (2006). *City Edge: Contemporary Discourses on Urbanism (English Edition) (1.a ed.)*. Routledge.

Clos, Oriol. (1988) El moll de la fusta de Barcelona. *UR: urbanismo revista*, number. 6

Della Paolera, C.F. (1999). La Ribera de Buenos Aires. *Revista CPAU*, 2, 8-13.

Desfor, G. (2011). *Transforming urban waterfronts: fixity and flow*. New York: Routledge.

Freire Silva, M. J. (2014). Permeabilidad, mixtura y escala: tres “Cosas Urbanas” en HafenCity. *Departament d’Urbanisme i Ordenació del Territori*. Universitat Politècnica de Catalunya.

Garcia Ferrari, M., & Smith, H. (Eds.) (2012). *Waterfront Regeneration: Experiences in City Building*. Routledge.

Gehl, Jan. *Cities for People*, Island Press, 2010. ProQuest Ebook Central, <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=3317503>.

Gehl, J., & Koch, J. (1987). *Life between buildings: Using public space*. New York: Van Nostrand Reinhold.

Hamburg in pictures – a welcoming city of opportunities. (2019) Lee Kuan Yew World City Prize. Retrieved from <https://www.leekuanyaworldcityprize.gov.sg/resources/in-pictures/hamburg/>

López Goyburu. P. (2018). Buenos Aires nace como una ciudad planificada. El espacio de articulación urbano-rural entre 1580 y 1720. *Geograficando* 14 (1), e034. <https://doi.org/10.24215/2346898Xe034>

Lorenzo, C. (2017). Passeig de Colom and Moll de la Fusta: The New Waterfront of Barcelona. *Barcelona Photoblog*. Retrieved from <https://www.barcelonaphotoblog.com/2017/10/passeig-de-colom-and-moll-de-la-fusta.html>

Louekari, M. (2018). Revitalizing New York’s East River Waterfront. *Architectural Research in Finland*, 2(1), 165–179.

Retrieved from <https://journal.fi/architecturalresearchfinland/article/view/73190>

Lynch, K. (1960). *The image of the city*. Cambridge, Mass: MIT Press.

Marrades, R., Collin, P., Catanzaro, M., & Mussi, E. (2021). Planning from failure: Transforming a waterfront through experimentation in a placemaking living lab. *Urban Planning*, 6(1), 221-234. doi:<http://dx.doi.org/recursos.biblioteca.upc.edu/10.17645/up.v6i1.3586>

Masoud, F., & Ryan, B. D. (2021). *Terra-sorta-firma: Reclaiming the littoral gradient*.

Montgomery, C. (2013). *Happy city: transforming our lives through urban design*. First edition. New York: Farrar, Straus and Giroux.

Novik, A. (2002). La costa en proyectos. *Revista de la Sociedad Central de Arquitectos*, (201), pp. 56-65.

Nel, D., & Bruyns, G., & Higgins, C. (2018). *Urban Design, Connectivity and its Role in Building Spatial Resilience*. Retrieved from <http://hdl.handle.net/10397/81444>

Pando, H. J. (2014). *Historia urbana de Buenos Aires*. Buenos Aires, Argentina: Editorial Nobuko. Retrieved from <https://elibro.net/es/ereader/upcatalunya/77271?page=18>.

Perahia, R. (2011). *Cuestiones territoriales en la región metropolitana de Buenos Aires*. Buenos Aires, Argentina, Argentina: Editorial Nobuko. Retrieved from <https://elibro.net/es/ereader/upcatalunya/77850?page=112>.

Russo M. (2016) *Harbourscape: Between Specialization and Public Space*. In: Carta M., Ronsivalle D. (eds) *The Fluid City Paradigm*. UNIPA Springer Series. Springer, Cham.

Saer, J. J. (1991). *El río sin orillas*. Buenos Aires: Alianza Editorial.

Schneider, H. (2011) *HafenCity Hamburgo: linking urbanity with ecological sustainability*. Portus.

Seaman Cuevas, K. (2012) *El Modelo Barcelona de Espacio Público y Diseño Urbano*. Port Vell: imagen y espacio público de un Puerto Urbano.

Silber, K. (1996). New York’s vast, neglected shoreline was once central to the city’s economic and cultural life. It could be again. *The Wasted Waterfront*. Retrieved from <https://www.city-journal.org/html/wasted-waterfront-12041.html>

Stevens, Q. (2021). *Activating Urban Waterfronts: Planning and Design for Inclusive, Engaging and Adaptable Public Spaces*. First edition. New York: Routledge

Stewart, N. R. , Denevan, . William M. , Oliveira, . Waldir Freitas and Oteiza, . David (2014, October 10). Río de la Plata. *Encyclopedia Britannica*. <https://www.britannica.com/place/Rio-de-la-Plata>

Westerhof, E. (2018). Foreword. In Al, S (Ed.). *Adapting cities to sea level rise: Green and gray strategies* (pp. xi-xiii). Island Press.

LIST OF FIGURES

Figure 1. Taullard, A. (n.d.) Los libros más antiguos de Buenos Aires: 1580-1880. Buenos Aires: Jacobo Peuser SA. Retrieved from <https://sites.google.com/view/ba-en-cartografia/p%C3%A1gina-principal>

Figure 2. Drawing by author. (2020). Expansion of the City of Buenos Aires.

Figure 3. Drawing by author. (2021). Evolution of the coasts of the City of Buenos Aires.

Figure 4. Drawing by author. (2021). Buenos Aires highway and avenues.

Figure 5. Drawing by author. (2021). Buenos Aires metro lines.

Figure 6. Drawing by author. (2021). Buenos Aires bicycle lanes.

Figure 7. Drawing by author. (2021). Buenos Aires infrastructures.

Figure 8. Atlas Archivo. (1949). Balneario municipal. Retrieved from: <https://www.atlasarchivo.com.ar/?page=archivo&volver=1>

Figure 9. AGN. (1949) El espigón del Balneario Municipal de Buenos Aires. Retrieved from: https://www.plataformaarquitectura.cl/cl/956275/97-percent-de-rechazo-publico-al-proyecto-de-costa-salguero-en-buenos-aires-la-participacion-ciudadana-y-su-papel-en-el-desarrollo-urbano?ad_medium=gallery

Figure 10. Drawing by author. (2021). Buenos Aires public spaces along the waterfront.

Figure 11. RECU-CN (n.d.) Ecological reserve of the University of Buenos Aires Campus. Retrieved from: <http://www.recucn.com.ar/>

Figure 12. Google Maps. (2021). Monument to the victims of State Terrorism.

Figure 13. Rafael Mario Quinteros (2021) Pedestrian walk on Costanera Norte.

Figure 14. Google Maps. (2021). Aerial view of the existent waterfront pathway.

Figure 15. Google Maps. (2021). Pedestrian walk on Costanera Norte.

Figure 16. Google Maps. (2021). Aerial view of Costanera Norte.

Figure 17. Drawing by author. (2021). North Coast and Youth District.

Figure 18. Drawing by author. (2021). Site.

Figure 19. Drawing by author. (2021). Site.

Figure 20. Drawing by author. (2021). Diagrams of the urban development of the project of reconfiguration on the waterfront.

Figure 21. Drawing by author. (2021). Buenos Aires – site actuality.

Figure 22. Drawing by author. (2021). Diagram of Buenos Aires connectivity strategies.

Figure 23. Drawing by author. (2021). Buenos Aires – connectivity: grid and blocks of the new neighborhoods.

Figure 24. Drawing by author. (2021). Buenos Aires - connectivity: new connections to the waterfront.

Figure 25. Drawing by author. (2021). Buenos Aires - connectivity: avenues.

Figure 26. Drawing by author. (2021). Buenos Aires - connectivity: streets.

Figure 27. Drawing by author. (2021). Buenos Aires - connectivity: pedestrian.

Figure 28. Drawing by author. (2021). Buenos Aires - connectivity: bicycle lanes.

Figure 29. Drawing by author. (2021). Buenos Aires - connectivity: nodes.

Figure 30. Drawing by author. (2021). Buenos Aires - connectivity: details of the four different nodes in the waterfront area.

Figure 31. Drawing by author. (2021). Diagram of Buenos Aires morphological strategies.

Figure 32. Drawing by author. (2021). Buenos Aires – morphological: sectors.

Figure 33. Drawing by author. (2021). Buenos Aires – morphological: buildings.

Figure 34. Drawing by author. (2021). Buenos Aires – morphological: ground floor uses.

Figure 35. Drawing by author. (2021). Buenos Aires – morphological: top floors uses.

Figure 36. Drawing by author. (2021). Diagram of Buenos Aires environmental strategies.

Figure 37. Drawing by author. (2021). Buenos Aires – environmental: green connections.

Figure 38. Drawing by author. (2021). Buenos Aires – environmental: flower gardens.

Figure 39. Drawing by author. (2021). Buenos Aires – environmental: detail of the flower gardens.

Figure 40. Stan Schebs. (n.d.) Photo of Nassella tenuissima (Mexican feather grass) at the Springs Preserve garden in Las Vegas, Nevada. Retrieved from: https://en.wikipedia.org/wiki/Nassella_tenuissima

Figure 41. Mokkie. (2014). Pennisetum advena 'Rubrum'. Synonyms: Pennisetum setaceum 'Rubrum'. Pennisetum setaceum 'Cupreum'. Common names: Purple Fountain Grass. Red Fountain Grass. Rose Fountain Grass Retrieved from: [https://commons.wikimedia.org/wiki/File:Purple_Fountain_Grass_\(Pennisetum_advena_%27Rubrum%27\).jpg](https://commons.wikimedia.org/wiki/File:Purple_Fountain_Grass_(Pennisetum_advena_%27Rubrum%27).jpg)

Figure 42. Wikimedia Commons. (n.d.) Agapanthus Umbellatus. Retrieved from: <https://commons.wikimedia.org/w/index.php?search=Agapanthus+umbellatus&title=Special:MediaSearch>

Figure 43. Drawing by author. (2021). Buenos Aires – environmental: wetlands.

Figure 44. Drawing by author. (2021). Buenos Aires – environmental: detail of the wetlands.

Figure 45. Bernd Haynold. (n.d.) Schoenoplectus lacustris, Hohenloher Land, Germany. Retrieved from: https://en.wikipedia.org/wiki/Schoenoplectus#/media/File:Schoenoplectus_lacustris_260605.jpg

Figure 46. Drawing by author. (2021). Buenos Aires – environmental: ceibo amphitheater.

Figure 47. Drawing by author. (2021). Buenos Aires – environmental: detail of the ceibo amphitheater.

Figure 48. Wikimedia Commons. (n.d.) Erythrina Crista Galli. Retrieved from: https://es.wikipedia.org/wiki/Erythrina_crista-galli_var._crista-galli#/media/Archivo:Ceibo_en_Mar_del_Plata.JPG

Figure 49. Drawing by author. (2021). Buenos Aires – environmental: Jacarandá forests.

Figure 50. Drawing by author. (2021). Buenos Aires – environmental: detail of the Jacarandá forests.

Figure 51. Wikimedia Commons. (2020). Jacaranda mimosifolia in Fairfield, Queensland, Australia, 2020. Retrieved from: https://commons.wikimedia.org/wiki/File:Jacaranda_mimosifolia_in_Fairfield,_Queensland,_Australia,_2020,_05.jpg

Figure 52. Drawing by author. (2021). Buenos Aires – environmental: waterfront edges.

Figure 53. Drawing by author. (2021). Buenos Aires – environmental: detail of the hard waterfront edges.

Figure 54. Drawing by author. (2021). Buenos Aires – environmental: detail of the adaptive waterfront edges showing high a low tides.

Figure 55. Drawing by author. (2021). Buenos Aires – environmental: detail of the soft waterfront edges.

Figure 56. Drawing by author. (2021). Buenos Aires – Aerial view of the project of waterfront regeneration.

Figure 57. Drawing by author. (2021). Comparison in scale and year of the waterfront areas analyzed.

Figure 58. Drawing by author. (2021). Barcelona – aerial view of the coastline.

Figure 59. Julio Cunill. (1981). Panoràmica del port, del Portal de la Pau, el monument a Cristòfor Colom i la Rambla. Retrieved from: <http://hdl.handle.net/11703/107258>

Figure 60. Julio Cunill. (1981). Panoràmica del passeig de Colom i del Moll de Bosch i Alsina (Moll de la Fusta). Retrieved from: <http://hdl.handle.net/11703/105338>

Figure 61. Adjuntament de Barcelona. (n.d.) Moll de la Fusta. Retrieved from: https://guia.barcelona.cat/es/detall/moll-de-la-fusta_99400095445.html

Figure 62. Manuel de Sola Morales. (1988). Moll de la Fusta section. Retrieved from: <https://www.esteyco.com/proyectos/remodelling-of-the-moll-de-la-fusta/>

Figure 63. Drawing by author. (2021). Barcelona – Moll de la Fusta longitudinal and transversal connections.

Figure 64. Drawing by author. (2021). Hafencity, Hamburg – aerial view of the coastline.

Figure 65. City of Hamburg. (n.d.) Aerial view of Hafencity before redevelopment. Retrieved from: <https://www.leekuananyewworldcityprize.gov.sg/resources/in-pictures/hamburg/>

Figure 66. Andreas Vallbracht. (n.d.) Aerial view of Hamburg today. Retrieved from: https://www.prachtvoll.de/ngg_tag/grau/nggallery/page/3.

Figure 67. Drawing by author. (2021). Hafencity land profile.

Figure 68. Drawing by author. (2021). Hafencity levels.

Figure 69. Drawing by author. (2021). Hafencity public spaces: parks and promenades.

Figure 70. EMBT. (2011). Sandtorpark – Hafencity public spaces. Retrieved from: <http://www.mirallestagliabue.com/project/sandtorpark-hafencity-public-spaces/>

Figure 71. EMBT. (2011). Magellan. Terrassen – Hafencity public spaces. Retrieved from: <http://www.mirallestagliabue.com/project/magellan-terrassen-hafencity-public-spaces/>

Figure 72. EMBT. (2011). Dalmannkai Treppen – Hafencity public spaces. Retrieved from: <http://www.mirallestagliabue.com/project/dalmannkai-treppen-hafencity-public-spaces/>

Figure 73. EMBT. (2011). Marco Polo Terrassen – Hafencity public spaces. Retrieved from: <http://www.mirallestagliabue.com/project/marco-polo-terrassen-hafencity-public-spaces/>

Figure 74. Giuseppe Micciché. (2017). Hafencity public spaces: Lohsepark. Retrieved from: https://www.vogt-la.com/lohsepark_hamburg

Figure 75. Mark Pflüger. (2019). Hafencity public spaces: Baakenpark. Retrieved from: <https://atelier-loidl.de/en/baakenpark-hamburg>

Figure 76. Drawing by author. (2021). Aerial view of Hamburg and Hafencity.

Figure 77. Drawing by author. (2021). Hafencity: ground floor uses.

Figure 78. Drawing by author. (2021). Hafencity: top floors uses.

Figure 79. Drawing by author. (2021). Manhattan, New York – aerial view of the coastline.

Figure 80. BIG. (n.d.) The Big “U” Rebuild by design. Promoting Resilience Post-Sandy Through Innovative Planning, Design & Programming. p.22.

Figure 81. BIG. (n.d.) The Big “U” Rebuild by design. Promoting Resilience Post-Sandy Through Innovative Planning, Design & Programming. p.173.

Figure 82. BIG. (n.d.) The Big “U” Rebuild by design. Promoting Resilience Post-Sandy Through Innovative Planning, Design & Programming. Tailored resiliency. p.38.

Figure 83. BIG. (2018) BIG U flood defences for Manhattan move forward. Retrieved from: <https://www.dezeen.com/2018/07/20/big-u-storm-flood-defences-east-side-coastal-resiliency-manhattan-move-forward/>