“NEW MANNAHATTA 2100”:
Re-interpreting the urban patterns in Manhattan island, NYC

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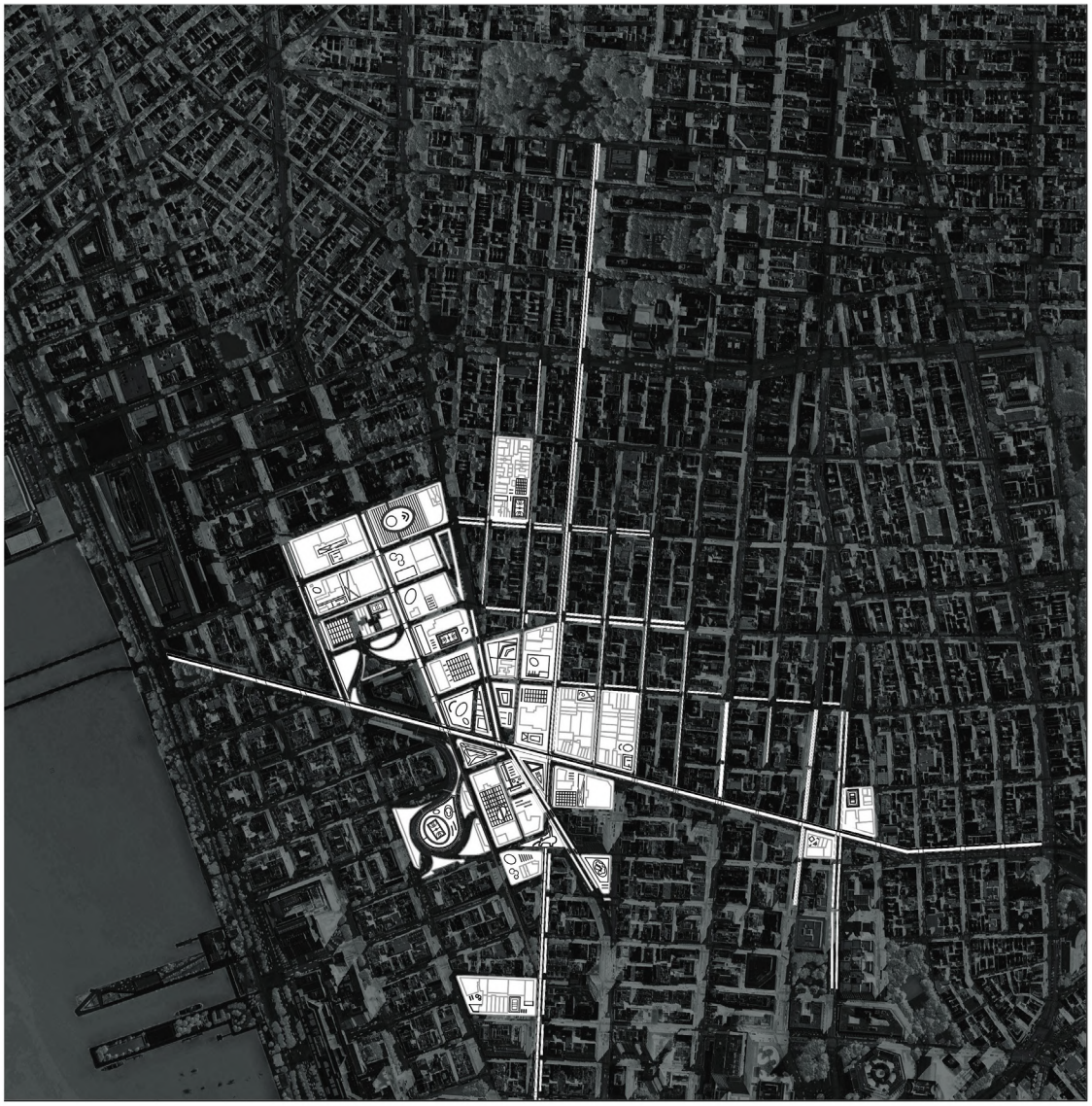
5483646

P5 report



"New Mannahatta 2100":
Re-interpreting the urban patterns in Manhattan island, NYC

Keywords: urban patterns, redefinition, expansion, grid, hidden streams, palimpsest, Manhattan

"The designation ***terra firma*** (firm, not changing; fixed and definite) gives way in favor of the shifting processes coursing through and across the urban field: ***terra fluxus.***"

- James Corner, 2006

Colophon

Msc Graduation Thesis P5 Report
Msc 4 Urbanism Track
Department of Architecture, Urbanism and the Building Sciences
Faculty of Architecture and the Built Environment, TU Delft

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Urbanism

Contents

1 Motivation

Madelon Vriesendorp, *Freud Unlimited*, 1976

Figure 1 Source: Architectural Review

MOTIVATION

I guess a number of factors motivated me to dive into the challenges of flood risk, social segregation and housing crisis in the complex environment of Manhattan in New York City. Having a strong passion for pattern investigation as a multiscalar regeneration strategy in metropolitan areas as well as my reading stimuli throughout my architecture studies in Greece, motivated me to choose Manhattan as the urban context of my graduation thesis. Being an Architect inspired by Art and Social Activism interwoven with Urban design, I delved into Jane Jacob's theories, Rem Koolhaas' delirious New York and Madelon Vrisendorp's surrealistic perception.

Manhattan itself is the epicenter of patterns, from the grid to the skyscraper. External forces such as the impending housing crisis, social segregation and the emergent flood risk will reconfigure the pattern image of the city in the future. The region has been altered extensively during the years by significant drivers which turned the primitive green paradise into an artificial world of skyscrapers. Natural elements of the past have been covered due to the increasing demand of building industry forming a compact environment. The grid offered the fast and effective organization of the metropolitan area, however it did not take into account in a great extent the natural landscape.

The graduation thesis explores the possibilities of the grid into the mitigation of flood vulnerability while bolstering the social inclusion in an aim to reconfigure the pattern image of the city in the future through the unraveling of important elements of palimpsest landscape. The flood adaptation of the grid will question the impact on housing densification strategies for the future of the island. The identity as well as the resilience of the metropolitan area will be reinforced and people will come closer to nature.

2 Problem Field

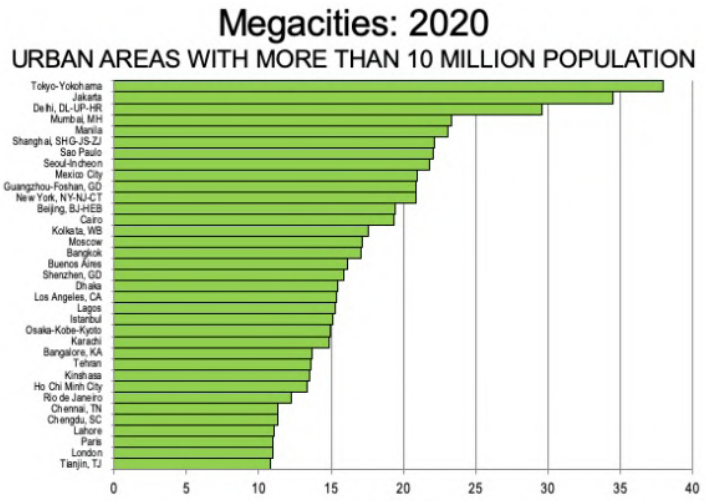
Anonymous, *New York as the center of the world*, 1970

Figure 2 Source: Viewing.NYC

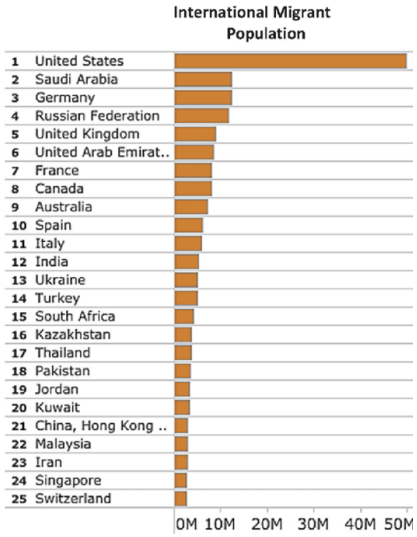
2.1 Probem Statement - Challenges

Manhattan island in New York City suffers from housing crisis, social segregation and flood risk. The limited new horizontal development, social inequalities and the threatening rising sea levels make vital the re-interpretation of the existing urban patterns and the potential for a future expansion.

New York City is one of the 32 megacities in the world with an overall population of more than 10 million people and specifically Manhattan of about 1.6 million people (figure 3 & 6). The delirious urbanization of the metropolitan area is mainly the result of mass migration both internal and international throughout the years thus forming a population of diverse cultural backgrounds (figure 4 & 7). The intensive development had a significant global impact making New York City the center of the world. As climate change emerges, the metropolitan area constitutes one of the areas with great flood hazard due to coastal flooding and storm surge in the years to come (figure 8). According to IPCC, New York will experience a sea level rise of about 1 meter until 2100 (figure 5).

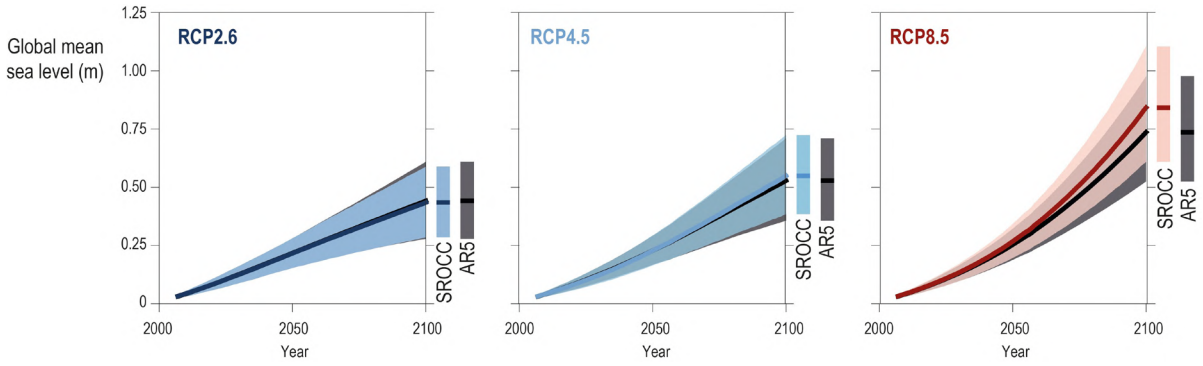


Megacities Figure 3 Source: New Geography



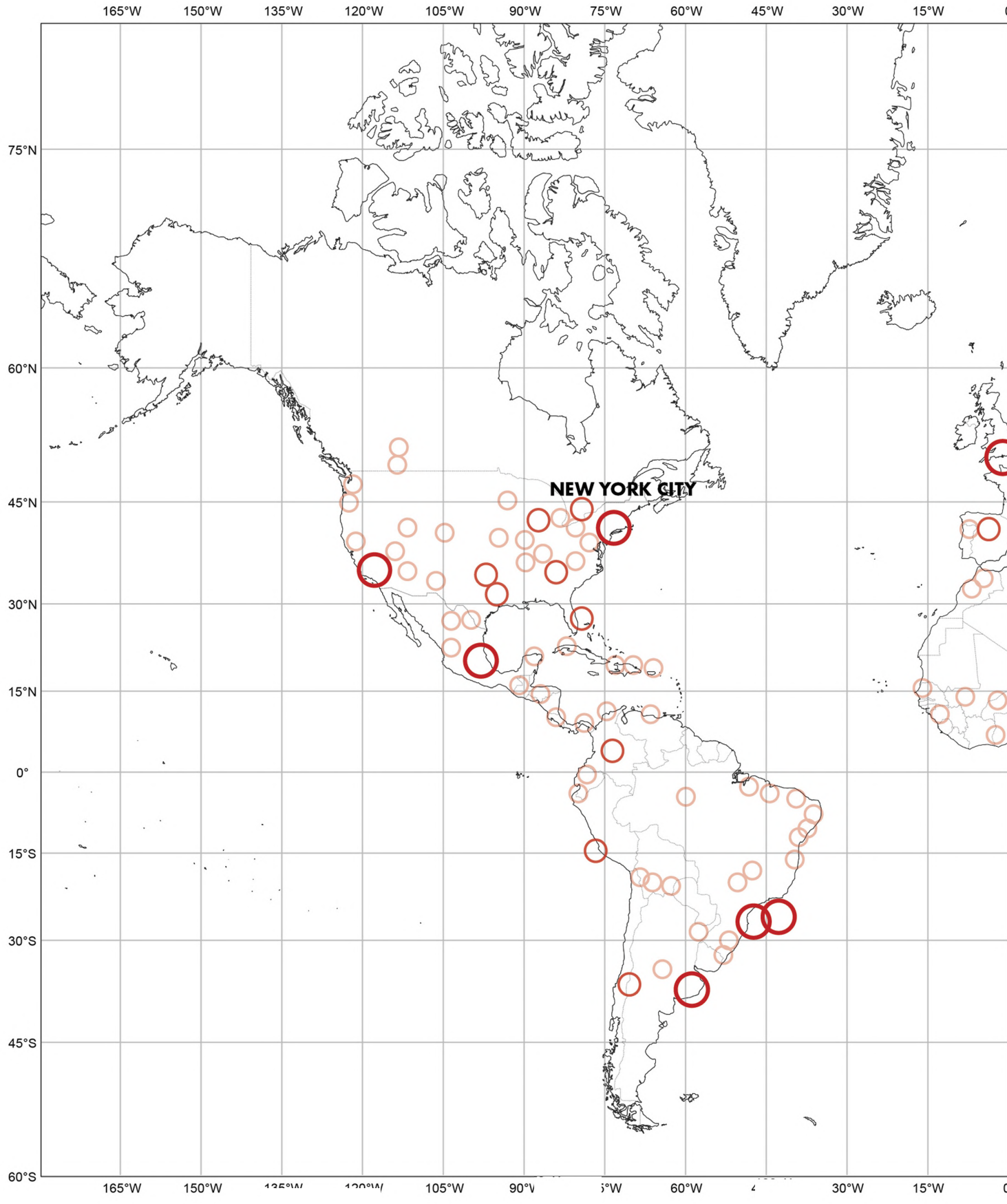
Migrant population Figure 4

Source: Research Gate



Sea Level Rise Projection Figure 5 Source: IPCC

MEGACITIES


165°W
150°W
135°W
120°W
105°W
90°W
75°W
60°W
45°W
30°W
15°W
75°N
60°N
45°N
30°N
15°N
0°
15°S
30°S
45°S
60°S
NEW YORK CITY
City population
10 million or more
5 - 10 million
1.5 million

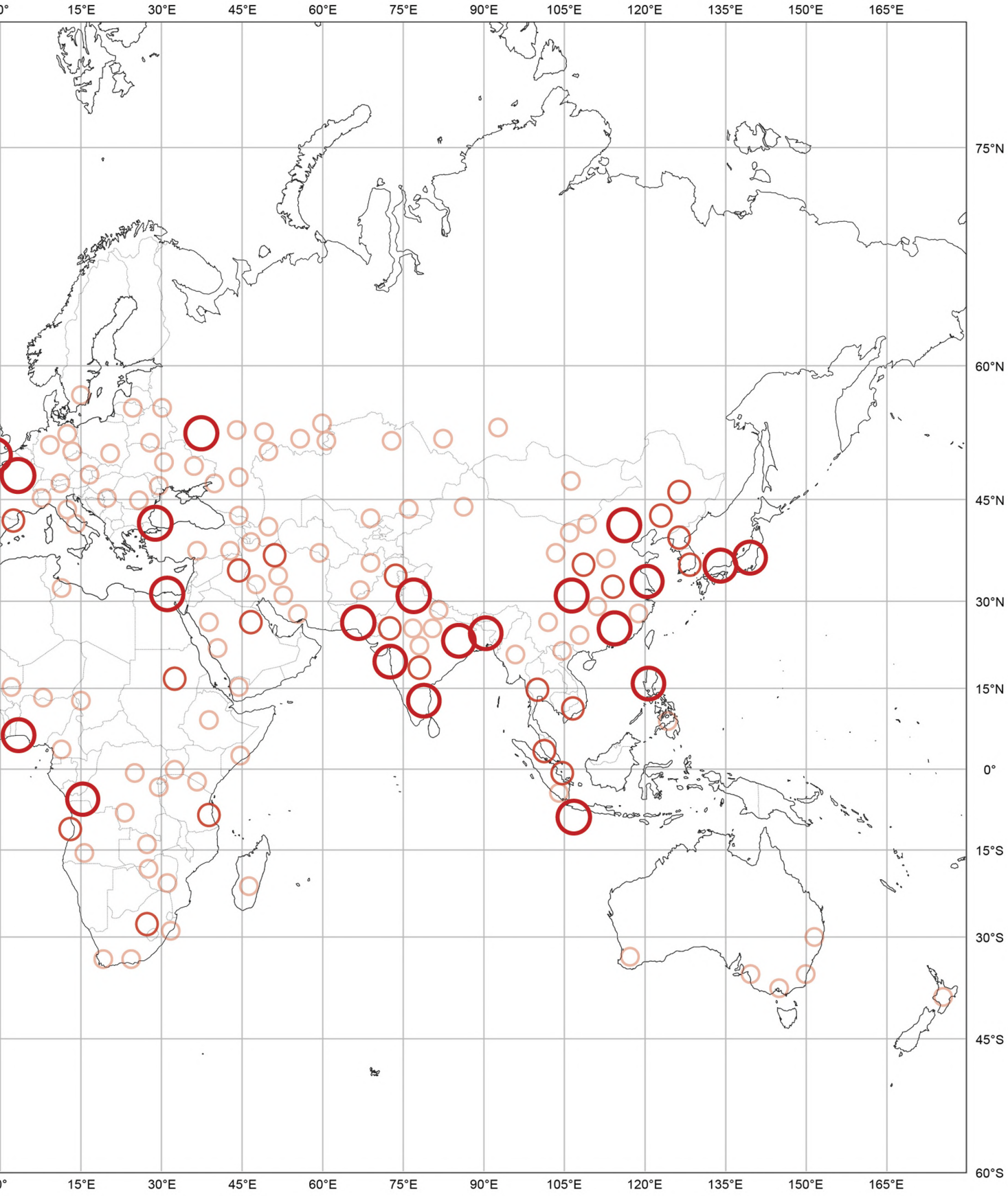
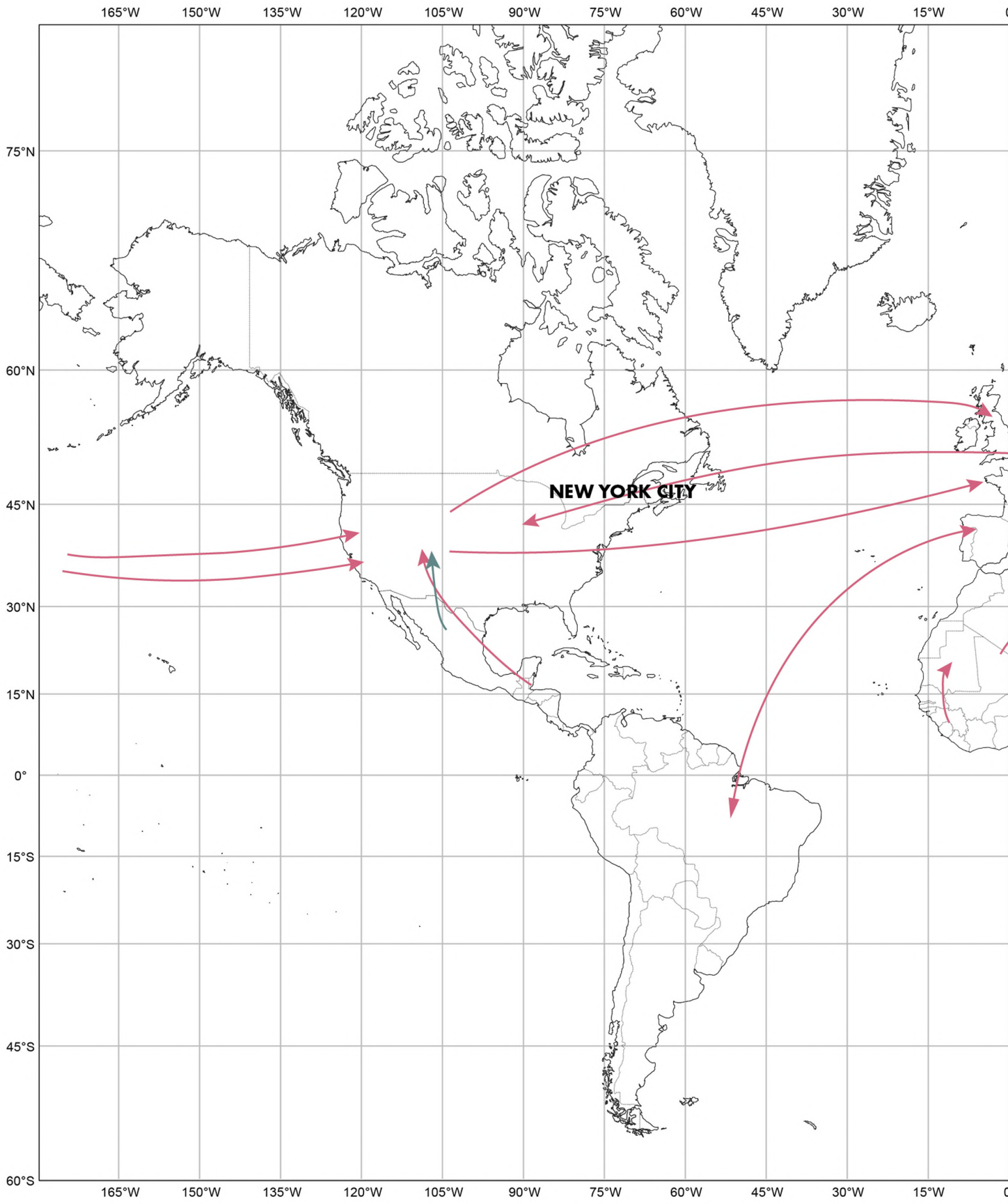


Figure 6 Source: AUTHOR based on United Nations

MIGRATION ROUTES



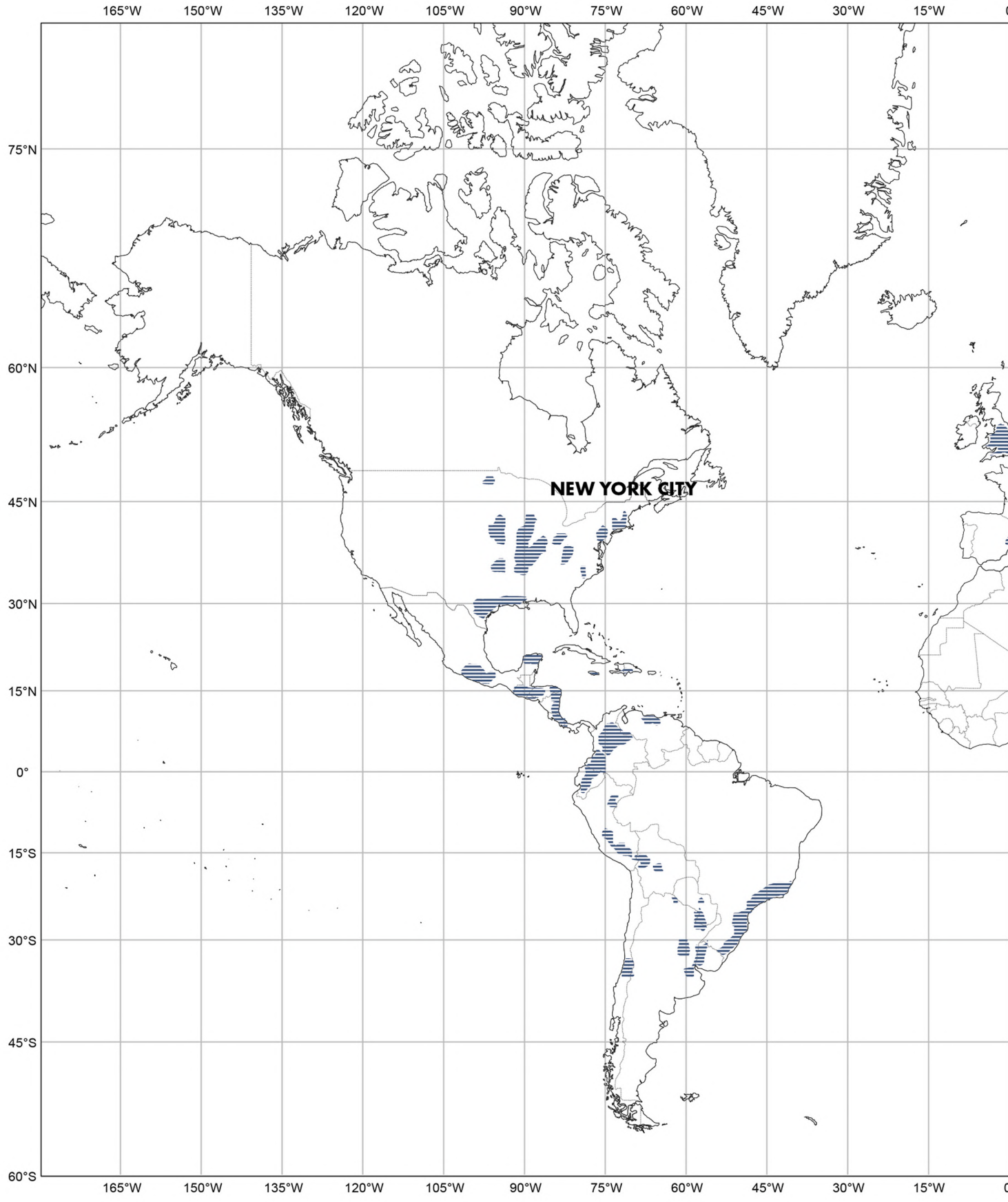
Global Routes → **Main international Migration Routes**

Figure 7

Top Ten Bilateral Migration Corridors with largest average annual change, 2010 - 2015

Source: AUTHOR based on Economic Forum

GLOBAL FLOOD RISK MAP



Areas with greatest flood risk

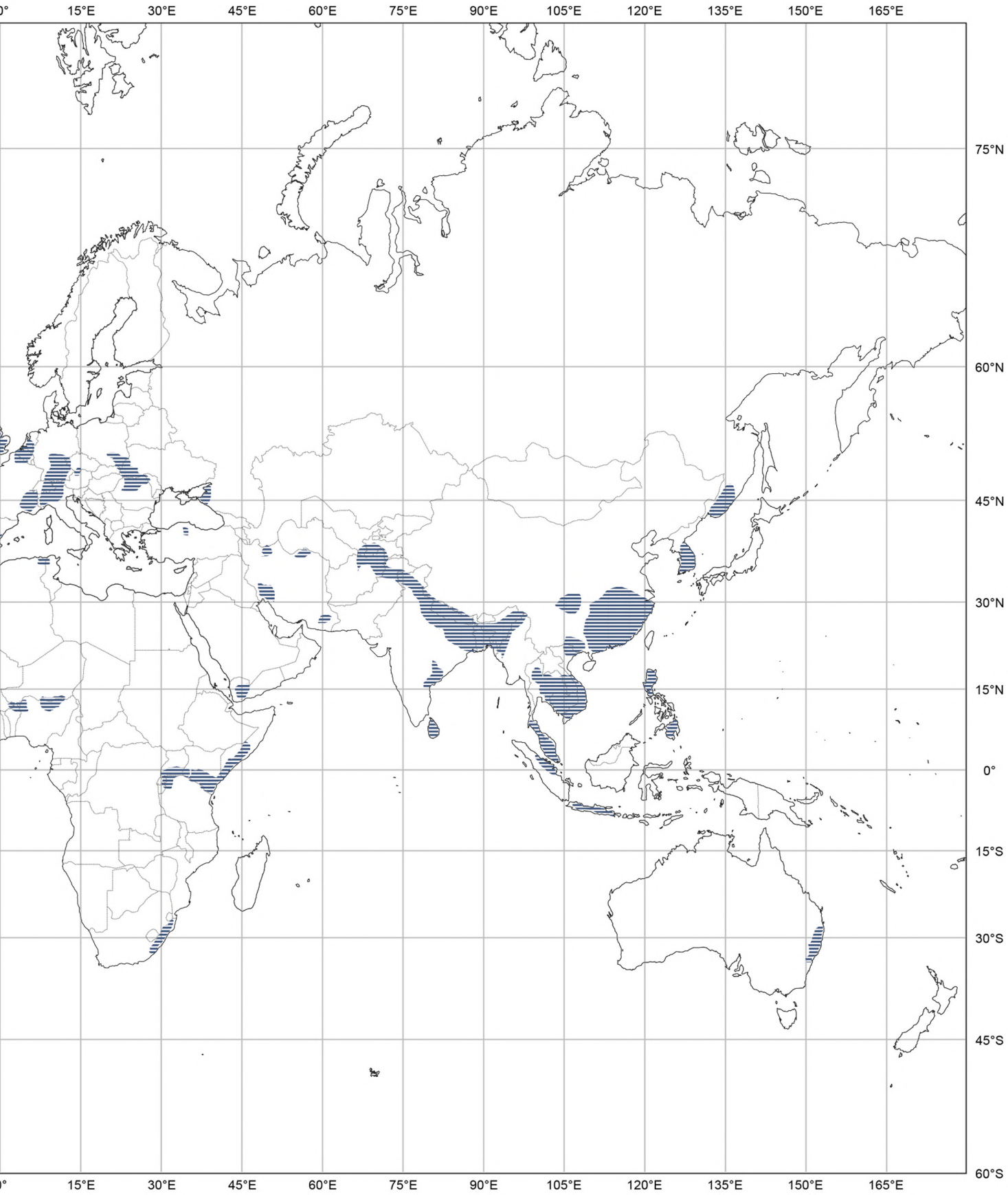


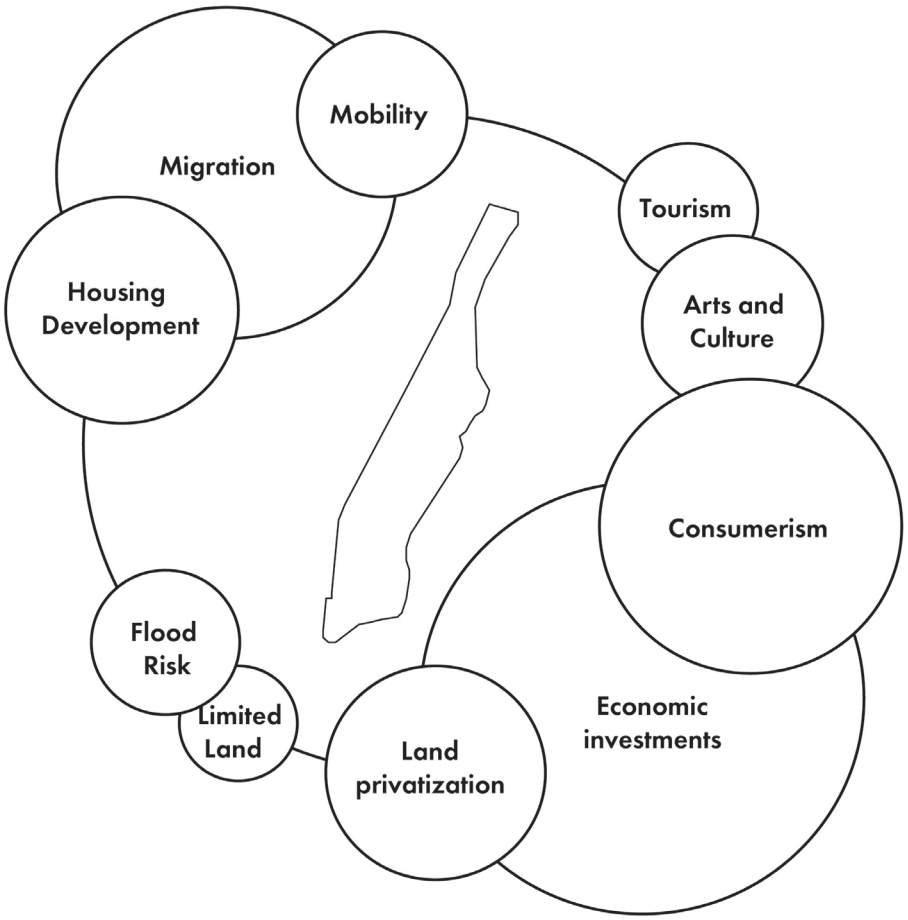
Figure 8 Source: AUTHOR based on Journal of Advances in Modeling Earth Systems

Manhattan urban context

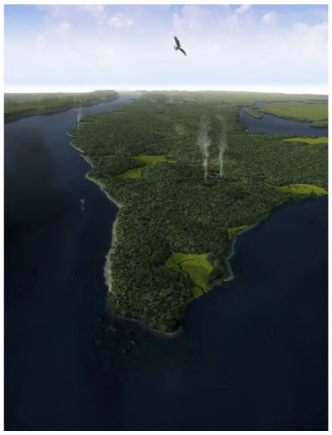
Figure 9

Source: AUTHOR based on Google Earth

Manhattan island was discovered in 1609 by Henry Hudson on behalf of the Dutch East India Company (Koolhaas , 1978). The green primitive island was colonized by Dutch people who later formed New Amsterdam after bying the island for 24 dollars from the Indians (Koolhaas , 1978). The rapid urbanization of the metropolitan area was fostered by significant drivers of change (figure 10). Housing development, migration, economic investements, mobility, consumerism, land privatization, arts and culture, tourism, limited land use and flood vulnerability turned Manhattan from a green natural paradise into an artificial hypermodern world of skyscrapers (figure 11 & 12). The evolving materialization of Manhattan responds to a constant transformation of the necessary programs of uses and the new demands (Busquets & Katsikis, 2017). The application of the grid plan in 1811 as a tool of spatial organization in an aim of rapid development created limitations in the island from the early beginning. The intense densification resulted in the genesis of high rise buildings, the skyscrapers. The deleriosity of the region in combination with the increased inflows of migrants created the need for more housing units. The diverse cultural backgrounds in combination with economic inequalities shaped the social structure of the metropolitan area. It is notable that the antithesis between deprived and priviledged neighborhoods resulted in social segregation. In terms of environmental resilience, Manhattan is vulnerable to coastal flooding and storm surge with a significant sea level rise until 2100. All in all, the challenges of housing crisis, social segregation and flood risk constitute the three pillars of the graduation thesis (figure 13).

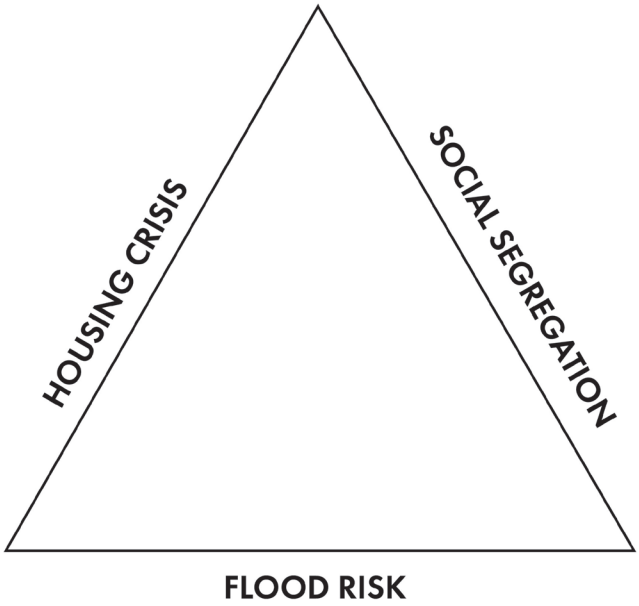


Drivers of change Figure 10 Source: AUTHOR



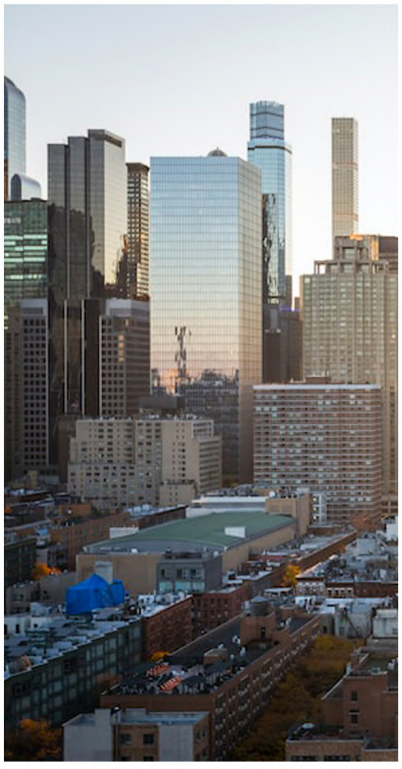
Past Figure 11
Source: NY Times

Present Figure 12
Source: NY Times



The three pillars

Figure 13 Source: AUTHOR



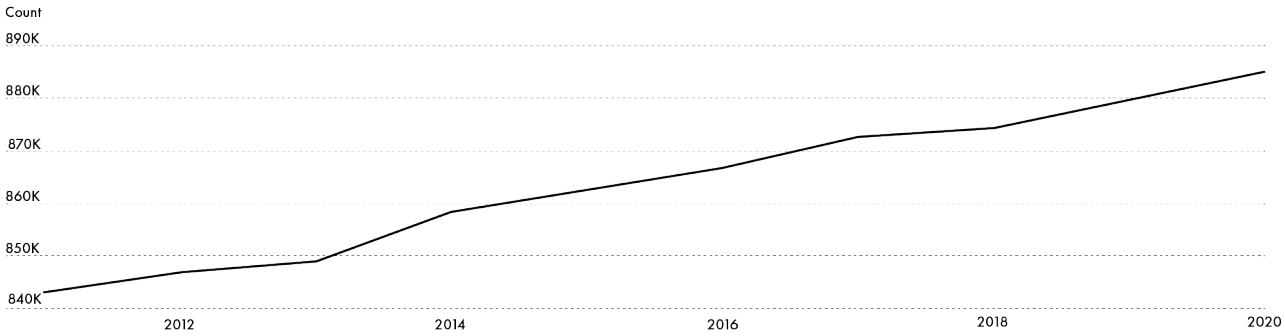
The challenges

Figure 14 Sources: EF Education, Vogue, Daily Mail (photos edited by AUTHOR)

2.1.1 Housing Crisis

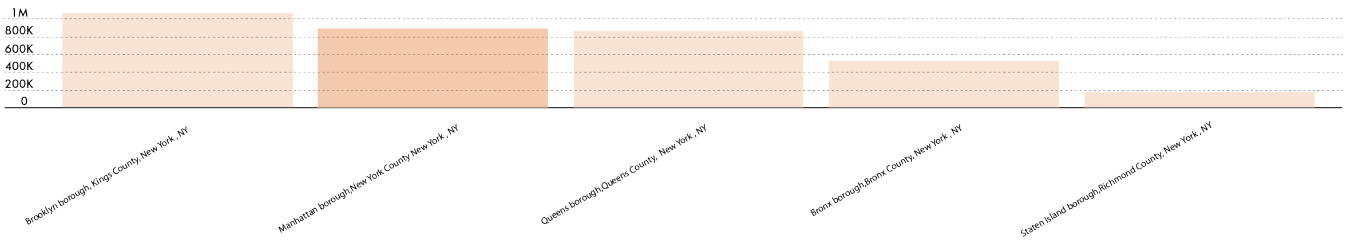
The dense built environment of Manhattan in combination with the limited land for further development arises several questions for future housing demands. In order to have an overview at the time being there are almost 880.000 housing units (figure 15) and according to projections by the NYC government there will be a need for additional 20.000 housing units by 2040 (NYC government, 2013) (figure 18). Taking into account the fixed grid of the island, there is a restriction towards horizontal development.

The skyscraper typology which was introduced in an aim to offer a vertical form of living as a solution to urban expansion (figure 19), presents great potential in housing in the compact metropolitan area in the future. However, since the built environment is getting more dense the capacity of the specific typology in the fixed grid requires re-interpretation.



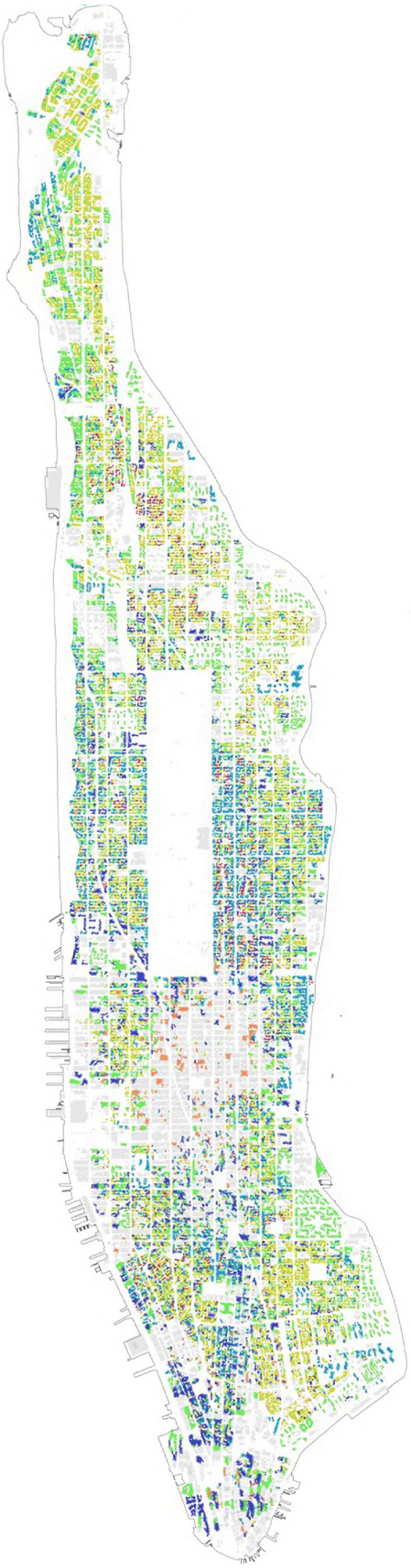
Count of Housing Units, Manhattan

Figure 15 Source: AUTHOR based on Data Commons



Housing Units by Borough, NYC

Figure 16 Source: AUTHOR based on Data Commons



Building Classes

Figure 17 Source: AUTHOR based on https://tbaldw.in/nyc-buildings/

Looking at the map (figure 17) we realize that the majority of the buildings in the metropolitan area are residential with multiple classifications from one family homes to mixed use residential buildings. The compactness of the housing stock and the demand for additional housing units is a very significant point to consider.

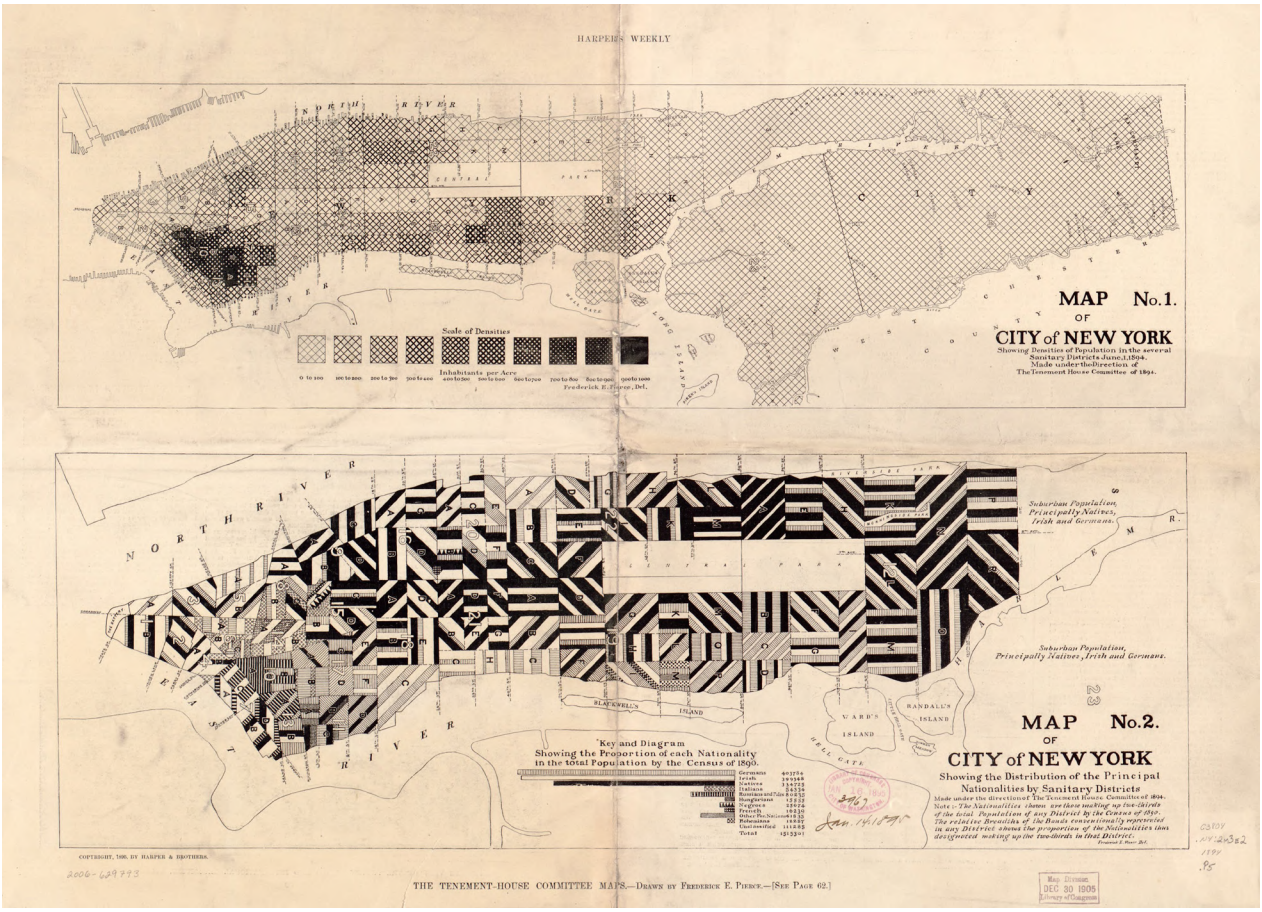
	2010	2020	2030	2040
NYC	3.375.002	3.503.175	3.614.576	3.696.359
Bronx	511.896	535.487	563.105	586.147
Brooklyn	1.000.293	1.038.258	1.080.203	1.114.581
Manhattan	847.090	876.326	897.769	906.079
Queens	839.067	869.387	885.721	900.485
Staten Island	176.656	183.718	187.779	189.067

Increase of Housing Units

Figure 18 Source: AUTHOR based on Data Commons

Herman Bollman, *Pictorial Maps*, New York, 1963

Figure 19 Source: New World Cartographic



Population growth and migration patterns

Figure 20 Source: Mapping the Nation

NYC's Immigration Patterns over 387 years

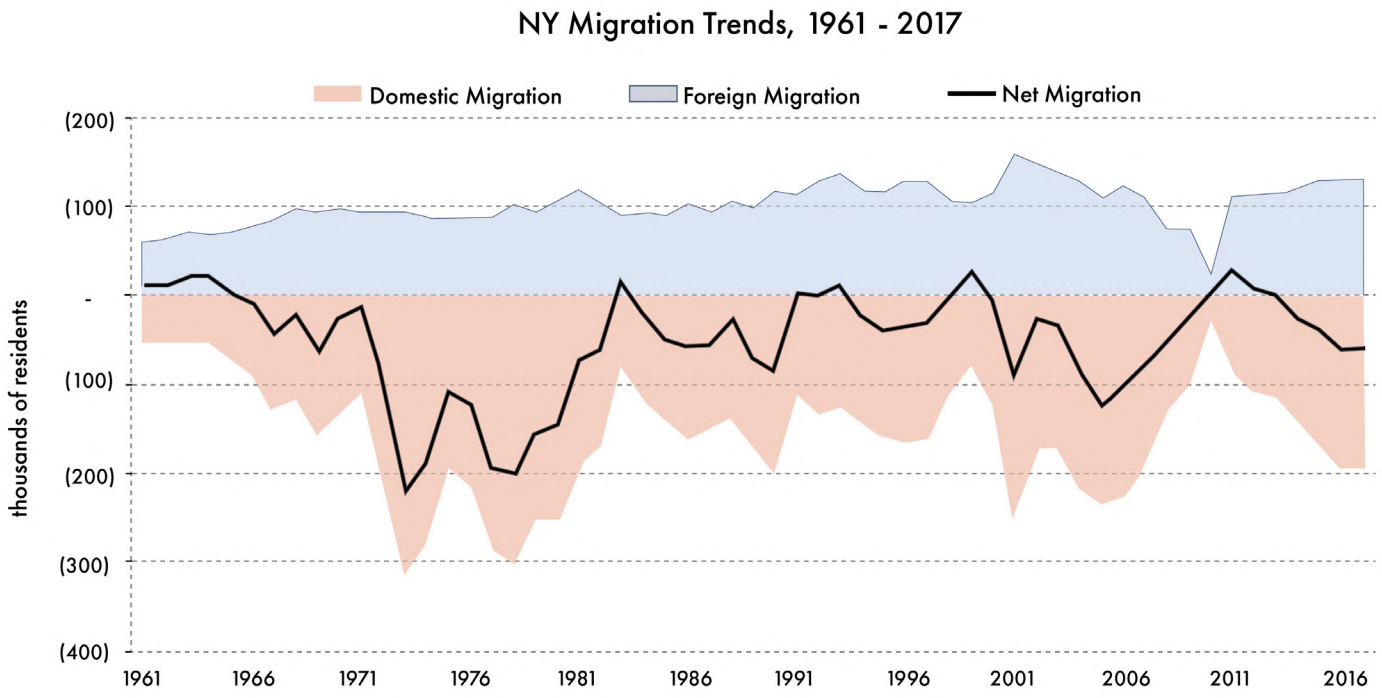
Figure 21 Source: 6sqft

2.1.2 Social Segregation

Manhattan started as a Dutch colony and during the years a significant number of people from all over the world migrated in the island. According to statistics, the migration trends have an increasing development thus contributing to the population growth of the metropolitan area. As figures 20 and 21 indicate, the great influx of migrants has formed various patterns in terms of specific racial communities. This number has reached almost the 1/3 (400.000 people) of the total population in the region (figure 24).

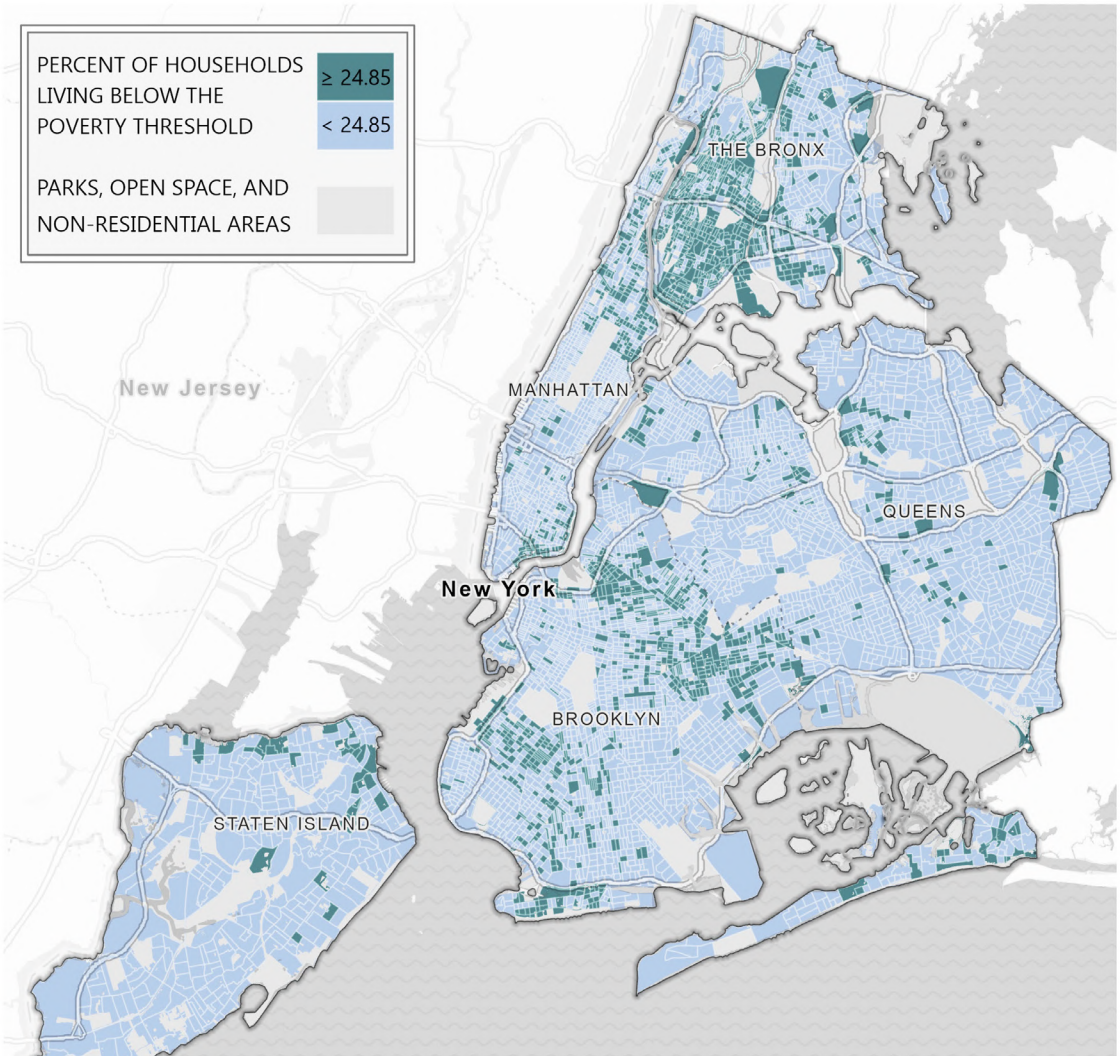
According to the map, the racial diversity is distributed in a way where the Non – Hispanic white people occupy the largest and more central part of the island (figure 27). Hispanic, Asian and Non Hispanic black people are settled on the edges of the metropolitan area. It is worth noting that the social inequalities are impending with a significant percentage of more than 20% of households living below the federal poverty level (figure 23) . The majority of poorest neighborhoods are allocated in close proximity with the edges of the island as well (figure 26).

The lack of social mix and diversity has resulted in social inequalities leading to segregation. Sharon Zukin notes that the city does not do enough to protect the poor and the middle class while the social diversity, and not just the diversity of buildings and uses, gives the city its soul (Zukin, 2010). According to Jane Jacobs, inert cities do contain the seeds of their own destruction, while lively, diverse and intense cities contain the seeds of their own regeneration (Jacobs, 1961). In this sense, the mitigation of social segregation is crucial for the livability and diverse nature of the metropolitan area of Manhattan.



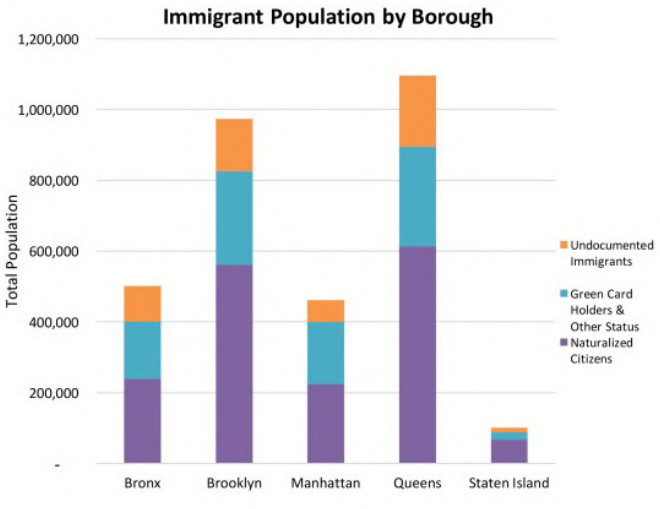
NYC migration trends 1961 - 2017

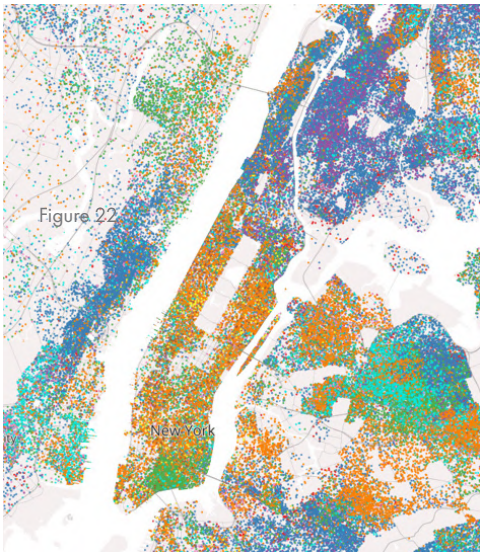
Figure 22 Source: AUTHOR based on U.S. Census Bureau



NYC households living below the federal poverty level

Figure 23 Source: Rebuild by Design





Immigrant population and number of migrants

Figure 24 & 25 Source: NYC gov

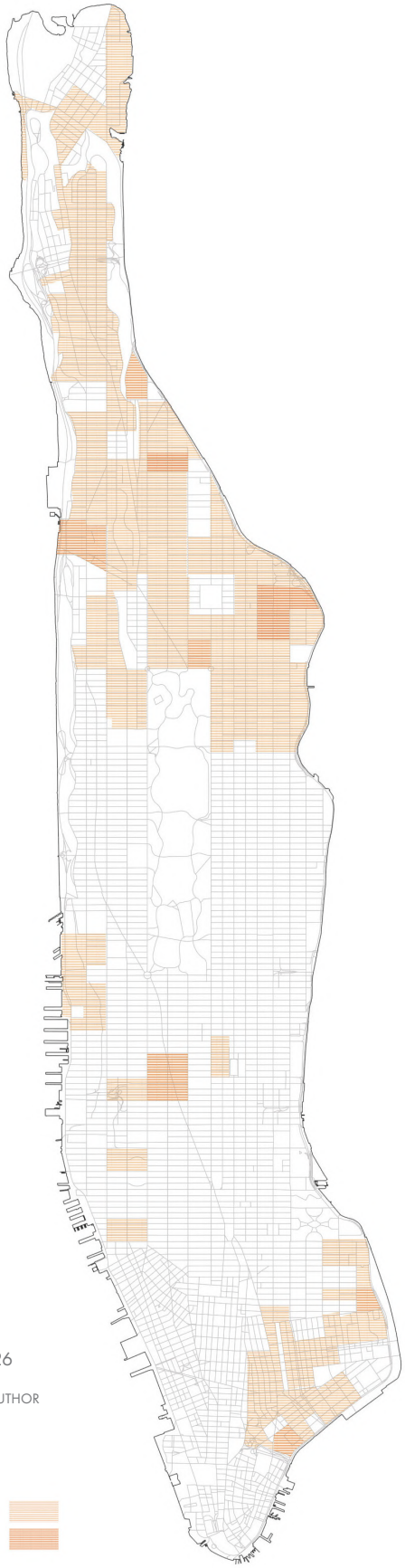


Figure 26

Source: AUTHOR

Level 1

Level 2

Poorest Neighborhoods

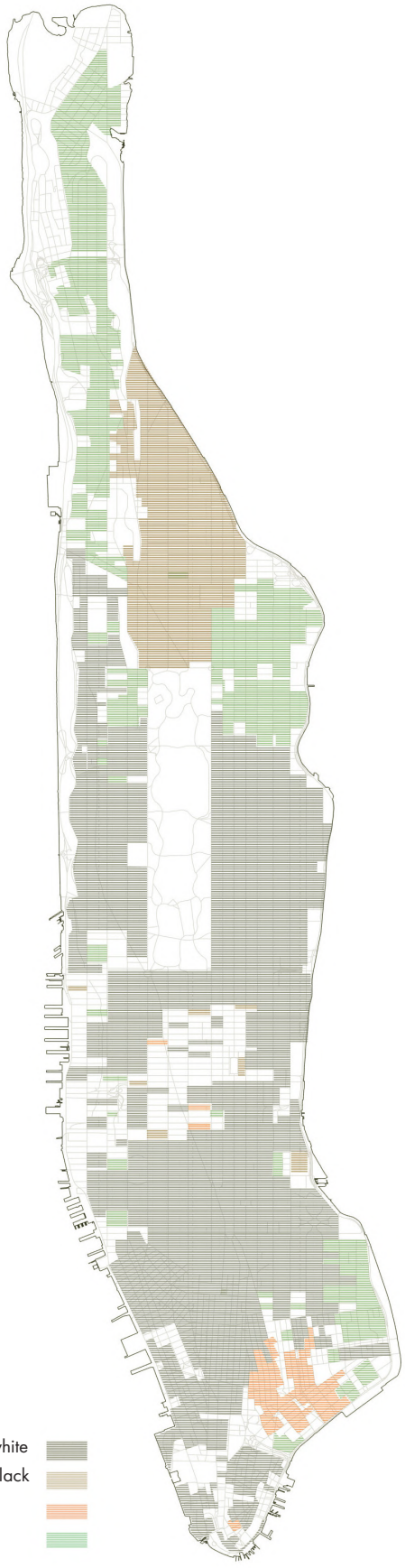


Figure 27

Source: AUTHOR

Non hispanic - white

Non hispanic - black

Asian

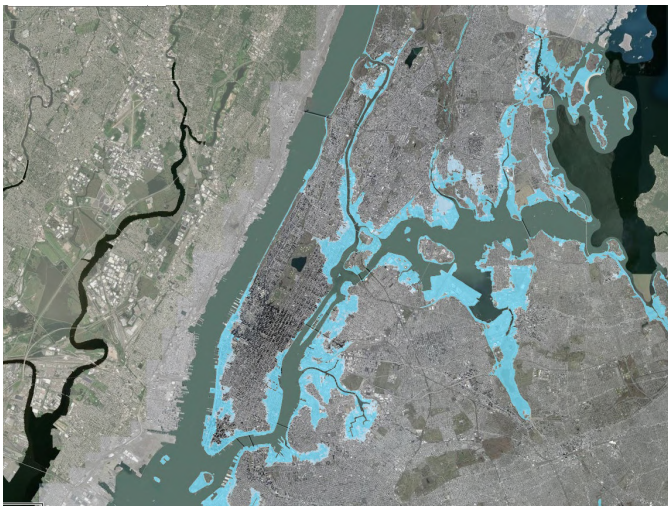
Hispanic

Racial Diversity

0 1.5 3 km

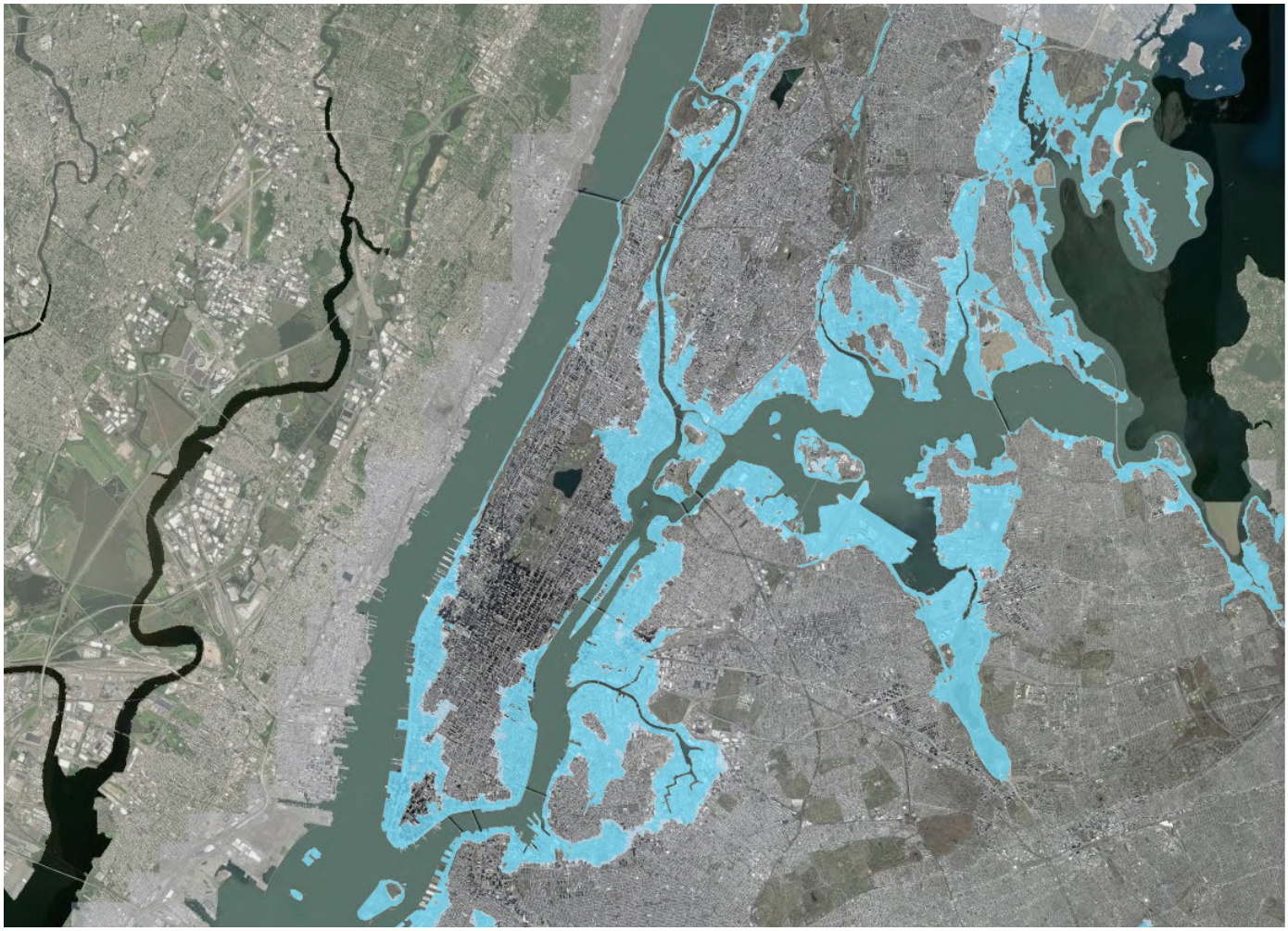
Floodplain 2020

Figure 28 Source: Extracted from DCP MAPS ARCGIS



Floodplain 2050

Figure 29 Source: Extracted from DCP MAPS ARCGIS



Floodplain 2100

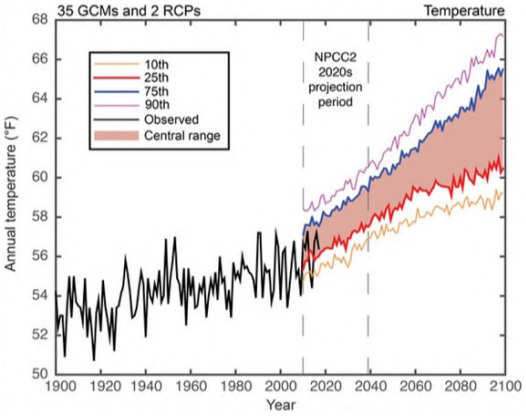
Figure 30 Source: Extracted from DCP MAPS ARCGIS

2.1.3 Flood Risk

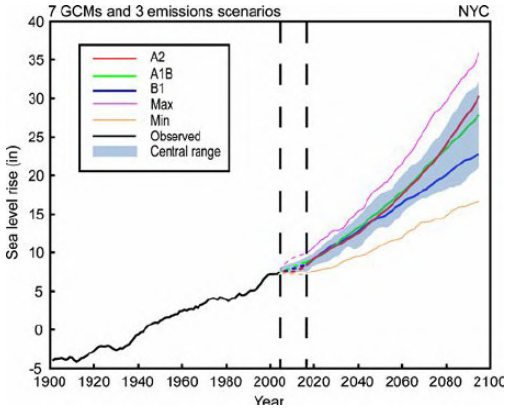
The increasing frequency of climate events has great impact on metropolitan areas. New York City is at risk to future coastal flooding from storm surge and sea level rise. Hurricane Sandy which hit New York in 2012 caused severe disasters noting the damage of 800 buildings, including 70.000 housing units (Institute for Public Knowledge, 2022).

The floodplain from 2020 to 2100 shows the increasing vulnerability of the coastal areas (figures 28 - 30). The possibility of almost 1 meter sea level rise in the year 2100 due to significant temperature increment in combination with storm surge makes vital the need for resilience of the metropolitan area in the future (figures 31 & 32).

The current strategies for rebuilding and defending the region are artificial, while a notable number of experts assumes that the proposed solutions are both ineffective and detrimental (Keenan & Weisz, 2016). Flood vulnerability constitutes a significant climate concern that needs to be mitigated in an effective way the following years.



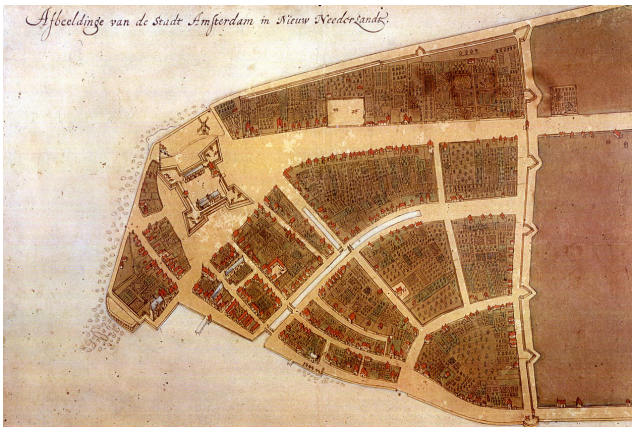
Temperature rise Figure 31 Source: The New York Academy of Sciences



Sea level rise Figure 32 Source: Research Gate

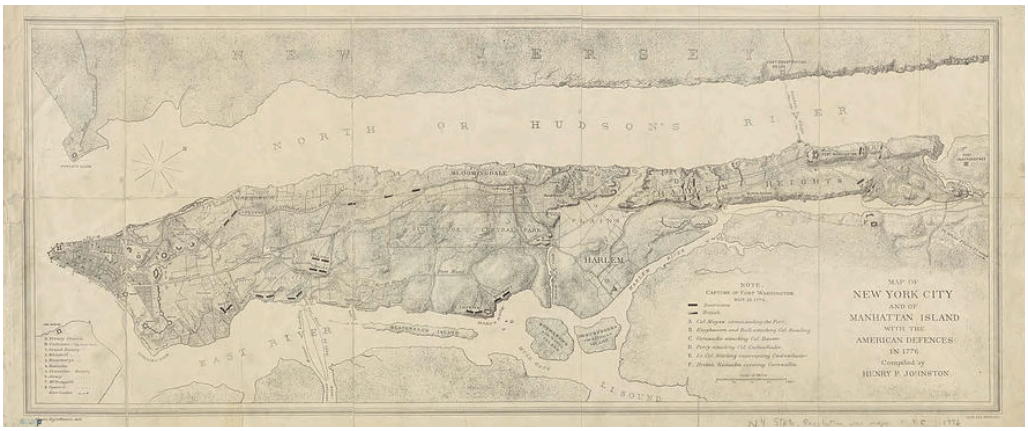
Visualization of Flooded Manhattan Figure 33 Source: Rolling Stone

3 Research Objective



1660

Figure 34 Source: New York Public Library

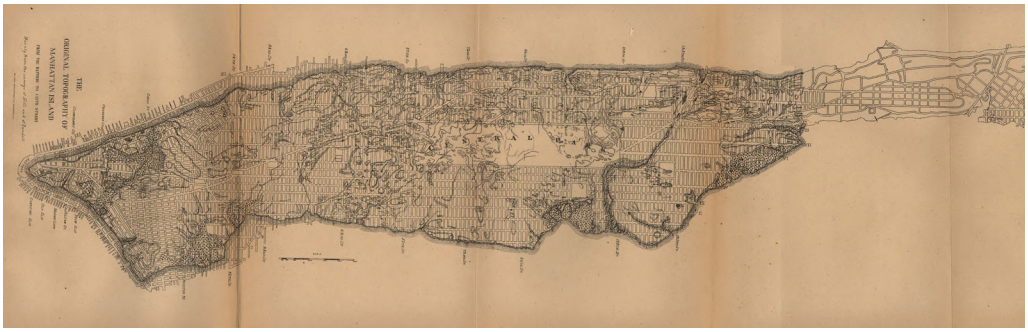


1776

Figure 35 Source: Brooklyn Public Library

1865

Figure 36 Source: Library of Congress



1880

Figure 37 Source: Report on the Social Statistics of Cities

3.1 Historical Evolution of the island

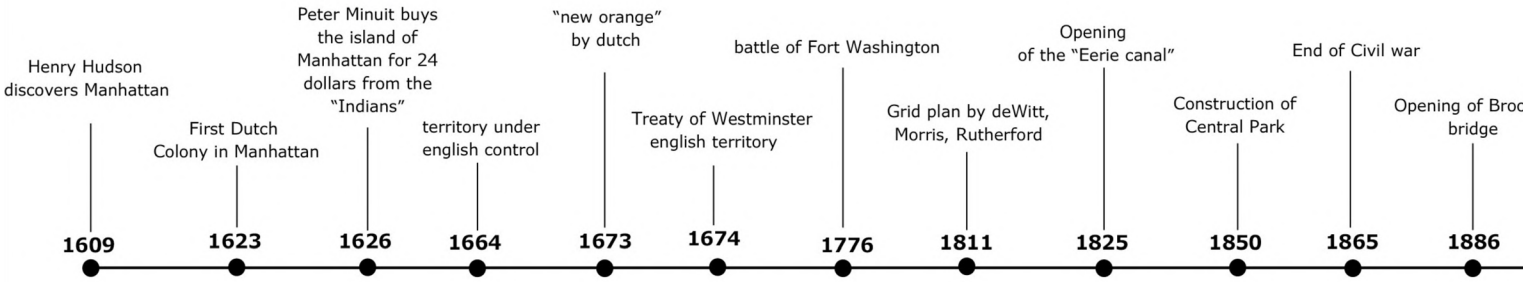
The island of Manhattan was discovered in the 17th century by Henri Hudson when the Indian Lenape tribe was dominating the region named "Mannahatta". In 1623 the first Dutch colony, the New Amsterdam, was formed in the Lower part of the island. After a long period of shift between Dutch and English territory, the rapid urbanization of the area took place (figure 34). In 1811 the Grid Plan by De Witt, Morris, Rutherford was applied. Forty years later, the implementation of construction of Central Park initiated. Important historical events like the Civil War, Harlem Renaissance, the Great Migration, the Industrial Restructuring, the upgrade of Wall Street into the Financial Center of the world, the gentrification of neighborhoods and strong climate events such as Hurricane Sandy shaped the present image of the island (figure 39 & 40).

Manhattan started as a green island with wetlands and streams. The Dutch colonization in New Amsterdam was followed by the first urban plan respecting the natural elements. During the years as well as the implementation of the Grid Plan, the island has experienced various alterations in the landscape including the coverage of streams and the ignorance of green element in the urban core. Manhattan has bolstered the building development while covering the palimpsest natural elements. (figure 40). Another notable point is the coastline expansion, possibly due to the increasing housing demand and emergent flood vulnerability (figure 38).

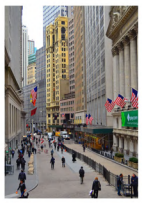
Coastline expansion

Figure 38 Source: AUTHOR

Timeline of Events



MANHATTAN 1609



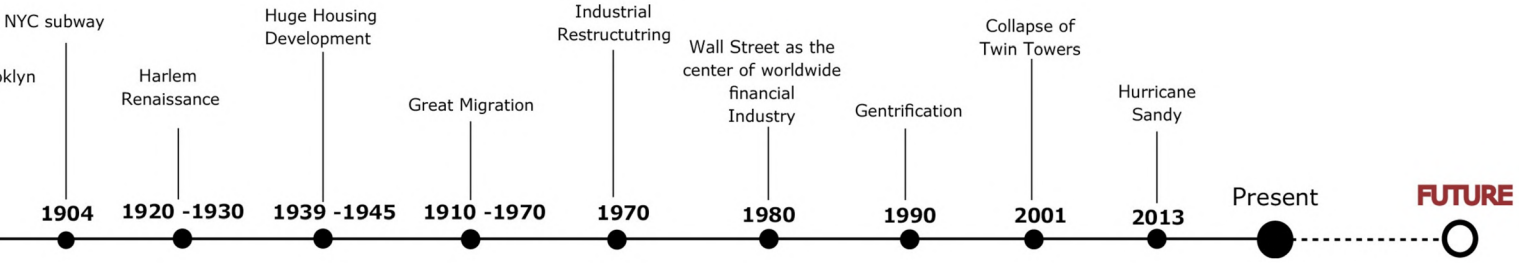


Figure 39 Source: AUTHOR

MANHATTAN 2022

Figure 40 Source: Extracted from Thirteen.org

The Commissioners, *The City of New York,* 1807

Figure 41

Source: Public Domain
United States

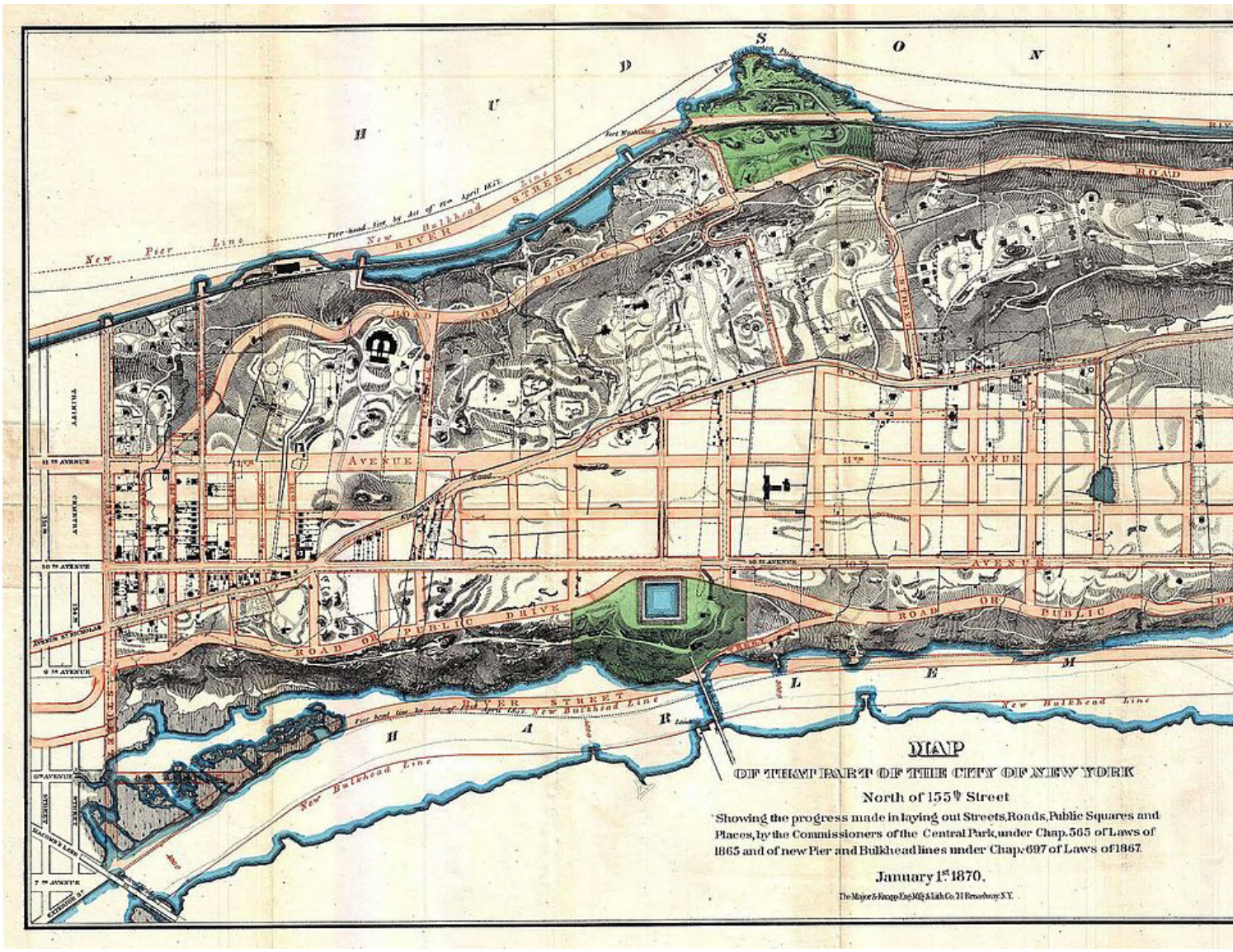
3.2 Manhattan is the Grid

The plan of Manhattan has been widely criticized from its origins. The application of the strict grid in an aim to provide an effective spatial organization of the island has been considered both an intelligent paradigm as well as a tool for fast building development without taking into account the natural elements and topography of the region.

New Amsterdam was laid out in a more organic way with the streets following the natural topography and hydrology of the landscape. The urbanization of the rest of the metropolitan area was finally planned in a rectilinear grid as a result of the Commissioner's Plan in 1811 (figure 41). The Council of New York City was looking for a plan able to unite regularity and promote public health bearing in mind that the city suffered for decades from the epidemics of yellow fever as a result of "miasma" associated with sewage, standing water and low sunlight.

According to the Commission, the adoption of the final plan was considered to be the best after taking all circumstances into consideration. However, Hendrick Hartog noted that their choice was resonant with the political values of the country in order to avoid inequality of special privilege and that the hidden agenda of the plan was the reconstruction of the natural environment to fit the requirements of republican authority (Hartog, 1983). Reuben Rose- Red Wood agrees that the grid's designers were aiming to promote real estate development and the most economically efficient use of urban space (Reuben, 2011). The landscape architect and inspirer of Central Park, Frederick Law Olmsted, was arguing about the grid's adaptation to natural topography and the destruction of the rocky landscape. He believed that no city is more unfortunately planned with reference to metropolitan attractiveness (Olmsted, 1876) Clement Clarke Moore indicated that the great principle of the plan was to reduce the surface of the earth as nearly as possible and that the natural inequities of the ground are destroyed with the existing water courses disregarded. (Moore, 2015) The architect Isaak Newton Phelps Strokes implied that the crooked streets wooded hills, and fertile valleys traversed by streams and winding country roads, began to be absorbed into a new city, in which antiquity and nature are no longer respected, with streets laid out in accordance with a carefully considered symmetrical plan. (Strokes, 1915). It is clear that the grid plan fostered the rapid building development in an organized manner, while at the same time it lacked successful adaptation to the natural topography of Manhattan island.

On the other hand, the gridiron plan is considered an inspiring paradigm for urban planning. Rem Koolhaas has praised Manhattan's grid noting that although the "magic carpet" of the Grid provided similarity of the blocks, it created freedom for three dimensional anarchy (Koolhaas, 1978). According to Wendy Evans Joseph the grid embodied a democratic – republican ideal in an aim to provide order in the chaotic madness of the city. (Joseph, 2013). The flexibility of the gridiron system is discussed by Hilary Ballon who explained that the plan provided a remarkably flexible and orienting framework for growth and change (Ballon, 2013). Edward Glaeser insistes that Manhattan grid imposed clarity on the burbling chaos, enabling ordinary pedestrians to negotiate New York's complex system. (Glaeser, 2013). The inherent intelligence of the plan and the size of the blocks being nearly five times longer in the east-west dimension (avenue to avenue) than in the north south (street to street) ensured the proper lightning of the buildings. According to Lance Hosey, the fact that the grid sits at a twenty nine degree angle off of true north, potentially every building on every street can receive direct daylight everyday of the year (Hosey,2012). The grid supporters emphasized the flexibility and clarity of the grid in an aim to provide equity of space and spatial organization in the metropolitan area.



The Knapp map, 1870

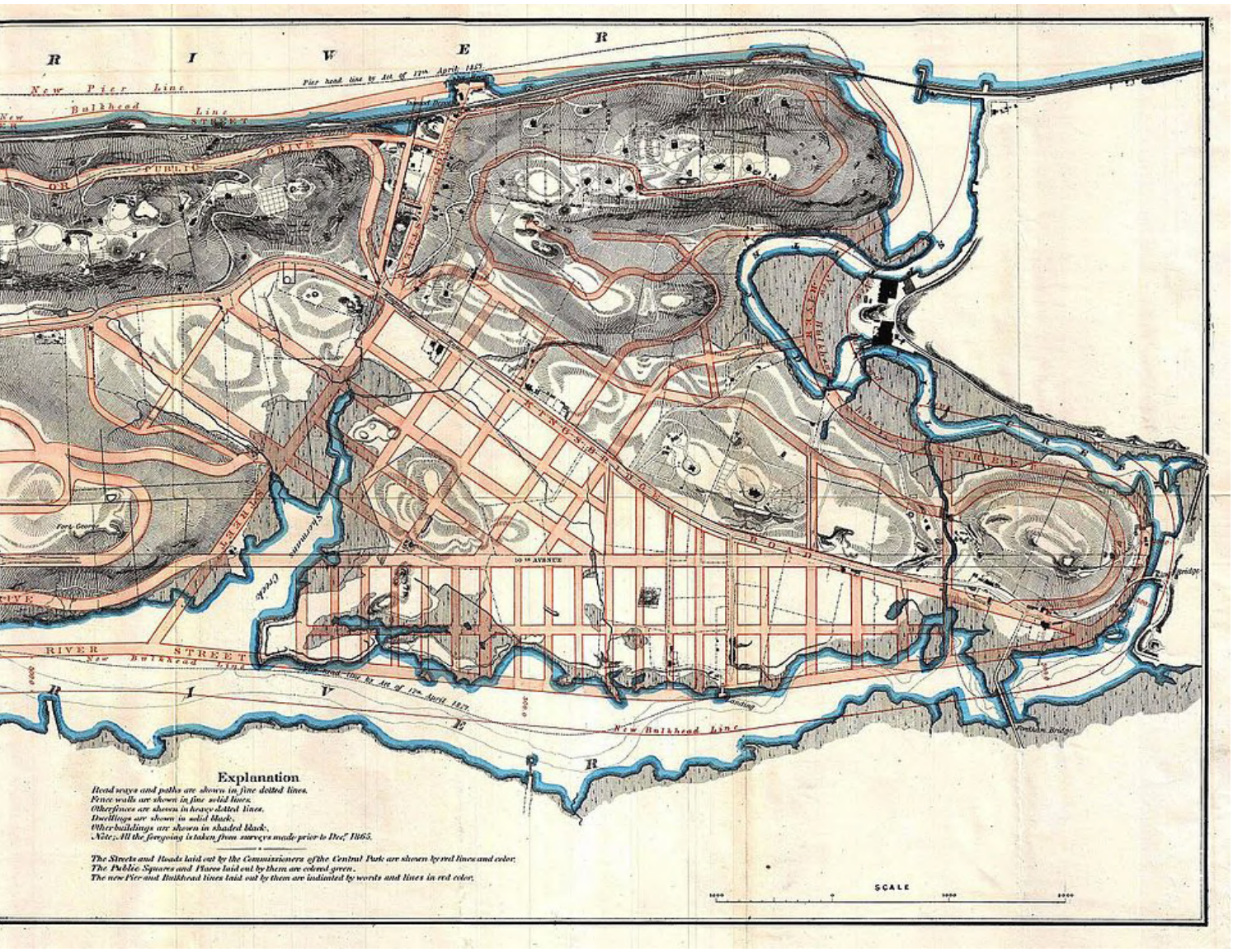


Figure 42 Source: Geographicus.com

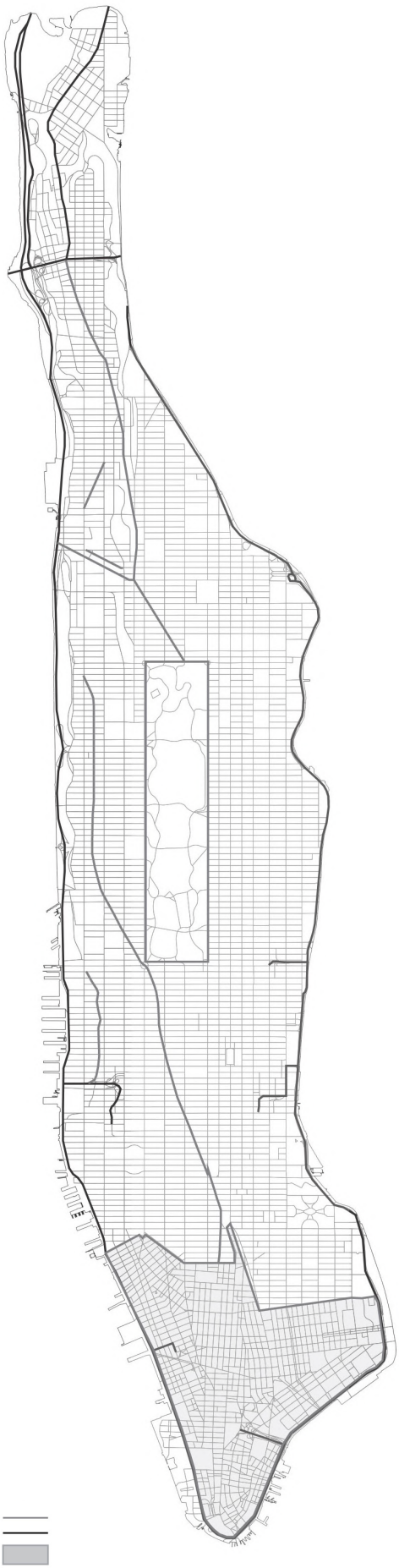


Figure 43

Source: AUTHOR

Structural Elements

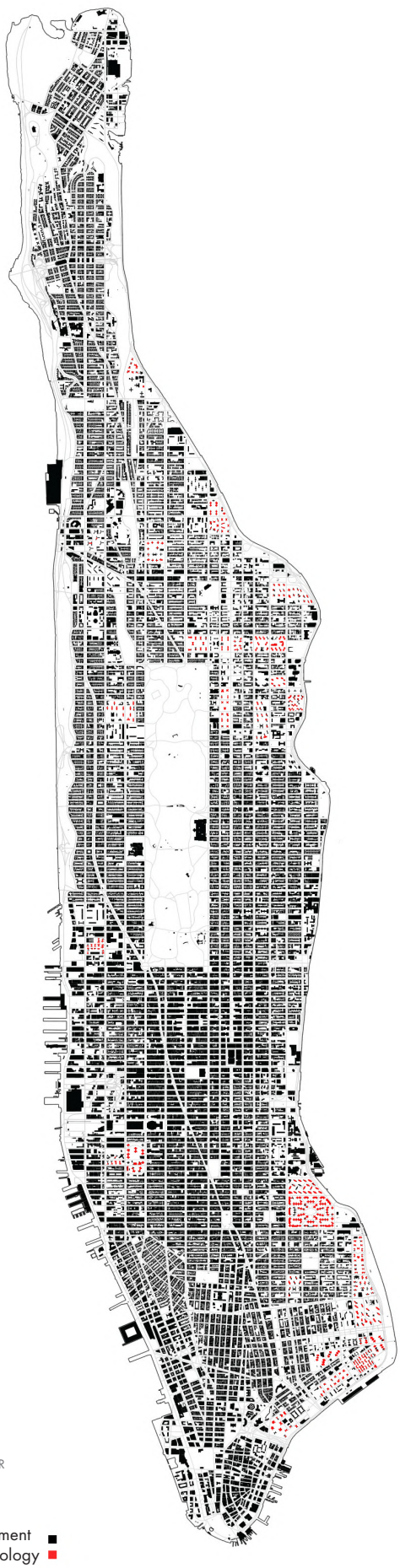


Figure 44

Source: AUTHOR

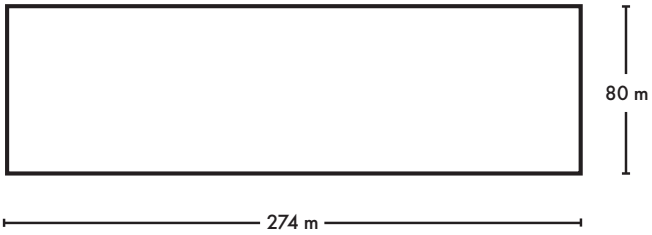
Building Envirnonment

Delving into the spatial structure of the grid in Manhattan, we realize the difference between the urban plan of New Amsterdam and the gridiron plan of the rest of the metropolitan area (figure 43). The grid pattern was based on the typical block size of 274 m x 80 m, allowing the formations of avenues and streets (figure 45).It is notable that there are urban elements breaking the grid such as major highways and the Central Park due to its rocky landscape.

The building environment is extremely dense and in some areas, mostly in Lower East Side and Harlem, the buildings present a common typology (figure 44). Most of these homogenous areas are the sites for social housing. It is significant to indicate that in these specific areas the typical grid also differs forming superblocks.

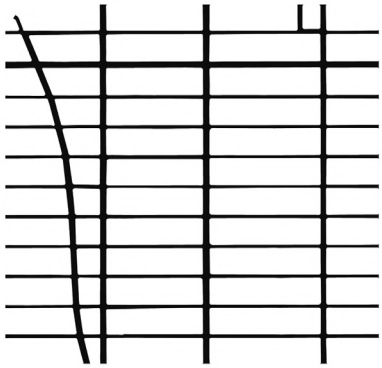
Looking closer into an urban area right below Central park , we realize that due to the breakings of the grid, the block sizes differ from 2.000 m2 to 20.000 m2 (figure 46). Moreover, the area is mixed used with high rise residence, offices, institutional facilities, hotels, cultural and religious facilities, parking lots, mixed use residence and mixed use commercial.

All in all, the grid of Manhattan is a key element for the spatial organization of the metropolitan area with many supporters as well as critics claiming that the strict structure alterated the natural landscape of the island. The extensive dialogue and impact of the grid, can logically lead to the conclusion that " Manhattan is the grid".

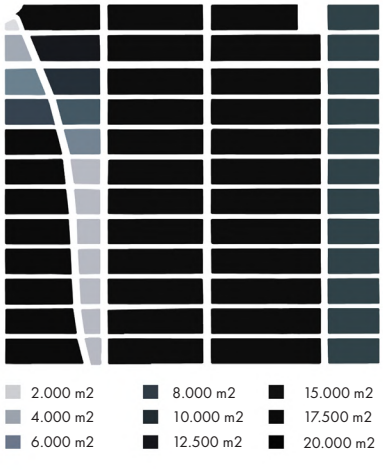


Typical Block Dimension

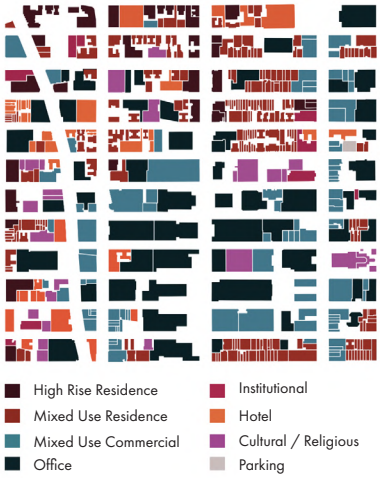
Figure 45 Source: AUTHOR



Grid



Block Dimension



Program

Figure 46

Source: AUTHOR based on Busquets , J., Yang, D., & Keller , M. (2019). Urban Grids: Handbook for Regular City Design . ORO Ed.

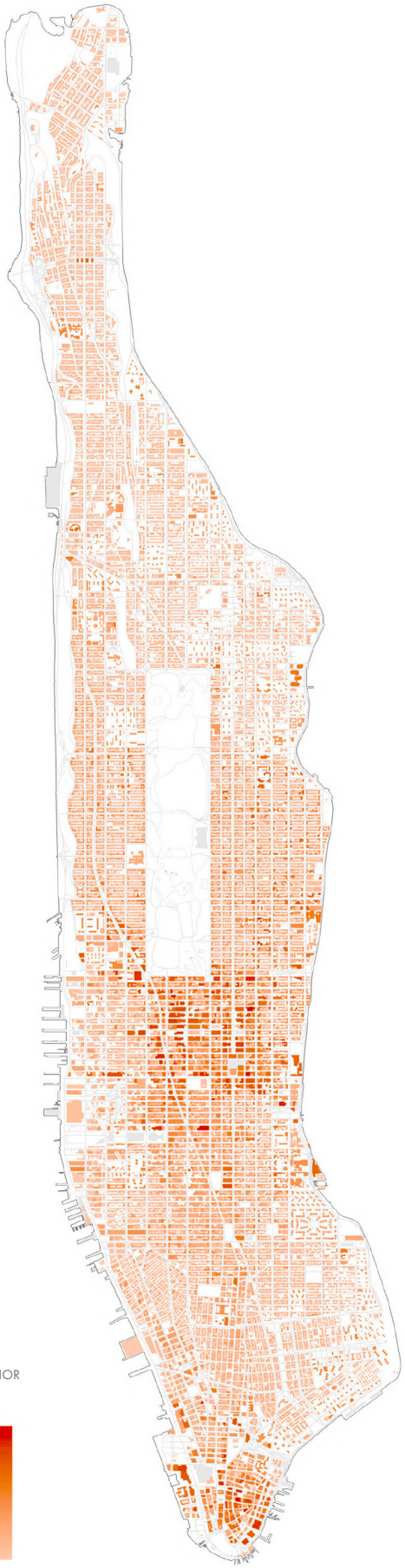


Figure 47
Source: AUTHOR

Building heights

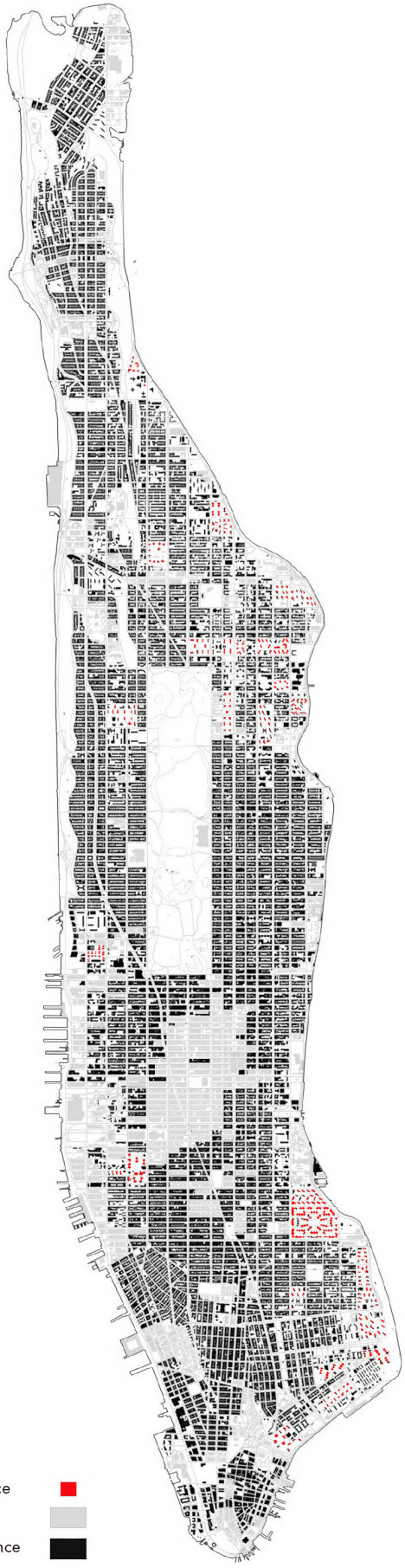


Figure 48
Source: AUTHOR

Buildings incl. Residence

3.3 The Grid and the Three challenges

The spatial structure of the grid presents advantages and disadvantages. Stanislawski made an extensive analysis of the gridiron plan concluding that the grid facilitates the equitable distribution of property by virtue of its efficient use of space through the strategic mode of spatial organization (Stanislaswski, 1946). However, at the same time, he indicates that the grid structure lacked in accommodation to local topography and that it fostered the conformity of building alignment while it could not provide the communication from the periphery to the center like the radial plan (Stanislaswski, 1946).

In order to conclude about the impact of the grid in the framework of our problem statement, it is vital to analyze the correlation of the grid per challenge. How can the gridiron plan affect the housing crisis, social segregation and flood risk in Manhattan?

3.3.1 Grid and Housing Crisis

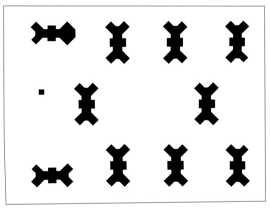
The application of the grid structure along Manhattan, created from the early beginning a fixed limit of horizontal building development in the island. During the years, the population increased significantly due to internal and international migration. The rising demand for housing as well as the limited horizontal development created a variety of building densities in the metropolitan region leading to a compact and dense building environment. The application of the grid resulted in vertical expansion, while a dialogue for land reclamation has started for an horizontal land addition as well.

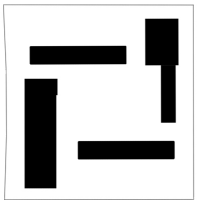
The architect Ernst Flagg insisted that the block size promoted over – crowding in the tenements. (Flagg, 1894). In the same direction, Frederick Law Olmsted argued that the rigid uniformity of the system required that no building could be more than 100 feet in depth, providing no independence to its citizens (Olmsted, 1876).

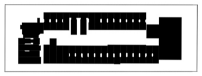
Nevertheless, Rem Koolhaas praised the grid and its capacity to create three dimensional anarchy despite the rigidity in the second dimension. In this sense, additional housing can be designed in the form of new densities given the freedom of the third dimension. His perception towards the grid structure is summarized in the following words: " *The theoretical omnipresence of the grid does not imply homogenous density: it will organize the coexistence of solid and void, density and emptiness...The grid will allow different intensification*" (Koolhaas & Mau, 1995).

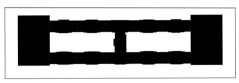
The maps indicate that there are various building densities along the island with the majority of the biggest heights located in the typical grid plan (figure 47). The housing allocation is spread along the metropolitan area in different forms and densities as well (figure 48). The superblocks meant for social housing present homogeneity. After a closer investigation, eleven density housing typologies were extracted (figure 49). It is clear that the typical block fosters the formation of high rise residential units, while the grid differentiation presents more homogenous forms and densities.

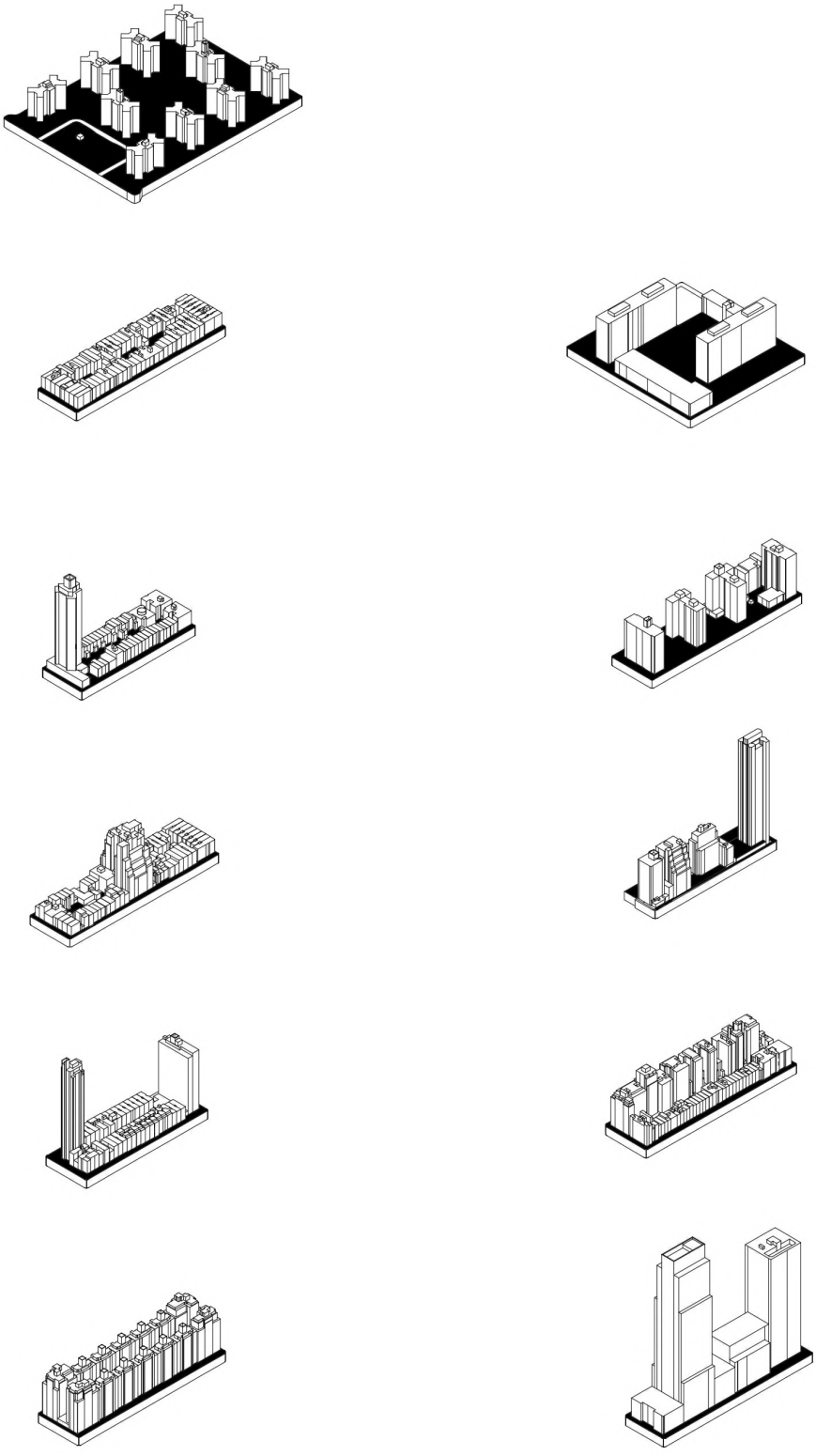
It seems that although the grid puts limits of size and alignment in the urban plan, it does not impose restrictions in the third dimension. Probably, it fostered the overcrowding due to the island's limited capacity but it provided room for additional housing innovations in a high rise urban environment leading to a compact and more sustainable development.











Housing Densities Figure 49

Source: AUTHOR

based on Busquets , J., & Katsikis, N. (2017). Manhattan: Rectangular Grid for Ordering an Island. Harvard Graduate Schoolof Design

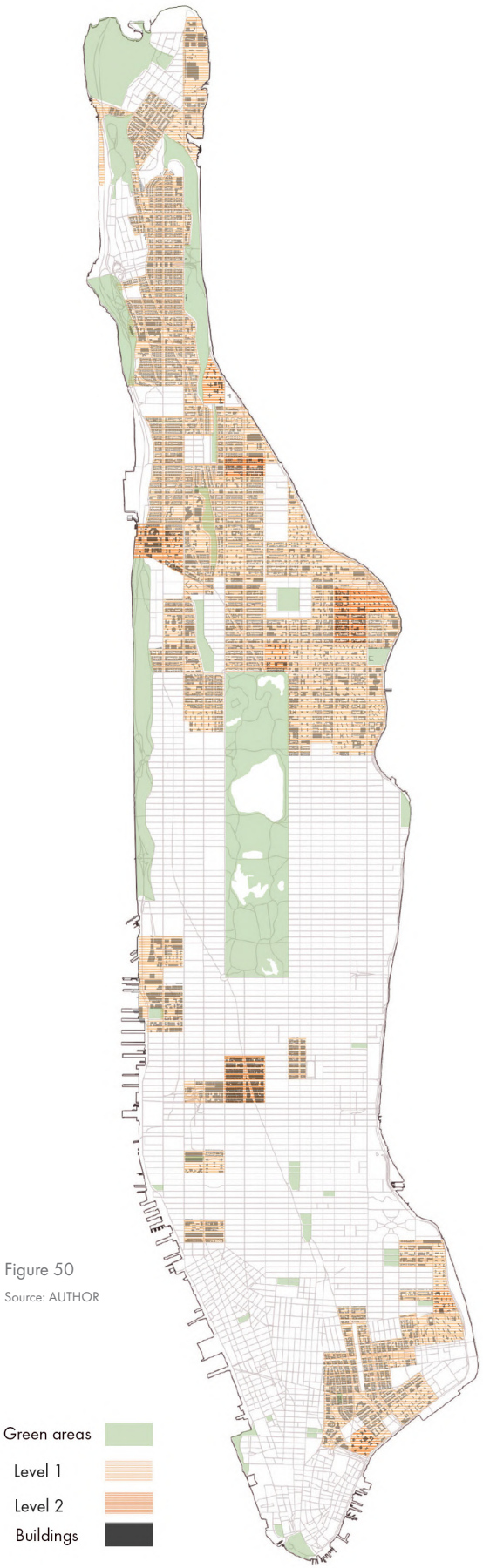


Figure 50

Source: AUTHOR

Grid and Social Segregation

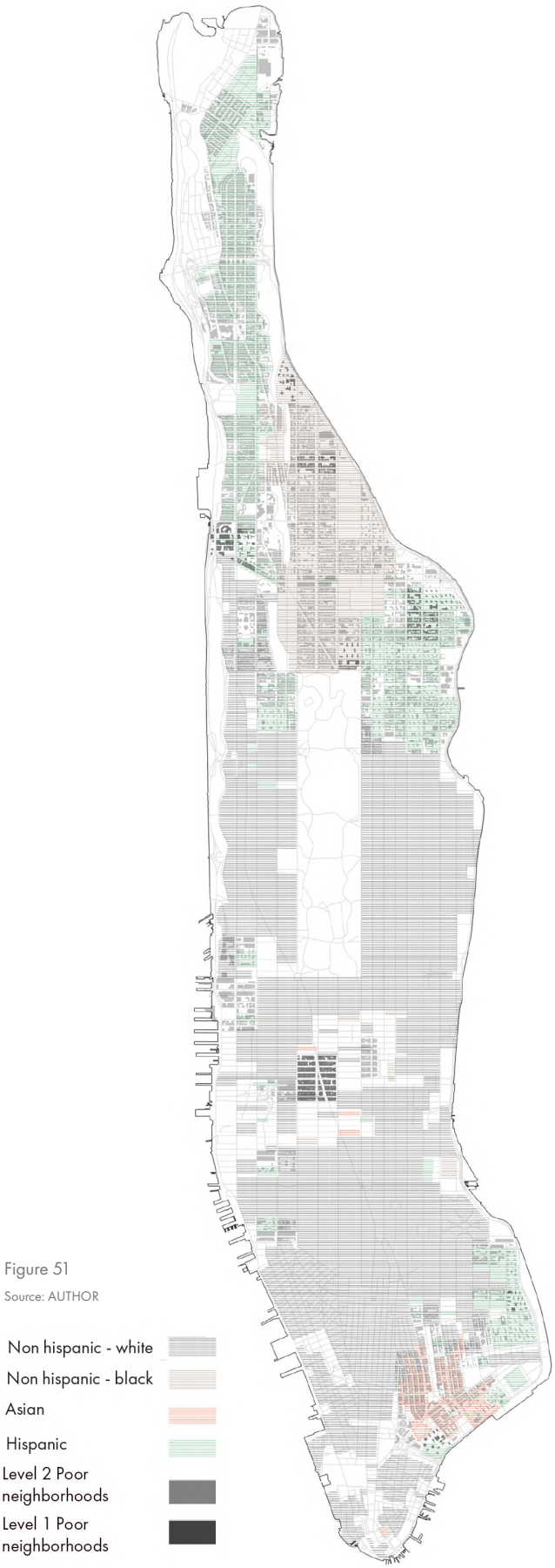


Figure 51

Source: AUTHOR

Grid - Racial Diversity - Poor neighborhoods

3.3.2 Grid and Social Segregation

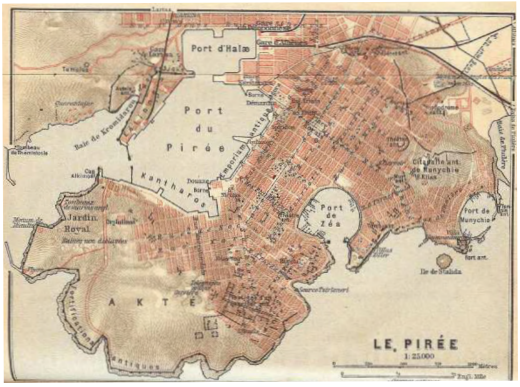
The grid emphasized the equitable distribution of property due to its uniform block size. The spatial structure of the gridiron plan is a tool towards the democracy of space, organization and social interaction. In the case of Manhattan the grid can act as a socio technical device towards the mitigation of the existing social segregation.

Starting from the origins of the grid plan in the Hippodamian Plan in Greece, we realize that this specific spatial structure started as a democratic technique of land parcellation (figure 52). Stanislawski insisted that the grid facilitated the social control of populations by a centralized state authority (Stanislaswski, 1946). Despite the notions of Plato that the ideal city should be in circular shape with uniform distance from the center, there are urban examples like the one of Cerda's Superblocks in Barcelona that tried to re – interprete the inherent intelligence of the grid in an aim to provide a fair, harmonious city in an isotropic distribution of resources along the city (figure 53). The mixed use superblocks provided differentiation in use and social mix while being uniform and equal in size. For Cerda "Justice demands, requires, imposes this uniformity and equality, which fools call monotony. Justice is always equal and uniform for all.." (Cerdá, 1867).

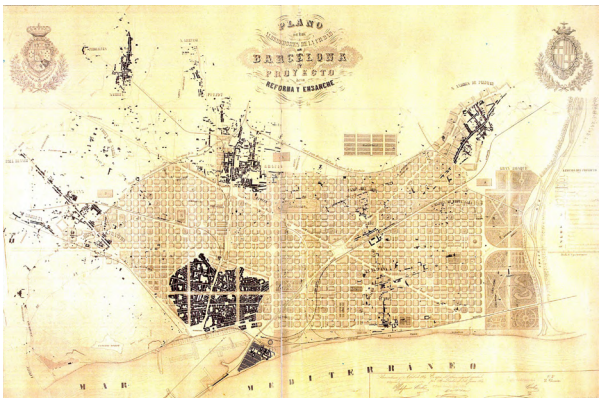
Looking closer into Manhattan grid, Jane Jacobs insists that the monotony and repetition of movement can create a chaos and that the more homogeinity of use in a street or a neighborhood, the greater the temptation to be different in the only way to be different (Jacobs, 1961). She also indicates that the general aim should be to introduce uses different from residence, because lack of enough mixed uses is precisely one of the causes of deadness, danger and plain inconvenience (Jacobs, 1961). There is a need for diversity not only in uses but also in the people using the space. This is how the metropolitan area will be both intense and alive.

According to the maps, there are two levels of poor neighborhoods in the metropolitan area (figure 50). The majority of the poorest ones are located in the edges of the island and most specifically in Harlem and Lower East Side. It is interesting to indicate that in these neighborhoods the typical grid differs, forming in most cases superblocks. Moreover, these sites accommodate large numbers of racial communities including Asian, Hispanic and Non Hispanic – black people (figure 51). The rest part of the island, which is organized in the typical form of the gridiron plan includes Non Hispanic white people. The allocation of green public space in the plan does not effectively foster the social interaction between all classes of people. In the case of superblocks there is no social diversity like the ones in the case of Barcelona. The grid organizes democratically the spatial structure but the way it is used it does not benefit the social cohesion.

All in all, the grid presents a duality: It can both control and liberate the individual. It is important to conceive the dual nature of the grid.- the ability to manage the multivalence quality of the seemly chaotic world, and the potential to allow the individuals to elaborate on their own bounded square (Lai Charles, n.d.) In Manhattan, there is need for using the grid as an incubator for social interactions between all classes and ethnicities in order to achieve social diversity.



Hippodamian Plan Figure 52 Source: Alchetron.com



Cerda Superblocks Figure 53 Source: Archdaily.com

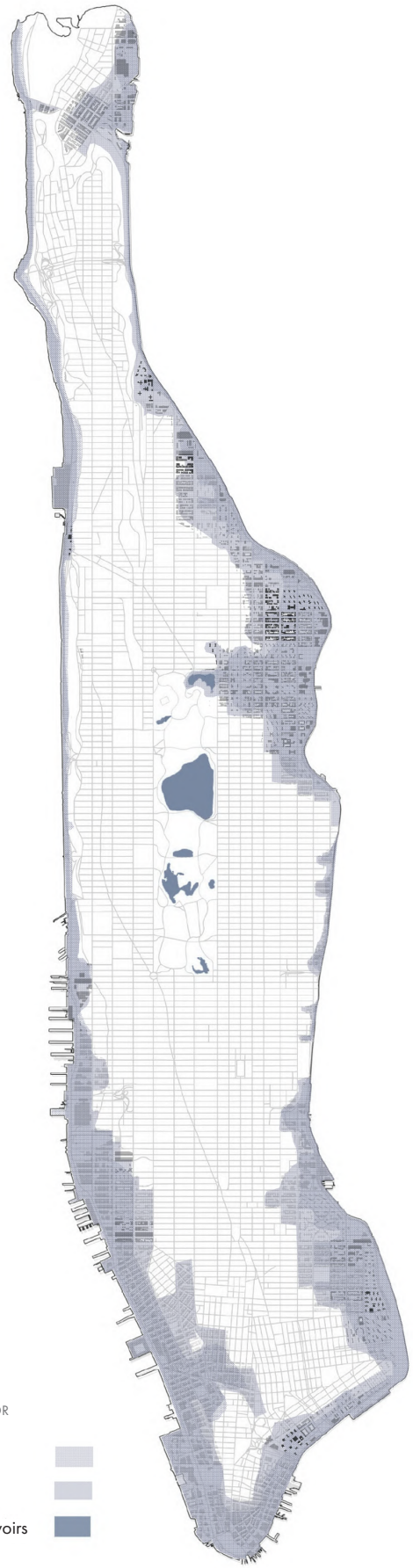


Figure 54
Source: AUTHOR

flood 2050
flood 2100
water reservoirs

Grid, Water and Flood Risk

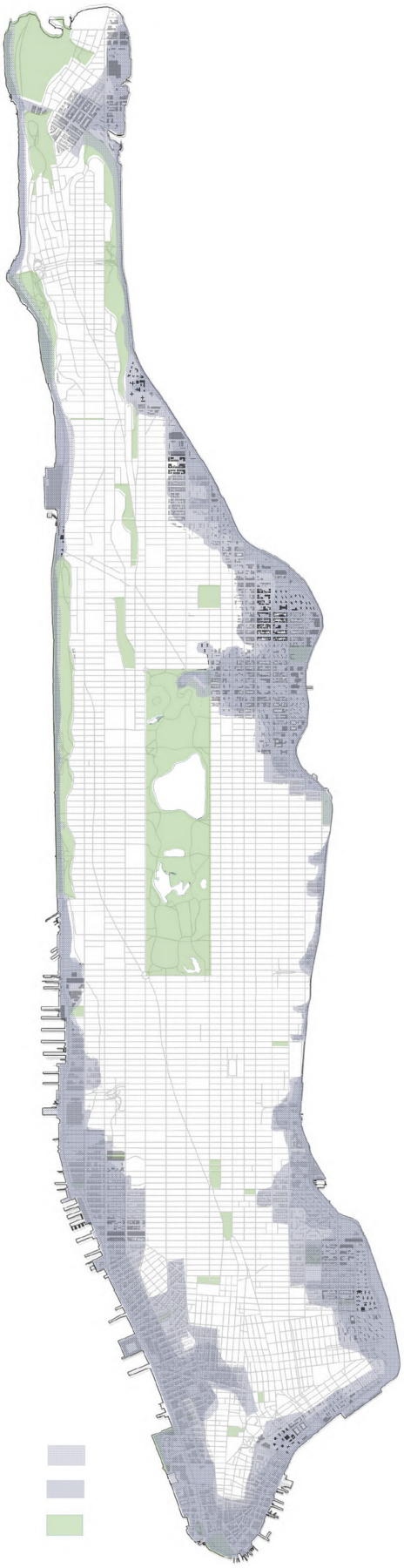


Figure 55
Source: AUTHOR

flood 2050
flood 2100
green space

Grid, Green and Flood Risk

0 1.5 3 km

3.3.3 Grid and Flood Risk

The spatial organization of a city plays significant role in its resiliency towards flood vulnerability. More specifically, the urban model layout influences the distribution of water discharges between roads as well as the flow depth and velocities (Mustafa, et al.,2020). The geometric characteristics of urban patterns such as the street width and park ratio have an important impact on flow properties during urban flood (Mustafa, et al.,2020). According to studies, the larger the parcel area and road width, the better the city acts in flooding events (Mustafa, et al.,2020).

Manhattan is susceptible to coastal flooding and as the maps indicate, the areas with more irregular planning like the one of New Amsterdam in the lower part of the metropolitan region are more vulnerable. Moreover, the water presence is very limited with the only reservoirs in the Central Park (figure 54). Planning for flood resilience should prioritize urban areas and forests as well as a reasonable spatial configuration for water, grass, and other types of landscape (Luo, Tian, Zeng & Pilla, 2022). The internal coherence of urban patches is also vital for resilience against flooding. The use of intensive development in built – up areas instead of sprawl is more than beneficial against flood vulnerability (Luo, Tian, Zeng & Pilla, 2022). In this sense the compact and dense building environment of Manhattan island due to the fixed grid and limited horizontal development presents great advantages for flood resilience. Moreover, the regularity of urban plan makes easier the implementation of flood management strategies, thus reducing in an effective way the flood susceptibility.

The green patches as well as their interconnection along the rectangular grid are also very important. Bearing in mind that forests are the most effective land cover for reducing floods (Maxwell et al.2021), the proper planning for forests and the successful enhancement of their interconnection is a very significant point to consider. The current overview of the green areas in Manhattan grid indicates that the areas in danger of floodplain the following years are the ones that do not have enough presence of green patches (figure 55). What is also clear is that, there are very limited forest areas in the urban core which are located in the Central Park.

The waterbodies constitute a very important factor towards the mitigation of flood risk in a metropolitan area suffering from severe storm surge events like the one of Manhattan. The water corridors can prevent accumulation of too much pressure in specific locations during rainstorms (Luo, Tian, Zeng & Pilla, 2022).

The application of the grid plan, did not take into account the natural streams and wetlands inland of Manhattan. The natural environment of Mannahatta in 1609 is not present anymore (figure 56). If we overlap the streams and wetlands of the past in the present plan with floodplain, we realize that the coastal flooding is emergent in the areas where the natural wetlands were located (figure 57). Moreover, the streams were buried in order the grid plan be more easily adapted. Probably the presence of the streams nowadays would provide a mitigation system of flood during extreme rainfall events. The inherent intelligence of nature if properly incorporated in the current plan would protect the city from the impacts of extreme climate events. Henri Lefebvre notes that it is becoming impossible to escape the notion that nature is being murdered by "anti-nature". (Lefebvre, 1974) The artificial planning systems sometimes do not pay enough respect to the natural elements. White indicates that the fabric of urban areas was largely produced without much consideration for flood risk. (White, 2008). The design interventions often interrupt the natural flooding processes by removing vegetation, eliminating natural water storage capacity and disrupting flow paths (O'Neil, Scott & Lennon, 2013).

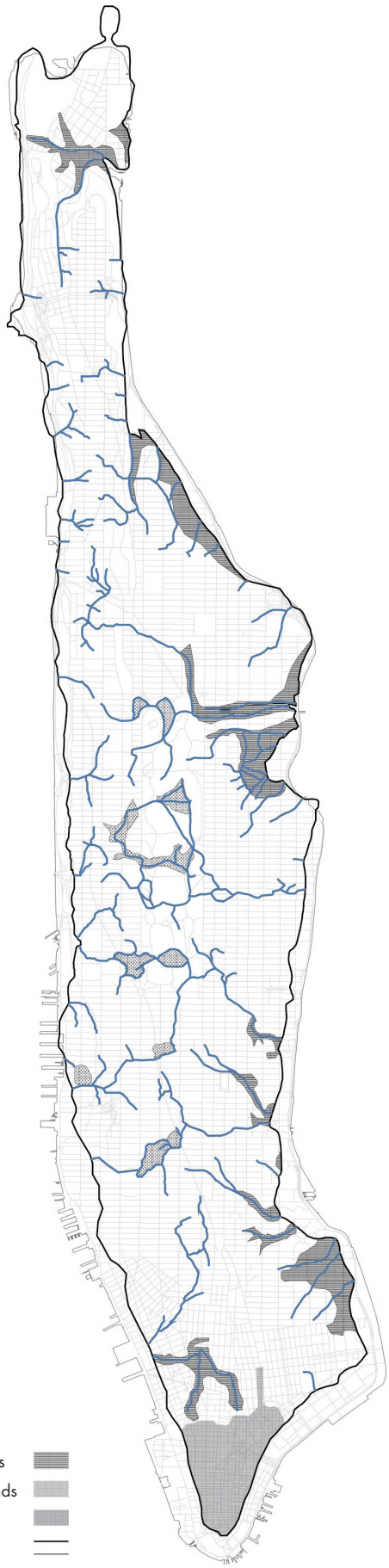


Figure 56

Source: AUTHOR

Past Landscape and Grid

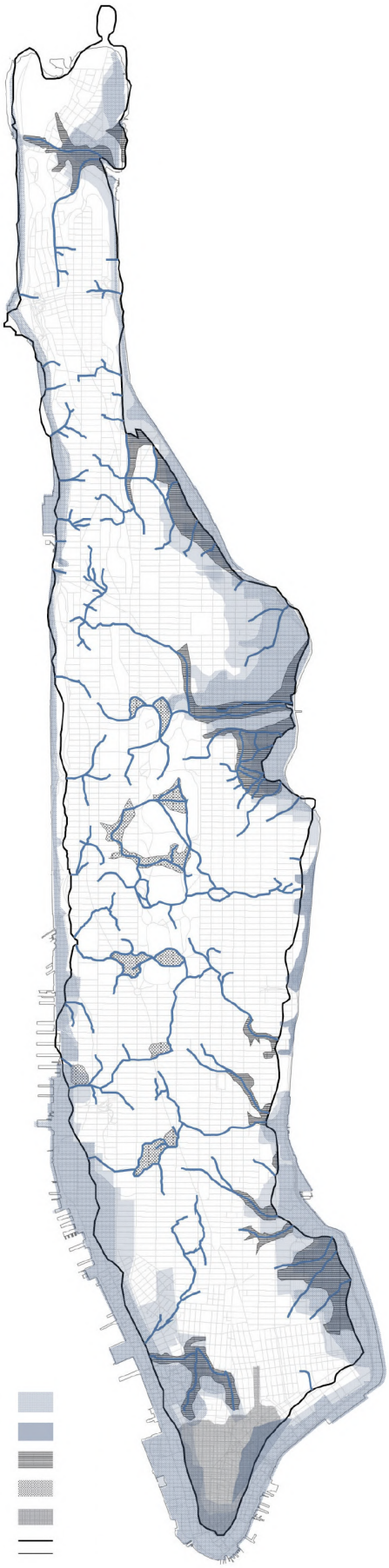


Figure 57

Source: AUTHOR

Past Landscape, Grid, Flood Risk

The subtettanean waterways become hazardous for cities. The concretization of rivers results in their indundation as rainfall intensifies. In general, the stream burial influences downstream ecosystem structure and function by decreasing hydrologic connectivity; increasing flashiness flood frequency and intensity. (Napierlaski, et al., 2015). Returning buried stream channels through stream daylighting is beneficial for flood mitigation (Pinkham, 2000) in an aim to increase hydraulic storage capacity while reducing flashiness and sedimentation.

It is clear that the legendary Manhattan grid presents advantages thanks to its rectangular and regular structure. However, the limited green patches and the burial of past water network affect in a negative way the resilience of the metropolitan area towards flood vulnerability,a fact that arises discussion for stream daylighting.

"The designation *terra firma* (firm, not changing; fixed and definite) gives way in favor of the shifting processes coursing through and across the urban field: *terra fluxus.*" (Corner, 2006)

At this point, it is important to emphasize that the graduation thesis will focus on the mitigation of flood vulnerability towards the resiliency of the metropolitan area, while bolstering the social inclusion and questioning the impact of flood mitigation on housing densification strategies. The study of the palimpsest landscape with streams and wetlands will unravel the inherent intelligence of natural mechanisms towards the flood resiliency.

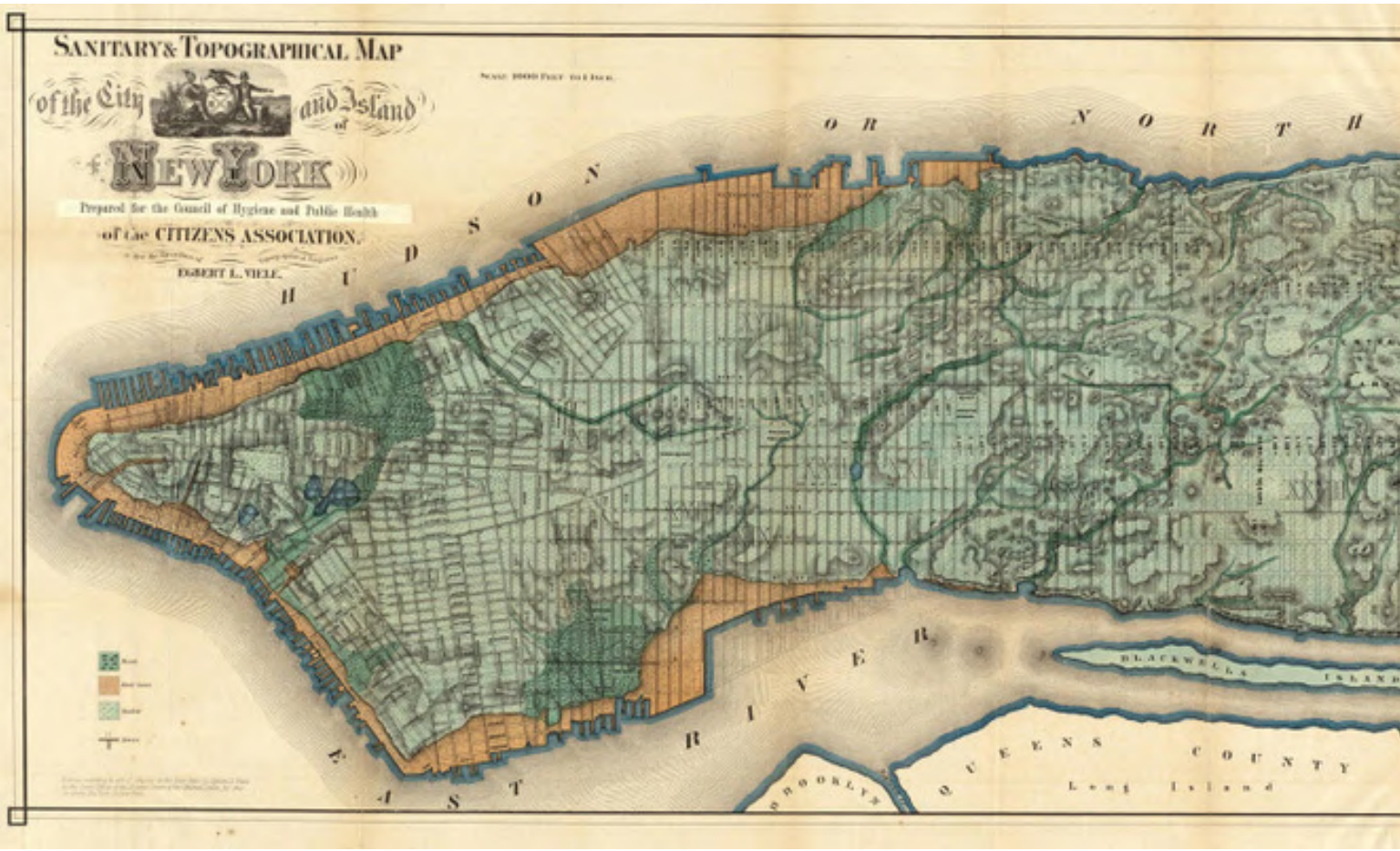
3.4 The Hidden Streams

According to the Sanitary and Topographical map (figure 58) as well the overlap of palimpsest landscape with streams and wetlands in the present map of Manhattan, we realize that the metropolitan area is disconnected with the past natural situation (figure 56). The grid structure did not incorporated the existing natural elements in an aim to provide as many buildings as possible.

Jean Paul Sartre indicated that while wandering the immense space of Manhattan, he realized that there was no vegetation (Sartre, 1946). Clement Clarke Moore notes that the existing water courses were disgarded (Moore, 2015). Bearing in mind, that the natural mechanisms possess an inherent power against natural phenomena like the one of flood, there is a logical question whether there is potential of incorporating the unraveling of buried streams in the present situation. As noted, the stream burial makes even worse the intensity of flooding events. According to the map, the floodplain is emergent in many areas were the streams and wetlands were not taken into consideration.

James Corner was preoccupied about the power of nature in urban processes, noting that the designation terra firma (firm, not changing , fixed and definite) gives way in favor of the shifting processes coursing through and across the urban field: terra fluxus. (Corner, 2006) In this sense the fixed grid is able to incorporate the flowing processes of nature.

Sergey Kadinsky made an extensive research for the hidden waters in New York City, noting nineteen streams in total in Manhattan (Kadinsky, 2016) . Prior to European settlement , its waterways included: Kettle pond, salt marshes, freshwater swamps and springs that satiated the Lenape natives (Kadinsky, 2016). In general, the streams powered the gristmills of New York's colonial settlements and served as freight transportation corridors during the Industrial Revolution (Kadinsky, 2016) (figure 59). The ones that avoided burial were turned into parks and storm water conduits such as the Collect Pond park in Lower Manhattan (figure 60 & 61).



Viele map, Sanitary & Topographical Map of the City and Island of New York, 1865

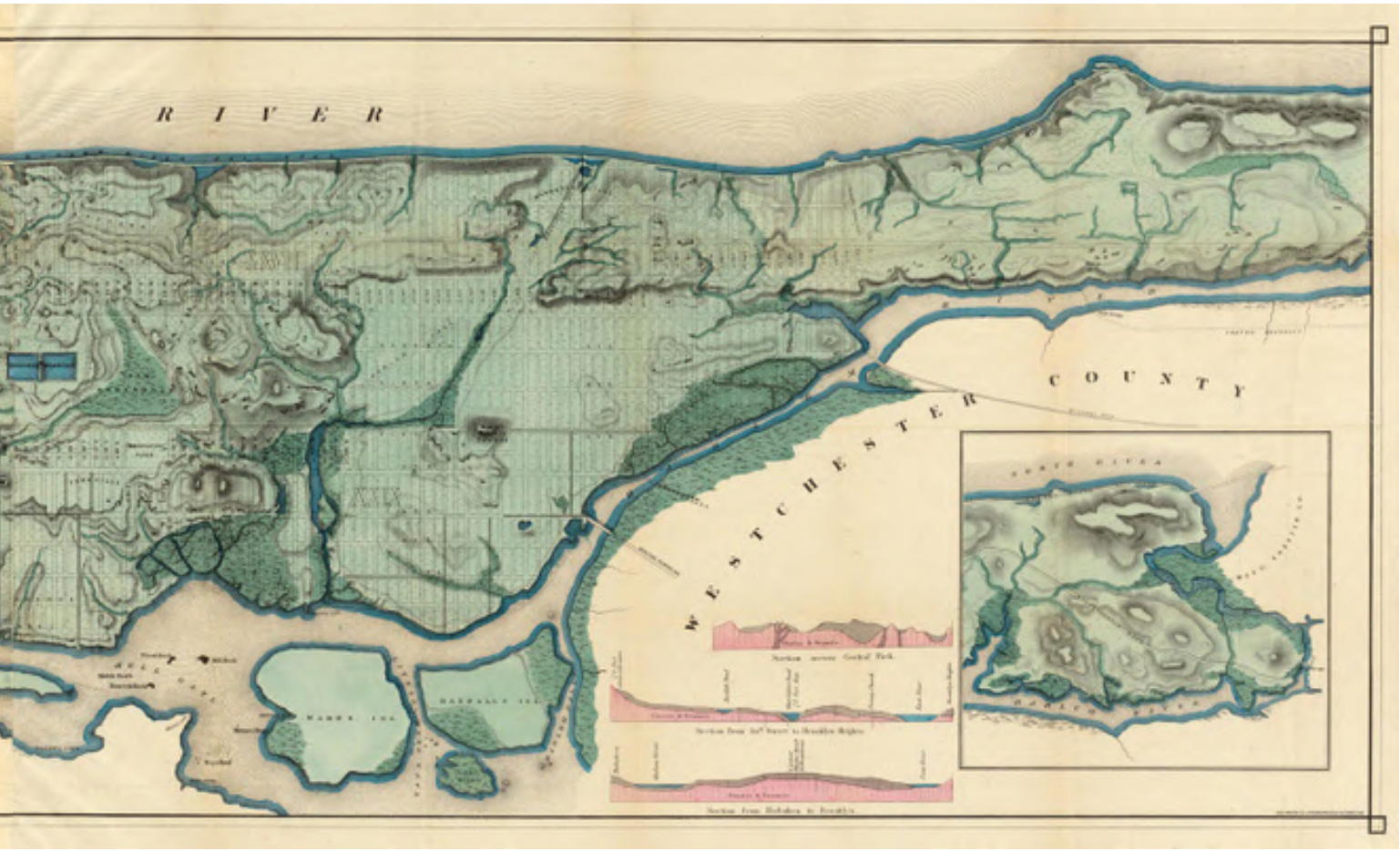
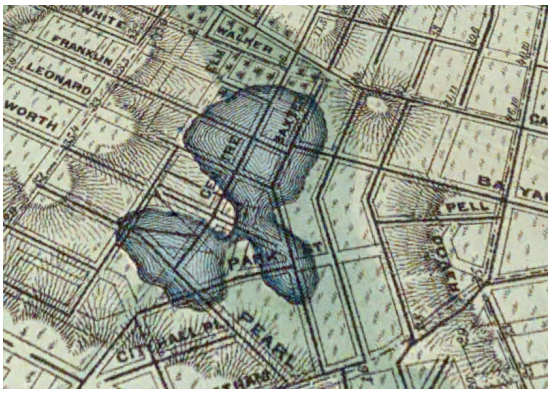


Figure 58 Source: Library of Congress

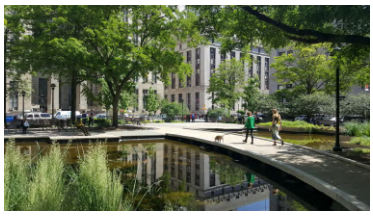
Steamboat experiments at the Collective Pond

Figure 59 Source: Hidden Waters Blog



Collective Pond

Figure 60 Source: Extracted from Viele Map (Figure 58)



The Park Figure 61 Source: NYC Parks

Canal Street

Figure 62 Source: Extracted from Viele Map (Figure 58)

Figure 63 Source: Elyn Zimmerman

Figure 64 Source: AUTHOR using VR lab

Capsuto Park and Canal Street

According to the map we realize that Lower Manhattan, Greenwich Village, East Village and Harlem are more vulnerable to flood in the future (figure 57). The covering of streams and wetlands in these sites probably affected the resiliency of the region against flood. The burial worsens the water capacity of these areas as well. In this way, it makes sense to make a reference to some of the streams running through these areas in an aim of possible daylighting.

Canal Street, Lower Manhattan

The canal that Canal Street was named after it existed only for a short time. It was built in 1807 to drain the Collect Pond into the Hudson River. The pond and the canal were both buried by 1819, but Canal Street kept its name for eternity. Near the Street, the Capsuto Park which opened in 2009 as a revitalization project, includes a water memorial evoking the canal that once flowed along the canal street. (figure 62 -64).

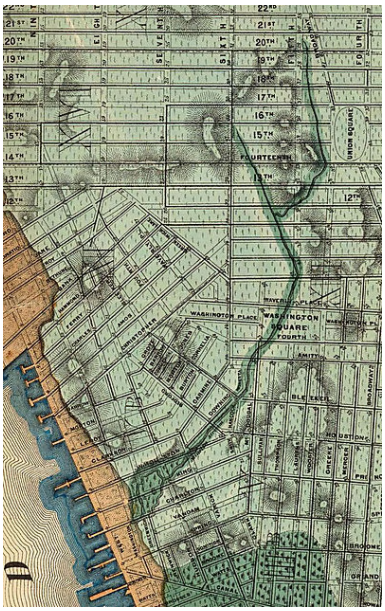
Minetta Brook, Greenwich Village

Through the urban Greenwich Village, flows an underground river that occasionally reappears in flooded basements, flowing beneath alleys that carry its name (figure 65). Minetta Brook originated from two tributaries, the main one having its source near what is now Fifth Avenue and 21st Street, and a secondary one at Sixth Avenue and 16th Street (Kadinsky, 2016). The streams merged at a point just west of the intersection of Fifth Avenue and 11th Street. In the 1820s, what remained of Minetta Brook on the surface was buried by leveling the Sand Hills to its east (Kadinsky, 2016). Traces of the stream are evident in basements of some buildings while in Two Fifth Avenue, there is a glass cylinder pipe indicating the underground flowing water (figure 66 & 67).

Harlem Creek, Harlem

Harlem Creek is a hidden waterway that shaped the development of Harlem in the first two centuries before its coverage by East 107th Street (figure 68). The application of the grid plan, building densification as well as the construction of the subway fostered the burial of the creek by 1891 (Kadinsky, 2016). During the years, there are various references that the hidden river floods the subway, while many building projects are taking place along the stream (figure 69 & 70). Kandisky indicates that there is a discussion for daylighting the stream in an aim to reduce street flooding with the proper mechanisms (Kadinsky, 2016).

The burial of the selected streams due to the application of the grid plan fostered the building development but at the same time it accelerated the flood vulnerability resulting in underground river overflows and limited water storage capacity. Efforts to bring back the hidden waters have already started in terms of pond revitalization and more specifically in the Collective Pond with the construction of a new green public space. The revival of the hidden streams apart from the benefits towards flood mitigation can benefit the surrounding communities. Environmental sustainability, improvement of quality of life and rise of land values are significant points to consider. As in New York's early years as a Dutch colonial outpost, when canals served as transportation routes and ponds provided drinking water, inland waterways today have resumed their role as vital elements of the city's identity; providers of a sense of place. (Kadinsky, 2016). The statement of Kadinsky indicates that the stream unraveling can be the connective element with the Dutch past providing the lost identity of Manhattan island.



Minetta Brook

Figure 65
Source: Extracted from Viele Map (Figure 58)

river overflow

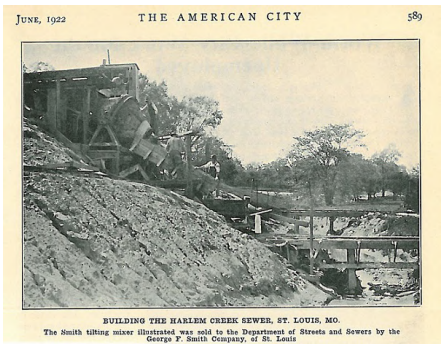
Figure 66
Source: ScoutingNY.com

hidden stream

Figure 67
Source: Untapped Cities.com

Harlem Creek

Figure 68
Source: Extracted from Viele Map (Figure 58)



River Burial

Figure 69
Source: Hidden Waters Blog

Underground flow

Figure 70
Source: Hidden Waters Blog

3.5 Research Question

The grid investigation in correlation with the flood vulnerability shows promising prospects since the regular structure assists in the smooth distribution of water discharges. It seems that the areas which will be more vulnerable to flood present a differentiation from the typical plan. Moreover, the specific areas have limited water storage capacity probably due to the distortion of the natural landscape forces. The floodplain sites once included wetlands and stream channels that according to the study of the palimpsest landscape and the application of the gridiron plan are in most cases buried and concretized.

It is clear that the flood resiliency of the metropolitan area poses significant questions about the grid structure in the future where the climate change will be emergent. The mitigation of flood vulnerability through the grid redefinition will question both the integration of inclusive public spaces and the housing densification strategies.

The overall study of the grid leads to the following **Research Question**:

What is the interpretation of the grid in the face of exacerbated climate change in Manhattan in order to achieve a flood adaptive system of interventions?

Research Sub-questions:

- How can the grid reinforce the resilience of the metropolitan area against flood vulnerability?
- How can the grid foster the integration of more inclusive public spaces?
- How can the flood resilience of the grid affect the housing densification strategies?

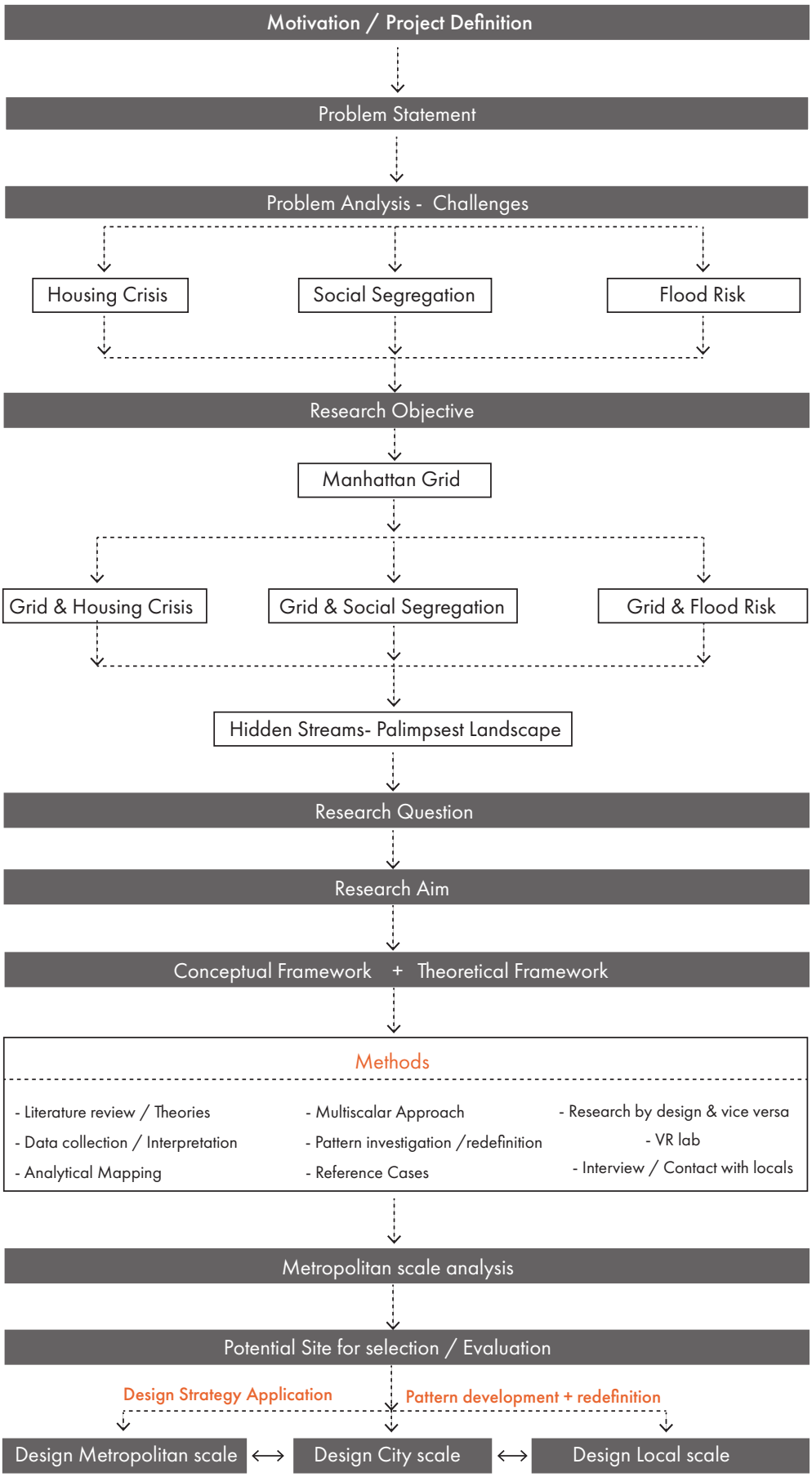
3.6 Research Aim

The proper application of the grid structure has great potential in the mitigation of the mentioned challenges and especially the flood vulnerability. The unraveling of the lost natural forces and the incorporation of green blue systems will stand as important elements towards flood mitigation. The urban patterns will be re-defined and people will come closer to nature. The addition of housing units in the existing compact urban core and the demand for green patches in an aim for flood resilience will also arise questions for a future expansion of the Lower Coast.

The analysis, the conclusions and the research question lead to the following **Research Aim**:

The project aims to mitigate the flood risk in Manhattan through the grid interpretation and the unraveling of the forgotten palimpsest natural landscape. The grid redefinition will re-configure the existing patterns bringing people closer to nature.

4 Methodology



Methodology Framework

Figure 71 Source: AUTHOR

4.1 Methodology Framework

The methodology used for the entire graduation thesis can be divided into the following main sections: Motivation-Project Definition, Problem Statement – Challenges, Research objective, Conceptual and Theoretical Framework, Analysis and Design Implementation (figure 71).

The first section presents the motives of the author towards the involvement with the specific topic based on personal research interests and reading stimuli. The influence of New York City in a global context has shaped the notion that the megacity is the center of the world. The impending challenges of housing crisis, social segregation and flood risk in Manhattan define the main pillars of the thesis. This section includes the problem statement and the analysis of the three challenges through data collection and interpretation, analysis mapping and literature review. The analysis indicated the extent of the housing shortage, social inequalities and flood vulnerability in the metropolitan area.

The section of the Research objective delves into the Manhattan Grid, the correlation of the grid with the three challenges, the hidden streams of Manhattan, the Research Question and the Research Aim. From the historical Evolution of the island, it is clear that the application of the grid structure fostered the building and economic development of the metropolitan area, while not taking into great consideration the natural elements and forces of the landscape. The extensive dialogue around the grid including both supporters and opponents as well as the impact of the structure in shaping the whole metropolitan area indicate that Manhattan is the grid. The next part of the chapter deals with the investigation of the grid per challenge. The methods used include data collection, interpretation, mapping and literature. The conclusions were derived from both the analysis and the relevant theories. The outcome that the application of the grid distorted the natural landscape mechanisms including streams and wetlands had as a result the lack of resiliency of some areas towards flood. The burial of the streams worsened the water storage capacity in the specific areas. The reference to the hidden streams and the investigation of crucial ones that are buried, show the importance of stream daylighting, water incorporation and thus the grid re-definition. It is important to say that the methods used for the analysis include data collection, interpretation, mapping, VR lab and literature. The conclusions formulated the Research Question and the Research Aim of the graduation project, making vital the grid interpretation in order to achieve a flood adaptive system of interventions through unraveling the lost natural forces, thus bringing people closer to nature.

The next section includes the Conceptual and Theoretical Framework. The research question *"What is the interpretation of the grid in the face of exarcebated climate change in Manhattan in order to achieve a flood adaptive system of interventions?" as well as the sub-questions 1) How can the grid reinforce the resilience of the metropolitan area against flood vulnerability? 2) How can the grid foster the integration of more inclusive public spaces ? 3) How can the flood resilience of the grid affect the housing densification strategies? ,* can be answered through the Conceptual framework. The Conceptual framework poses the main concept of Flood Resilience in combination with the Porous City and Social Inclusion. The grid is interpreted through the incorporation of design strategies in order to achieve the Research Aim. The strategies are investigated through Reference Projects. The Theoretical Framework includes the key literature for analysis of the urban context, the grid focus as well as the strategies towards the answer of the Research Question.

The overlap of analysis mapping in combination with the most vulnerable sites will lead to the conclusion map of metropolitan analysis in order to identify potentials for specific site selection. The design will follow a multi-scalar approach starting from the metropolitan scale and then delving into specific areas for city scale and local scale. The multi-scalar approach is important since we are referring to water and natural systems in correlation with urban design. It is notable that the thesis is driven by the idea" Research by Design and Design by Research" in combination with Literature.

Conceptual Framework

Figure 72 Source: AUTHOR

4.2 Conceptual Framework

The mitigation of Flood risk through the investigation of the grid possibilities is framed around the main concept of Flood Resilience including the Porous City and Social Inclusion (figure 72).

Flood Resilience

Solutions to the complex set of wicked problems surrounding rapid urbanization and climate change have vexed normative modes of rational thinking and problem solving. (McGrath, 2013). The reduction of Flood Risk will be achieved through Flood Resilience using the strategies of Adaptation, Mitigation and Water as the Meeting point. The grid will incorporate more green - blue patches as well as the partial unraveling of the hidden streams in order to make the metropolitan area more resilient and at the same time bringing people closer to nature.

Porous City

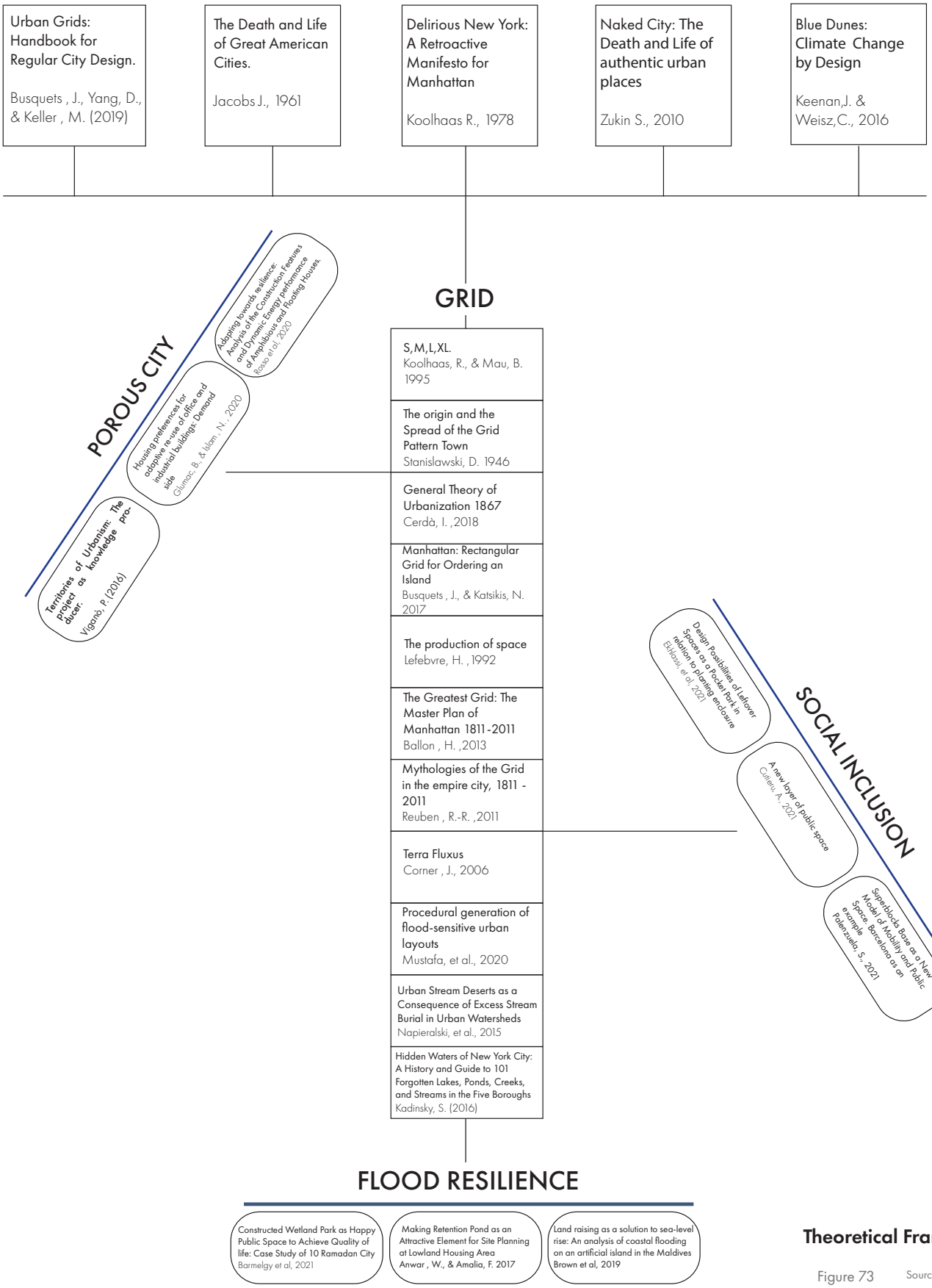
Taking into account the ability of the fixed grid block to incorporate different forms of densities, uses and users, there is a need for Porosity. The Porous City or "La ville poreuse" by Paola Vigano refers to the dual nature of the Porosity which is simultaneously individual and fully shared (Viganò, 2016). The Porosity has to do with density, ecological rationality and social implications (Viganò, 2016). In this sense, the grid needs to be reinterpreted as a tool towards the Porous City through the Strategies of Densification, Expansion and Reuse in order to provide more green - blue spaces for all economic classes.

Social Inclusion

The analysis indicated that there is a notable number of poor neighborhoods in the island as well as urban patches for specific racial categories. The typical block grid presents homogeneity of economic wealth, while the public space is not that reinforced. People do not effectively interact which leads to a social segregation. The concept of Social Inclusion integrates the ideas of social infrastructure, public space and the collective living. Jacobs insisted that there is a need for mixed uses in order to avoid deadness (Jacobs, 1961), while Cerda noted that there is a demand for justice as well as an isotropic distribution of resources (Cerdá, 1867).

All in all, the grid interpretation and the palimpsest landscape will be the connective elements of the interventions in order to achieve a resilient new Mannahatta in 2100.

KEY LITERATURE



Theoretical Framework

Figure 73 Source: AUTHOR

4.3 Theoretical Framework

The graduation thesis is constructed through a theoretical framework based on key literature related to the investigation of the grid in correlation with the Flood Resilience, Porous City and Social Inclusion in Manhattan context (figure 73).

A combination of urbanism, social science and climate resilience theories constitute the core of the thesis. It is important to note that the theoretical framework is incorporated into the whole range of the report as a means of argumentation.

The key literature includes remarkable notions of Rem Koolhaas from *Delirious New York: a Retroactive Manifesto for Manhattan regarding the historical evolution Manhattan island*, the mass building development and the application of the gridiron plan. The spatial structure of the plan and its organization intelligence is addressed by Busquets, Yang and Keller through the *Urban Grids Handbook for Regular City Design* . The need for social inclusion and diversity is widely analyzed by Jacobs in the *Death and Life of Great American Cities as well as by Zukin in the Naked City*: The death and life of authentic urban places. The emergence for landscape incorporation in the urban processes as a successful means towards the mitigation of flood vulnerability is investigated by Keenan & Weisz in *Blue Dunes Climate Change by Design.*

The investigation of Manhattan Grid turnes out to have both critics and supporters. Reuben in *Mythologies of the Grid in the empire city 1811-2011* refers to the plan as a fast and economic efficient solution promoting real estate development (Reuben, 2011). Ballon on the other hand in the *Greatest Grid: The masterplan of Manhattan 1811-2011* explained the flexibility of the grid for future growth and change. (Ballon, 2013)

The correlation of the grid and the mitigation of housing shortage is framed according to the notion of Koolhaas and Mau in *S, M, L, XL* for the potential of the grid to provide three dimensional anarchy despite the fixed plan. It seems that the grid is able to incorporate various intensifications.

The interpretation of the grid along with the social segregation is based on the theories of Stanislawski about the equitable and democratic distribution of property of the gridiron plan as well as the social surveillance (Stanislawski, 1946). The challenge for social inclusion and the distribution of resources among all economic classes in the grid structure is widely analyzed by Cerda (Cerdá 1867). The elements of the grid if properly designed can bolster the social interaction between all economic classes.

The urban layout of the grid affects the flood resilience of a metropolitan area. The notions of Mustafa and Napierlaski show that the grid is beneficial towards flood (Mustafa, et al., 2020), (Napierlaski, et al.2015). However, the burial of the streams and the distortion of natural landscape has negative effects on water capacity, making vital the incorporation of green patches and stream daylighting. Kadinsky shows the importance of unraveling the hidden water network towards the sustainability of Manhattan and the connection with the forgotten Dutch past (Kadinsky, 2016) . In this direction, James Corner puts forward the emergence of the contemporary cities to adapt into a terra fluxus instead of a terra firma (Corner, 2006).

The grid is both interpreted and reinforced through strategies that aim into the Porous City as described by Paola Vigano (Viganò, 2016), the Social Inclusion and the Flood Resilience. The strategy investigation is based on design principles extracted from relevant papers and reference cases.

All in all, the grid shows great potential but the elements inside the structure need to be both intensified and redefined. In terms of natural landscape, the grid needs to incorporate the beneficial natural elements of the forgotten palimpsest landscape in order to be more resilient in the years to come.

4.4 Analysis Mapping

In this chapter of the Methodology, the extensive Analysis Mapping is presented. The mapping delves into the structural elements of the built environment of Manhattan, their spatial organization according to the grid structure, the identification of poor neighborhoods, the social segregation ,the natural elements and the flood vulnerability.

Structural Elements and Built Environment (Figures 74 - 77)

Starting from the structural elements and the building environment , it is clear that the structure of Manhattan island is formed basically according to the typical grid structure with the exception of New Amsterdam (figure 74). Infrastructural elements such as highways and major roads as well as the Central Park interrupt the gridiron plan. The structure of the grid led to the application of an extensive railroad subway system network with most of the stations allocated in the central core of the island (figure 75) The development of the dense building environment due to limited horizontal capacity created buildings with common typology allocated in most of the cases in the edges of the metropolitan area (figure 76). The majority of great buildings according to the area they occupy are also built near the waterfronts (figure 77). It seems that the grid shaped the building environment of Manhattan, leaving the edges the freedom to develop in a different way than the central core.

Zoning (Figures 78 - 81)

The zoning of Manhattan island includes Manufacturing, Commercial and Housing Districts. The Manufacturing areas are mostly located in the lower part of the metropolitan area and in most cases in the waterfront (figure 78). The Commercial districts occupy the lower part as well with the majority allocated in the core of the region (figure 79). The delirious housing development is evident and we can conclude that the housing districts are more in number than the other types (figure 80) It seems also that most of the houses are located in the upper part. What is also interesting are the historic districts located in the upper, middle and low part of the island (figure 81). The grid plan allowed the fast development and zoning, creating at the same time the need for more housing.

Building Densities and Housing Distriution (Figures 82 - 85)

Delving into the built environment, the investigation of building heights ranging from almost 4.50 meters to 400 m, shows that the tallest buildings are located in the lower part of New Amsterdam and below Central Park. (figure 82). Moreover, the great number of the non-residential buildings belong to the tallest range (figure 83). The housing distribution shows great number of housing including either only residence or mixed use (figure 84). The common housing typologies are presented in the form od superblocks, not following the typical grid. The building classification indicates that co-ops and condos are allocated mostly in the central part and the lower part. It is notable that there are less 1-2 family homes (figure 85). What is also important is that there are many walk-ups and mixed uses as well as elevator rentals in both the upper and lower part of the island. The hotels are also built in the are high -rise buildings, right below central park. The grid plan despite the limited horizontal development offers solutions towards 3 dimensional intensification for high-rise residential and mixed-use.

Social Segregation (Figures 86 - 89)

The identification of poor neighborhoods and racial diversity in accordance with the grid is significant. According to the maps, there a re two levels of poor neighborhoods with the poorest ones located in the edges of the island in Harlem, East River and Lower East Side (figure 86). In these specific neighborhoods we see that the grid differs from the typical one forming in most cases homogenic typology of buildings and superblocks. The organization of the green open spaces and the limited number seems not that beneficial for the social interaction between the economic classes (figure 87). The racial communities are also located on the edges where the typical grid differs and in many cases they overlap with the poorest neighborhoods (figure 88 & 89). The limited social interaction between all the economic classes is a very important point to consider.

Natural Elements (Figures 90 - 93)

The application of the grid plan resulted into radical changes to the natural topography and the elements of landscape (figure 90). The green open spaces seem limited with the Central park being the biggest in size. It is notable that the majority of green spaces are located in the upper part of the island and not included in the typical grid block (figure 91). The only present water reservoirs are located in the Central Park, which is in complete contradiction with the primitive state of the metropolitan area that once included ponds, wetlands and running streams (figure 92 & 93). It is clear that the gridiron plan distorted the natural elements, leaving a limited number of green spaces and water landscape in the current state.

Flood Risk (Figures 94 - 97)

Looking closer into the flood vulnerability, it seems that there are many areas and mostly in the edges suffering from floodplain in the future (figure 94). The majority of the areas with high flood risk are not organized according to the typical grid plan and they do not also include enough green patches (figure 95) The burial of the streams resulted in low water storage capacity and the removal of crucial wetlands in the flood prone zones makes vital the consideration of stream daylighting as well as the incorporation of green mechanisms along the island (figure 96 -97).

Conclusions from mapping

The extensive mapping analysis indicated that the Manhattan Grid has shaped the built environment of the entire metropolitan area. The application of the plan fostered the fast building development and the delirious demand for housing. The fixed plan allowed the variety of densification typologies in height and size. The limited allocation of public space in accordance with the existence of poor neighborhoods makes vital the need for social inclusion. The application of the gridiron plan distorted the natural mechanisms of landscape making crucial the demand for green and water landscape incorporation thus bringing people closer to nature. In this sense, despite the grid's spatial rigidity, there is room for reinforcement of its capacities, reshaping and reinvention in order to overcome the limitations. The grid interpretation will bolster the Flood resilience, Porous City and Social Inclusion.

Structural Elements & Built Environment

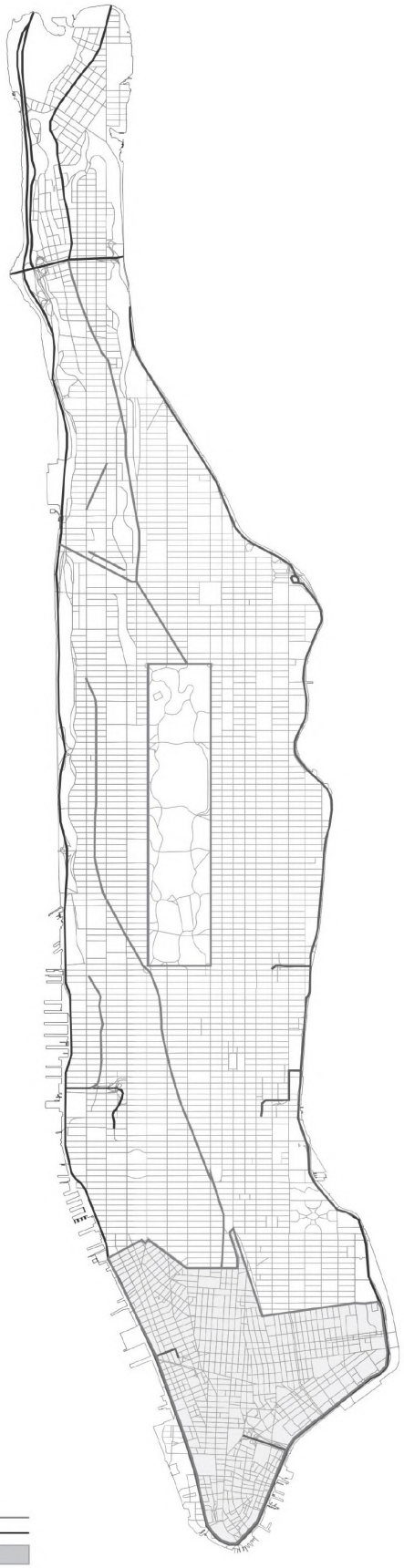


Figure 74
Source: AUTHOR

breaking the grid
highways
New amsterdam

Structural Elements

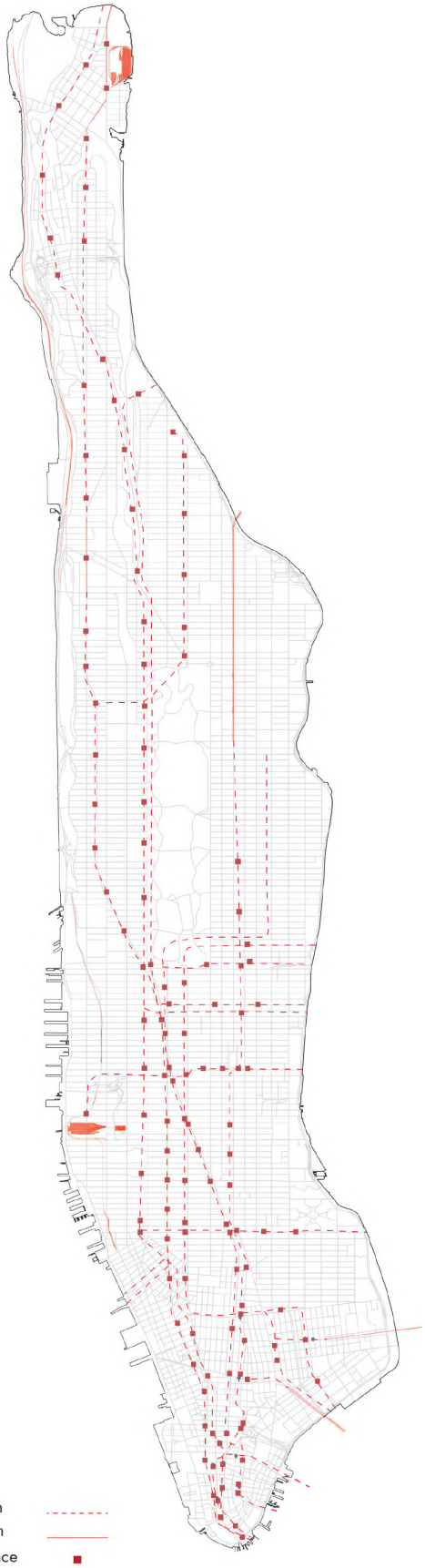


Figure 75
Source: AUTHOR

subway system
railroad system
subway entrance

Railroad and Subway System

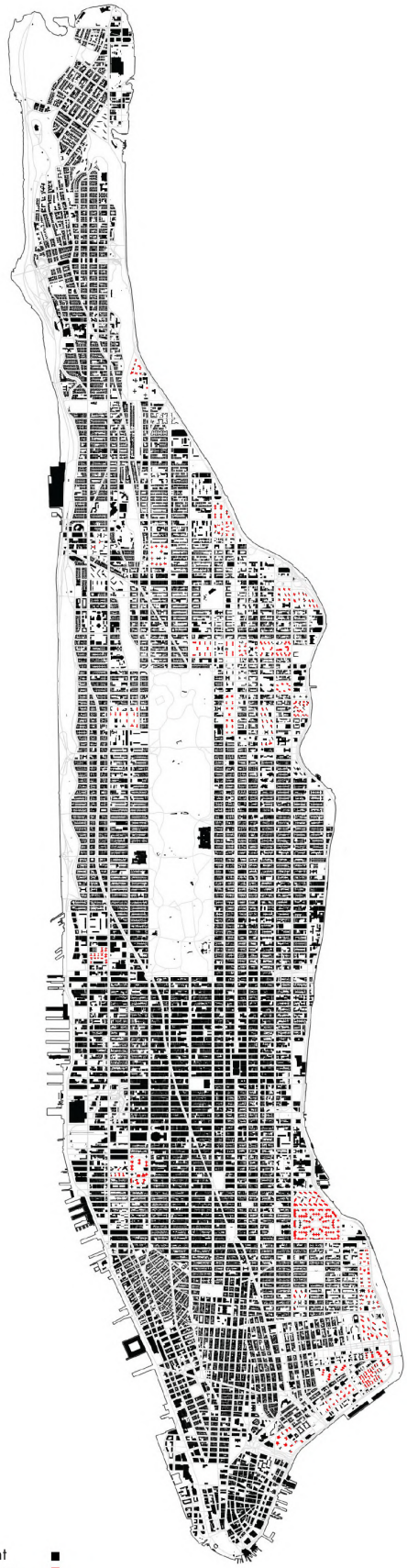


Figure 76
Source: AUTHOR

built environment
common typology

Building Envirnonment

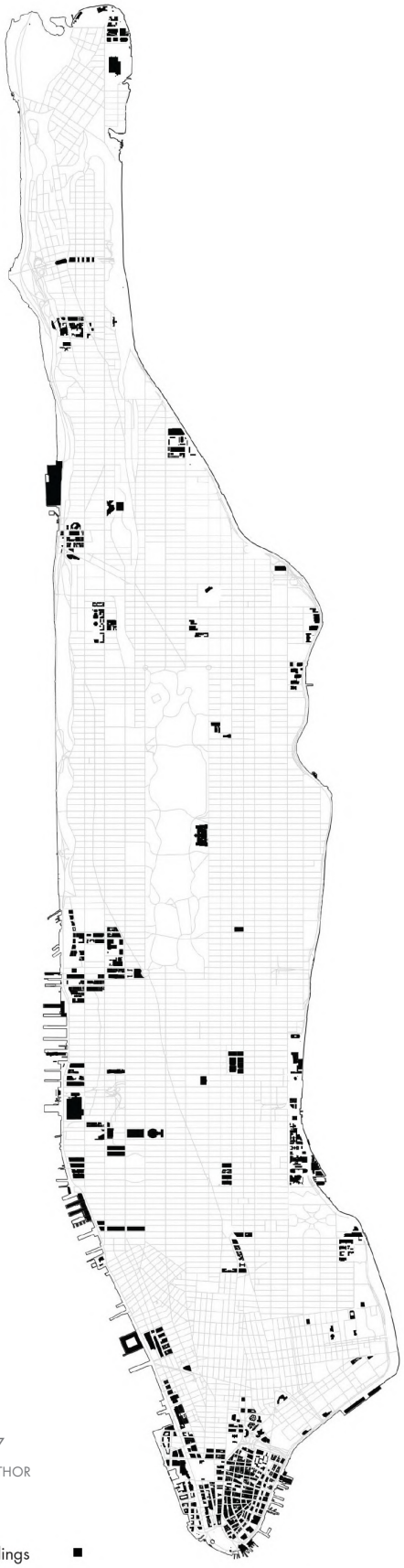


Figure 77
Source: AUTHOR

great buildings

Great Buildings

0 1.5 3 km

Zoning

Figure 78
Source: AUTHOR

Manufacturing

Manufacturing Districts

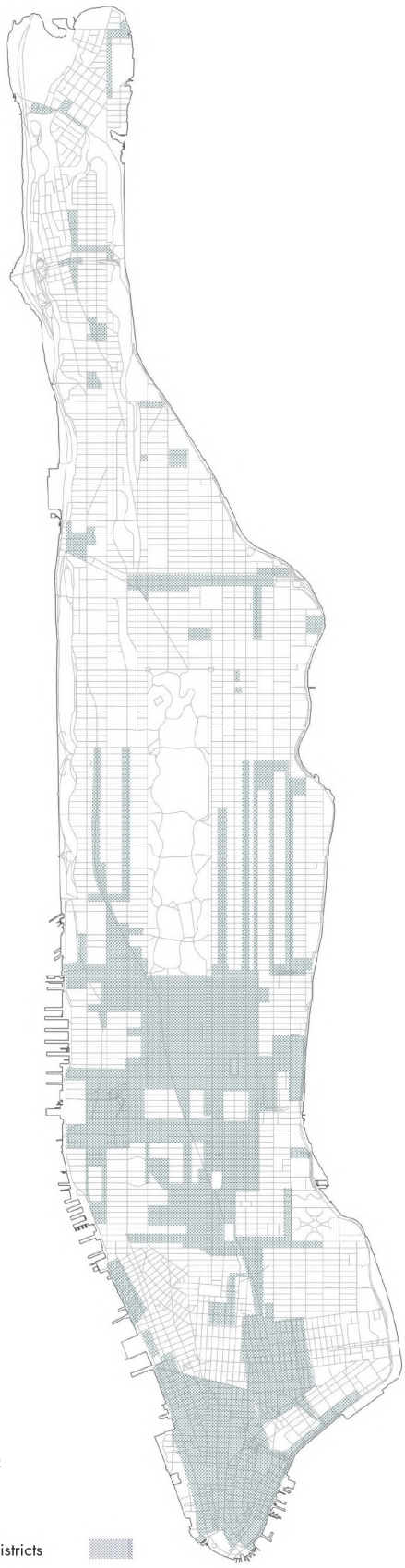


Figure 79
Source: AUTHOR

Commercial Districts

Commercial Districts

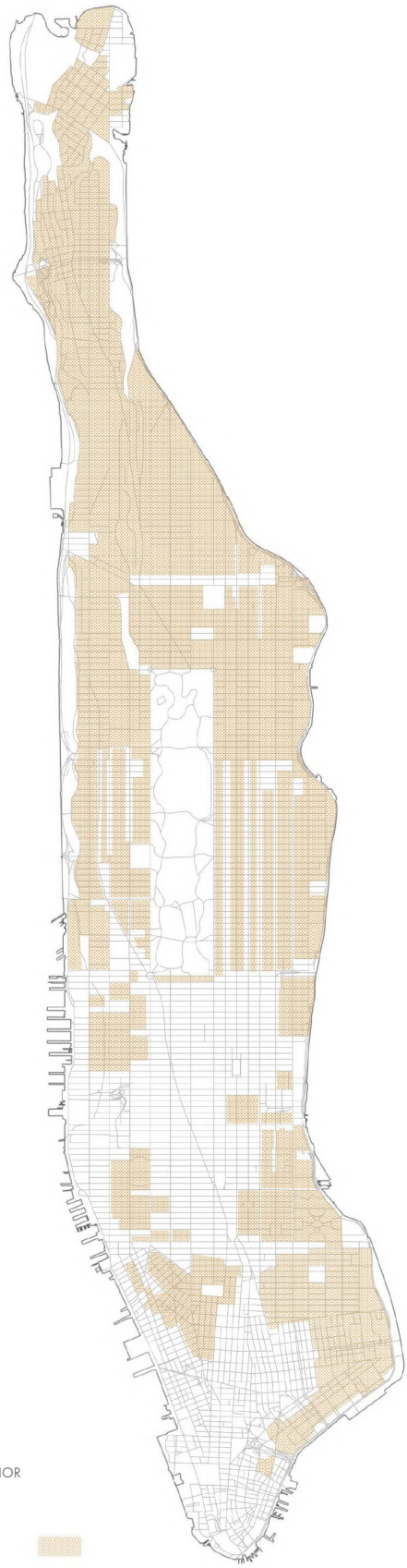


Figure 80
Source: AUTHOR

Housing

Housing Districts

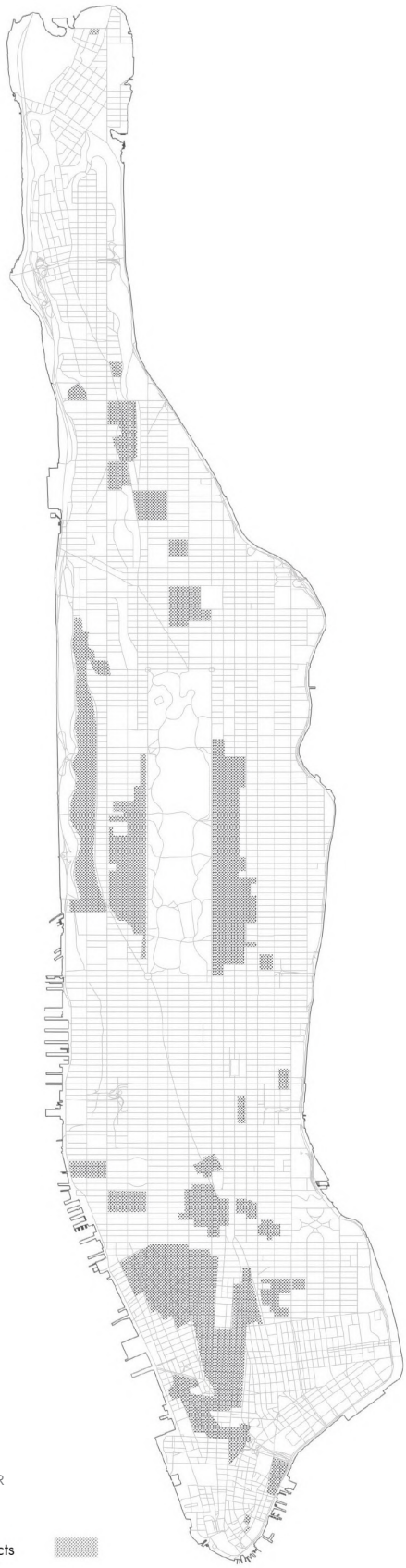


Figure 81
Source: AUTHOR

Historic Districts

Historic Districts

0 1.5 3 km

Building Densities & Housing Distribution

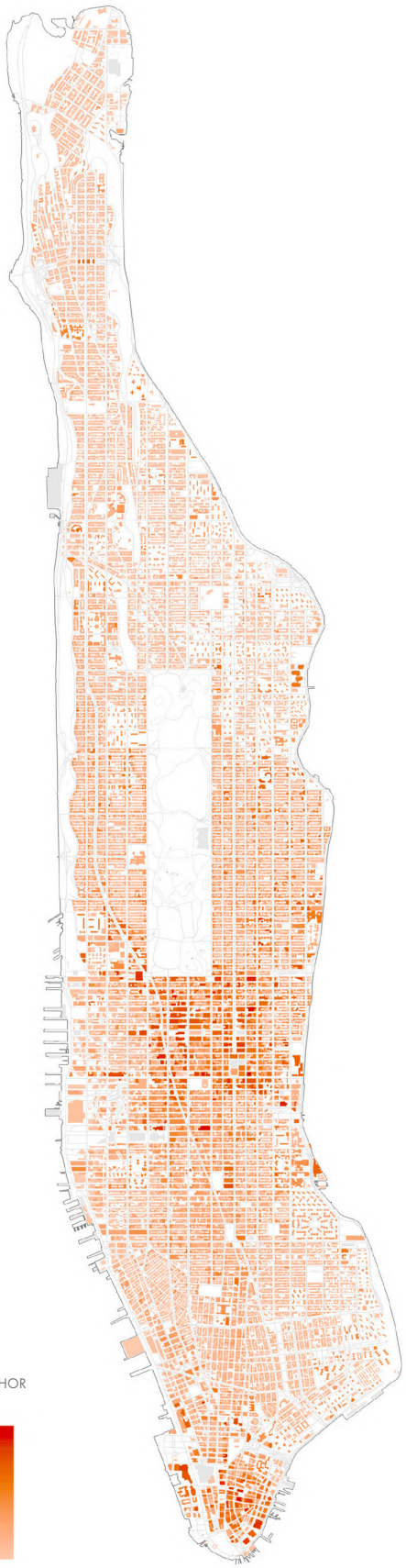


Figure 82
Source: AUTHOR

Building heights

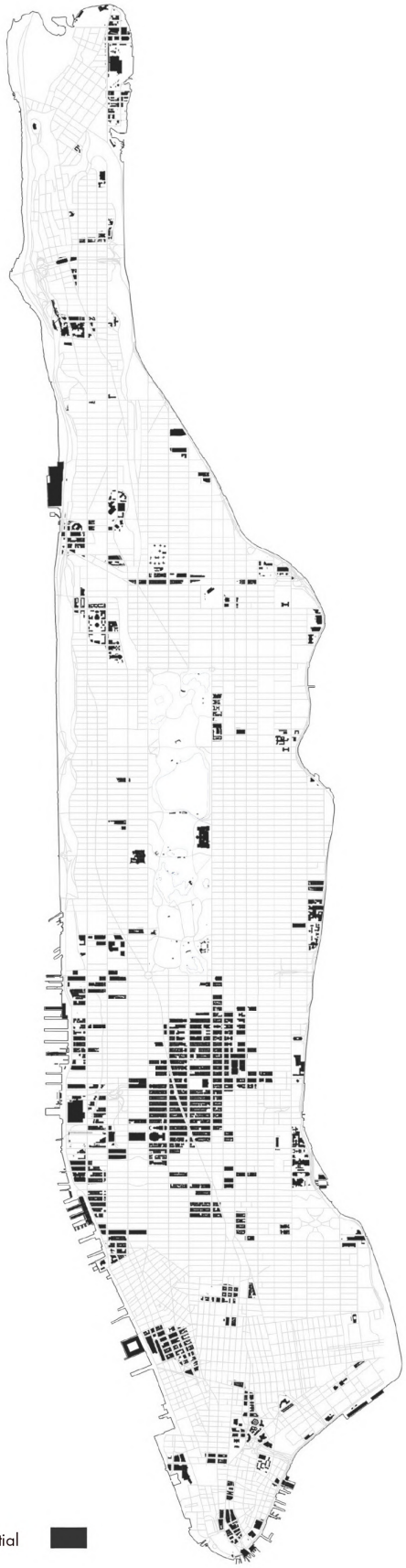


Figure 83
Source: AUTHOR

Non-residential buildings

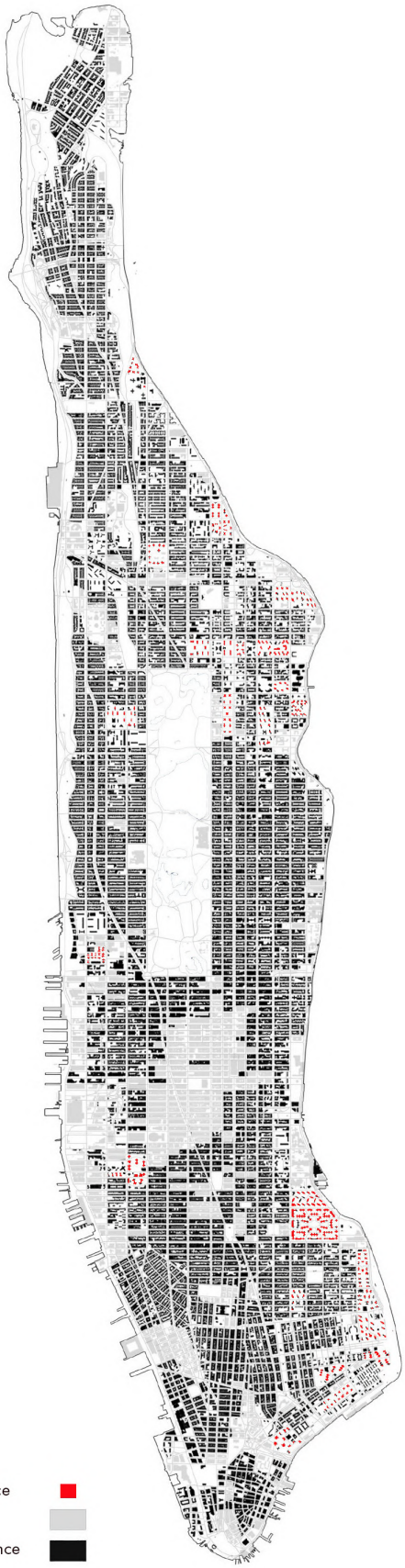


Figure 84
Source: AUTHOR

Buildings incl. Residence

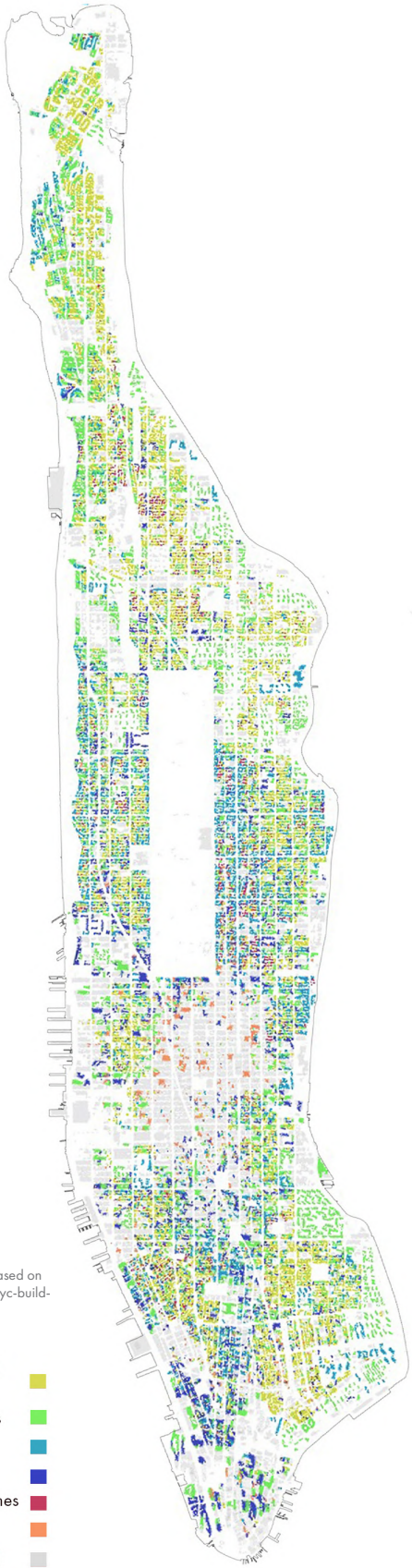


Figure 85
Source: AUTHOR based on https://tbaldw.in/nyc-buildings/

Building Classification

0 1.5 3 km

Social Segregation

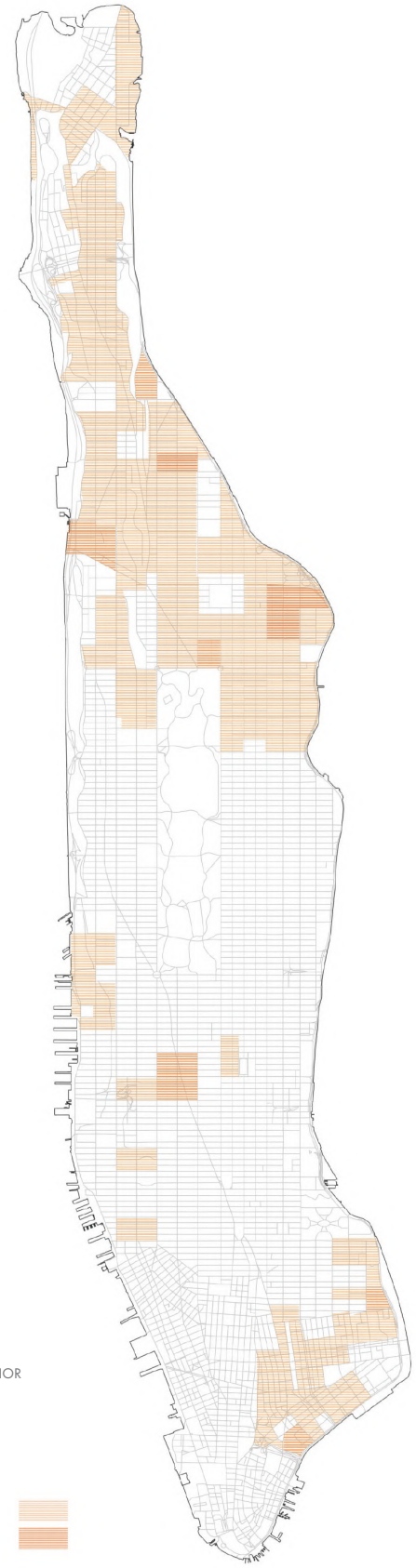


Figure 86
Source: AUTHOR

Poorest Neighborhoods

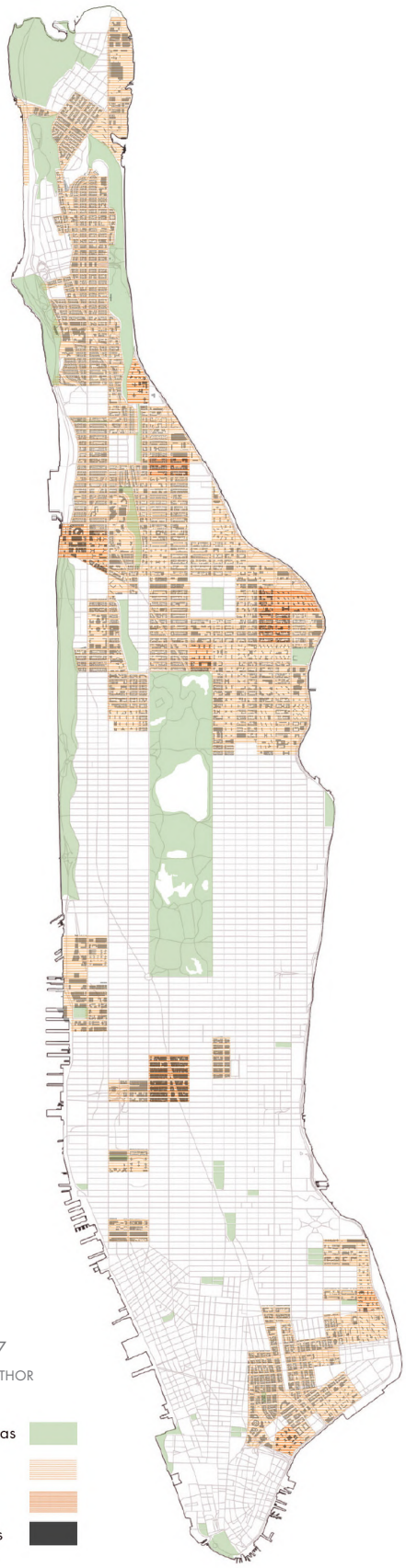


Figure 87
Source: AUTHOR

Grid and Social Segregation

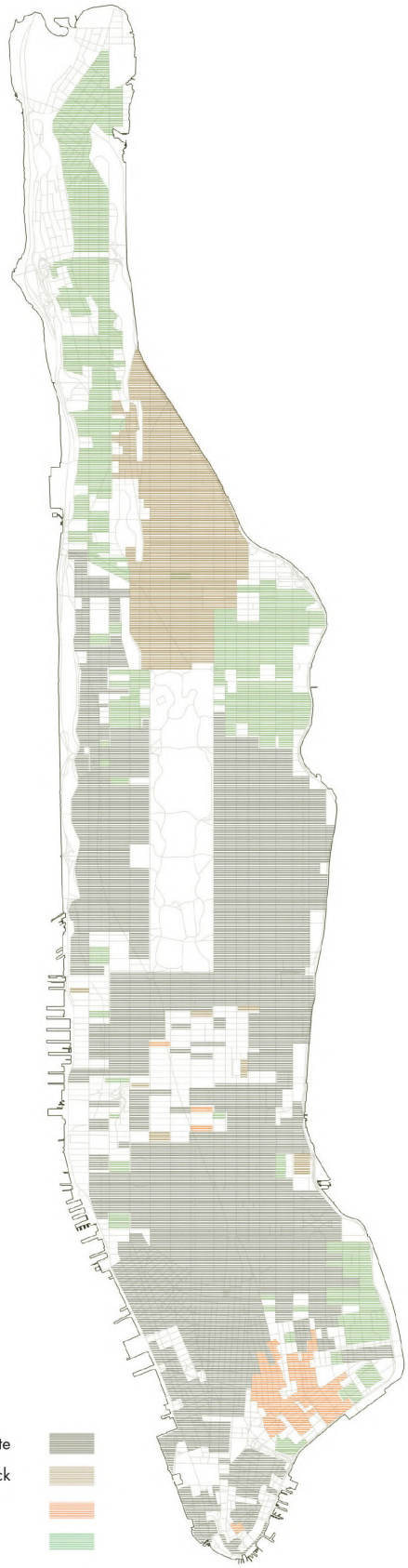


Figure 88
Source: AUTHOR

Non hispanic - white
Non hispanic - black
Asian
Hispanic

Racial Diversity

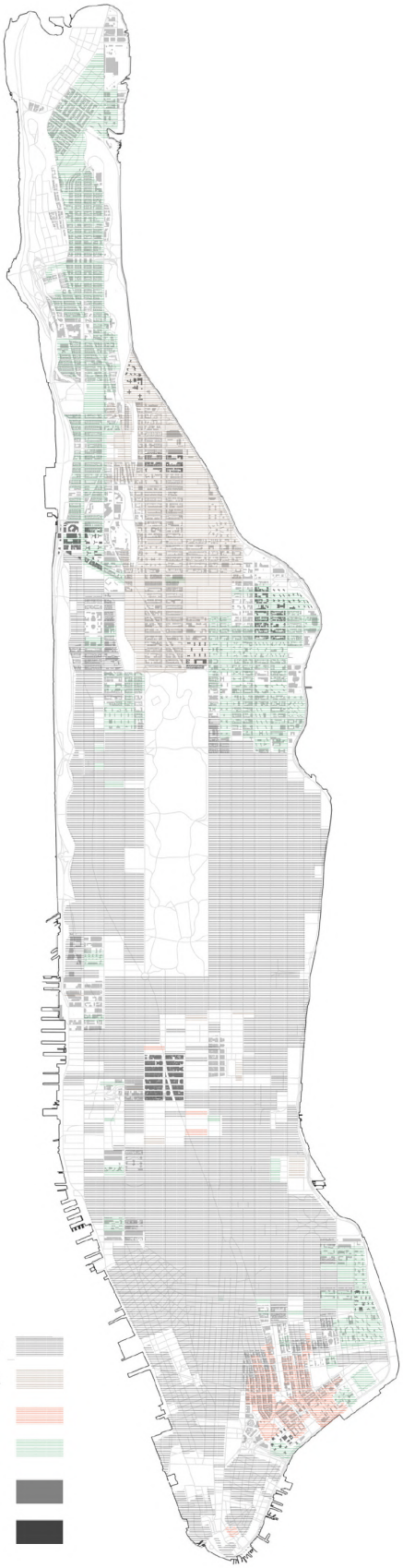


Figure 89
Source: AUTHOR

Non hispanic - white
Non hispanic - black
Asian
Hispanic
Level 2 Poor neighborhoods
Level 1 Poor neighborhoods

Grid - Racial Diversity - Poor neighborhoods

Figure 85

0 1.5 3 km

Natural Elements

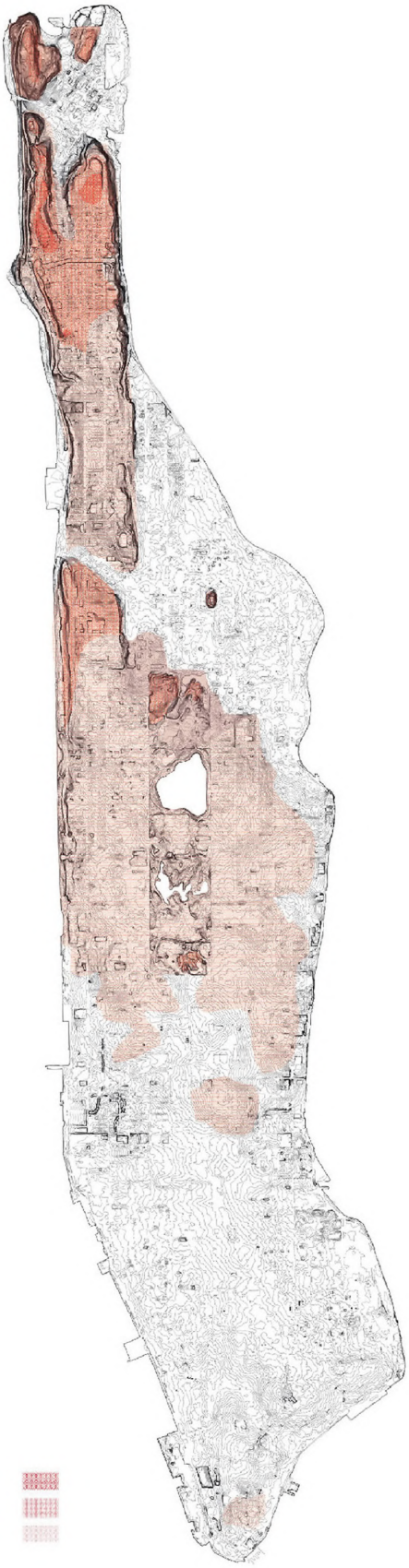


Figure 90
Source: AUTHOR

Topography

Figure 91
Source: AUTHOR

Green areas

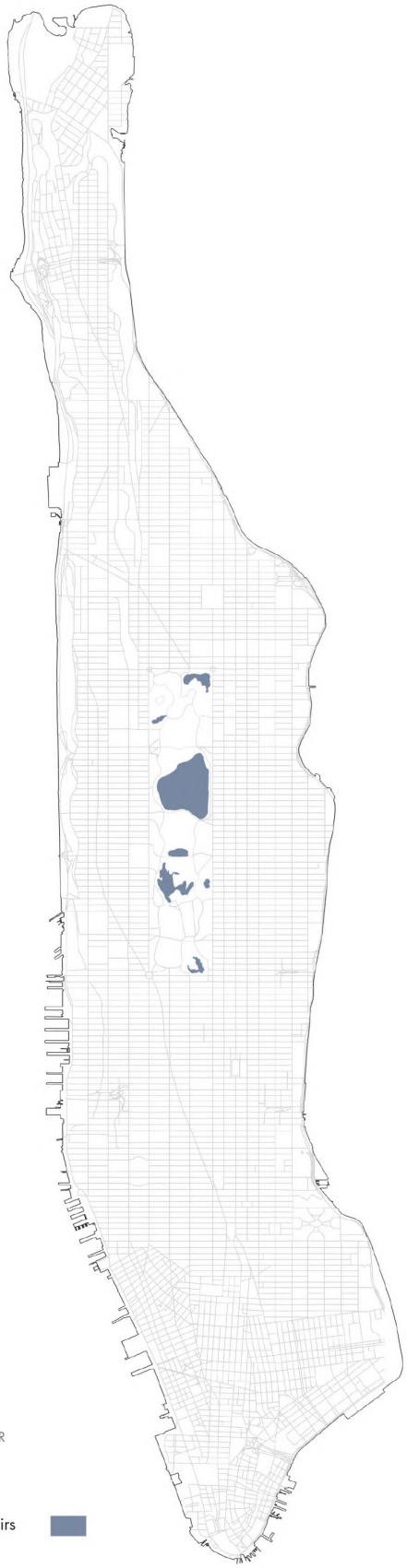


Figure 92
Source: AUTHOR

water reservoirs

Water Element

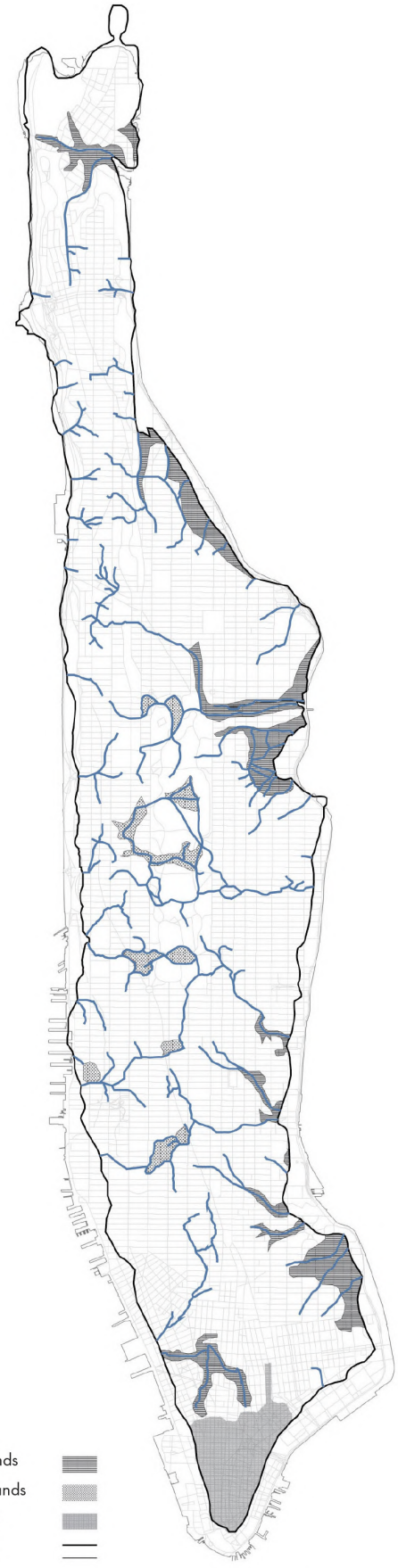


Figure 93
Source: AUTHOR

saltwater wetlands
freshwater wetlands
new amsterdam
hidden streams

Natural element of the past

0 1.5 3 km

Flood Risk

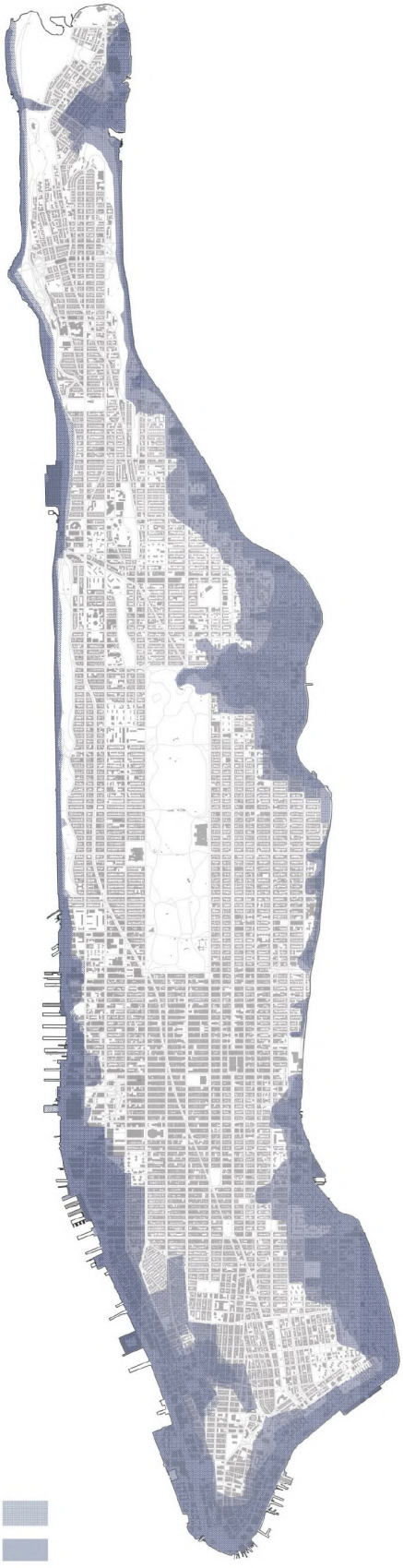


Figure 94
Source: AUTHOR

Floodplain 2050, 2100

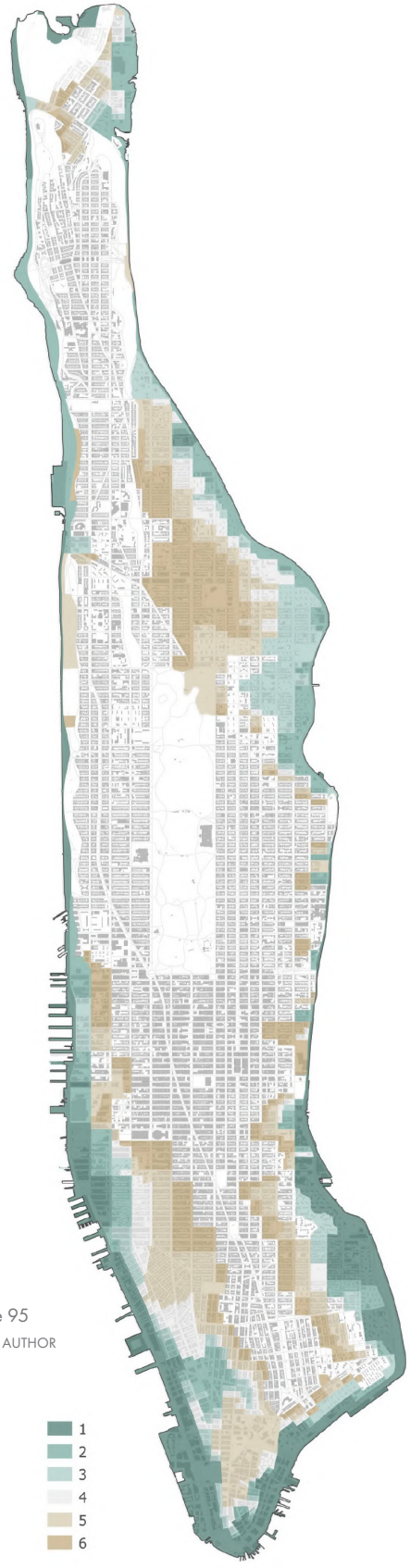


Figure 95
Source: AUTHOR

Evacuation Zones

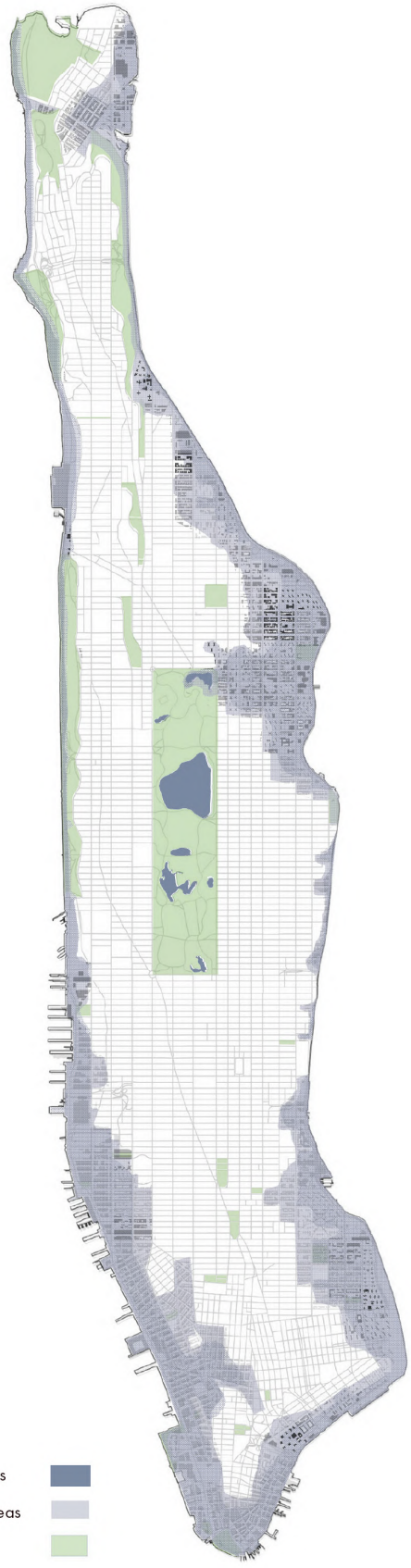


Figure 96
Source: AUTHOR

Grid, Water, Green areas, Floodrisk

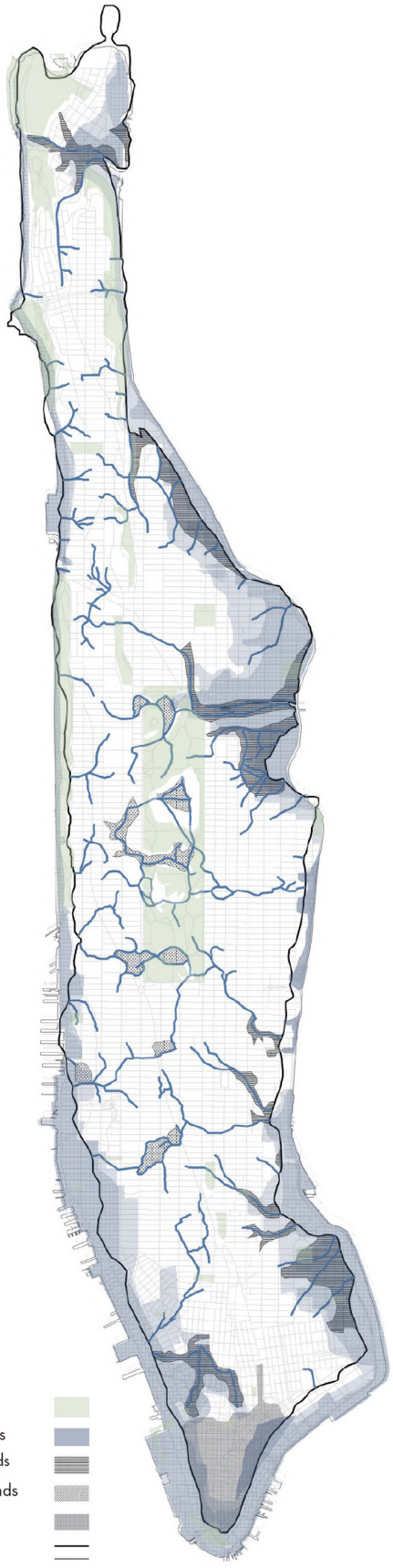
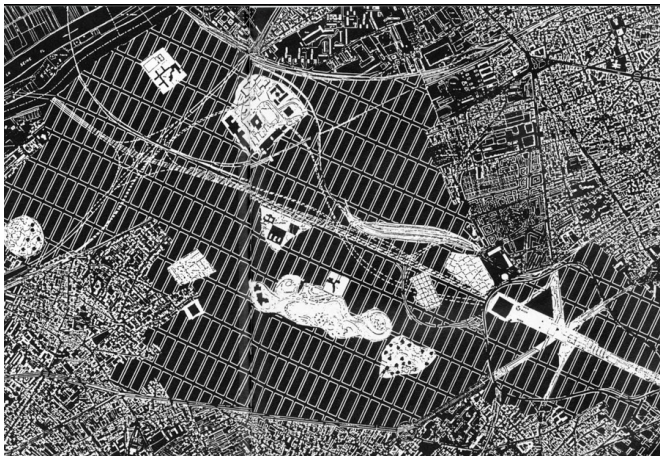


Figure 97
Source: AUTHOR

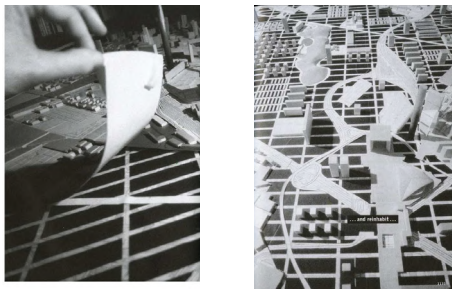
Palimsest Landscape - Flood Risk

0 1.5 3 km



OMA, Mission Grande Axe, Paris, 1991 Figure 98

Source: OMA.com

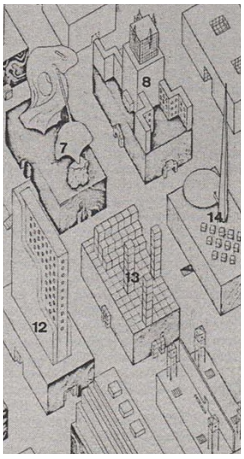


Grid as organization tool Figure 99

Source: OMA.com

Rem Koolhaas, The City of the Captive Globe, 1978

Figure 100 Source: MoMA.org

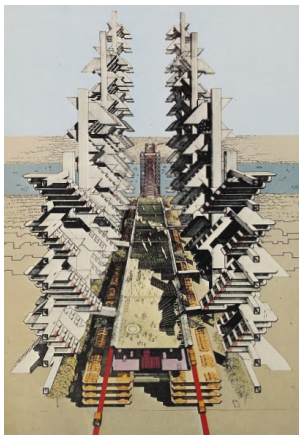


City in the city -Densification

Figure 101 Source: Socks-Studio.com

Paul Rudolph, Lower Manhattan Expressway, 1972

Figure 102 Source: Urbanomnibus.net



Grid Megastructure

Figure 103 Source: Gothamcenter.org

4.5 Reference Cases

The first part of the reference cases delves into the possibilities of the grid interpretation in order to create a new dialogue with the city and its rudiments. The inherent intelligence of this structure can overcome the limitations posed by its fixed form and formulate a new arena of urban interventions based either on its organization logic, the density intensification inside the blocks or even the creation of grid mega - infrastructures.

The second part of reference cases deals with the design principles which serve as patterns for grid interpretation and strategy towards the flood resilience, porous city and social inclusion.

Grid Possibilities

The first reference case deals with the organizational logic of the grid as well as its potential to operate the space for present and future interventions. The vision for Grande Axe in Paris organizes the coexistence of solid and void, density and emptiness (figure 98) .The grid in this case organizes an area offering the freedom of construction, demolition and evolution of the entities in the future (figure 99). This specific reference case can be an inspiration for the project in terms of grid repurpose through block redefinition. Green and Blue elements can be integrated, while new centralities as public space nodes can be formulated.

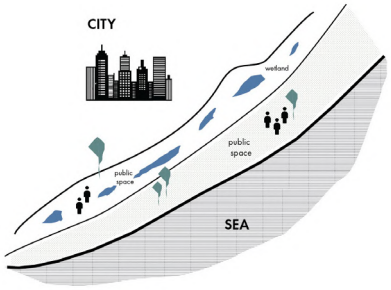
In the case of the Captive Globe, the elements inside the building blocks are intensified (figure 100). The capacity of the grid is stretched in order to support multiple functions in various densities and typologies. Every block is aimed to be a unique entity, a city inside the city (figure 101). The uniform grid is diverged in the third dimension in an aim to produce heterogeneity. The block densification of Captive Globe can inspire the project through the integration of green - blue “cities” and the incorporation of mixed uses.

The Expressway project in Lower Manhattan was envisioned by Paul Rudolph as a mixed-use megastructure above the existing grid (figure 102). Residential Units, plazas, parking lots would provide a new interpretation of the grid as a mega social incubator (figure 103). This specific case provides inspiration for the project in terms of green - blue megastructures inside the urban core that can bolster the integration of nature and the social interaction through the creation of inclusive public spaces.

It seems that the potential of the grid is quite significant. Despite the uniform plan, there are possibilities for intensification and densification in various ways. The grid is able to organize the chaos and the same time it can offer new urban tools for reconfiguration.

Weiliu Wetland Park, China Figure 104

Source: worldlandscapearchitect.com

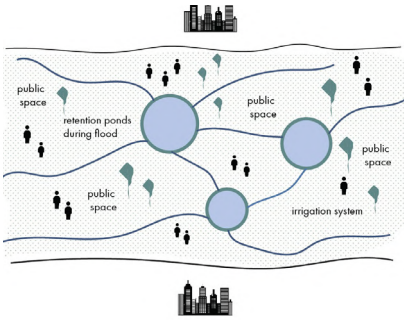


Wetlands Figure 105

Source: AUTHOR

Hans Tavsens Park, Copenhagen Fig.106

Source: dezeen.com

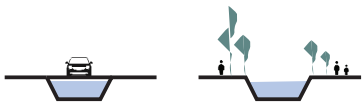


Retenion Ponds Figure 107

Source: AUTHOR

Cheonggyecheon River, Seoul Figure 108

Source: Twitter.com

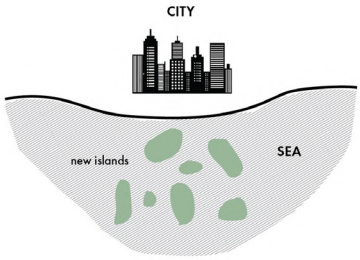


River Daylight Figure 109

Source: AUTHOR

Tidal Basin, Washington DC Figure 110

Source: fieldoperations.net



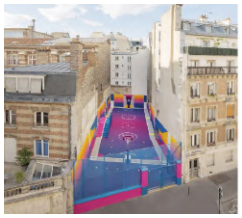
Green Islands Figure 111

Source: AUTHOR

Pattern Design Principles

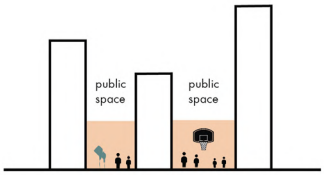
The flood resilience of the metropolitan area of will take into account the unraveling of natural mechanisms that once existed in the region as well as the addition of building with nature principles. It is important to note that the grid will be interpreted as a device for incorporation of green - blue natural elements. As previously noted, Manhattan once included wetlands and running streams which are now covered and concretized. The constructed wetlands have a spread of environmental and social benefits (Barmelgy, et al, 2021). The case in China indicates that wetlands can offer flood mitigation mechanisms and at the same time can act as social infrastructures (figure 104 & 105). The revitalization of the hidden river in Seoul shows that the need for river daylight would benefit the flood mitigation in combination with larger water storage capacity in the urban core (figure 108 & 109). The urban transformation followed the creation of public space enclaves along the riverline. Moreover, the retention area can be utilized as water catchment area as well as a place for supporting the residents' social activity (Anwar & Amalia 2017). The example of Hans Tavens Park in Copenhagen is an important reference towards the integration of water in social activities (figure 106 & 107). Last but not least, given the potential horizontal urban expansion due to the increasing demand of more and more housing units in the future, the formation of a green artificial island network like in the case of Tidal Basin by James Corner could be formed (figure 110 & 111). The artificial raising of whole islands to appropriate heights can cope with future sea level rise (Brown, et al., 2019). The new land would reconfigure the potential of the grid in a future development.

The creation of inclusive public spaces and the collective living serve as strategies towards the social inclusion and the porous ciy. Taking into account the dense building environment of Manhattan, it is important to exploit the existing building environment and its porosities. Vacant space between the buildings like in the case of Paris (figure 112& 113) indicate that there are various possibilities for the formation of alternative public space in the forms of pocket parks inside the grid blocks. Due to the compact built environment and the limited horizontal development posed by the application of the grid, an urban expansion in the sea seems also possible. The incorporation of a green blue system inside the grid, sets priorities into the integration of nature and thus the new housing development could be designed as an expansion in the sea. The plans for Tokyo in the case of Kenzo Tange re-interprete the grid through a floating city with housing units (figure 114 & 115).



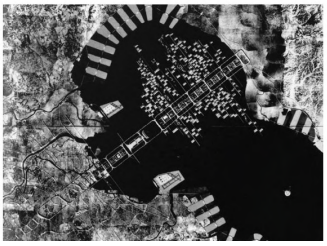
Pigalle Duperré, Paris

Figure 112
Source: dezeen.com



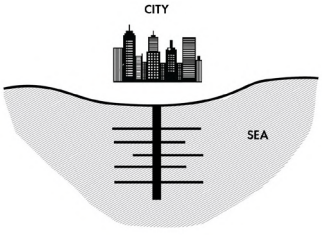
Activating the in between

Figure 113
Source: AUTHOR



Kenzo Tange Plans for Tokyo

Figure 114
Source: archeyes.com

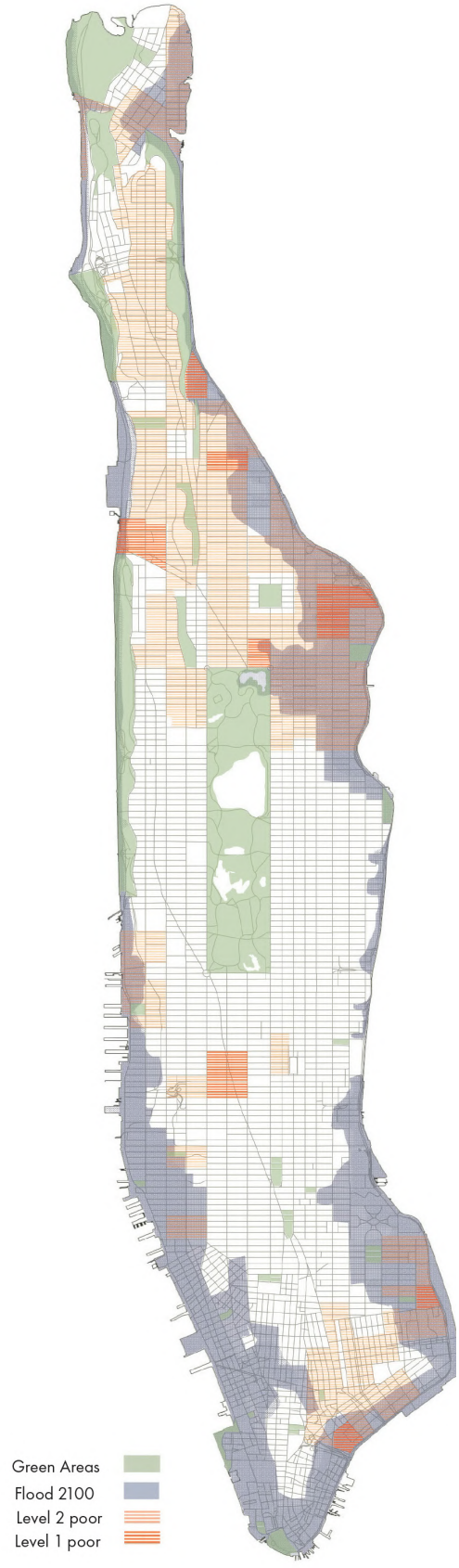


Expansion

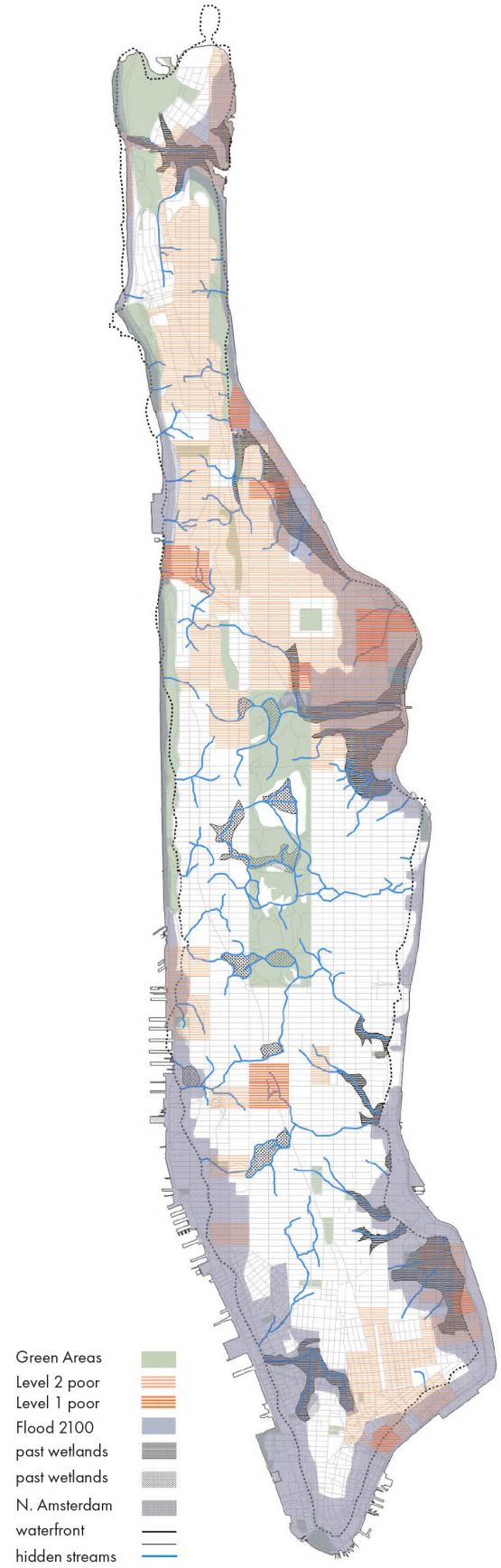
Figure 115
Source: AUTHOR

5 Vision & Site selection

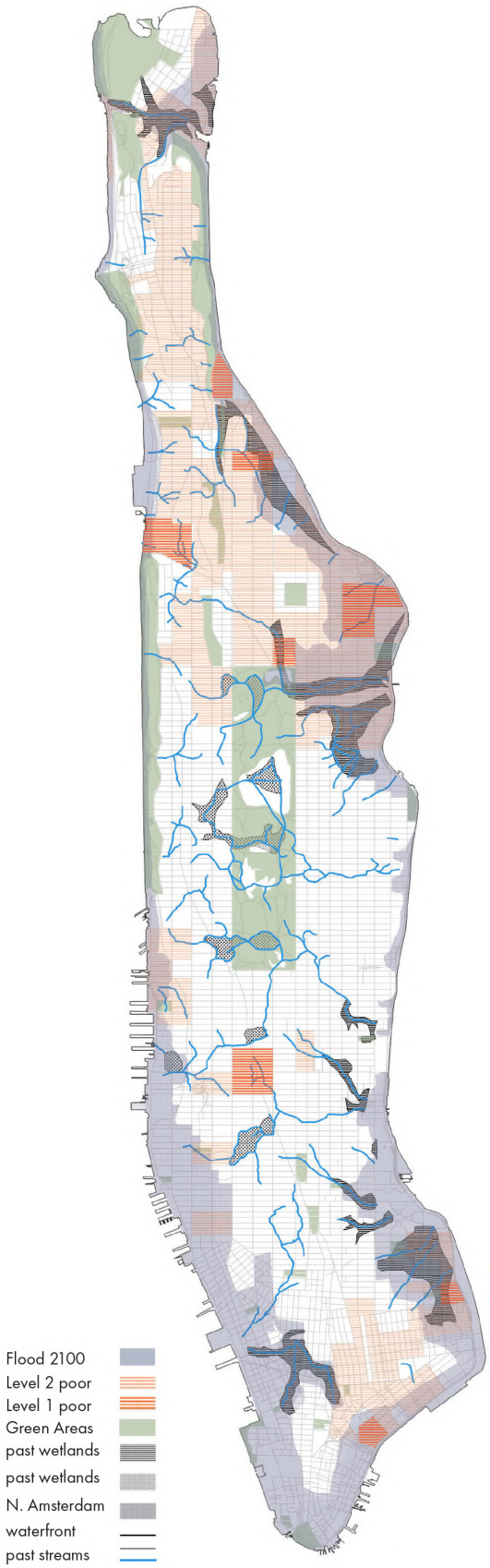
Poor Neighborhoods and flood risk



Poor Neighborhoods,flood risk, green areas



Overlapping the palimsest landscape



Past - the connecting element

Figure 116

Source: AUTHOR

0 1.5 3 km

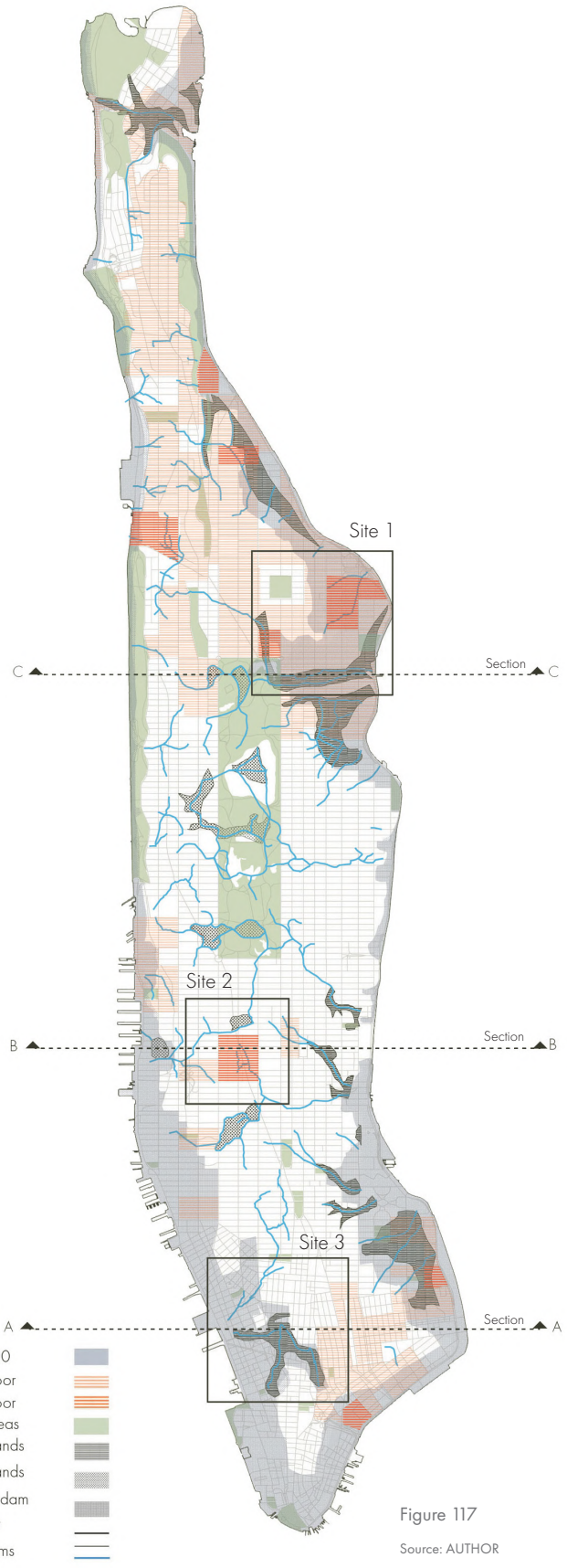


Figure 117

Source: AUTHOR

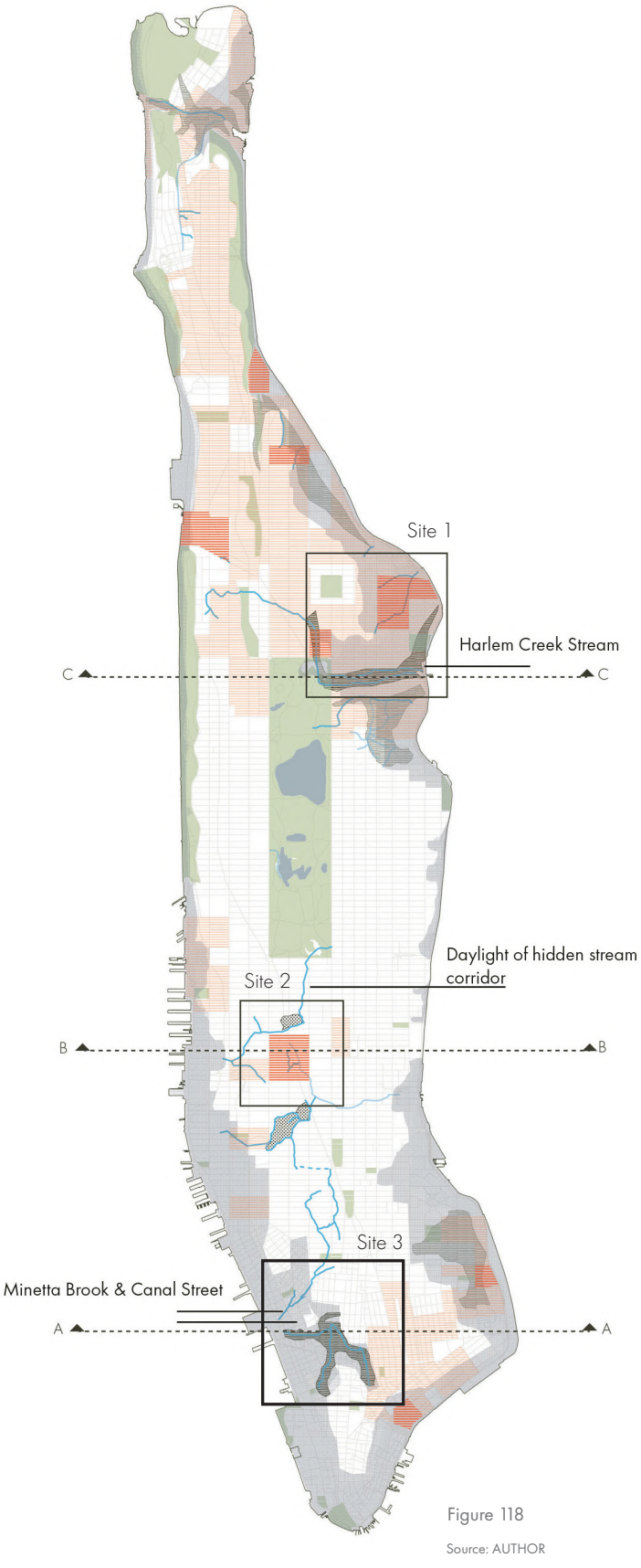


Figure 118

Source: AUTHOR

Vision

Focus Area

The metropolitan scale analysis of Manhattan as well as the reference cases in terms of grid interpretation and the design principles as a pattern tool, assist towards the design approach and thus the answer of the research question.

Overlapping the flood vulnerable areas, the poorest neighborhoods, the green public space and the palimpsest landscape including wetlands and streams, it is possible to identify the areas for possible intervention (figure 116). The analysis of the hidden streams indicated that there are important buried streams such as the Canal Street, Minetta Brook and Harlem Creek.

Starting from these specific streams as a starting point, three sections in the island will take place in the upper, middle and lower part of the island respectively (figure 117).It is evident also that there is a hidden streamline connection between these parts, connecting the upper part with the lower part. This streamline corridor including the Central Park will be the connective element between the three chosen sites fore intervention (figure 118). This corridor will be repurposed as a green - blue spine with linear parks that in case of extreme rainfall they can be flooded.

The project will have a holistic approach starting from the metropolitan scale and then delving into the specific areas (figure 119). The three selected areas along the stream waterway will be conceived as sites for grid interpretation in according to the patterns. The flood resilience will be achieved through the palimpsest landscape as the connective element in an aim to bring back the lost identity and natural elements of Mananhatta (figure 121). The interventions will be accompanied by an expansion of Manhattan in the form of new green islands since there will still be an emergence for more housing and flood mitigation in the future.

The key interventions will stand as incubators of a new social infrastructure with the water as the main element.

For the purpose of detailed design, one test site will be chosen which will serve as a design pilot for the other two sites. Taking into account the restrictions of every site, Site number 3 in Lower Manhattan has the most restrictions in terms of historical value, flood vulnerability and grid structure.

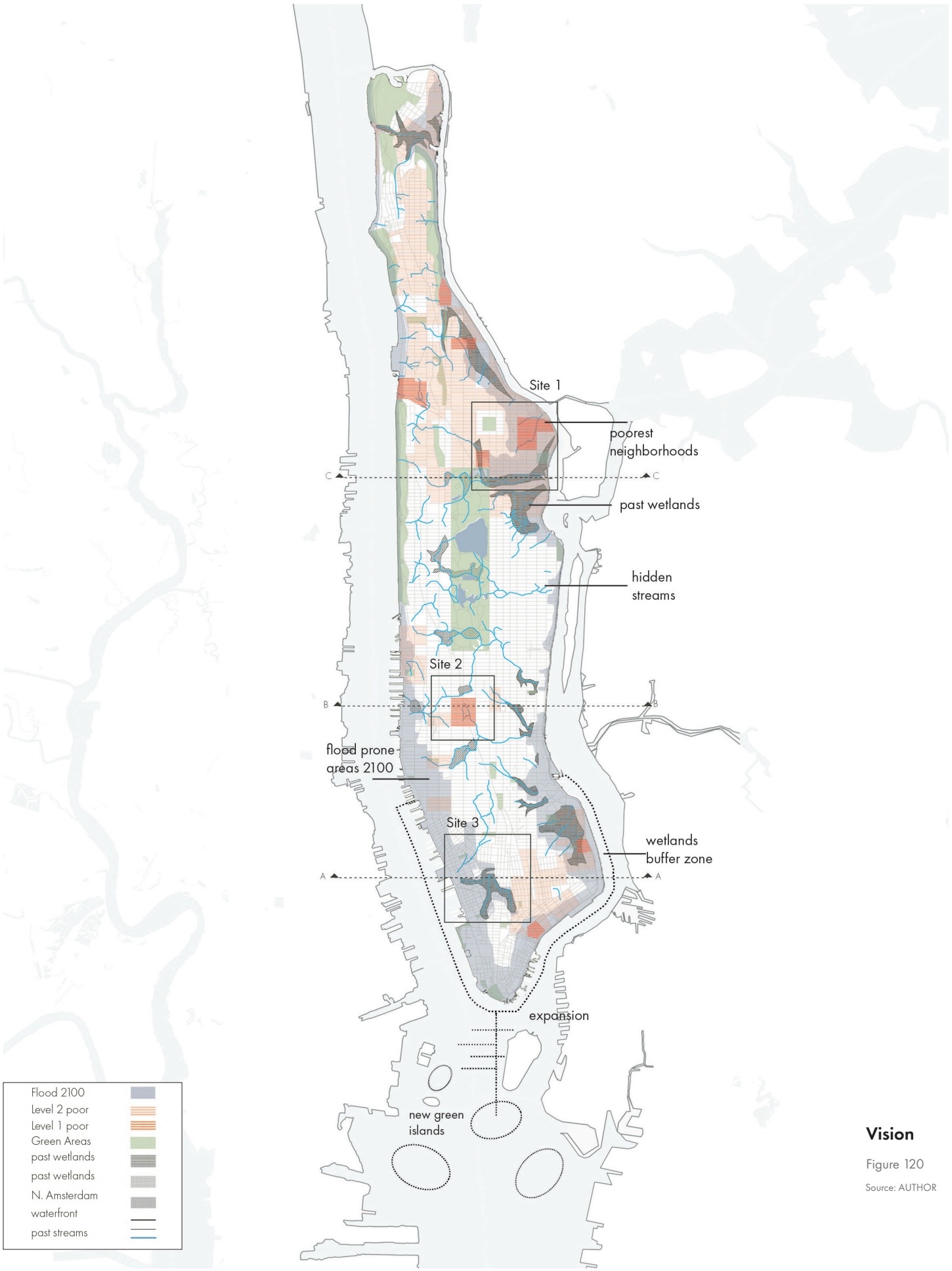
Site 1

Site 2

Site 3

Site Selection

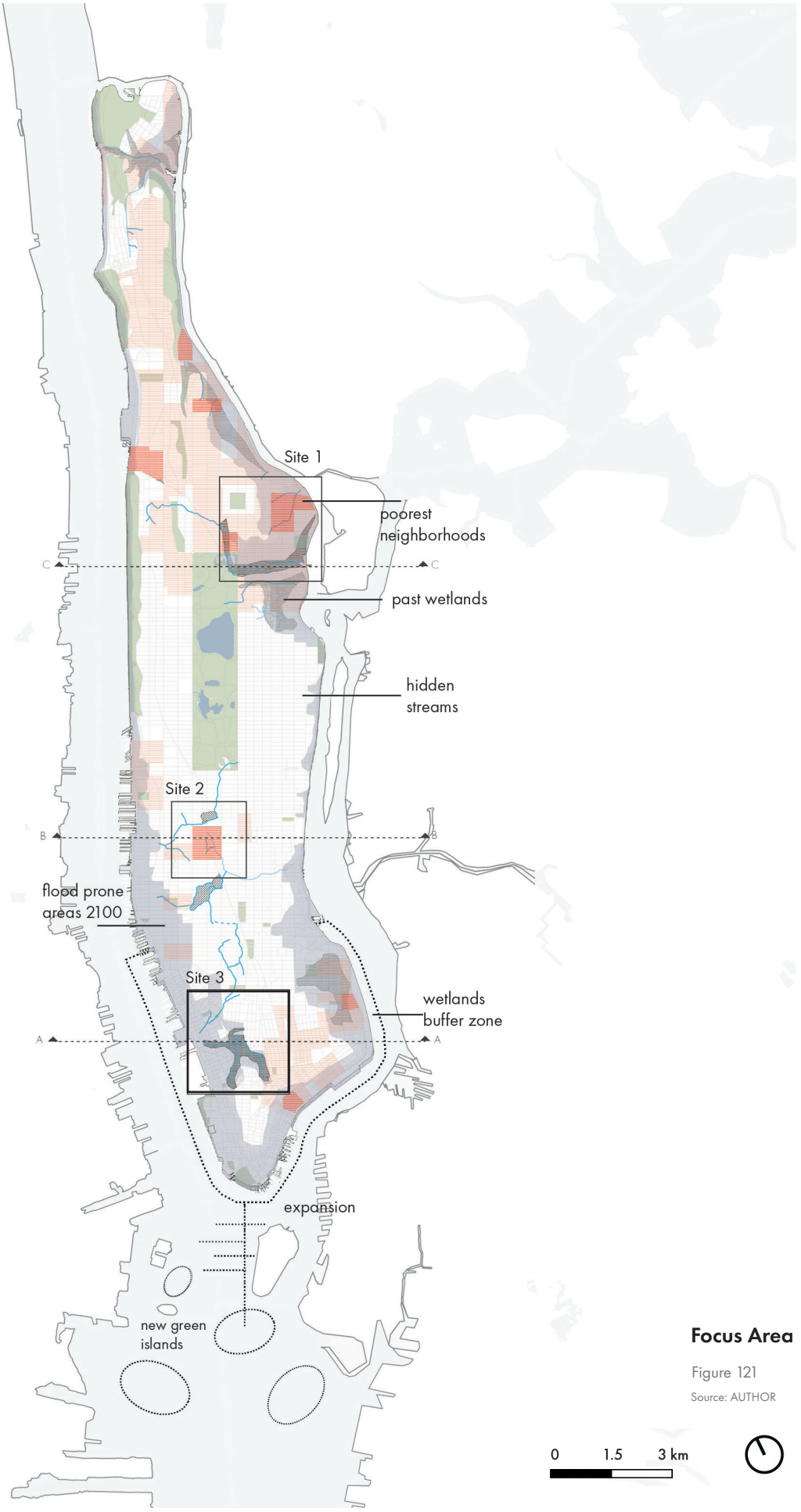
Figure 119 Source: Extracted by Google Earth and edited by AUTHOR



Vision

Figure 120

Source: AUTHOR



Focus Area

Figure 121

Source: AUTHOR

6 Lower Manhattan - Focus Area

Flood prone - Green Areas

Open space
Parks
Floodplain 2100

Figure 122
Source: AUTHOR

Past Wetlands

Open space
Parks
Floodplain 2100
Past Wetlands

Figure 123
Source: AUTHOR

Neighborhoods

Open space
Parks
Neighborhoods

Figure 124
Source: AUTHOR

Past Streams

Open space
Parks
Floodplain 2100
Past Rivers-Hidden Streams

Figure 125
Source: AUTHOR

0 250 500

6.1 Site 3 - Analysis

The selected area of focus is located on the Lower part of Manhattan where the future flood hazard is emergent (figure 122). The site presents notable restrictions in terms of historical value, grid structure and drosscapes.

More specifically, part of the flood prone area in the early years before Dutch colonization was a wetland with running streams (figures 123 & 125). The Canal street used to be a water canal built in 1807 to drain the Collect Pond into the Hudson River. However, the canal was buried almost ten years after due to sewage pollution.

Nowadays, the area is subdivided into specific neighborhoods with distinctive identity. Soho, Hudson square, Tribeca, Nolita – Little Italy and Chinatown compose the present urban landscape where the past wetland was located. (figure 124). The grid does not follow the normal typical form while the public space and green areas are not that present in the urban core. The limited green space is a notion arising questions about the resiliency towards flood risk and how the incorporation of new green spaces combining social interaction could be a design solution towards both the mitigation of flood risk and social inclusion.

What is evident is the numerous amount of parking spaces which tend to be more than the green areas (figure 127). In a scenario where there will not be an extensive use of cars in the future, these specific spaces could gradually be repurposed as pocket parks.

Bearing in mind that the selected site is part of the older Manhattan, there are a lot of historic neighborhoods including Soho, Tribeca, Greenwich Village and West Village (figure 128). The historical parts include buildings that provide a specific identity in the area and in these terms are protected from potential demolition.

The underground space is occupied by an extensive subrail system with numerous substations (figure 129). Taking into account the concretization of the underground in several parts, the incorporation of new running water systems seems difficult.

Last but not least, there are numerous small vacant land spaces which could also be repurposed as new areas for both meaningful communal interaction and green patches as a solution against flood vulnerability (figure 130).

Area of interest

Figure 126
Source: AUTHOR based on Google Earth

Parking Spaces

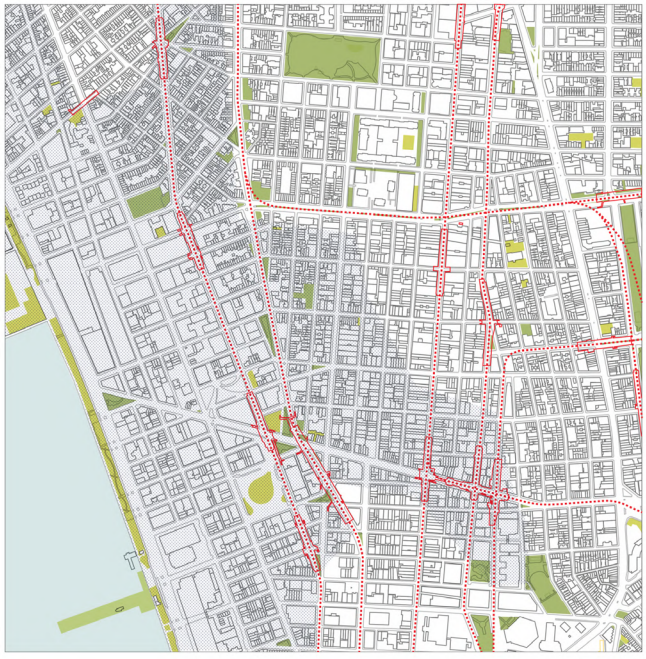
Open space
Parks
Floodplain 2100
Parking

Figure 127
Source: AUTHOR

Historic Neighborhoods

Open space
Parks
Floodplain 2100
Historic Neighborhoods

Figure 128
Source: AUTHOR



Subrail System

Open space
Parks
Floodplain 2100
Subrail

Figure 129
Source: AUTHOR

Vacant Land

Open space
Parks
Floodplain 2100
Vacant Land

Figure 130
Source: AUTHOR

0 250 500 m

THE STONE BRIDGE, 1800.

The Canal in Canal Street

Figure 131

Source: Sohobroadway.org

Soho neighborhood

Figure 132 Source: AUTHOR based on GoogleEarth

Hudson Square neighborhood

Figure 133 Source: AUTHOR based on GoogleEarth

Looking closer into the urban context, the navigation in the specific neighborhoods led to important conclusions. In Soho the streets seem either wide or narrow with many commercial – residential as well as historic buildings (figure 132). The neighborhood of Hudson Square seems less noisy with a great amount of industrial buildings mostly commercial and office use (figure 133). In Tribeca there are a lot of parking spaces and commercial buildings giving the impression of a very busy neighborhood with many wide streets (figure 134). The neighborhoods of Nolita – Little Italy as well as Chinatown have their own cultural identity (figures 135 & 136). Nolita – Little Italy has a picturesque Italian vibe including a wide range of economic classes. The presence of many restaurants of Italian cuisine is very characteristic which act as a meeting node for the people. The vibe from Chinatown seems very touristic and dense with a great amount of restaurants. All in all, the closer investigation of the area set many opportunities for future development in terms of porosities and grid redefinition. Indeed there is a lack of water presence while the green element in combination with public space seems limited.

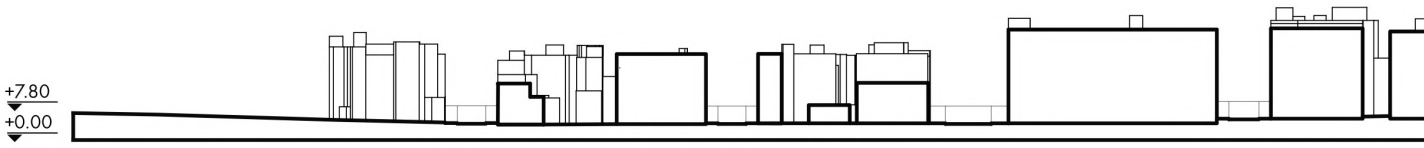
Last but not least, the street sections across the Soho neighborhood indicate that the inclination of the road system allows the incorporation of green blue infrastructure across the grid, an element that would provide both flood mitigation and social inclusion for the whole area (figure 137).

Tribeca neighborhood

Figure 134 Source: AUTHOR based on GoogleEarth

Nolita - Little Italy

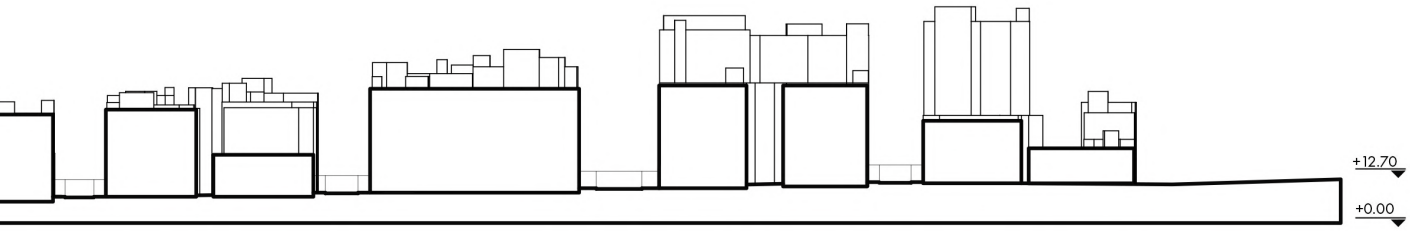
Figure 135 Source: AUTHOR based on GoogleEarth



Chinatown

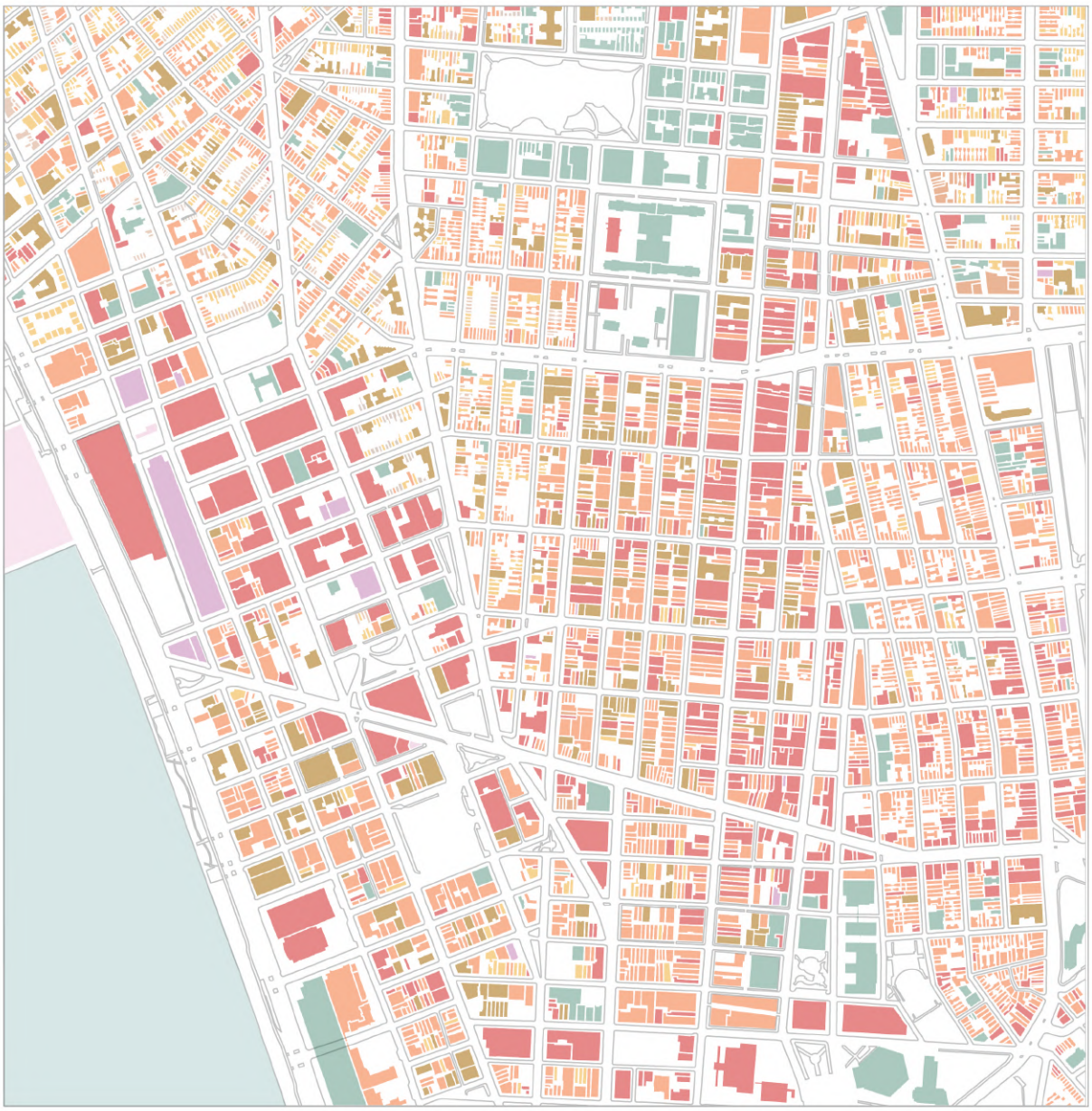
Figure 136 Source: AUTHOR based on GoogleEarth

Section along W Broadway Street



Section along Soho Streetscape

Figure 137 Source: AUTHOR



Building Uses

- Public Facilities & Institutions
- Industrial & Manufacturing buildings
- One and two Family buildings
- Multi family walk up buildings
- Multi family elevator buildings
- Mixed Residential & Commercial Buildings
- Commercial & Office Buildings

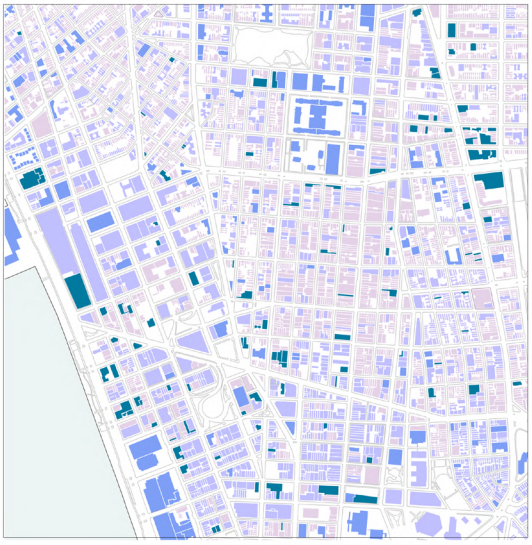
Figure 138

Source: AUTHOR
based on Zolaplanning.nyc.gov

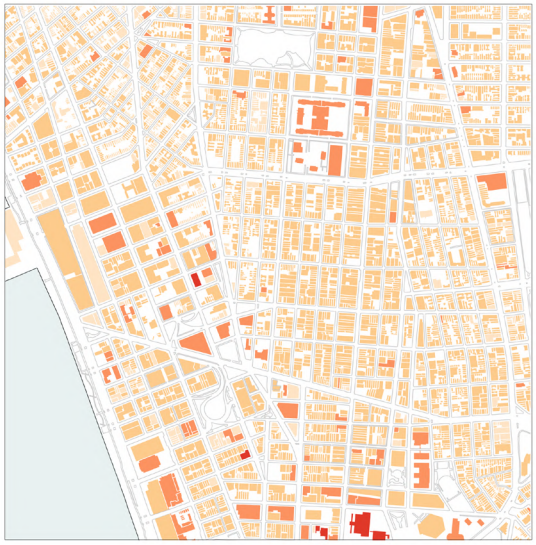
0 250 500 m

In terms of building uses it is clear from the map that the majority of buildings in the site are mostly office and commercial buildings mixed with residential use (figure 138). The housing buildings are in the type of mixed use, multifamily walk-up buildings and multi - family elevator ones. The manufacturing sector is not that present, while public facilities and institutions are located on the edges of the site. Moreover, the buildings in the area are not that high (figure 140), creating opportunities for roof repurpose and the building age is mostly between 1850 and 1900 (figure 139) posing limitations for potential demolition in an aim to create more room for green space.

The porosities of the site and most specifically the great amount of parking areas, the underdeveloped plazas and in many cases the inactive roofscape offer great opportunities for the incorporation of new green – blue spaces for communal interaction (figure 141). In this way the existing misused space is repurposed while all the economic classes and cultures will have the opportunity to interact in a green and water inclusive environment.



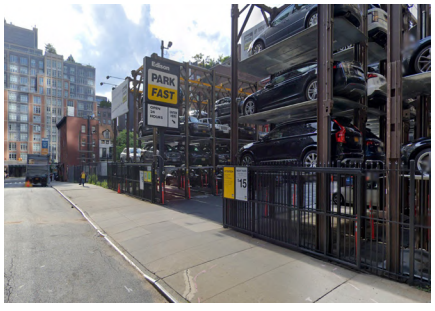
Building Age



Building Height

Figure 139 & 140 Source: AUTHOR based on Zolaplanning.nyc.gov

Plazas

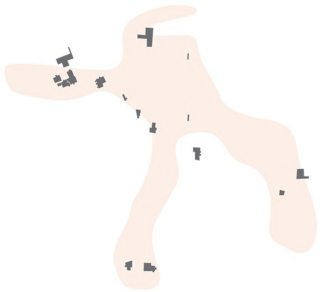


Parking Space

Inactive Roofscape

Drosscapes and Mis used space

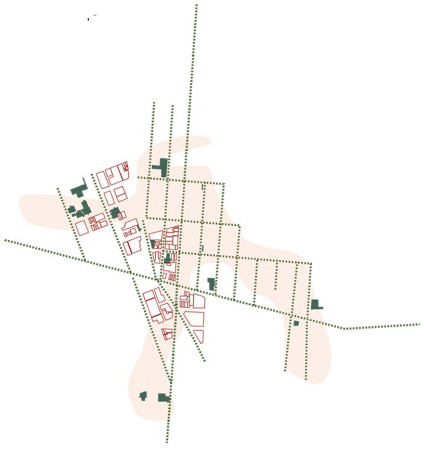
Figure 141 Source: AUTHOR based on Google Earth



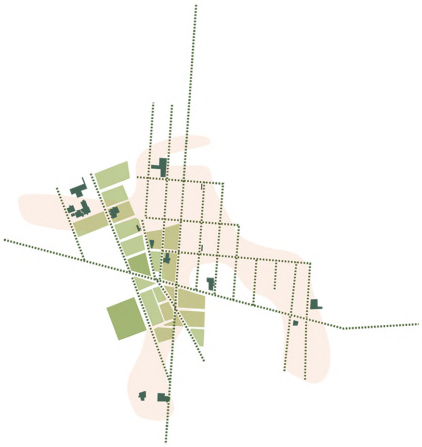
1. Parking Space

2. Parking Space repurspose as green space

3. Potential Building repurpose



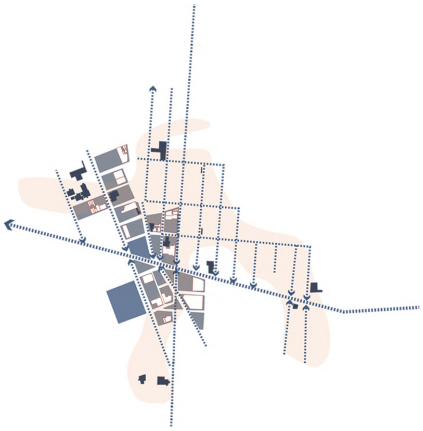
4. Green corridors



5. New green space

6. Potential Building Demolition

7. Green Network



8. Blue network during Flood

Figure 142

Source: AUTHOR

Strategy Steps

6.2 Design Strategy

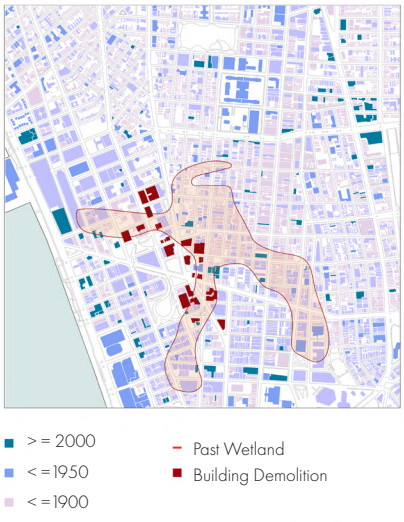
In order to achieve the Flood Resilience, Porosity and Social Inclusion this specific site will serve as the design pilot for the other two selected sites in the metropolitan area of Manhattan.

The design scenario starts with the notion that in the future the car use will be not that extensive in order to foster the environmental resiliency in the region. The diagrams in the figure 142 indicate the steps needed to be taken in an abstract way while the maps in the next pages (figure 146 - 153) incorporate the strategy in the urban context.

Delving into the specific site, the first step will be the overlap between the existing parking spaces that could be re-purposed and the imprint of the past wetland (figure 146) .The second step will be the greenification of these parking spaces and their alteration into green – blue spaces for communal interaction (figure 147). Taking into account the imprint of the past running streams in the area and most specifically the Canal Street (figure 148), a new green – blue network will appear in the grid acting as a system that during rainstorms the flooded water in the green zones will be driven towards Canal Street (figure 149 & 150). In order to make space for the nodes of the green – blue network, apart from the repurpose of the parking spaces, there will be a need to create additional green spaces in the area (figure 151).

Considering the outline of the historic neighborhoods and the potential green spaces that could be added to the system, a selection of buildings which could be potentially demolished (figures 152) can create the new space for the green blue network (figure 153). It is important to say that the potentially demolished buildings are not part of the historic neighborhoods and the majority of them are commercial and office buildings. Some of these newly created public spaces could accommodate storm water running from the green blue network.

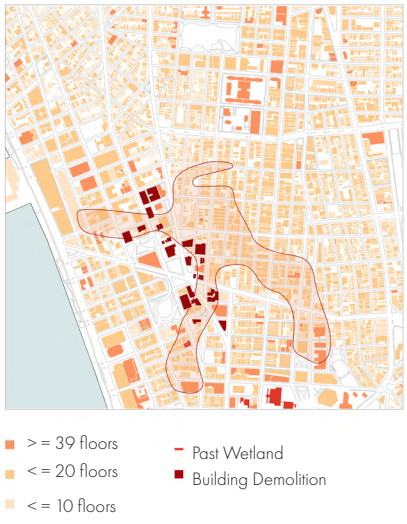
All in all, the design approach delves into the idea of design as a system in an aim to mitigate the Flood Vulnerability through porosities and inclusionary green public spaces.



Demolished buildings by Age

Figure 143

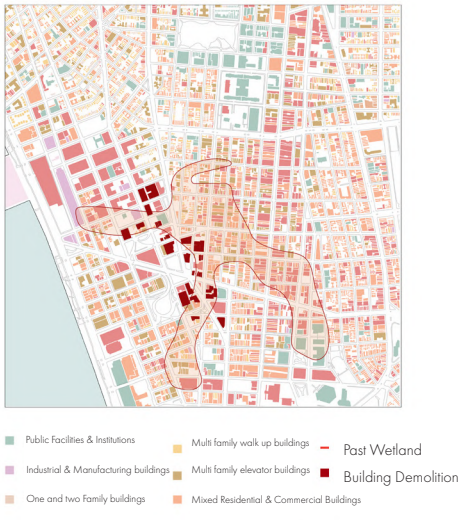
Source: AUTHOR



Demolished buildings by Height

Figure 144

Source: AUTHOR



Demolished buildings by Use

Figure 145

Source: AUTHOR

Potential Parking Spaces for repurpose

Figure 146 Source: AUTHOR

Parks
Vacant Land
Past Wetland
Floodplain 2100
Open Space
Parking Space
Historic Neighborhoods
Selected parking spaces

Repurpose of Parking Spaces as Green Public Space

Figure 147 Source: AUTHOR

Past Streams

Figure 148 Source: AUTHOR

New Green Corridors

Figure 149 Source: AUTHOR

Blue Network during flood

Figure 150 Source: AUTHOR

New Green nodes - Public Space

Figure 151 Source: AUTHOR

Parks
Vacant Land
Past Wetland
Floodplain 2100
Green Corridors
Open Space
Parking Space
Historic Neighborhoods
New green spaces
Green Nodes

0 250 500 m

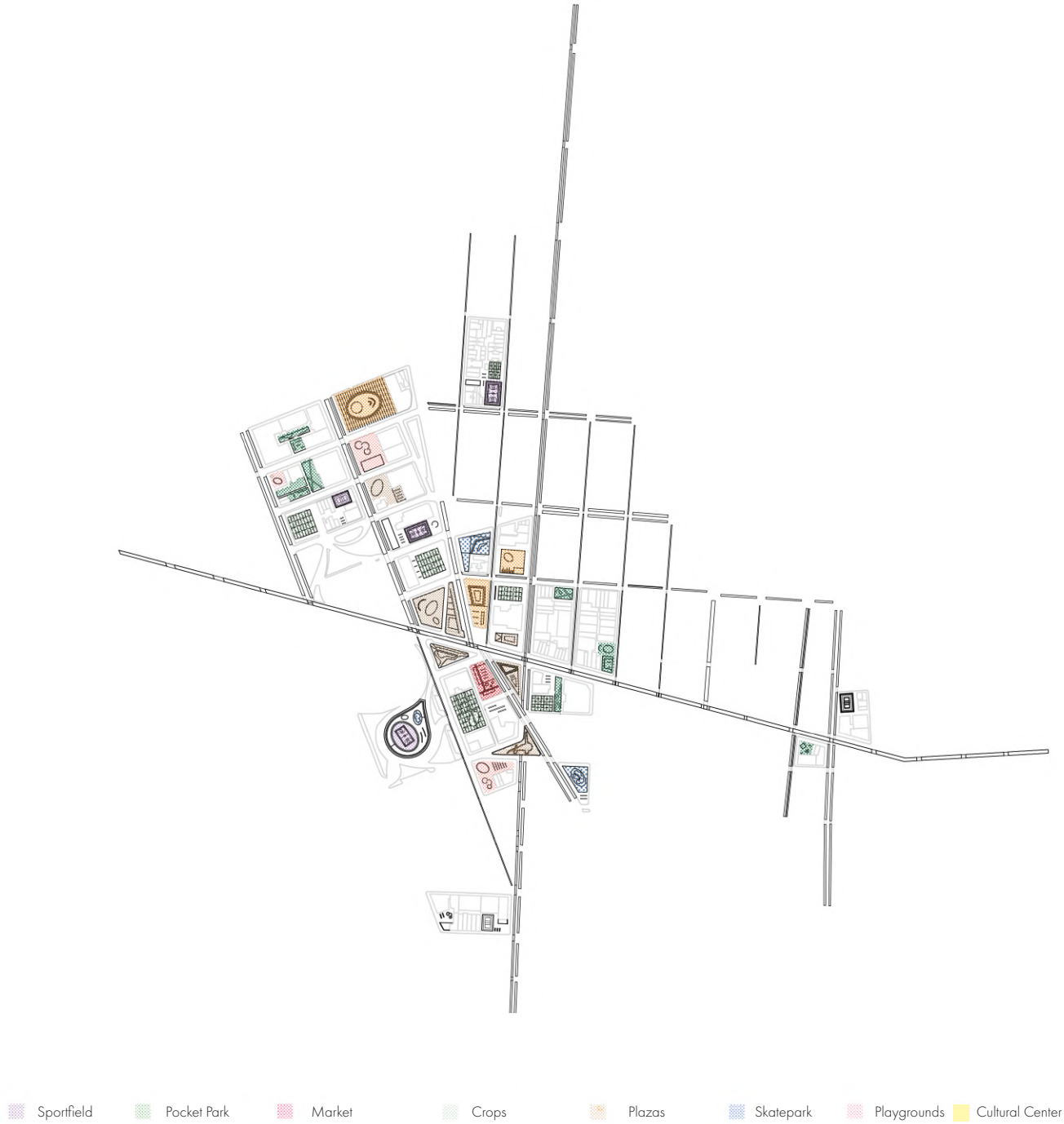
Potential Building Demolition

Figure 152 Source: AUTHOR

Parks
Vacant Land
Past Wetland
Floodplain 2100
Green Corridors
Open Space
Parking Space
Historic Neighborhoods
New green spaces
Green Nodes
Demolished buildings imprint

Final Plan

Figure 153 Source: AUTHOR



Network of Public Spaces

Figure 154 Source: AUTHOR

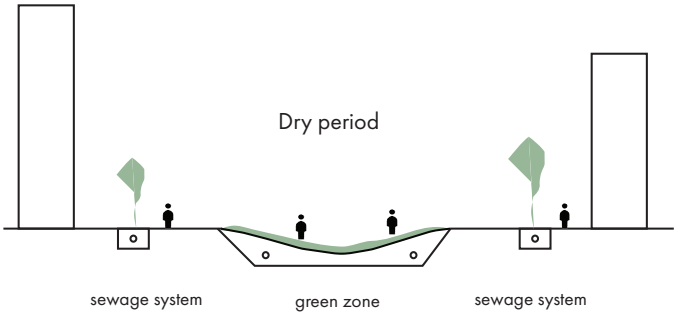
6.3 Detailed Design

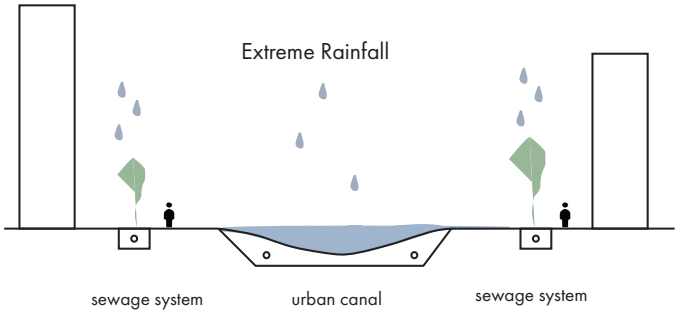
Looking closer to the design of the system, a network of green – blue spines is proposed in appropriate roads in the grid taking into account the scenario that the car use in the future will be not that extensive. The replacement of some existing car lanes with green linear parks in combination with public spaces is a way of redefinition of the grid in order to achieve both Flood Resiliency and Social Inclusion. Inspiration for this design solution stood the Cloudburst formula in Copenhagen where the repurpose of the existing streets and the addition of green spaces assists not only towards the extreme flood events in the area but also in the formation of a new public realm (figure 155).

The new green road system is connected with a network of public spaces including sport facilities, agriculture spaces, culture venues, plazas, a market, playgrounds and pocket parks as a transformation of the existing parking spaces. (figure 154). The incorporation of wetland parks in some of the spaces for the absorption of the excess of rainwater is inspired by the Weiliu park in China (figure 156).

Some of the new public spaces include retention ponds for stormwater collection like in the case of Hans Tavsens Park in Copenhagen (figure 157). It is significant to note that the stormwater cycle responds to a holistic system for stormwater management from the running green spines to the retention ponds. The basketball courts, the skateboard venues and some spaces from the cultural venues are filled with stormwater in an extreme rainfall like that of Manhattan.

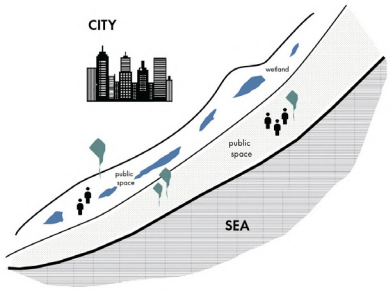
The map sequence in the next pages indicates the design intervention in multiple scales, the correlation with the past wetland imprint, the future flood prone areas and the historic neighborhoods that need to be preserved. (figures 158 - 163).



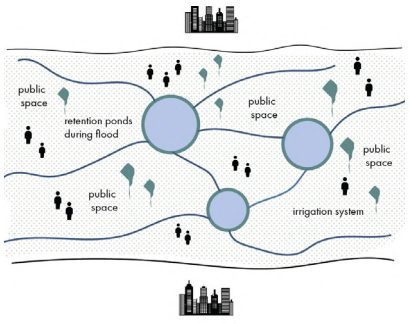


Cloudburst Formula, Copenhagen

Figure 155 Source: AUTHOR



Weiieu Park, China



Hans Tavsens Park Copenhagen

Figure 156, 157 Source: AUTHOR

Masterplan Proposal

Figure 158 Source: AUTHOR

Parks
Vacant Land
Floodplain 2100
Past Streams
New Green corridors
Open Space
Parking Space
Retention ponds
Subway Entrances
New Green public space

Masterplan Proposal in combination with Historic Neighborhoods and Flood prone Areas

Figure 159 Source: AUTHOR

Parks
Vacant Land
Floodplain 2100
Past Streams
New Green corridors
Open Space
Parking Space
Historic Neighborhoods
Subway Entrances
New Green public space

0 250 500 m

Masterplan Proposal in combination with Past wetland

Figure 160 Source: AUTHOR

Parks
Vacant Land
Floodplain 2100
Past Streams
New Green corridors
Open Space
Parking Space
Past Wetland
Subway Entrances
New Green public space

Masterplan Proposal during Extreme Flood

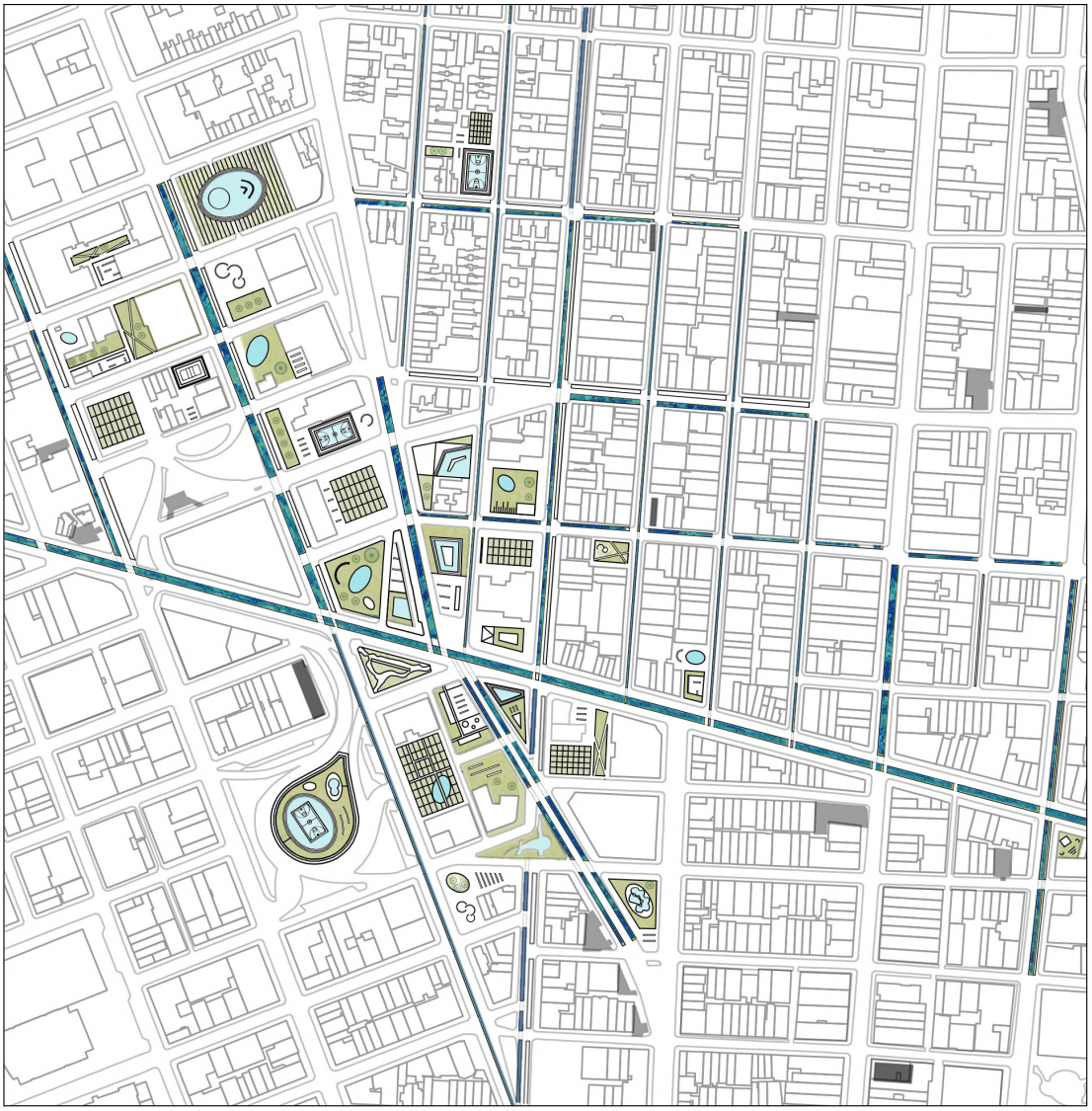
Figure 161 Source: AUTHOR

Parks
Vacant Land
Floodplain 2100
Flooded Public Space
Blue corridors during flood
Open Space
Parking Space
Retention ponds
Subway Entrances
New Green public space

0 250 500 m

Proposal during dry period

Figure 162 Source: AUTHOR

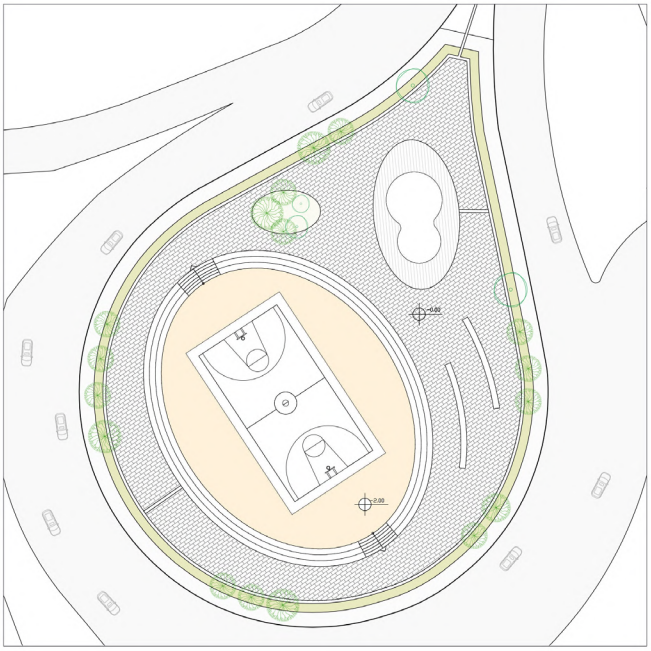


Proposal during extreme flooding period

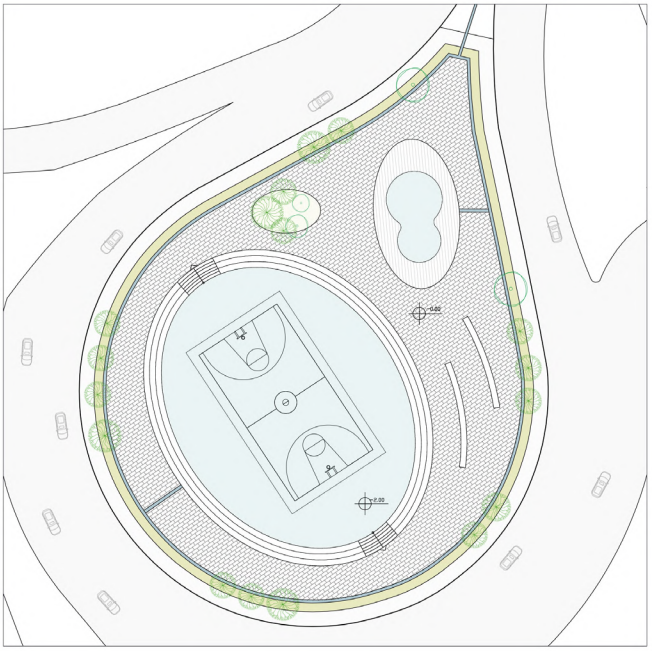
Figure 163 Source: AUTHOR

The water capacity of the intervention is quite significant since according to calculations it can both collect and store stormwater of about 24.000.000 litres during an extreme flood period.

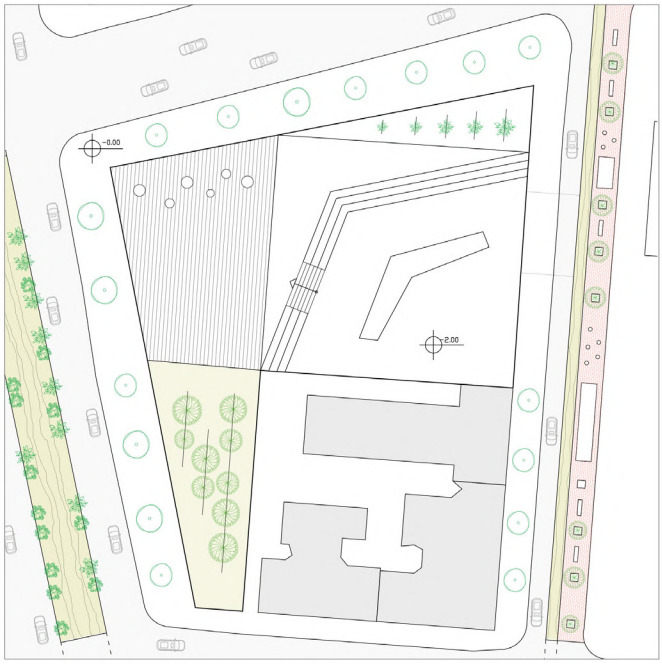
0 100 250 m



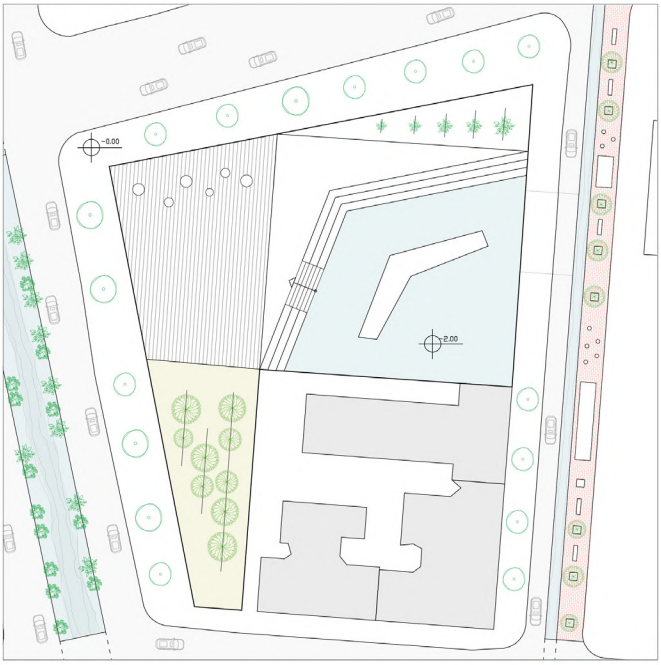
Basketball watersquare (dry period) Figure 164 Source: AUTHOR



Basketball watersquare (flood period) Figure 165 Source: AUTHOR



Skateboard watersquare (dry period) Figure 166 Source: AUTHOR



Skateboard watersquare (flood period) Figure 167 Source: AUTHOR

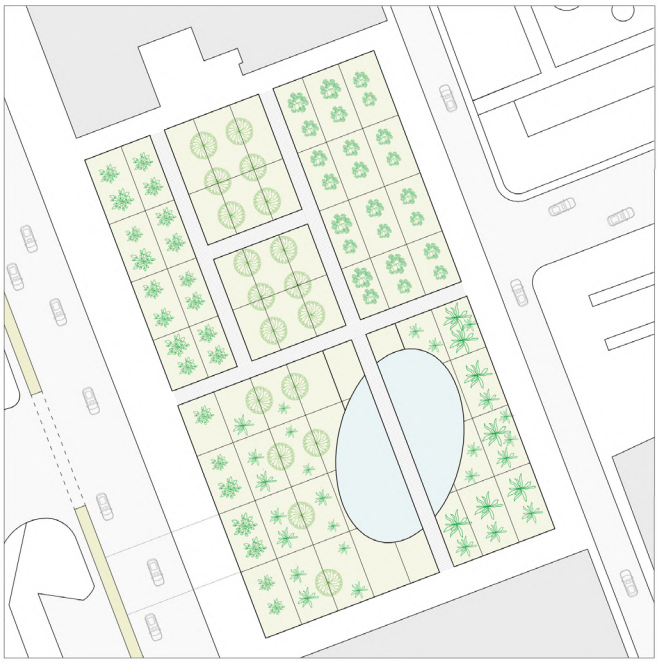
The selected public spaces for detailed design include the basketball watersquare, the skateboard watersquare, the agricultural field and the pocket park. The public spaces are inclusionary in order attract people from different cultural and economic backgrounds. These specific nodes will bolster the social interaction thus blurring the boundaries created by the social segregation.

The basketball watersquare is designed in an organic way with vegetation able to absorb the flood, permeable pavement and a gutter system able to transfer the stormwater from the flooded green spines to the basketball court in a lower level (figures 164 & 165).

The skateboard watersquare incorporated in an existing residential block includes a newly green public space, a sitting area and the skateboard court in a lower level which concentrate the water from the green -blue spines in the road (figures 166 & 167).

The agricultural field is designed as a promenade between a variety of crops cultivated by residents. The intervention includes a retention pond leading the water into the crops. People can meet together and grow their own food, thus contributing into a more self - sustainable economy (figure 168).

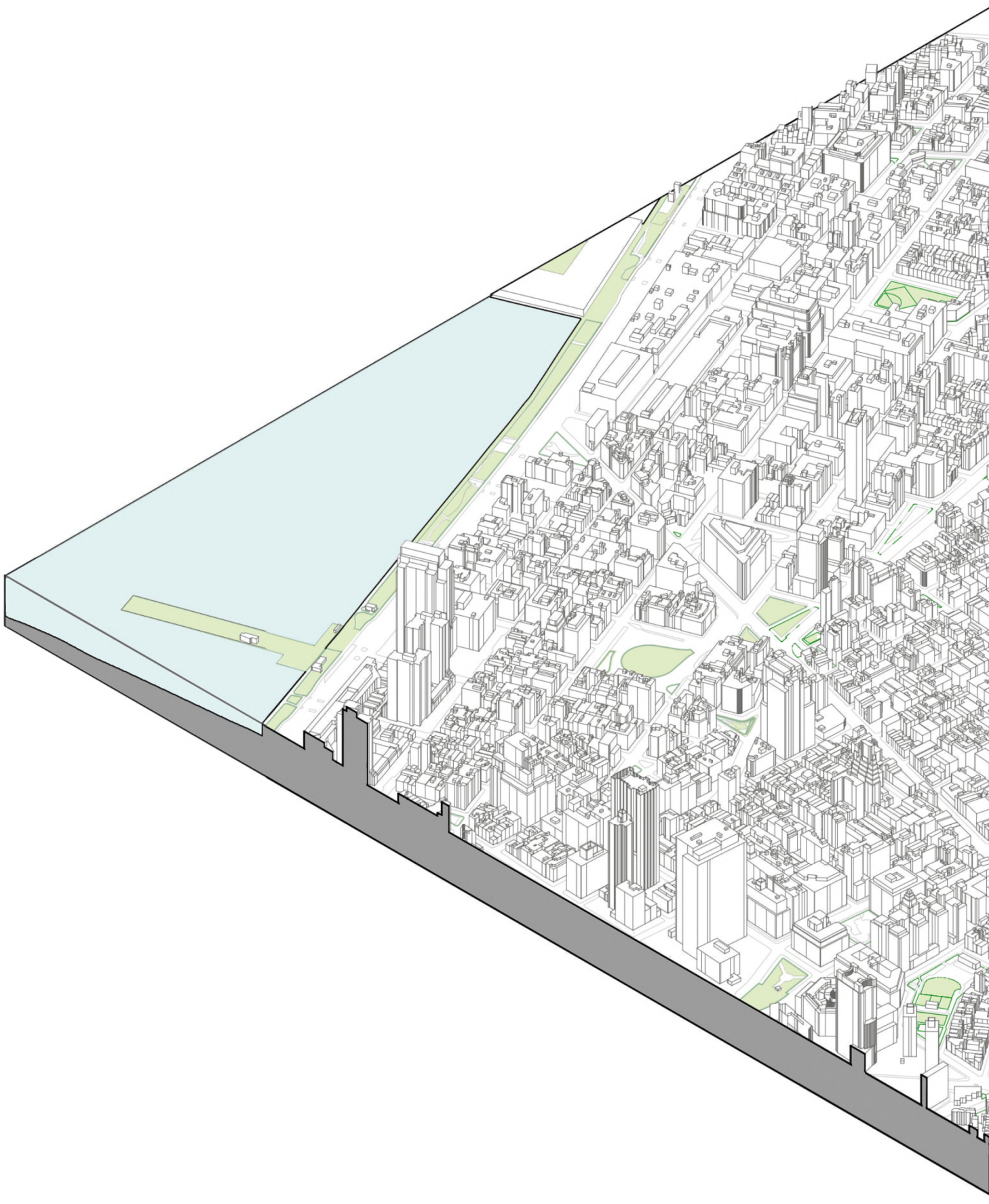
Last but not least, the repurposed parking lots are transformed into pocket parks including playgrounds, flood resilient vegetation and sitting areas in an aim to foster the human interaction (figure 169).



Agricultural Field Figure 168 Source: AUTHOR

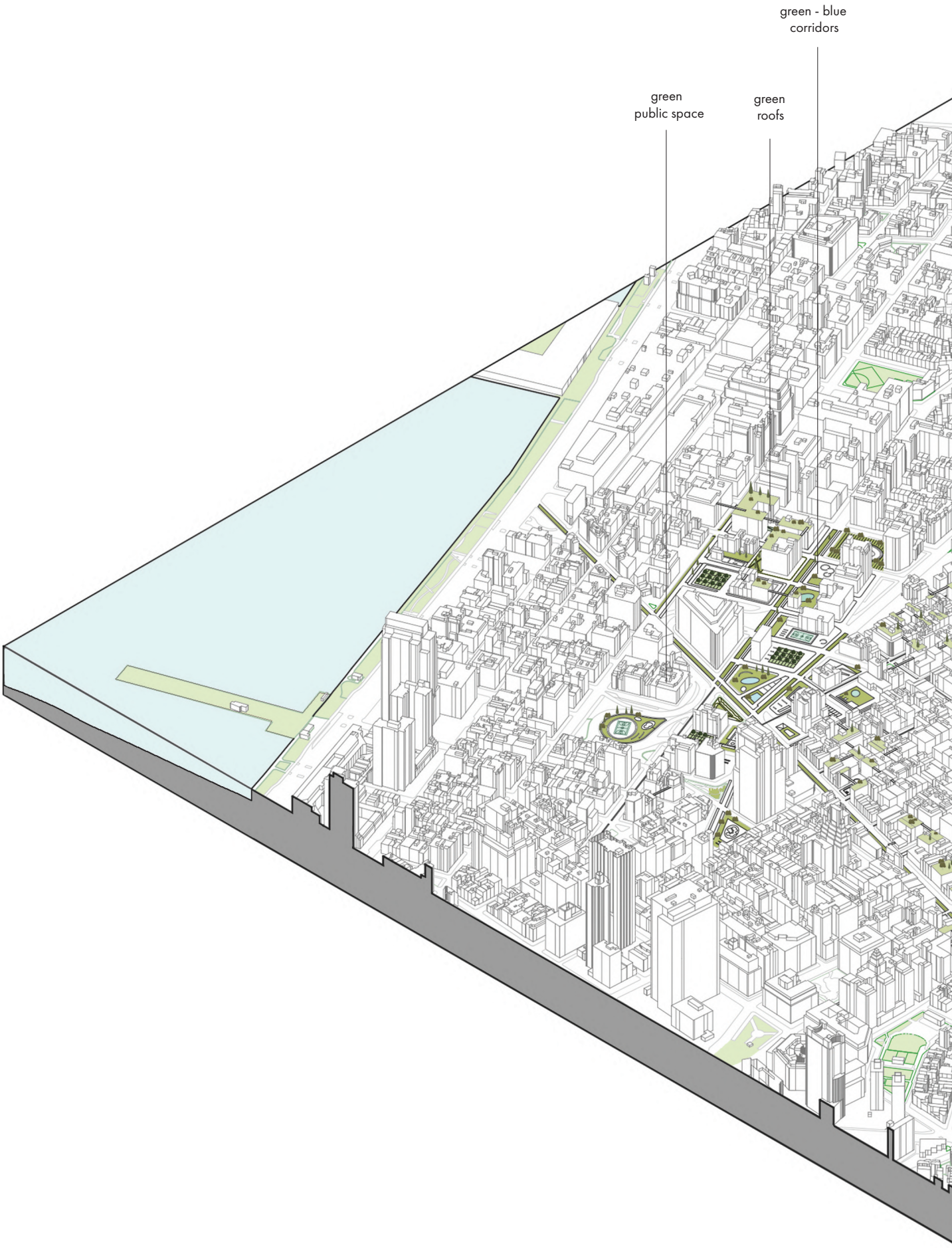
Pocket Park Figure 169 Source: AUTHOR

0 25 50 m

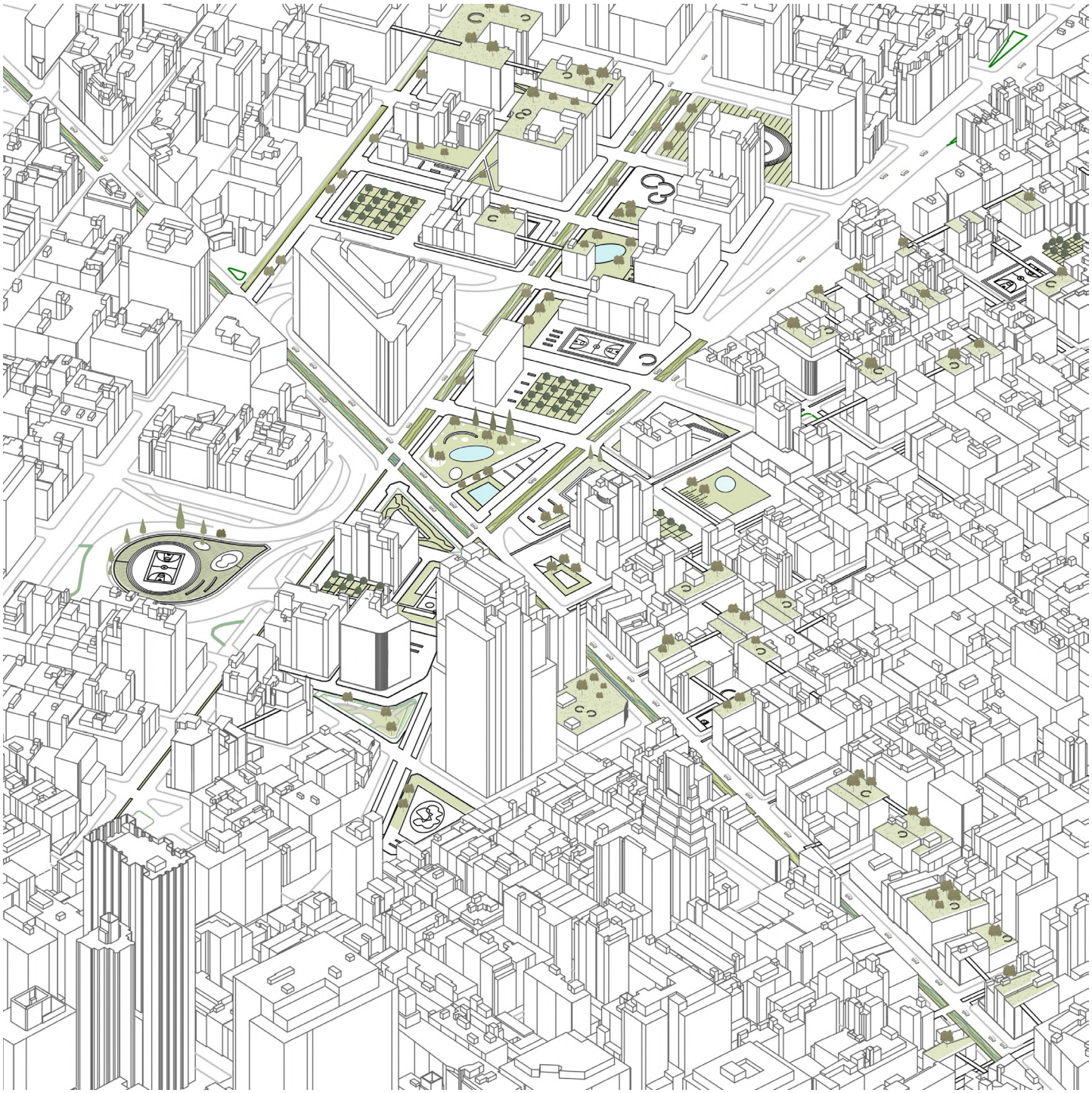


From the following axonometries it is clear that the existing situation of the area does not present enough green patches (figure 170), while the intervention provides a new binding matrix with the green - blue system serving as a central urban core in the wider urban context (figure 171).

Existing Situation Figure 170 Source: AUTHOR


green - blue
corridors
green
public space
green
roofs

Design Proposal Figure 171 Source: AUTHOR

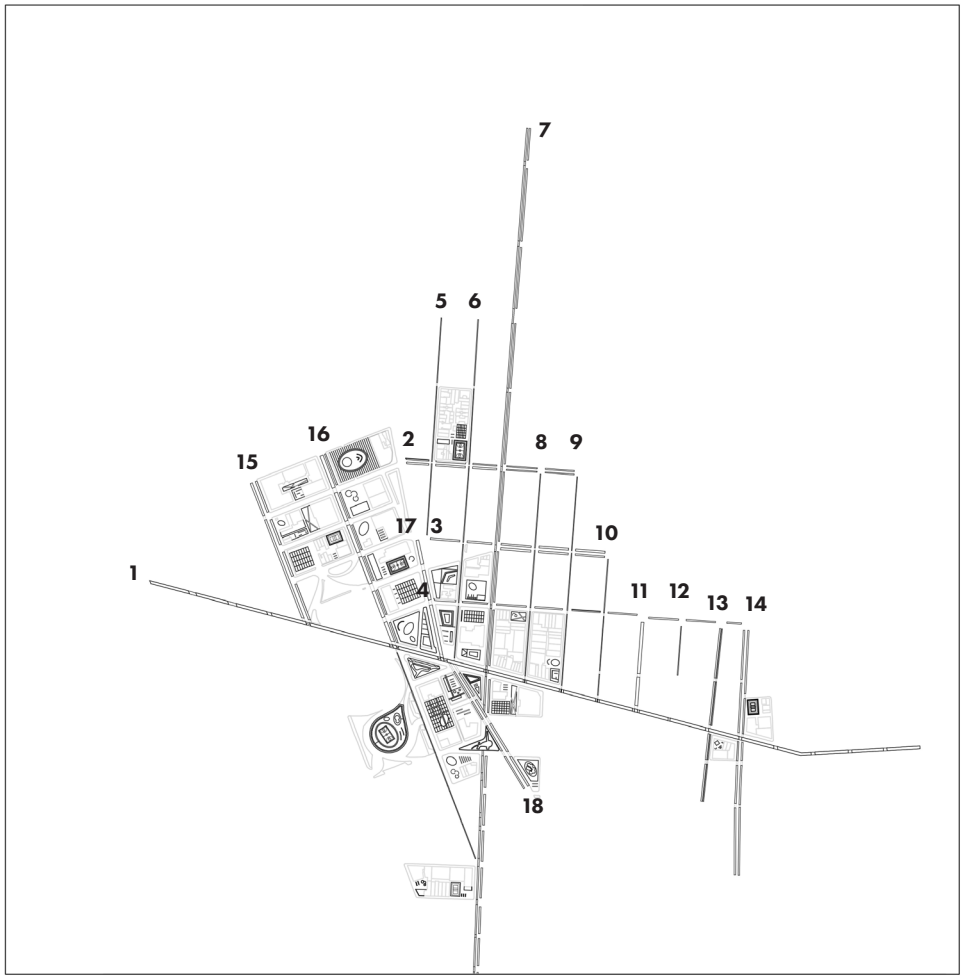


Axonometric Overview

Figure 172 Source: AUTHOR

Looking closer into the overall intervention, the new green - blue system on the ground and the activation of roofscape through green roofs in combination with public space will create a new dialogue between the city and its rudiments (figure 172). The grid is redefined through the incorporation of green linear parks in an aim to achieve the desired Flood Resilience through porosities and green inclusionary public spaces.

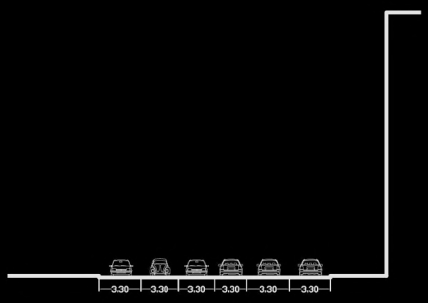
According to the sections per indicated road (figure 173), the profile of the streets will change through the greenification of the numerous existing car lanes (figures 174, 175, 176). Some other lanes will be repurposed as bicycle lanes while the narrow streets will have a small inclination on both sides in order to lead the water in the central green – blue canal. The boulevards such as the Canal Street will include a bigger central canal. Through the creation of blue spines during flood , the area will come closer to the forgotten Dutch past.



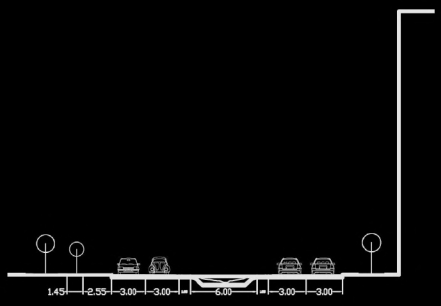
Green - blue network road indication

Figure 173 Source: AUTHOR

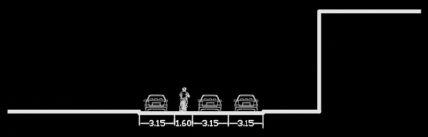
Street sections



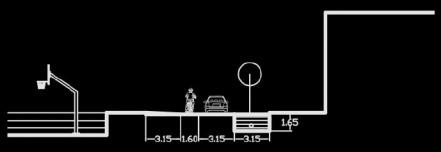
1 Existing Profile



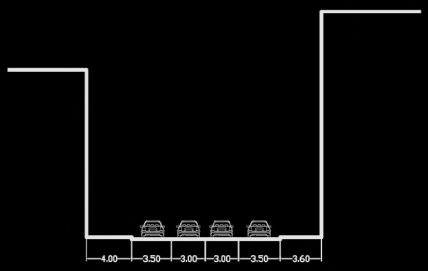
1 Proposed Profile



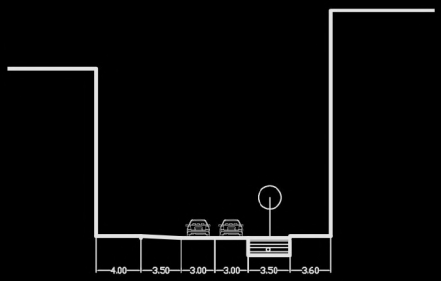
2 Existing Profile



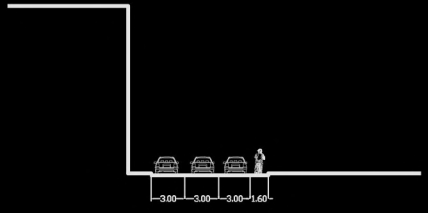
2 Proposed Profile



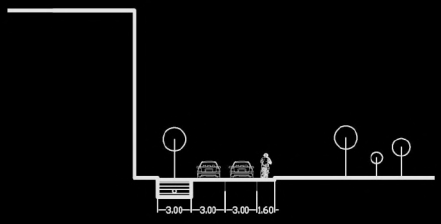
3 Existing Profile



3 Proposed Profile

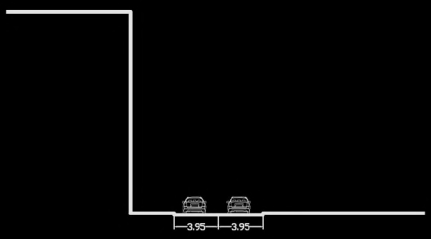


4 Existing Profile

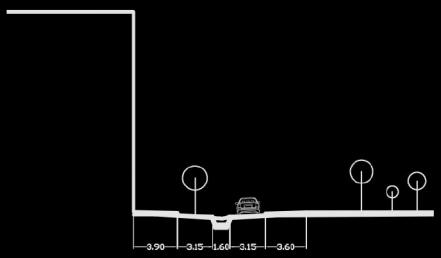


4 Proposed Profile

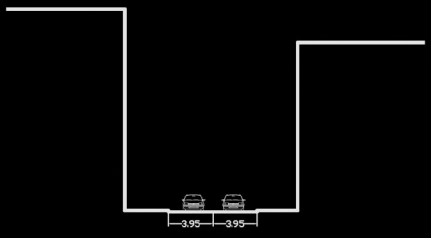
Figure 174 Source: AUTHOR



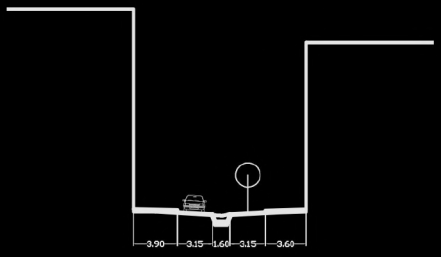
5 Existing Profile



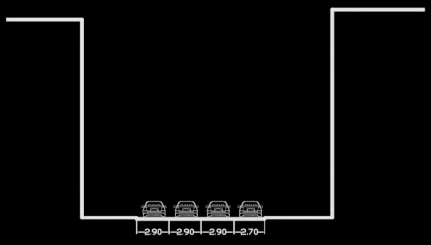
5 Proposed Profile



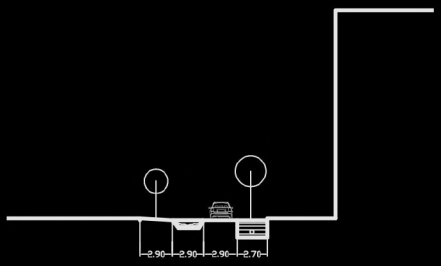
6 Existing Profile



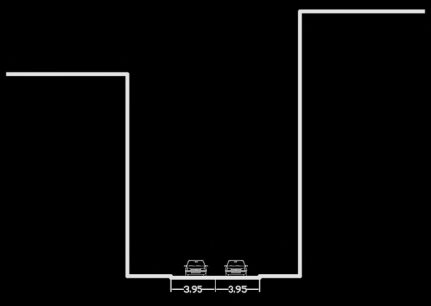
6 Proposed Profile



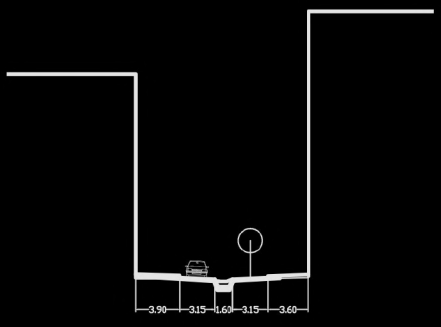
7 Existing Profile



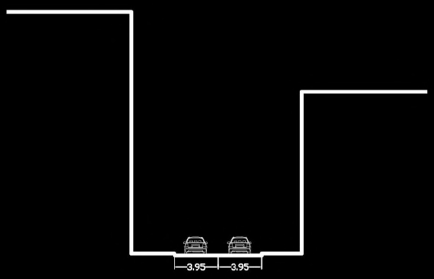
7 Proposed Profile



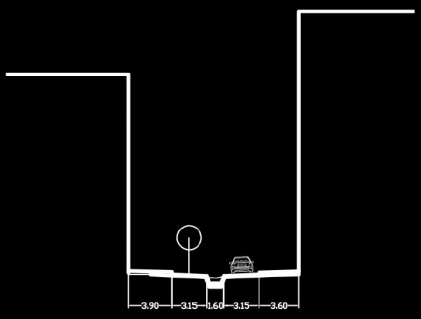
8 Existing Profile



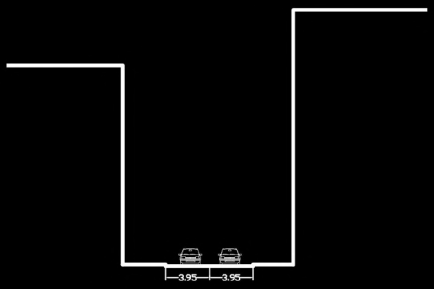
8 Proposed Profile



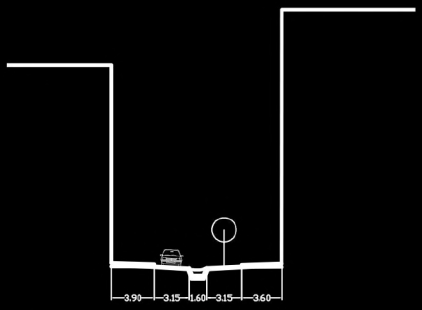
9 Existing Profile



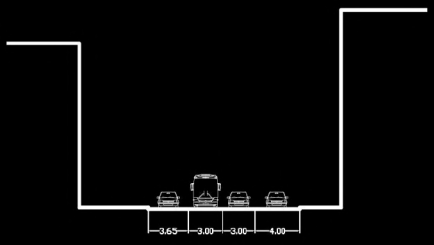
9 Proposed Profile



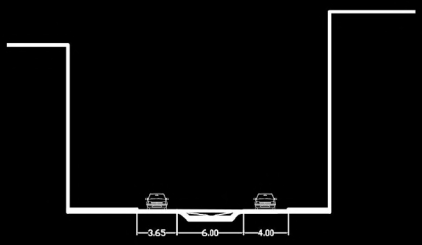
10 Existing Profile



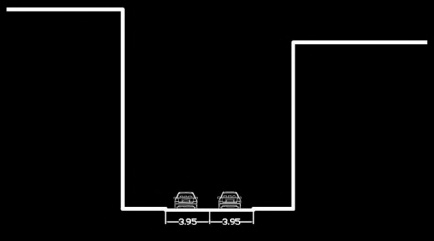
10 Proposed Profile



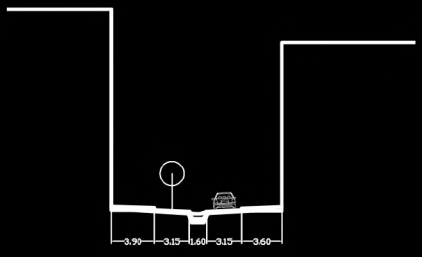
11 Existing Profile



11 Proposed Profile

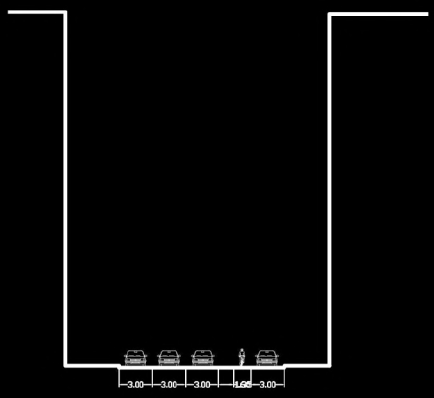


12 Existing Profile

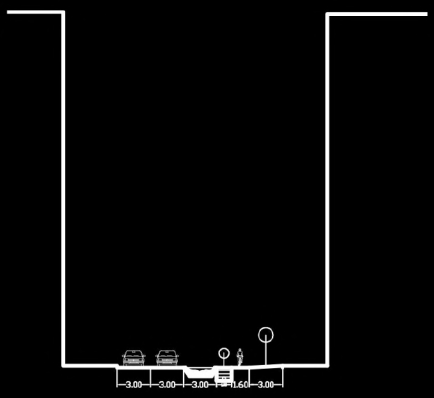


12 Proposed Profile

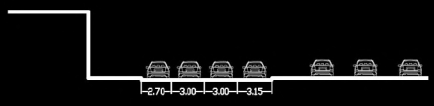
Figure 175 Source: AUTHOR



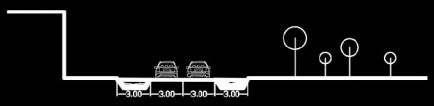
13 Existing Profile



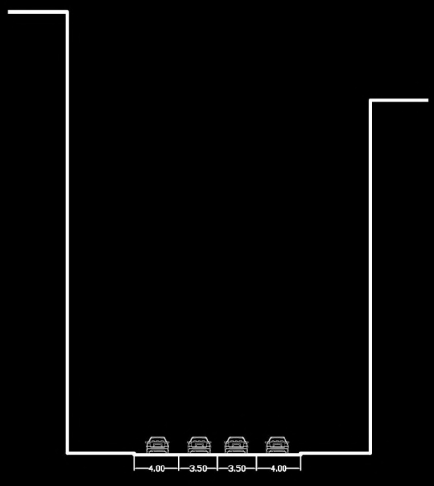
13 Proposed Profile



14 Existing Profile



14 Proposed Profile



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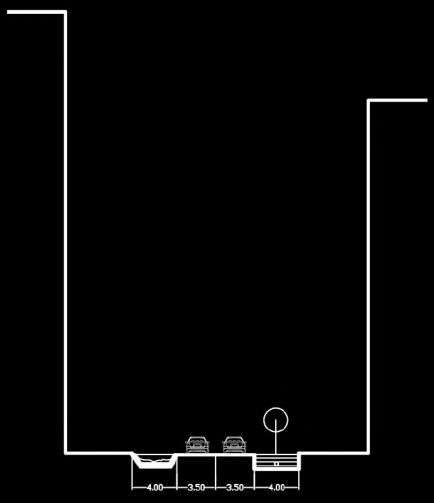

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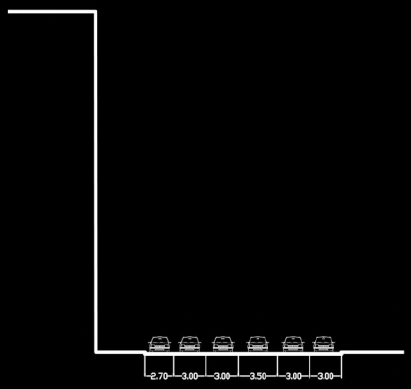
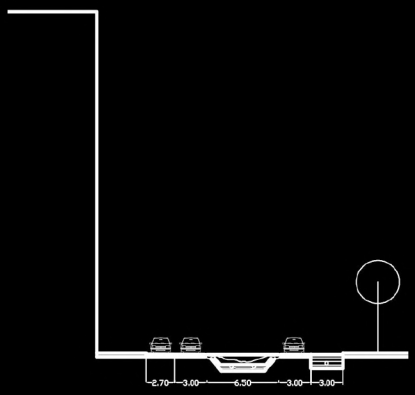
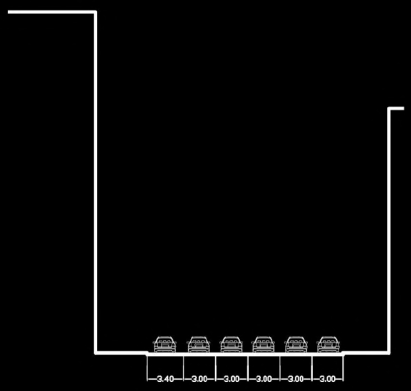


16 Existing Profile



16 Proposed Profile



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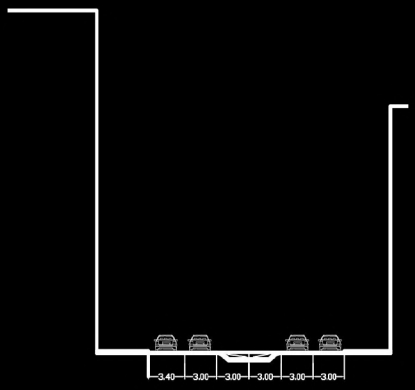

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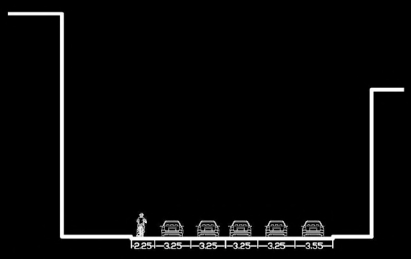

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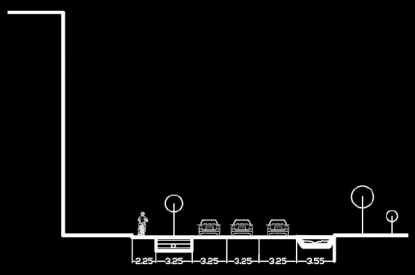


18 Proposed Profile

Figure 176 Source: AUTHOR

Wooster Street proposal (dry period)

Figure 177 Source: AUTHOR

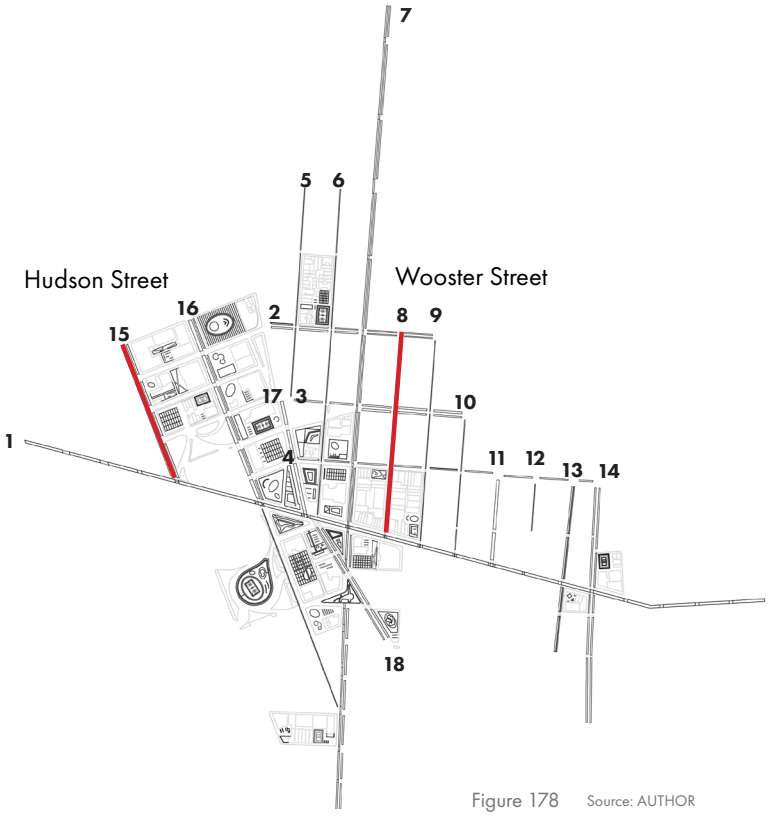


Figure 178 Source: AUTHOR

The following section illustrations indicate the incorporation of the green - blue network in the existing roads in dry, rainy and extreme flooding conditions. The first narrow road in Soho includes a central small canal with vegetated public space on one side (figures 177, 178, 179). Across a boulevard in Hudson square a green linear park occupies the central part in combination with green public space on one side (figures 181, 182, 183). The ground level of specific buildings is also repurposed including public space, while the existing inactive roofs become a green meeting node. The grid redefinition in combination with the green porosities aim towards the mitigation of Flood Vulnerability bringing people closer to nature.

Wooster Street proposal (rainy period)

Figure 179 Source: AUTHOR

Wooster Street proposal (extreme flood)

Figure 180 Source: AUTHOR


Hudson Street design proposal
(dry period)
3.00
3.00
pedestrian zone
urban activation- green public space
one way traffic - cycle / drive
green belt - inclus

Figure 181 Source: AUTHOR

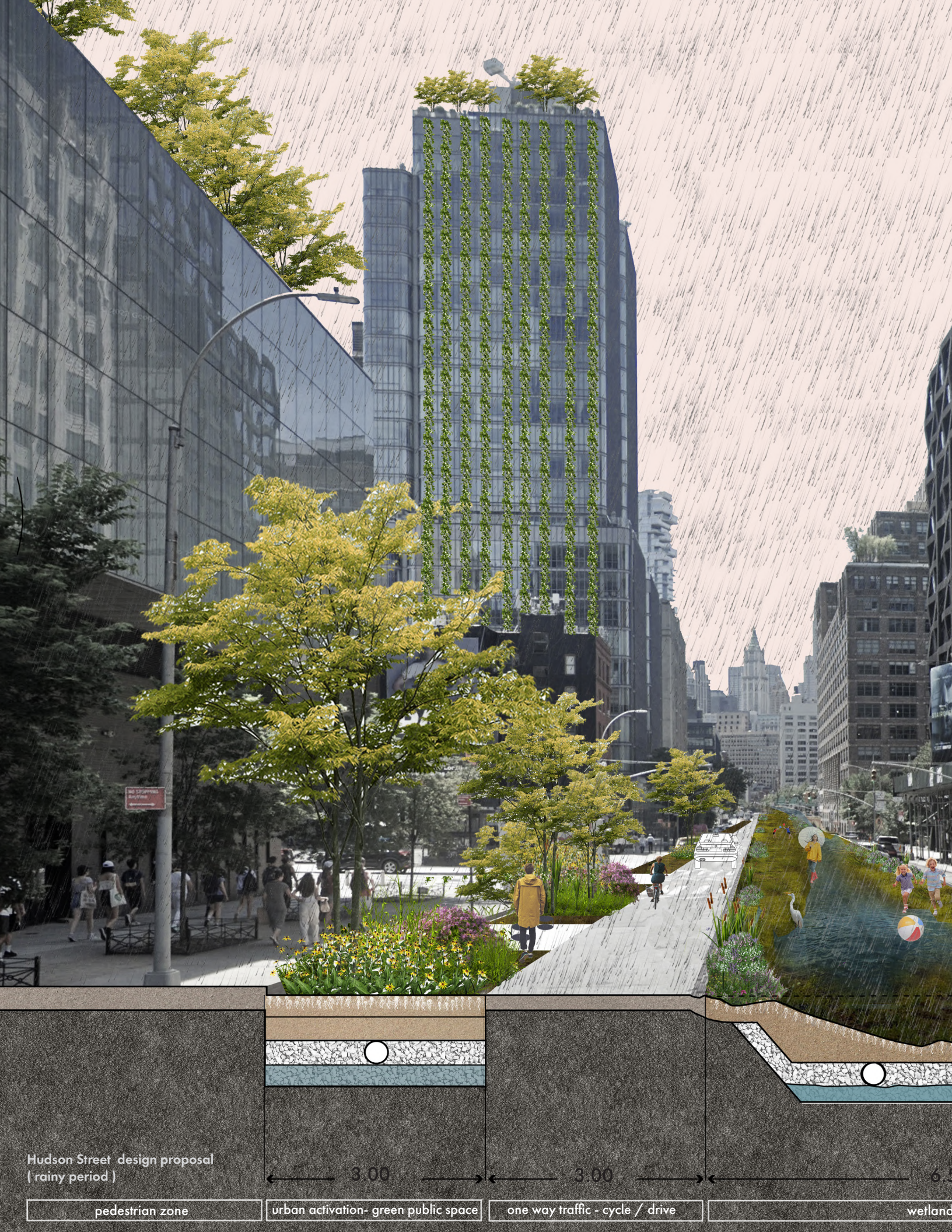
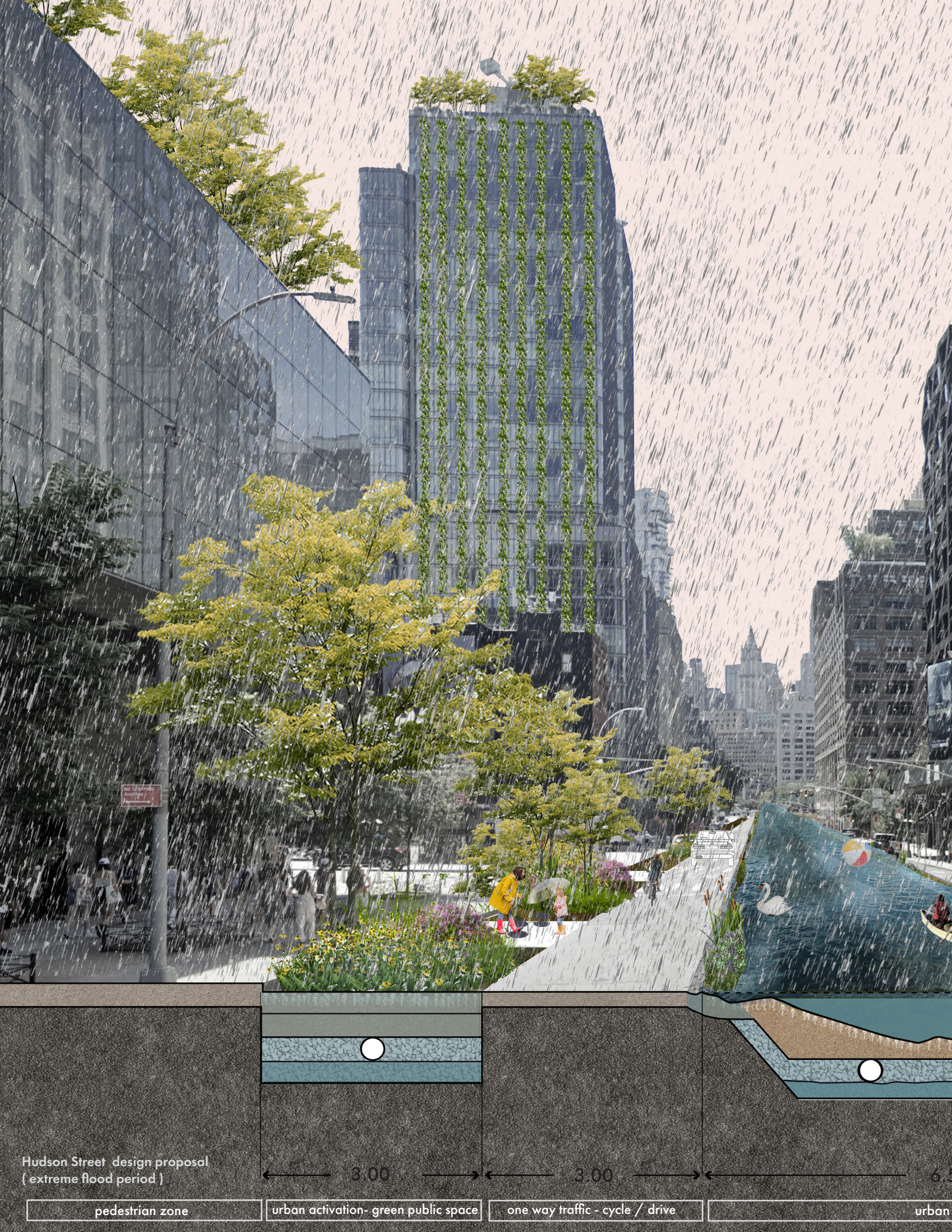

Hudson Street design proposal
(rainy period)
3.00
3.00
pedestrian zone
urban activation- green public space
one way traffic - cycle / drive
wetland

Figure: 182 Source: AUTHOR


Hudson Street design proposal
(extreme flood period)
3.00
3.00
pedestrian zone
urban activation- green public space
one way traffic - cycle / drive
urban

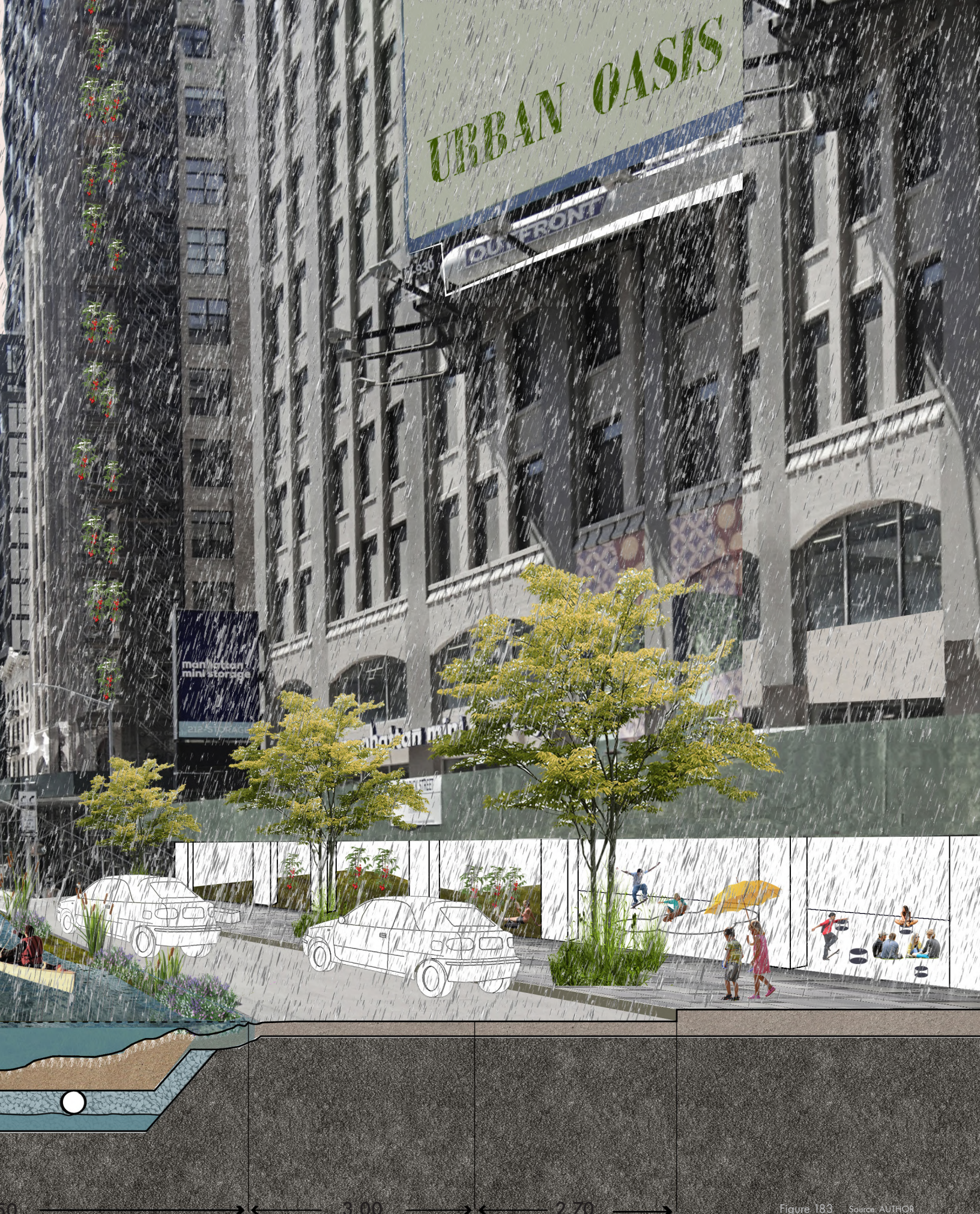


Figure 183 Source: AUTHOR

7 New Mannahatta 2100

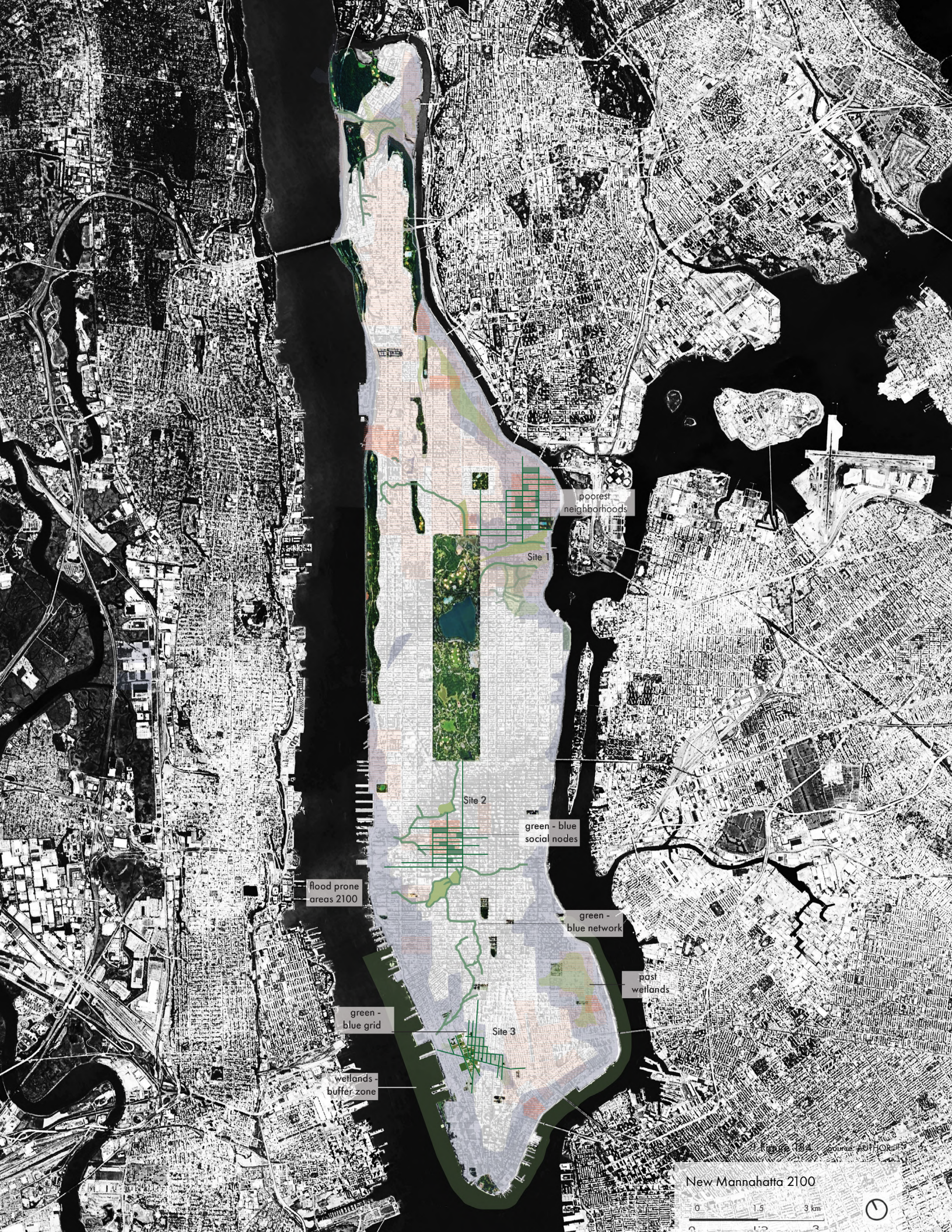
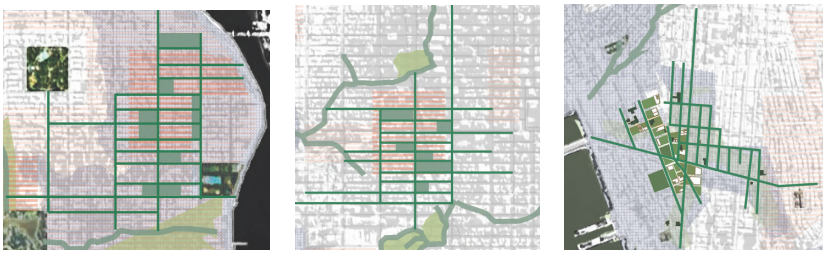


Figure 184 source: AUTHOR

NEW MANNAHATTA 2100

The selected site for detailed design in Lower Manhattan serves as a pilot for the strategic design of the other two sites that constitute the metropolitan vision (figure 185). The grid is re-interpreted through the incorporation of a green – blue system with the palimpsest landscape as the connective element starting from the upper to the lower part. The internal metropolitan core deals with the grid redefinition which in combination with the already proposed projects for the incorporation of a wetland buffer zone in the edge of the island, will act complementary towards the mitigation of Flood Vulnerability. The flood adaptive system indicates that the region needs to proceed into a more pioneering way of operations in order to achieve the desired Flood Resilience, Porosity and Social Inclusion.

Despite the criticism that the gridiron plan received, it seems that the grid can be re-interepreted in an aim to integrate important elements of the palimpsest landscape. The vision aims to foster the inherent intelligence of the grid tool through design patterns and natural elements as social incubators. The dense building environment of Manhattan can no longer include more building densities since there is a need for space for nature able to manage the excess of stormwater. All in all, the holistic green – blue approach towards the Flood Resilience, Porosity and Social Inclusion will shape the future of the *New Mannahatta.* (figure 184).



Site 1 Site 2 Site 3

Site strategic interventions

Figure 185 Source: AUTHOR

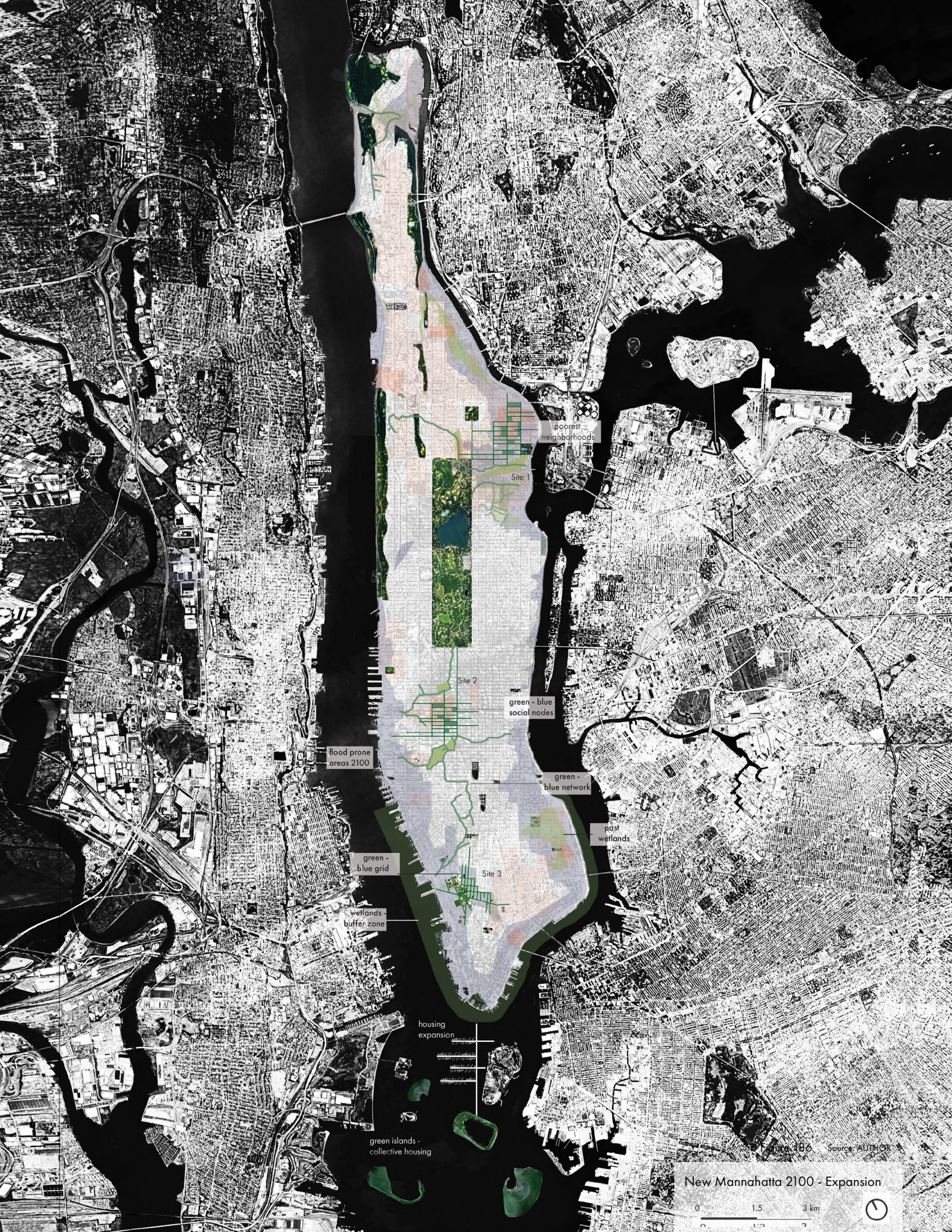
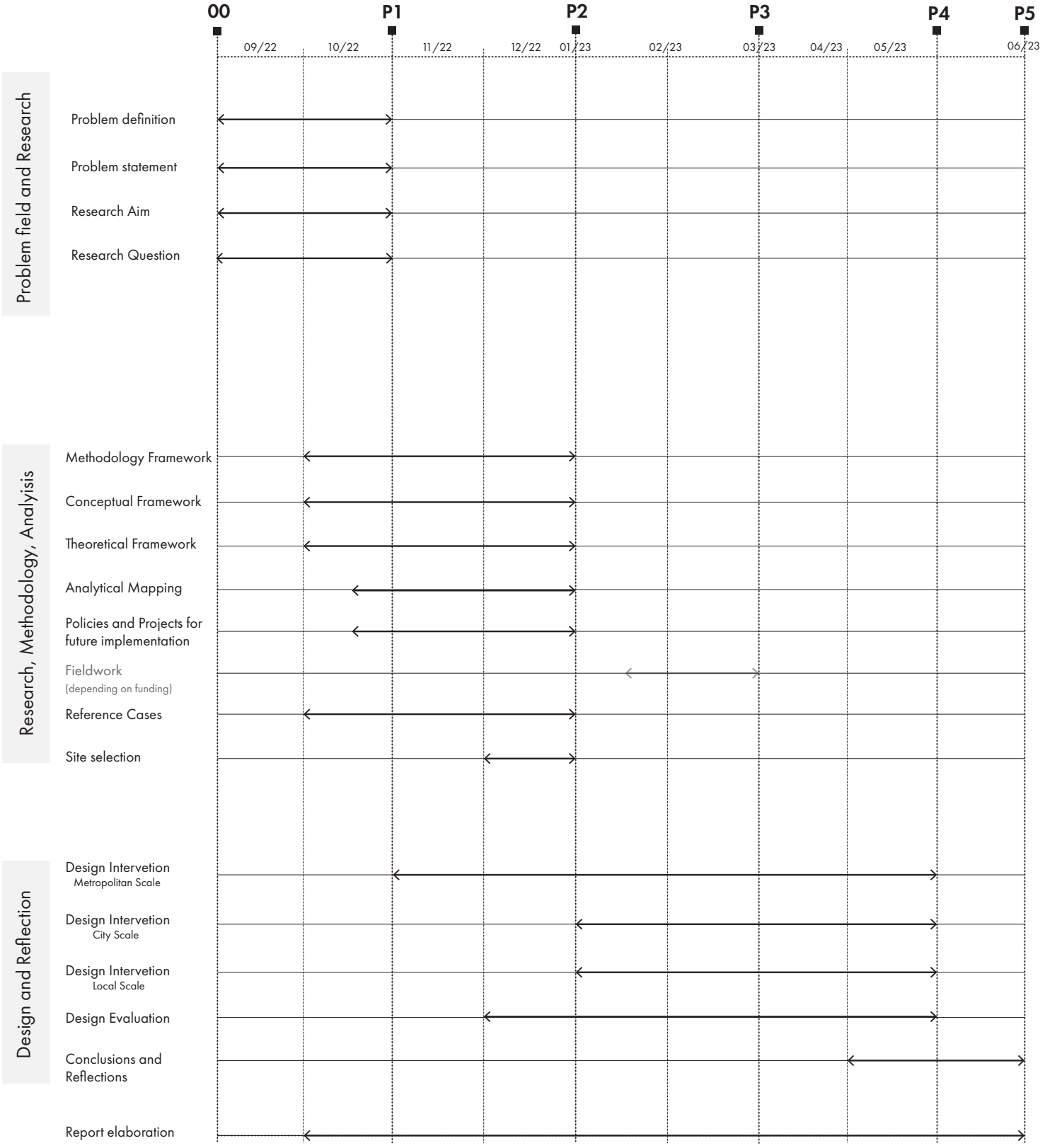


Figure 186 Source: AUTHOR

AFTER THE EDGE

The incorporation of the green – blue system in the urban core makes vital the need for spatial configuration. The compactness of the building environment in combination with the space for nature arises several questions for future housing densification strategies. The internal part of the island will be redefined through the natural systems, while new housing densities will apper after the edge of the island. The New Mannahatta will incorporate housing structures as an urban expansion in the sea. A combination of floating houses with green islands meant for collective housing will assist towards the impending housing shortage. Manhattan island will gradually become a green – blue megastructure, laying the foundations for the connection with the forgotten Dutch past aiming to Flood Resiliency, Porosity and Social Inclusion (figure 186).

8 Project Timeline



Project Timeline

Figure 187 Source: AUTHOR

The time planning of the thesis is an important element towards the graduation procedure. The related graph indicates the preparation material for all the phases until P5 (figure 198). The problem statement, research question and research aim were formulated until P1. The analysis, the research, the conceptual and theoretical framework, analytical mapping and site selection were prepared for P2. The next steps until P4 were devoted to the design implementation of the research question in metropolitan, city and local scale. In between P4 and P5 the last details were fixed until the last presentation.

9 Relevance & Ethical Considerations

Scientific Relevance

The graduation thesis explores mechanisms for mitigation of flood risk through the grid redefinition and its impact on social segregation and housing crisis in the dense building environment of Manhattan. Although there has been an extensive scientific research per challenge separately, the project aims to address for the first time the three challenges at once as a holistic approach setting the flood mitigation as a priority towards the flood resilience, porous city and social inclusion. The unraveling of palimpsest natural elements will assist in the grid re-interpretation.

More specifically, the projects aims to bring the natural elements in the urban core, thus contributing to the revival of the forgotten Dutch identity through building with nature operations as social and flood adaptive infrastructures.

Societal Relevance

The emergence for social inclusion and the porous city, constitute the main points for the societal relevance of the thesis. However, the social impact of flood risk would lead to the notion that the environmental factor is much related. Since the aim of the project is to create flood adaptive social infrastructures, it is important to note that the building environment, the social justice and the flood resilience are parts of societal relevance.

The housing densification strategies are heavily affected by the incorporation of green blue systems in the urban core. In this sense, there is a need for space for nature inside the grid. The new collective housing could be reinterpreted through floating houses in the sea and through the incorporation of housing units in new green islands. Moreover, the demand for more public space and the interaction between all economic classes through mixed use areas in the grid are crucial parts of the thesis. Overall, the grid becomes a social incubator in ain aim to achieve the Flood Resilience, Social Inclusion and the Porous City.

Bearing in mind that the urban projects are the products of politics of a topos, the thesis delves into the conversion of current capitalistic logic into a socialistic vision for the future of Manhattan.

Professional Relevance

As an architect and future urban designer, I investigate the power of architecture in the cohesion of the city. Climate change, the hectic pace of life and social inequalities dominate the world and they have contributed to the change of the urban environments and their rudiments. The possibility of developing new city patterns, the interpretation as well as the redefinition of the existing urban factors and the revitalization of decadent landscapes in the urban core all constitute the main research topics I am passionate about.

Through the cross – scalar redefinition of the grid pattern as a tool towards the Flood Resilience, Porous City and Social Inclusion in Manhattan, I am confident that I will evolve as a student and professional. This specific graduation thesis incorporates my entire concerns firstly as a person and then as an architect – urban designer trying not only to stay in the "fixed" form of things but leave the "flow" show the way of design.

Ethical Considerations

The project aims to contribute to both the the environmental resilience and social justice through the reinterpretation of urban patterns. The research of the author has been based on production of personal material, literature review and scientific research. Since, the access to the site was not possibe due to funding limitations, the author has used alternative methods for conducting fieldwork such as literature, VR lab and contact with local people for further englightment. The author ensures the proper citation of references and the aknowledgemnent of contributions.

10 Reflections

Palimpsest Landscape - Mannahatta

Figure 188

Source: history101.nyc
& edited by AUTHOR

New Mannahatta

Figure 189 Source: AUTHOR

The aim of the reflection is to understand whether the methodological approach for the project worked, to understand "how and why" and what was the outcome of the research.

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1. The relationship between research and design

- How did the research influence the design/recommendations and how did the design/recommendations influence the research?

- What is the value of working (approach, used methods, methodology)?

The project is driven by the idea of research by design and vice versa following a multiscalar approach starting from the metropolitan scale to the local scale. In order to answer the research question **" What is the interpretation of the grid in the face of exacerbated climate change in Manhattan in order to achieve a flood adaptive system of interventions?"** it was crucial for me to dive into literature and analytical mapping in order to understand the correlation of the challenges with the gridiron plan. The process was fruitful since the outcomes led to important conclusions about the influence of the grid on flood vulnerability. The grid structure seems significant for the spatial configuration of a city and despite the criticism that the gridiron plan of Manhattan received due to the distortion of the natural landscape, the design project proved that the grid can incorporate both natural elements and social incubator nodes.

The analysis starting from the metropolitan scale led to the selection of specific sites for closer investigation. The chosen site for detailed design was based on the restrictions posed by the historical value of the area, the differentiation from the typical grid structure, the flood vulnerability, the housing densities and the limited public spaces. The selected site serves as a design pilot for the other two sites and potentially for other parts of Manhattan metropolitan area. The creation of a design system through the repurpose of porosities and grid redefinition works in multiple scales of the project. The research of the graduation project was based on design and vice versa through the pattern investigation and the study of related design references.

The feedback gained from both my mentors was more than useful since they also motivated me to look back and investigate in a wide range of scales how and why I am proceeding to every research and design exploration. Birgit and Luca supported my concerns from the very beginning of our collaboration. Moreover, I am grateful for the fact that they insisted on narrowing down the project workload despite my tendency to solve the problem statement by testing the design in more than one selected sites.

All in all, the approach towards the answer of the Research Question in combination with the advice from my mentors, helped me recognize the importance of multiscalar analysis and design by research. The approach was vital in order to address the challenges in an aim to achieve the Flood Resilience, Porous City and Social Inclusion.

2. What is the relation between the graduation project topic, the Urbanism master track and the MCs AUBS program?

Manhattan constitutes a complex urban environment with multiple drivers of change. My focus on mitigation of flood risk and its impact on Social Inclusion and housing densification strategies has been approached across scales with specific focus on Design on local level through the redefinition of the grid in the framework of creating a pattern language.

The cross-scalar approach of the studio starting from the regional scale and ending at the neighborhood scale has been a fascinating pro-cedure for me. The objective of the future public space, the redefinition of the urban landscape in the framework of growing porosity and plurality constituted a challenging voyage for me to explore through my thesis.

Bearing I mind that through the thesis I am dealing with multiple scales of intervention, I think that it has close relation to most of the tracks in the master's program. The local scale has to do with Architecture and built environment through the design patterns. The Landscape track is much related since I am dealing with solutions towards flood resilience using landscape elements. Building technology is probably related since the incorporation of green – blue spines in the urban core involved a more detailed study of the street profile. Moreover, taking into account that the MBA track has to do with management, this sector has a close relationship with the graduation project considering the close supervision of the interventions in the public realm.

Last but not least, the topic incorporates the principles of Urbanism aiming to benefit both the society and the environment.

3. Does the grid foster the desired Flood Resilience, Porosity and Social Inclusion?

Despite the criticism that the grid plan received, the project proves that the grid application as a tool of organization in the urban context when it is properly designed, can be more than beneficial towards the Flood Resilience, Porosity and Social Inclusion. The existing grid structure in Manhattan includes only a road system mainly for car use. The redefinition of the grid in the project trough the incorporation of green – blue corridors that function under a system according to stormwater management can benefit the metropolitan area both socially and environmentally. The social incubator nodes including a network of public spaces connecting with the new spines, indicate that the porosities of the existing blocks in the grid can be repurposed.

4. What is the value of transferability according to the project results?

Part of the research towards the possible design applications was devoted to the investigation of reference projects across the globe dealing with the challenges of the graduation topic. The grid redefinition in Manhattan by the incorporation of green blue spines like in the case of Cloudburst formula in Copenhagen indicates that the same principle could be adapted to related urban environments with flood vulnerability. The watersquares designed in the selected site could also be applied to other urban contexts like there are already in Rotterdam, the Netherlands.
The most important part of the project is that every design solution belongs to a system in order to achieve the Flood Resilience, Porosity and Social Inclusion. The holistic approach is the unique element of the project, a strategy that can also be applied to many other cities in the world that deal with the same challenges.

5. What conditions are necessary for the implementation of the project? (legally, financially, politically, societal)?

Legal conditions

The application of such a project requires the incorporation of a green – blue network into the grid road system and thus the limitation of car use in Manhattan. For this purpose, the legislation for road infrastructure needs to integrate design principles for the new system in an aim to assist towards the flood adaptive interventions.

Financial conditions

The integration of a holistic green – blue system into the urban core through the grid redefinition and block repurpose requires the alteration of the street profile, the creation of pocket parks in the existing parking spaces, the incorporation of green – blue public spaces, the demolition of selected buildings and the roofscape activation. The implementation of such a project would demand a significant amount of funding. However, the advantages offered by the high concentration of people and the overall development of the site as a node able to manage the excess of water caused by flood would benefit the economic growth of the area. It is believed that the potential disasters due to flood will be mitigated, while the attraction of diverse economic and cultural backgrounds will pay back the money used for the initial economic investment.

Political conditions

The project aims to foster the social inclusion through the interaction between all economic classes and ethnicities. In terms of politics, the most important condition for the implementation is the reverse of current capitalistic logic into a more socialistic system in Manhattan. Moreover, the integration of natural systems and the limitation of car use require the respect towards nature - environment, an action that it does not favor consumerism which is inextricably related to capitalism.

Societal conditions

The implementation of the project aims to bolster the social inclusion. In order to achieve this, the social justice is fundamental. The lack of social mix and diversity in Manhattan has resulted in social inequalities leading to segregation. In this sense, the social cohesion in terms of integration, accesss to opportunities and participation in urban life is crucial for the livability and diverse nature of the metropolitan area.

6. What are the limits of such a project and what is the impact on the local communities?

The integration of a green – blue system into the urban core creates certain limitations. More specifically, the incorporation of green corridors in the roads and the repurpose of the existing parking spaces as pocket parks pose restrictions on the currently extensive car use.

The impact towards the flood resiliency is complementary since most of the projects in the area focus on the mitigation of flood vulnerability through the design of the island's edge. Taking into account the capacity to of the intervention to store significant amount of water during extreme rainfall events, it is clear that the impact of the project is of valuable assistance of the metropolitan area.

The benefits of the project in the local communities are quite significant. As previously noted, there is a lack of social mix with many distinctive neighborhoods in the metropolitan area. The design of a holistic system with green and blue public spaces aims to foster the inclusivity and the meaningful interaction between all economic classes and ethnicities. The limitation of car use will assist towards the resiliency of the communities, assuring safety and well - being. The system will serve as a node able to attract more and more people, thus contributing to the local economy.

The green and blue spaces will become a new social infrastructure that aims to bring people closer to nature and the forgotten Dutch palimpsest landscape.

7. What are the challenges the grid brings and what are its advantages?

- What is the meaning of the continuity of the street-network and the grid-cells/blocks?
- In what way the new lens of the grid differs from the original lens?

Manhattan grid has received both positive and negative criticism. The application of the gridiron plan assisted in the spatial organizational logic of the island in an aim to foster the fast building development. However, the grid distorted in a great extent the natural landscape of the region forming a compact building environment.

Taking into account the need for Flood Resiliency, Social Inclusion and Porosity the grid presents valuable opportunities in terms of intensification – densification as well as redefinition. The incorporation of a continuous green – blue system that can expand in a form of a green megastructure in the metropolitan area aims to assist towards the mitigation of flood vulnerability and bring people closer to nature. The grid is redefined through the incorporation of green – blue linear parks while the porosities inside the blocks are intensified in an aim to formulate inclusive public spaces. The flood resiliency of the grid affects the housing densification strategies since there is impending housing shortage. The incorporation of the green blue system in the already dense building environment of Manhattan, poses limitations on new housing densities inside the urban core. The internal part of the island will partially become a green – blue matrix while new housing densities will appear in the sea in the form of floating houses and in green islands as an urban expansion.

The holistic design approach of the street network in combination with the grid blocks as a continuous system is vital for the flood resiliency. The excess of rain water will run into a system forming canals and watersquares while the green network is beneficial for the local communities and the metropolitan area in terms of communal interaction and environmental resilience. What is important to keep from the project is that designing in systems through multi-scalar strategies assists towards the mitigation of complex challenges.

All in all, the project aims to offer a new lens of the grid system. The original grid constitutes a concrete road network with limited and disconnected green public space leading to a compact building environment. The grid system does not incorporate the water element as well. The new lens of the grid aims to integrate green and blue structures as well as inclusive public spaces in a holistic design system that contributes to Flood Resiliency, Social Inclusion and Porosity.

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APPENDIX

HOUSING PLAN

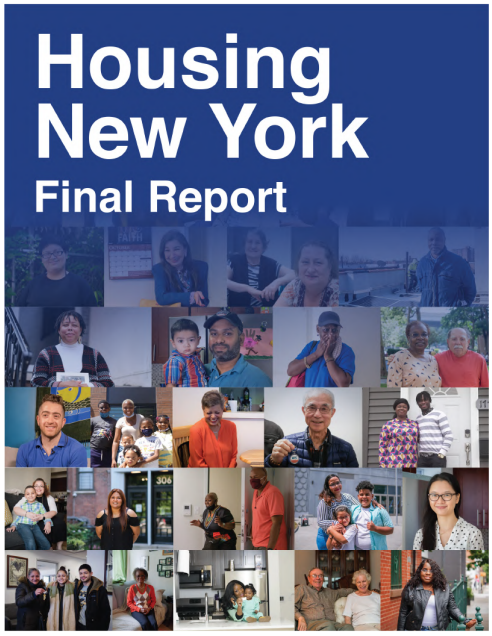


Figure 190

Source: NYC.gov

Figure 191

Source: NYC.gov

Housing Initiatives:

• **Housing +**:Many affordable developments constructed a century ago were built as islands in a sea of unused parking lots.

• **Neighborhood construction program**(NCP): Use of smaller vacant and underused parcels of land for affordable housing.The Initiative started in 2015 and it was approved in 2020 for Central Harlem.

• **Modular Construction:** In 2017, HPD piloted modular construction through the Build It Back program, financing the construction of nearly 100 single-family modular homes, and achieving cost savings of roughly 25% per singlefamily home as compared to conventional construction.

• **Big Ideas for Small Lots NYC:**
The initiative of utilizing vacant lots of land for affordaable housing resulted in some remainingoddly shaped small plots. In search of innovative housing solutions for these lots, HPD launched a design competition with American Institute of Architects (AIANY) in 2019.

• **Affordable Neighborhood cooperative program:**
The Affordable Neighborhood Cooperative Program (ANCP) was created in 2012 to select qualified developers to rehabilitate the remaining City-owned TIL properties in order to create affordable cooperatives for low and moderate-income households.

• **Share NYC:**Shared housing as a solution for one to two people housegholds looking for affordable housing options in New York City. The initiative startedin 2018

Policies for Equitable neighborhood growth

• Zoning for quality and affordability (ZQA)
ZQA updated the zoning code to allow higher-quality buildings, better ground floor retail, community facility spaces and affrdable housing.

• Mandatory Inclusionary Housing (MIH)
Mandatory Inclusionary Housing (MIH) program in the nation to ensure that permanently affordable apartments are included in new development in areas zoned for growth.

• Voluntary Inclusionary Housing Program (VIH):
A market-based incentive program designed to encourage developers in neighborhoods already zoned for high density to create permanently affordable homes.

Spearheaded Neigborhood Plans and Rezonings

The City initiated community planning processes in neighborhoods where land use changes and improvements to infrastructure and services could result in new housing and amenities. The City has completed 11 comprehensive neighborhood plans, eight of which resulted in rezonings that create the capacity for approximately 34,000 homes, of which roughly 9,800 would be permanently affordable through MIH.

Among them is
- The East Harlem Neighbirhood Plan
- Soho /Noho Neighborhood Plan

Remediating Browfields and Affordable Housing Devoplement in Hamilton Hills.

Figure 192

Source: NYC.gov

Dawson Plaza, Affordable complex with 136 units in Harlem in a former underused area.

Figure 193

Source: NYC.gov

Hotel Reuse and Housing Development in Brooklyn

Figure 194

Source: NYC.gov

Redevelopment and Mixed Use Housing Complex in Bronx

Figure 196

Source: NYC.gov

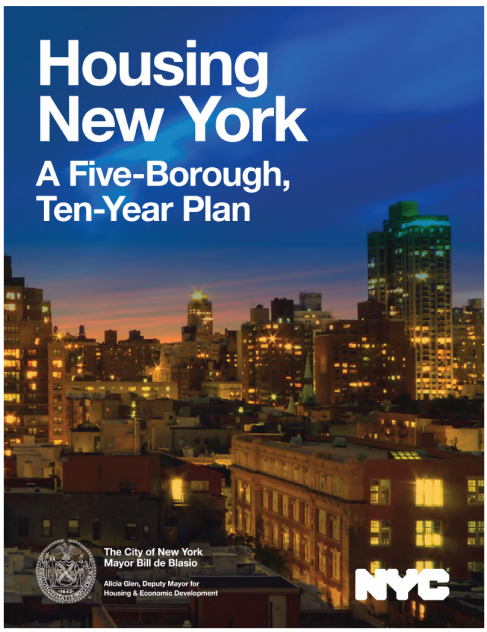


Figure 195

Source: NYC.gov

Aim:

- Fostering diverse, livable neighborhoods
- Preserving the affordability and quality of the existing housing stock
- Building new affordable housing for all New Yorkers
- Promoting homeless, senior, supportive and accessible housing
- Refining City financing tools and expanding funding sources for affordable housing

A new expansion

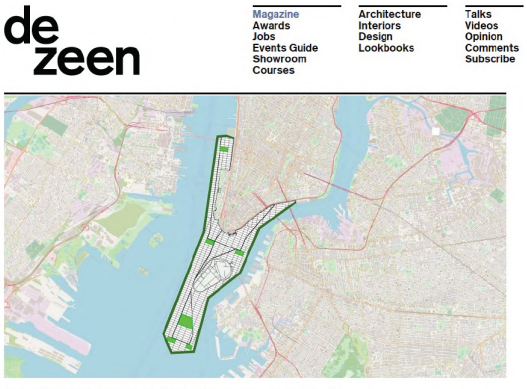


Figure 197

Source: dezeen.com

SOCIAL INCLUSION PLAN

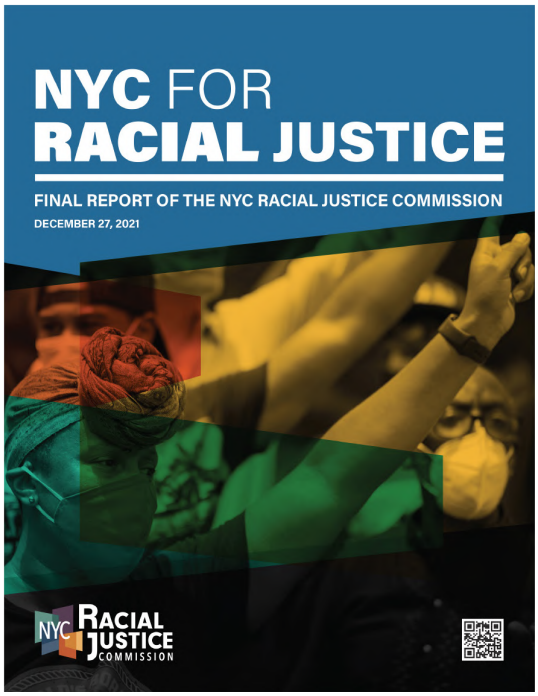


Figure 198 Source: racialjustice.cityofnewyork.us

In March 2021, Mayor de Blasio announced the formation of the Racial Justice Commission and appointed 11 Commissioners, to focus on racial justice and reconciliation.

Aim

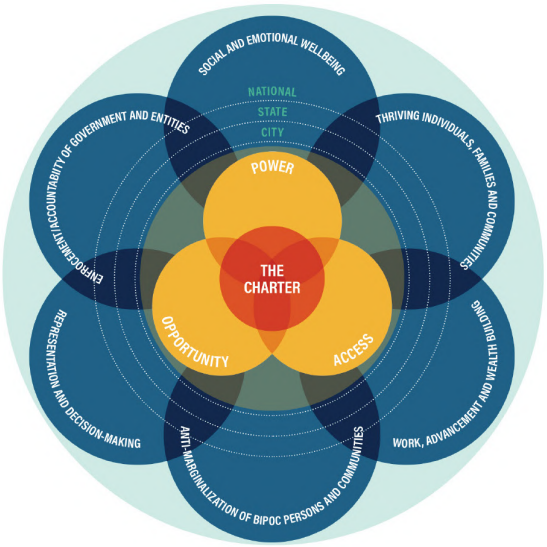
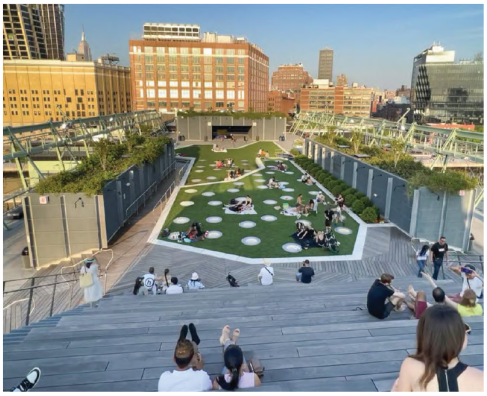


Figure 199 Source: racialjustice.cityofnewyork.us

Public Space as a form of social Interaction

High Line Park Figure 200

Source: thehighline.org



Pier 27, Rooftop Park, Chelsea, Manhattan

Figure201

Source: triptins.com

Little Island, Manhattan Figure 202

Source: gonomad.com

Superblocking for Social cohesion

Aerial View of Housing Superblocks on the Lower East Side, April 30, 1952

Figure 203 Source: thegreatestgrid.mcny.org and edited by AUTHOR

Efforts to improve tenement building standards failed to improve what was already built, and in the 20th century, reformers turned to a new strategy: building demolition, site clearance, block aggregation, and new housing solutions on superblocks. The superblock carried a 20th-century social reform agenda.

The area along the East River was dramatically altered by superblocking from 42nd Street to the Williamsburg Bridge. This aerial view from 1952 shows, from north to south, the United Nations building under construction; two middle-class housing projects, Peter Cooper Village and Stuyvesant Town; and three public housing projects: Jacob Riis, Lillian Wald, and the Baruch Houses, for which clearance had just begun on the area directly north of the

Figure 204 Source: Extracted from Google Earth & edited by Author

FLOOD RESILIENCE PLAN

Lower Manhattan Coastal Resiliency (LMCR), "Rebuild by Design"

The Big U is a project to protect a 16-kilometer coastline stretching from West 57th Street to The Battery at the southern tip of Manhattan, and from there up to East 42nd. The public initiative aims to mitigate the structural and environmental vulnerabilities that Hurricane Sandy exposed and develop flood resilient solutions.

Figure 205 Source: rebuildbydesign.org

Figure 206 Source: rebuildbydesign.org

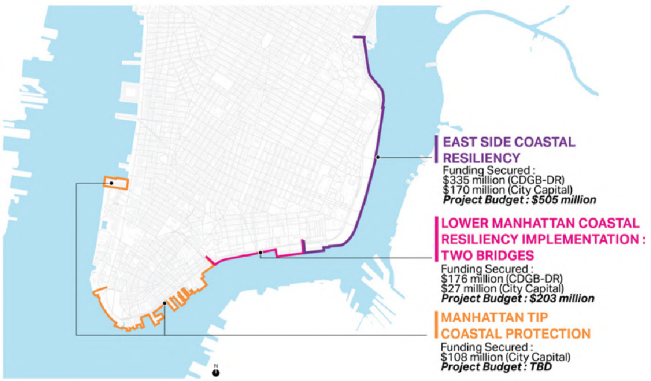


Figure 207 Source: rebuildbydesign.org

PATTERNS

PATTERNS TOWARDS THE MITIGATON OF
FLOOD RISK

PATTERNS TOWARDS THE MITIGATON OF
HOUSING CRISIS

PATTERNS TOWARDS THE MITIGATON OF
SOCIAL SEGGREGATION

Fn

Hypothesis

Theoretical back up

Practical Implication

Reference Image

Relationship with other patterns

Hn

Hypothesis

Theoretical back up

Practical Implication

Reference Image

Relationship with other patterns

Sn

Hypothesis

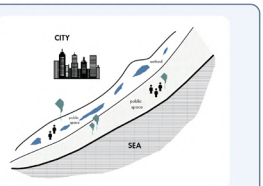
Theoretical back up

Practical Implication

Reference Image

Relationship with other patterns

F1 WETLAND AS A SOCIAL INFRASTRUCTURE



Hypothesis

Constructed wetlands form a social infrastructure which mitigates the flood risk in Manhattan region.

Theoretical back up

Constructed wetland parks have a spread of environmental and social benefits. (M. Barmelgy, M. Elsaman, T.Refaat, A.Haron, El. Maalt, 2021). The formation of wetlands can support various public activities in order to create an urbanized landscape friendly for people and at the same time preventing the flood prone areas from threatening sea level rise.

Practical Implication

Manhattan in NYC suffers from flood risk. It is estimated that in 2100 the sea level will rise almost 1 meter. Wetland formation on the the edges of Manhattan island could act as a buffer zone able to accomodate public facilities, thus reinforcing human interaction and flood adoptation.

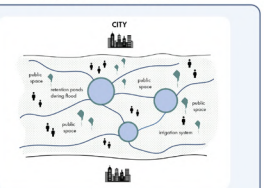
Reference Image

Weiliu Wetland Park, Xianyang, China

Relationship with other patterns: F2, F3, F5, H1, H5, S4

Reference paper: M. Barmelgy, M. Elsaman, T.Refaat, A.Haron, El. Maalt (2021).
Constructed wetland Park as Happy Public Space to Achieve quality of life:Case study of 10 Ramadan City.

F2 THE WATER AS A MEETING POINT



Hypothesis

Water storage in the form of retention ponds trigger public space development in the flood prone areas of Manhattan.

Theoretical back up

Bearing in mind that Manhattan will experience significant storm and flood events in the future, there is a need for adaptation with water sensitive design. The retention area can be utilized as water catchment area as well as a place for supporting the residents' social activity. (F. Anwar, F. Amalia, 2017). The retention ponds in combination with irrigation systems can offer a great opportunity for a public space network across Manhattan region.

Practical Implication

Manhattan lacks in interaction between people and the water element. Given the flood risk of the future, a system of retention ponds combined with public space could be the answer towards the integration of water into public space and the formation of a new system of social centralities. The example of Copenhagen is an important reference towards the integration of water in social activities.

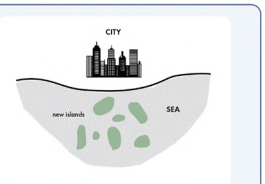
Reference Image

Hans Tavsens Park, Copenhagen, Denmark

Relationship with other patterns: F1, H1, S1, S4, S5

Reference paper: F. Anwar, F. Amalia, 2017
Making Retention Pond as an Attractive Element for Site Planning at Lowland Housing Area

F3 AN ARTIFICIAL GREEN ISLAND NETWORK



Hypothesis

A network of artificial green islands assists in the mitigation of rising sea levels in Manhattan.

Theoretical back up

Given the threatening rising sea levels of Manhattan and the need for urban expansion, the solution of artificial green islands could be integrated. The artificial raising of whole islands (island raising) to appropriate heights can cope with future sea-level rise (S.Brown, M.Wadey, R. Nicholls, A. Shareef, Z. Khaleel, J.Hinkel, D.Lincke, M.McCabe, 2019). The creation of a network of new green islands can assist towards the mitigation of flood risk in the area of Manhattan through the integration of wetlands.

Practical Implication

In order to create a new network of green islands in the area of Manhattan in an aim to mitigate flood risk, we need to test the proximity with natural salt marshes. In areas where there is an existing salt marsh there is a possibility of the integration of new islands that are connected to existing salt marsh. In this way, the flood risk is mitigated as well as a new alternative urban expansion is proposed.

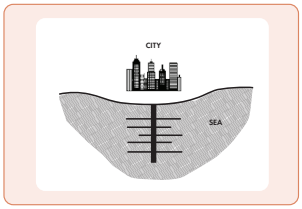
Reference Image

Tidal Basin, Washington DC, United States

Relationship with other patterns: F1, H1, S3

Reference paper: S.Brown,M.Wadey,R. Nicholls,A. Shareef, Z. Khaleel,J.Hinkel,D.Lincke, M.McCabe, 2019
Land raising as a solution to sea-level rise: An analysis of coastal flooding on an artificial island in the Maldives

H1 AMPHIBIOUS LIVING



Hypothesis

Floating housing units constitute a form of urban expansion the dense environment of Manhattan region.

Theoretical back up

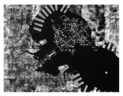
In the volume "Aquatecture", the authors, define amphibious houses as "houseboats designed to rise on fixed foundations [...] and that rise on guide-posts, floating on the water", while floating houses "rise on a floating base, designed to rise and fall with the water level". (C. Cecere, M. Ferrero, S.Mannucci, F.Rosso, 2020). Bearing in mind that Manhattan experiences a housing crisis which will increase the coming years, living in the water through amphibious or floating structures could assist towards the mitigation of the problem in the dense built environment while adapting to changing climate conditions.

Practical Implication

According to statistics the number of housing units will rise up to almost 900.000 (40.000 housing units more than 2020) by 2040 in Manhattan. In an already dense environment, practical solutions are needed in order to overcome the housing crisis. Urban expansion in the sea through floating structures could respond to the demands of the future.

Reference Image

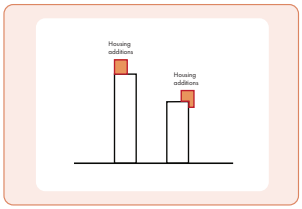
Kenzo Tange Plans for Tokyo, Tokyo, Japan



Relationship with other patterns: F1, F2, F3, H5, S3

Reference paper: (C.Cecere, M. Ferrero, S.Mannucci, F.Rosso, 2020).Adapting towards resilience: Analysis of the Construction Features and Dynamic Energy Performance of Amphibious and Floating Houses

H2 PARASITING THE ROOFSCAPE



Hypothesis

Parasite structures as housing additions to the roofscape of Manhattan formulate a desfication solution.

Theoretical back up

Parasitism is to describe the relationship between two organisms living together. The parasite gets benefit from the host and the host is victimized from providing nutritional substance and living space. (Australian National University, Research School of Biology,n.d). This dependedt relationship between organisms could be inspirational to architectural design and the fromation of patterns in the urban context, thus resulting to what is called parasite urbanism. Housing parasites in Manhattan context could create an interesting relationship between the existing buildings and the new additions.

Practical Implication

The parasite structures can be a practical solution towards the housing crisis in a dense environment like the one of Manhattan. As a form of addition in an existing structure, it presents various benefits in terms of a cheaper solution than the creation of a brand new building. Furthermore, these structures can activate the dead space of many unused roofscapes. Las Palmas parasite in Rotterdam is an innovative solution towards the housing problem in the Netherlands.

Reference Image

Las Palmas Parasite, Rotterdam, the Netherlands

Relationship with other patterns: S2, S3, H3

Reference paper: Australian National University, Research School of Biology, n.d. What is a parasite?

H3 RE-USE: FROM OFFICE TO HOUSING

Hypothesis

Housing complexes as a result of tranformation from office buildings offers a re-use solution in the dense evrironment of Manhattan.

Theoretical back up

The reuse of a building and the transformation from one use to another is a cost effective solution. Adapting instead of demolishing when possible is an essential ingredient to change the building industry towards more sustainable future and conserve valuable resources for the time ahead. (B.Glumac, N. Islam , 2020). More specifically, the reuse of office building complex into a housing complex can be an efficient solution towards the mitigation of housing crisis in Manhattan.

Practical Implication

Thinking about the dense built environment of Manhattan in combination with the impending housing crisis, there is a question arising about the potential of building re-use. Office complexes could be transformed into housing units like in the case of Alexandria, Egypt, where an abandonned office complex was turned into a residential complex. The re-use of buildings can be both resilient and sustainable solution for the city of the future.

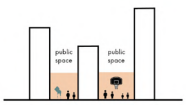
Reference Image

Transformation from Office into Housing Complex, Alexandria, Egypt

Relationship with other patterns: H2, S2, S3

Reference paper: B.Glumac, N. Islam , 2020 Housing preferences for adaptive re-use of office and industrial buildings: Demand side

S1 ACTIVATING THE IN - BETWEEN



Hypothesis

The activation of the space between the buildings leads to an alternative form of public space in the dense envrinonment of Manhattan.

Theoretical back up

Urban green areas are significant for people who live in cities to experience nature. The compactness of Manhattan offers limited number of large scale interventions. Since vacant lands inherently receive limited budgets, design practices must develop innovative ways to implement the projects. (A. Ekhlassi, M. Faizi, M.Naghibi, 2021). The space between the buildings could offer a great opportunity for multifunctional pocket parks.

Practical Implication

The dense built environment of Manhattan makes vital the redefinition of public space integration. Small scale interventions such as pocket parks in the inactive in - between space of buildings could create a new form of meeting place, thus mitigating the social segregation. Pocket parks including plazas, playgrounds, sport facilities could redefine the public space meaning in Manhattan region.

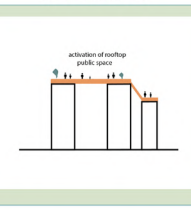
Reference Image

Pigalle Duperré, Paris, France

Relationship with other patterns: F2, H4, S3

Reference paper: A. Ekhlassi, M. Faizi, M.Naghibi, 2021 Design possibilities of leftover spaces as a pocket park in relation to planting enclosure

S2 ROOFTOP MUTATIONS



Hypothesis

The inactive roofs present strong potential for transformation into a network of public spaces in Manhattan.

Theoretical back up

In increasingly denser urban environments, there is a new-found interest in underused spaces as opportunities for further development. (A. Cutieru, 2021). From sustainable infrastructure and urban farming to social spaces and cultural venues there is a strong potential of creating a multi-layered city through the activation of urban rooftops. In Manhattan, this strategy could form a significant mutation of roofscapes into an interconnected network of public spaces.

Practical Implication

The activation of the rooscape in Manhattan through a network of alternative public spaces could be a practical solution towards the mitigation of social segregation in a dense built environment. The rooftop walk in Rotterdam is a representative example of roof connections through promenades connecting the centralities of public spaces.

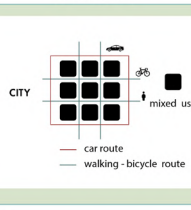
Reference Image

Rooftop Walk, Rotterdam, the Netherlands

Relationship with other patterns :H2, H3

Reference : A.Cutieru, 2021 A New Layer of Public Space: The Case for Activating Urban Rooftops

S3 SUPERBLOCKING



Hypothesis

The integration of Superblocks with mixed uses combats the social segregation in Manhattan.

Theoretical back up

The superblocks are urban cells of about 400 × 400 m that can serve as the basis for the mobility and public space model of any city. (S. Polenzuela, 2021). Superblocks significantly improve quality and public health through the integration of pedestrian - bicycle networks in combination with multifunctional public spaces. The redefinition of the urban grid in Manhattan through superblocking could offer a potential for social segregation mitigation.

Practical Implication

The car dependency and dense built environment in Manhattan affects the social gathering. Superblocks combining 6 existing blocks leaving the car route in the perimeter is a sustainable and viable solution for the city. The formation of public spaces can be genrated by the process of superblocking, thus bringing people together.

Reference Image

Superblocks, Barcelona, Spain

Relationship with other patterns: F3, F4, F5, H1,H3, H4, S1, S5

Reference paper: S. Polenzuela, 2021 Superblocks Base of a New Model of Mobility and Public Space. Barcelona as an Example

Figure 208

Source: AUTHOR

What if ?

Figure 209

Source: AUTHOR

Figure 210

Source: history101-nyc
& edited by AUTHOR