

AMERICAN UNIVERSITY OF BEIRUT
UNDERGRADUATE CAPSTONE PROJECT
IN
LANDSCAPE ARCHITECTURE
SUBMITTAL FORM

LIFELANE

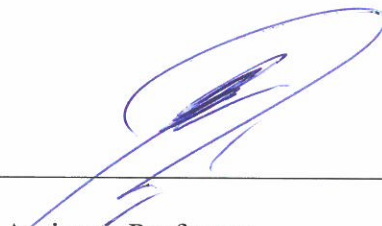
by

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FYP Report - Elie Zeinoun

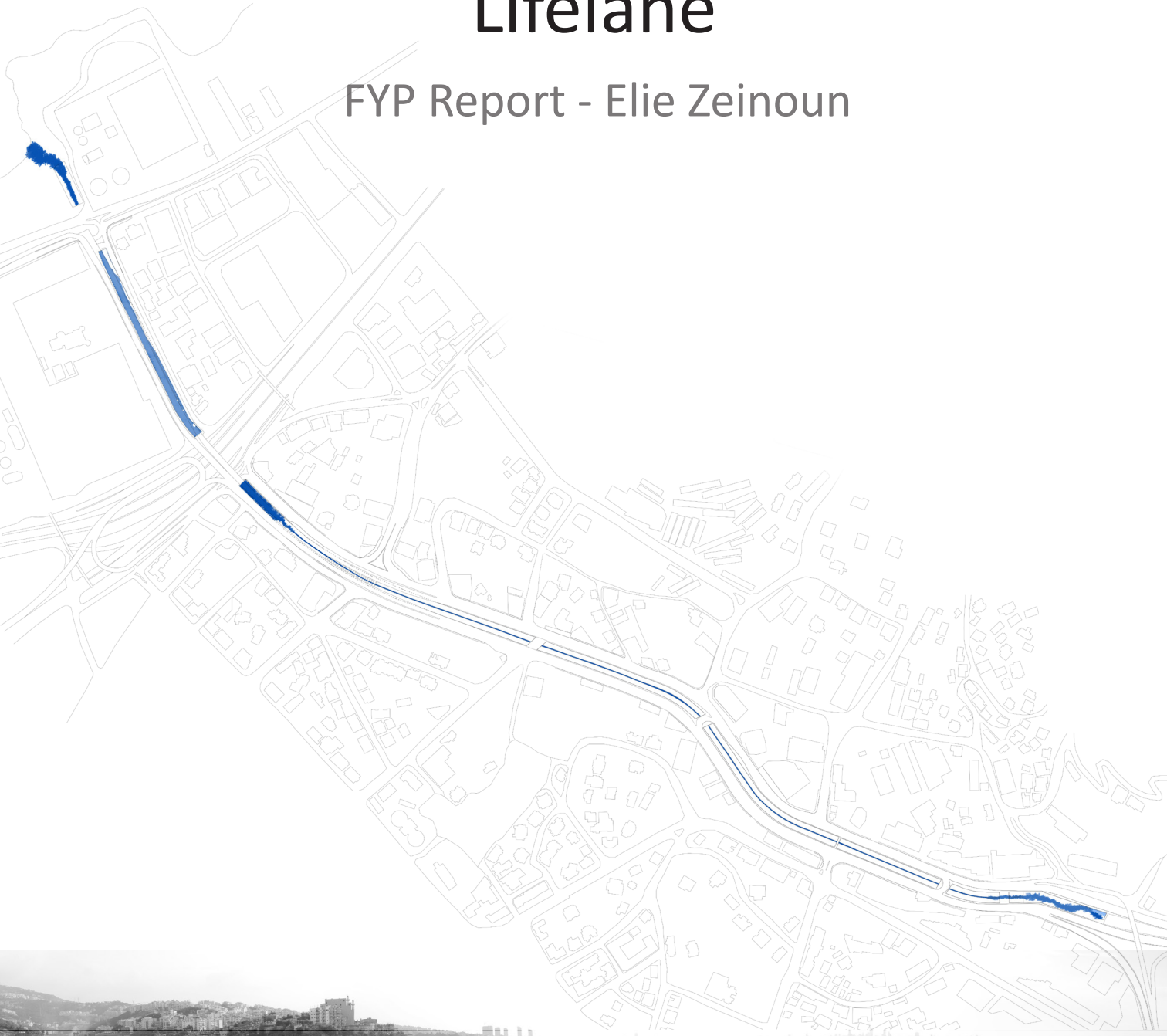


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Introduction

The project presented here is the work done during the first semester of my FYP. The semester started with a one week warm-up exercise where we had to fully design one part of our site to understand the mood we were heading towards. After that, the semester mainly consisted of analyzing thoroughly our site and its context to finally come up with a preliminary schematic diagram for our design after proposing three concept diagrams alternatives.

The site I chose is Nahr el Mot's river, precisely the 2km long canalized stretch that ends at the estuary. The fact that I pass by this site every day from my way home to university opened my eyes to the ecological threat that it is facing and made me choose this canal as my FYP to restore its wasted potential and bring back life to its surrounding.

The softwares and tools used during this semester were the following:

- Photography
- Hand sketch
- Google earth
- Sketchup
- Autocad
- Photoshop
- Illustrator
- Rhinoceros
- 3ds Max + Corona

Problem and project statement

The location of Nahr el Mot in an urbanized setting and industrial zone exposes it a diversity of threats. The canalized section of the river, which is my site of intervention is acting as a barrier between the East and West banks. Not only is it socially dividing between the five different municipalities on its sides, it is also facing many ecological problems.

One of the biggest issues is the release of liquid waste by the nearby industries into the canal itself causing public health problems for the area around it as well as threatening biodiversity inside of the concrete canal. However one can't deal with the site specific issues without looking at the broader context. By looking at the upper natural part of the watershed, one can see the dumping of solid waste at the banks of the seasonal River that started since the summer garbage crisis in Lebanon.

The project will be dealing with these issues by transforming a grey infrastructure into a landscape infrastructure turning a dead line into a lifeline. The canal will be transformed into a linear park where several natural filtration on situ will mitigate the pollution caused from the Industrial inlets and different activities will be held along this reinvigorated corridor.

Landscape infrastructure

Traditional city infrastructure generally incorporates transportation and communications systems, as well as water and power lines, and other utilities and structures. It often places a premium on through-put and efficiency. Landscape Infrastructure is a methodology that expands the performance parameters of a designed landscape to a multi-functional, high performance system, including those systems originally ascribed to traditional infrastructure. Similarly, traditional urban design is oriented towards building massing and grids. Urban design based on principles of Landscape Infrastructure is focused on landscape-based integration of the built and natural environments—seeking out innovative opportunities for building nature and public amenities into the infrastructure of a city. Thinking in terms of Landscape Infrastructure adds multiple additional benefits to traditional infrastructure: city beautification and re-vegetation/forestation; water and energy conservation; natural systems restoration; storm water management; energy farming; wildlife habitat expansion; favored pedestrian use; and expanded park land and open space built in neglected segments of existing urban infrastructure. Landscape Infrastructure can transform urban blight into urban destination.

It can help to create an iconic identity for a city based on the city's latent natural and cultural features.

Thinking in terms of Landscape Infrastructure adds multiple additional benefits to traditional infrastructure:

- City beautification and re-vegetation/forestation
- Water and energy conservation
- Natural systems restoration
- Storm water management
- Energy farming
- Wildlife habitat expansion
- Expanded parkland and open space built in neglected segments of existing urban infrastructure
- Recreational opportunities
- Health and wellness
- Increased pedestrian activity
- Community programming

Source: http://swacdn.s3.amazonaws.com/1/d281f914_swadesignbriefing-landscapeinfrastructure.pdf

I Warm up exercise

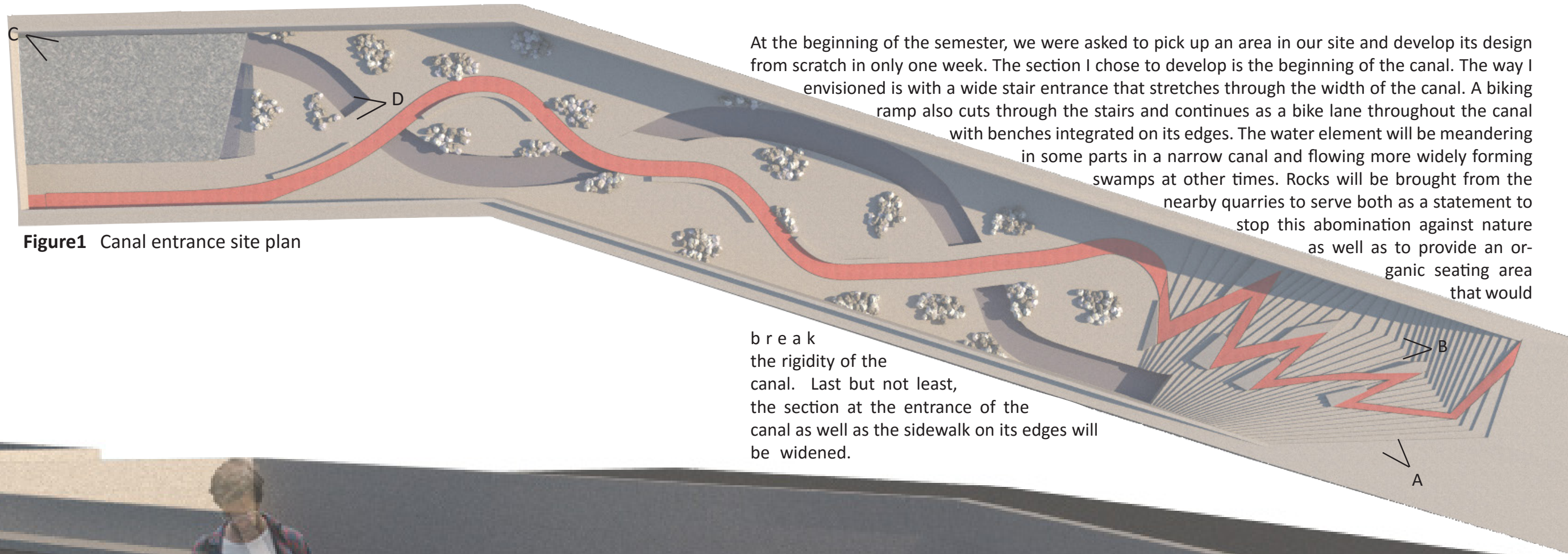


Figure1 Canal entrance site plan

At the beginning of the semester, we were asked to pick up an area in our site and develop its design from scratch in only one week. The section I chose to develop is the beginning of the canal. The way I envisioned is with a wide stair entrance that stretches through the width of the canal. A biking ramp also cuts through the stairs and continues as a bike lane throughout the canal with benches integrated on its edges. The water element will be meandering in some parts in a narrow canal and flowing more widely forming swamps at other times. Rocks will be brought from the nearby quarries to serve both as a statement to stop this abomination against nature as well as to provide an organic seating area that would

break the rigidity of the canal. Last but not least, the section at the entrance of the canal as well as the sidewalk on its edges will be widened.

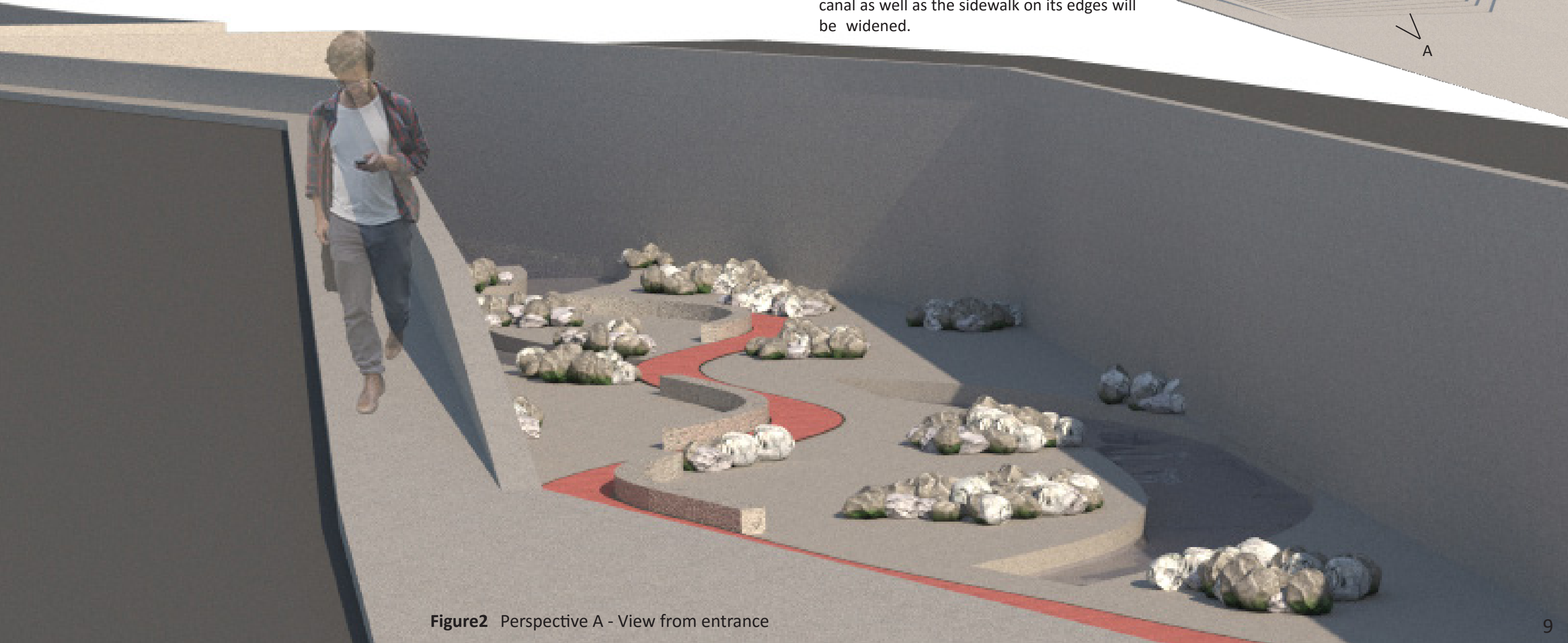


Figure2 Perspective A - View from entrance

| Warm up exercise

Figure3 Perspective B - View from stairs

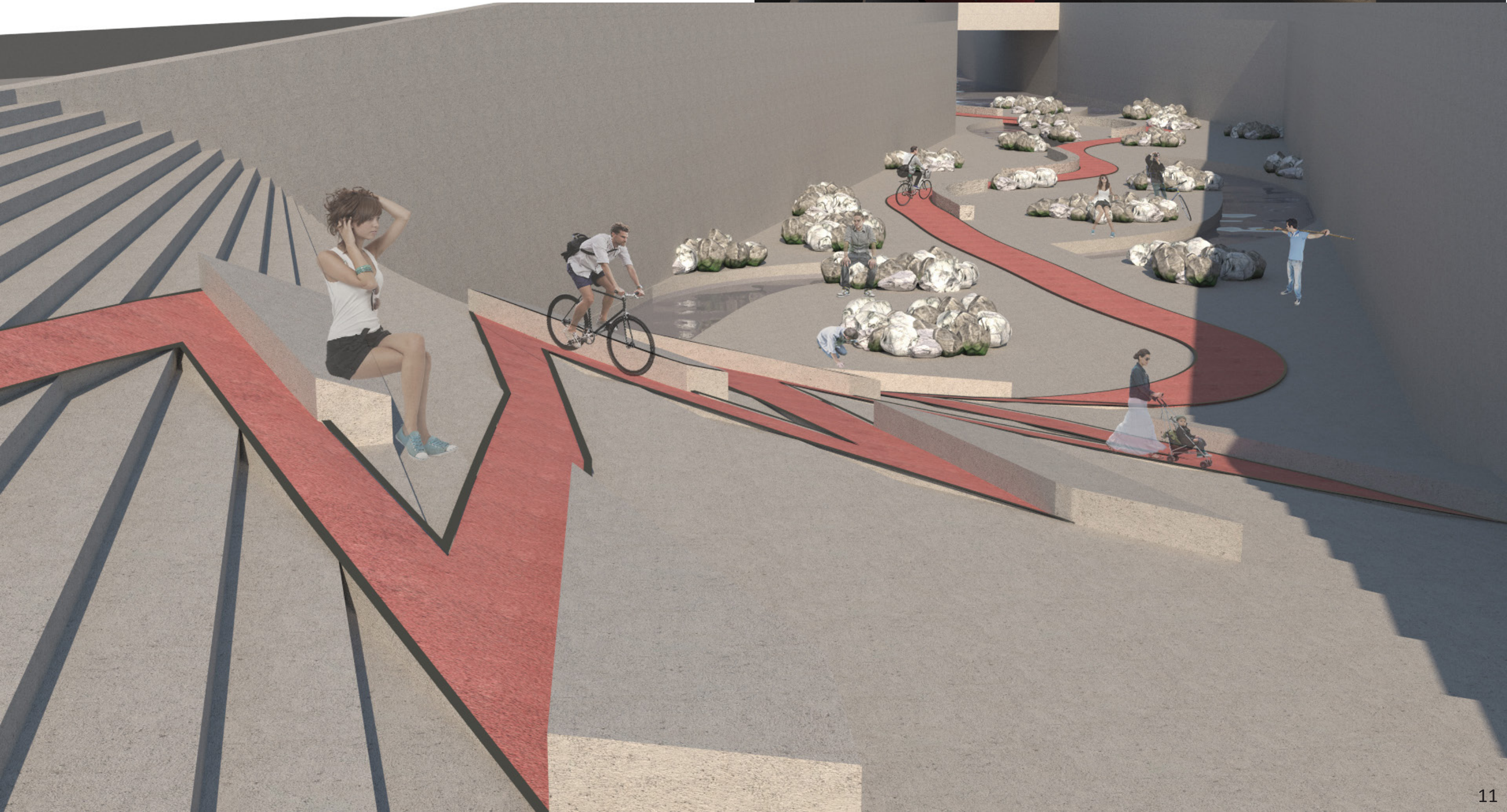
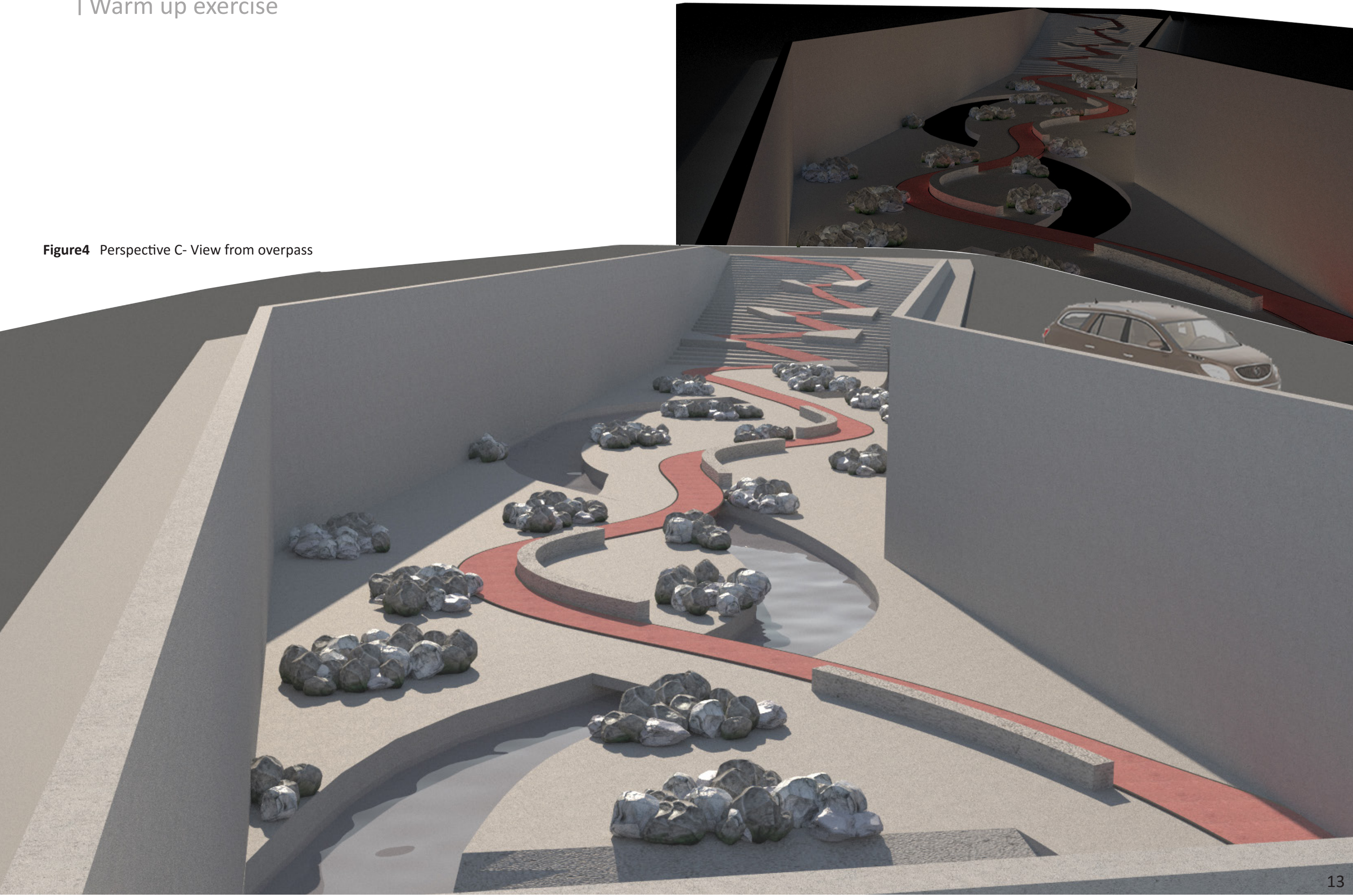
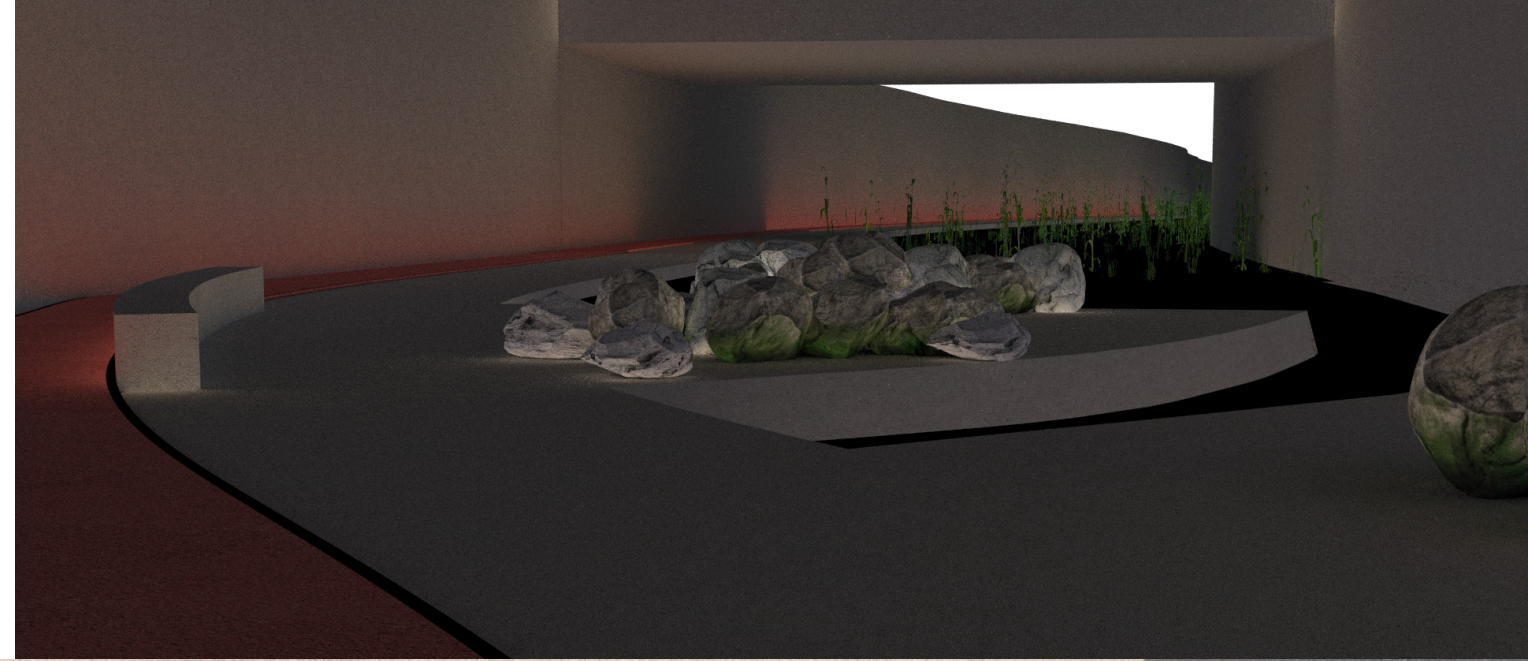


Figure4 Perspective C- View from overpass



| Warm up exercise

Figure5 Perspective D - View towards pond



Case studies

GENERAL INFORMATION

Location: Central Seoul, Korea
 Landscape architect: Mikyoung Kim Design
 Completion: 2007
 Owner/Client: Seoul Metropolitan Government
 Materials: Granite, Water, Fiber Optic Lighting
 Budget: 24M USD
 Dimensions: 91000 sq. m, 11km distance

BRIEF SUMMARY

This design was the winning project in an international competition in which the major requirement was to highlight the future reunification of North and South Korea.

PROBLEMATIC & STRATEGY

The goal was to restore this highly polluted and covered water-way with the demolition of at grade and elevated highway infrastructure that divided the city.

DESIGN APPROACH

The project symbolizes this political effort through the use of donated local stone from each of the eight provinces of North and South Korea. The individual stones act to frame the urban plaza and the eight source points where runoff is daylighted and represents the unified effort in the transformation of this urban center.

The creation of a pedestrian focused zone from this former vehicular access way that brings people to the historic ChonGae River while mitigating flooding and improving water quality. In addition to the environmental restoration effort, this urban open space has become a central gathering place for the city which is in dire need of more public landscapes. During specialized events such as the traditional New Year's festivals, political rallies, fashion shows and rock concerts both the plaza and the Water Source area get redefined in inventive ways.

Organic meandering river



Busy night activities - waterfall



Underwater lighting - crossing bridge



Close contact with water

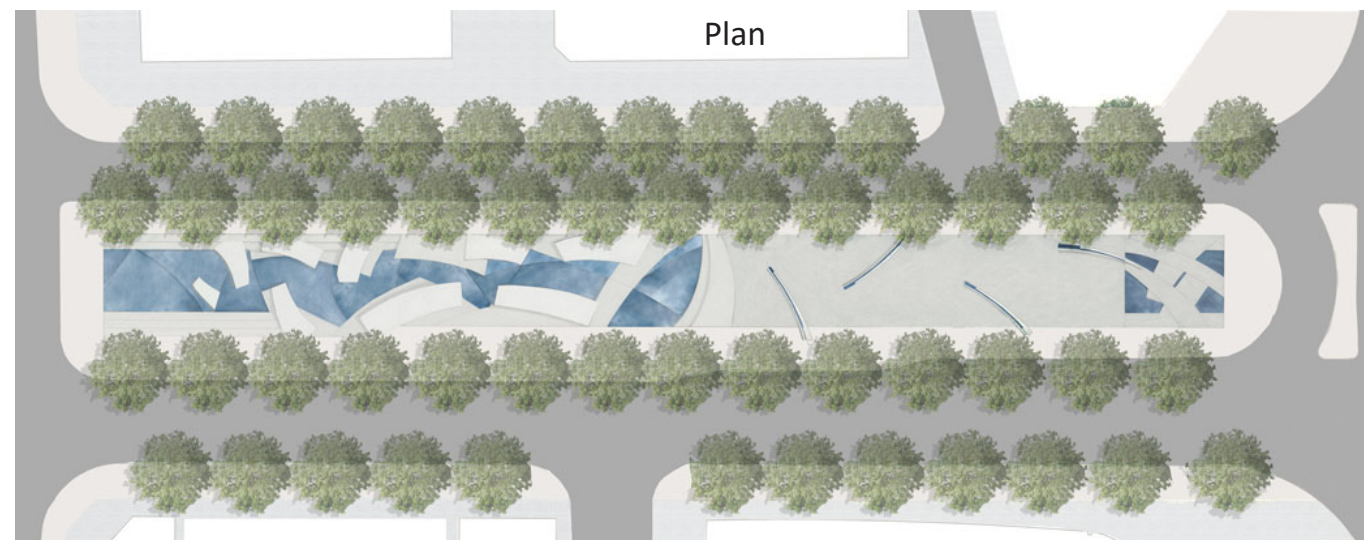


Figure6 Organic central river flow

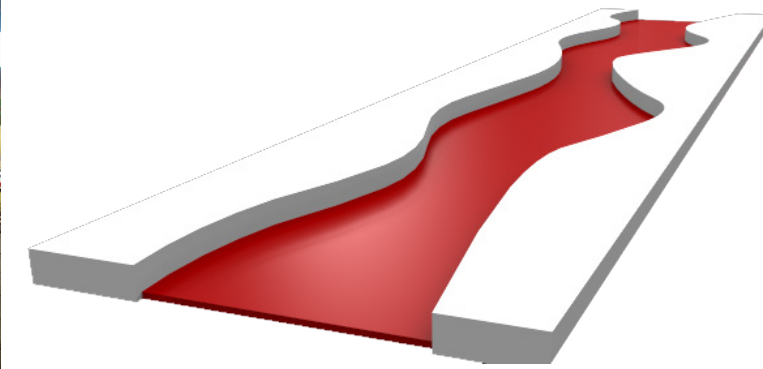


Figure7 Linear outer tree arrangement

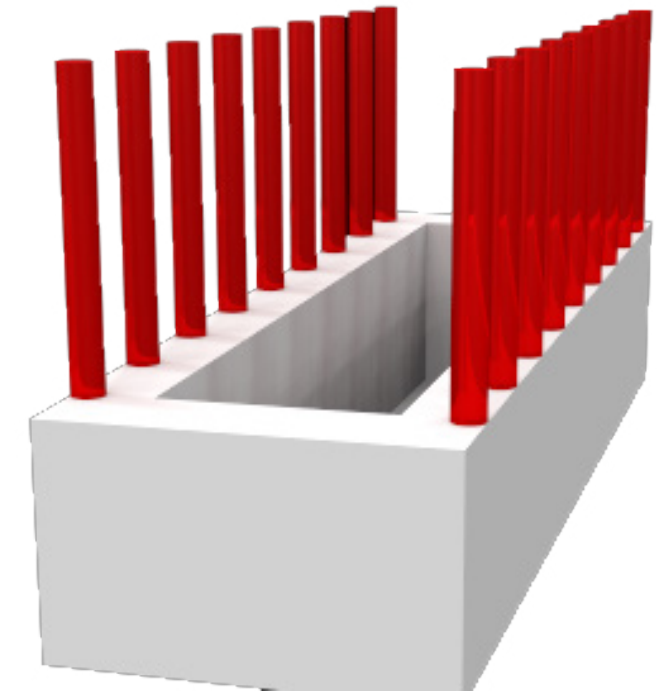
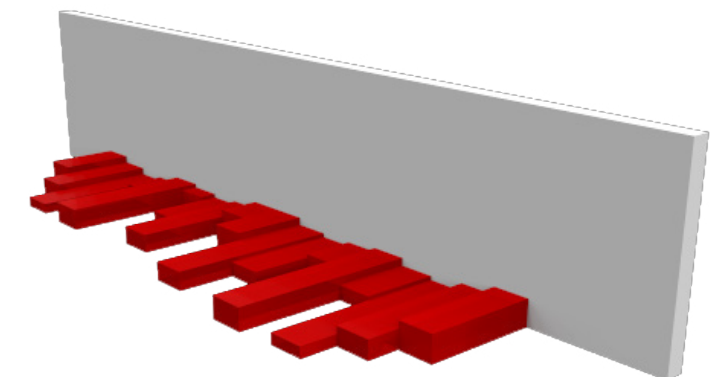


Figure8 Variable walkable width



Case studies

GENERAL INFORMATION

Location: Velenje, Slovenia
 Landscape architect: Enota
 Completion: 2014
 Owner/Client: Velenje Municipality
 Materials: Concrete, Water, Wood, Sand, Plants
 Budget: 3M USD
 Dimensions: 17020 m2

BRIEF SUMMARY

The Velenje "Promenada" is an important city space and a vital city thoroughfare. It is one of the central axes of the centre of Velenje. More greenery and more program are still needed.

PROBLEMATIC & STRATEGY

The existing promenade was created by closing the erstwhile traffic road almost thirty years ago. Even though it was re-paved, the promenade retained the character of a road, remaining too wide and rather dull due to the lack of content.

DESIGN APPROACH

The wide straight connection with a clearly delineated beginning and termination underwent a transformation into a sequence of micro-ambients, slowing down the users and provides focus, framing the space for the additional program content to take place. In the initial phase, all these newly-formed public spaces are simply and cost-effectively laid out as sand or grass surfaces. The river Paka is a torrential river, which means that its watercourse swells up significantly a few times a year, but remains relatively shallow at all other times making it deep and unnoticed. By creating an amphitheatre, which slowly slopes down towards the river surface, the contact between the people and the river is recovered. With the transformation, the Promenada is turning into a main event axis of the city.

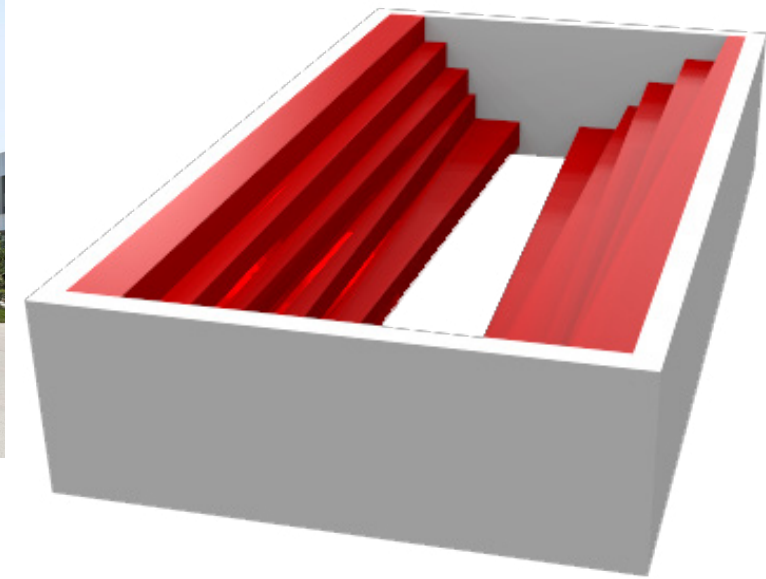
Project Overview



Outer Part



Figure9 Amphitheater from both sides



River daytime



River nighttime



Figure10 Centered river - seasonal flow

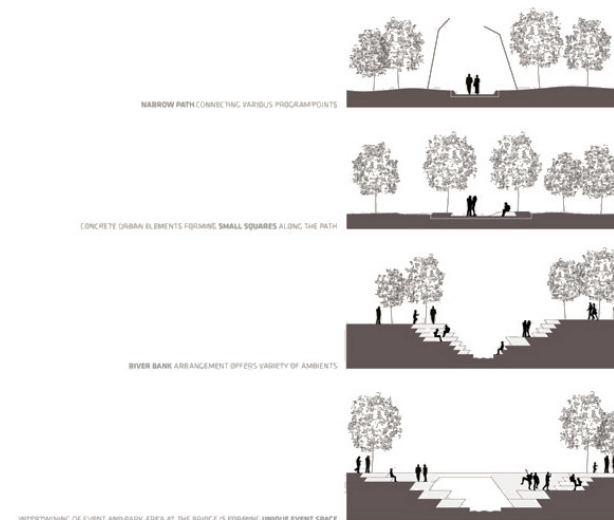
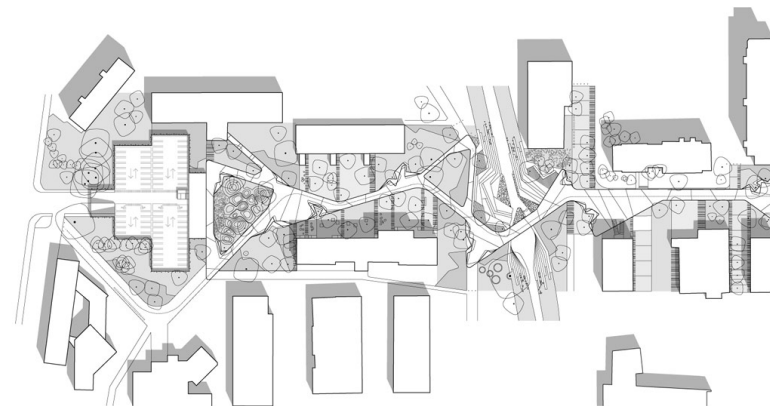
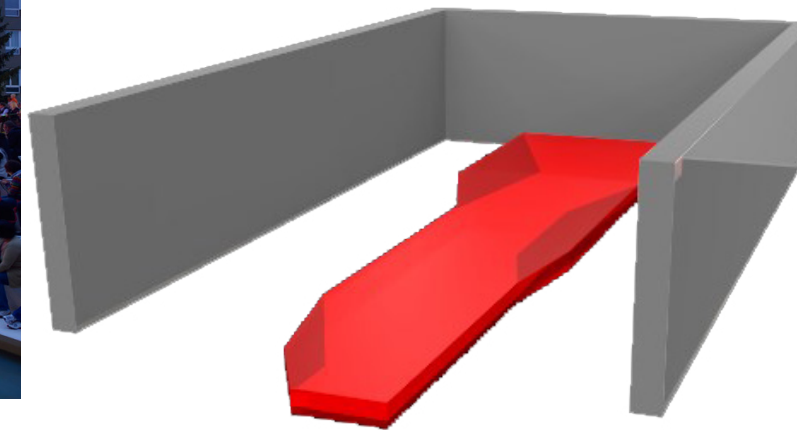
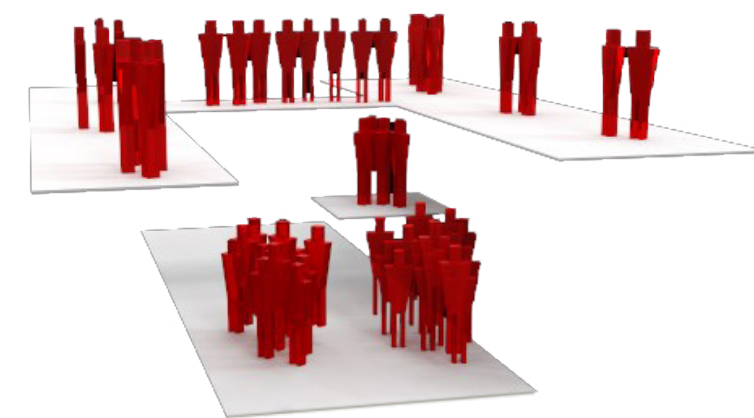


Figure11 People distribution



| Case studies

GENERAL INFORMATION

Location: New York city, US
 Landscape architect: James Corner field operations
 Completion: 2011
 Owner/Client: The city of New York & Friends of the high line
 Budget: \$152.3 million
 Dimensions: 1.6km distance

BRIEF SUMMARY

The High Line is an elevated railroad reclaimed as an extraordinary public space, a connector of neighborhoods and a new model for the 'greening' of the urban environment. It is creating a new way of seeing the city, is recognized as an icon for innovative design and sustainability.

PROBLEMATIC & STRATEGY

Left unused since 1980, the line was considered an eyesore in the neighborhood

DESIGN APPROACH

This project touches people. It enhances human health, controls stormwater, and restores natural habitats. Over 300 species were carefully selected to produce a primarily native landscape working with specific environmental conditions. Green-roof technologies along with open joint pavement enhance water retention, drainage and aeration and minimize irrigation requirements. Recycled materials are promoted including reclaimed wood, recycled steel and local aggregate for precast concrete. The park is lit with energy-efficient LED lighting. It is a consistent transect through a varied city landscape. The mix of building types and how they meet the High Line. High Line provides a unique urban experience; where one is both a part of the City and removed from the City at the same time.

Linearity vs organicity



Overlooking extruding platforms



Figure12 Accessibility- Stairs & Elevators

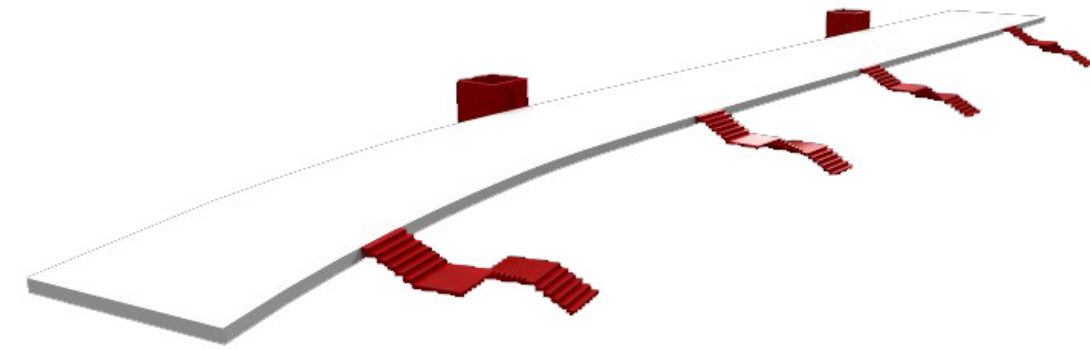


Figure13 Vegetation on sides

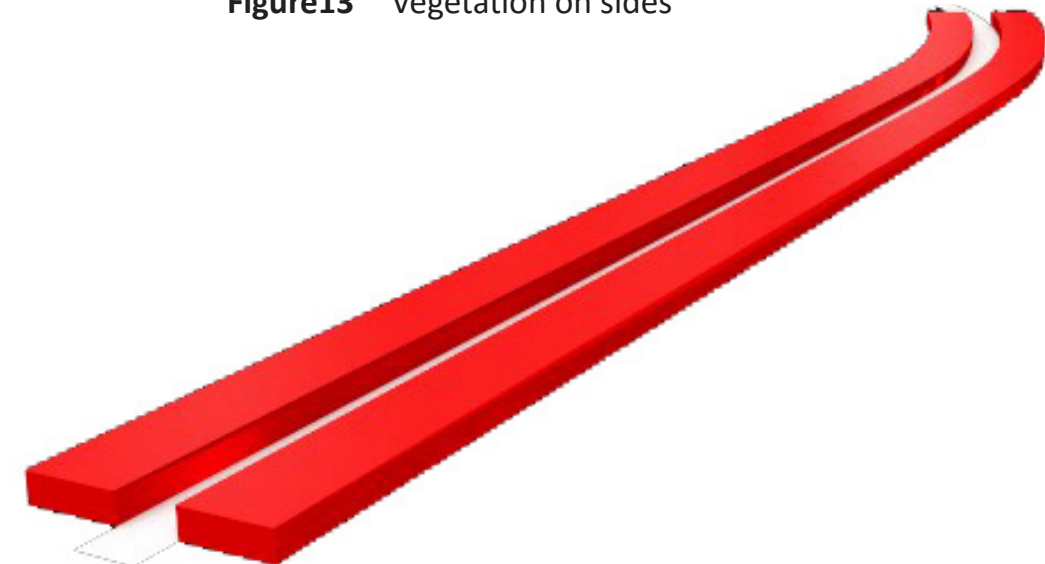
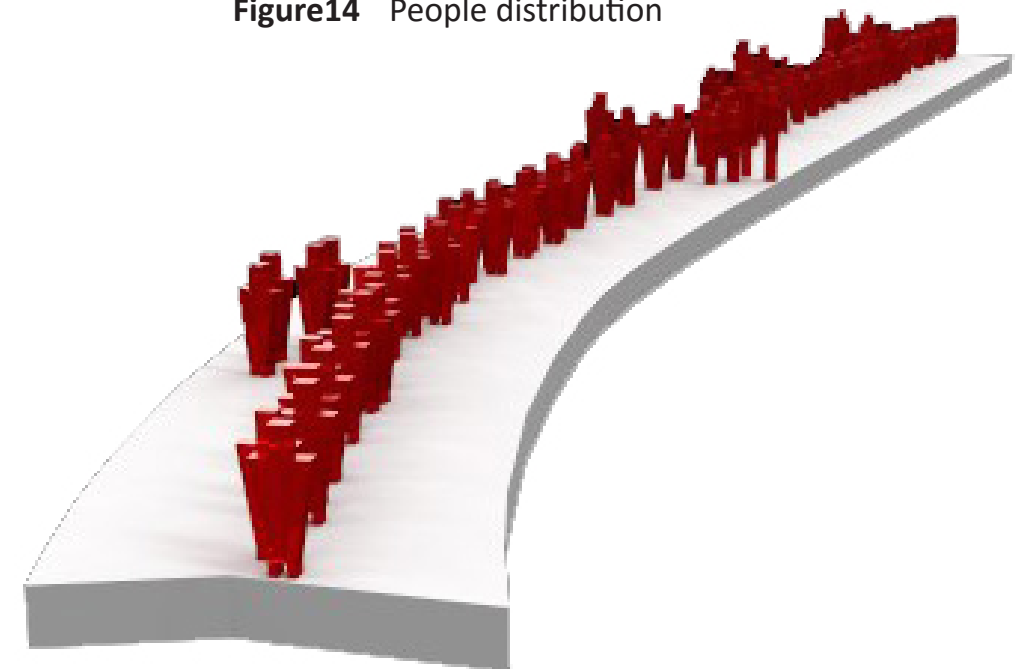


Figure14 People distribution



Case studies

GENERAL INFORMATION

Location: New York city, US
 Landscape architect: Dan Barasch
 Owner/Client: The city of New York
 Materials: Wood, Water, Solar panels, Plants
 Dimensions: 4000 m2

BRIEF SUMMARY

The Lowline is a plan to use innovative solar technology to illuminate an historic trolley terminal. Our vision is an underground park, providing a beautiful respite and a cultural attraction in one of the world's most dense, exciting urban environments.

PROBLEMATIC & STRATEGY

The site was opened in 1908 for trolley passengers, but has been unused since 1948 when trolley service was discontinued. The space still retains some incredible features. It is also directly adjacent to the existing JMZ subway track so park visitors and subway riders would interact daily. This hidden historic site is located in one of the least green areas of New York City— presenting a unique opportunity to reclaim unused space for public good.

DESIGN APPROACH

The Lowline aims to build a new kind of public space— one that highlights the historic elements of a former trolley terminal while introducing cutting-edge solar technology and design, enabling plants and trees to grow underground. Through a “remote skylight” technology, sunlight passes through a glass shield above the parabolic collector, and is reflected and gathered at one focal point, and directed underground. Sunlight is transmitted onto a reflective surface on the distributor dish underground, transmitting that sunlight into the space. This technology would transmit the necessary wavelengths of light to support photosynthesis, enabling plants and trees to grow.



Figure15 Pedestrian flow - linear & organic

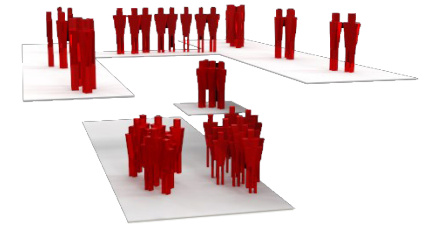


Figure16 Lighting system

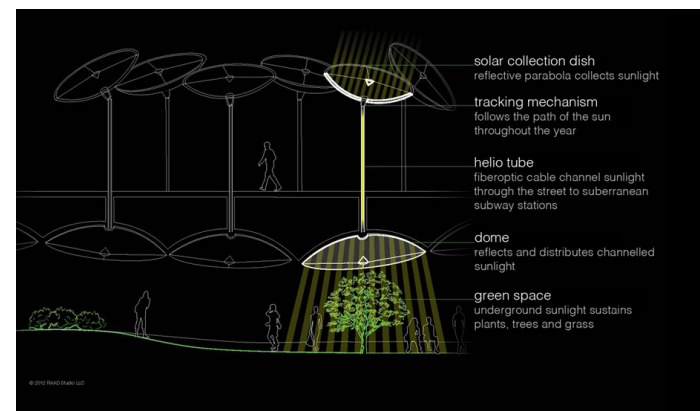
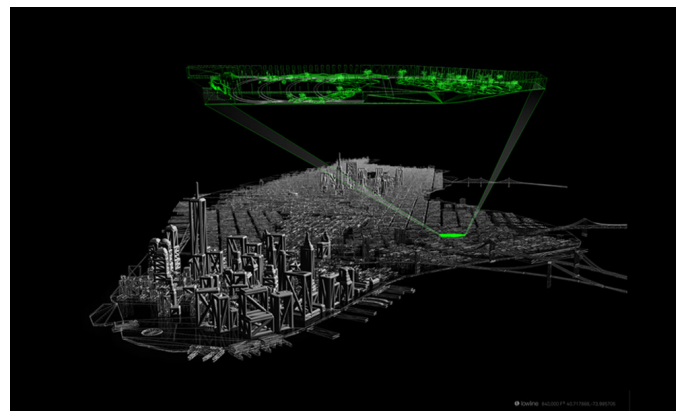
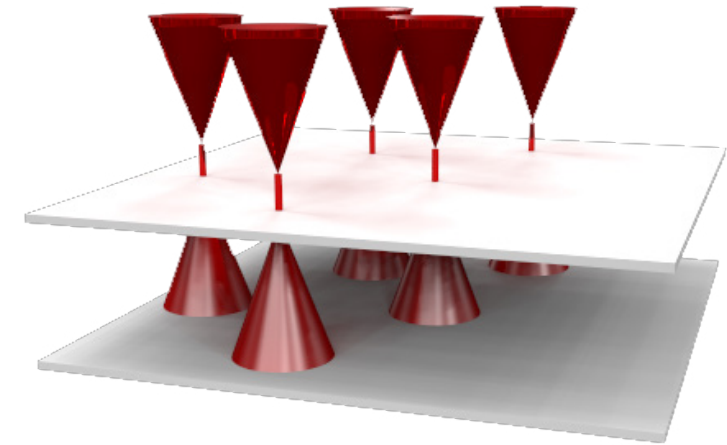
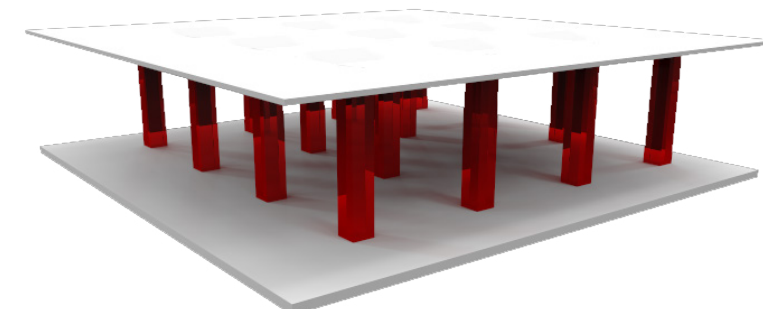


Figure17 Preservation of existing poles



Case studies

GENERAL INFORMATION

Location: Nahr Beirut, Lebanon
Landscape architect: Logan Littlefield
Owner/Client: Beirut Municipality
Materials: Concrete, Pines & Vines, Football net

BRIEF SUMMARY

Two veins for the design approach: One was about method, an inventory of designated and spontaneous public space types in Beirut, and the other involved site selection and a rationale for civic space in more unlikely places. The peri-urban Beirut River, a seasonal river fed by snowmelt, is an ideal testing ground for a new idea of civic space.

PROBLEMATIC & STRATEGY

Areas of natural, cultural, and civic heritage co-opted by private luxury development, preventing them from serving as potential devices to foster social cohesion and civic identity.

DESIGN APPROACH

The proposed design prototype responds to the evolving transformation of the Beirut river. In a transition from biophysical system to hydrologic and transportation infrastructure; from a seasonally flooding estuary with an ever changing course to an increasingly restrained and finally channelized riverbed, the next iteration becomes a new urban ground ; a constructed topography of civic space infrastructure to meet the needs of the surrounding neighborhoods.

This is done by drawing upon, deploying, and hybridizing formal and spontaneous public space types to create a series of platforms. These platforms are linear strips with varying degrees of program that as a whole, produce a transverse connection across the infrastructural landscape, acting as both a connection and a destination in it's own right.

Public space analysis

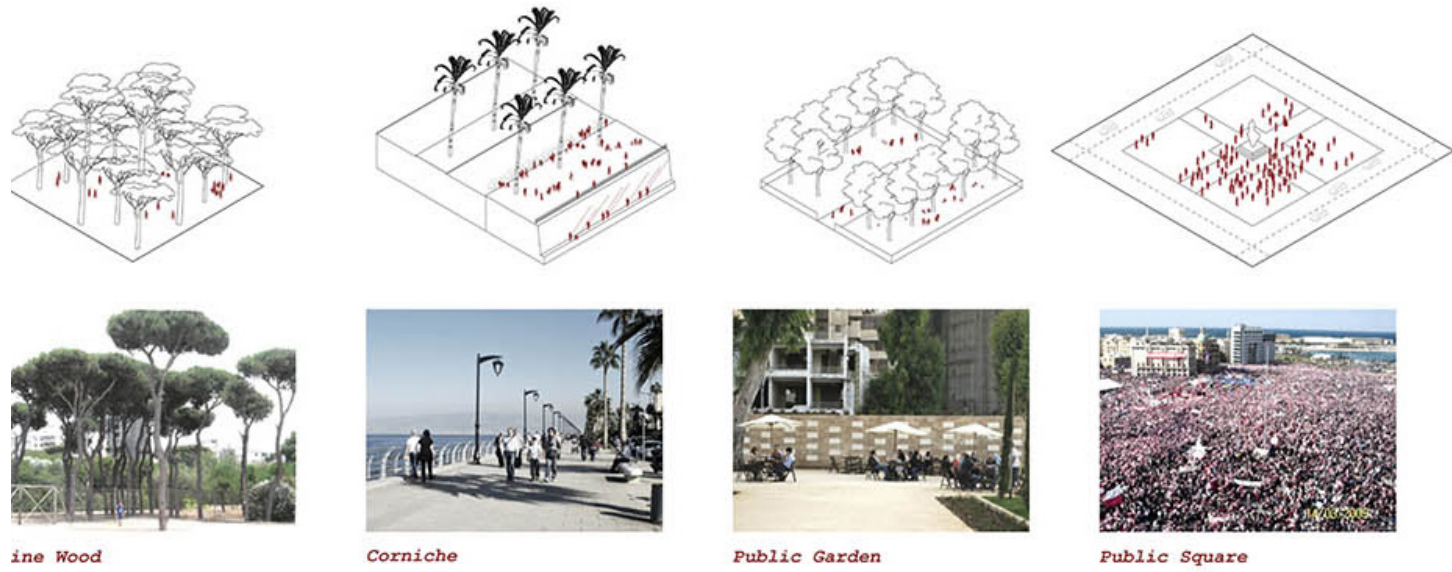


Figure18 People distribution

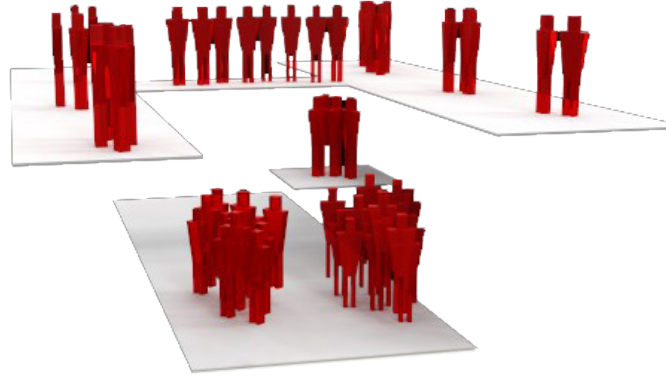


Figure19 Softscape layers

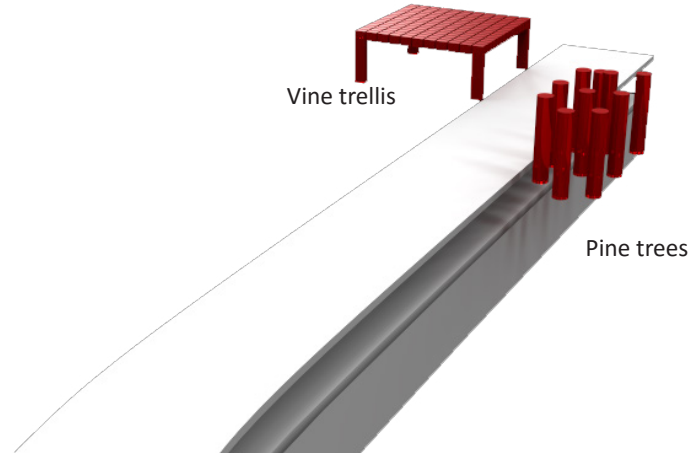
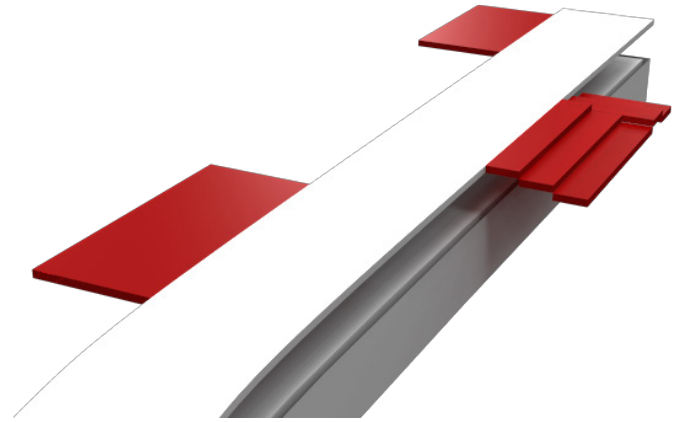
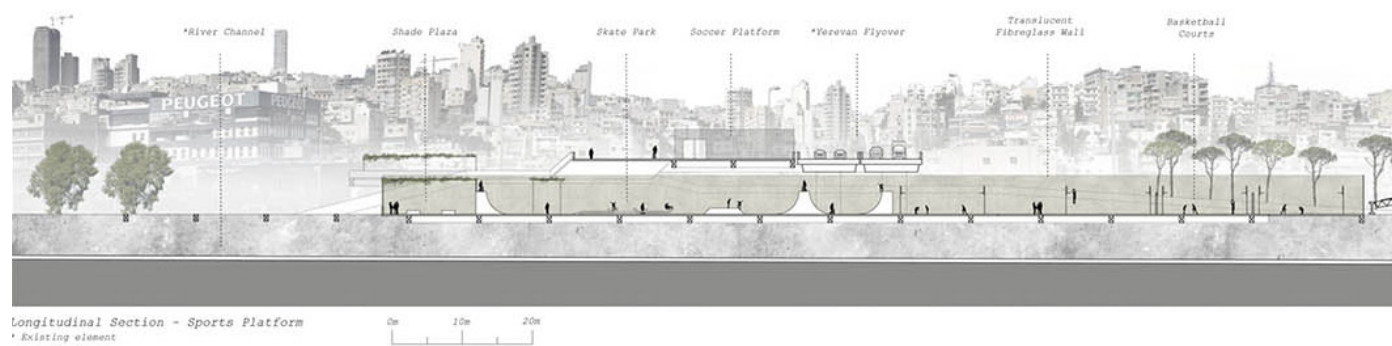


Figure20 Platforms



Perspective collages



| Context analysis



Figure21 Lebanon map context
Scale 1:2500000

Nahr El Mot is located at proximity from the capital Beirut between the rivers of Nahr Beirut and Nahr Antelias. The length and drainage basin of Nahr El mot is much smaller than the two other rivers around it. However, despite the fact that it has a small catchment of 10km squared, the stream order of the river is still as high as Nahr Beirut's river, that being an order of 5. The two main branches of the river join into one at the point of canalization and the difference in the geological rock layers uphill are clearly seen at the entrance of the canal after a heavy rain. When one looks at the heavy urbanization that's happening along the watershed, we notice that it mainly happens on the ridges due to the nice view that this high point provides or on the lower and flatter part of the river. And if we overlay it with the streams, one can note the streams that are being directly affected by this urbanization.

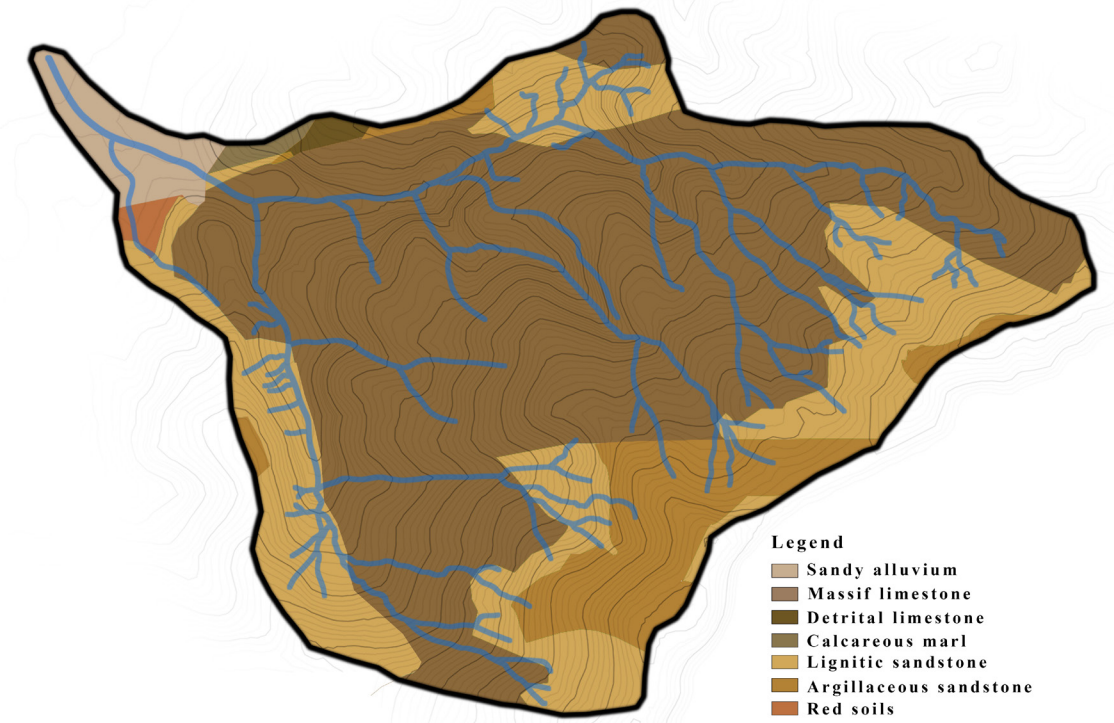


Figure24 Rock layers
Scale 1:50000

- Legend**
- Sandy alluvium
 - Massif limestone
 - Detrital limestone
 - Calcareous marl
 - Lignitic sandstone
 - Argillaceous sandstone
 - Red soils



Figure22 Context in greater Beirut
Scale 1:50000

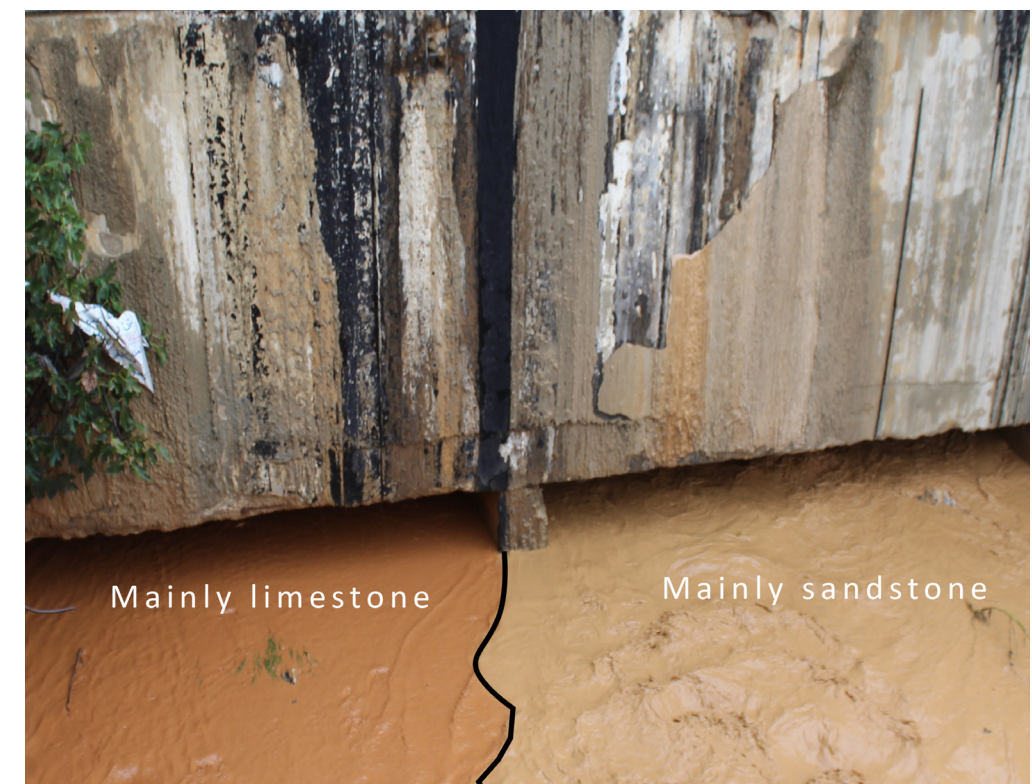


Figure23 Water color

| Context analysis

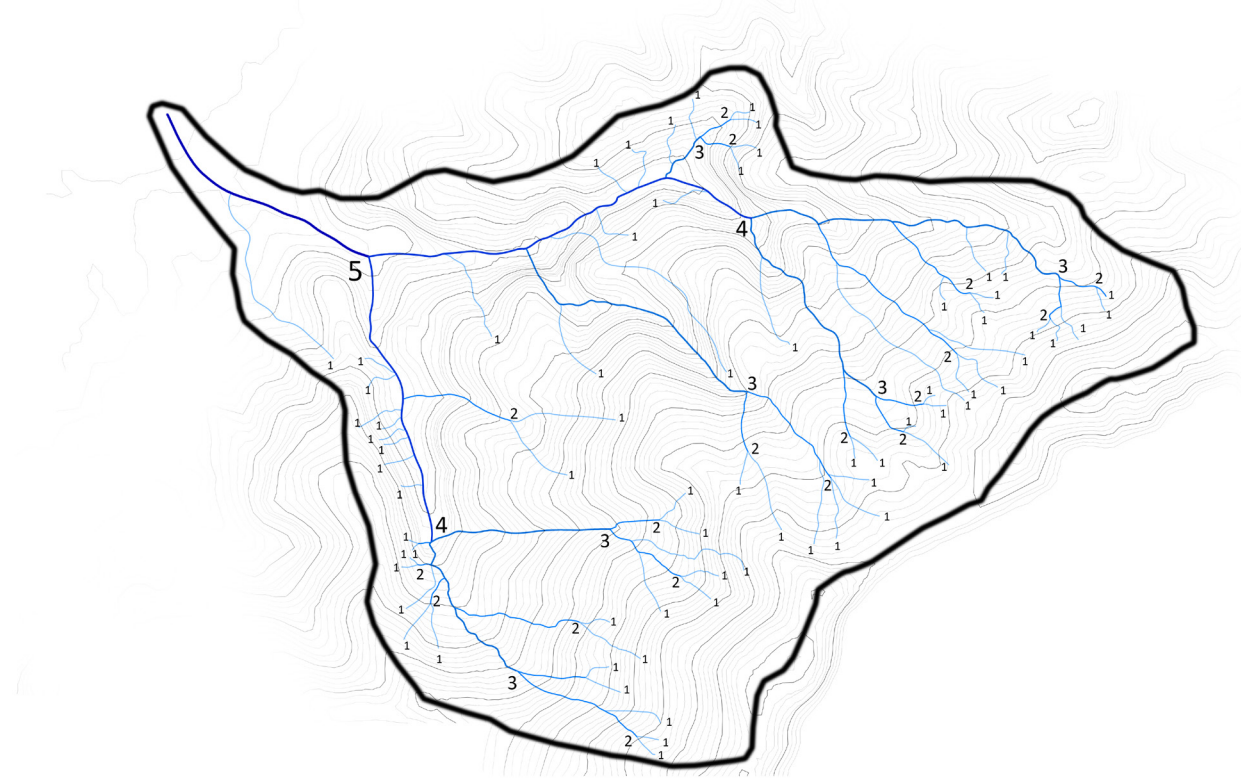


Figure25 Stream orders - Scale 1:50000

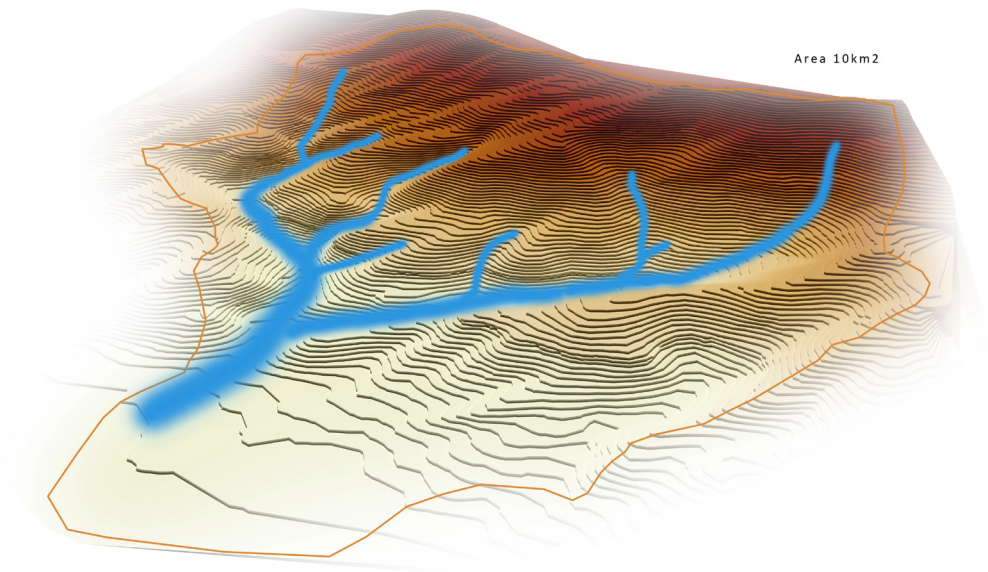


Figure28 Watershed model & topography

+

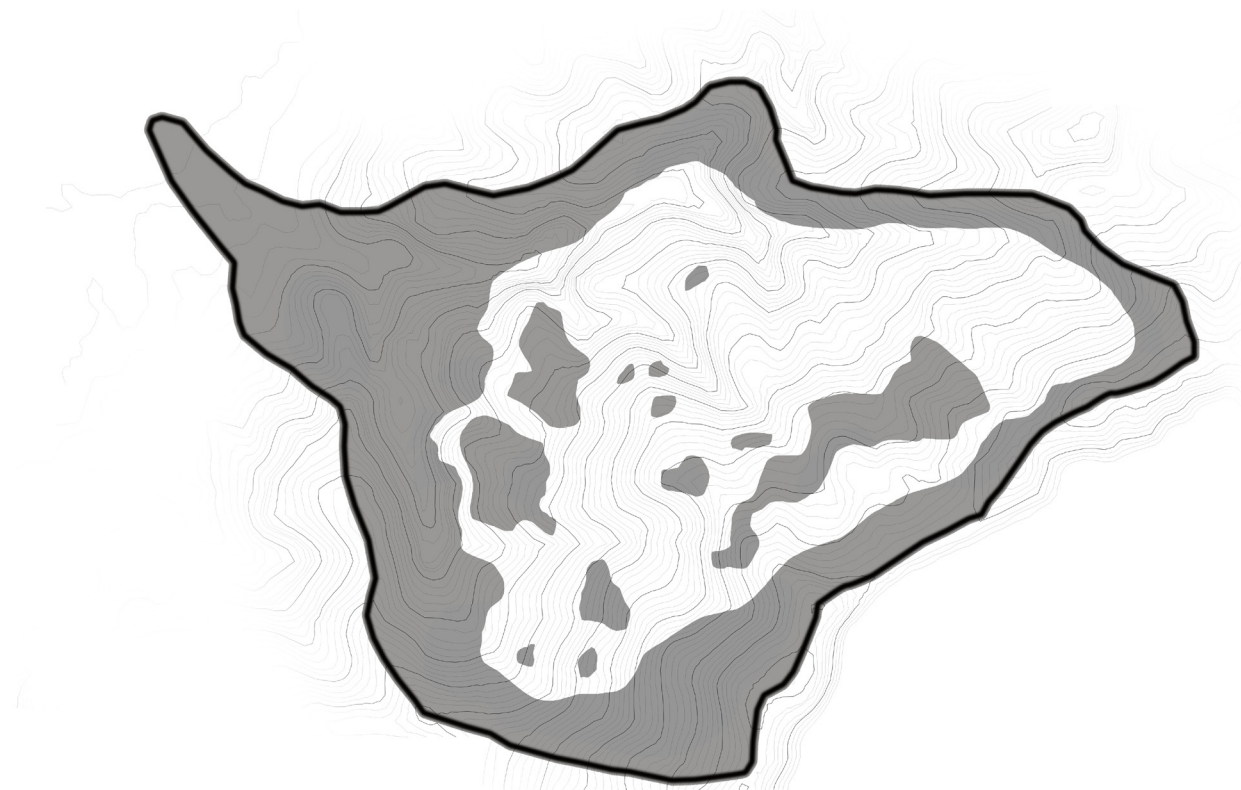


Figure26 Urbanization - Scale 1:50000

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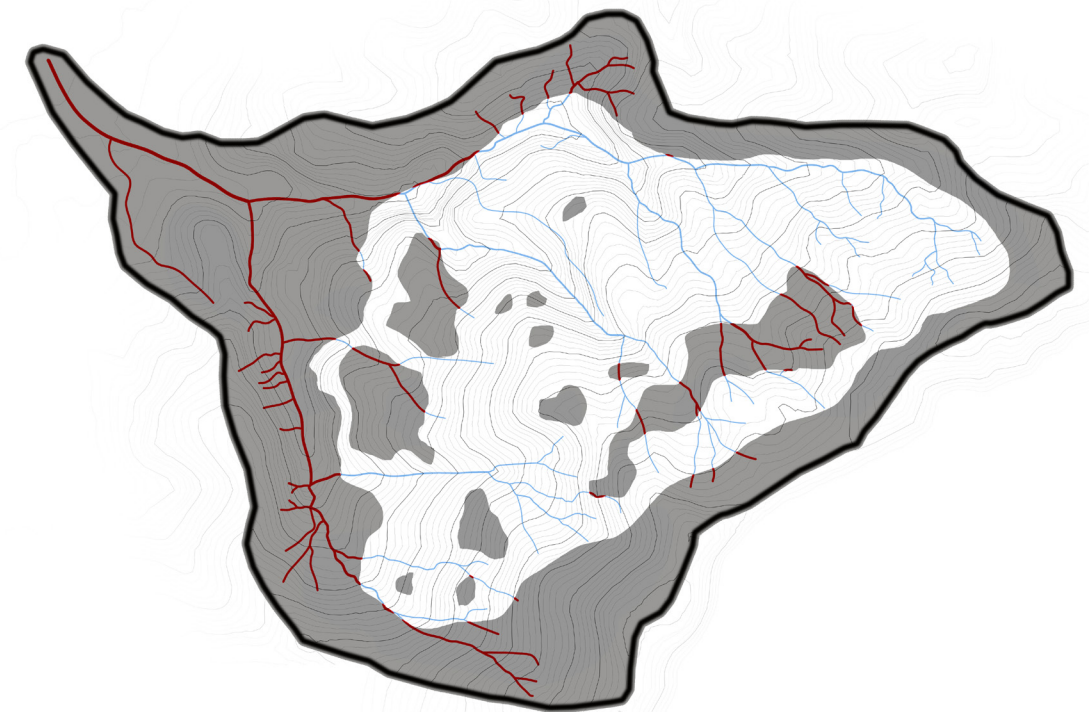


Figure27 Affected streams - Scale 1:50000

It is true that one can't tackle the details without looking at the big picture, especially when dealing with water as the whole watershed is one linked system of water. But now that we've given a small overview about the watershed, let's zoom in to the actual site of intervention which is the canalized part of the river. Before starting to analyze the immediate entourage of the canal, one has to look at the history of the site and how it ended up being that urbanized as it is right now. Back in 1859, the river was still in its natural state, free flowing with few scattered settlements along its bank. Around 1962, the river was already canalized as it was the most common solution back then to respond to the increasing urbanization around the river. In 2004, an important landmark, City Mall known as Géant back then opened its doors which made the site heard of from the Lebanese that live in the outskirts. This huge attraction to the site because of that mall increased even more two years later when the Metn highway was created and linked several mountains like Broummana, Bifkaya, Baabdat to the main highway passing by Nahr el Mot as a final step. Last but not least, in addition to the urbanization that was gradually increasing through these years, the creation of the overpass enhanced the accessibility to Nahr el Mot from the main highway.

The current situation is a densely urbanized site with five municipalities around the river, Amaret Chalhoub, Zalka & Biakout on the East side and Jdeideh and Sed El Baouchrieh on the West side. However, despite the fact that five municipalities circle the site, the river belongs to the Gouvernement of Water & Energy and not to any of them.

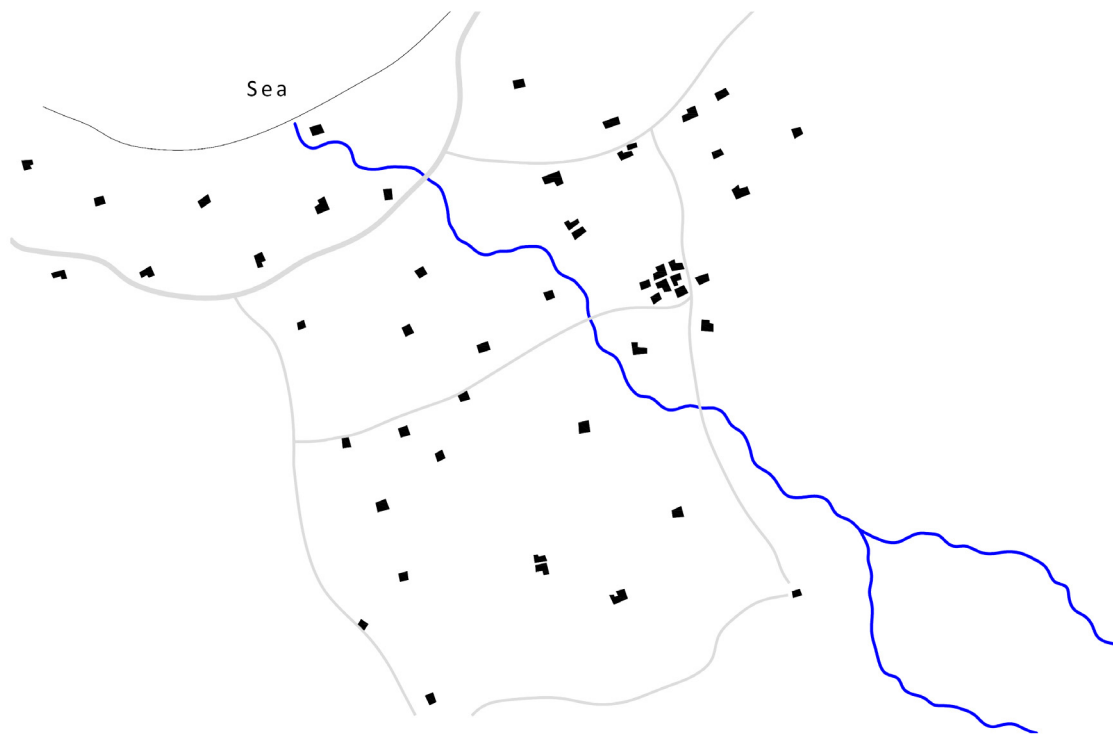


Figure29 1859:River in its natural state with few settlements around
Scale 1:17000

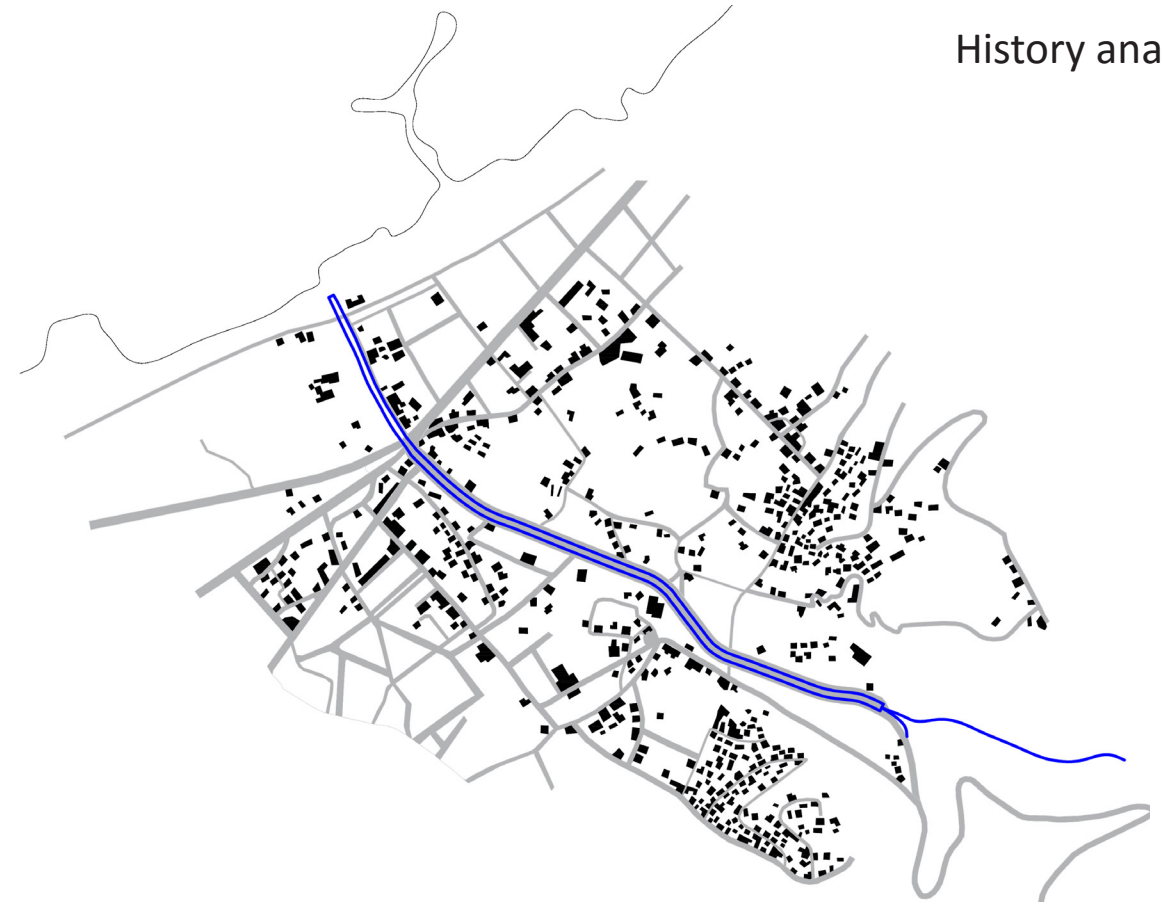


Figure30 1962 : River in channelized state with urbanization around
Scale 1:17000



Figure31 2004: City mall opening --> Increased attraction to site
Scale 1:17000

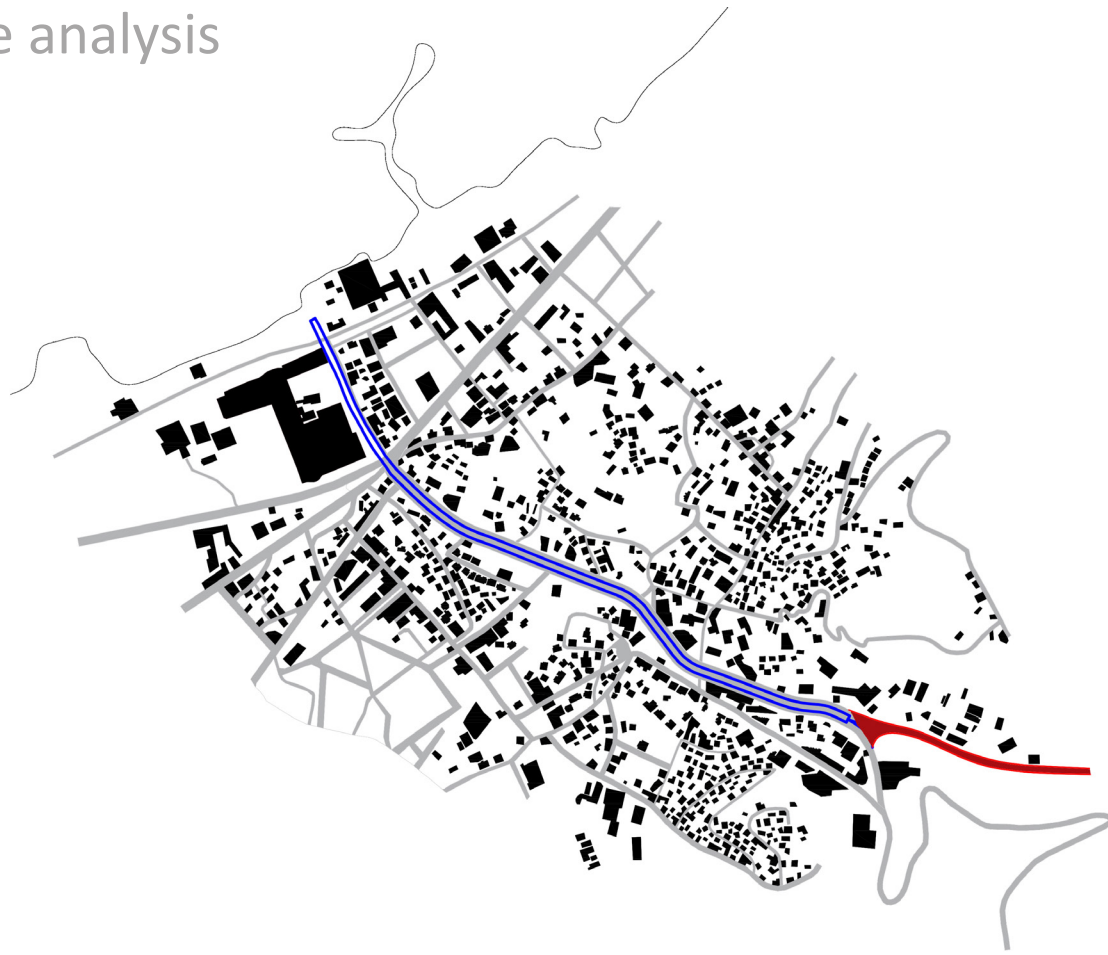


Figure32 2006: Metn highway opening --> Vehicular flow from mountains
Scale 1:17000

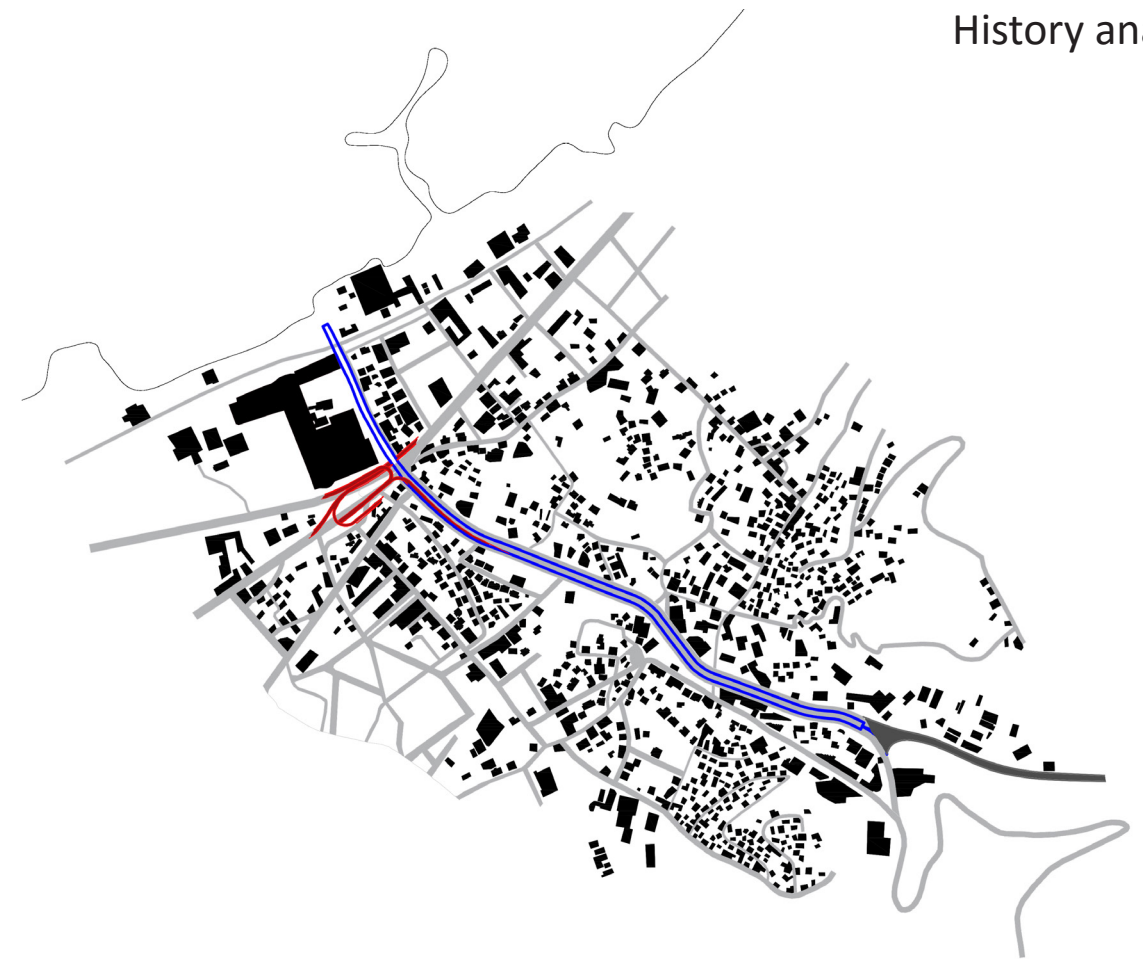


Figure33 2011 : Overpass opening --> Vehicular flow from main highway
Scale 1:17000





Figure35 Base map



Figure34 Municipality boundaries

Scale 1:5000

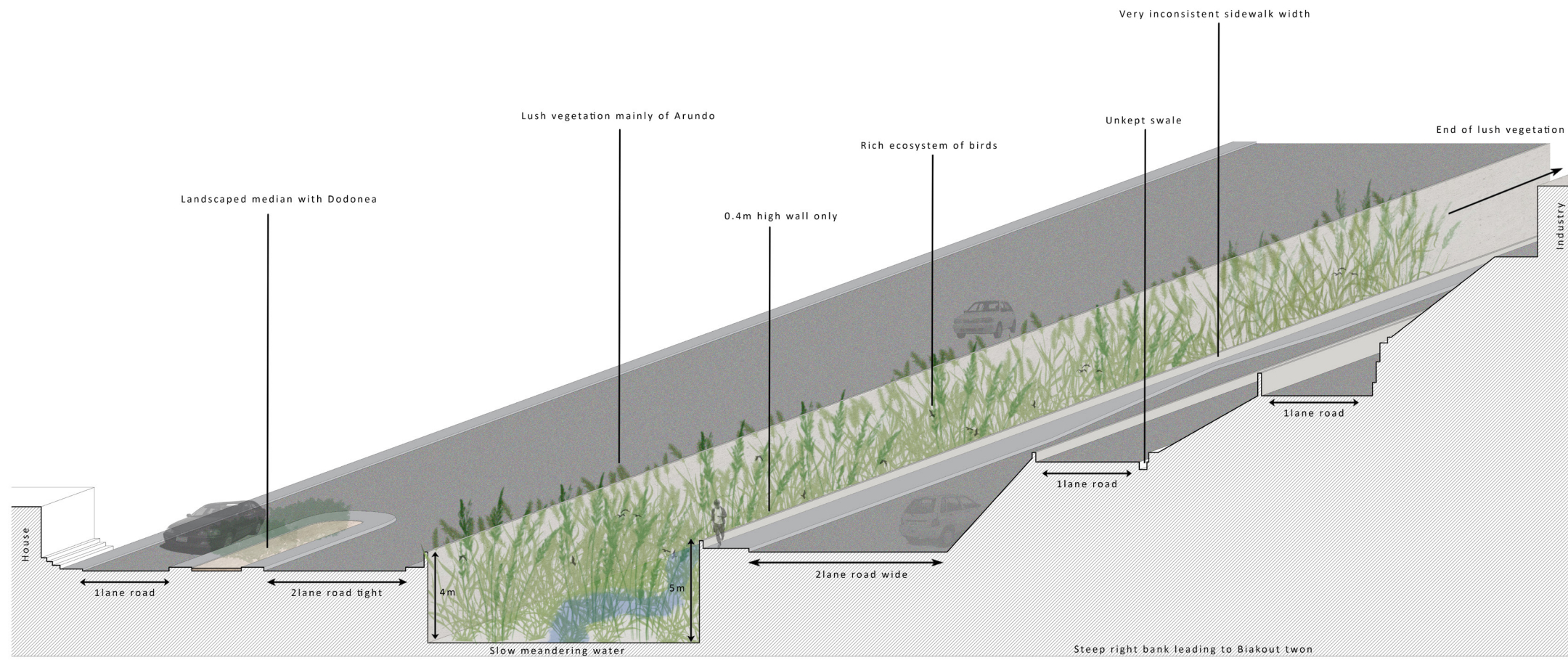


Figure37 Section A-A
Scale 1:200

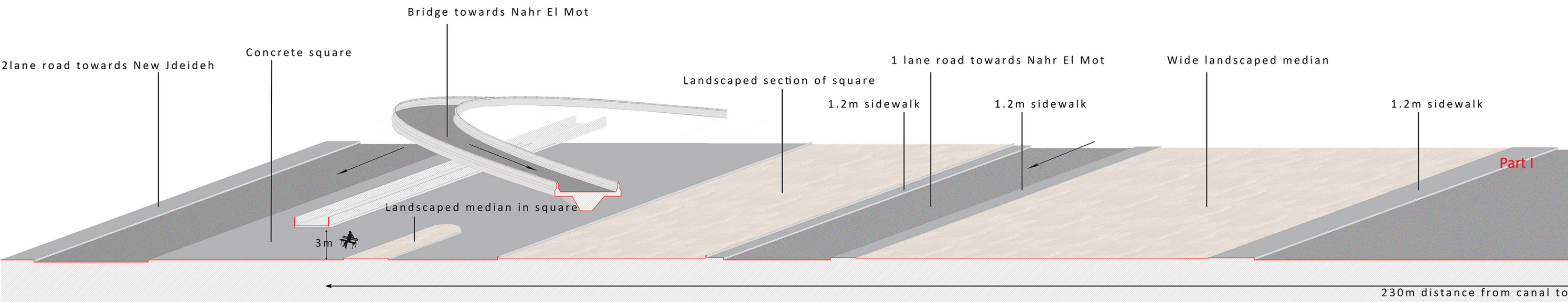


Figure36 Section D-D Scale 1:400

| Site analysis

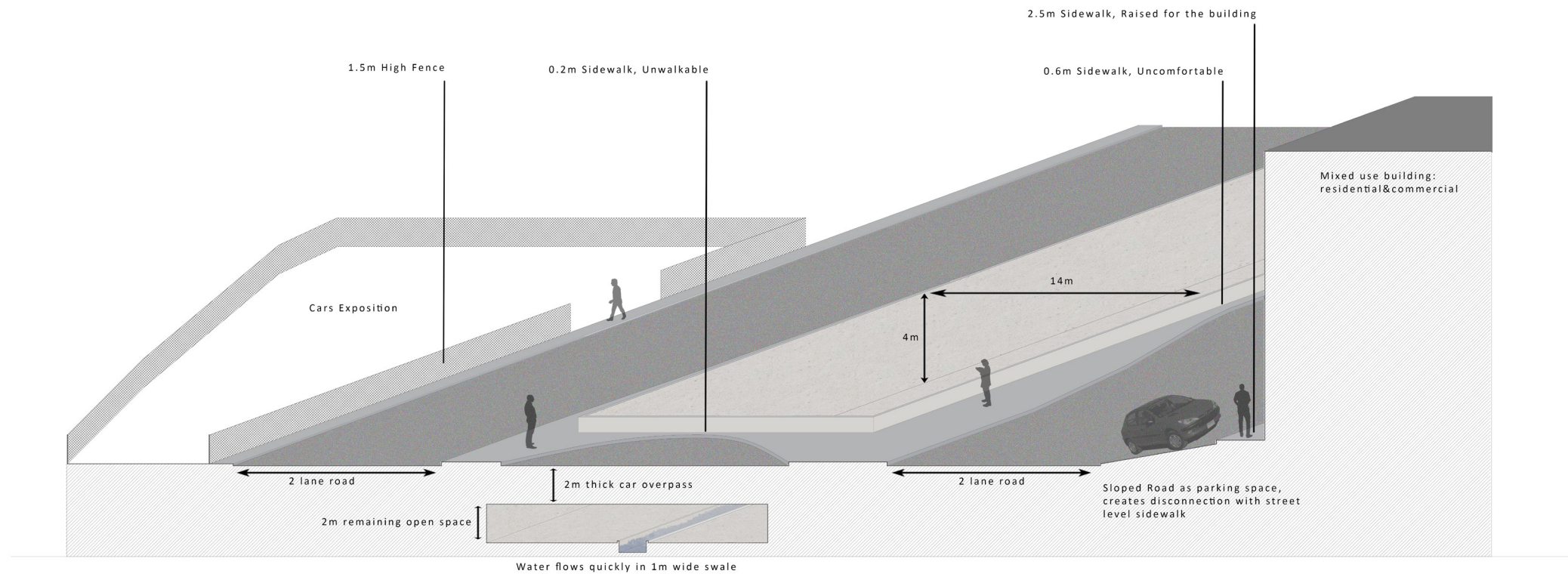


Figure38 Section B-B Scale 1:200

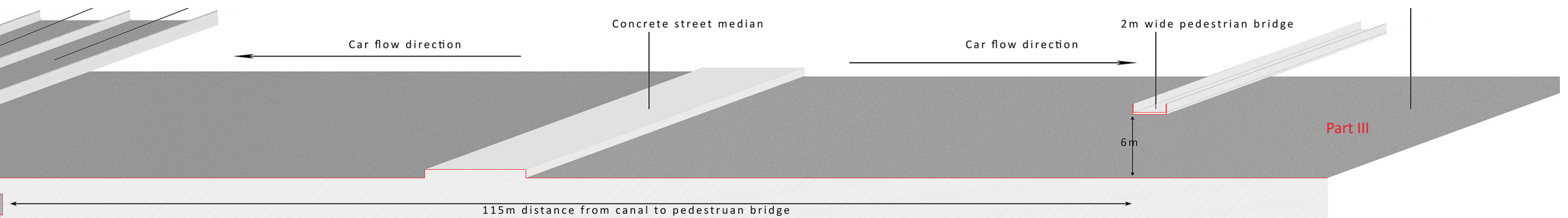
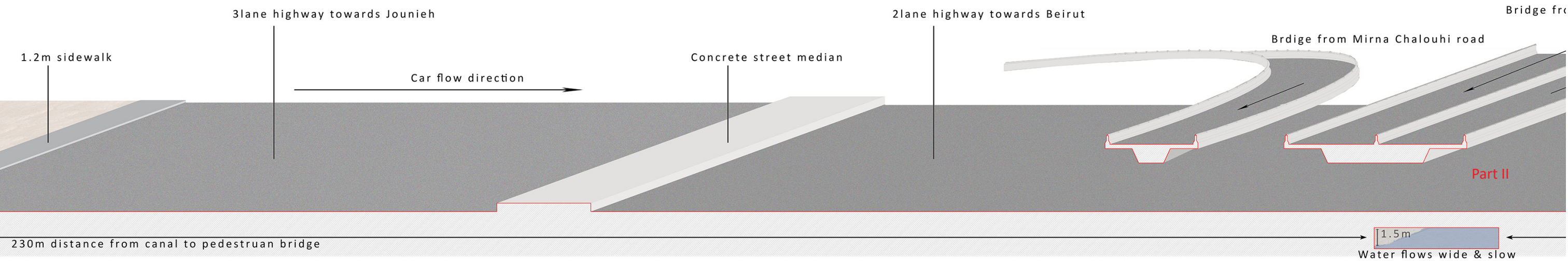
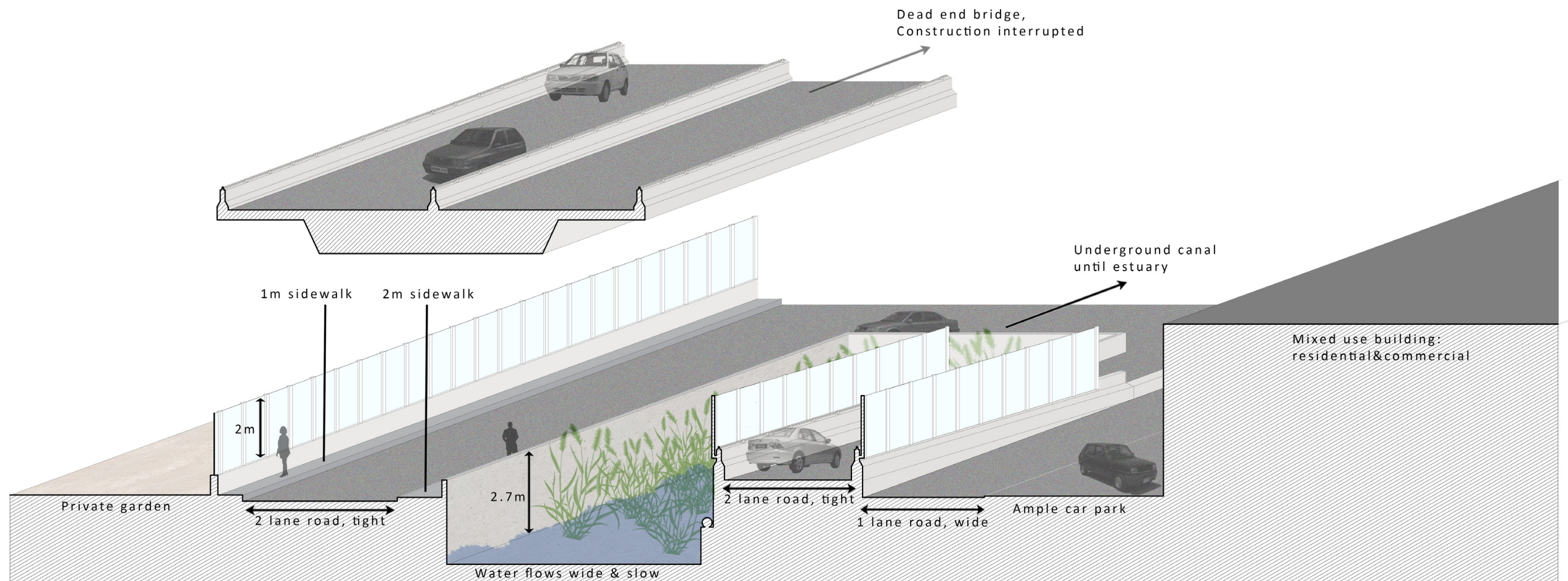
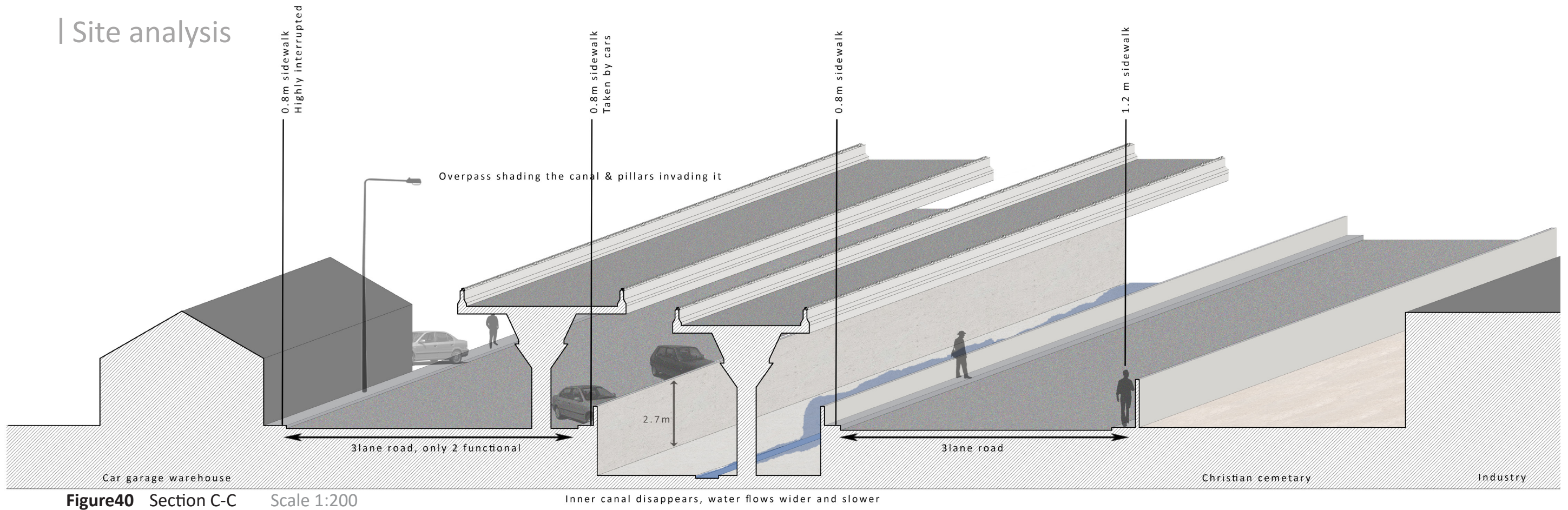


Figure39 Section D-D Scale 1:400

Site analysis





Legend

- 1 lane road
- 2 lane road
- 3 lane road
- 4 lane road
- 5 lane road

Figure42 Lanes per road

⌚ Scale 1:5000

Traffic gravity calculation

Volume In	61 cars
Inputs	15 cars
Outputs	19+5=24 cars
Volume Loss	9 cars
Theoretical Volume Out	61-9=52 cars
Practical Volume Out	46 cars
Theoretical - Practical (Due to speed loss--> leading to traffic)	52-46=6 cars

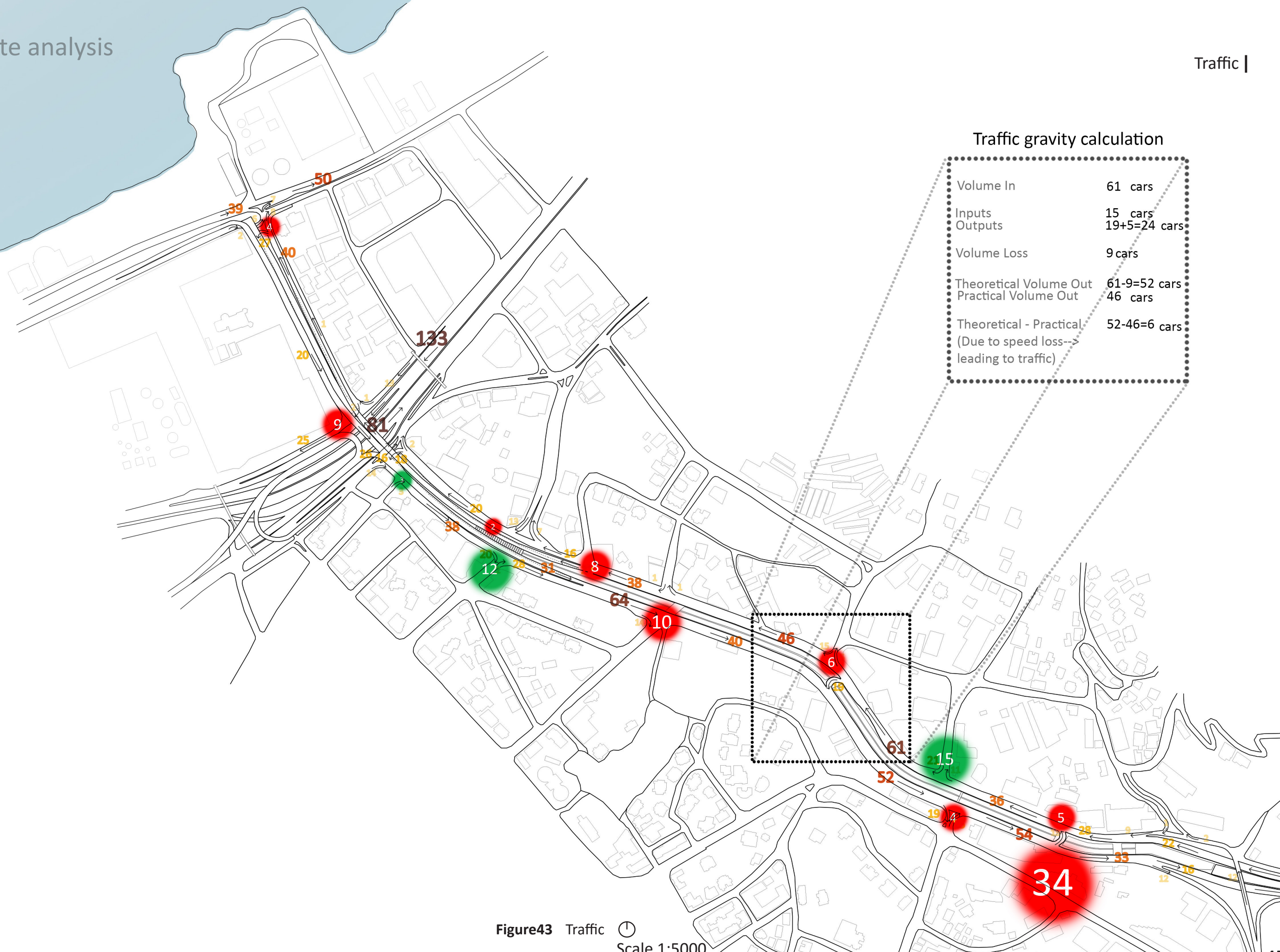



Figure43 Traffic  Scale 1:5000

By looking at the lanes per road map, an identification and sortage of the 1 to 2 lanes per road has been made as these are much easier to cross than wider roads and the vehicular speed is usually slower on these. Then the main traffic nodes depicted by the red circles in the traffic map has been overlayed with the 1 to 2 lanes roads in order to obtain the safe crossings shown in this map.

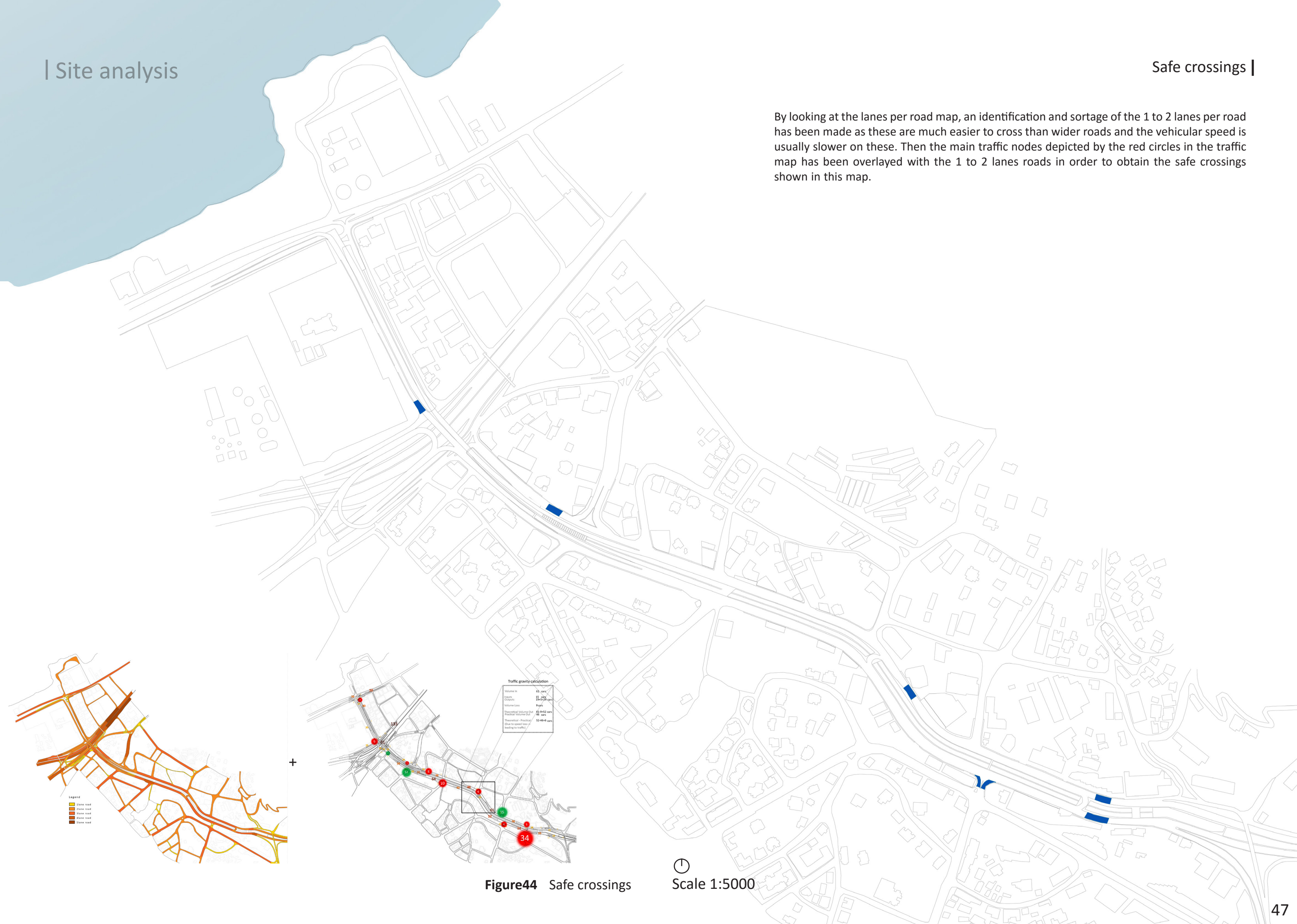


Figure44 Safe crossings

Scale 1:5000



Figure45 Sidewalk infrastructure ⓘ
Scale 1:5000



Legend

- Shrine
- Street hardware
- Cars occupation
- Broken sidewalk

Figure46 Sidewalk obstructions

⌚ Scale 1:5000

By looking at the sidewalk infrastructure in itself, one can notice the discontinuities throughout. However the real discontinuities appear when analyzing all the sidewalk obstructions like the many street hardware placed right in the middle of it at different occasions. Not only the obstructions cause the problem for the pedestrian ease of flow , it is also the many cars that are parked right on the sidewalk occupying the space. By overlaying the sidewalk infrastructure with the numerous obstructions and occupations that happen along, the very discontinuous remaining safe sidewalk can be extracted.

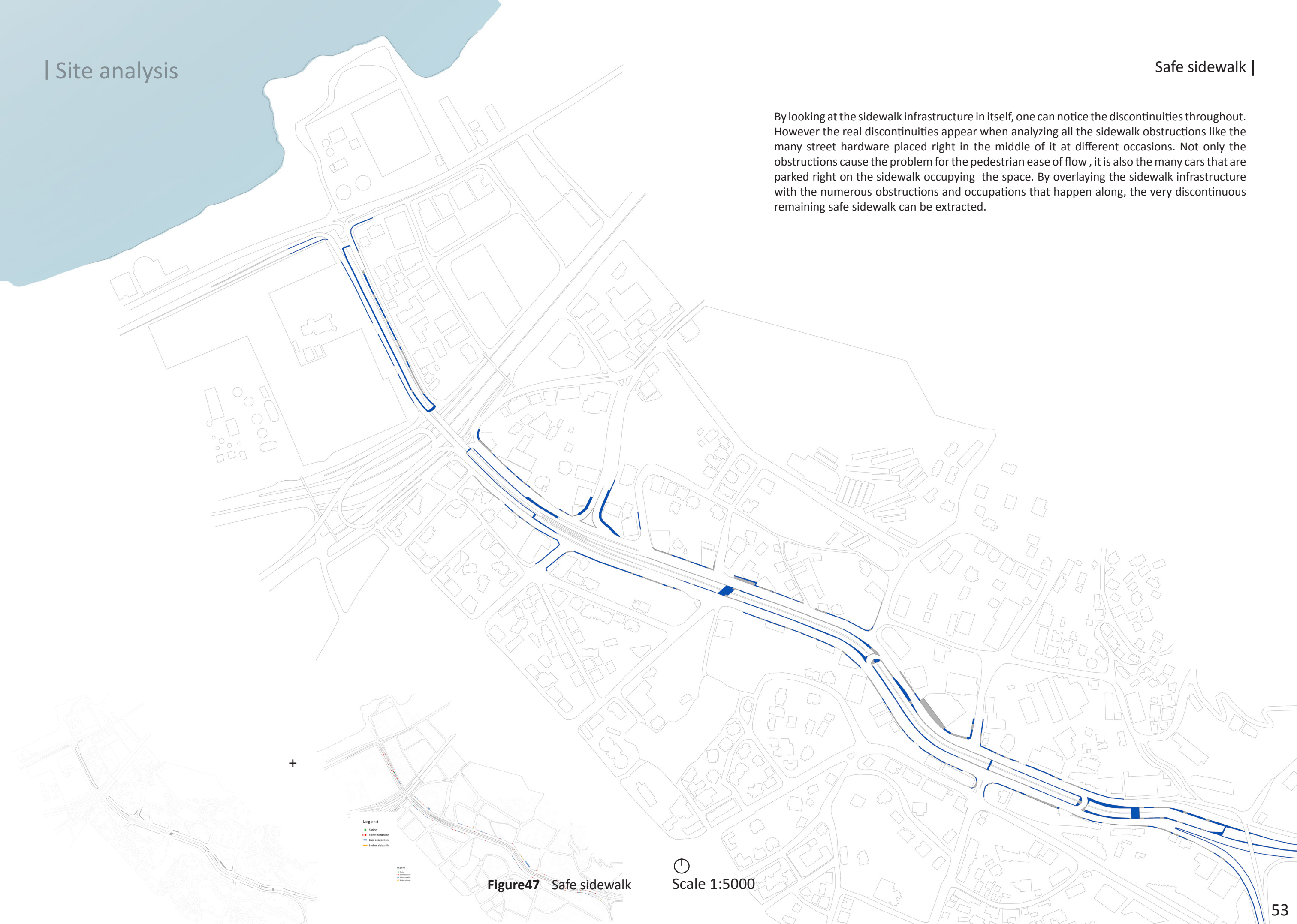


Figure47 Safe sidewalk

Scale 1:5000

Last but not least regarding the pedestrian flow, a safe pedestrian network map has been made. This was done by overlaying the safe crossings map obtained earlier with the safe sidewalk map. This map shows the safe crossings in order to be able to plan accordingly the safest entry points from the immediate entourage to the canal itself. In addition it shows the very discontinuous safe sidewalk, which backs up the need for a safer alternative for the pedestrian flow, inside the canal itself.

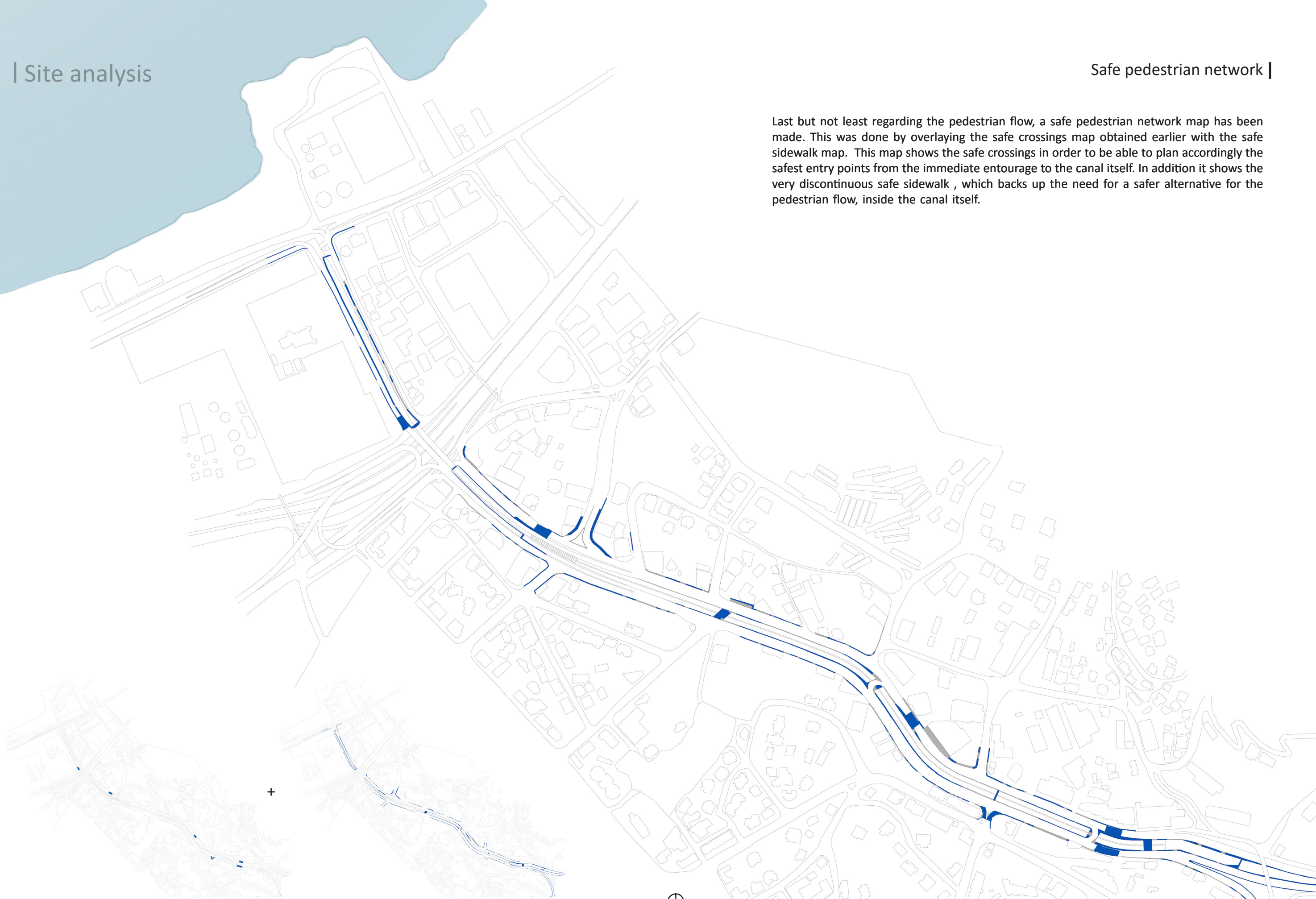


Figure48 Safe pedestrian network

Scale 1:5000

After having analyzed the vehicular and pedestrian networks, I have moved to look at how the pedestrian would interact with those infrastructures. To do so, I have simulated two possible trails one would take if he was to go from the industrial area at the beginning of the canal to the waterfront at its very end.

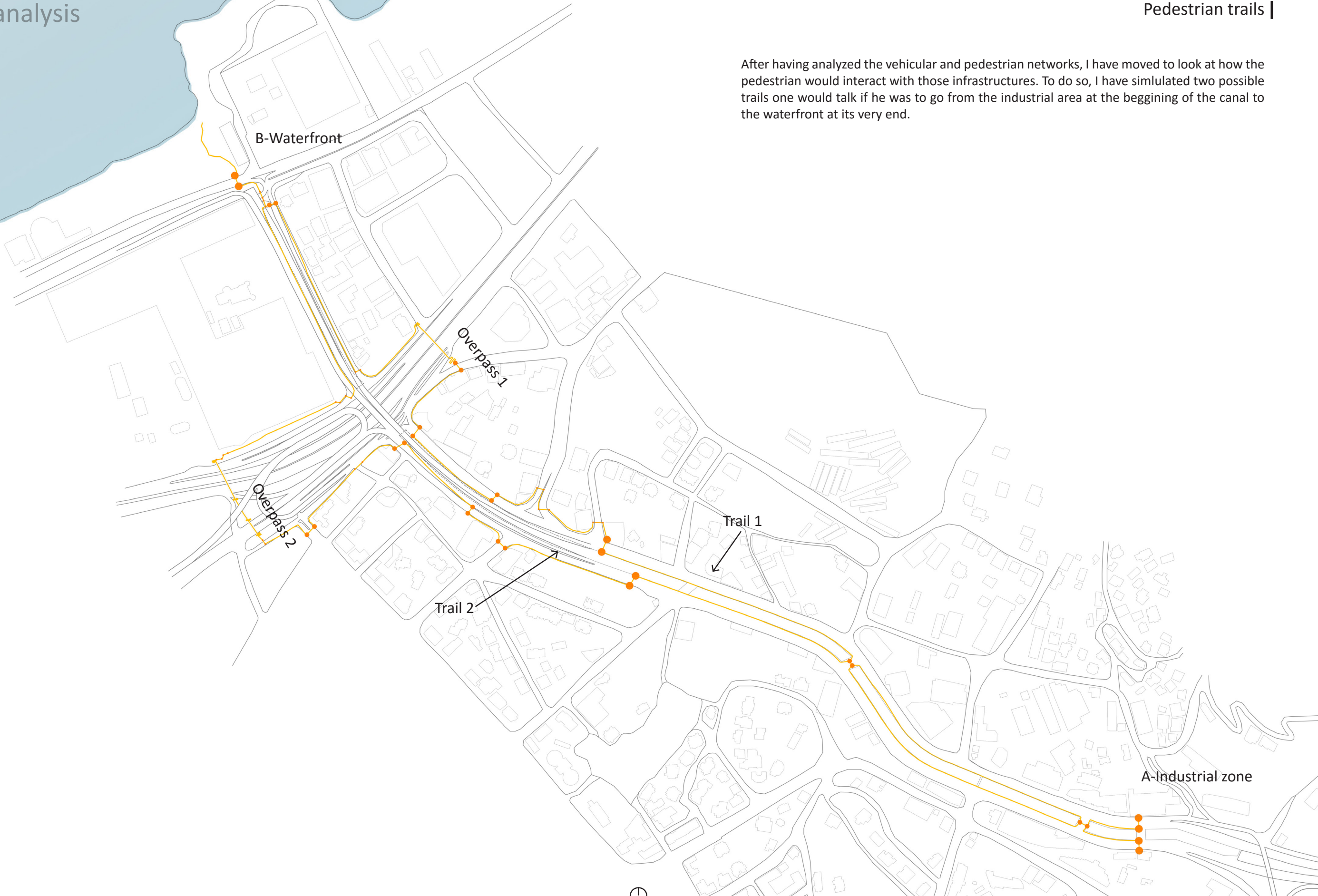
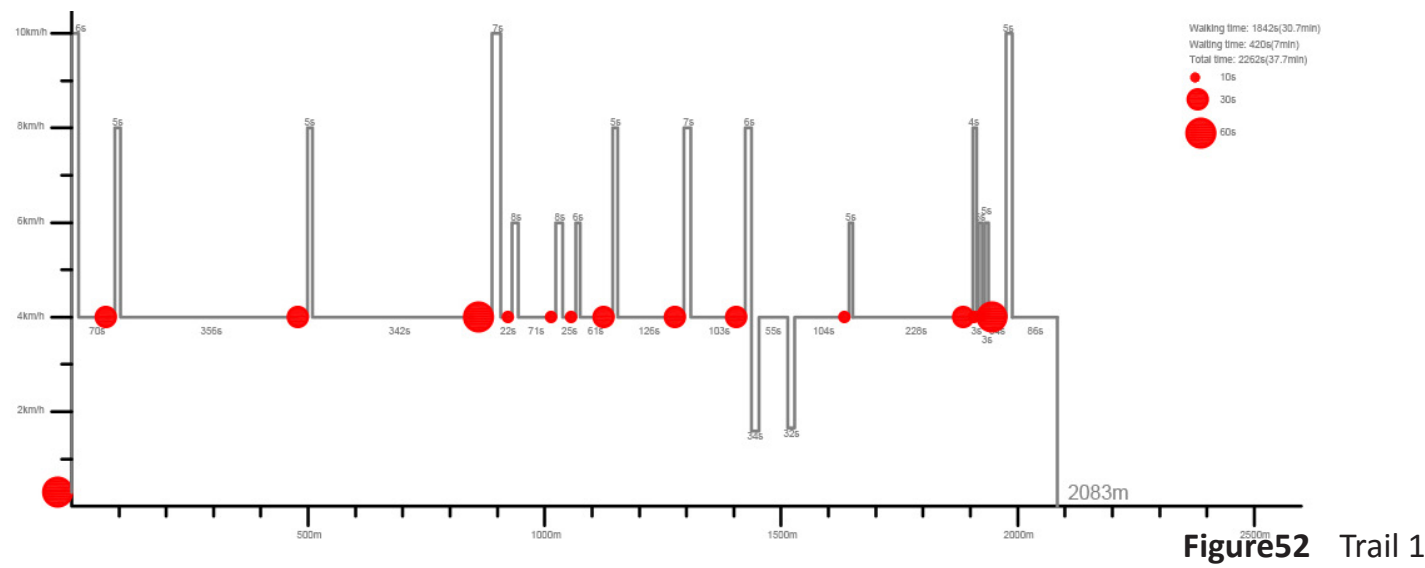
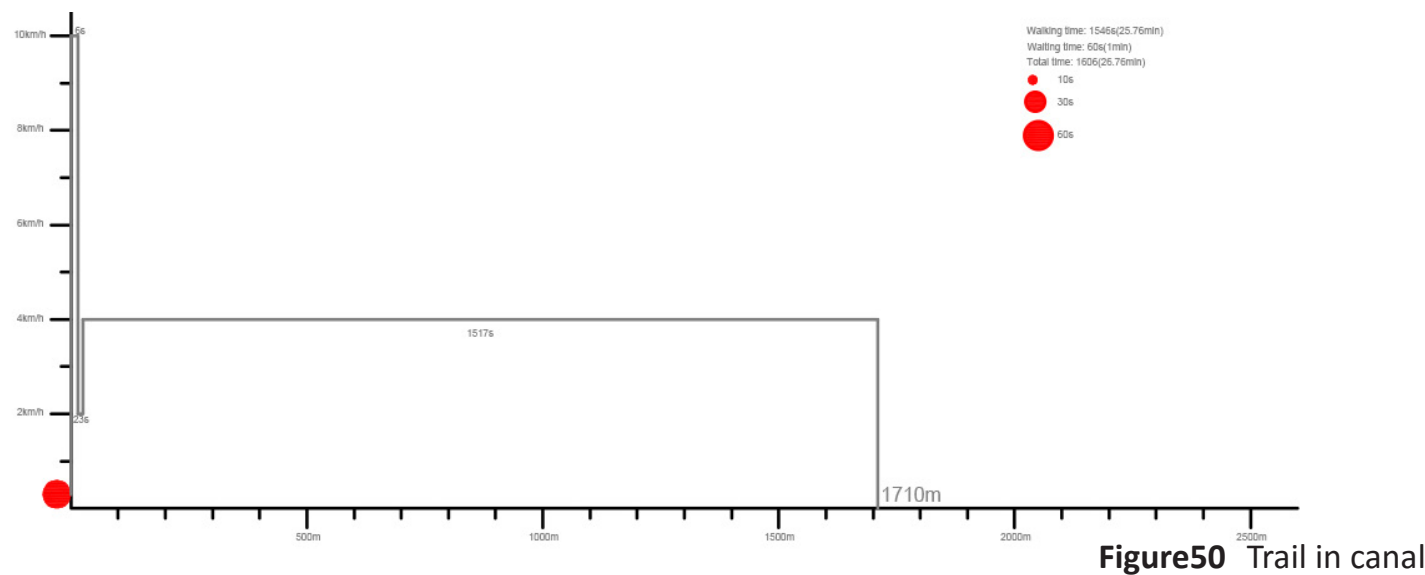
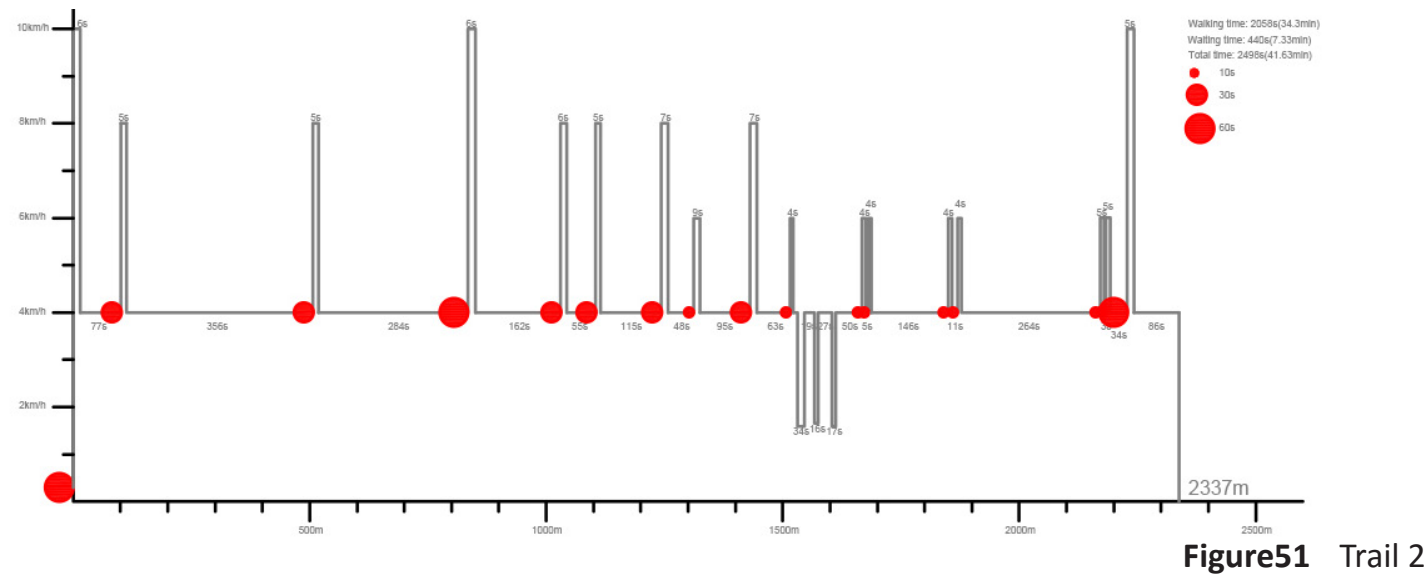


Figure49 Pedestrian trails

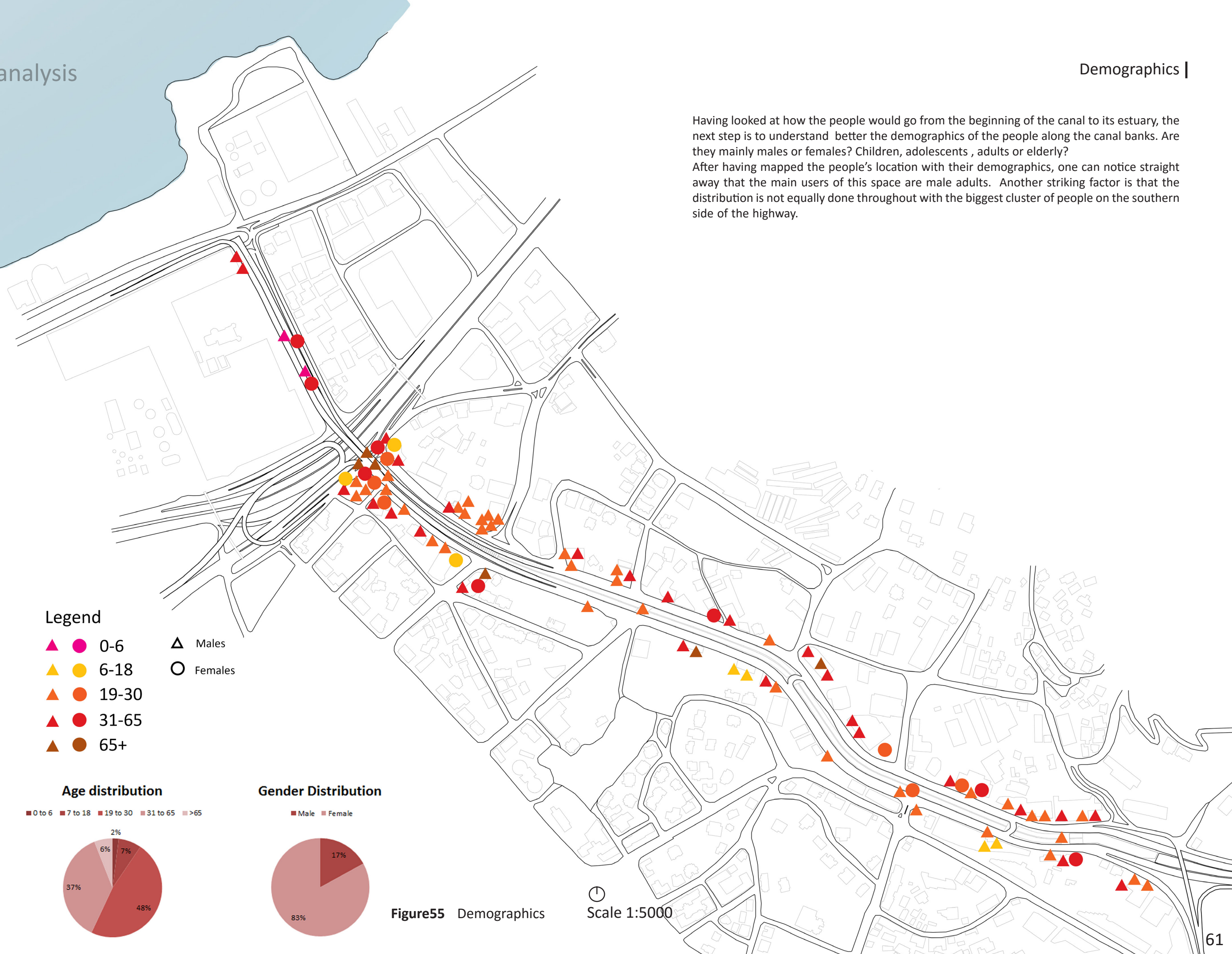
Scale 1:5000



If one looks at the two shortest paths one has to take to go from the beginning on the canal to the sea, one has to cross thirteen to sixteen times the road without taking into consideration the many times one has to walk out of the sidewalk because of the obstructions or sidewalk occupation. In addition, to those crossings being an issue of safety, they are also a waste of time as one tends to wait between ten seconds if crossing a laneway up to sixty seconds and above if crossing a fast three lane road. Instead of wasting around 7 min in both paths on crossings, one would only have to wait one minute to get inside the canal and safely walk without having to cross or be interrupted. The total walk time, including the waiting time on crossings will be much less, a mere 27 minutes instead of respectively 38 minutes and 42 minutes on the two other existing paths.



Having looked at how the people would go from the beginning of the canal to its estuary, the next step is to understand better the demographics of the people along the canal banks. Are they mainly males or females? Children, adolescents, adults or elderly? After having mapped the people's location with their demographics, one can notice straight away that the main users of this space are male adults. Another striking factor is that the distribution is not equally done throughout with the biggest cluster of people on the southern side of the highway.

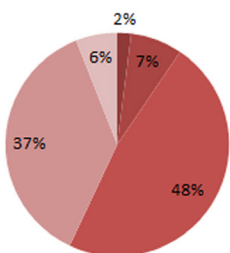


Legend

- ▲ 0-6
- ▲ 6-18
- ▲ 19-30
- ▲ 31-65
- ▲ 65+
- △ Males
- Females

Age distribution

■ 0 to 6 ■ 7 to 18 ■ 19 to 30 ■ 31 to 65 ■ >65



Gender Distribution

■ Male ■ Female

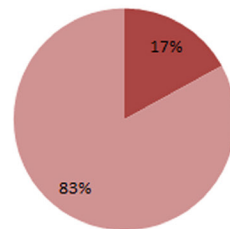


Figure55 Demographics

Scale 1:5000

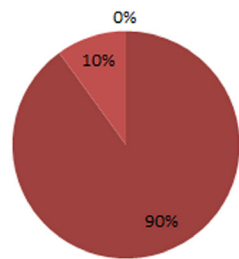
After mapping the people's demographics, it is also important to see what are those people doing in that space, which brings us to mapping their activities. Technicians as well as salespersons formed the majority as there were many garages and shops along the banks of the canal. There were also many passerby crossing from a side to the other or simply walking along to reach another destination. When one analyzes these activities, one can notice that almost all of them are of a necessary nature, purely functional activities that one has to do in their every day life no matter what. Only very few social activities were observed were a friend would just visit his friend and sit with him at his shop. There were absolutely no optional activities at all which points to a degraded quality of this space, not catering for anything beyond the regular functional activities.

Legend

- Street beggar 
- Security guard 
- Peddler 
- Technician 
- Salesperson 
- Passerby 
- Grocer 

Activity category

■ Necessary ■ Social ■ Optional



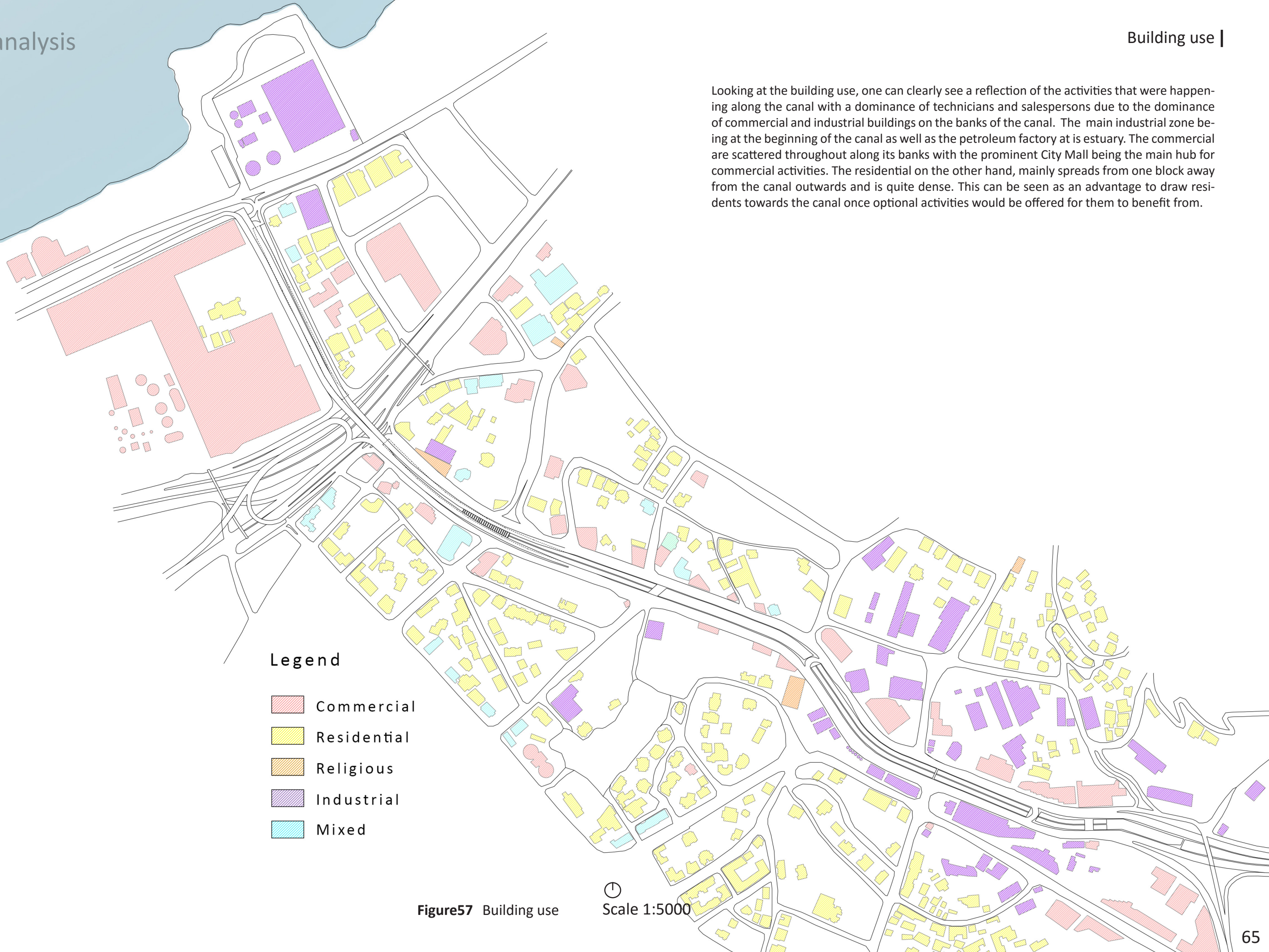
— Necessary activities
— Social activities

Necessary, Optional, and Social Activity. Gehl distinguishes between necessary/functional activities, optional/recreational activities and social activities in public spaces. While necessary activities take place regardless of the quality of the physical environment, optional activities depend to a significant degree on what the place has to offer and how it makes people behave and feel about it. The better a place, the more optional activity occurs and the longer necessary activity lasts. Social activity is the fruit of the quality and length of the other types of activities, because it occurs spontaneously when people meet in a particular place. Social activities include children's play, greetings and conversations, communal activities of various kinds, and simply seeing and hearing other people. Communal spaces in cities and residential areas become meaningful and attractive when all activities of all types occur in combination and feed off each other.

-Jan Gehl

Figure56 Activities

Scale 1:5000



Looking at the building use, one can clearly see a reflection of the activities that were happening along the canal with a dominance of technicians and salespersons due to the dominance of commercial and industrial buildings on the banks of the canal. The main industrial zone being at the beginning of the canal as well as the petroleum factory at its estuary. The commercial are scattered throughout along its banks with the prominent City Mall being the main hub for commercial activities. The residential on the other hand, mainly spreads from one block away from the canal outwards and is quite dense. This can be seen as an advantage to draw residents towards the canal once optional activities would be offered for them to benefit from.

Legend

- Commercial
- Residential
- Religious
- Industrial
- Mixed

Figure57 Building use

Scale 1:5000

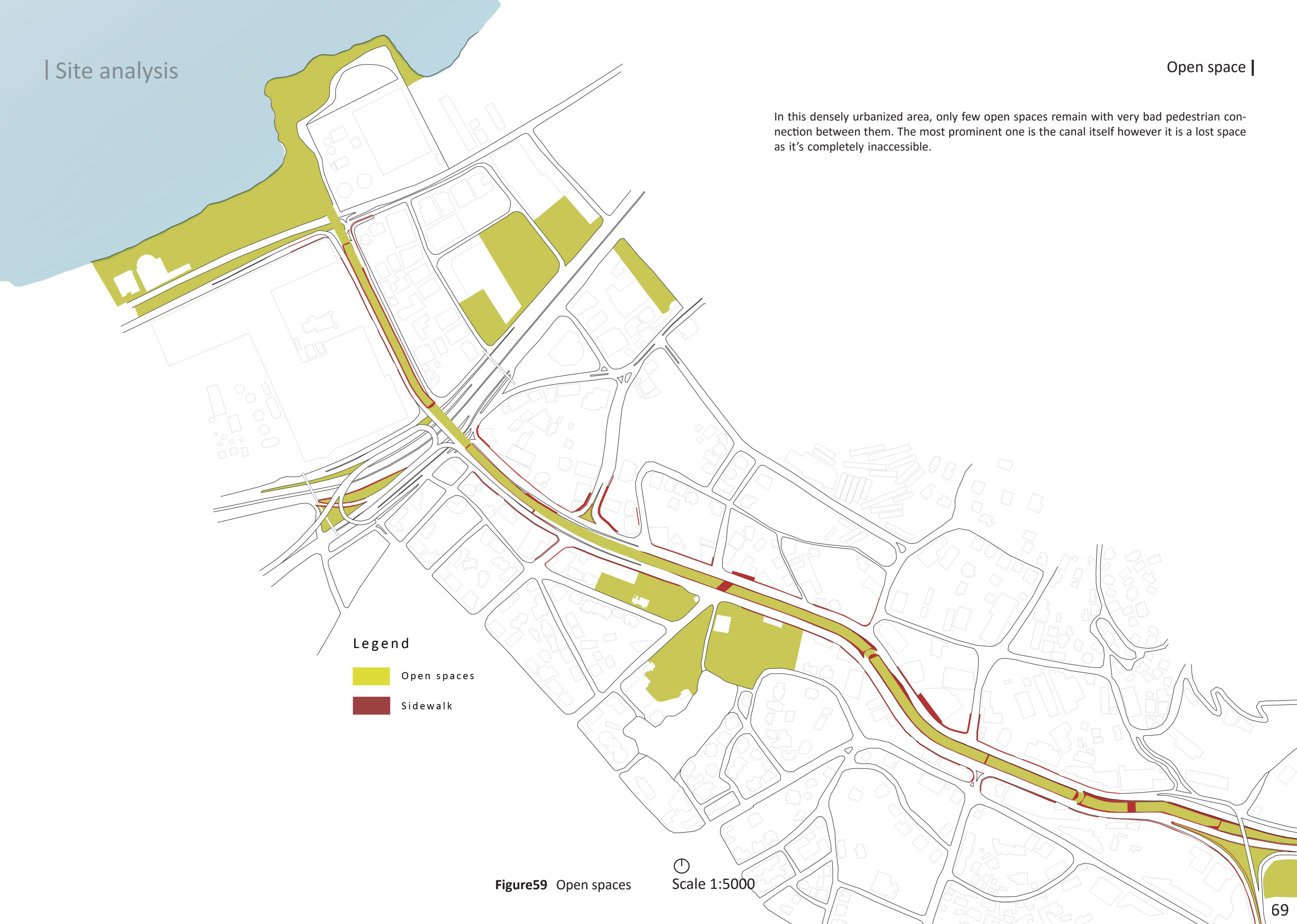
Then taking a closer look to the buildings, one sees that some have interesting multi purpose facades. Those facades generate a wider range of street level activities and enhance the feeling of security around them by providing passive watch over from the inside for the pedestrians. These attractive facades are mainly on the commercial or mixed used buildings and not on the industrial ones.



Figure58 Attractive facades

⌚ Scale 1:5000

In this densely urbanized area, only few open spaces remain with very bad pedestrian connection between them. The most prominent one is the canal itself however it is a lost space as it's completely inaccessible.



Legend

- Open spaces
- Sidewalk

Figure59 Open spaces

Scale 1:5000

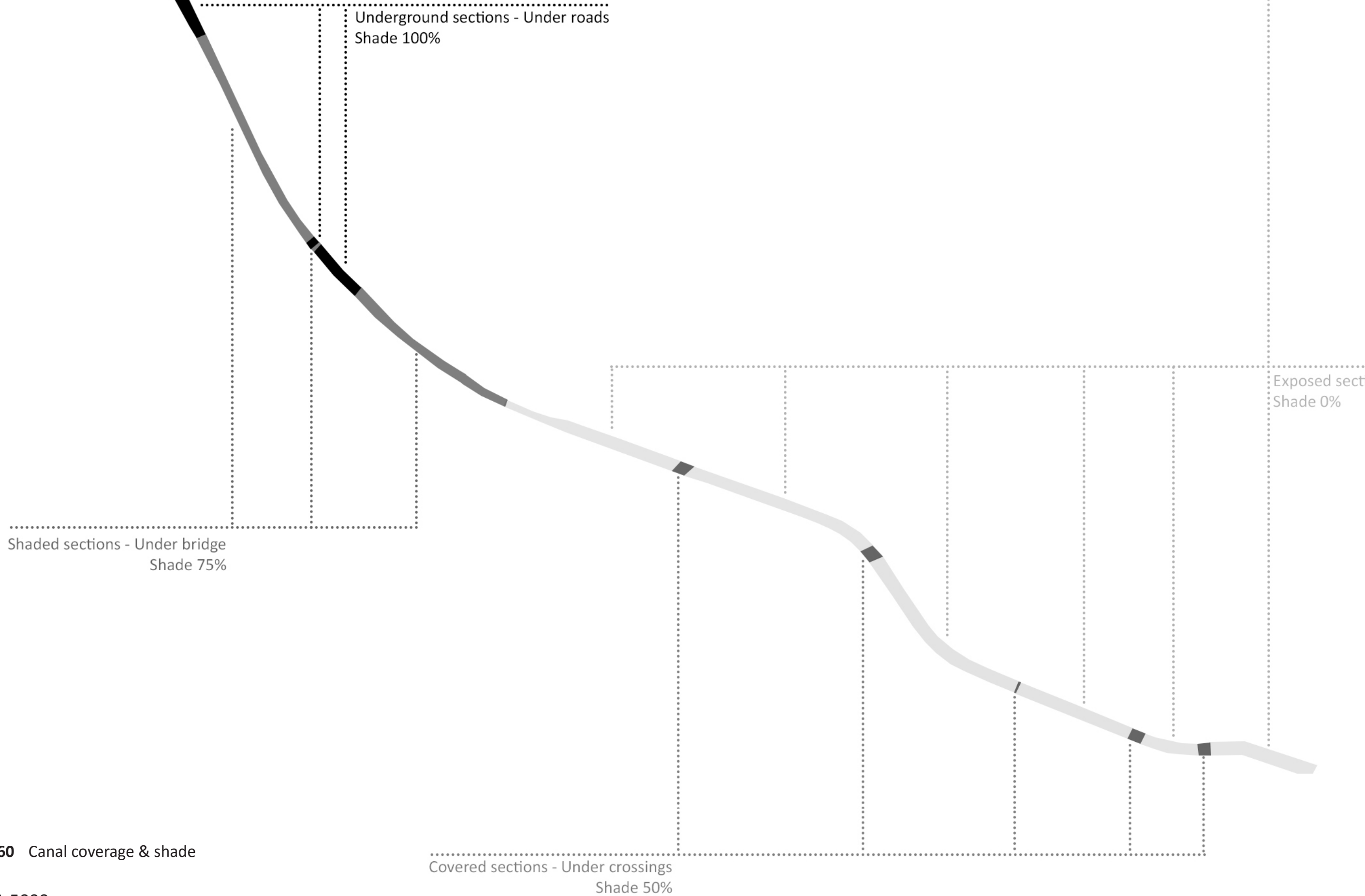


Figure60 Canal coverage & shade

🕒
Scale 1:5000

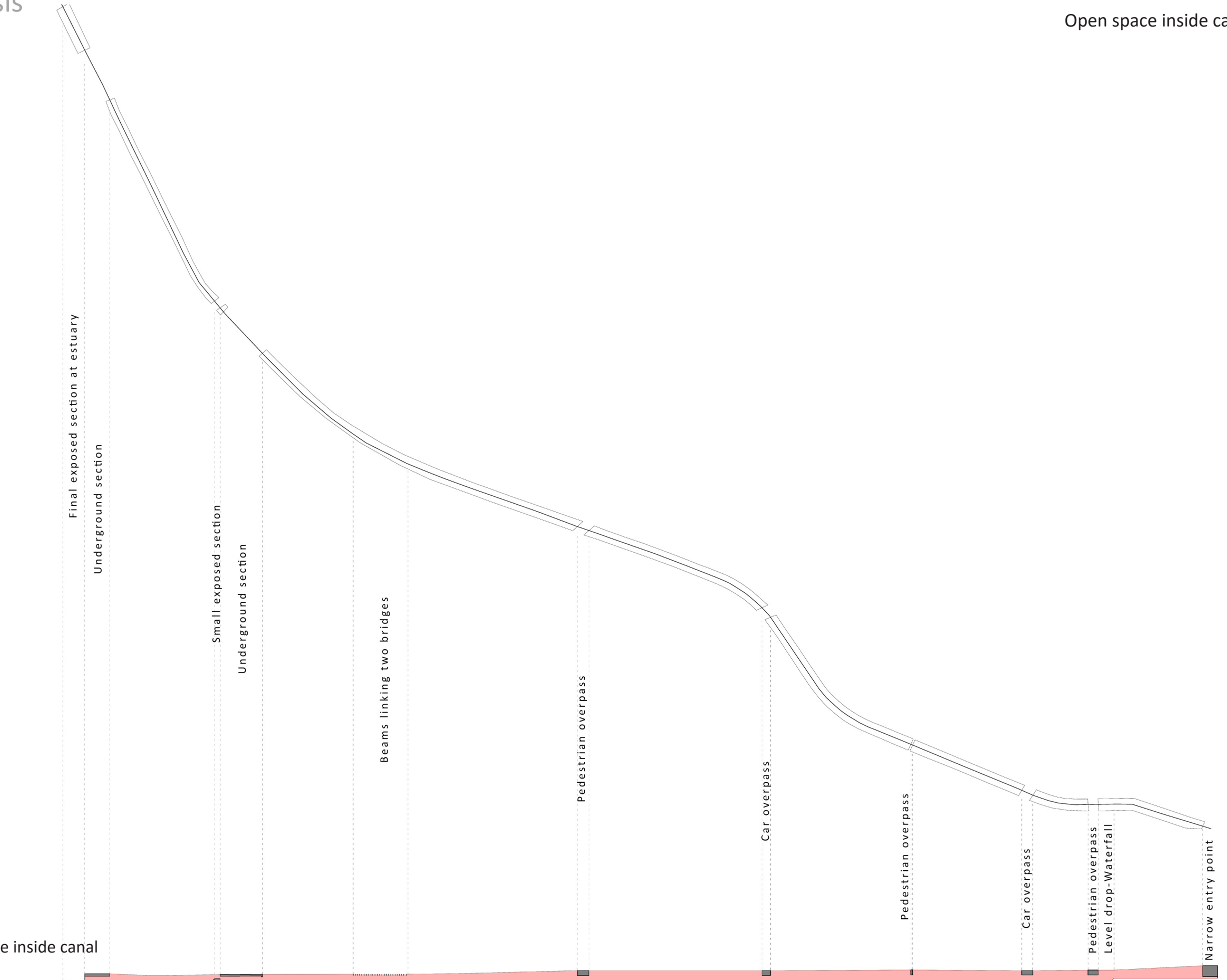


Figure61 Open space inside canal

🕒
Scale 1:5000

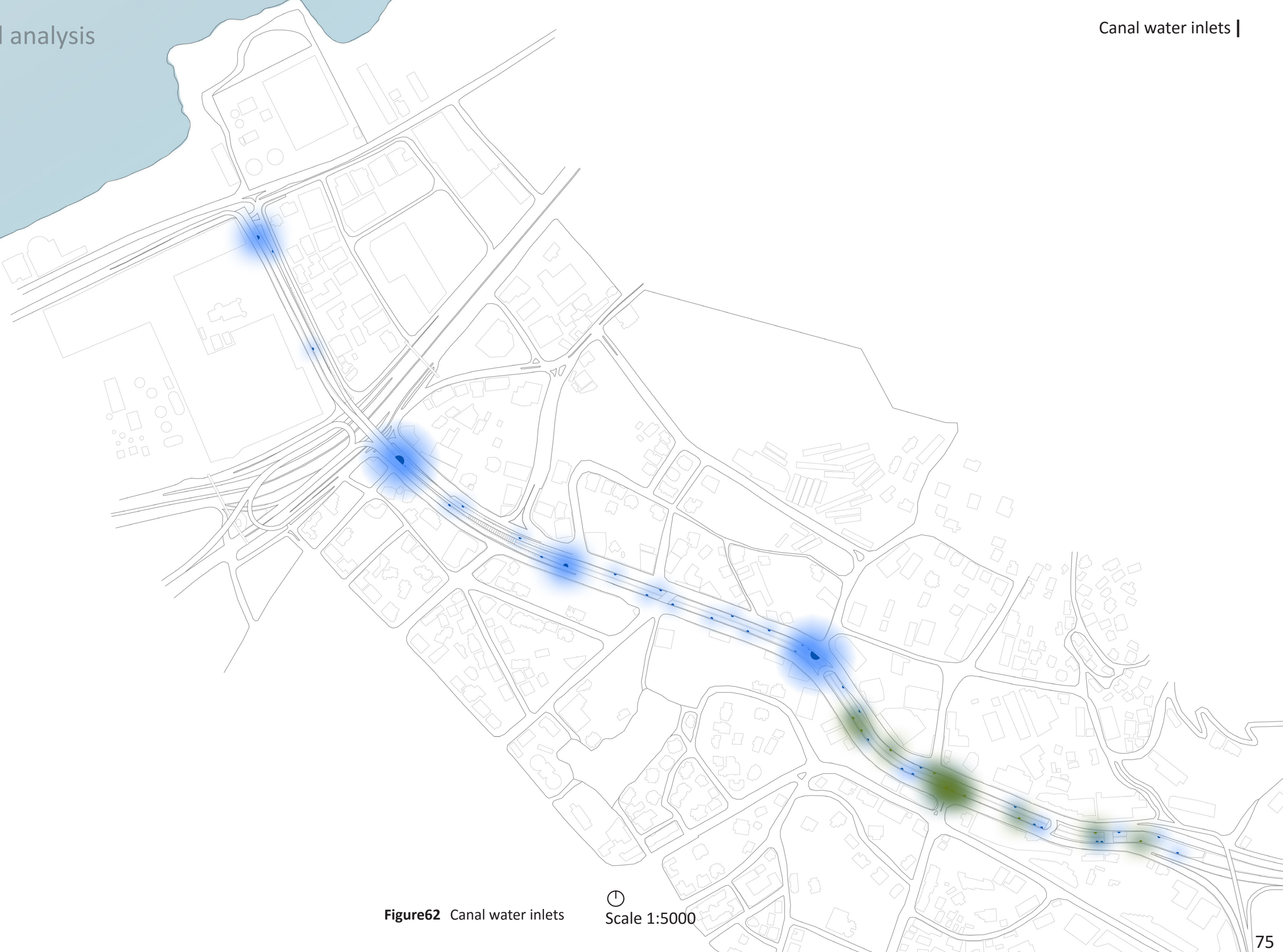


Figure62 Canal water inlets

Scale 1:5000

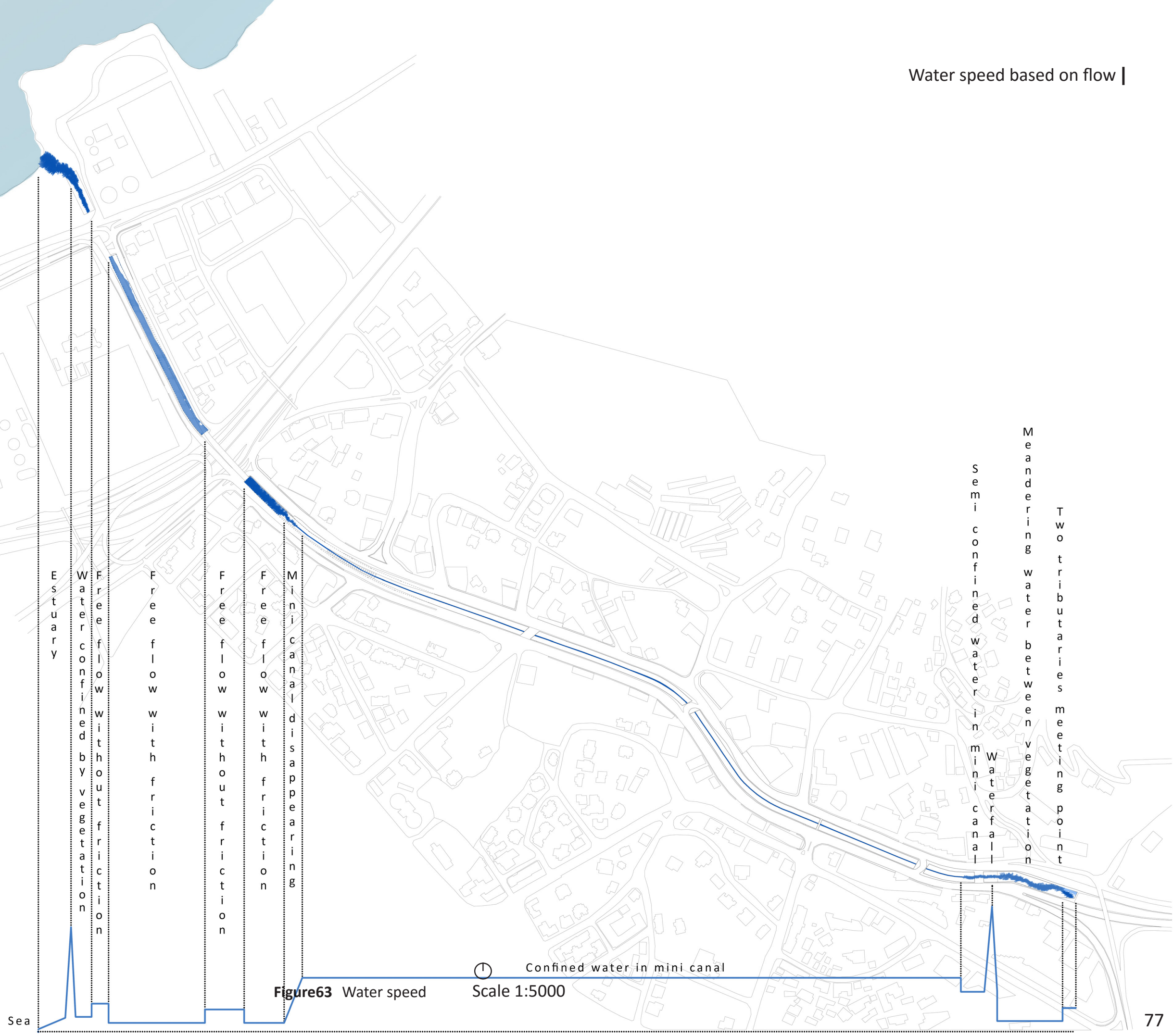


Figure63 Water speed

① Confined water in mini canal
Scale 1:5000

Sea

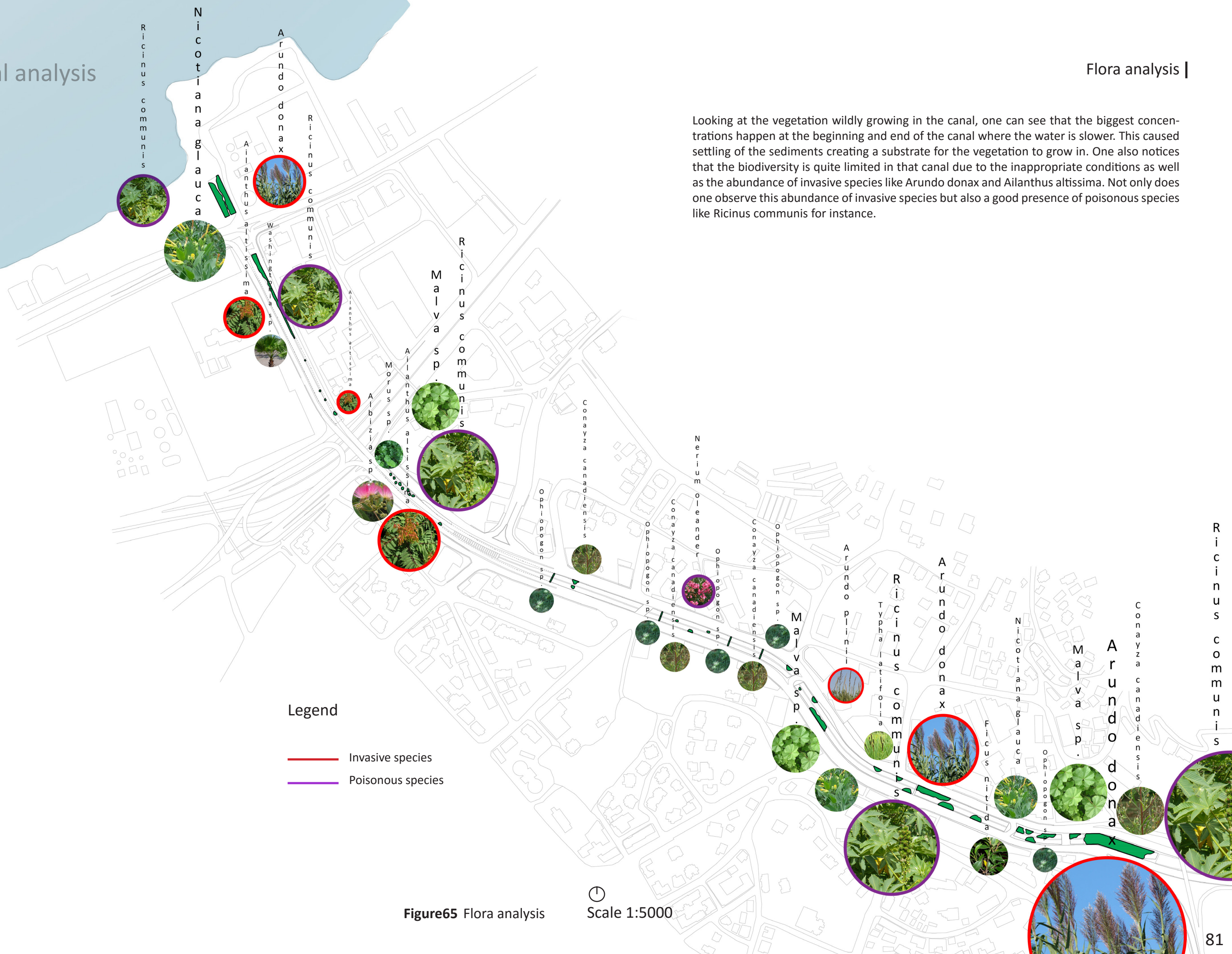
By analyzing the water inlets in the canal, specifically the gray and black water that is being dumped from the nearby industries, one can have a rough estimate of the smell being located around these sewage inlets. However for more accuracy, the water speed has been overlaid with the sewage inlets, where slower and stagnant water led to stronger smell nodes than where water was rapidly flowing. These nodes will help in determining in which locations a bigger treatment will be required.



Figure64 Smell analysis

Scale 1:5000

Looking at the vegetation wildly growing in the canal, one can see that the biggest concentrations happen at the beginning and end of the canal where the water is slower. This caused settling of the sediments creating a substrate for the vegetation to grow in. One also notices that the biodiversity is quite limited in that canal due to the inappropriate conditions as well as the abundance of invasive species like *Arundo donax* and *Ailanthus altissima*. Not only does one observe this abundance of invasive species but also a good presence of poisonous species like *Ricinus communis* for instance.



Legend

- Invasive species
- Poisonous species

Figure65 Flora analysis

Scale 1:5000

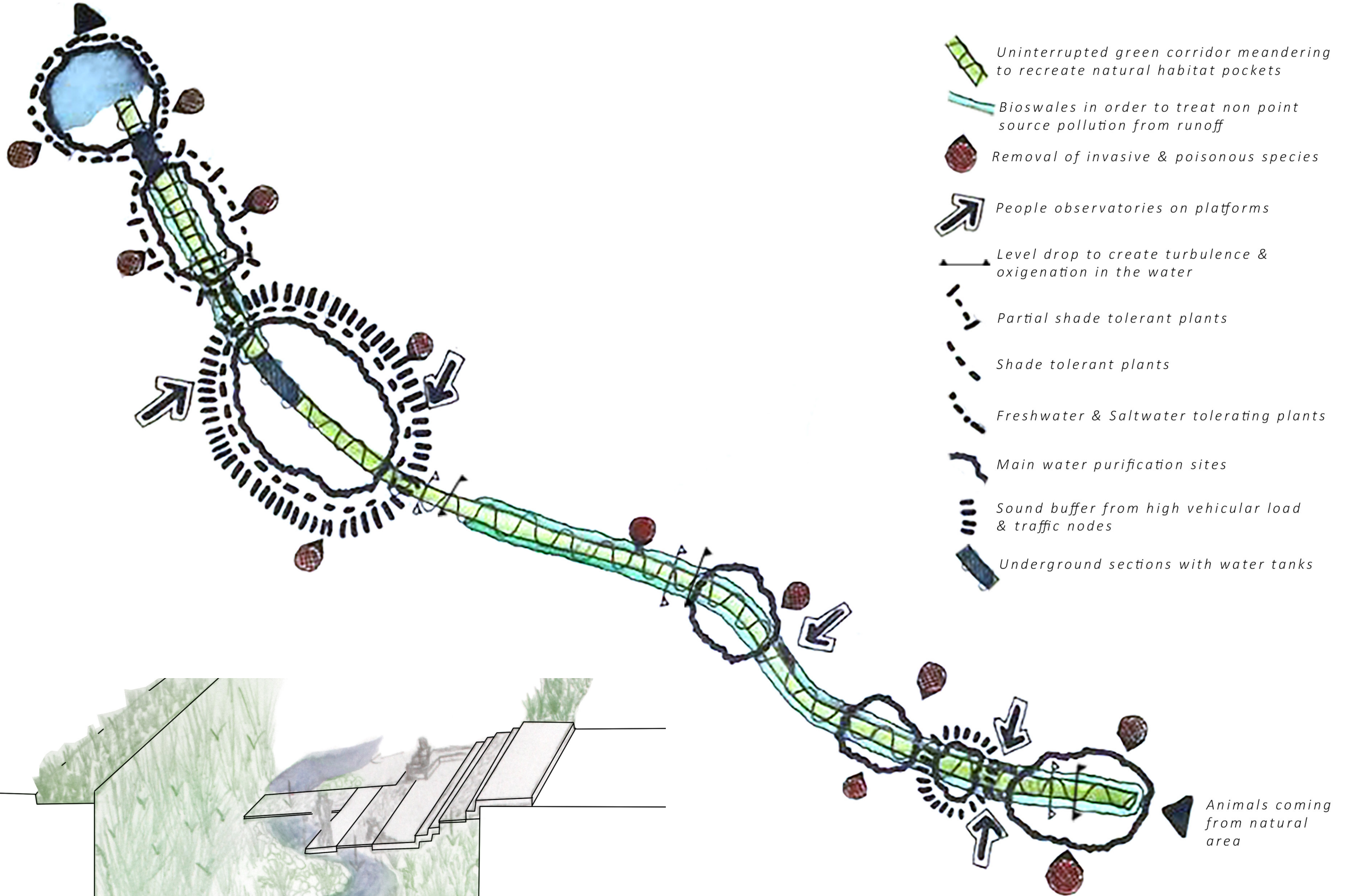
It is of no surprise that the fauna coincides with the flora with the highest concentration being at the beginning and end of the canal. The majority of the animals are ones that are unpleasant to sight, living in this degraded environment like stray dogs and rats. Only few birds are seen where lush vegetation exist and seagulls on the estuary-that rich interface with the sea.



Figure66 Fauna analysis

Scale 1:5000

Animals reaching the sea waterfront



Legend

- Uninterrupted green corridor meandering to recreate natural habitat pockets
- Bioswales in order to treat non point source pollution from runoff
- Removal of invasive & poisonous species
- People observatories on platforms
- Level drop to create turbulence & oxigenation in the water
- Partial shade tolerant plants
- Shade tolerant plants
- Freshwater & Saltwater tolerating plants
- Main water purification sites
- Sound buffer from high vehicular load & traffic nodes
- Underground sections with water tanks

Animals coming from natural area

Figure67 Green corridor sketch

Scale 1:5000

Figure68 Green corridor diagram

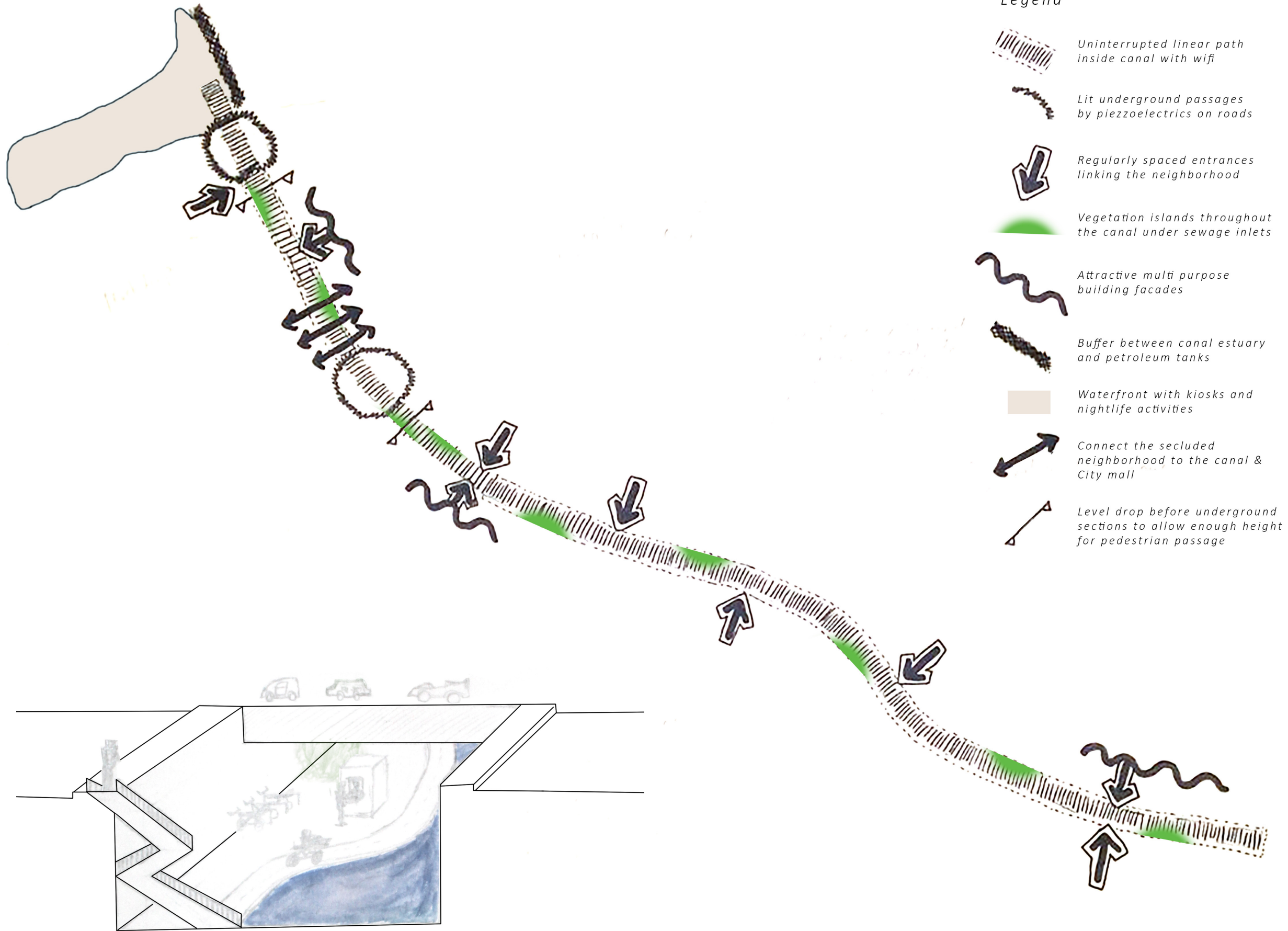


Figure69 Linear park sketch

Scale 1:5000

Figure70 Linear park diagram

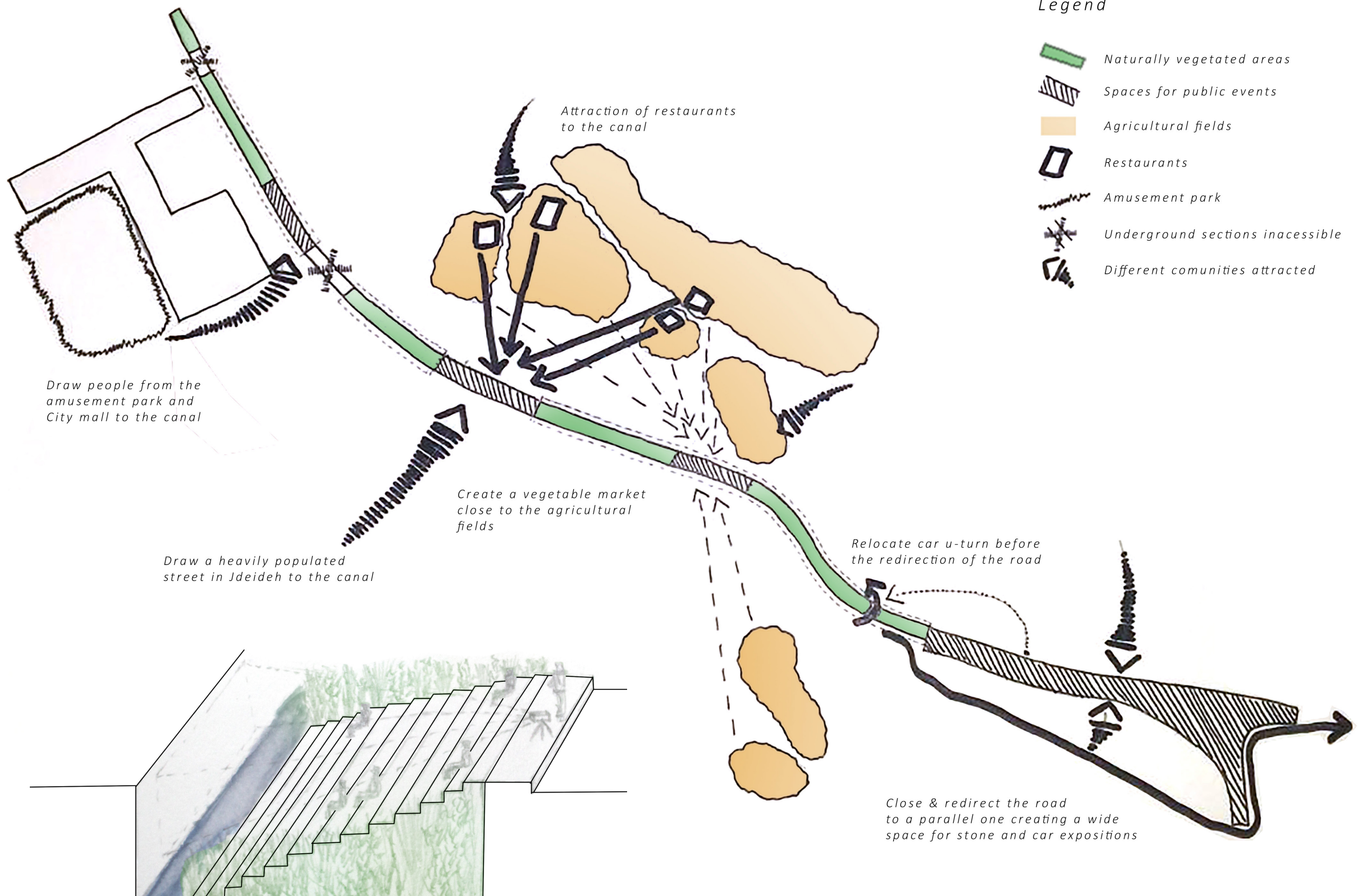


Figure71 Social nodes sketch

Scale 1:5000

Figure72 Social nodes diagram

Three concept diagrams were proposed for the design of the canal. The first one, the green corridor, focuses mainly on the ecological aspect by transforming all of the canalized stretch into a green vein lush with native vegetation. This will also act as a corridor for animals who want to pass safely from the natural area uphill to the sea. In addition to the canal being a protected buffered zone for both fauna and flora, several platforms will be designed throughout the canal where people can come into close contact with nature without disturbing it as these would be elevated platforms.

The second concept, linear park, is more about an uninterrupted corridor for people this time. The main driver behind this idea of a continuous pedestrian strip comes from the poor pedestrian infrastructure outside the canal and the difficulty to move from a place to another efficiently and safely. This will mainly be an attraction for the immediate entourage, whenever they have lunch break for instance or feel like doing a morning jog or something from this genre.

The third concept, social nodes, is mainly about different areas along the canal designed for crowd gathering and public events while the rest stays green and natural. This option will primarily attract people from the different municipalities around the canal and potentially from other regions in Lebanon to assist to these public events.

The three options were drawn in both a conceptual plan and a small sketch. These drawings were then used for a pictorial survey of different people along the site surrounding. After explaining the main ideas behind each concept, each person voted for what they think lacks most in the region and what will best fit their own needs. The majority voted for the second option, the linear park followed by the first one, the green corridor with only one person out of the thirteen electing the third option, social nodes.

Following the pictorial survey, I decided to develop a fourth option called lifelane that is based on the people's first choice, the linear park. In addition, it merges some ideas of the green corridor with the first section being transformed into an observatory only and several in-situ filtration happening along the canal. This final proposal, in addition to the discontinuous bike lane from beginning to end, offers several activities at different locations responding to the immediate context's needs. Some of these activities will be public events like in the third option proposed previously like the amphitheater and the stone exposition.

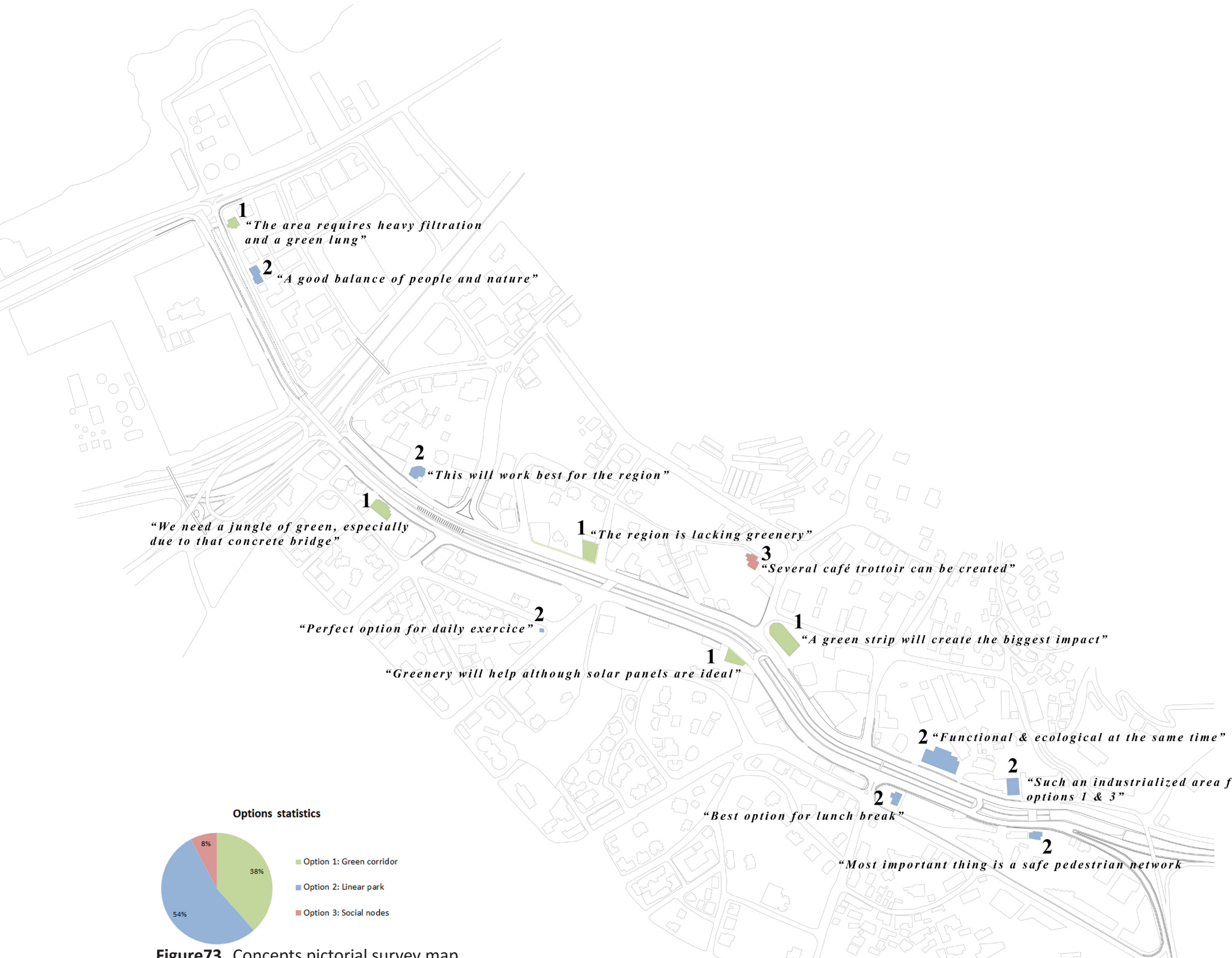
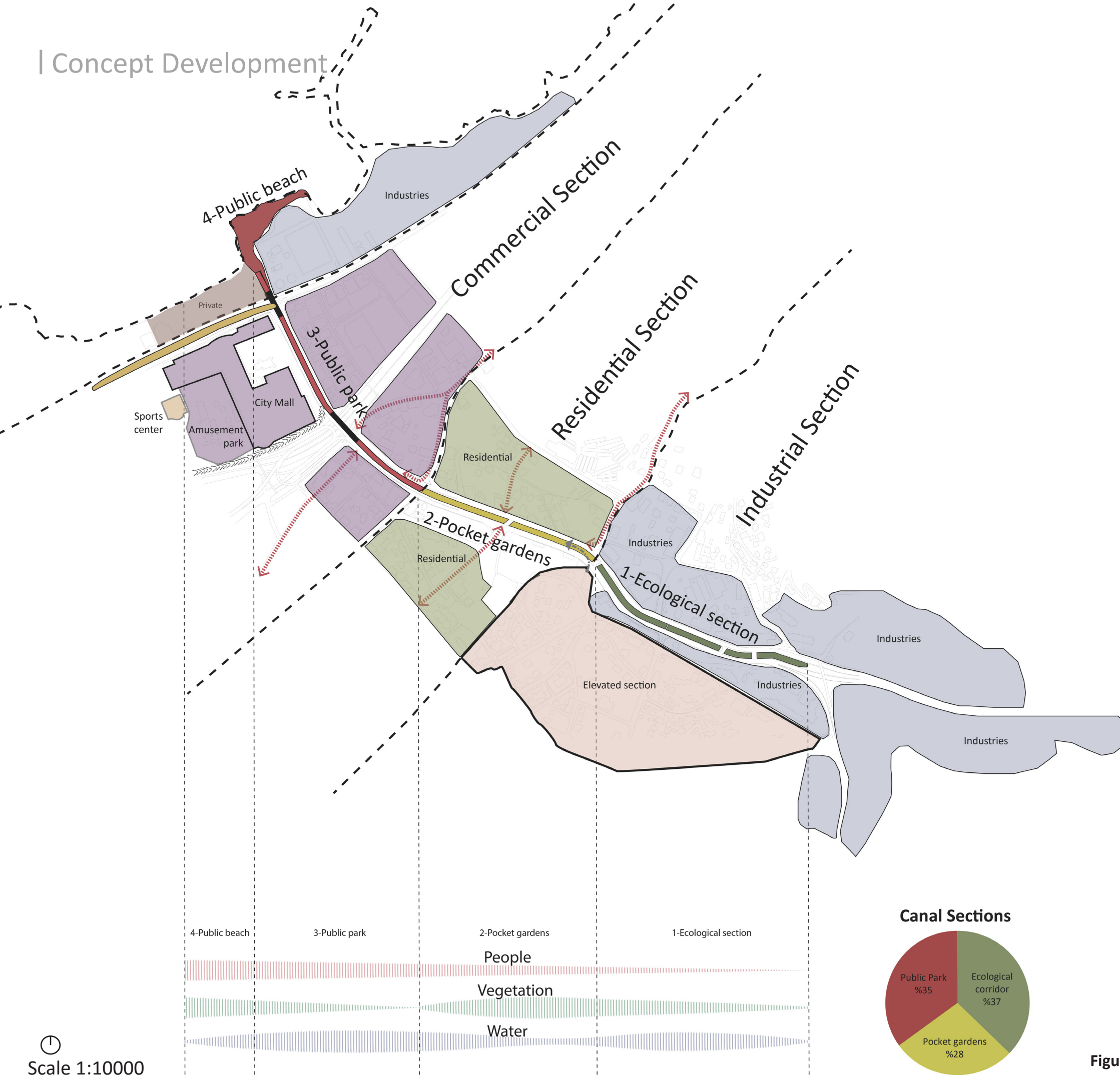


Figure73 Concepts pictorial survey map



The project will be transforming a grey infrastructure into a landscape infrastructure turning the Dead River into a lifelane. The canal will be divided into three sections as a response to its surrounding.

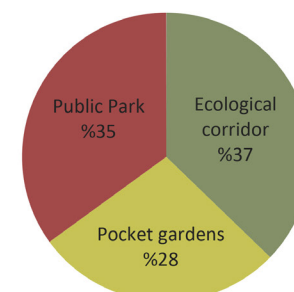
The first section upstream will be the **ecological restoration** part. As it's surrounded by industries on both of its banks that dump their wastewater into the canal, this INDUSTRIAL section is in urgent need of filtration and remediation. In addition to the fact that the water is being treated and people shouldn't get into contact with it, the buildings beyond the industries are elevated and isolated, further reinforcing the fact that people wouldn't even access this part. Therefore, in that section, several stream rehabilitation techniques will take place, treating the polluted water as well as restoring biodiversity.

The second section will be the **pocket gardens**. The neighboring context being mainly high rise RESIDENTIAL and due to the lack of private gardens in this concrete jungle, the canal will provide the residents with pocket gardens where they could escape from the noisy city life and enjoy a relaxing moment. In addition, some of these gardens will be orchards and vegetable lots reflecting the abundant present of agricultural fields in the area as well.

The third section where most of the COMMERCIAL activity and people density happens, will be divided into two sub sections: the **public park** and the **public beach**. They will both cater for many public activities that will bring people from different regions across Lebanon, especially thanks to the big attraction at its western bank, City Mall.

The project effect will reverberate beyond the canal walls, boosting the economy of the whole region, dealing with public health issues, pedestrian circulation problems, enhancing the living experience of the surrounding... Lifelane will become the living artery of the region pumping life into its surrounding in many forms, be it ecologically, socially or even economically.

Canal Sections



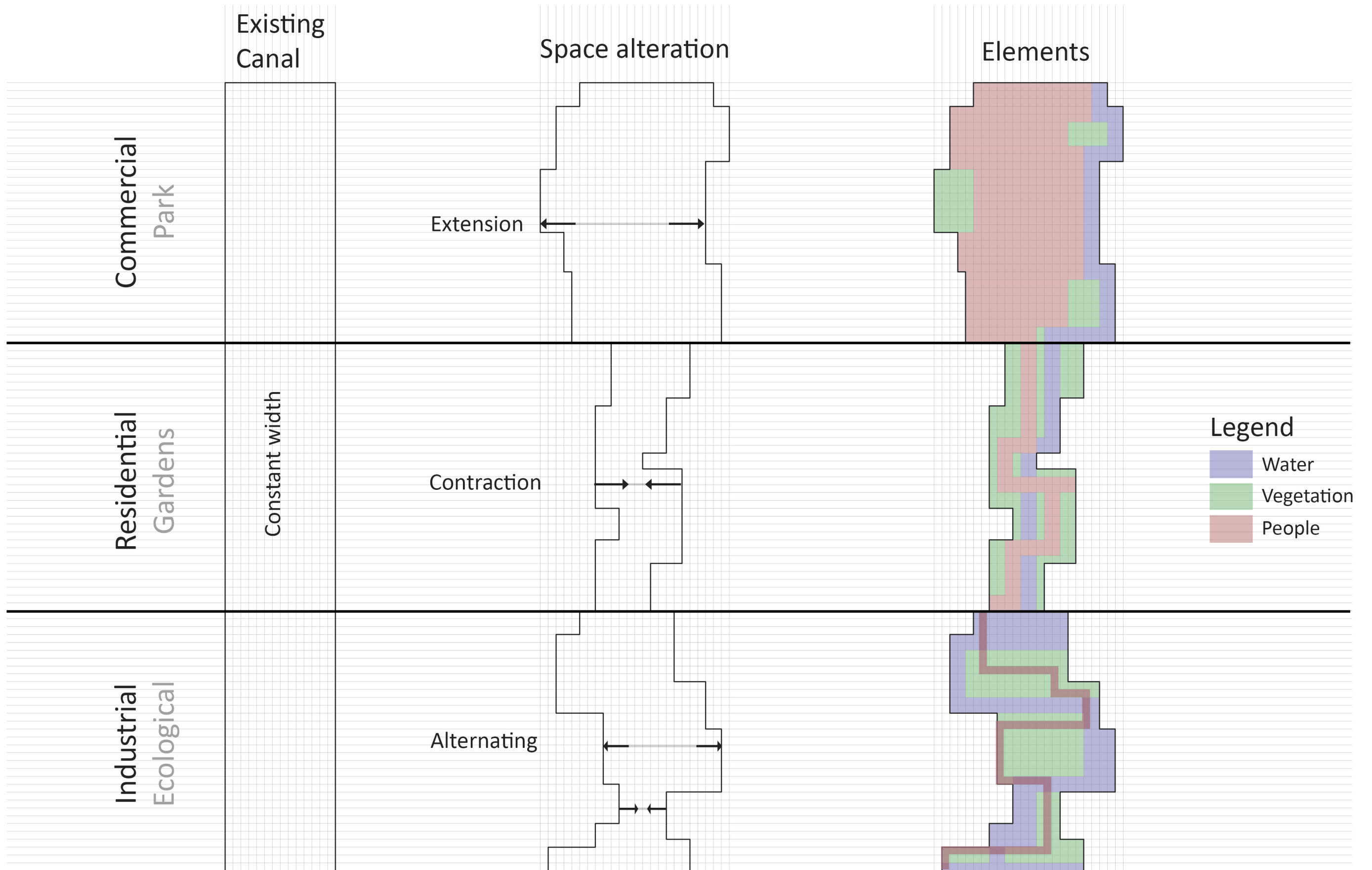


Figure75 Concept elements

As mentioned previously, the canal will be divided into three sections according to its surrounding. The three lane roads on each side of the canal will be transformed into two lane roads after having analyzed the car volume and verified that no traffic will be generated by doing so.

The reduction in road lanes will provide an additional 3.5m expansion of the sidewalk in the industrial and residential sections and of the canal space itself in the commercial strip.

In the industrial section, the extra sidewalk space along the edges of the canal will be transformed into bioswales that will treat surface runoff before entering the canal in this highly sloped ecological section.

In the residential section, the sidewalk will become a planted buffer area in order to provide sound and visual buffering for the aromatic gardens inside the canal.

Last but not least, the extension of the canal space itself in the commercial section will allow for additional space for public activities.

The design lines of the extended sidewalk as well as the water, vegetation and people elements previously mentioned will follow the urban river concept, bringing the urban and the rural together, expressed through diagonal angular shapes.

Urban river concept

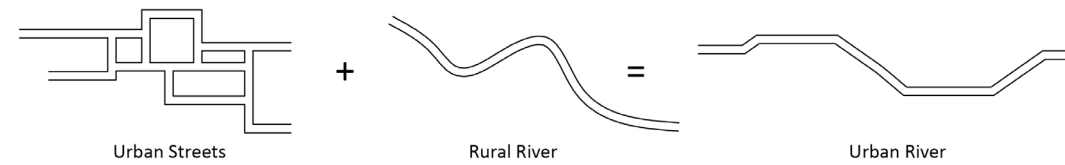


Figure76 Urban river

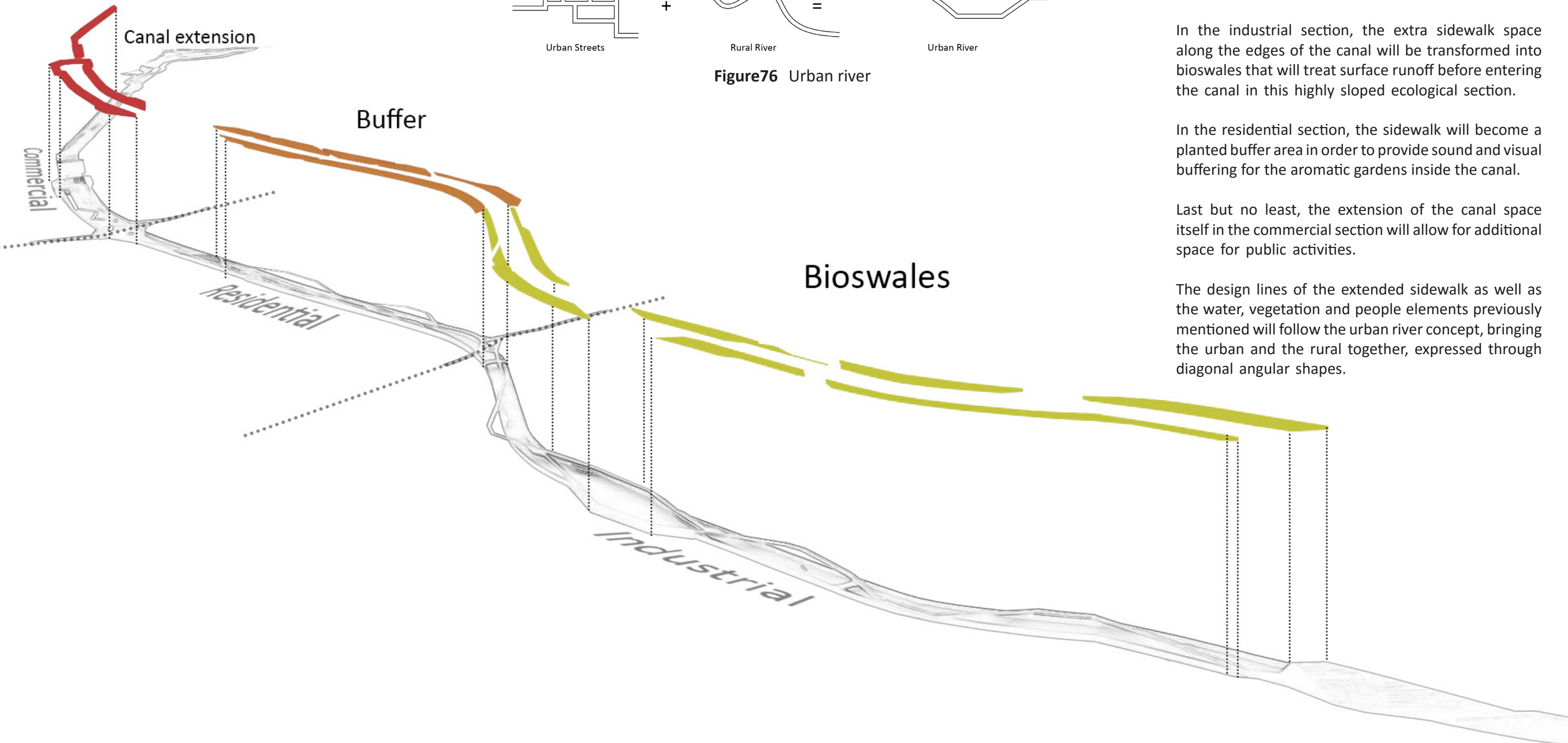
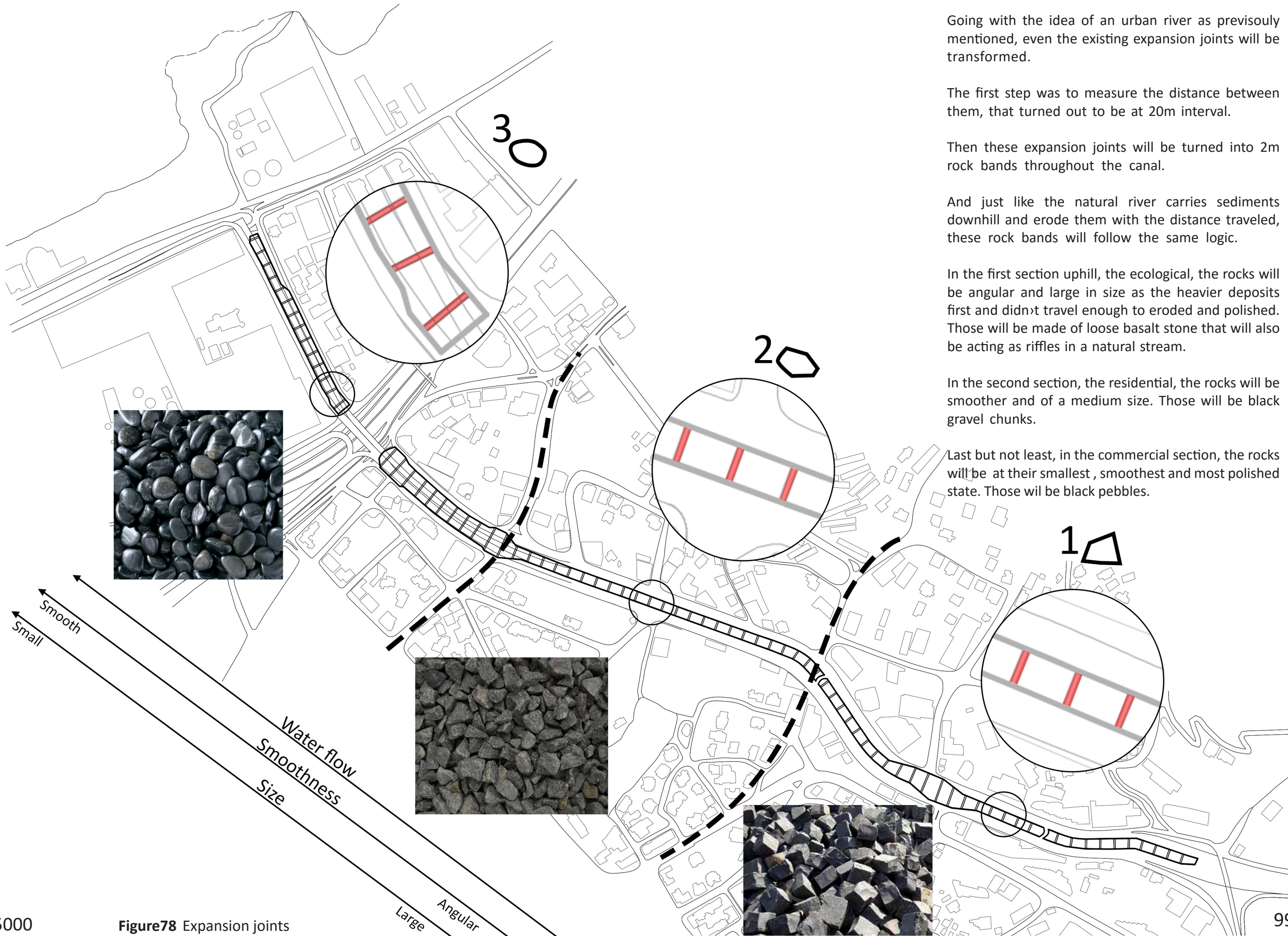


Figure77 Canal sidewalk



Going with the idea of an urban river as previously mentioned, even the existing expansion joints will be transformed.

The first step was to measure the distance between them, that turned out to be at 20m interval.

Then these expansion joints will be turned into 2m rock bands throughout the canal.

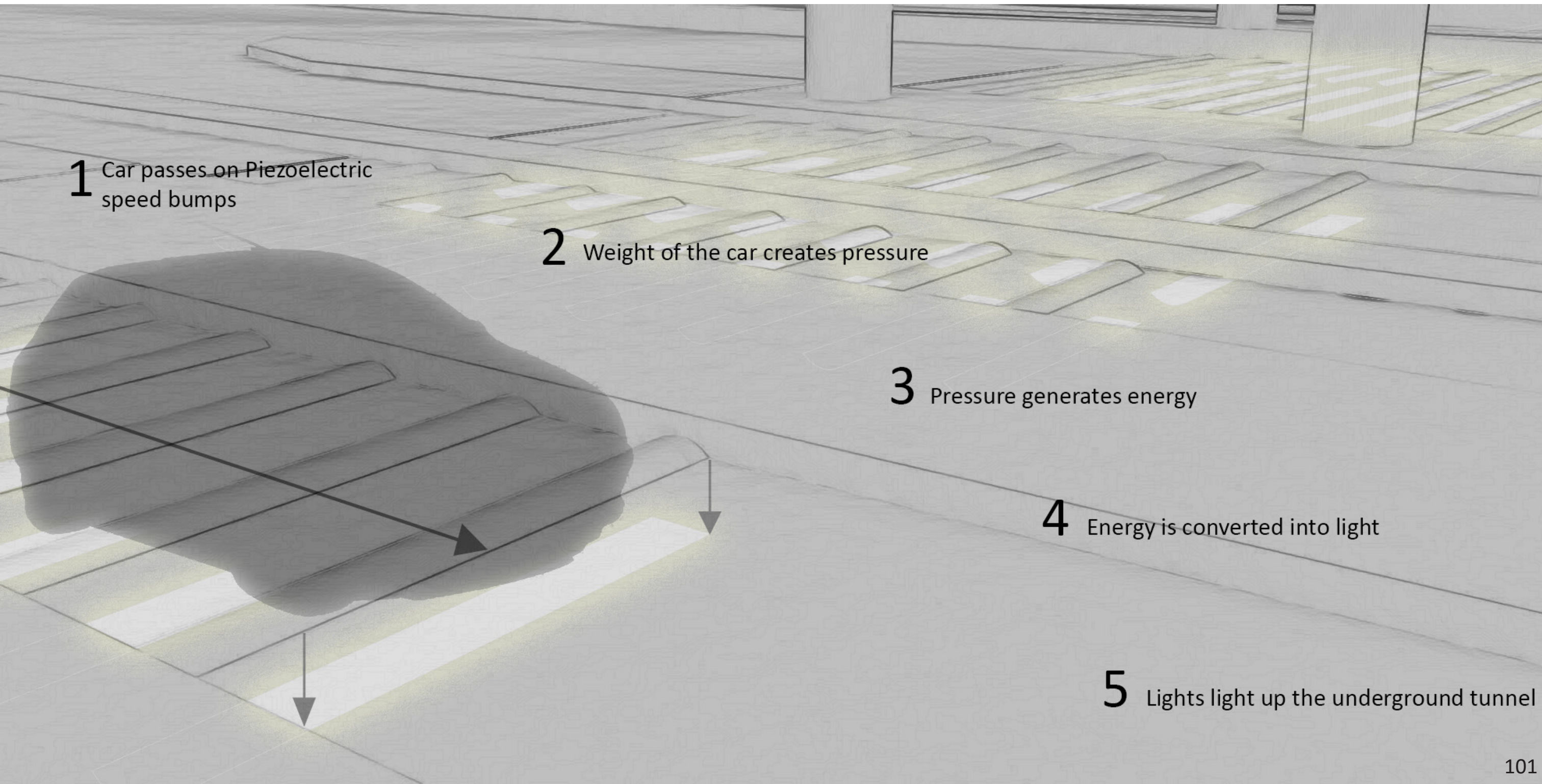
And just like the natural river carries sediments downhill and erode them with the distance traveled, these rock bands will follow the same logic.

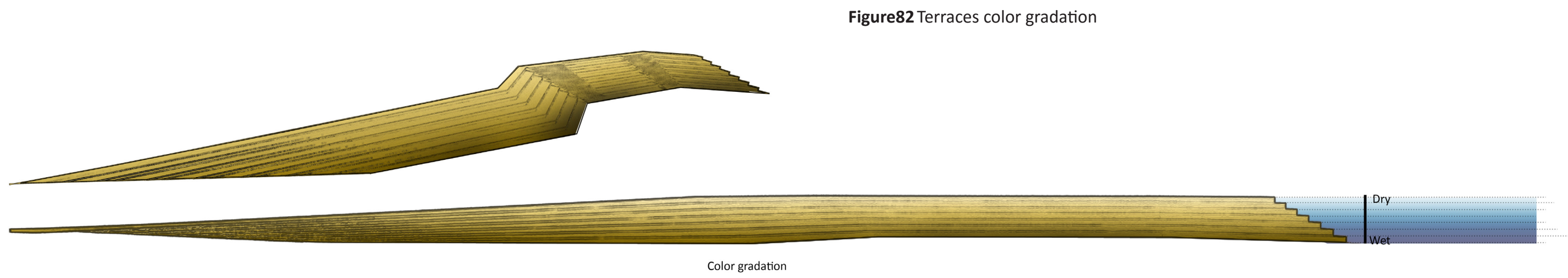
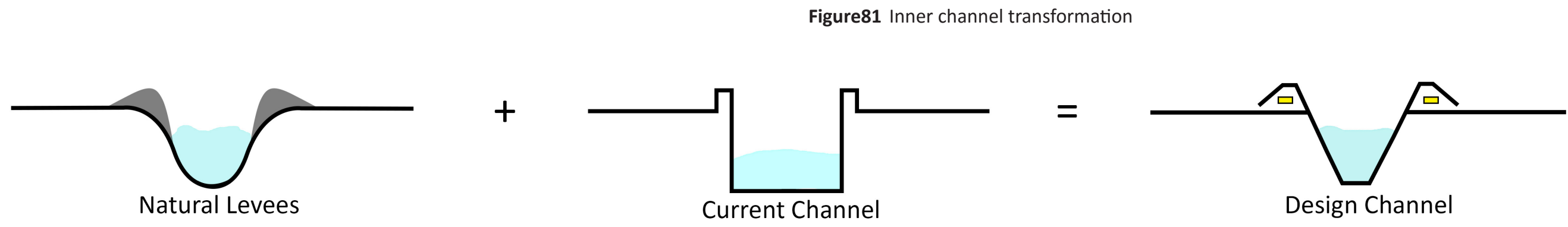
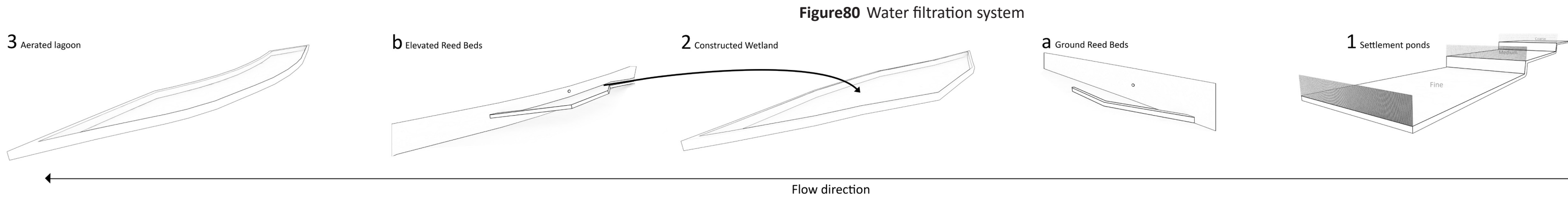
In the first section uphill, the ecological, the rocks will be angular and large in size as the heavier deposits first and didn't travel enough to erode and polished. Those will be made of loose basalt stone that will also be acting as riffles in a natural stream.

In the second section, the residential, the rocks will be smoother and of a medium size. Those will be black gravel chunks.

Last but not least, in the commercial section, the rocks will be at their smallest, smoothest and most polished state. Those will be black pebbles.

Figure79 Piezoelectric bumps





The masterplan will consist of three sections of the canal, the ecological, the garden and the park as stated before. The ratio between the three main elements of water, vegetation and people will vary according to the section.

In the industrial section, the water element will be the dominant followed by the vegetation and lastly the people as it is more about the water filtration process. The program for this section will consist of a parking and an information booth at the beginning, bioswales, pedestrian bridges and observatories and a filtration system that will be explained next.

In the residential section, the vegetation element will be the dominant followed by the people and lastly by the water. This is because this section focuses on buffering the urban noise and creating the aromatic gardens inside the canal that will allow the residents for some relaxation time, isolated from the busy city. The program will simply consist of aromatic gardens accompanied by seating areas in between and wi-fi sections.

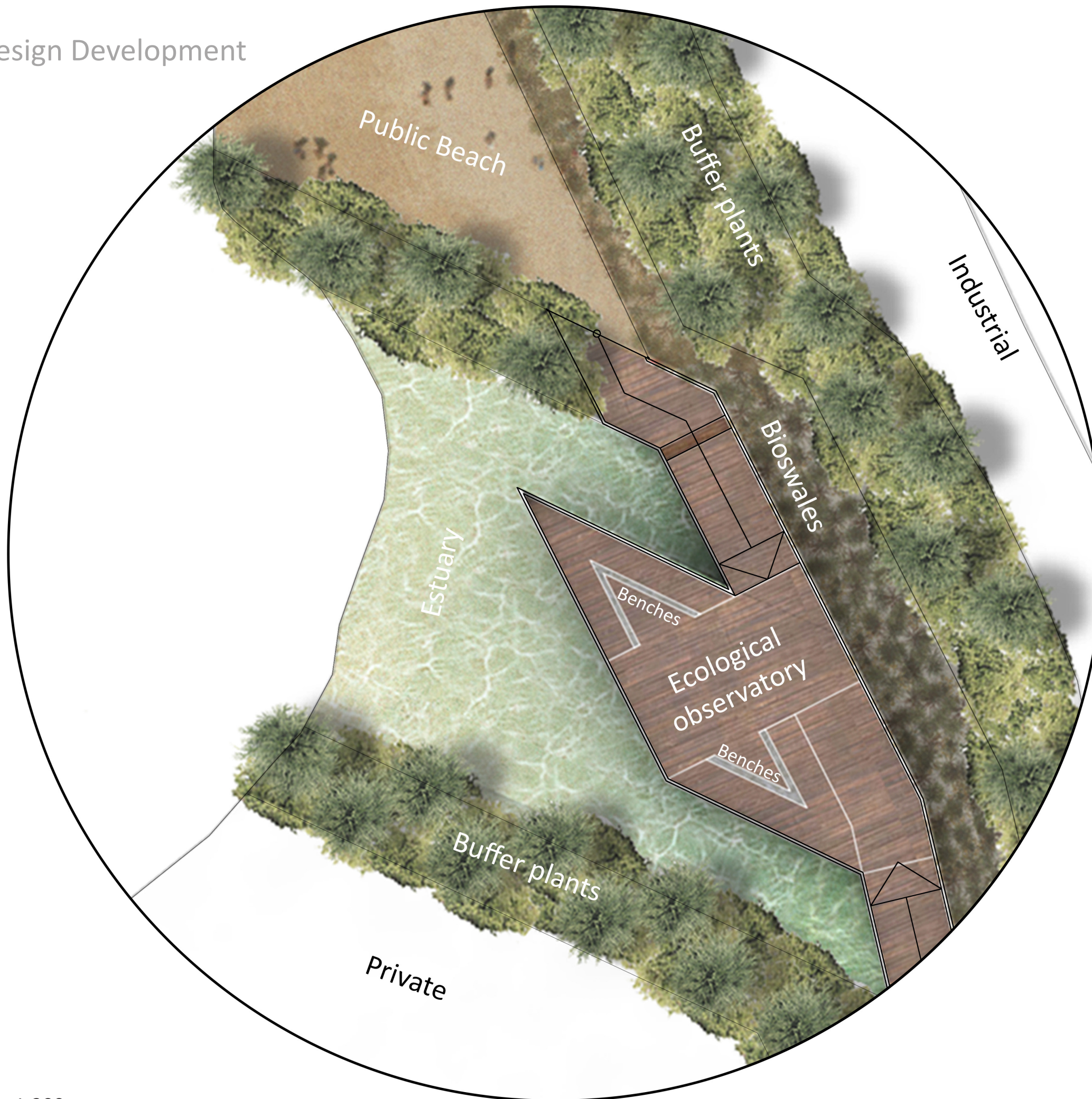
In the commercial section finally, the people will be the dominant element followed by the water and finally vegetation. This is due to the fact that the open public space will be maximized social activities as well as the water element being used for recreation in places. The program will consist of a public pool, a water feature, lawn dunes, amphitheatres with stages, a café trottoir, two underground exposition passages, a running track, an estuary observatory, a public beach, fishing decks and beach bars.

	Ecological	Garden	Park
Water	3	1	2
Vegetation	2	3	1
People	1	2	3

Figure83 Elements table

Scale 1:5000

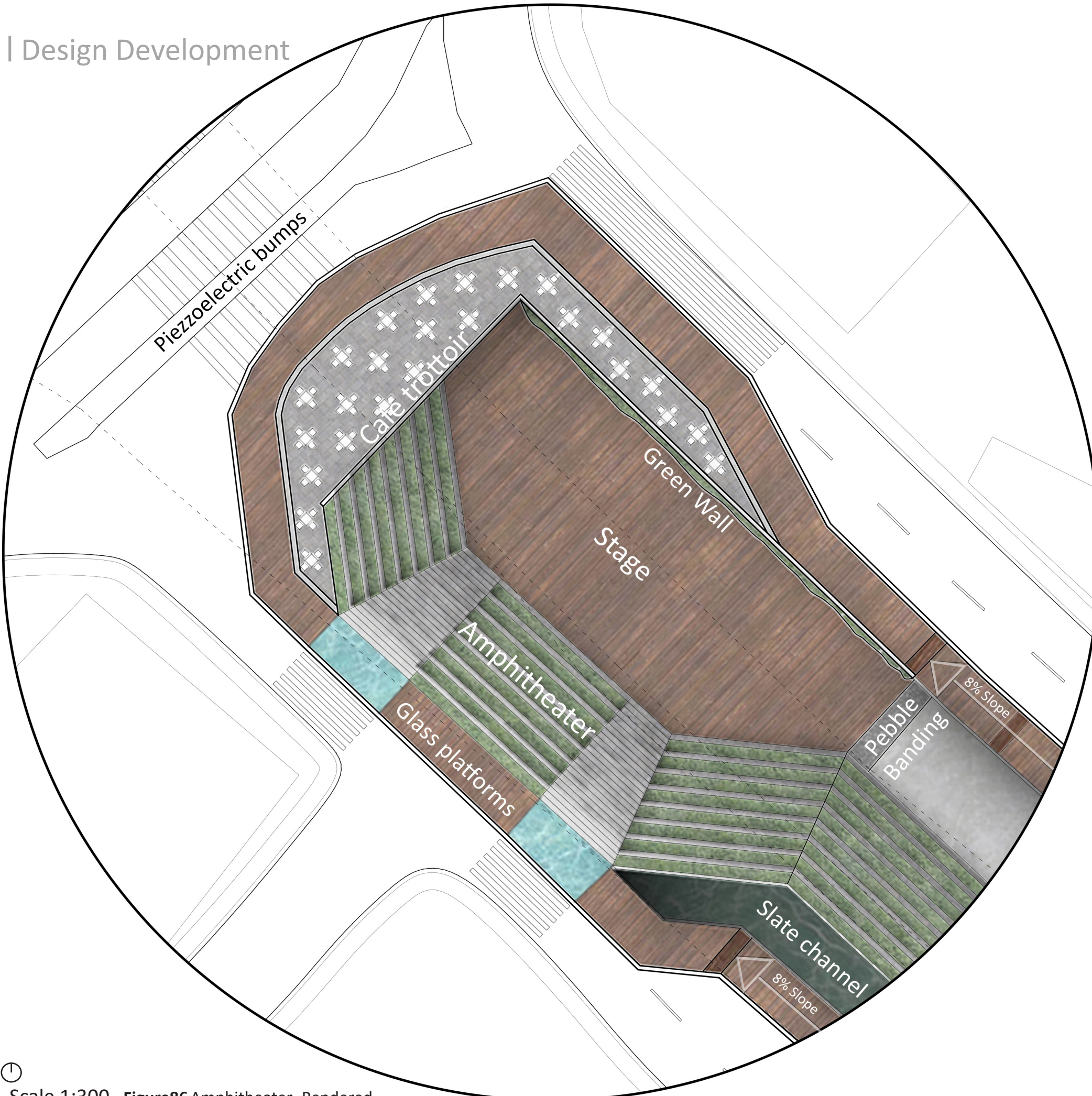
Figure84 Masterplan



At the Estuary, an ecological observatory will be elevated two meters above ground to separate the people from the seagulls and the other wildlife that flourish at this meeting point between freshwater and saltwater.

This section will be buffered from the people on both edges by *Pinus marittima* and *Juniperus aurea* to create this mini reserve from the wildlife. Benches will also be integrated into the observatory to rest while enjoying the spectacle.

Then a ramp will lead to the public beach from the ecological observatory. Beyond the beach, bioswales will emerge and form a river delta shape alongside with wooden decks and fishing decks at the elevated section from the sea.



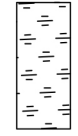
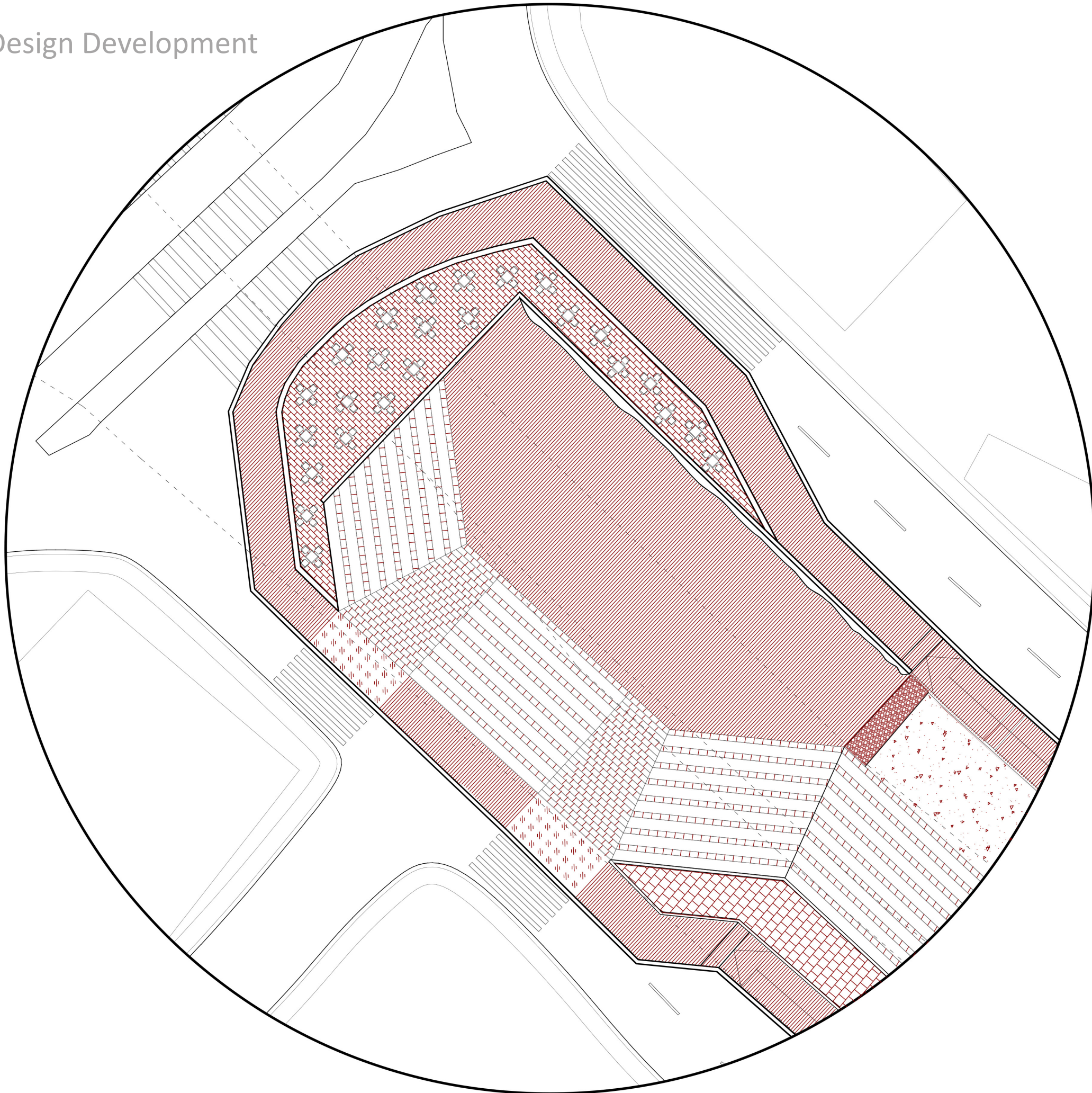
Also in the commercial section, right before the main highway, the canal expands leaving a one lane road in order to allow for easier and safer pedestrian crossings at this busy node as seen previously in the demographic map.

To cater for the large amount of people around that area, a huge amphitheater has been created with a wide stage where live performances can take place. In addition, the inner slate water channel will be passing under the stairs with glass platforms overlooking them in order to allow for a wider discontinued public space. In addition, the water passing behind the amphitheater steps will generate a soothing melody through pipes and slits in the steps that will allow the displaced air from the water chamber to blow.

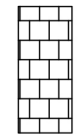
Furthermore, a green wall will serve as the stage background and the amphitheater steps will be alternating between shade tolerant lawn and granite to break the rigidity of the canal and set a living atmosphere.

Higher up, a café trottoir will allow people to relax while enjoying some food. This café can become a very frequently visited lunch break destination in this commercial section.

Last but not least, piezoelectric bumps will be placed on the highway in order to light the underground passages



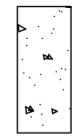
Glass



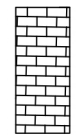
Green Slate



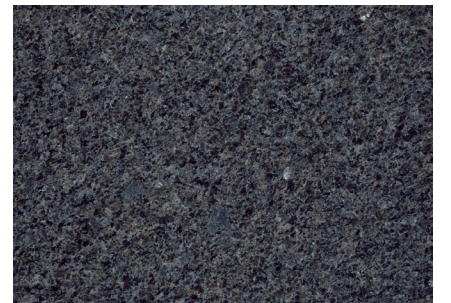
Gravel



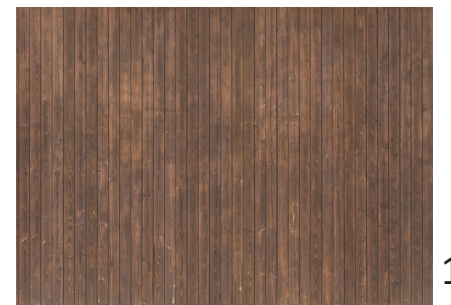
Concrete

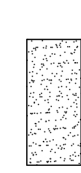
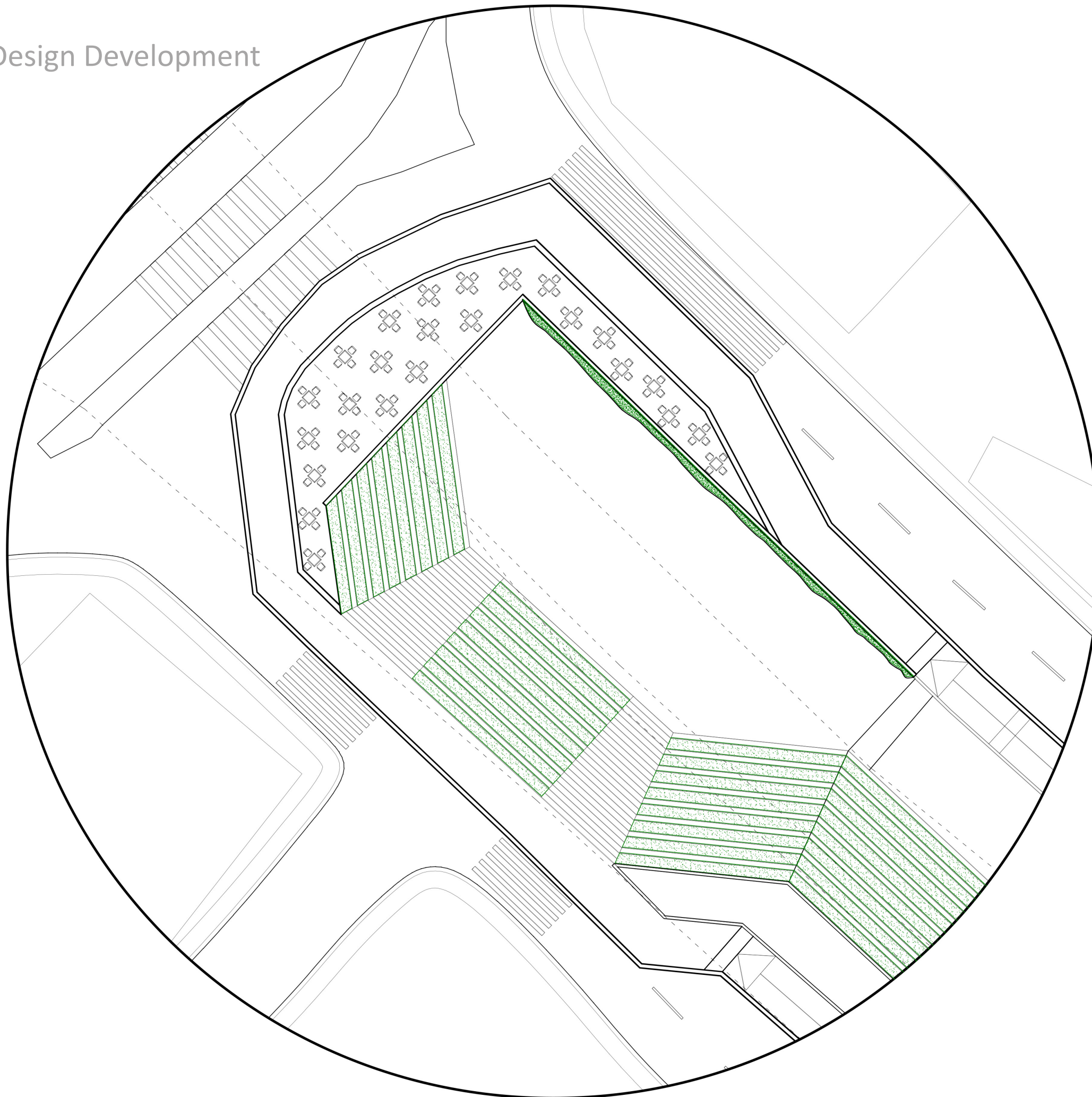


Granite



Composite wood

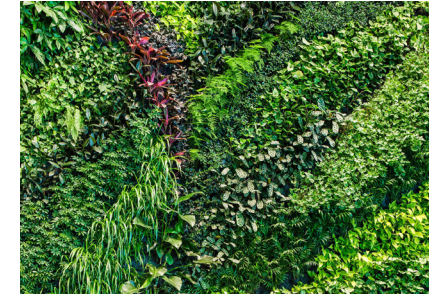


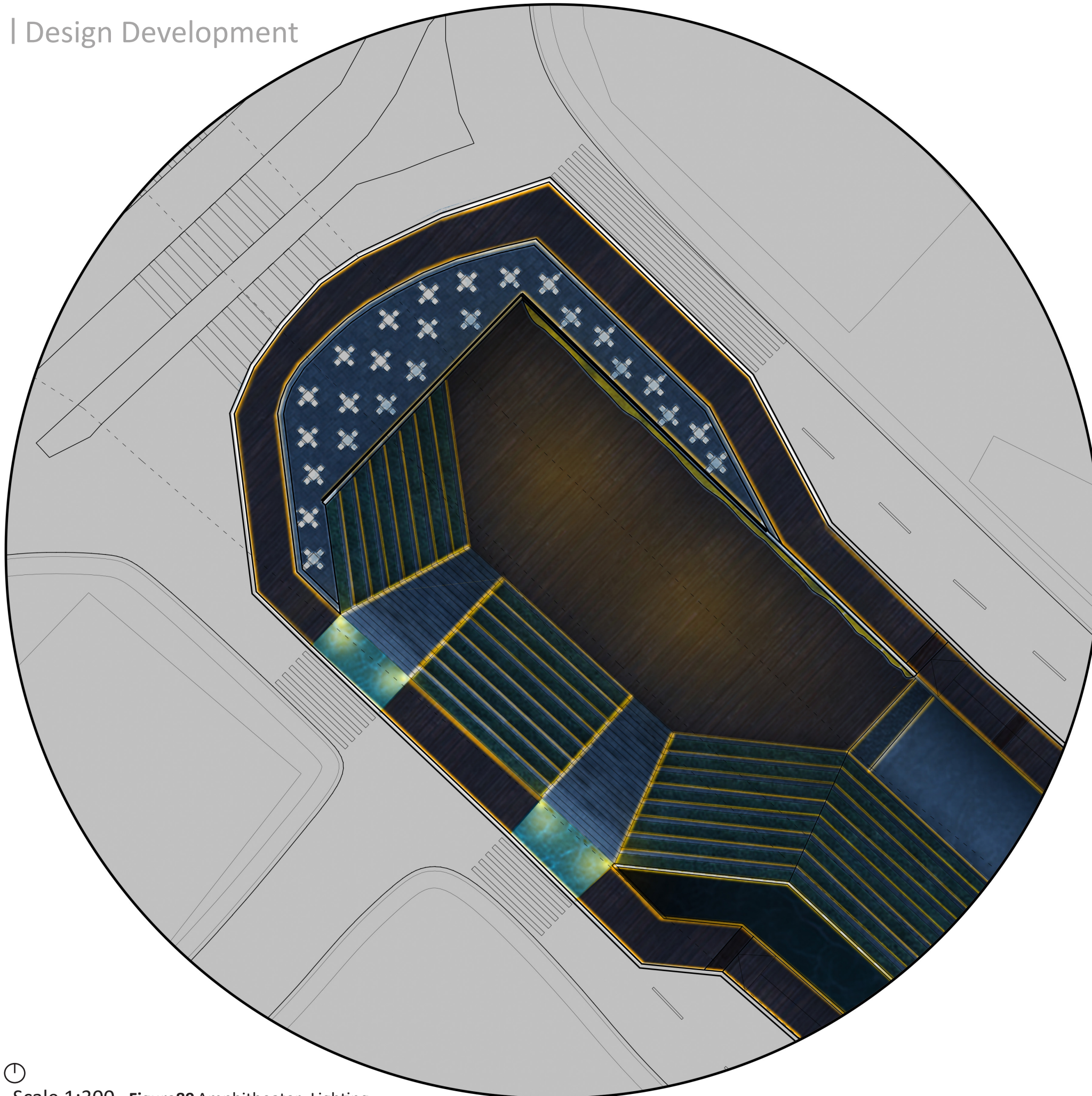


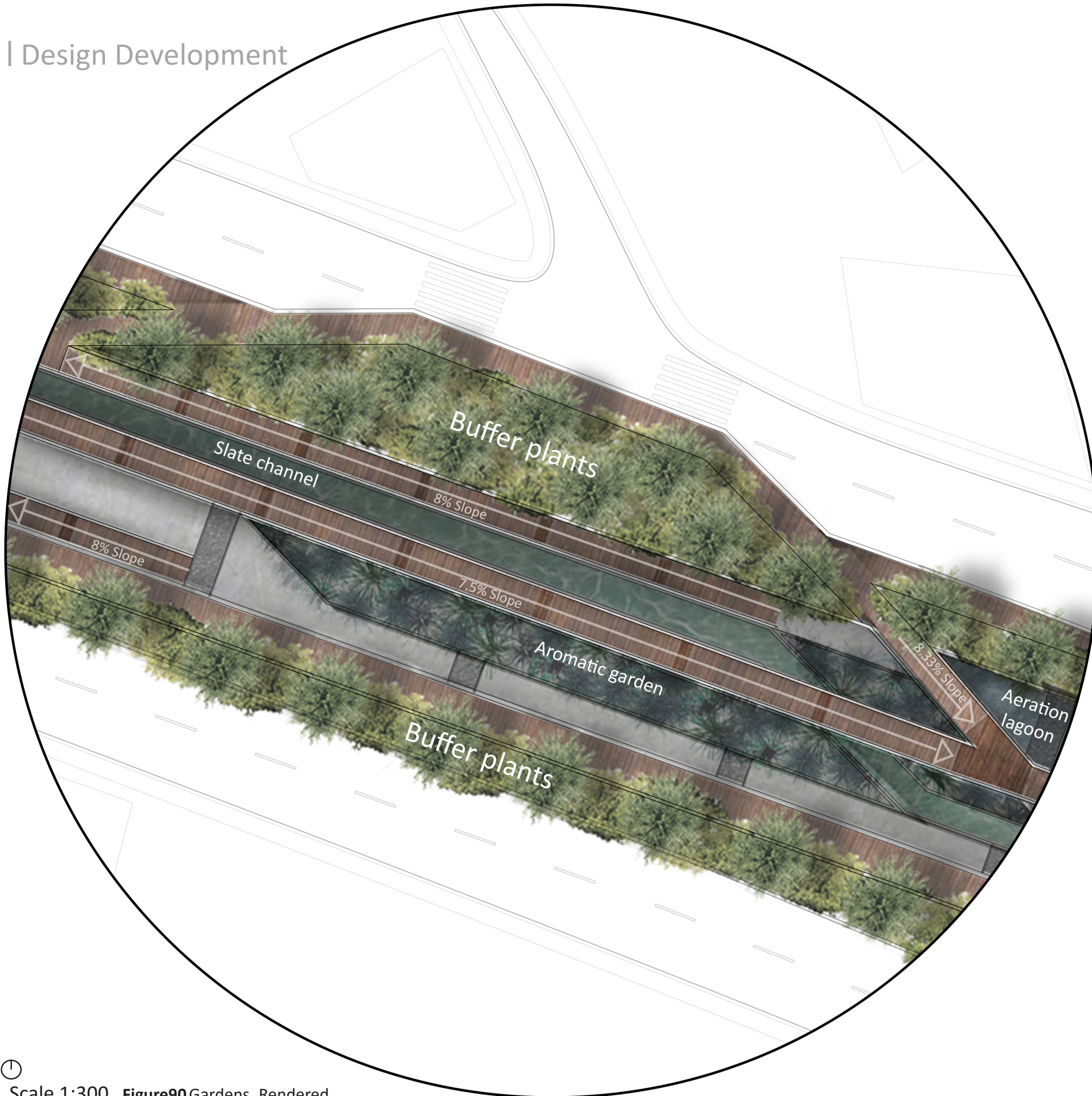
St. Augustine lawn



Green wall





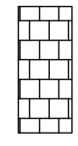
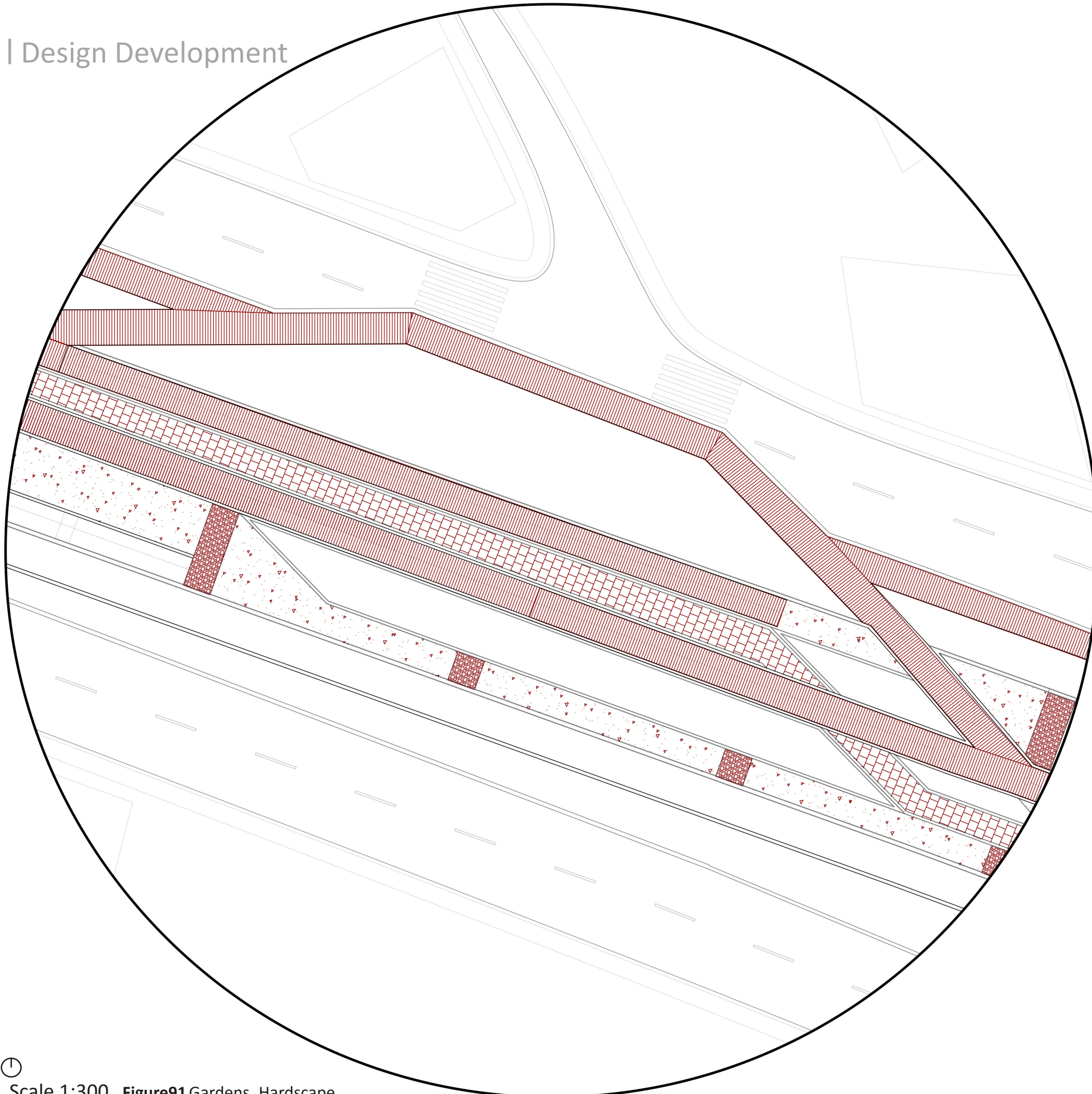


In this residential section, the typical stretch would be like the one hereby presented. The ramps would be leading inside the canal itself with a slope lower than 8.33% for the handicapped as well.

On the street level, buffer plants consisting of *Thuja orientalis* and *Juniperus aurea* will be preventing some sound pollution from entering the canal as well as creating a dense visual buffer. This will allow for the residents to come to the canal and spend some time isolated from the noisy urban life and relax.

In order to enhance this relaxing experience, benches will be placed in between aromatic gardens where lavender, rosmary and many other scented plants will be planted.

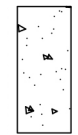
In this strip in particular that shows the end of the industrial section on the right and the beginning of the residential section, we can note a small part of the aerated lagoon which is the last phase of the water filtration system.



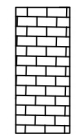
Green Slate



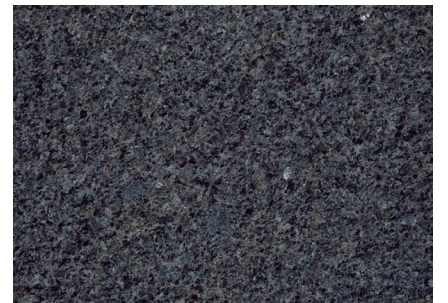
Gravel



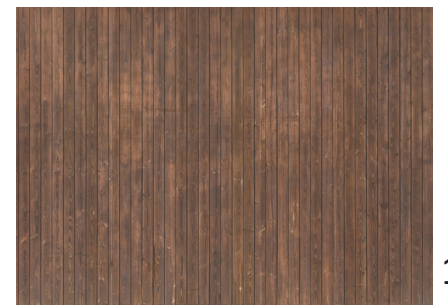
Concrete

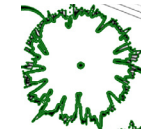
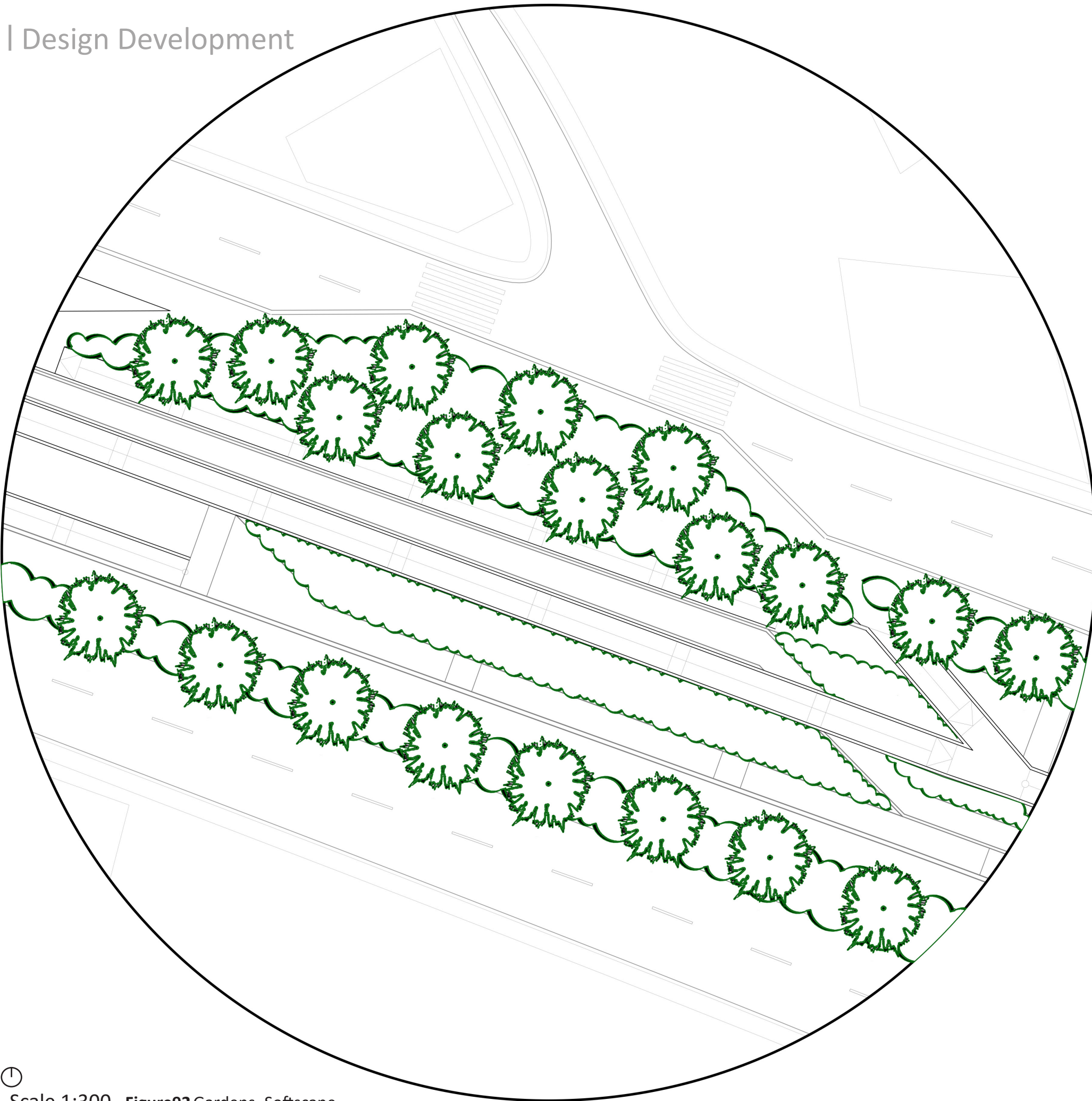


Granite



Composite wood





Thuja Orientalis



Juniperus aurea



Lavendula



Salvia

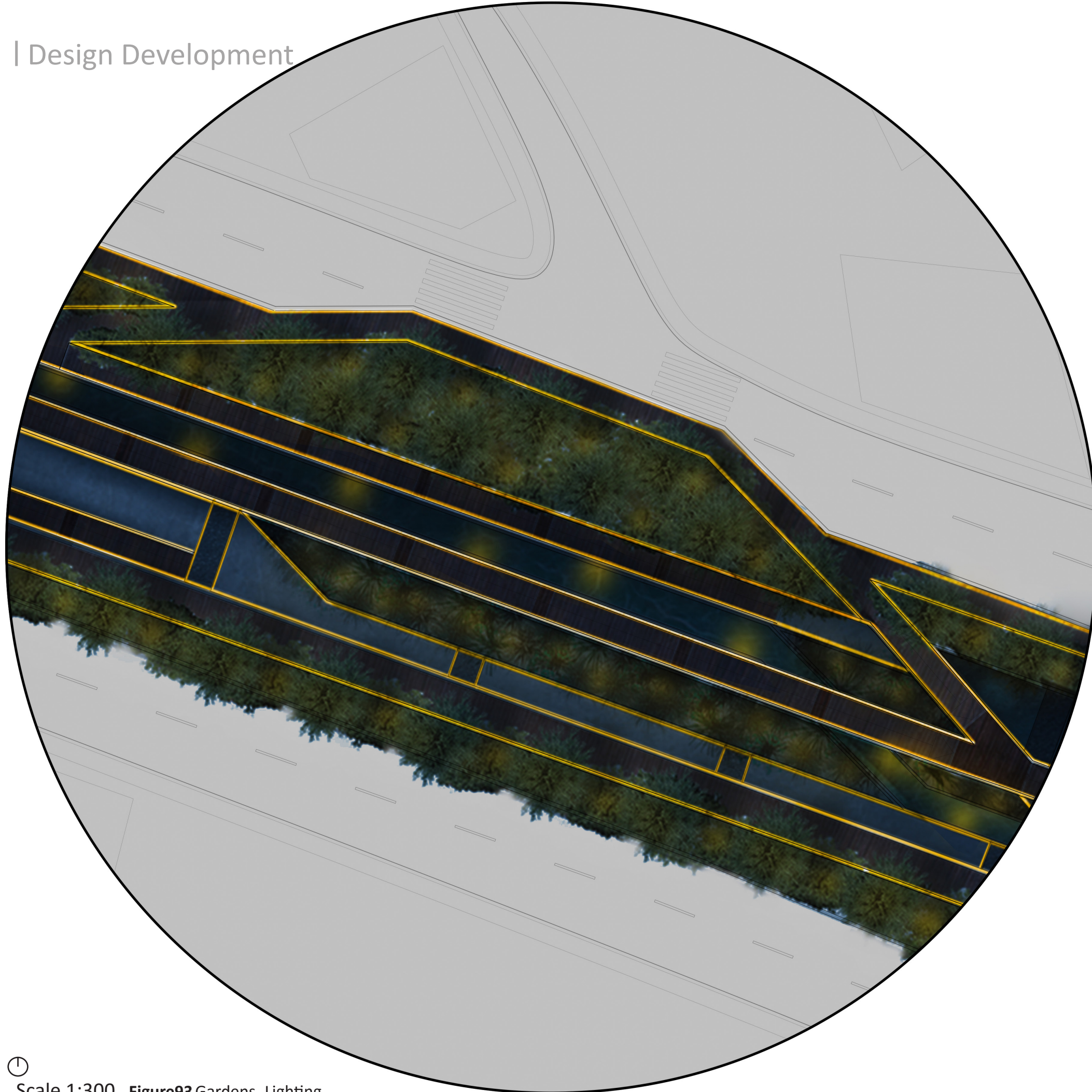


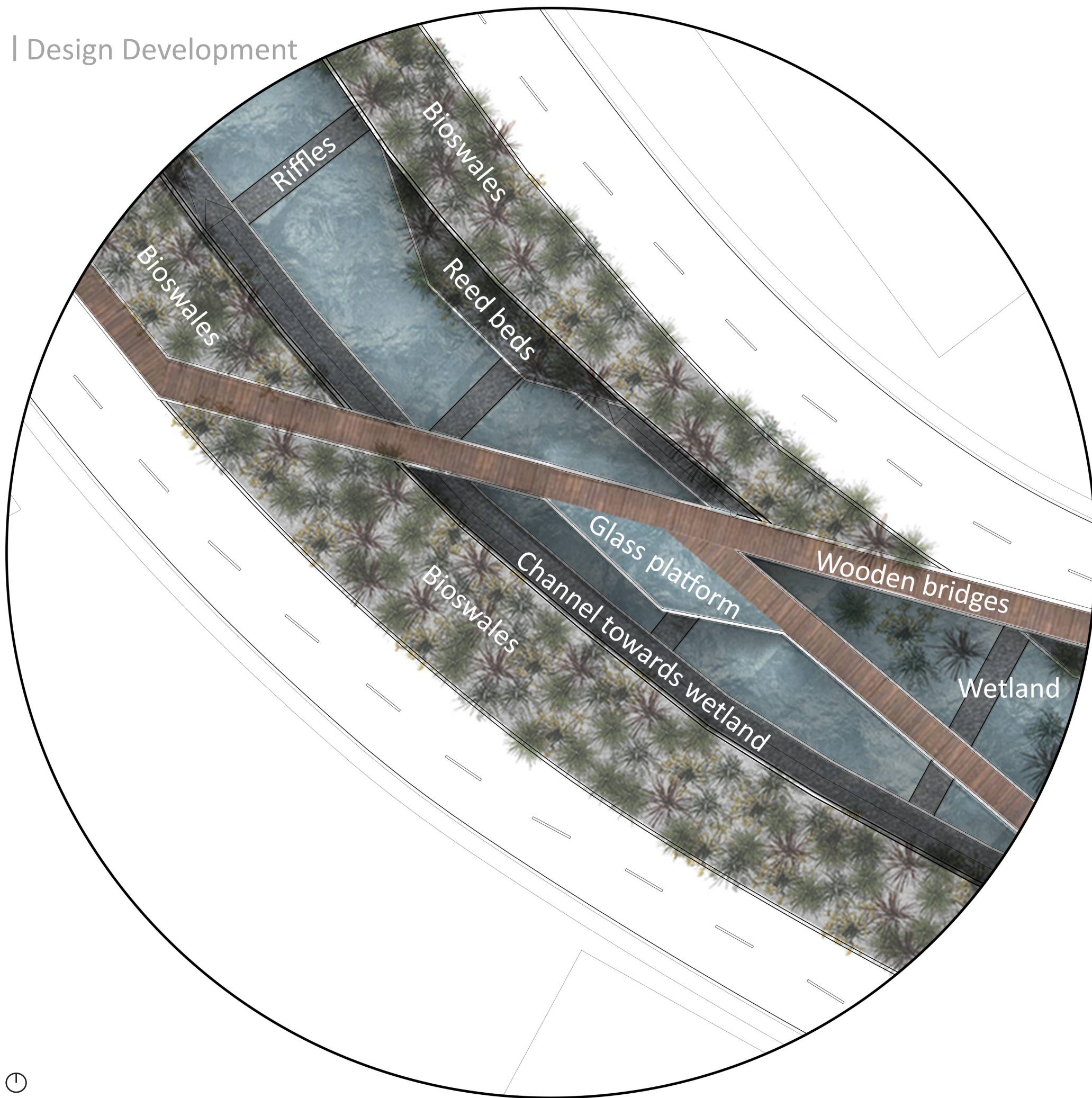
Rosmarinus



Murraya







In this part of the industrial section, we can see some of the water filtration system. The wetland on the extreme right acts as the secondary step in the system coming after the sedimentation ponds and before the aerated lagoon.

The reed beds that are seen in the pictures that deal with the point source pollution treating directly the industrial waste that is being emptied in the canal are located after the wetland. Therefore they will be elevated on the canal walls so that a channel will slope down from them towards the wetland through gravity only in order for the industrial waste to be treated in the wetland before proceeding to the last step, the aerated lagoon.

In addition, the extension joints at this point will be transformed into riffles made of loose basalt stone that will allow for some alteration in the water speed restoring its natural flow.

On the upper level, bioswales will deal with the non-point source pollution coming from all the surface runoff in this highly sloped section before entering the canal.

Last but not least, people will be able to observe these processes and learn about the filtration methods without disturbing nature or coming into contact with the polluted water. This will be possible through wooden bridges as well as glass platforms.

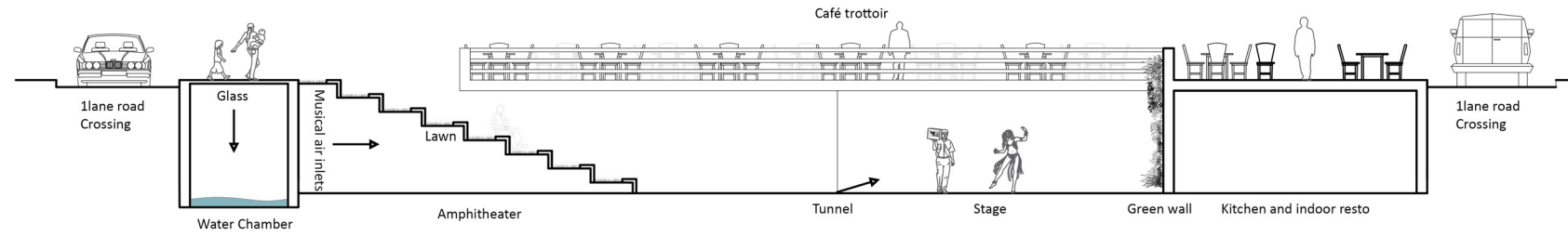


Figure95 Section A-A Scale 1:200

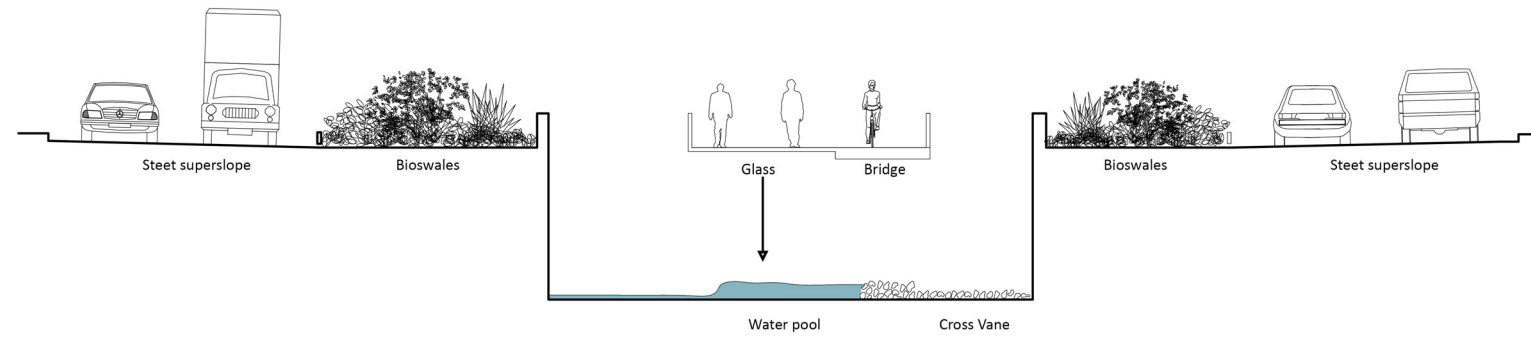


Figure96 Section B-B Scale 1:200

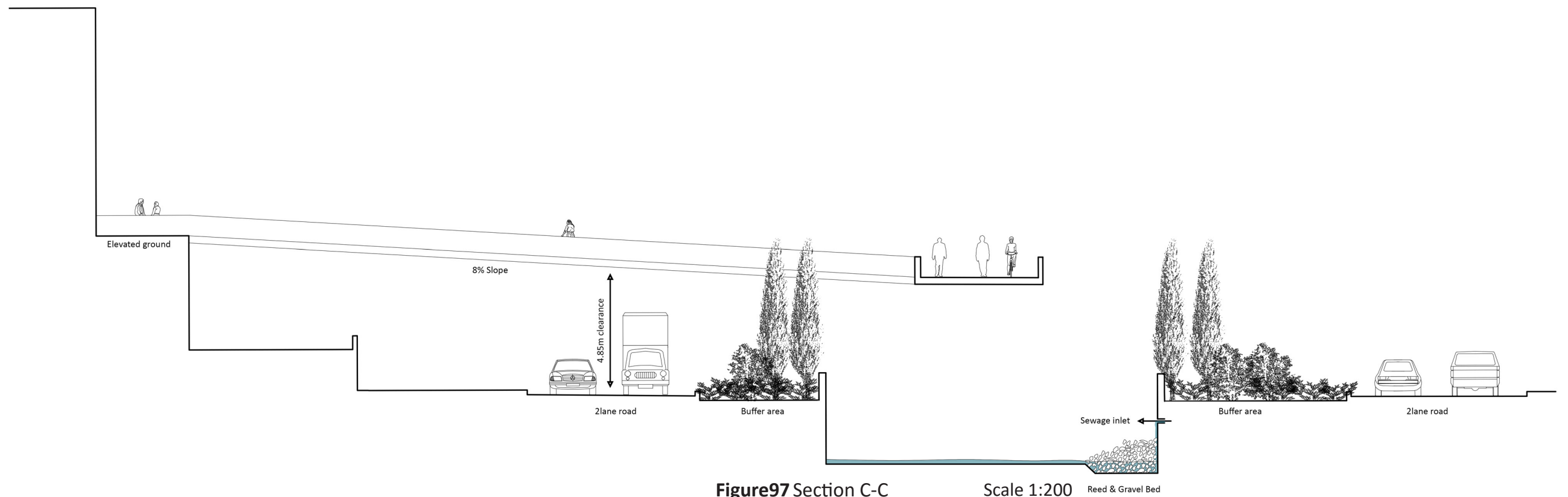


Figure97 Section C-C Scale 1:200 Reed & Gravel Bed

Figure98 Perspective_Running track

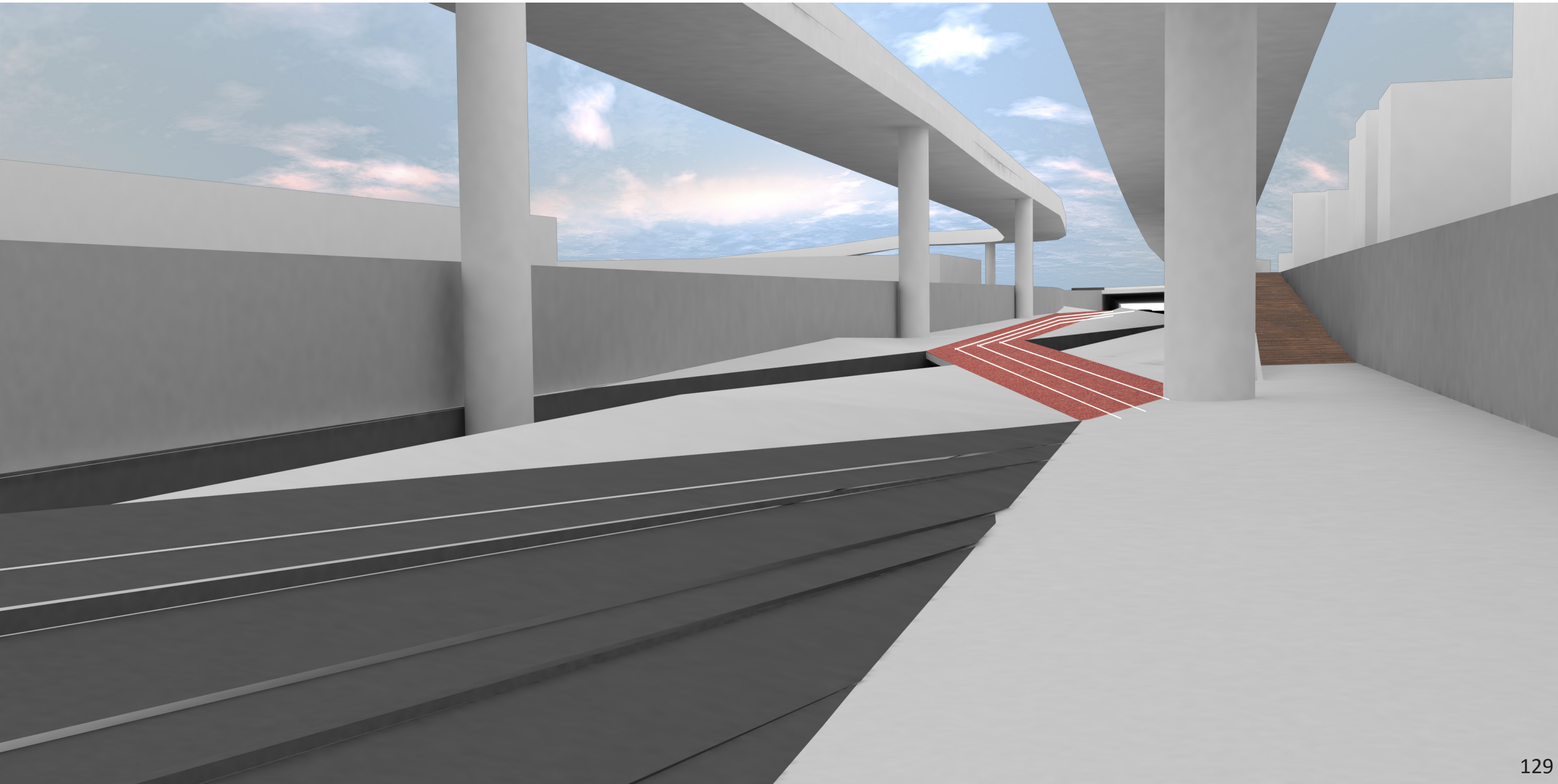


Figure99 Perspective_Aromatic gardens

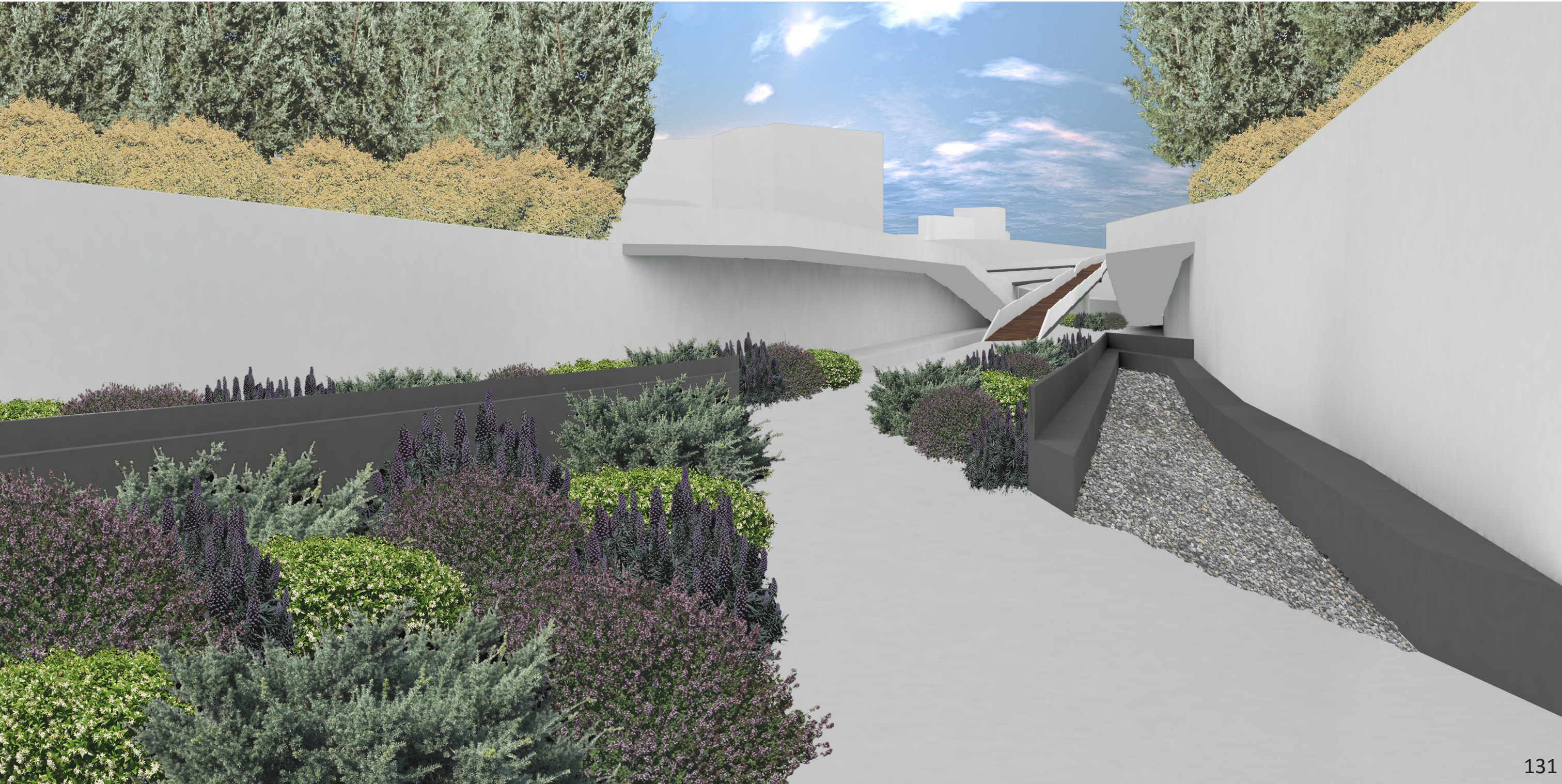


Figure100 Perspective_Water feature



Figure101 Perspective_Amphitheater

