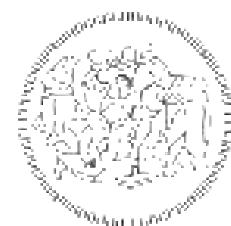


Group n. 09

RURAL | URBAN  
synergy

POLITECNICO DI MILANO | SCUOLA DEL DESIGN  
CORSO DI LAUREA MAGISTRALE IN INTERIOR AND SPATIAL DESIGN  
LANDSCAPE DESIGN STUDIO 1 | A.Y. 2023-24 | SEZ.I3

Professors Team: Giovanna Piccinno, Alice Zingales,  
Chiara Sangermani, Andrea Granitzio  
Assistants: Andrea Atzeni, Alessandro Lorefice



# PHORMA3



Alessia Giglia 251867  
Najibeh Movahedi 243662  
Chiara Orsini 247751  
Luca Silvestri 251092

# STEP

# 1

## EXPLORATION

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## // ABSTRACT

The project is based on four main values: amusement, human activity, wildlife and farming. by combining these ideas it was developed a repeatable system that can be adapted to different types of waterscapes. the goal of “**PHORMA3**” is to provide a functional and fun activity structure to pulluted and neglected water areas. in this case we are talking about “lake varese”, Italy, a body of water that it is unfortunatly known for its fragile ecological sistuation.

There are four main challenges that the project tries to face: the first one is to depurate the water in a natural way, the second one is to add a touristic and amusing space capable to attract more visitors, the third one is to be versatile and the last one is to regenerate the wildlife biodiversity in the lake. These objectives have been achieved by creating floating platforms and floating wetlands that are based on triangular and square modules. There are three typologies of structure: a water depuration one, a walkable water depuration platform one with 3d farming and an activity platform with 3d farming one. The lake treatment system that has been chosen is “Phytodepuration”. This specific type of process uses the natural cleaning power of plants roots to detoxify water making zero impact on the environment. The depuration strategy that has been used is based on a double action, in fact, there are two project locations: The main one, which is located in Luigi Zanzi park and the secondary one, which is located at the end of the main tributary of the lake, river Brabbia. This last location is the main sewage system and It is characterized by a broadwalk and a “Lake organ”, a water instrument that produces sound thanks to the flow and waves created by the river.



STEP

0

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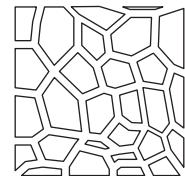
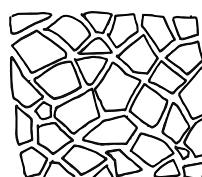
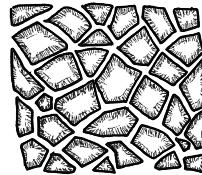
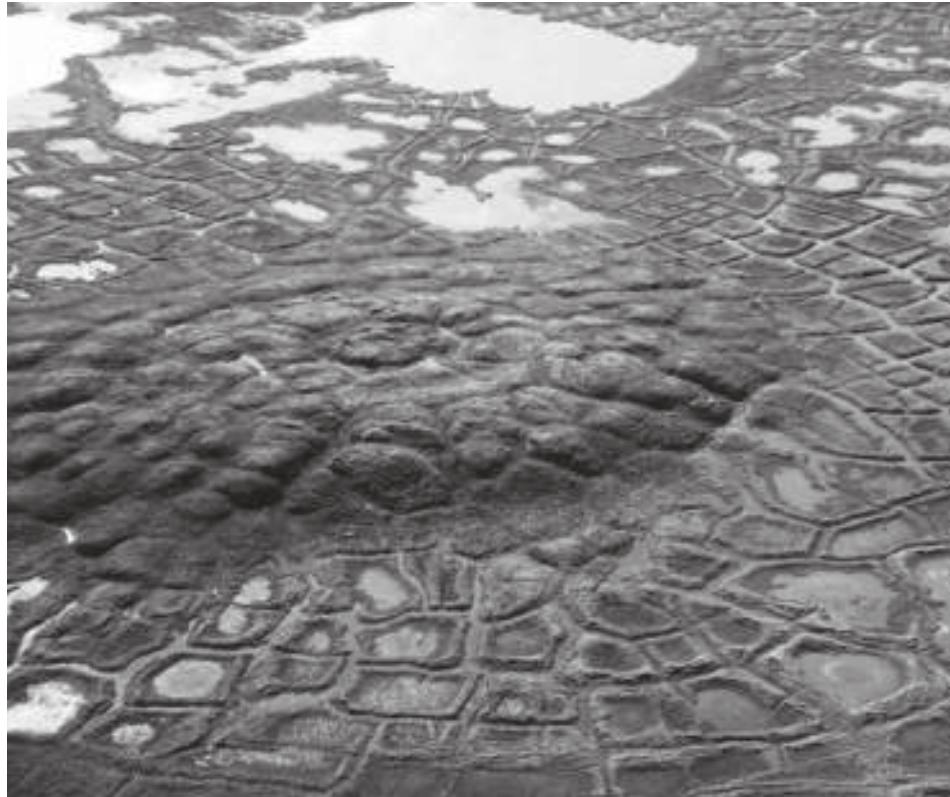
// GENERATIVE GEOMETRY



# 0

## GENERATIVE GEOMETRY

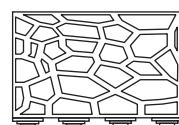
### 0.1\_ALESSIA GIGLIA#



#### GEOMETRY IDENTIFICATION PROCESS

Original natural pattern created by polygonal shapes, simplification of the pattern and geometrization.

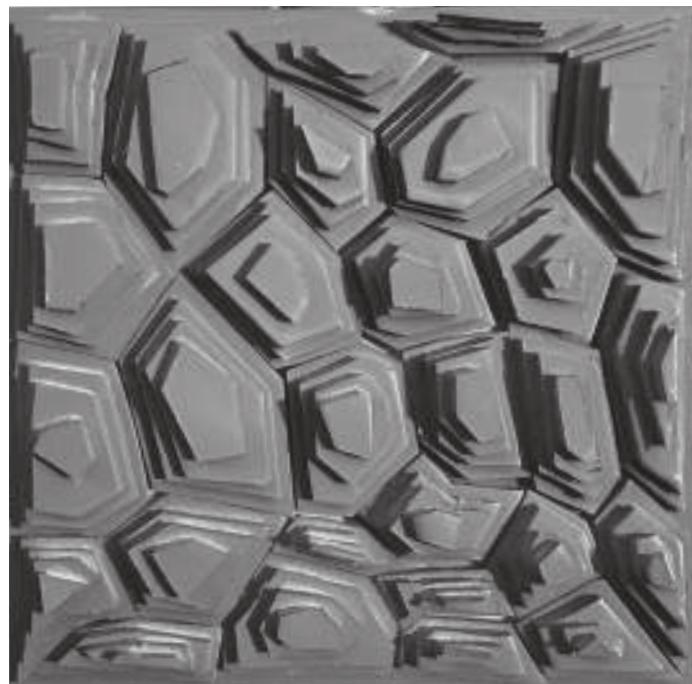
The idea and the structure of “melting layers” comes from the study and analysis of the permafrost thawing phenomenon. Due to global warming and the consequent increase of the temperature of the earth, the arctic landscape has begun to change and polygon shaped little “islands” and ponds started to appear. By tracing the shapes created by nature and by analyzing the melting of permafrost it was created 3d layered model. The inspiration behind its structure is the natural pattern that characterizes the surface of the Arctic regions and the problem of ground collapse caused by permafrost thawing,

**MAQUETTE ELABORATION PROCESS**

Permafrost ground pattern, ground layering and maquette shaping finalization.

**MAQUETTE RENDER**

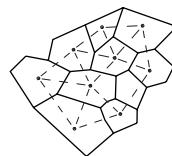
Isometric overall view.

**MAQUETTE PHOTOS**

Top and back view

# GENERATIVE GEOMETRY

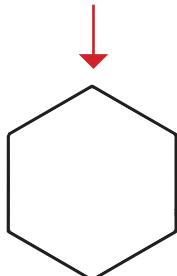
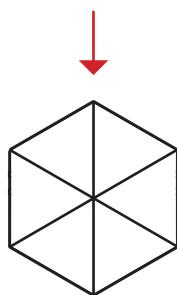
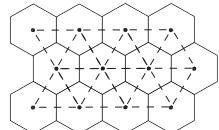
## 0.2\_NAJIBEH MOVAHEDI#



### GEOMETRY IDENTIFICATION PROCESS

Original natural pattern created by polygonal shapes, simplification of the pattern and tessellation.

Tessellations in crack patterns of mud through drought require three main “steps” of formation: drying, shrinking, and cracking of the mud. I started my research on this crucial element (drought) which is vital for nature and landscape changes. The causes of hexagonal cracks on dry land can be attributed to various factors. Some of the primary reasons for the formation of hexagonal cracks on dry land include: Water Scarcity: Dry lands often experience water scarcity, leading to drier soil conditions. This water scarcity can result in soil contraction, which can, in turn, lead to the formation of hexagonal cracks. Geotechnical



**Operations:** Some geotechnical operations like excavations and underground exploration can alter the soil's shape and lead to the formation of cracks.  
**Natural Factors:** Natural events such as earthquakes and tectonic changes can also create hexagonal cracks on dry land, etc..

I chose the drought plan for my research because it has a direct role in human life and is considered one of the most important factors for changing the shape of the earth and our environment. And I have inspired the design of the hexagon from the cracks on the surface of the earth caused by drought and lack of water, and I studied the process of transfer and initiation of cracks from the beginning of the drought and when it causes a serious change in the surface of the earth.

#### MAQUETTE ELABORATION PROCESS

Hexagonal cracking ground pattern.



MAQUETTE PHOTOS

Top view

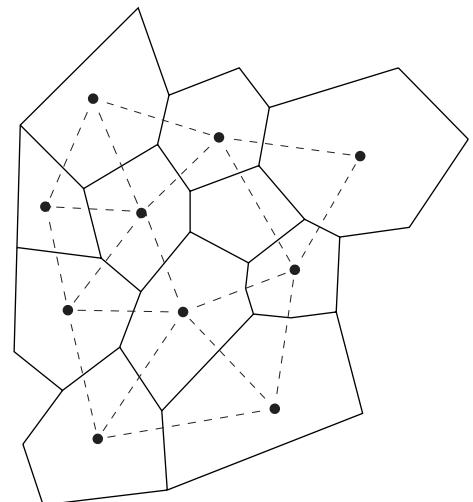


MAQUETTE RENDER

Overall view.

# GENERATIVE GEOMETRY

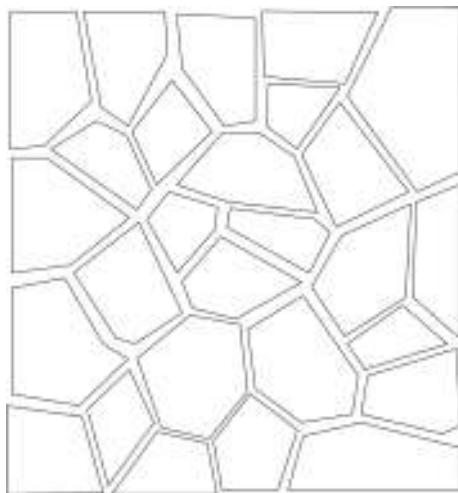
## 0.3\_CHIARA ORSINI#



The initial inspiration for the pattern came from the dry soil, which when dried creates splits; these splits resemble the mathematical voronoi diagram, which allows the pattern to be recreated more precisely. These polygons were extruded upward of different heights, then assembled with a small distance from each other, to recreate the splits created by the soil during dry periods . The shapes are higher toward the outside, and slightly lower in the middle.

### GEOMETRY IDENTIFICATION PROCESS

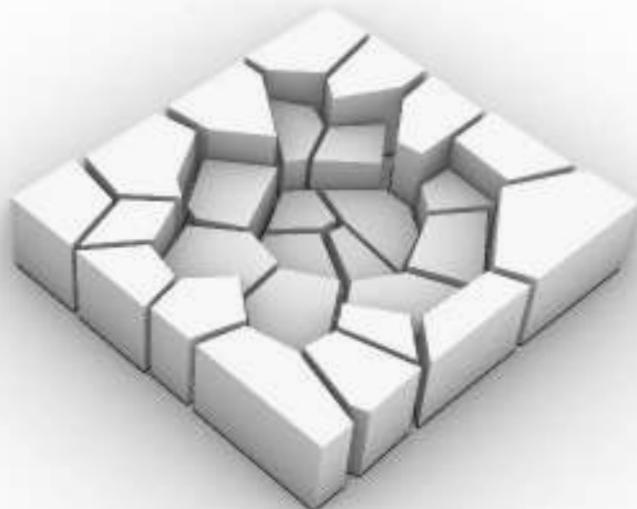
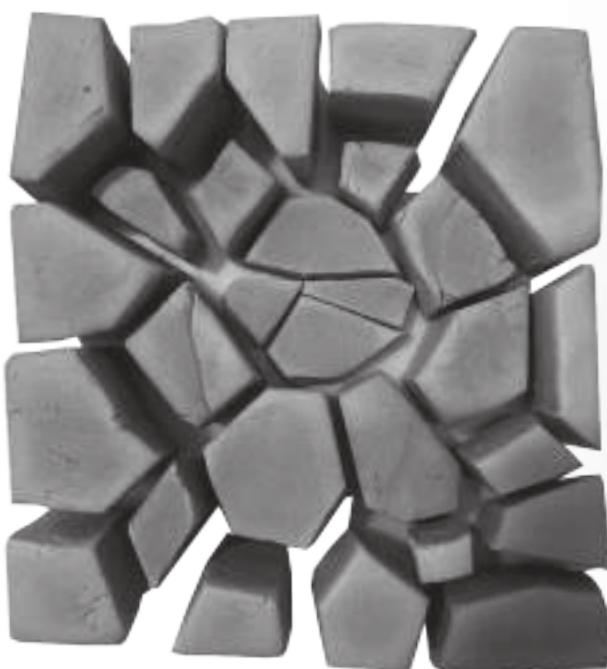
Ground tessellation process.



This height difference recreates the depth of the lake, visible once “empty,” to recall the initial concept of the chosen case study, the pozzillo desert in Sicily. Operations: Some geotechnical operations like excavations and underground exploration can alter the soil’s shape and lead to the formation of cracks. Natural Factors: Natural events such as earthquakes and tectonic changes can also create hexagonal cracks on dry land, etc.. I chose the drought plan for my research because it has a direct role in human life and is considered one of the most important factors for changing the shape of the earth and our environment. And I have inspired the design of the hexagon from the cracks on the surface of the earth caused by drought and lack of water, and I studied the process of transfer and initiation of cracks from the beginning of the drought and when it causes a serious change in the surface of the earth.

#### MAQUETTE ELABORATION PROCESS

Shapes tracing and maquette shaping finalization.



#### MAQUETTE PHOTOS

Top view

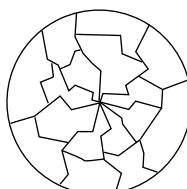
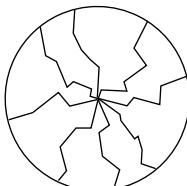
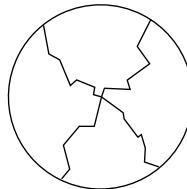
#### MAQUETTE RENDER

Overall view.

# 0

## GENERATIVE GEOMETRY

### 0.4\_LUCA SILVESTRi#

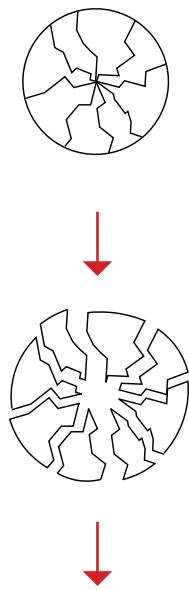


#### GEOMETRY IDENTIFICATION PROCESS

Original natural pattern created by Ice breaking, simplification of the pattern and geometrization.

The ongoing meltdown of glaciers in the polar ice caps has evolved into a critical focal point within the broader scope of global warming, capturing significant attention since the 1990s. Amid discussions surrounding this environmental crisis, a particularly thought-provoking perspective emerges when we delve into the intricate pattern resulting from the thawing of ice and glaciers.

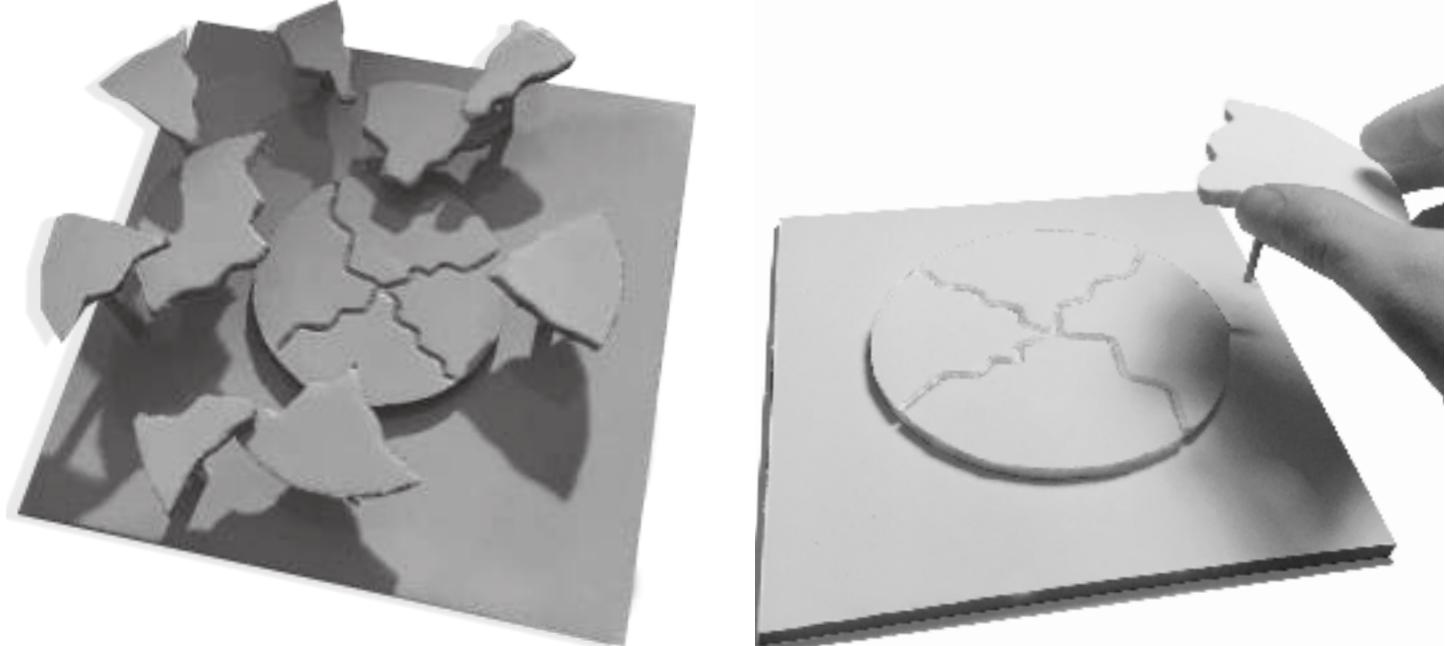
This distinctive pattern is both irregular and concentric, originating precisely from the center and gradually manifesting irregularities as it extends towards the periphery. Its temporal nature adds an intriguing layer, as this pattern continually



morphs and transforms over time. One can visually track the progression as the ice gradually fractures, starting from the central point and splintering along irregular centerlines.

To envision this phenomenon, imagine a piece of ice suspended in a hypothetical undefined space, gracefully floating on water. However, it's crucial to recognize that this captivating pattern is not a simple linear occurrence. Instead, it is a dynamic interplay of a multitude of irregular causes and effects, creating a complexity that adds layers of uncertainty to our understanding of the environmental repercussions. As we explore the implications, the concentric irregularity becomes a metaphorical reflection of the intricate and unpredictable consequences that unfold from the core of this environmental challenge.

#### MAQUETTE ELABORATION PROCESS



#### MAQUETTE PHOTOS

Top and backstage view



STEP

1

#

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// EXPLORATION

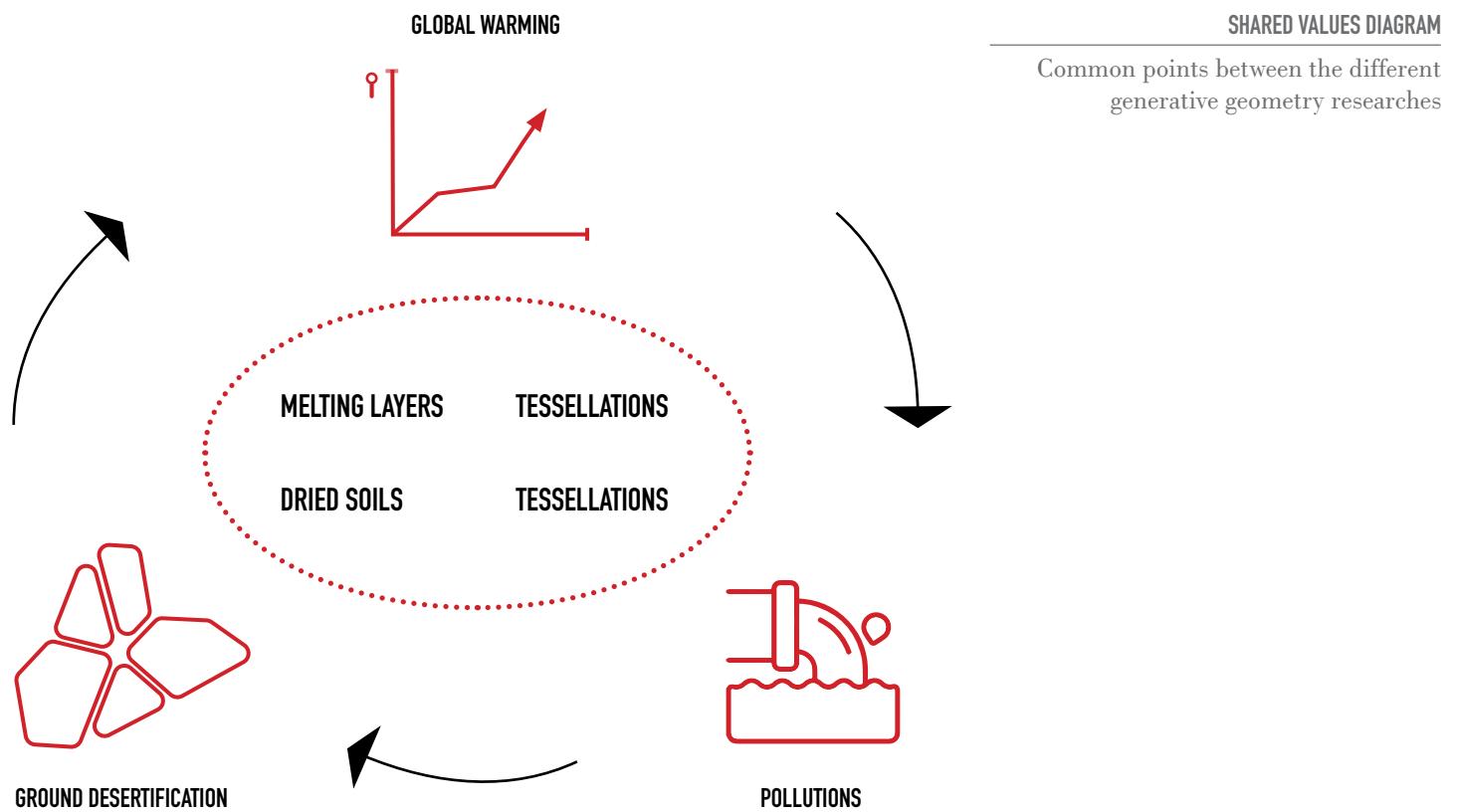


# 1

## WATERSCAPES EVOLUTIONS

### 1.1\_CLIMATE CHANGE EFFECTS

Even though the generative geometry projects dealt with different topics and locations, It was clear that there were three main common factors among the researches: the first one is the ecological issue of increasing temperatures, the second one is pollution and the last one is the cracking pattern of the ground and its desertification.

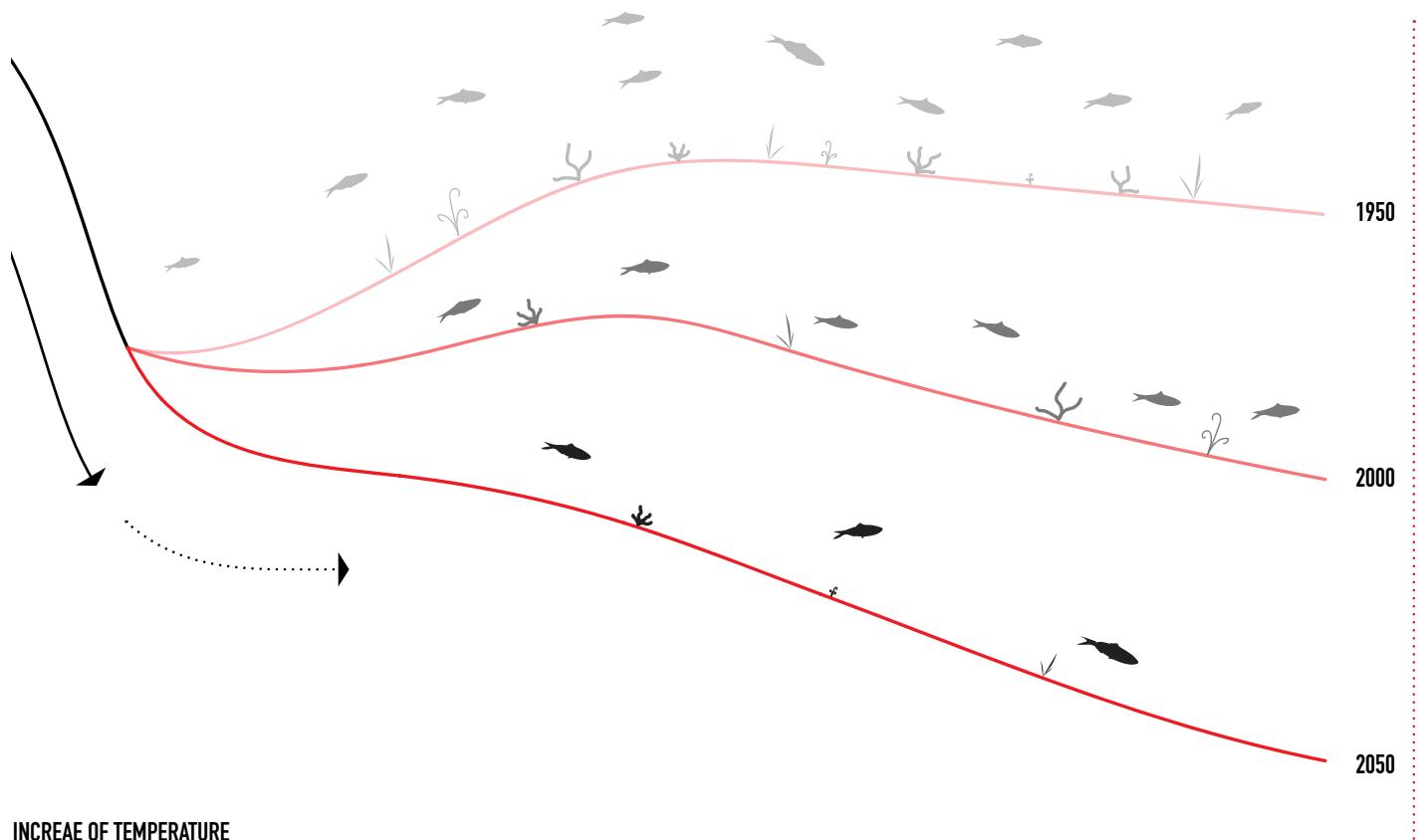


These types of issues are shared by many types of waterscapes (as it can be seen in the researches): in the artic, in desertic areas etc... But their consequences are more visible in environments where water exchange is less frequent. For this reason It was natural to investigate more on freshwater reservoirs. In these particular areas the climate change and increase of temperature can result in two main problem: the first one is the desertification of the water basin bed, so the gradual reduction of flora and fauna biodiversity and the second one is the eutrophication of the water, a process in which a water body becomes overly enriched with nutrients, leading to the plentiful growth of toxic and simple plant life. This condition is not only dangerous for the local wildlife, but also for human beings.

#### CLIMATE CHANGE EFFECT DIGRAM

Biodiversity decrease and desertification in reaction to high temperatures

#### WATER BIODIVERSITY



#### INCREASE OF TEMPERATURE

# WATERSCAPES EVOLUTIONS

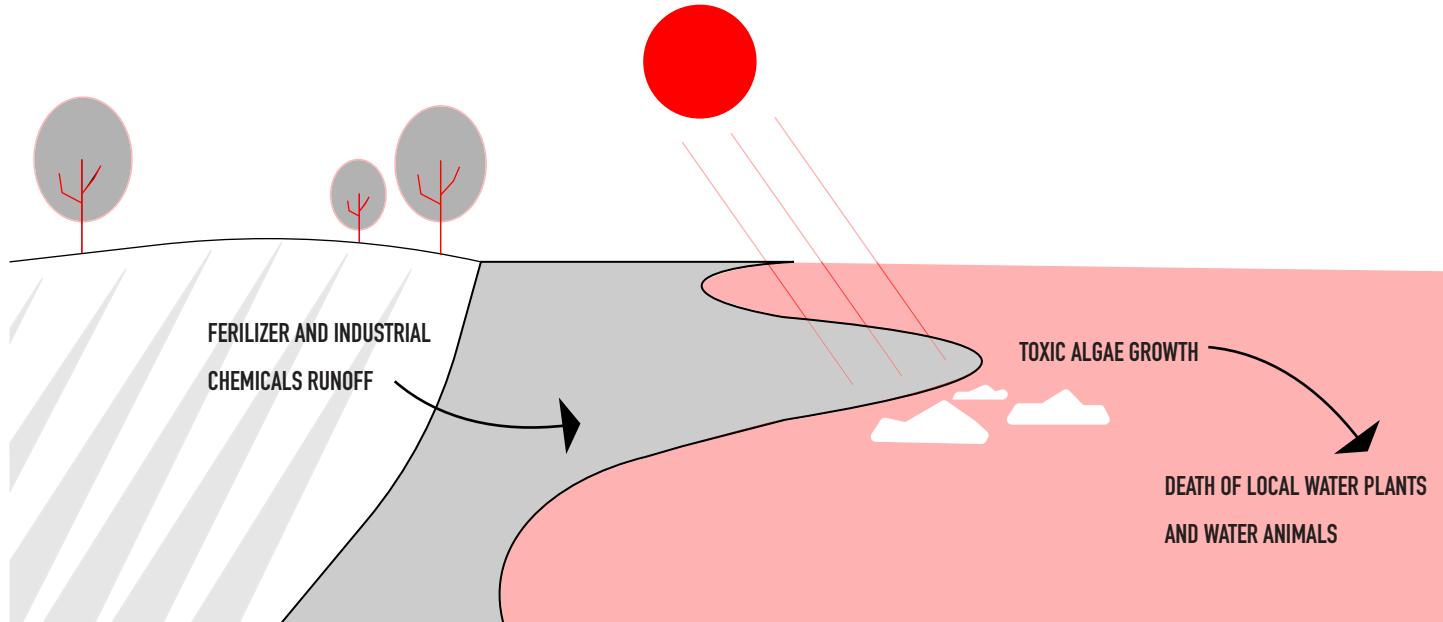
## 1.2 ACTION AND REACTIONS OF WATER

Another major issue that is emerging is the poor maintenance of the banks and of the depuration and filtrating systems. In many world places the native wildlife is starting to be replaced by non-native species that are ruining the ecosystem. The double action of chemical agents and the increasing temperatures is more and more waterscapes uninhabitable and it is triggering the acidification reaction of the water.

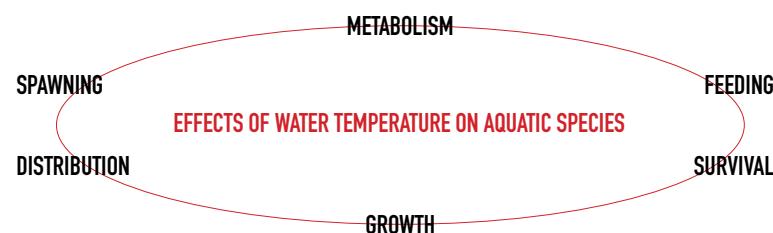
EUTROPHICATION DIAGRAM

Growing process of cyanobacteria and pollution discharges

EUTROPHICATION PROCESS

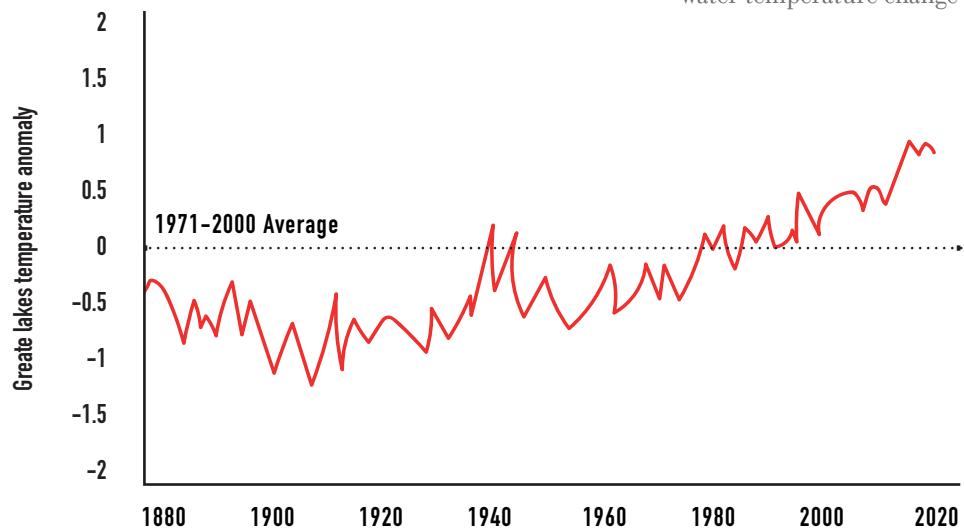


Aquatic plants and algae are important because from the natural point of view they are an oxygen supply for the waters and living beings living there, but also as a nourishment for small organisms. Many water species deposit their eggs right among the aquatic plants, which in return provide shelter and oxygenation. Warm water holds less dissolved oxygen than cool water, and may not contain enough dissolved oxygen for the survival of different species of aquatic life. Some compounds are also more toxic to aquatic life at higher temperatures. Also, due to the unpredictable weather conditions caused by global warming is the constant change of water level. In fact, in the last few years, we have been experimenting more frequent drought in river and lake areas which are consequently followed by floods.



TEMPERATURE EFFECTS DIAGRAM

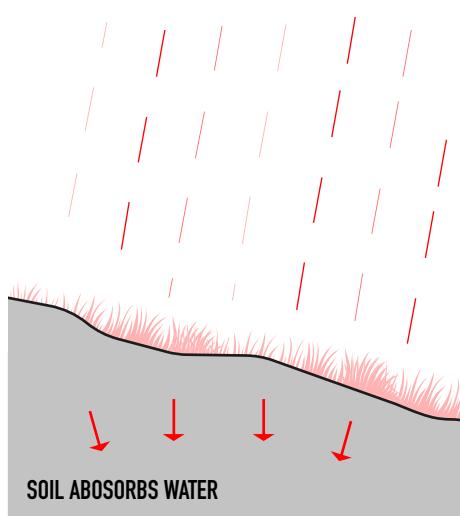
Water animals factors effected by the water temperature change



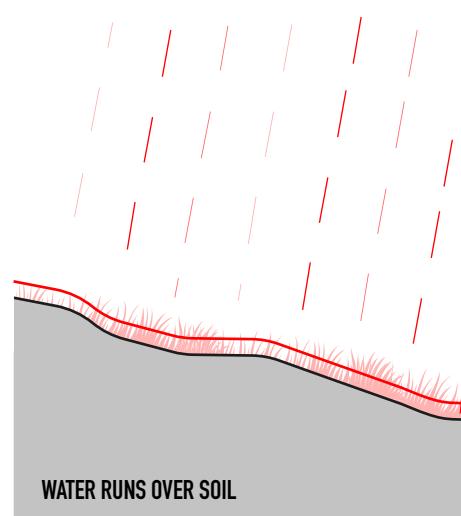
WATER LAKE TEMPERATURE GRAPHIC

Great lakes temperature anomaly variations over the years

NORMAL CONDITIONS



DROUGHT AND FLOOD



WATER FLOW DIAGRAM

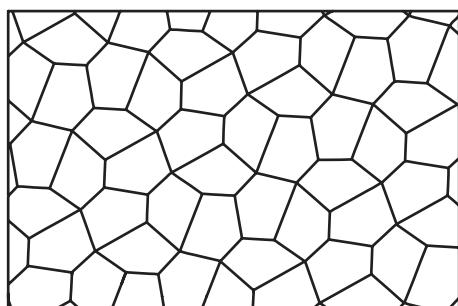
Dry soil effect on water flow and liquids absorption and creation of floods

# 2

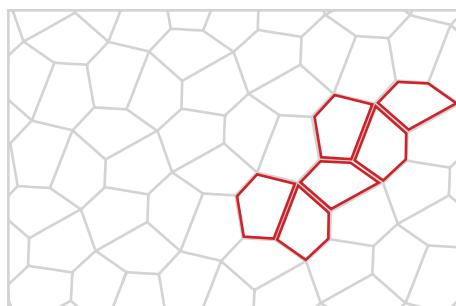
## BI-DIRECTIONAL VALUES

### 2.1\_SPATIAL ARTICULATION

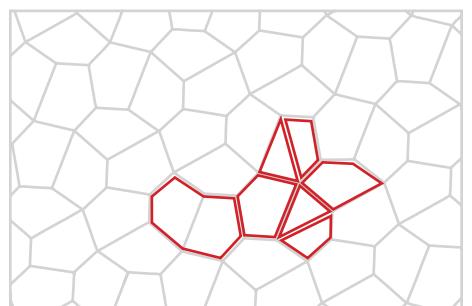
Considering that tessellation of the cracking ground marked a meeting point for the generative geometry researches, It was used as a sarting point for the spatial articulation of the devices. At first, the polygonal shapes have been traced and then It was designed a system that allowed the construction of various and multiple platforms. The floating platform concept is great for aquatic locations since It allows the transportation by water and It adapts to water levels changes.



POLYGONS TESSELLATION



SHAPES TRACING



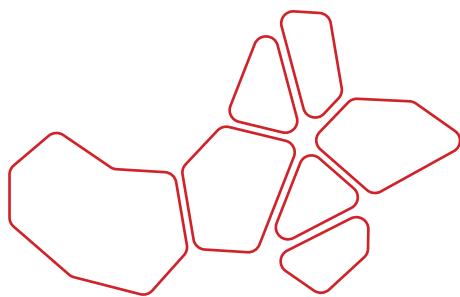
COMPOSITION AND DECONSTRUCTION OF SHAPES

TESSELLATION DEVELOPMENT

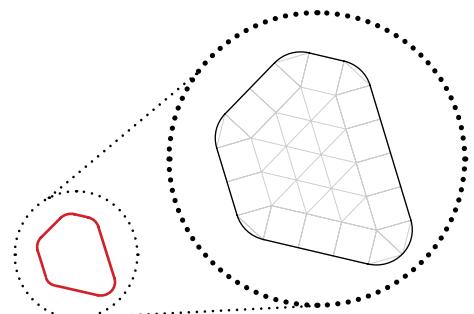
Polygonal shapes construction process

**SHAPING PROCESS**

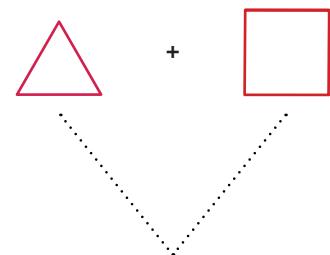
Modular system conception and composition of shapes



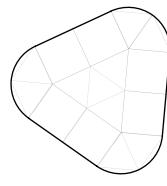
SMOOTH EDGES



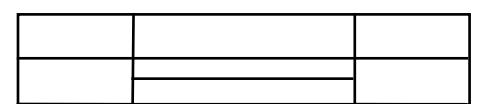
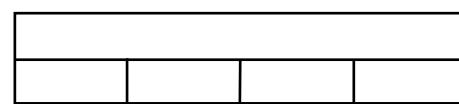
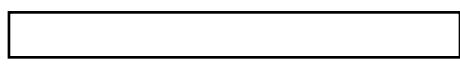
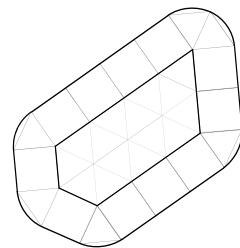
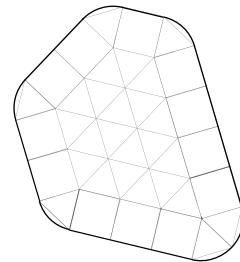
SHAPES CONSTRUCTION SIMPLIFICATION



MODULARITY CONCEPT



MOLTITUDE OF PLATFORM SOLUTIONS



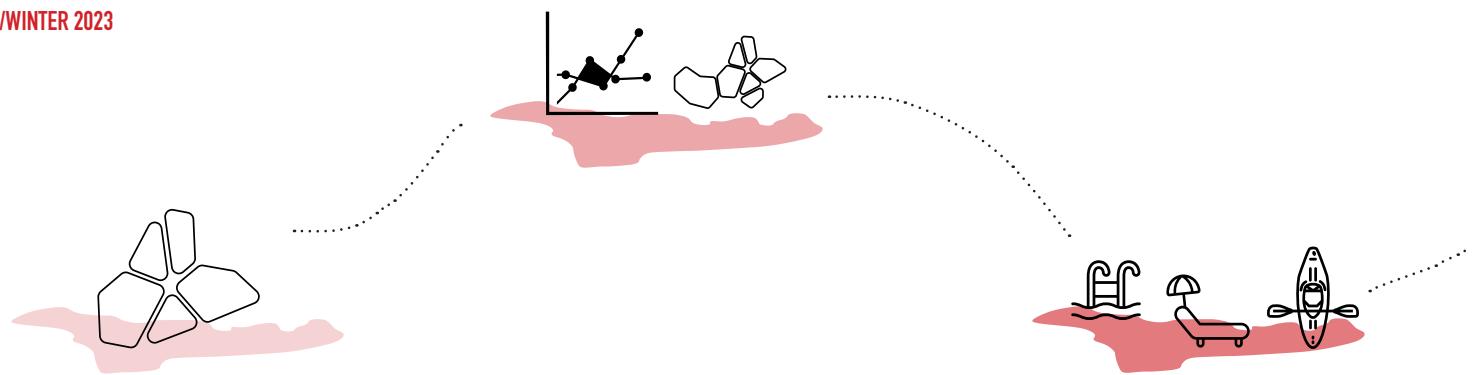
THREE POSSIBLE CONFIGURATIONS

Since the shapes that have been found are characterized by sharp edges, It was decided to smooth out the angles to have a softer feeling. With the aim of obtaining a construction methodology that was modular and versatile It has been carried out a deconstruction of a platform into simpler pieces. This process has brought to light the fact that squares and equilateral triangles can be used to achieve the desired result.

# SPATIAL DEVICE SYSTEM

## 2.2\_LIFE-CYCLE DESIGN

AUTUMN/WINTER 2023

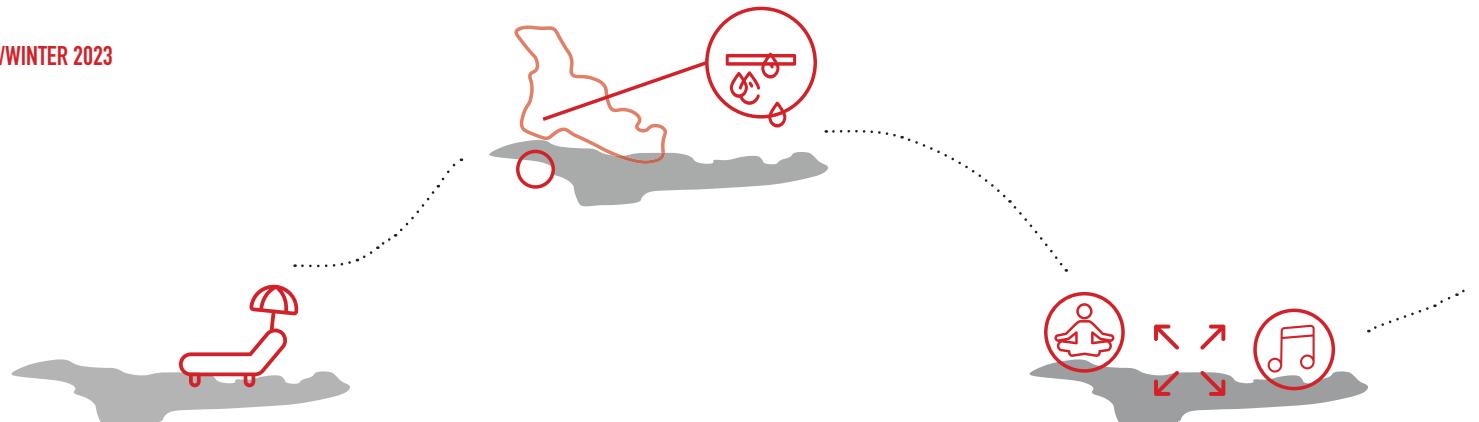


1. Installation of the first set of floating phytodepuration platforms with the aim of reducing pollution and increasing lake's fauna and flora activity

2. Tracing the water quality progresses and adding more platforms if necessary

3. Adding more water and outdoor activities for the spring

AUTUMN/WINTER 2023

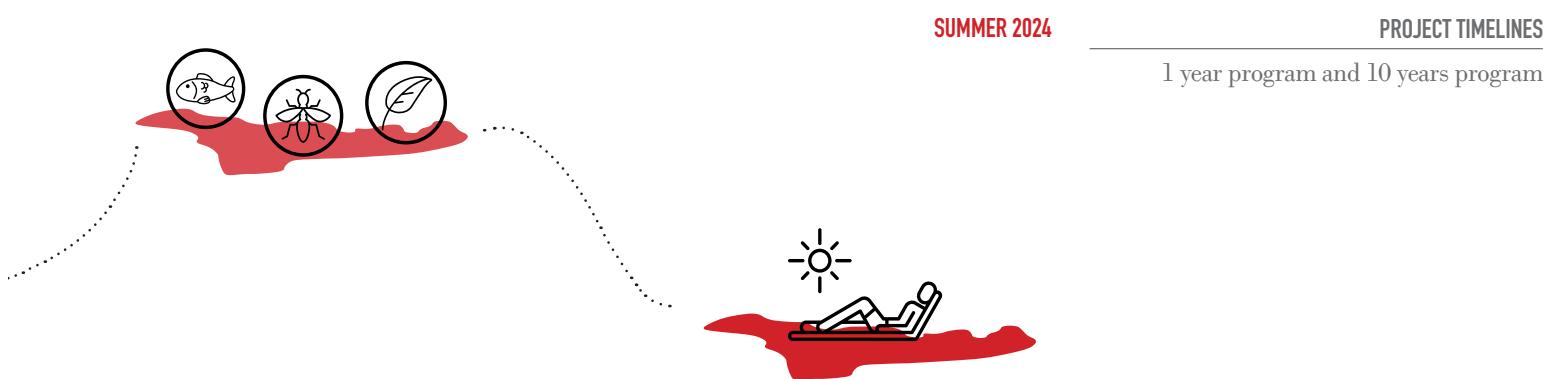


1. Guarantee the possibility of secure bathing with floating pools platforms in Lake Varese

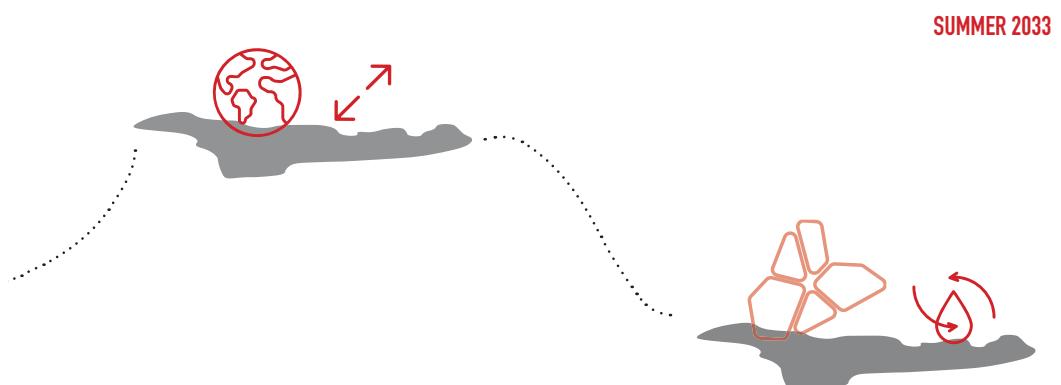
2. Monitration of the main phytodepuration area and expantion of the project in different lake locations

3. Adding new activities and implementing and expanding the project to Rivers

After the first research fase It is clear that the three main objectives of the project are: the depuration of the water from toxic chemicals, the restoration of the biodiversity in water basin and versality. From these premises It was created “**PHORMA3**”, a modular floating platform system that allows the cohesion between amusement activities for man and the restoration of the ecosystem. All of that can be achieved thanks to the natural water treatment process of “phytodepuration” This proposal can be better explained by describing the short-term and long-term life-cycle of the project



- 4. Increasing the level of water native vegetation and wildlife biodiversity**
- 5. Guarantee the possibility of secure bathing with floating pools platforms**



- 4. Increasing the level of water native vegetation and wildlife biodiversity**
- 5. Removal of the depuration platforms as the condition of the location gets better. Keeping in activity the amusement platforms**



STEP

# 2

---

// CREATION

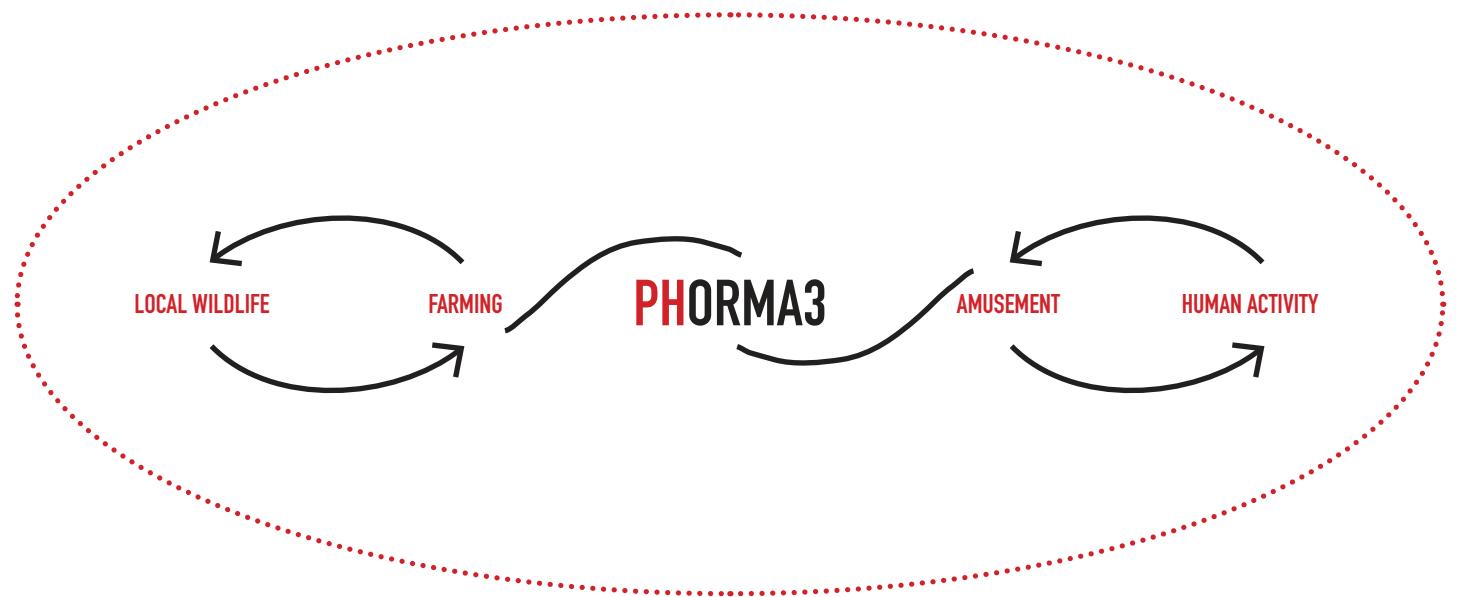


# 3

## SPATIAL DEVICE SYSTEM

### 3.1\_PROJECT VALUES AND TACTICTS

The four main values that form the basis of the “PHORMA3” project are: local wildlife, farming, amusement and human activity. The platform system aims at functioning as a natural amusement park in which the concepts of sustainability and ecology are not overlooked. Thanks to their modular design every floating set can host a different structure activity creating a multifunctional archipelago. The integration of aquatic sports and possible connections increases the interaction with the surrounding landscape.

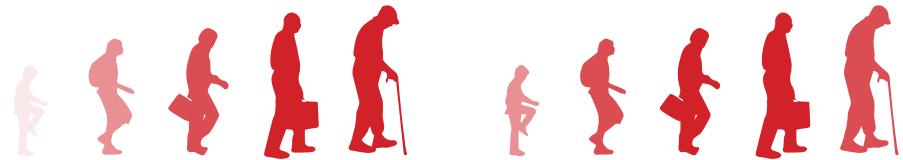


VALUES DIAGRAM

Intrinsic relationships

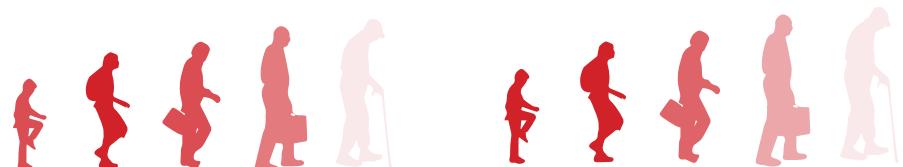
RELAX

ENTERTAINMENT



SPORTS

GAMES



RELAX

GAMES

SPORTS

ENTERTAINMENT

“PHORMA3” aims at becoming a meeting point for visitors of all ages and backgrounds. Thanks to its versatility It is able to adapt to multiple functions and interests of the users, promoting its structures to a growing public. In fact, another purpose of the project is to attract new tourists and visitors in places where this mechanistic went slowly to vane.

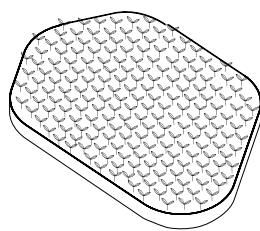
#### TAGERGET AND ACTIVITIES DIAGRAM

Relationships between users activities and mass appreciation

# SPATIAL DEVICE SYSTEM

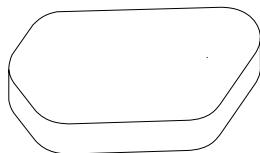
## 3.2\_SUSTAINABLE APPROACH ON WATER

In the same way that platforms are versatile by activity and function they are also for environmental impact sustainability. In fact the depuration system, in addition to providing floating wetlands, allows to reconvert any activity structure to accomodate phytodepuration modules. Phytodepuration is a natural wastewater treatment system that reproduces the principle of self-purification typical of aquatic environments and wetlands. It consists of the creation of more or less deep and impermeable ponds or basins with a substrate that provides support for the roots of emerging plants. At the outlet, only purified water is obtained, without any sludge production. This is an excellent system that has already been applied for the purification of polluted water in some lakes in northern Europe.

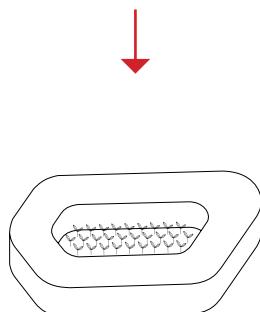


### FLOATING WETLANDS

These are smaller floating platforms that are used only for the phytodepuration and purification of the surrounding waters in the area. Through the phytodepuration of these plant platforms, the area become swimmable and safe for human beings.



### BASIC FLOATING PLATFORM



### MIXED FLOATING PLATFORM

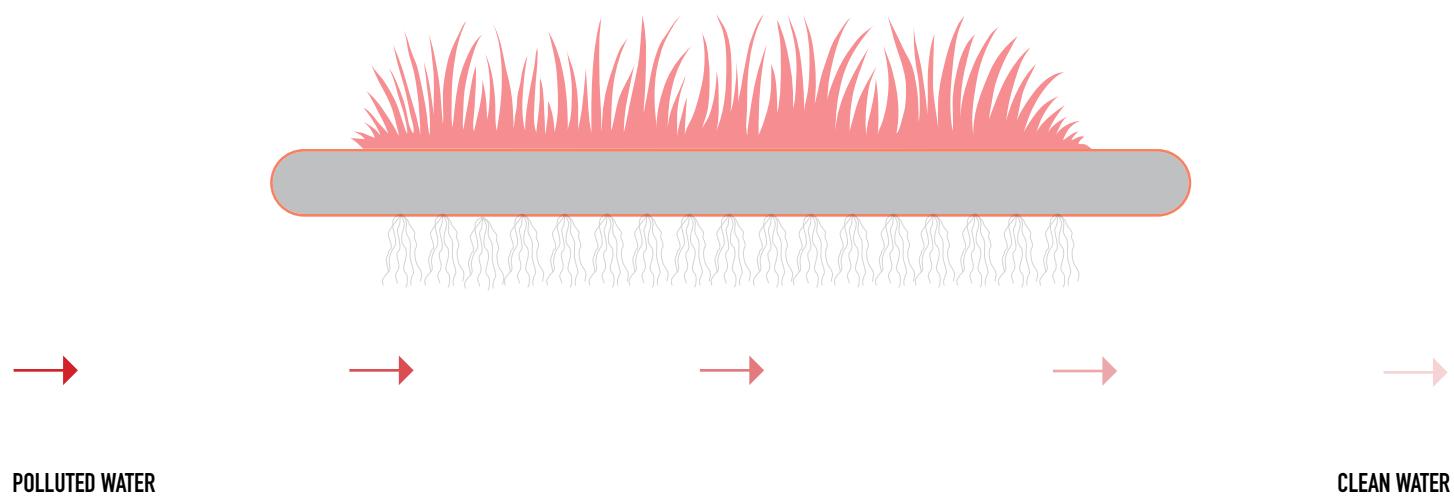
Platforms with walkable way in which in the center there are placed phytopurification wetlands. They have connection and functional purpose

### PLATFORMS SETS

Functioning and repurpose

**PHYTODEPURATION PROCESS**

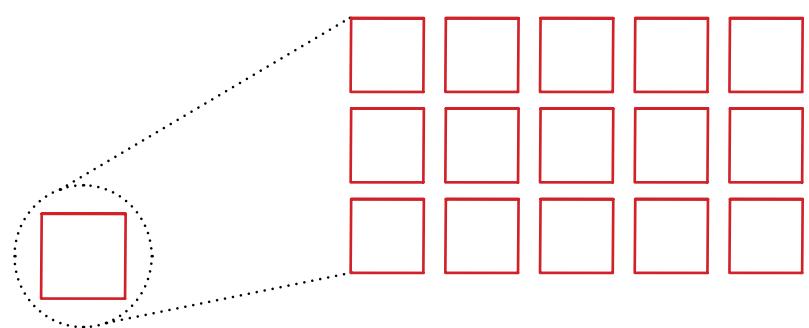
Polluted to clean water transition

**CLEANING PROPORTION**

Depuration power ratio

**CLEANING POWER RATIO**

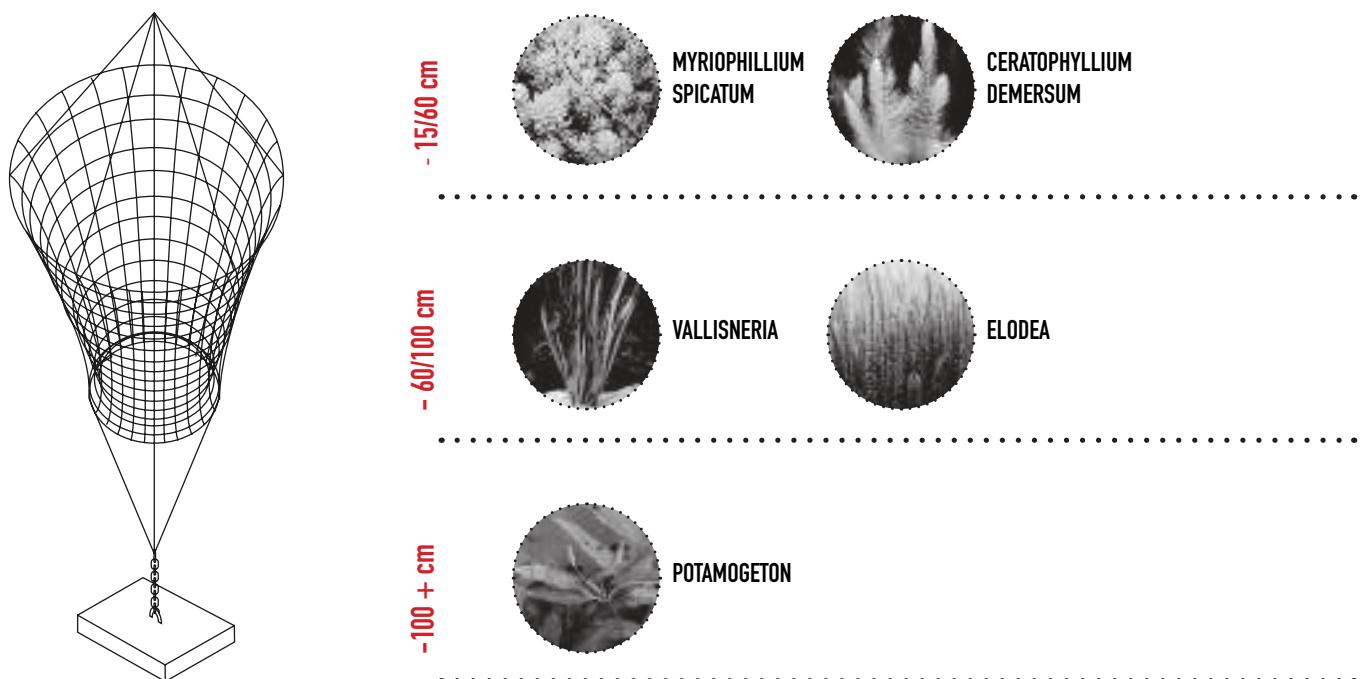
Floating wetlands, despite being simple, have a great efficiency. They have a one to fifteen cleaning power ratio. And, therefore, 1 square meters of wetlands can depurate 15 square meters of water in a short-time period.



Each module is characterized by the presence of native aquatic plants and algae. With the natural depurating power of their roots it is obtained clean water. This process does not need any additional mechanical system and it has 0 impact on the environment.

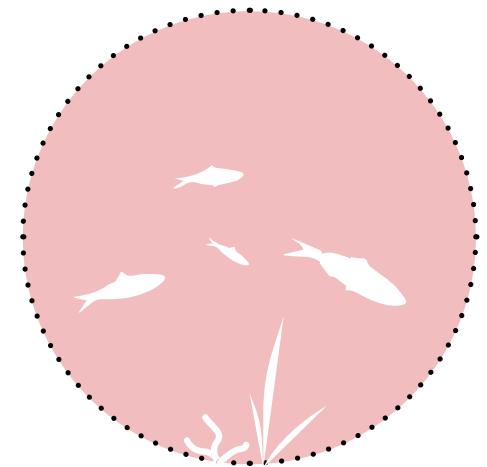
## 3D FARMING CULTIVATION

Shape and aquatic plants set

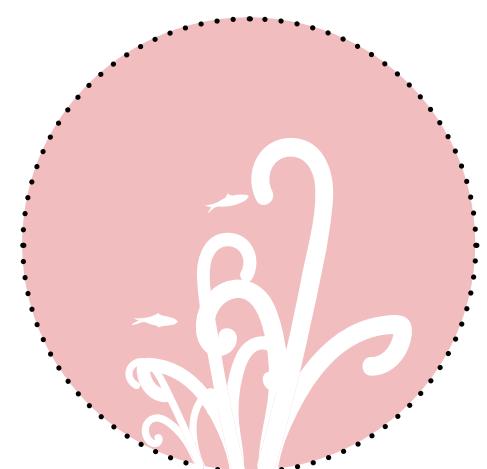


In addition to the phytodepuration system It was decided to introduce a non-conventional method of plants cultivation: the three-dimensional farming. This type of growing approach is usually used in oceans and It simple, replicable type farming which uses the entire water column to grow restorative species. It has a small footprint, because It grows vertically, and has a low aesthetic impact. It is a polyculture vertical farming system that grows a mix of seaweeds and shellfish that require zero inputs - making it the most sustainable form of food production on the planet - while sequestering chemicals and rebuilding ecosystems. The crops are used as food, fertilizer, animal feed and more.

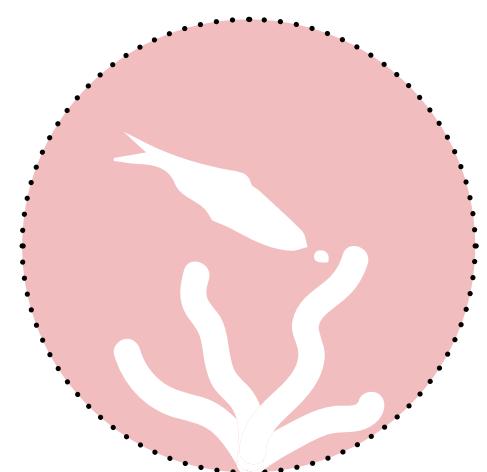
INCREASING BIODIVERSITY



PROVIDING A SHELTER FOR AQUATIC ANIMALS



PROVIDING FEED



#### CULTIVATION ADVANTAGES

Wildlife improvements

# 4

## RURAL | URBAN SYNERGY

### 4.1\_SPACE READING

By using the previous information as a starting point the research shifted to Italy, particularly to Lake Varese. It is located at the foot of the Varese Pre-Alps at an altitude of 238 m above sea level; it has a average depth of 10.7 m and maximum of 26, while the area is 14.52 km<sup>2</sup>. It is located a few kilometers from the city of Varese. The lake is deeply affected by eutrophication. It consists in the excessive increase of substances, such as phosphorus and nitrogen, caused by the increase of temperatures and by urban and industrial discharges that are thrown in water and act as fertilizer proliferating cyanobacteria, improperly called algae.

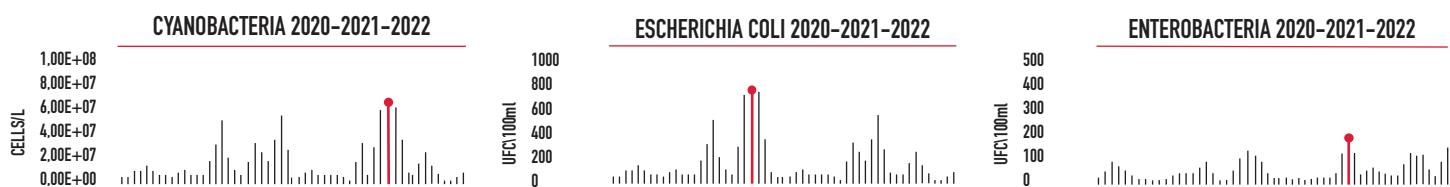
PROJECT LOCATION ZOOM-IN



The pollution of Lake Varese is a serious problem; it is one of the most polluted lakes in Europe, due to the outdated sewage system that discharges waste liquids directly into the water. Intervention through dedicated phyto-purification areas would lead to the recreation of the natural fauna-flora cycle: with the repopulation of fish and crustaceans, the increase of vegetation. In addition to this, many beaches on the lake would also become swimmable again for humans.

#### PHYTODEPURATION PROCESS

Polluted to clean water transition



#### SWOT ANALYSIS

Strengths, weaknesses, opportunities and threats of the lake area

#### STRENGTHS

- Proximity to a town center
- Wide range of shores locations
- Good connection with other cities
- Huge green areas

- Water regeneration
- Safe swimming conditions
- Native biodiversity restoration
- New tourist attraction

#### OPPORTUNITIES

#### WEAKNESSES

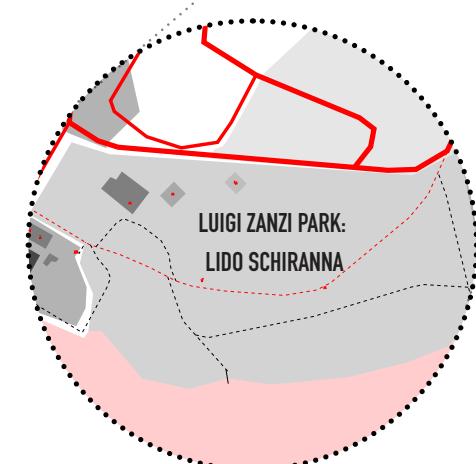
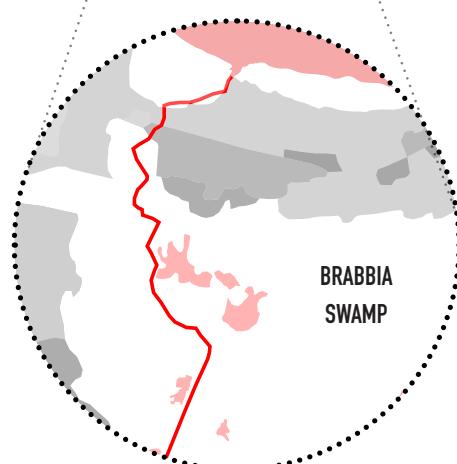
- Industrial hub near the lake
- Low tourist interest
- Unattractive to visitors

- Industrial drains
- High pollution rate
- Non-native species

#### THREATS

## LEGEND

- Main tributary: Brabbia river
- Secondary rivers
- Industries
- Main phytodepuration site
- Project site: Luigi Zanzi Park



### LUIGI ZANZI PARK

The Luigi Zanzi Public Park is located in Schiranna, on the shores of Lake Varese. It was born in the sixties by the Autonomous Company of the city, headed by Luigi Zanzi.

## LAKE VARESE MAPPING

Important geographical and spatial location aspects

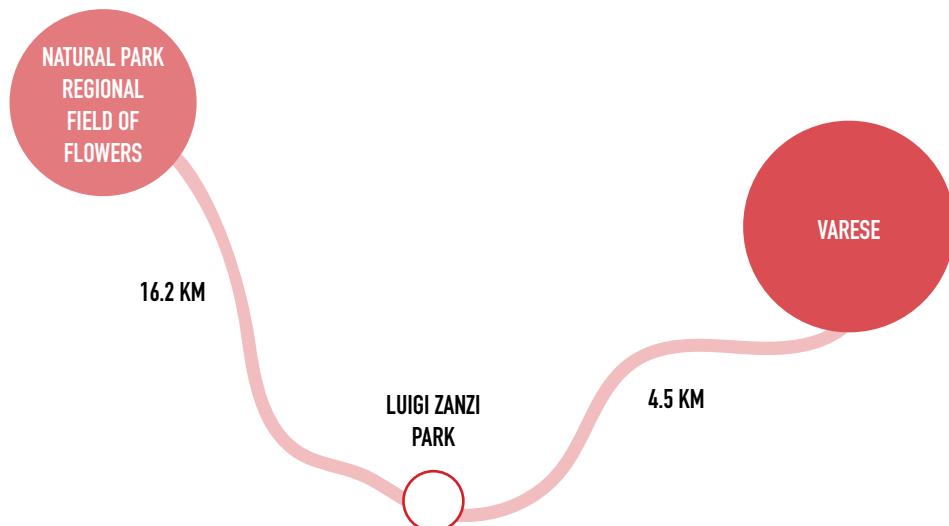
Lake Varese It is the 10th Italian lake by extension, among those entirely included in the national borders, and the 12th in total. Known for its unmistakable shoe shape, it has nine municipalities: Varese, Azzate, Bardello with Malgesso and Bregano, Biandronno, Bodio Lomnago, Buguggiate, Galliate Lombardo, Cazzago Brabbia and Gavirate, the latter has long been the main town overlooking the lake (the town of Varese acquired a large part of the shores only in the twenties). It is only six kilometers from the city, and once was the main economic source of the surrounding territory: in its shores were born, at the end of 1800, the first factories of the territory.

## ZOOM IN

Projects locations zoom in

# RURAL | URBAN SYNERGY

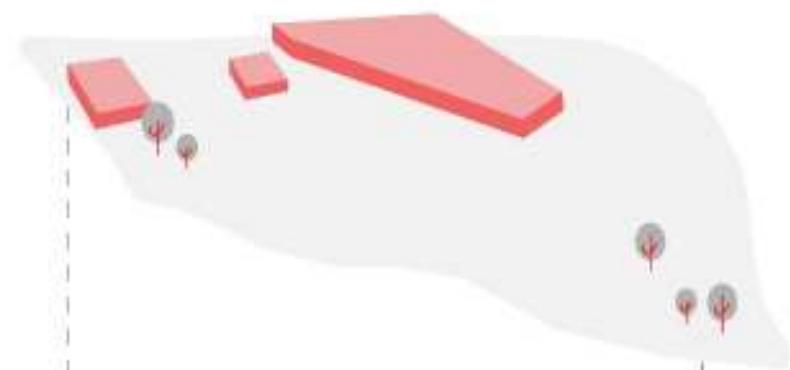
## 4.2\_PROMIXITY | PROMISCUITY RELATIONSHIP



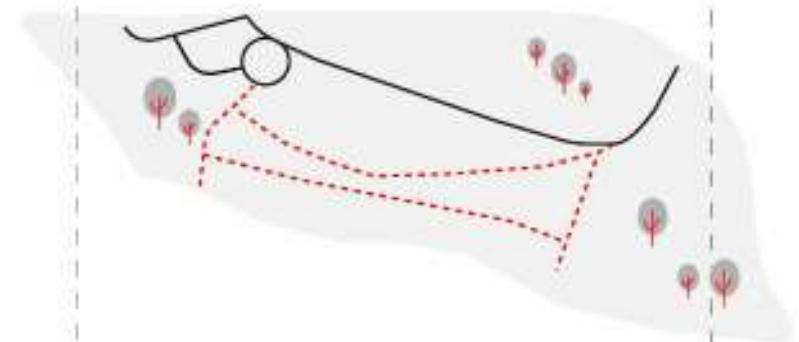
The Luigi Zanzi Park is located in Schiranna, in the south-west of the city and on the shore of Lake Varese. The main entrance of the Park is in Via di Canottieri. Near the park there is the historic seat of the rowers of Varese and the lake has often been home to major European and world sports competitions. It looks like a quiet green oasis bathed by the lake, has a picnic area with tables and games for children and is crossed by the pedestrian path that winds for about 28 km around Lake Varese. In the immediate vicinity there is also a swimming pool. Peculiarity of this area is the wealth of sports opportunities: a bike path that starts from Schiranna and returns here covering the entire perimeter of the lake, allows lovers of jogging and two wheels to breathe fresh air in a safe area and not beaten by car; a track for gliding allows lovers of glider cruises to admire the city from a different and evocative perspective.

## SPACE COMPOSITION

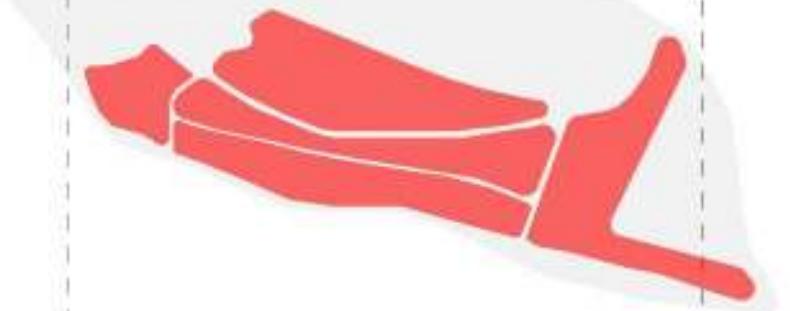
## BUILDING AND EXISTING ACTIVITIES



## PATHS AND STREETS



## FREE GREEN AREAS



## LUIGI ZANZI PARK





STEP

# # 3

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// REFLECTION

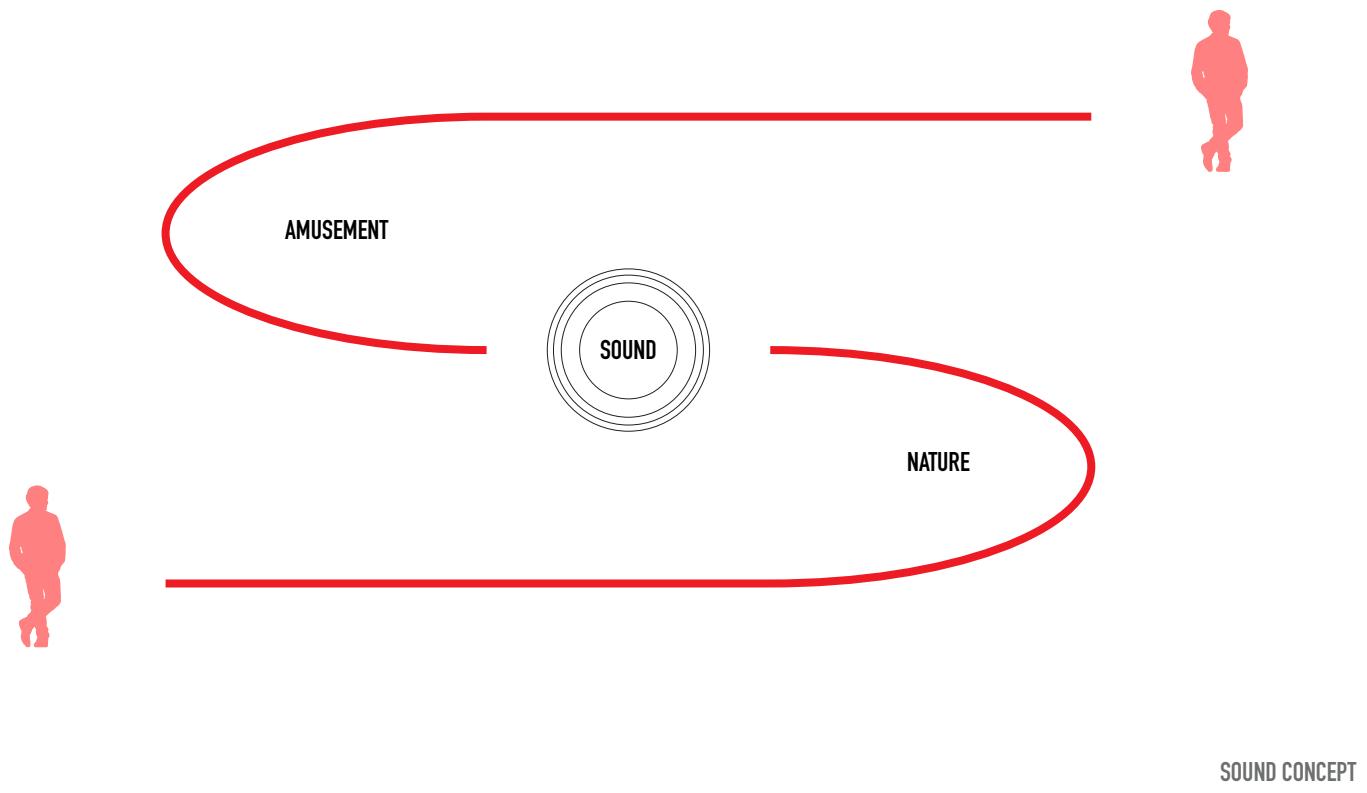


# 5

## ACTION-REACTION

### 5.1\_HUMAN | SOUND CO-EXISTENCE

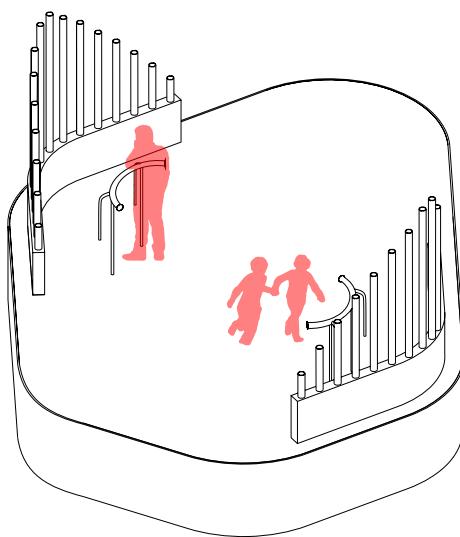
Nature and human activity are two of the most important concepts that surround the project. For that reason the sound spectrum has been analysed by thinking in both ways. Since the “PHORMA3” system in lake Varese is based on a double purification action it was thought to incorporate this aspect in different but similar ways: one focused on man action with water and the other focused on the action of water in nature.



The metaphor that has been used to develop the sound role is the organ. In music, the organ is a keyboard instrument consisting of one or more divisions of pipes or other means of producing sounds. In this case it has been conceived to be able to adapt to water. The “Hydraulophone” is located in the main project area, which is dedicated to the amusement park. On the other hand, the “Lake Organ” is located in the main depuration system.

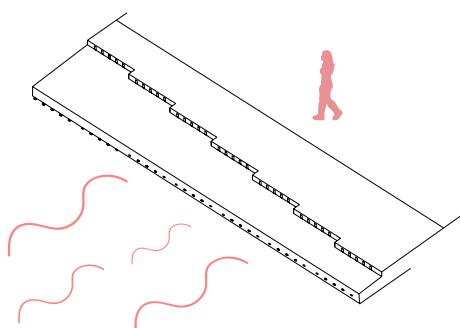
#### SOUND INTERACTION WITH WATER

Hydraulophone and Lake organ description



#### HYDRAULOPHONE

It is a water organ that is activated by the action of water and air pressure. It can be freely played by people like a common musical instrument.



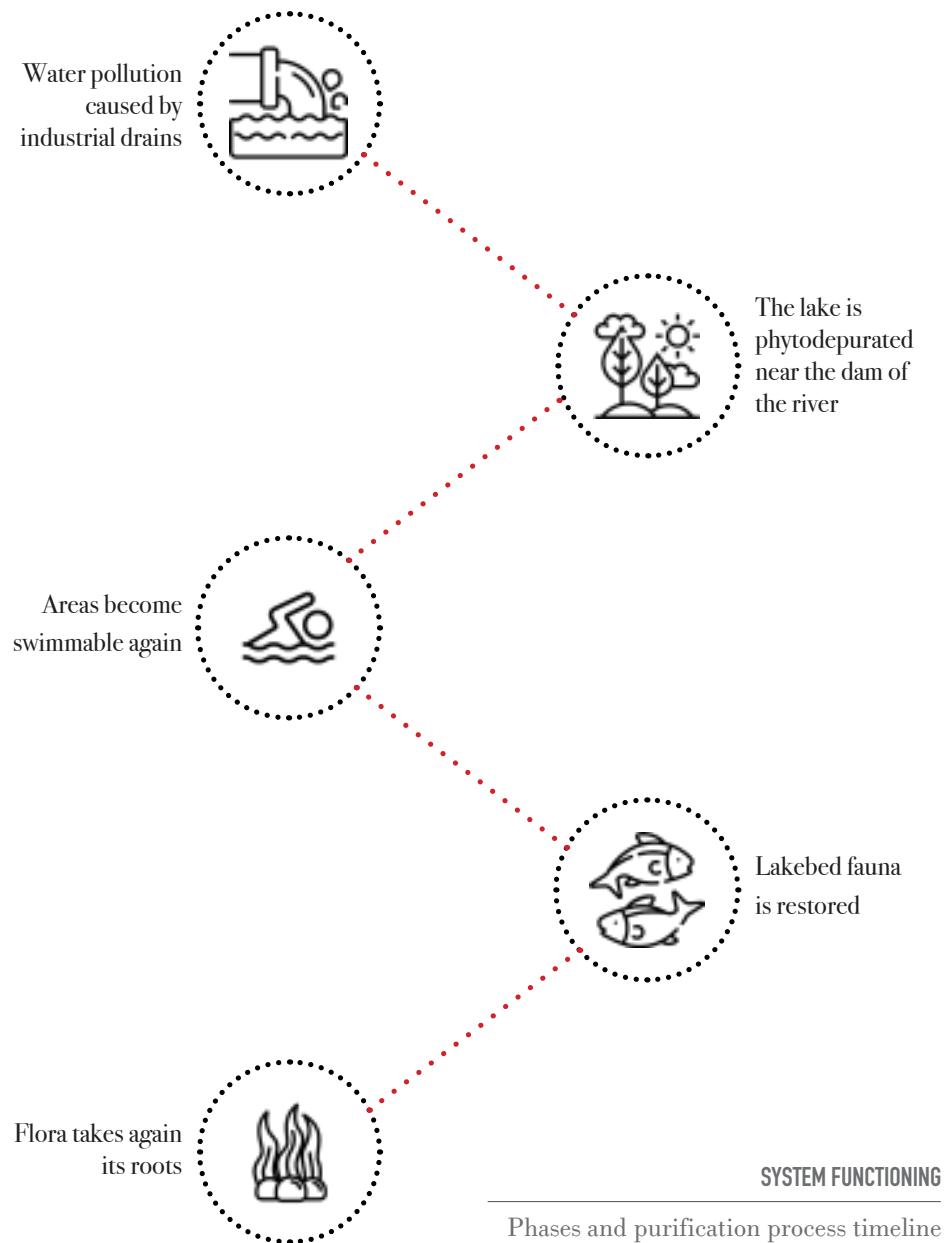
#### LAKE ORGAN

The “Lake Organ” is a water activated organ that produces sound thanks to the air pressure created by waves. It is located near the lake’s main tributary

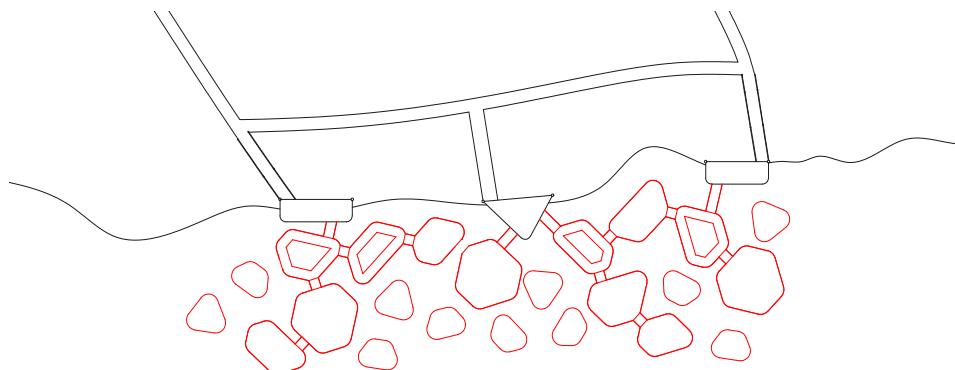
# ACTION-REACTION

## 5.2\_TIME-SPACE TRANSFORMATION

The pollution of the lake Varese is a serious problem; it is one of the most polluted lakes in Europe, due to the outdated sewage system that discharges liquids directly into the water. Also a big part of the pollution it is caused by the drains of the factories in the surrounding area. The phytodepuration could help the lake situation if it is act in a strategic way with the help of the main depuration system (located near the lake's tributary). The “PHORMA3” process can be devied in 3 phases. In each of them It can be seen how, as the ecological sistuation improves, there's a reduction of the wetlands and a gradual introduction of water activity based platforms.

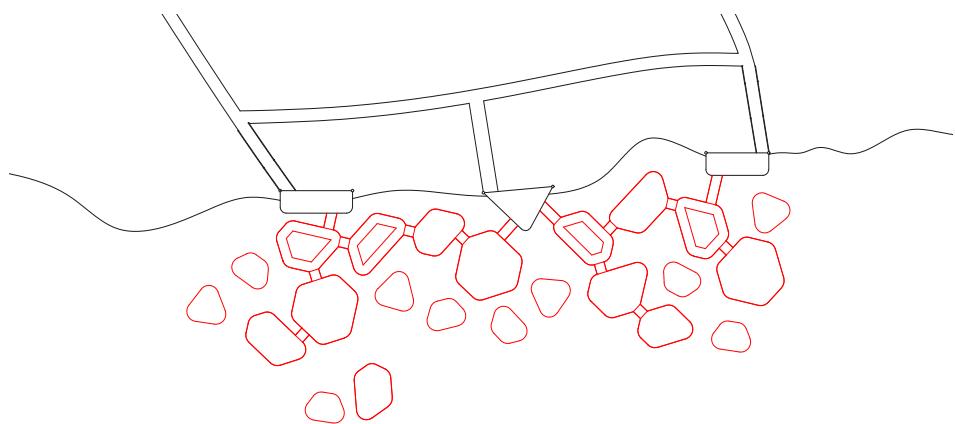


PHASE 1

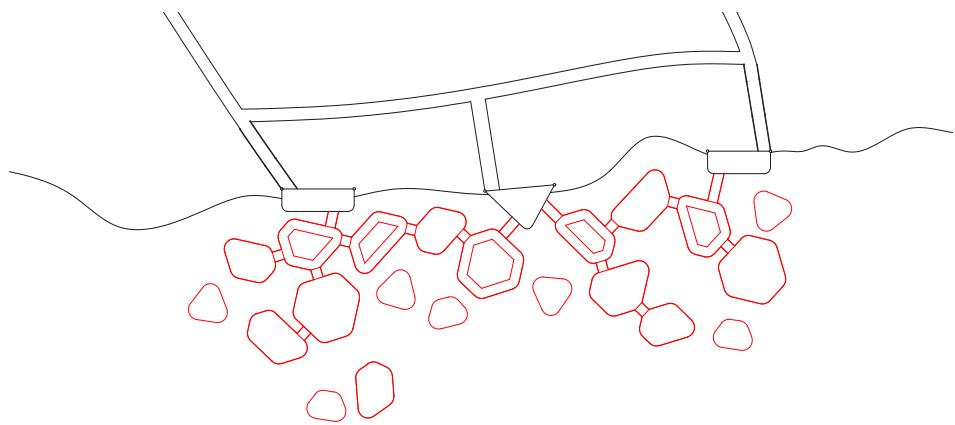


AUTUMN|WINTER 2023

PHASE 2



PHASE 3



SUMMER 2024

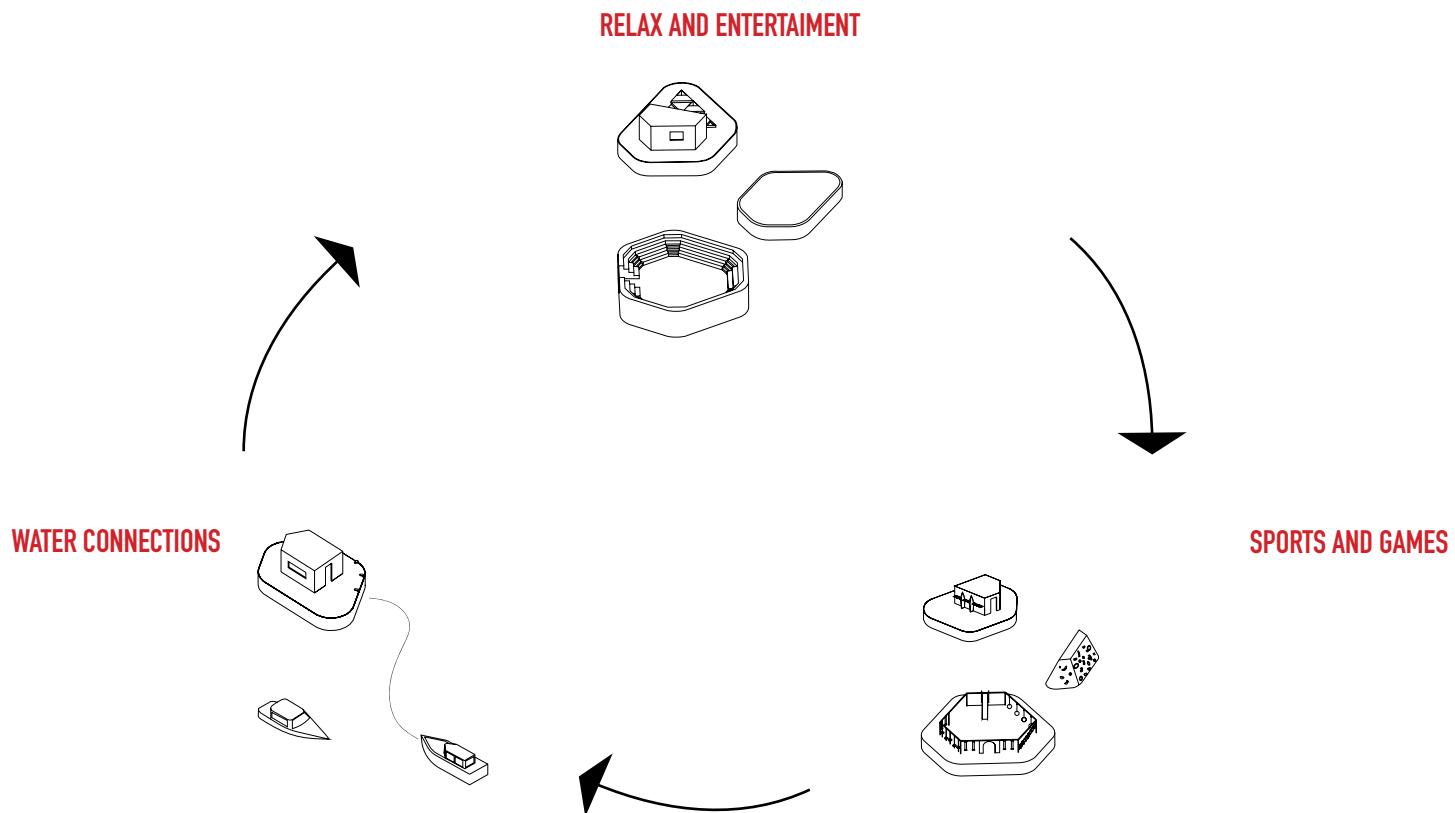
# 6

## SPATIAL APPLICATION

### 6.1\_SPATIAL ARTICULATION | COMPOSITION

On the shore of lake Varese, the “**PHORMA3**” system, is designed as an archipelago of multifunctional floating islands. The configuration of the platforms can be changed continuously, as well as their location inside the lake. In this way it is possible to have a perfect balance among the activity proposed. Also the possibility of connection by boat makes the project even more integrated in the surrounding landscape.

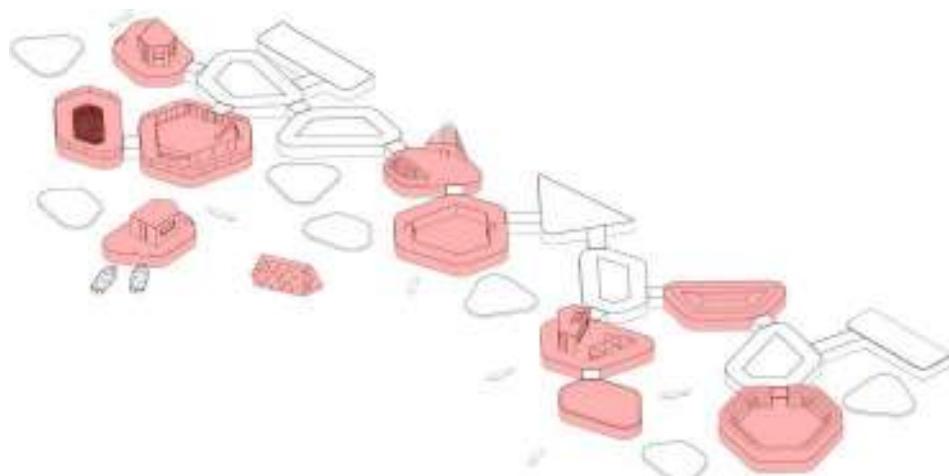
ACTIVITIES DIAGRAM



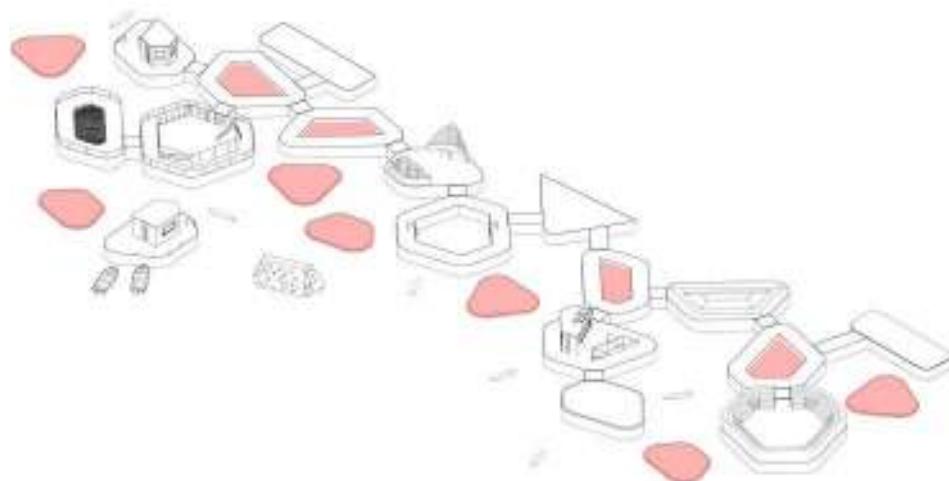
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MAIN PROJECT SPATIAL COMPOSITION

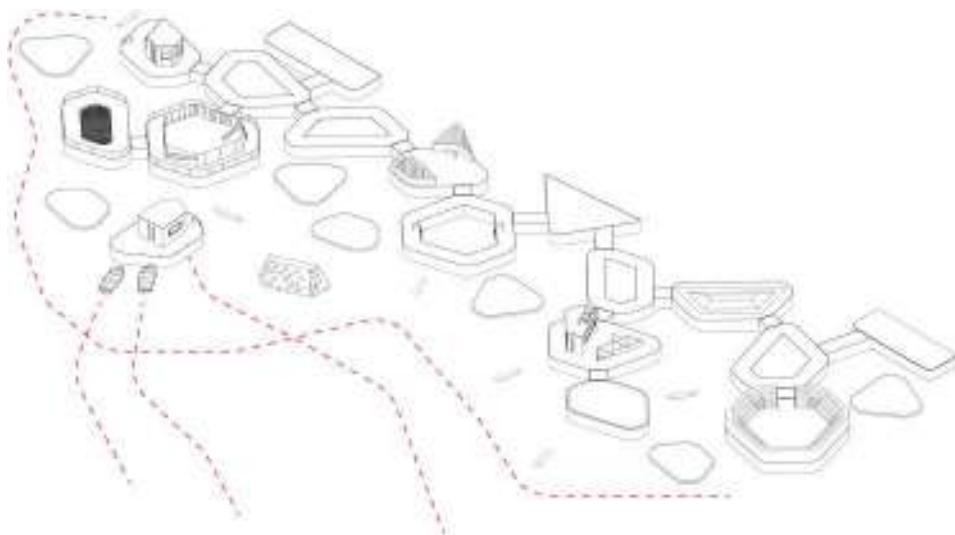
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**ACTIVITY PLATFORMS**

In the platforms it will be possible to experience water sports and climbing. It will also be available a play area dedicated to children and relax and entertainment areas.

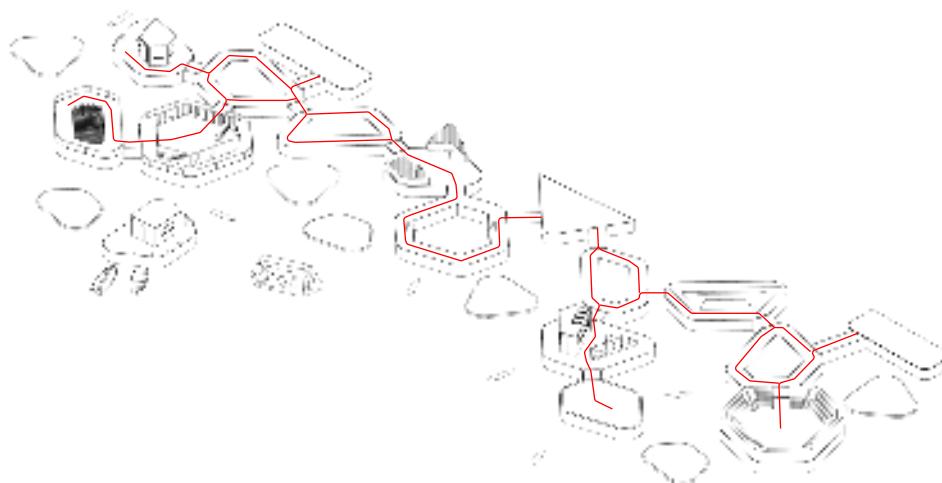
**PHYTODEPURATION PLATFORMS**

These are smaller floating platforms that are used for the purification of the water. There are also platforms with walkable ways in which in the center there are placed phytopurification wetlands.



#### WATER CONNECTION

Thanks to the phytodepuration system the platforms could allow water activities. The platforms can be reached via boat thanks to the docking platform.



#### FLOW AND MOVEMENTS

Every platforms can be reached using floating bridges that allow visitors to move from one side to the other

In the other side of the lake, at the end of its main tributary, River Brabbia, it is located the main depuration system. It consists in a wood pier, in which it is attached the "Lake organ" and various depuration platform, which are necessary to complete the cleaning process.



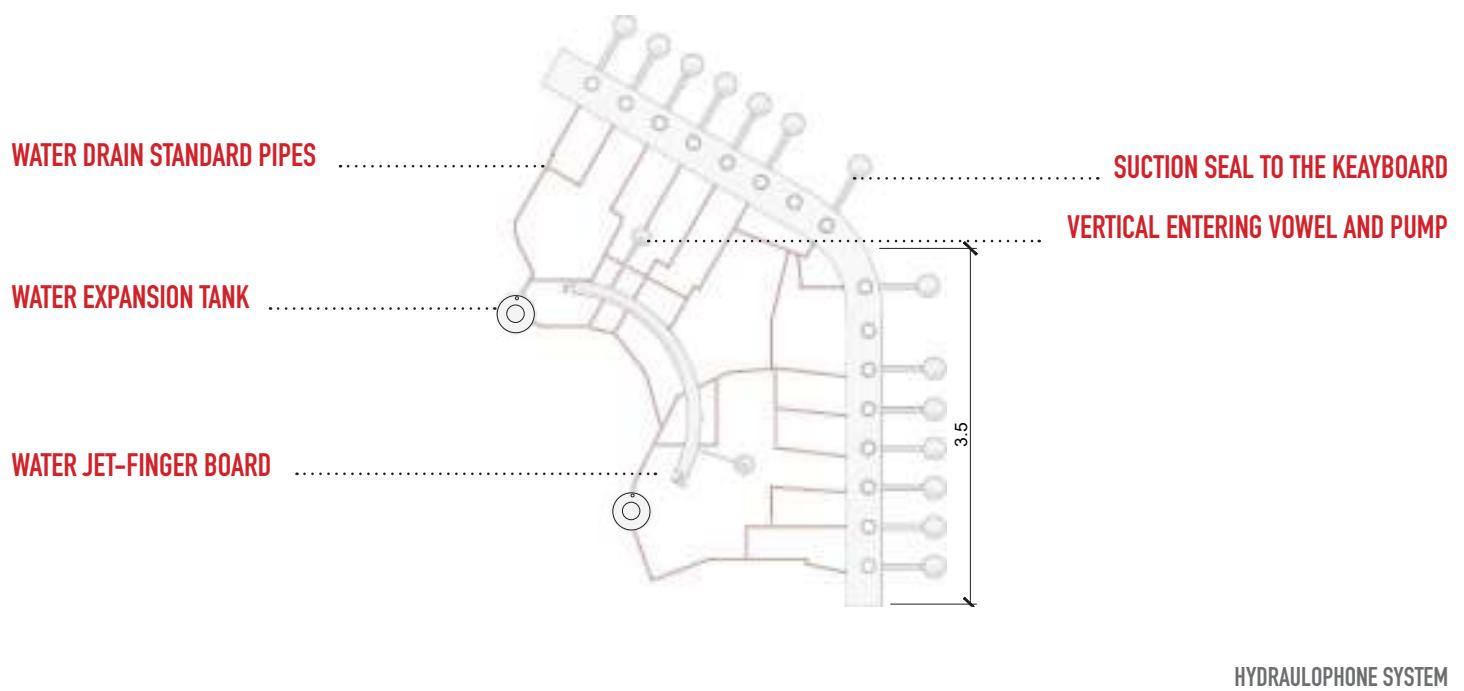
#### PHYTODEPURATION SYSTEM

Thanks to the strategic placing of the depuration platform it is possible to achieve a complete natural cleaning of the lake

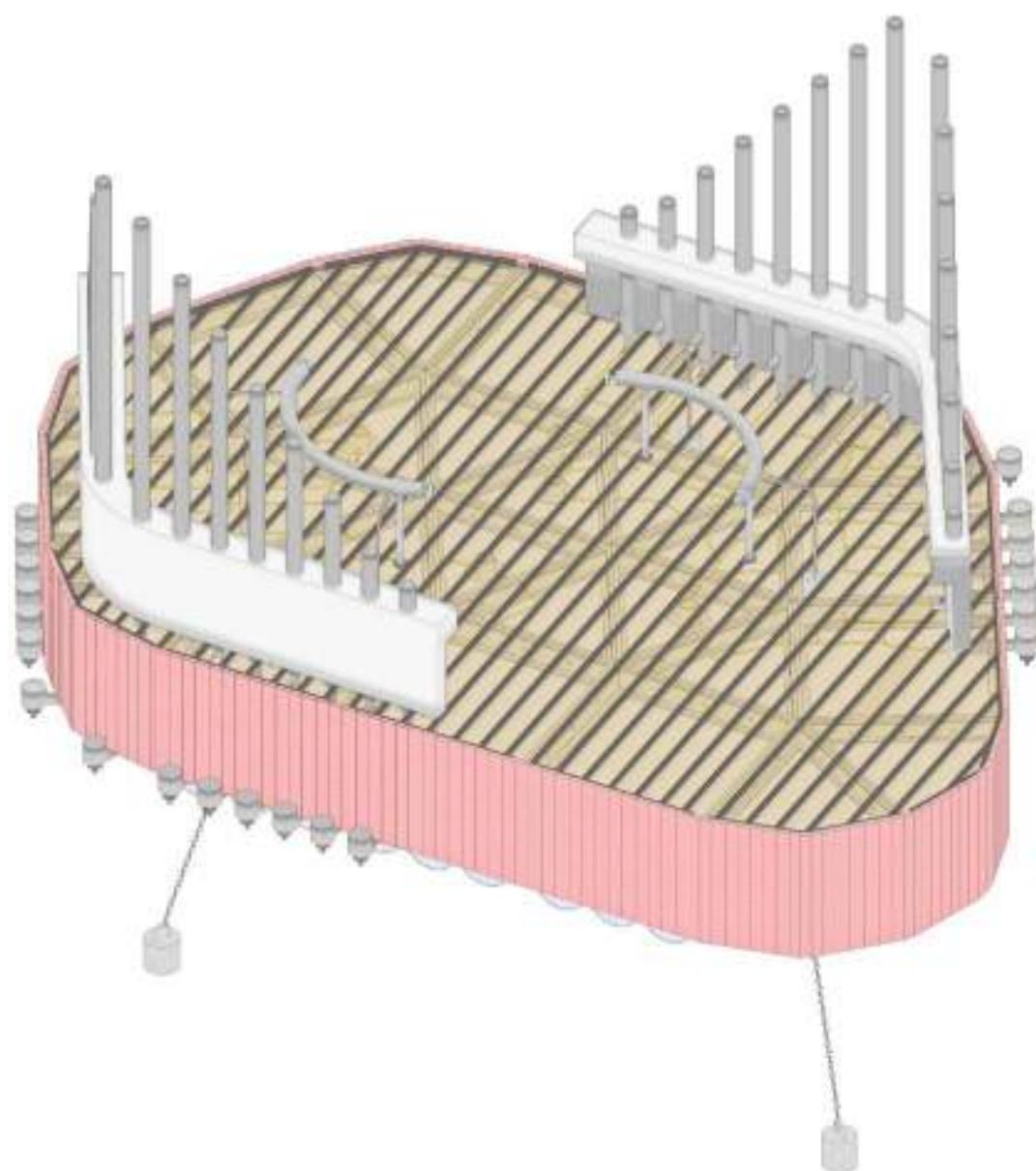
# SPATIAL APPLICATION

## 6.2 WATER AND SOUND ROLES

The hydraulophone is a musical instrument that produces sound by using water to generate and manipulate vibrations. It is an interactive instrument that allows players to create music by pressing their fingers against water jets or other water sources. It consists of a series of water jets or nozzles, similar to small fountains, arranged in a particular pattern. Each jet produces a different pitch or tone when water is flowing through it. By blocking or altering the flow of water with their fingers or other objects, players can control the pitch and volume of the sounds produced. When a finger is placed over a water jet, it creates a similar effect to covering a hole on a wind instrument, changing the pitch. .

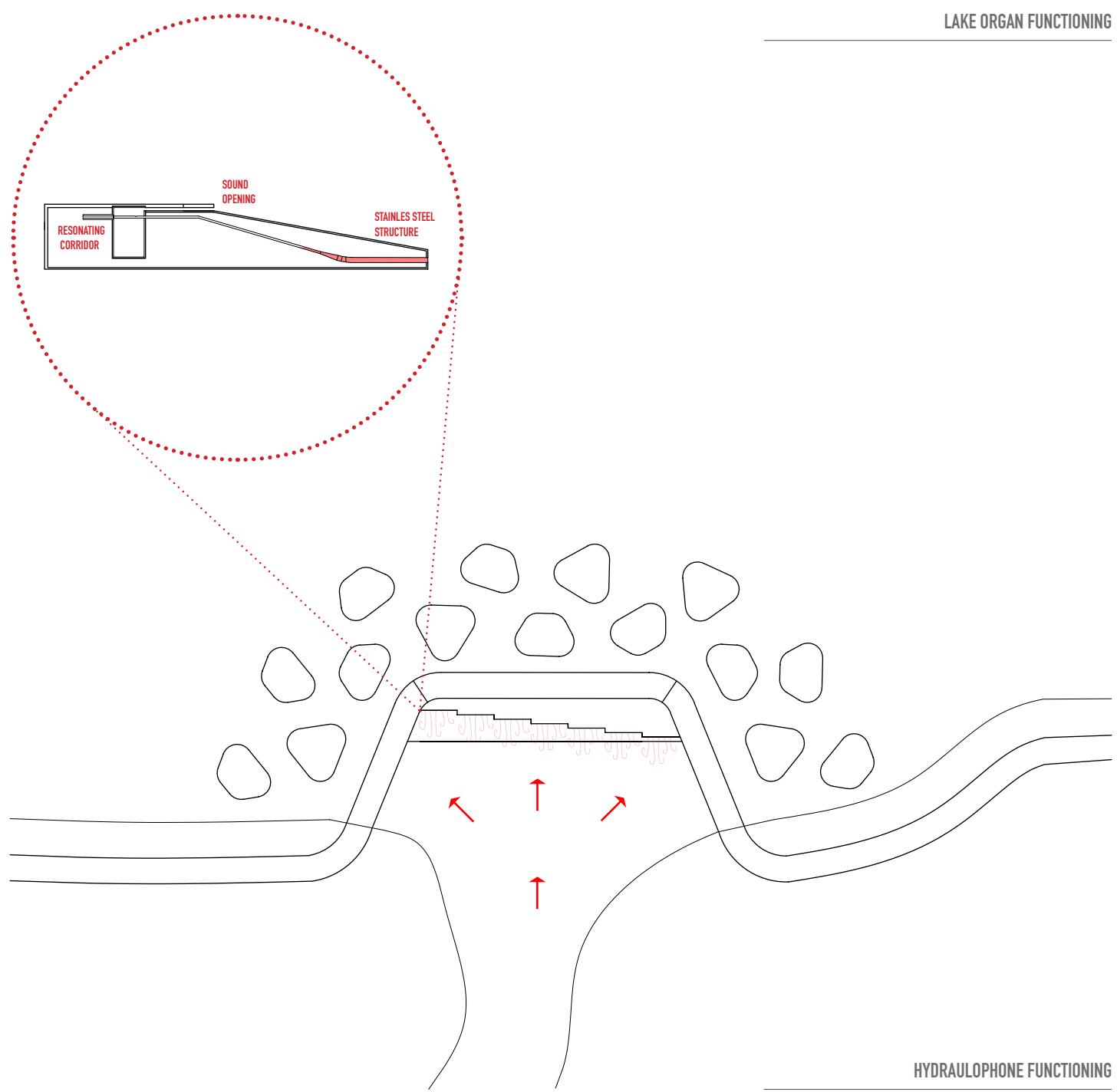


STRUCTURE AXONOMETRY



Using the power of the natural flow of the main tributary of the lake the “Lake organ” produces a variety of sounds. The organ is composed by 35 pipes that are divided in 7 sets of different length. Each set presents 5 different pipes open diameter. Its music is produced thanks to the air pressure that is generated by the water waves entering the system. The air channeled inside a resonating corridor and its expelled through specific holes that are placed in the upper part of the organ.

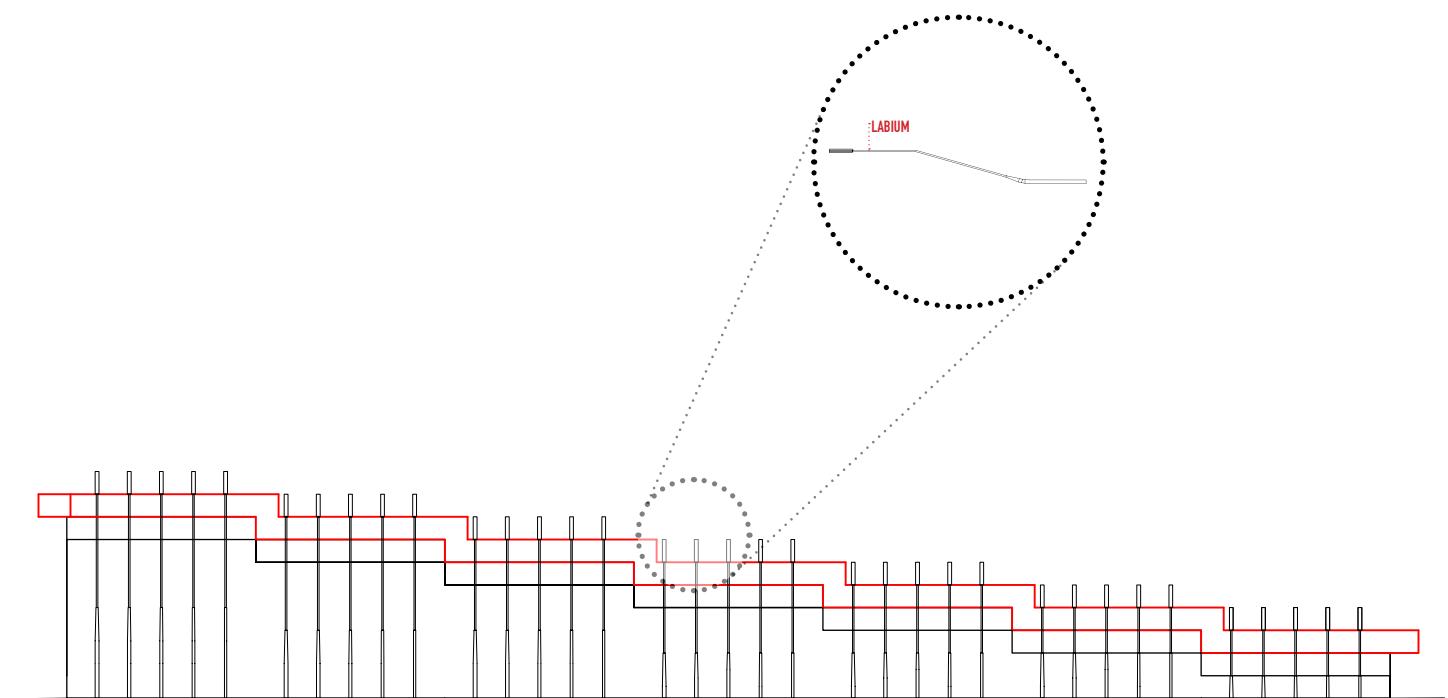
LAKE ORGAN FUNCTIONING



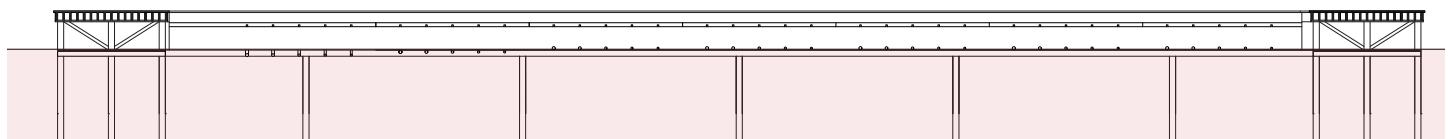
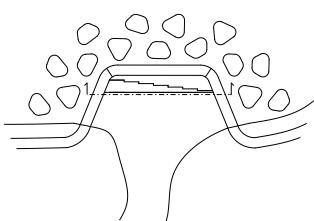
HYDRAULOPHONE FUNCTIONING

**FUNCTIONING SCHEME**

Each of the 6 sections of pipes it's characterised by a group lenght and each water entrance has a different diameter ( 10-9-8-7-6 cm)



LAKE ORGAN SECTION 1:50



# WILD MILE

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3D VIEWS





#### WILDMILE, CHICAGO, SOM, 2017

The north branch of the Chicago River, just outside of the city's downtown, was once lined with smoke-spewing factories, occupied by barges, and treated like little more than a convenient sewer. Its edges were straightened, and much of its life was drained in favor of efficient shipping. Today, a remarkable transformation is underway. Long linear patches of wetlands are spreading along the channel's edges, and docks have been built alongside as a kind of floating walkway.



STEP

# 4

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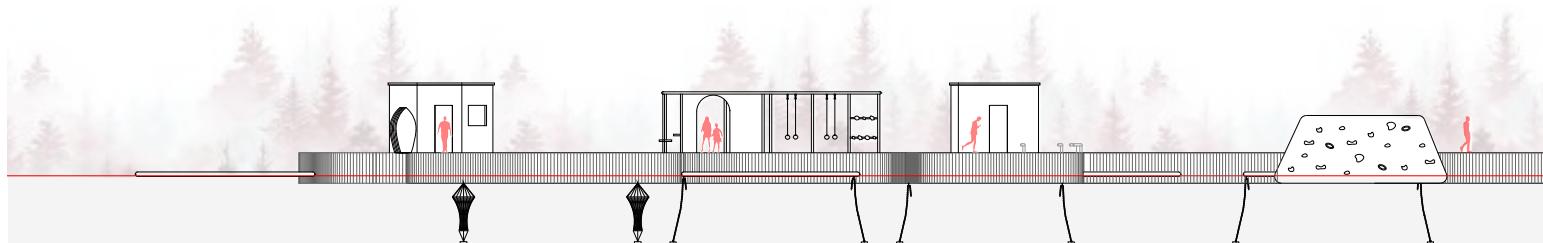
// IMPLEMENTATION



# 7

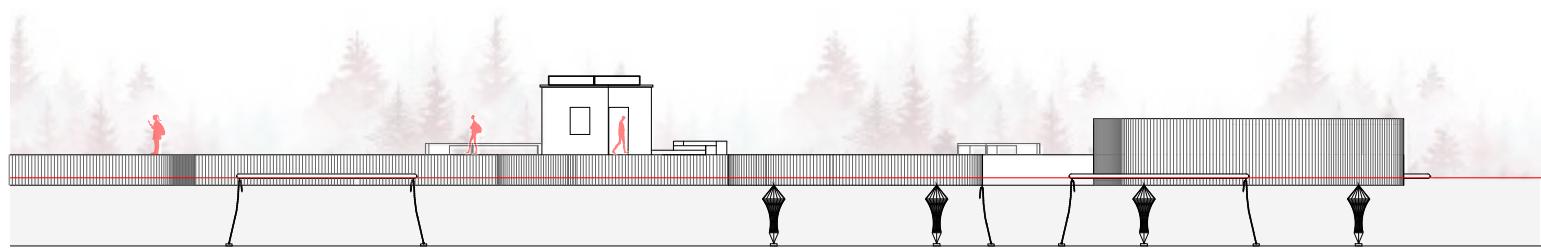
## PROJECT ZOOM-IN

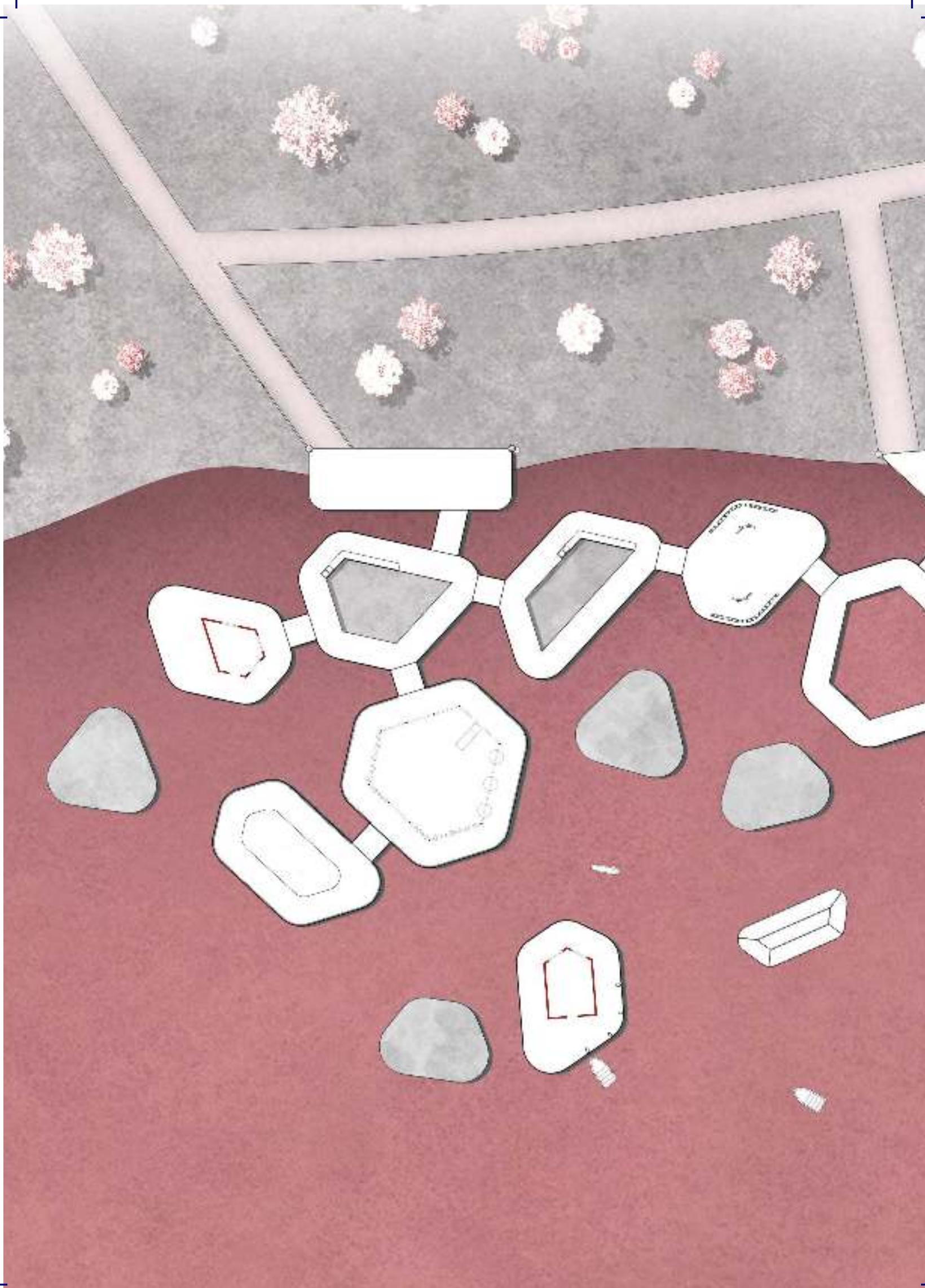
### 7.1\_SPATIAL DESIGN\_MASTERPLAN

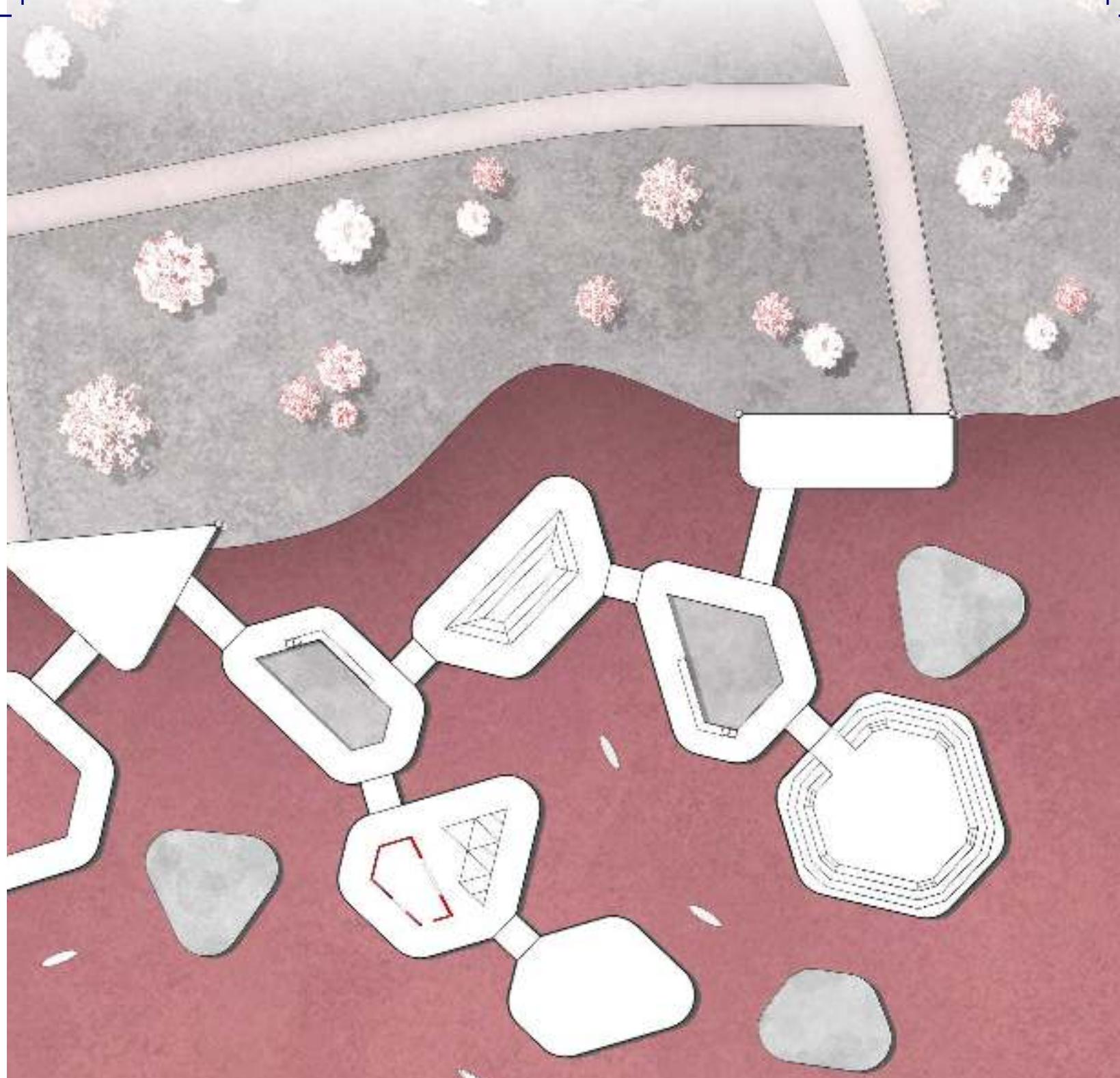


The “**PHORMA3**” system creates a layering of shapes and functions, which does not lose its integrity and focus from the surface to the lake bed. The simplicity of its construction and its versatility allow an expansion and a continuous development of the project.

PHORMA FRONT ELEVATION 1:100











DEPURATION SYSTEM MASTERPLAN 1:500

# THE FLOATING ISLAND

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3D VIEWS





#### THE FLOATING ISLAND, BRUGES, OBBA, 2018

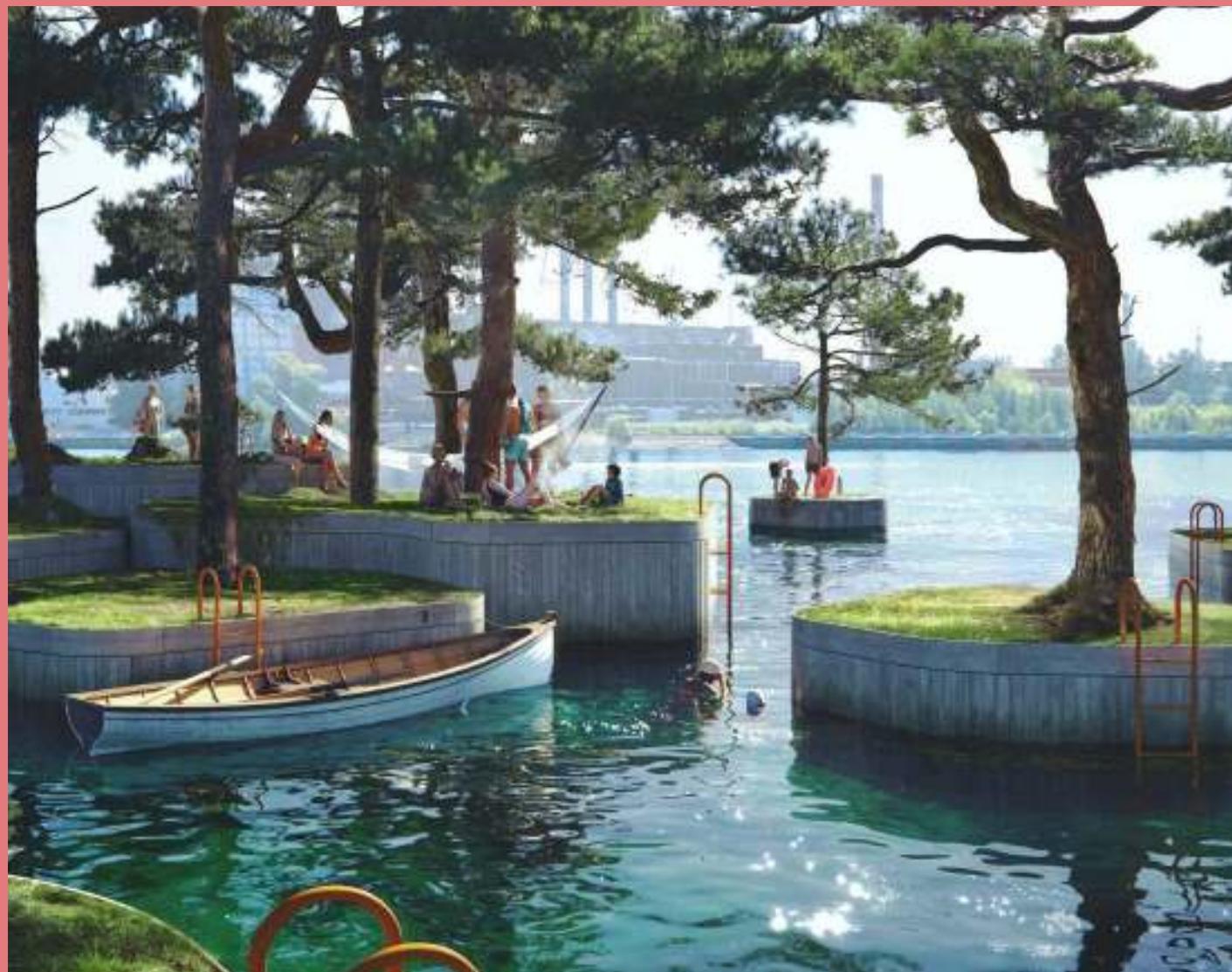
The Floating Island is a unique experience on the canals near the Snaggaardbrug. With this structure, the Korean architectural firm OBBA wished to create additional public space within the Bruges city centre. Together with the Bruges architectural workshop Dertien12, OBBA has designed a floating platform that covers more than 100 square metres. The installation is surrounded by green islands and is open to the public. You can stroll along the bank or take a little break to enjoy the surroundings; elastic nets that simultaneously serve as supports and can be used as hammocks or couches that lean right over the water.

# COPENHAGEN ISLANDS

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3D VIEWS





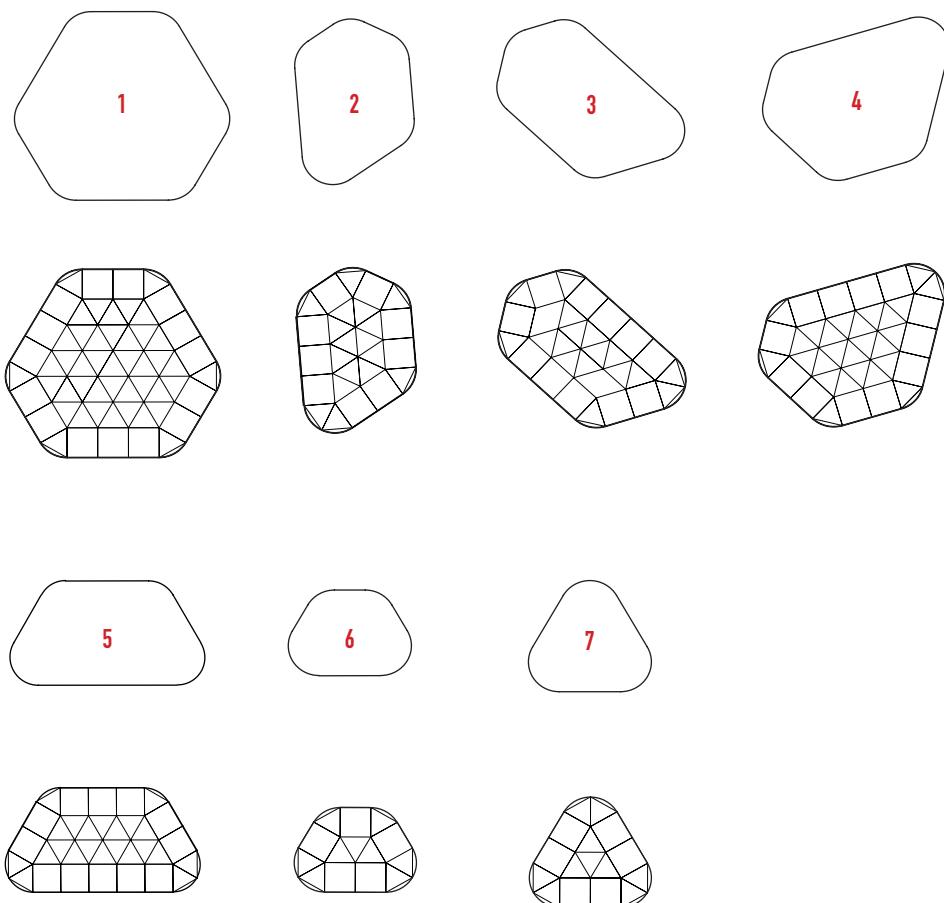
#### COPENHAGEN ISLANDS, DENMARK, 2020, BLECHER AND STUDIO FOKSTROT

A cluster of roaming artificial islands designed by Marshall Blecher and Studio Fokstrot is set to be built in Copenhagen's harbour. Australian architect Blecher and Danish firm Studio Fokstrot created the Copenhagen Islands project to bring "wildness and whimsy" to the capital. Anchored to the harbour floor, the islands will be made of steel and recycled floatation elements clad in sustainable Forest Stewardship Council-approved timber.

# PROJECT ZOOM-IN

## 7.2\_SYSTEM DESIGN

In the case of Lake Varese the PHORMA3 system is composed by 7 main modules: 2 are dedicated exclusively to phytodepuration and all the remaining are dedicated to multiple activities. It is important to remind that the platforms are formed by triangular and square modules and for that reason can be created infinite compositions.

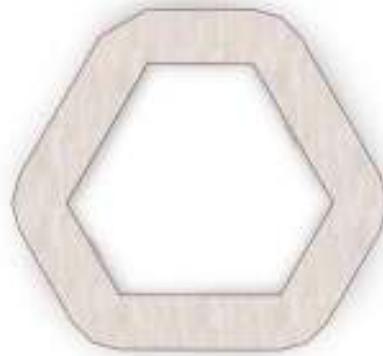
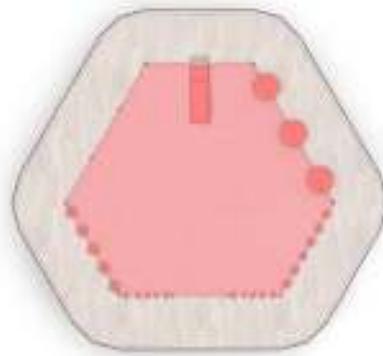
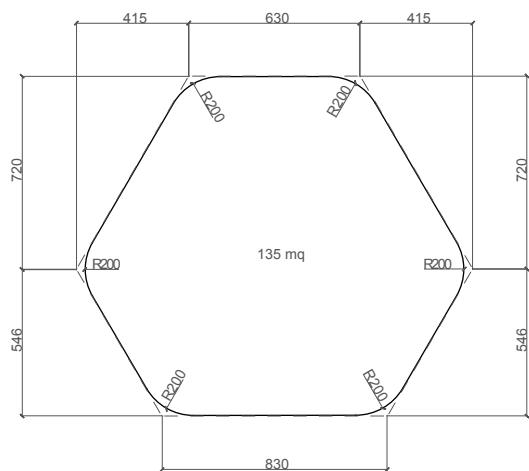


3D RENDERINGS OVERVIEWS



The first platform module is the biggest in size (135 mq) and in the projects It has three declinations: An auditorium, a kids playground and a swimming pool. The auditorium is composed by four levels, each one with a height of 40 cm. The kids park is characterised by a red Styrene Butadiene Rubber central flooring, to more safe for children, and a hexagonal wood playground that follows the perimeter of the floor. Finally there is the swimming pool, which is composed by steel ladders and a central swim area.

PLATFORM 1 CONFIGURATIONS 1:50



3D RENDERINGS OVERVIEWS

KIDS PLAYGROUND



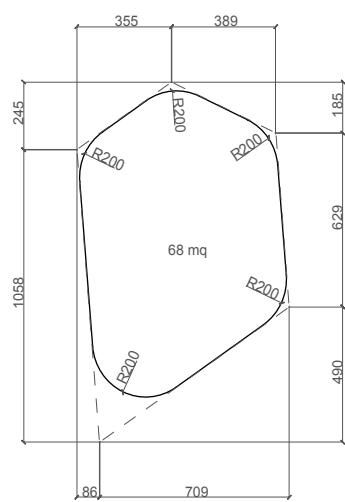
AUDITORIUM



SWIMMING POOL



PLATFORM 2 CONFIGURATIONS 1:50



3D RENDERINGS OVERVIEWS

SUP/KAYAK RENTING



BOATS DOCKING

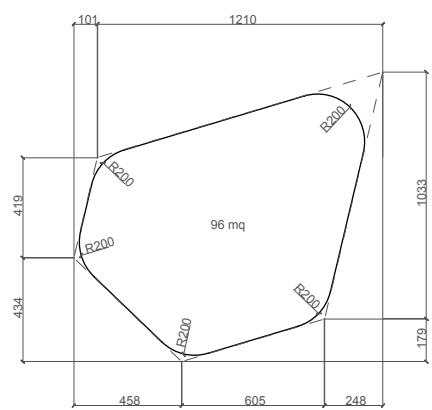
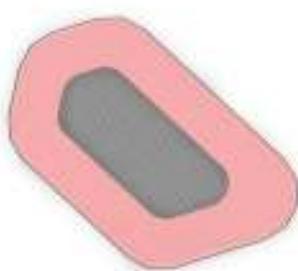
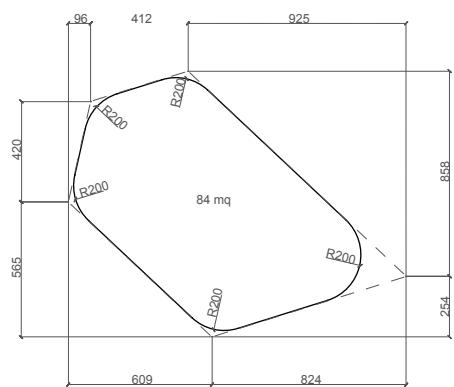


HYDRAULOPHONE



The third and the fourth modules present two different configurations: walkable phytodepuration one, a trampoline and a kiosk. The trampoline is part of the kids playground and It is characterised by Styrene Butadiene Rubber flooring and a jumping mat. The kiosk has a solar paneling system and a triangular seating area with vases for plants.

PLATFORM 3-4 CONFIGURATIONS 1:50



3D RENDERINGS OVERVIEWS

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KIOSK

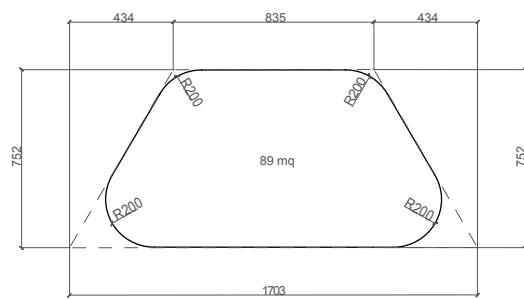


TRAMPOLINE



The fifth module presents two configurations: a walkable phydepuration one a relax area. The Relax construction is composed by a Styrene Butadiene Rubber flooring perimeter flooring and sitting system that consists in inclined wood surfaces that function as backrests.

PLATFORM 5 CONFIGURATIONS 1:50



3D RENDERINGS OVERVIEWS

RELAX PYRAMINF

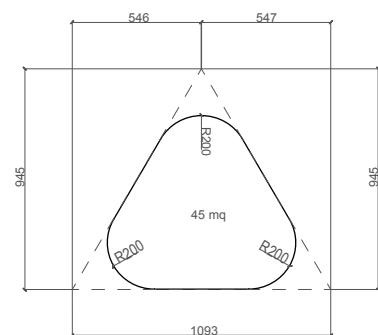
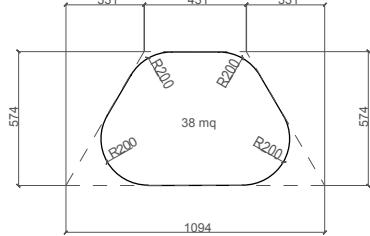


PHYTODEPURATION WALKABLE PLATFORM



The sixth and the seventh modules are dedicated to phytodepuration. They consist in a floating perimeter made with recycled red plastic and a plants growing matrix. This last one is composed by triangular modules that are compacted with a net and attached to the float to maintain a good water balance. The roots of the plants grow underwater in order to permit the cleaning water process.

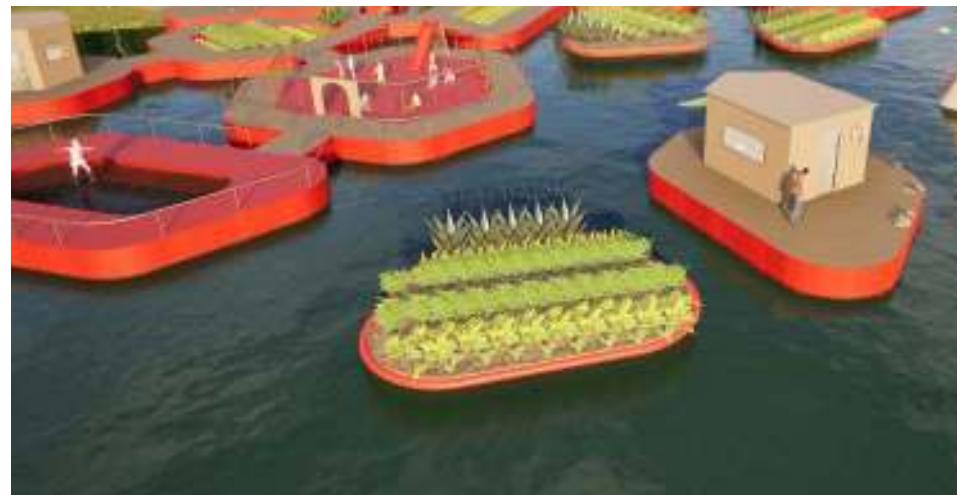
PLATFORM 6-7 CONFIGURATIONS 1:50



3D RENDERINGS OVERVIEWS

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PHYTODEPURATION PLATFORMS



# FLOATING GARDENS

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3D VIEWS





#### FLOATING GARDENS, GERMANY , DREISEILT CONSULTING, 2020

The Floating Gardens have been thoughtfully laid out in a fan-shaped pattern on the lake. This arrangement allows individuals to establish a more profound connection with the water, complete with the rhythmic motion of the undulating waves. Cozy seating resembling beanbags beckons visitors to relax, encouraging them to contemplate the serene views, gaze upward at the lake and the sky, and perhaps even indulge in some daydreaming. These garden islands, integrated into the Floating Gardens, have been carefully curated and designed by four local VGL companies: Heasum, van Elzen, Gropper, and Grimm.

# ICEBERG

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3D VIEWS





#### ICEBERG, UNITED STATES , BULOT+COLLINS, 2019

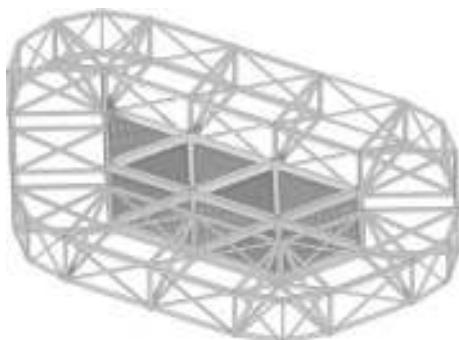
The Iceberg is a slanted wood structure buoyed by a series of empty barrels. The frame is covered with plywood panels (all the wood was sourced locally) on which are placed several hundred tiles of thermochromic plastic. These tiles were manufactured on-site by the campers according to an innovative process that was exclusively developed by the design team for this project. The plastic is recycled HDPE that was melted and molded in triangular shapes, and covered with a mix of resin and thermochromic pigment. The combination of angular volumes creates an exciting playing space of 63m<sup>2</sup>.

# 8

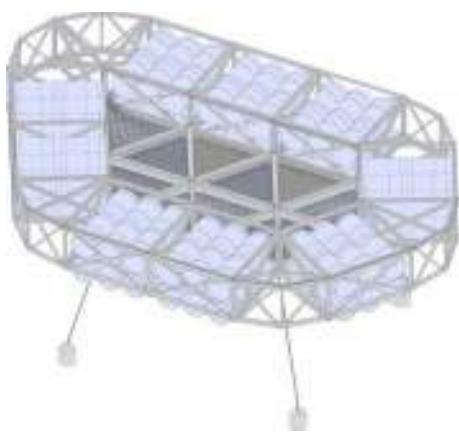
## SYSTEMIC DEVELOPMENT

### 8.1\_SYSTEMIC ASPECTS

As a base elements the platform structures are created with a metal grid, which It is composed by steel elements. There are cylindric floats placed under the square modules in order to maintain the system stable on water and to properly balance the weight. There is also the possibility to replace the central part of the platform with phytodepurative triangular elements that are created with a metal grid.

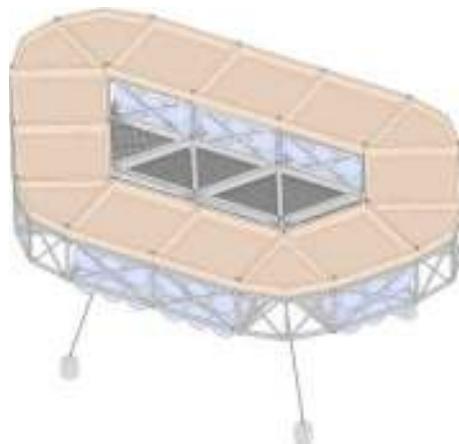


STEEL GRID MODULES

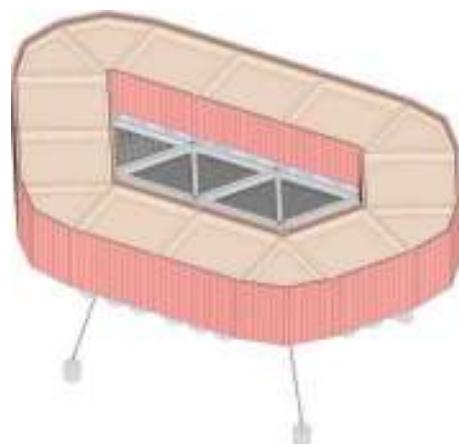


FLOATS PLACEMENT

CONSTRUCTION PROCESS



RECYCLED PLASTIC GRID TOPPER



PERIMETER SLATS PLACEMENT



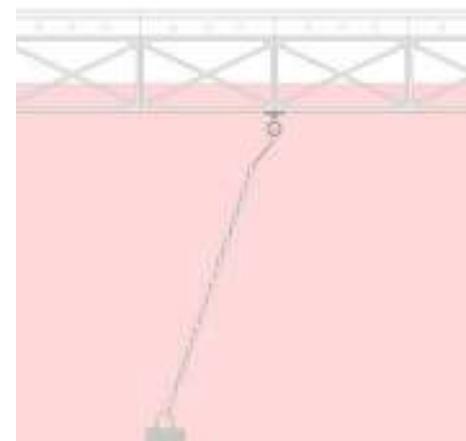
FLOORING STRUCTURE

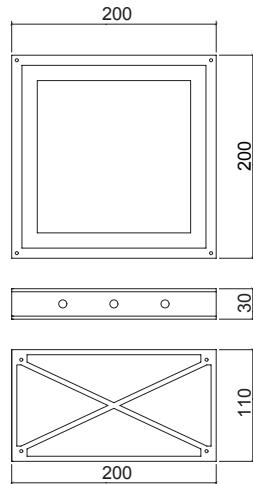
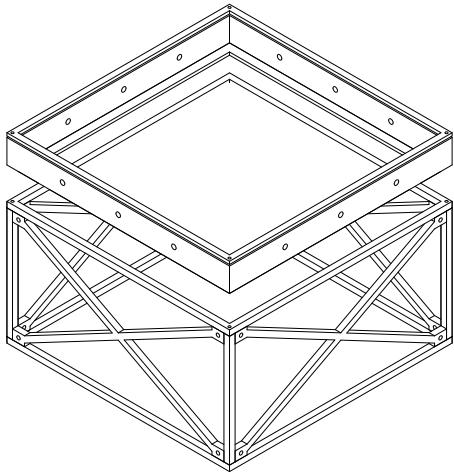


FLOORING PLACEMENT

On top of the metal modules there are placed recycled plastic elements. They are needed to support the flooring system and the perimeter slats covering. As the next step there is the positioning of wooden beams and the flooring of the platform surface. The structure are kept on position thanks to a dead weight underwater system. Under the water level It is also attached the 3d farming net, in which can be grown aquatic algae.

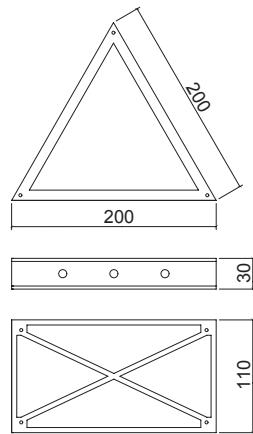
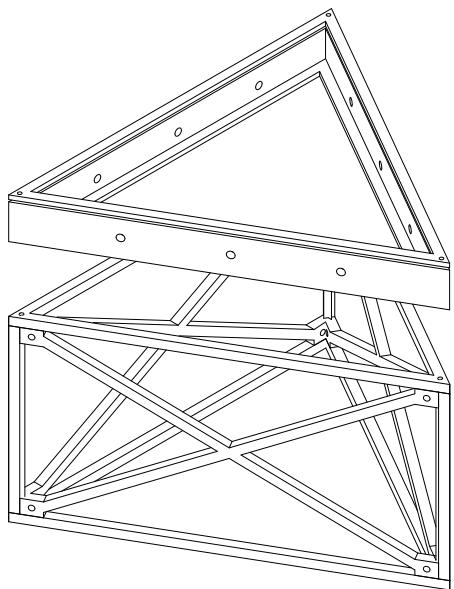
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DEAD WEIGHT ANCHORING



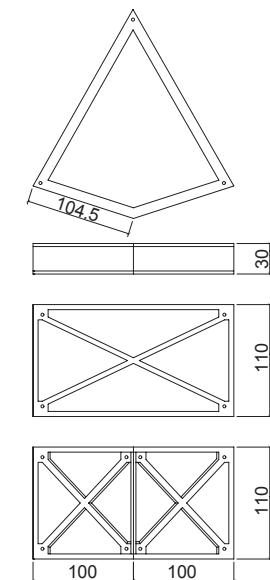
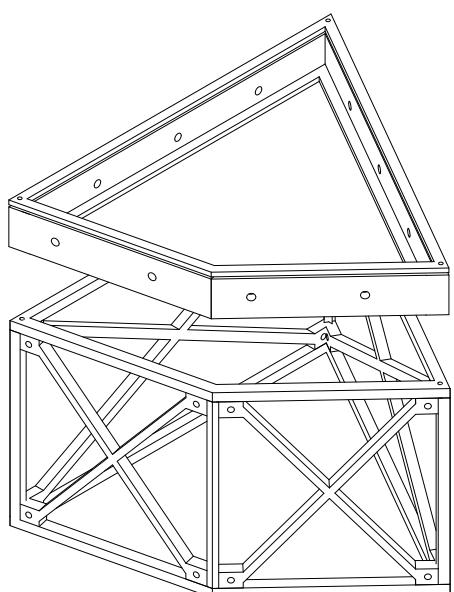
#### SQUARE MODULE AXONOMETRY

First structure composition element



#### TRIANGLE MODULE AXONOMETRY

Second structure composition element



#### "CURVED" MODULE AXONOMETRY

Third structure composition element

**PHYTOFILTRATION MODULES**

Modules designed to be planted



The phytofiltration platforms and the walkable phytofiltration platforms use the same type of plants growing element. Is composed by a loam matrix, that is compacted with a net. Each module can be attached the other thanks to metal joins. The first time of platform mentiones is also equiped with a floating perimeter that permits the correct placing of the structure.



The 3d farming net It is composed by four layers and it is projected to allow the natural grow and cultivation of aquatic algae. This element it is made of steel and It is kept in position with a dead weight.

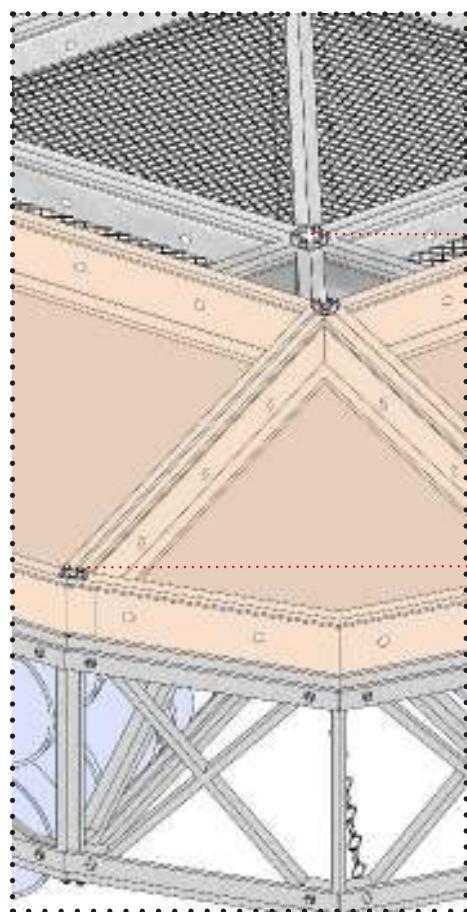
**3D FARMING NET**

Underwater plants growing

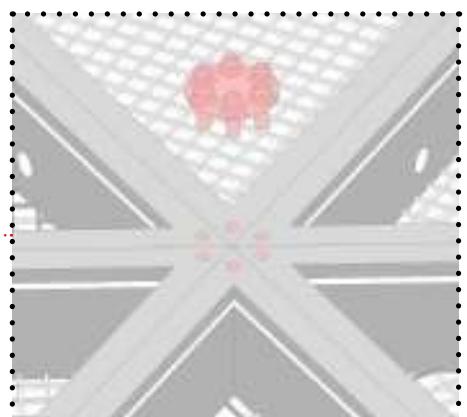
# SYSTEMIC DEVELOPMENT

## 8.2 DESIGN DETAILS

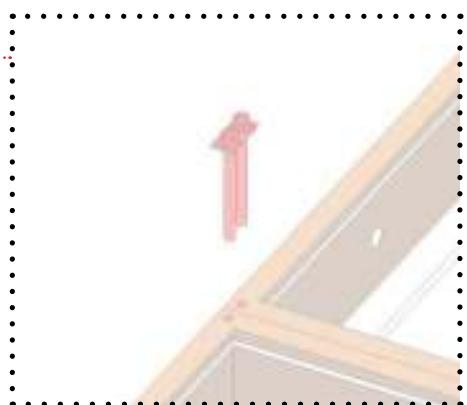
For what concerns the construction details It must be said that main focus of the structure is the intersection between modules. In fact, in that position takes place every upper platform building or area. The joins are made of steel and can be adabted to any kind of module.



MODULES JOIN

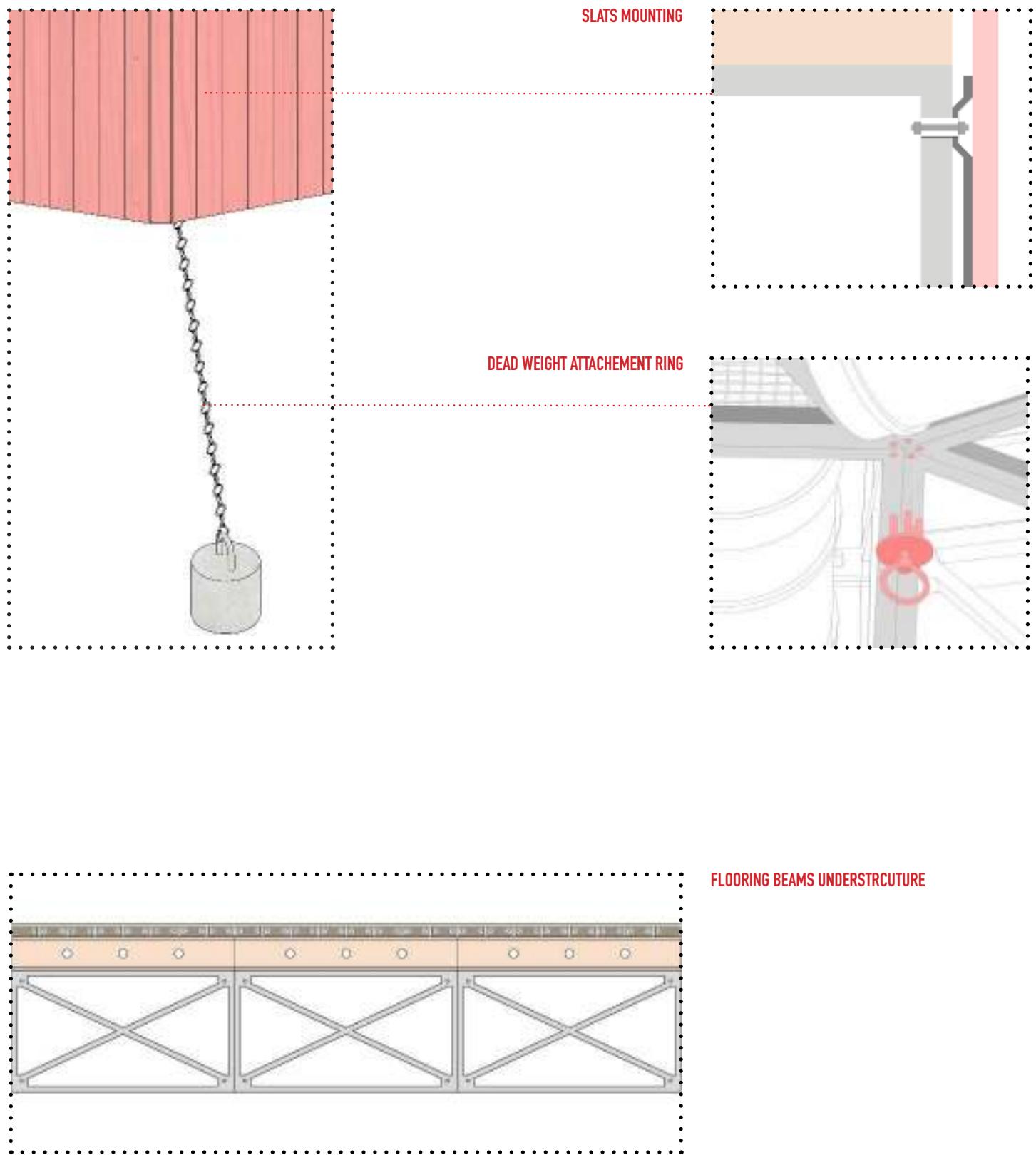


RECYCLED PLASTIC GRID TOPPER ATTACHEMENT

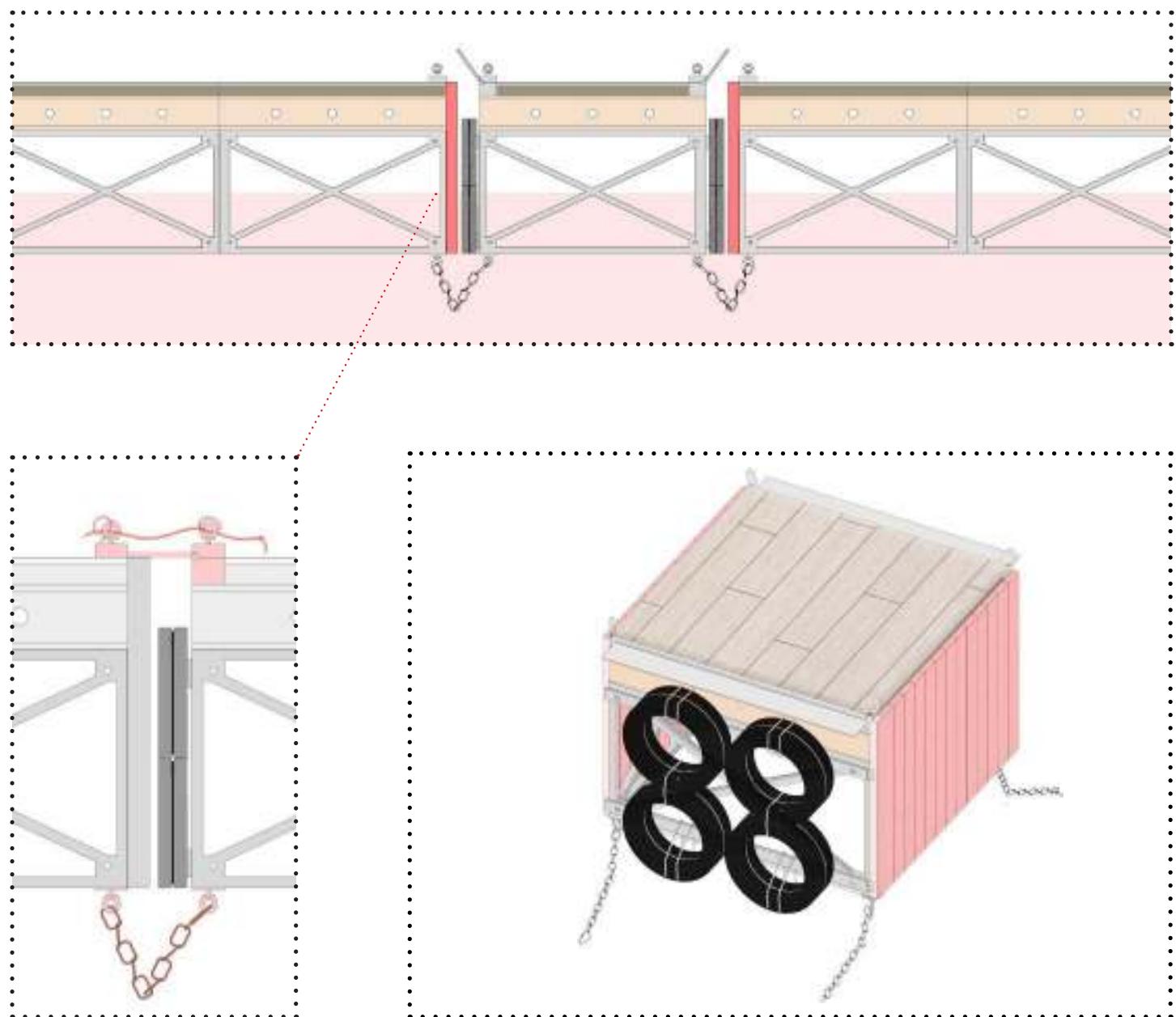


## CONSTRUCTION JOINS 1:10

Detailed assembling of the platforms



The floating bridges design permits to control the oscillations and collisions with the other platforms. They are connected with the main structures with chain joints and equipped with recycled tyres. The gap that are formed in the connection process are filled with metal plates.

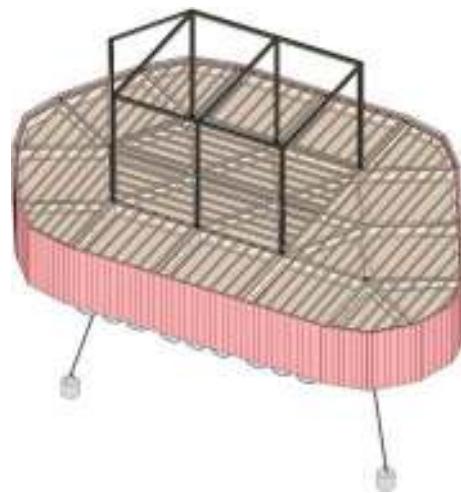
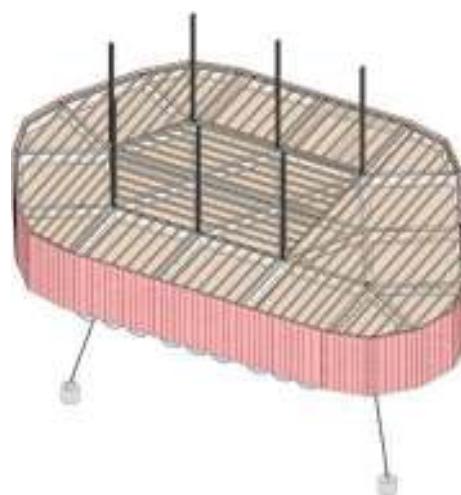
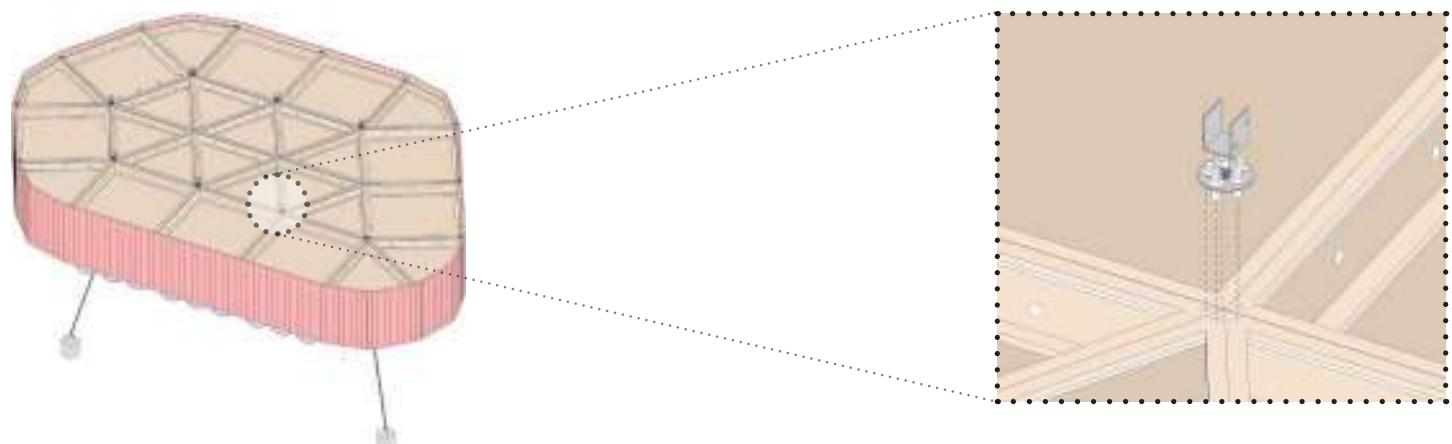


#### BRIDGES CONNECTION CONSTRUCTION

Relationship between the platforms and  
the bridges

**UPPER BUILDING AN AREAS CONSTRUCTION SYSTEM**

Construction elements for surface buildings and structures



This versatile method of construction can be used for multiple buildings and designs. The intersections between the modules can be used, once again, as a starting point of development.

# 9

## BIBLIOGRAPHY

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### LAKE VARESE AND PHYTODEPURATION

- <http://www.biomatixwater.com/floating-ecosystems/>
- <https://bustler.net/news/3439/seawater-greenhouse-agriculture-with-ocean-distiller-farm>
- <https://climate-adapt.eea.europa.eu/en/metadata/case-studies/the-integrated-system-of-nature-based-solutions-to-mitigate-floods-and-drought-risks-in-the-serchio-river-basin-italy>
- <https://criticalconcrete.com/phytodepuration-with-degre-47/>
- <https://www.downtoearth.org.in/news/agriculture/resort-to-heritage-53346>
- <https://e360.yale.edu/features/floating-wetlands-cities-pollution#:~:text=A%20city%20would%20also%20need,continue%20to%20flow%20into%20them.>
- <https://friendsofgreenlake.org/taiga-wetlands/>
- <https://gardencollage.com/change/sustainability/testing-the-waters-how-floating-gardens-could-solve-our-biggest-environmental-challenges/>
- <https://landezine-award.com/floating-gardens/>
- <https://www.ohga.it/varese-un-lago-da-salvare-per-lambiente-e-per-la-societa/>
- <https://www.pescideinostrilaghi.it/acqua-e-ambiente/sotto-l-acqua-limpida-praterie-di-piante-acquatiche>
- <https://www.regione.lombardia.it/wps/portal/istituzionale/HP/aqst-lago-di-varese/stato-del-lago>
- <https://www.savelakevarese.org/>

## CASE STUDIES

- <https://www.archdaily.com/935881/iceberg-diving-platform-bulot-plus-collins>
- <https://divisare.com/projects/394015-obba-kyungsub-shin-the-floating-island>
- <https://www.dreiseitlconsulting.com/floatinggardens>
- <https://www.ohga.it/copenhagen-un-parco-di-isole-galleggianti-per-rilanciare-un-area-dimenticata-del-porto/>
- <https://wildmile.org/>

## CONSTRUCTION PROCESS

- <https://www.archisearch.gr/student-works/reactivations-thesis-by-heidi-kaproulia/>
- <https://www.designboom.com/architecture/studiomobile-jellyfish-boat-flooding-greenhouse-11-19-2014/>
- <https://www.designboom.com/architecture/natura-futura-juan-carlos-bamba-fishermans-refuge-ecuador-10-01-2020/>
- <https://www.piemme-italia.com/2016-mantova-arcipelago-ocno-grima/mantova-arcipelago-ocno-joseph-grima.html>

# 10

EXTRA

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## 10.1\_MAQUETTES



## MAQUETTE PHOTOS

Overview and playground zoom in





MAQUETTE PHOTOS

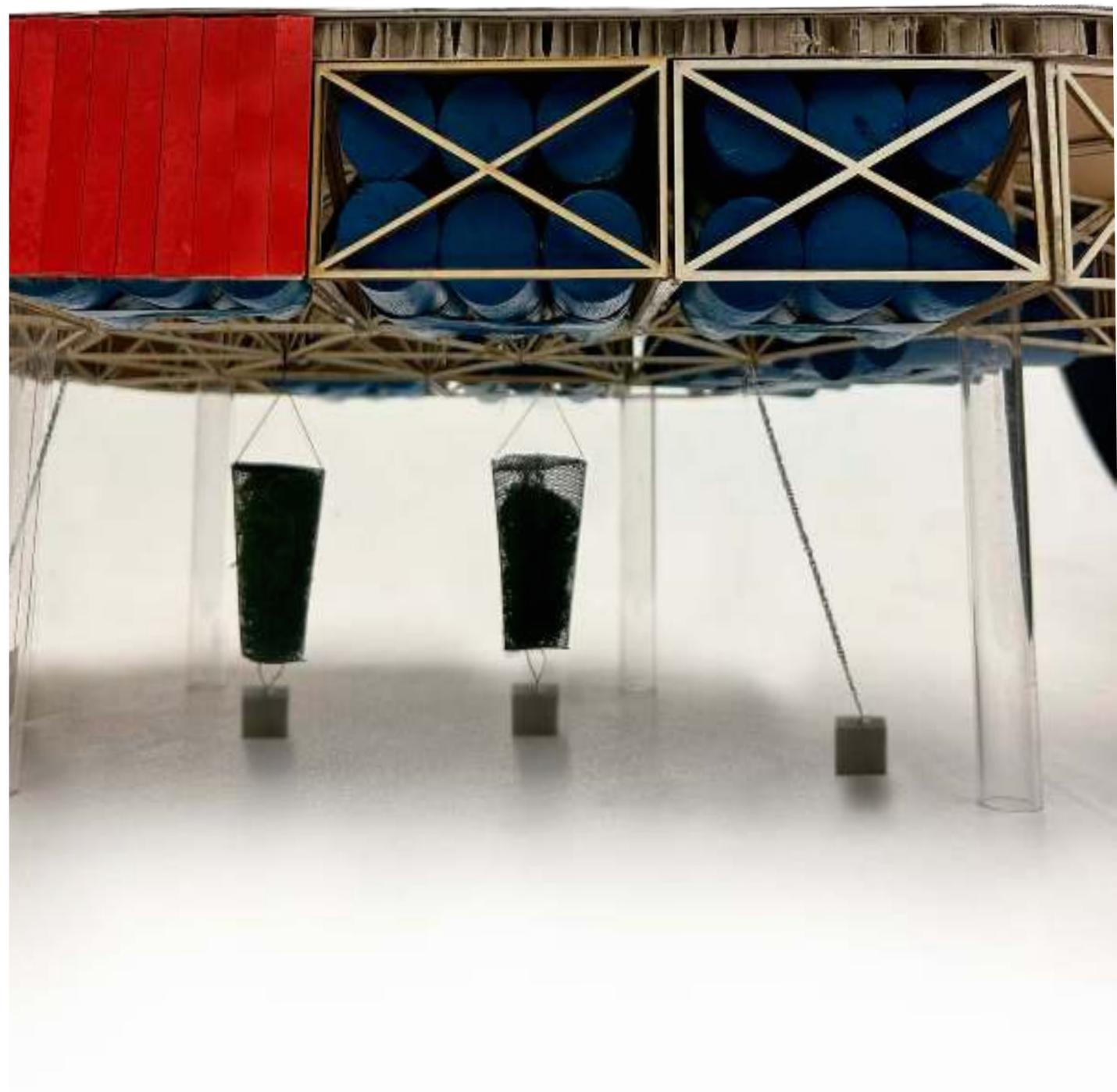
Auditorium zoom in and land connection





## MAQUETTE PHOTOS

Structure zoom in 1:20 scale



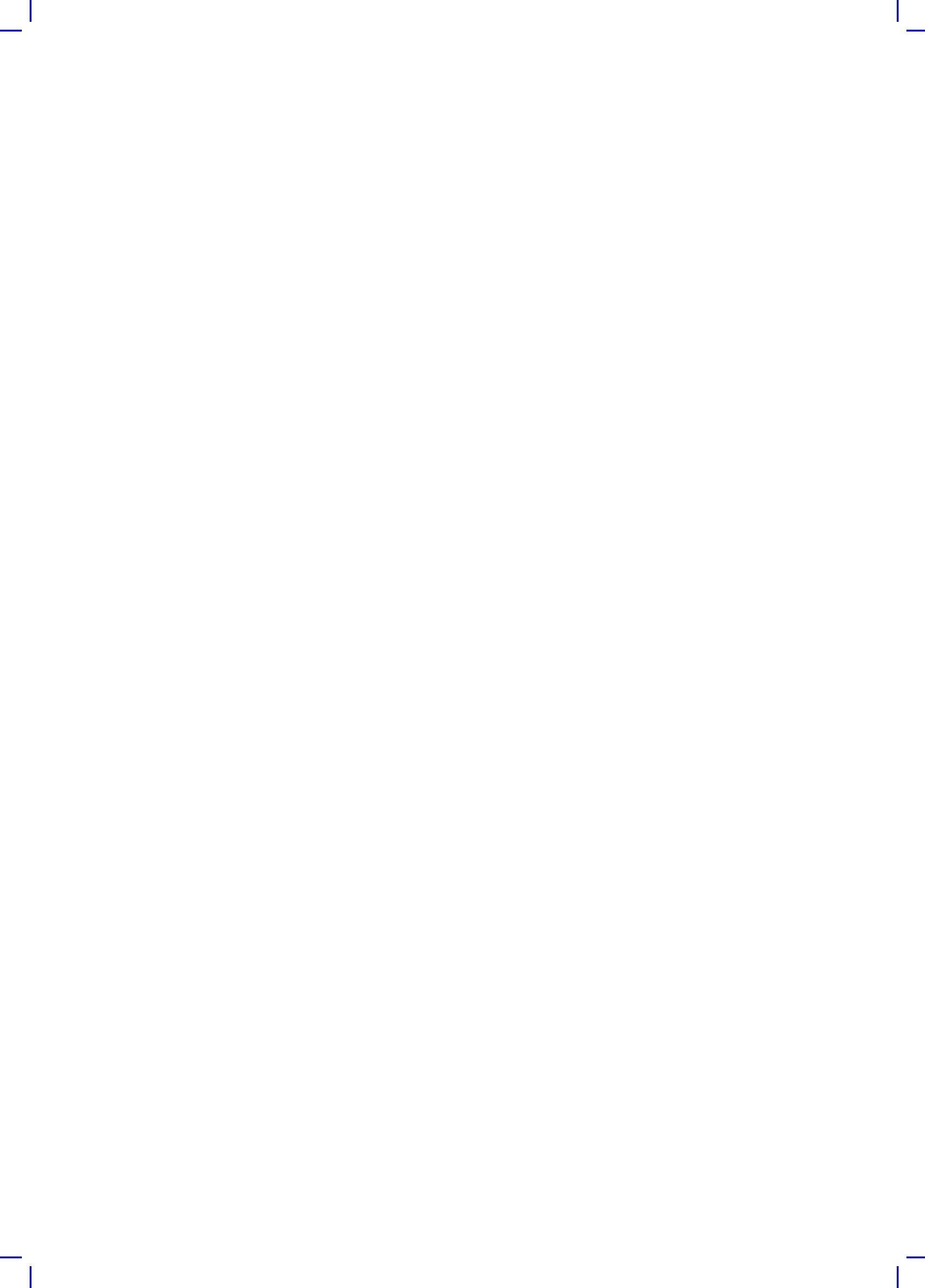
# EXTRA

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## 10.2\_VIDEO FRAMES









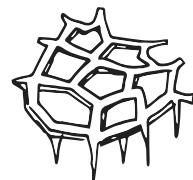


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caption related  
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scheme

**IMAGE/DIAGRAM TITLE**

if necessary, short description of the  
image, diagram, scheme, ect...

insert an image /3d visualization /render/collage/  
diagram representing the chapter contents



## ↓ WATERSCAPES EVOLUTIONS



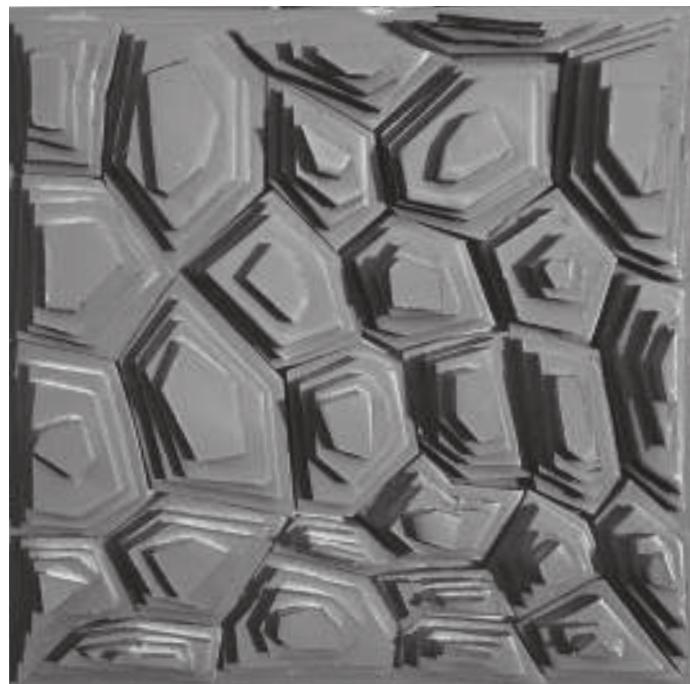
### 1.1\_CLIMATE CHANGE EFFECTS

#### MAQUETTE ELABORATION PROCESS

Permafrost ground pattern, ground layering and maquette shaping finalization.

#### MAQUETTE RENDER

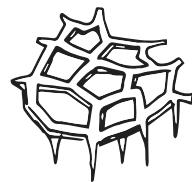
Isometric overall view.



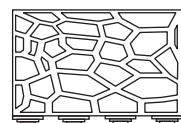
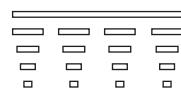
#### MAQUETTE PHOTOS

Top and back view





# SPATIAL DESIGN SYSTEM



## 2.1\_SPATIAL ARTICULATION

### MAQUETTE ELABORATION PROCESS

Permafrost ground pattern, ground layering and maquette shaping finalization.

### MAQUETTE RENDER

Isometric overall view.



### MAQUETTE PHOTOS

Top and back view





