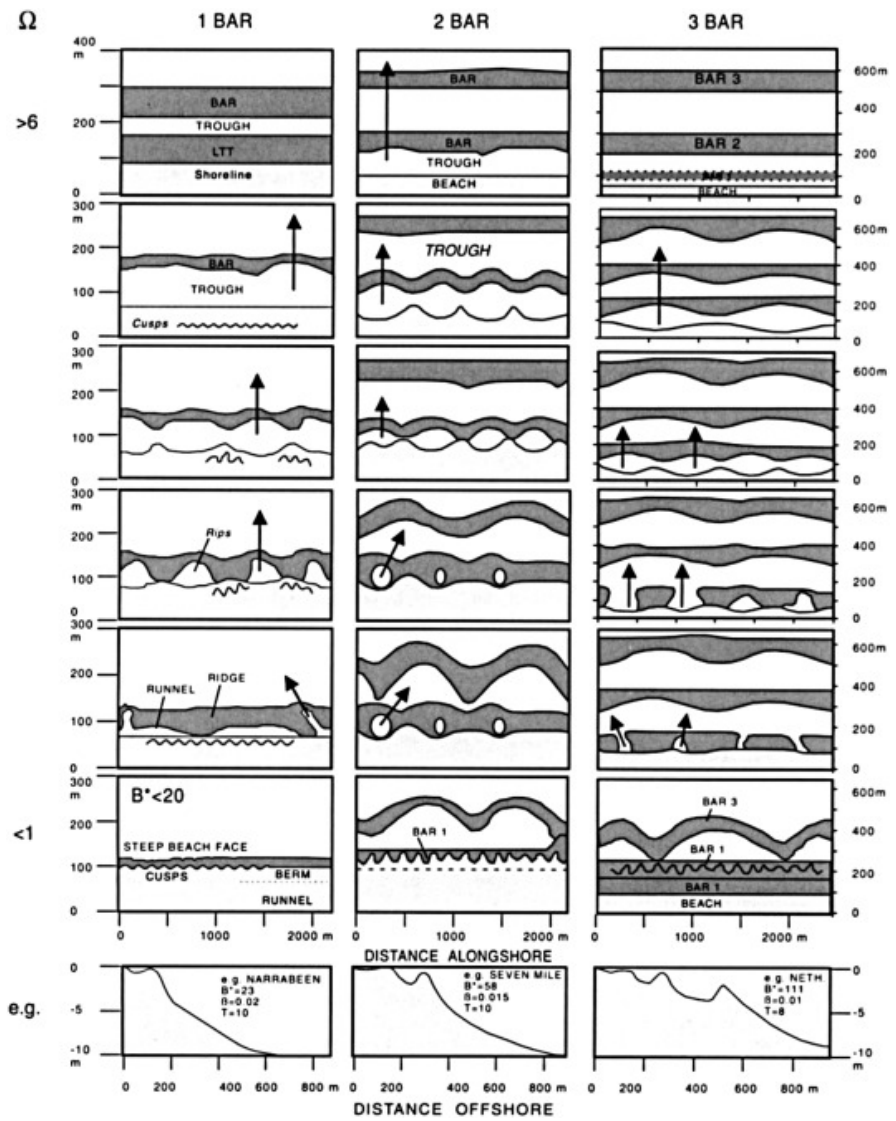
Beneath the pavement,
the beach

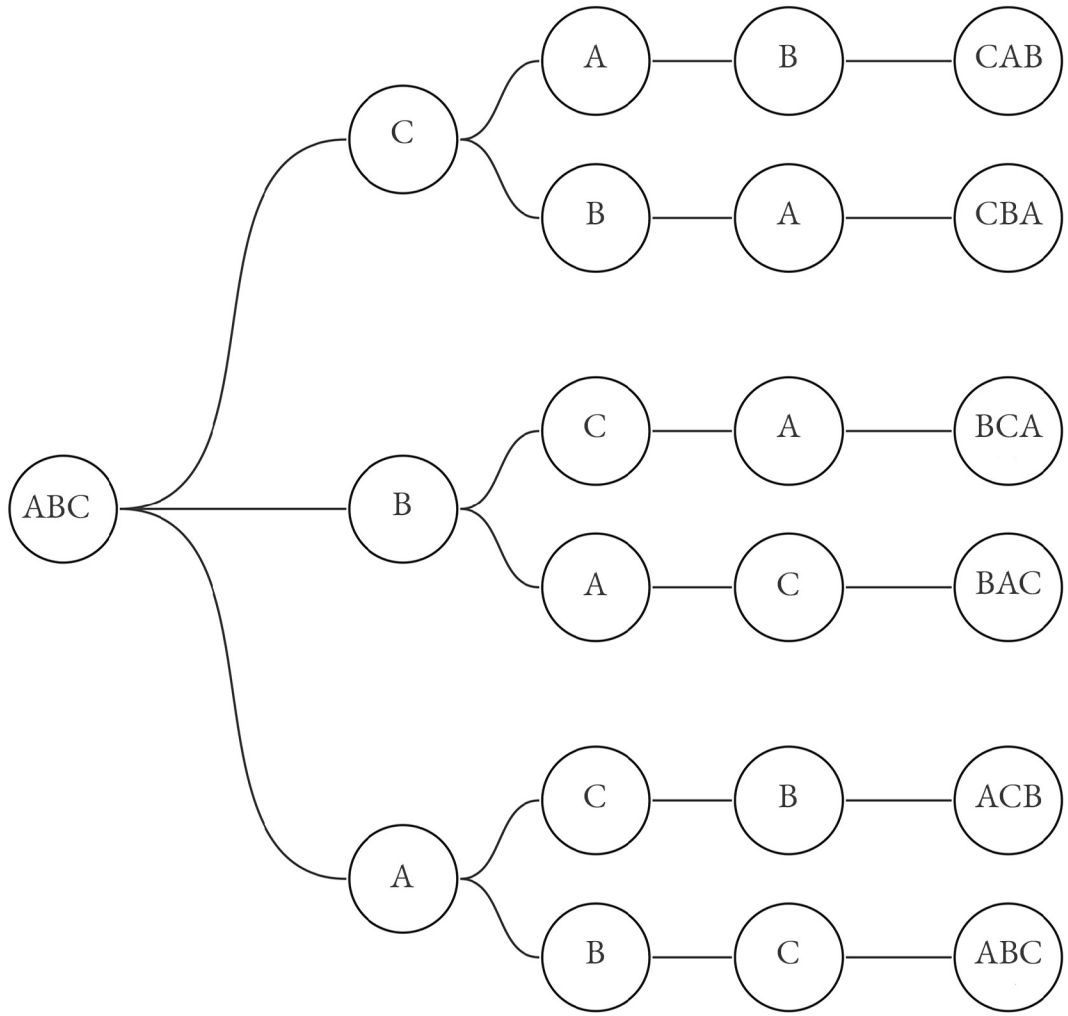
A semantic exploration of time, space, and
their volume of permutations through
Lebanon's littoral

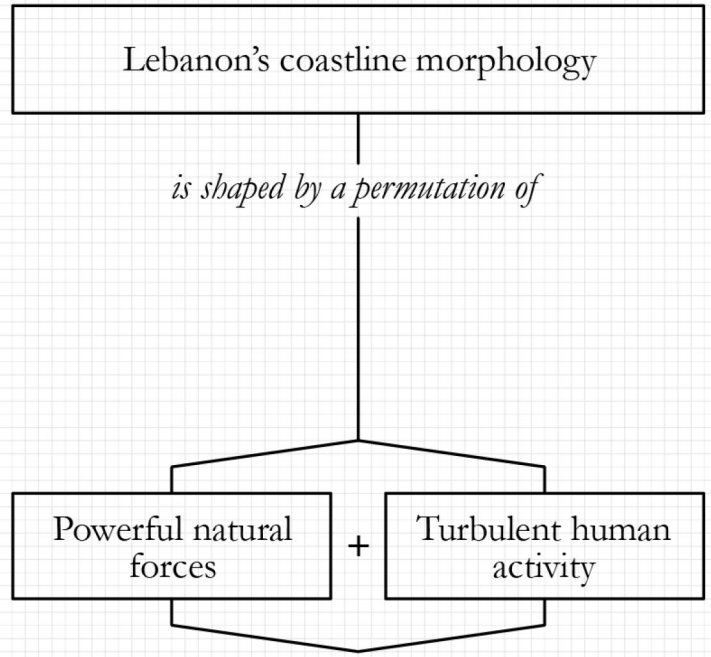
Coastal morphodynamics

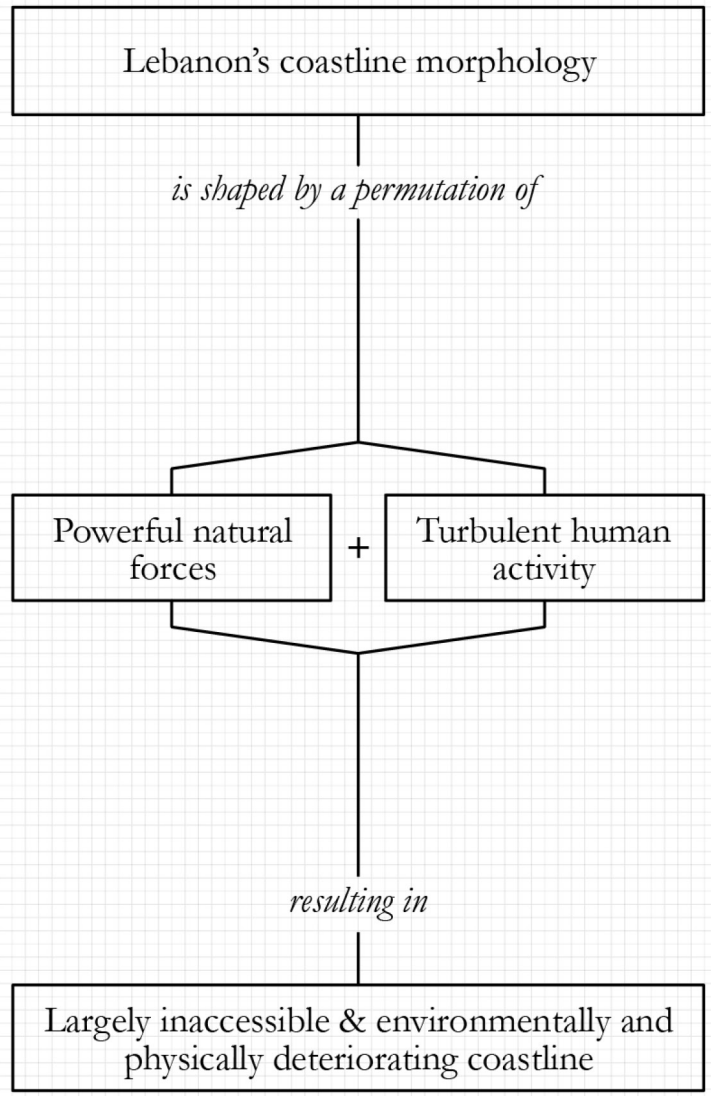


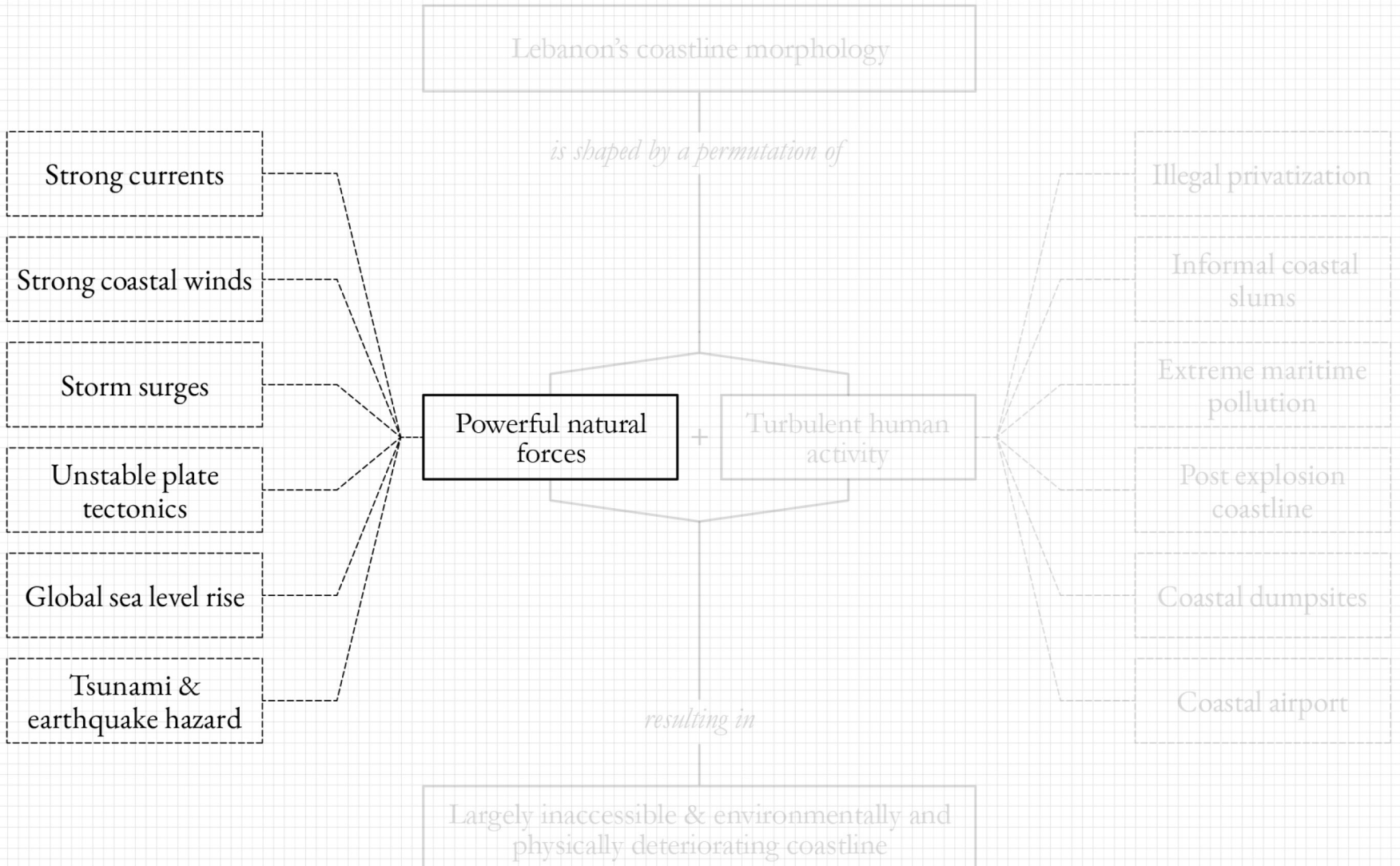
Source: Senechal & Ruiz de Alegría-Arzaburu, Seasonal imprint on beach morphodynamics, 2020

Permutations

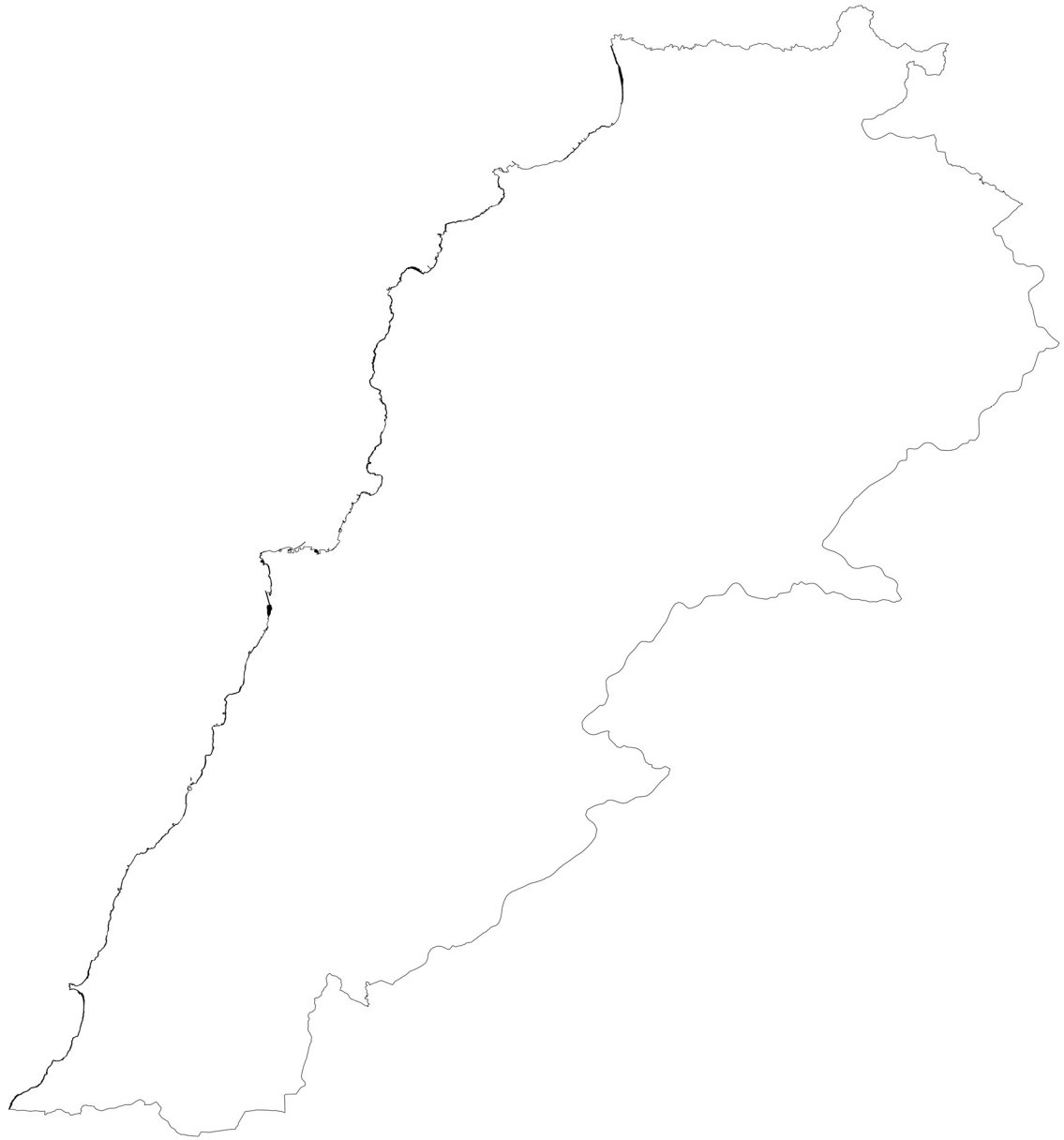



Lebanon's coastline morphology
is shaped by a permutation of
Powerful natural forces
+
Turbulent human activity

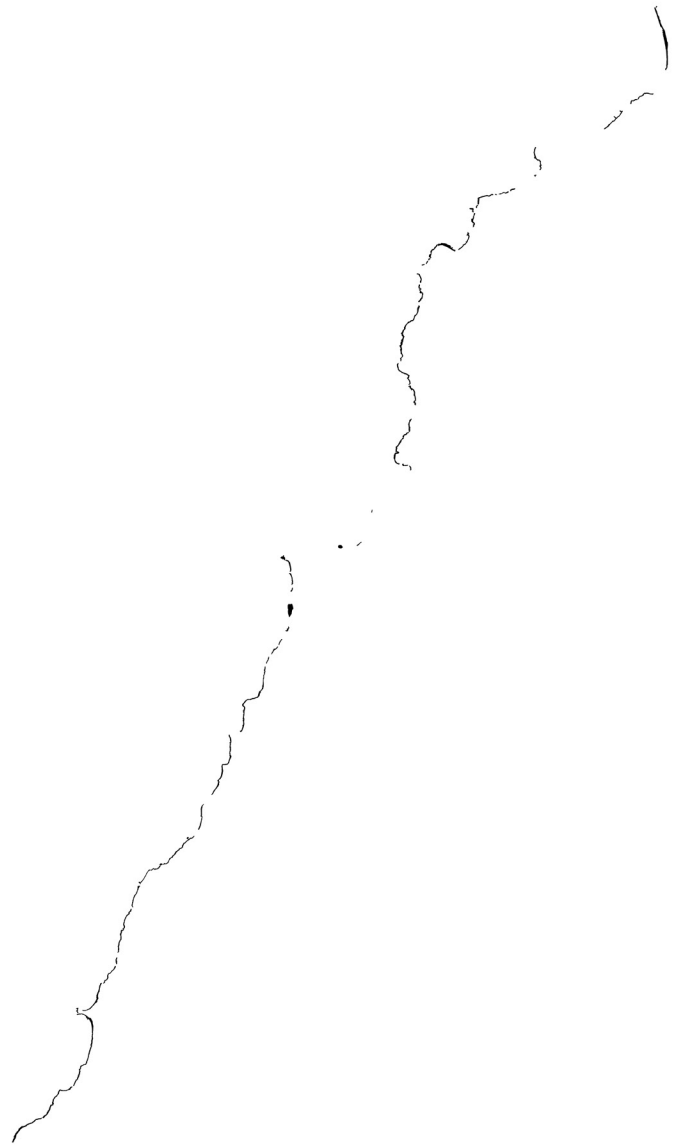

Lebanon's coastline morphology
is shaped by a permutation of
Powerful natural forces
+
Turbulent human activity
resulting in
Largely inaccessible & environmentally and physically deteriorating coastline


Lebanon's coastline morphology
is shaped by a permutation of
Strong currents
Strong coastal winds
Storm surges
Unstable plate tectonics
Global sea level rise
Tsunami & earthquake hazard
Powerful natural forces
+
Turbulent human activity
Illegal privatization
Informal coastal slums
Extreme maritime pollution
Post explosion coastline
Coastal dumpsites
Coastal airport
resulting in
Largely inaccessible & environmentally and physically deteriorating coastline

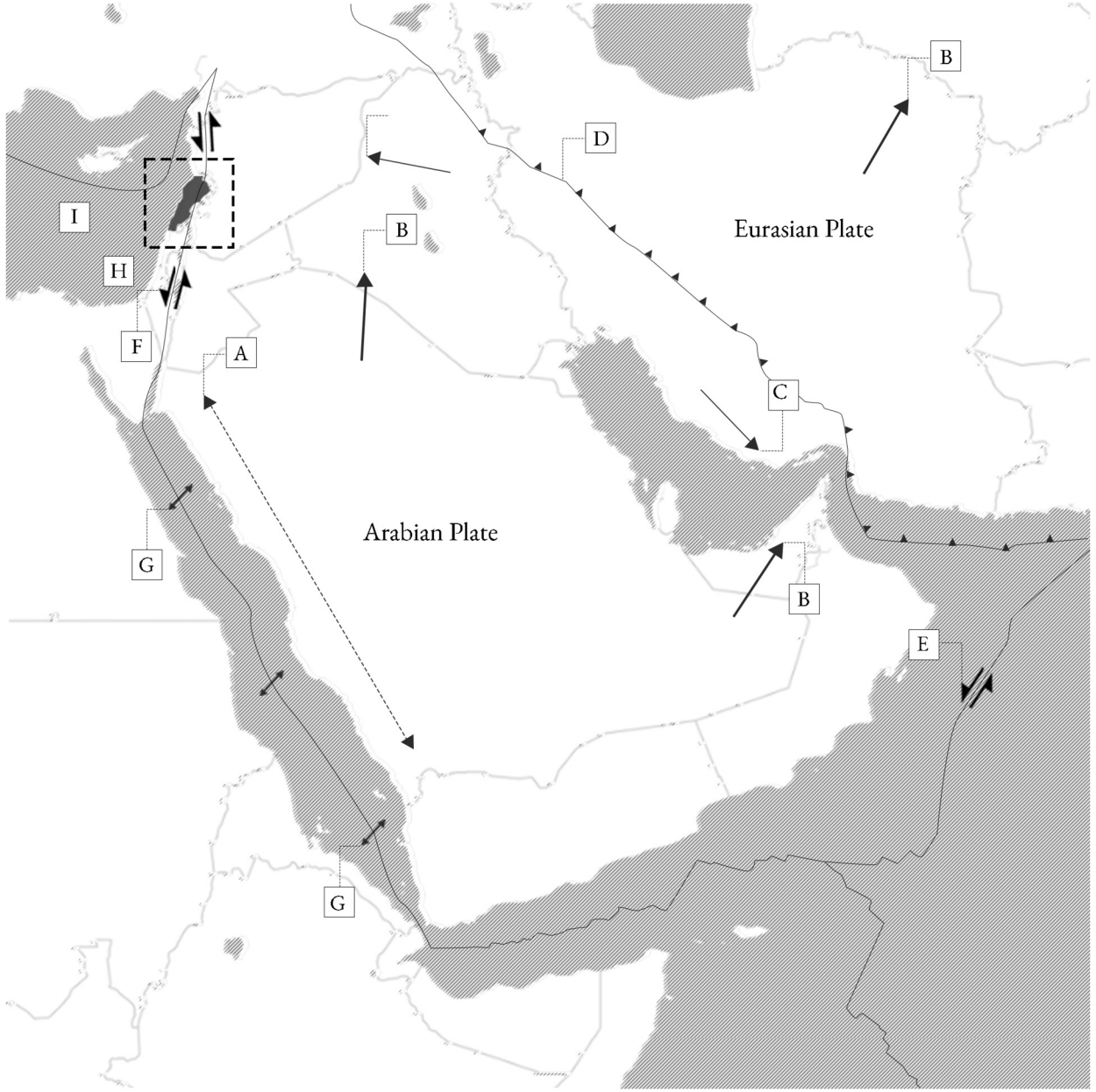
Lebanon’s coastline



Lebanon’s coastline



Unstable tectonics

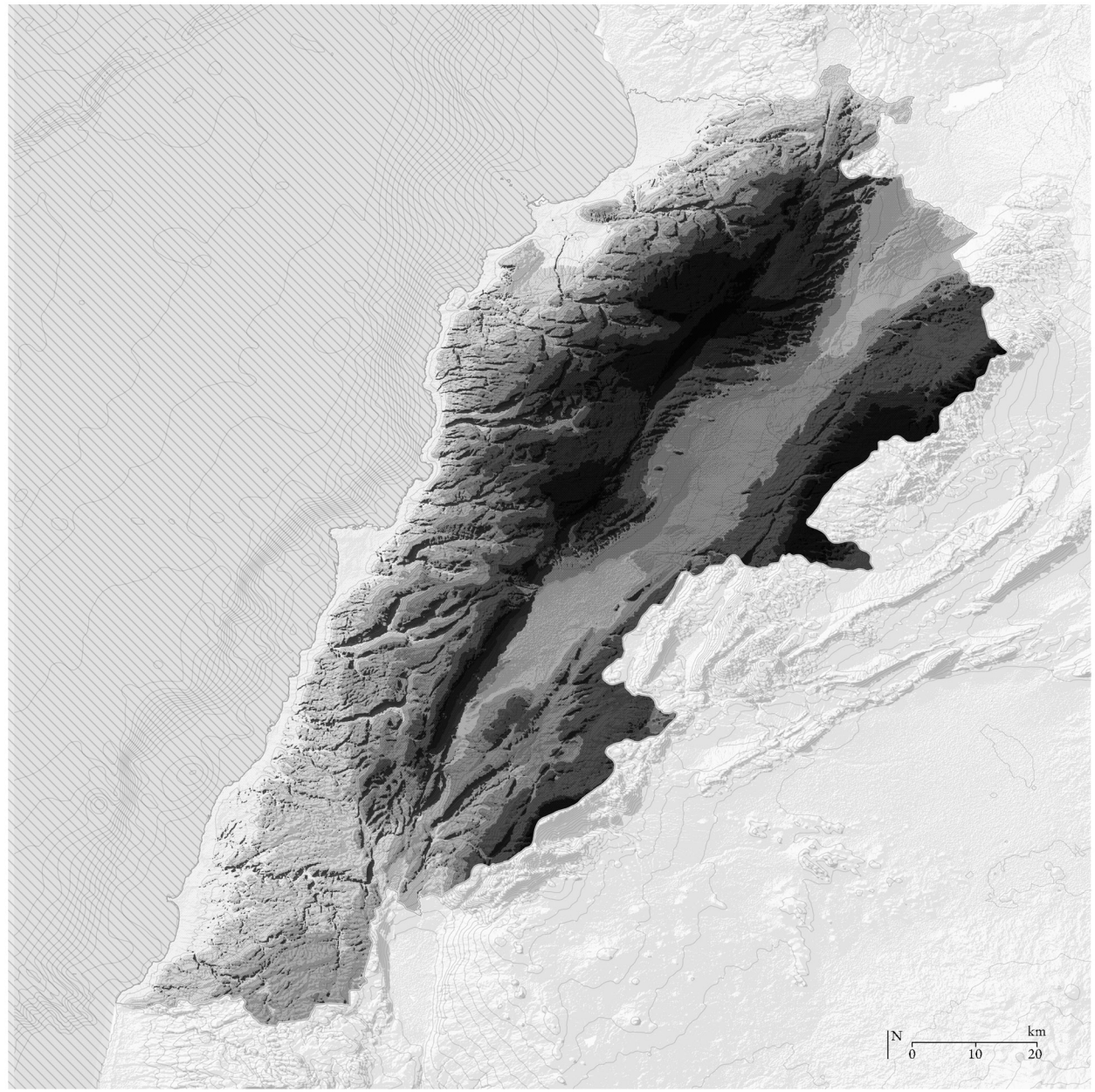


The Levant fault system

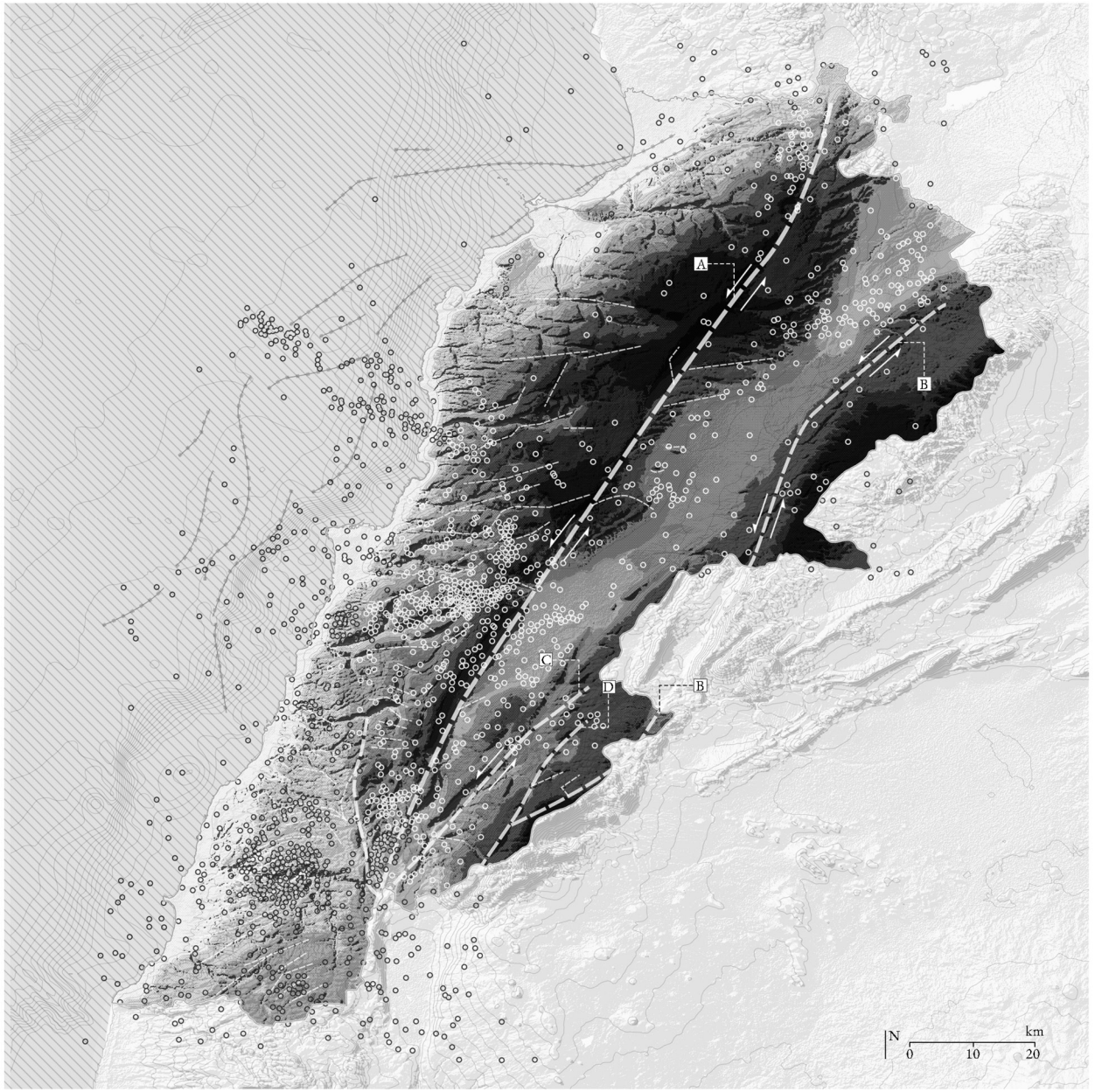
Arabian Plate Tectonics ▷

- A Spreading margin
- B Direction of movement of Arabian plate
- C Collision margin
- D Zagros thrust
- E Owen fracture zone
- F Transform margin
- G Red Sea spreading axis
- H Levant transform zone
- I Eastern edge of Mediterranean

Lebanon’s geology



Lebanon's geology



Features

- Fault (by significance)
- Thrust
- Earthquake epicenters from 2006 - 2020

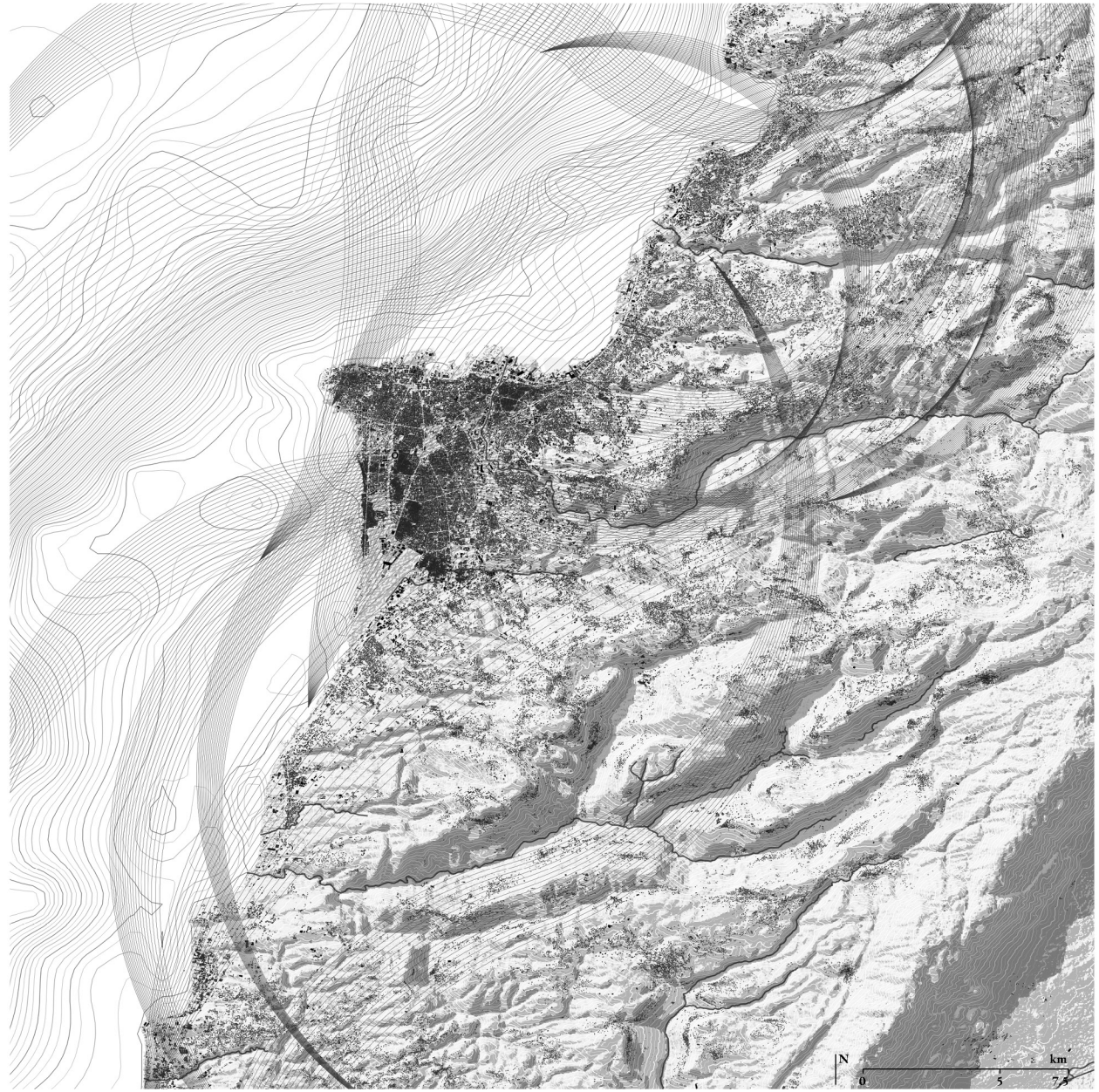
Elevation

- >1500
- 1000 - 1500
- 500 - 1000
- 100 - 500
- 50 - 100
- 0 - 50

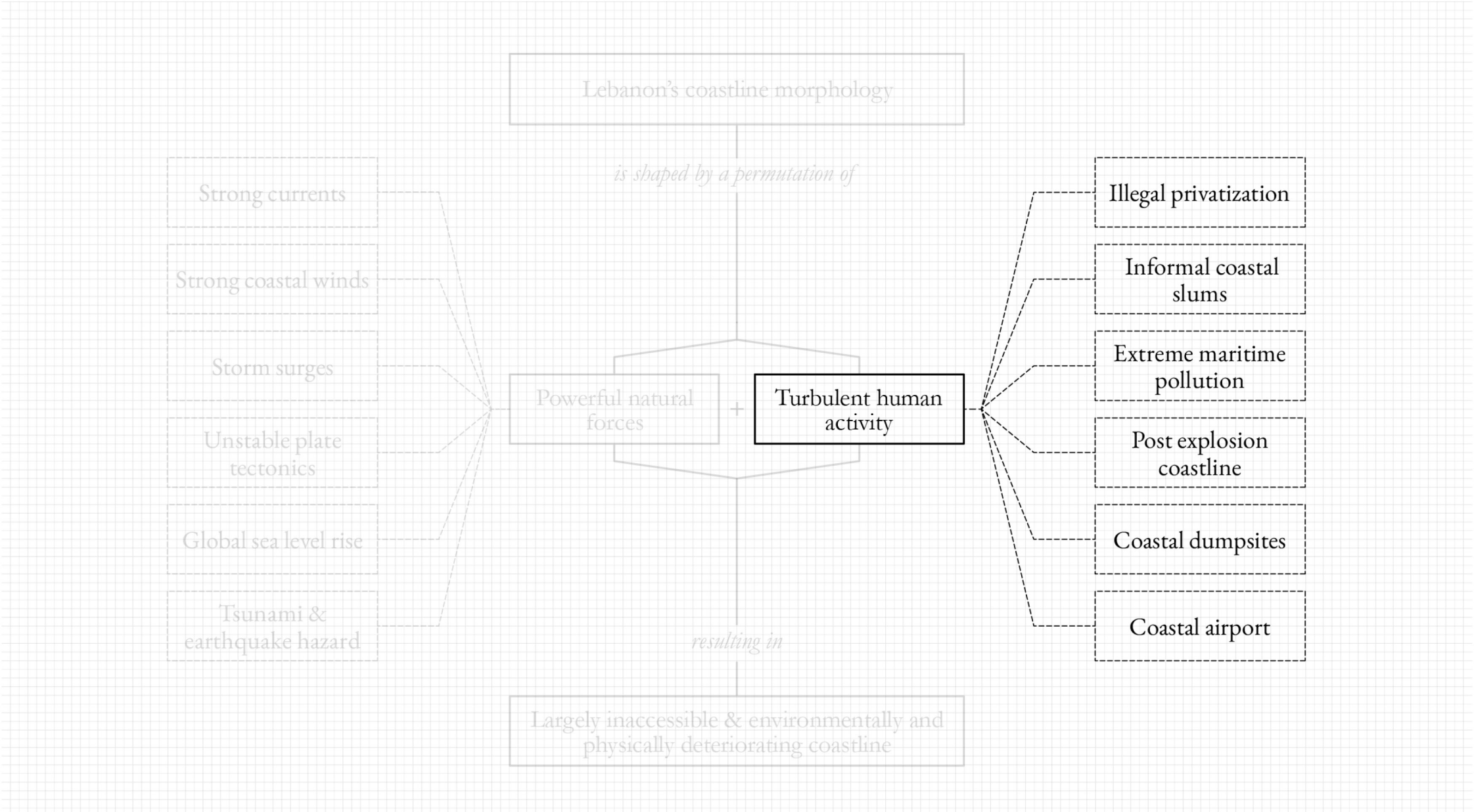
Main faults

- A Yammouneh
- B Serghaya
- C Hasbaya
- D Rachaya

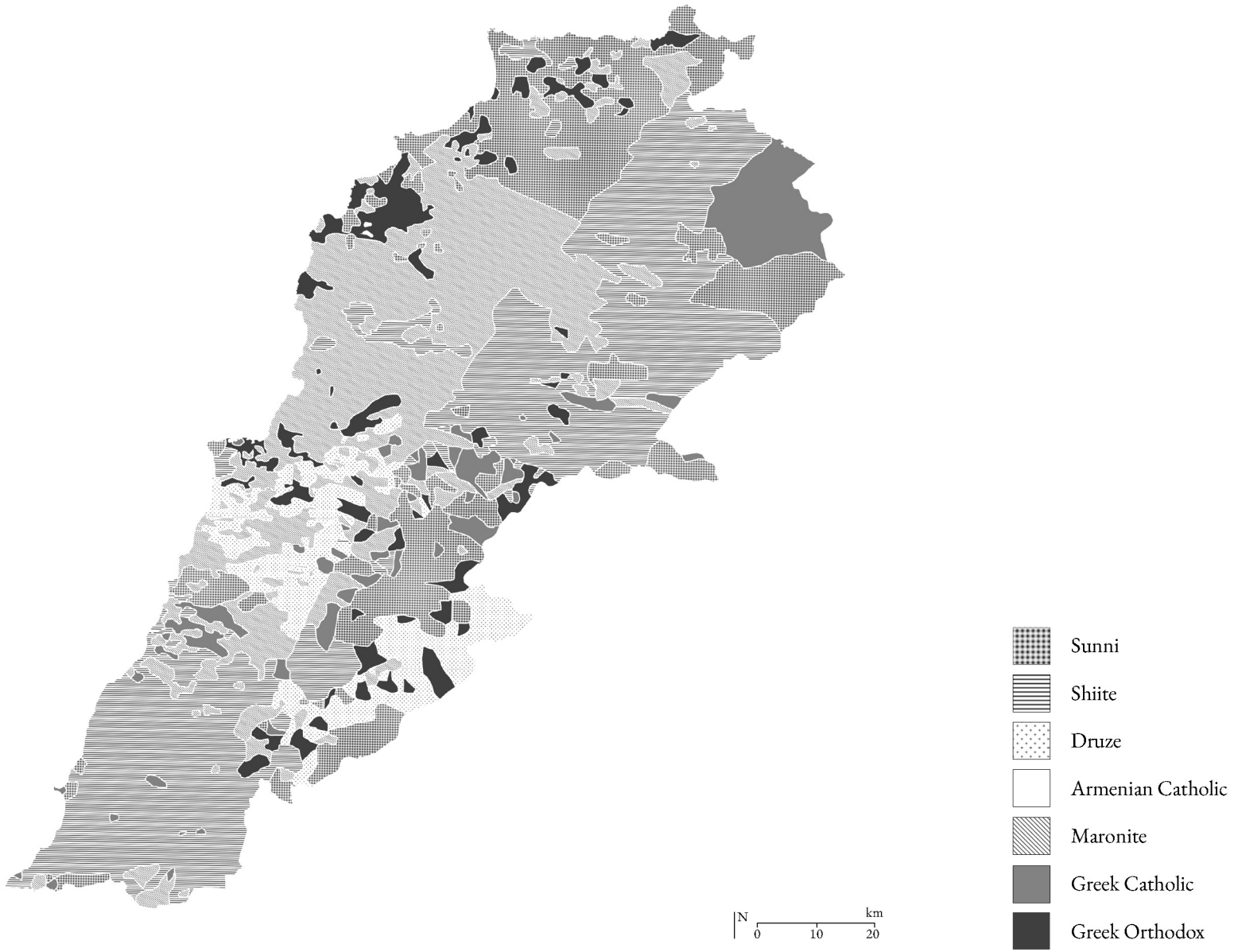
Lebanon’s geology



Anthropogenic forces

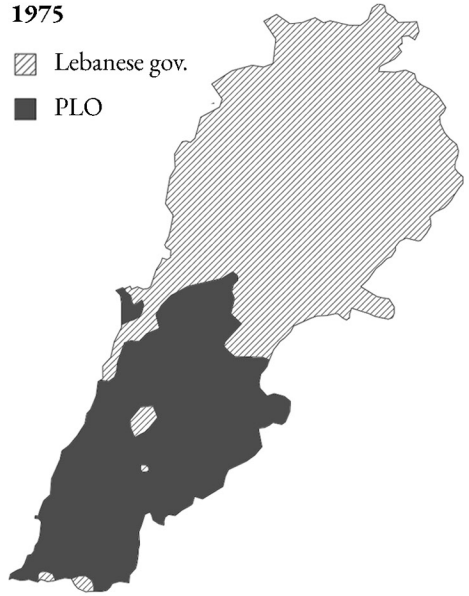


Religious division



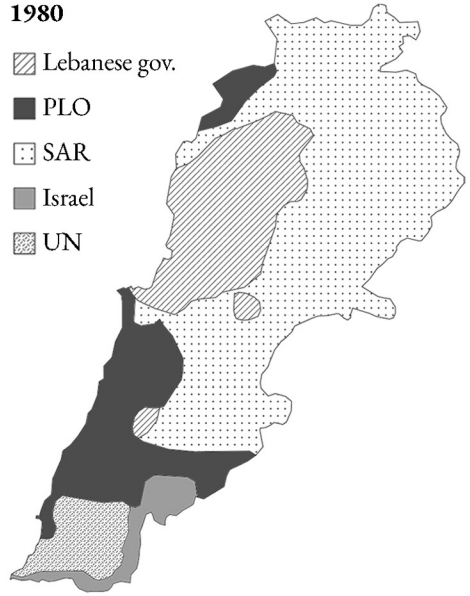
Territorial borders through time

1975



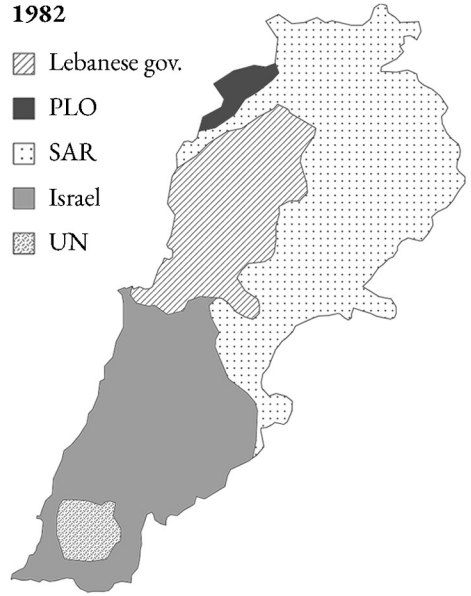
63%	6618.5 km2	Lebanese gov.
37%	3,834.5 km2	PLO

1980



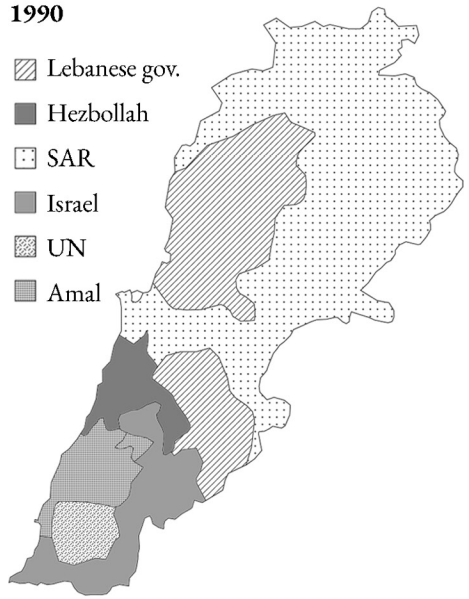
19%	1,956 km2	Lebanese gov.
18%	1,783.5 km2	PLO
55%	5,736 km2	SAR
2%	394 km2	Israel
6%	594 km2	UN

1982



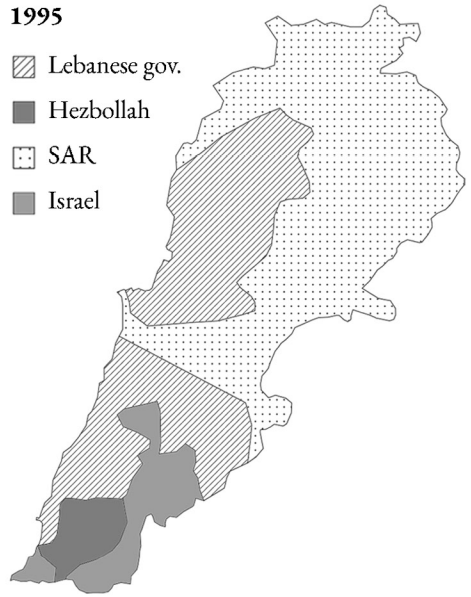
19%	1,956 km2	Lebanese gov.
18%	1,783.5 km2	PLO
55%	5,736 km2	SAR
2%	394 km2	Israel
6%	594 km2	UN

1990



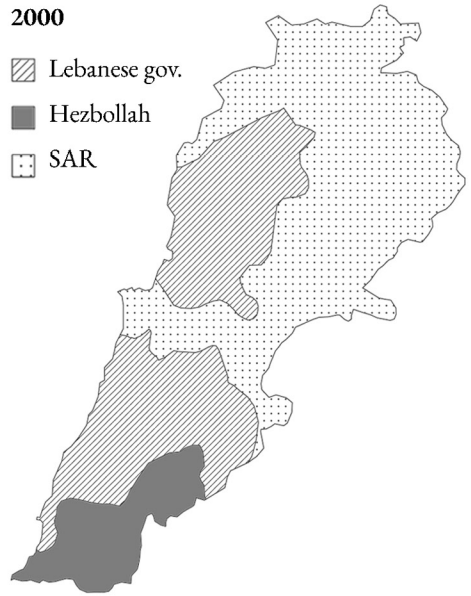
25%	2,621 km2	Lebanese gov.
5%	552 km2	Hezbollah
53%	5,417 km2	SAR
9%	990 km2	Israel
3%	338 km2	UN
5%	534 km2	Amal

1995



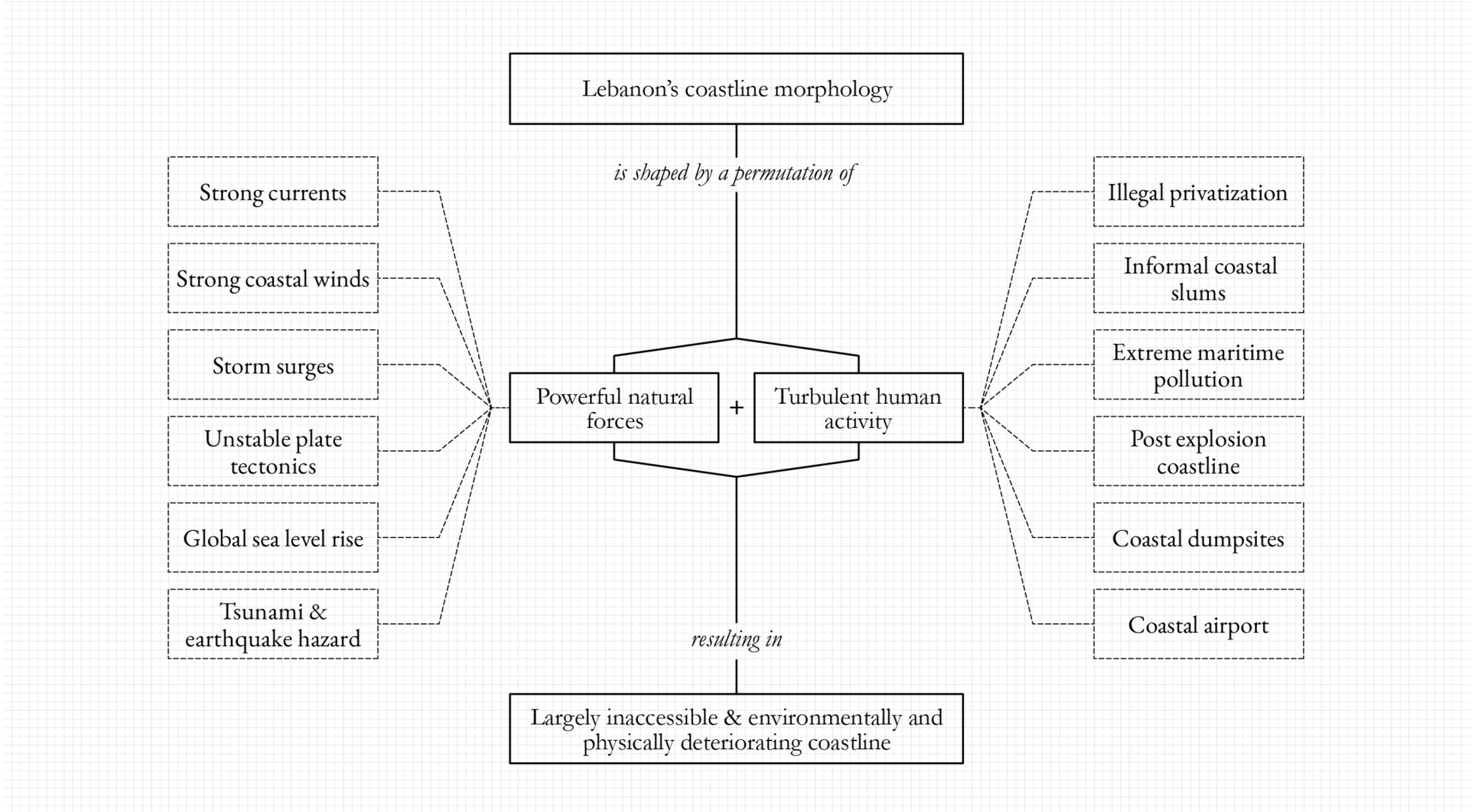
36%	3,750 km2	Lebanese gov.
4%	430 km2	Hezbollah
51%	5,406 km2	SAR
8%	866 km2	Israel
	10,453 km2	

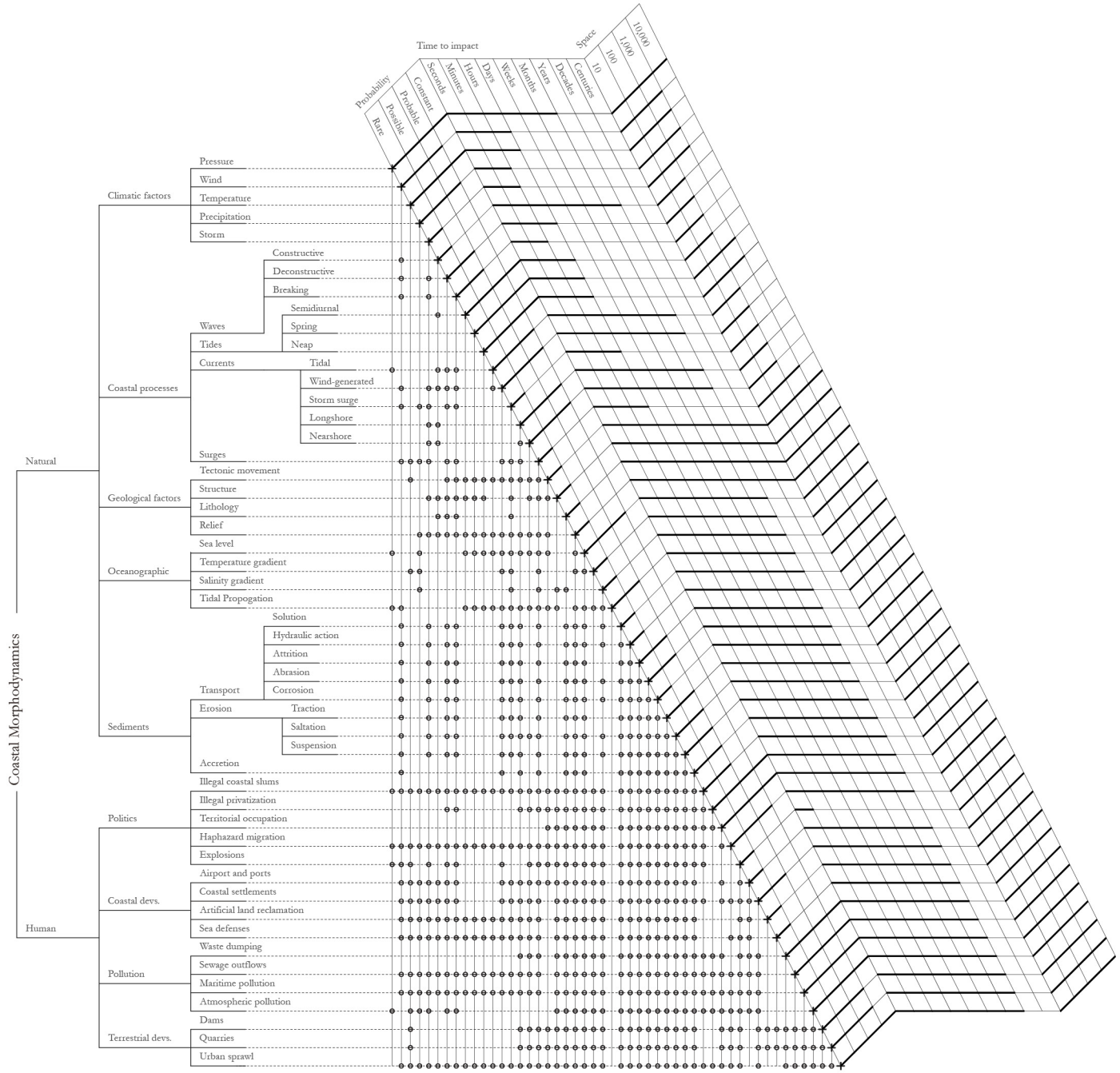
2000



36%	3,868 km2	Lebanese gov.
11%	1,141 km2	Hezbollah
53%	5,443 km2	SAR

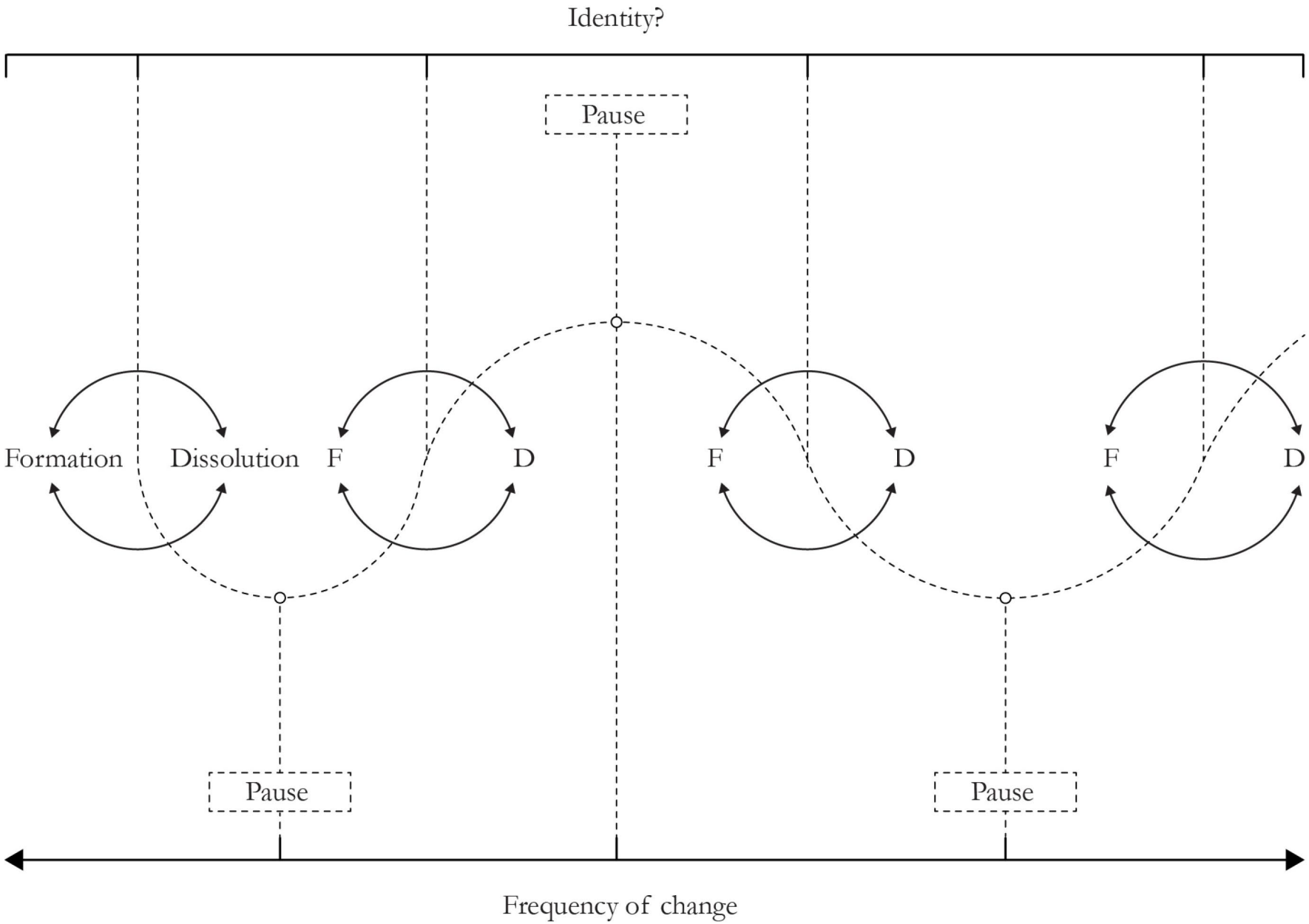
Problem statement

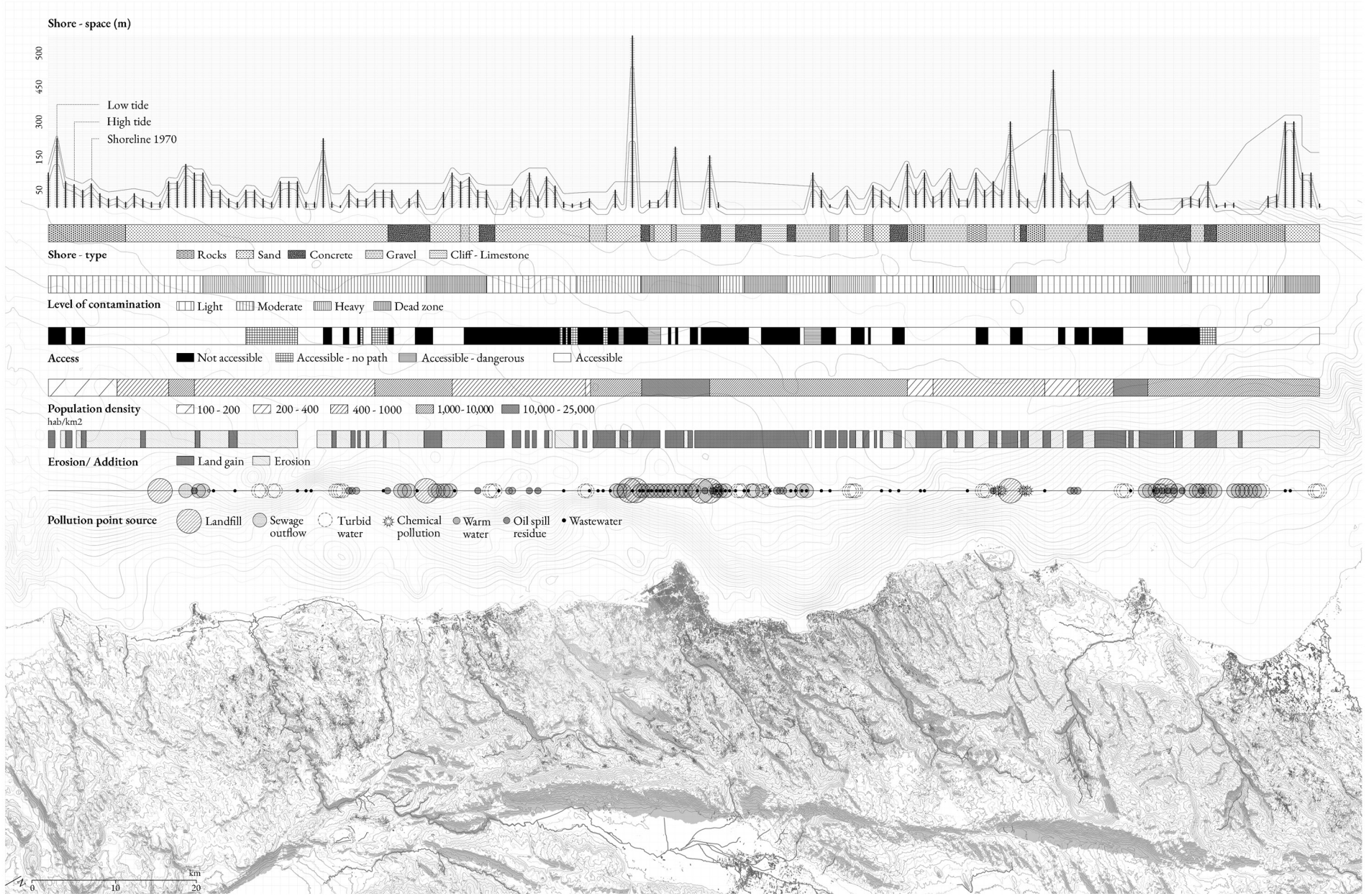


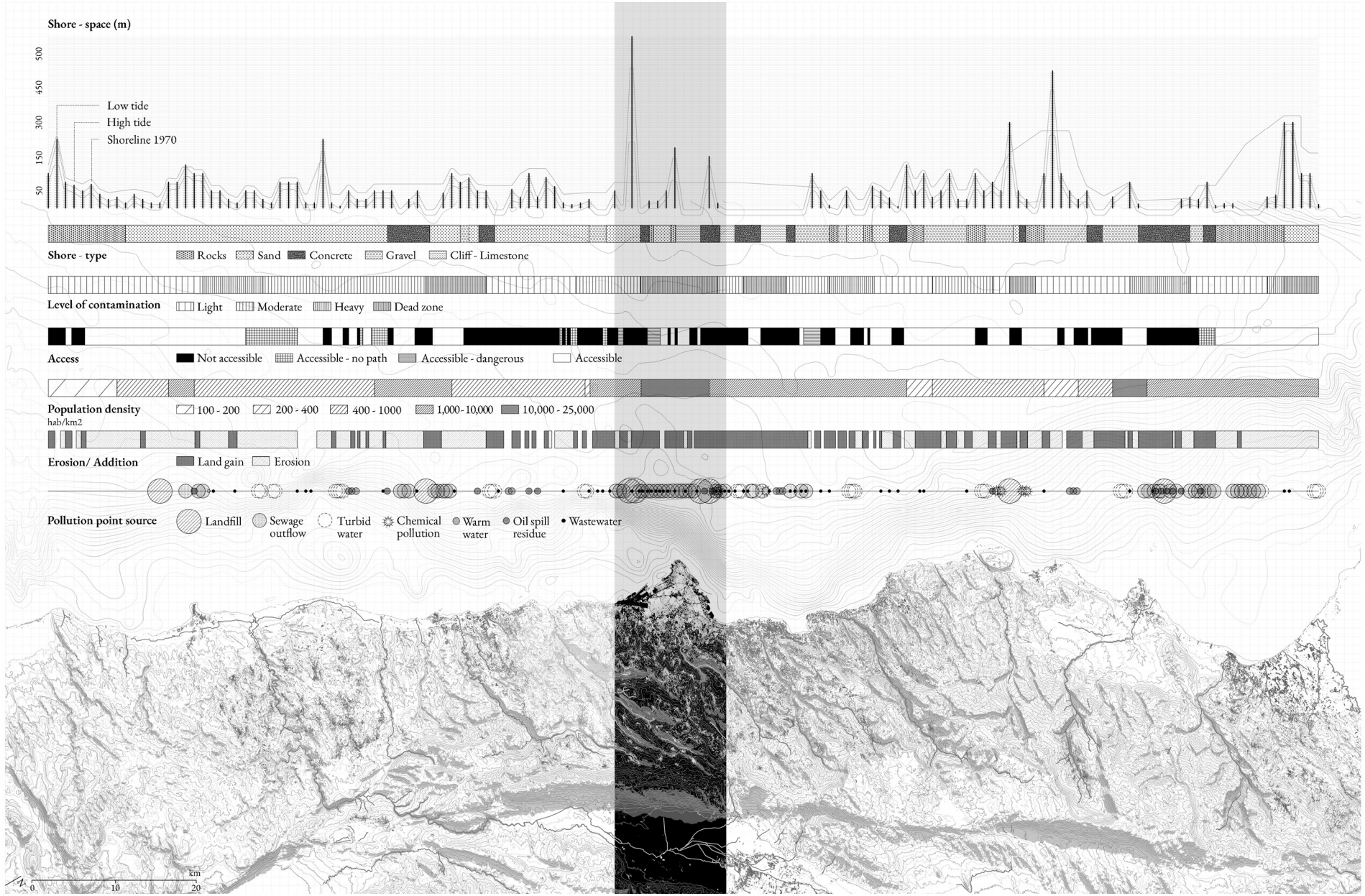

Time to impact
Space
Probability
Rare
Possible
Probable
Constant
Seconds
Minutes
Hours
Days
Weeks
Months
Years
Decades
Centuries
10
100
1,000
10,000
Coastal Morphodynamics
Natural
Human
Climatic factors
Pressure
Wind
Temperature
Precipitation
Storm
Coastal processes
Waves
Constructive
Deconstructive
Breaking
Tides
Semidiurnal
Spring
Neap
Currents
Tidal
Wind-generated
Storm surge
Longshore
Nearshore
Surges
Geological factors
Tectonic movement
Structure
Lithology
Relief
Oceanographic
Sea level
Temperature gradient
Salinity gradient
Tidal Propogation
Sediments
Solution
Hydraulic action
Attrition
Abrasion
Corrosion
Transport
Erosion
Traction
Saltation
Suspension
Accretion
Politics
Illegal coastal slums
Illegal privatization
Territorial occupation
Haphazard migration
Coastal devs.
Explosions
Airport and ports
Coastal settlements
Artificial land reclamation
Sea defenses
Pollution
Waste dumping
Sewage outflows
Maritime pollution
Atmospheric pollution
Terrestrial devs.
Dams
Quarries
Urban sprawl

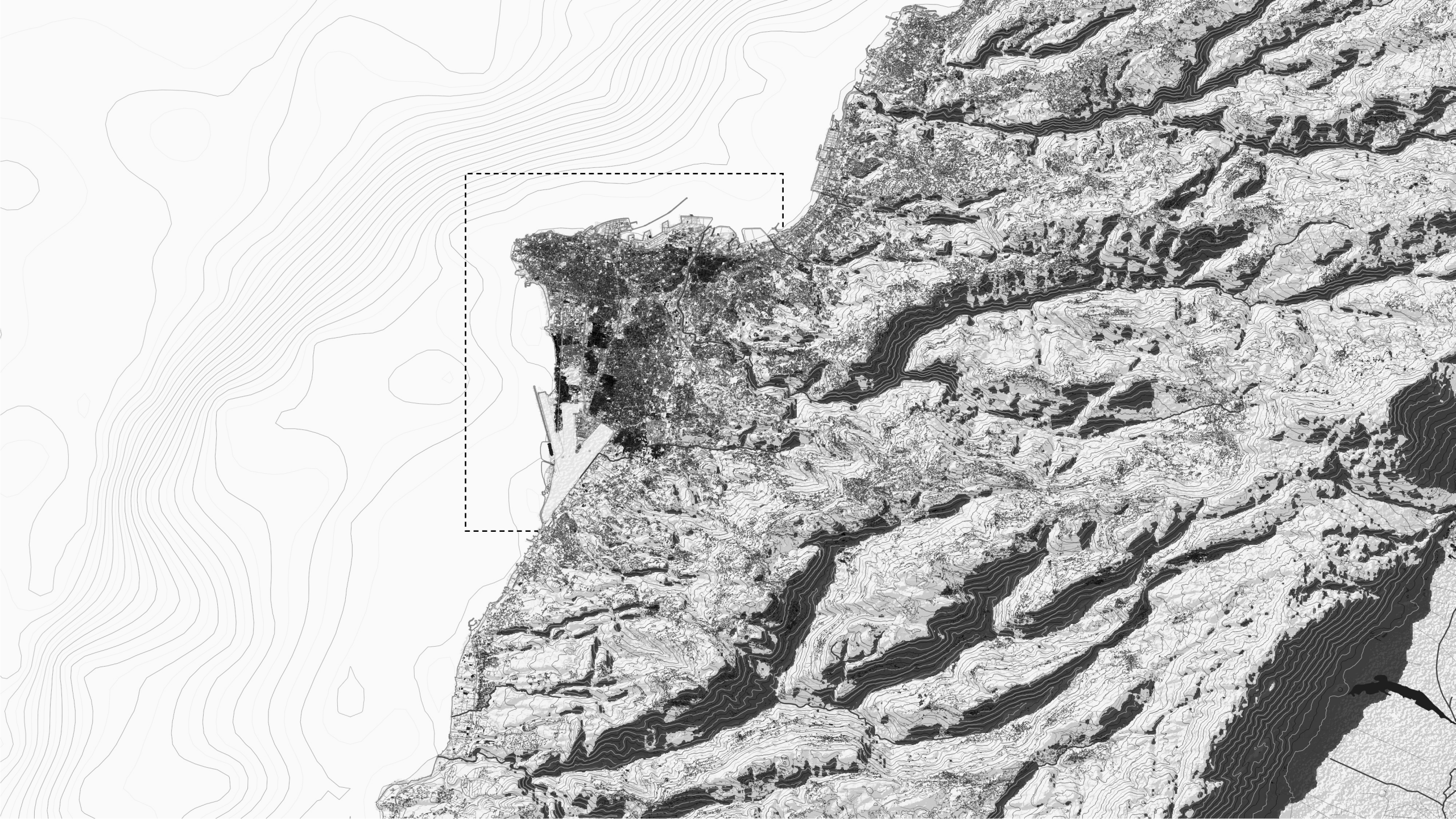
Research Question

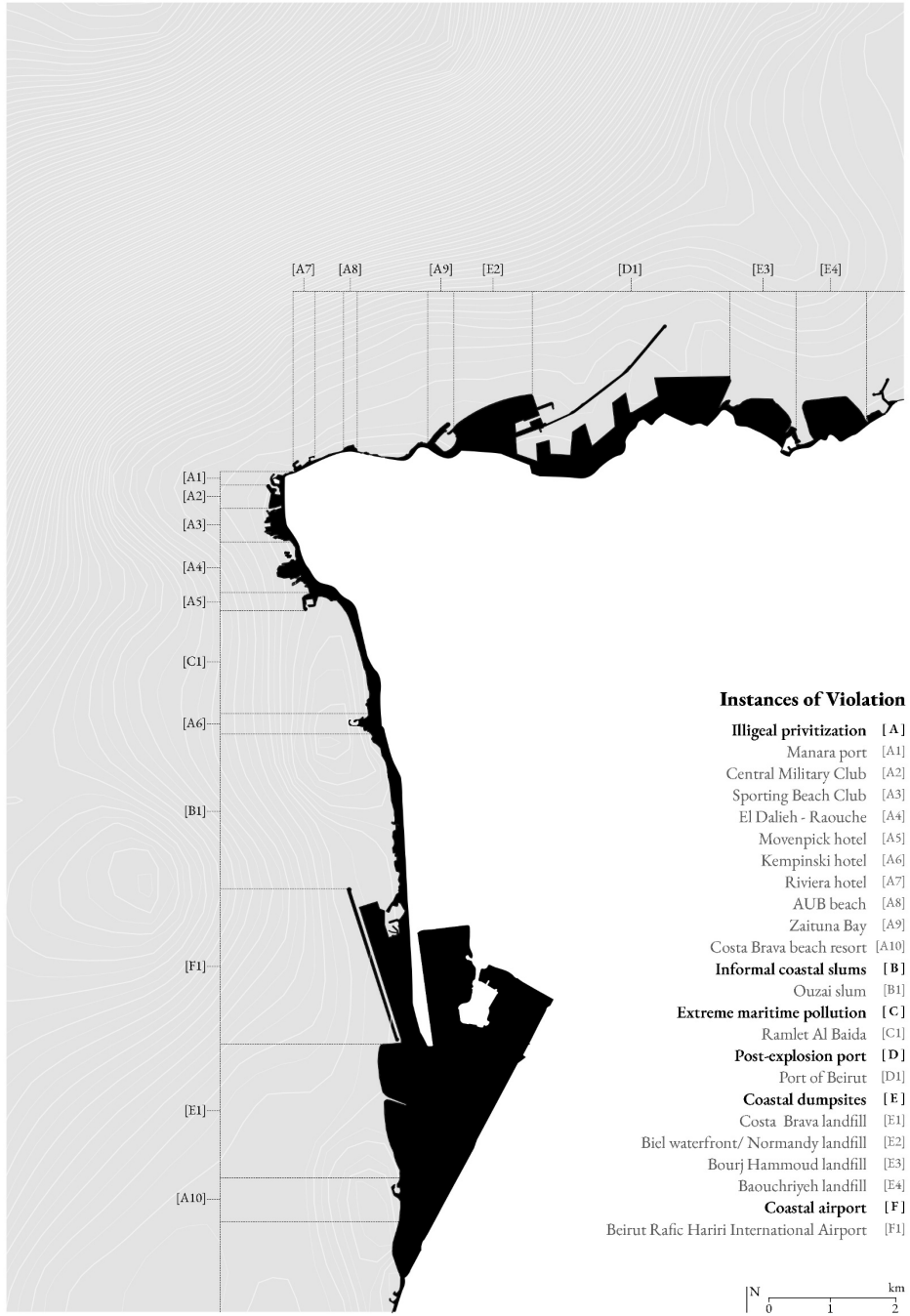
How can the understanding of Beirut's coastline as a [A] series of extreme environmental and anthropogenic permutations inform its [B] design agency, programming a coastal space which functions as an autonomous littoral landscape while simultaneously [C] attaining spatial justice for its inhabitants?

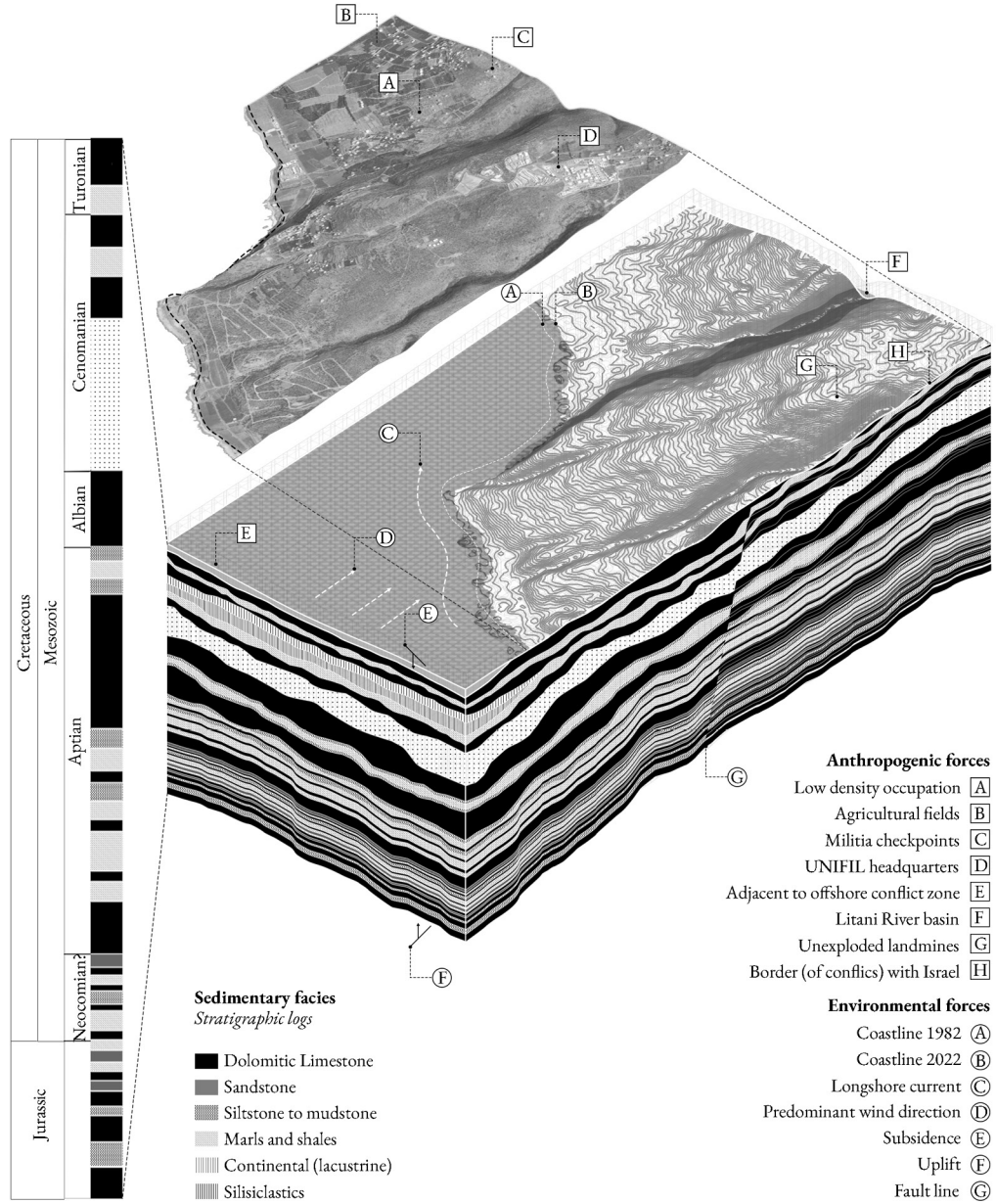

Identity?
Pause
Formation
Dissolution
F
D
F
D
F
D
Pause
Pause
Frequency of change

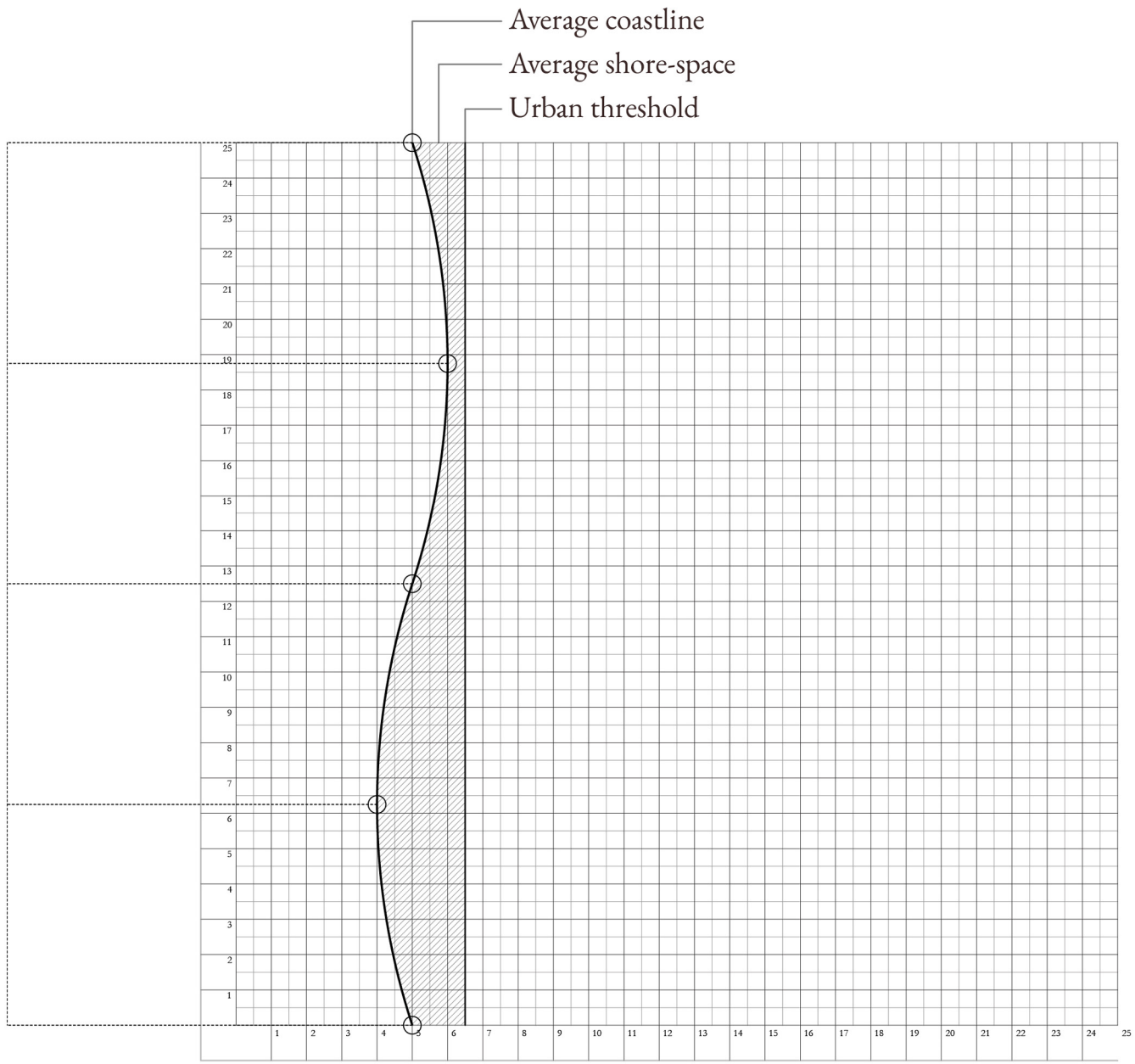

Shore - space (m)
500
450
300
150
50
Low tide
High tide
Shoreline 1970
Shore - type
Rocks
Sand
Concrete
Gravel
Cliff - Limestone
Level of contamination
Light
Moderate
Heavy
Dead zone
Access
Not accessible
Accessible - no path
Accessible - dangerous
Accessible
Population density
hab/km2
100 - 200
200 - 400
400 - 1000
1,000-10,000
10,000 - 25,000
Erosion/ Addition
Land gain
Erosion
Pollution point source
Landfill
Sewage outflow
Turbid water
Chemical pollution
Warm water
Oil spill residue
Wastewater
km
0
10
20


Shore - space (m)
500
450
300
150
50
Low tide
High tide
Shoreline 1970
Shore - type
Rocks
Sand
Concrete
Gravel
Cliff - Limestone
Level of contamination
Light
Moderate
Heavy
Dead zone
Access
Not accessible
Accessible - no path
Accessible - dangerous
Accessible
Population density
hab/km2
100 - 200
200 - 400
400 - 1000
1,000-10,000
10,000 - 25,000
Erosion/ Addition
Land gain
Erosion
Pollution point source
Landfill
Sewage outflow
Turbid water
Chemical pollution
Warm water
Oil spill residue
Wastewater
km
0
10
20



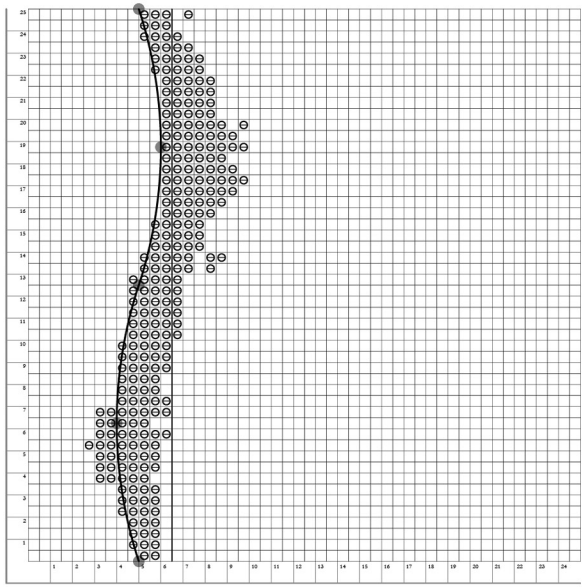

[A7]
[A8]
[A9]
[E2]
[D1]
[E3]
[E4]
[A1]
[A2]
[A3]
[A4]
[A5]
[C1]
[A6]
[B1]
[F1]
[E1]
[A10]
Instances of Violation
Illigeal privitization [A]
Manara port [A1]
Central Military Club [A2]
Sporting Beach Club [A3]
El Dalieh - Raouche [A4]
Movenpick hotel [A5]
Kempinski hotel [A6]
Riviera hotel [A7]
AUB beach [A8]
Zaituna Bay [A9]
Costa Brava beach resort [A10]
Informal coastal slums [B]
Ouzai slum [B1]
Extreme maritime pollution [C]
Ramlet Al Baida [C1]
Post-explosion port [D]
Port of Beirut [D1]
Coastal dumpsites [E]
Costa Brava landfill [E1]
Biel waterfront/ Normandy landfill [E2]
Bourj Hammoud landfill [E3]
Baouchriyeh landfill [E4]
Coastal airport [F]
Beirut Rafic Hariri International Airport [F1]
N
km
0
1
2


Cretaceous
Mesozoic
Turonian
Cenomanian
Albian
Aptian
Neocomian?
Jurassic
B
C
A
D
F
A
B
H
G
C
E
D
E
G
F
Sedimentary facies
Stratigraphic logs
Dolomitic Limestone
Sandstone
Siltstone to mudstone
Marls and shales
Continental (lacustrine)
Silisiclastics
Anthropogenic forces
Low density occupation A
Agricultural fields B
Militia checkpoints C
UNIFIL headquarters D
Adjacent to offshore conflict zone E
Litani River basin F
Unexploded landmines G
Border (of conflics) with Israel H
Environmental forces
Coastline 1982 Ⓐ
Coastline 2022 Ⓑ
Longshore current Ⓒ
Predominant wind direction Ⓓ
Subsidence Ⓔ
Uplift Ⓕ
Fault line Ⓖ


Average coastline
Average shore-space
Urban threshold
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

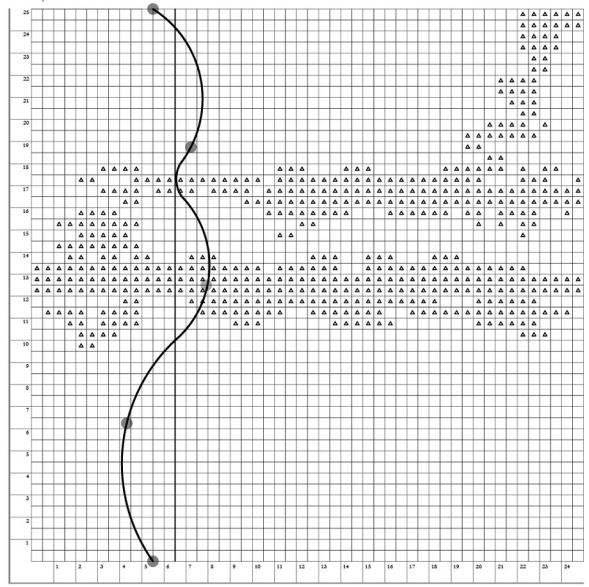
Waves & Swell

Minutes to Hours



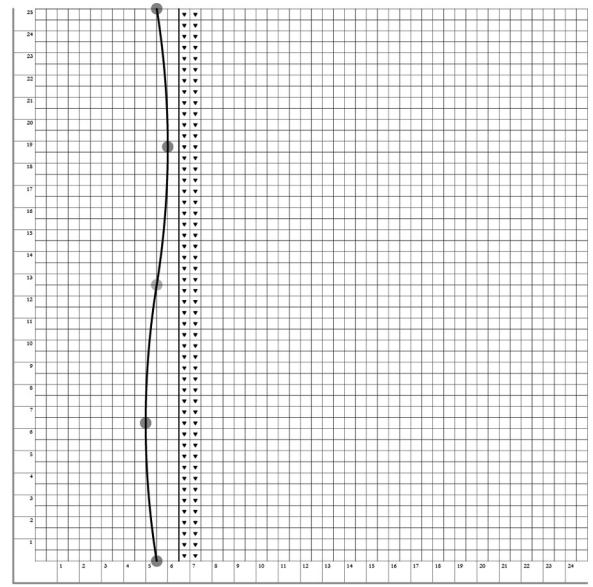
River Runoff

Days to Years



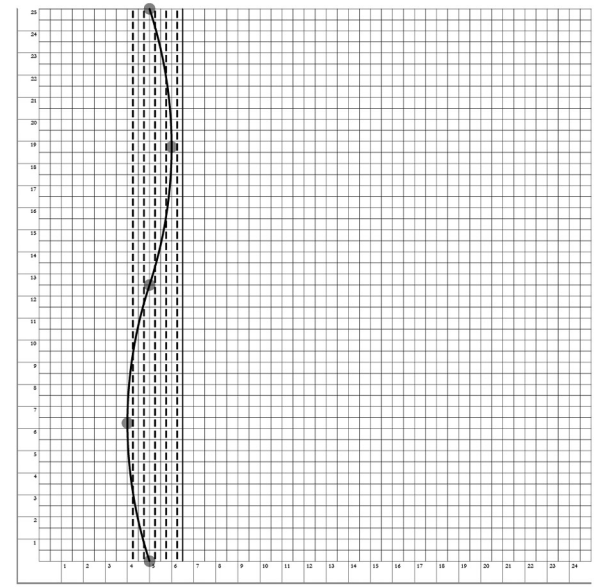
Coastal settlements

Years to decades



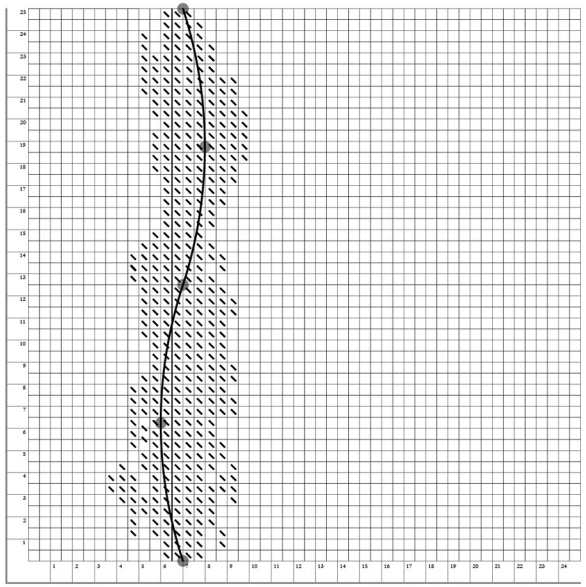
Semidiurnal Tides

Minutes to hours



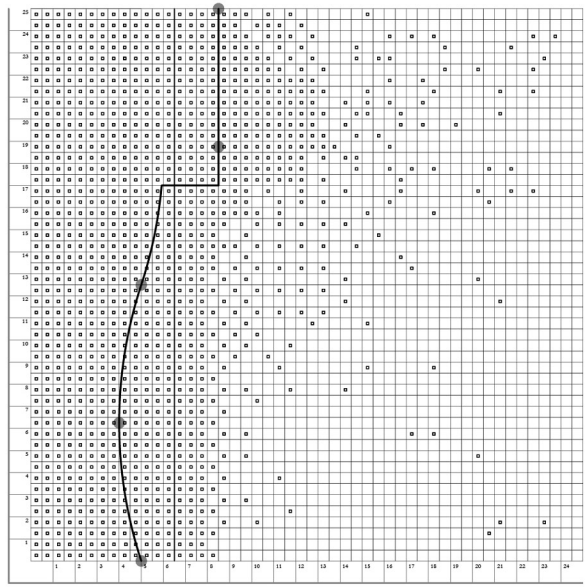
MSL

Decades to centuries



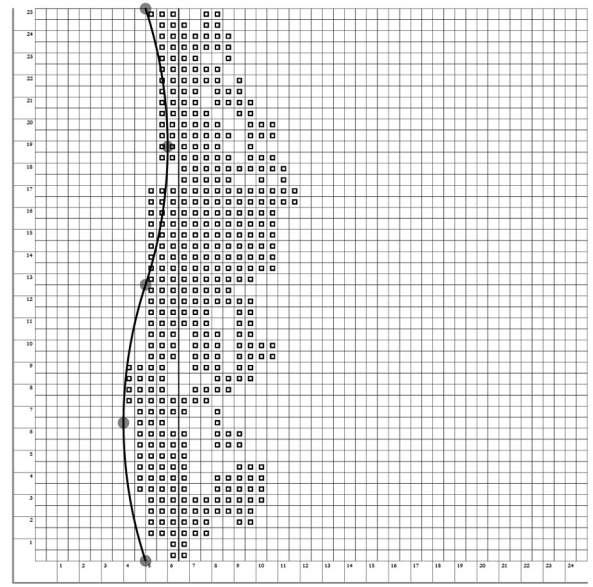
Incident Explosion

Milliseconds to Seconds



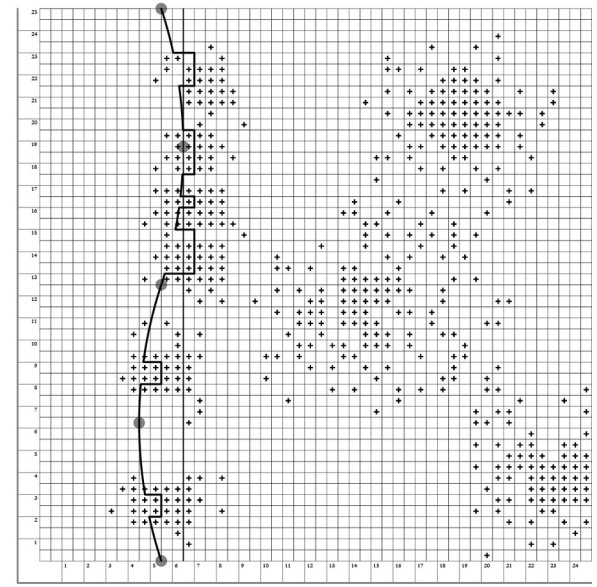
Storm surges

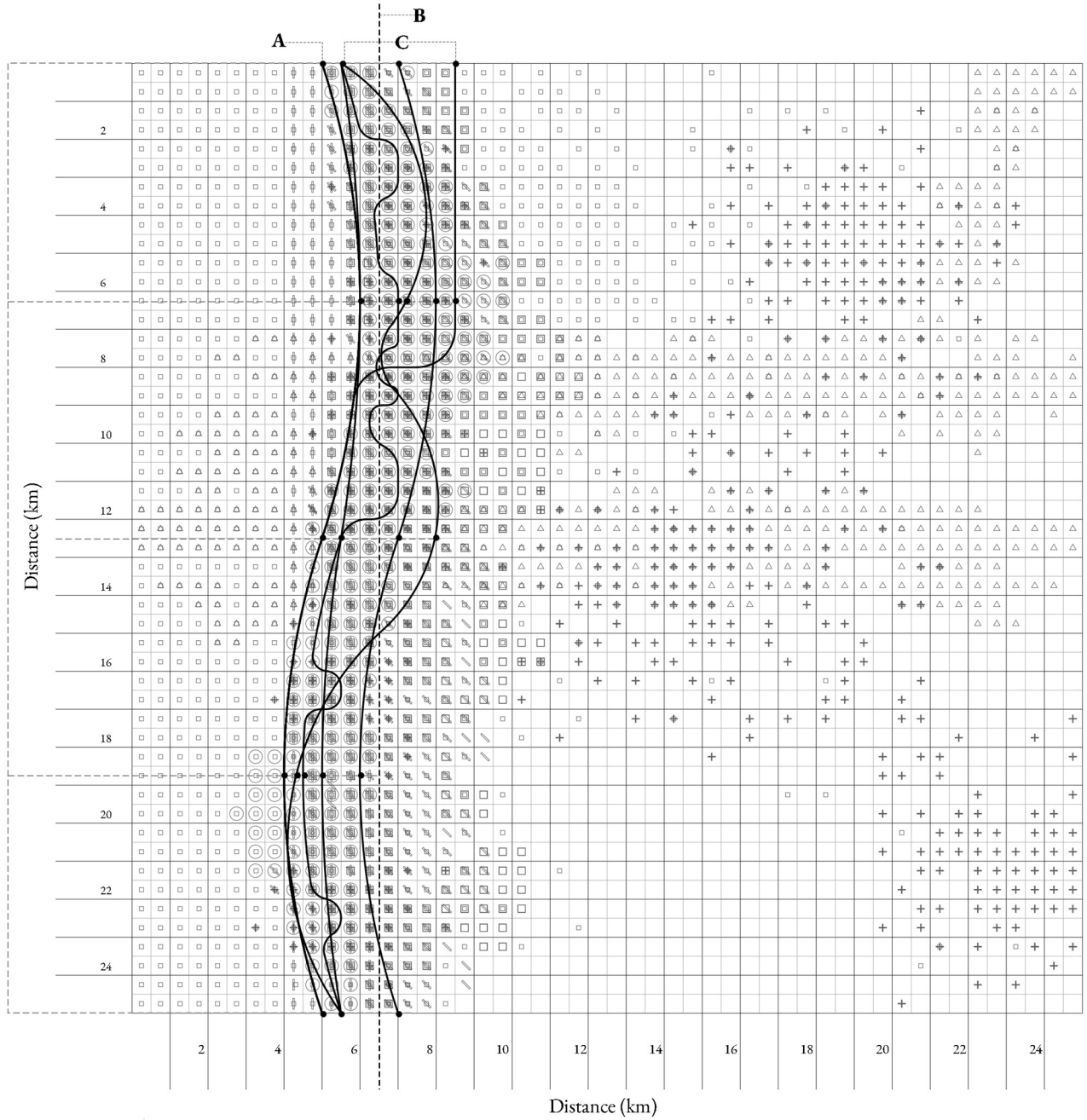
Hours to days



Wars battles

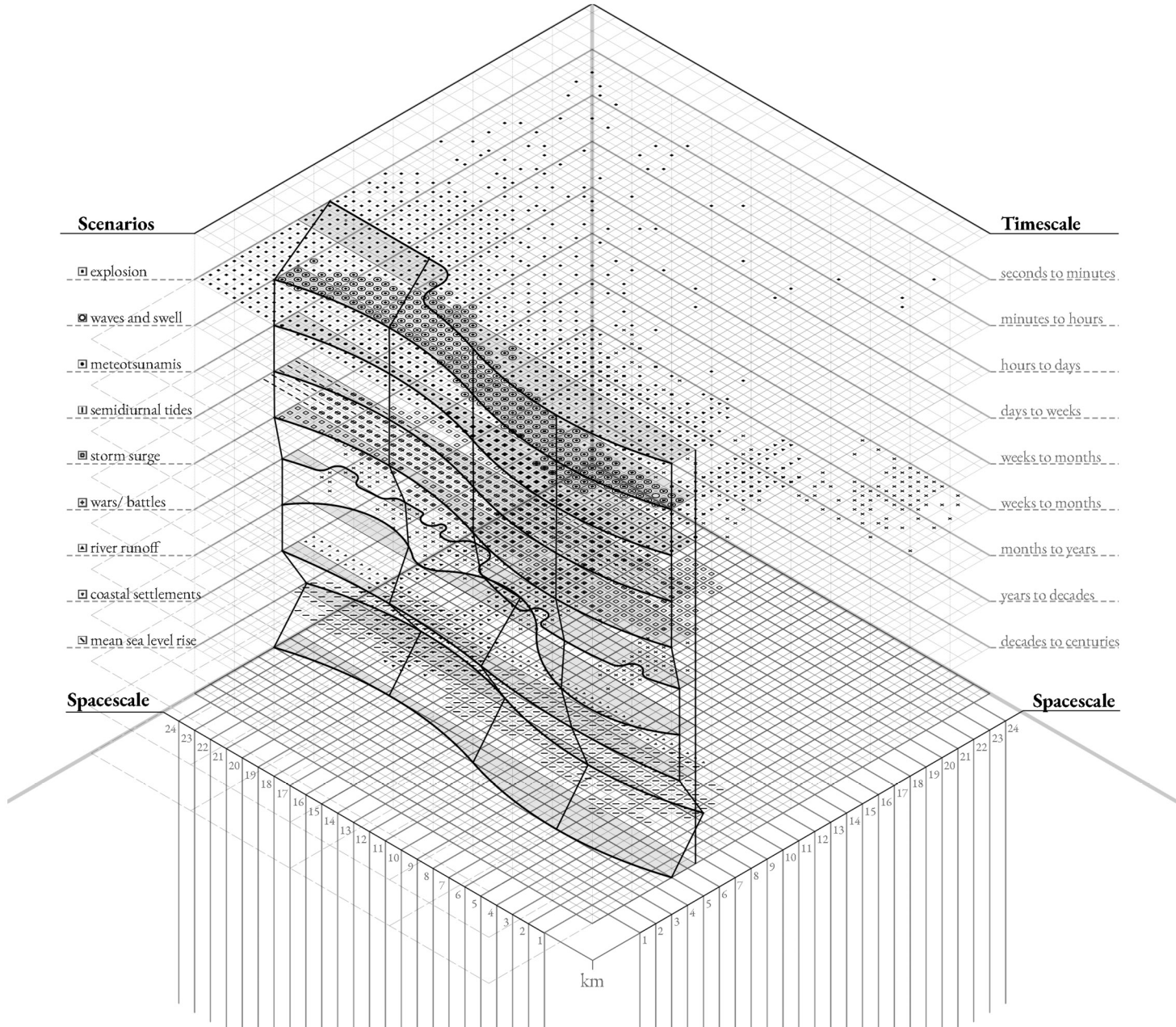
Days to months

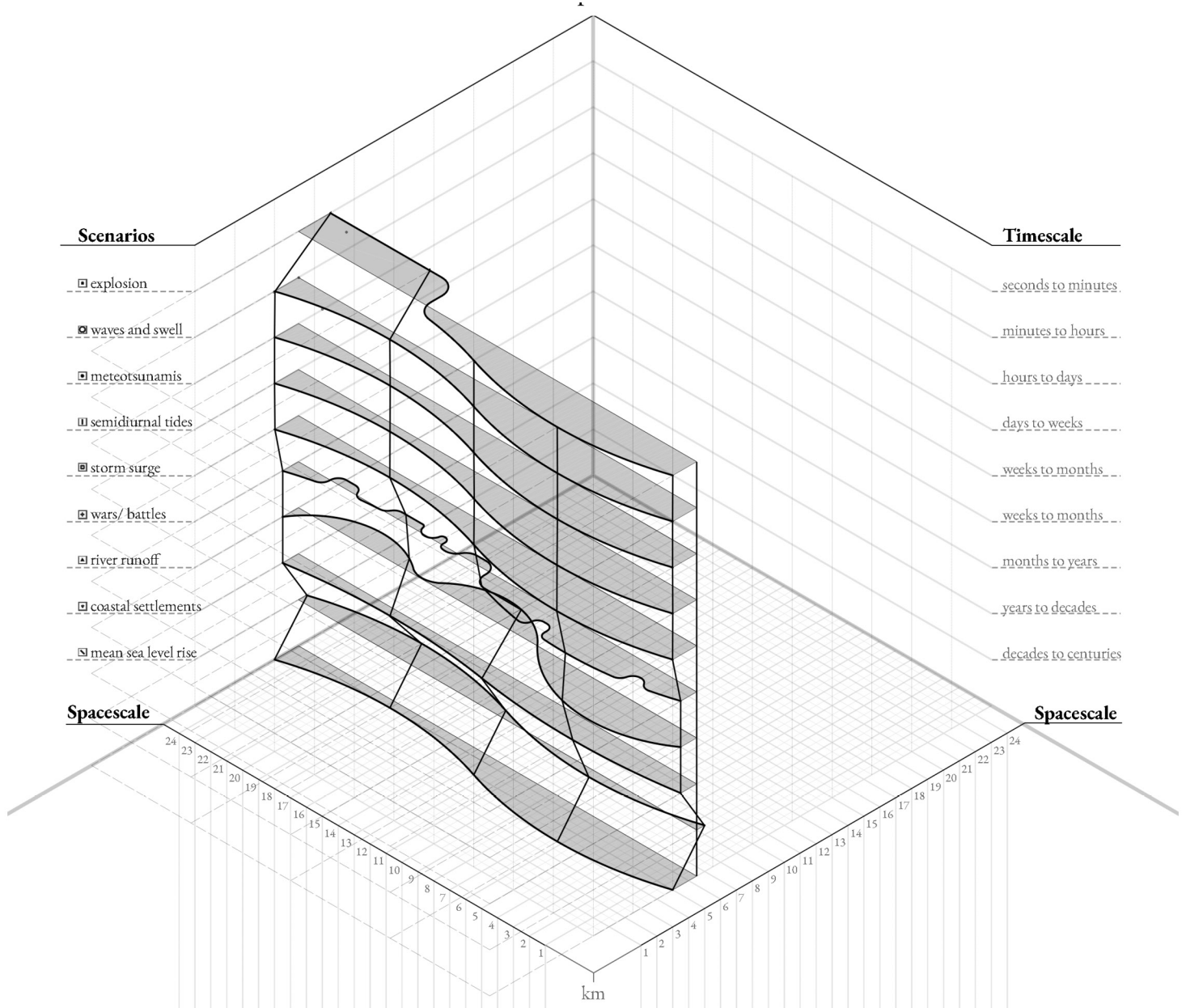




A Average coastline
B Urban threshold
C Scenario coastlines

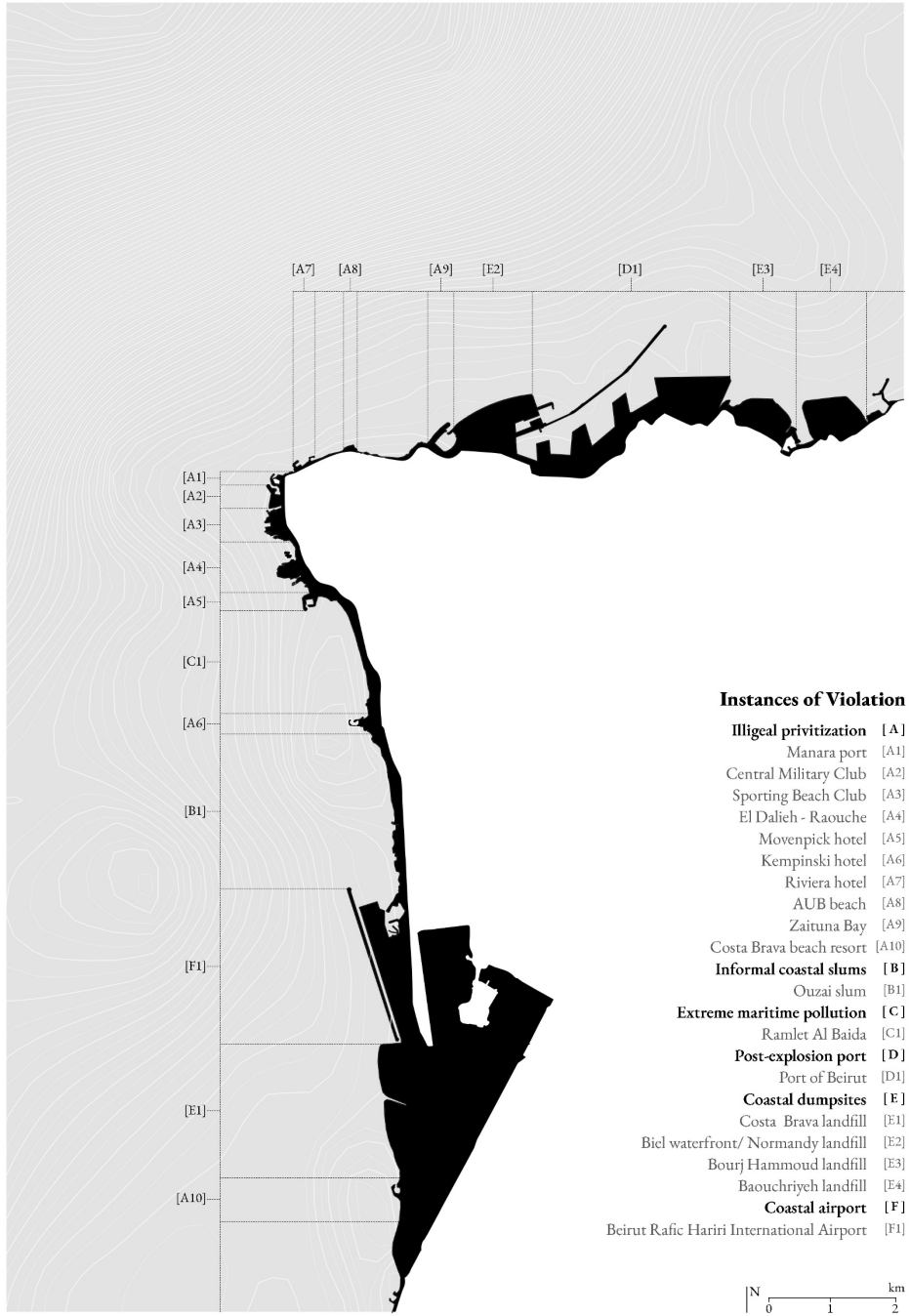
- Incident Explosion - *milliseconds to seconds*
- Meteotsunami - *millisecond to hours*
- Waves & Swell - *minutes to hours*
- River runoff - *days to years*
- Semidiurnal Tides - *minutes to hours*
- Storm surges - *hours to days*
- Coastal settlements - *months to decades*
- War battles - *days to years*
- Mean Sea Level rise - *decades to centuries*


Scenarios
explosion
waves and swell
meteotsunamis
semidiurnal tides
storm surge
wars/ battles
river runoff
coastal settlements
mean sea level rise
Timescale
seconds to minutes
minutes to hours
hours to days
days to weeks
weeks to months
weeks to months
months to years
years to decades
decades to centuries
Spacescale
Spacescale
km


Scenarios
explosion
waves and swell
meteotsunamis
semidiurnal tides
storm surge
wars/ battles
river runoff
coastal settlements
mean sea level rise
Timescale
seconds to minutes
minutes to hours
hours to days
days to weeks
weeks to months
weeks to months
months to years
years to decades
decades to centuries
Spacescale
Spacescale
km

Research question

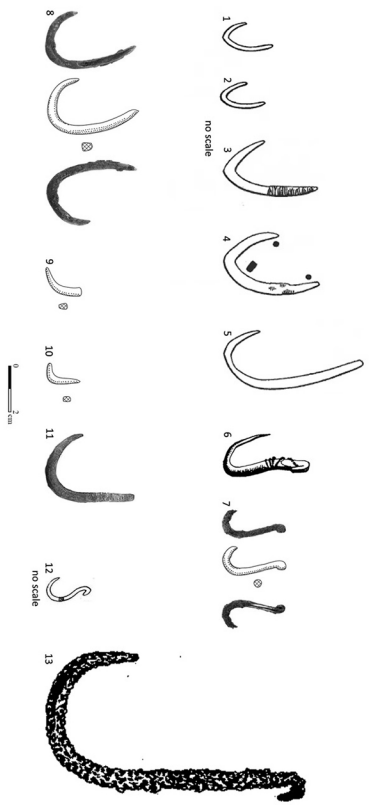
How can the understanding of Beirut's coastline as a [A] series of extreme environmental and anthropogenic permutations inform its [B] design agency, programming a coastal space which functions as an autonomous littoral landscape while simultaneously [C] attaining spatial justice for its inhabitants?


[A7]
[A8]
[A9]
[E2]
[D1]
[E3]
[E4]
[A1]
[A2]
[A3]
[A4]
[A5]
[C1]
[A6]
[B1]
[F1]
[E1]
[A10]
Instances of Violation
Illigeal privitization [A]
Manara port [A1]
Central Military Club [A2]
Sporting Beach Club [A3]
El Dalieh - Raouche [A4]
Movenpick hotel [A5]
Kempinski hotel [A6]
Riviera hotel [A7]
AUB beach [A8]
Zaituna Bay [A9]
Costa Brava beach resort [A10]
Informal coastal slums [B]
Ouzai slum [B1]
Extreme maritime pollution [C]
Ramlet Al Baida [C1]
Post-explosion port [D]
Port of Beirut [D1]
Coastal dumpsites [E]
Costa Brava landfill [E1]
Biel waterfront/ Normandy landfill [E2]
Bourj Hammoud landfill [E3]
Baouchriyeh landfill [E4]
Coastal airport [F]
Beirut Rafic Hariri International Airport [F1]
N
km
0
1
2

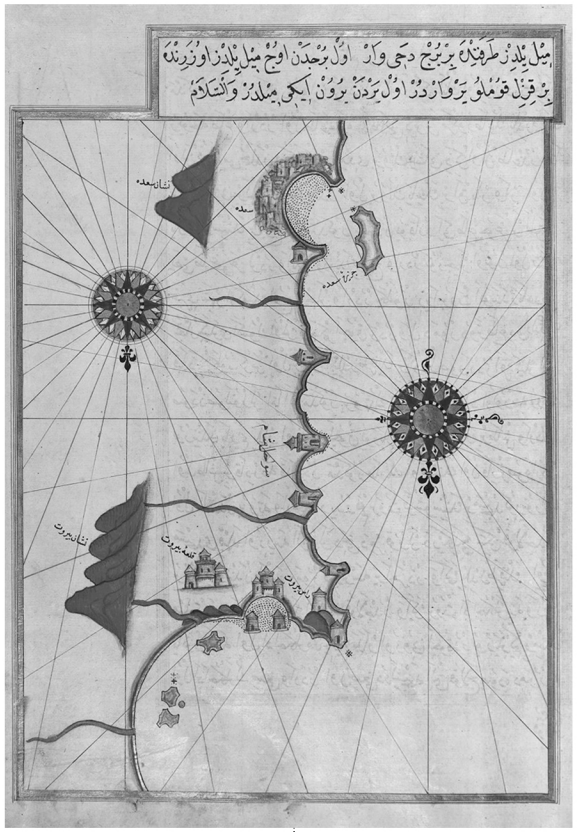
Beneath the pavement,

Beneath the pavement,

the beach





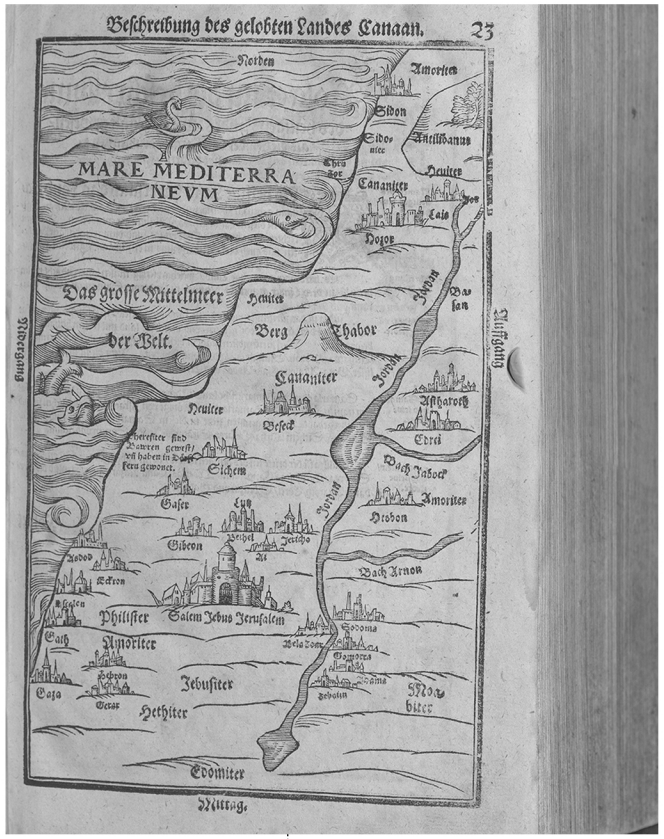


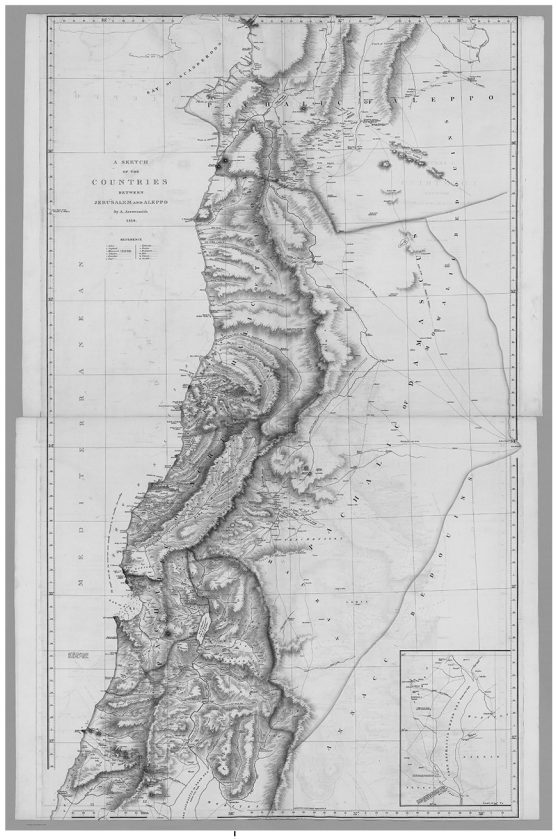
5,000-3,500 B.C.
Neolithic & Chalcolithic

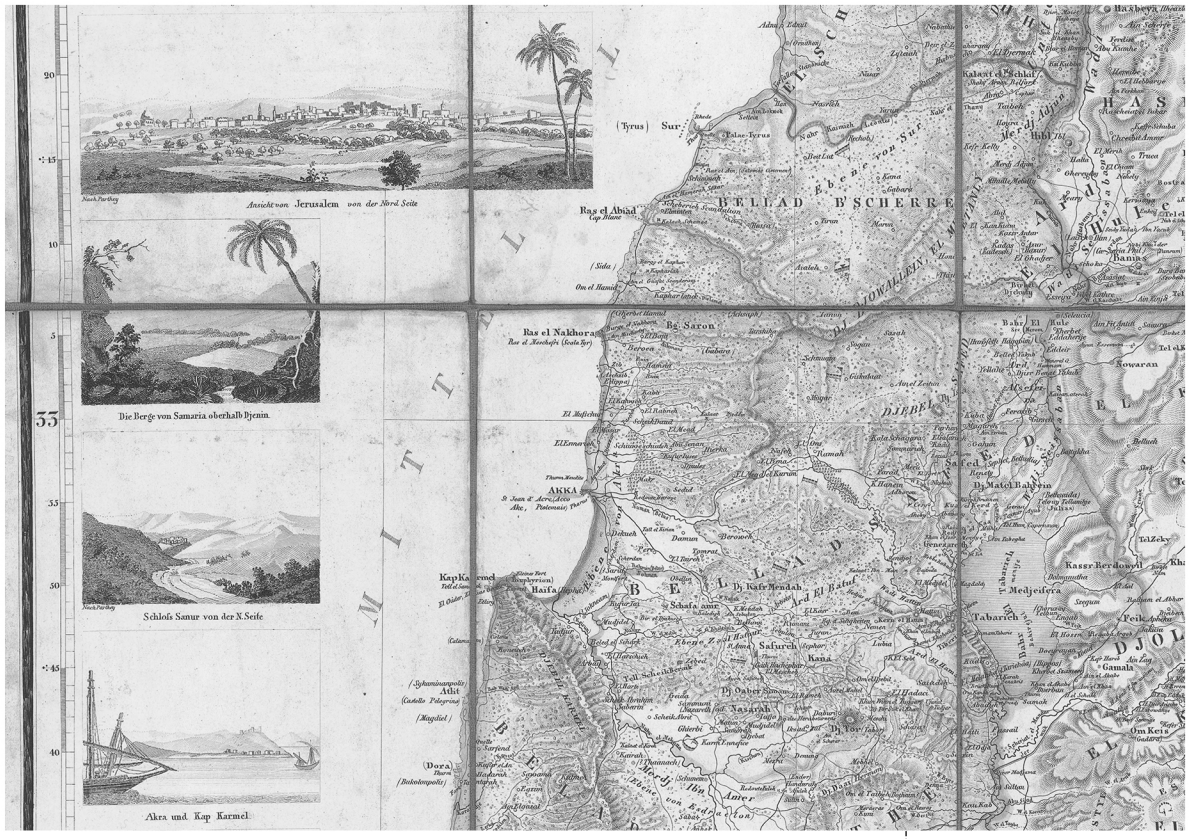
3,500-344 B.C.
Phoenecians

333-64 B.C.
Greek rule

64 B.C.-399 A.D.
Roman rule





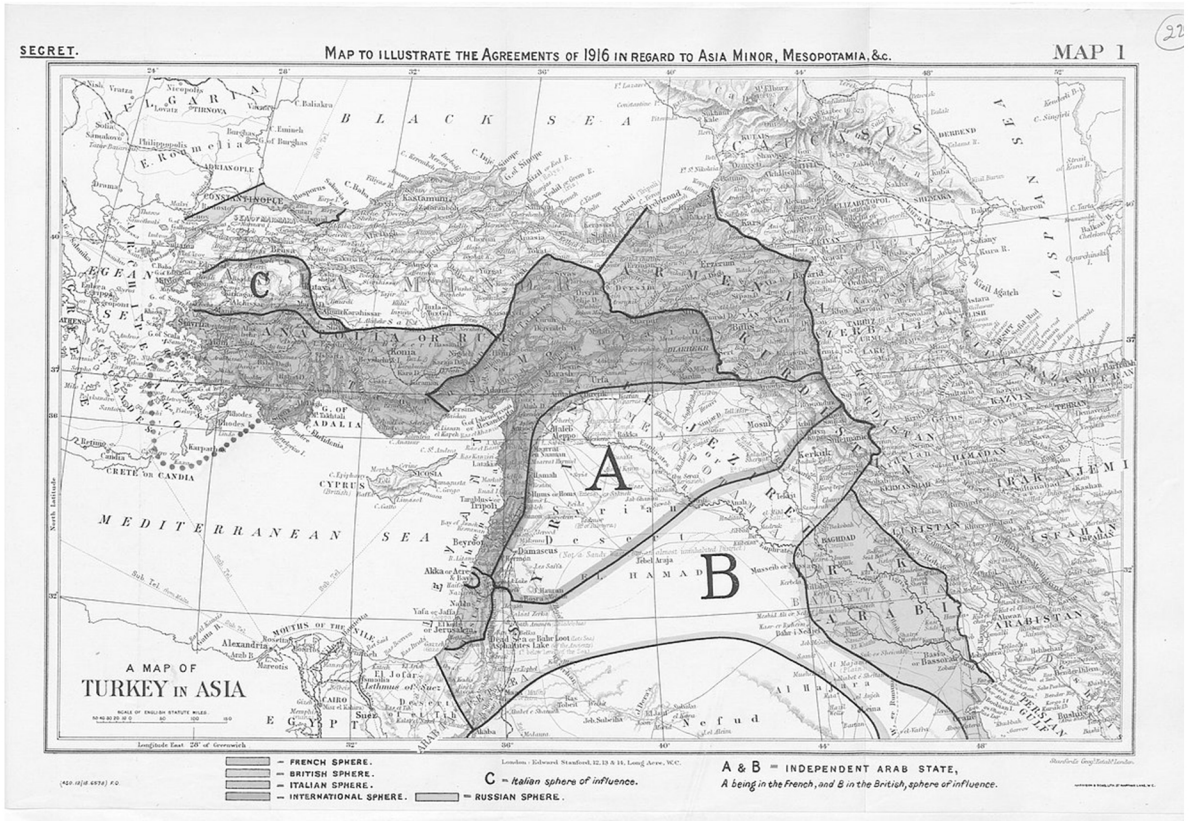


660-1258 A.D.
Byzantines

1099-1291 A.D.
Crusaders

1250-1516 A.D.
Malmlukes

1516-1914 A.D.
Ottomans



1920

French Mandate

1944

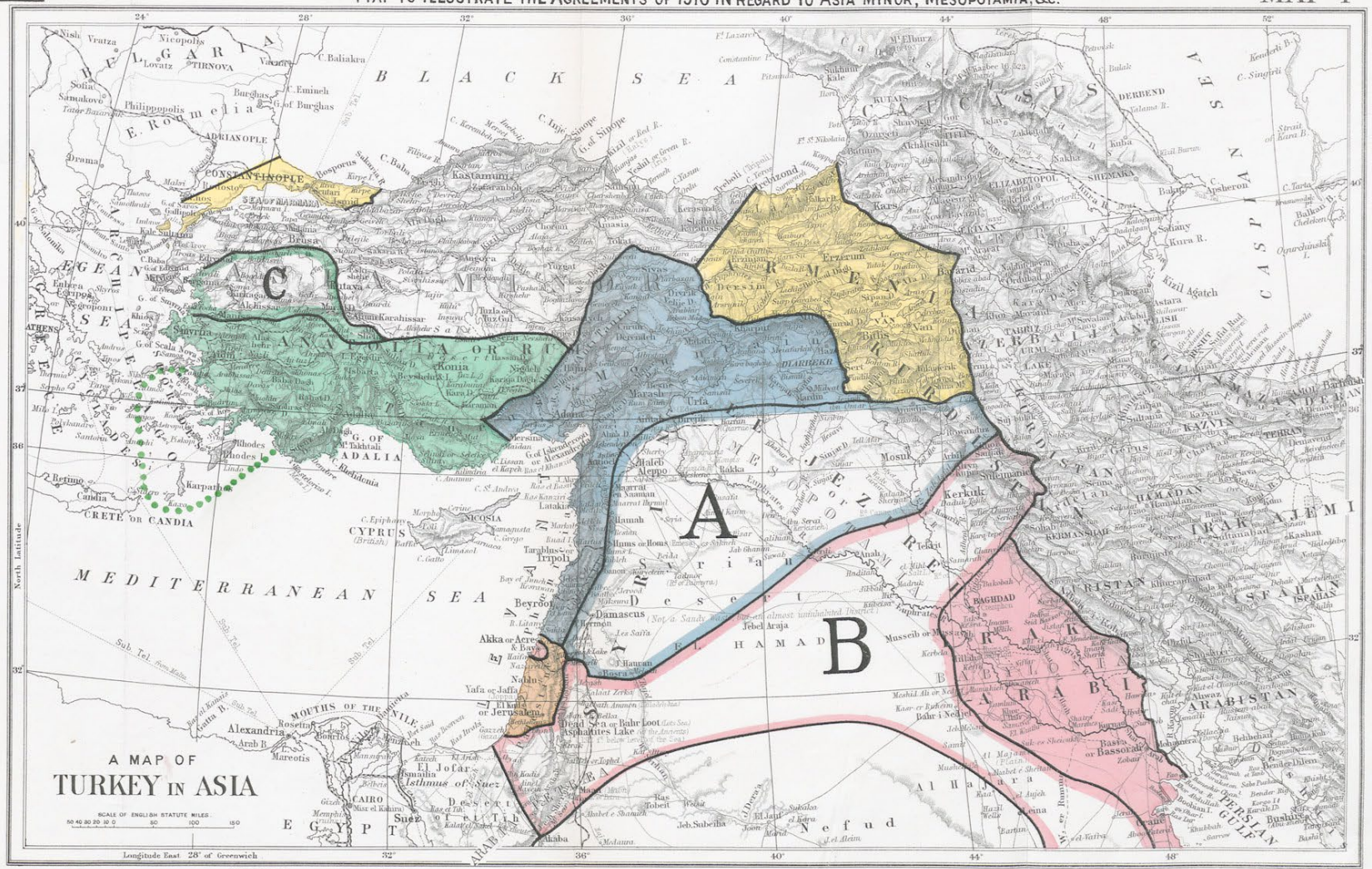
Independance

SECRET.

MAP TO ILLUSTRATE THE AGREEMENTS OF 1916 IN REGARD TO ASIA MINOR, MESOPOTAMIA, &c.

MAP 1

(220)



= FRENCH SPHERE.
= BRITISH SPHERE.
= ITALIAN SPHERE.
= INTERNATIONAL SPHERE.
= RUSSIAN SPHERE.

C = *Italian sphere of influence.*

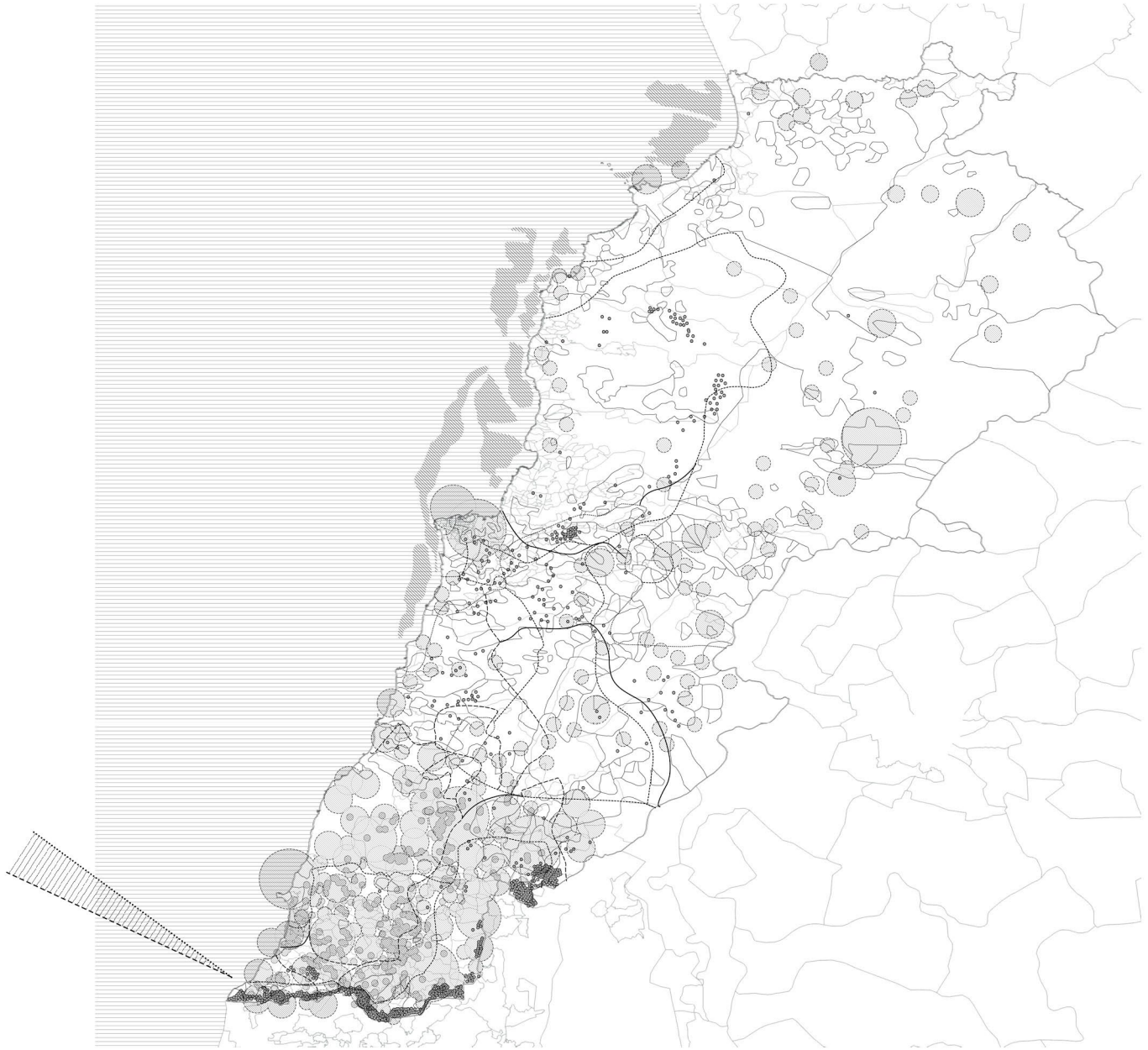
A & B = INDEPENDENT ARAB STATE,
A being in the French, and B in the British, sphere of influence.

London: Edward Stanford, 12, 13 & 14, Long Acre, W.C.

Stanford's Geog.l Estabt London.

(450. 12|18. 6578) F.O.

Shifting Territories



Division

Division of religious confessional and voting systems

Shifting Borders

1975 - 1980

1980 - 1990

1990 - 2000

2000 - 2022

Strikes

Unexploded mines

Cluster Bomb Units

Strike Ranges

>30 strikes

16 - 30 strikes

6 - 15 strikes

1 - 5 strikes

Offshore

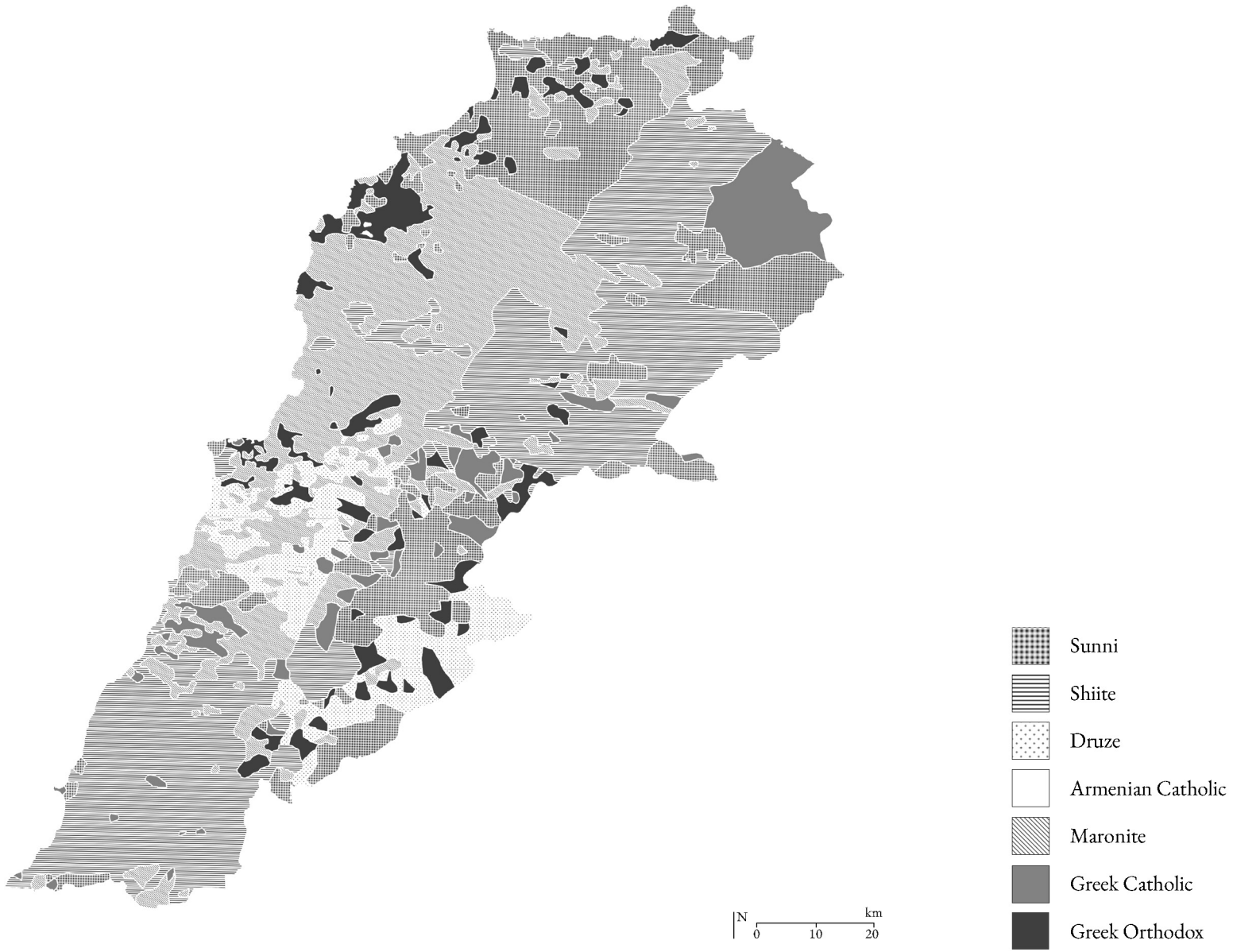
Border claimed by lebanon

Border claimed by Israel

Area of dispute

Extent of oil spill

Religious Division





Fragments through time



Topos

Mater

Habitat

Geopolitics

Topos

Morphological shifts: cyclical timescale


High tide


Low tide

Morphological shifts: Linear timescale


Addition


Recession

Probable instances


Microscale_events


Microscale_seasons


Mesoscale


Macroscale

Mater

Habitat

Geopolitics

Topos

Morphological shifts: cyclical timescale


High tide


Low tide

Morphological shifts: Linear timescale


Addition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Probable instances


Microscale_events


Microscale_seasons


Mesoscale


Macroscale

Mater

Material


Soil


Rock


Concrete

Habitat

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Soil


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Concrete

Habitat

Biodiversity


Biogenic reefs


Benthic flora & fauna


Terrestrial flora & fauna

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Mater

Material


Soil


Rock


Concrete

Habitat

Biodiversity


Biogenic reefs


Benthic flora & fauna


Terrestrial flora & fauna

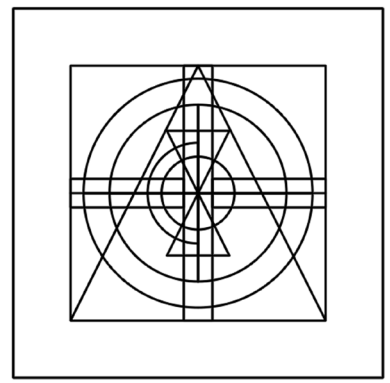
Geopolitics

Access


Accessible

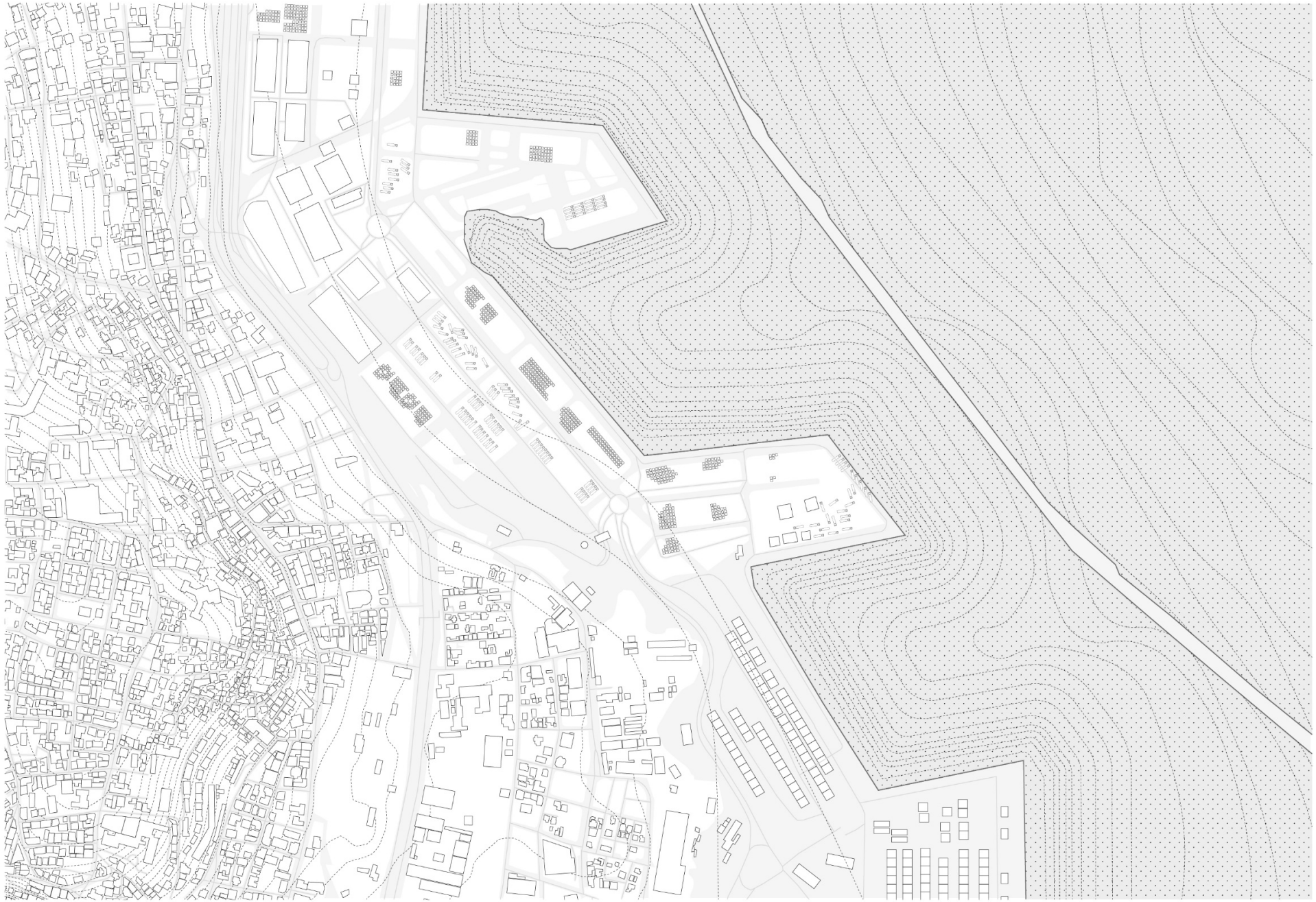

Accessible_physical danger

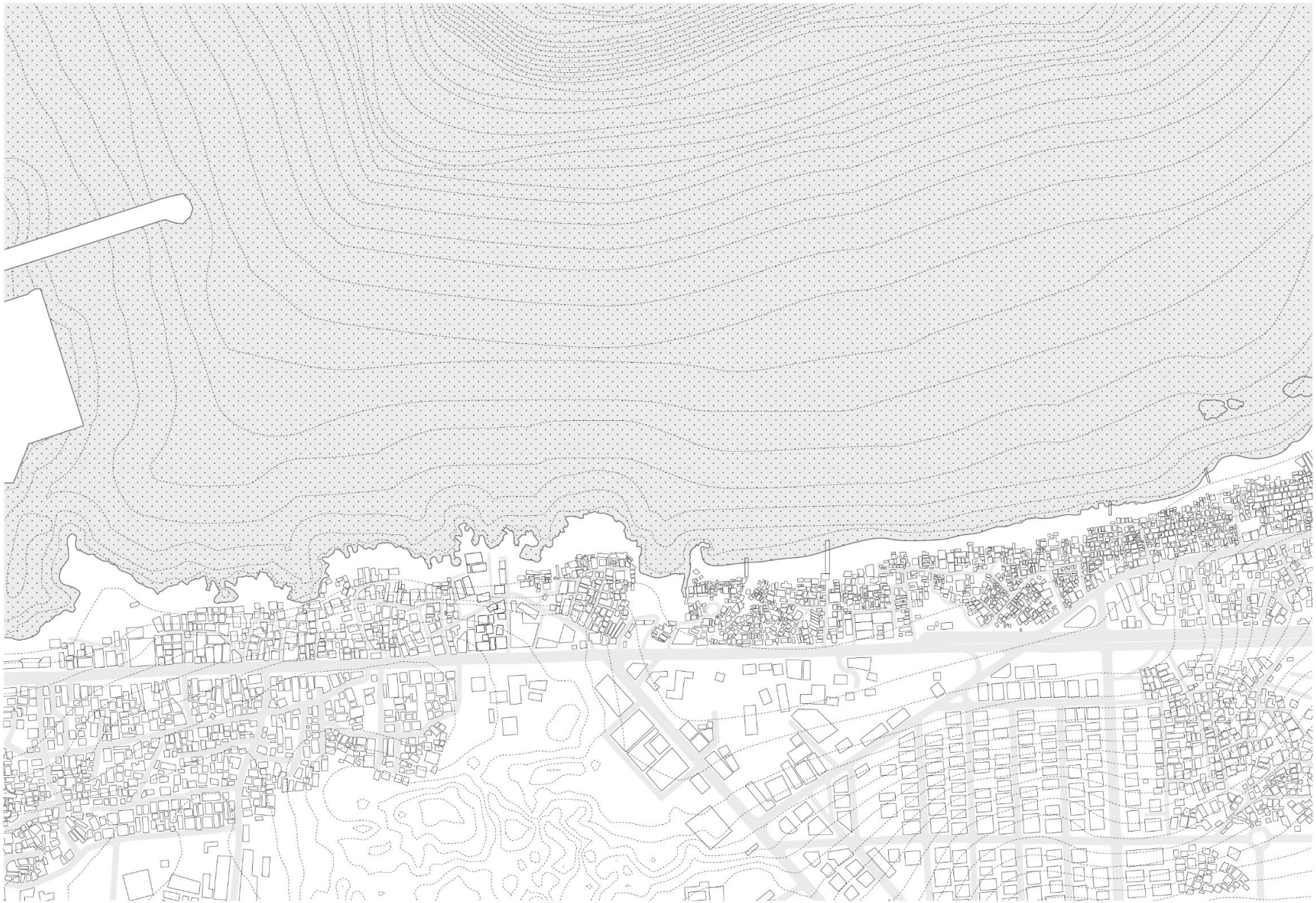

Accessible_political danger



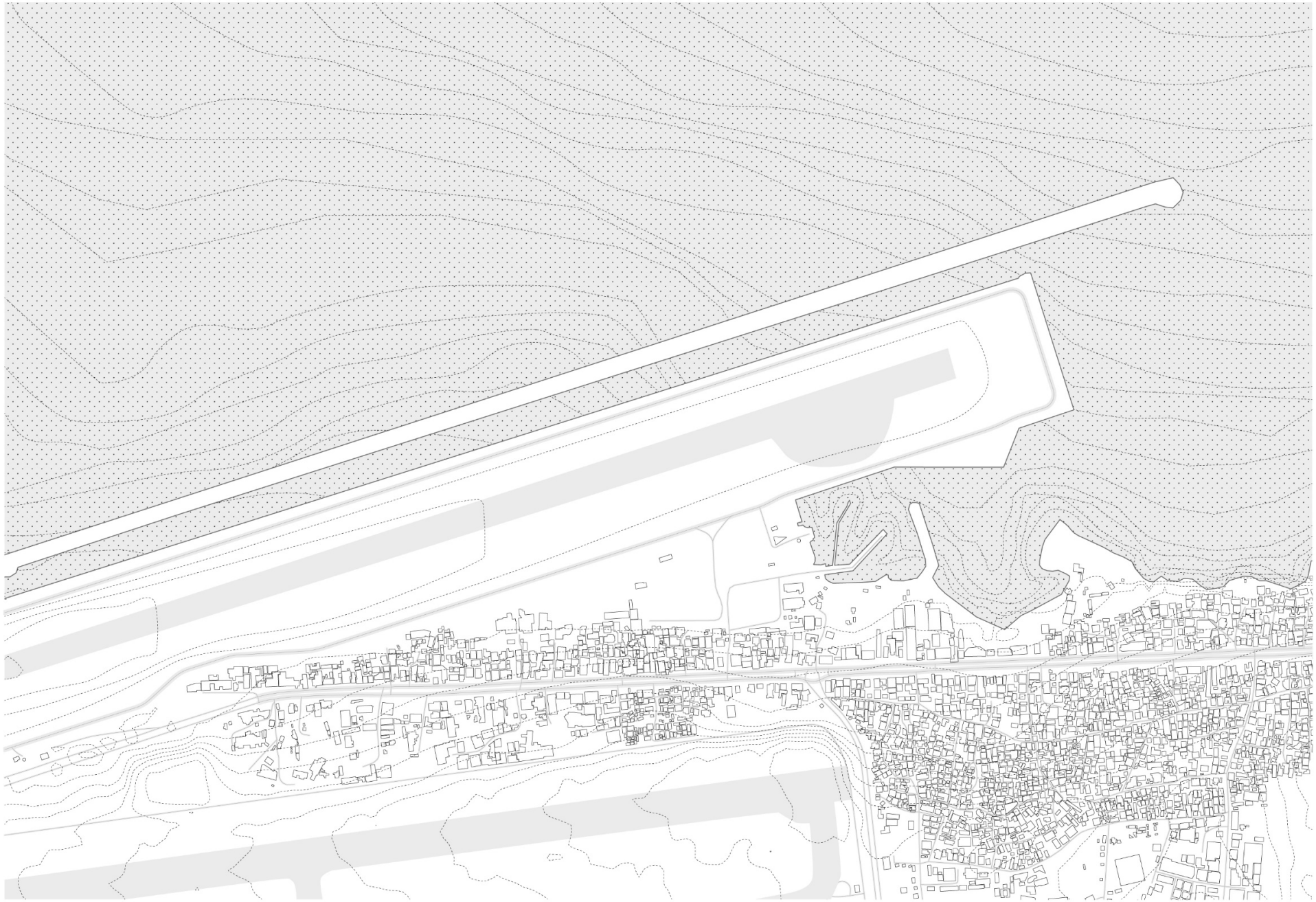




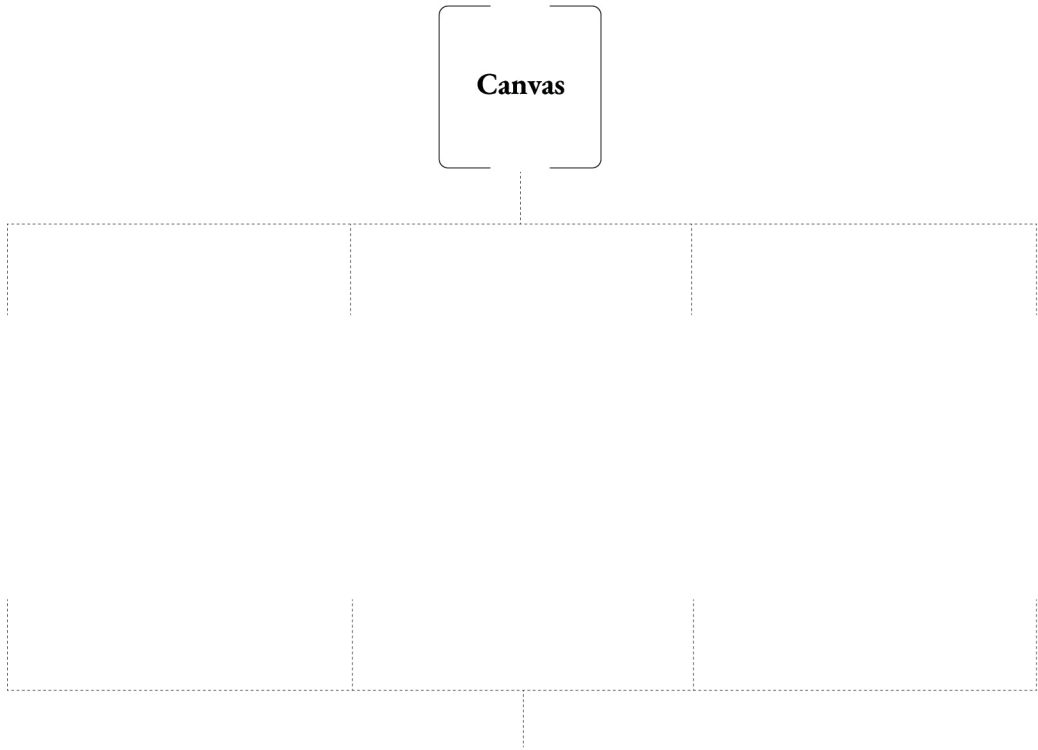


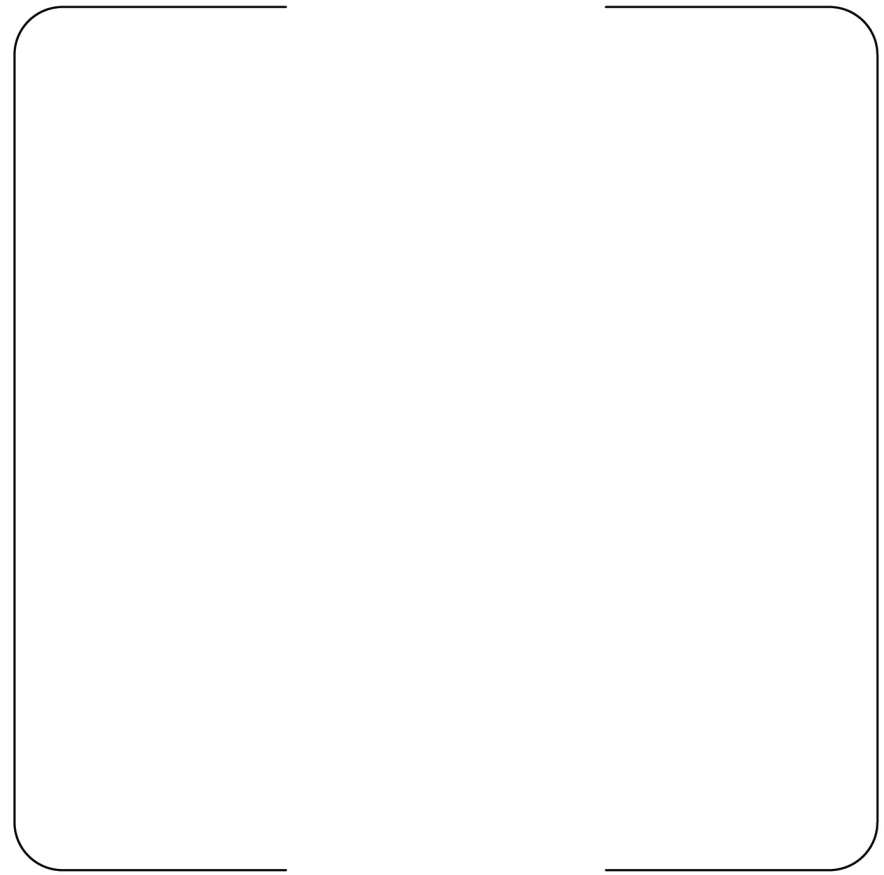


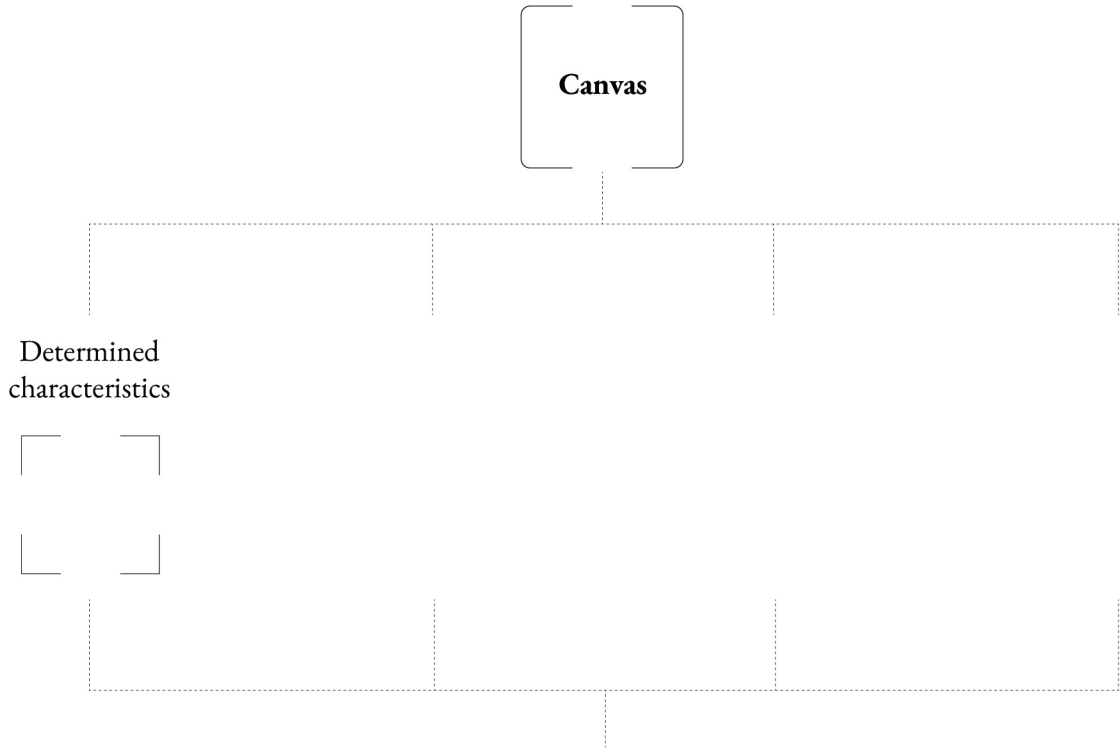


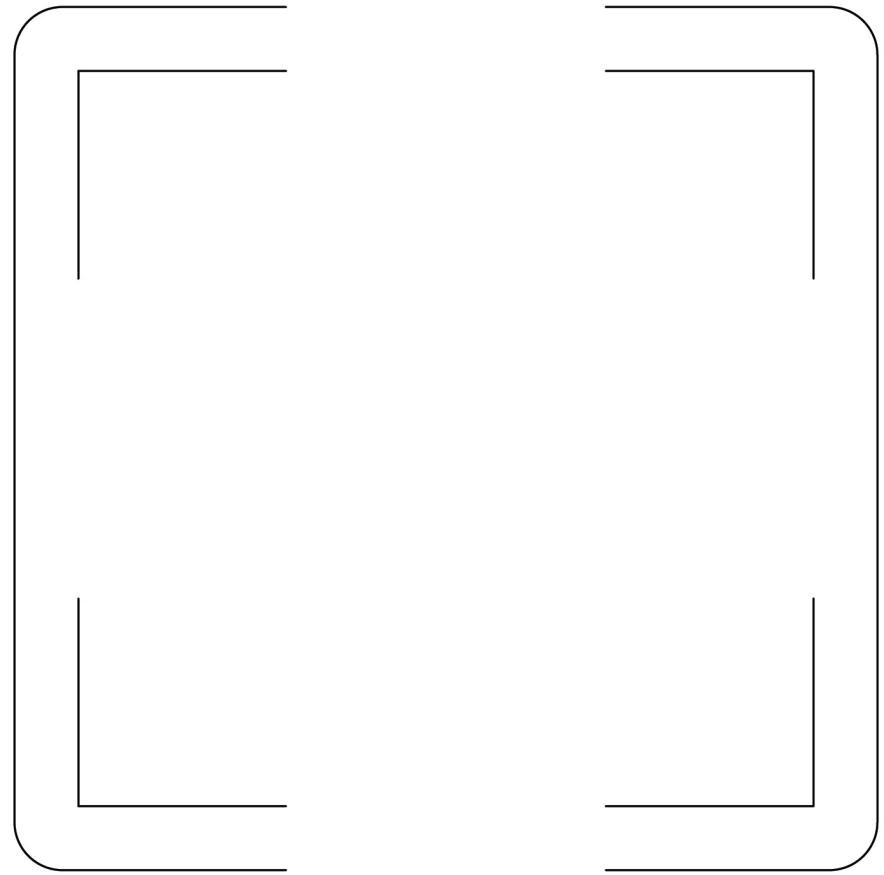


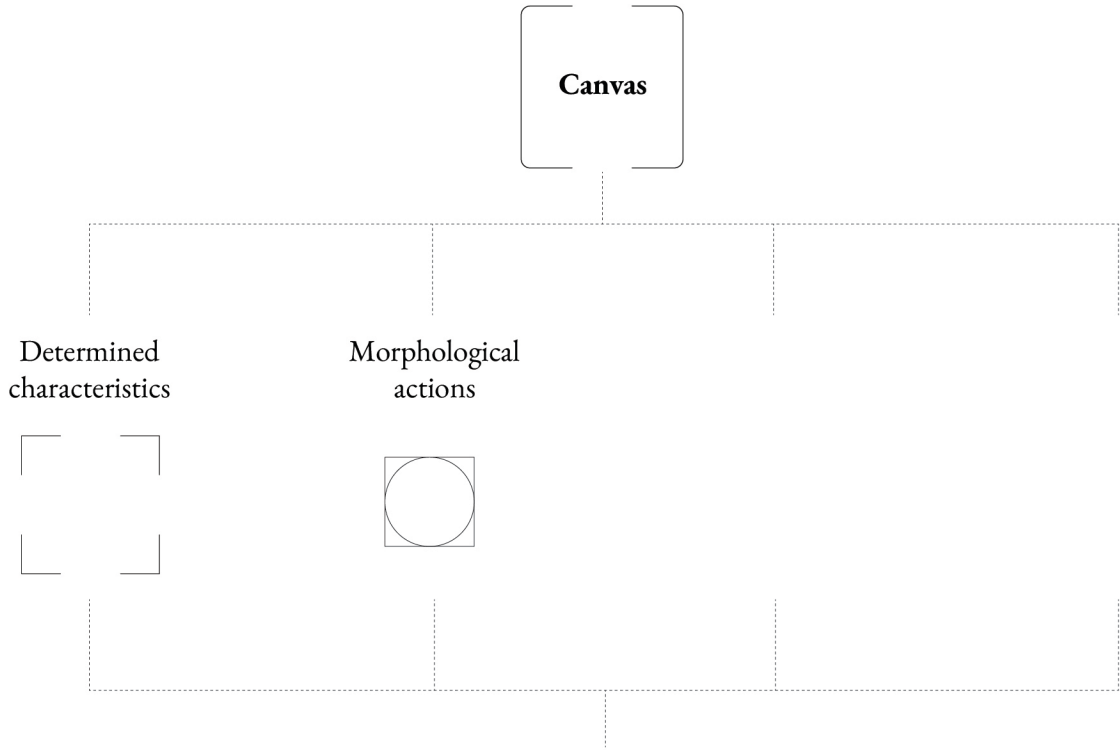

Canvas

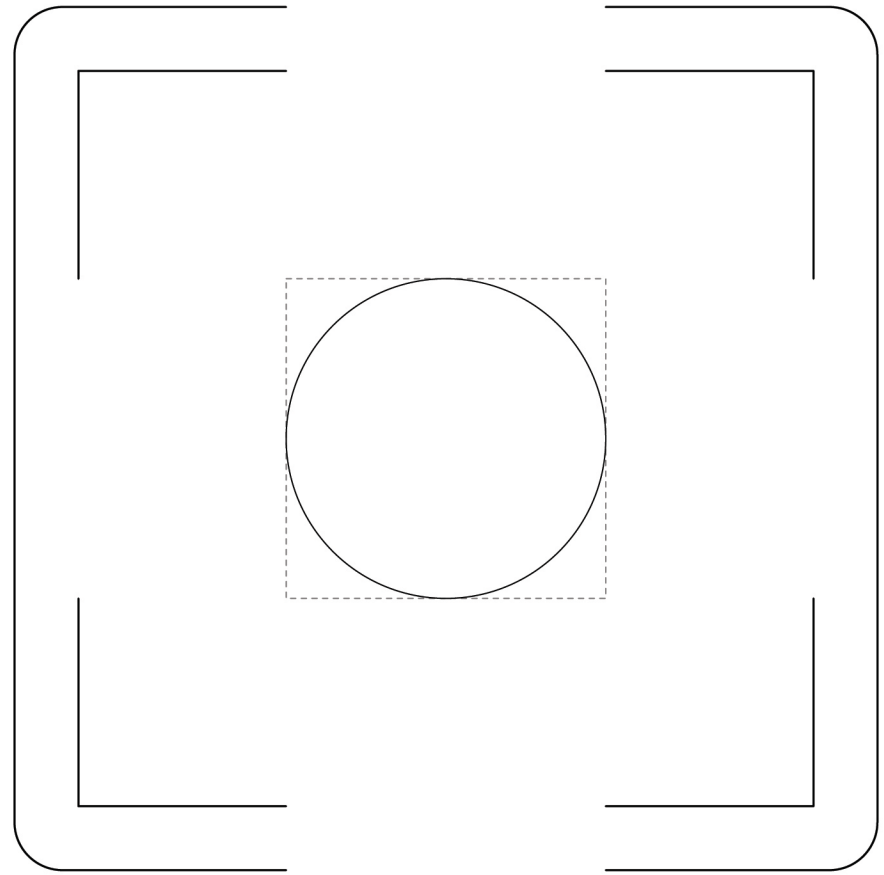

Canvas

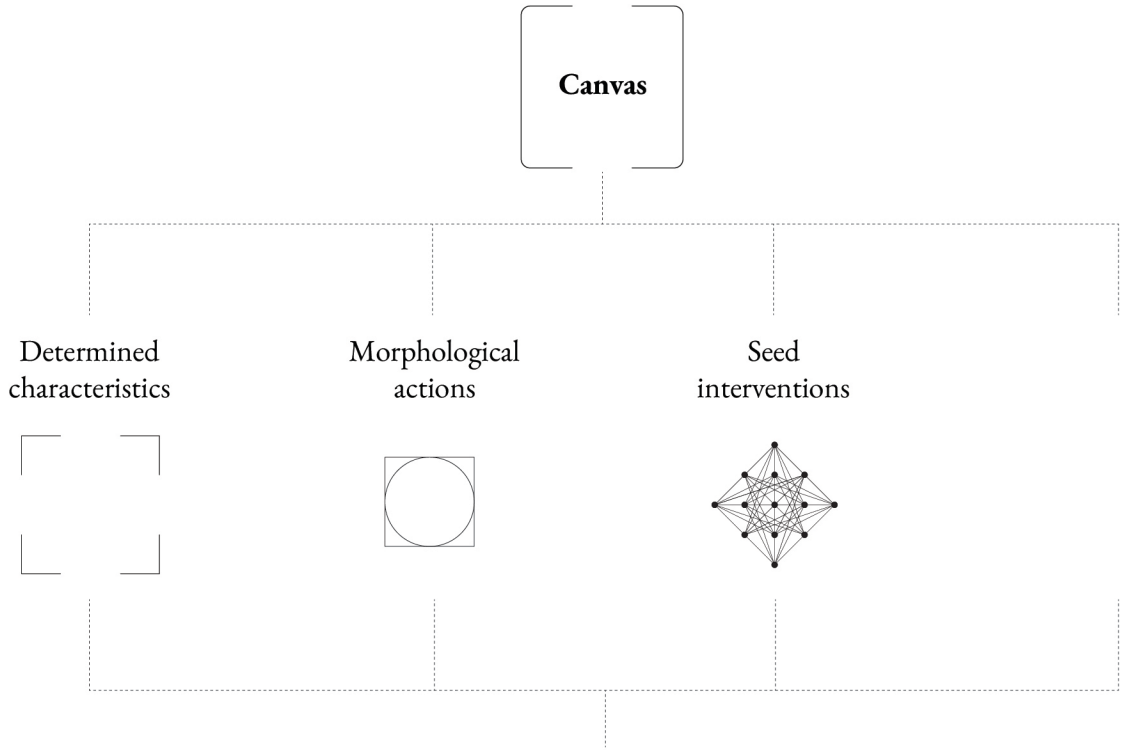


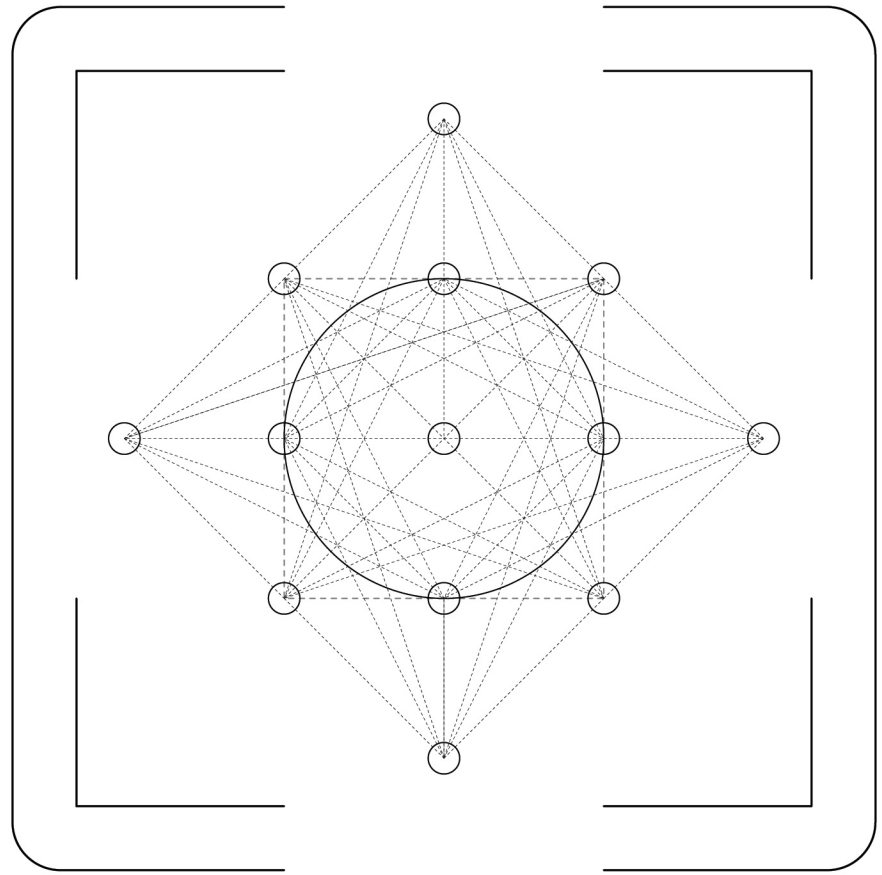

Canvas
Determined characteristics

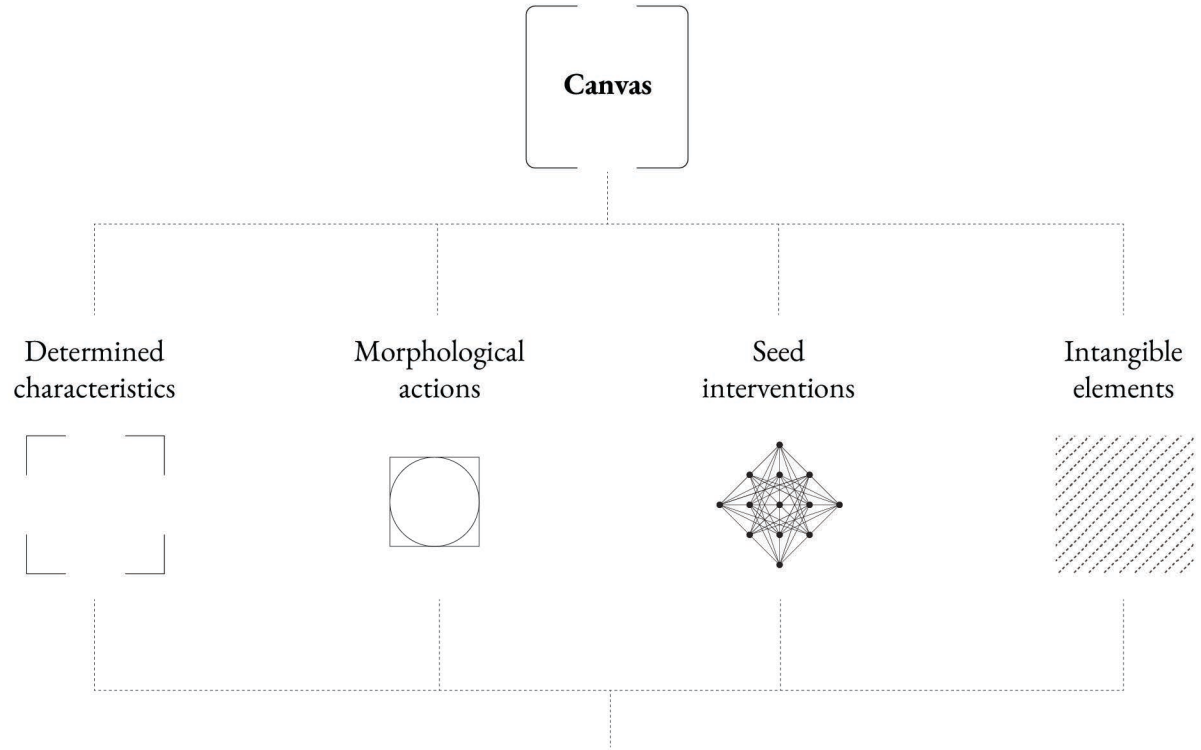


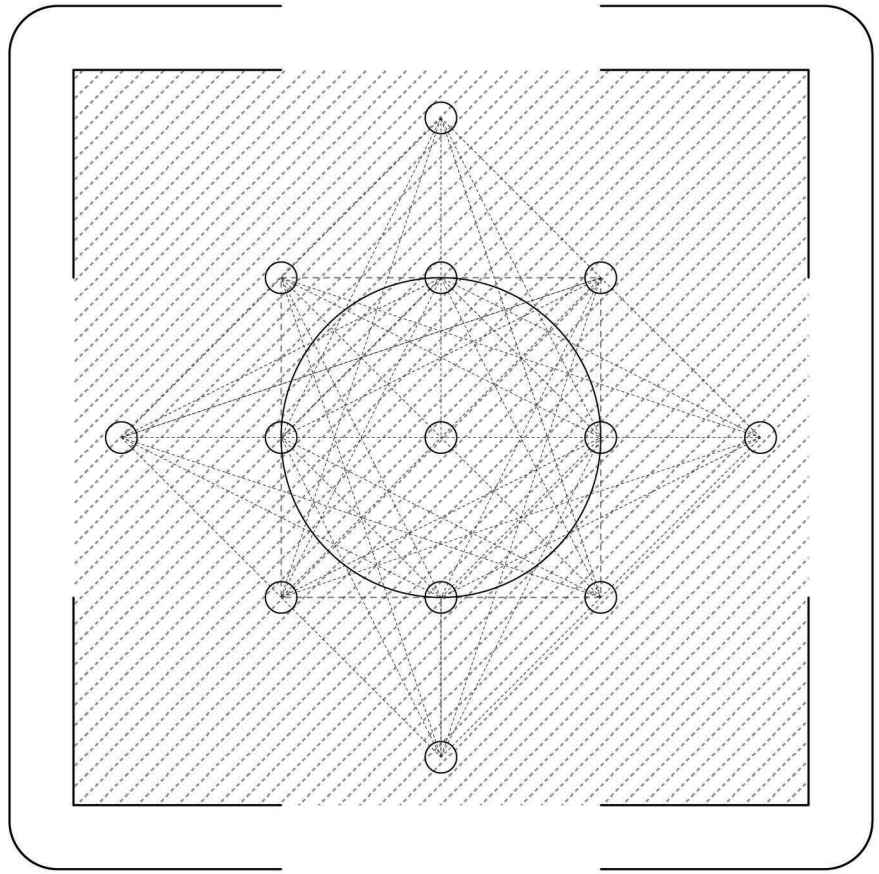

Canvas
Determined characteristics
Morphological actions

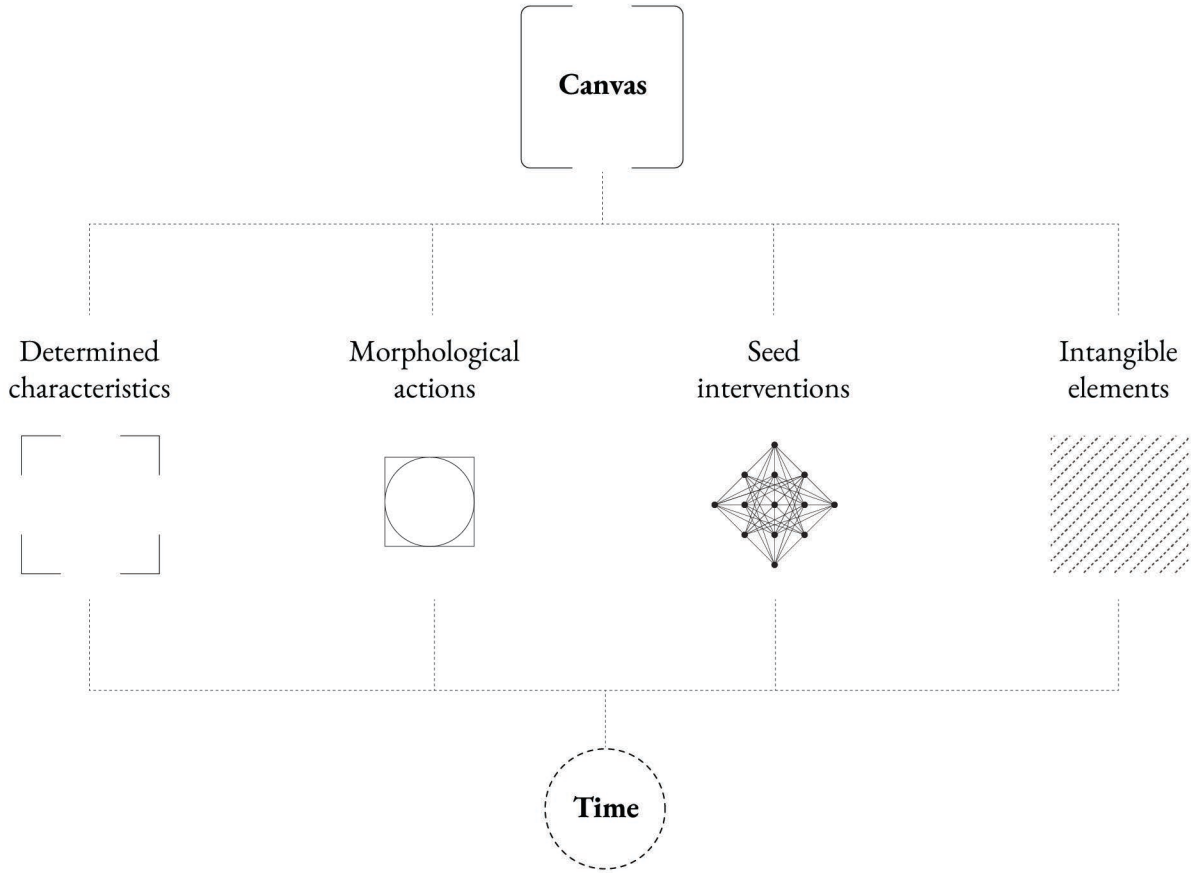


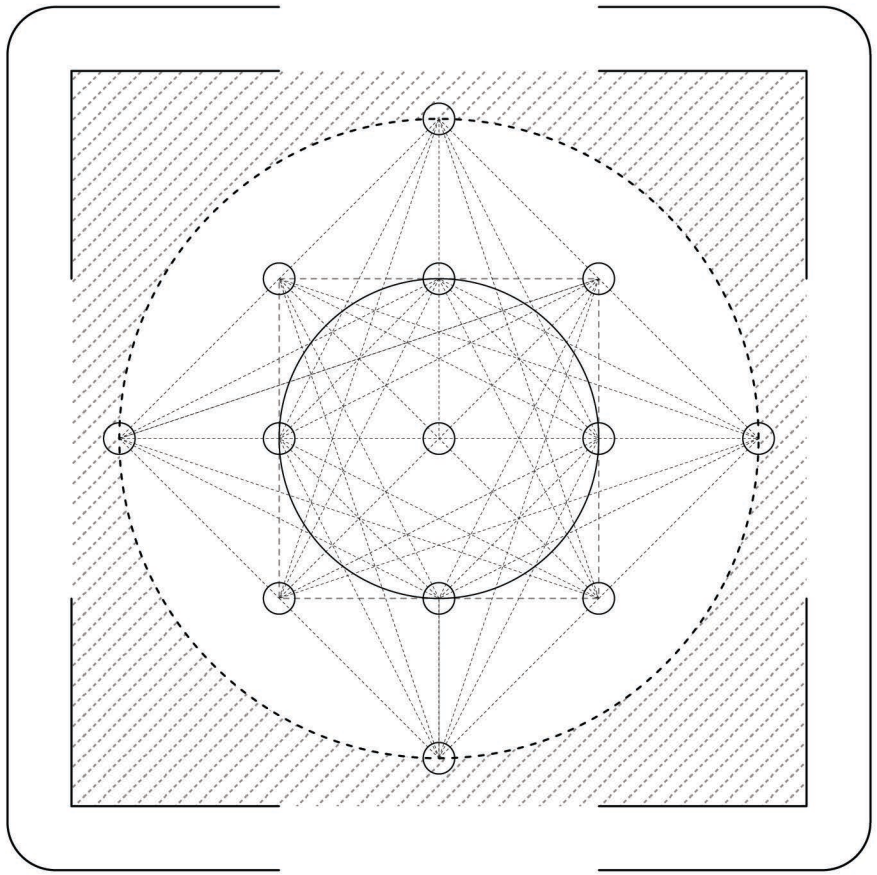

Canvas
Determined characteristics
Morphological actions
Seed interventions




Canvas
Determined characteristics
Morphological actions
Seed interventions
Intangible elements




Canvas
Determined characteristics
Morphological actions
Seed interventions
Intangible elements
Time



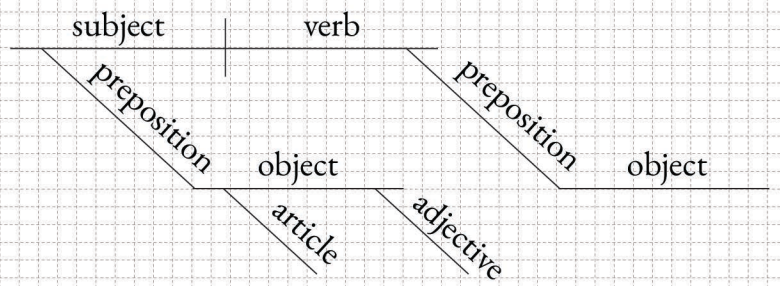
Defining Criteria

- Seamless integration
- The beach tackles pollution
- Is a horizon/collective space

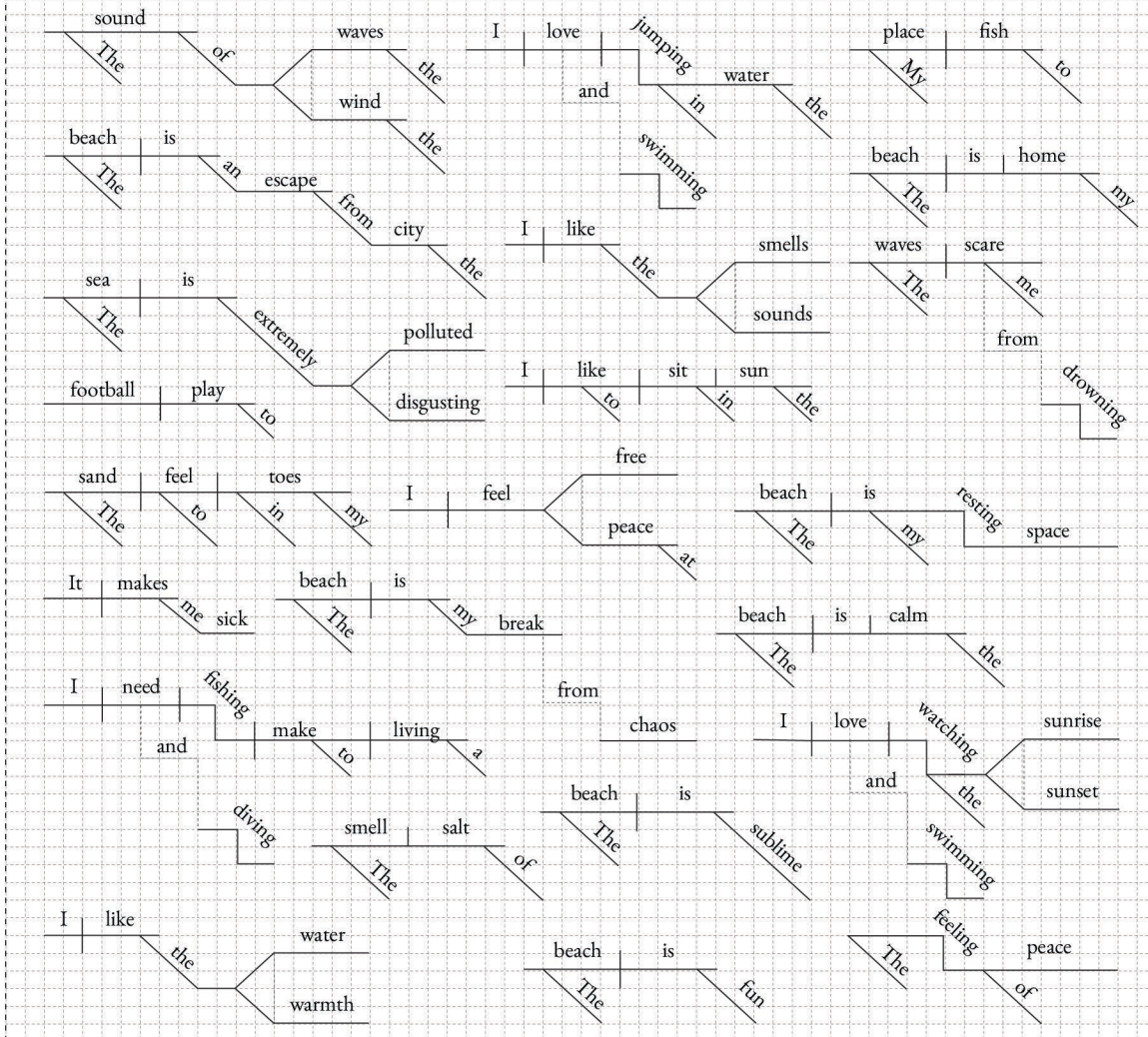
Fragments of beach conditions as a diffused state of being

شو بيعنيلك البحر ؟

شو بيعنيلك البحر ؟



شو بيعنيلك البحر ؟



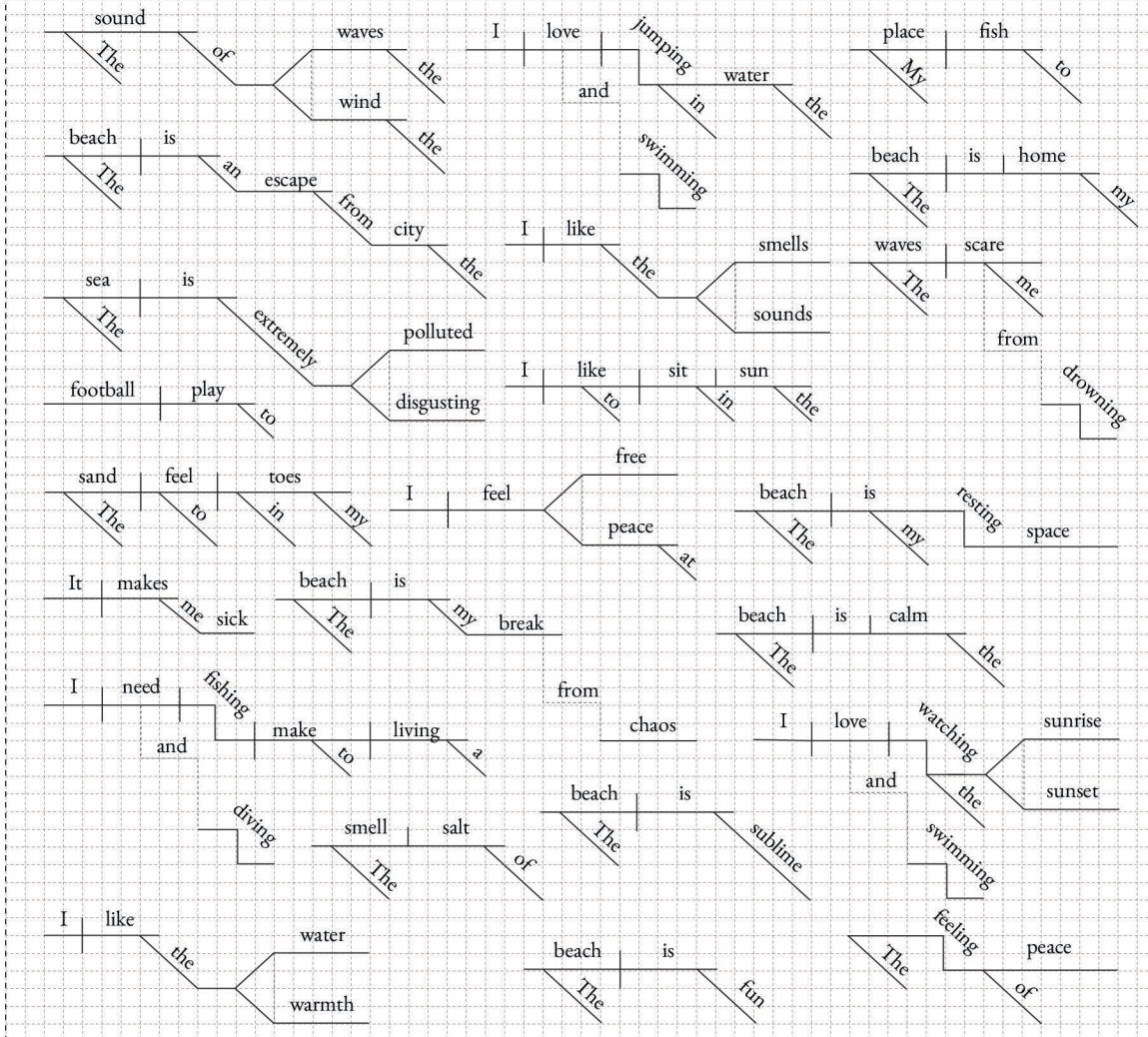
Subjects


شو بيعنيلك البحر ؟
waves
wind
beach
sand
sea
sand
beach
water
beach
salt
water
beach
sun
horizon
beach
place
fish
rocks
home
waves
sunrise
sunset

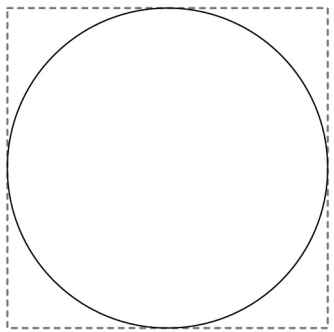
Verbs


شو بيعنيلك البحر ؟
jumping
feeling
playing
drowning
running
resting
looking
fishing
watching
diving
swimming
sleeping

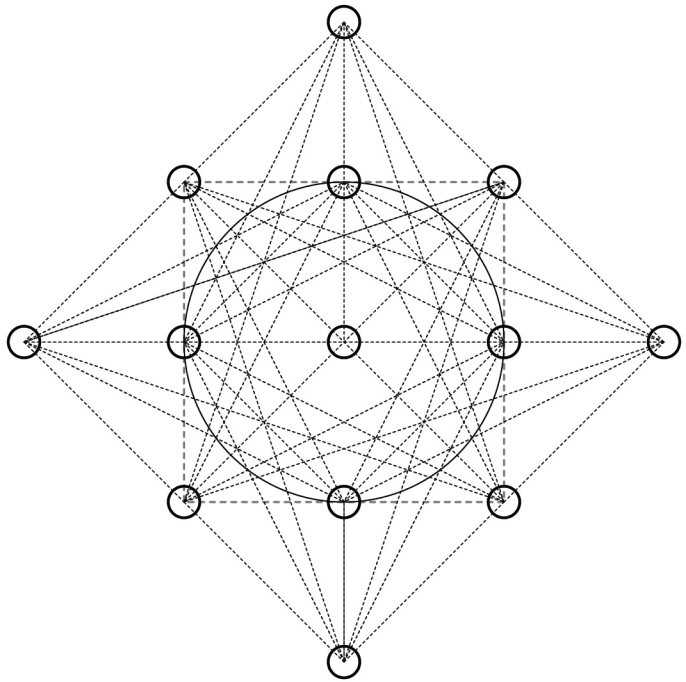
شو بيعنيلك البحر ؟



Morphological actions



Seed Interventions





Rotate



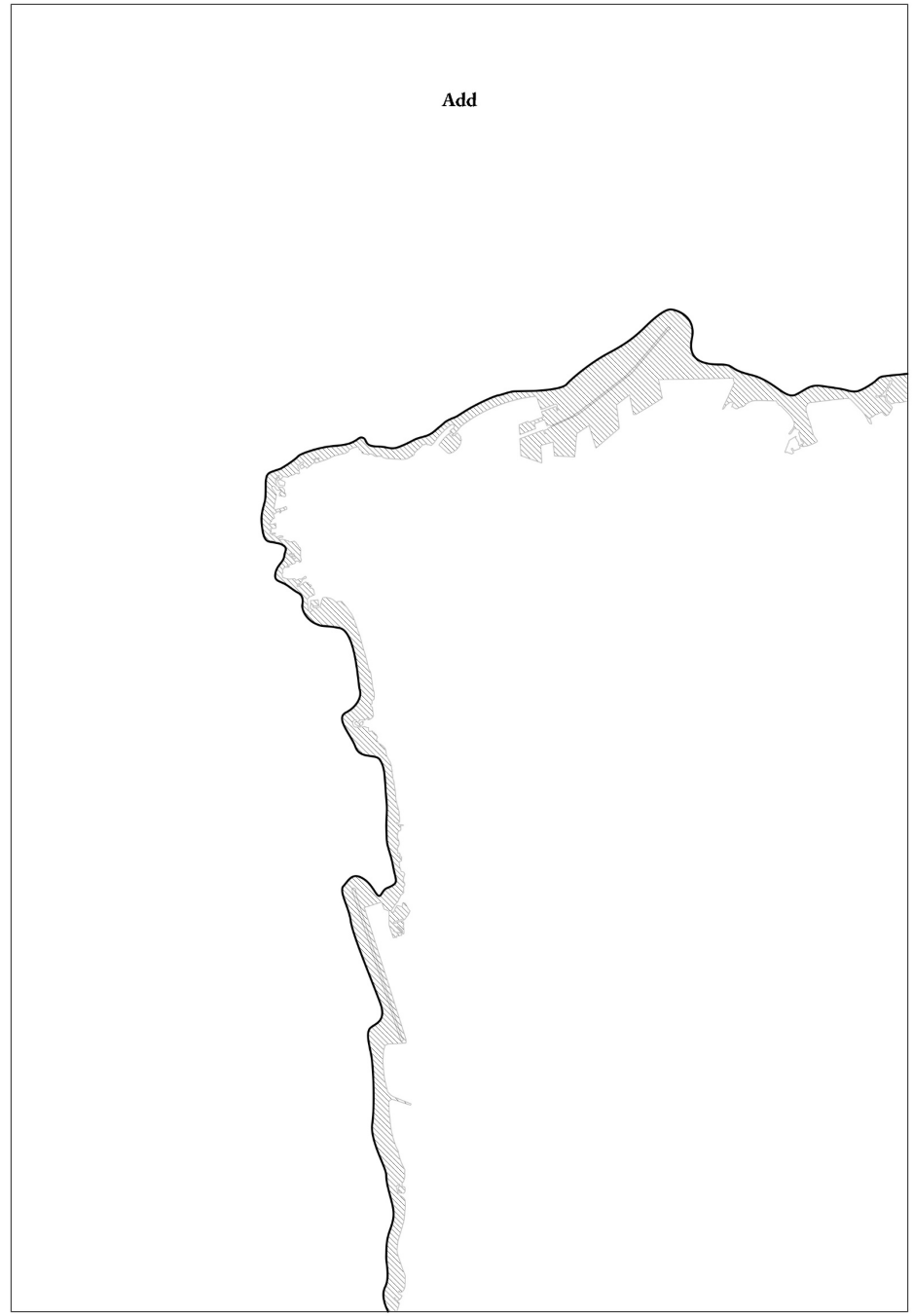
Move



Move



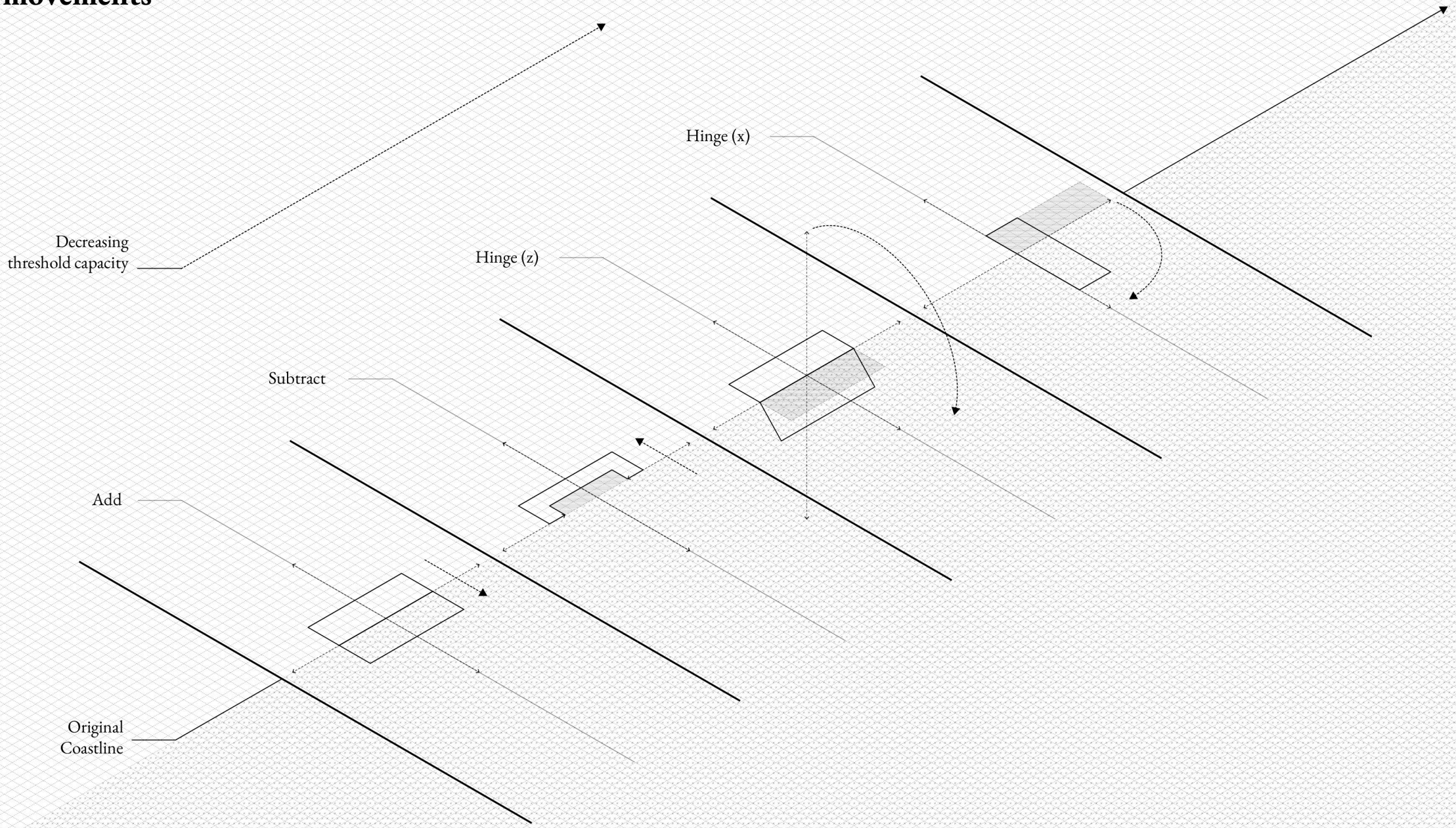
Add



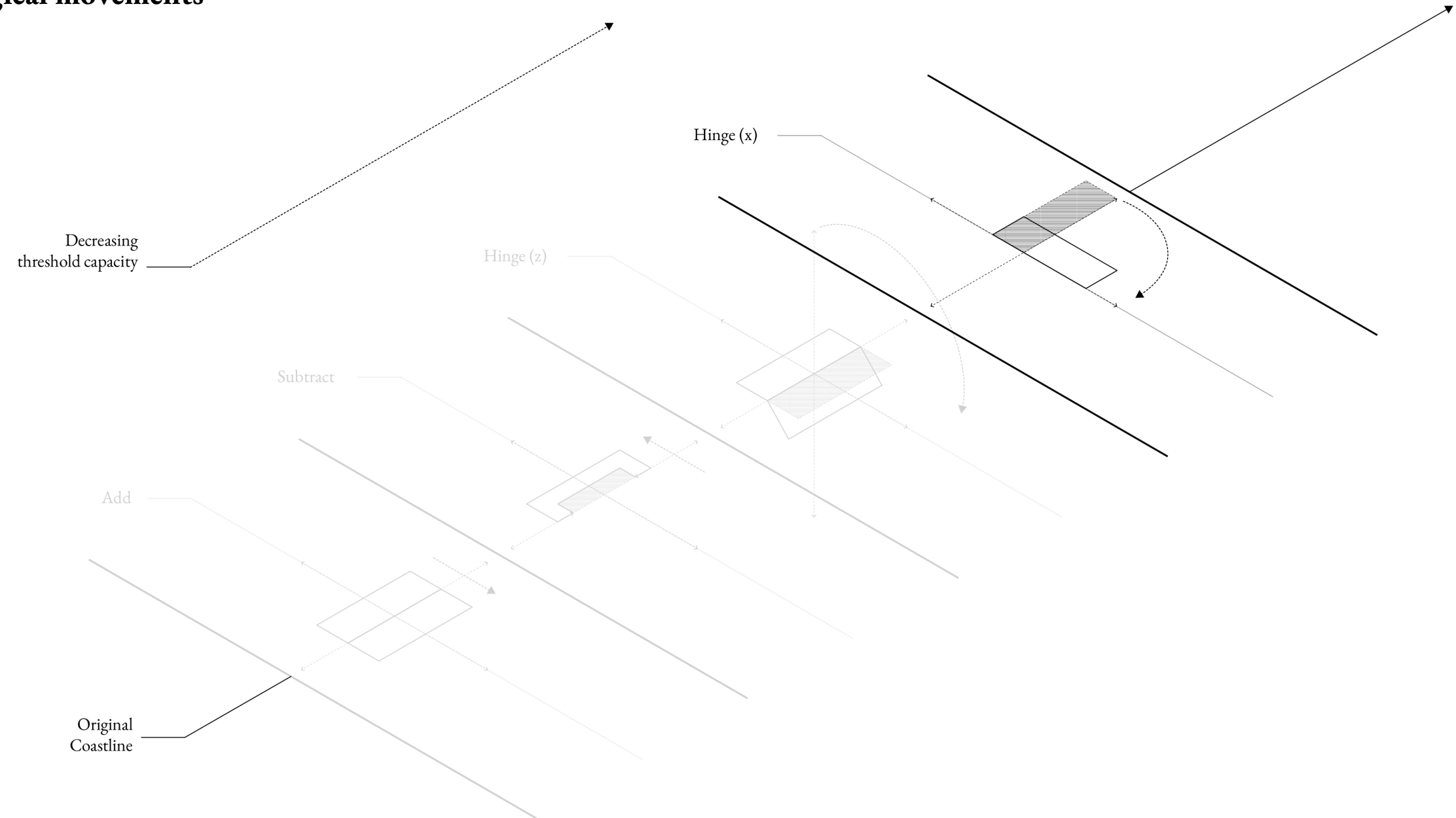
Subtract

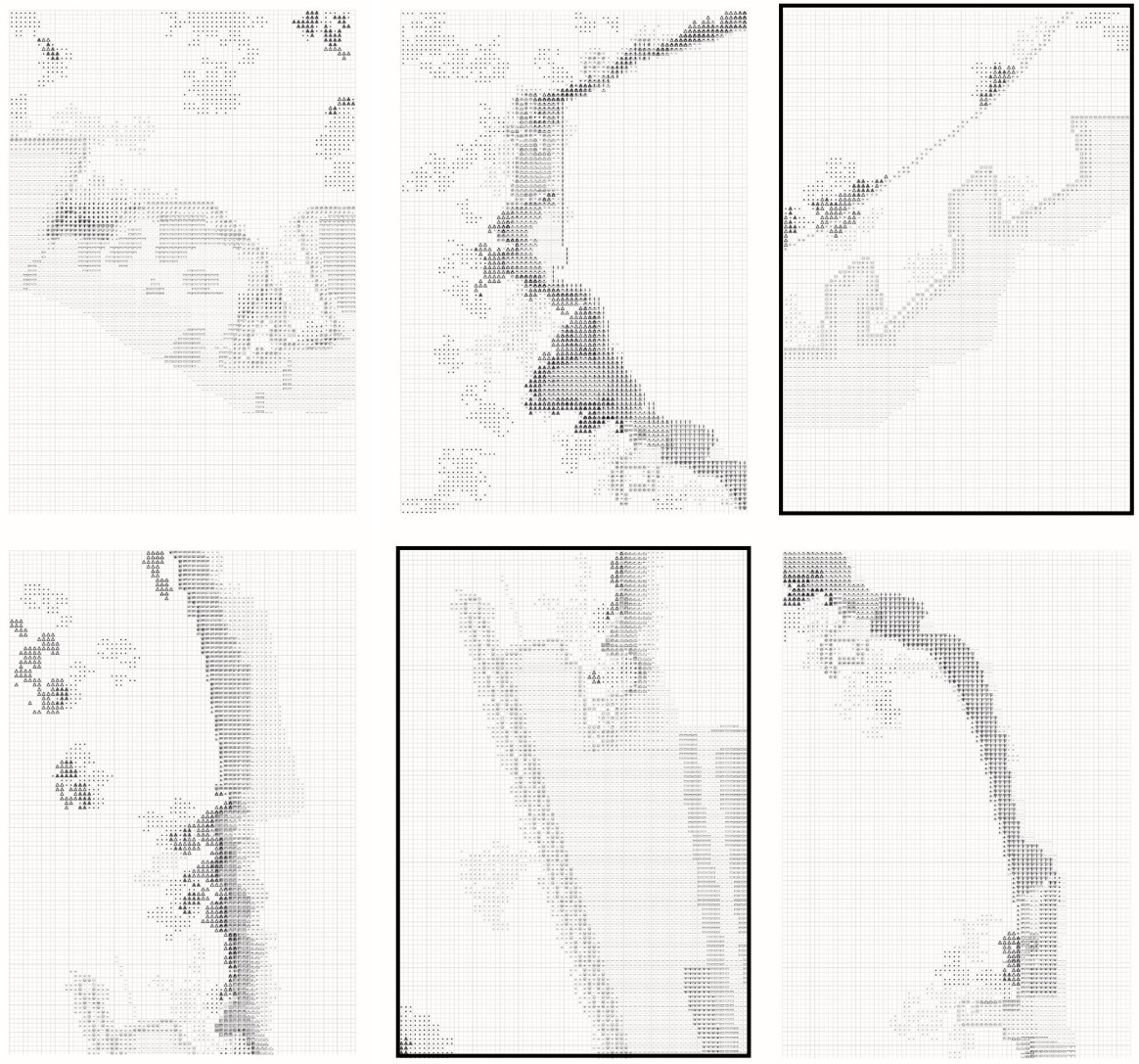


Morphological movements

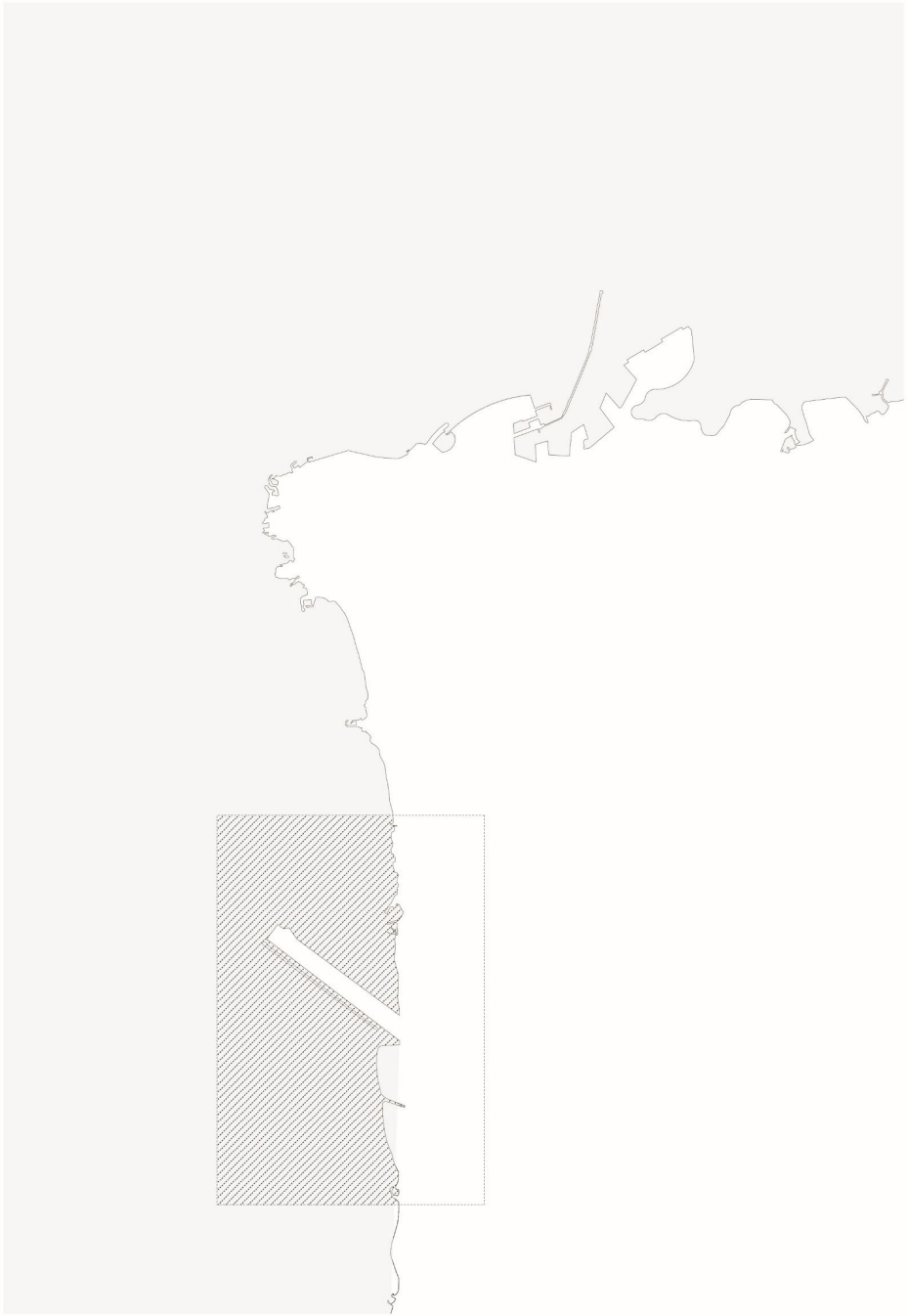


Morphological movements





Hinge (x) #1



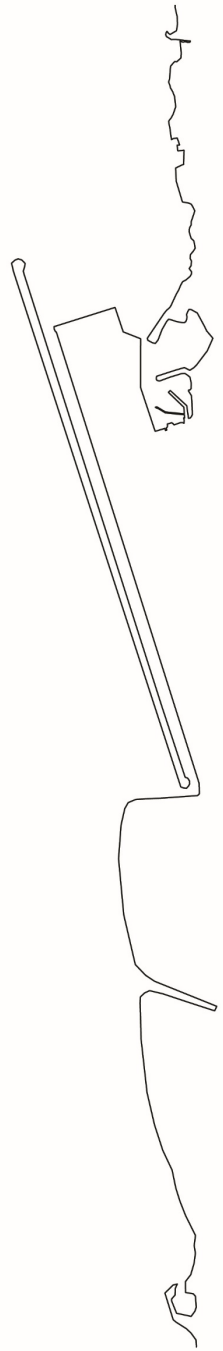
Hinge (x) #1

Runway 16/34



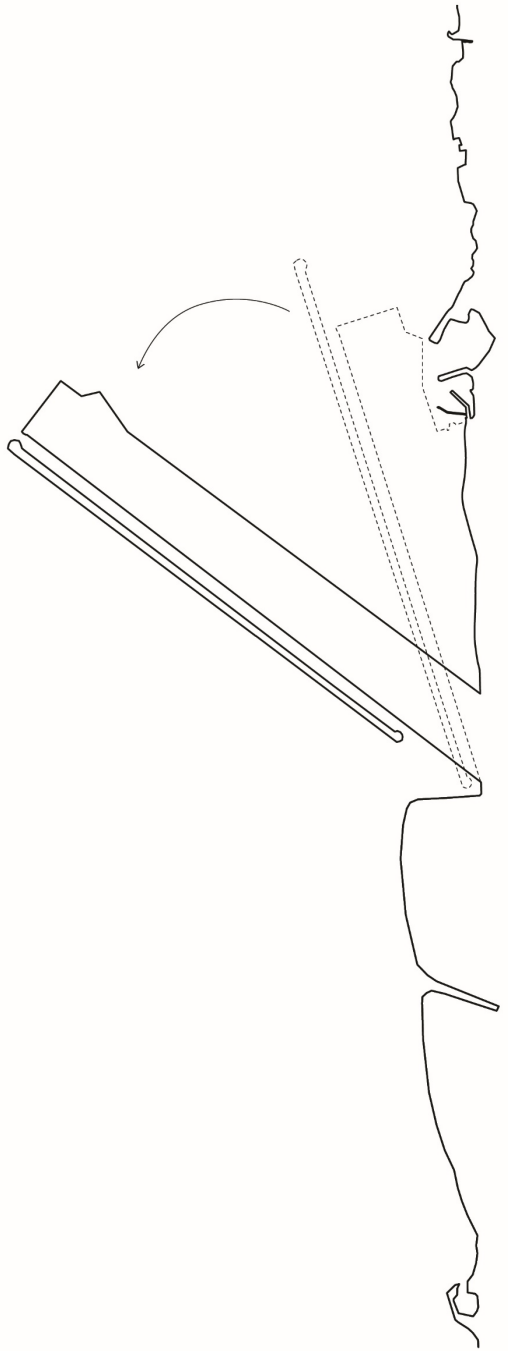
Hinge (x) #1

Runway 16/34



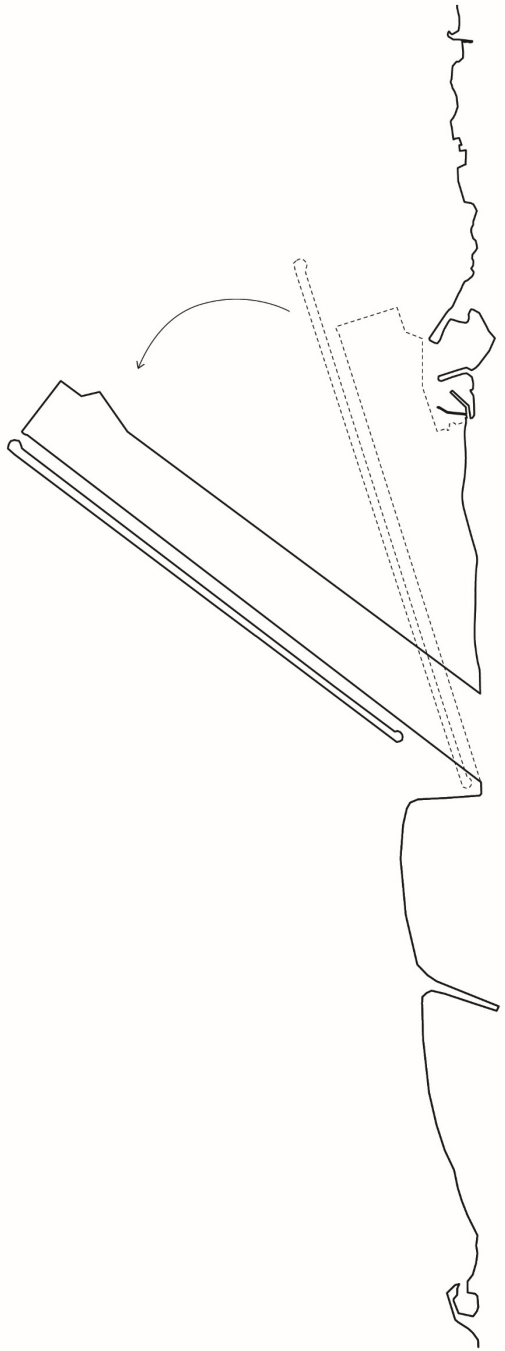
Hinge (x) #1

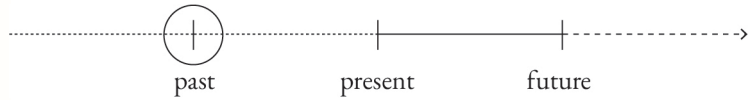
Runway 16/34

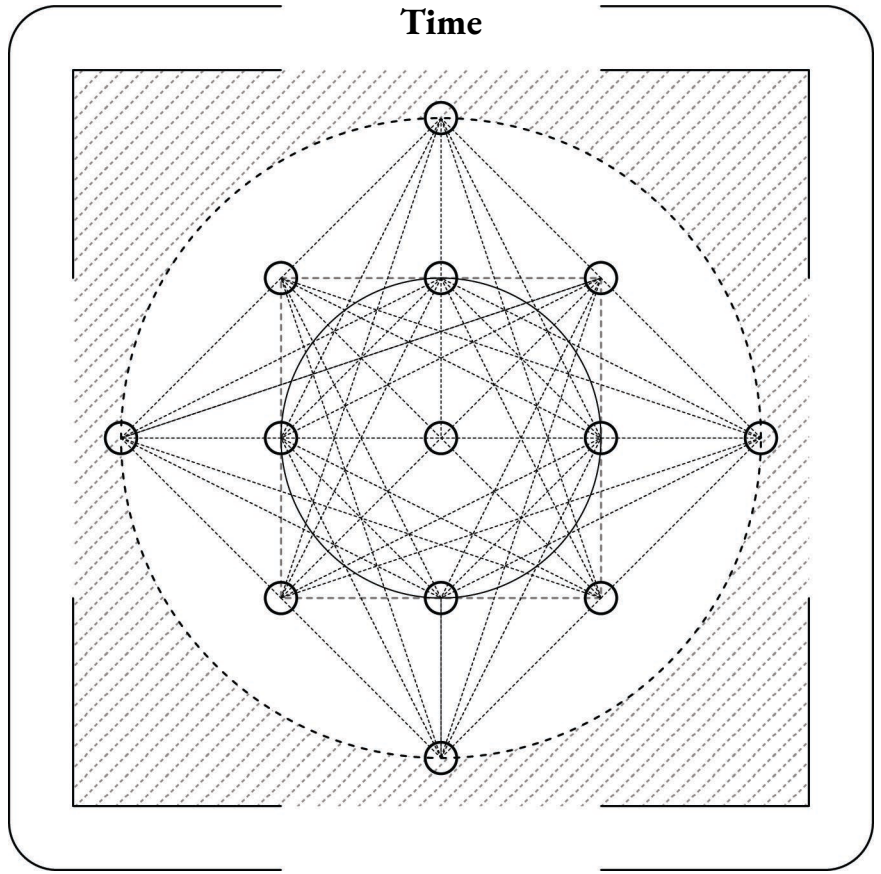


Hinge (x) #1

Runway 16/34

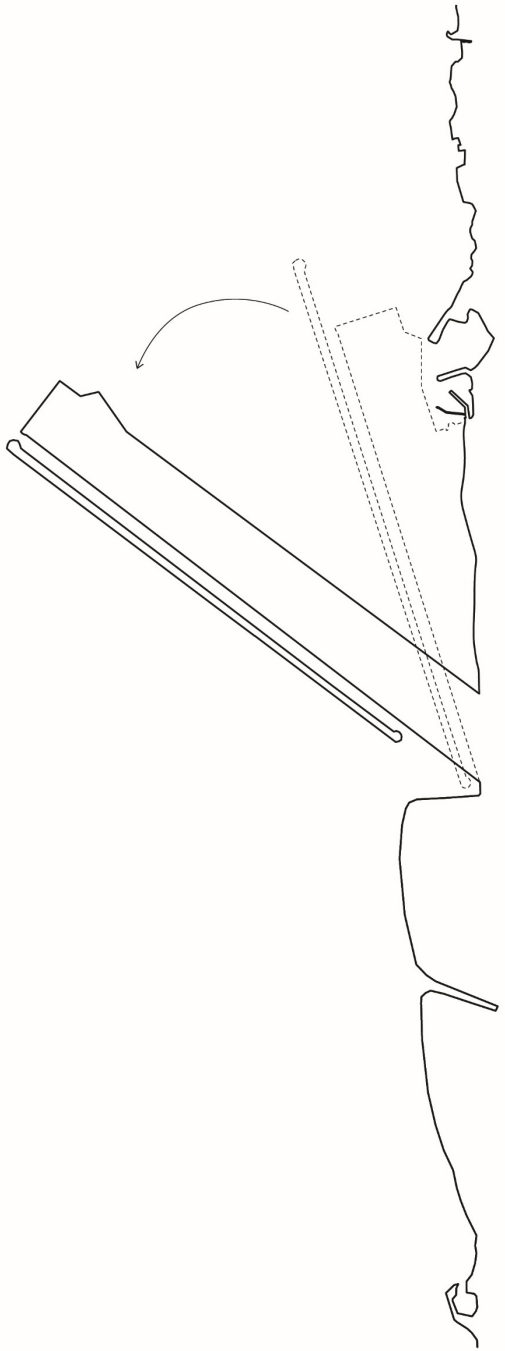


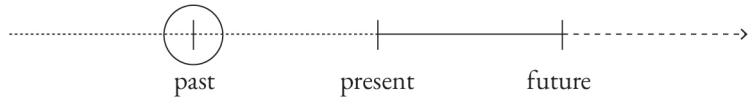



Time

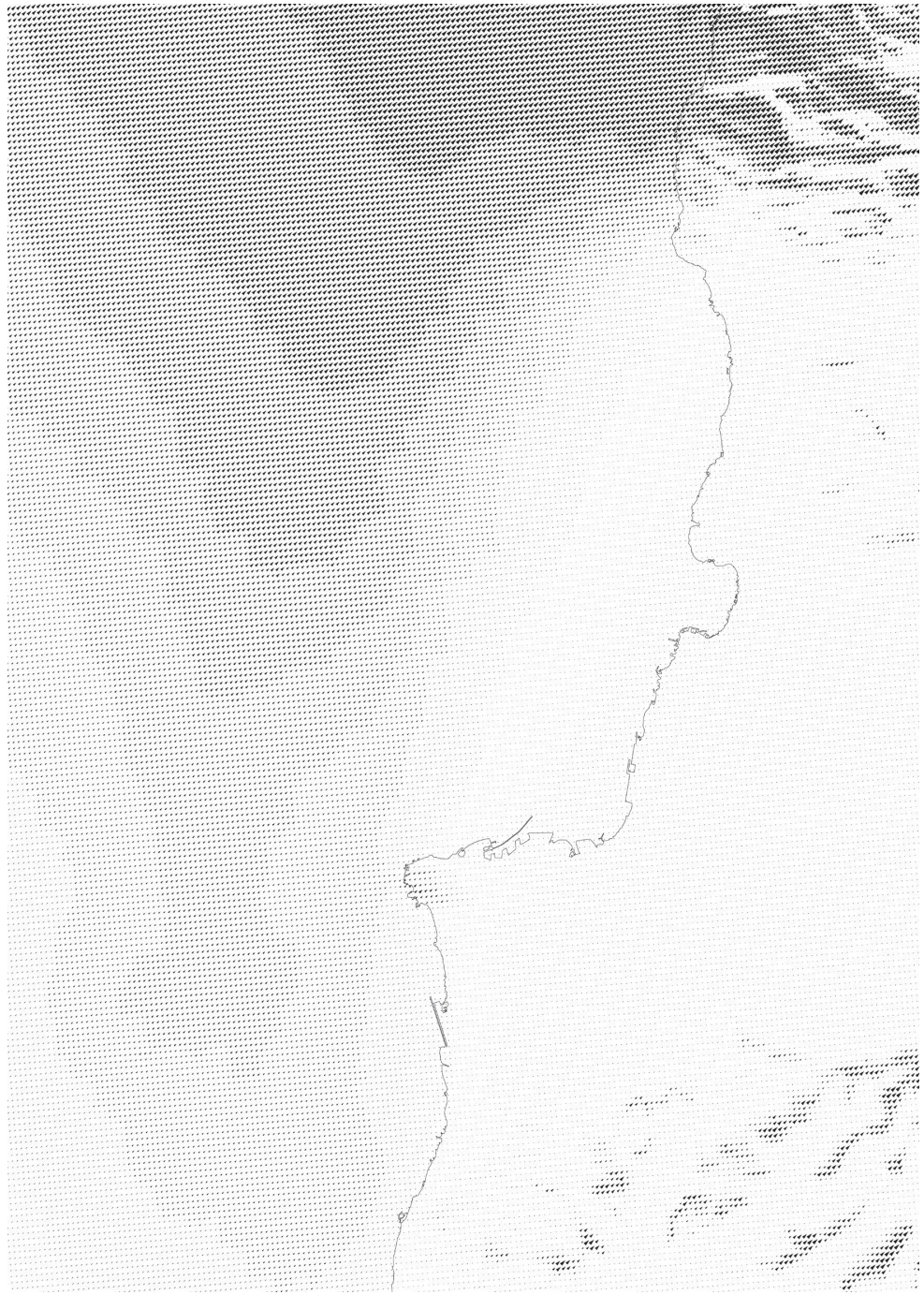
Hinge (x) #1

Runway 16/34



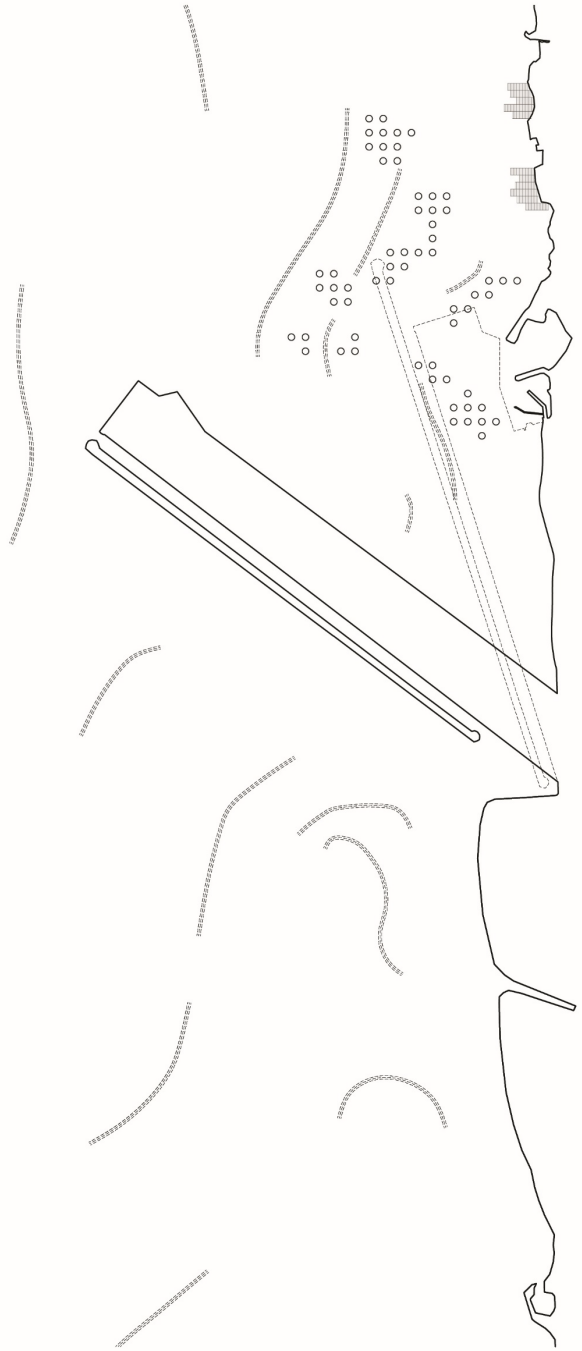


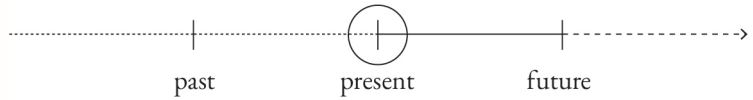
Wind, waves, and currents



Hinge (x) #1

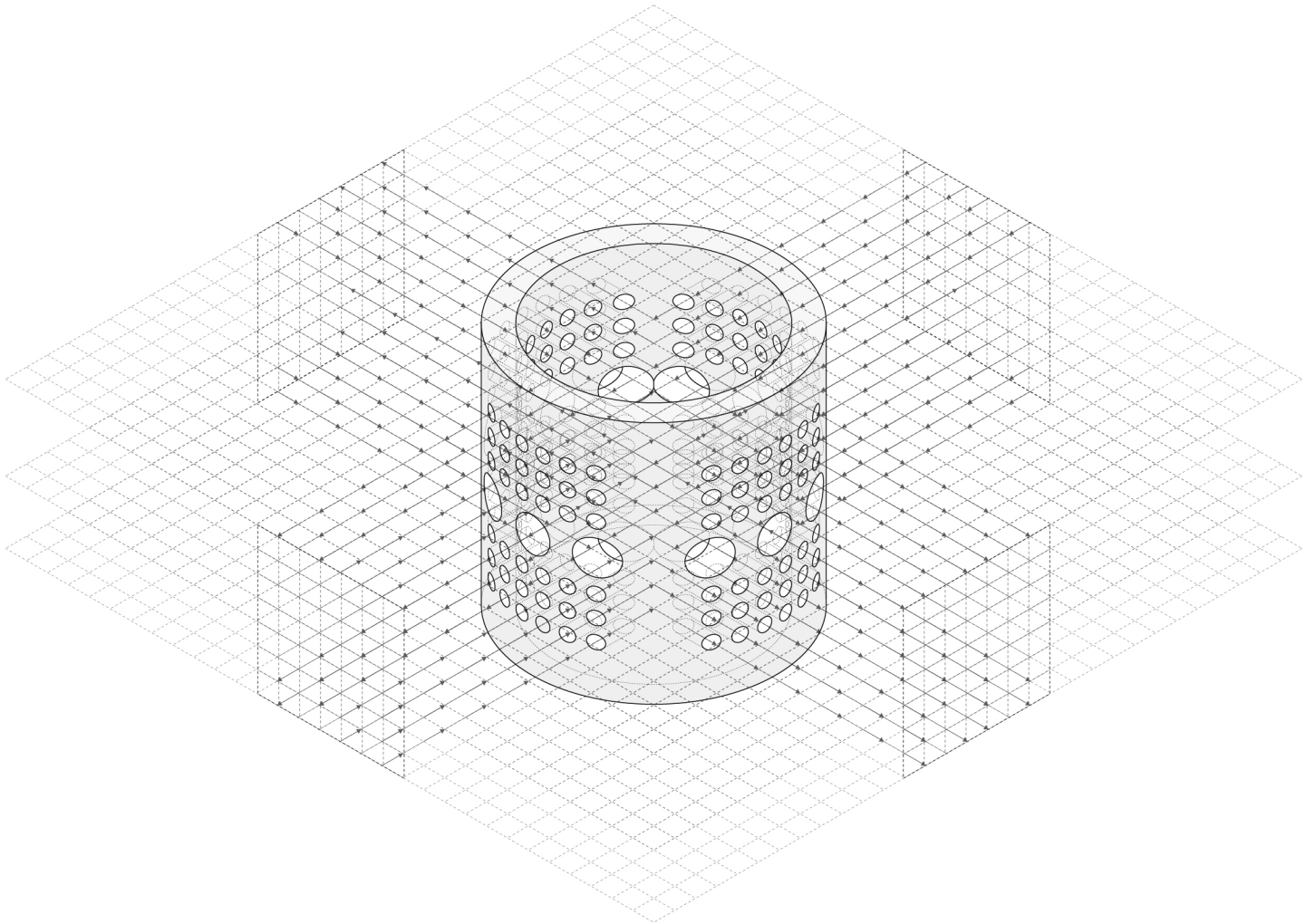
Runway 16/34

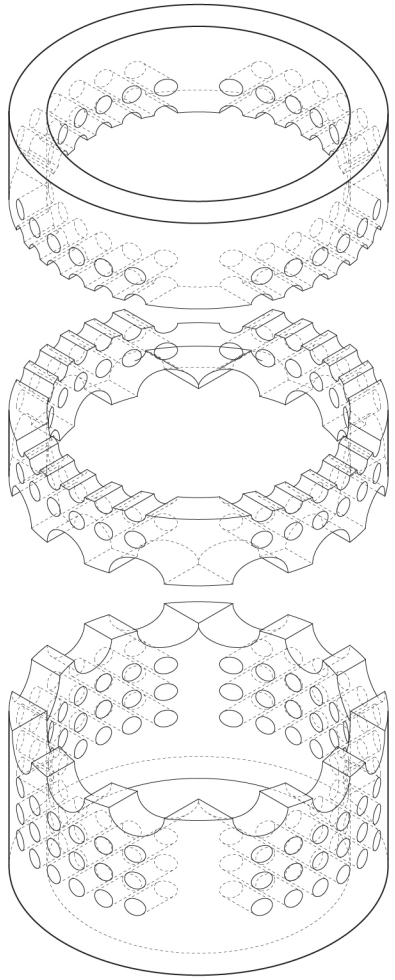




Seed Intervention

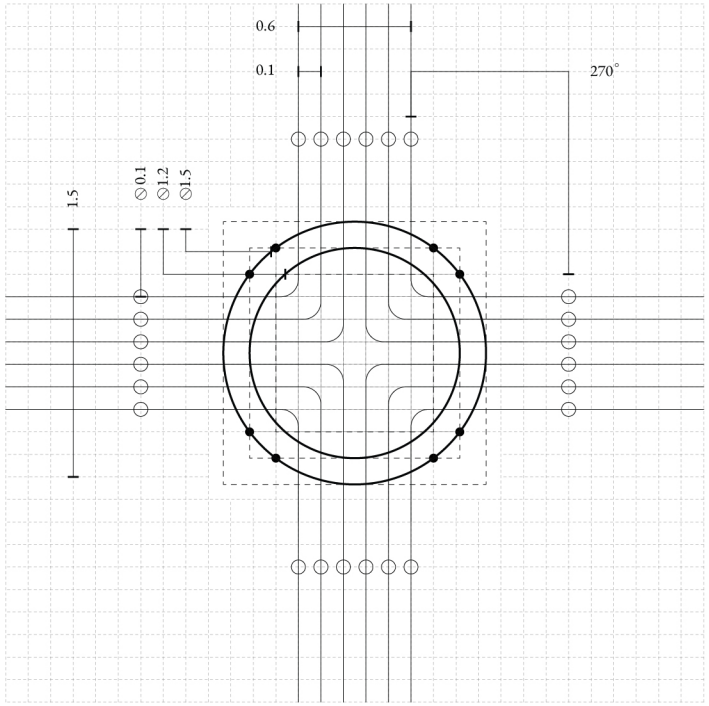
Submerged Biogenic Reefs

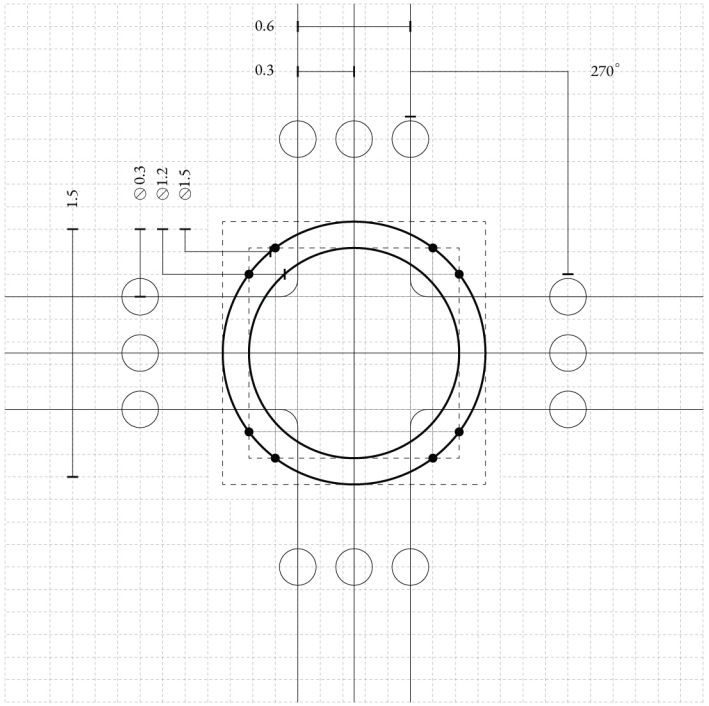


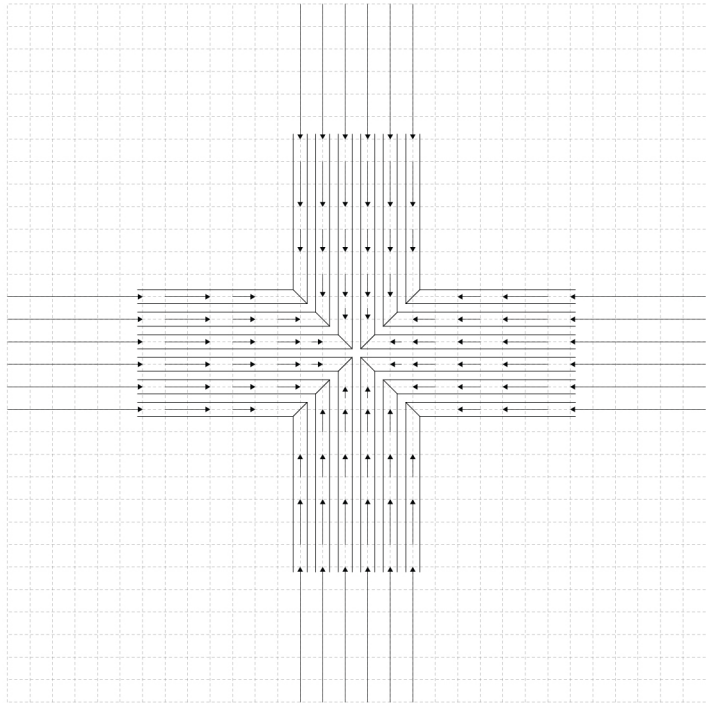


Seed Intervention

Submerged Biogenic Reefs

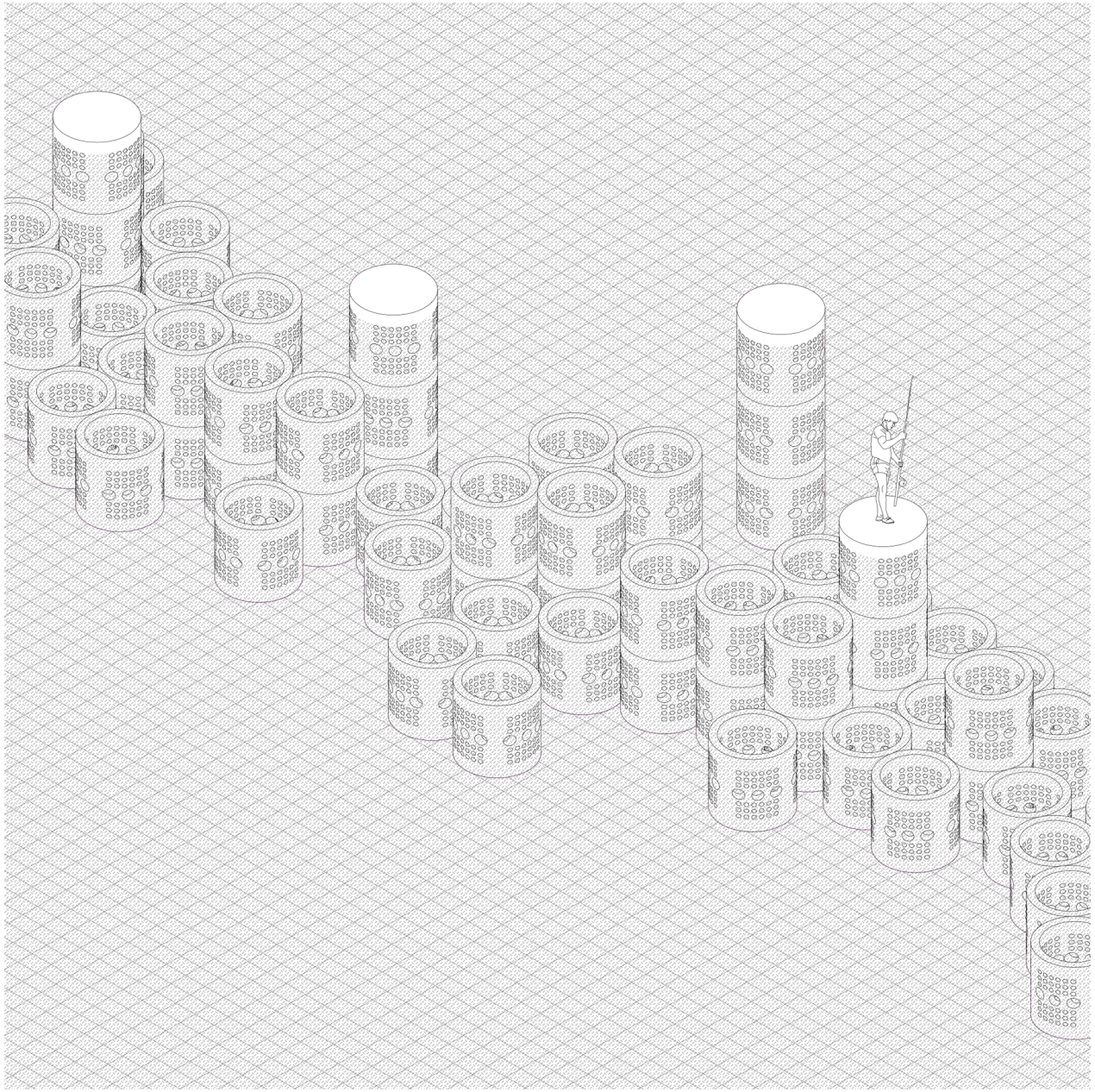






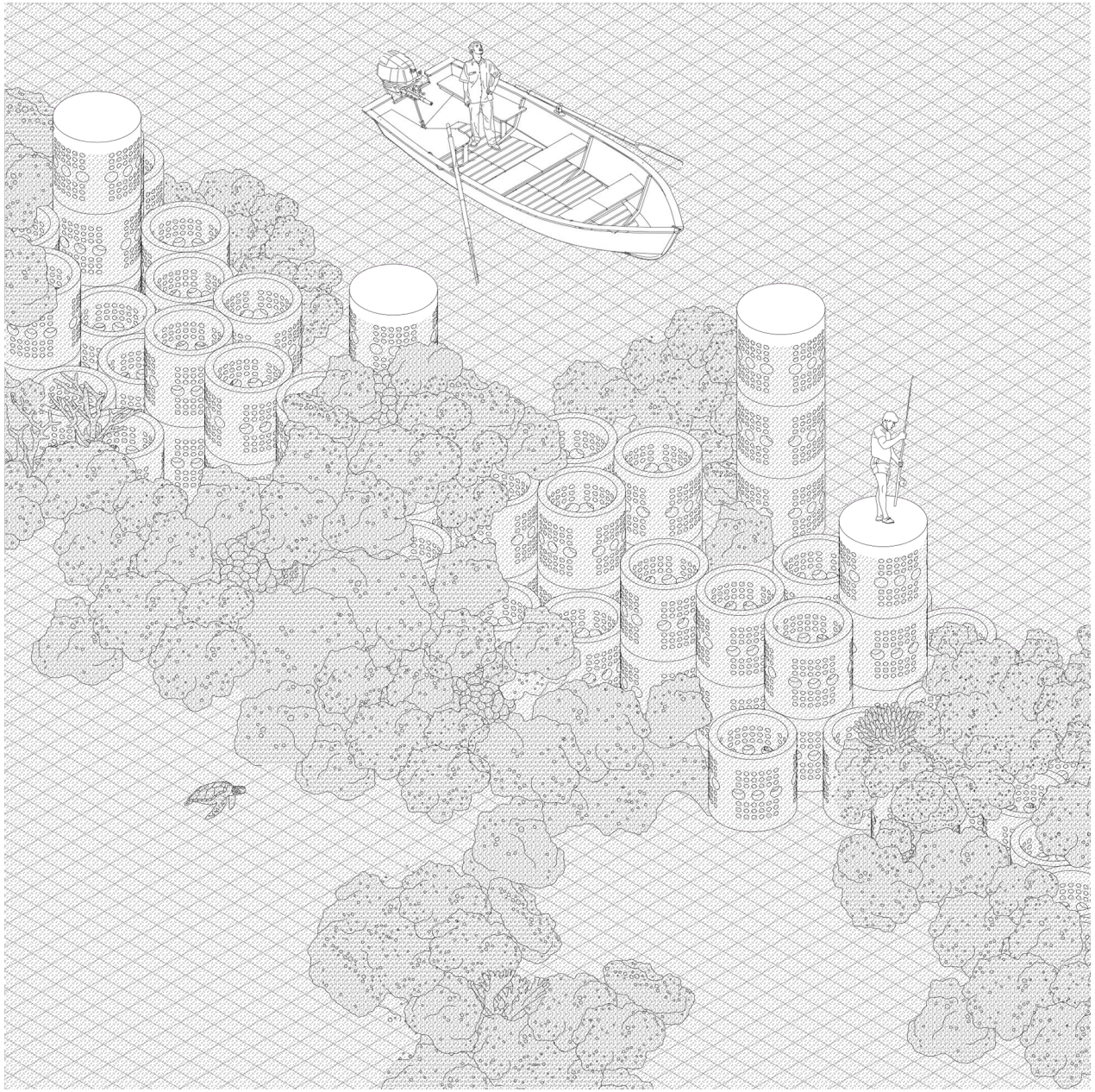
Seed Intervention

Submerged Biogenic Reefs



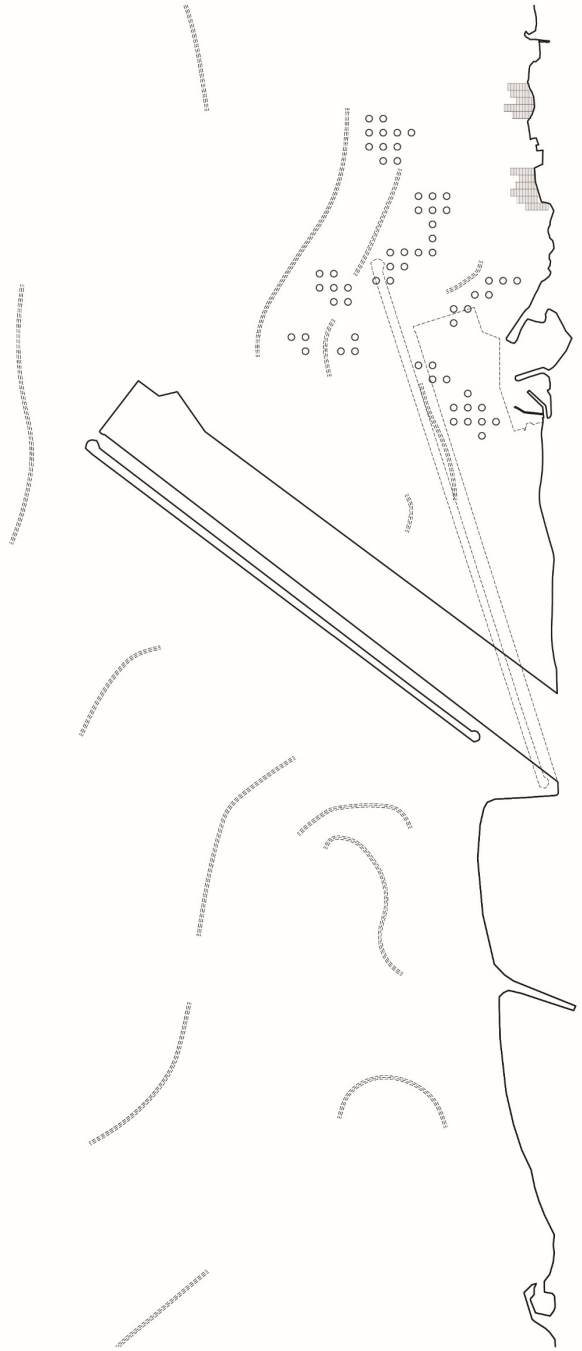
Seed Intervention

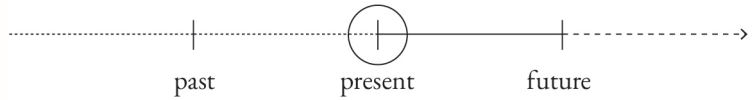
Submerged Biogenic Reefs



Hinge (x) #1

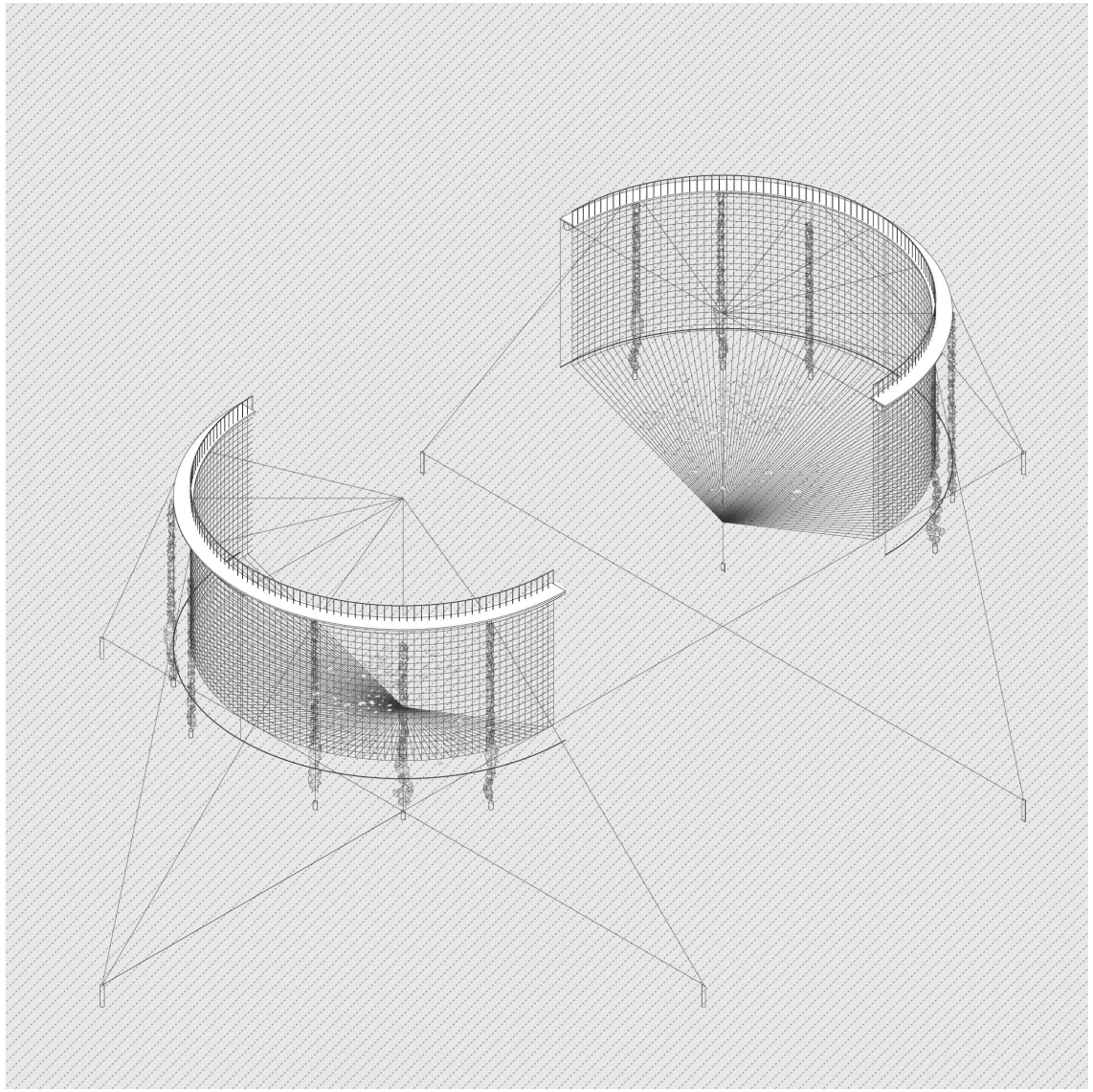
Runway 16/34

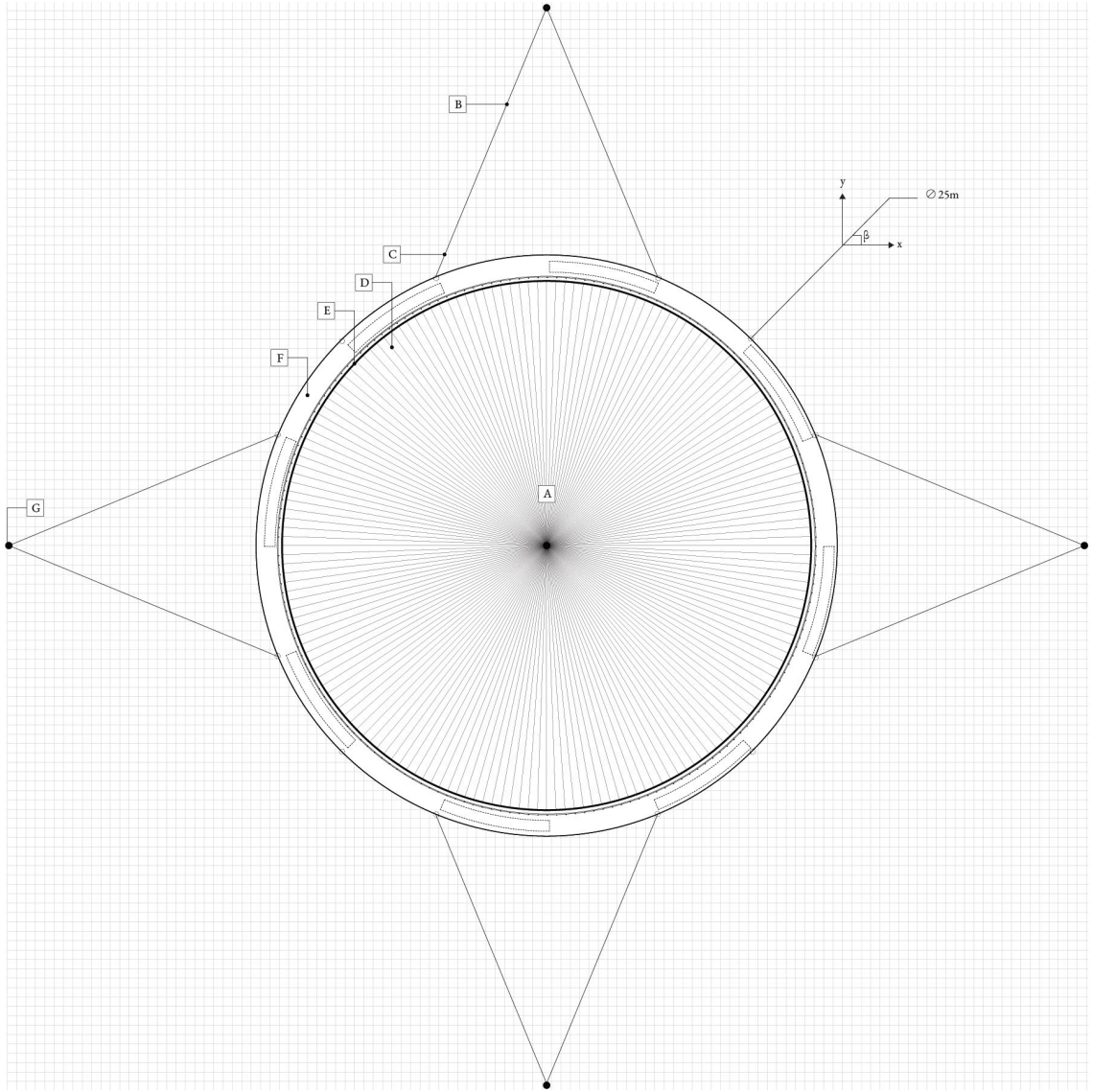




Seed Intervention

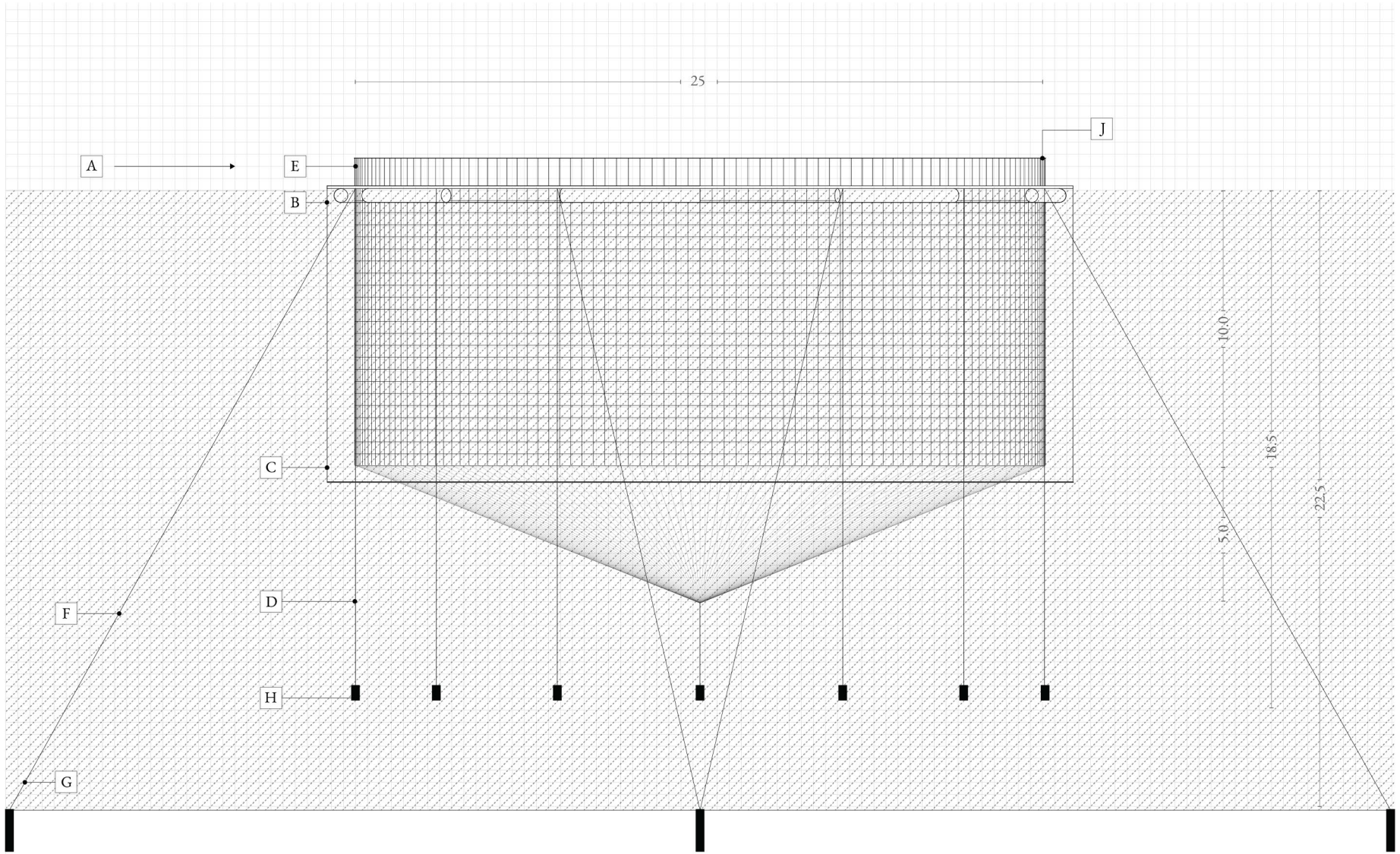
Fish Quadrats





Seed Intervention

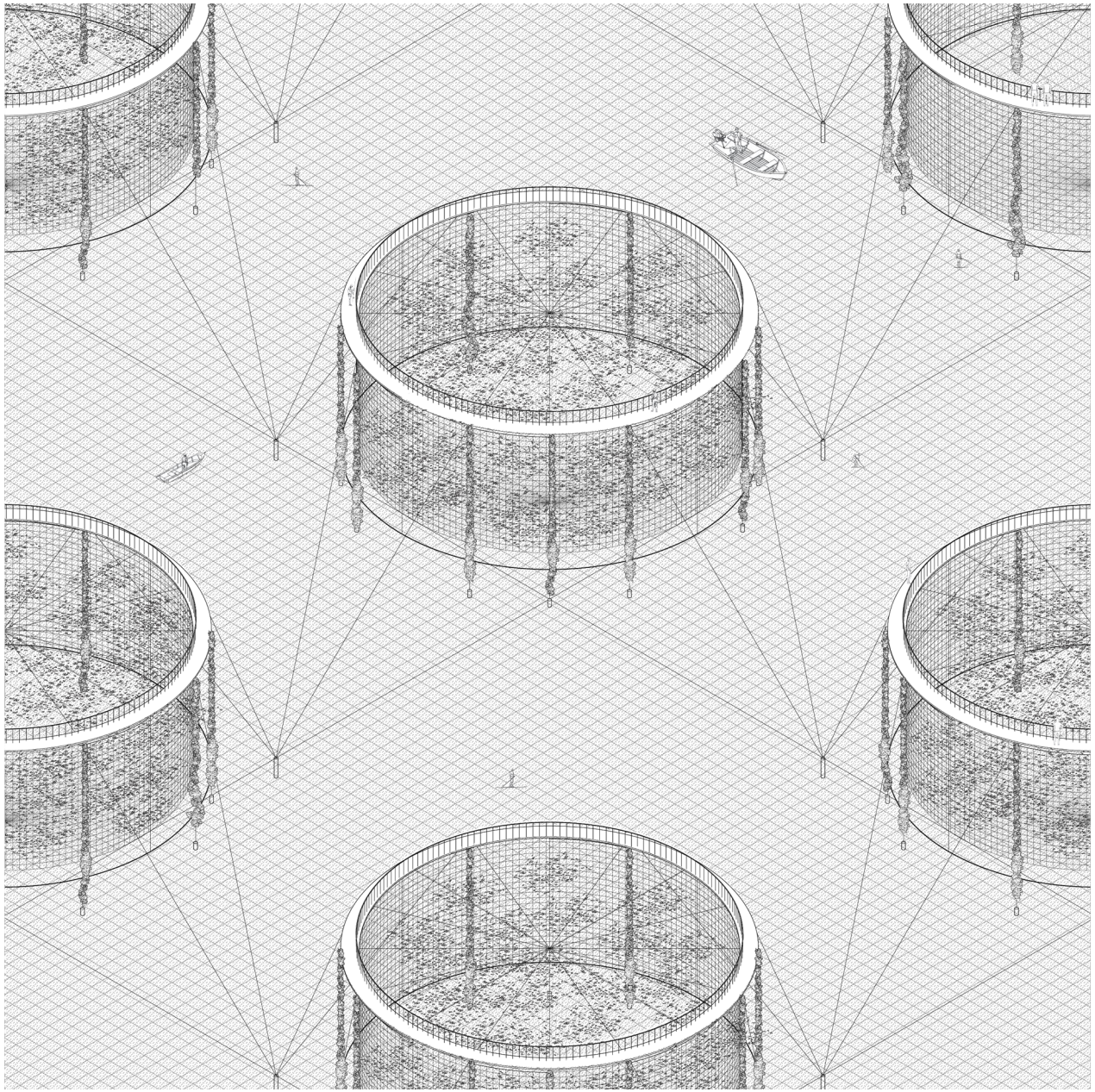
Fish Quadrats



A Incident wave direction
B Floating bouy
C Sinker tubes
D Bridle ropes [reef accumulation ropes]
E Floating collar
F Anchor ropes
G Anchor
H Weights
I Center-point weight
J Floating path

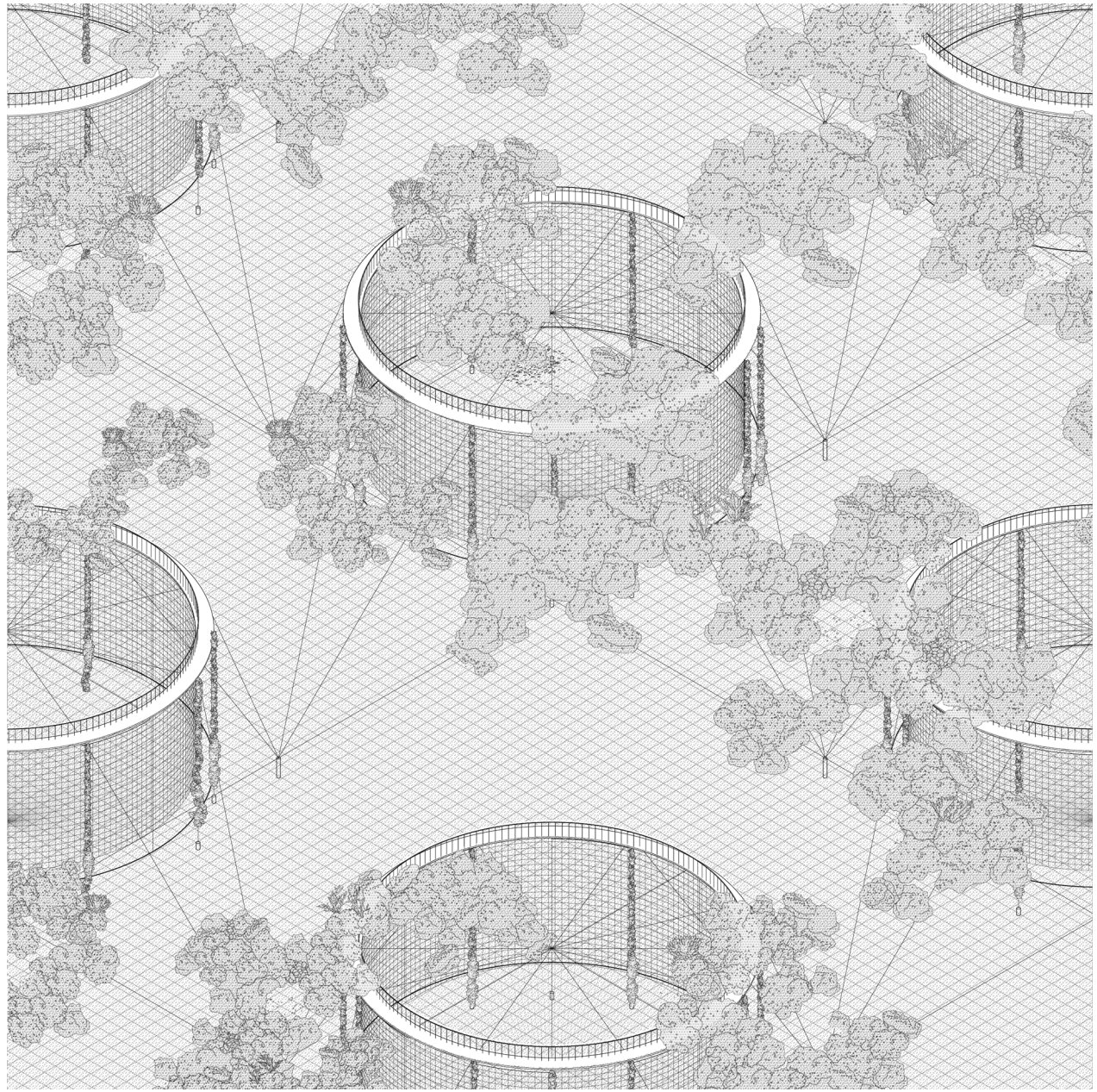
Seed Intervention

Fish Quadrats



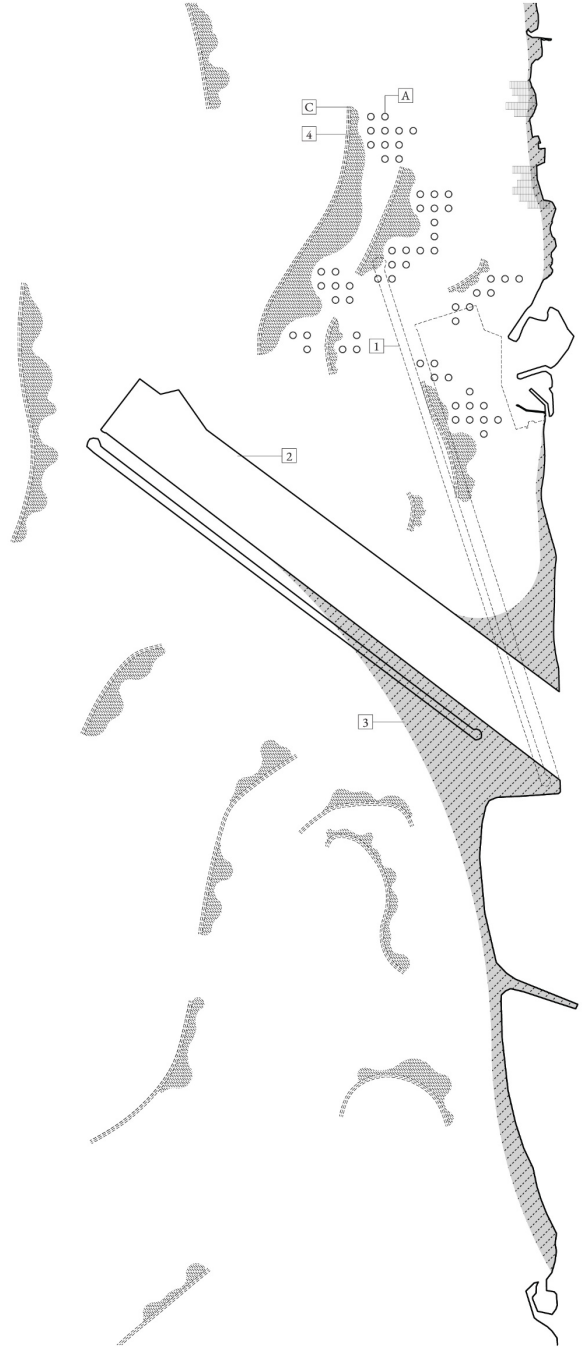
Seed Intervention

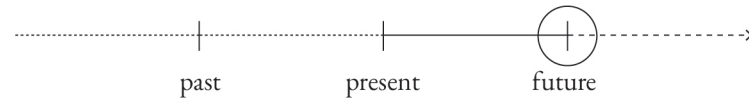
Fish Quadrats



Hinge (x) #1

Runway 16/34





Morphologies

1	Existing coastline
2	Proposed coastline
3	Accumulation_sediments
4	Accumulation_reefs
5	Carving
6	Bathymetry

Seed Interventions

A	Fish quadrats
B	Seagrass plantation
C	Biogenic reefs
D	Sand fences
E	Breakwaters
F	Intertidal tiles
G	Perforated paths

Hinge (x) #1

Runway 16/34



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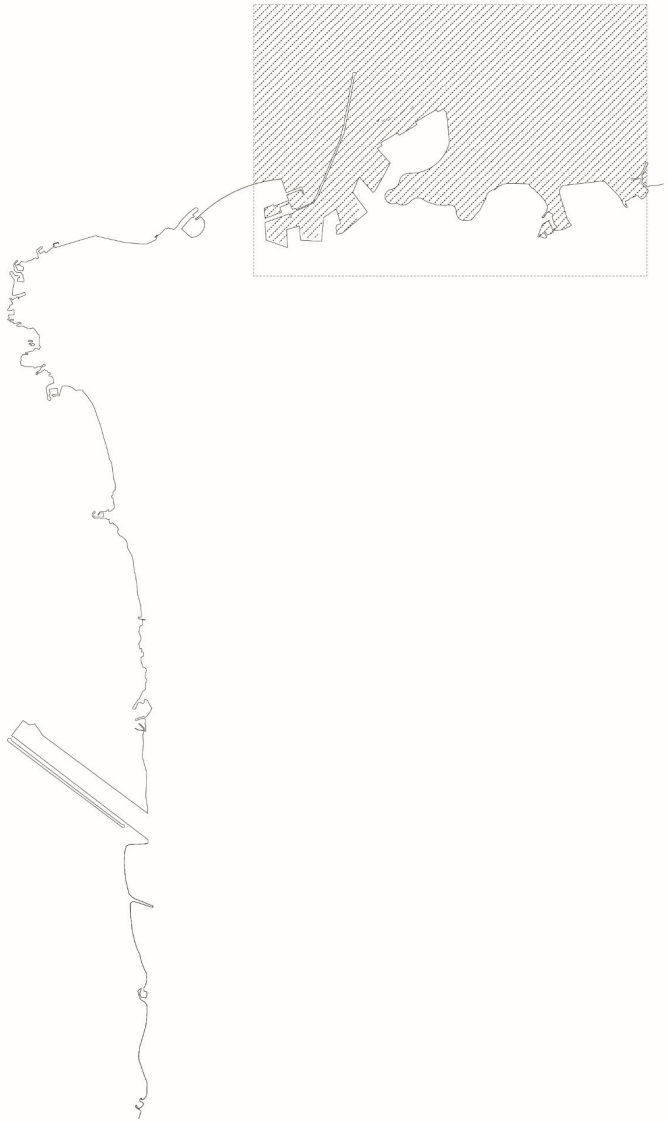
F	Intertidal tiles
G	Perforated paths

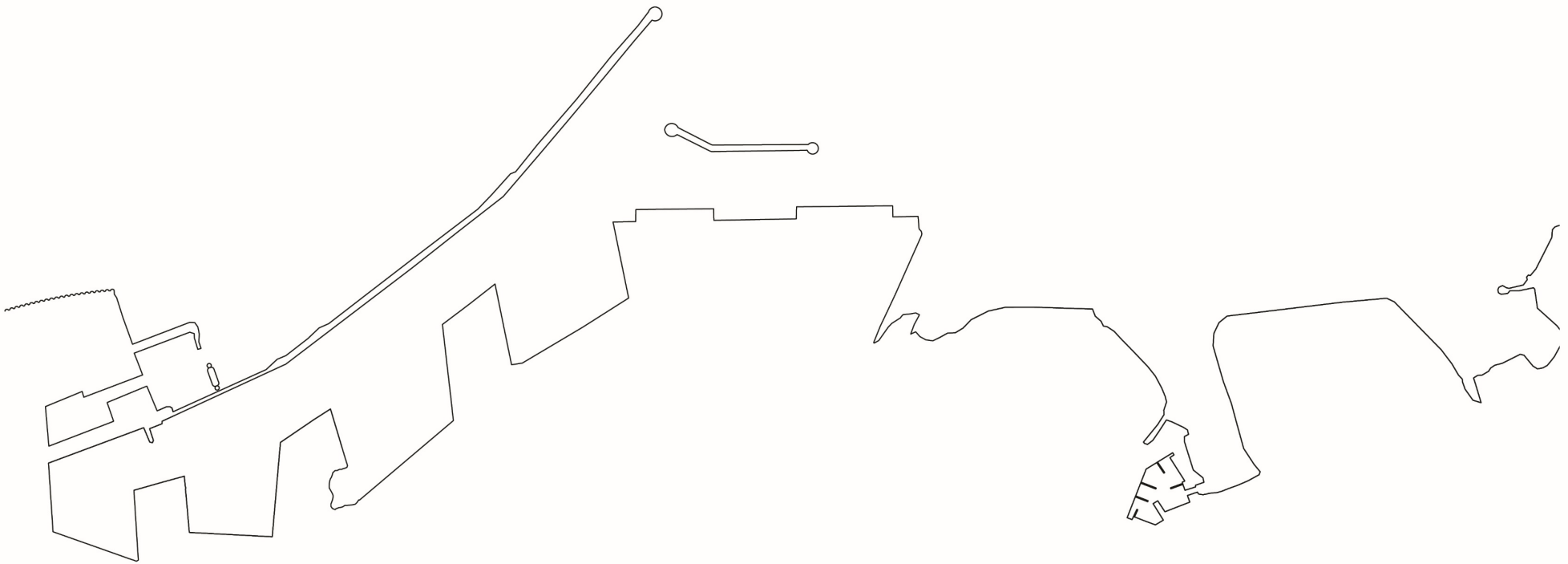
Hinge (x) #2

Port of Beirut



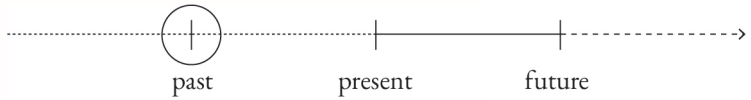
Hinge (x) #2

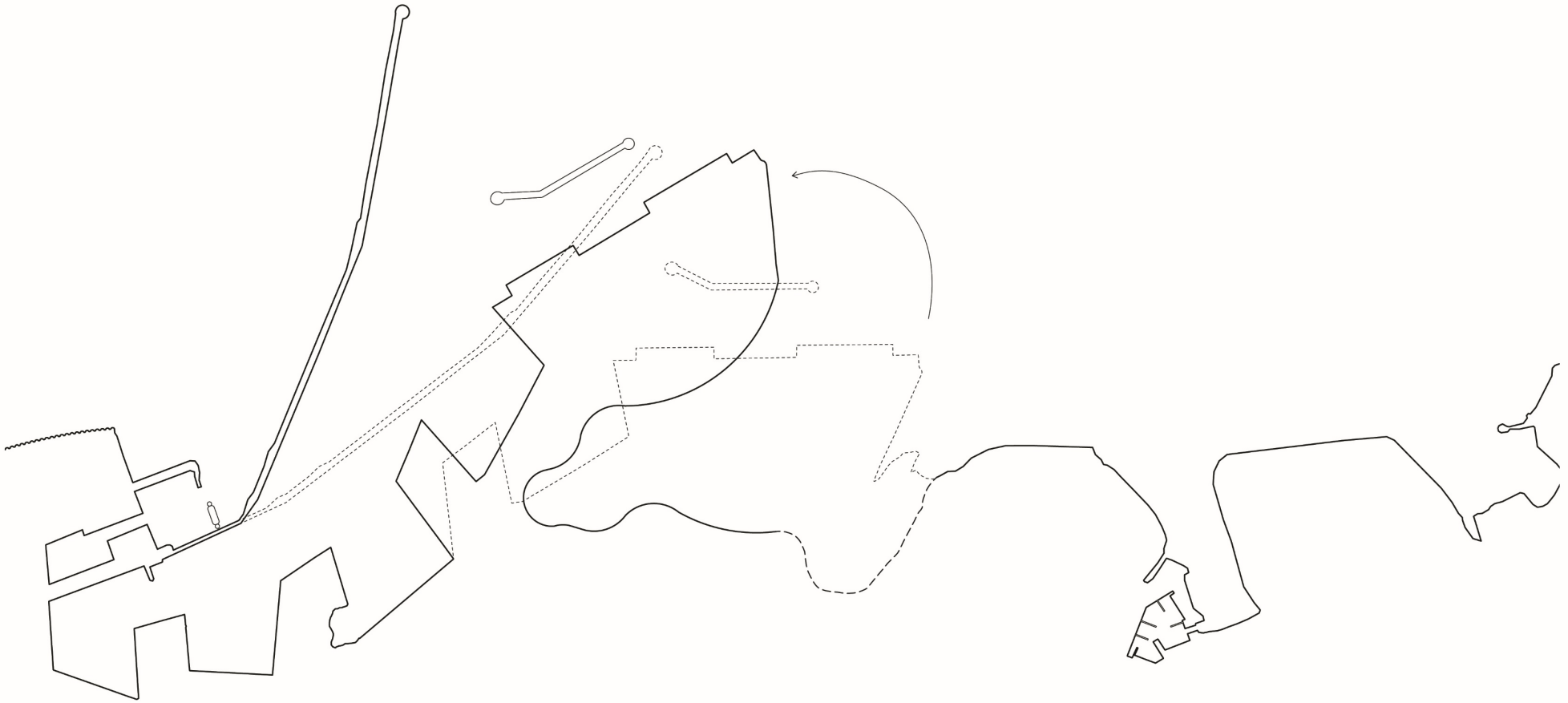
Port of Beirut



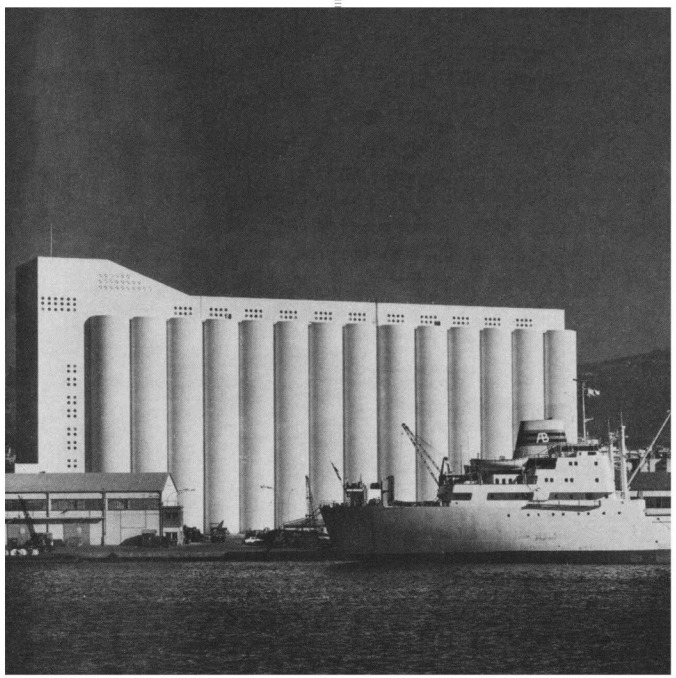
Hinge (x) #2

Port of Beirut



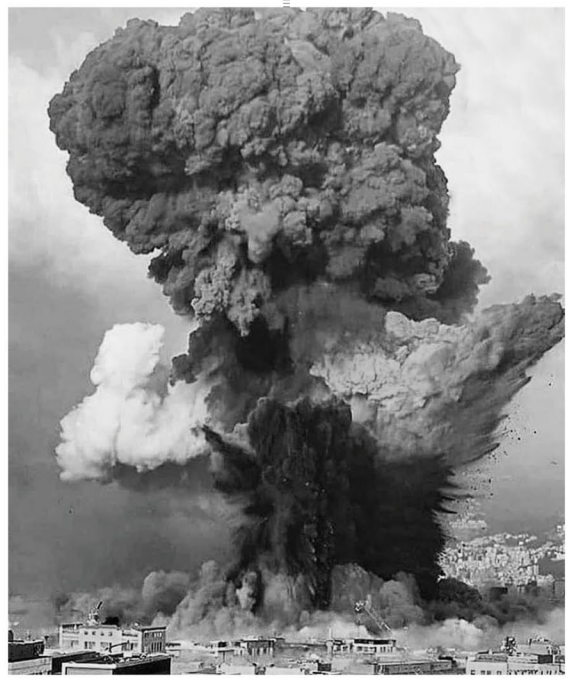


1953



[Source: Hemr (1953)]

2020



[Source: CNN (2020)]

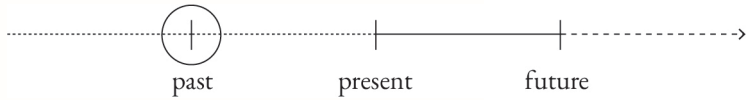
2022

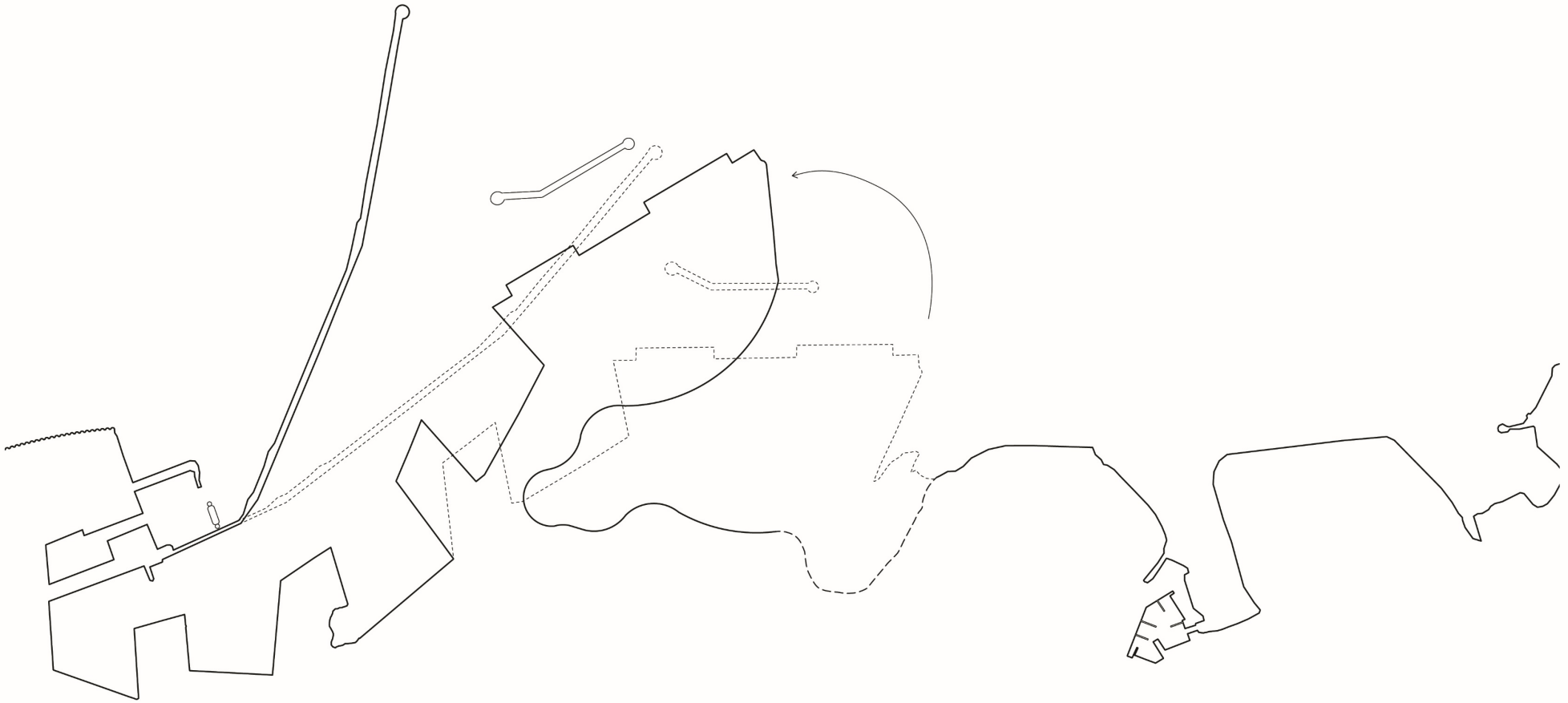


[Source: Durand (2023)]

Hinge (x) #2

Port of Beirut





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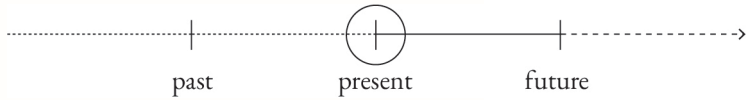



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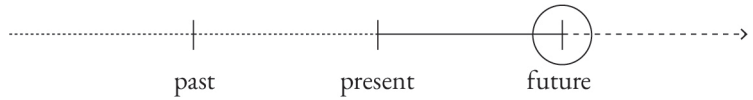
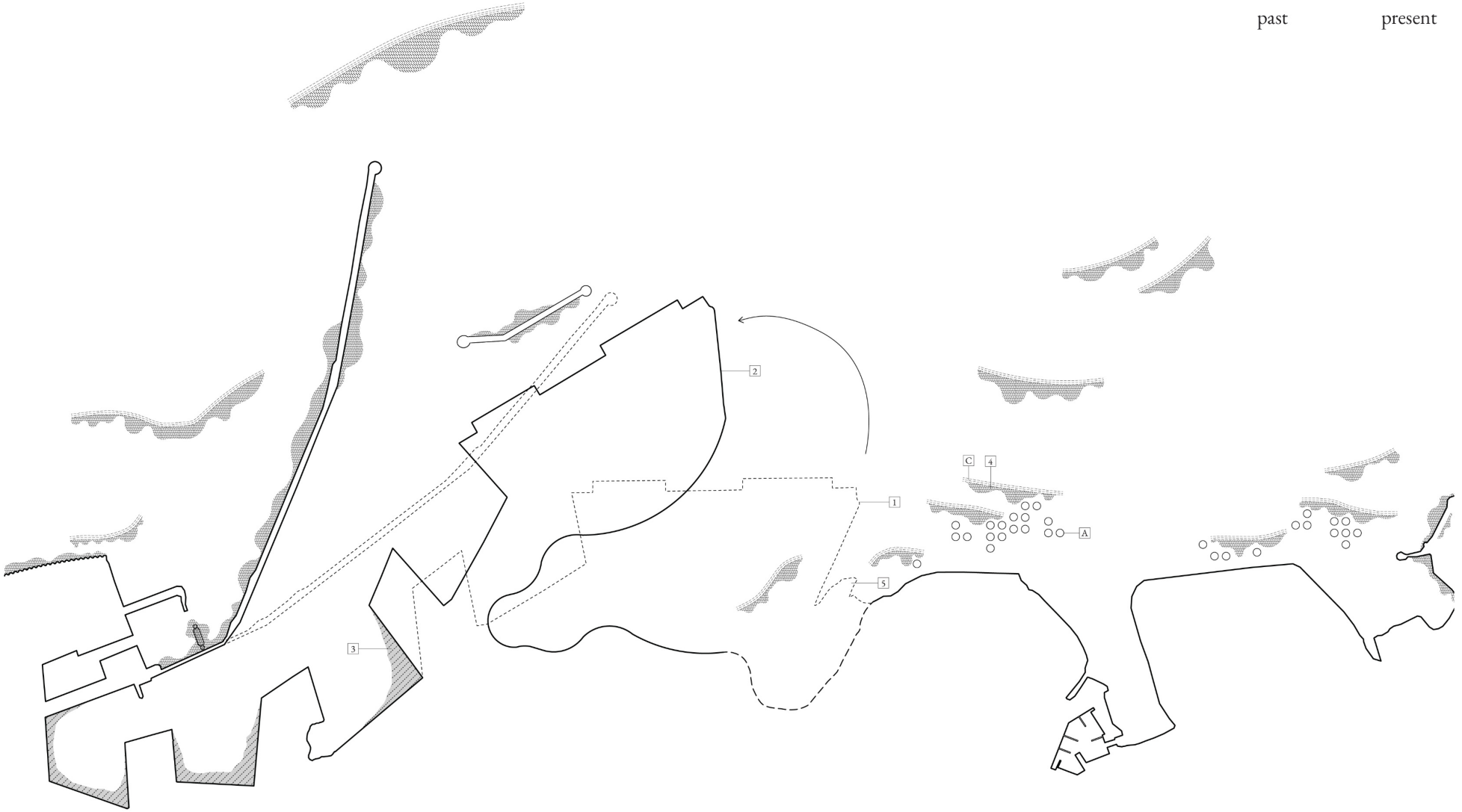
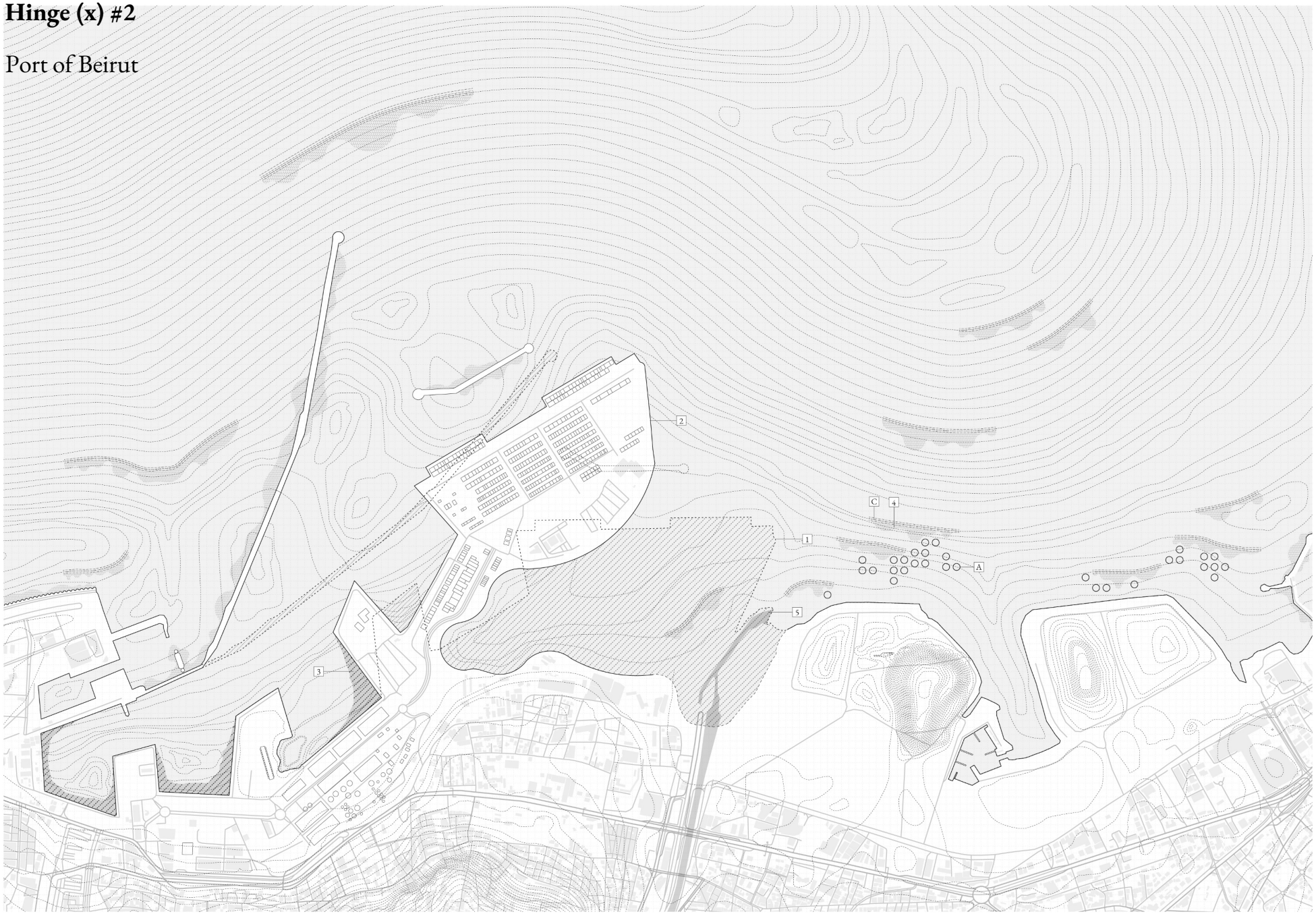




Hinge (x) #2

Port of Beirut



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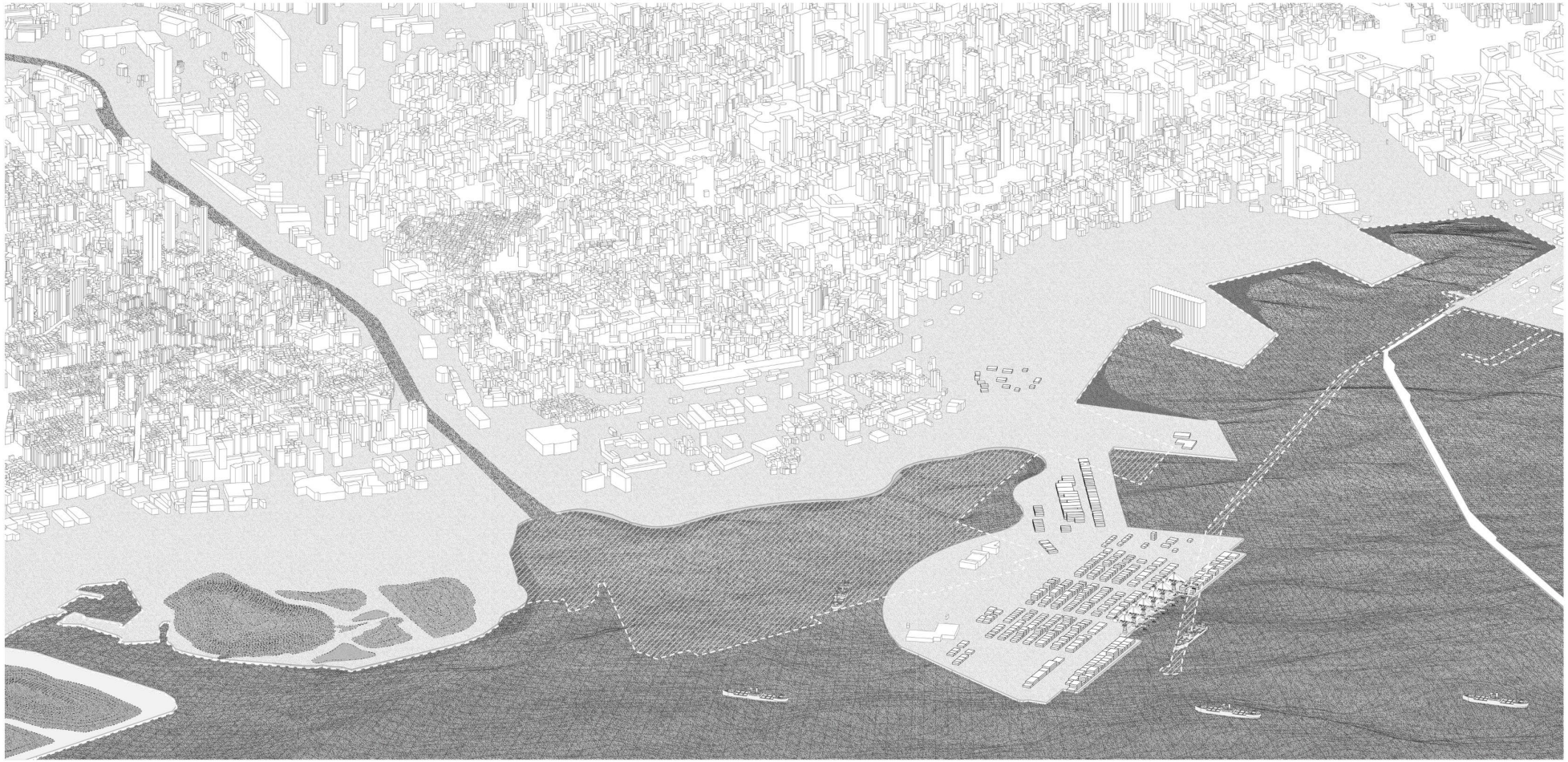
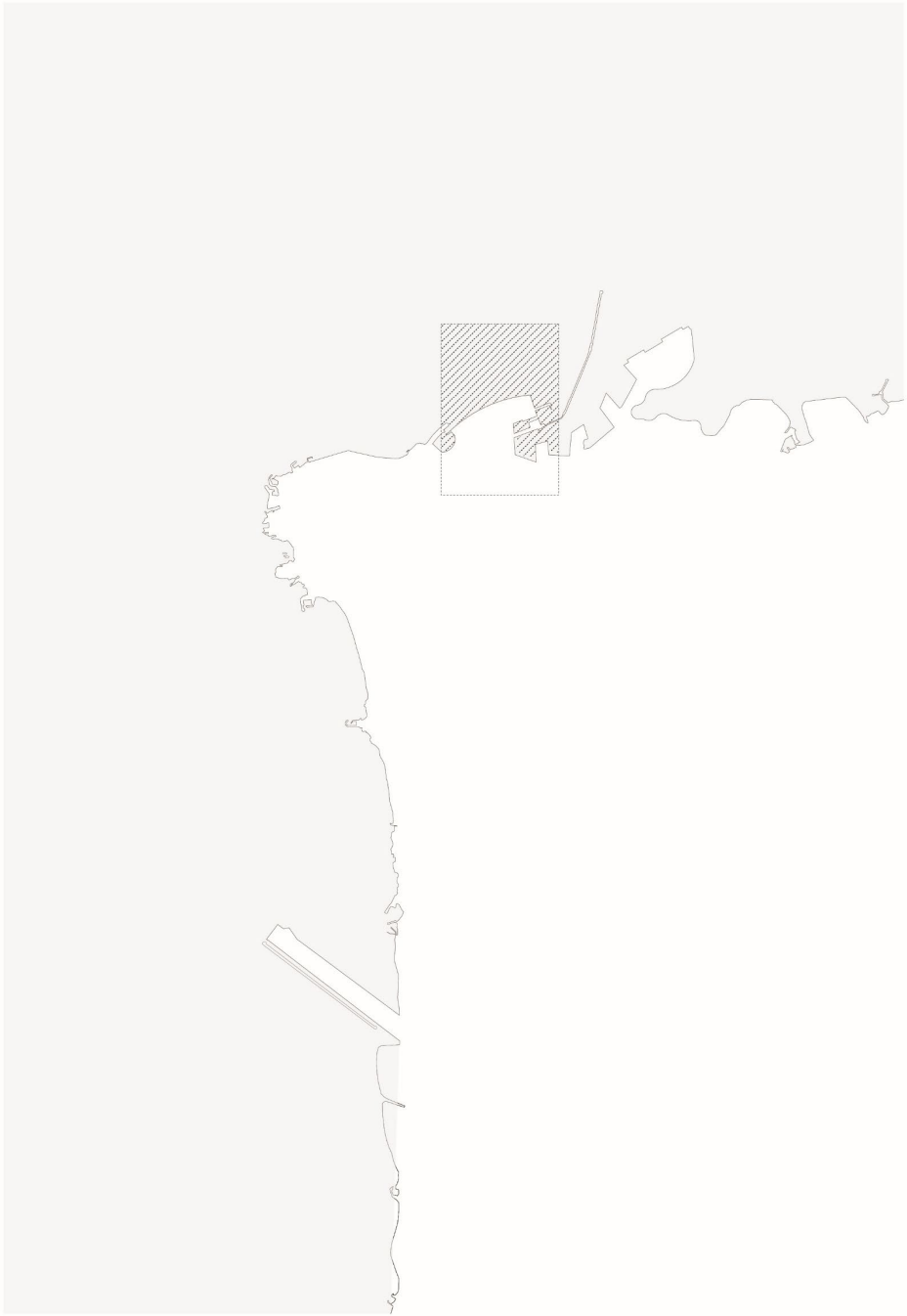


Hinge (z)

Biel Waterfront





Hinge (z)

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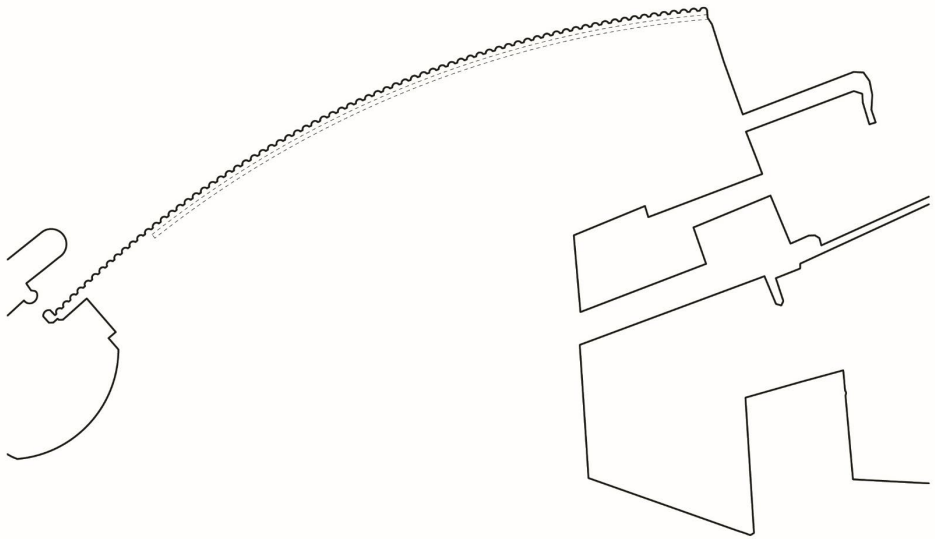

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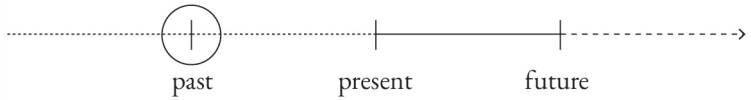

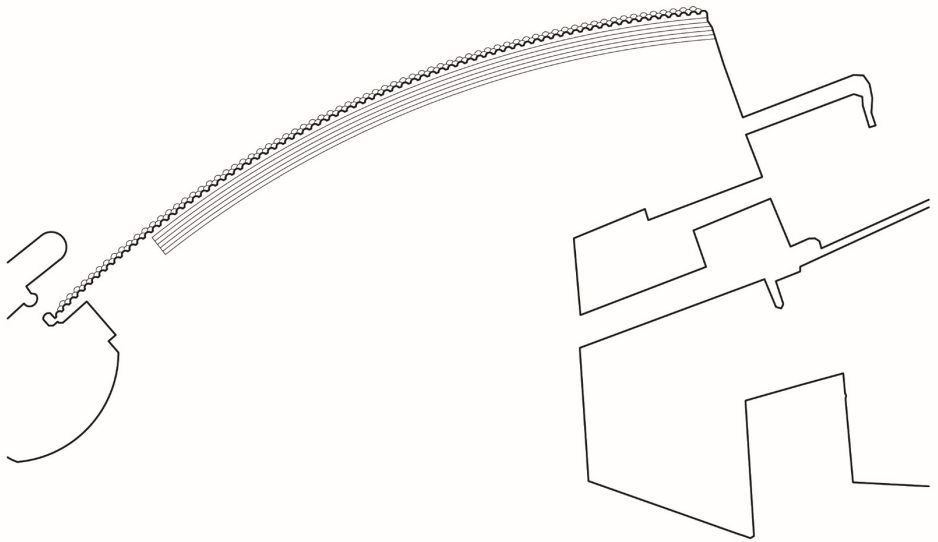

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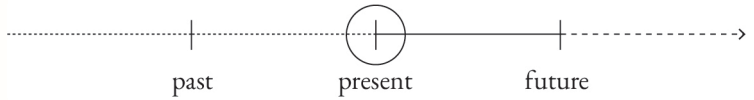

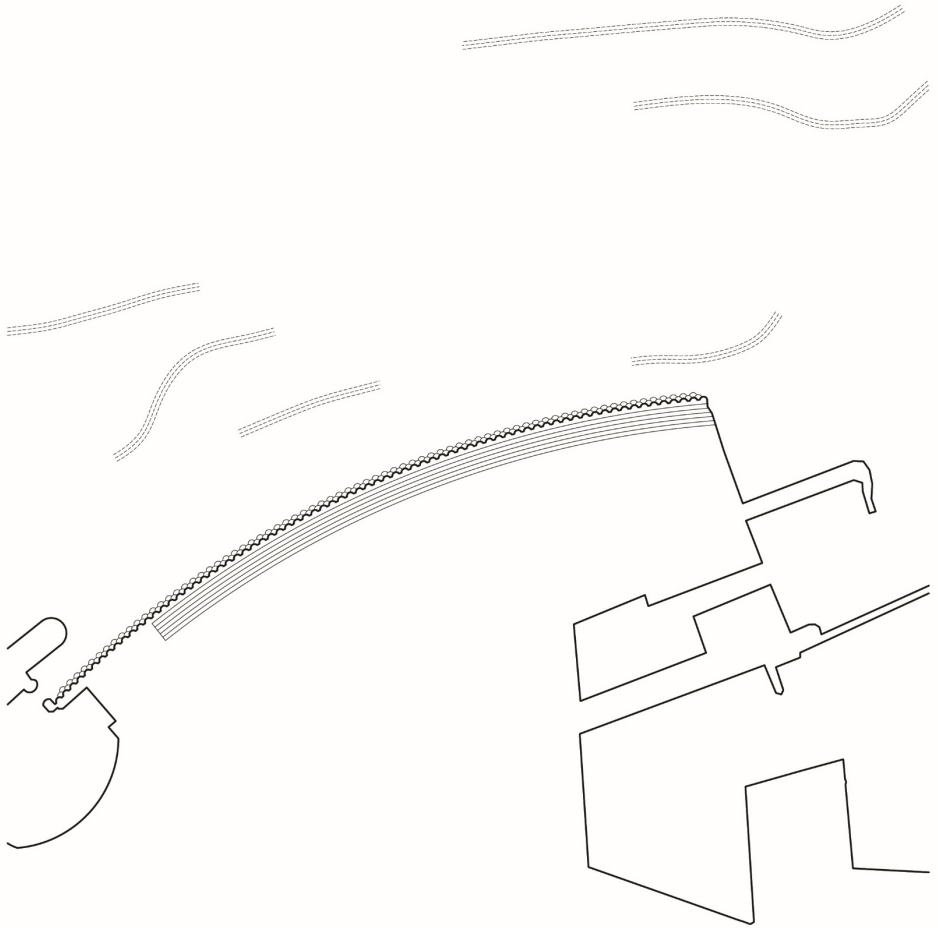

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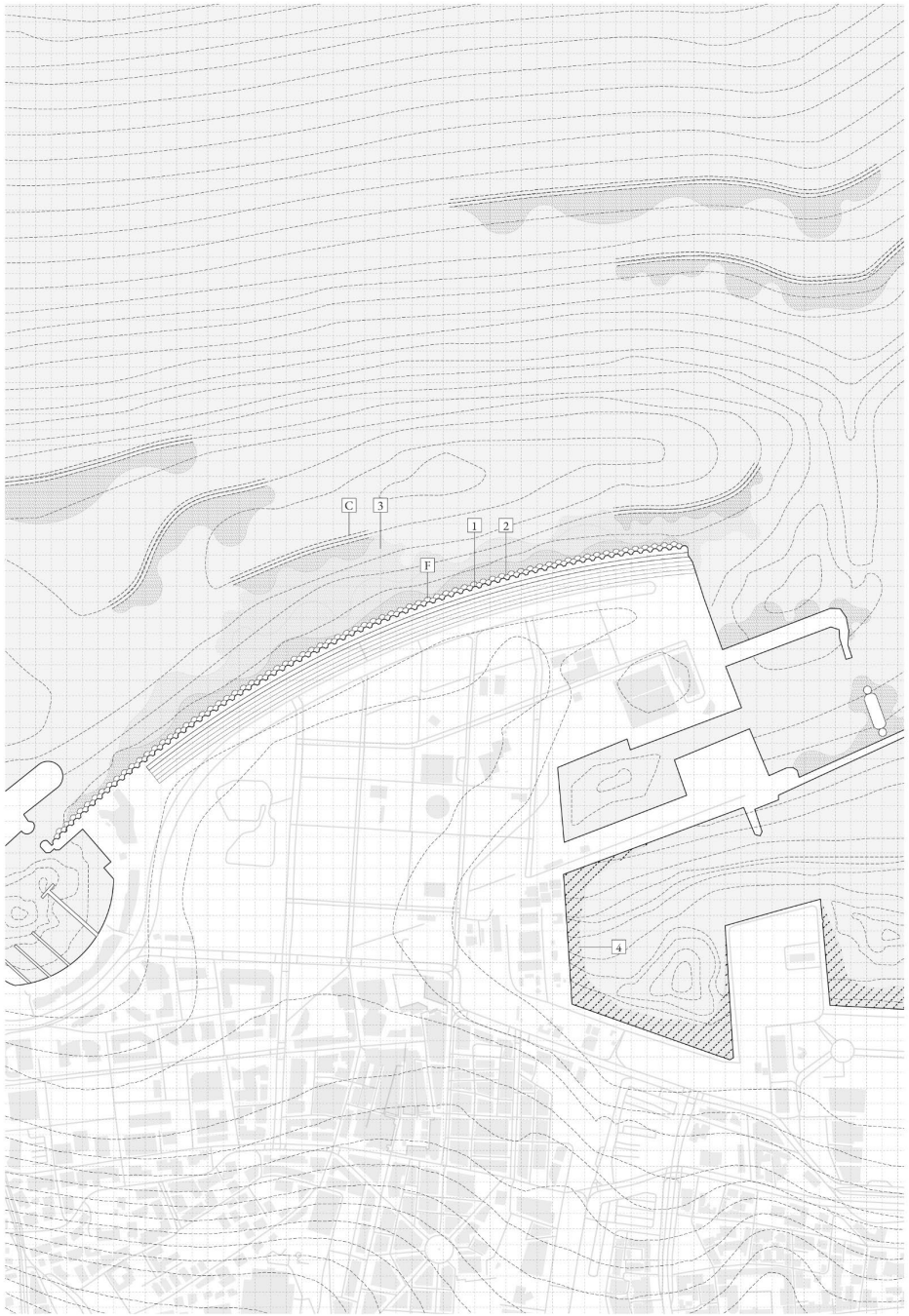
Biel Waterfront



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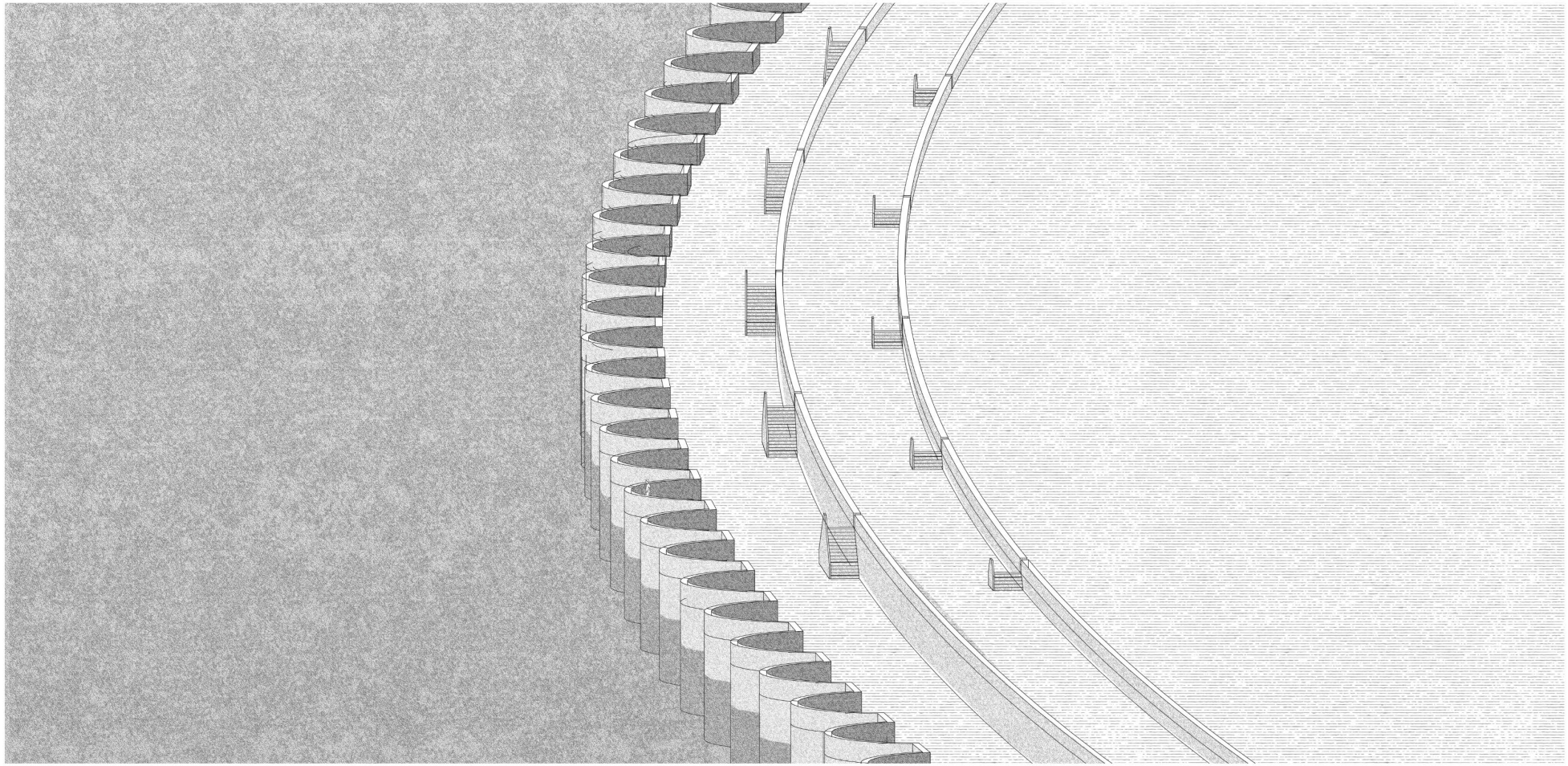
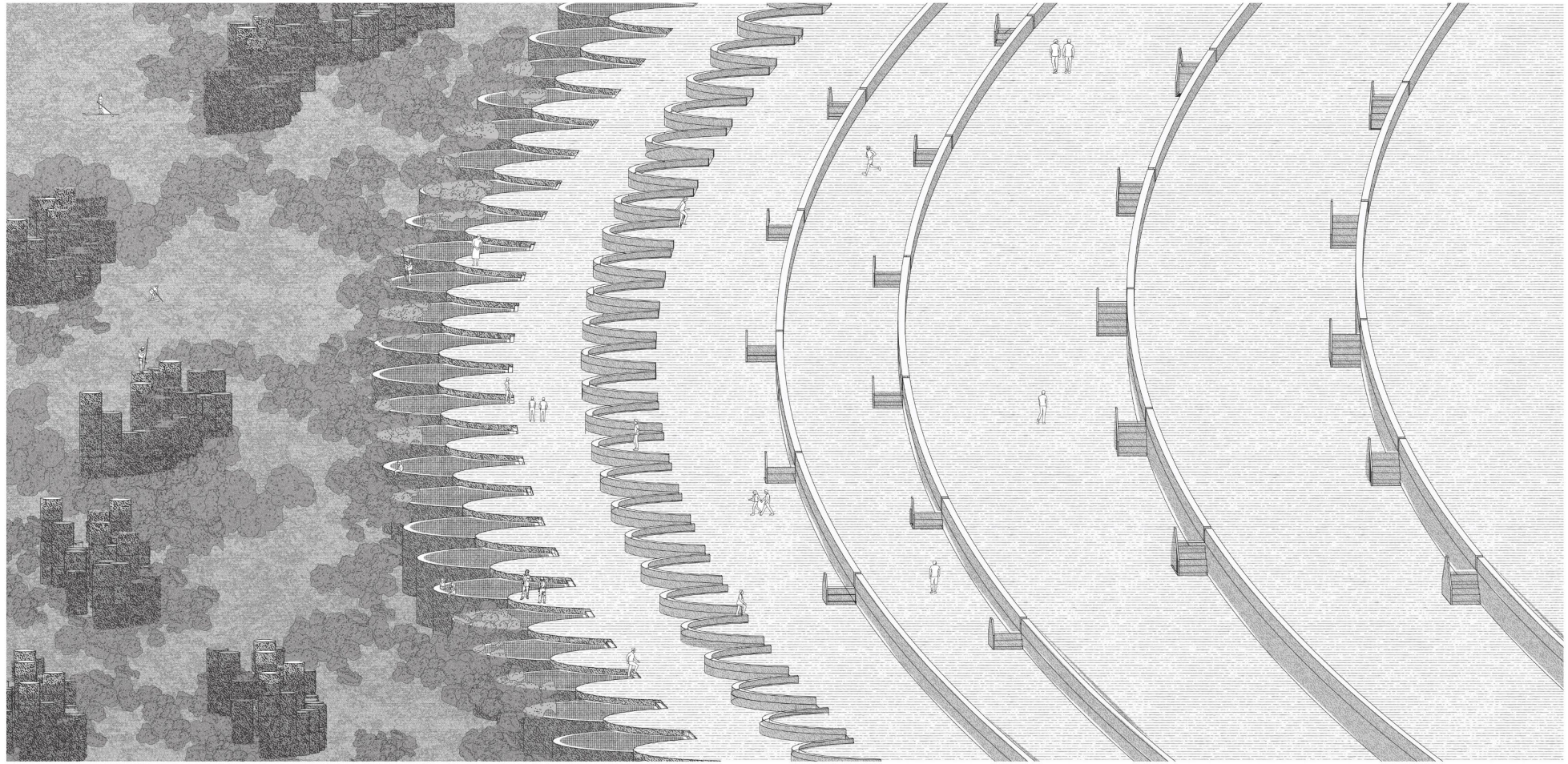
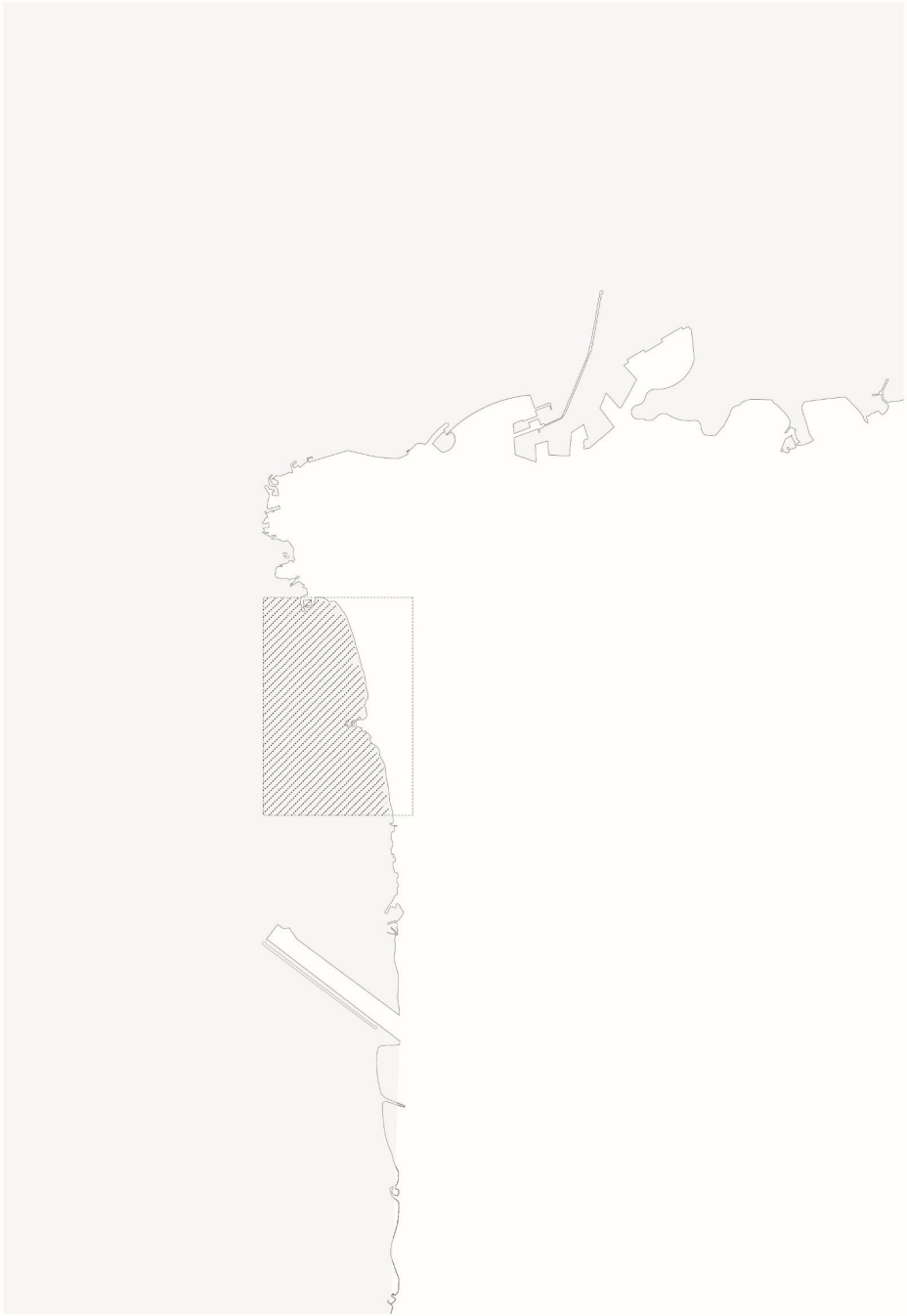




Addition

Ouzai coastal settlement &
Ramlet al Baida public beach



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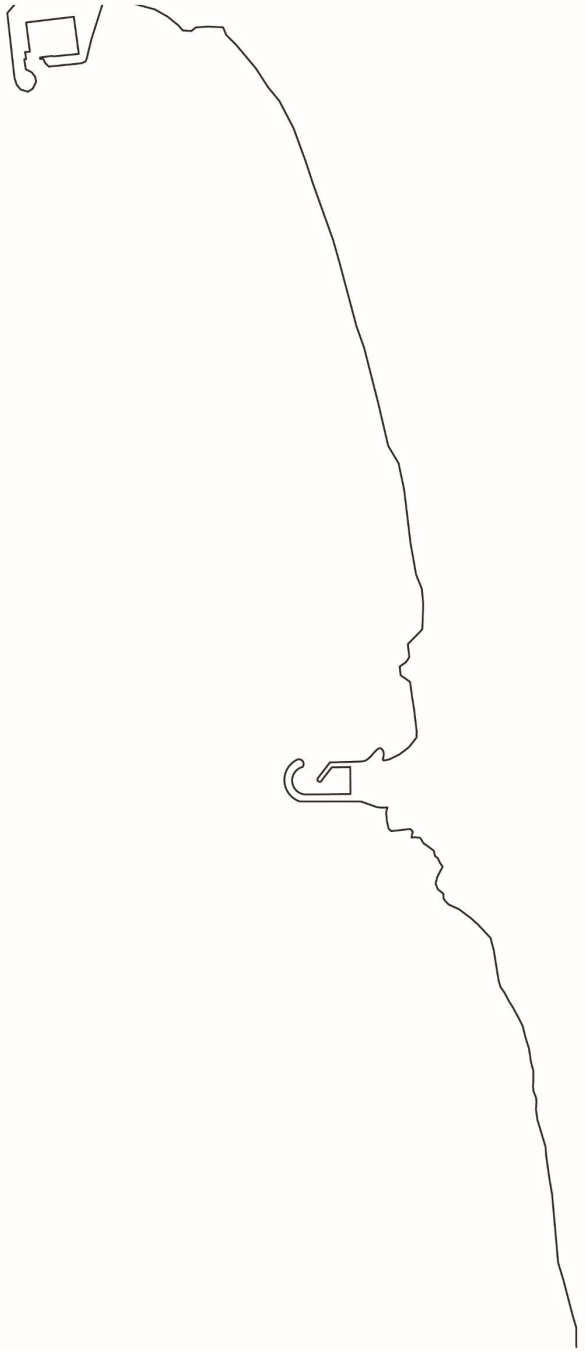

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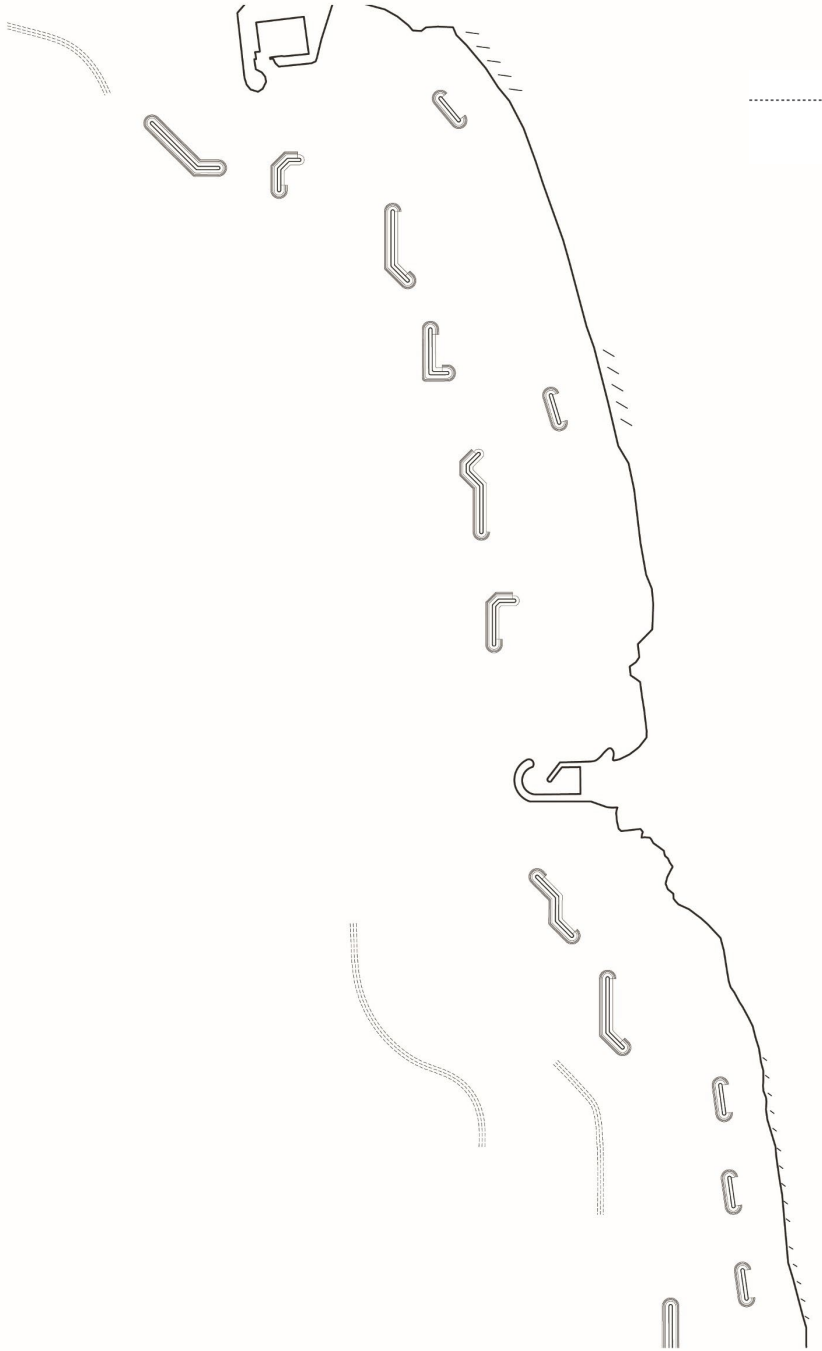
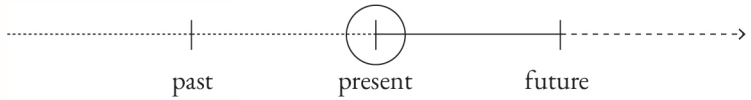
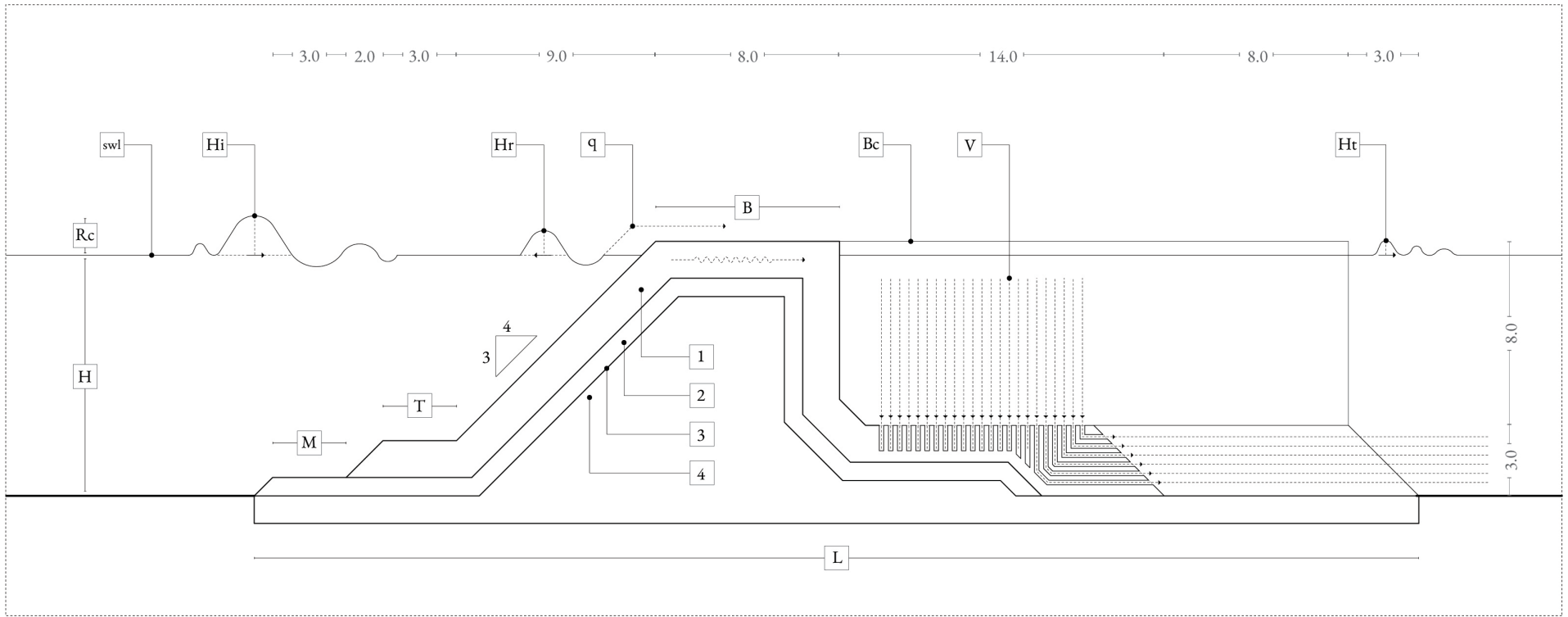




Seed Intervention

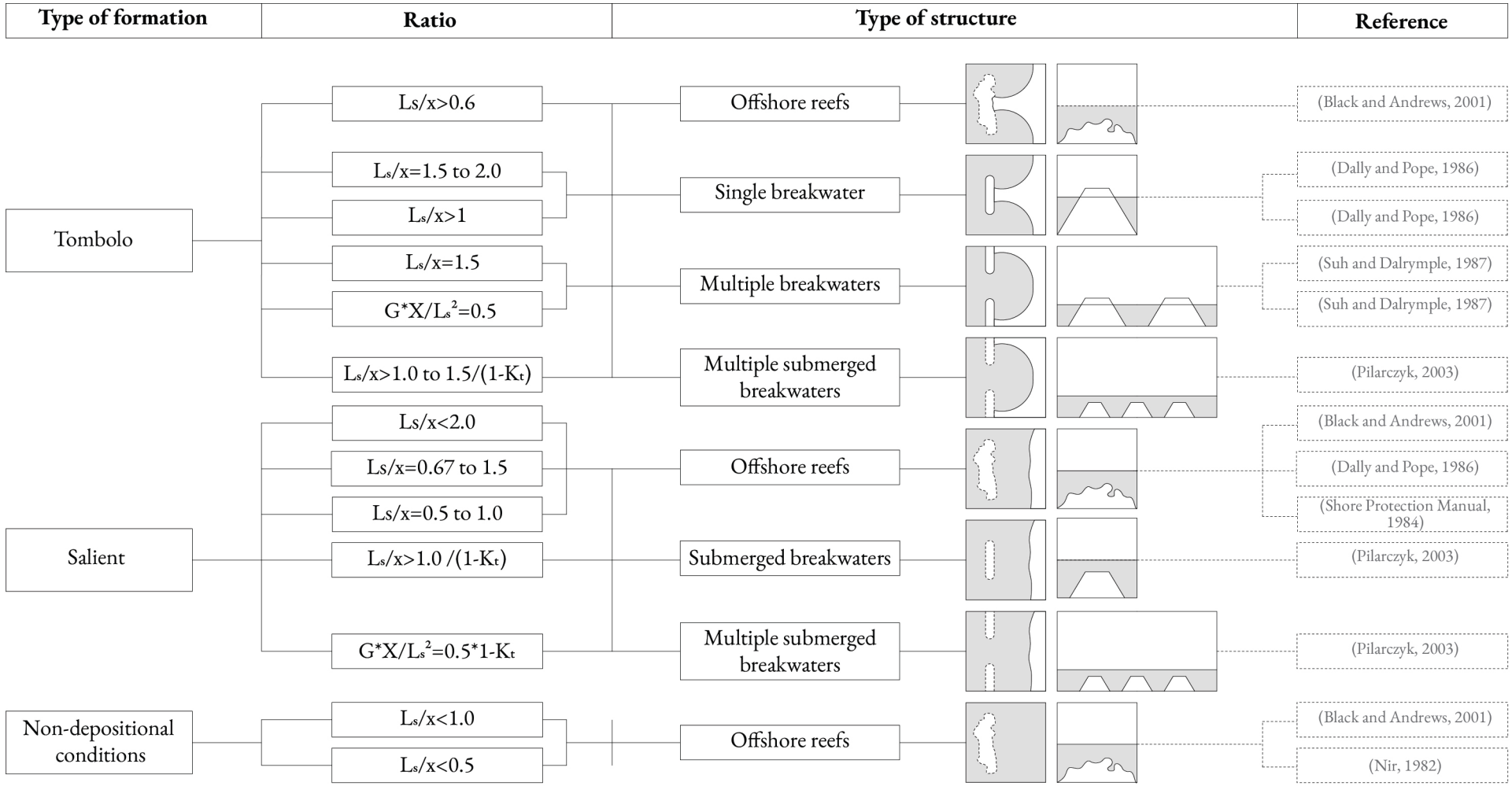
Breakwaters



- B Crest width
- H Structure height
- Rc The crest free board
- M Scour width
- T Toe width
- swl Still water level
- Hi Incident wave height
- Hr Reflected wave
- Ht Transmitted wave height
- q Run-up and over-topping
- 2 Armour layer
- 3 Under layer
- 4 Geotextile membrane
- 5 Rubble core

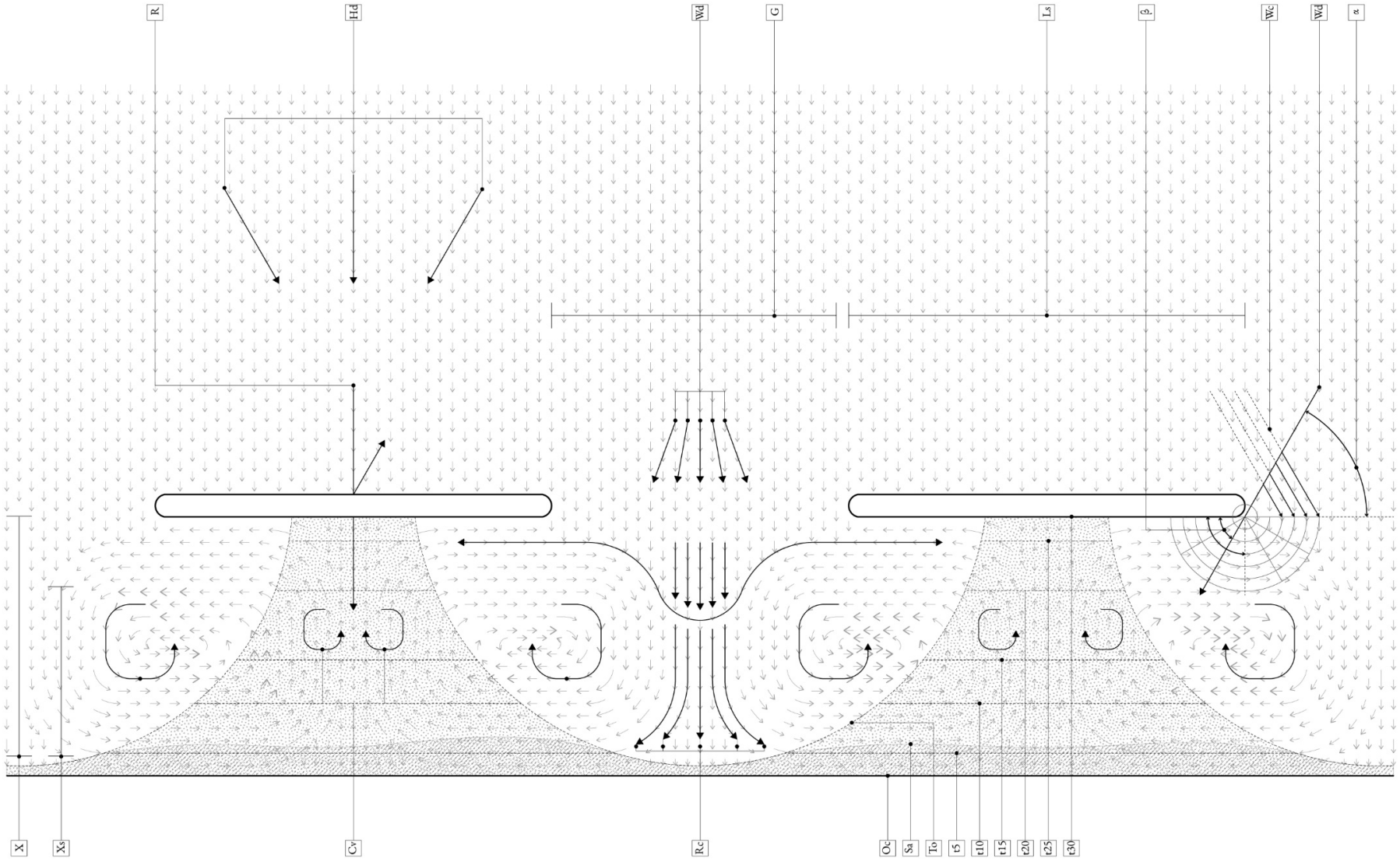
Seed Intervention

Breakwaters

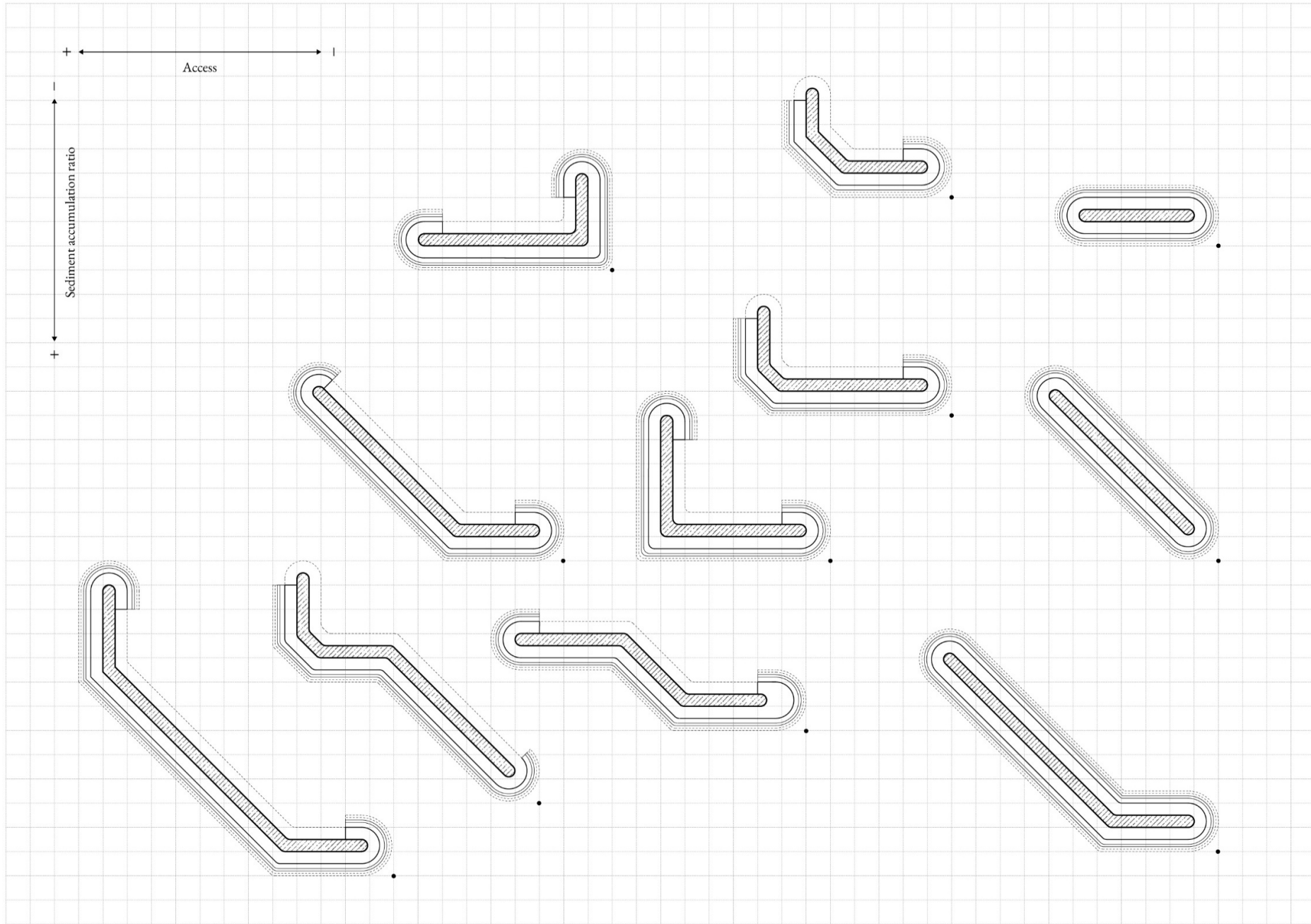


Seed Intervention

Breakwaters



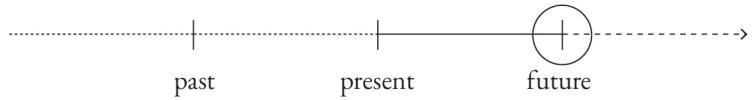
Ls Length of btreakwater
G Distance gap between breakwaters
X Distance offshore from the coastline
Xs Distance from original
Wc Wave crest
Wx Wave direction
Cv Convergent vortices
Wd Wave diffraction
Rc Rip current
Hd Incident wave direction
R Reflection
α Incident wave direction from the breakwater
β Angle between the breakwater and the radial, r
Ic Initial coastline
Sa Salient
To Tombolo
t5 Coastline evolution at 5 months [salient]
t10 Coastline evolution at 10 months
t15 Coastline evolution at 15 months
t20 Coastline evolution at 20 months
t25 Coastline evolution at 25 months
t30 Coastline evolution at 30 months [complete tombolo]


+
Access
−
Sediment accumulation ratio
+

Addition

Ouzai coastal settlement &
Ramlet al Baida public beach





Morphologies

1	Existing coastline
2	Proposed coastline
3	Accumulation_sediments
4	Accumulation_reefs
5	Carving
6	Bathymetry

Seed Interventions

A	Fish quadrats
B	Seagrass plantation
C	Biogenic reefs
D	Sand fences
E	Breakwaters
F	Intertidal tiles
G	Perforated paths

Addition

Ouzai coastal settlement &
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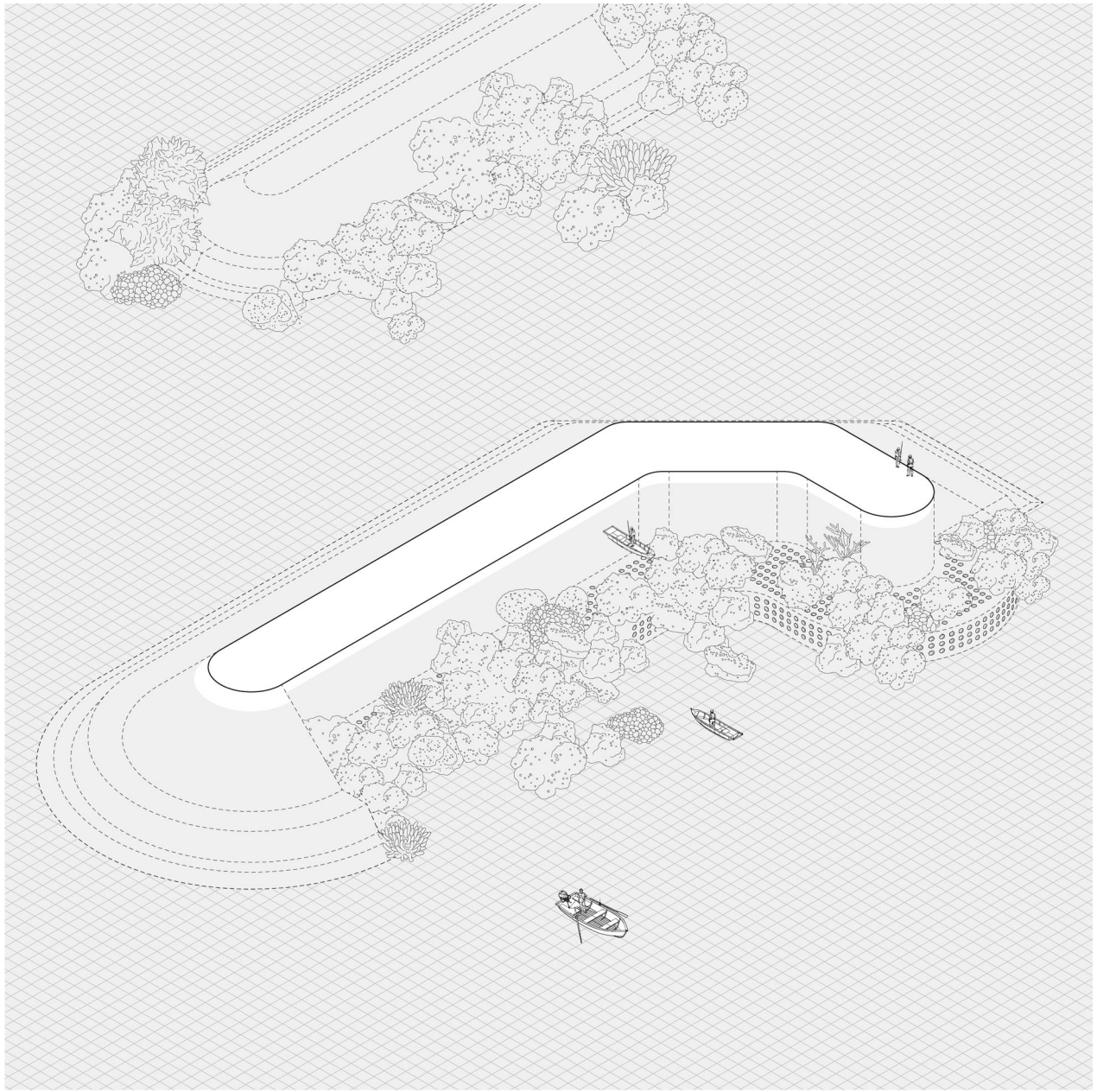
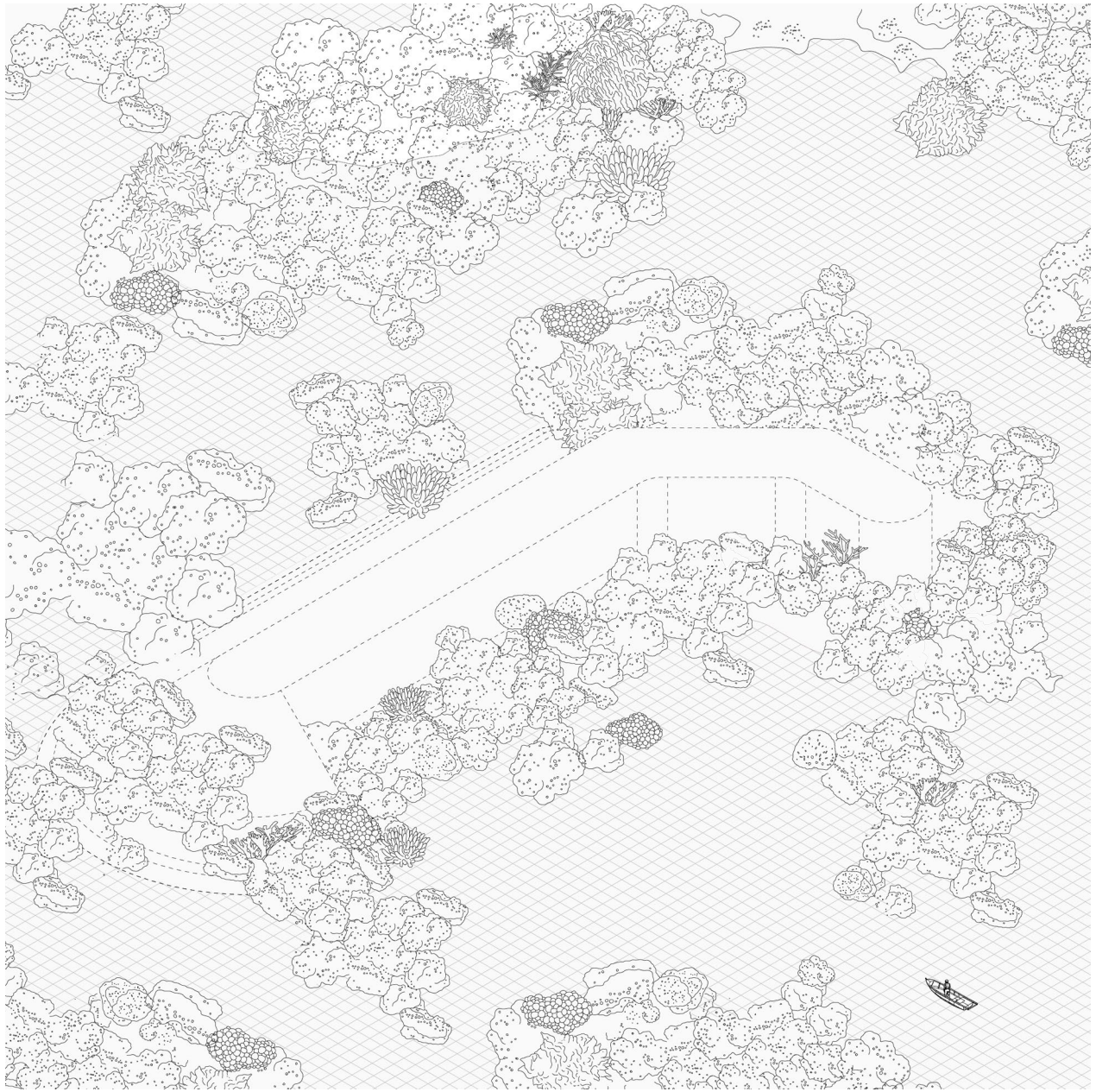
Seed Intervention

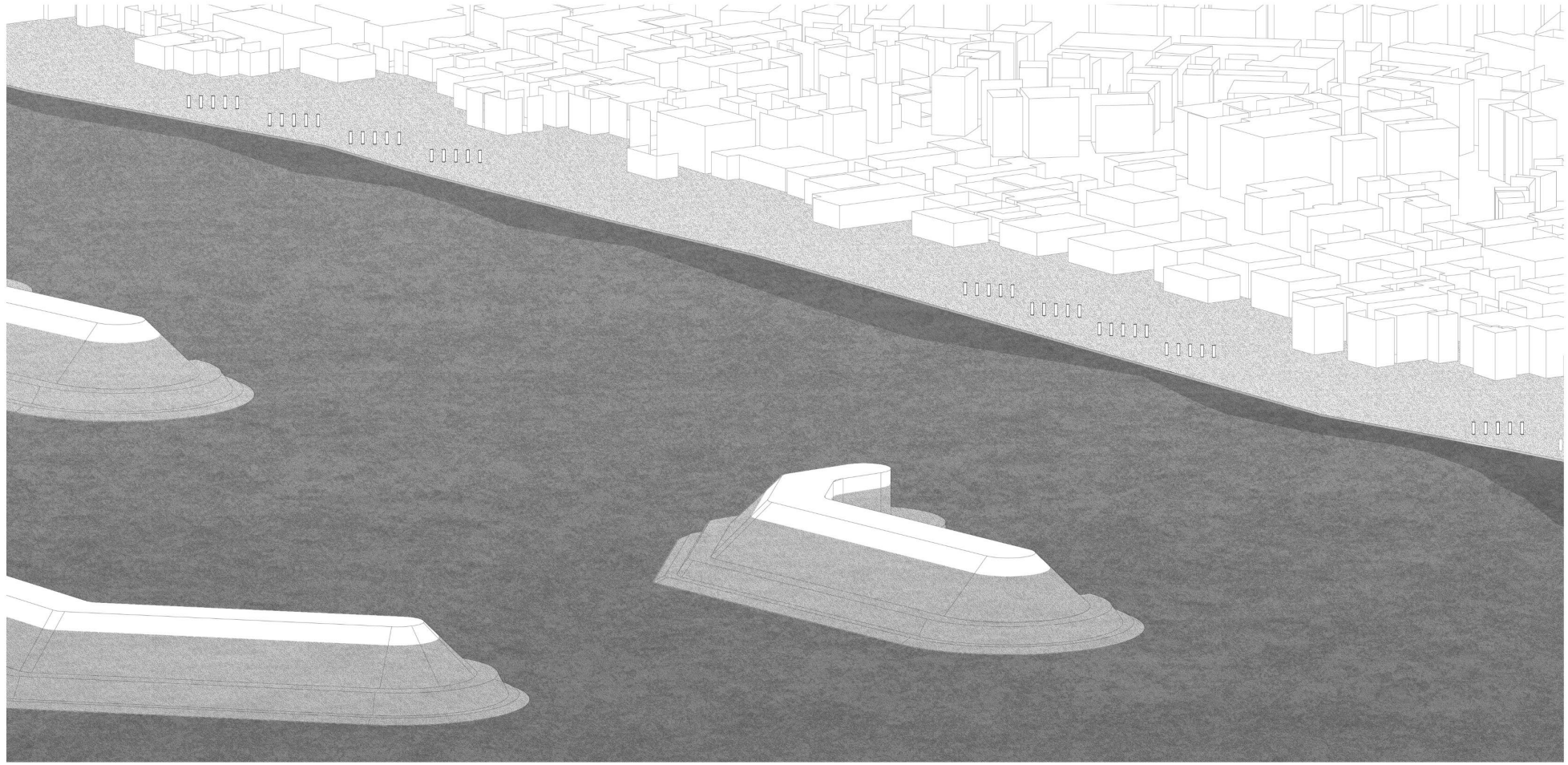
Breakwaters

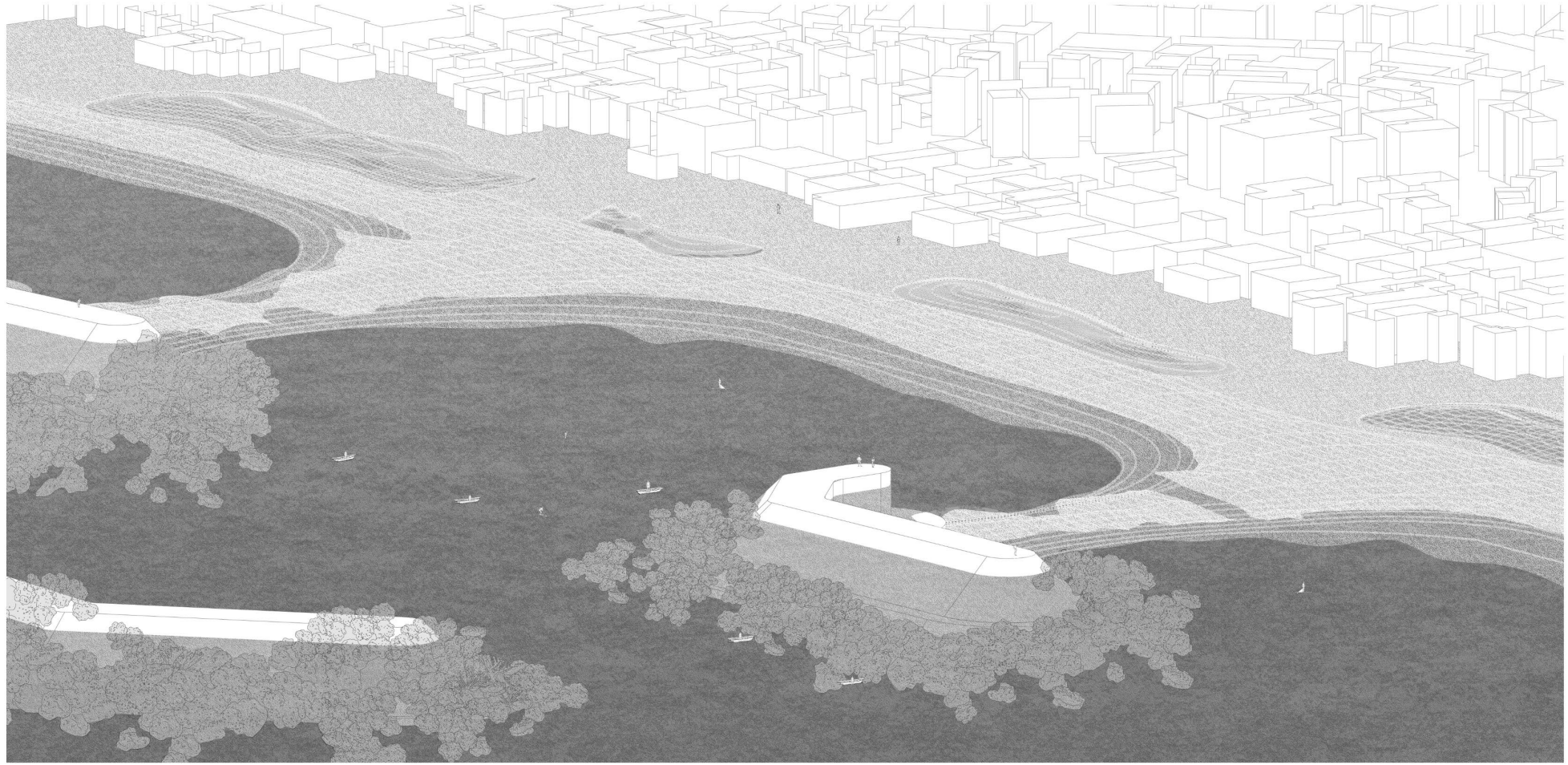


Seed Intervention

Breakwaters







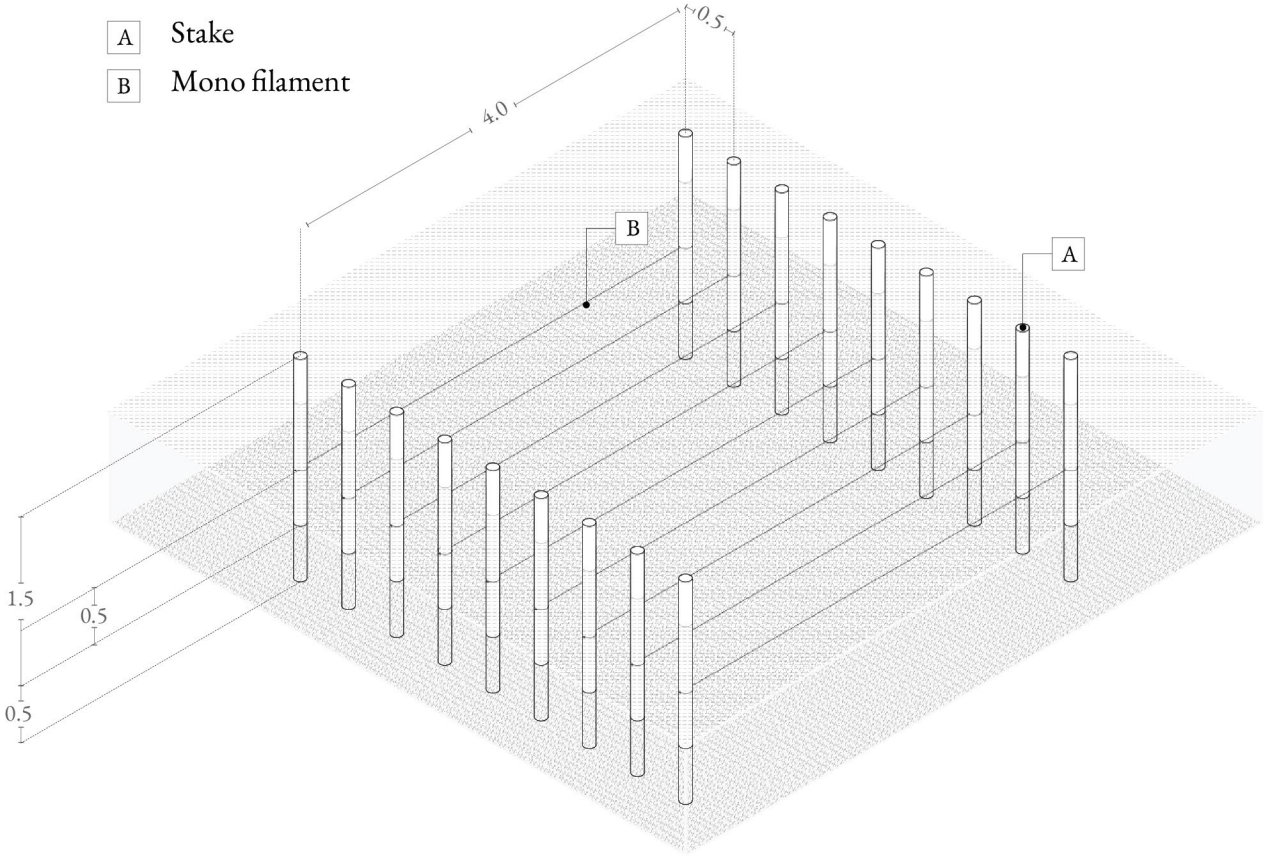
Seed Intervention

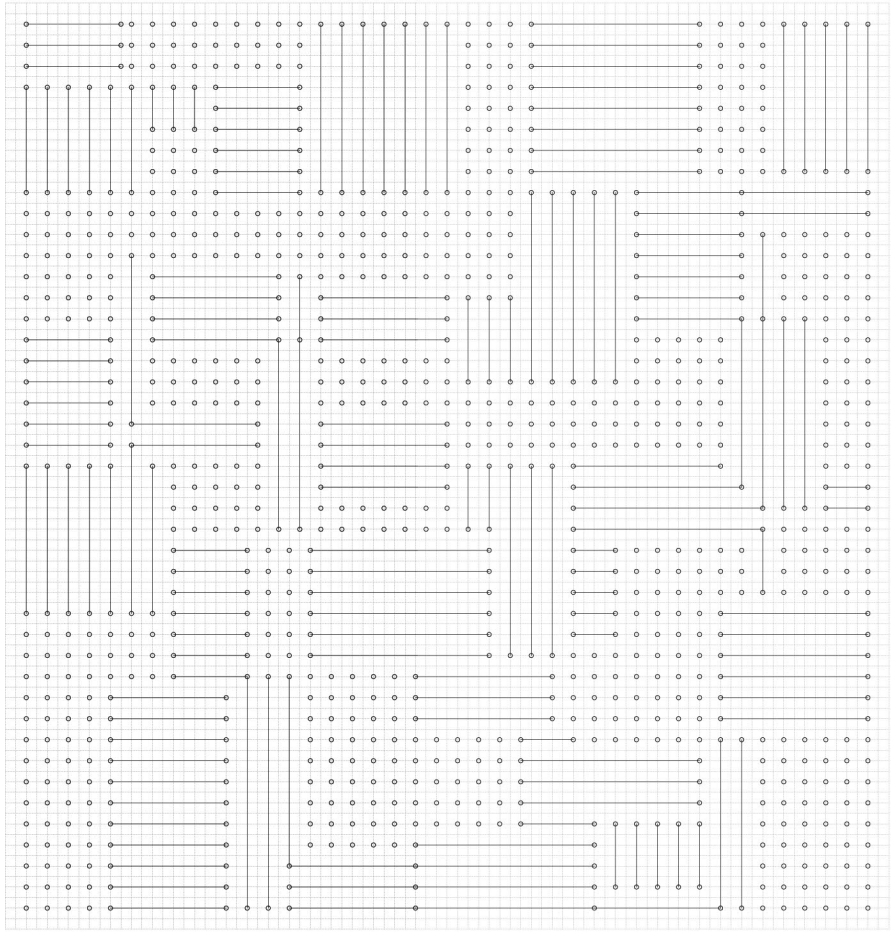
Seagrass Beds

Basic guidelines

A Stake

B Mono filament





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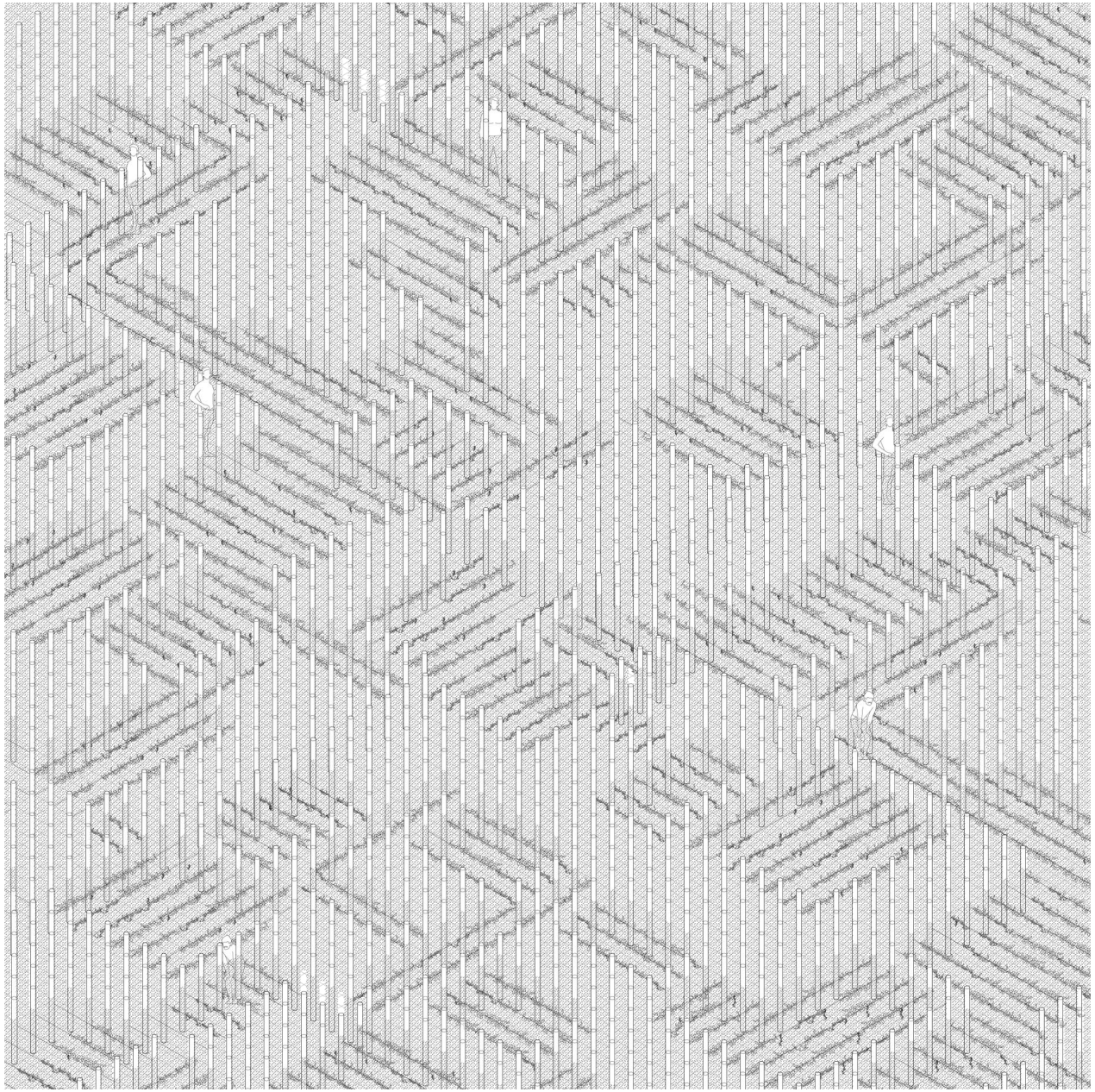
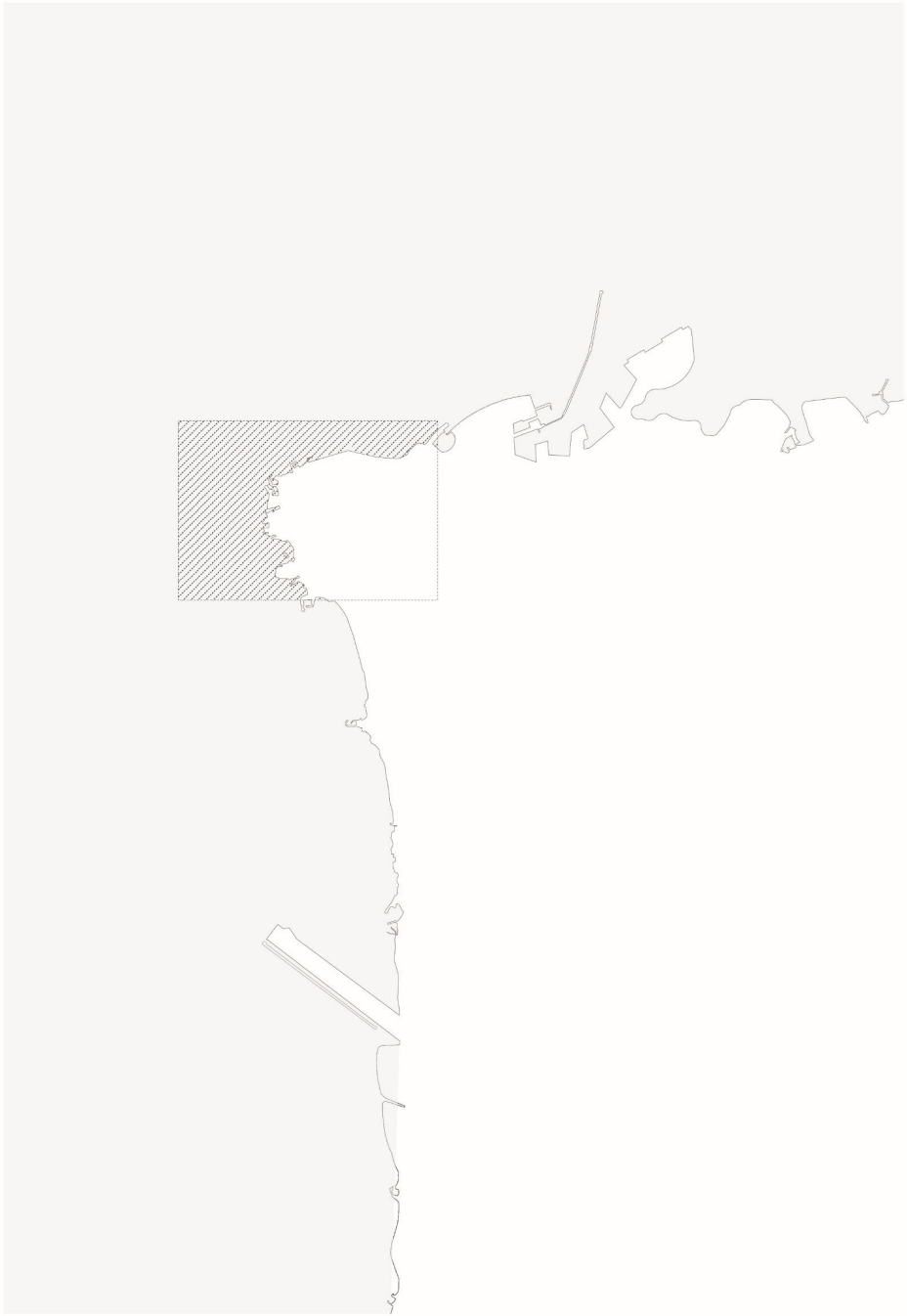


Addition # 2

Dalieh



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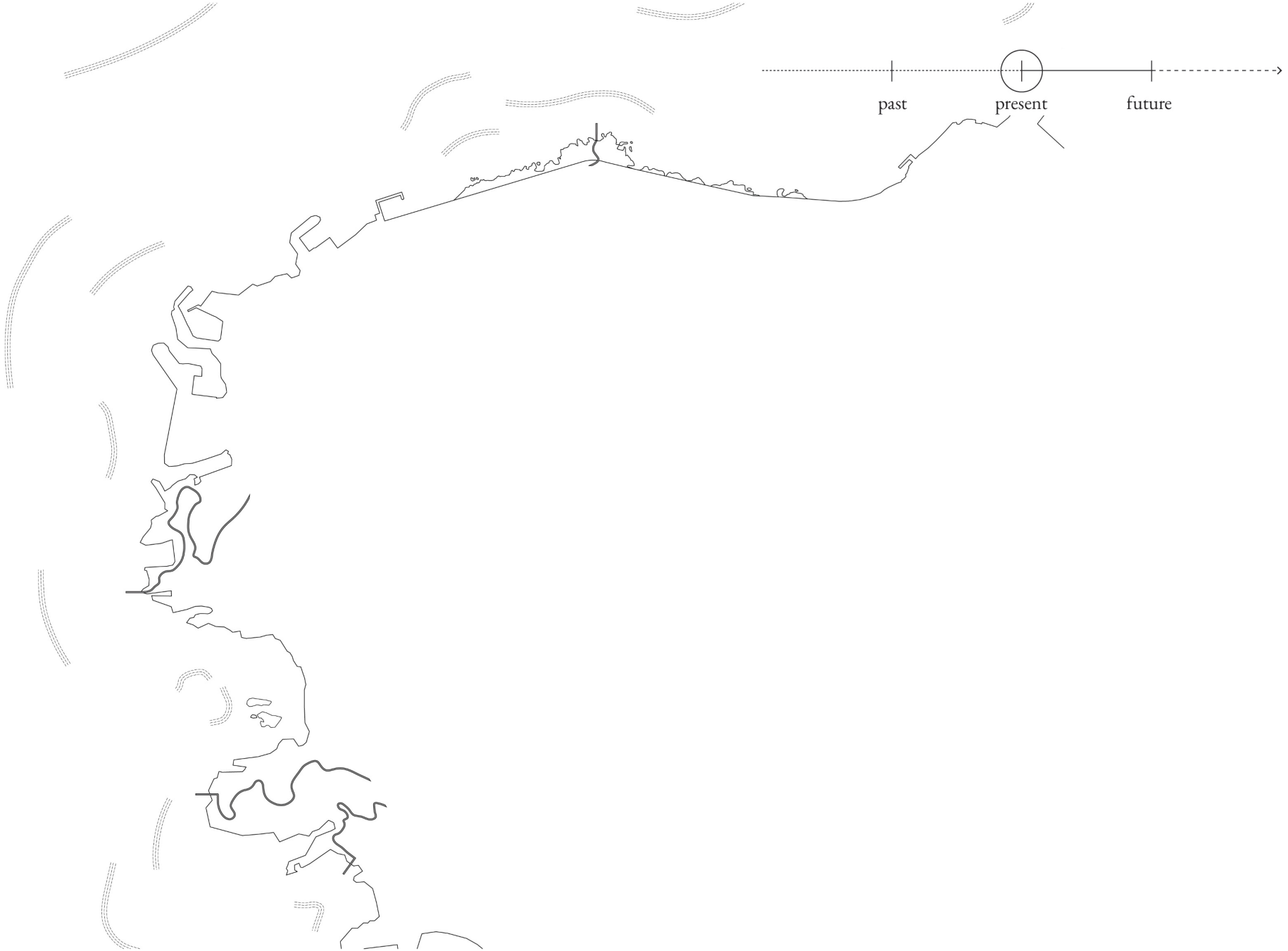

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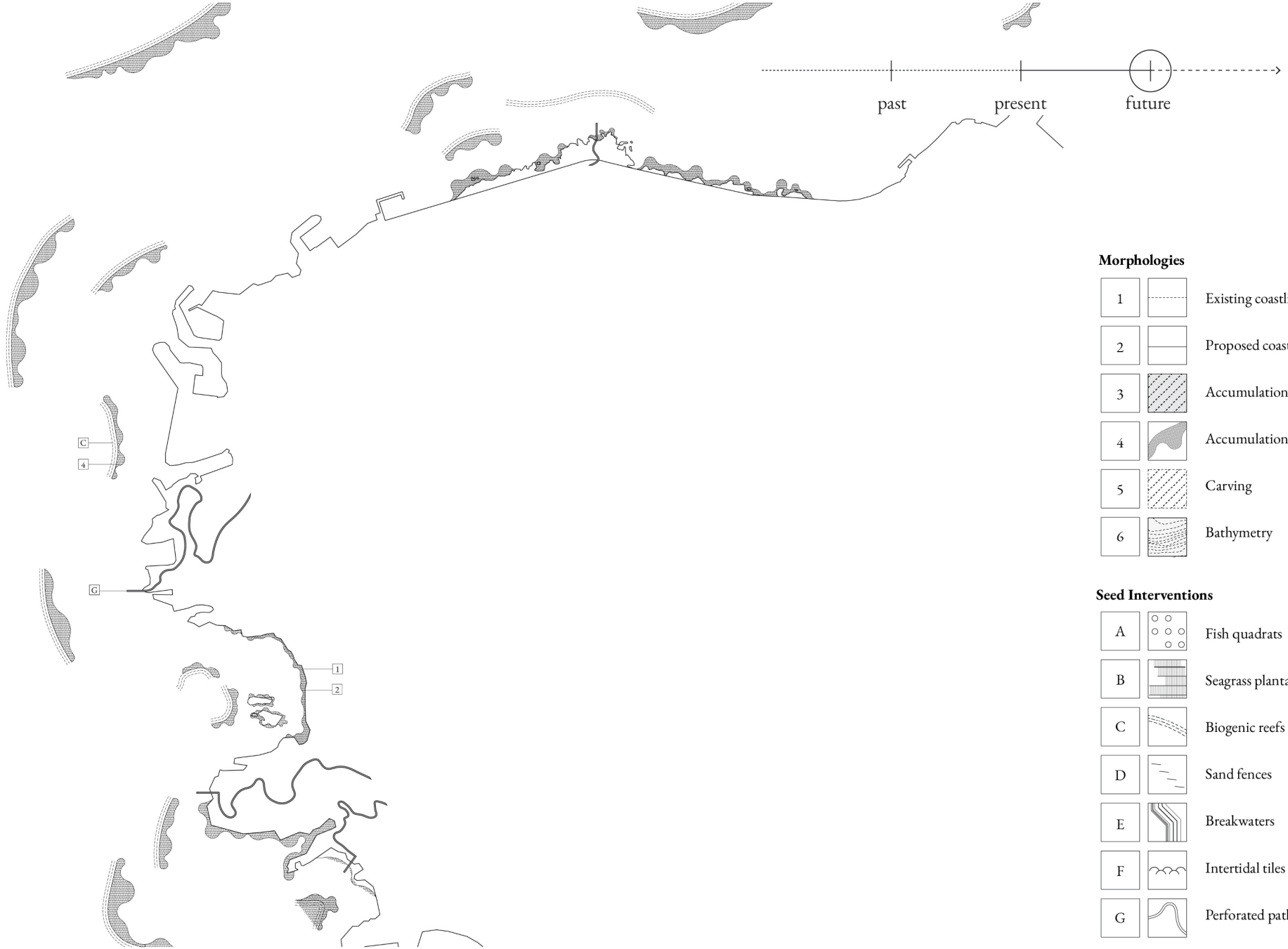

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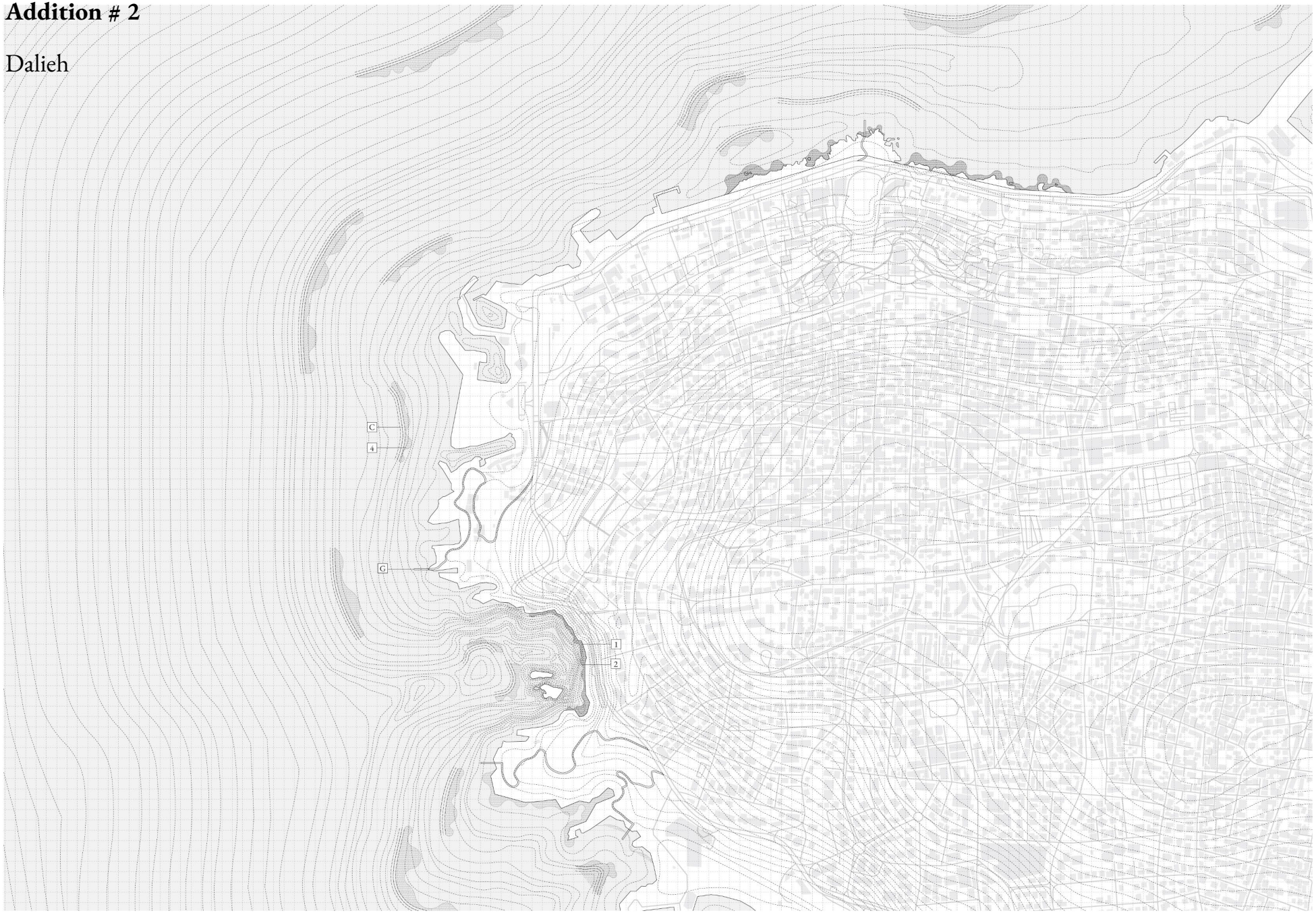

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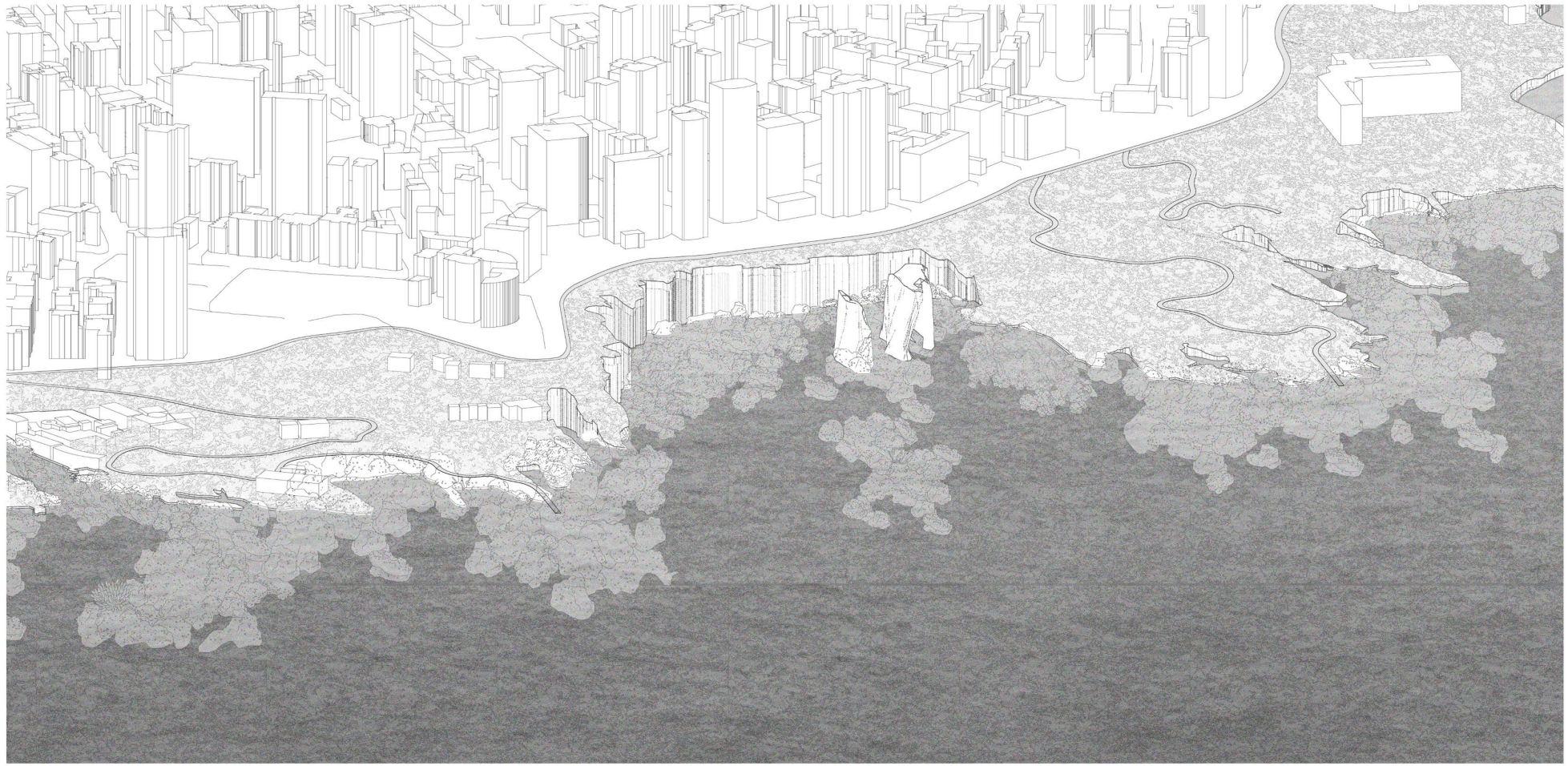
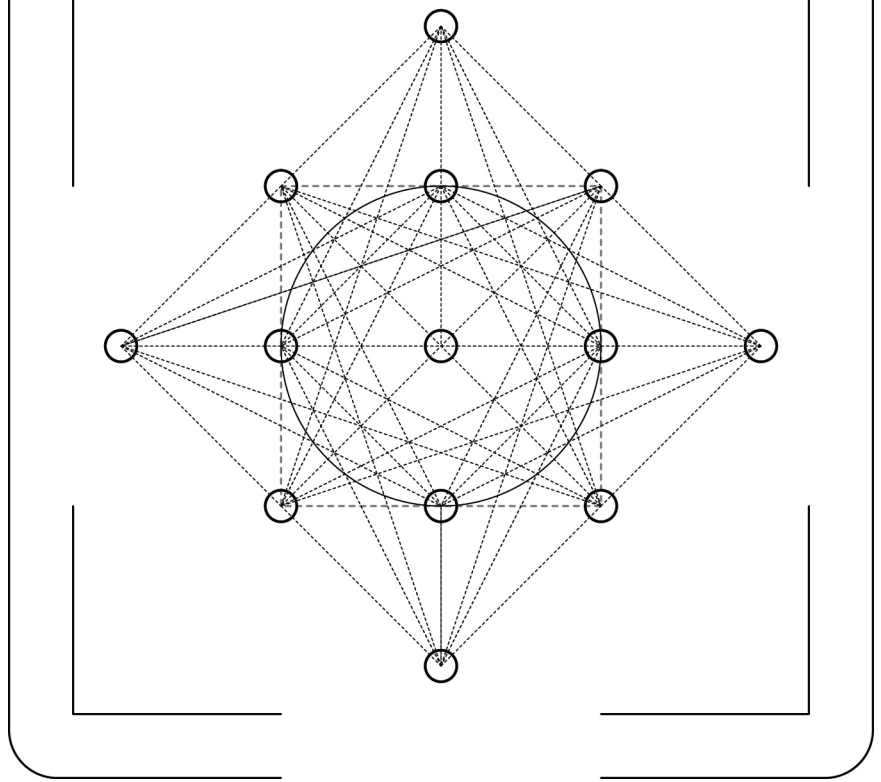


Seed
Interventions







Problematics

Maritime pollution

Terrestrial pollution

Hard edge

No access



Problematics

Maritime pollution

Terrestrial pollution

Hard edge

No access

Potentialities

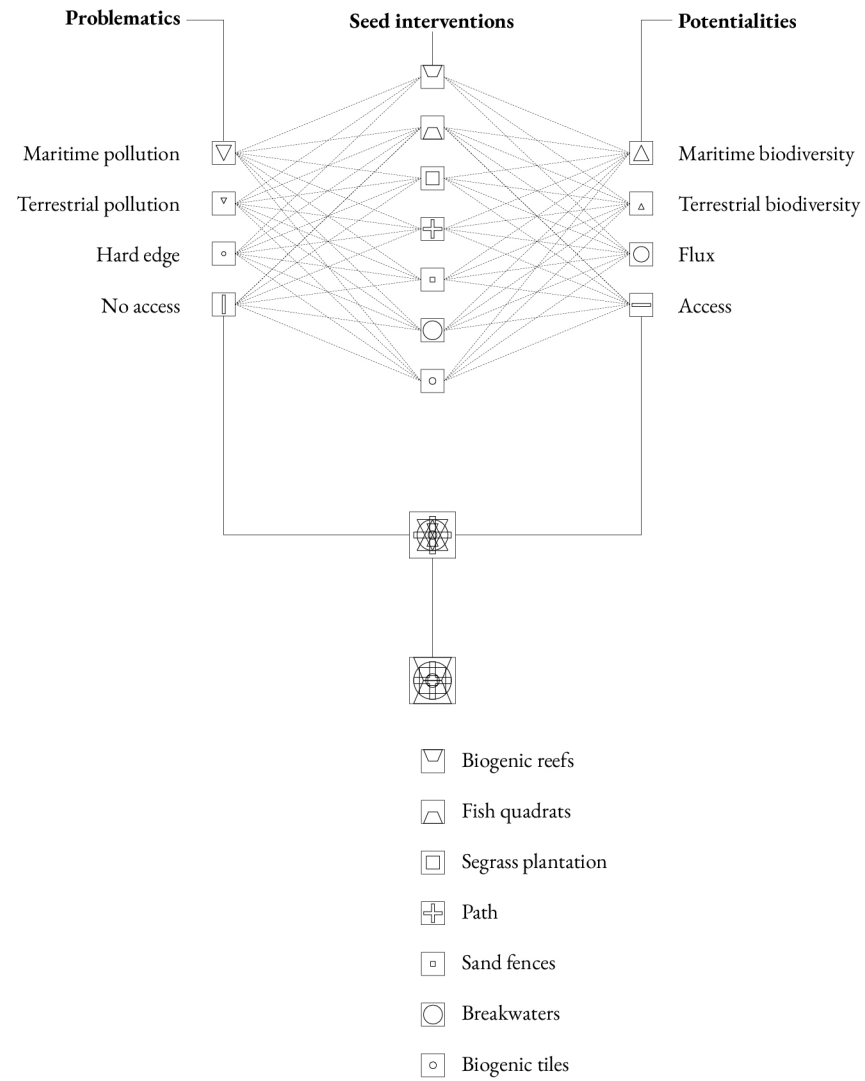
Maritime biodiversity

Terrestrial biodiversity

Flux

Access




Problematics
Seed interventions
Potentialities
Maritime pollution
Terrestrial pollution
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No access
Maritime biodiversity
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Fish quadrats
Segrass plantation
Path
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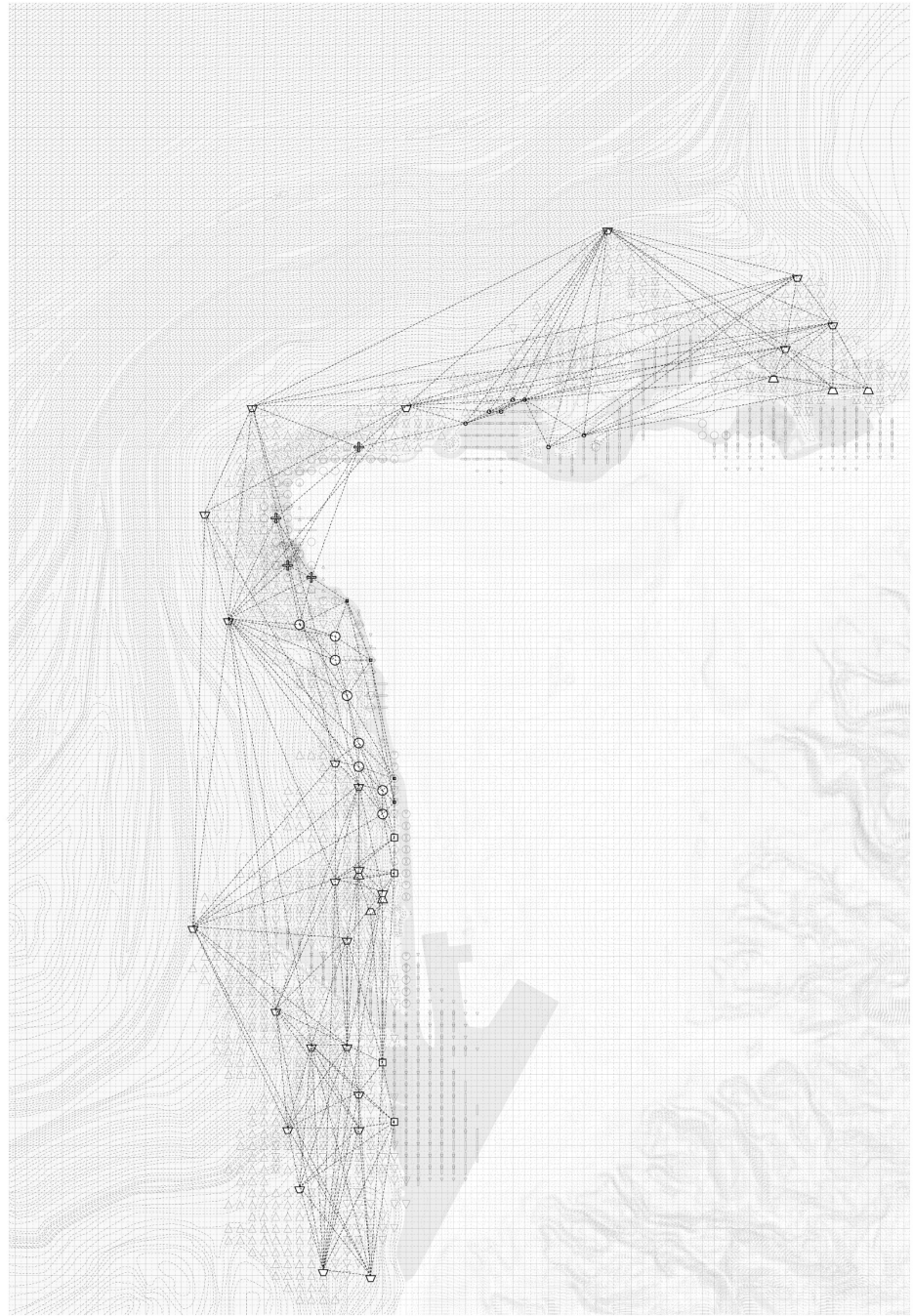
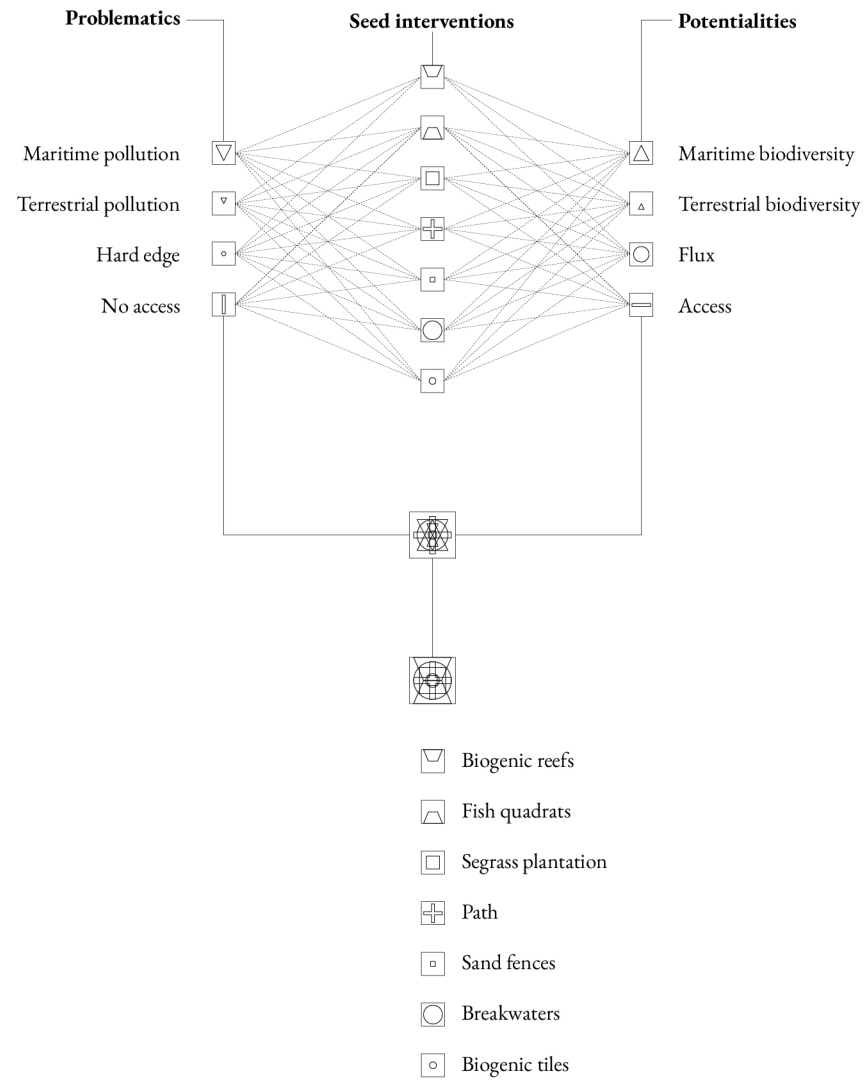
Breakwaters
Biogenic tiles

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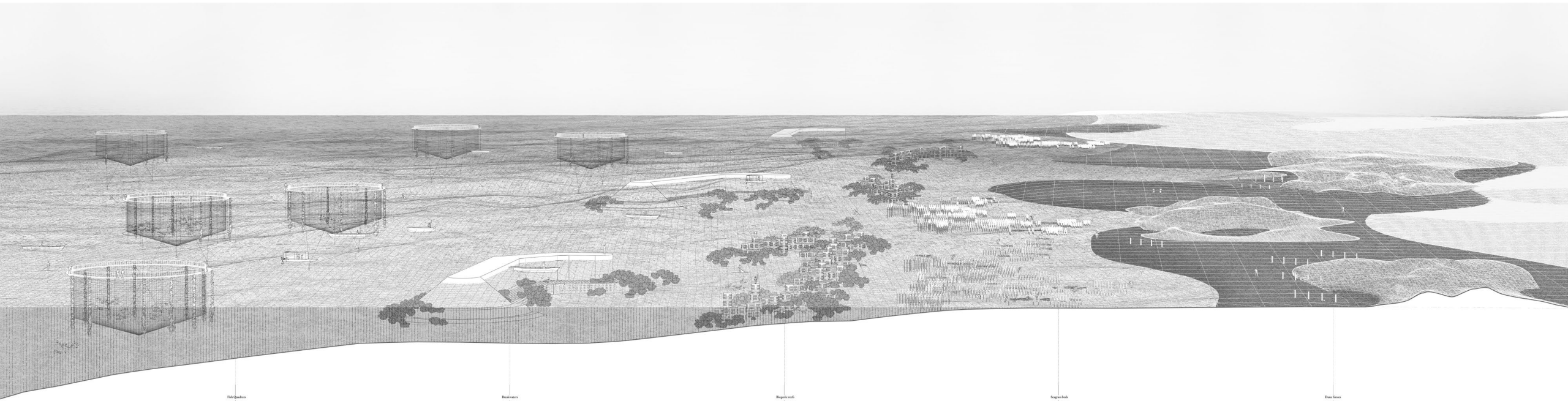


Fish Quadrats

Fishing in Lebanon holds a rich cultural heritage as it has played an important role in coastal communities for centuries. It has been an integral part of the economy and serves as a primary source of livelihood for a large part of the population. The practice of fishing has been significantly hindered by overfishing, pollution, and habitat destruction. Fish quadrats are designed to address these issues by providing a sustainable solution for the future of fishing businesses. Fishing grounds are weighted and produced on the edge, often adjacent to areas of mass violation, such as landfills, sewage outflows, or coastal dams. Fish quadrats, designed with an accessible floating path, provide a controlled and monitored environment for the reintroduction of fish species in areas where they have been depleted or overfished. By creating a safe haven for fish to breed and grow, fish quadrats can help to restore the balance of the marine ecosystem, leading to increased biodiversity and improved water quality. Additionally, fish quadrats can serve as a tool for education and research, allowing scientists and students to study the behavior and habitat of fish in a controlled environment. Overall, fish quadrats have the potential to play a significant role in promoting sustainable fishing practices and restoring the health of the region's ecosystems. While a portion of the fish is harvested, a specific number is designated to be returned to the sea, ensuring sustainable fishing practices, and maintaining a robust fishing economy, which is a crucial foundation for the country's economic development. The structure is made of a metal frame and a wooden floating path, and is anchored to the seabed with concrete blocks. Aside from accessibility from the floating path which can be accessed by boat, the structure is also accessible for scientific purposes. Divers can enter the quadrats to monitor the fish and collect data, while the structure's design allows for easy maintenance and repair. Overall, fish quadrats are a promising solution to the problem of overfishing and habitat destruction in Lebanon's coastal waters. By providing a safe haven for fish to breed and grow, they can help to restore the balance of the marine ecosystem and promote sustainable fishing practices for the benefit of both the environment and the local economy.

Breakwaters

Breakwaters are engineered structures placed offshore to dissipate wave energy and protect the coastline from flooding and erosion. Along sandy coasts, in addition to their protective capacities, breakwaters possess the capacity to morph the coastline through sedimentation dynamics and the subsequent formation of tombolos. The shape of the tombolo is determined by the breakwater's distance from the shoreline (D), and its length (L). The rate and volume of accumulation of sediments attached to the structure. The resulting morphologies are determined by several aspects of the design of the breakwater and its placement. These parameters include the length(B) and height (H) of the breakwater, distance from the shoreline (D), and distance from neighboring breakwaters (G). Based on the ratio between these parameters, the tombolo can be classified as a salient, double tombolo, or a symmetrical straight-shape. The basic strategies for designing a breakwater are adopted, but they are further customized by allowing a shift on the left side of the structure to enable docking, and the base of the breakwater includes perforations to enable the proliferation of biogenic reefs, eventually creating a habitat for marine species. Additionally, the breakwater's surface is textured to allow for the settlement of algae, which further contributes to the ecological value of the breakwater itself. The placement of these interventions along Beirut's coastline was determined by conducting a marine clearance review that examined the diverse impacts of sedimentation in relation to the aforementioned parameters. The findings of this review are summarized in the table below. Accordingly, different forms are explored and placed on a marine board on their extent of access in relation to sedimentation accumulation rates.

Biogenic reefs

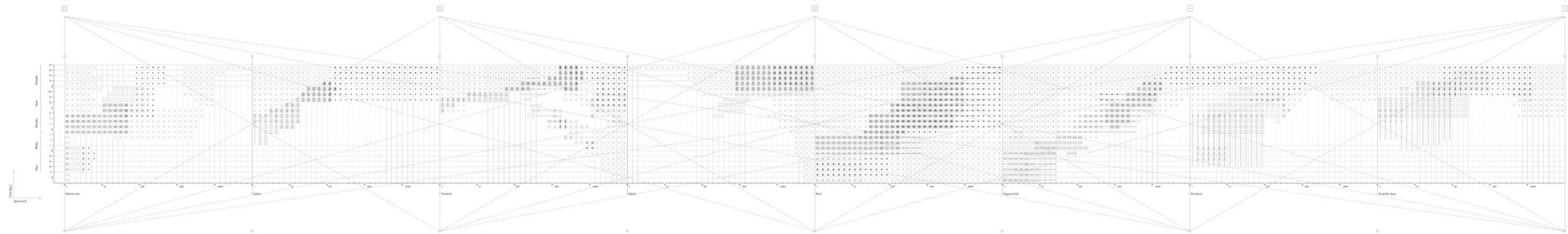
The Levantine basin hosts diverse shellfish species, mostly native to their origin. This research effort is once again aimed at shifting the narrative towards highlighting the inherent potentialities and maximizing their benefits. Recognizing the importance of exploiting this, extensive research has been undertaken to identify species that are suitable for the proposed intervention. Ostrea edulis, commonly known as the European flat oyster, was selected as the species of choice. As a critical role as a keystone species, offering a multitude of benefits. Similar to other bivalve mollusks, the Mediterranean strand is a filter feeder, in that, they extract suspended particles, phytoplankton, and organic matter from the water. As filter feeders, they are essential components of the nitrogen and phosphorus cycles, helping to maintain the balance of these nutrients in the ecosystem. Additionally, they provide habitat and shelter for other marine organisms, which can benefit from aggregations at the site first through their attachment to hard substrates. They establish complex habitats by providing shelter, clean water, and feeding ground for other organisms. Once transformed into reef, mussel beds stabilize sediments and dissipate wave energy, through the slow movement of water through the reef structure, which can help to reduce erosion and protect the shoreline. Finally, they can also improve water quality by filtering out pollutants and excess nutrients. The reef intervention aims at serving as food and also as a supplier for spawning and development of fishing pelagos and other shellfish native to the Levantine basin. The intervention is simply composed of 3 shallow structures with perforations, copied all an optimally constructed reef foundation. They are designed in a way such that the entire structure could break without any risk; therefore were scatter their pieces on an optimal distance for benefit. Three types of scatter structures are established through the creation of varying clearance perforations. This translates the designation of water energy and extracts a higher diversity of benefits. Oysters are filter feeders that consume algae and other microscopic organisms by pumping water through their gills. They have a relatively simple digestive system and nutrients and growth. Often for adult mussels release their eggs and sperm, the fertilized eggs develop into larvae known as veligers, which spend several weeks drifting in the water column, aided by water currents. Once they undergo metamorphosis, they transform into juvenile mussels (spat), which then settle on a suitable substrate, such as rocks or other mussels, and begin to grow into adults. Mussels can also reproduce asexually through budding, where new individuals can contribute to the ecosystem's biomass different to sexual habitats. The aggregated reef eventually develops into and transforms completely into shellfish reefs.

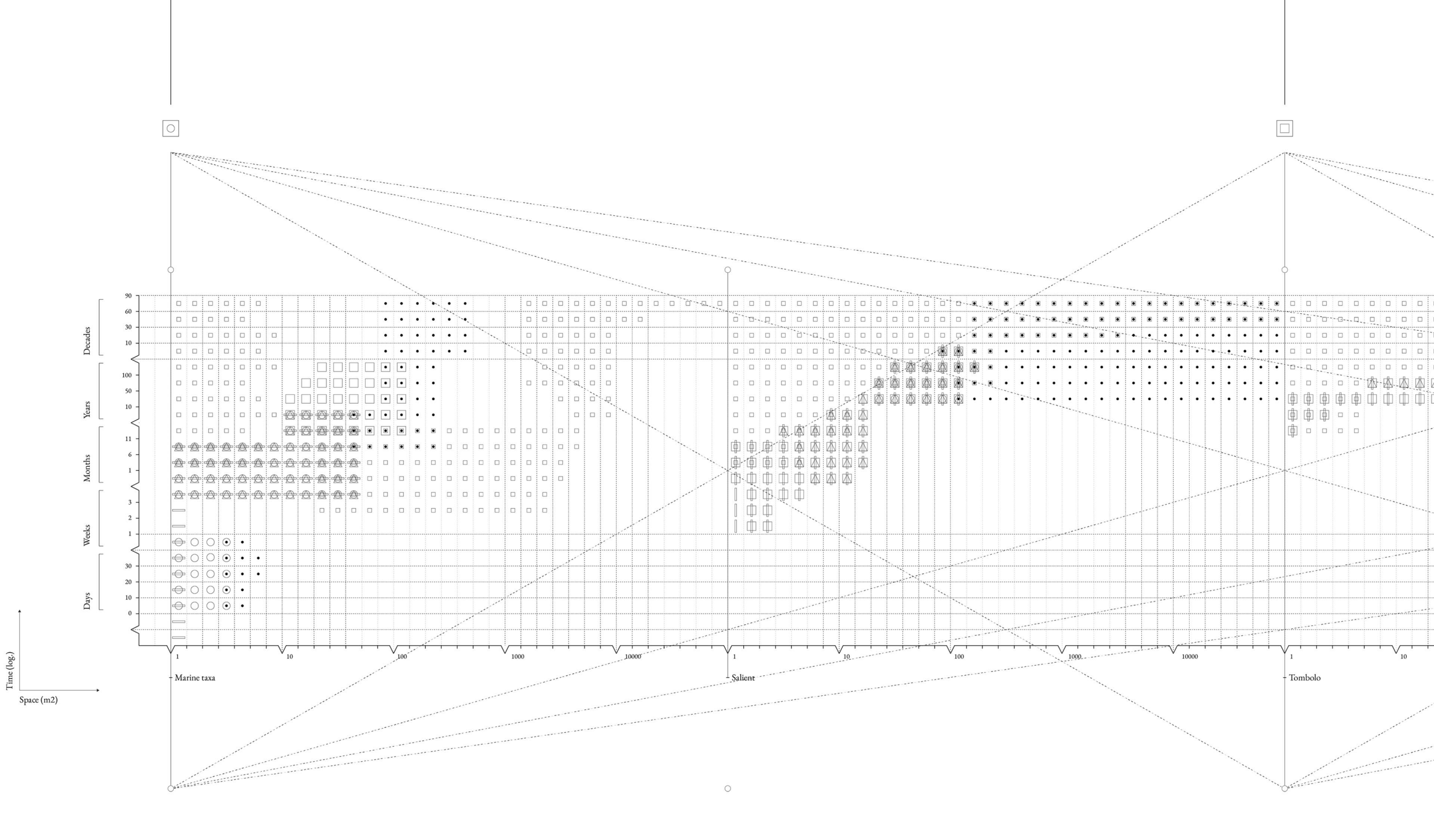
Seagrass beds

This multidimensional ecosystem encompasses the growth of Neptune grass and the restoration and transplantation into seagrass beds. Neptune grass, a native species of seagrass in Lebanon, is the primary habitat and nursery ground for the majority of the local bivalve fauna. It forms dense intertwined submerged meadows offering shelter, food, and breeding grounds for a wide variety of marine organisms, including fish, crustaceans, and mollusks. Seagrass beds are also important carbon sinks, as they can sequester large amounts of carbon dioxide from the atmosphere and store it in their roots and rhizomes for long periods of time. This helps to mitigate the effects of climate change on marine ecosystems. Seagrass beds are also important for coastal protection, as they can help to reduce wave energy and prevent erosion of the shoreline. Their dense root systems help to stabilize sediments and maintain the clarity of the water, which is important for the health of other marine organisms. Overall, seagrass beds are a valuable and important ecosystem that provides a wide range of benefits to both the environment and human society. They are also remarkably resilient, as they can recover from disturbances such as storms and pollution events relatively quickly. However, seagrass beds are also vulnerable to a number of threats, including habitat loss, pollution, and climate change. It is important to protect and restore seagrass beds in order to maintain the many benefits they provide. This can be done through a variety of methods, such as reducing pollution, planting new seagrass beds, and establishing marine protected areas. By taking these steps, we can help to ensure that seagrass beds continue to thrive for generations to come.

Dune fences

With the aim of capturing and accumulating sand particles, the intervention works symbiotically with offshore structures to further stabilize the shore. The poles, stacked significantly 0.5 meters apart, angled perpendicular to the dominant wind direction, decrease the velocity of the wind and encourage the deposition of sediment. Over time, the sand will bury the lower portion of the fence, creating a natural barrier that can help to protect the dune from erosion. As the further planting of stabilizing dune grasses, the shoreline is reinforced and slowly increases over time, further creating the effect of sea level rise.




Decades
Years
Months
Weeks
Days
90
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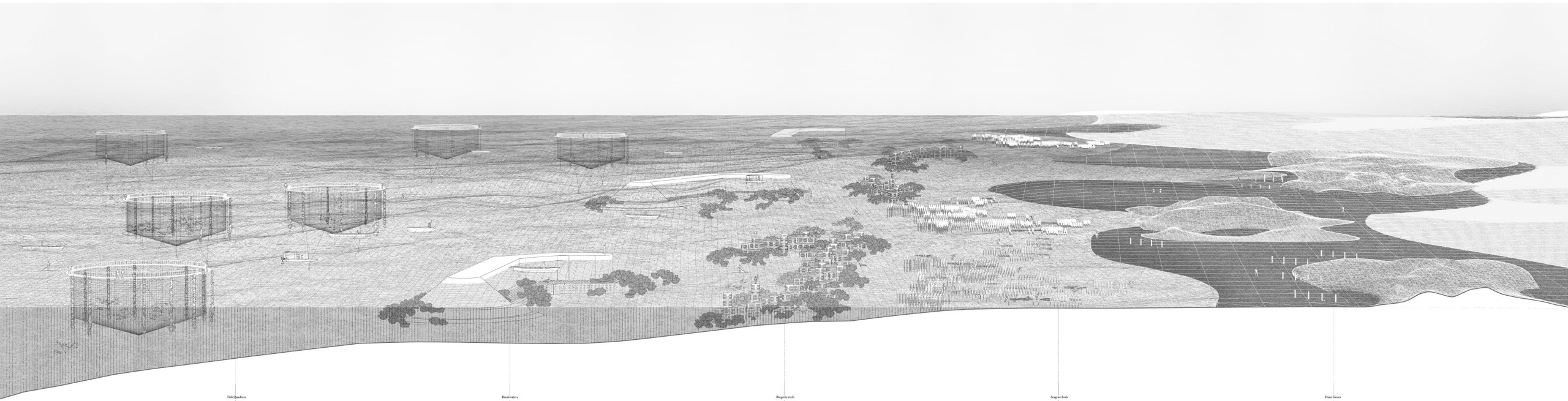
1000
10000
Marine taxa
Salient
Tombolo
Time (log.)
Space (m2)



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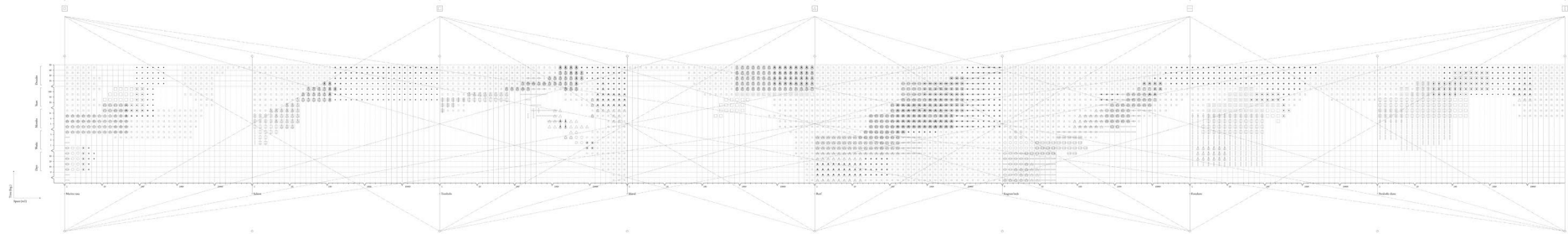
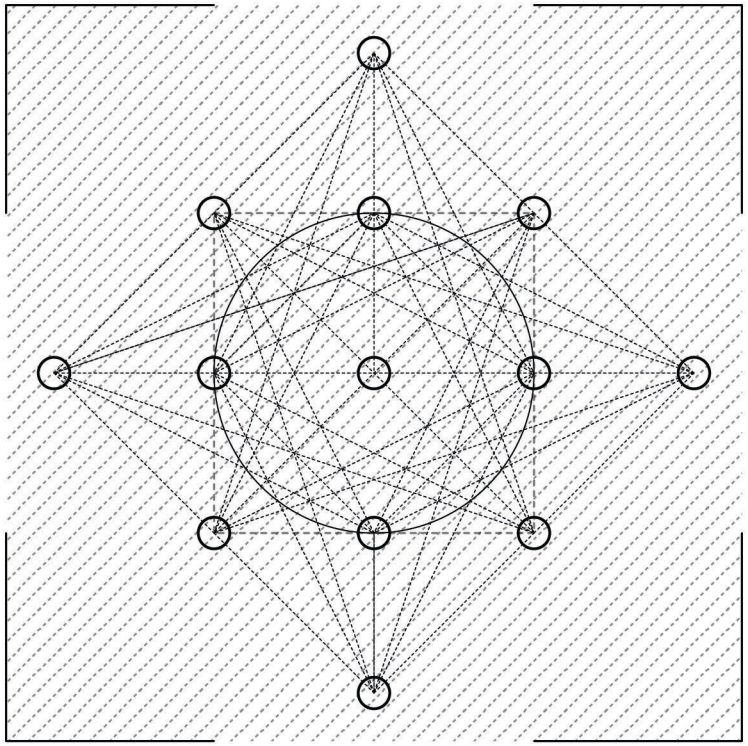
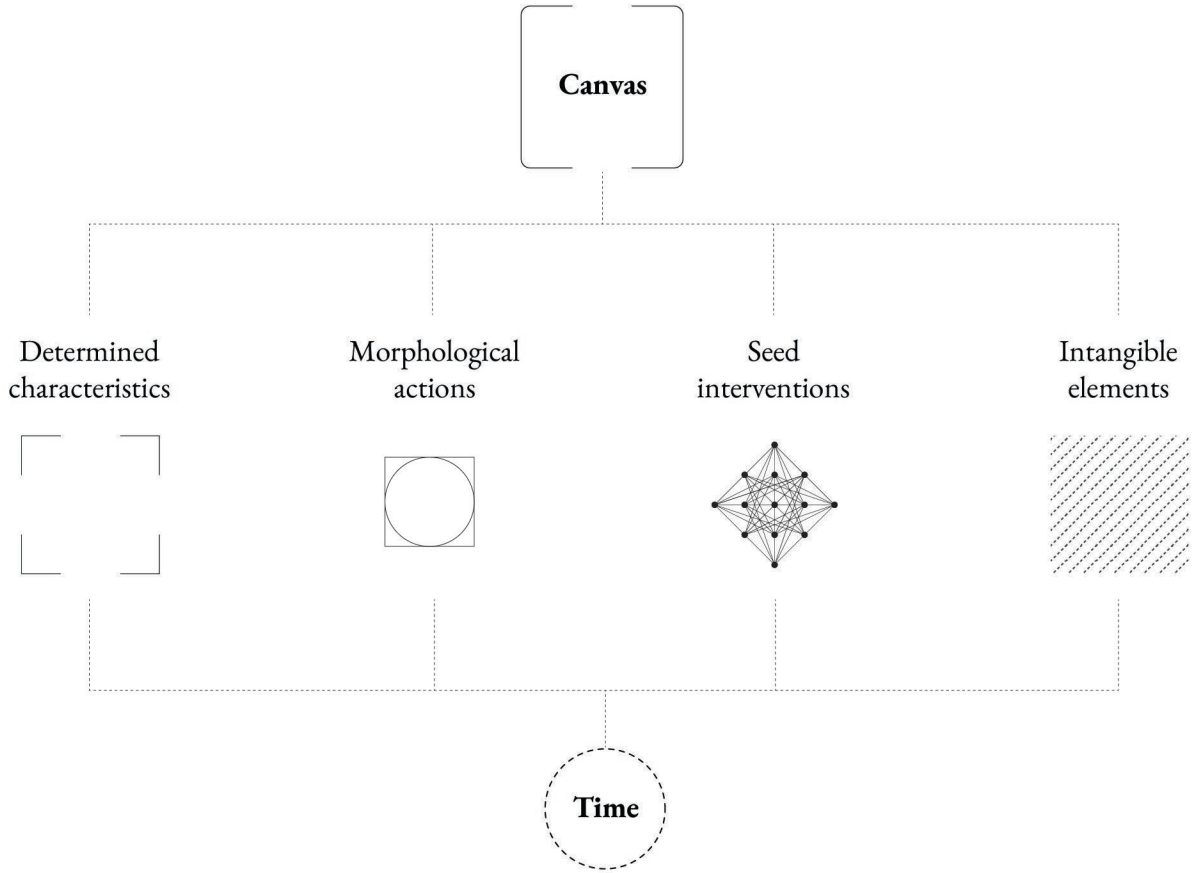
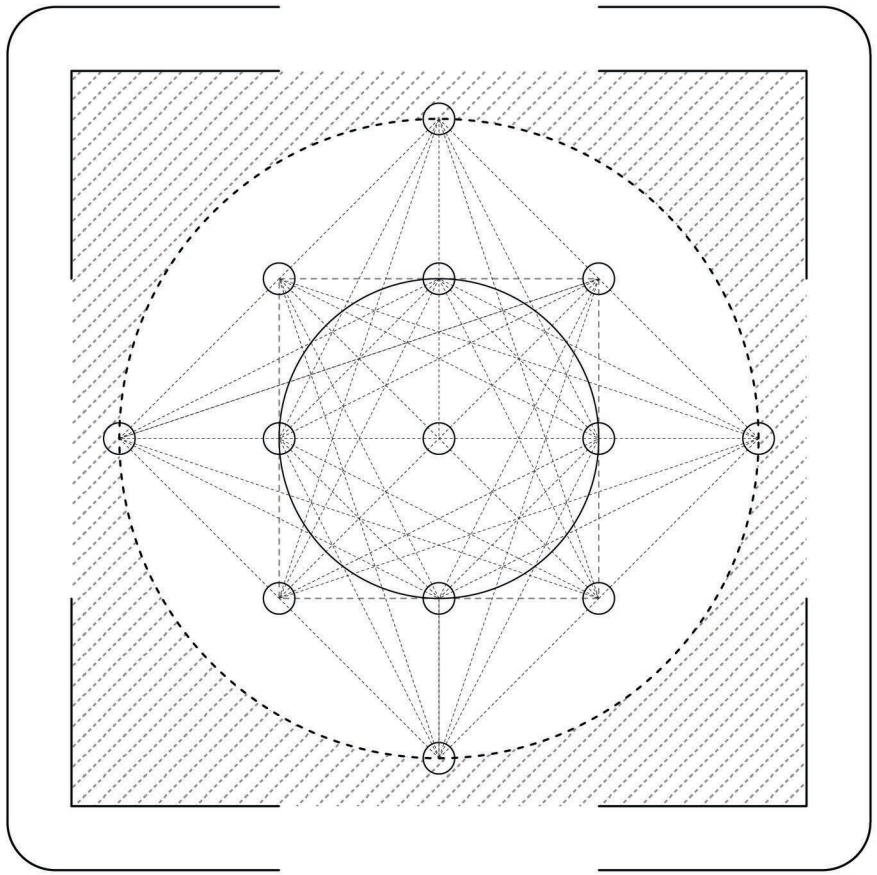
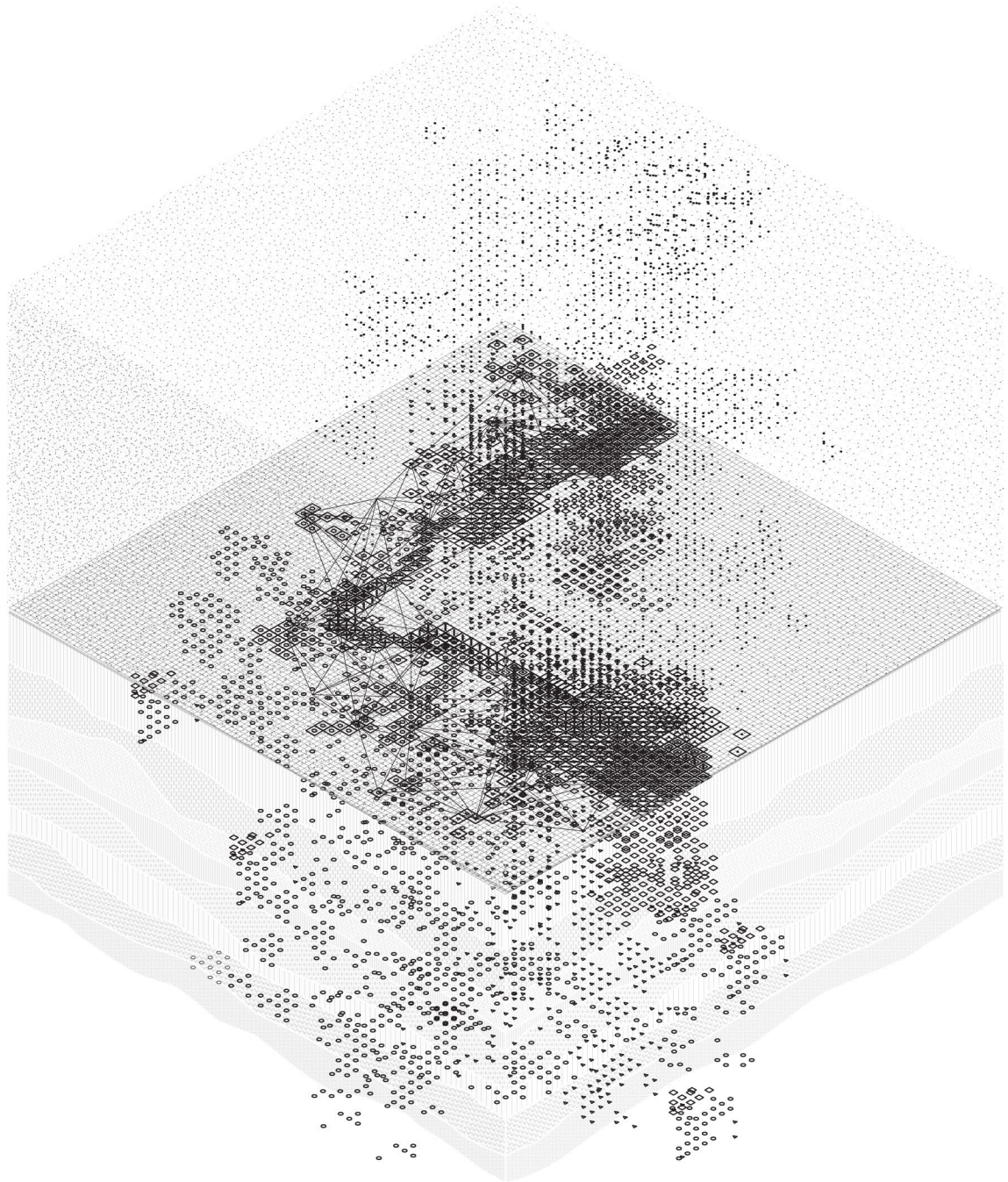


Intangible elements




Canvas
Determined characteristics
Morphological actions
Seed interventions
Intangible elements
Time





Beneath the pavement,
the beach

A semantic exploration of time, space, and
their volume of permutations through
Lebanon's littoral