A DARK ECOLOGY PROJECT

THE SEA OF MARMARA

Symbiotic architecture along the edge zone

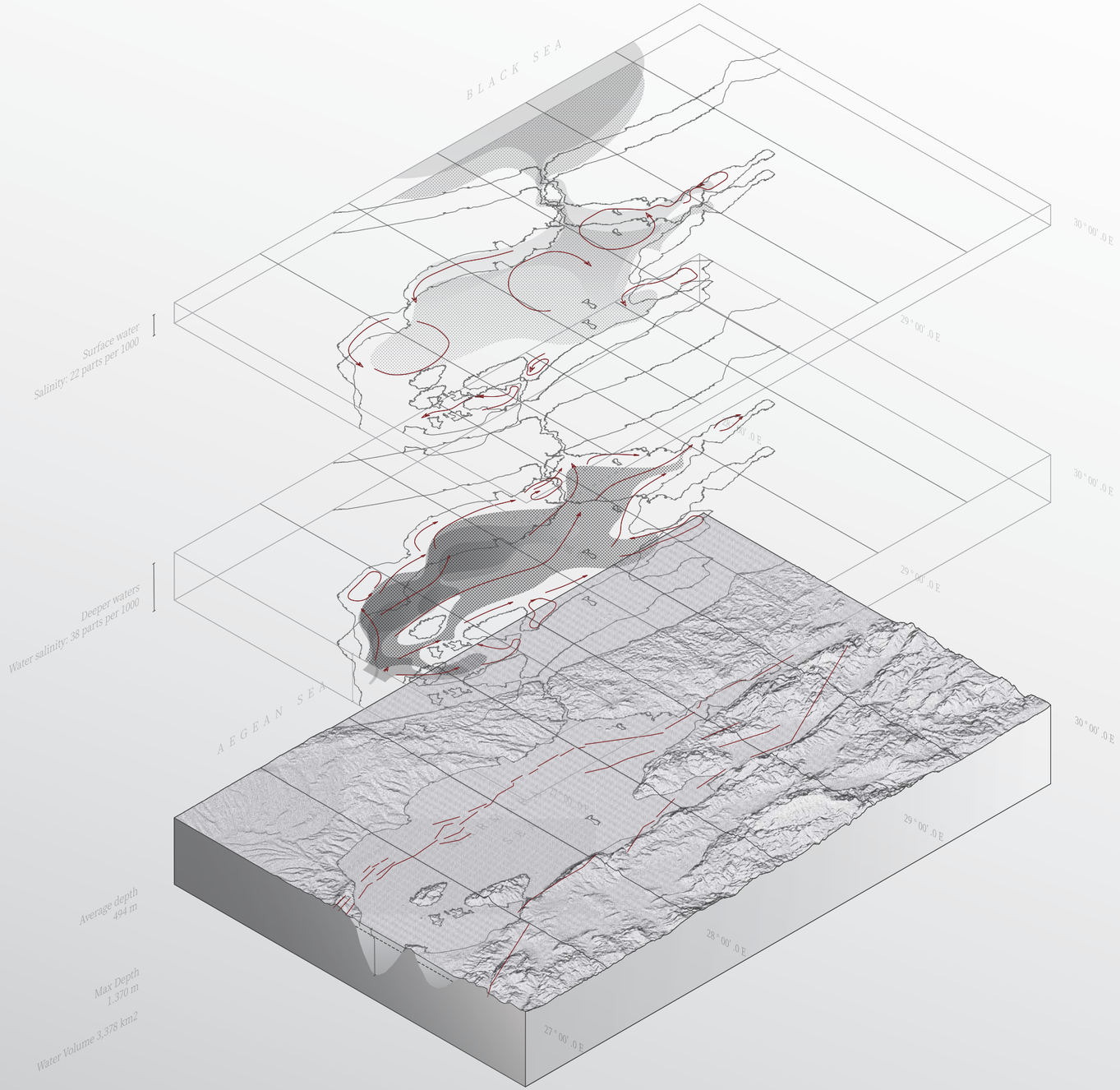
Carmen Wientjes

P5 presentation
2nd of Nov 2023

Borders & Territories
Delft University of Technology | Faculty of Architecture

Tutors: Peter Koorstra, Oscar Rommens, Gilbert Koskamp


BLACK SEA
NORTHERN SHELF
MARMARA SEA
SOUTHERN SHELF
TEKIRDAG BASIN
CENTRAL BASIN
CINARCIK BASIN
IZMIT BAY
GULF OF SAROS
DARDANELLES STRAIT



AEGEAN SEA — 30 cm — MARMARA SEA — 40 cm — BLACK SEA

Height differences of surface water in relation to neighbouring seas

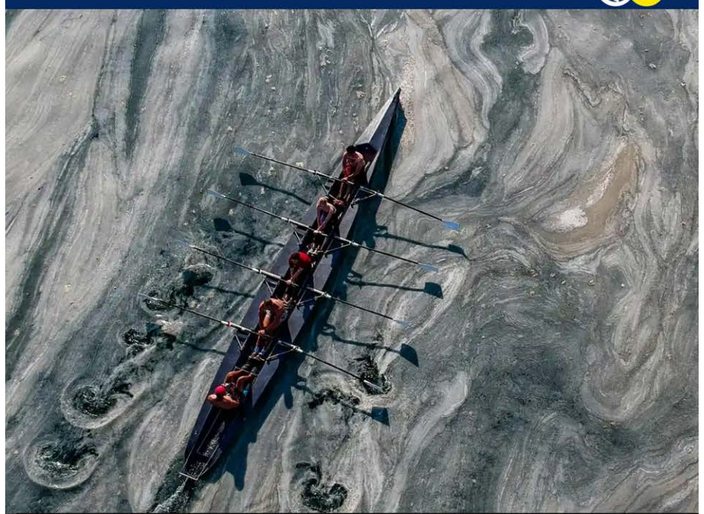
The Atlantic

Photos: Turkey's Sea-Snot Disaster

ALAN TAYLOR | JUNE 21, 2021 | 21 PHOTOS | IN FOCUS

For more than six months now, parts of the Sea of Marmara along Turkey's coast have been covered in a thick layer of glop known as mucilage, or "sea snot." Pollution, warmer temperatures, and other environmental factors appear to have resulted in a proliferation of phytoplankton, which are releasing an "overabundance of mucus." Government workers have been trying to clean up some of the worst-hit areas as biologists and environmentalists have expressed alarm. Below, you'll find a recent collection of sea-snot images; for the complete story, read "A Slimy Calamity Is Creeping Across the Sea" by our own Sarah Zhang.

News | Opinion | Sport | Culture | Lifestyle



'Sea snot' plagues the Turkish coast – in pictures

A thick layer of organic matter known as marine mucilage has spread in the Sea of Marmara, covering harbours, shorelines and swathes of the surface south of Istanbul. Some of the 'sea snot' has sunk below the waves, suffocating seabed life

Main image: Rowers cross the thick slime on the Marmara Sea. Photograph: Yasin Akgül/AFP/Getty Images

Wed 9 Jun 2021 08.40 BST

rtlnieuws 0° 9 km

Dikke laag slijm

Turkse Zee van Marmara weken geteisterd door 'zeesnot'

6 juni 2021 21:18 • Aangepast 6 juni 2021 21:34

Havens, kusten en delen van zeewater zijn bedekt met de stroperige, grijzige substantie.

De kusten aan de Turkse Zee van Marmara worden de afgelopen weken geplaagd door zogenoemd 'zeesnot', een dikke laag natuurlijk slijm dat een bedreiging vormt voor het zeeleven en de visserij

1.
Undisturbed marine life
Wide variety of sea life due to nutrient-rich top current & high salinity in bottom current

2.
Effects of Climate change & temperature rise
to changed biodiversity and increase bacteria

3.
Interruption by pollutants
Increase of microbial growth and subsequently an algae increase

4.
Seasnot occurence

5.
Polluted interrupted balance

GOLDEN HORN

BOSPHORUS

MARMARA SEA

CO_2

Cyanide
Nitrogen
Chromium
Lead
Copper

3 - 4 months

O_2

Suffocating blanket

O_2

0

30

PHOTIC

200

DISPHOTIC

Average depth 496

1000

APHOTIC

Max depth 1396

N_2

P_4

Spread of bacteria & viruses

Algae increase

Pathogen increase

Clogging of gills

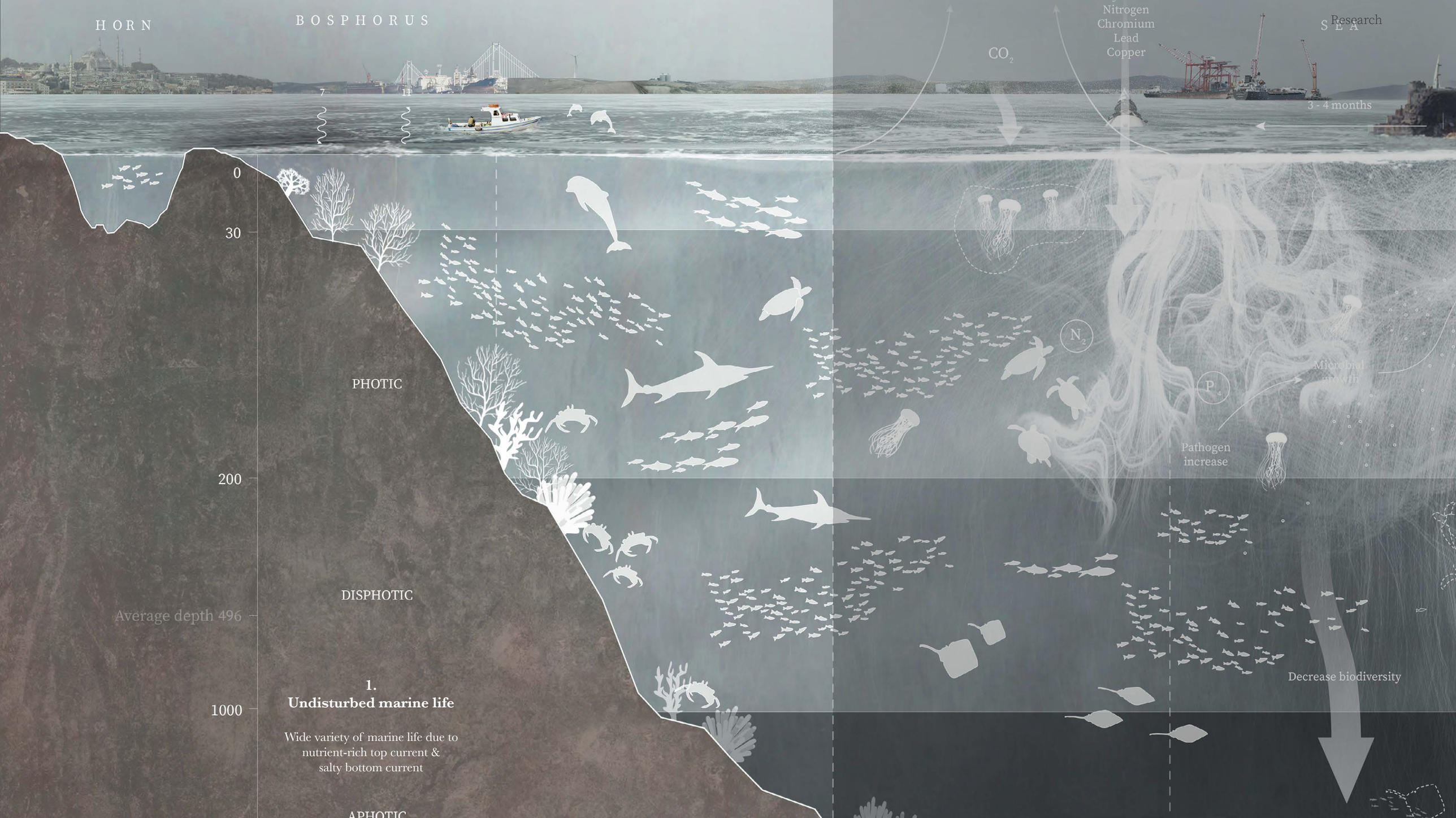
Decrease biodiversity

7 - 10 years

Death

Coral bleaching

Dolphin
Turtle
Sword fish
Blue fish
(groupers, such as sardines)
Octopus
Sting ray


HORN
BOSPHORUS
SEA
Research
7
11
CO_2
Nitrogen
Chromium
Lead
Copper
3 - 4 months
0
30
200
1000
PHOTIC
DISPHOTIC
APHOTIC
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Microbial growth
Pathogen increase
Decrease biodiversity
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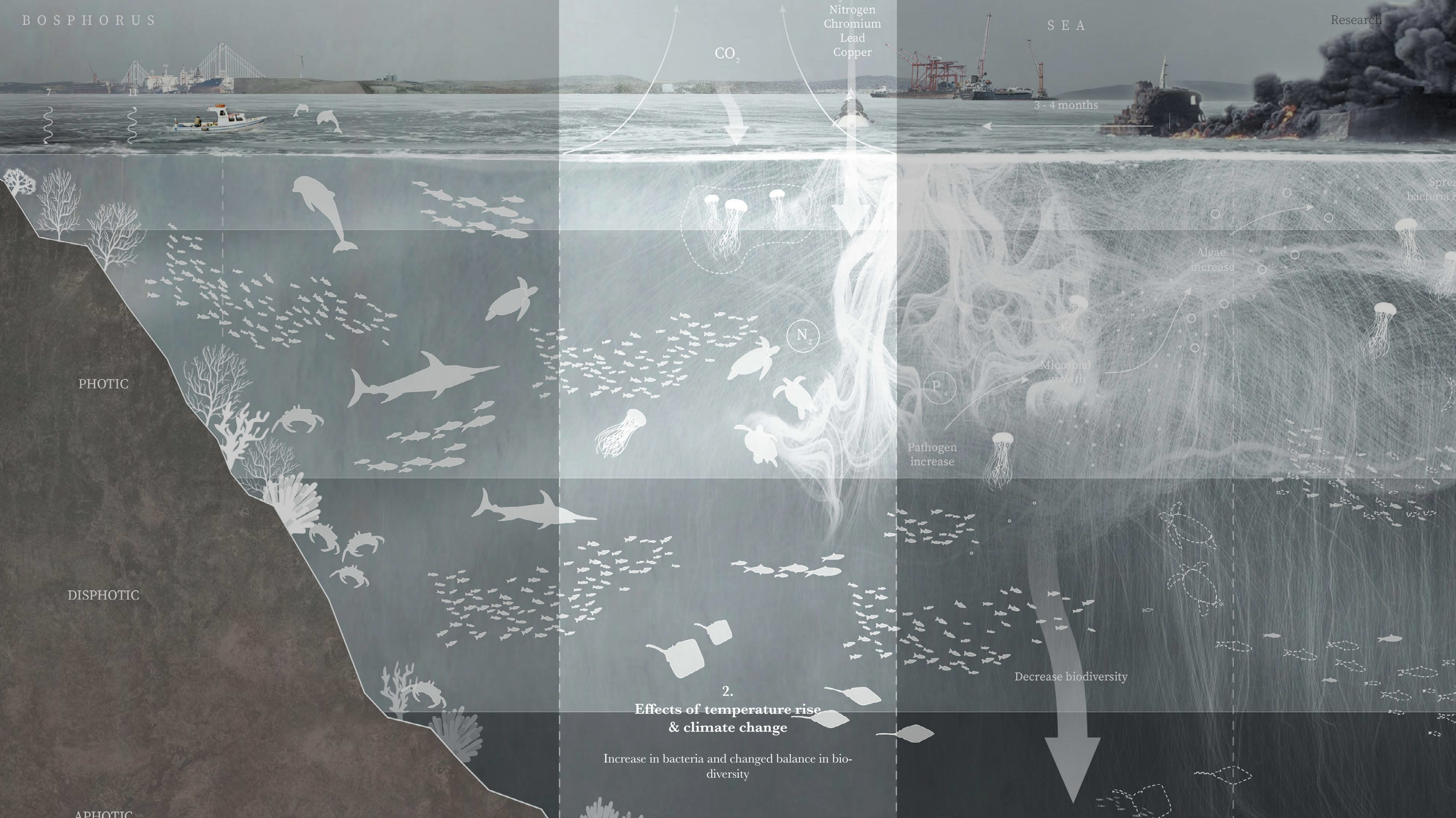
Undisturbed marine life
Wide variety of marine life due to nutrient-rich top current & salty bottom current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2.
Effects of temperature rise & climate change
Increase in bacteria and changed balance in bio-diversity


3 - 4 months
Research
Spread of
bacteria & viruses
Algae
increase
Microbial
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Increase of microbial growth and
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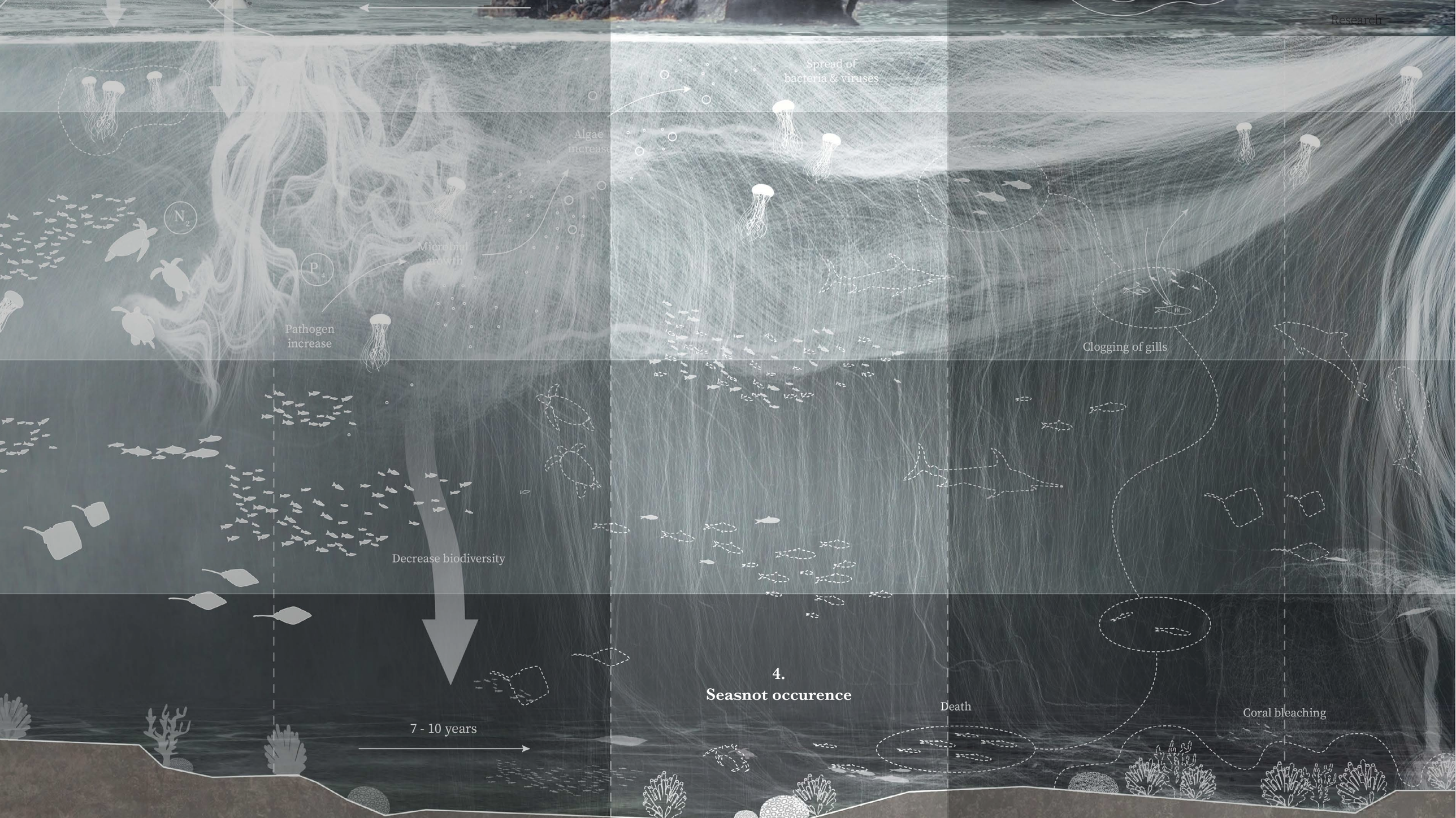
Dolphin
Turtle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7 - 10 years
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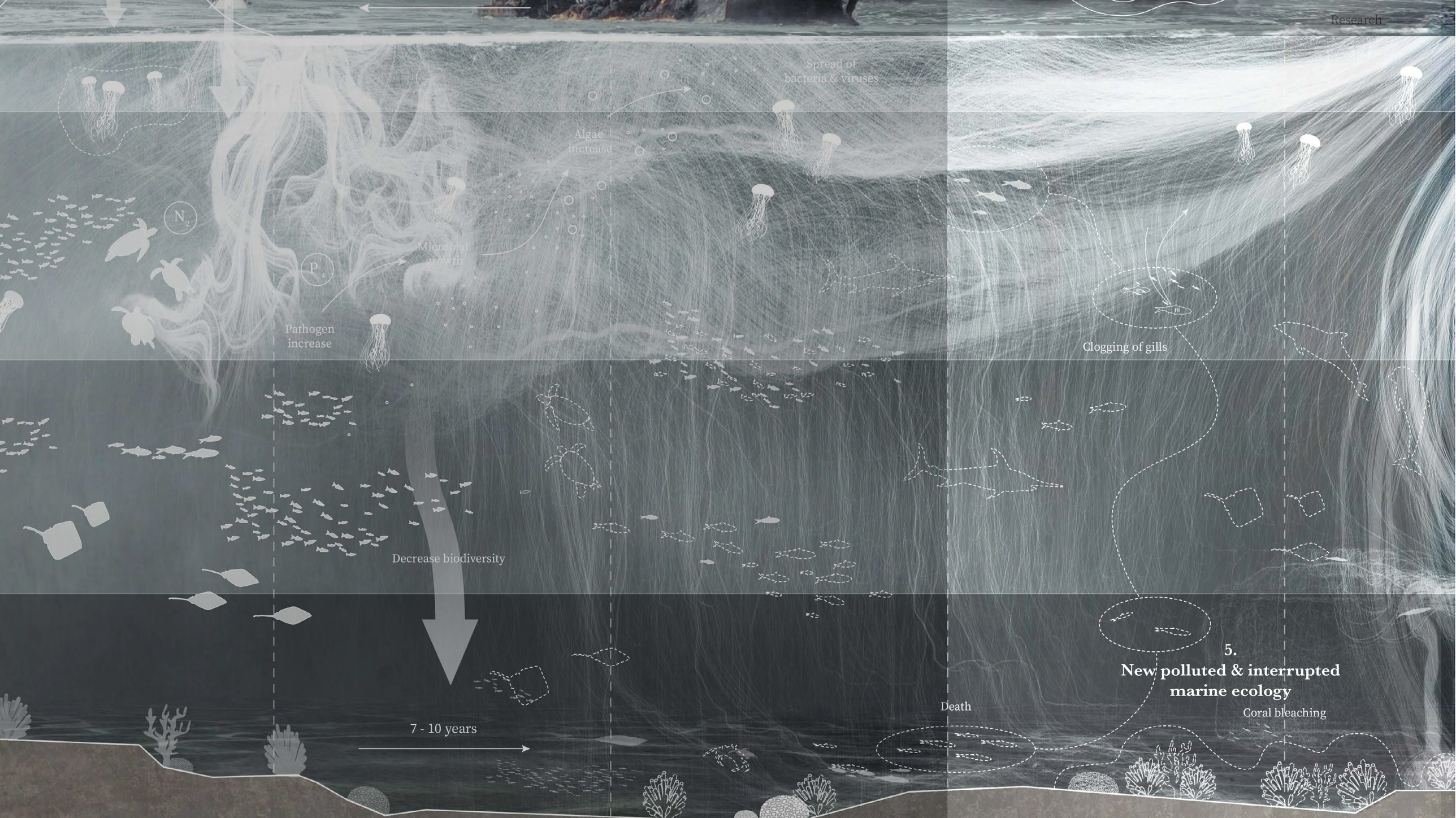
Seasnot occurence
Death
Coral bleaching



5.
New polluted & interrupted marine ecology

Marble quarries

Deep sea discharges

Ports & Shipyards

Main river discharges

Main industrial cities

Ergene river

Tekirdag

Istanbul

MARMARA

SEA

Izmit

Bursa

Biga river

Gönen river

Marble quarries

Deep sea discharges

Ports & Shipyards

Main river discharges

Main industrial cities

Ergene river

Tekirdag

Istanbul

Golden Horn

Bosphorus

MARMARA

SEA

Izmit

Bursa

Biga river

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Marble quarries

Deep sea discharges

Ports & Shipyards

Main river discharges

Marble quarries

Deep sea discharges

Ports & Shipyards

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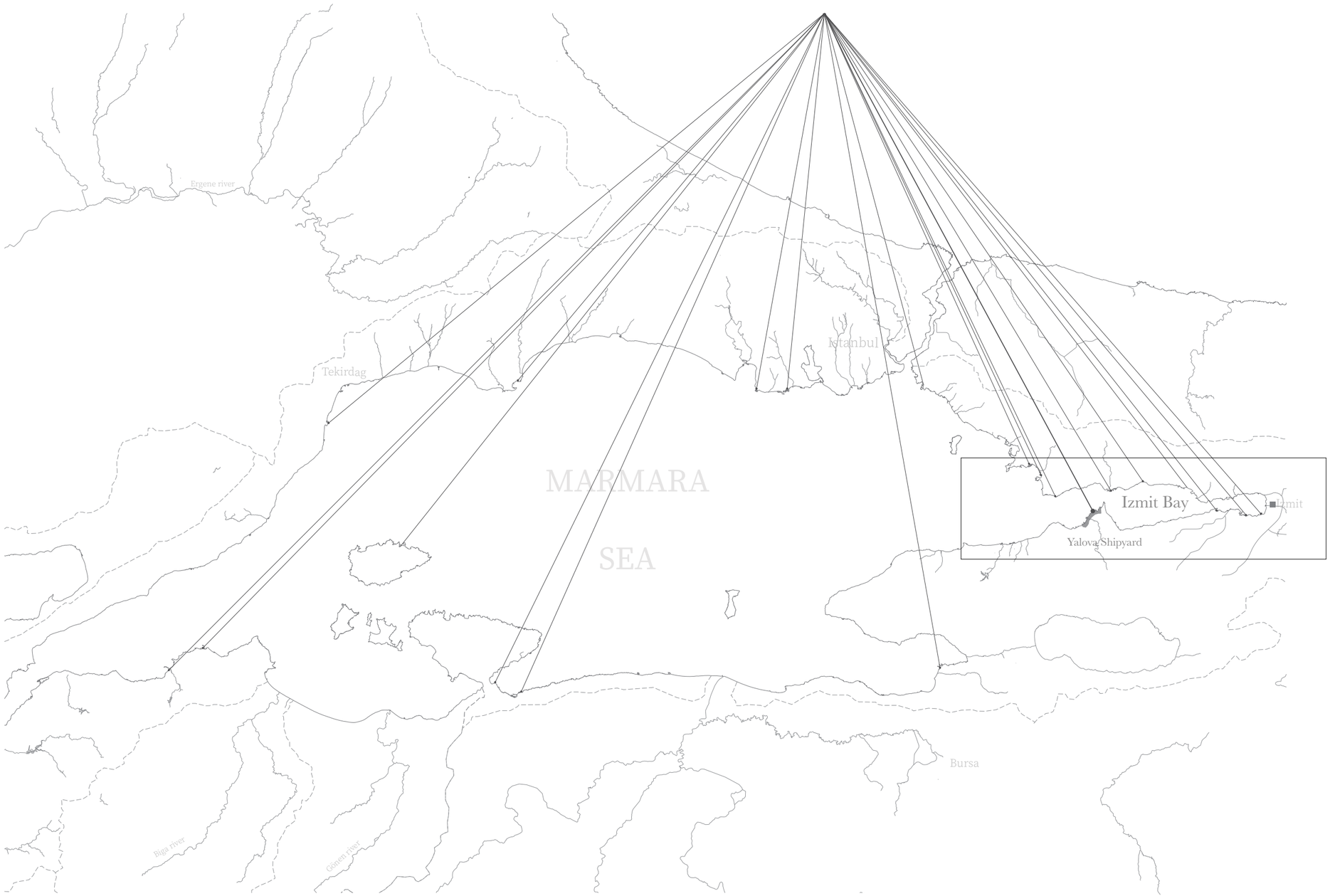
Main river discharges




Marble quarries
Deep sea discharges
Ports & Shipyards
Main river discharges
Ergene river
Tekirdag
Istanbul
MARMARA
SEA
Izmit
Simav River
basin: 22 400 km2
Kurs r.
Niluver r.
Emet r.
Koca r.
Simav r.
Bursa
Bursa
Biga river
Gonen river

Marble quarries

Deep sea discharges

Ports & Shipyards

Main river discharges

Main industrial cities

Ergene river

Tekirdag

Istanbul

MARMARA

SEA

Izmit

Simav River
basin: 22 400 km2

Kara r.

Niluver r.

Emet r.

Koca r.

Simav r.

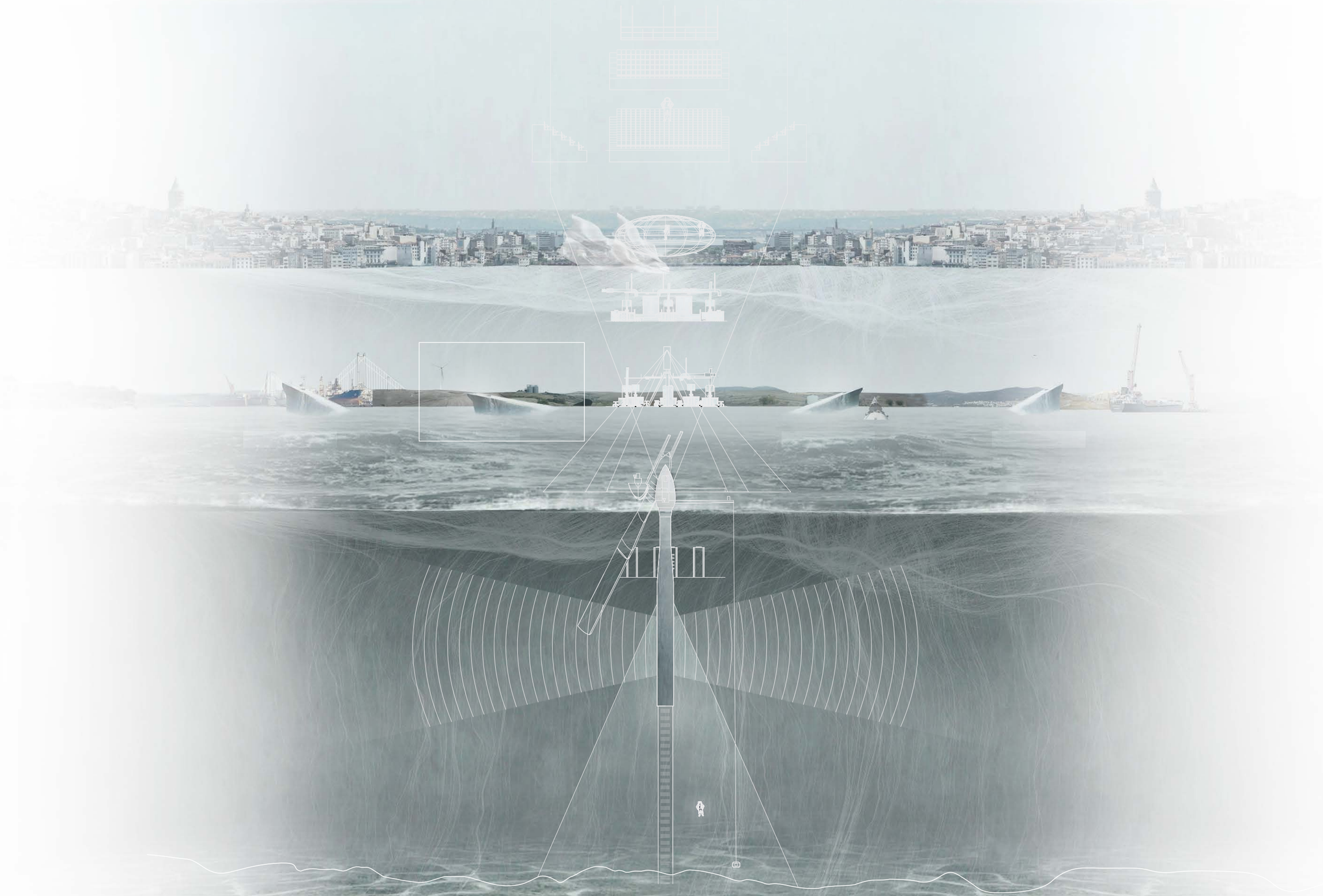
Bursa

Biga river

Gonen river

Coastline hinterland
1. Istanbul
2. Marmara Island (Central basin, Sea of Marmara)
3. Yalova Shipyard (Izmit Bay, Sea of Marmara)
4. Simav River estuary (Gulf of Gemlik, Sea of Marmara)
5. Tekirdag bay pipeline (Northern shelf; Tekirdag bay, Sea of Marmara)


SOUTHERN—USHA
Bursa




Marble quarries
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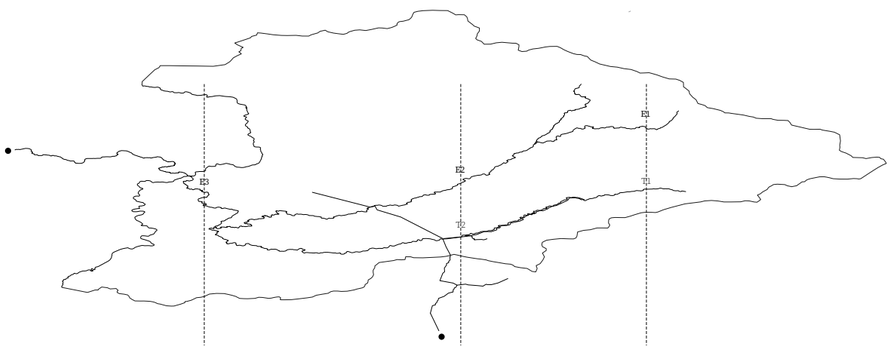
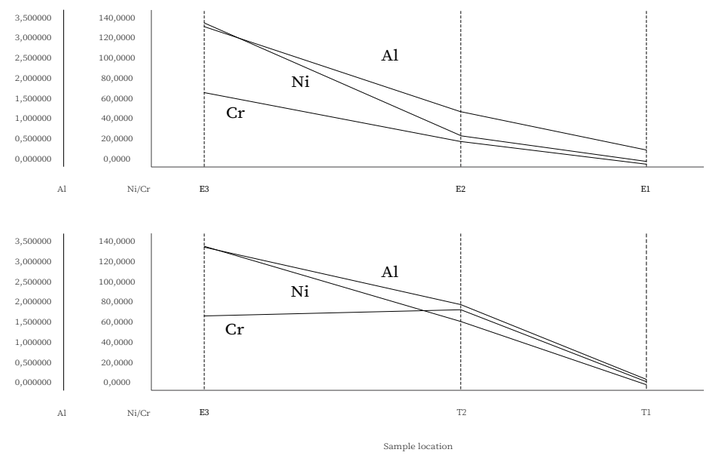
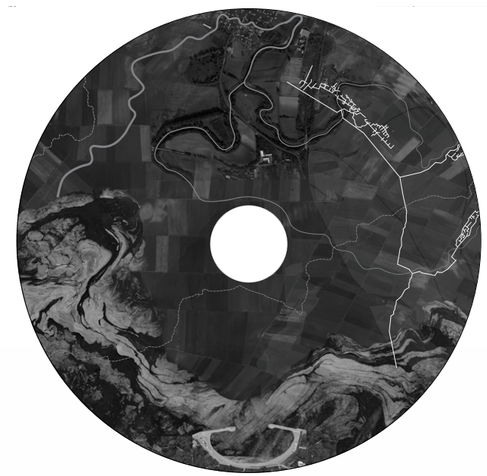




Contamination in Ergene River basin

River
Stream
Small stream
Sea
Pipeline

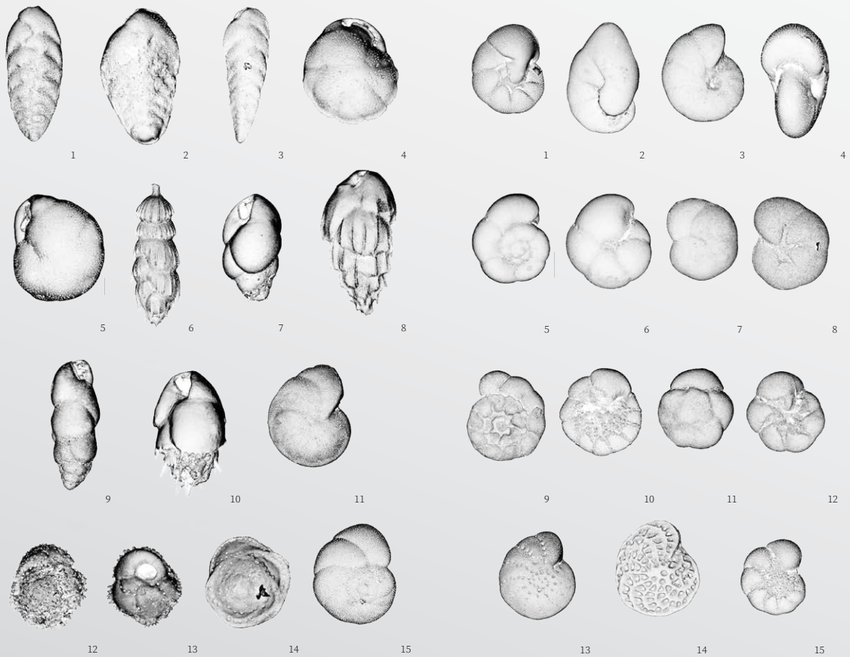
Al Aluminium
Ni Nickel
Cr Chrome



Own interpretation of the Loop Space

‘Stuck in a loop space’ (morton. T)

Moving piles of dust



Benthic Foraminers of the Sea of Marmara

1 Bolivina variabilis
2 Brizalina dilatata
3 Brizalina spathulata
scale = 100 µm
4 Cassidulina carinata
5 Globocassidulina subglobosa
6 Rectuvigerina phlegeri
7 Bulimina aculeata
8 Bulimina costata
9 Bulimina elongata
scale = 100 µm
10 Bulimina marginata
11 Discorbinella bertheloti
12 Asterigerinata adriatica
12a spiral side
12b umbilical side
13 Asterigerinata mamilla
scale = 100 µm
14 Valvulineria bradyana, spiral side
scale = 100 µm

1 Valvulineria bradyana
umbilical side
2 Nonionella turgida
scale bar = 50 µm.
3 Melonis barleanum
3a sideview
3b apertural view
4 Gyroidina umbonata
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5 Aubignyna perlucida
scale bar = 50 µm:
5a spiral side
5b umbilical side
6 Ammonia compacta
6a spiral side
6b umbilical side
7 Ammonia tepida
7a spiral side
7b umbilical side
8 Cribroelphidium poeyanum
9 Elphidium macellum
10 Porosononion subgranosum

Microparticles morphology in the Sea of Marmara, Kadikoy district

1 Bead

EHT: 10.00 kV
WD: 11.55 mm
Mag: 1.00 kN

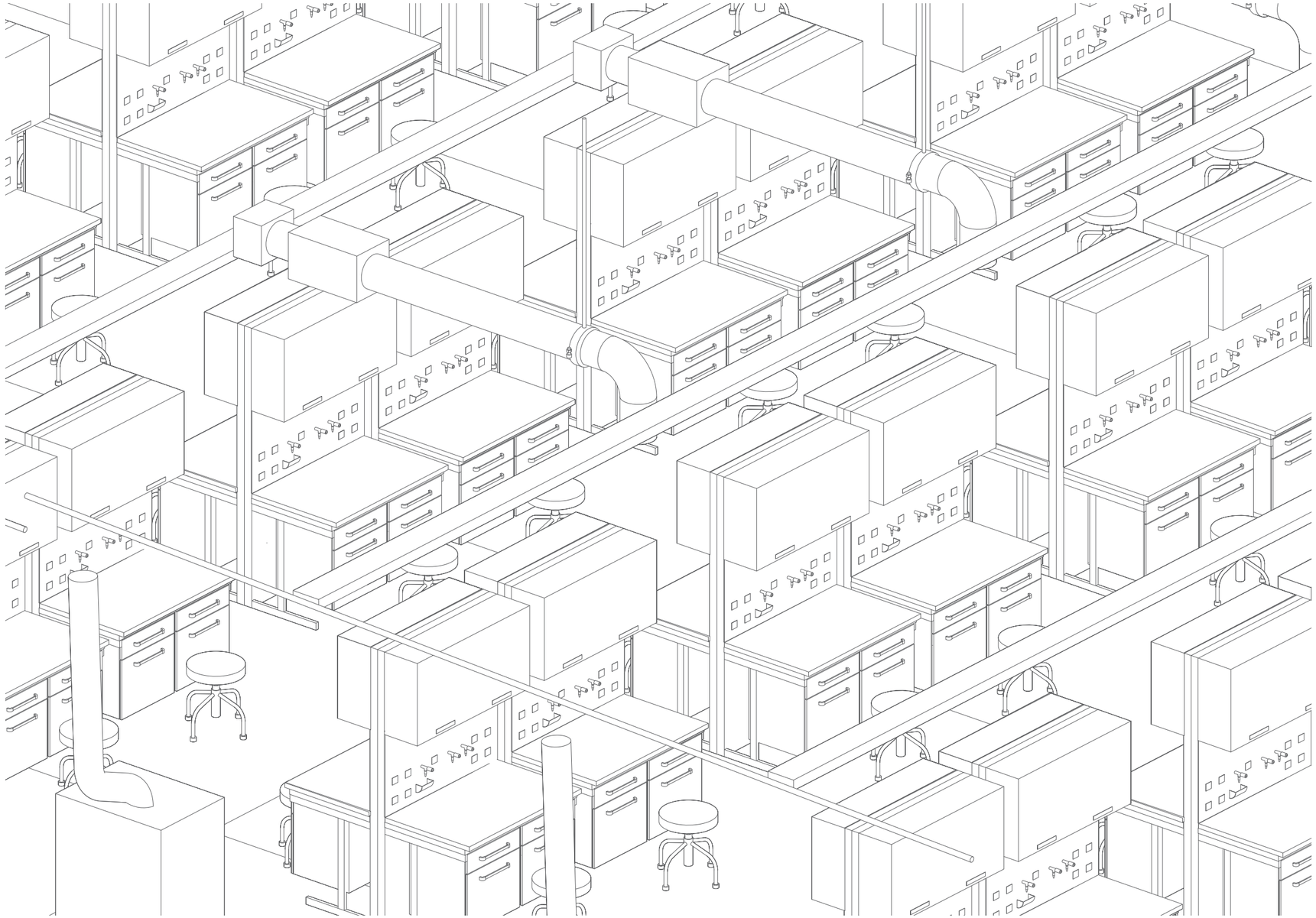
2 Fragment

EHT: 10.00 kV
WD: 9.55 mm
Mag: 0.2 kN

3 Fibre

EHT: 10.00 kV
WD: 11.0 mm
Mag: 0.5 kN

EDS results (in weight percentage)



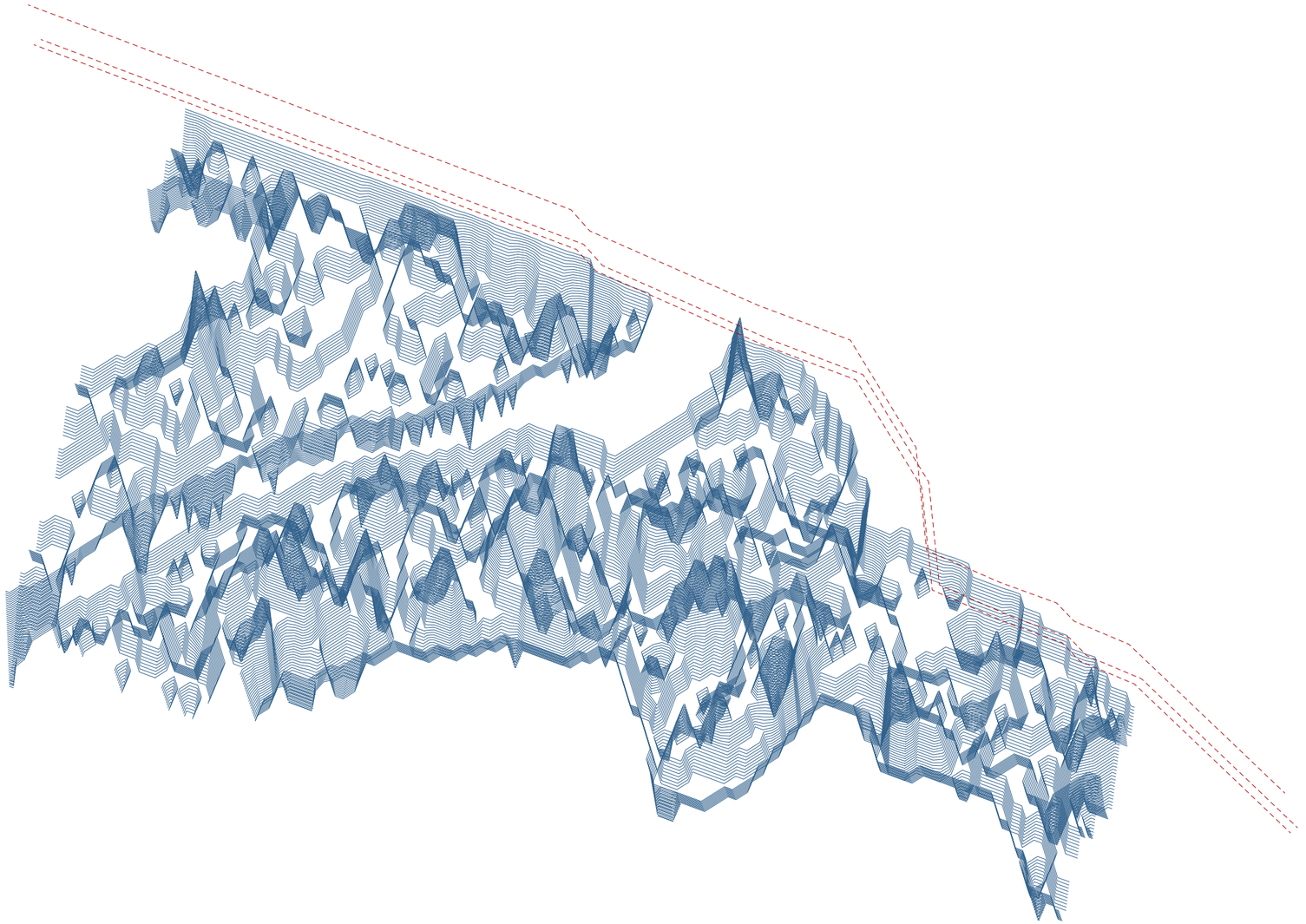

Oligopticon
Marine research
FLIP Floating Instrument Platform (1962).
Owned by US Navy.
Used for a broad range of oceanographic, research industry, wave attenuation sound propagation, scattering and seismic wave recording and, measurement of internal waves. FLIP resides at the Scripps Institution of Oceanography.
Margaret O. Knight in chemical laboratory (1948)
Ritter Hall, Scripps Institution of Oceanography, SIO Photographic Laboratory Collection, SAC #4, Special Collections & Archives, UC San Diego.
The first commercial ROV's,
Hydro Products RCV-125 and RCV-150,
developed to help recover torpedoes during testing.
The RCV-225 400m work class ROV was considered the first "living vehicle" to be used commercially.


TCDD
T.C. CUMHURİYETİ ULAŞTIRMA VE ALTYAPI BAKANLIĞI
SEWAGE DISCH
FW DISCH
INT. SHOR CON.


MAIN DECK
D
C


40
35
30
25
20
15
10
5
Yenikoy
Bayramdere
KOCASU RIVER DELTA
DALYAN GOLU
ARAPTCIFTLIGI GOLU
Balikaya
Bogazkoy
Eskili
Mesudiye
Camlok
Fazlikonagi
Ekmecsi
Camlica
KARADERE FAULT
Susurluk river Estuary, Marmara sea
Water
Sea
Lake
River
Bathymetry
Human
Village
Morphology
Heightline
Old Delta sediments
Alluvial valley sediments
Beach
Faultline

KOCASU NEHRİ SEDIMENTLER
DEPOSITIONAL LANDFORM OF THE RIVER DELTA



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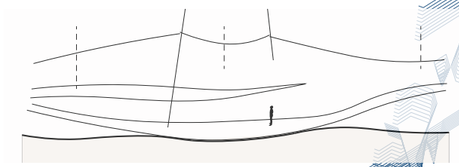
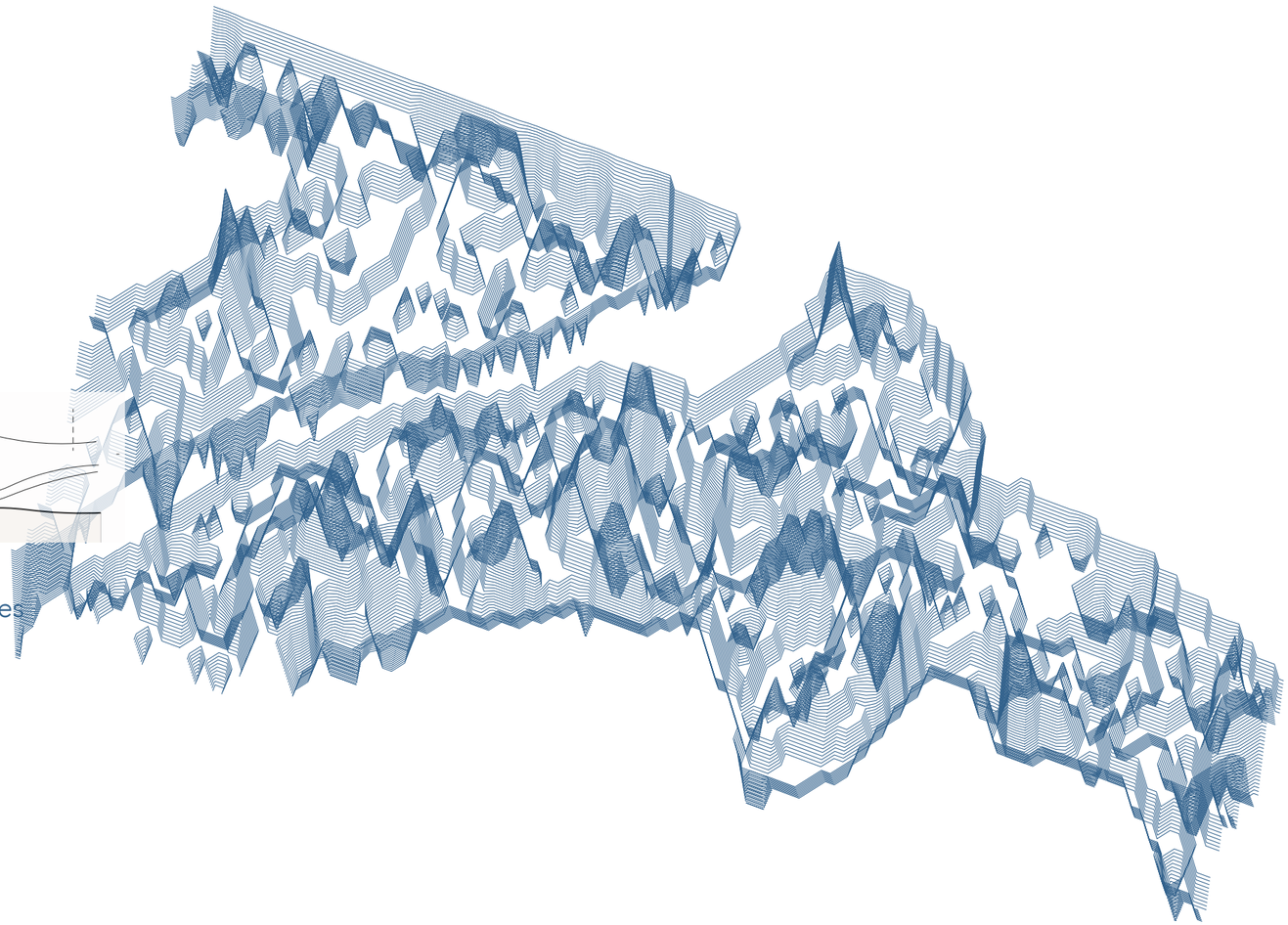


Pull of celestial bodies



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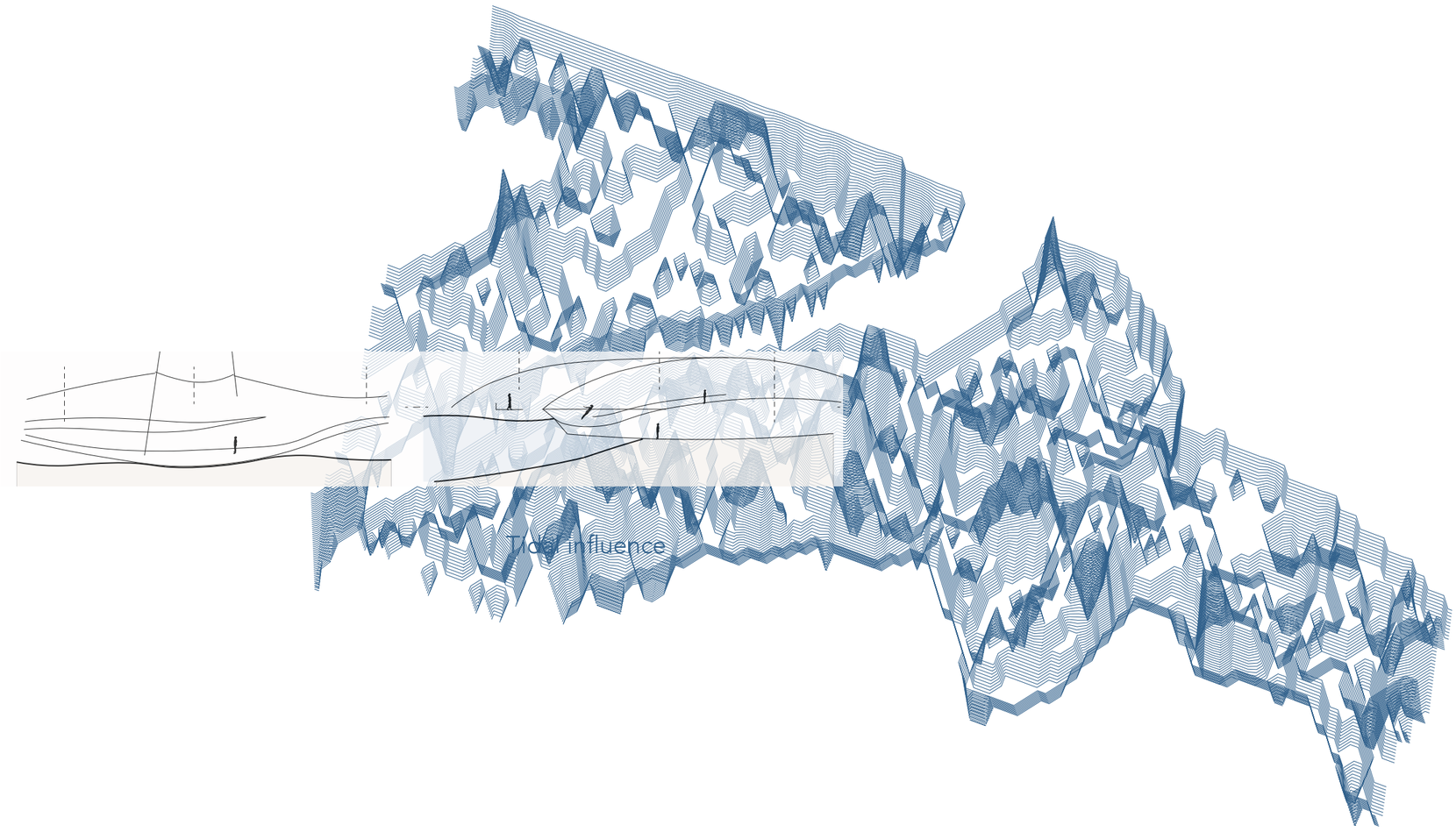

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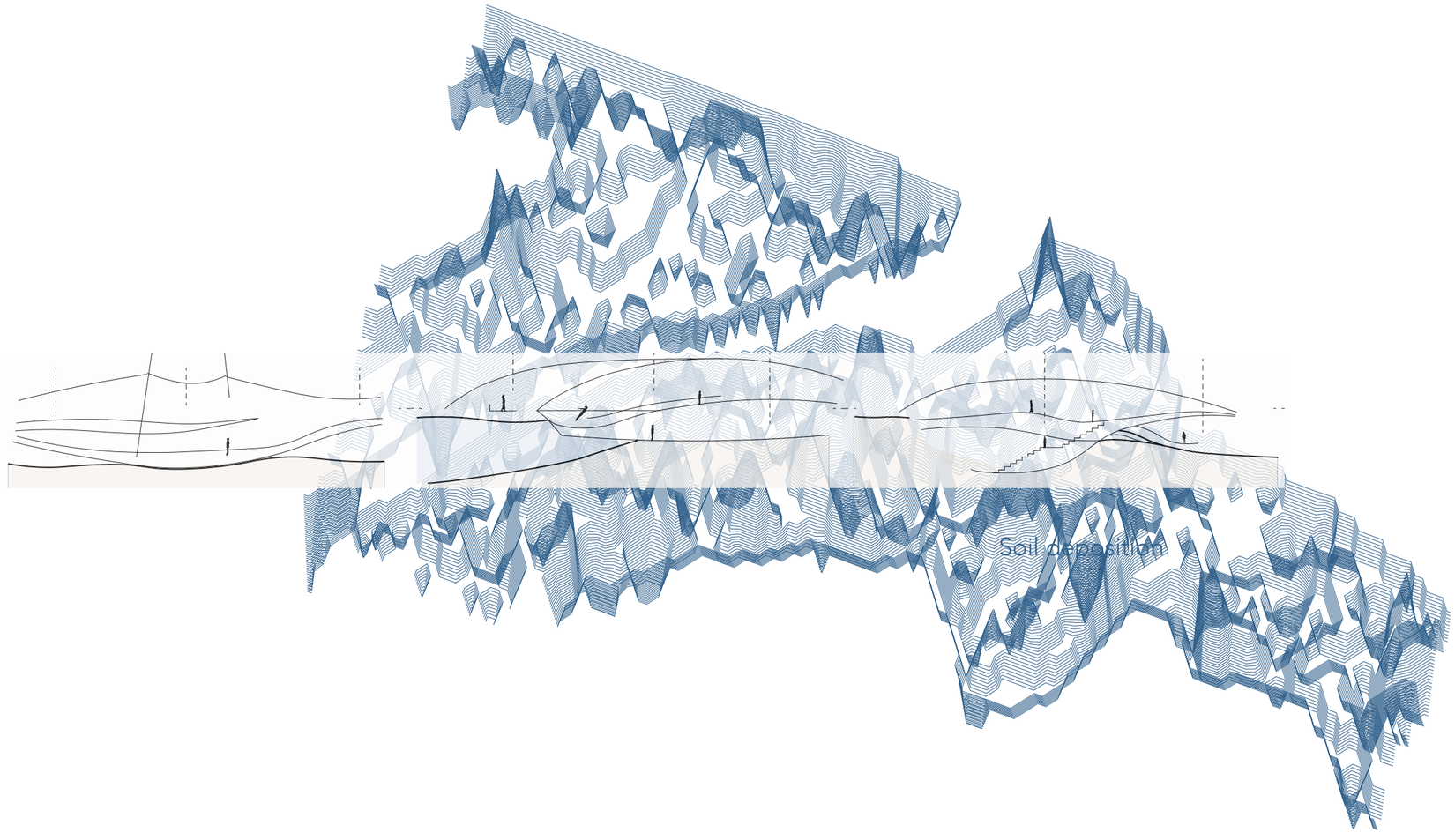

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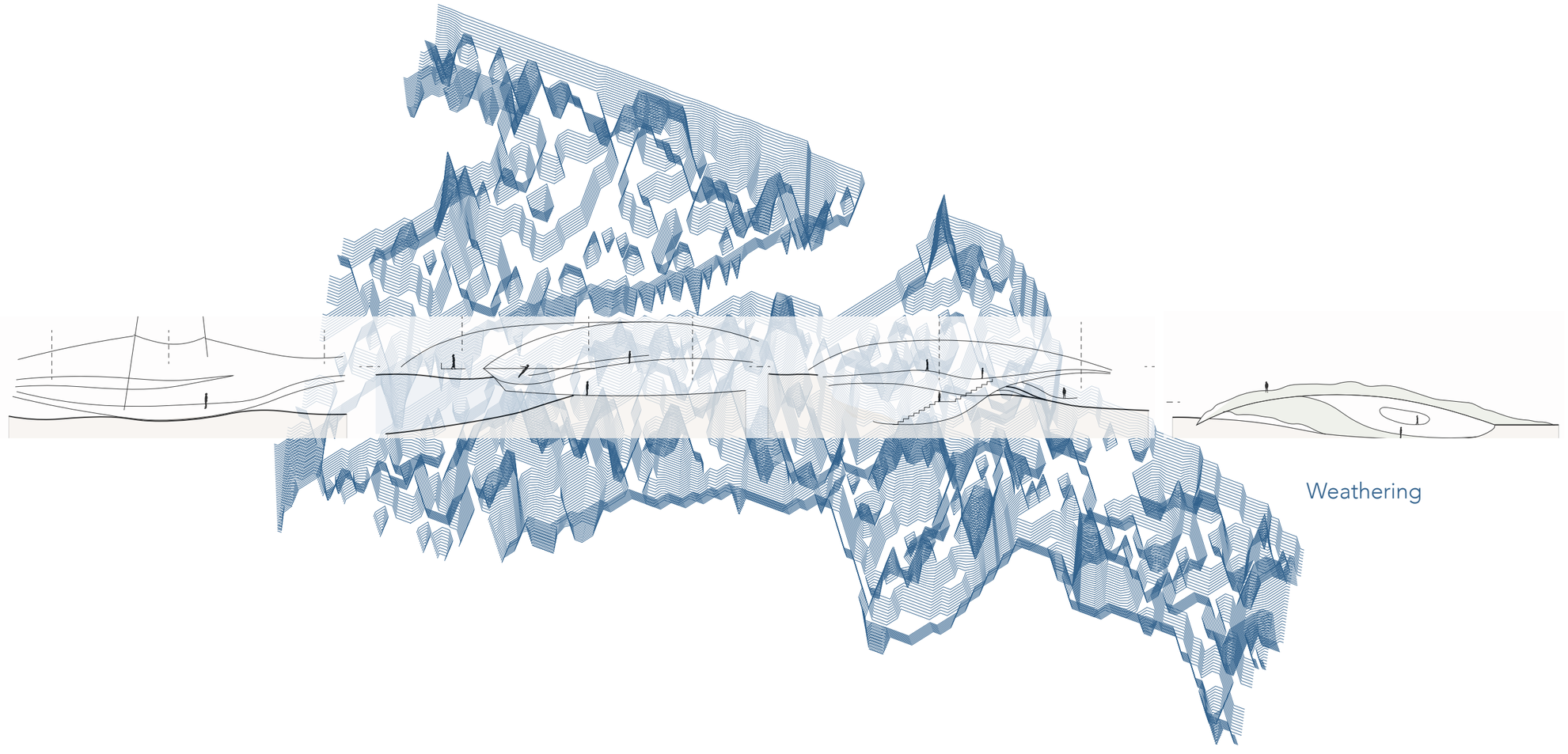


Weathering

People & Nature

SYMBIOTIC

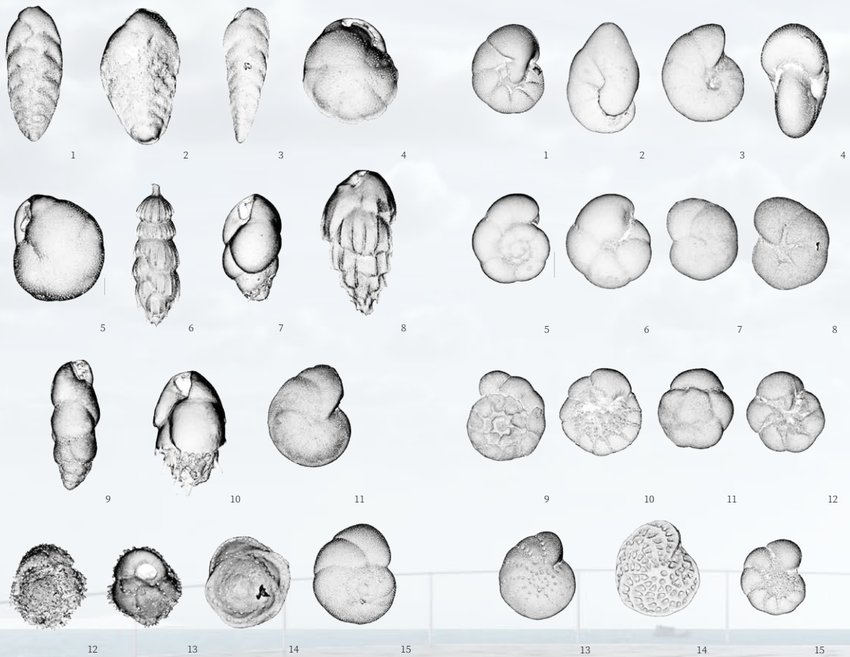
experiencing cycles

Research

Public observation /reflection

I would like there to exist places that are stable, moving, intangibly untouched and almost untouchably deeprooted. Places that might be points of reference, of departure, or origin.

Gearge Renee



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Microparticles morphology in the Sea of Marmara, Kadikoy district

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EHT: 10.00 kV
WD: 11.55 mm
Mag: 1.00 kN

2 Fragment

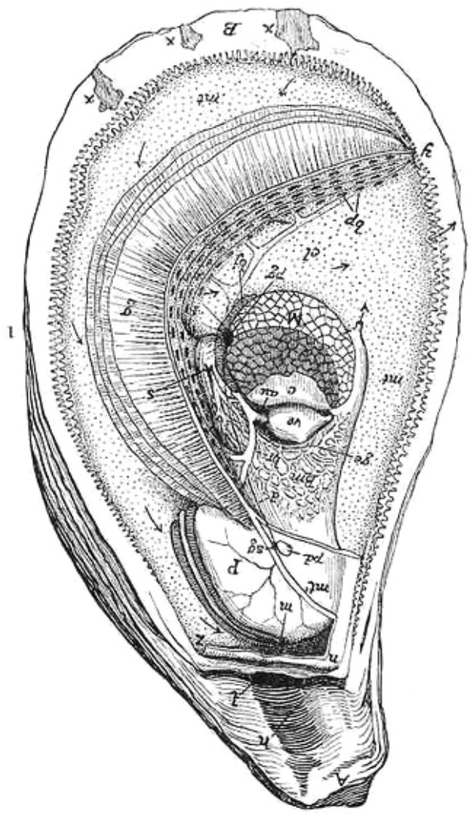
EHT: 10.00 kV
WD: 9.55 mm
Mag: 0.2 kN

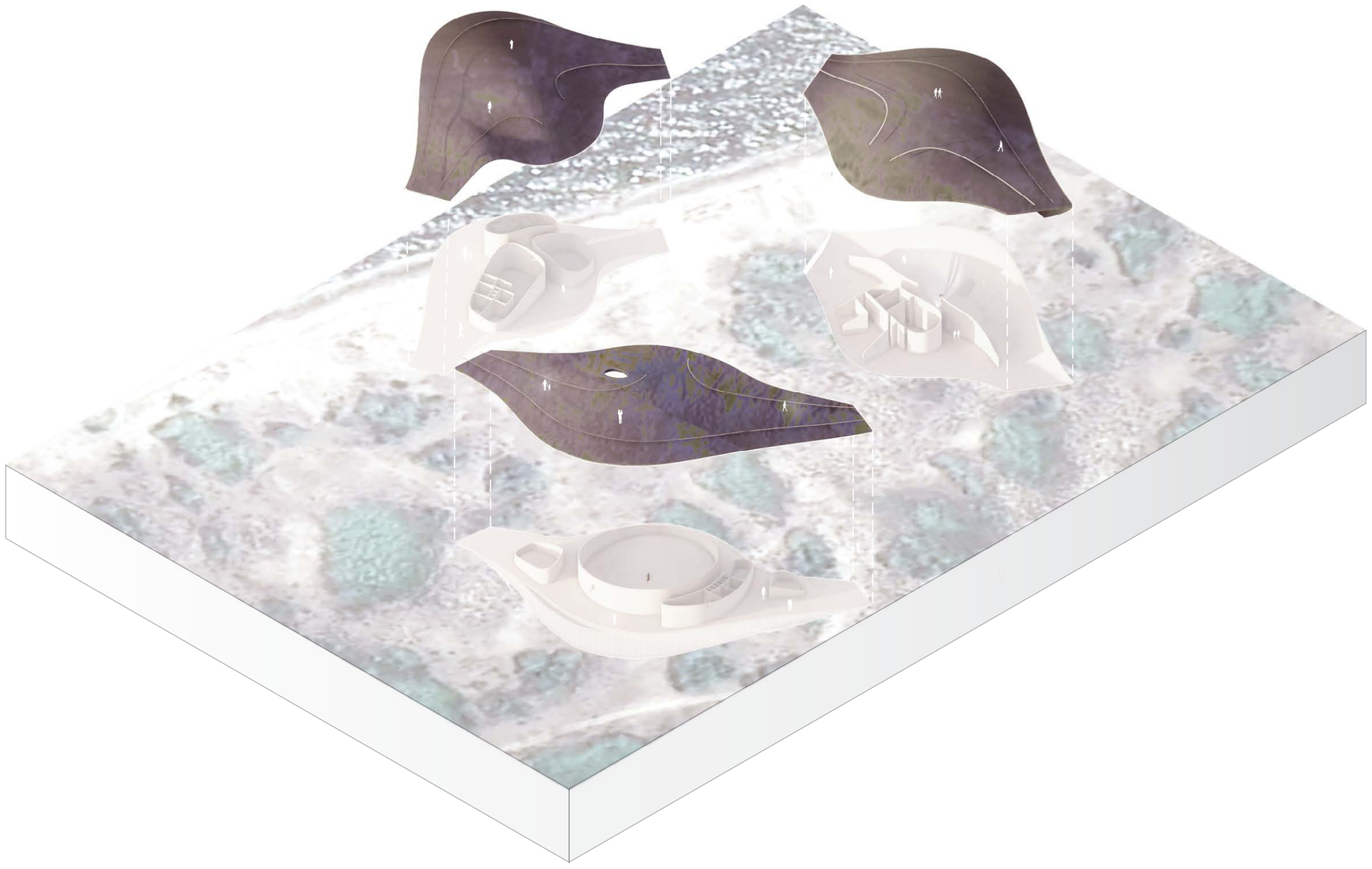
3 Fibre

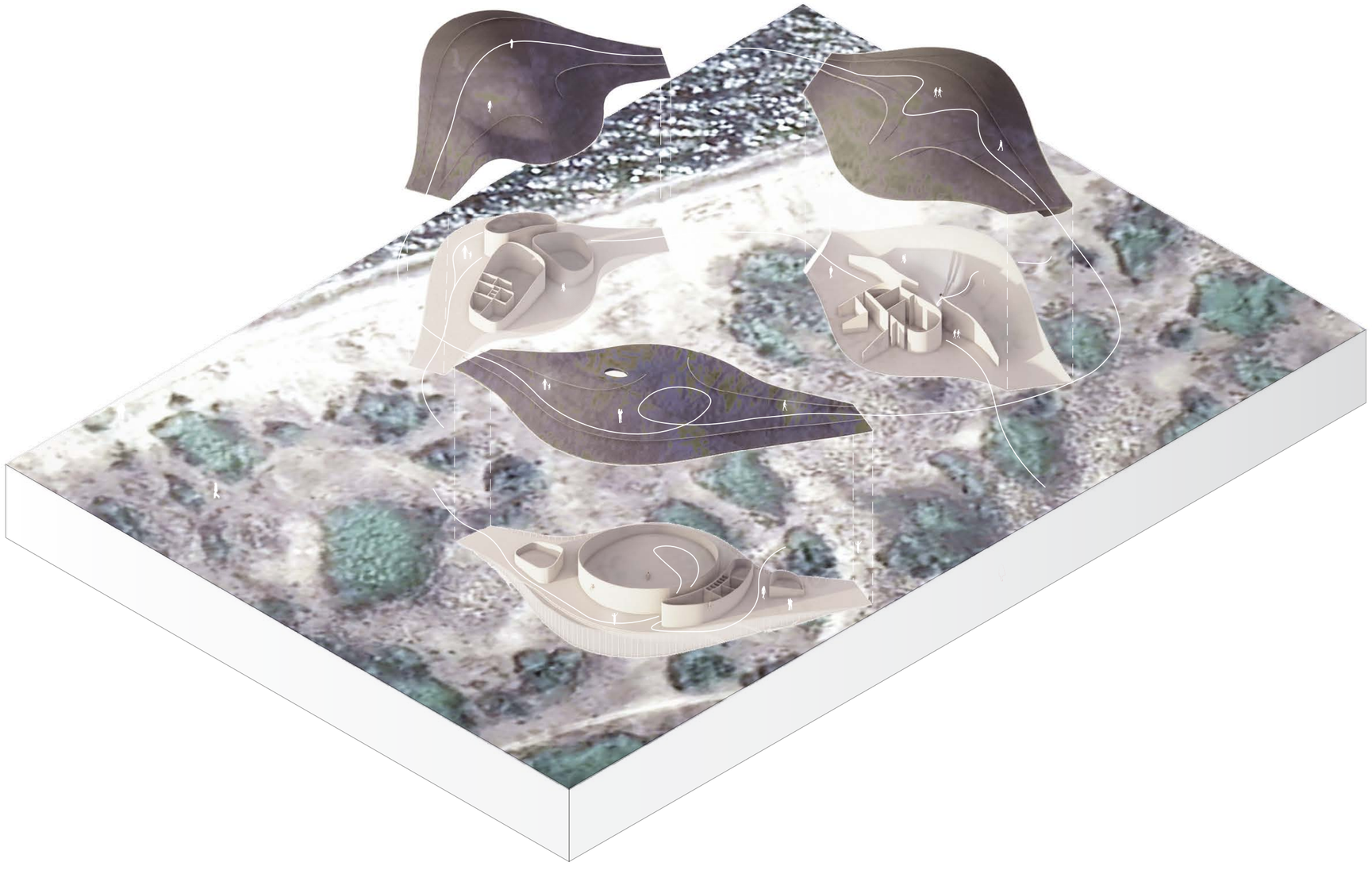
EHT: 10.00 kV
WD: 11.0 mm
Mag: 0.5 kN

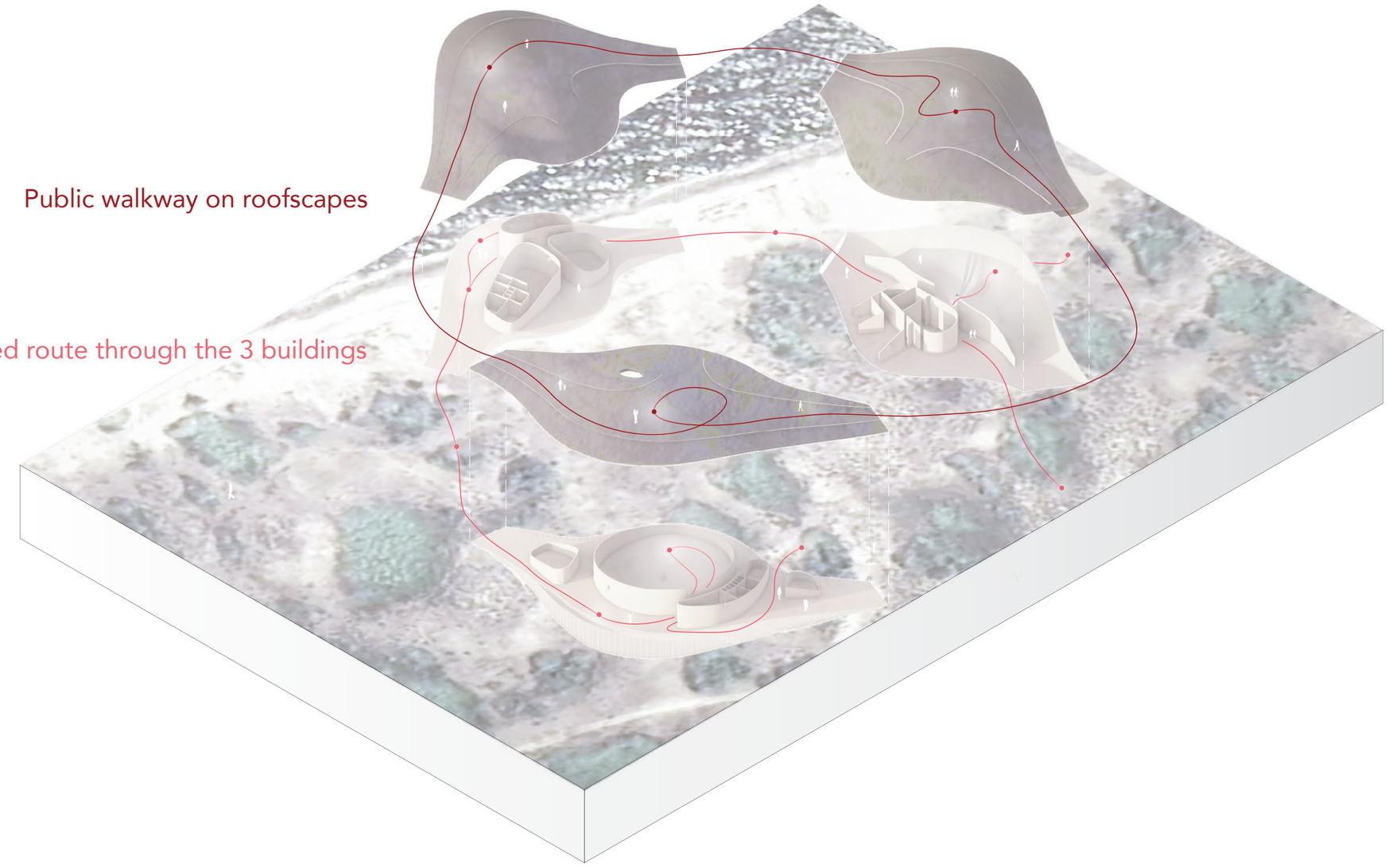
EDS results (in weight percentage)

Si - 5.61 %
Al - 1.79 %
Fe - 0.98 %



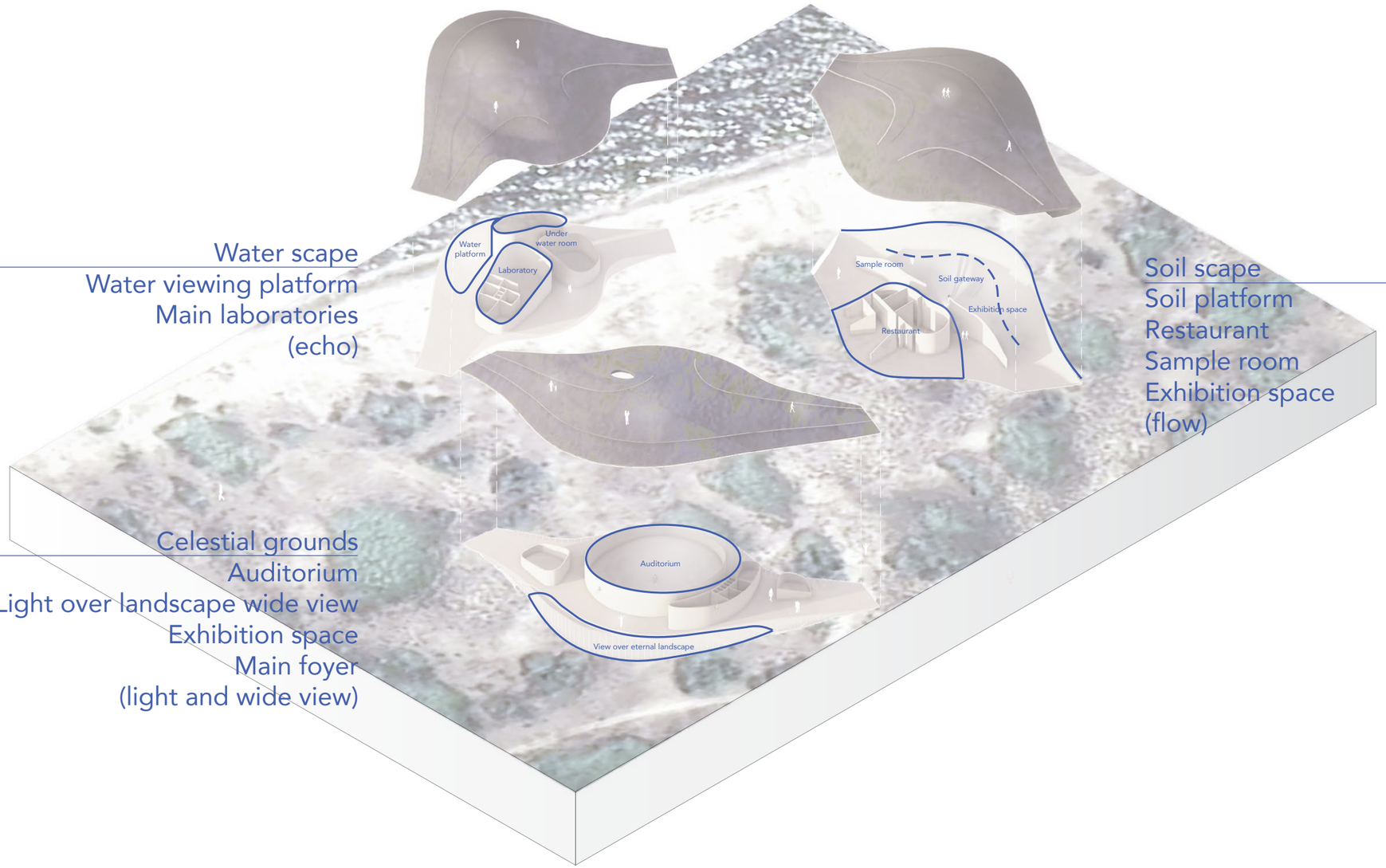




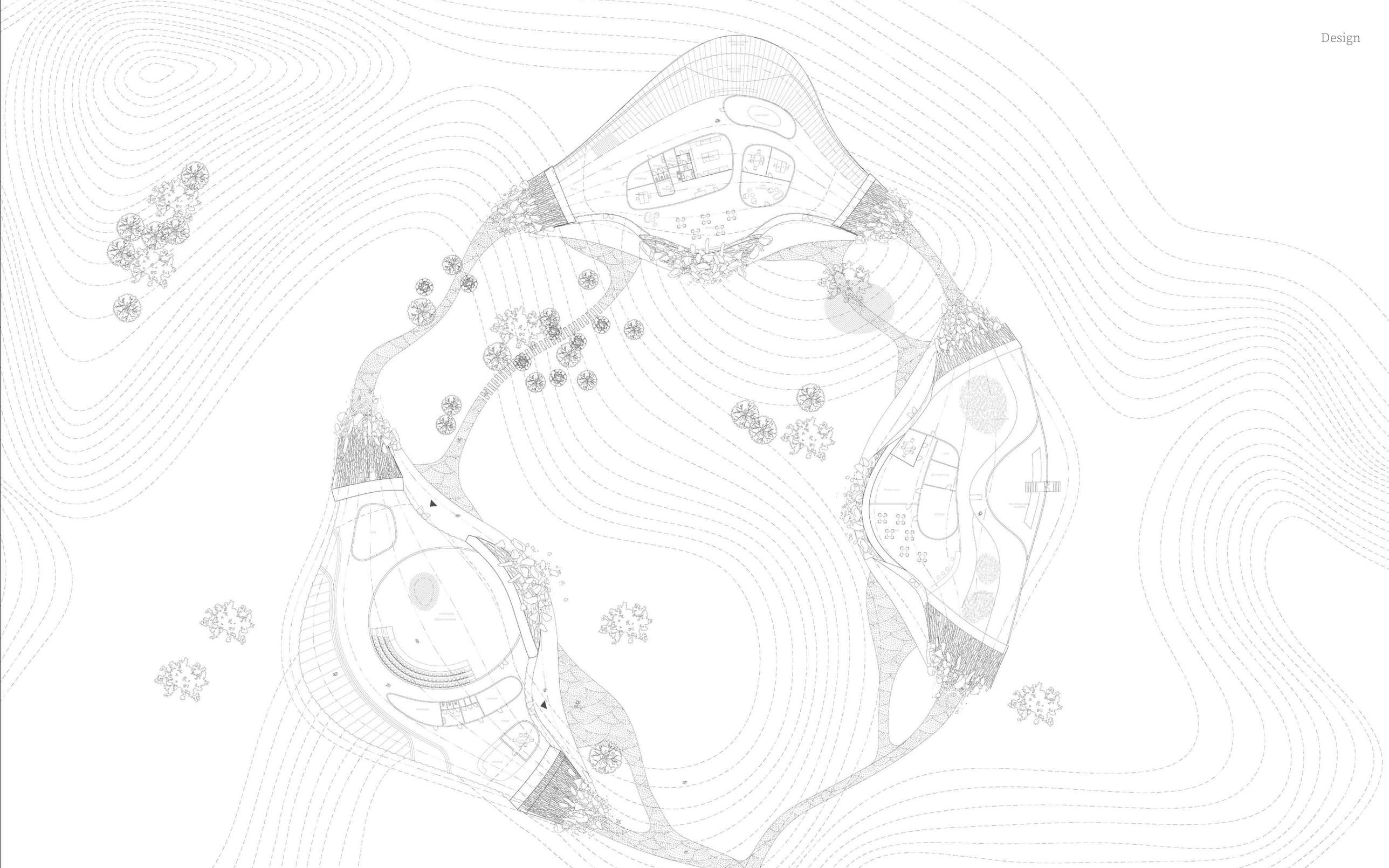

Public walkway on roofscapes
Narrated route through the 3 buildings

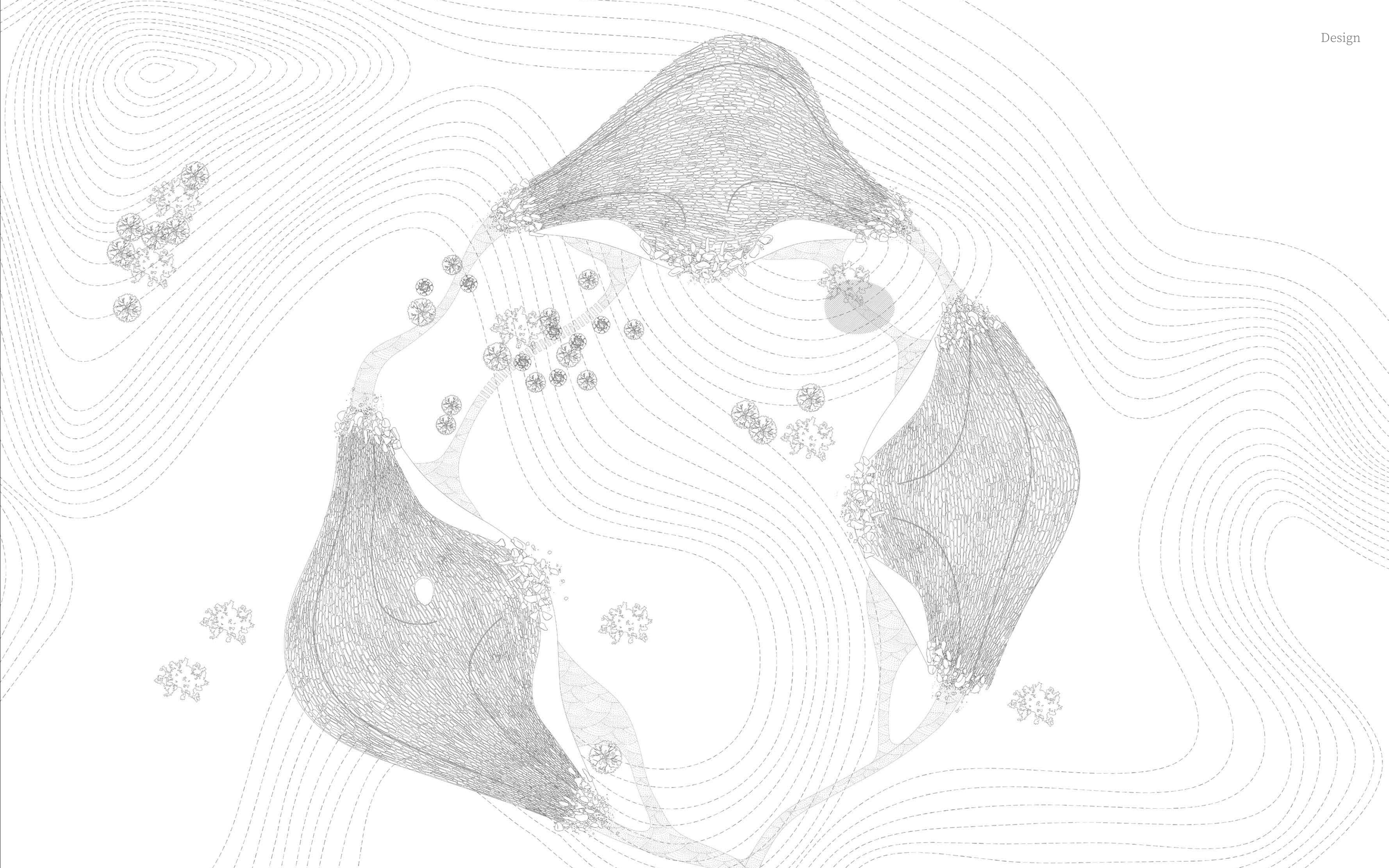
2
Water scape
Water viewing platform
Main laboratories
(echo)

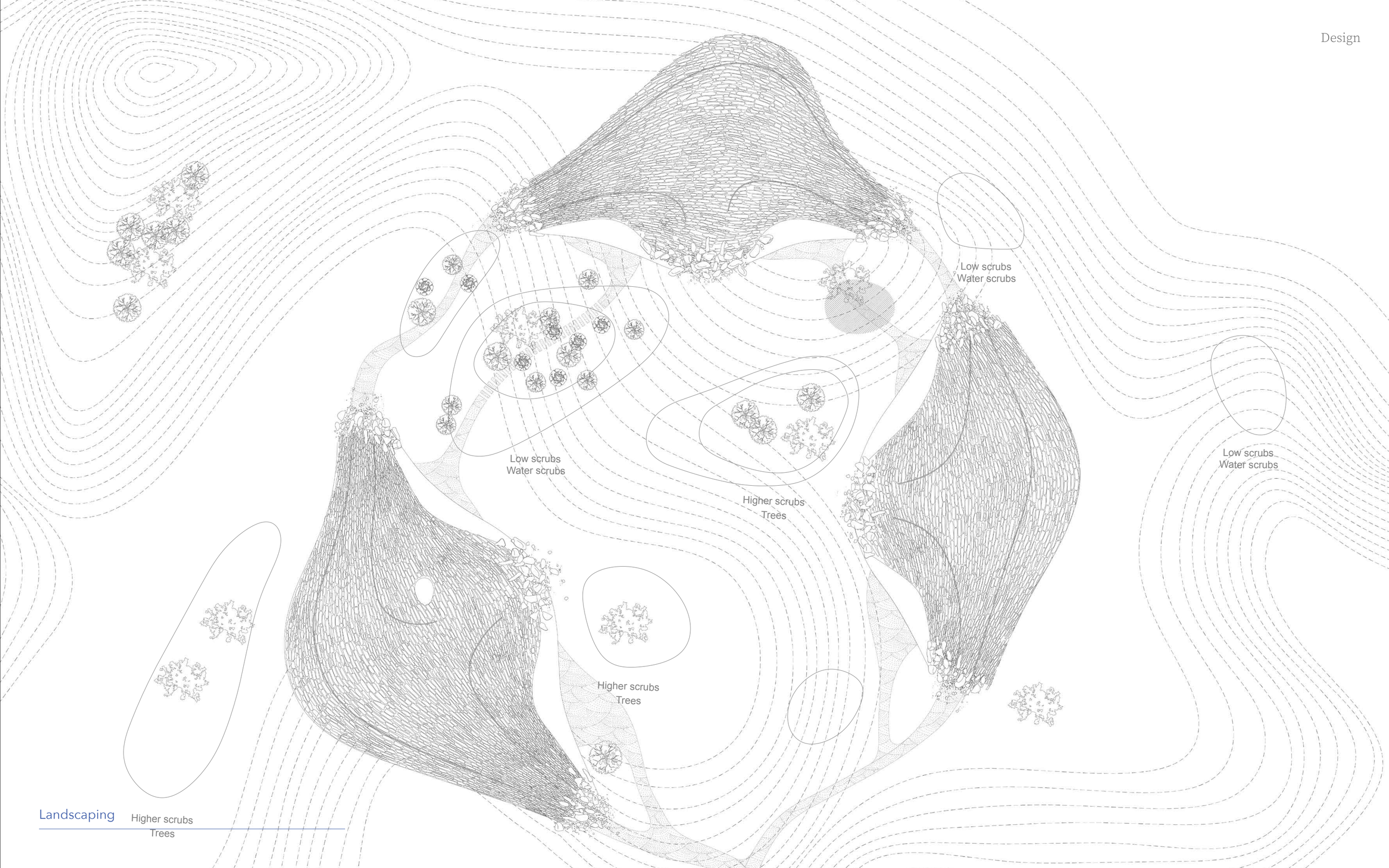
3
Soil scape
Soil platform
Restaurant
Sample room
Exhibition space
(flow)



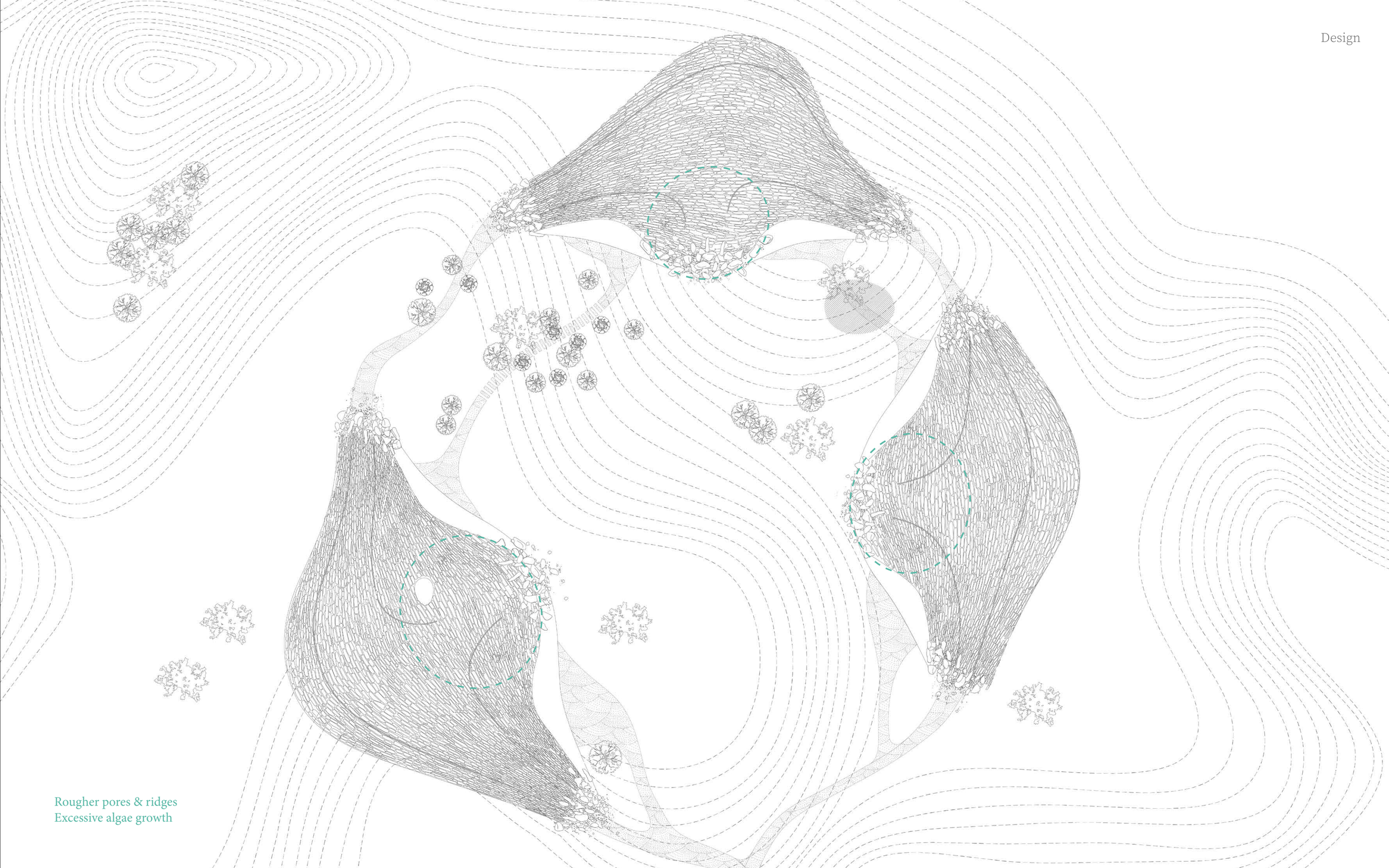
1
Celestial grounds
Auditorium
Light over landscape wide view
Exhibition space
Main foyer
(light and wide view)



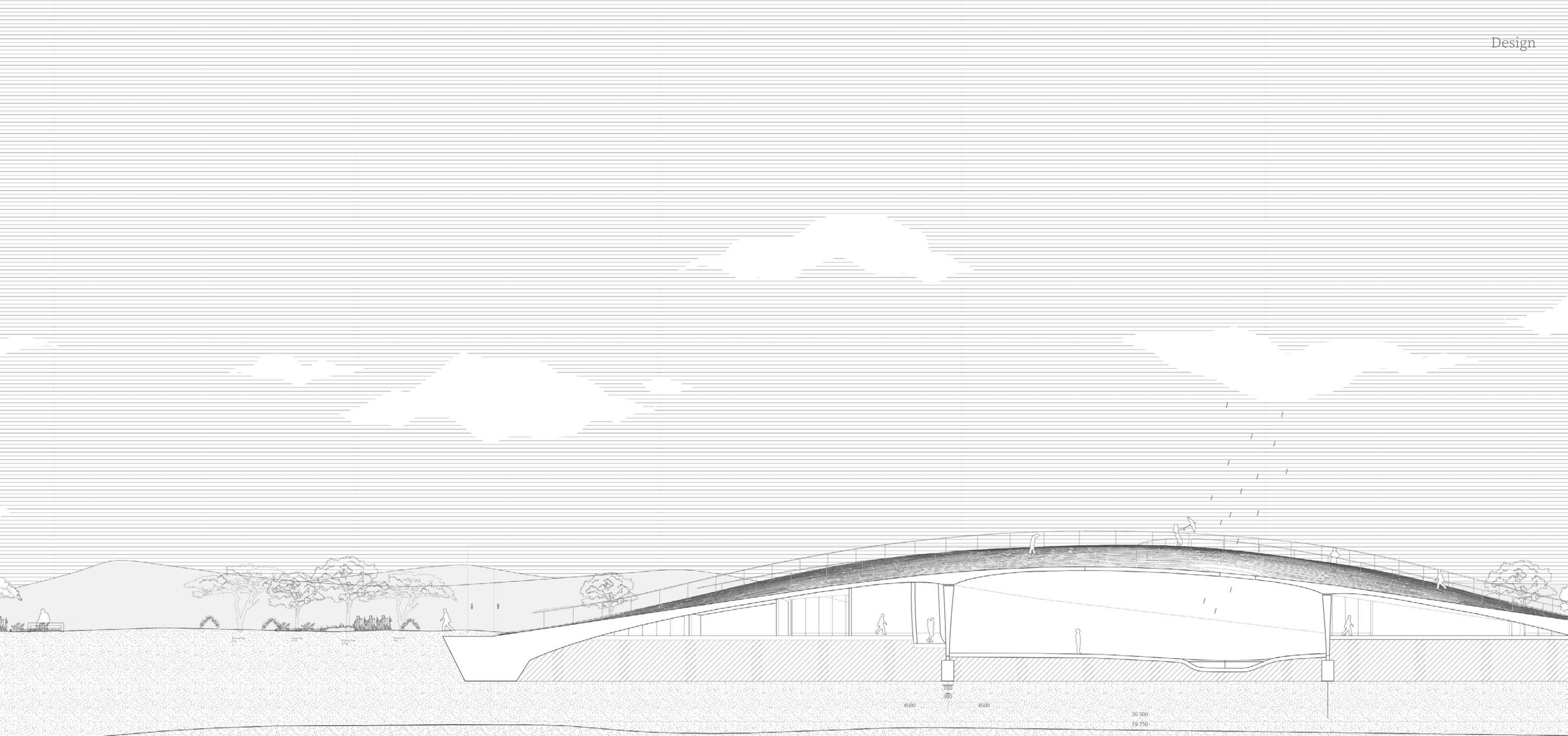


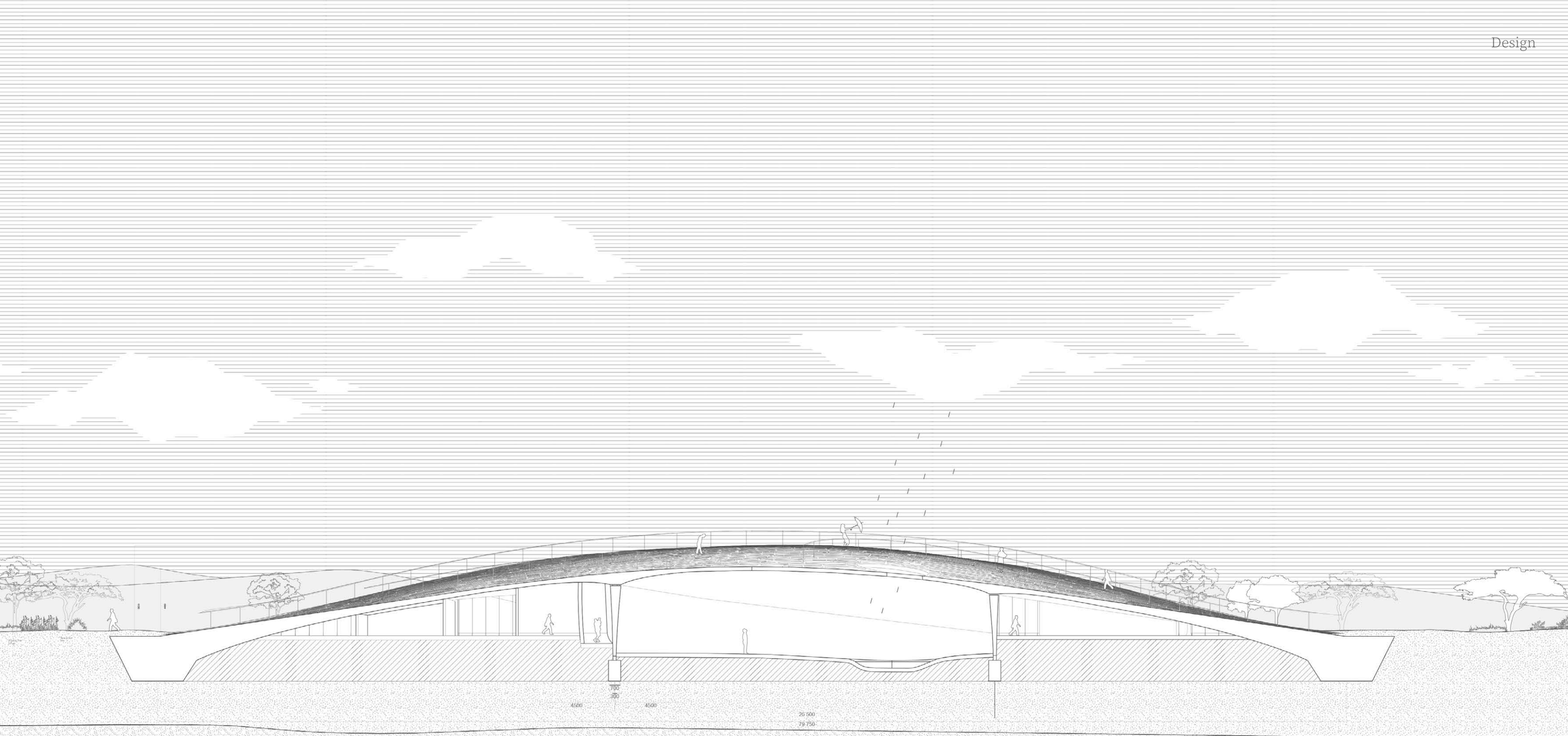


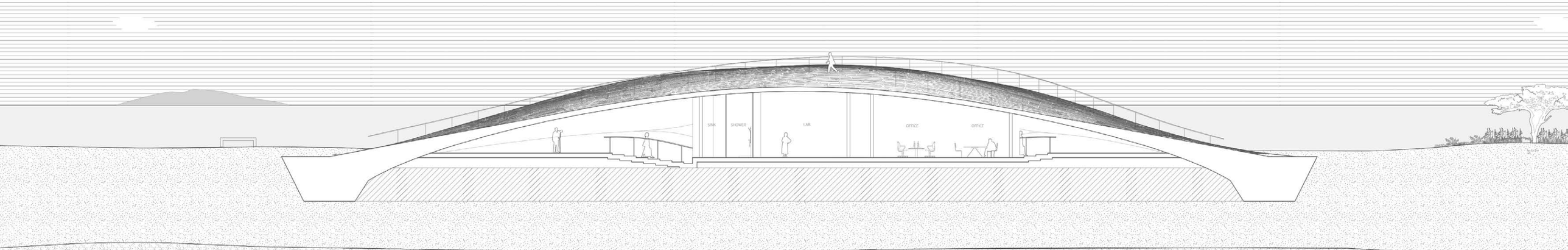
Landscaping

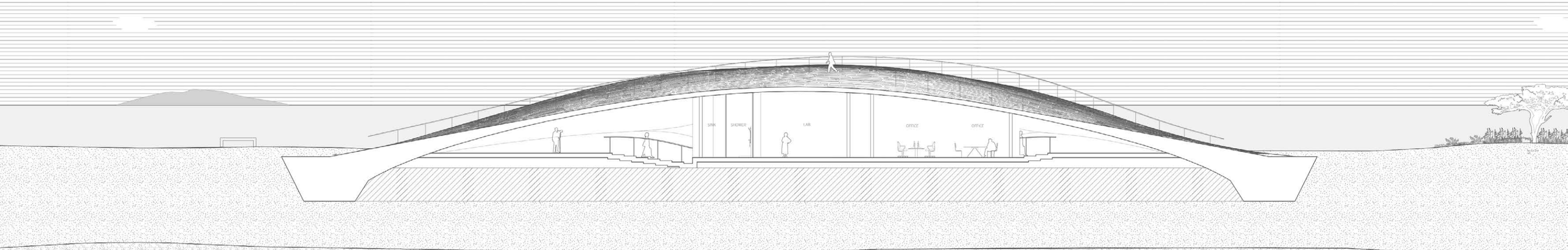


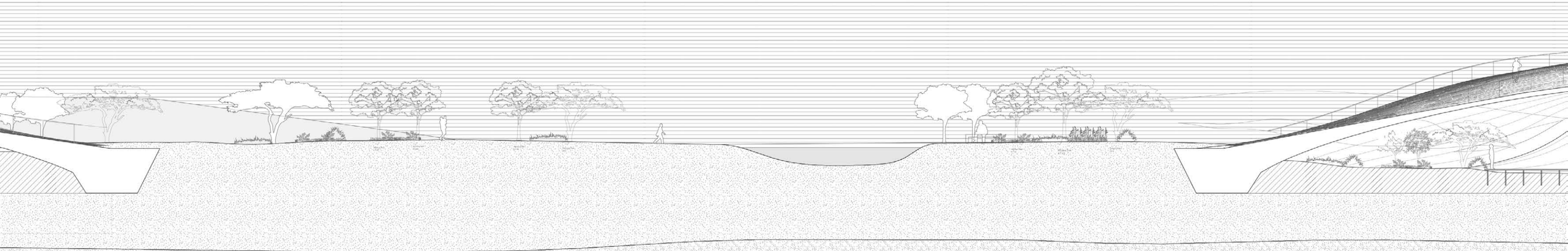
Rougher pores & ridges
Excessive algae growth

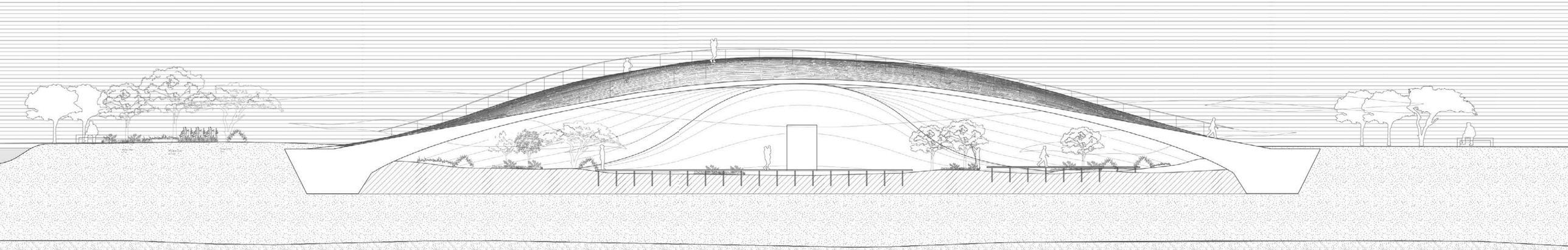

700
500
4500
4500
35 500
79 750

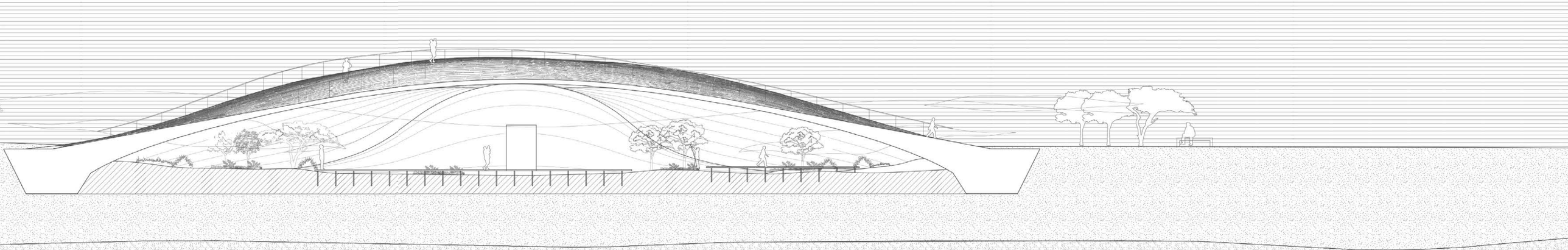

750
350
4500
4500
26 500
79 750

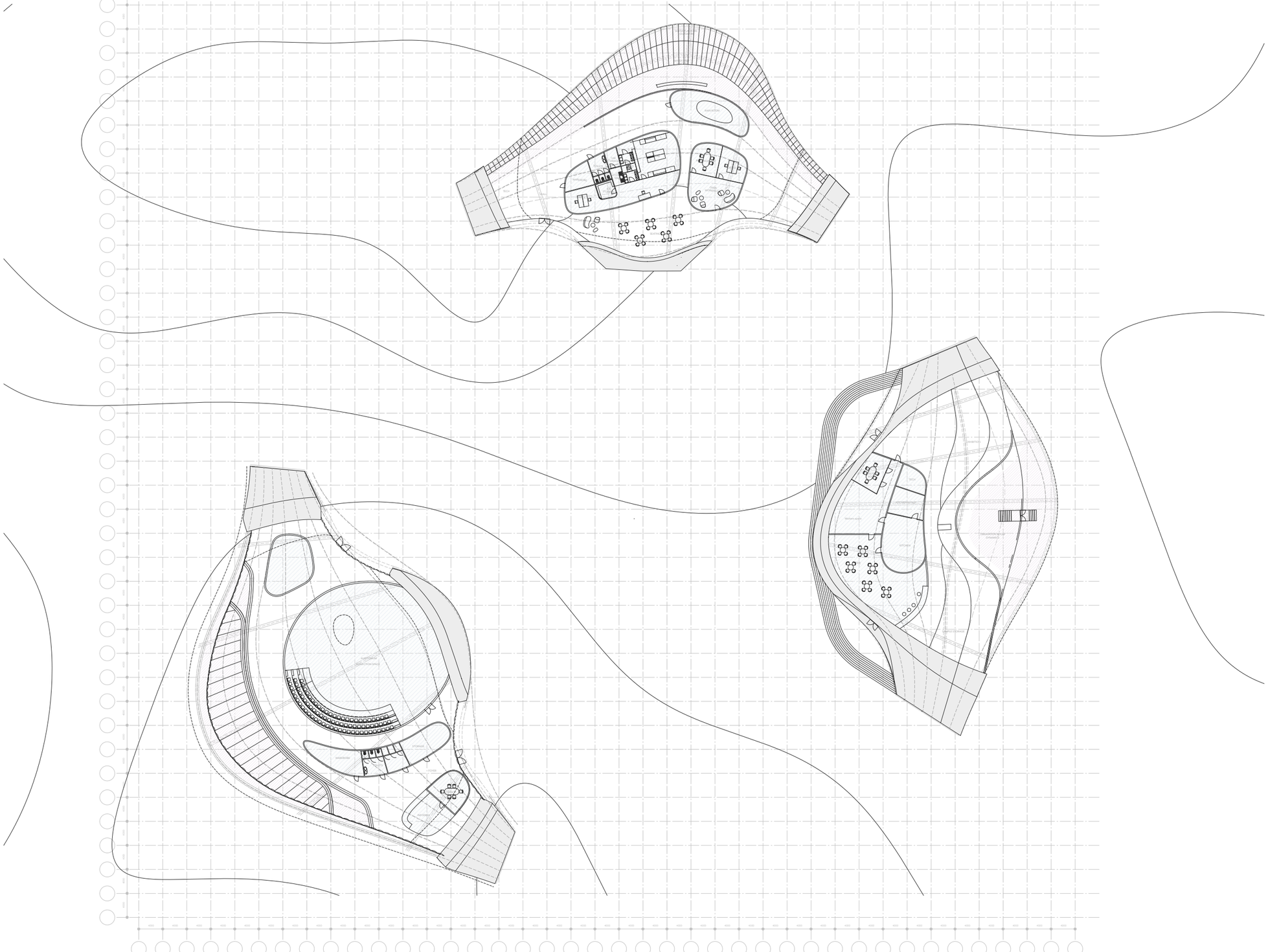

SINK
SHOWER
LAB
OFFICE
OFFICE

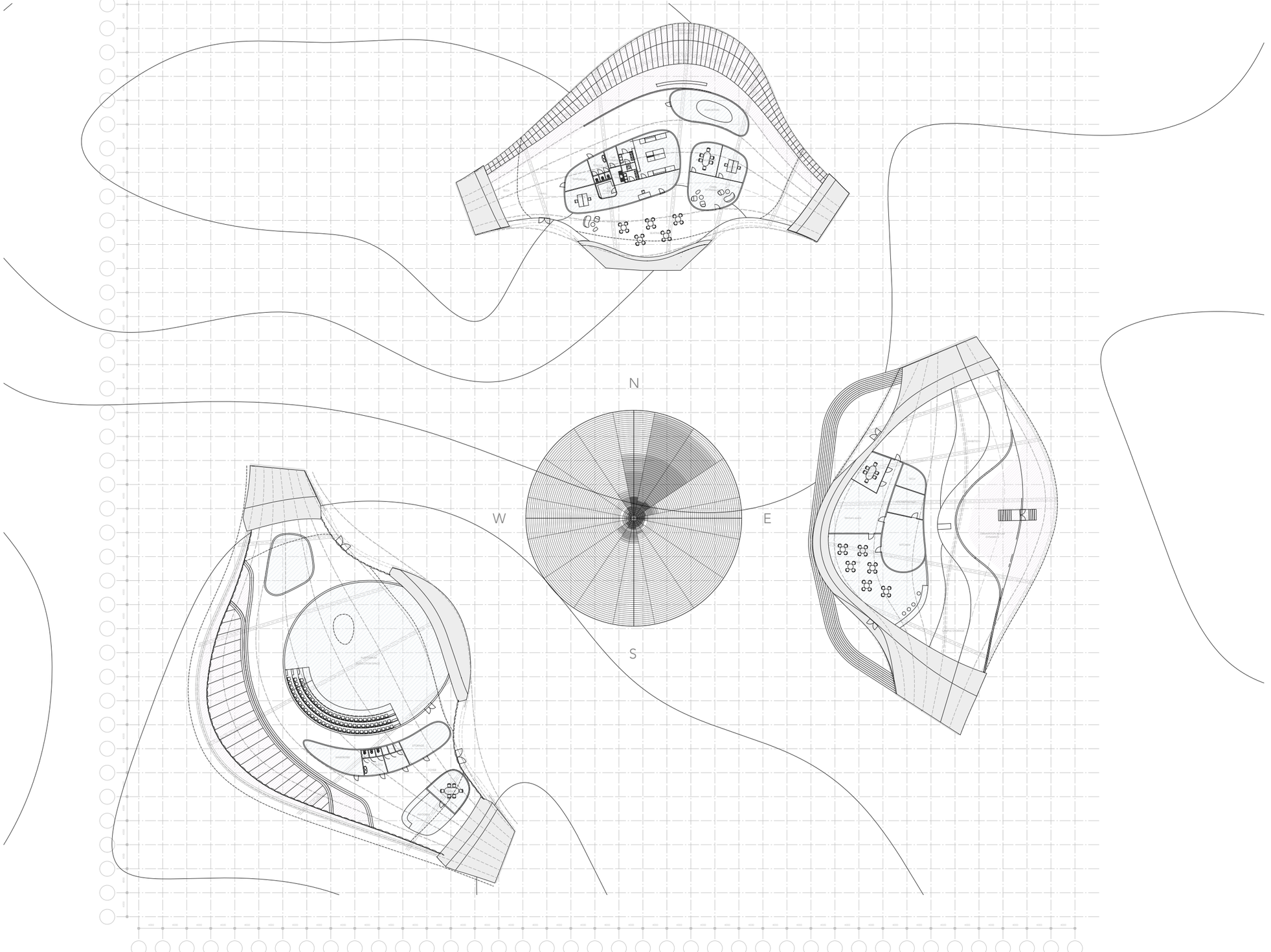

SINK
SHOWER
LAB
OFFICE
OFFICE

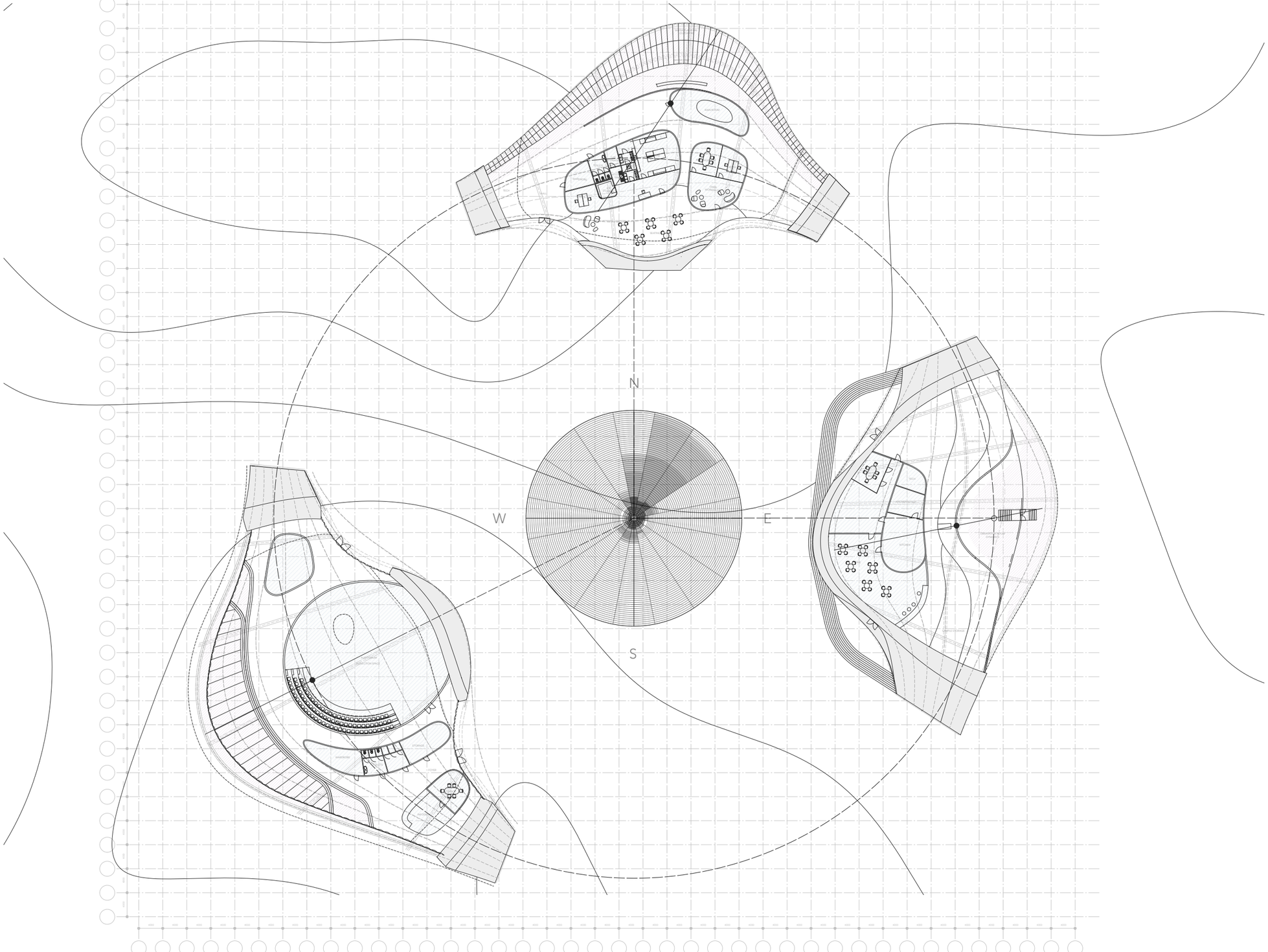







AUDITORIUM
LOBBY
LOBBY
AUDITORIUM
STORAGE
WARDROBE
STORAGE
WARDROBE
LOBBY
LOBBY
DECK
RESTAURANT
KITCHEN
OBSERVATION DECK
PYRAMID


N
W
E
S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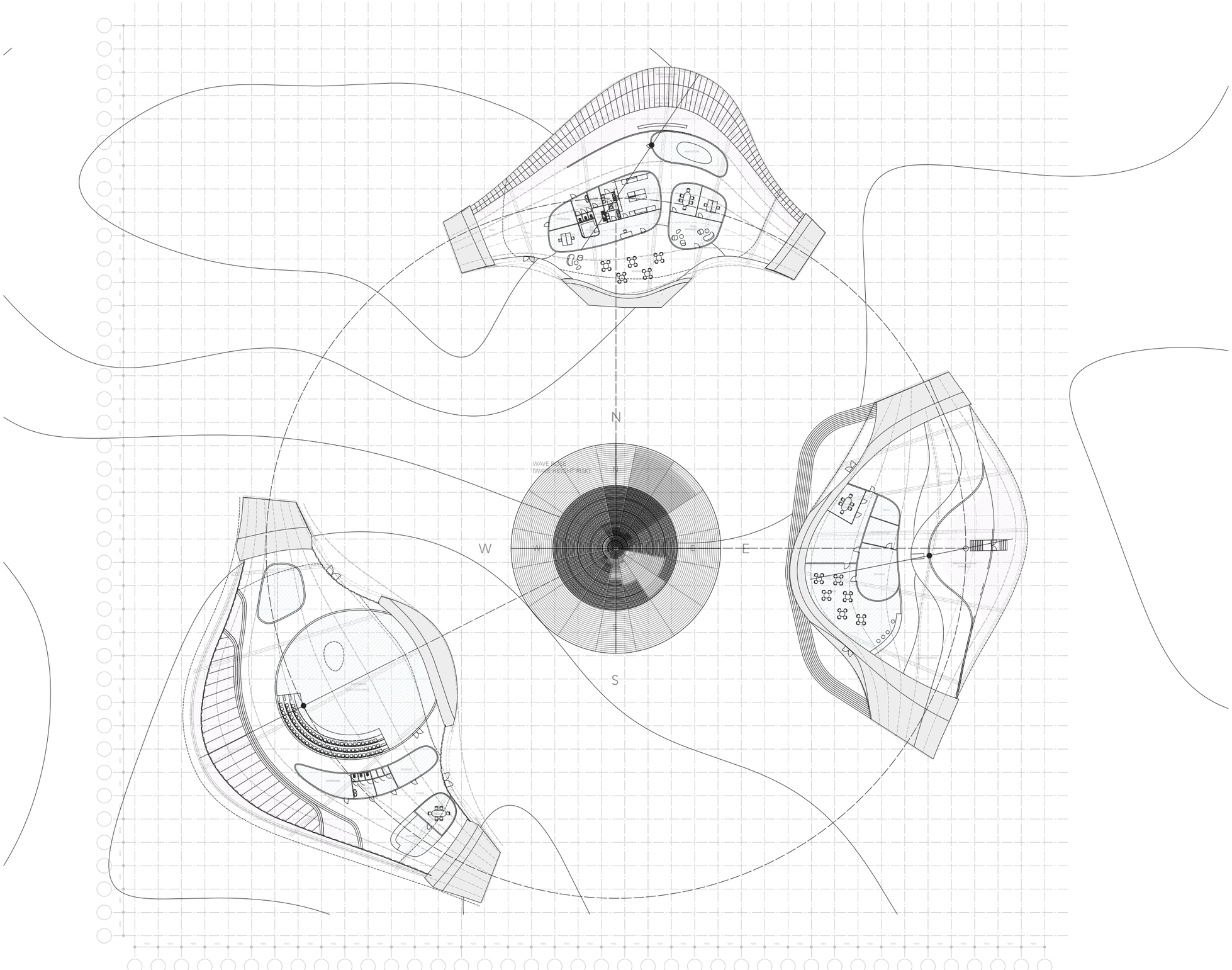
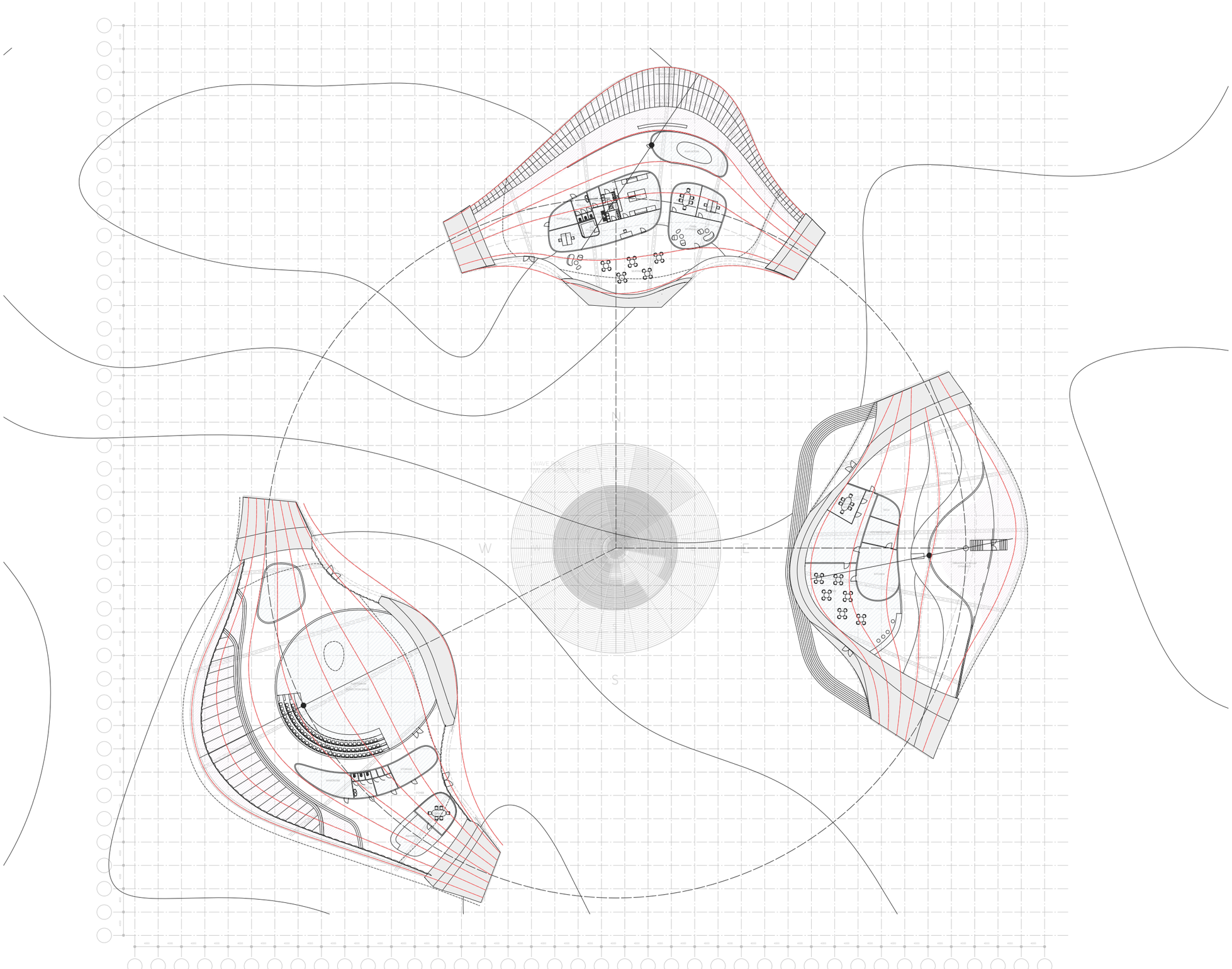
W
E
S


N
W
E
S
WAVE RISE
(WAVE HEIGHT RISE)


N
W
E
S

TEMPERATURE RISE
TURKEY (DATA BY RCM))

2070

0 °C — 2.8 - 5.5 °C

ARIDITY INDEX

NOW — 2070

20 — 13

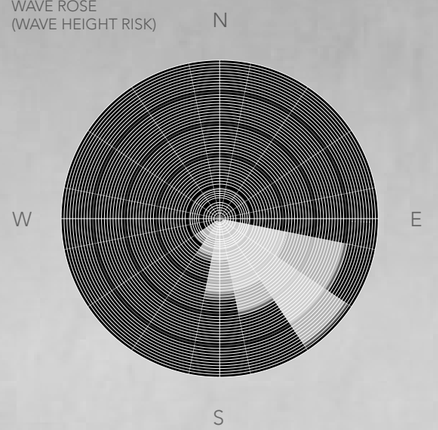
PRECIPITATION

NOW — 2070

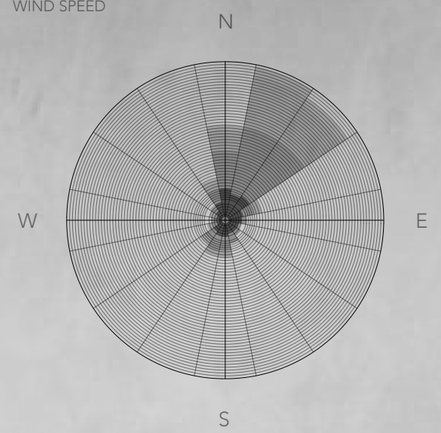
-29.6%

water scarcity common
Especially during dry summer months.

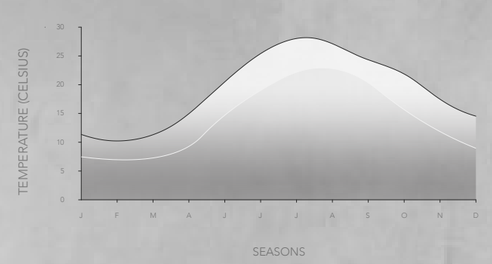
WAVE ROSE
(WAVE HEIGHT RISK)

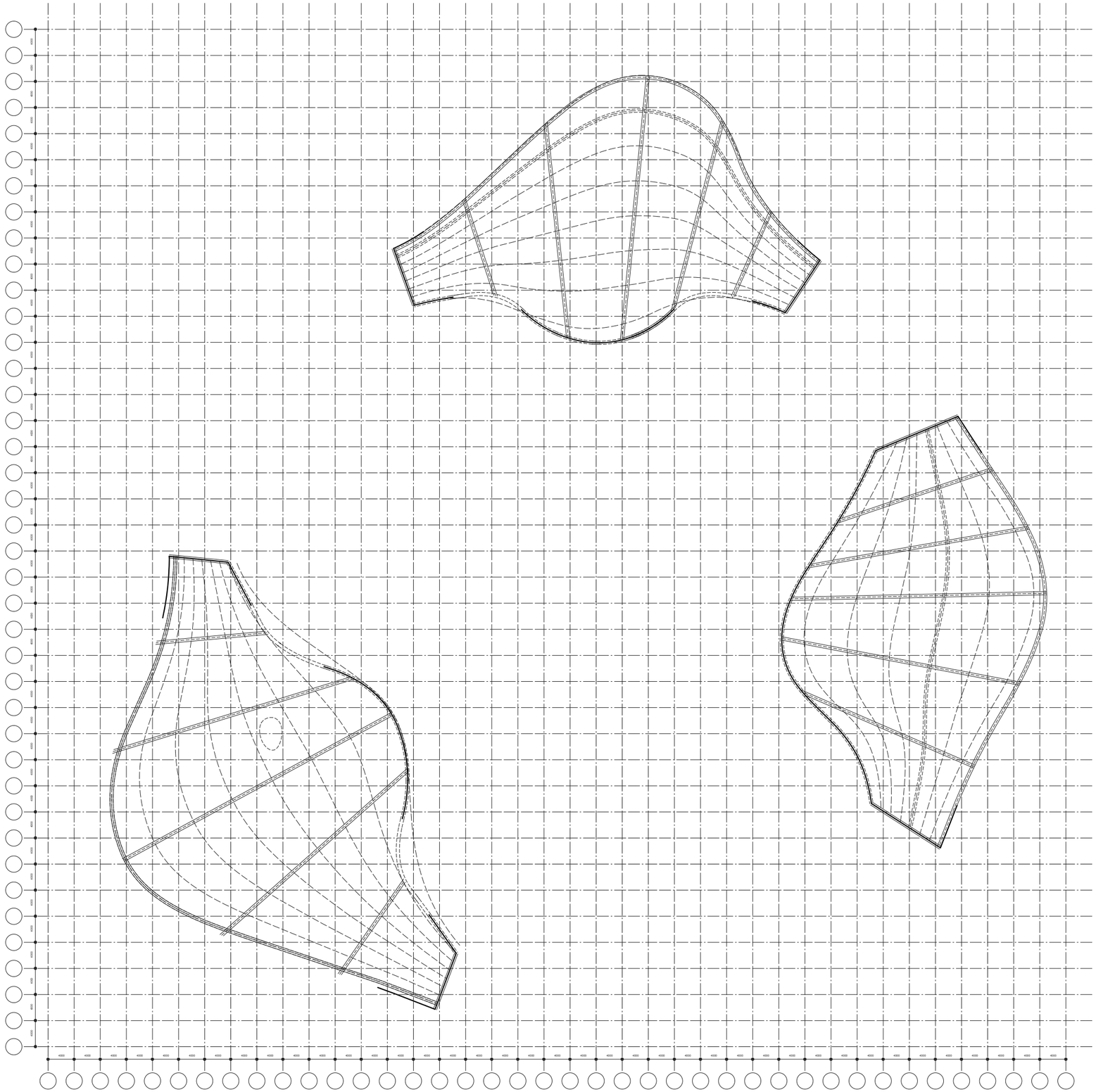


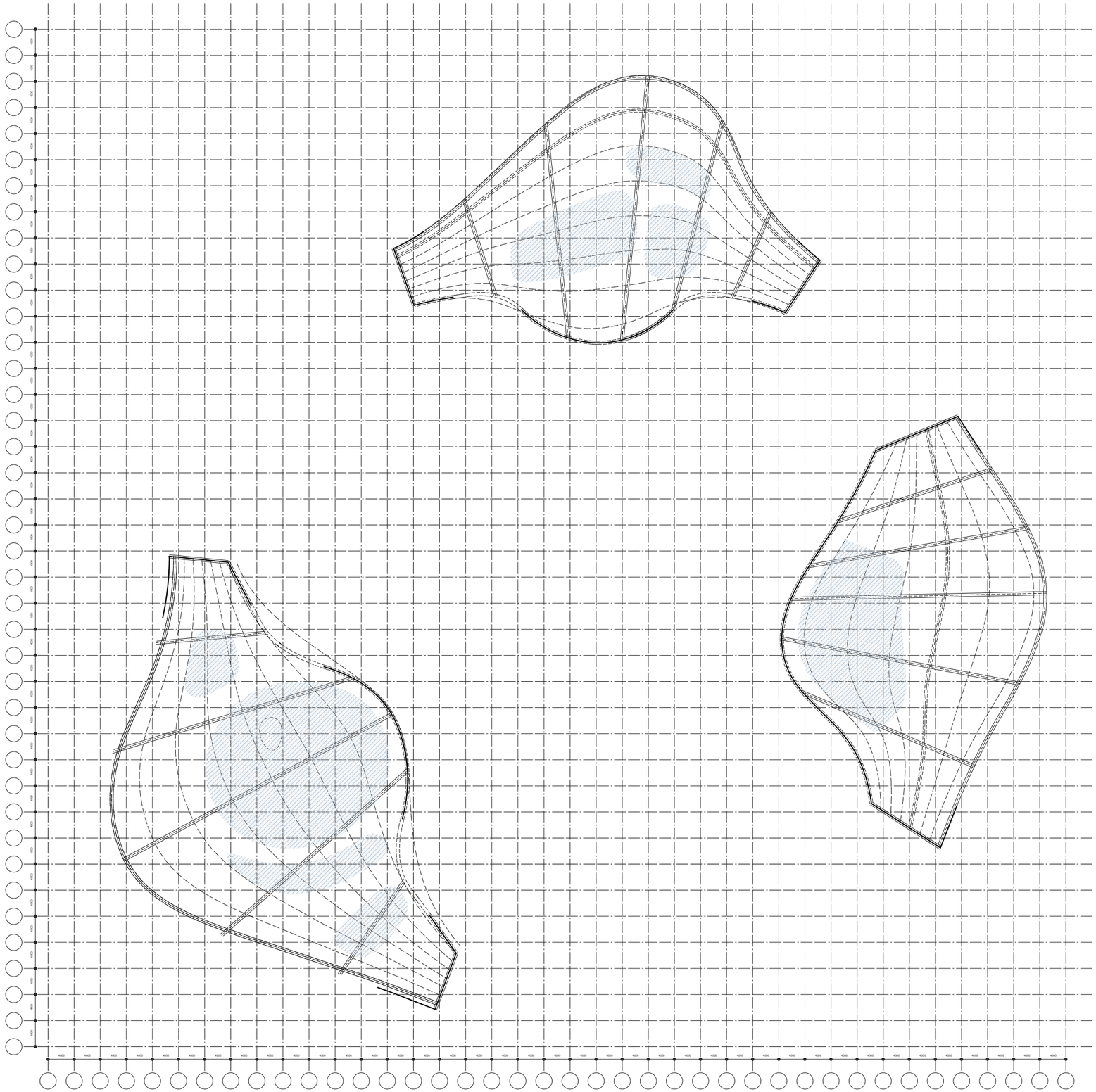
WIND SPEED

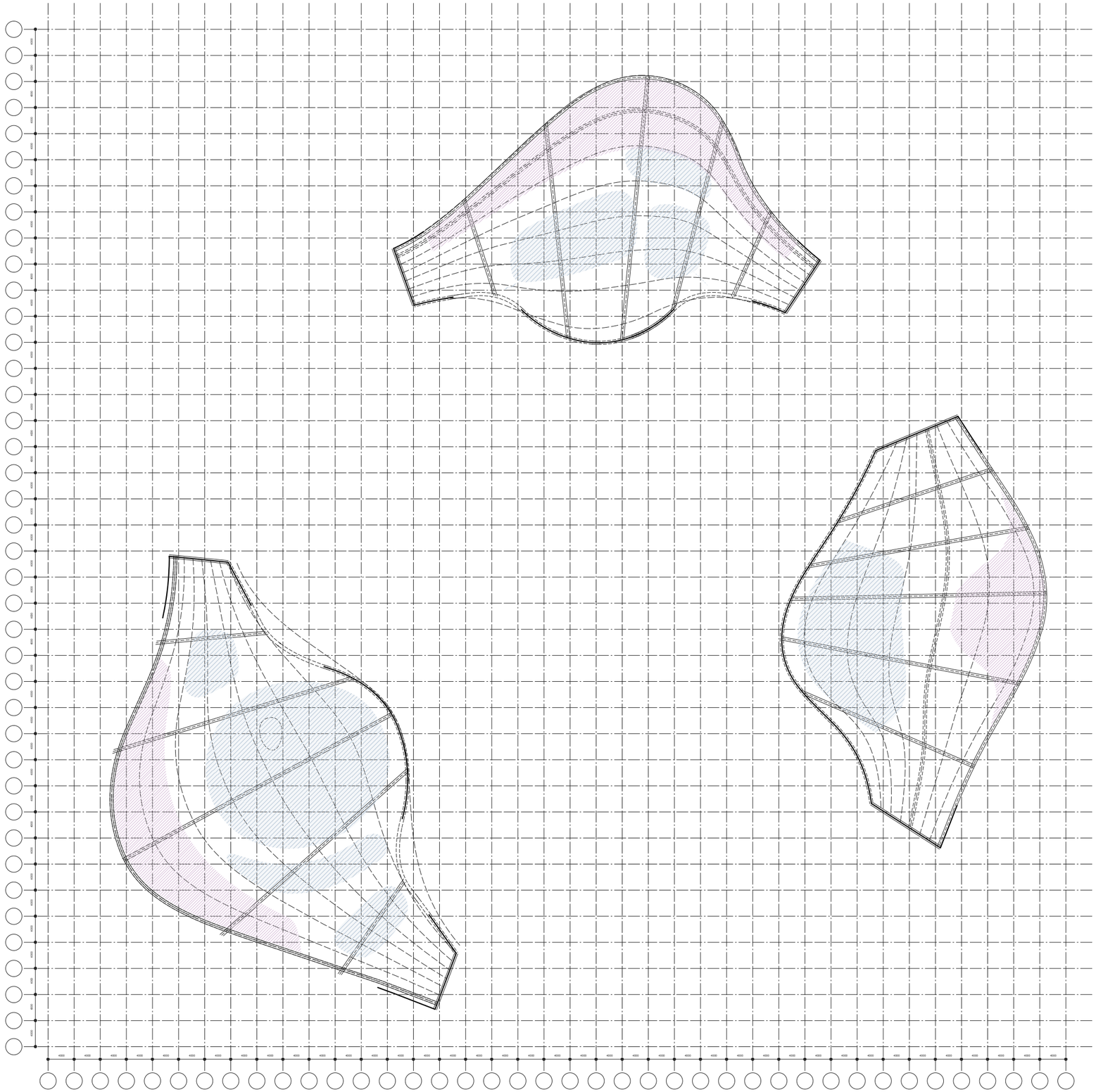


WATER SURFACE TEMPERATURE

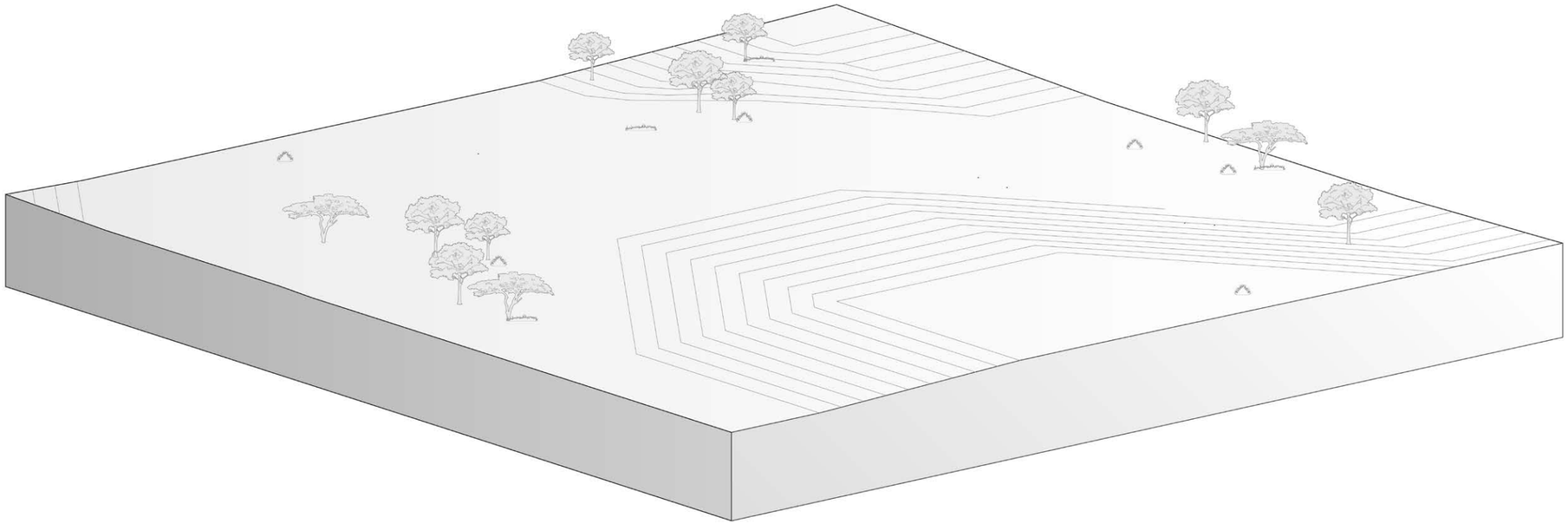




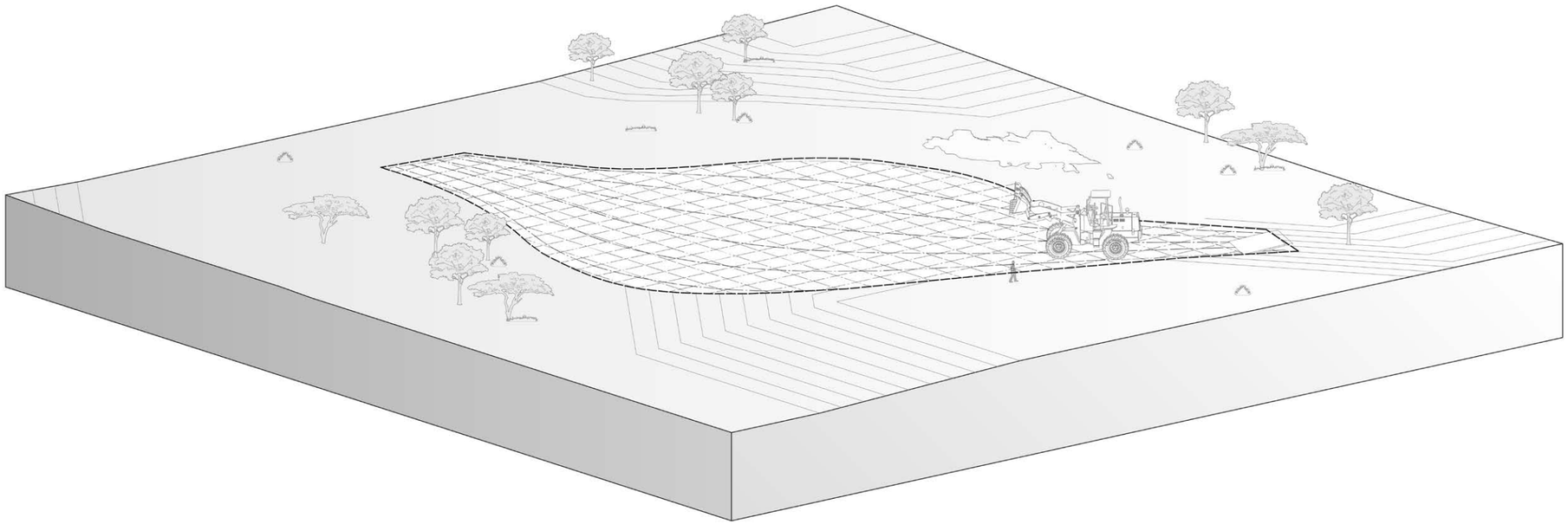




Building process of a biogenic concrete shell

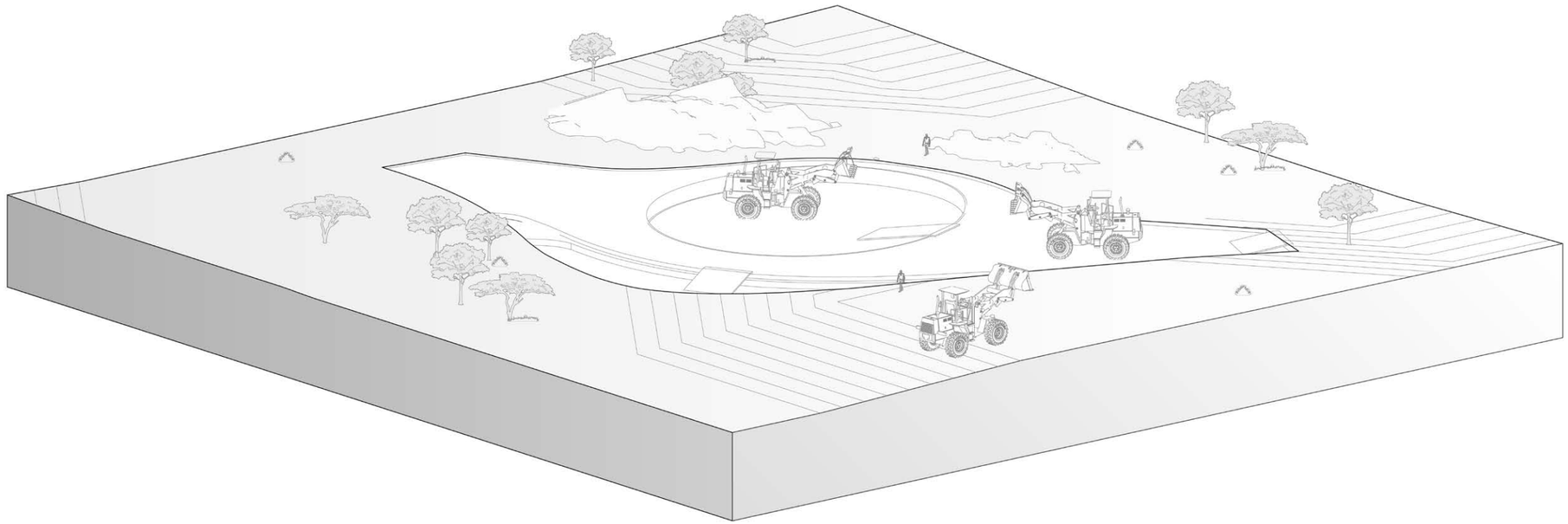


Current site



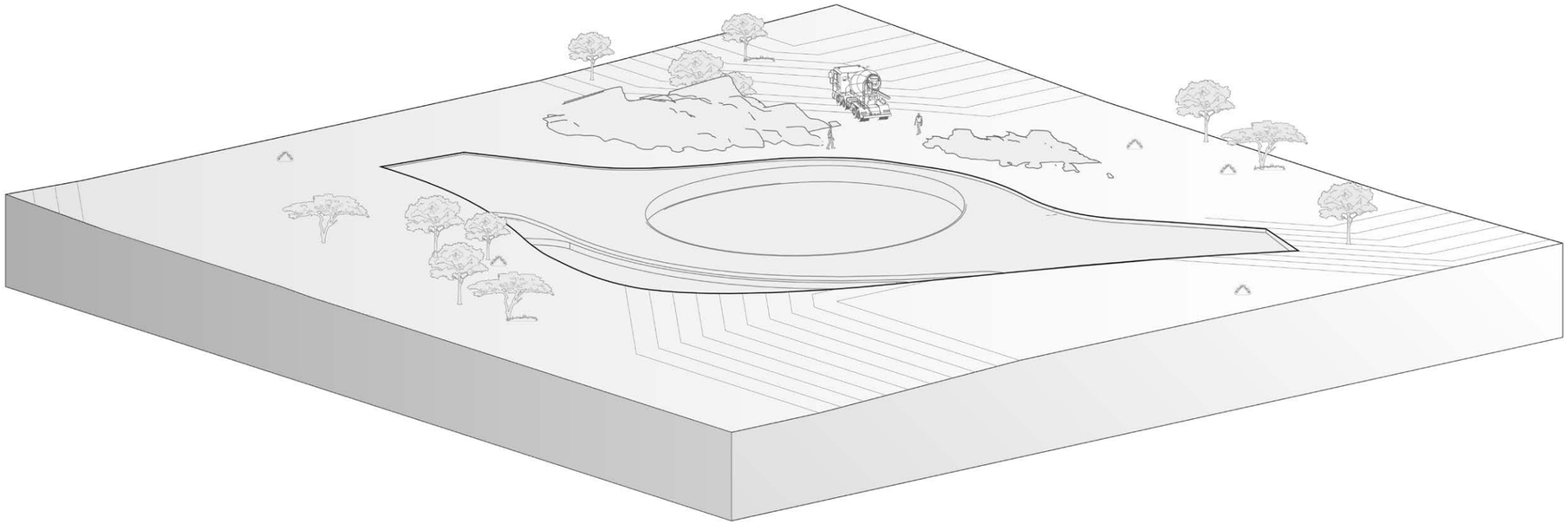
Creating a clear construction site, including:
-clearing the construction site of any obstructions
-leveling and compacting to provide a stable foundation
for the structure.

Site preparation

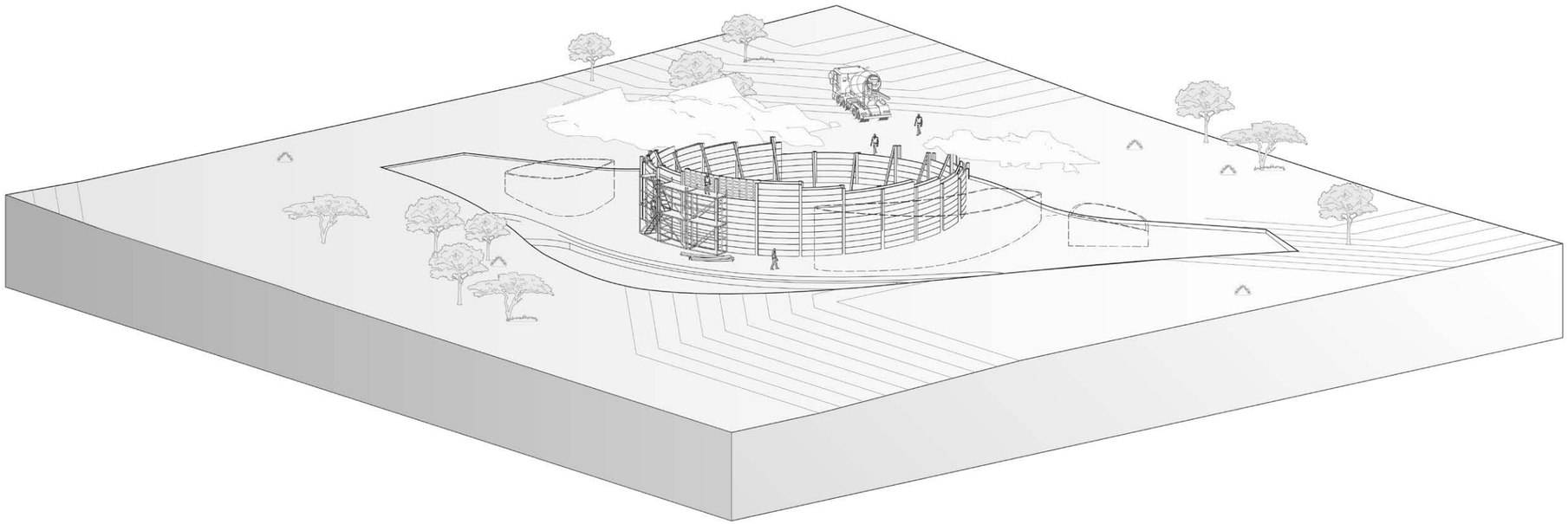


Further leveling to provide a stable foundation
for the structure.
Soil is excavated and collected for reuse.

Site preparation

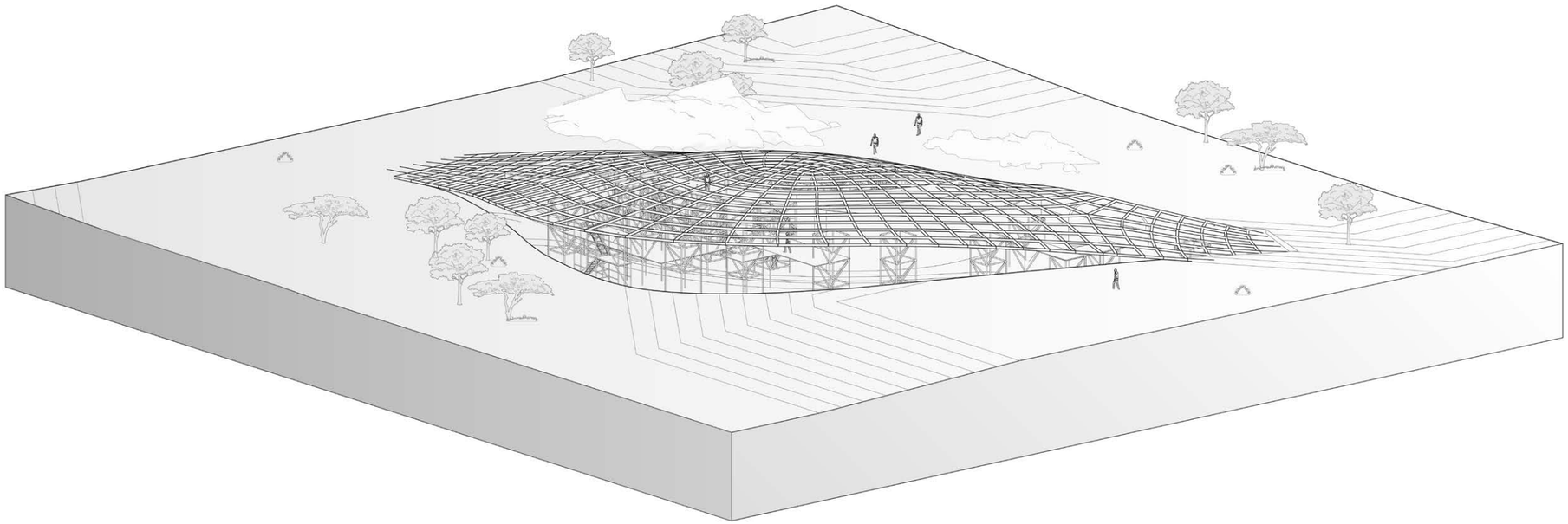


Foundation and floor preparation



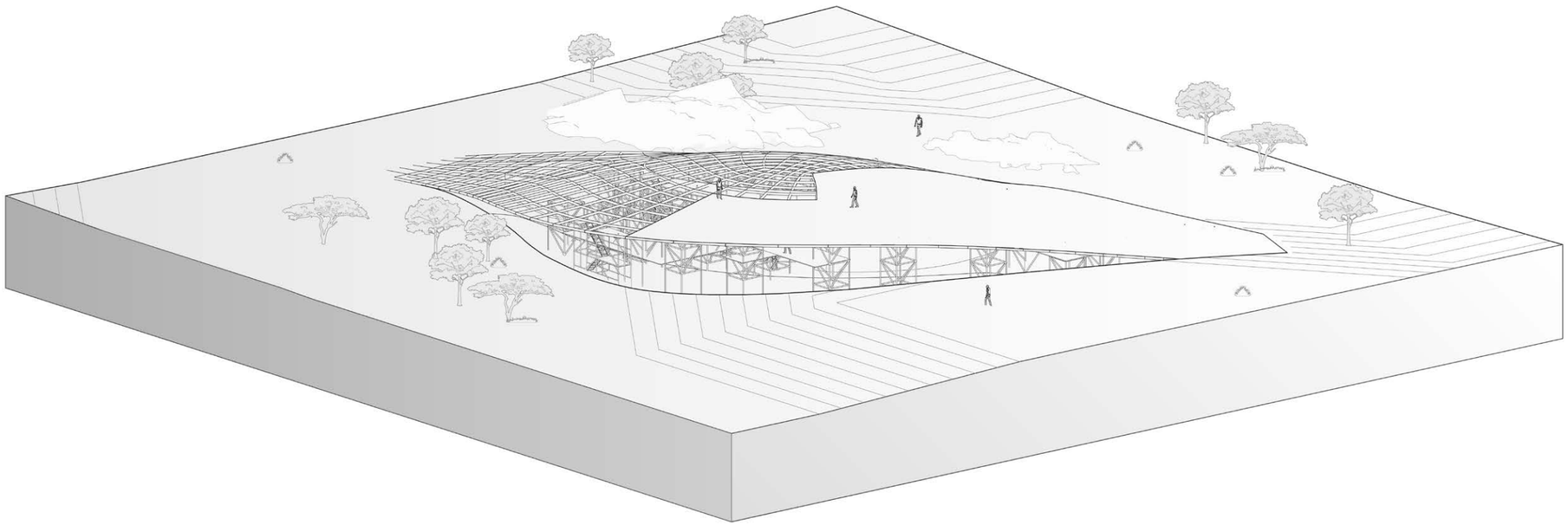
Constructing the formwork for the walls,
that will later be used to help carry the shell structure.

Formwork construction



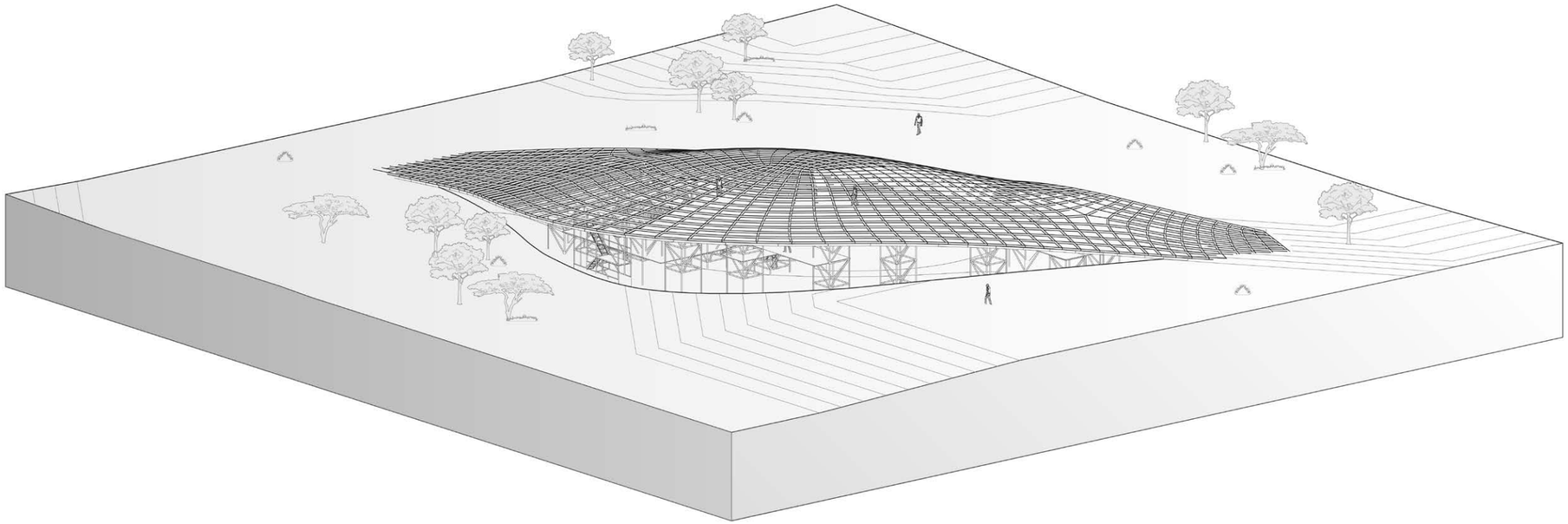
Constructing the primary steel formwork
for the shell structure.

Formwork construction



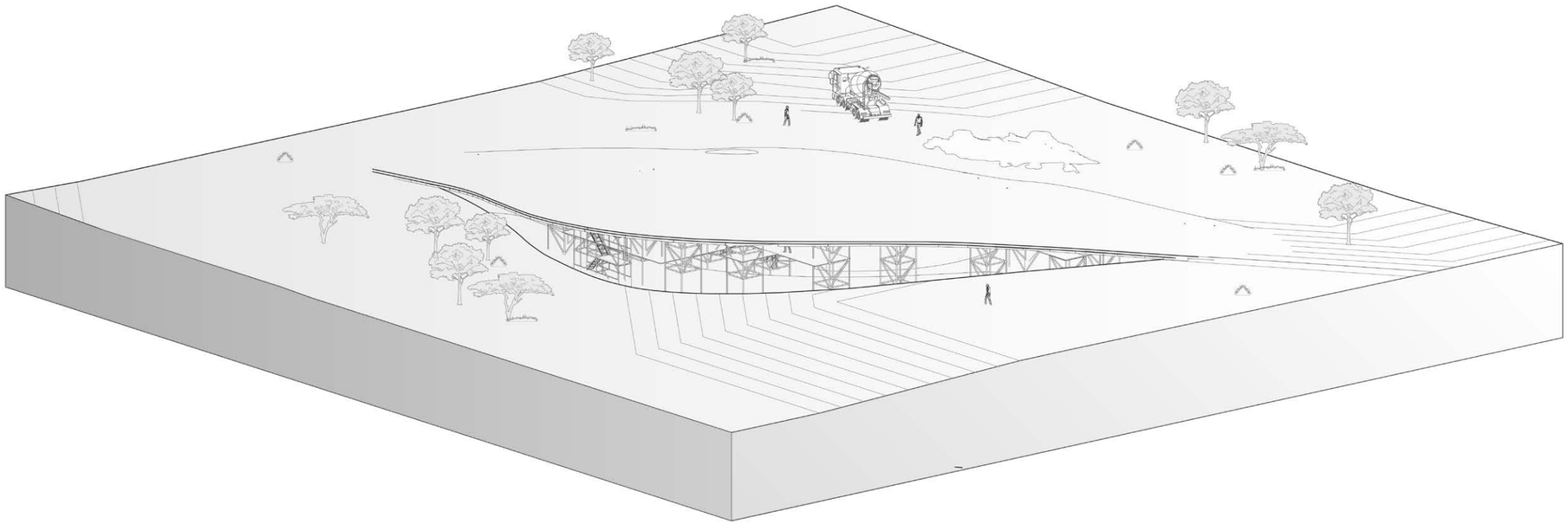
Finishing the formwork for the shell structure with secundary steel structure and panelling, to ensure that the formwork is strong enough to withstand the pressure of the concrete.

Formwork construction



Placing the steel reinforcement within the formwork
according to the specified structural design requirements

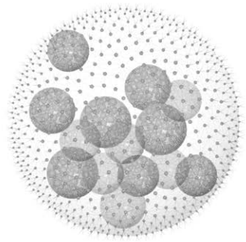
Reinforcement installation



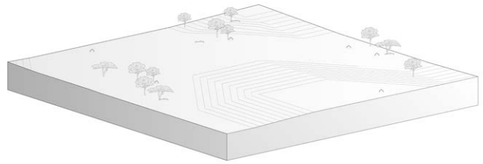
Pouring the concrete carefully into the formwork,
ensuring that it completely fills the space and eliminates
any air gaps or voids.

Concrete Pouring

White microalgae



White microalgae (Coccolitophore) that biologically grown limestone through photosynthesis



Biogenic limestone

biologically grown limestone that replaces the quarried limestone. The new mixture creates a net carbon neutral balance.

50% of biogenic crete mixture

Soil from site

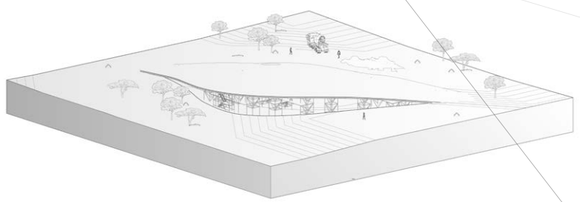
Soil that is excavated from site to create the groundscapes, is reused within the concrete mixture making the building one with landscape

50% of biogenic crete mixture

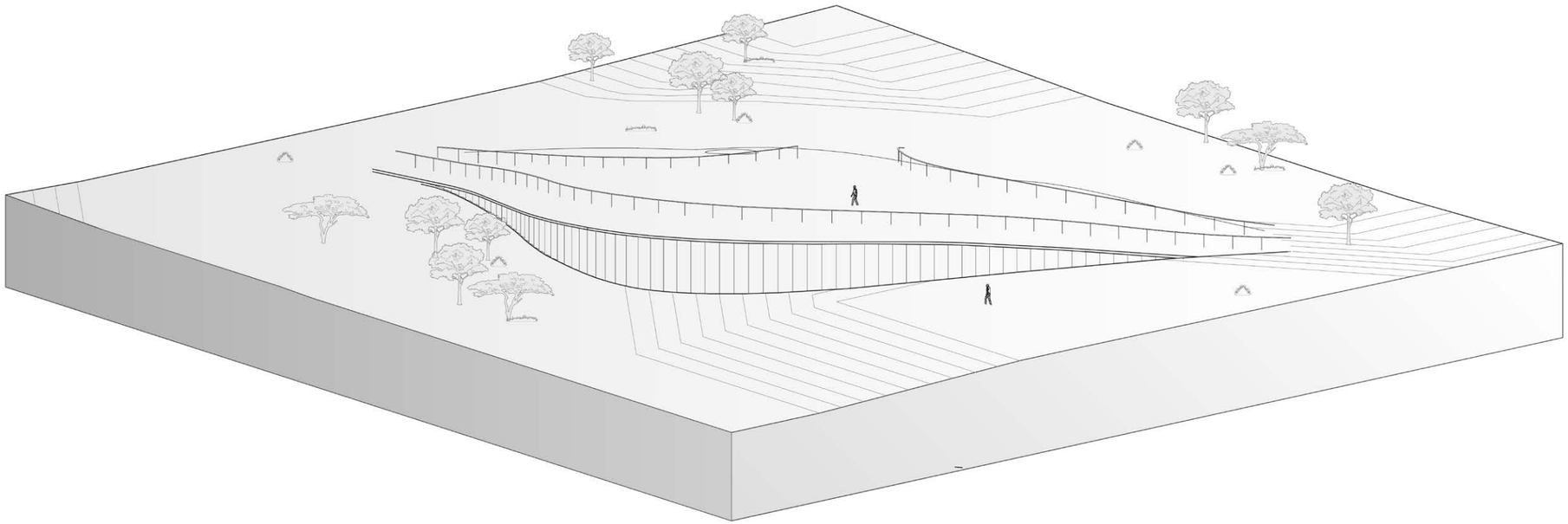
Biogenic concrete

The carbon dioxide that is produced through the production of the biogenic concrete, is now already captured by the microalgae and is embedded in the material, creating a carbon neutral material.

100% Carbon neutrality

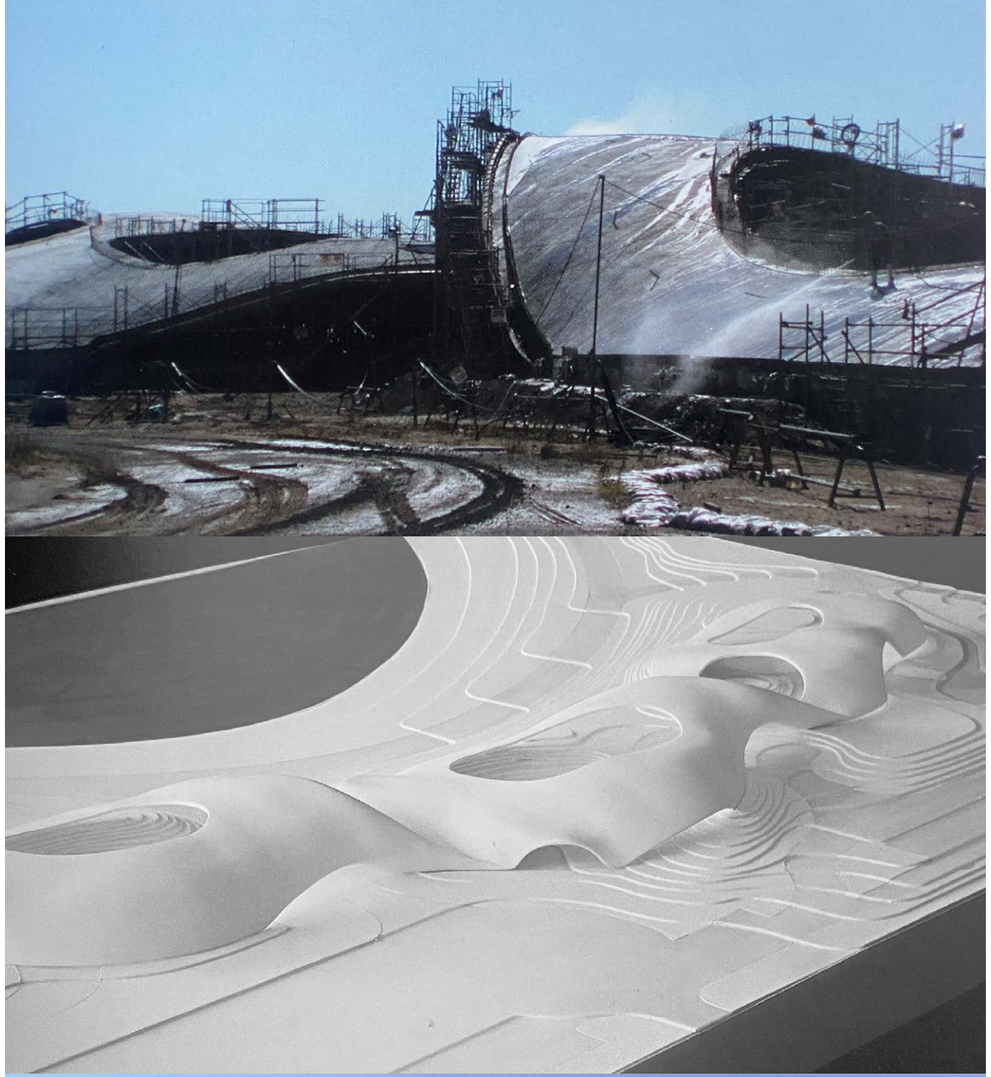


Concrete Mixing

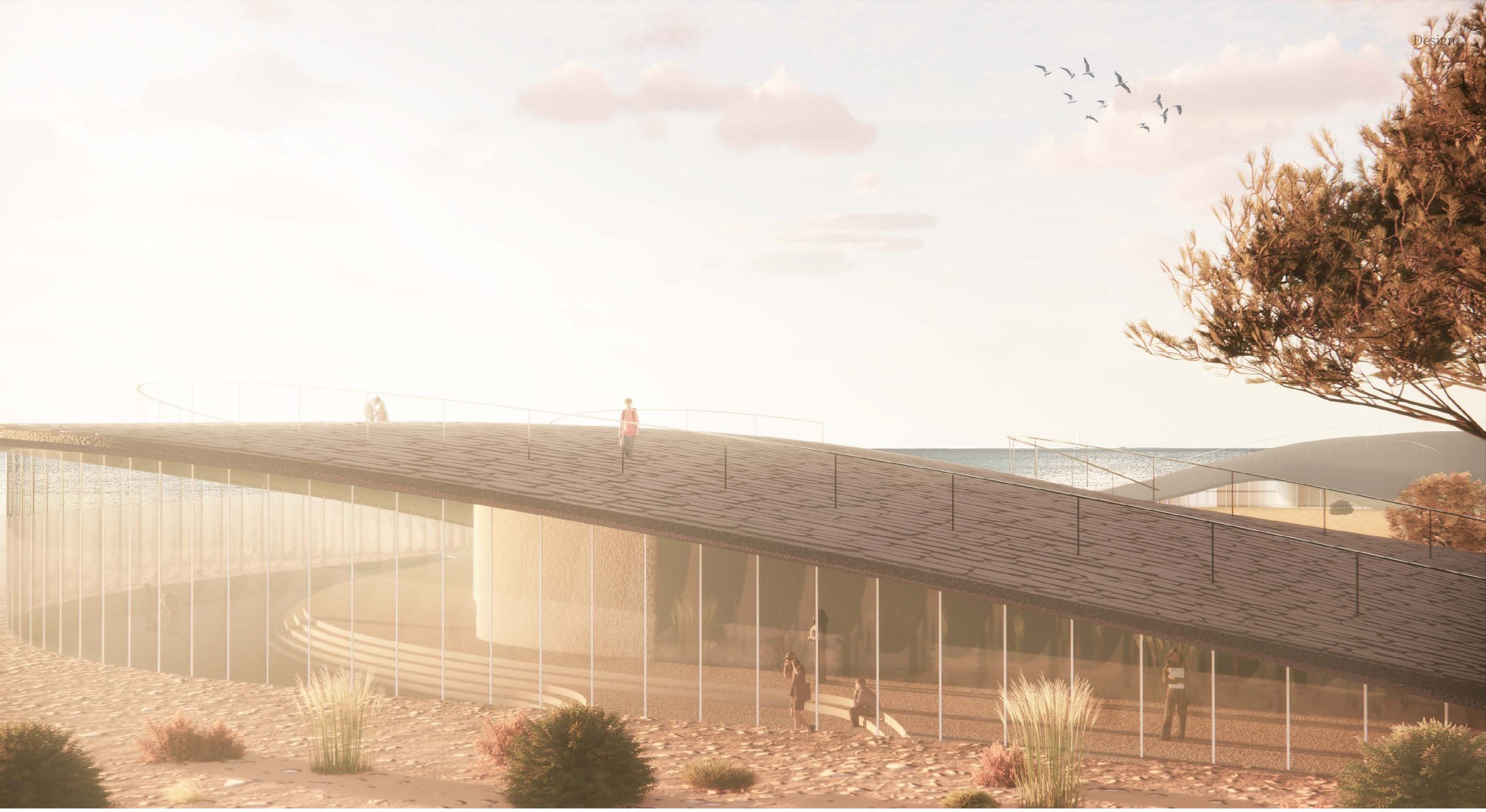


- Once the concrete has sufficiently cured and attained the necessary strength, the formwork can carefully be removed.
- Necessary finishing touches can be carried out, such as smoothing rough edges and applying protective coatings to enhance the structure's durability and aesthetics.
- Finished

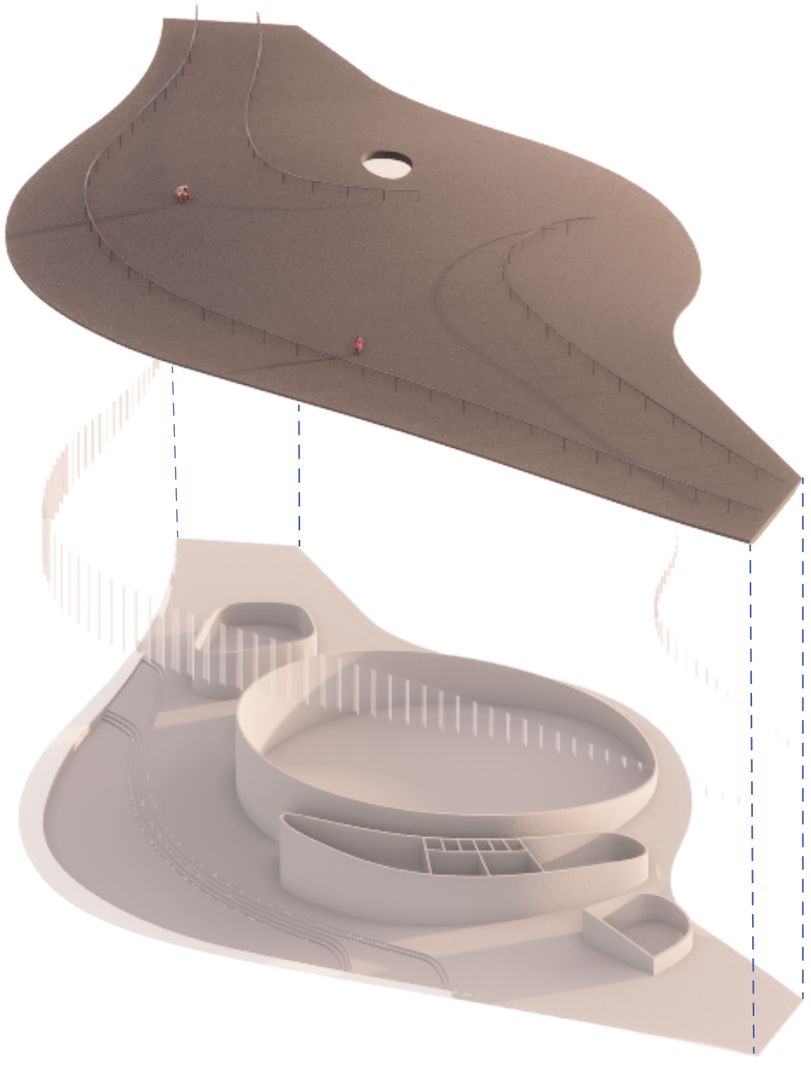
Curing, formwork removal, detailing & finishing



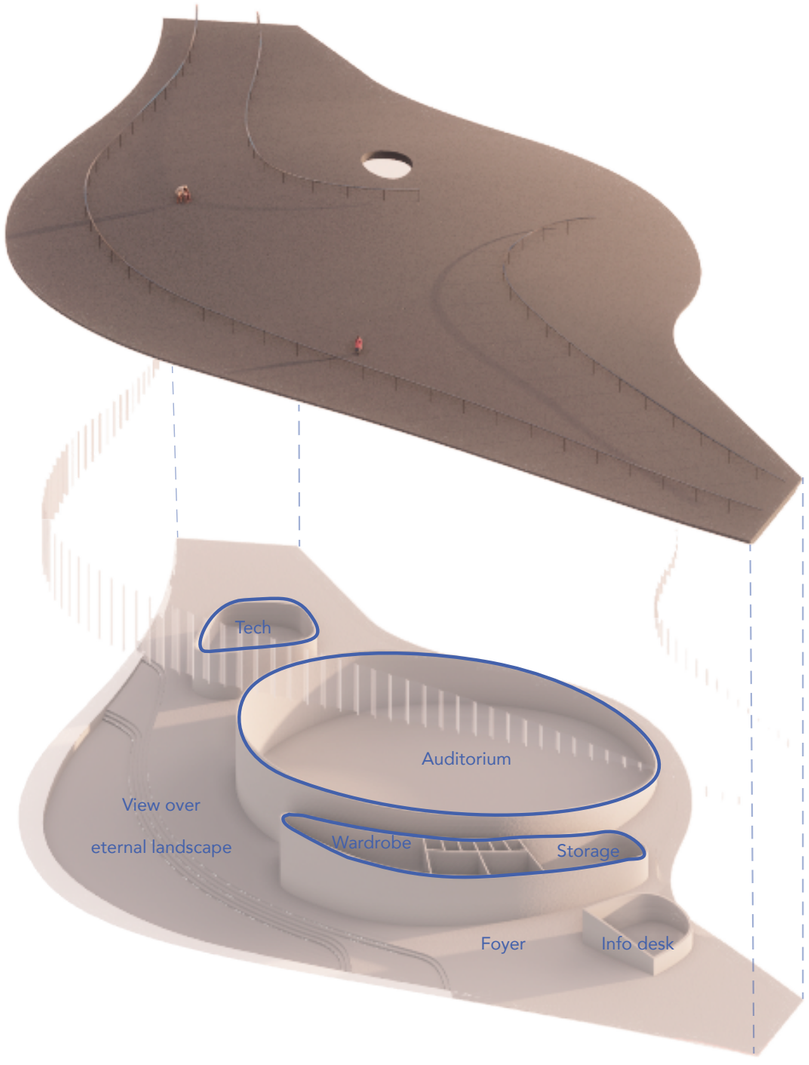
(Reference) Toyo Ito, I-project in Fukuoka, 2002-2005



1 Celestial groundscape



1 Celestial ground



1 Celestial ground

HVAC

AUDITORIUM

REFLECTION SPACE

WARDROBE

TOILETS

STORAGE

FOYER

OFFICE

INFODESK

TKK

Workers space

MPR

HVAC

AUDITORIUM

REFLECTION SPACE

WARDROBE

TOILETS

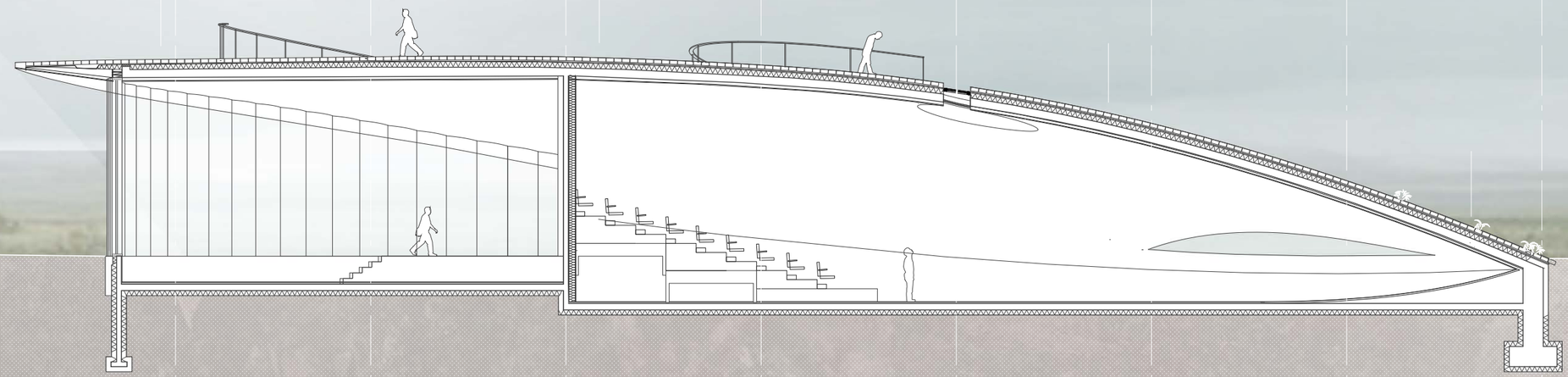
STORAGE

OFFICE

INFOBESE

Workers space

BPK



Sun shading

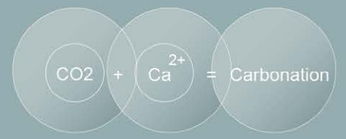
The façade features an architectural overhang designed to provide shading and solar mitigation effectively minimizing direct sunlight exposure.

Carbon Dioxide Sequestration

Algae and other marine life can clamp on the rough surface of the concrete tiles.
The biodiversity that will star to exist on the shell
can help erosion control and absorps Co2 from the environment

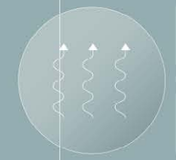
Hemp insulation

A sustainable and durable solution (low carbon footprint) to insulating the building.
Furthermore it can be locally sourced.
Its properties give the possibility of moisture control



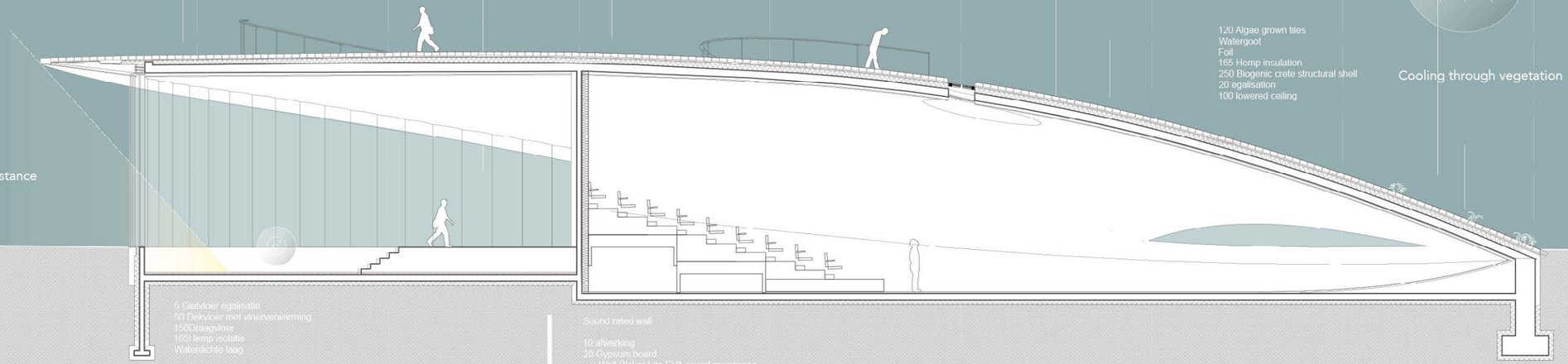
Self-healing properties of biogenic concrete

Formation of calciumcarbonate
that heals microcracks
within the biogenic concrete and
enhaces its durability



Cooling through vegetation

Use of thermal mass of landscape
to keep the interior temperature wround a constance



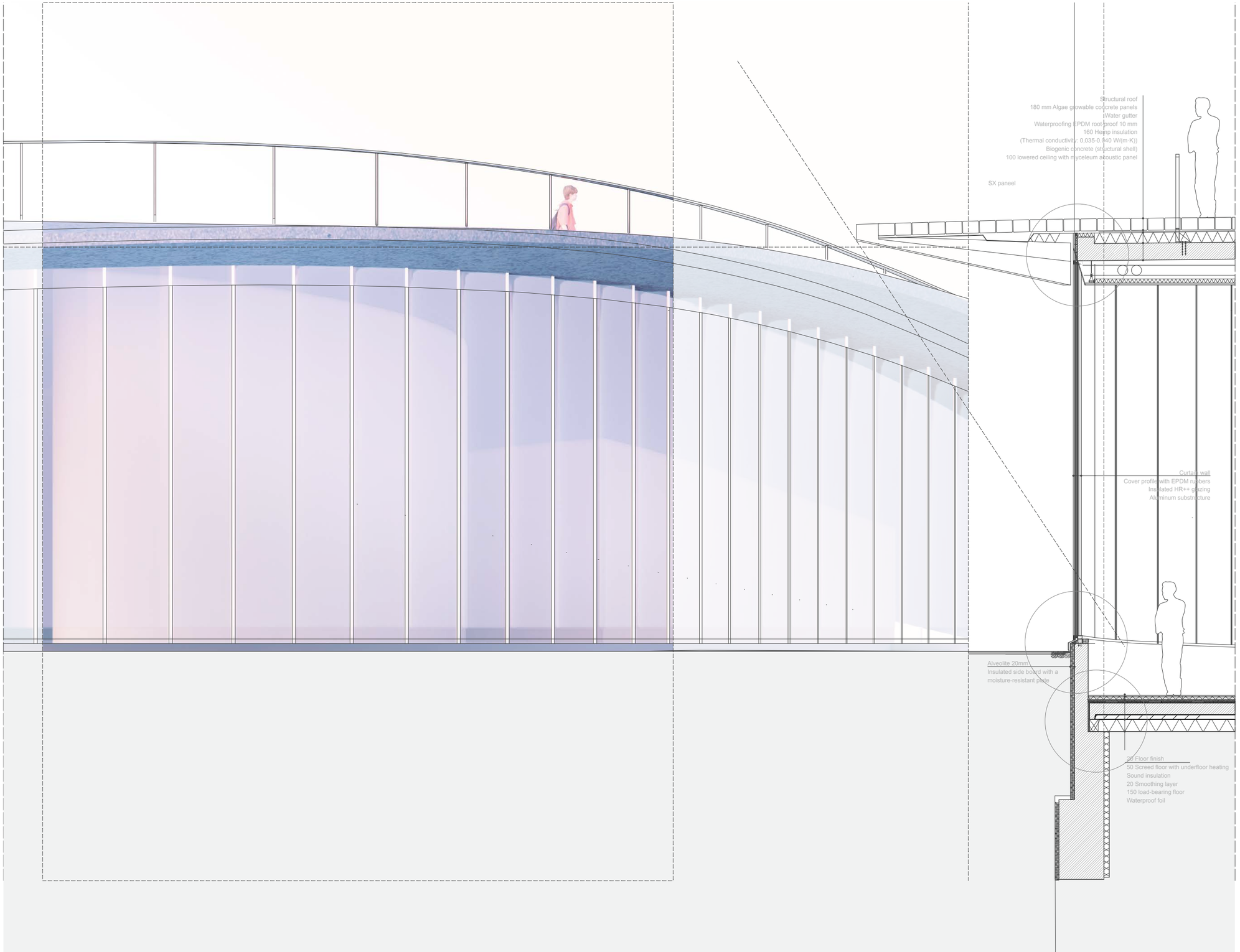
120 Algae grown tiles
Watergoot
Foil
165 Hemp insulation
250 Biogenic crete structural shell
20 egalisation
100 lowered ceiling

5 Gietvloer egalisatie
50 Tiekvloer met vloerverwarming
150Draagvloer
165l temp isolatie
Waterdichte laag

Sound rated wall

10 afwerking
20 Gypsum board
Wall Bloker Lite EVA sound membrane
200 Bist (sound) insulation
with Gauge metal studs every 600 mm
150 Biogenic crete wall
20 Gypsum board
10 afwerking

Geothermal heatpump


Structural roof
180 mm Algae growable concrete panels
Water gutter
Waterproofing EPDM roof proof 10 mm
160 Hemp insulation
(Thermal conductivity: 0,035-0,040 W/(m·K))
Biogenic concrete (structural shell)
100 lowered ceiling with myceleum acoustic panel
SX paneel
Curtain wall
Cover profile with EPDM rubbers
Insulated HR++ glazing
Aluminum substructure
Alveolite 20mm
Insulated side board with a
moisture-resistant plate
20 Floor finish
50 Screed floor with underfloor heating
Sound insulation
20 Smoothing layer
150 load-bearing floor
Waterproof foil

Curtain wall
Cover profile with EPDM rubbers
Insulated HR++ glazing
Aluminum substructure

Alveolite 20mm
Insulated side board with a
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50 Screed floor with underfloor heating
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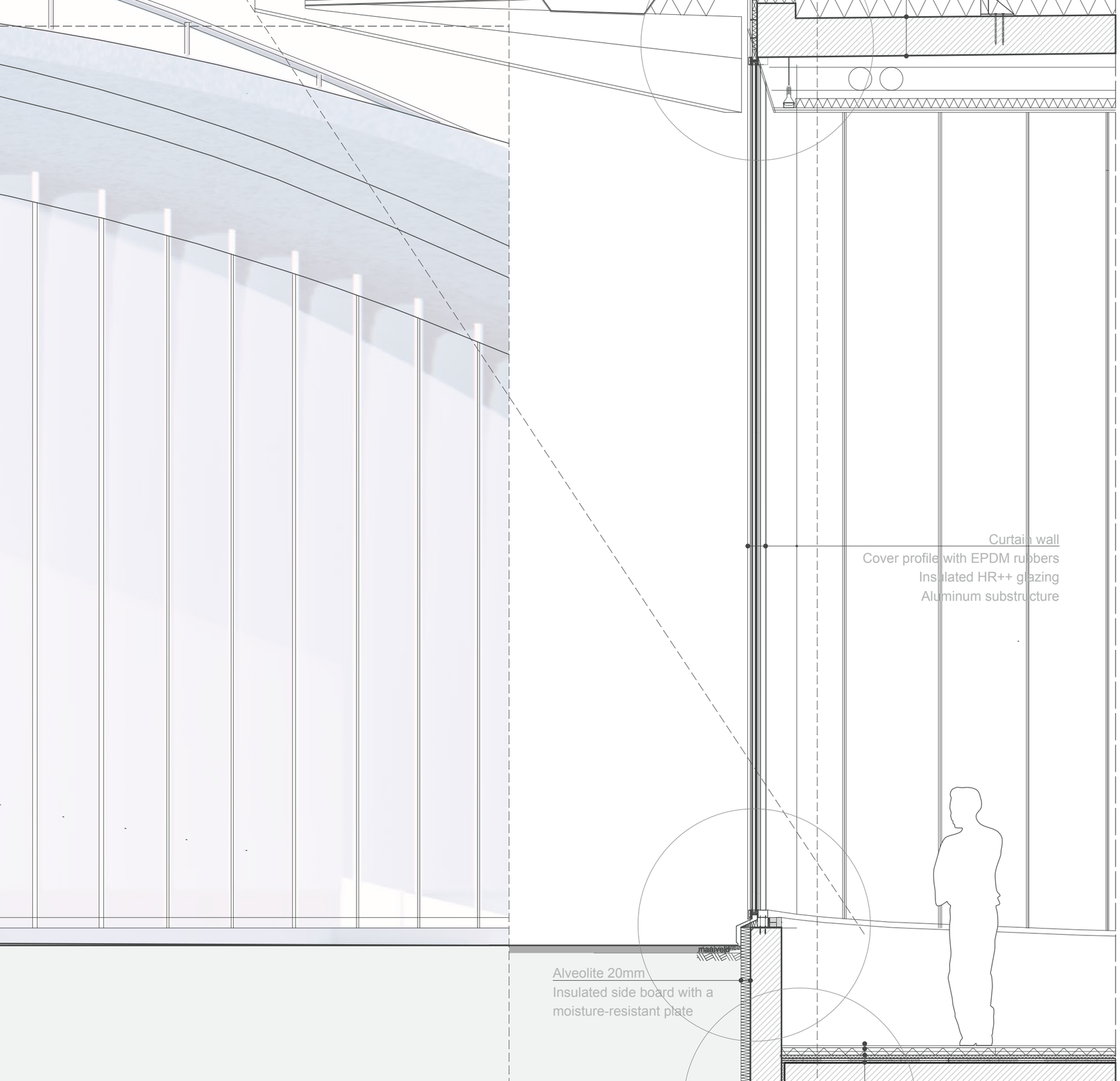
Waterproof foil


Curtain wall
Cover profile with EPDM rubbers
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Insulated side board with a
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Waterproofing EPDM root-proof 10 mm
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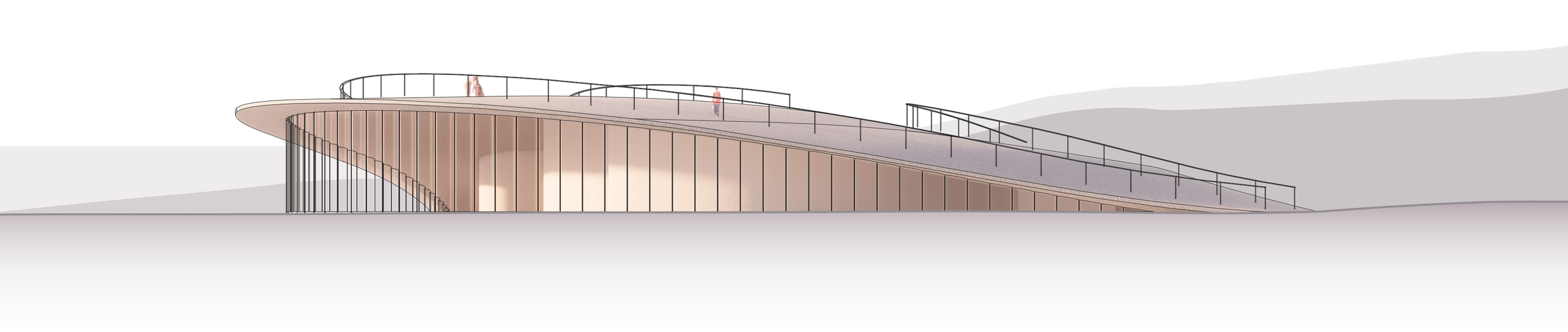
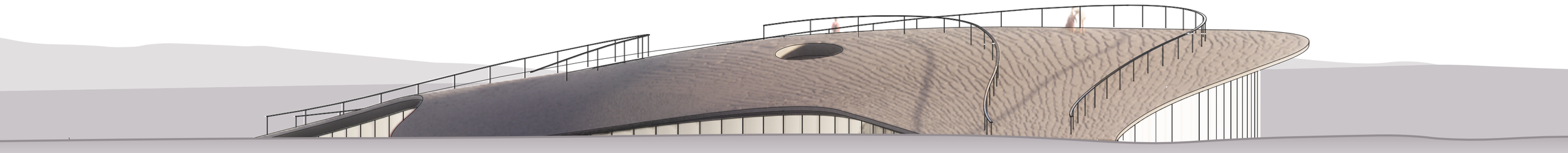
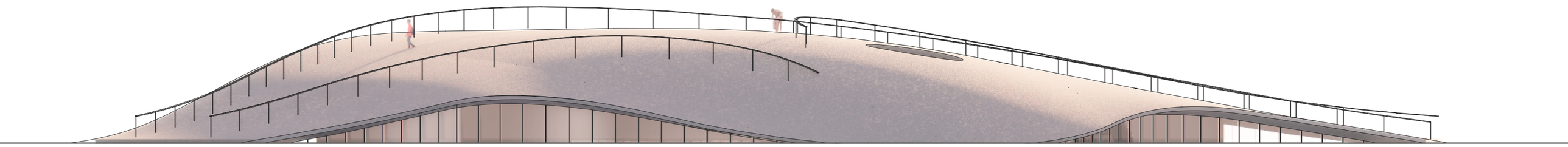


Elevations



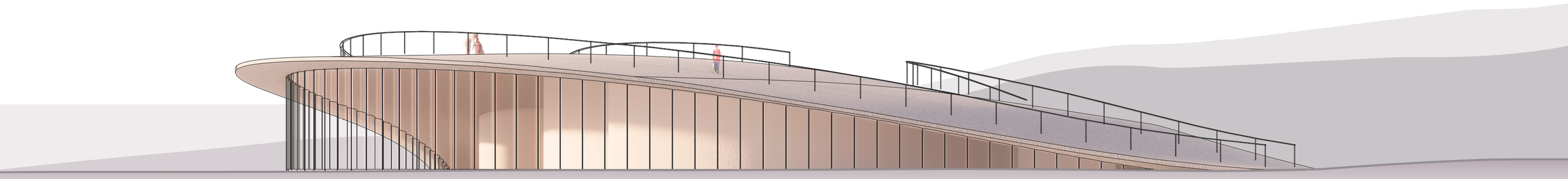
North
Originally 1 to 200 (A3)

0 200 400 600 800 1000



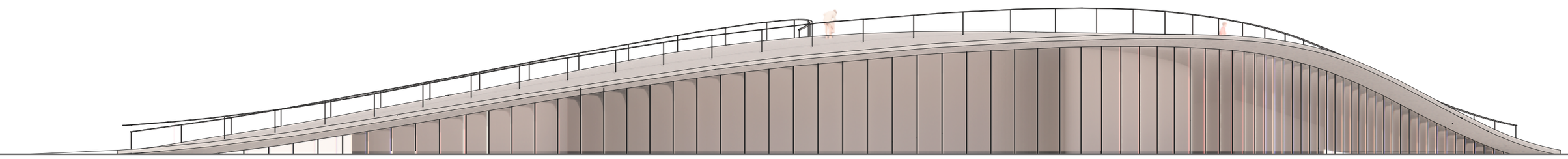
East
Originally 1 to 200 (A3)

0 200 400 600 800 1000



South
Originally 1 to 200 (A3)

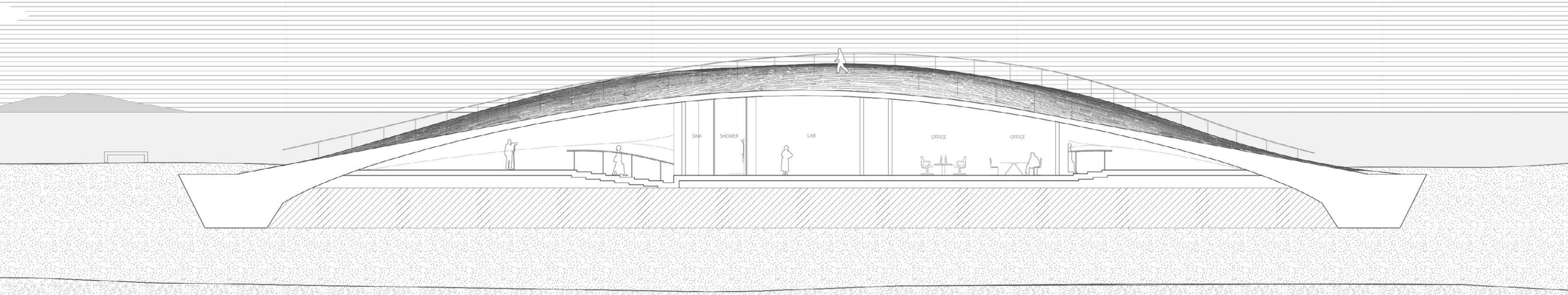
0 200 400 600 800 1000



West
Originally 1 to 200 (A3)

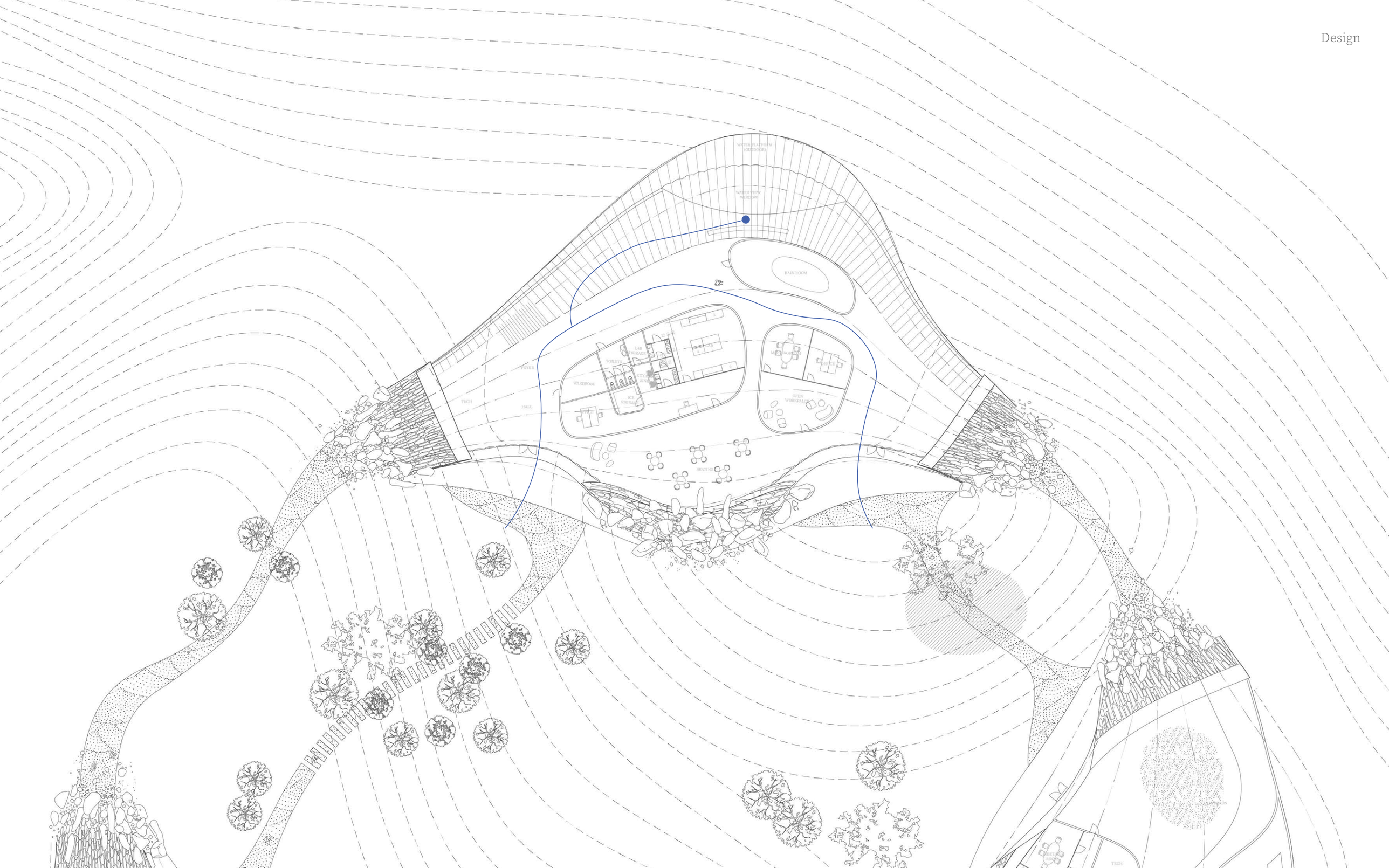
0 200 400 600 800 1000

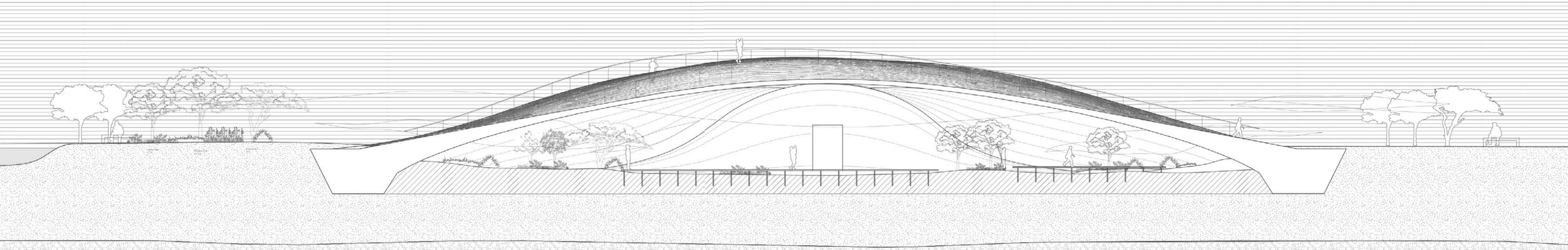
L



2 Water


WATER PLAY ROOM (OUTDOOR)
WATER VIEW WINDOW
RAIN ROOM
LAB STORAGE
TOILETS
KITCHEN SINK
WARDROBE
ICE STORAGE
STAFF
TECH
HALL
POWER
MEETING ROOM
OFFICE
OPEN WORKSPACE
SEATING
TECH

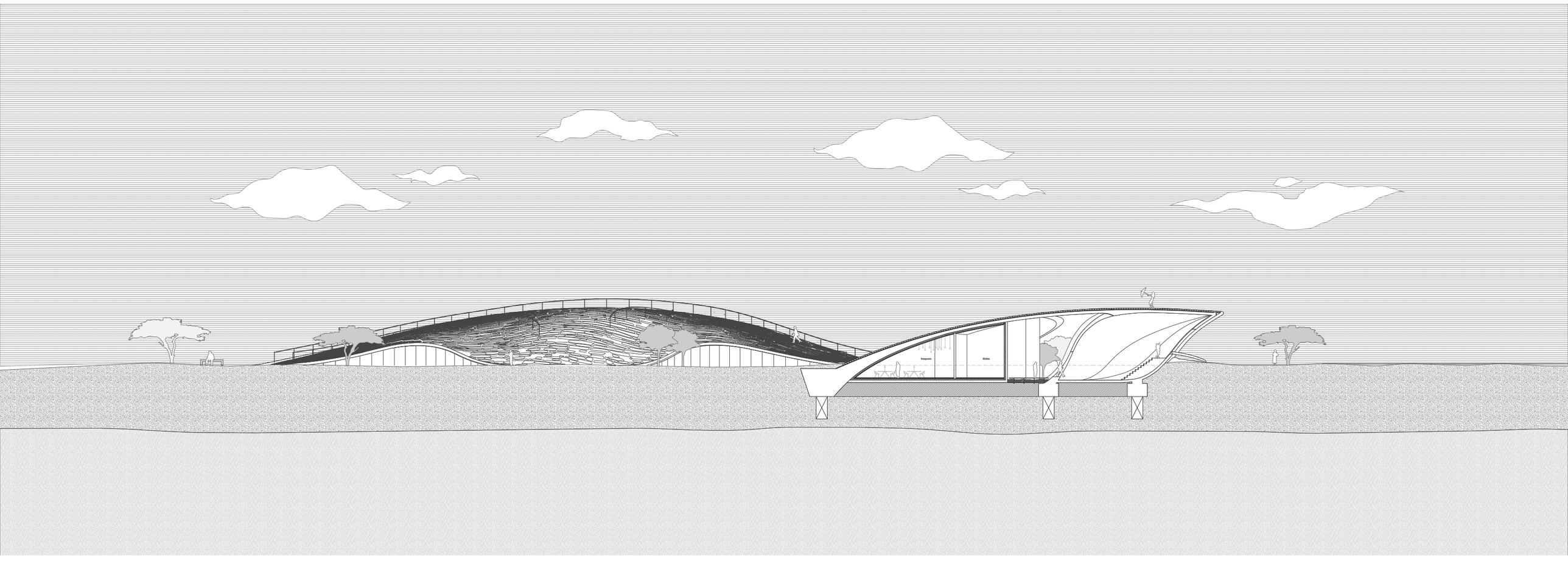

WATER PLAY POEM (OUTDOOR)
WATER VIEW WINDOW
RAIN ROOM
LAB STORAGE
TOILETS
KITCHEN SINK
WARDROBE
ICE STORAGE
STAFF
TECH
HALL
FOYER
MEETING ROOM
OFFICE
OPEN WORKSPACE
SEATING
TECH

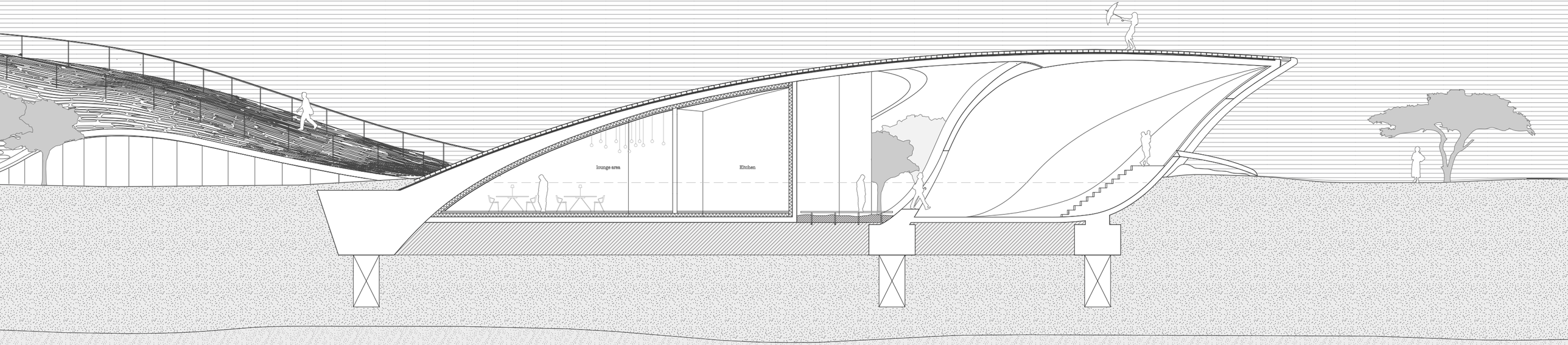


3 Soil


TECH
KITCHEN storage
Workers space
KITCHEN
OBSERVATION ROOM
DYNAMICS


TECH
KITCHEN storage
Workers space
KITCHEN
OBSERVATION ROOM
DYNAMICS

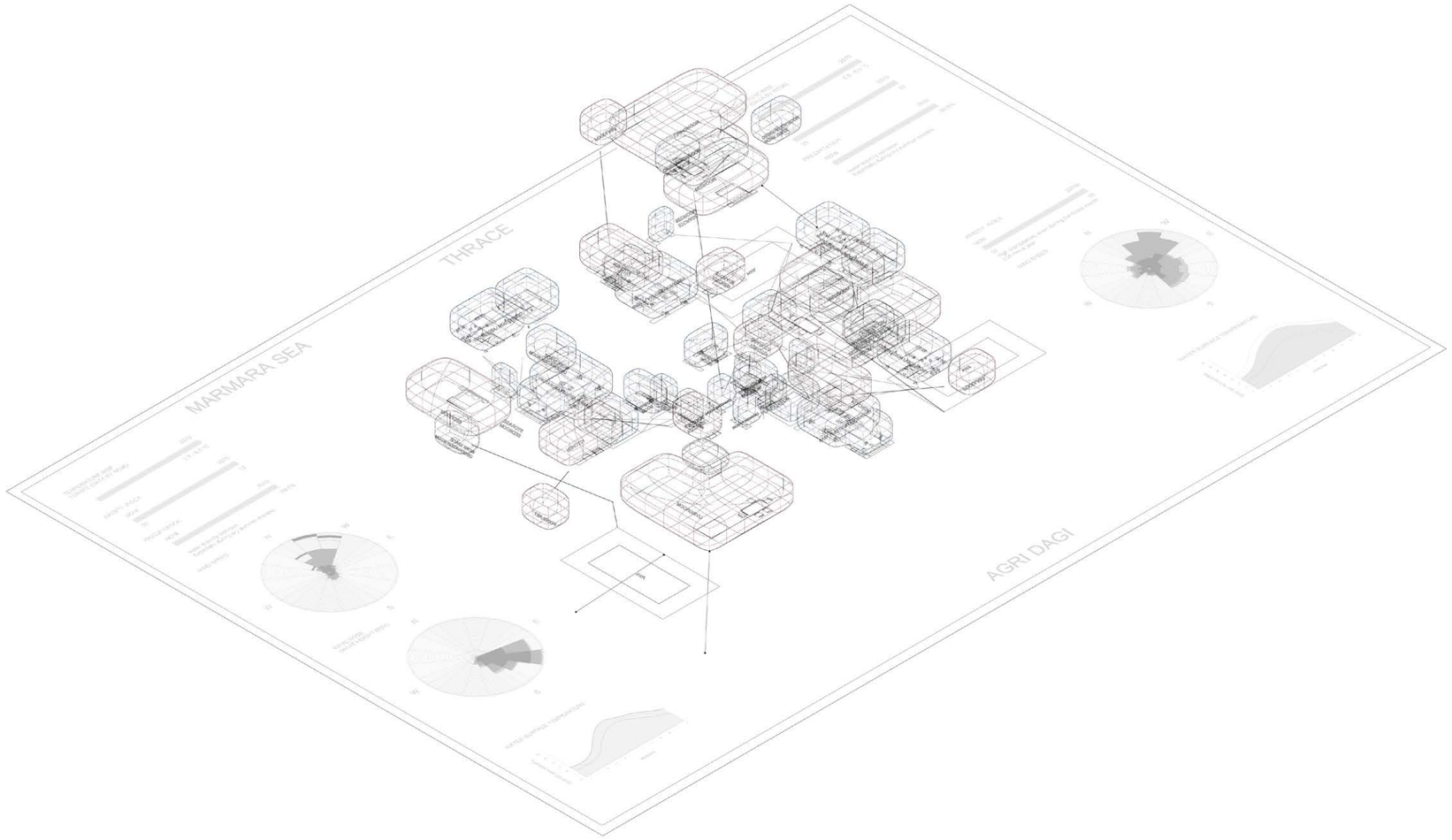

Innenraum
Kirchen


lounge area
Kitchen

A DARK ECOLOGY PROJECT

THE SEA OF MARMARA

Symbiotic architecture along the edge zone


MARMARA SEA
THRACE
AGRI DAGI

ERGENE BASIN

EUROPE

ASIA

THRACE

THE SEA OF MARMARA

MARMARA SEA

MOUNT ARARAT (AGRI DAGI)

ERGENE, CORLU

3 DIFFERENT ACCESSES

LAB

FOOD & WATER SUPPLY

ACCOMODATION

TEMPERATURE RISE TURKEY (DATA BY IPCM)

ARIDITY INDEX

WATER SURFACE TEMPERATURE

WAVE ROSE (WAVE HEIGHT RISK)

4 MAIN COASTAL PROCESSES

PULL OF CELESTIAL BODIES

TIDAL INFLUENCE

SEDIMENT DEPOSITION

WEATHERING

1:200

1 200 400

I would like there to exist places that are stable, moving, intangibly untouched and almost untouchably deeprooted. Places that might be points of reference, of departure, or origin.

Gearge Renee

Design

A DARK ECOLOGY PROJECT

THE SEA OF MARMARA

Symbiotic architecture along the edge zone

CO_2

3 - 4 months

O_2

O_2

0

30

PHOTIC

200

DISPHOTIC

Average depth 496

1000

APHOTIC

Max depth 1396

Decrease biodiversity

7 - 10 years