

A sepia-toned photograph of a beach. The ocean is on the right, with waves breaking onto the shore. The beach is sandy and covered with small rocks and debris. The sky is a uniform light color.

ECHOES OF TRANSFORMATION

ECHOES OF TRANSFORMATION

the dynamic interaction between water and land within polish coastal context

Justyna Maria Pawelczak

master's dissertation

Studio: Sv-On-Po-Gi

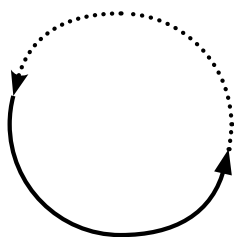
Supervisors: Arnaud Hendrickx, Filip Mattens

KU Leuven Faculty of Architecture

Sint-Lucas Brussels

June 2024

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“w cyklu przemian trwam...”

/ “Baltic” - Bovska

[translation from Polish: **I’m enduring in the
cycle of changes**]



(fig.1.01) the reappearing land



enduring in the cycle of changes

In the landscape of Polish coastal patches, **the tension between water and land** resonates. This study focuses on the exploration of an ecologically specific zone within the Baltic Sea—the Bay of Puck, enclosed by the mainland and the peninsula. Utilizing various media, from graphics to animations, the research aims to capture and convey the observations and experiences gathered during travel. Central to this study is an atlas that combines exploration defined as **echoes** and **transformations** within a boundless and unpredictable context, reflecting the rather nonlinear journey of this thesis.

The initial focus is on the coastal background, highlighting remnants of uncommon infrastructures that stand as testaments to both past human activity and nature's impact. While fortifications are intended to provide defense, they remain vulnerable to the forces of dynamic nature. Amidst rapid climate change and anthropogenic impacts on the landscape, this area, though bounded by natural parameters controlled by the Marine Acts, faces pressures of continuous development. The thesis delves into the ecological aspects of Polish coastal areas, emphasizing how these factors can inform and shape the space itself.

The study introduces findings that underscore the dynamic interaction between these elements, especially in the context of reappearing underwater land. The collected observations provide measures to create environmental **scenarios** across various **spatial** and **temporal** phases, representing the site's transformative nature and gradual transition between water and land through environmental adaptation.

By exploring adaptive architectural practices that respect and respond to the natural cycles of the environment, the study encourages different strategies, providing a spatial intervention, as a research outcome, that is both reactive and integrating. Ultimately, it aims to preserve the rhythm of the coastal landscape found on-site. The distinct sense of time at the seaside is shaped by the rhythm of tides and fluctuating water levels. The evolving landscape further enhances the comprehension of this dynamic environment.

The research question guiding this investigation is: ***How can architectural practice preserve and emphasize the dynamic interaction between land and water?*** The thesis explores architectural strategies that harmonize the built environment with the ever-changing natural world, enhancing the sensory engagement of people with the dynamic landscape.

Further exploration is conducted through a combined atlas of both “echoes” and “transformation,” defined after my travel to the Polish coast in March 2023. Prior to the travel, I gathered all available digital sources regarding the coast and fortifications in this area. To deepen my understanding, I consulted with a local architect whose expertise enabled me to identify more sites than I could have on my own. Additionally, I connected with an individual who worked behind the scenes at the Torpedo Launch Station. His tour, accompanied by a group of former soldiers and local residents, provided invaluable insights into the context, significance, and understated nature of the area.

TABLE OF CONTENT

Enduring in the cycle of
changes

Preface 15

ECHOES of the dynamic landscape

CONTEXT 25
travel

DAMAGE 37
insights from the bunkers

OBSERVATION 59
the matter of perception

PHENOMENA 107
atmospherical and seasonal

now

TRANSFORMATION

through change and
movement

SITUATING

93

reappearing land

MOVEMENT

107

— — — — —
soon

INTERCONNECTEDNESS

129

ecological characteristics

— — — — —
later

HOW CAN WE AVOID INTERFERING WITH
LOCAL INHABITANTS?
HOW THE LAND CHANGES?
WHAT'S THE ROLE OF WIND IN THE
INTERACTION BETWEEN WATER AND LAND?
HOW THE WATER FLUCTUATES?

REFLECTION

INHALATORIUM

167

ecological technology (purification)

ecological technologies (adaptive platform)

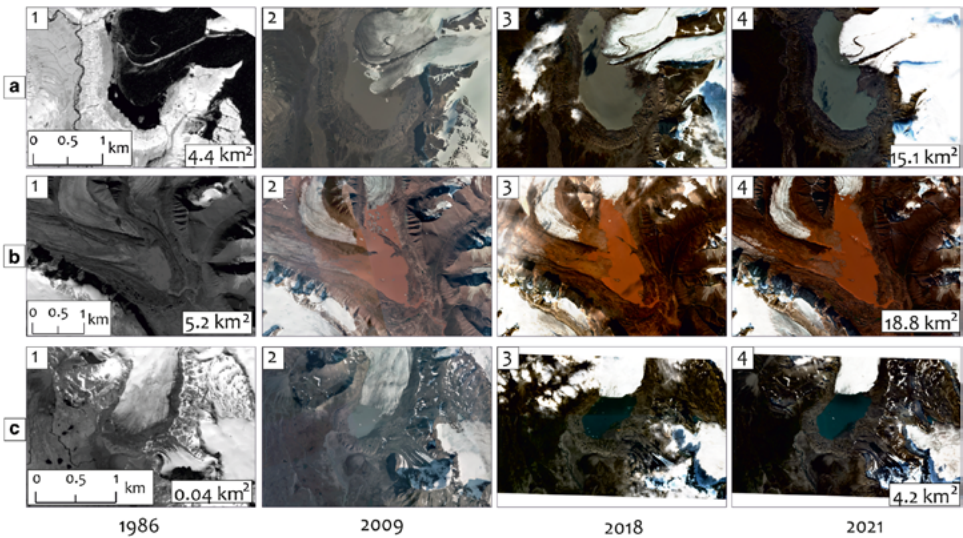
— — — — —
someday

Bibliography

218

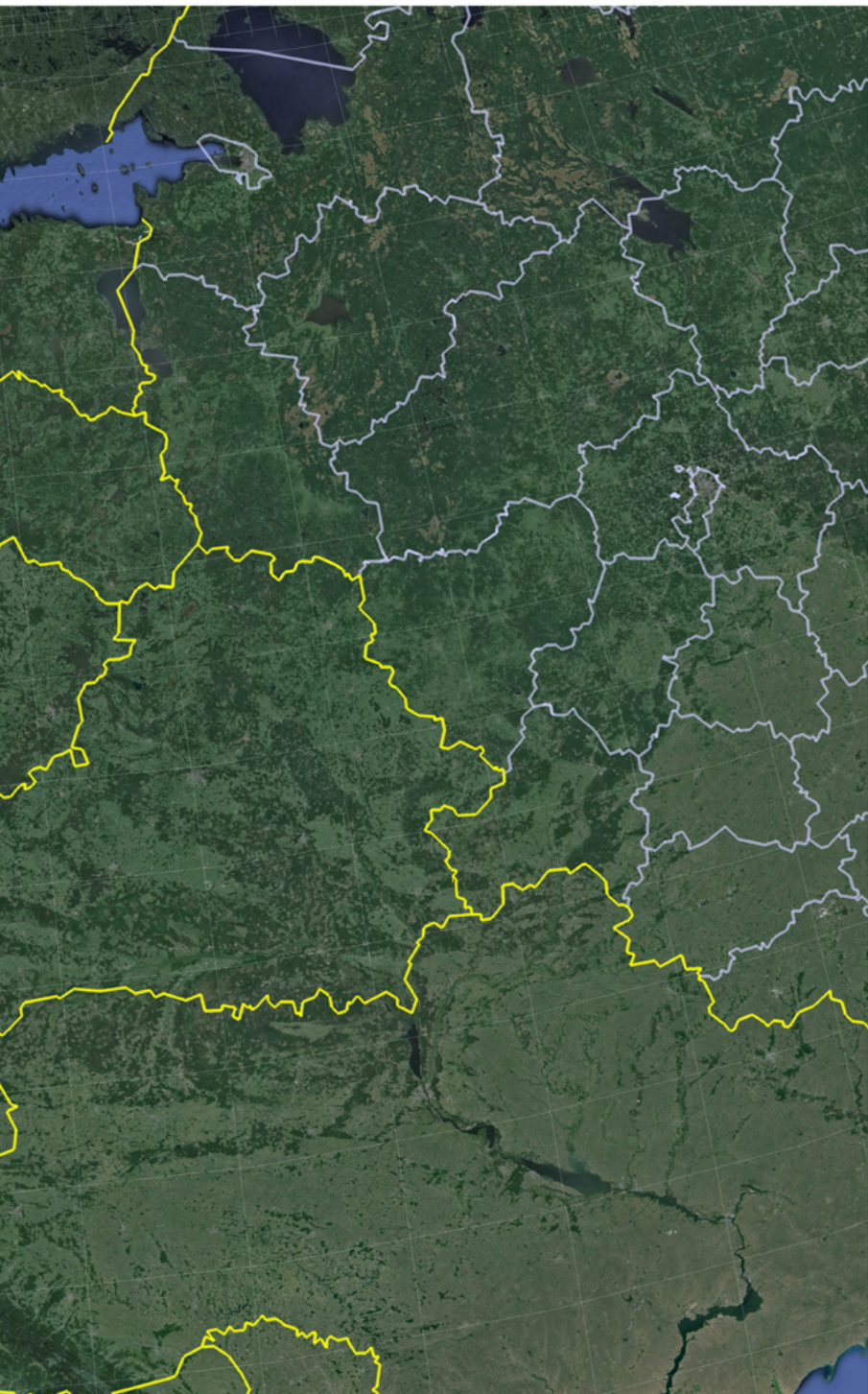
ATLAS

INSIGHTS FROM SVALBARD'S CHANGING GLACIAL LAKES understanding dynamic landscape occurrences

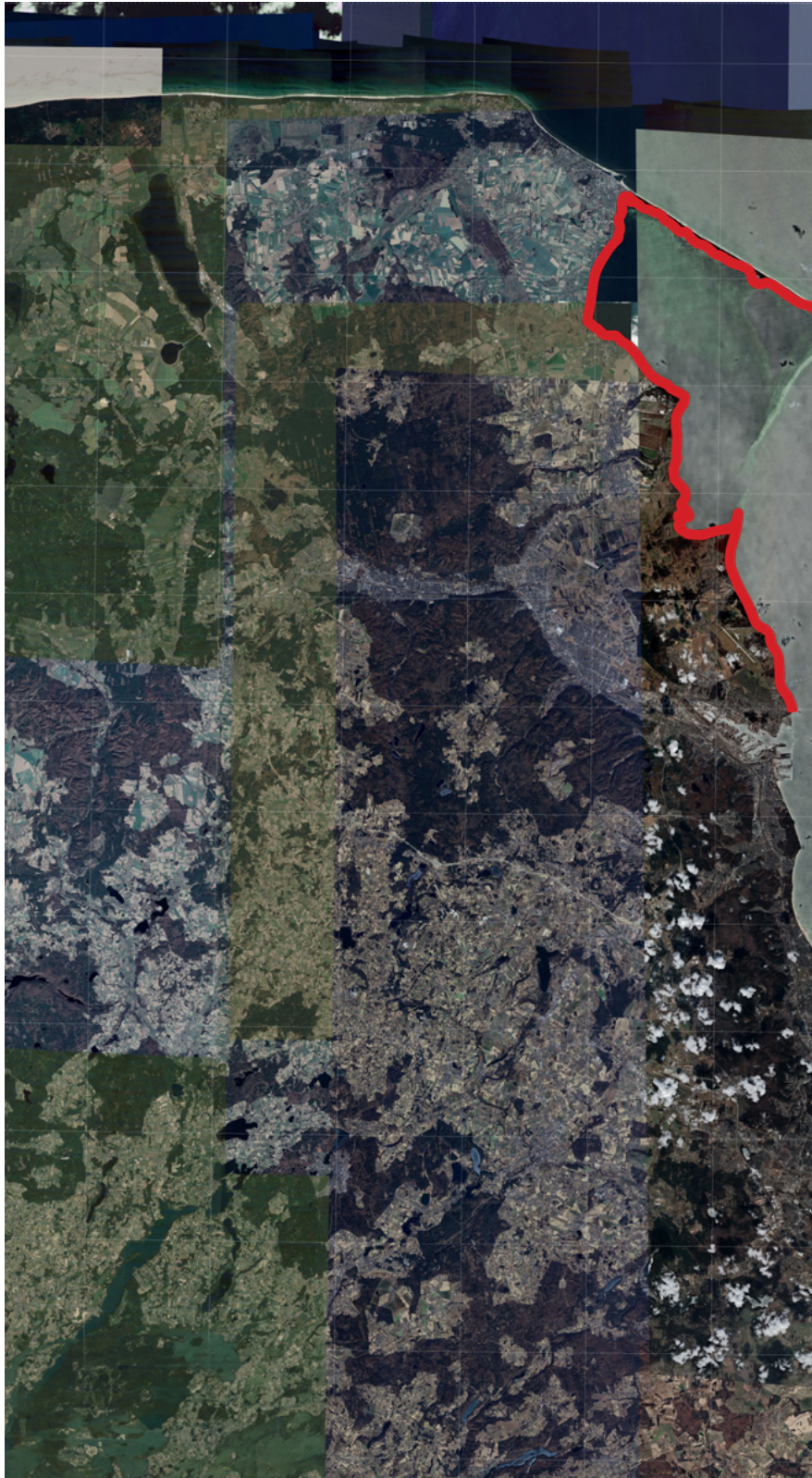


(fig.1.02) Examples of rapid changes in glacial lakes inSvalbard: (a)Lake Gandvatnet, (b)Lake Trebrevatnet, and (c)Lake Vetterndammen. Source: based on Sentinel and Land satsatellite images.





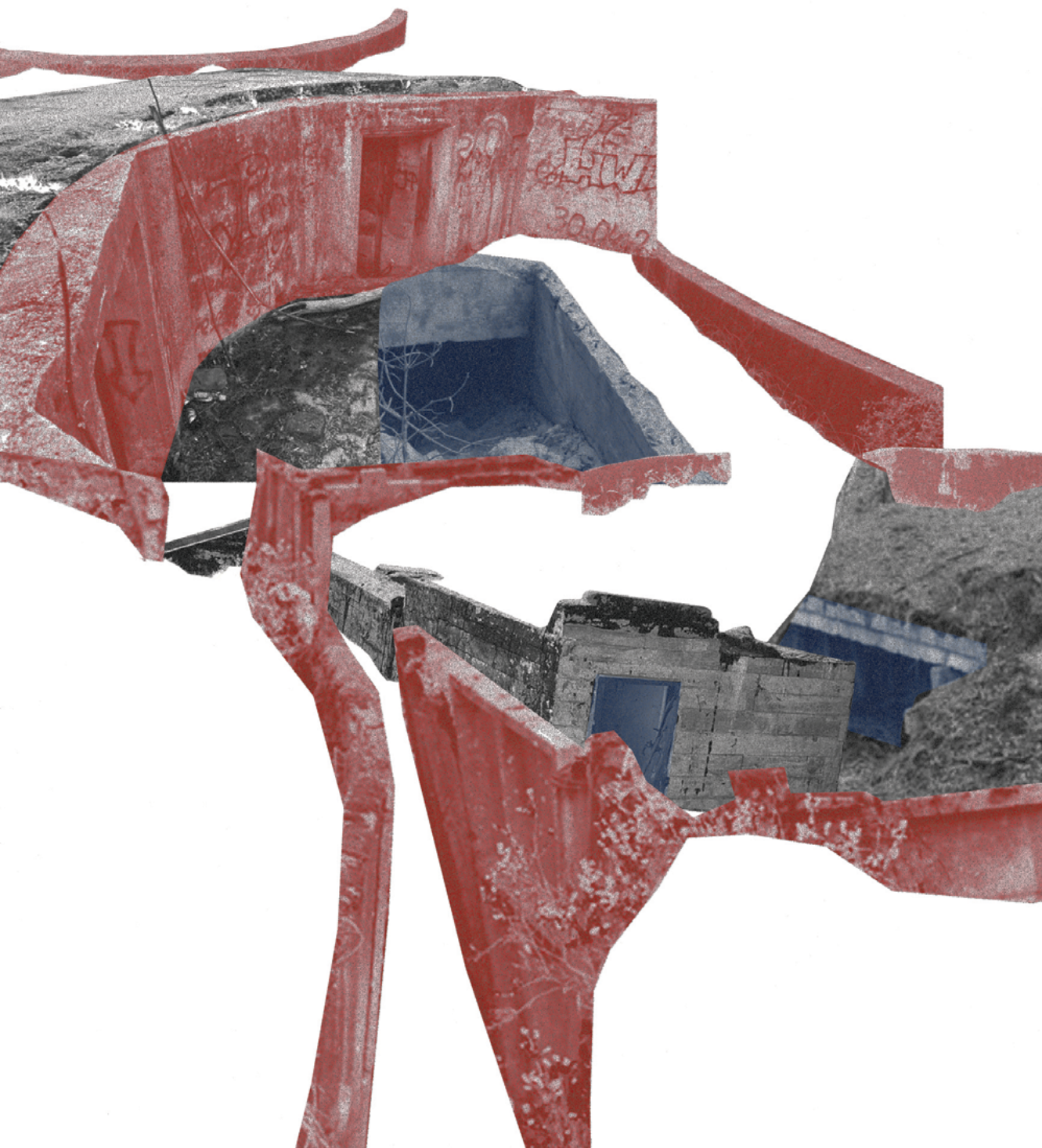
(fig.1.03) POLISH CONTEXT, Google Earth, 16.05.2024



*(fig. 1.04) THE SPATIAL FOCUS: PUCK BAY -
INNER COAST LINE; Google Earth, 18.05.2024*



echoes



“An imagined landscape, then, is a landscape not of being but of becoming: a composition not of objects and surfaces but of movements and stillness, not there to be surveyed but cast in the current of time.”

-22- *Tim Ingold, Imagining Landscapes: Past, Present and Future*

‘Echoes’ refers to the parameters and observed repeating patterns along the coast within the dynamic landscape, discovered during the travel to the site. It reflects a resonating effect, perhaps influencing others or extending beyond the initial impact.

CONTEXT

5 days of travel - site visit



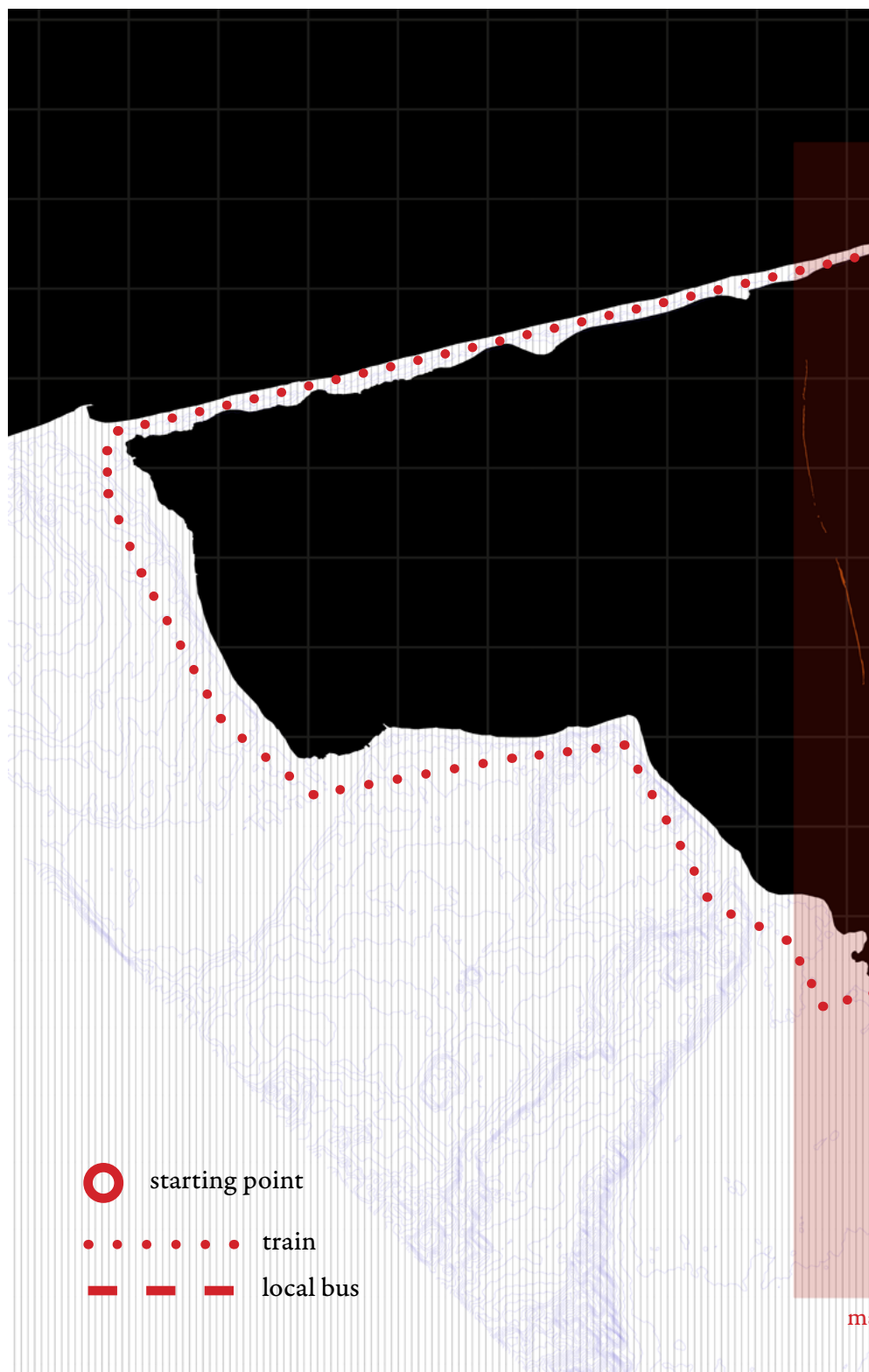
*(fig.1.06) CATEGORIZATION
OF INTEREST
WITHIN UNCOMMON
INFRASTRUCTURES /
FORTIFICATIONS
created as a research outcome before
the travel*

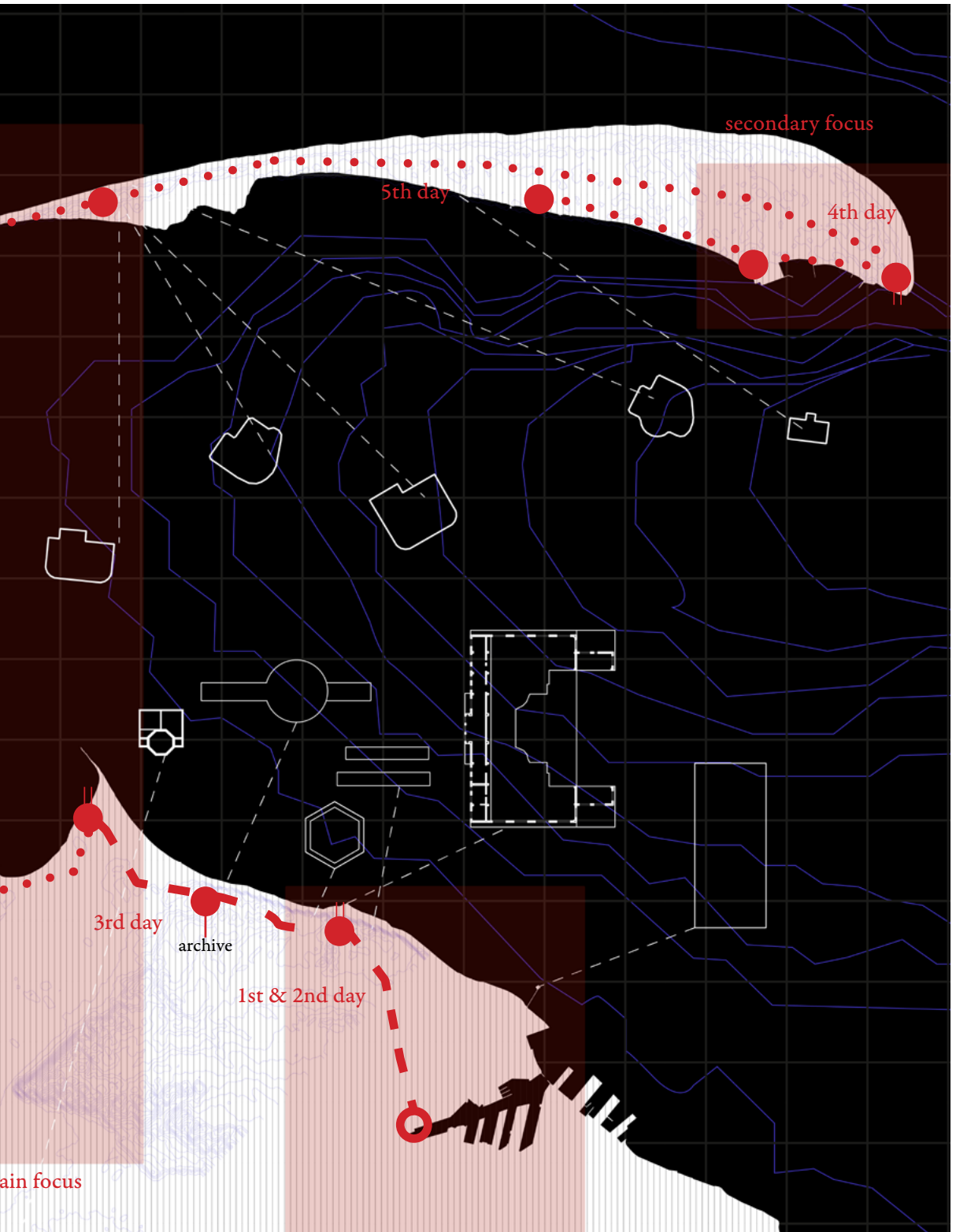
*uncovered in 2017 by the
storm Grzegorz*



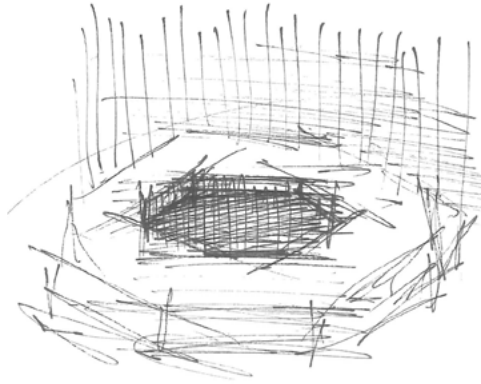
*AREA OF
INTEREST*

*(fig.1.07) (an
interpretative)
map of the
coastal polish
zone, projecting
tracked bunkers
by author, basing
on information
gathered pre site
visit and during
site visit*

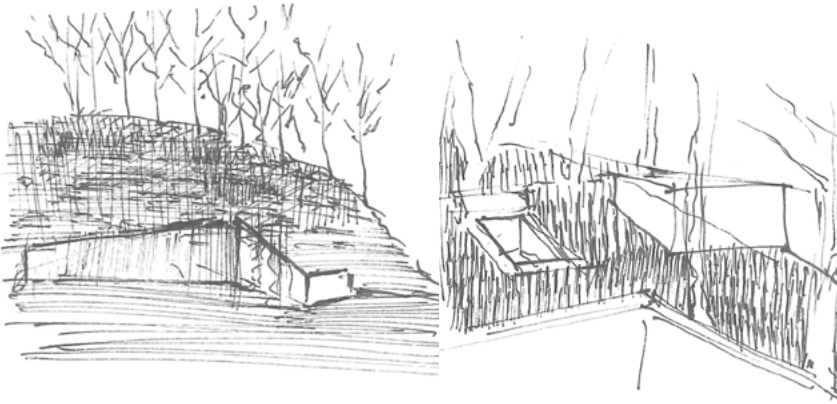




Treating fortifications immersed in the landscape, as part of the main infrastructures, stands for insights to better understand the decay process found in this specific context. Essentially, the structures are no longer there for people, but for nature to take them over and absorb them into its abyss.

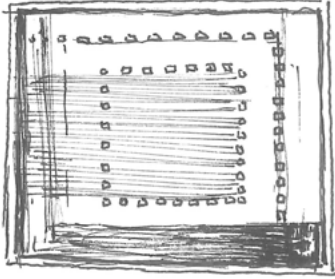


The lower inner plateau, inaccessible without a visible exit, lies within Hel Cape, adjacent to the coastal battery.



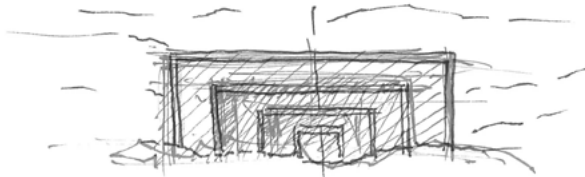
Openings in the man-made hill, further covered with trees.

**(fig.1.08) DRAWINGS FROM THE SITE VISIT
THROUGHOUT THE UNREACHEABLE
TRAILS**

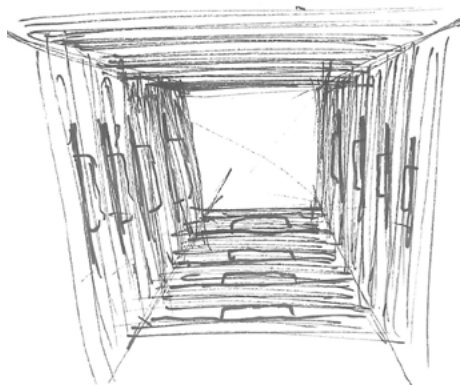
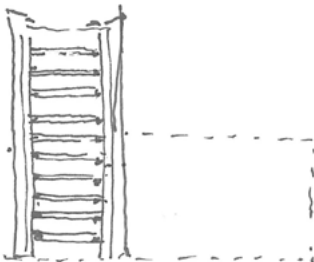


— Negative of light
penetrating the partially
destroyed bunker, seen
from the narrow tunnel
through which I passed.

-31-



The vanishing entrance to the
bunker within the military
airport site.



The only exit from the bunker
I explored in the forest.



(fig.1.09) photographs taken during train travel along the narrow peninsula. Bay side.

Traveling alone along the coast of Poland, tracing the Puck Gulf from the mainland to its terminus at the peninsula's cape known as "the end of Poland."

The mainland and peninsula are connected by a single railway track that follows the coastline.

On one side, you are always greeted by either the bay to the south or the open sea to the north. The scenery often intertwines with forests, which dominate the majority of the protected natural landscape. The peninsula varies in width, from about 100 meters at its narrowest point to approximately 3 kilometers at its widest.



(fig.1.10) **photographs taken during train travel along the narrow peninsula. Open seaside.**



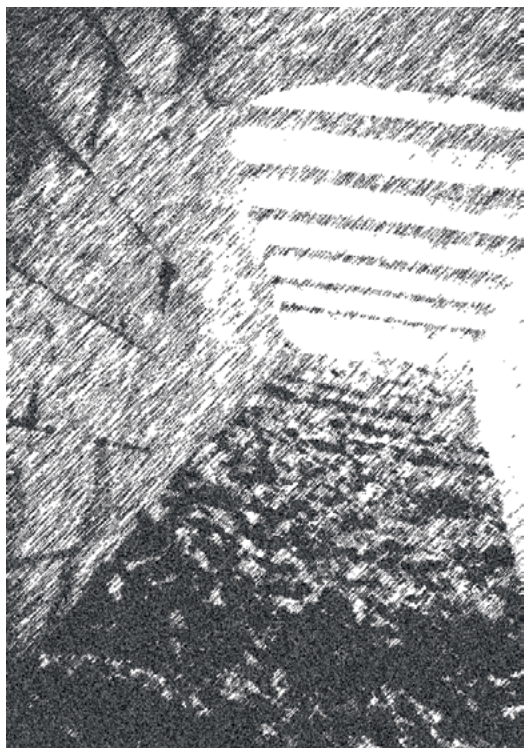
(fig.1.11) tracked fortifications | ruins



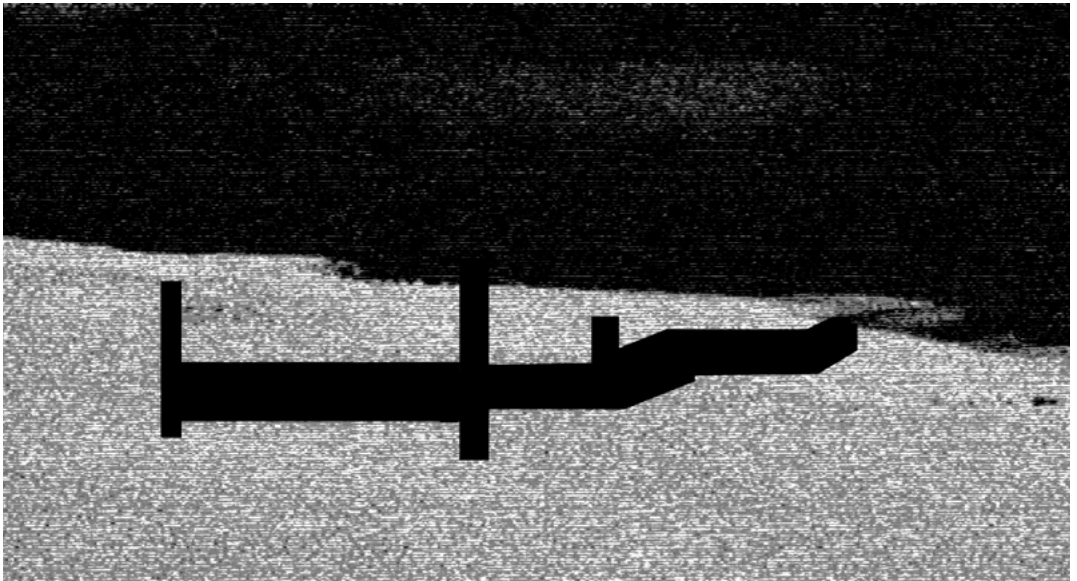
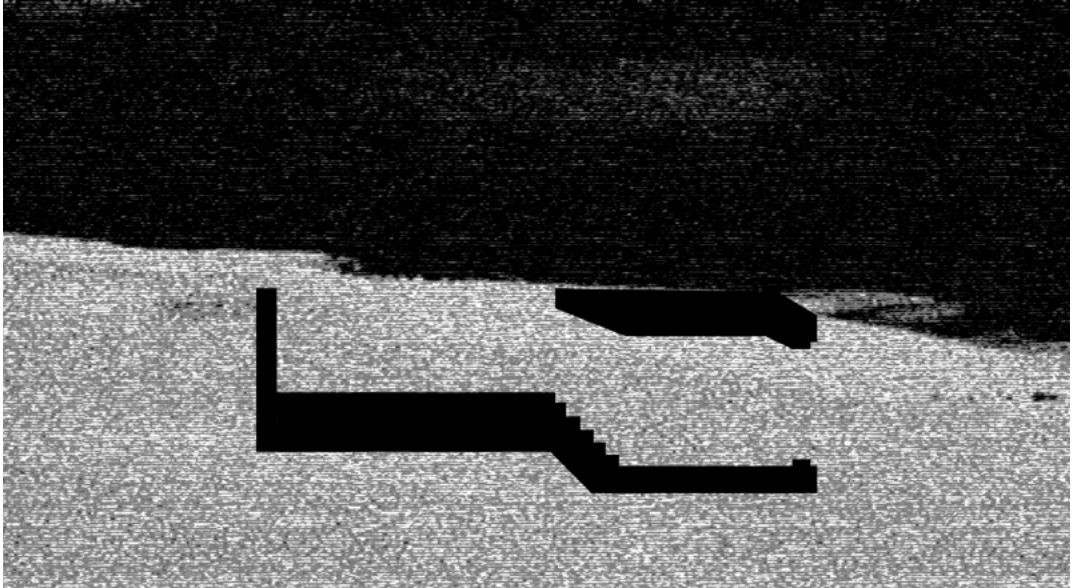
(fig.1.12) tracked fortifications | remnants

DAMAGE

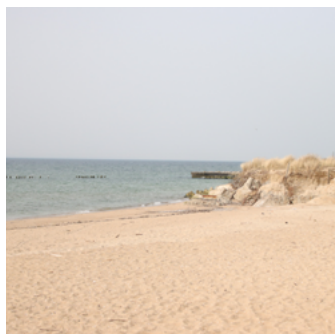
insights from the bunkers



(fig.2.01) restricted way out of at the miliarian site, which is currently in use



(fig. 2.02) **interpretative shift in
typology of the bunker impacted by
sand and water change**



(fig.2.03) surroundings of
Laskowski Battery at the beach
side | leftovers



(fig.2.04) water arriving towards the destroyed by
explosion of Laskowski battery at Hel's cape

2018



(fig.2.05) water retreat and coverage of battery by sand |
for safety reasons access from the dunes was restricted

2024

destroyed | Baltic sea abandoned Torpedo Launch Station

VISIT AT YOUR OWN RISK

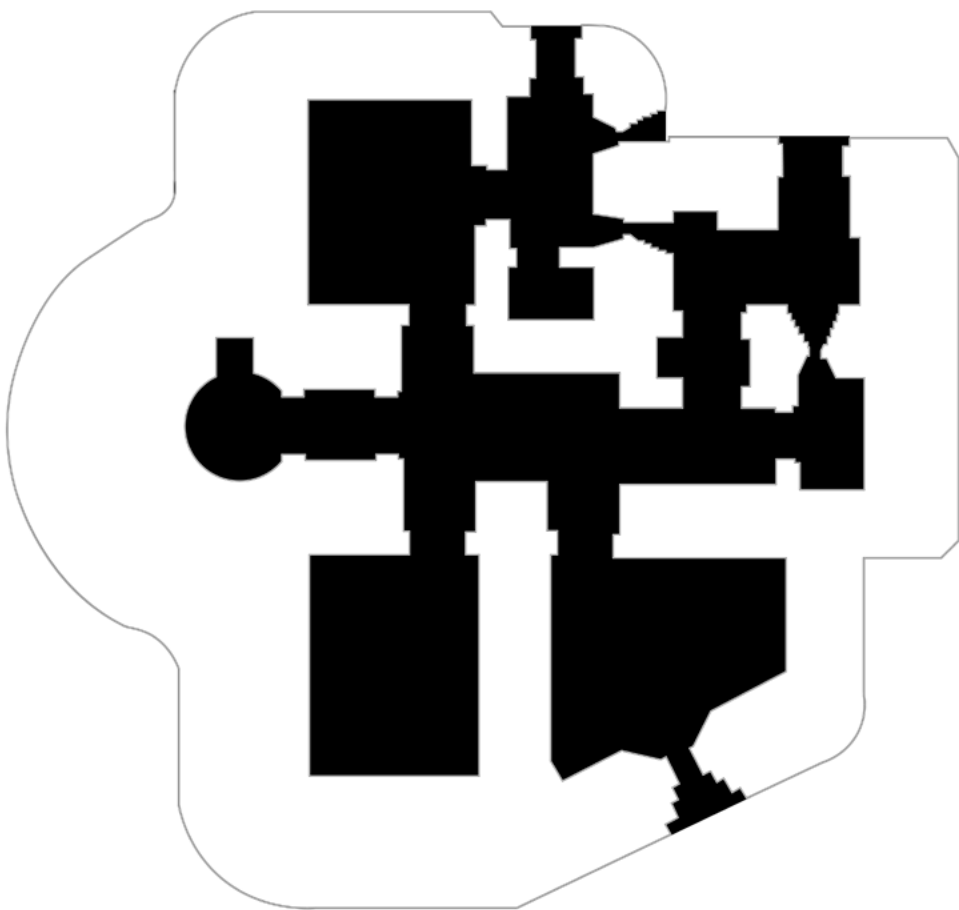


(fig.2.06) condition of the building
until 2024

the ones that still could be saved



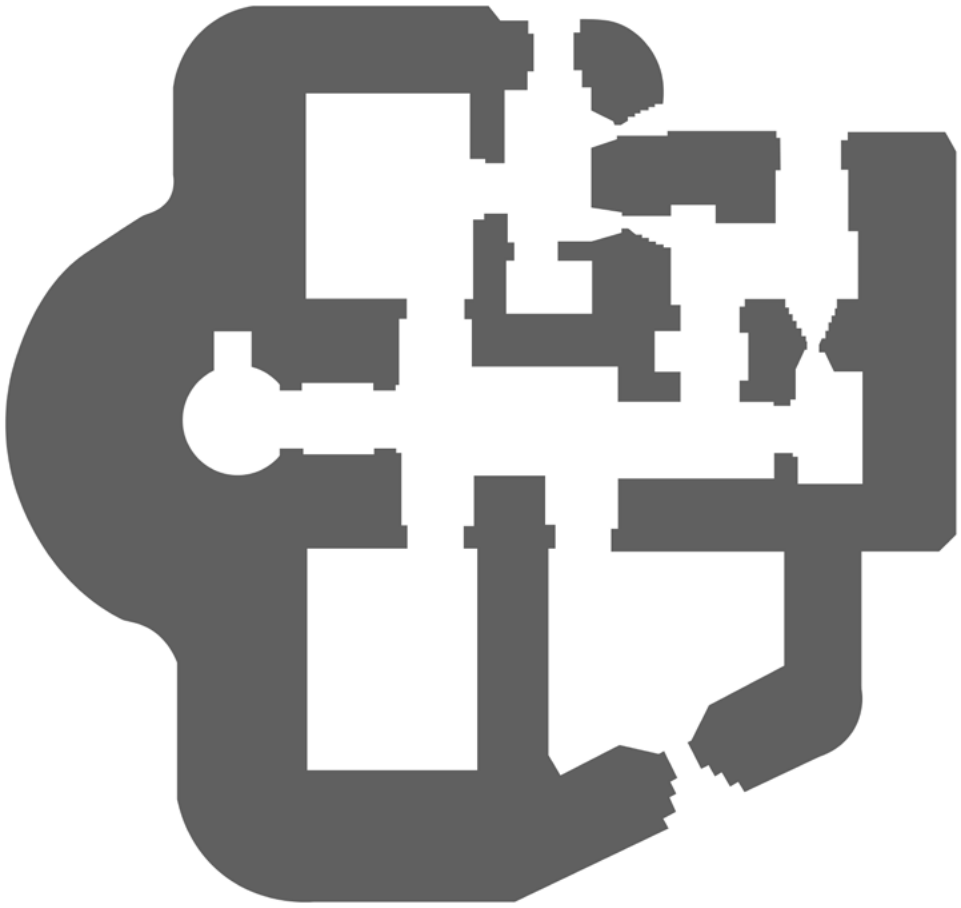
(fig.2.07) section based on
archival documents



(fig.2.08) **plan based on archival documents**



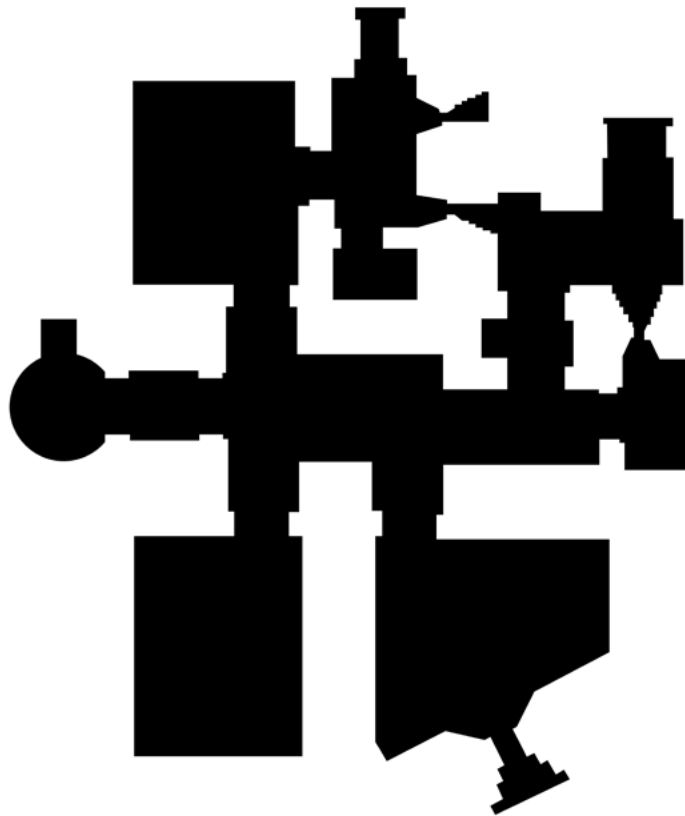
(fig.2.09) **highlighted walls on sections**



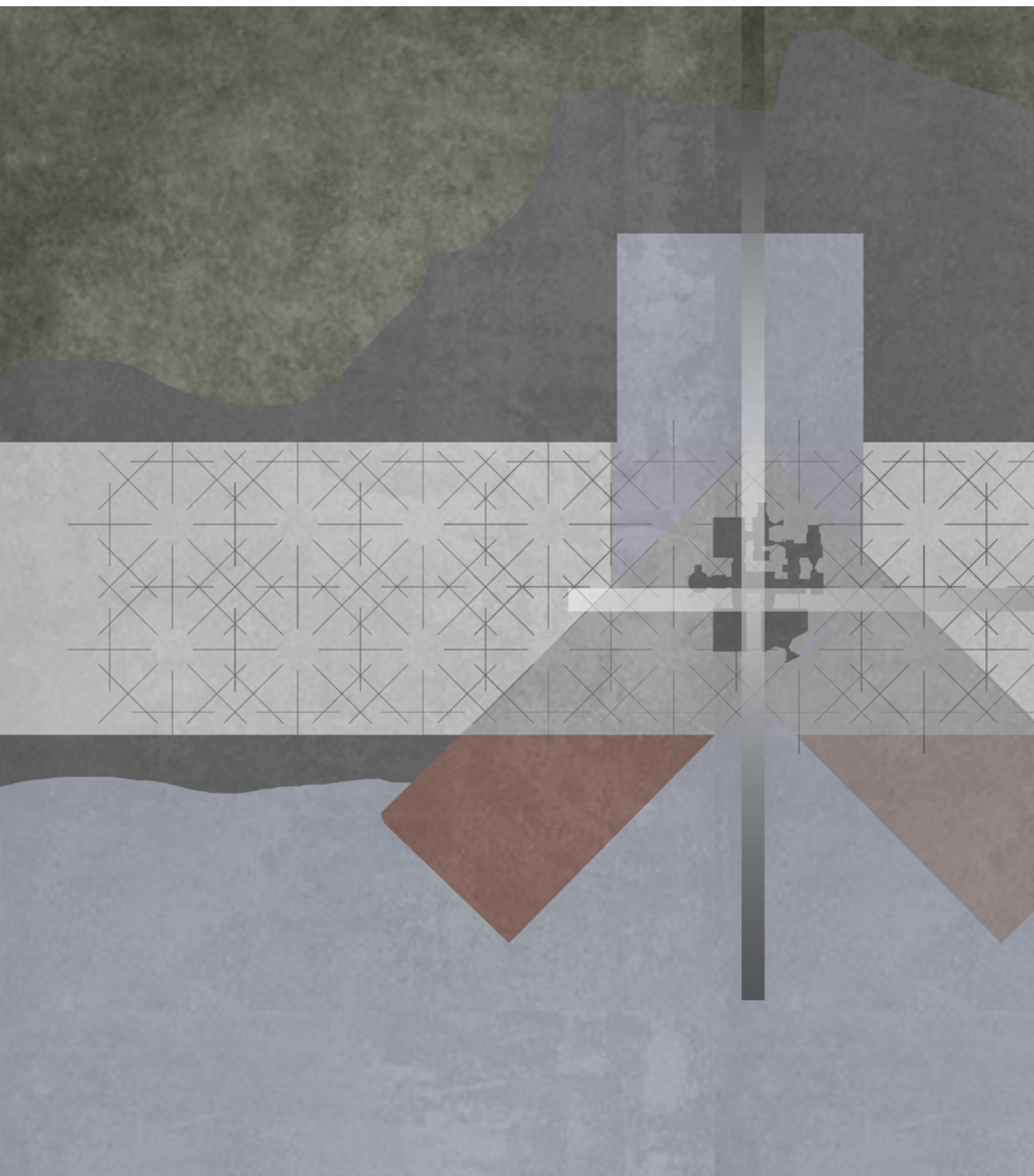
(fig.2.10) **highlighted walls on a plan**



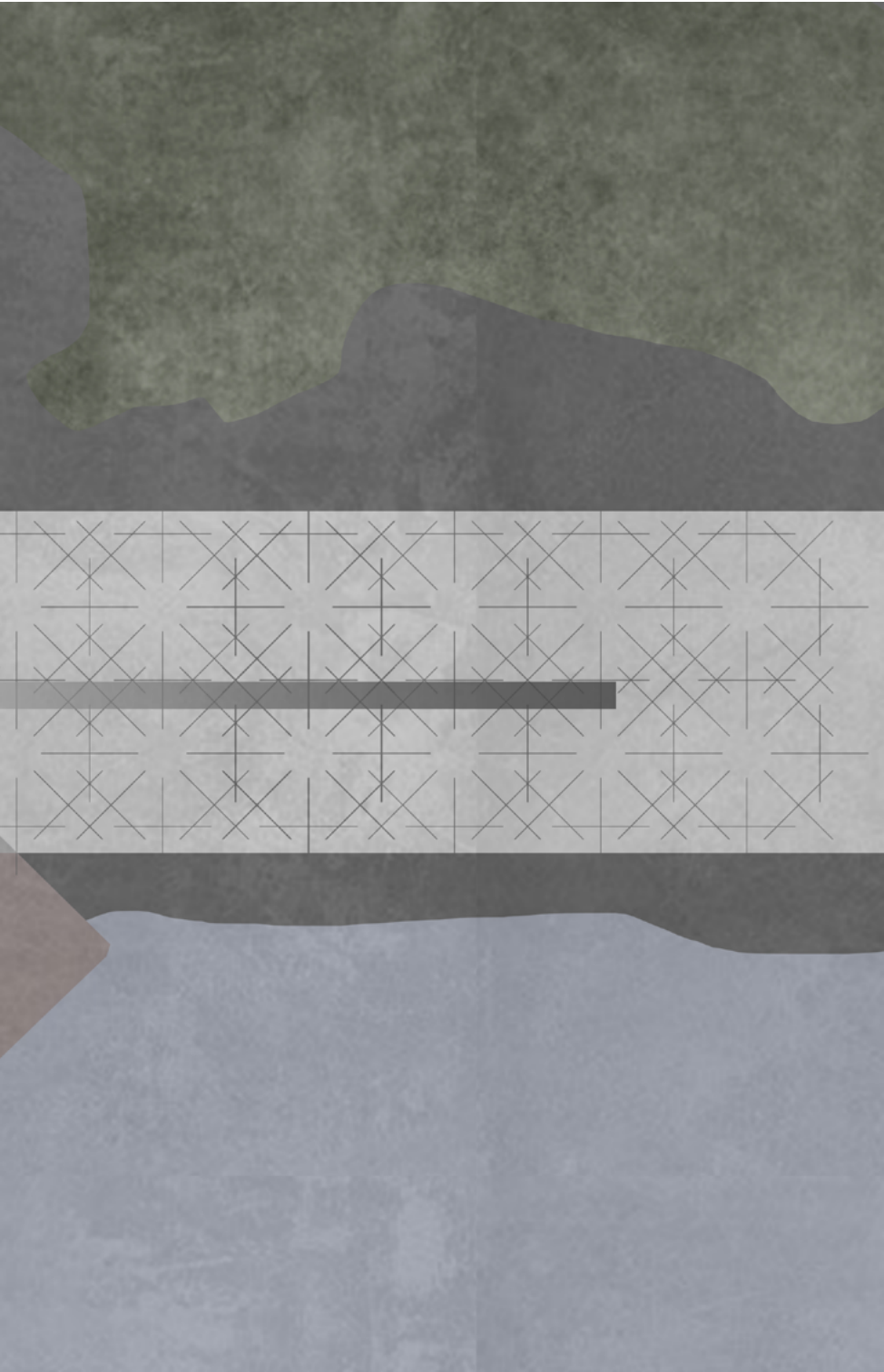
(fig.2.11) **negative to highlight the inner
space - sections**

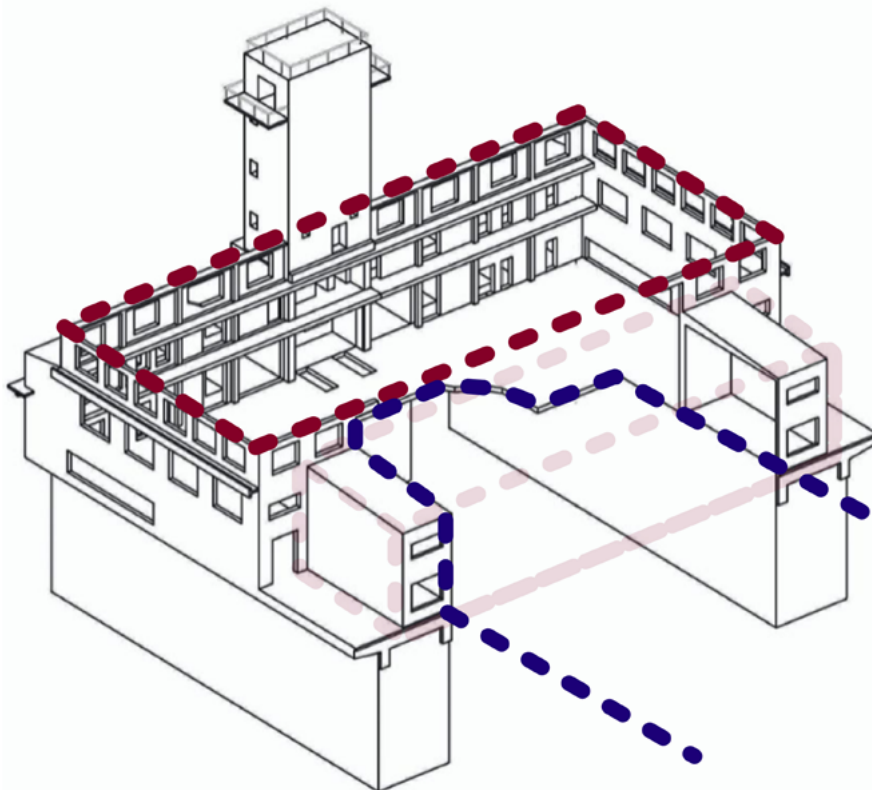


(fig.2.12) negative to highlight the inner
space - plan

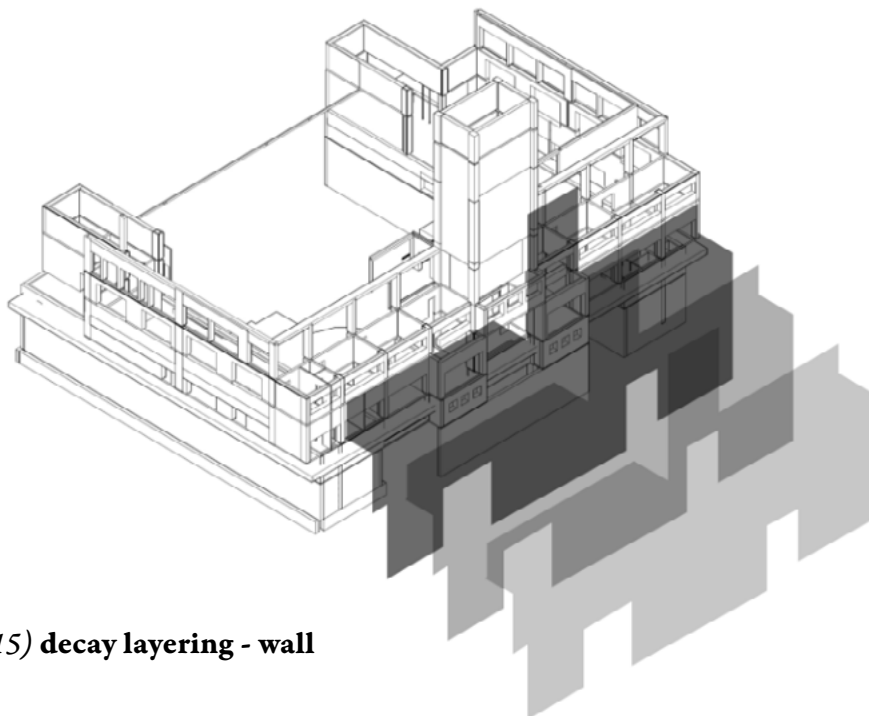


(fig.2.13) **analysis of un hiding the hidden -
implementing the bunker to connect it with
current campsite and Baltic Sea**

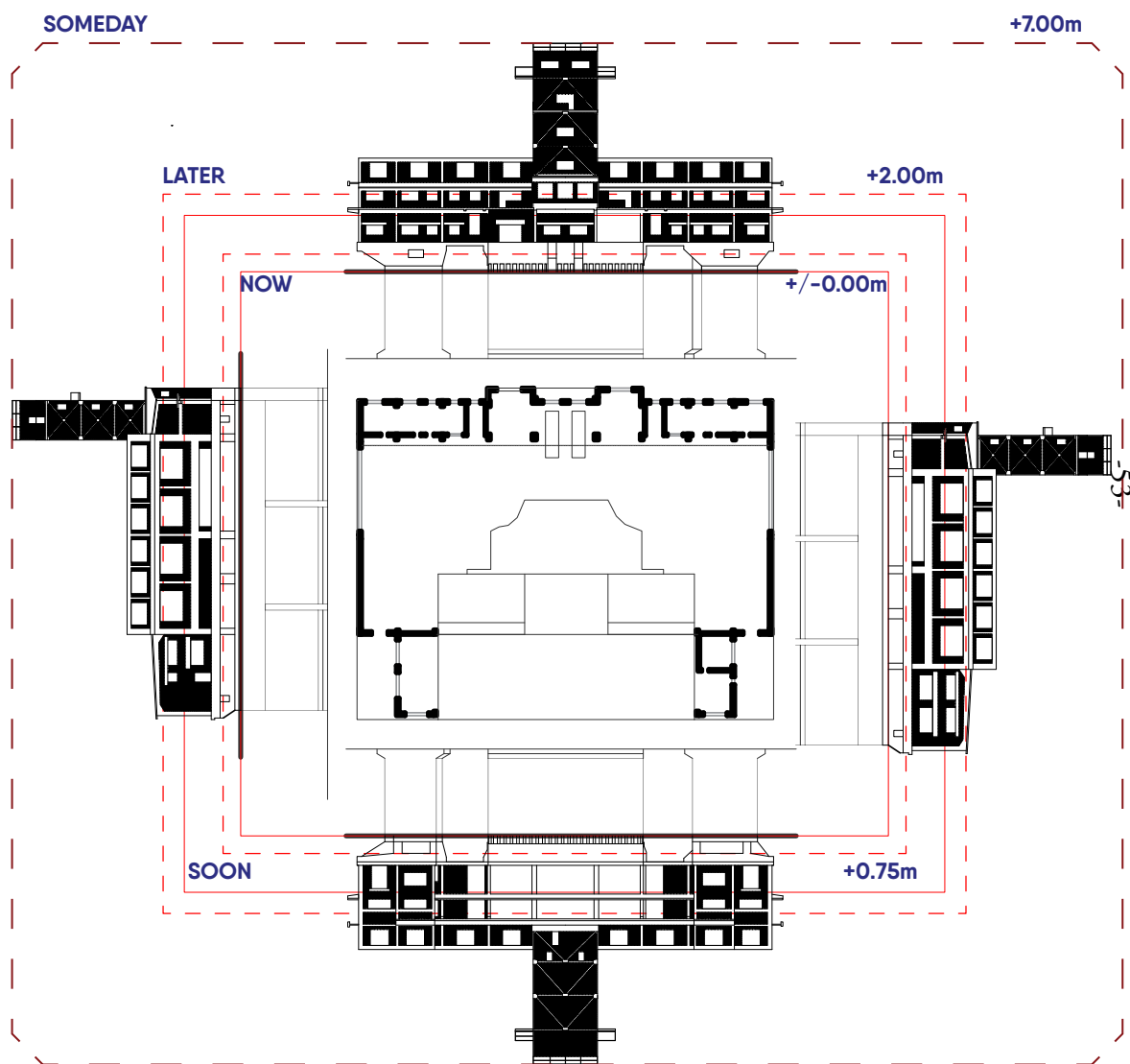




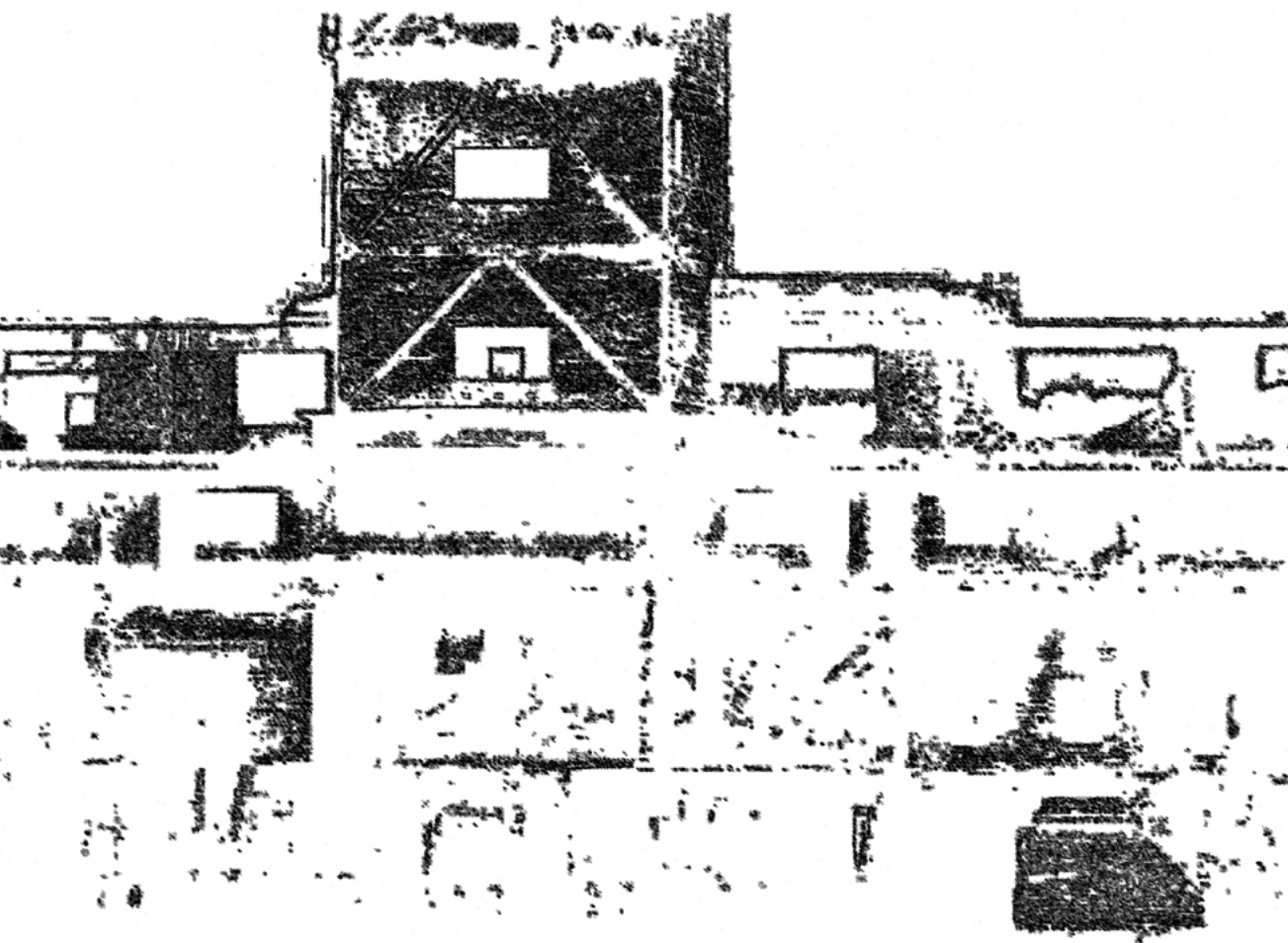
-52- (fig.2.14) **water influence - zones of destruction**



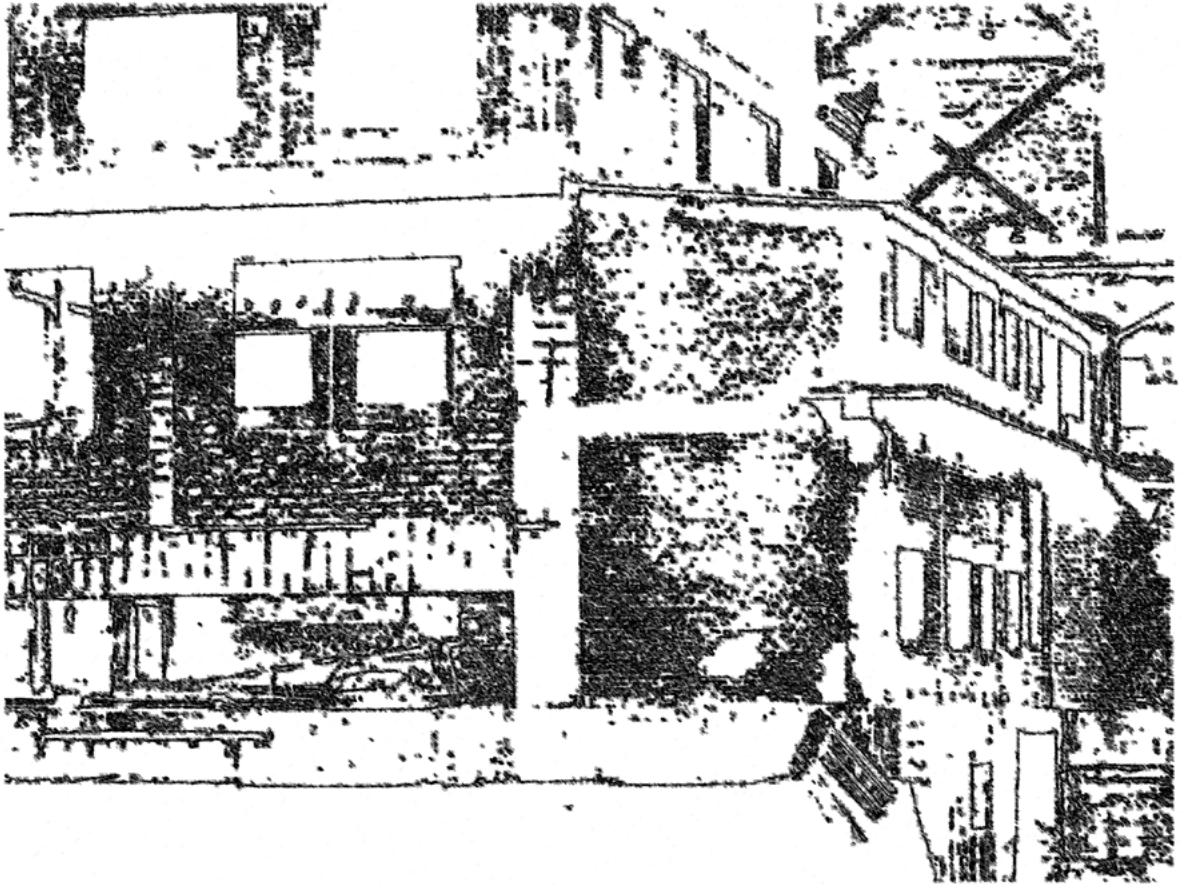
(fig.2.15) **decay layering - wall**



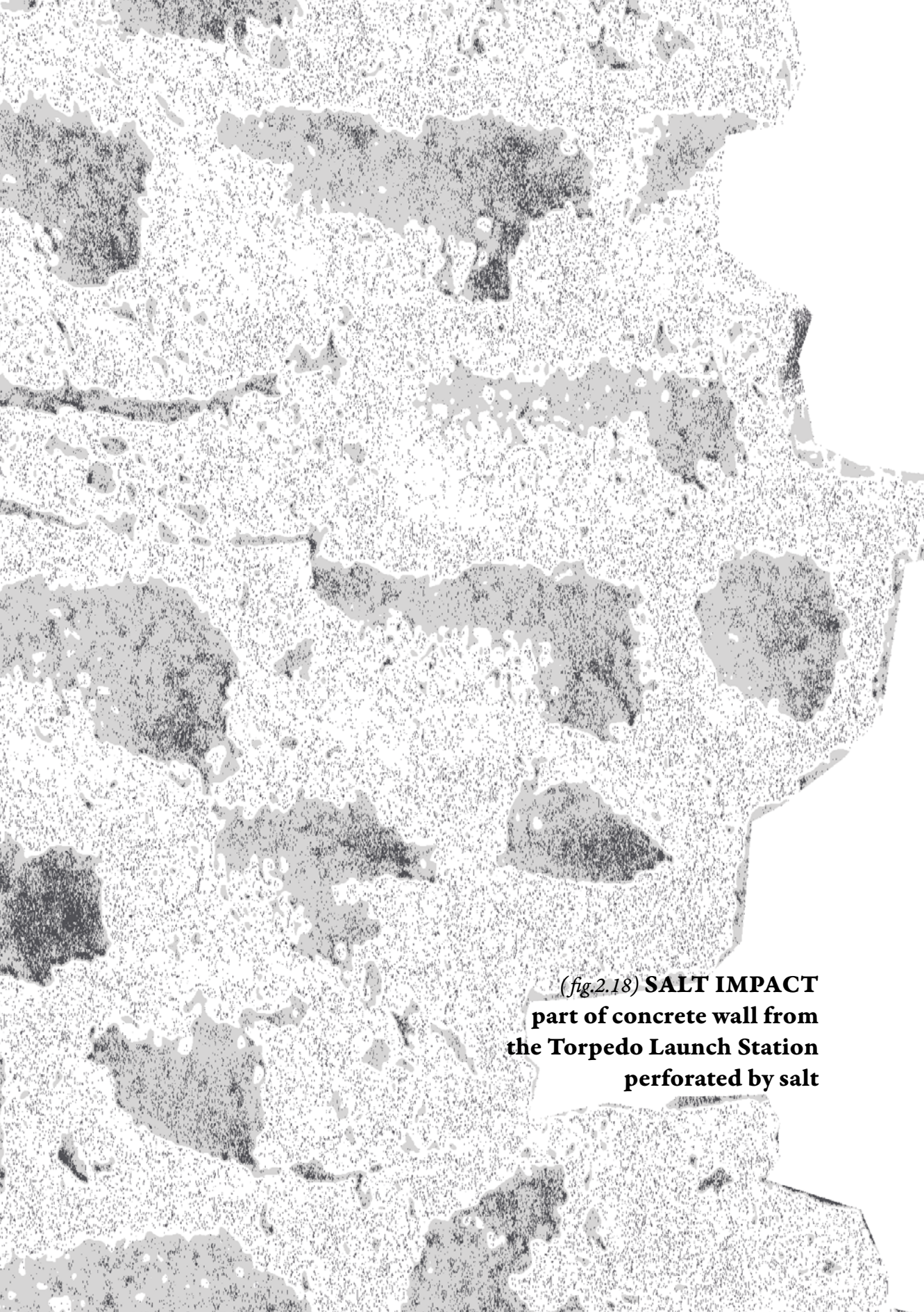
(fig.2.16) water fluctuations



(fig.2.17) mapping the impact of salt destruction
on the concrete structure of the torpedo launch
station - walls | falling apart facade



CHARCOAL
IMPRINT OF WALL'S
CRACKS



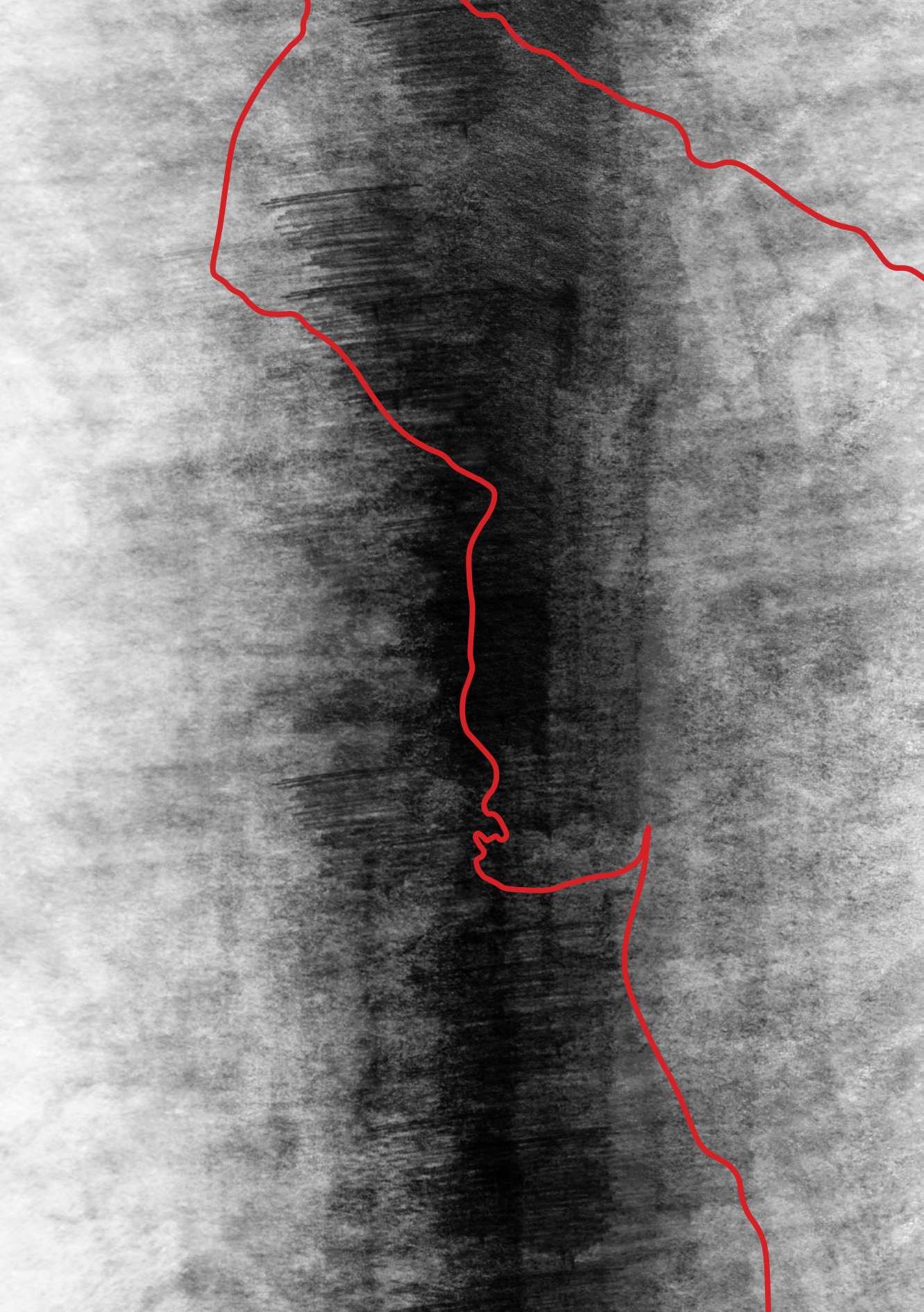
(fig.2.18) **SALT IMPACT**
part of concrete wall from
the Torpedo Launch Station
perforated by salt

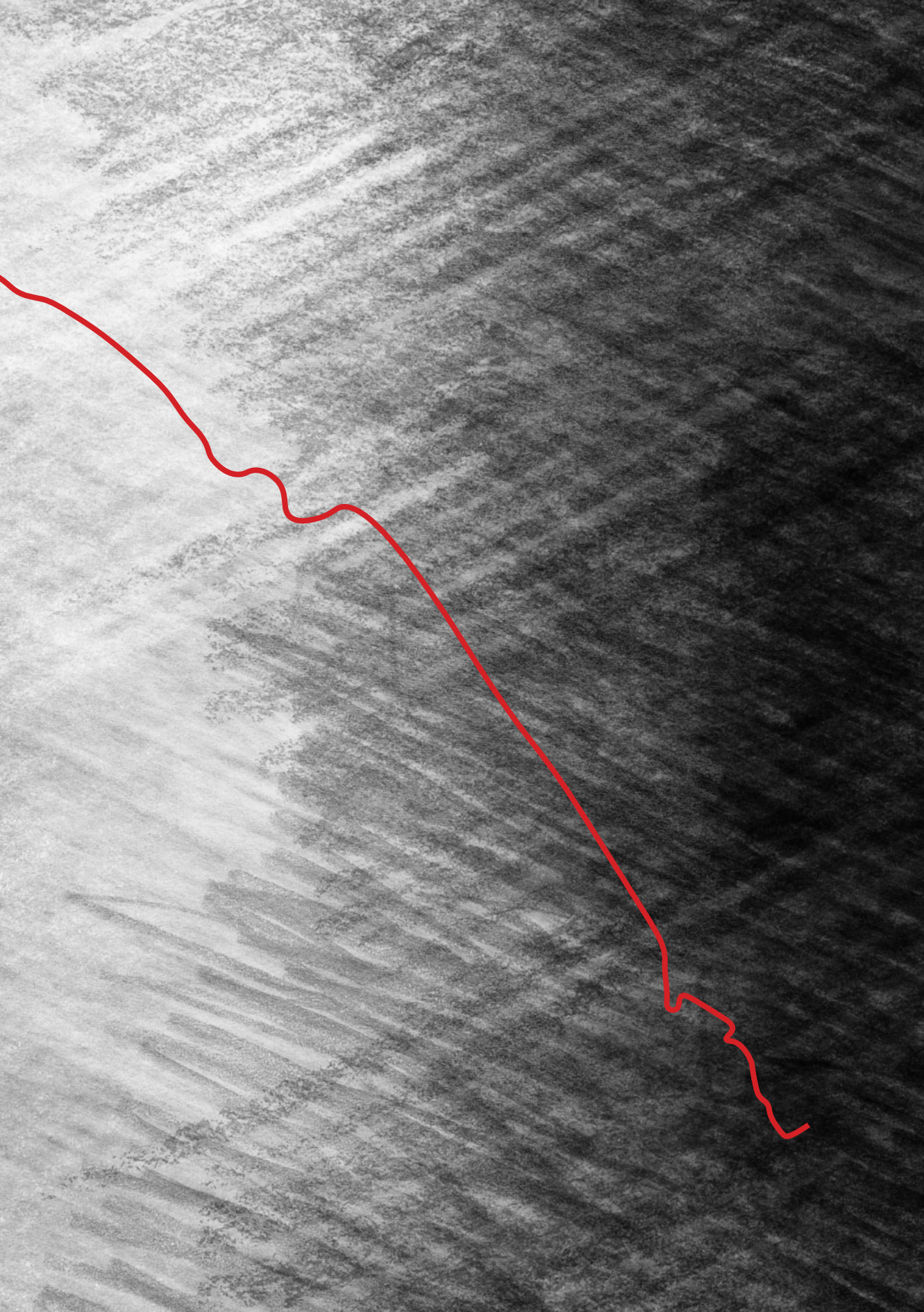


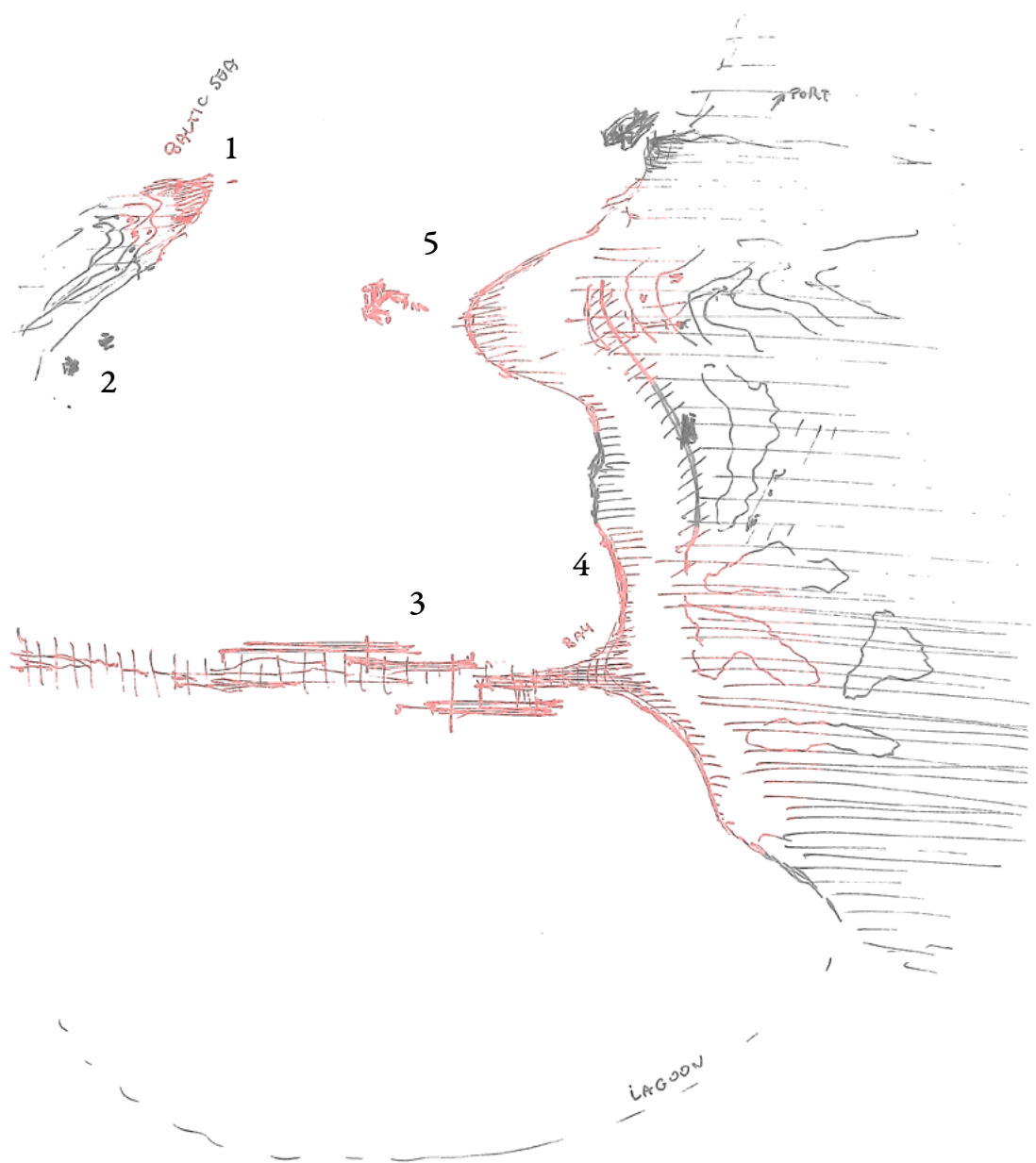
(fig.2.19) **the bank degenerated by
big amount of waste**

OBSERVATION

the matter of perception







1. dune letfovers - Hel cape
2. on-water observation points
3. pathway through the natural reserve
4. ryft - Rewa
5. Torpedo launch station

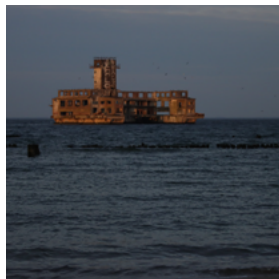
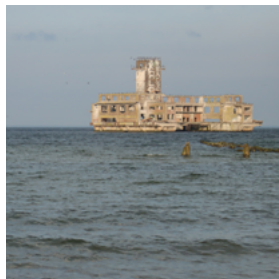
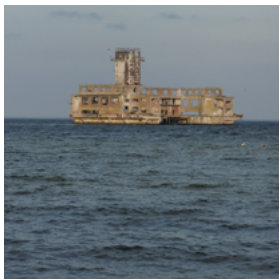
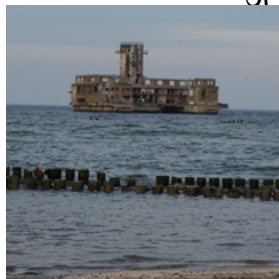
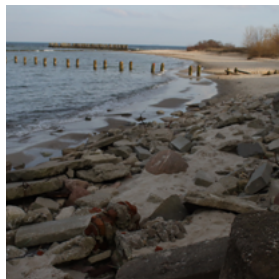
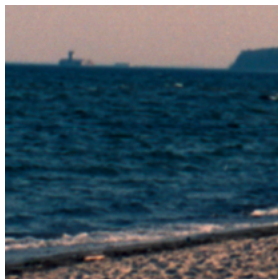
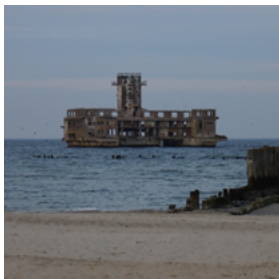
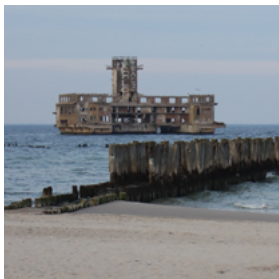
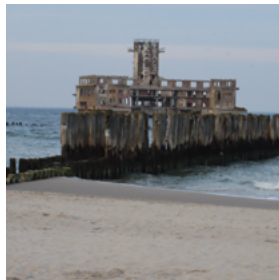
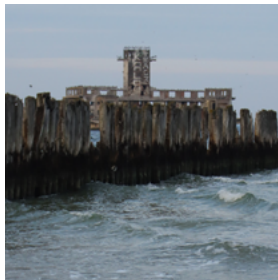
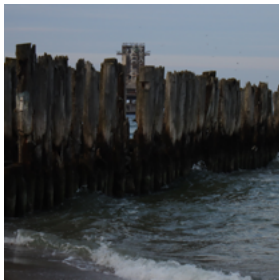
(MEMORY)
MAP OF CAPES

(fig.3.01) **memory map of my travel**

The way of perceiving and observing from a certain distance influenced how the implemented functions should correlate with each other. Observation from afar shapes our understanding, as distant functions intertwine symbolically like reflections on water. They suggest a wider viewpoint that is unattainable, prioritizing the overall essence rather than the small details. Specifically, this reflection pertains to, not so common along polish seaside, on-water structures.

way of observing of the Torpedo Launch Station

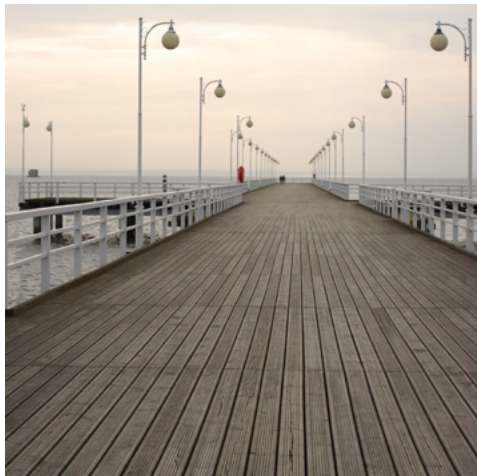
(fig.3.02) **status as of the end
March 2024**





9-

(fig.3.03) **analog photo**
from “far away”



(fig.3.04) **different
thresholds for**



(fig.3.05) **framing with/by the structure - view towards the Torpedo Launch Station from the didactic pathway and viewpoint tower**

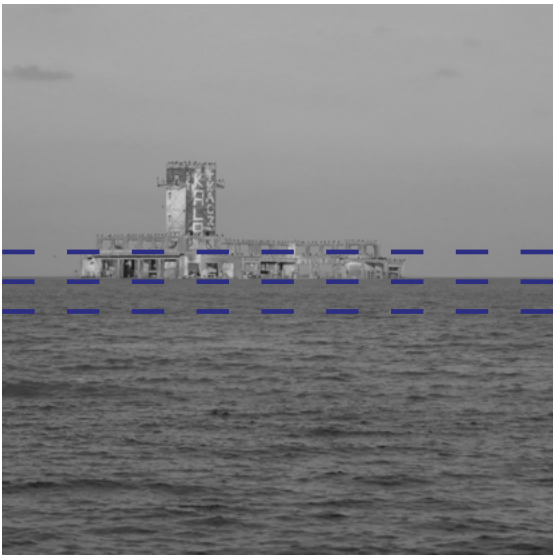


PHENOMENA

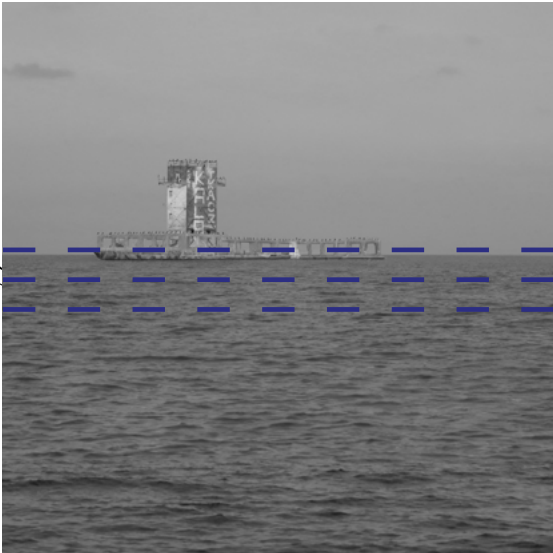
atmospherical and seasonal



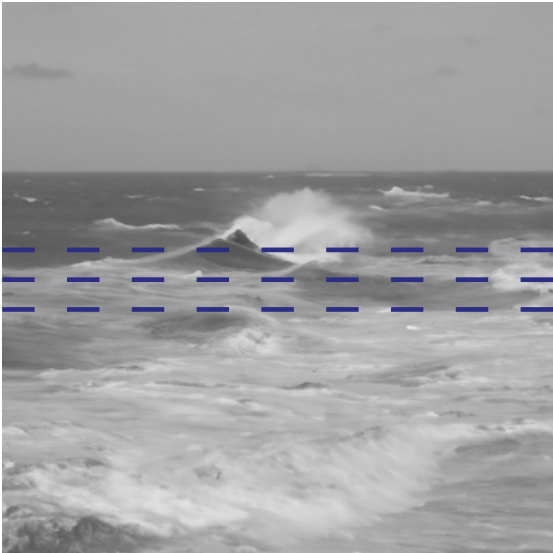
SEA LEVEL ON 0m



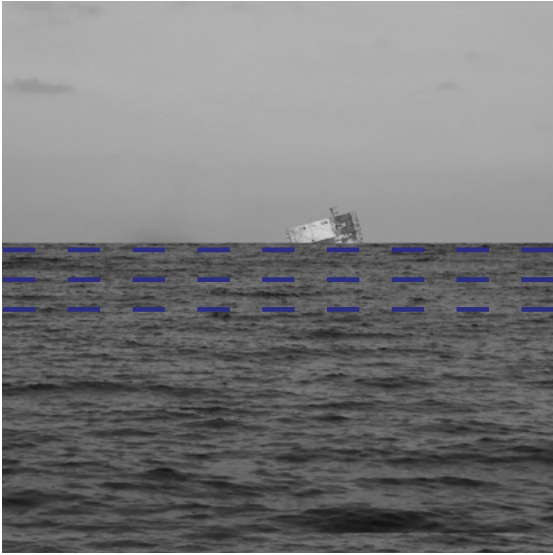
SEA LEVEL ON +0.75m



SEA LEVEL ON +2m



SEA LEVEL ON +5m



what the future holds?



(fig.4.01) **interpretive impact of
fluctuations in water tides**

winter



(fig.4.02) **ice shove lying
on the coast**



(fig.4.03) **wind-shaped
ice balls**



(fig.4.05) **floating
ice - state in
between**



(fig.4.04) **snow imitates
the land**



(fig.4.06) **aurora borealis above
the Torpedo Launch Station,
12.05.2024 | Photograph by L.
Cichorek**

summer/spring



(fig.4.07) **amber collection with
UV lighting | Collage**

First day of spring rituals

The effigy of Marzanna, often made of straw and dressed in old clothing, is paraded through the village or town before being set on fire and thrown into a river or other body of water. This act is meant to drive away winter and bring about the rebirth of nature.



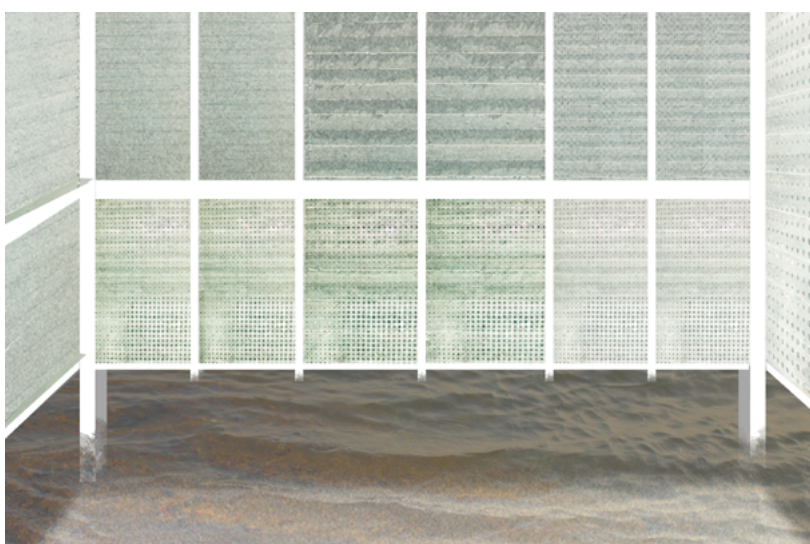
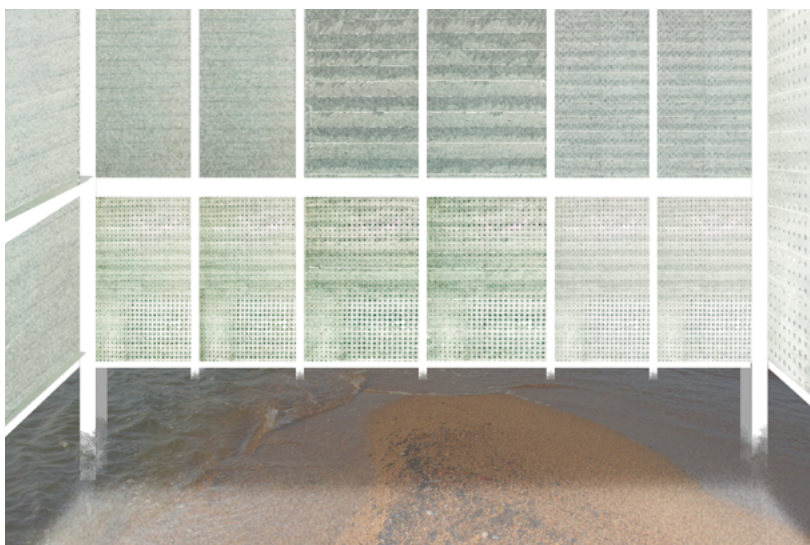
(fig.4.08) **burning madder**
by the seaside, March 21st



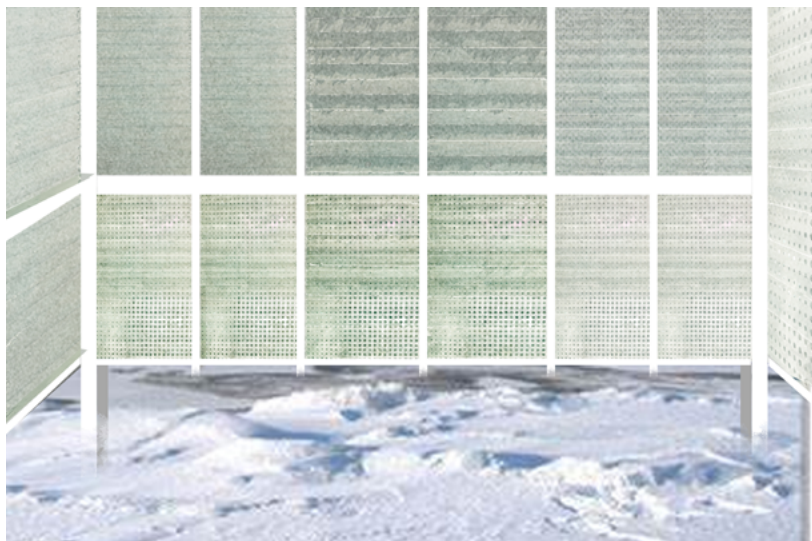
Marzanna is a Slavic goddess
associated with winter and
death

(fig.4.09) **Marzanna**
Mother of Poland, Marek
Hapoń (2014)

...NOW

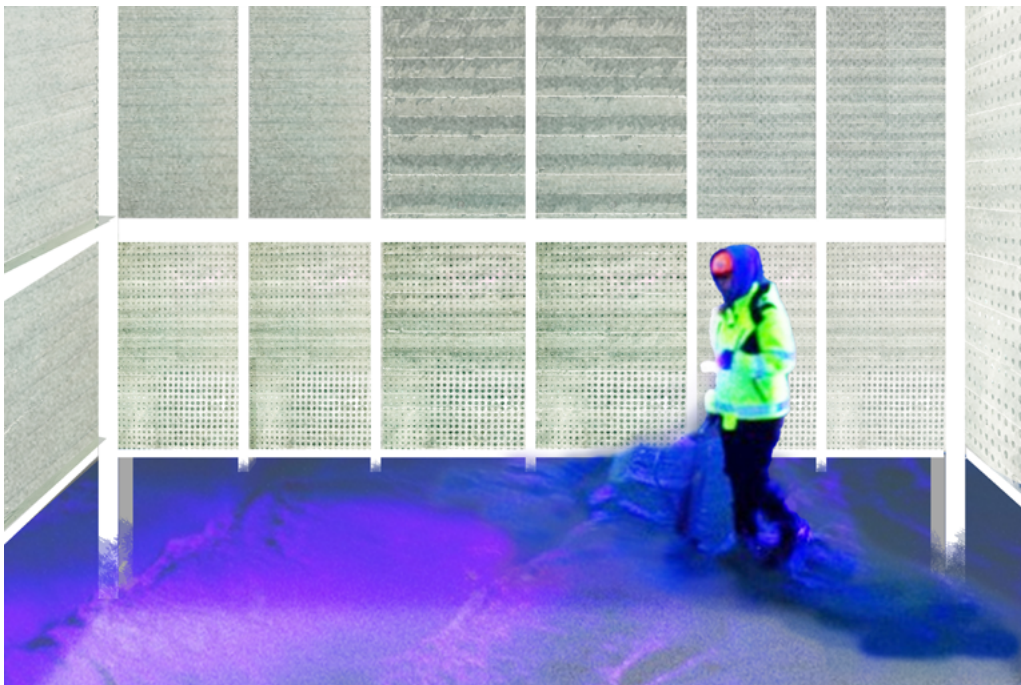


(fig.4.10)
**ACTIVATED
GROUND
LEVEL |**
*ever-changing
context |
collages*





(fig.4.11) **amber
found on-site,
March 2023**



(fig.4.12) **amber
collection**

transformation







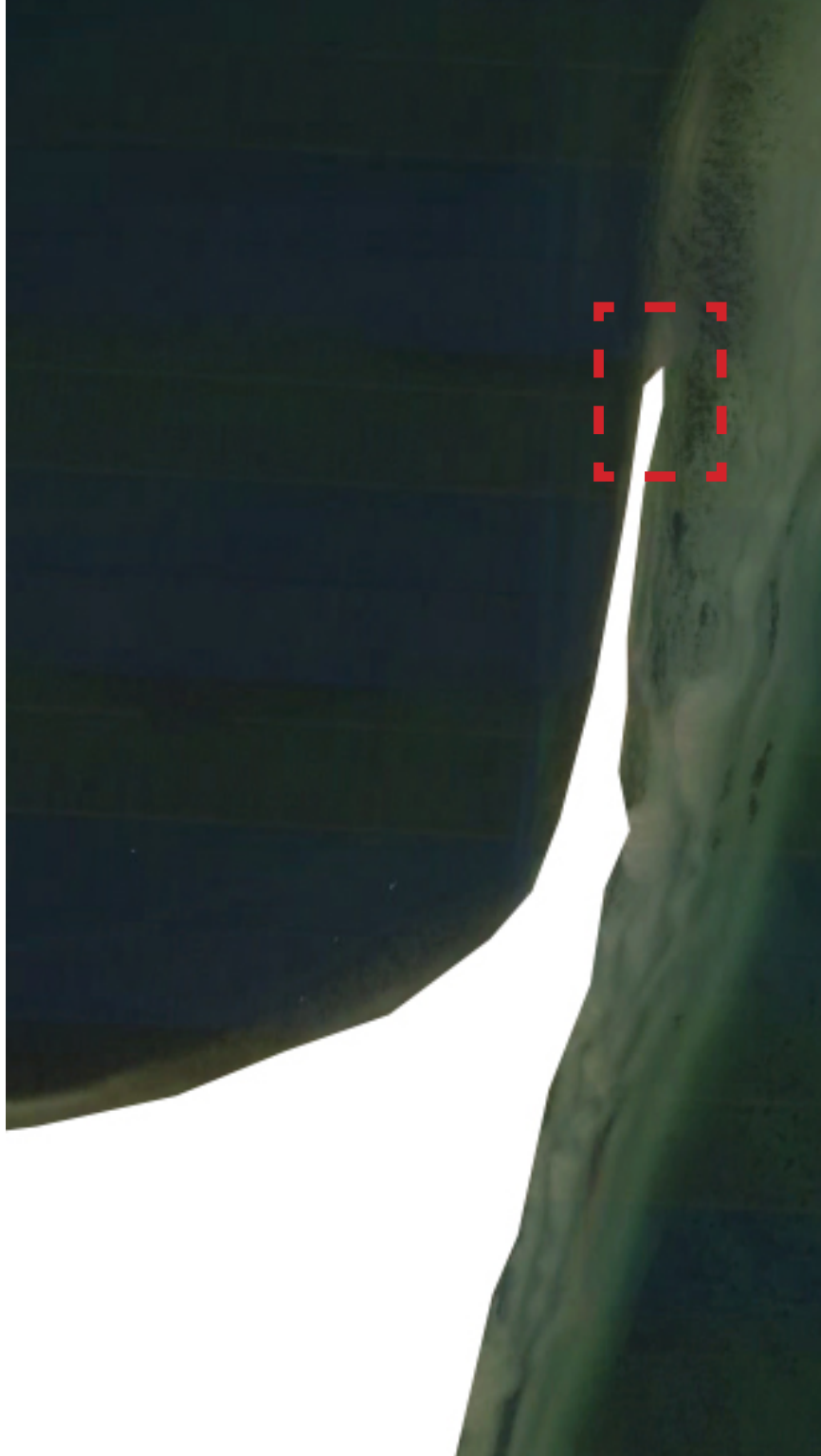
“This impression is a glimpse not of timelessness but timefulness, an acute consciousness of how the world is made by - indeed, made of - time.”

Marcia Bjornerud, Timefulness: How Thinking Like a Geologist Can Help Save the World

‘Transformation’ embodies change through both revealed and hidden movements, showcasing the ephemeral nature of the coastal landscape and unveiling deeper truths.

54° 38' 21" N

18° 30' 56" E



SITUATING

**CONNECTION BETWEEN
THE MAIN LAND AND THE
PENINSULA**

-94-

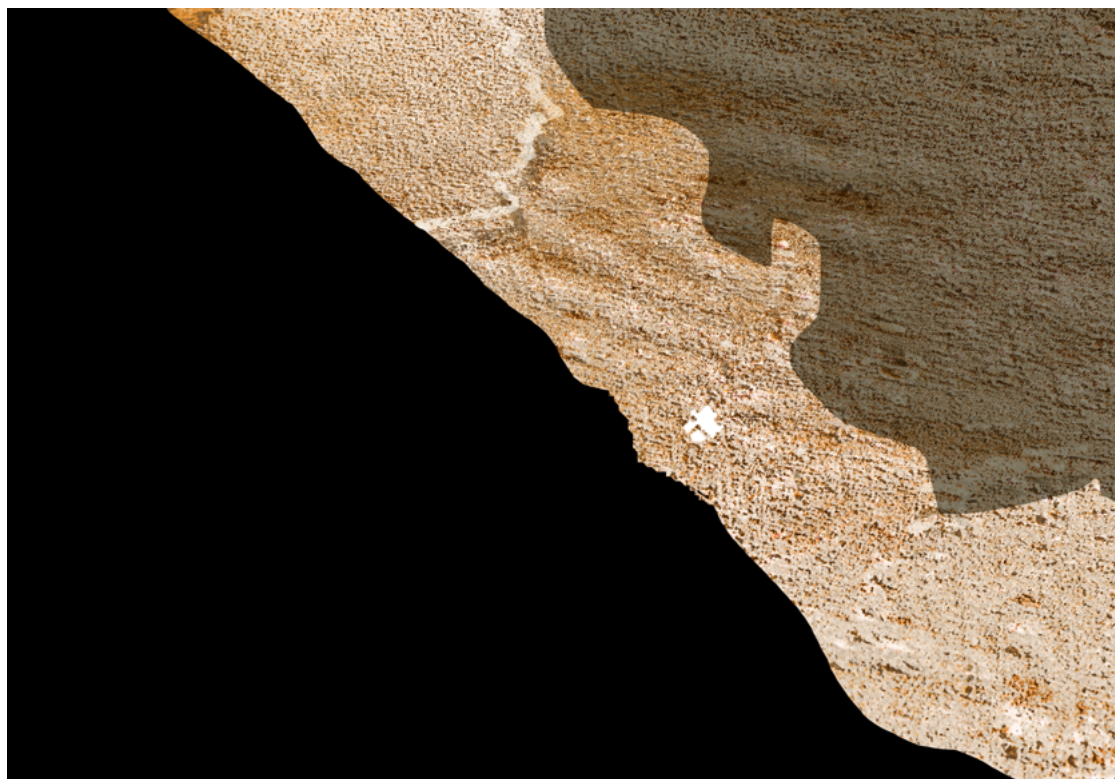


(fig.5.01) **land above water
level - the main land**



-95-

(fig.5.02) land above water
level - inner bay



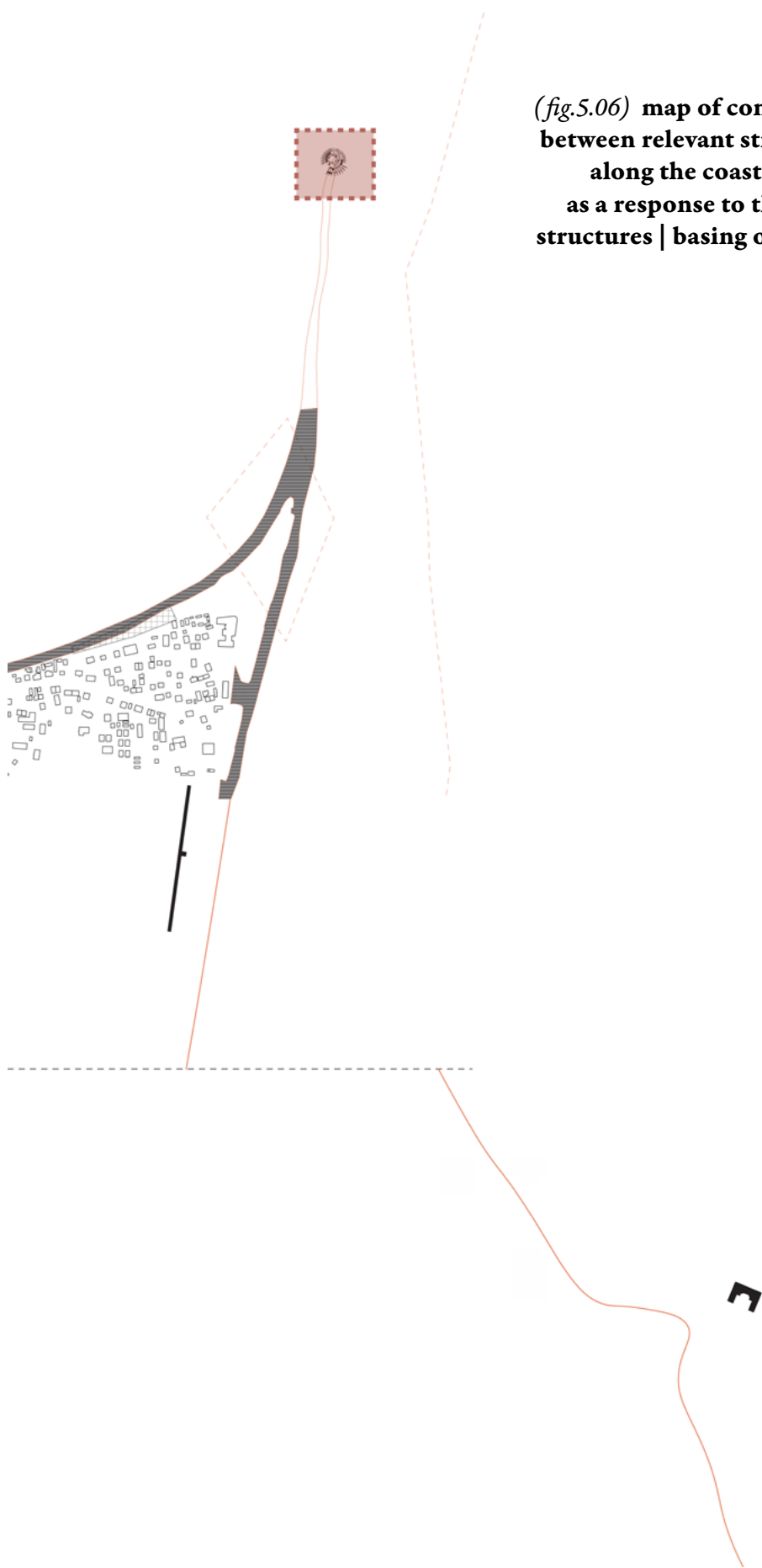
(fig.5.03) **land above water
level - the peninsula**



(fig.5.04)
**initial
plan of the
intervention
within sea
context**



(fig.5.05) **cutout mapping
of division between
natural areas and buildup**



(fig.5.06) map of connection
between relevant structures
along the coast | design
as a response to the other
structures | basing on QGIS
data

REWA (n.)

<SPIT (n.)>

“podwodny wał piasku równoległy lub skośny do linii brzegowej”

“an underwater bank of sand parallel or oblique to the shoreline”

-100-



(fig.5.07) **analog photo of
Cross Of The Sea overlooking
the coast**



-101-

(fig.5.08) **1.7 km trail
connecting Rewa and
Mechelinki through natural
reserve with a 6m tall view
tower**

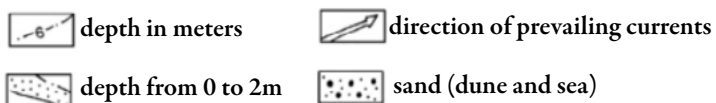
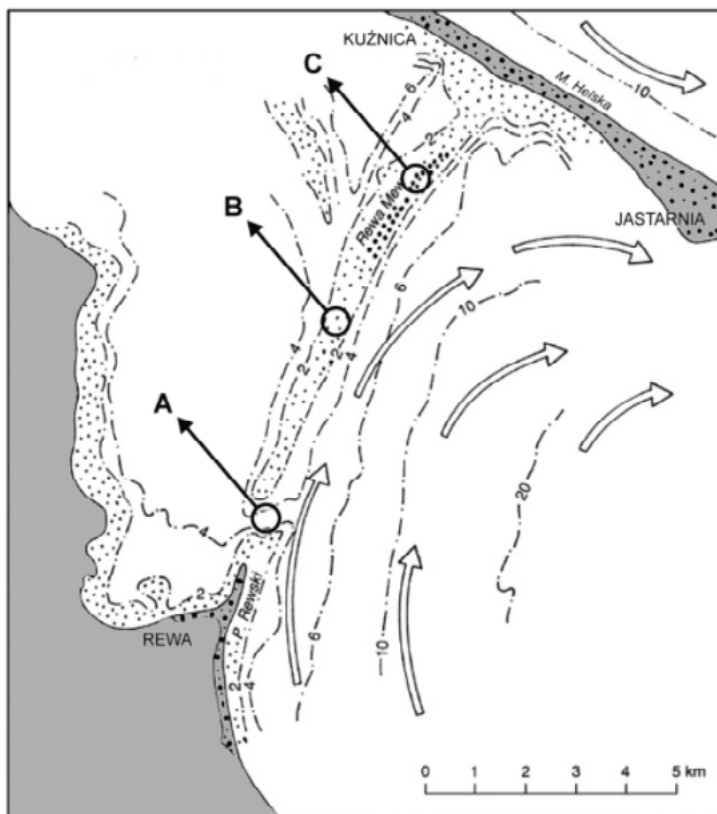


(fig.5.09) analog photography
of the site | 30.03.2024





MOVEMENT



(fig.6.01) the direction of main flow (wind+water) influencing the sandy environment | Institute of Educational Research

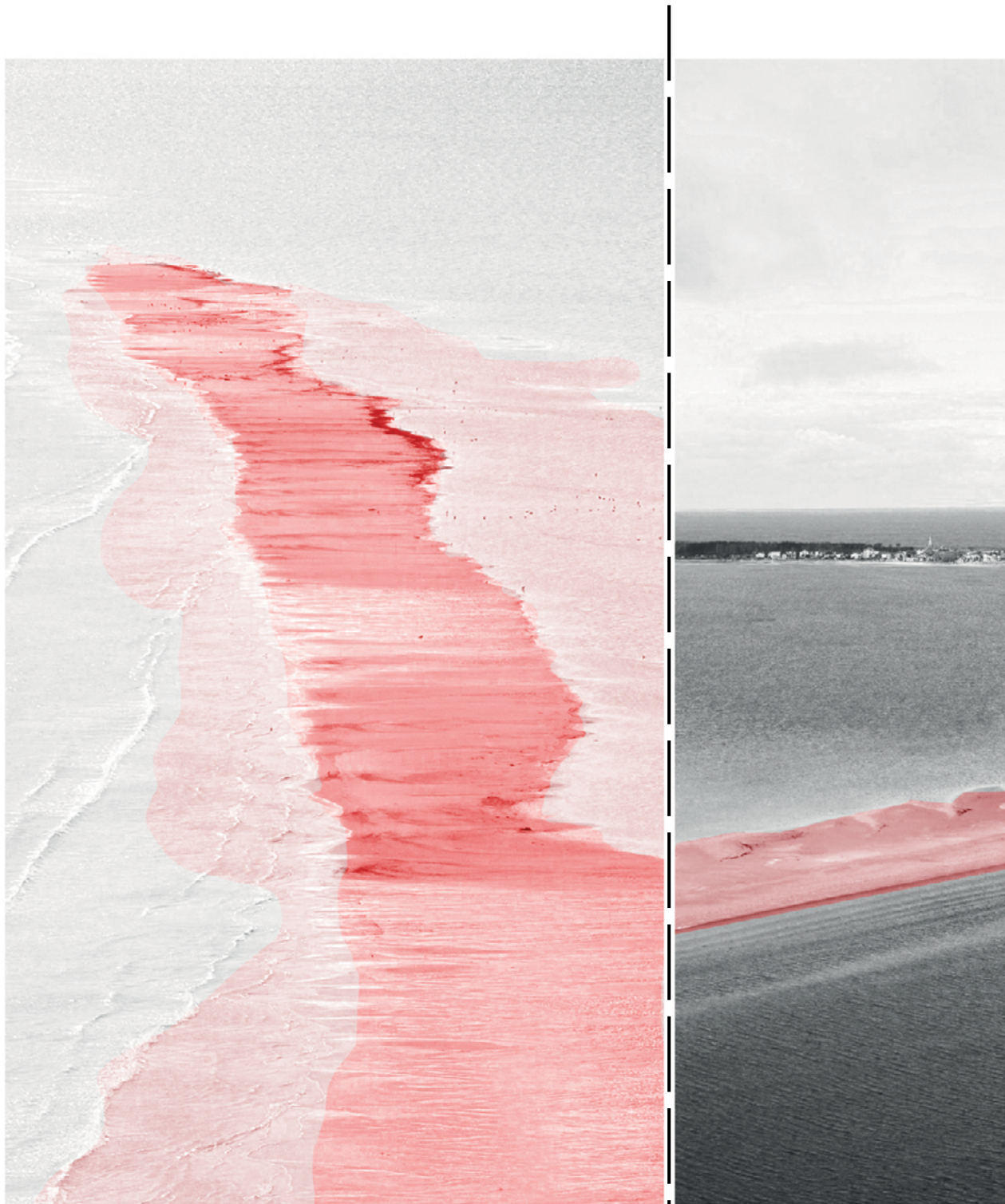
off-season



(fig.5.11) **SILENCE AS A MAIN
SPECTATOR** | Babie Doły, Poland,
March 29, 2023

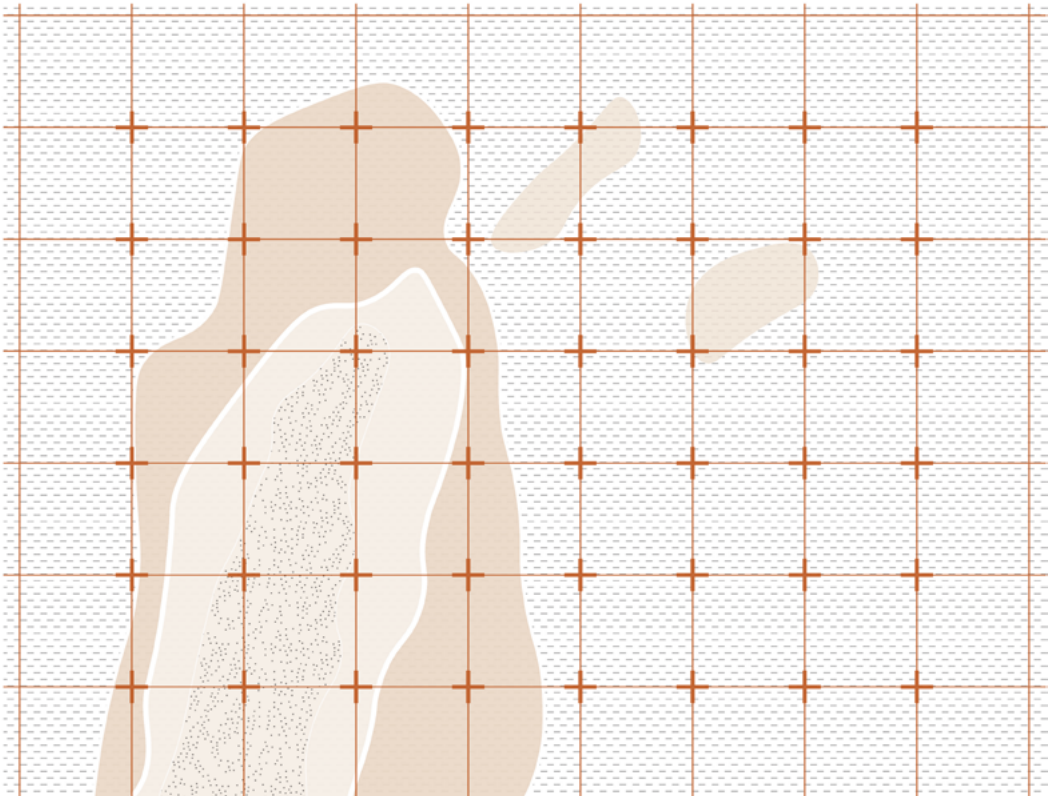


(fig.5.12) August 2022, peak of
the season along Baltic sea | A.
Logiewa and W. Radwański

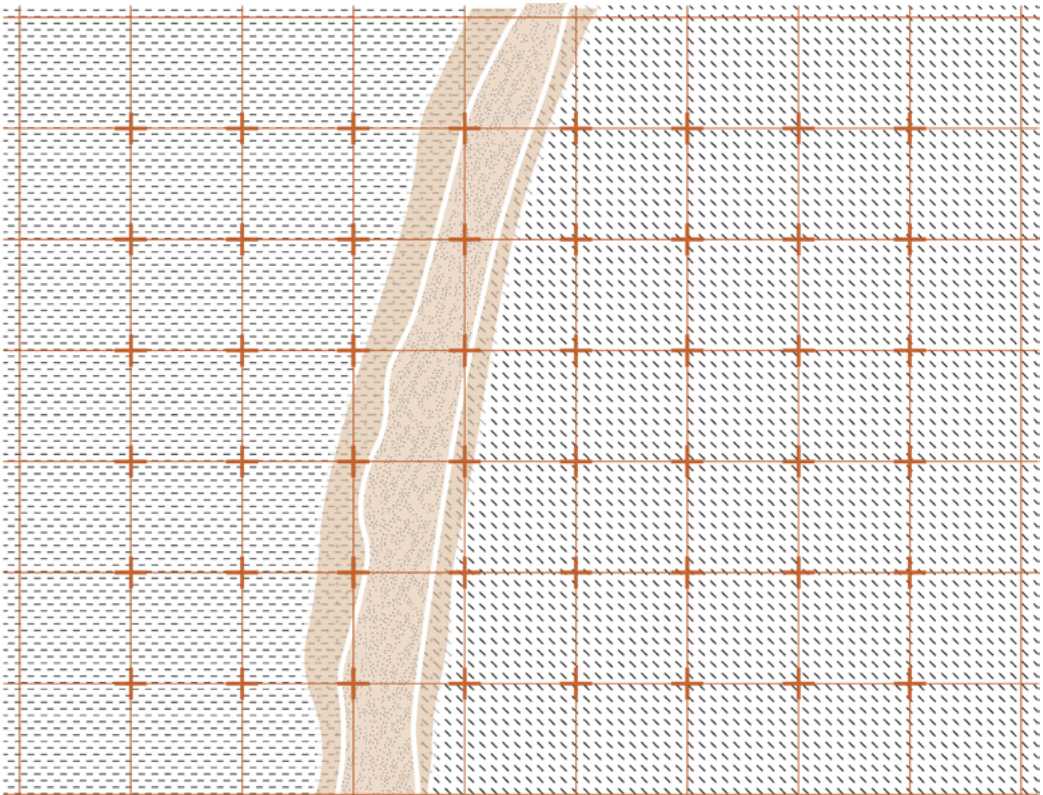


**(fig.5.13) the reappearing land,
drone photos**

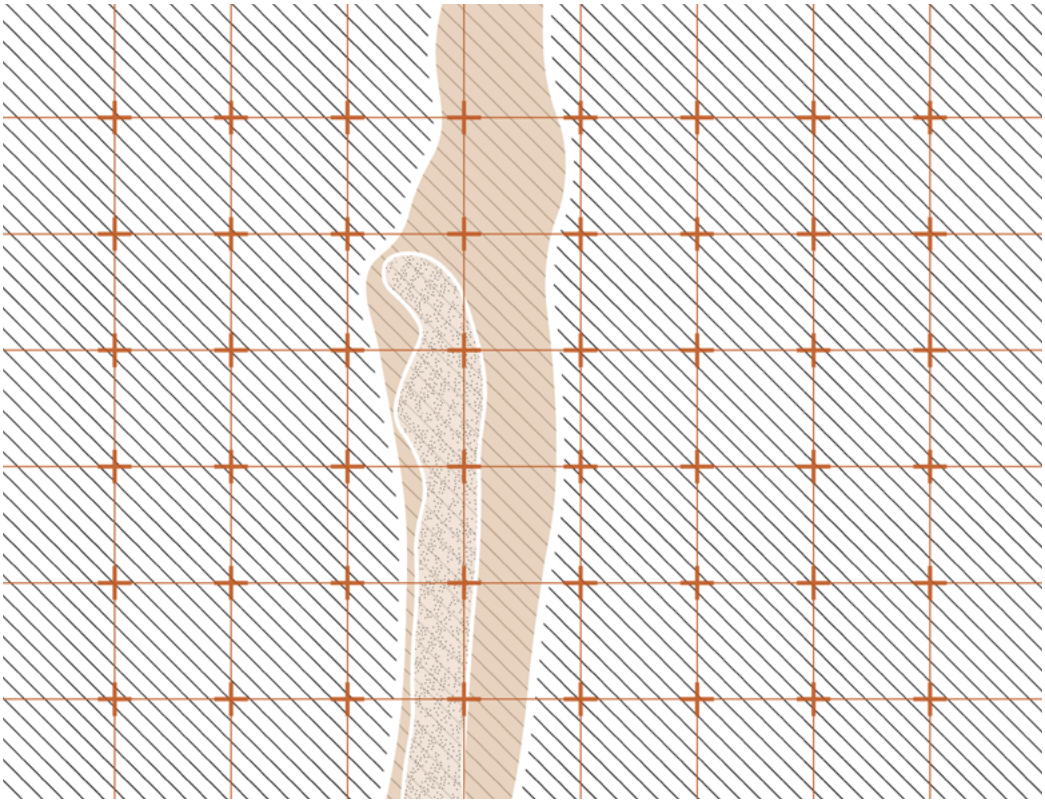




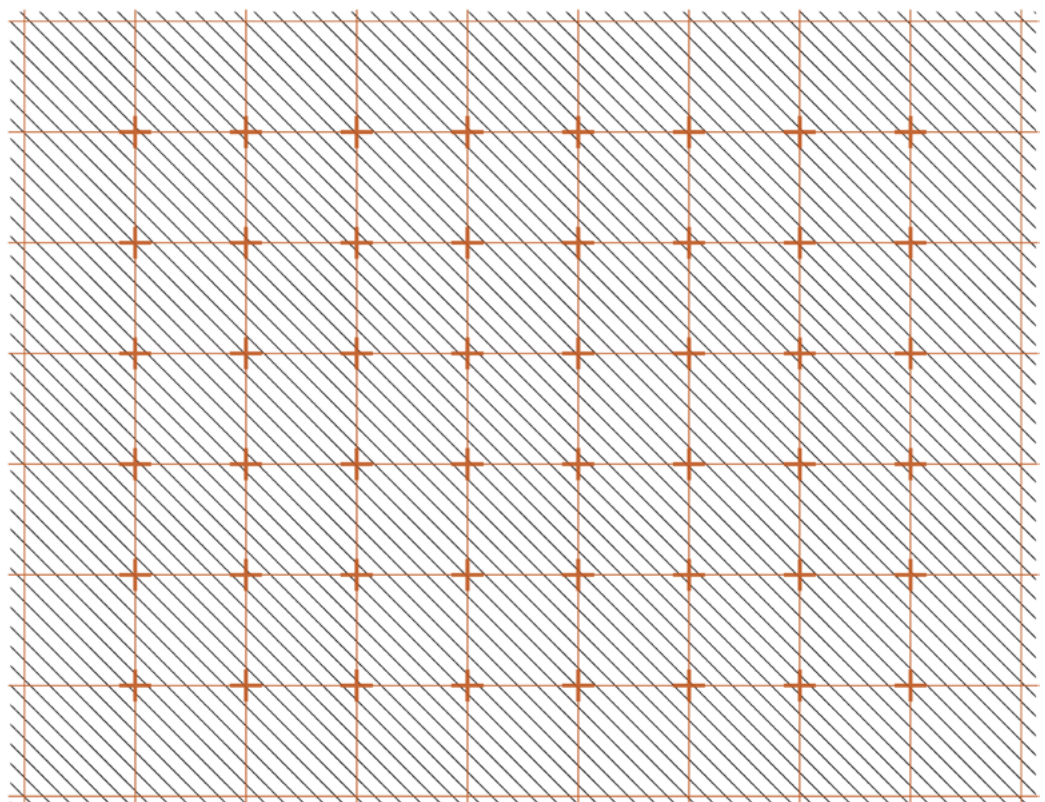
(fig.5.14) **SAND SUBMERGED AND EXPOSED**



(fig.5.14) **SAND EXTENSION**



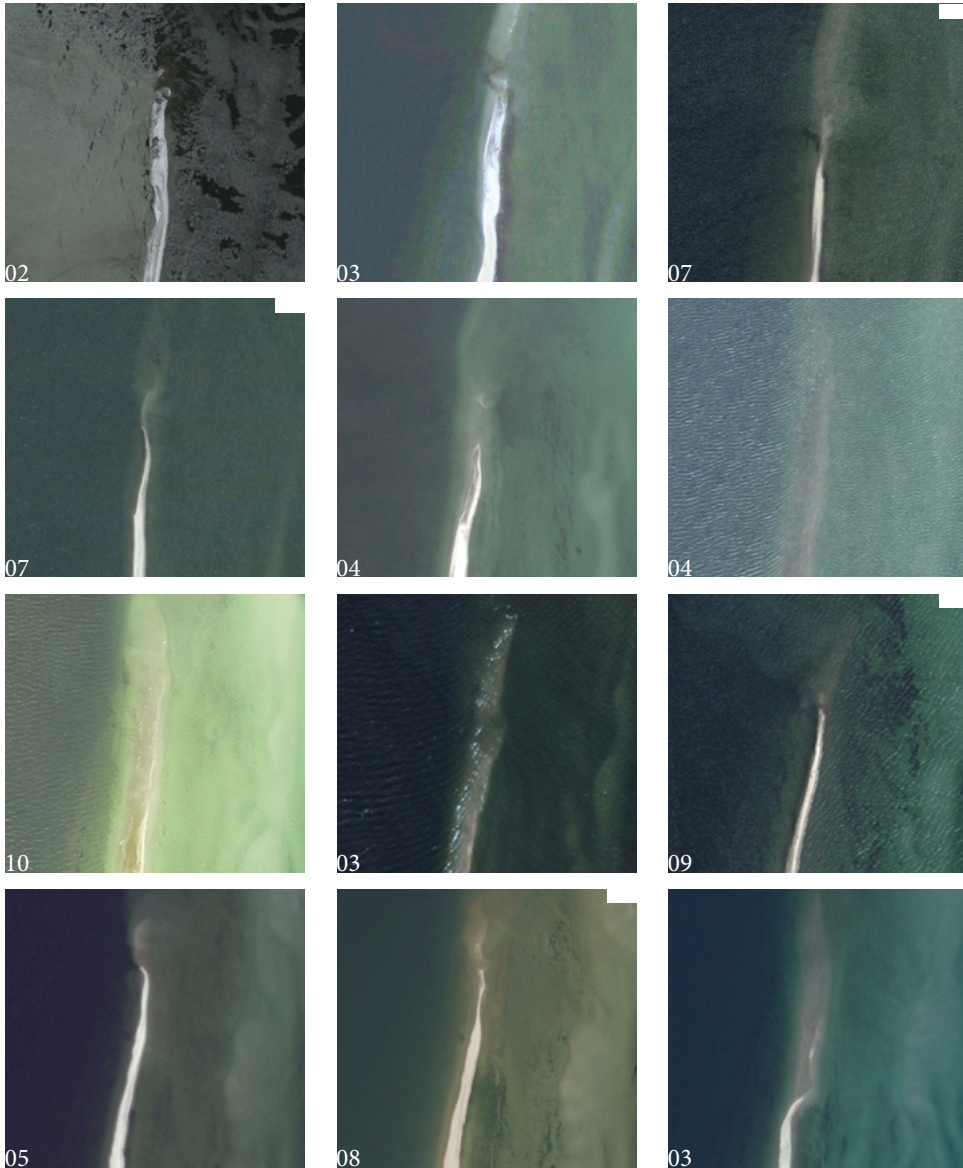
(fig.5.14) **DIRECTION/ORIENTATION CHANGE OF SAND BANK**



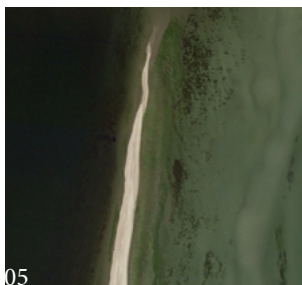
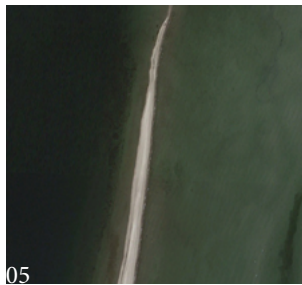
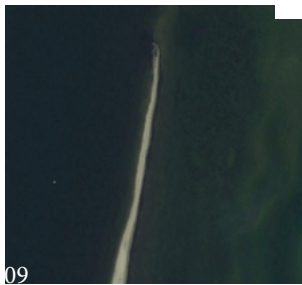
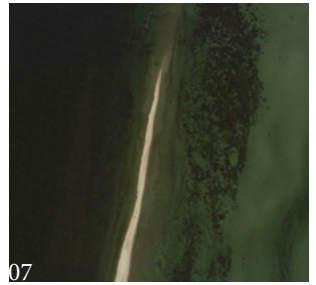
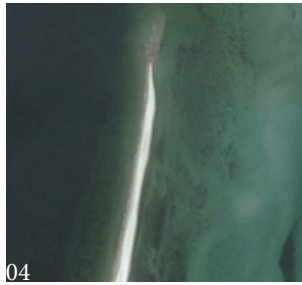
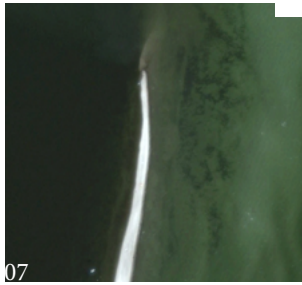
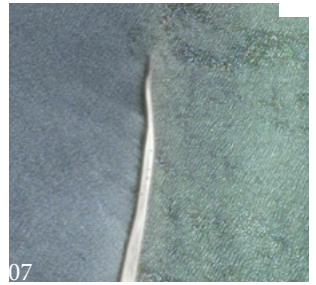
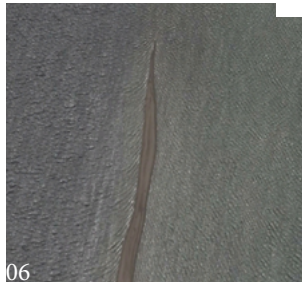
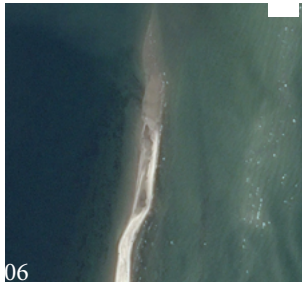
(fig.5.14) **SEA WATER OVERTAKING**

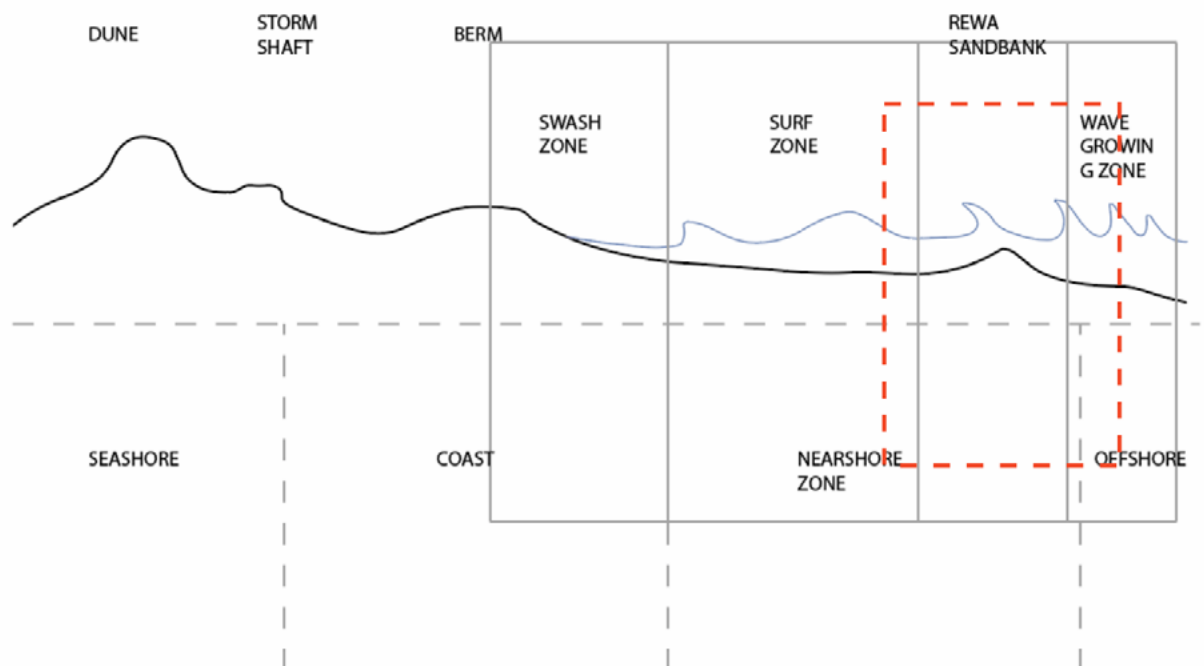
2005

-116-



(fig.5.15) transformation of reappearing
land Google Earth, 09.04.2024





(fig.5.16) the diagram based on governmental education board found on-site

*The rift is a very dynamic form - it changes both in its **longitudinal and transverse** profile, sometimes extremely intensively, such as in October last year, when a significant part of the rift was washed away after strong storms. Depending on the water level in the Bay of Puck, most of the rift may emerge (spring, summer) or be 'hidden' underwater (winter). Periodic flooding of the rift cleanses it of garbage accumulated during the rest of the year.*

calm



(fig.5.17) **inner bay**

vivid

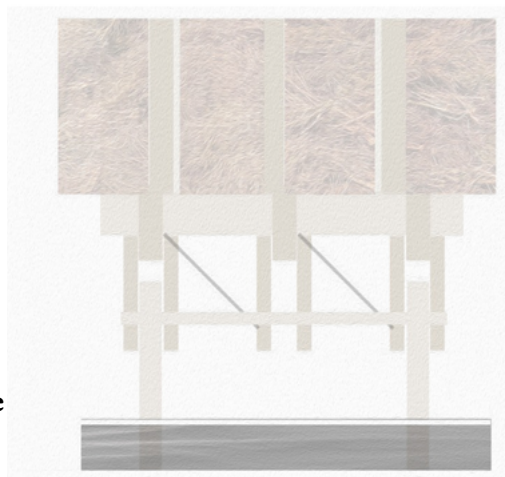


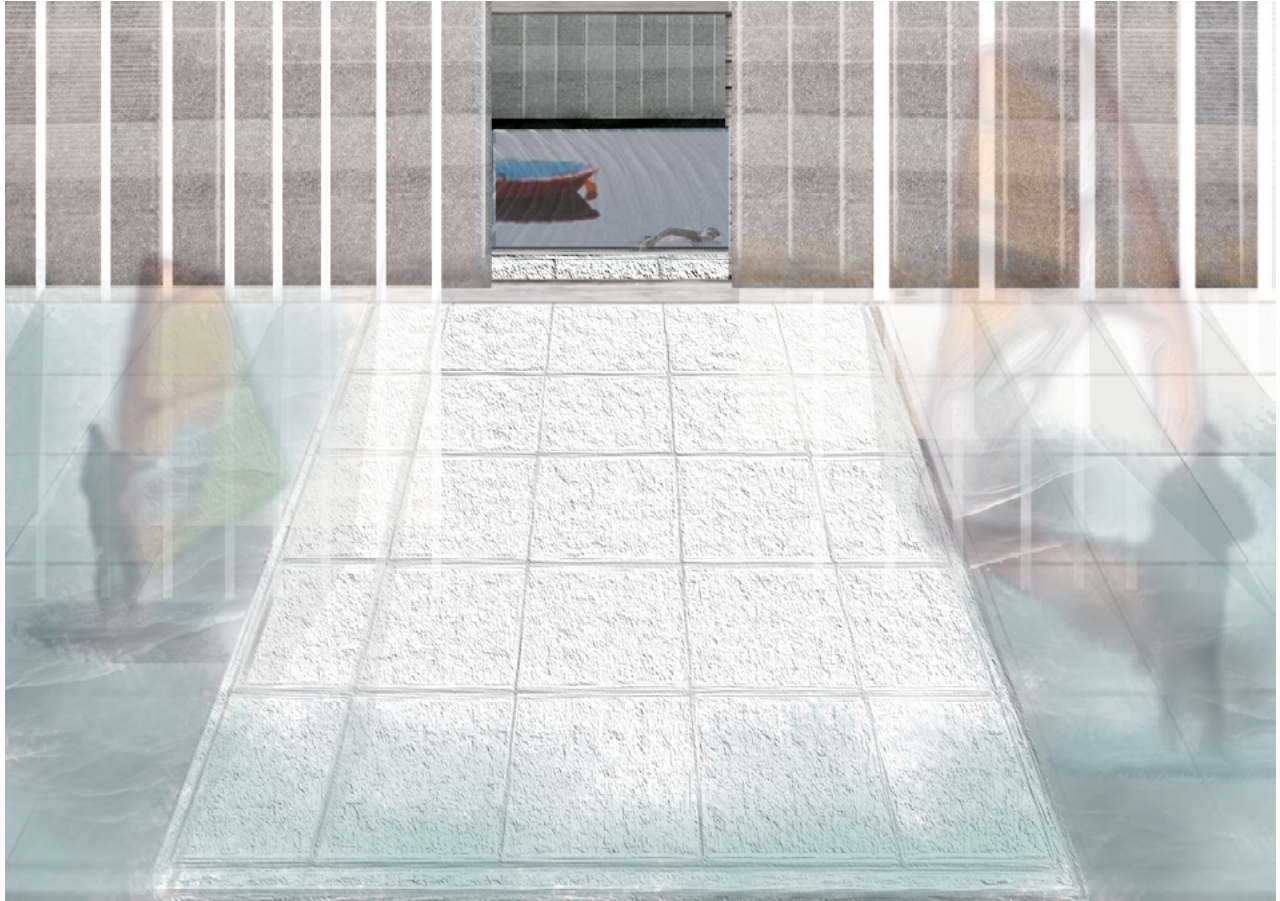
(fig.5.18) **outer bay**

...SOON...



(fig.5.19) imagining
the sediment
deposit or water
interfering with the
strucutre | front
view





(fig.5.20) **outside
the iodine
extraction wall**

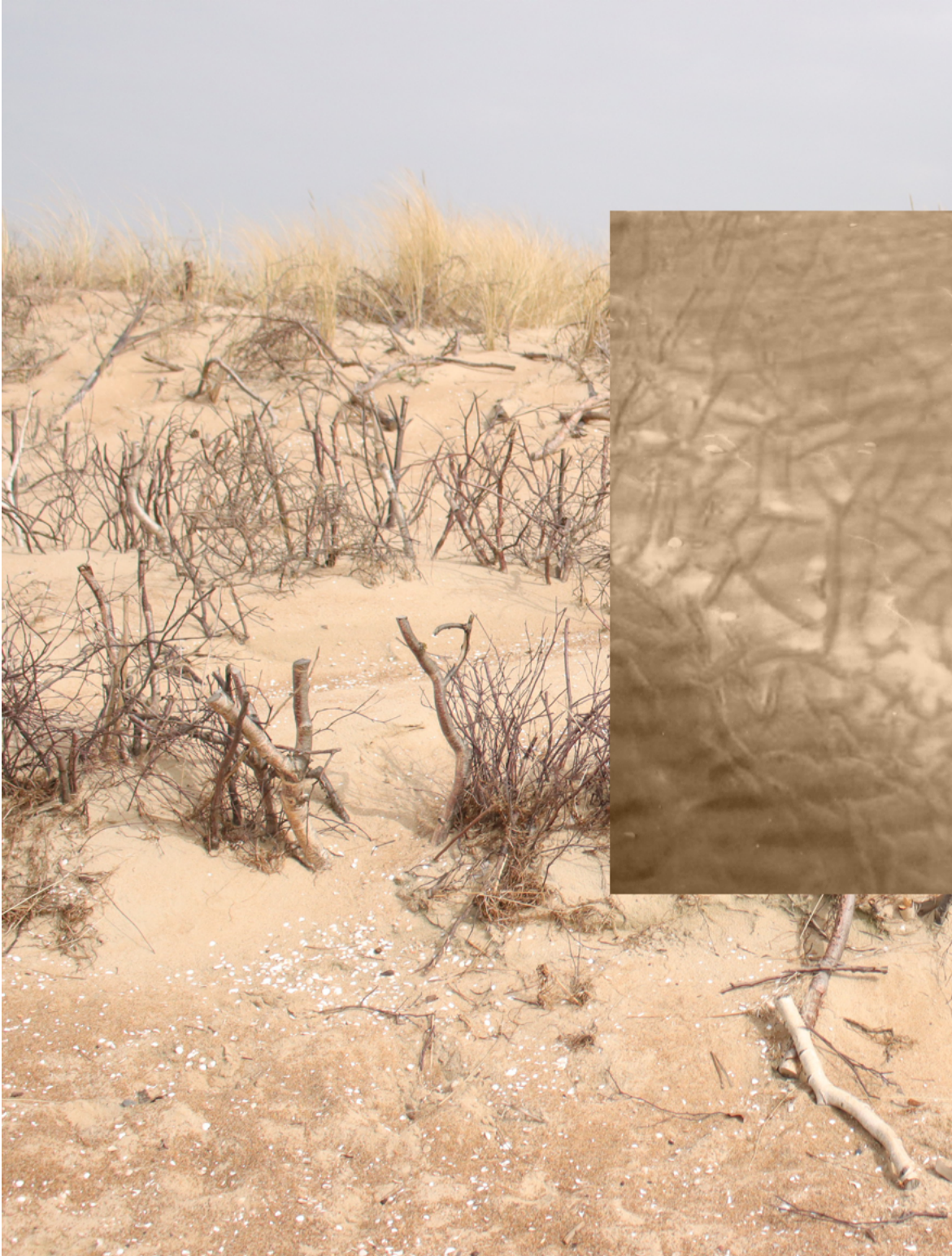
INTERCONNECTEDNESS

ecological characteristics

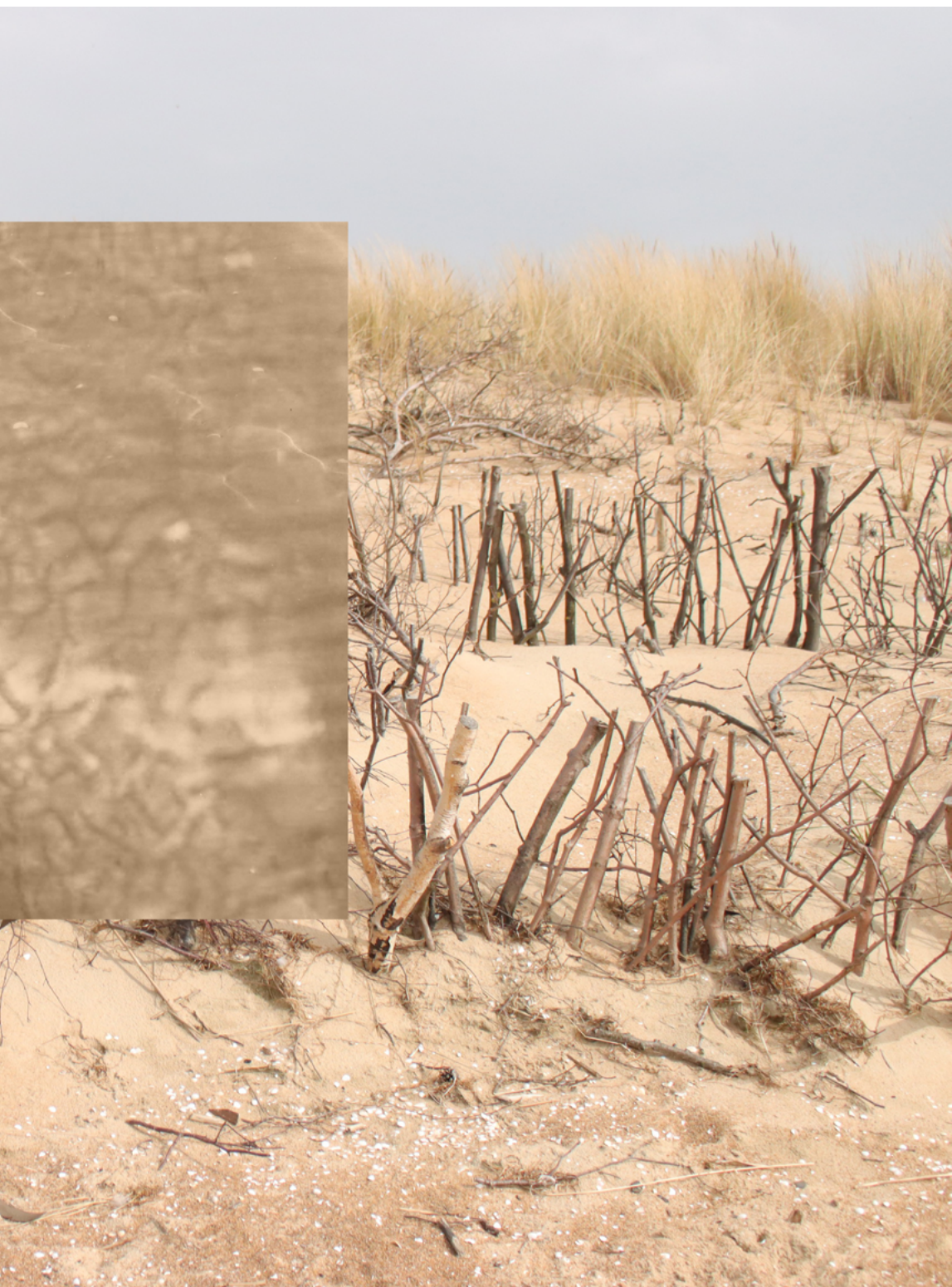


-131-

(fig.6.01) analog
photo of site - bay
shore



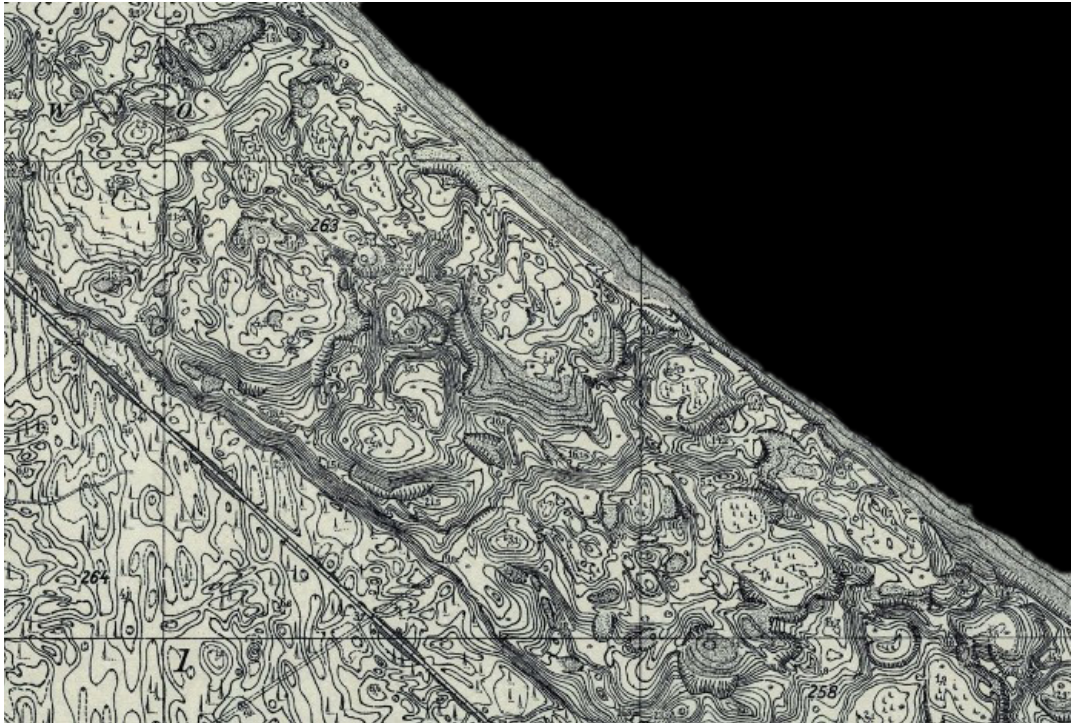
(fig.6.02) **WATER ON LAND**



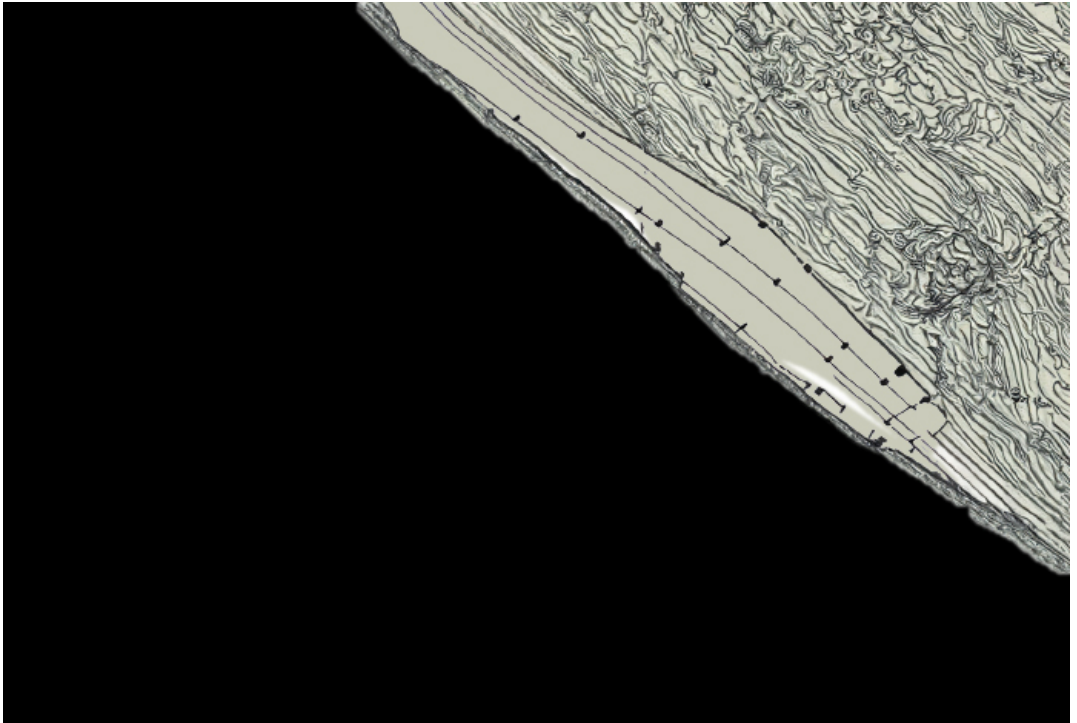




(fig.6.03) **LAND ON WATER**

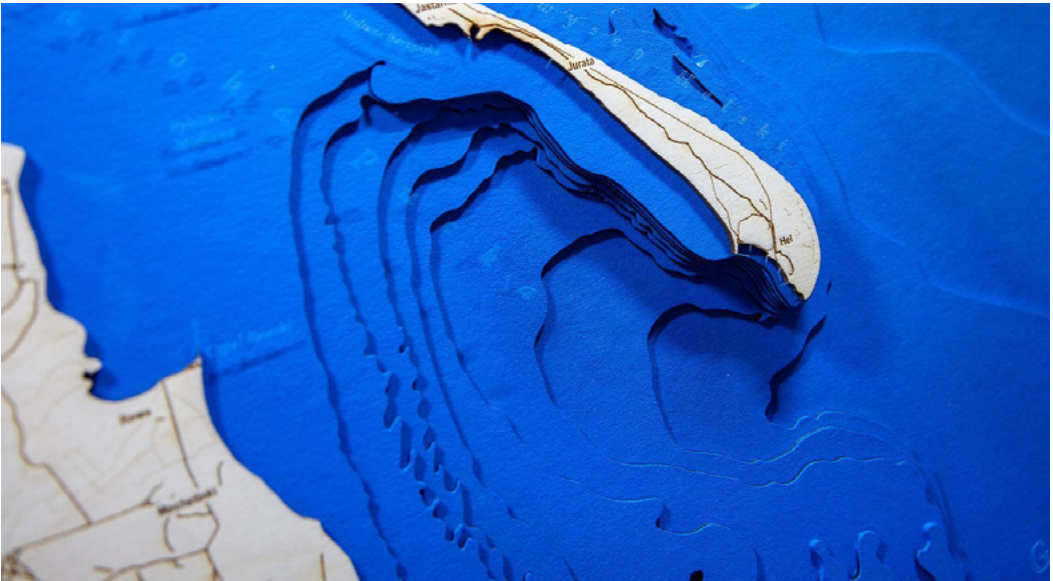


(fig.6.04) a map representing part of a coastal land with its terrain contour lines

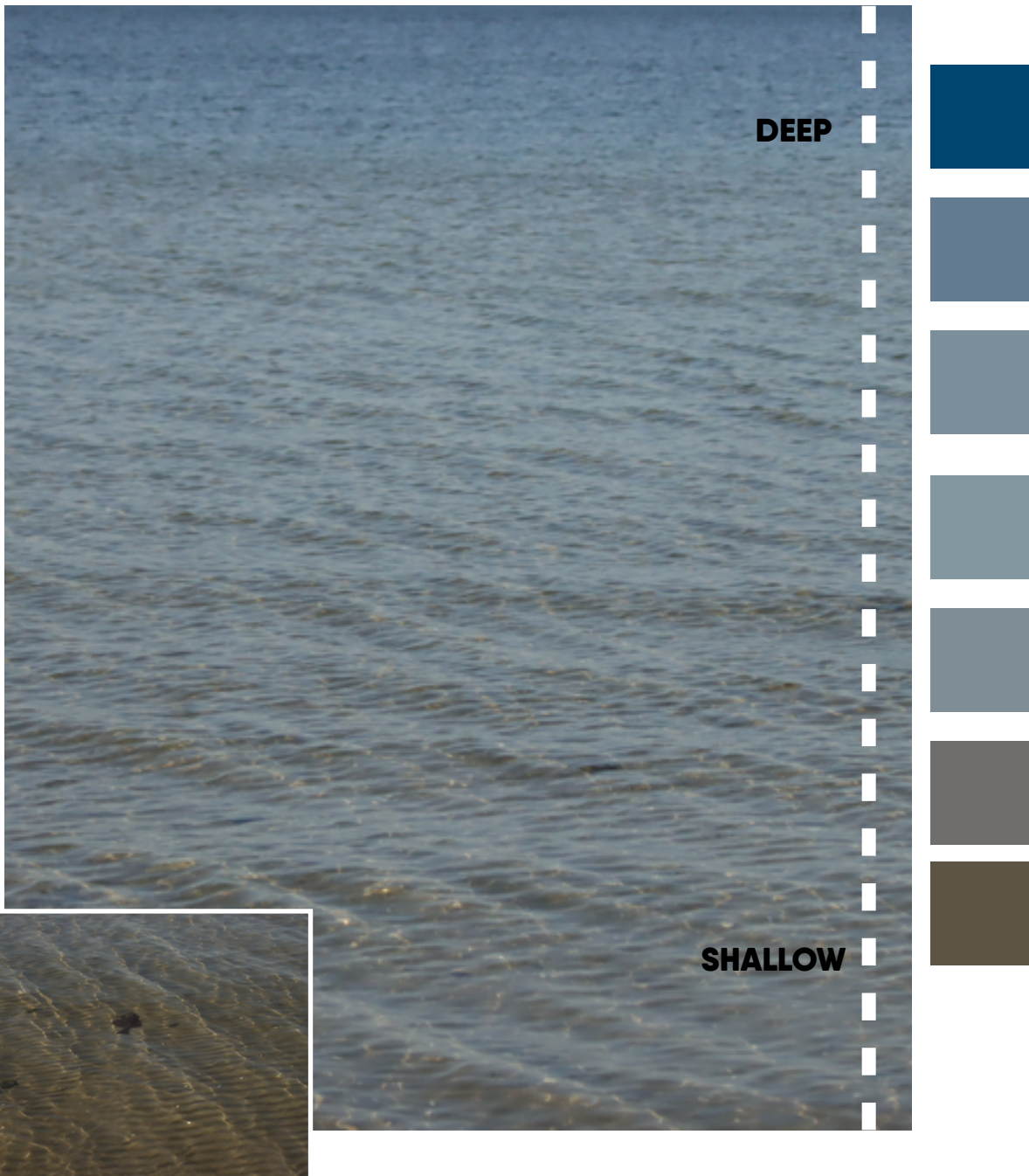


-137-

(fig.6.05) a map depicting the directly connected Baltic Sea with its interpretative isobaths.



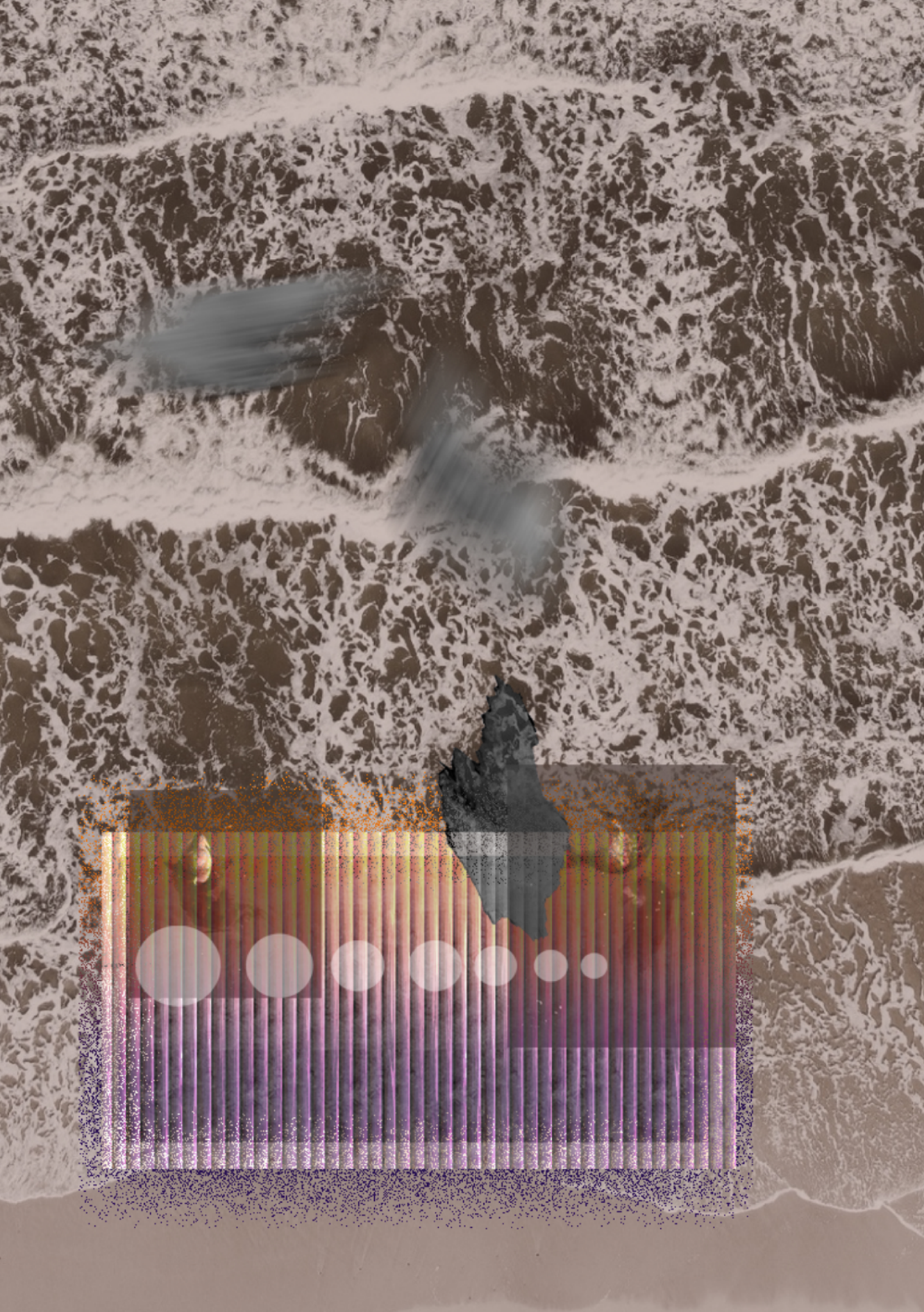
(fig.6.06) a bathymetric map of Puck Bay



(fig.6.07) **color intensity influenced by
angle and depth | inner basin**



(fig.6.08) **The Herring March, each August, a walk across the shallow waters of the Baltic Sea between the Hel Peninsula and the mainland.**

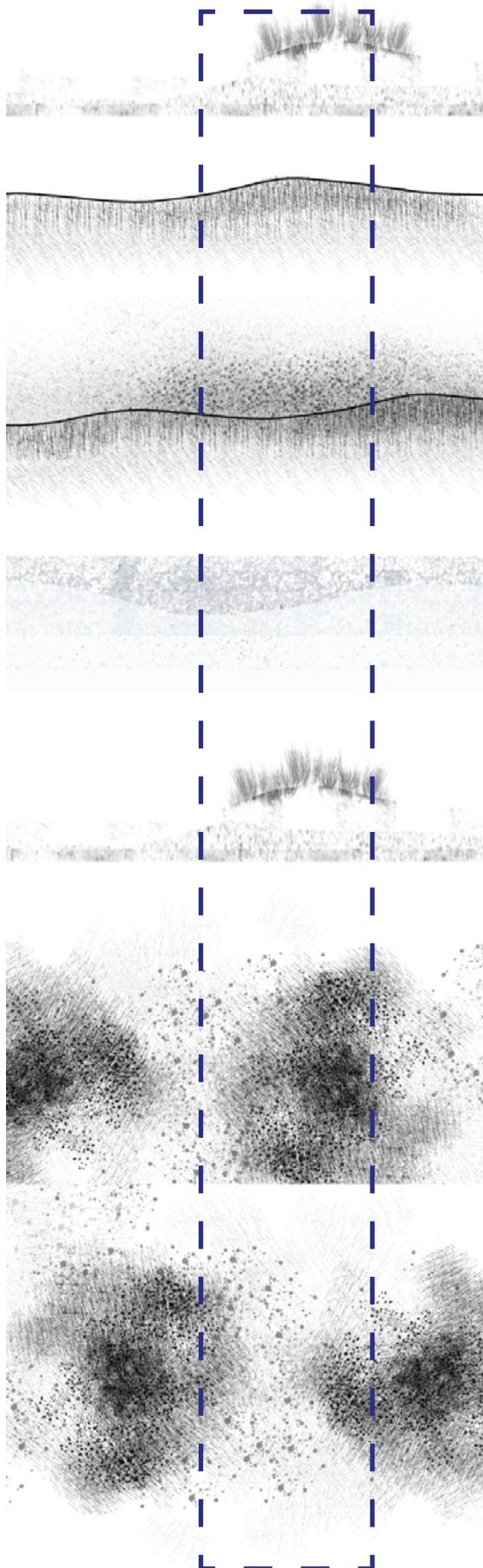


HOW CAN WE AVOID INTERFERING WITH LOCAL INHABITANTS?

-143-

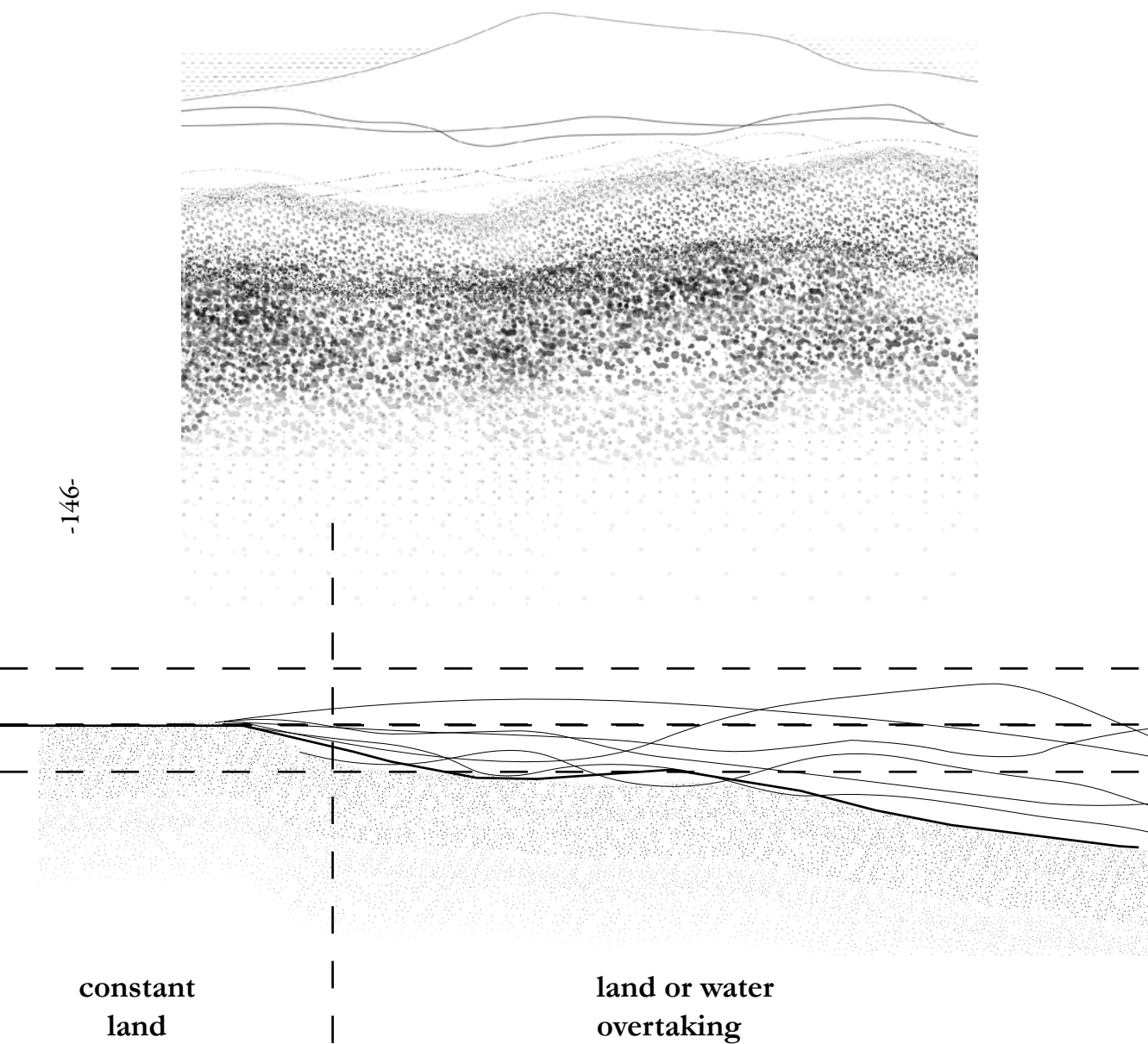
(fig.6.09) importance for
biodiveristy - nature over
population | collage

HOW THE LAND CHANGES?

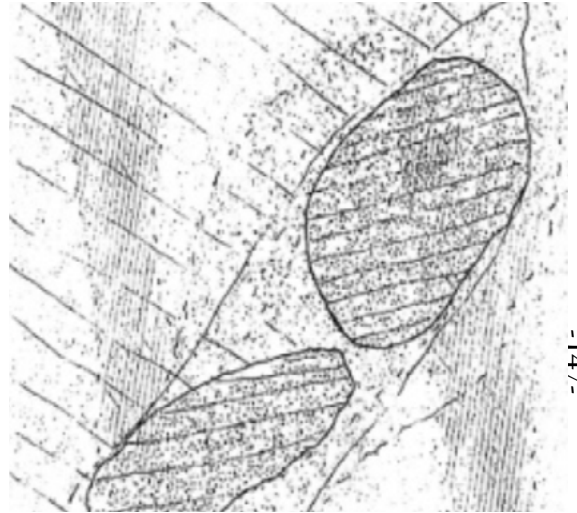
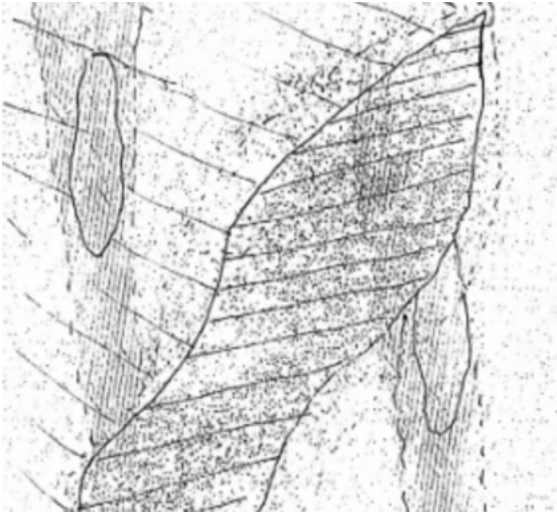


(fig.6.10)
mapping
of the land
change

*In these dynamics, nothing remains stable or constant,
the only constant is motion itself.*



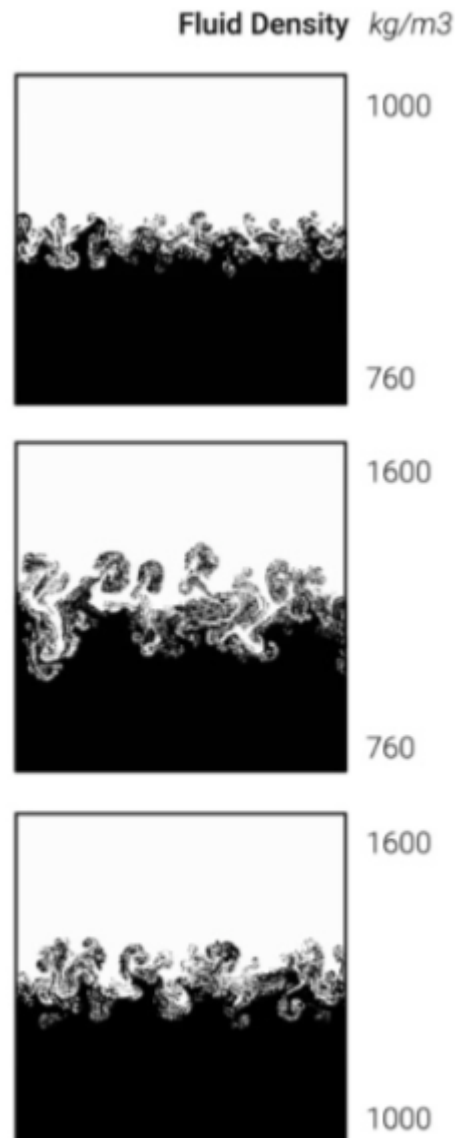
(fig.6.11) **section
through ever-changing
sandbank**



-147-

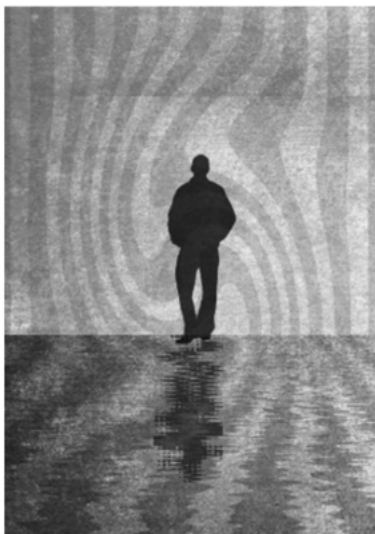
(fig.6.12) plan - land
underneath above the
water surface

**fluidization - layer
of ever - changing
and moving sand**



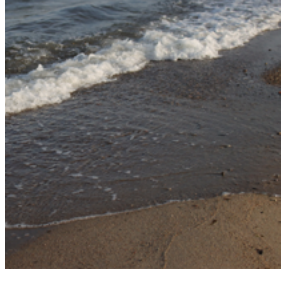
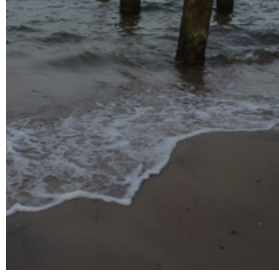
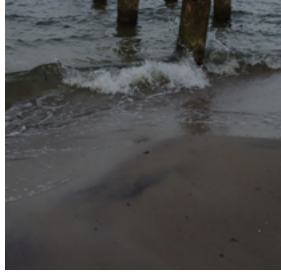
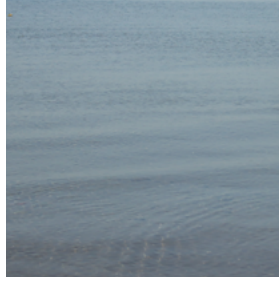
(fig.6.13) Valentina Marticorena Angela (2024): Fluidisation of sand beds is achieved through the suspension of its particles in a gas.

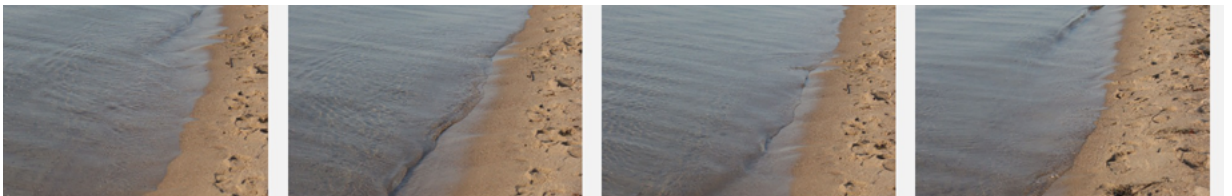
WHAT'S THE ROLE OF WIND IN THE INTERACTION BETWEEN WATER AND LAND?



(fig.6.14) **sea level change influences
human's perception**

HOW THE WATER FLUCTUATES?





(fig.6.15) tendencies of land and water

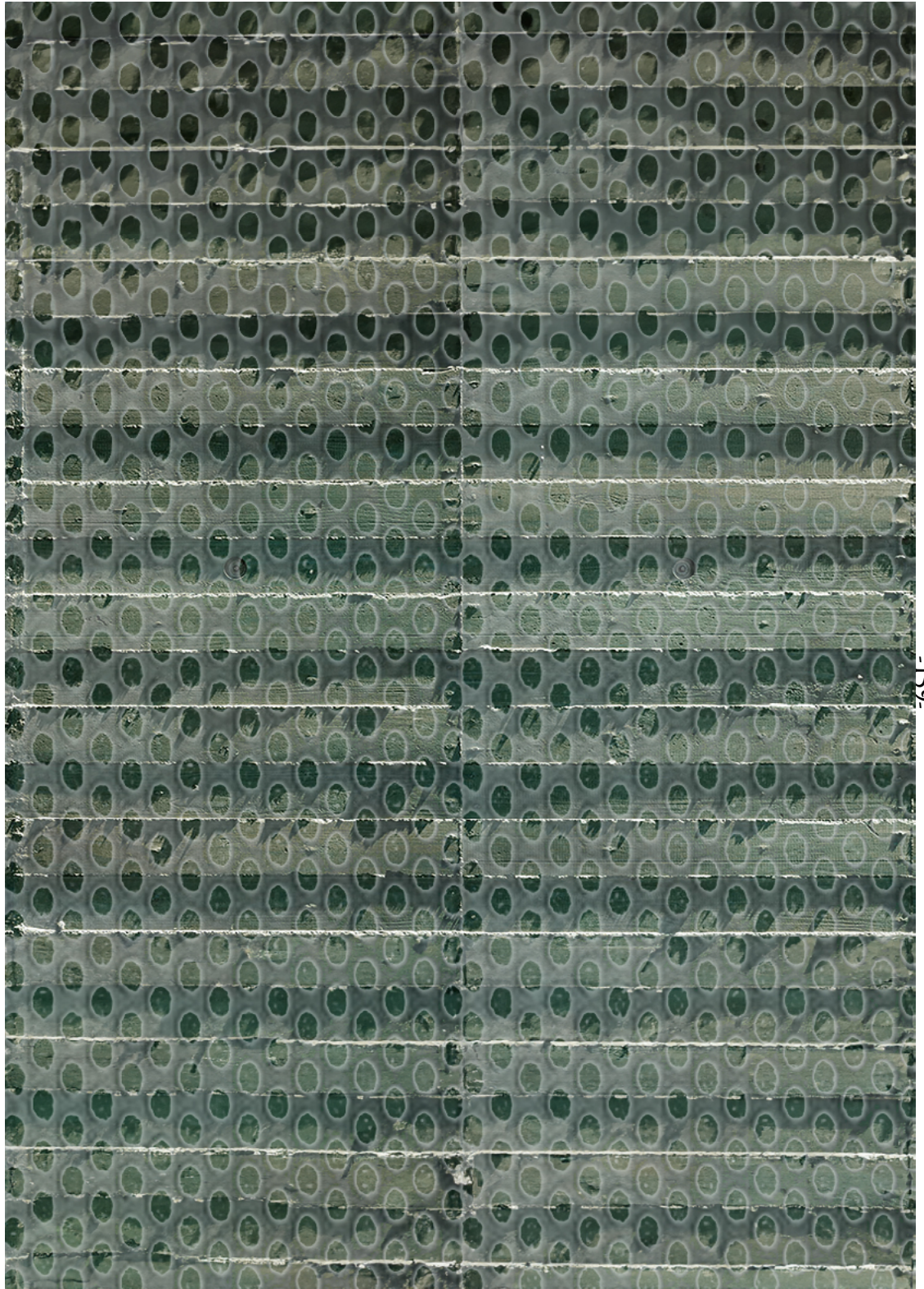


HOW TO DESIGN WITH WATER AS A MAIN TOOL?

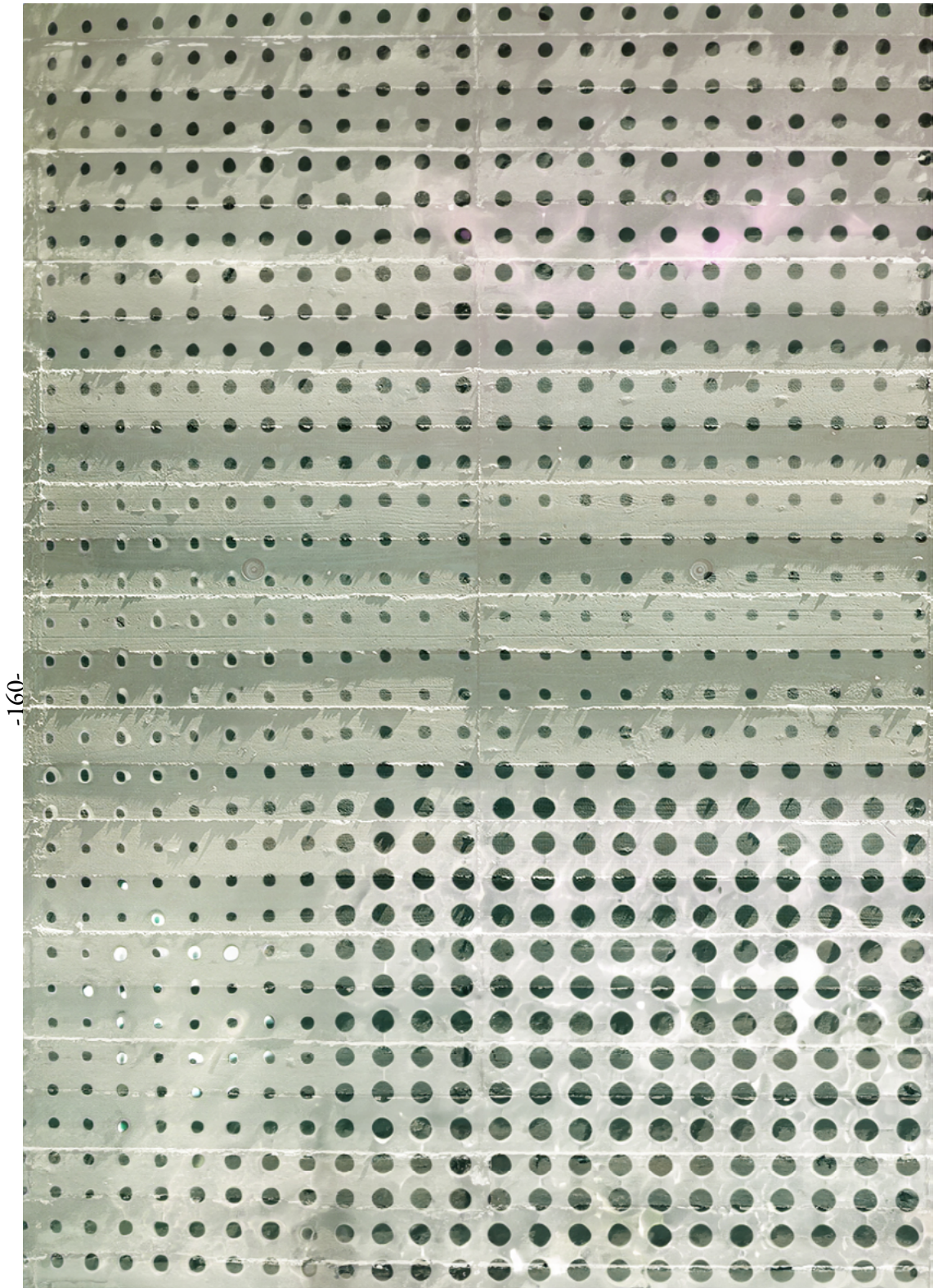
LATER...



(fig.6.16) wooden board affected by salinity - corrosive impact resulting in uneven texture



(fig.6.17) initial indications manifest through salt deposition



(fig.6.18) translation into corrosive perforation and bent sheet metal | the color fades | the perforation intensifies with direct exposure to water and evaporation



(fig.6.19) **implication of materials into coastal context**

Further reflection is embodied through spatial intervention, particularly influenced by the dynamics of the Baltic Sea. With a water level rise of +0.75m, the coastline undergoes significant transformation. At +2m, the landscape becomes impassable on foot yet remains navigable under certain wind conditions, highlighting the interplay of water flows and fluctuations.

The evolving terrain not only alters physical structures but also reshapes perceptual and sensorial experience. The uplift of land, in conjunction with the water, changes the way the structure could be seen or experienced. Land and water dynamics, driven by the movement of wind, define the evolving atmosphere. These scenarios unfold across spatial and temporal phases, enriching the experience of place and time.

reflection

....NOW

...SOON...

LATER...

....COMING

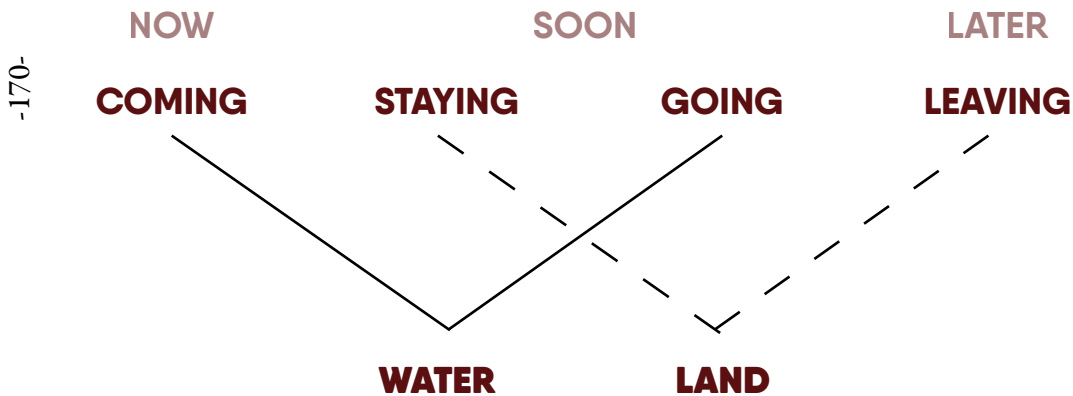
...STAYING...

...GOING...

LEAVING...

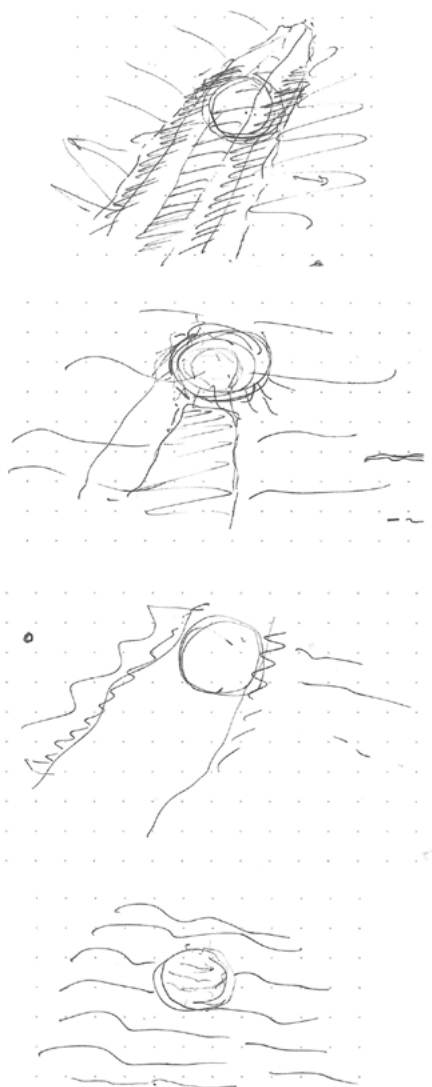
Each phase constitutes a temporal and spatial creation with tendencies of water through state of coming, going, staying and leaving within time span of now, soon and later and someday [1].

“Thinking in the long term makes it possible to design for uncertainty and adaptivity.”[2]



[1]the notions: “now, soon, later, someday” basing on RDVA at Rotterdam Architecture Biennale 2022 - The 10th International Architecture Biennale Rotterdam (IABR), titled “It’s About Time,” focused on the theme of designing for uncertainty with a long-term perspective. The event I visited, took place from 22 September to 13 November 2022 in Rotterdam.

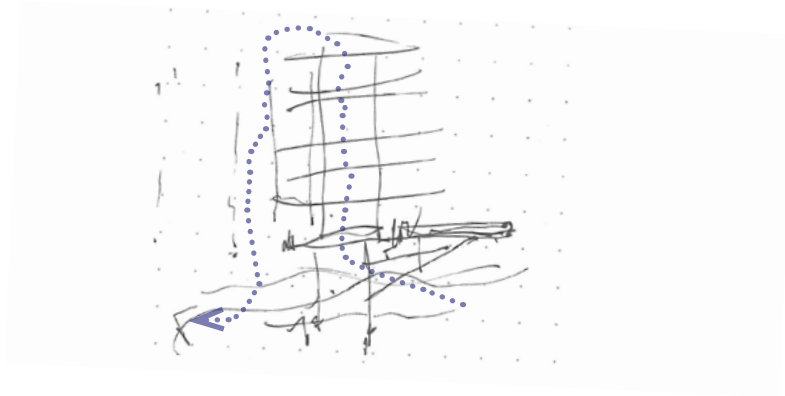
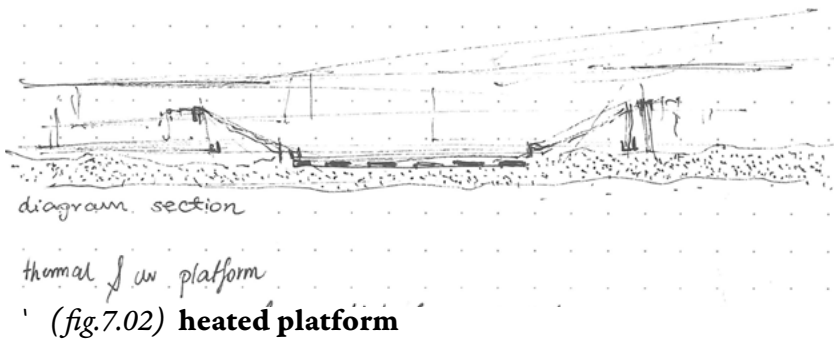
[2] insight from “The Netherlands 2100” by Future Studio NL2100 program.



(fig.7.01) drawings of
changing land with
intervention

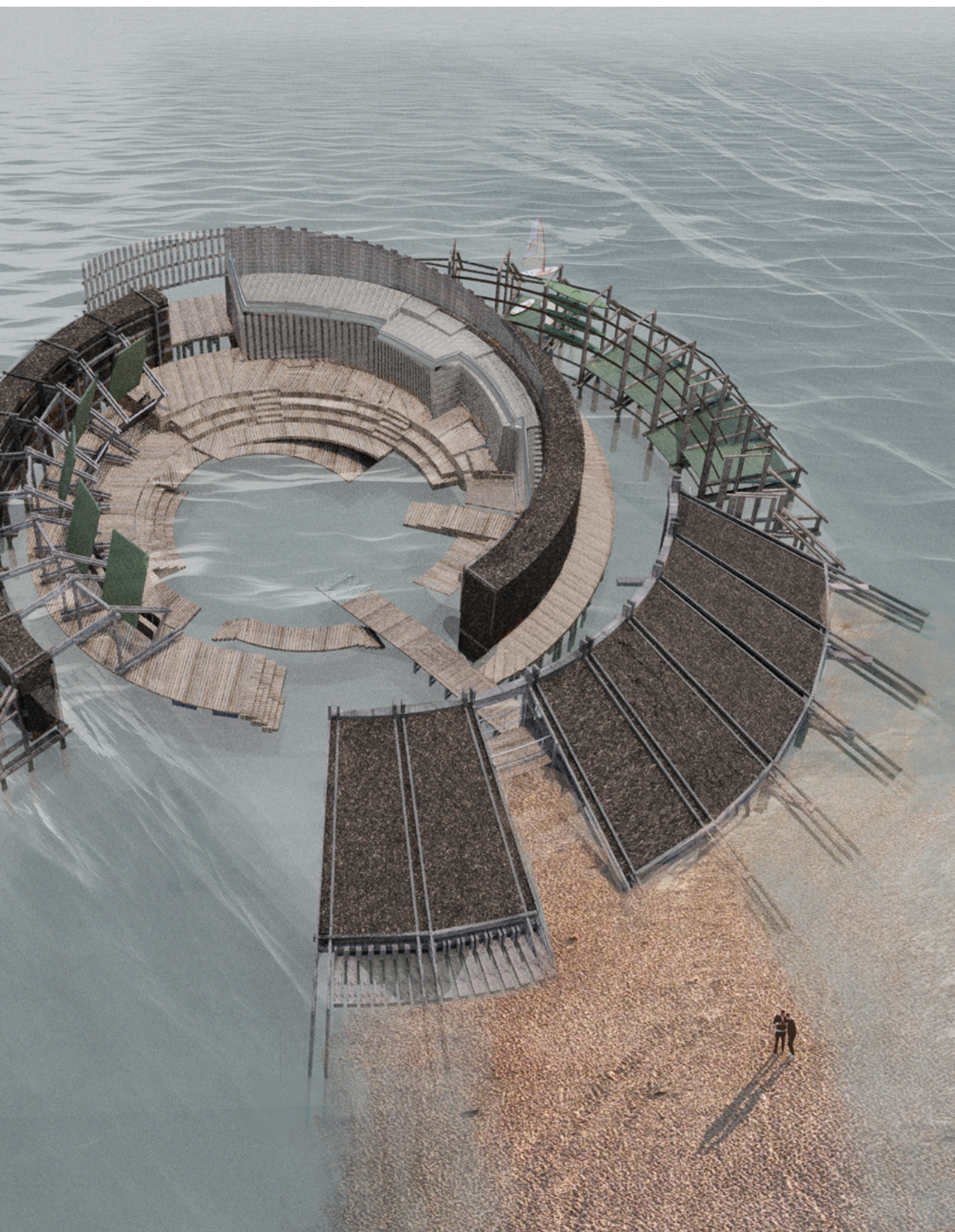
SALT INHALATORIUM

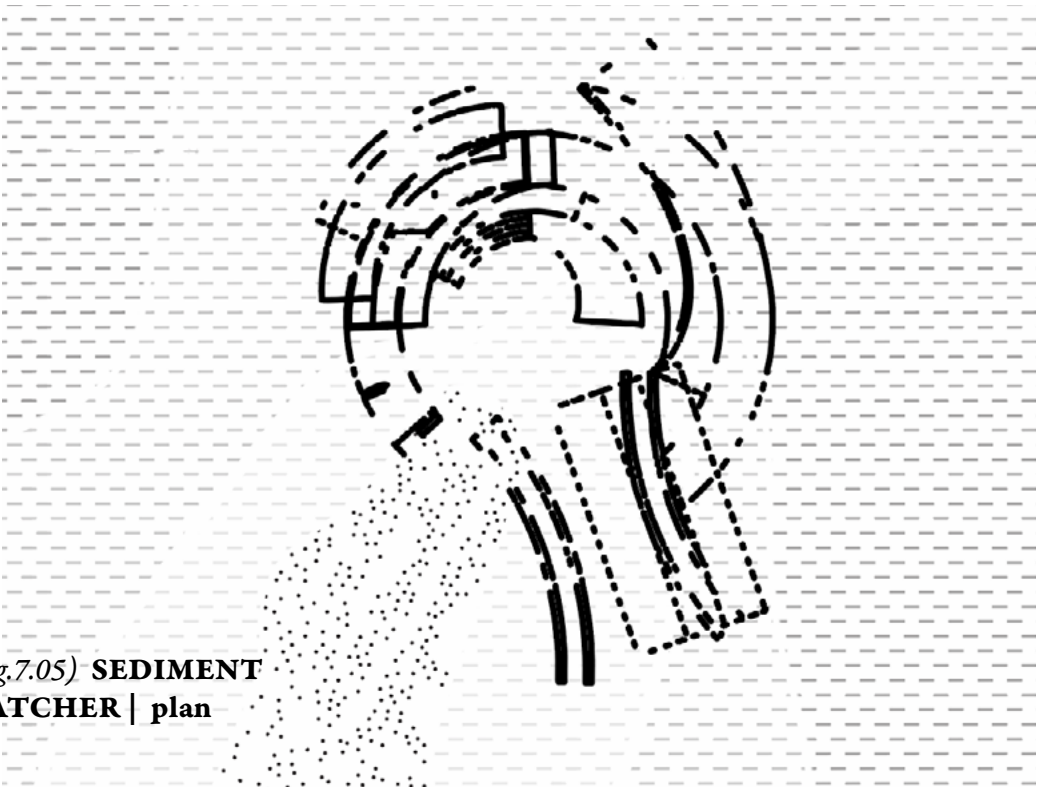
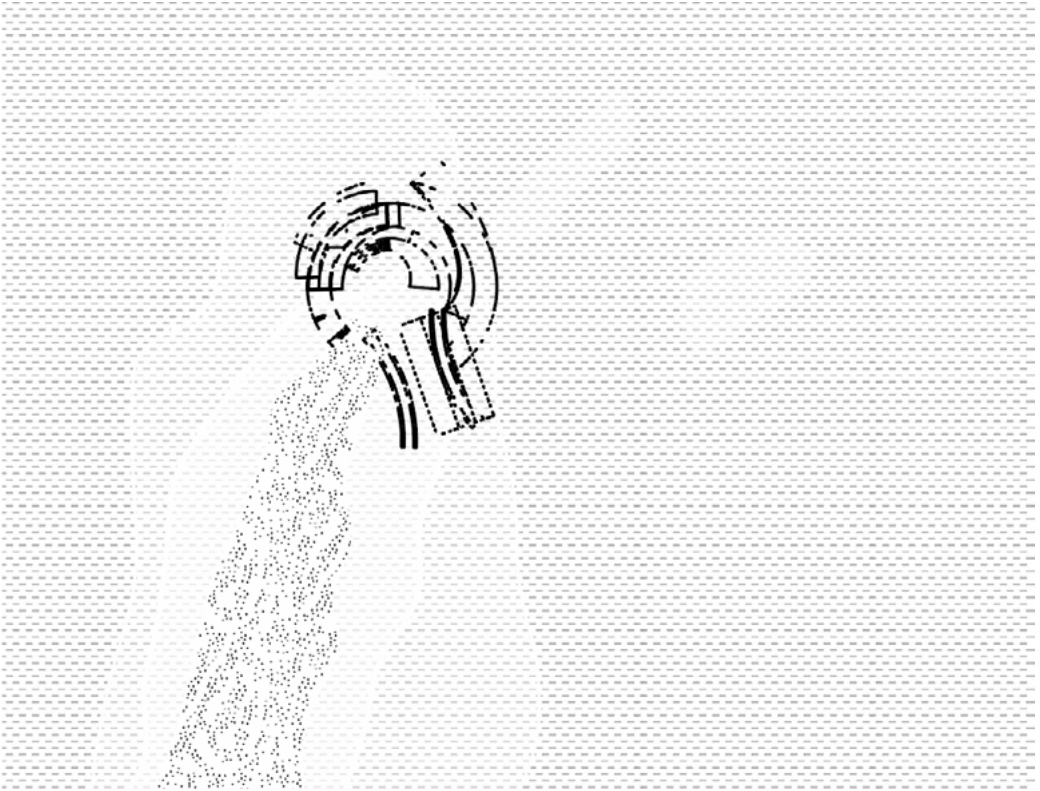
Creating an intensified inhalation zone through iodine extraction walls, harnessing the purified cycle of the Baltic Sea, with a platform activated and powered by tidal fluctuations.



(fig.7.04) intervention on the reappearing land

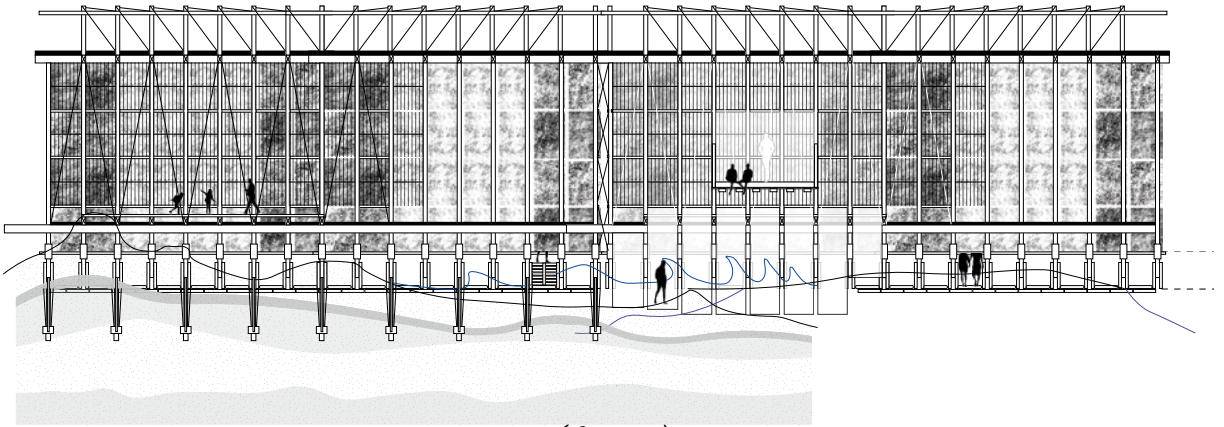




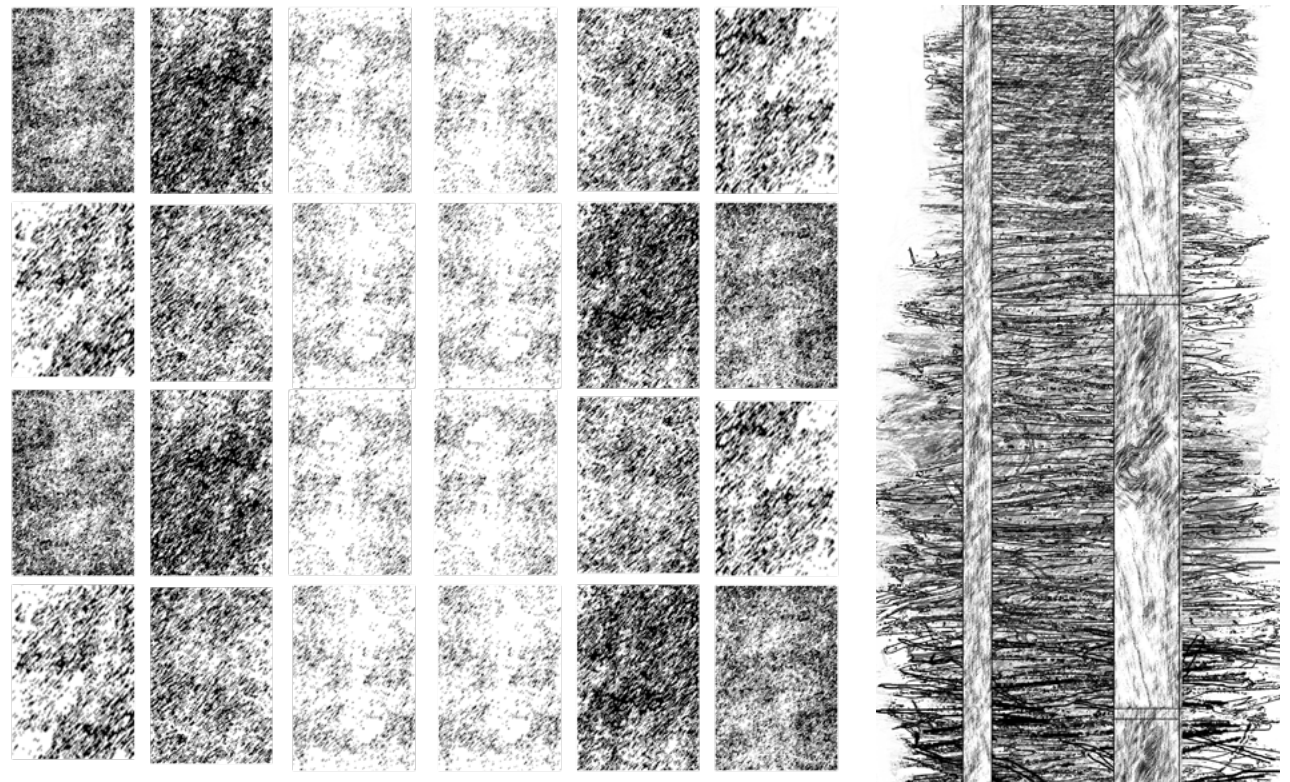


(fig.7.05) SEDIMENT
CATCHER | plan

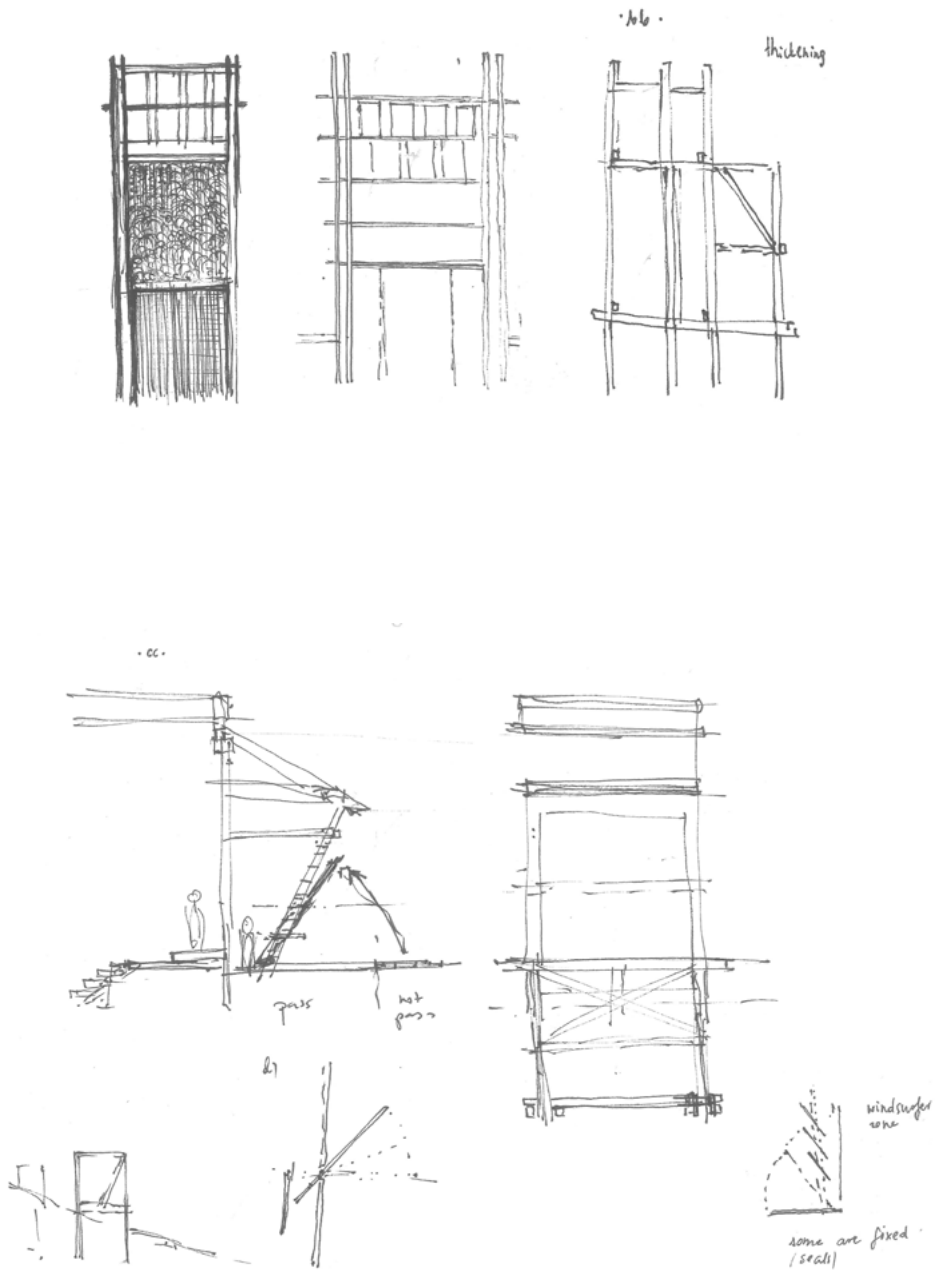
initial spatial tests



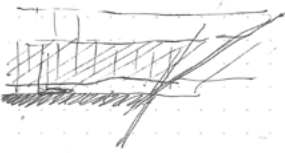
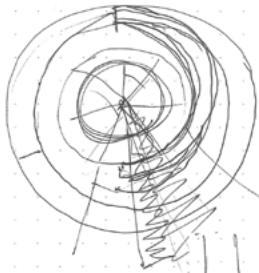
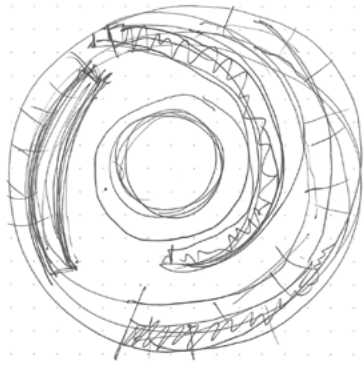
(fig.7.06) **ACTIVATED IODINE WALL
EXTRACTION | section**



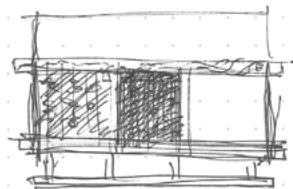
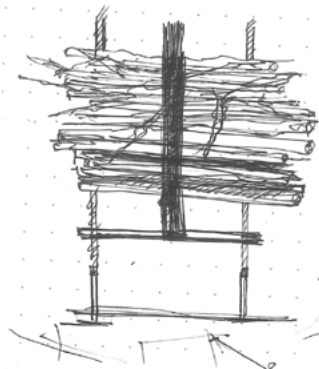
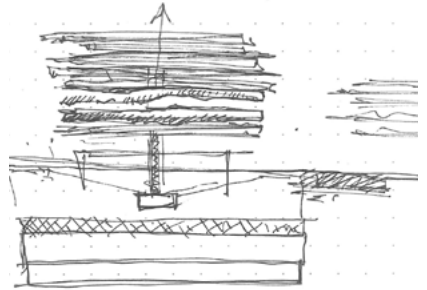
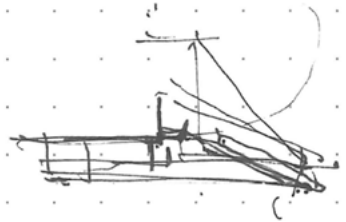
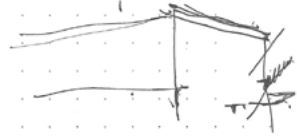
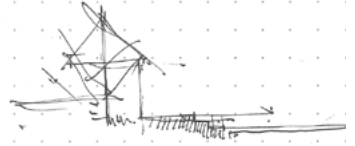
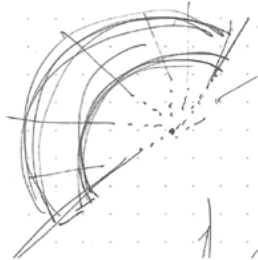
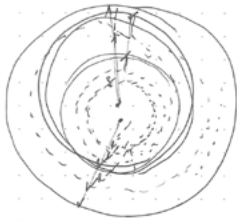
(fig.7.07) **wooden wall structure filling
with blackthorn branches**

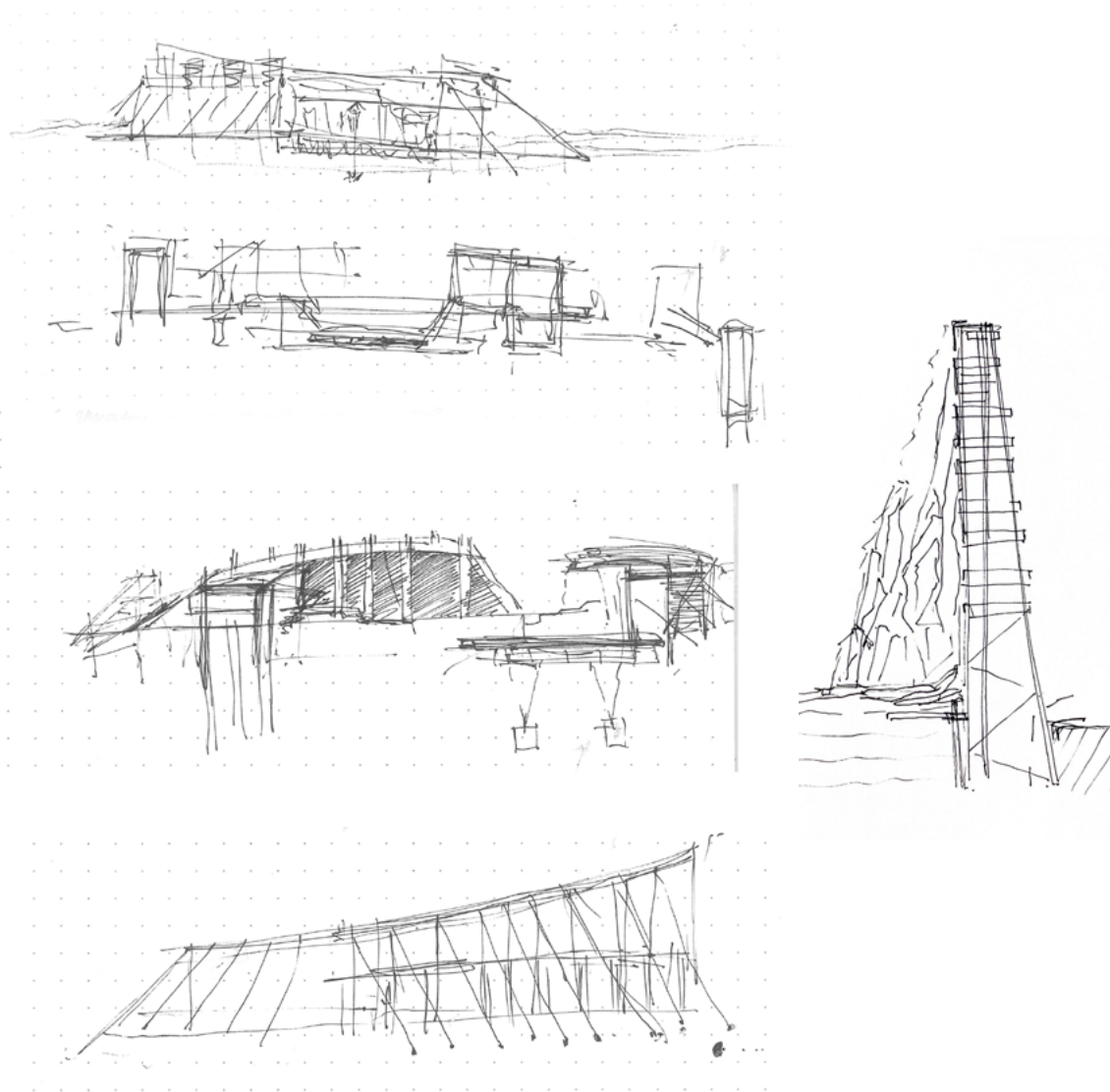


(fig.7.08) concept drawings



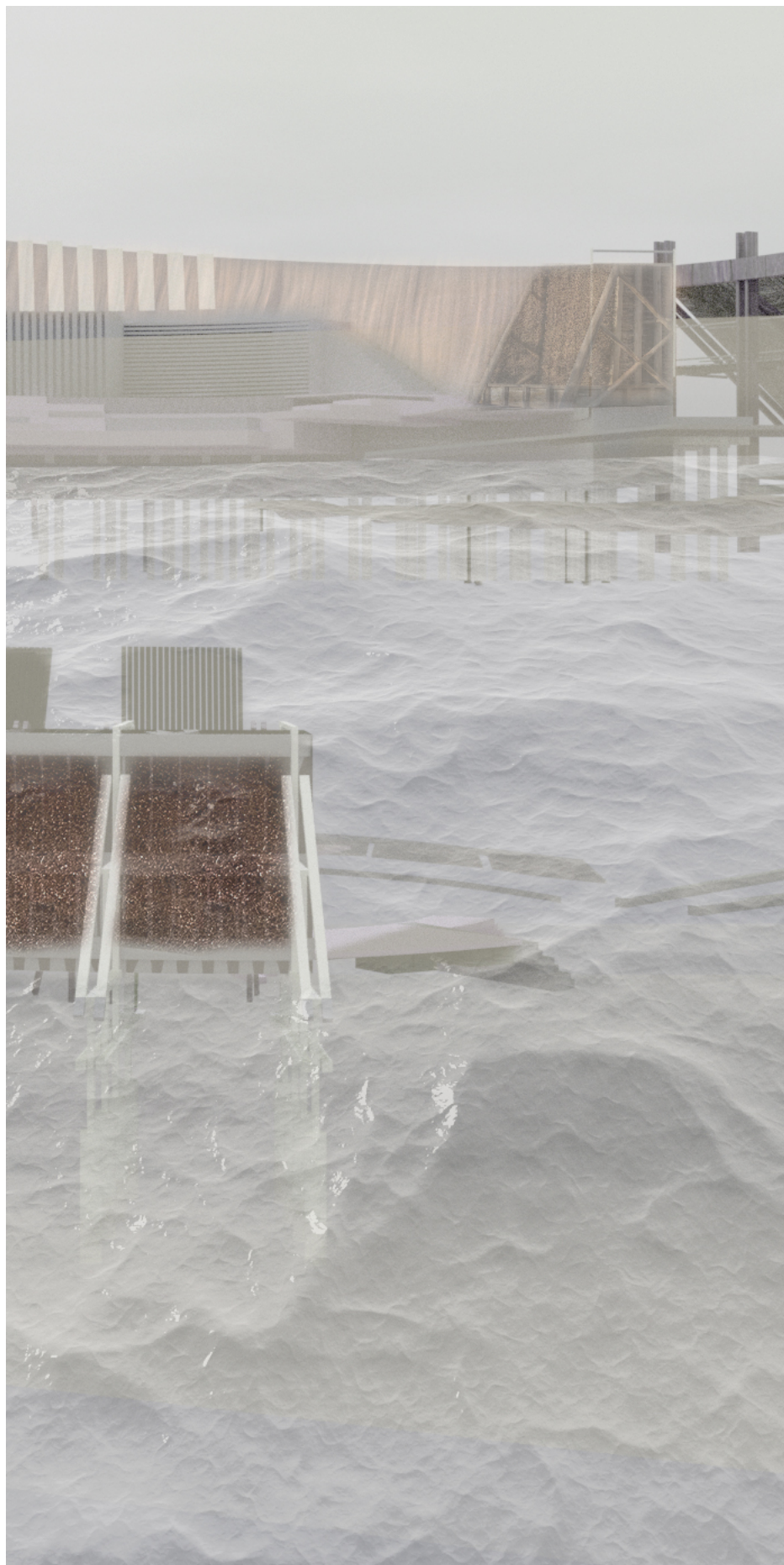
plan

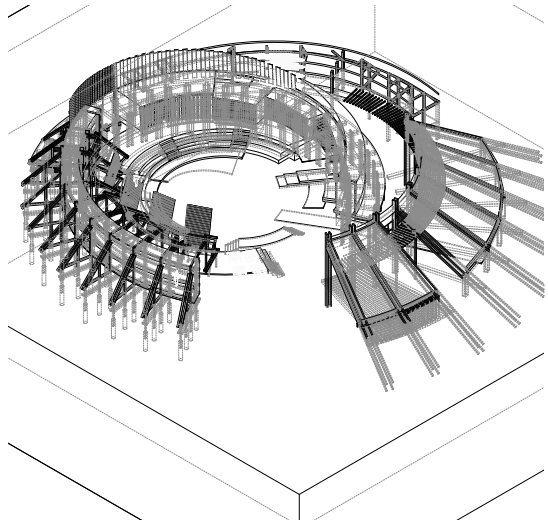
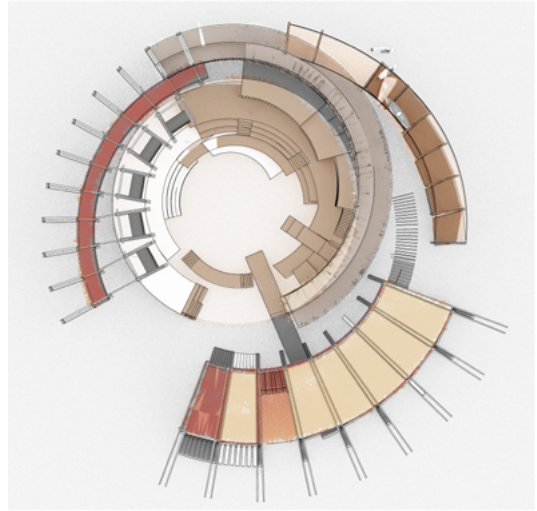
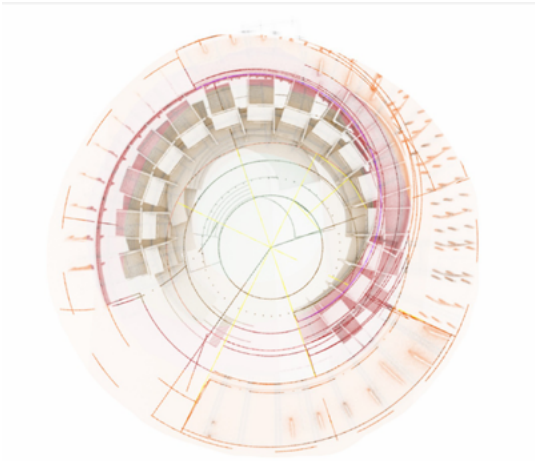




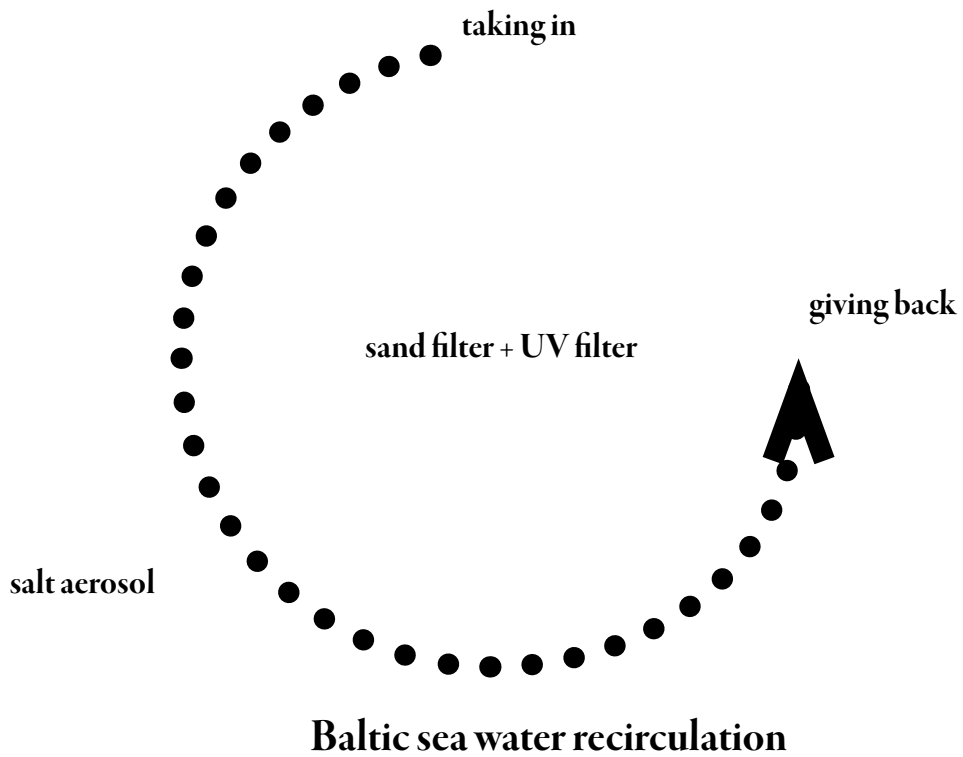
(fig.7.08) concept drawings

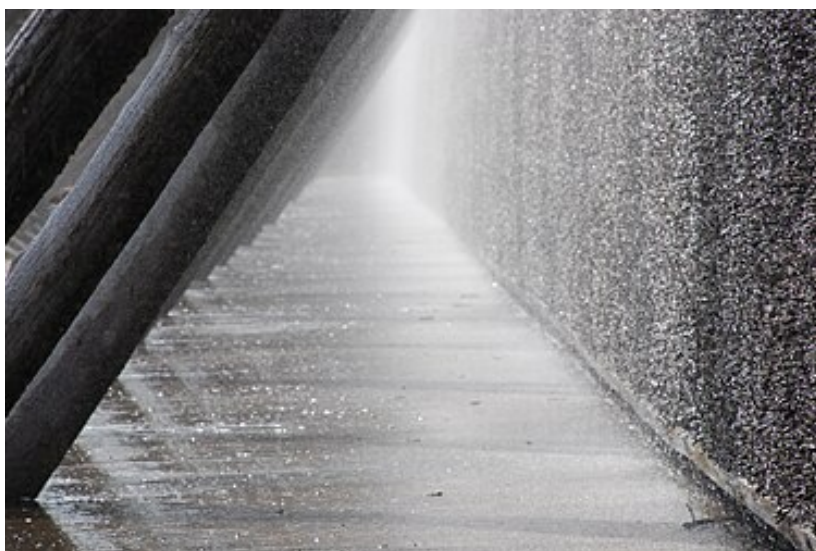
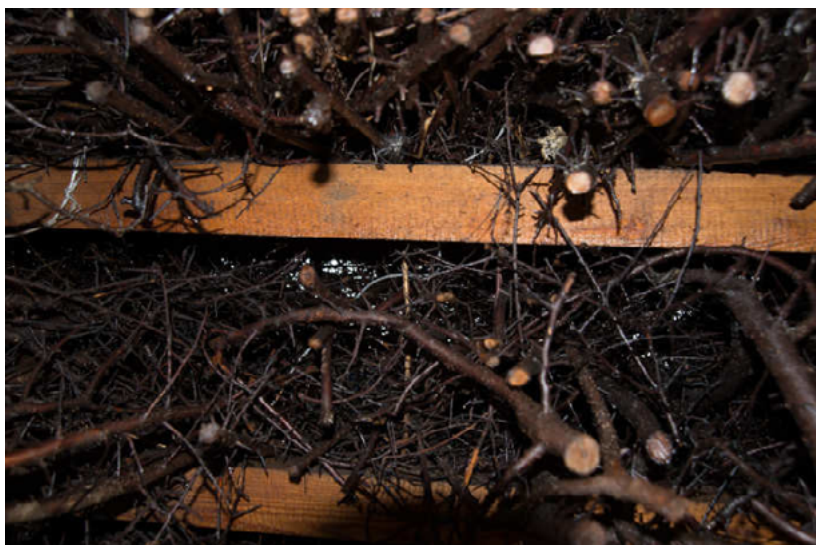
(fig.7.09) **three
salinity extraction
walls**





(fig.7.10) initial floor plans and axonometry | trials





The moment you pass through, feeling particles descend upon your skin, as if you can almost taste their saltiness.

salt aerosol | multisensorial experience

ecological technology | enclosed water cycle

(fig.7.12) the counterpart of
concept <polish - tężnia> salt
graduation “tower”



how to mimic the seaside environment? (example from Warsaw)



no need to mimicate, when you just can enhance the climate

what if it will be brought back to the site - Baltic Sea
ecological technology | tidal energy

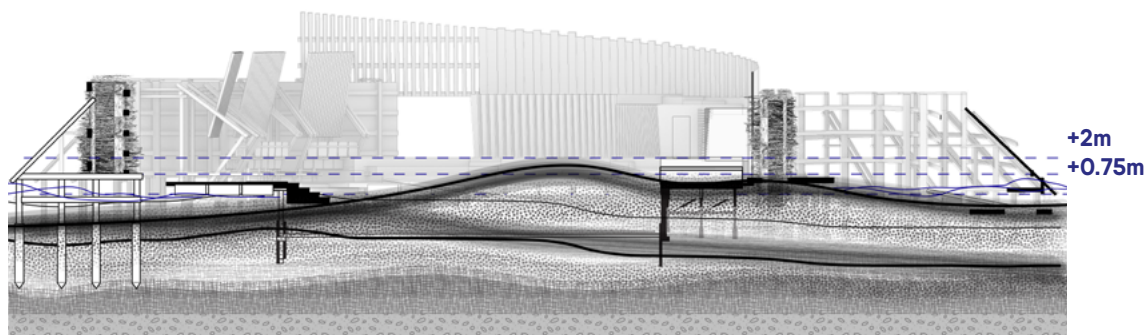
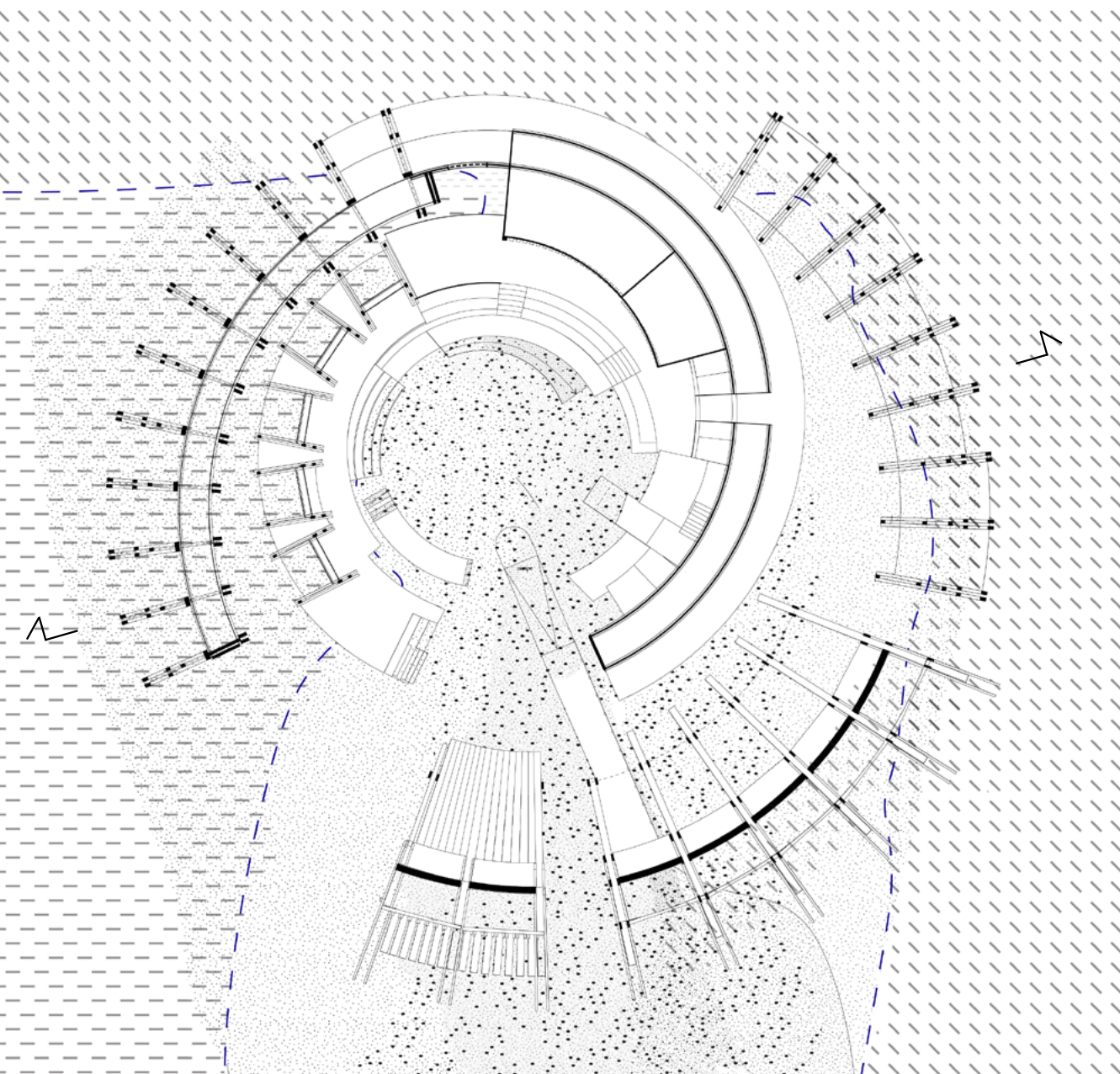


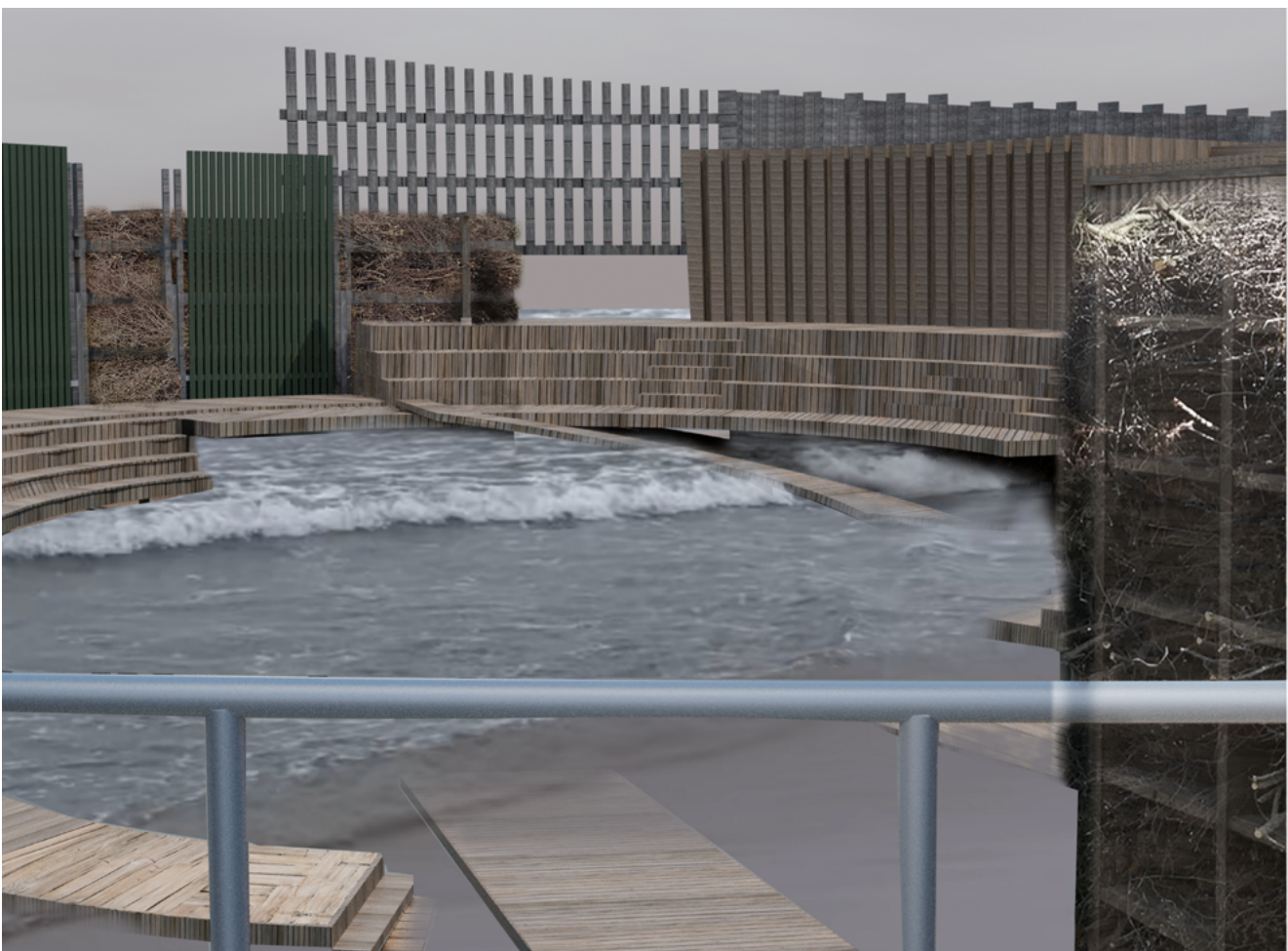
scenarios



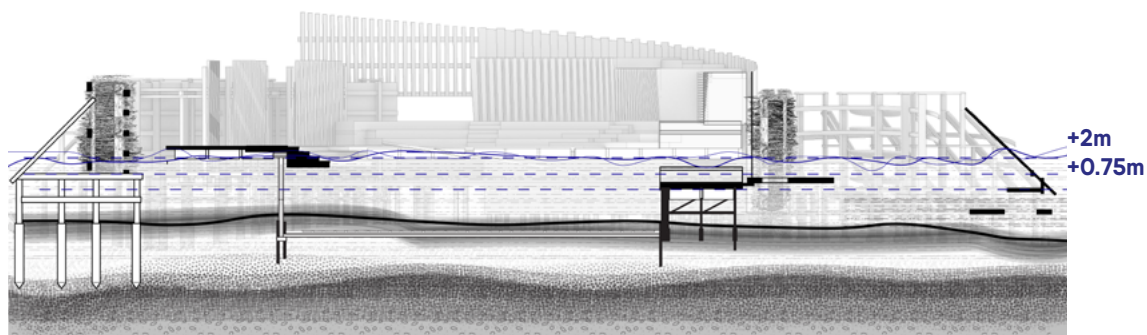
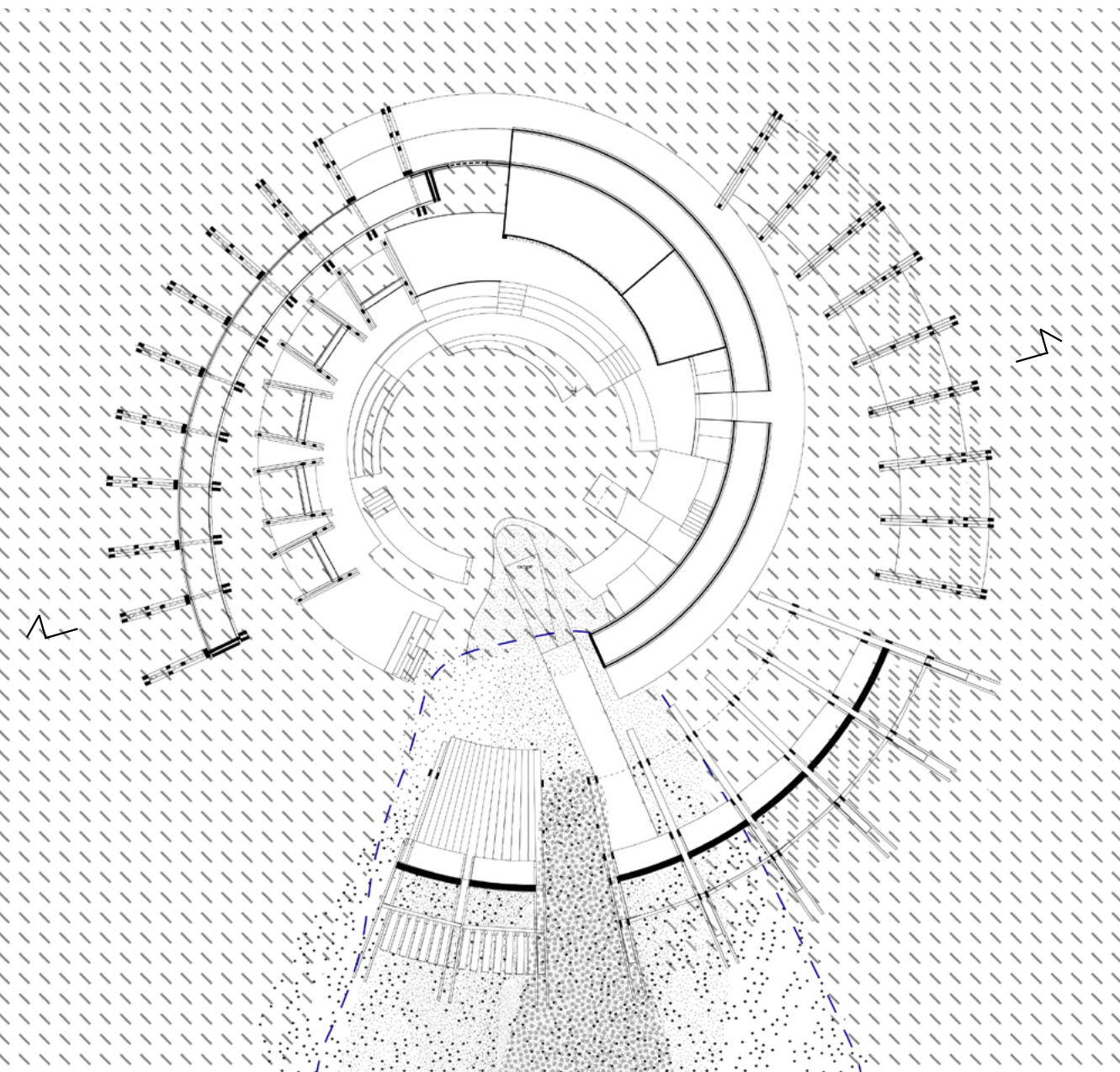


sand catcher, land overtaking



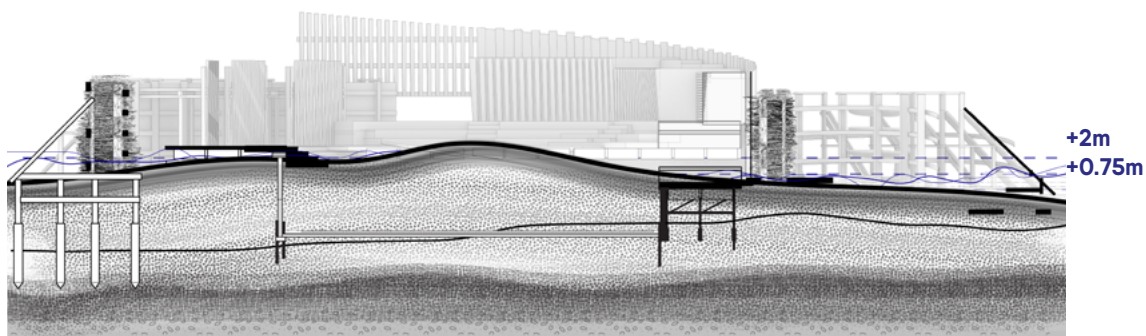
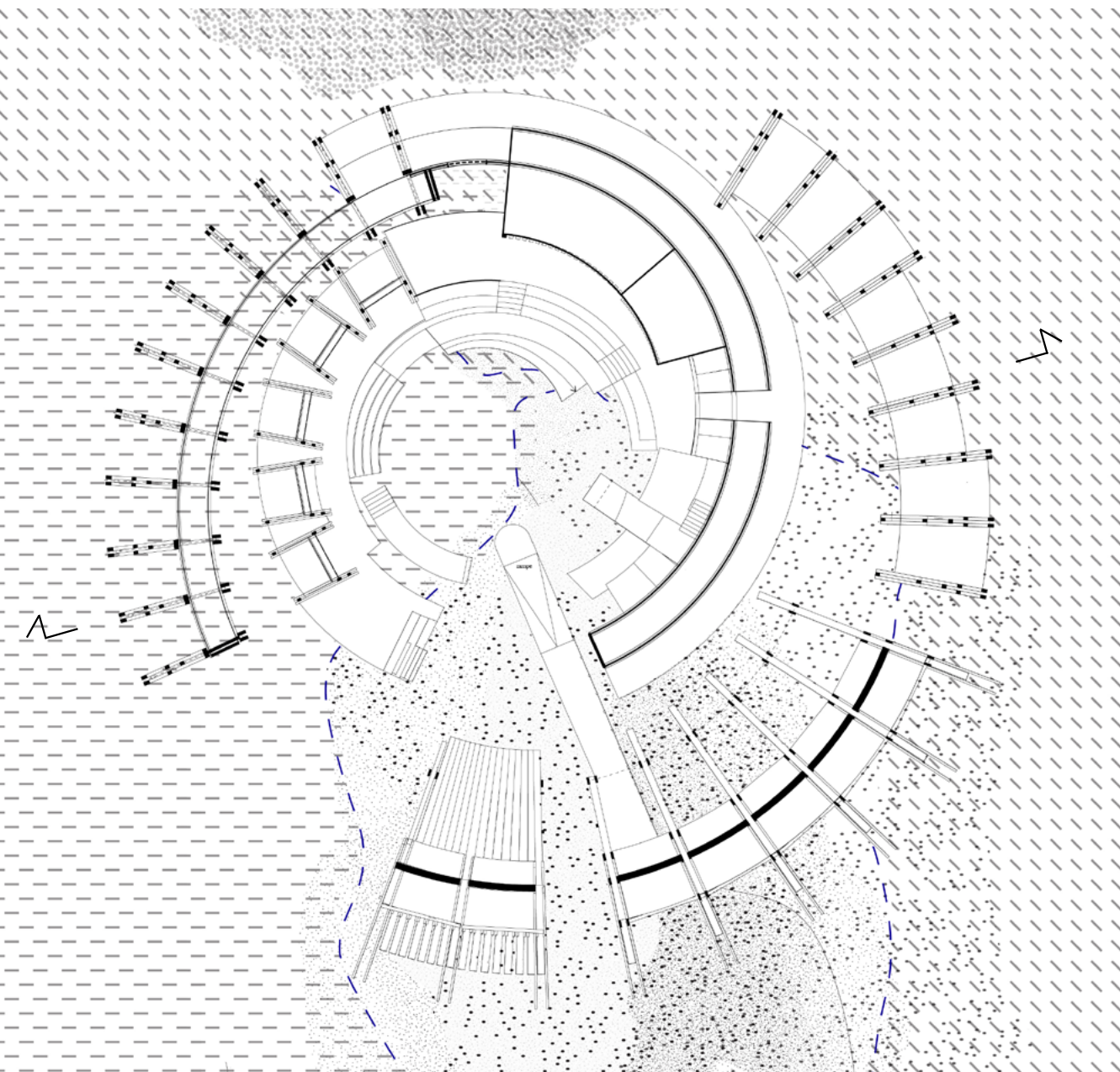


*the land stops before entering the structure
state in-between*



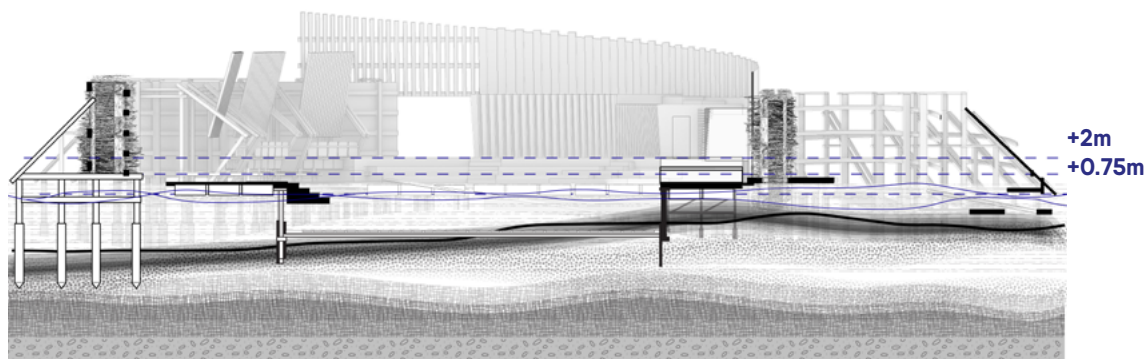
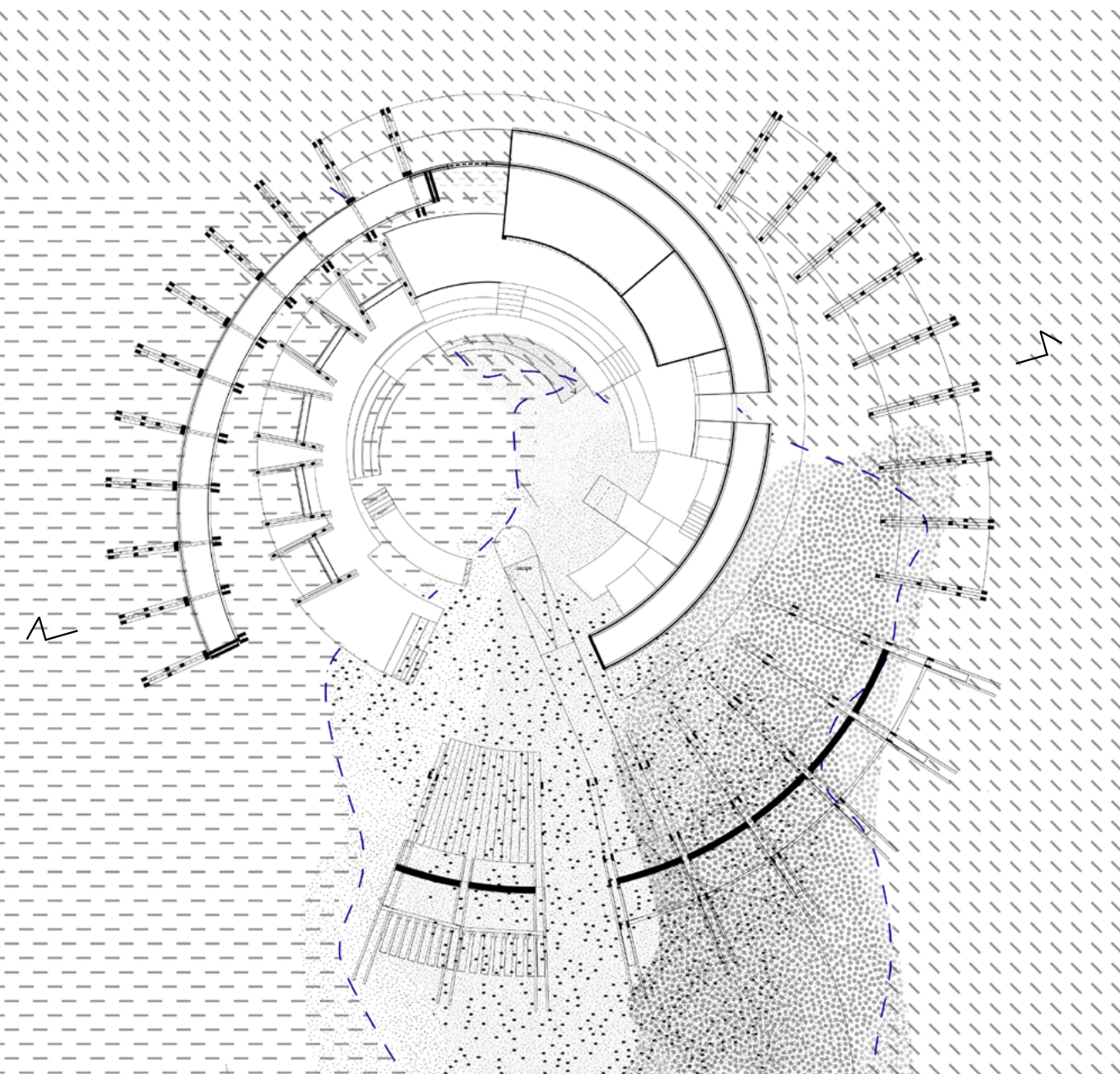


high tide



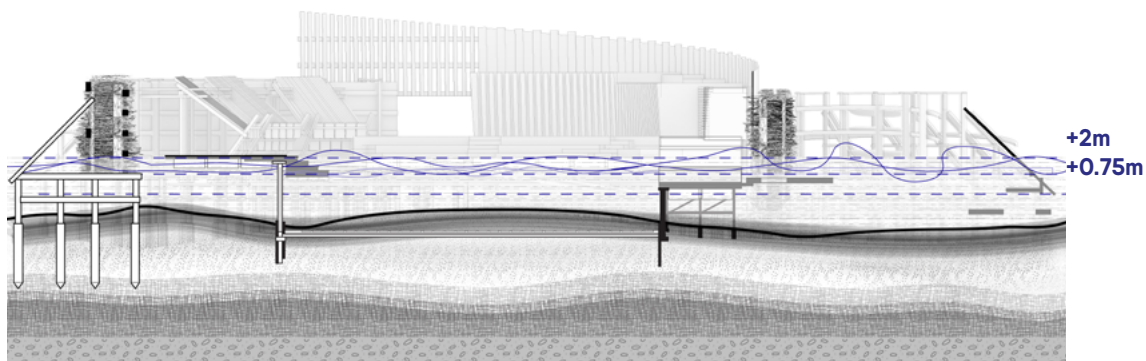
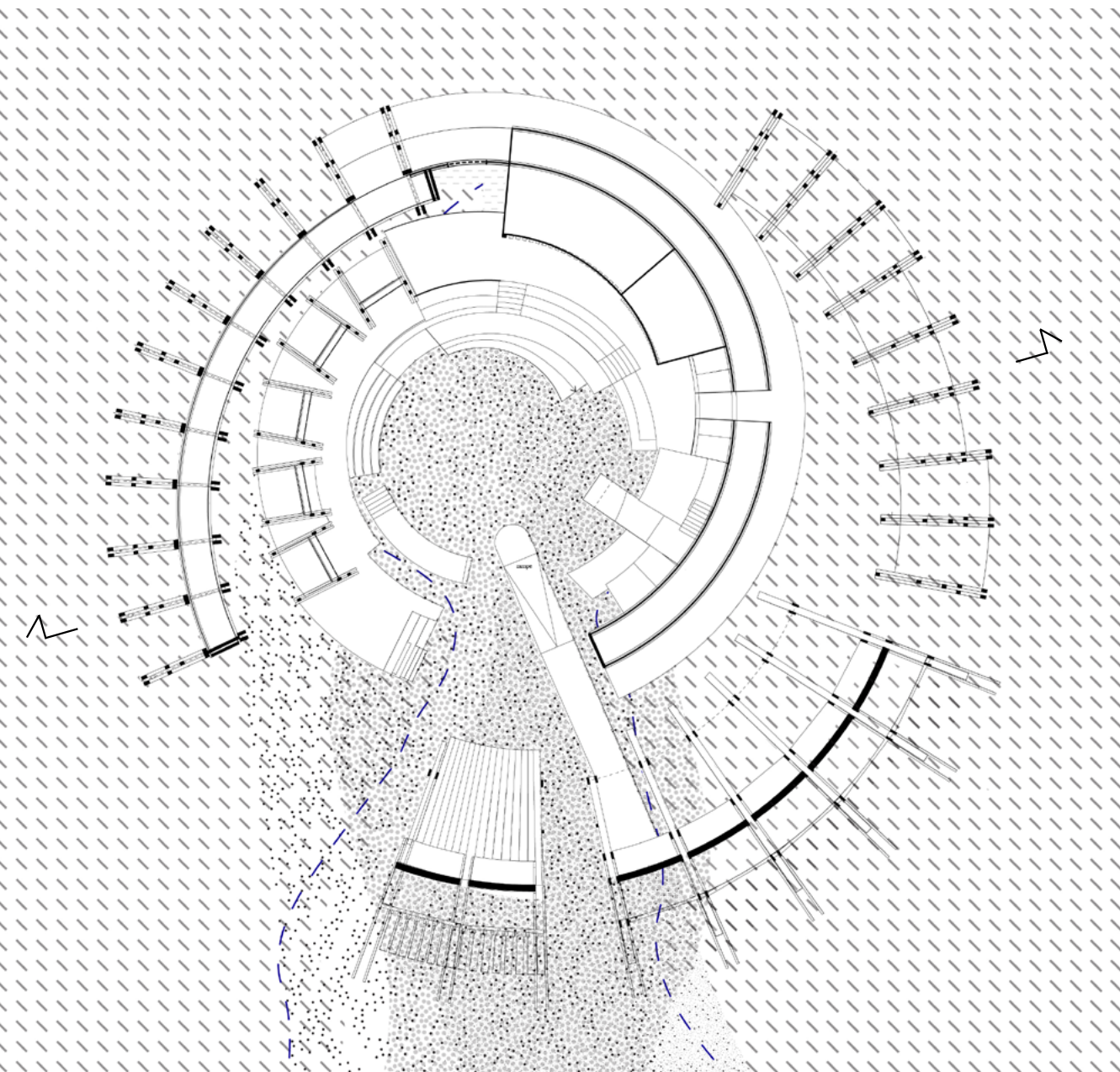


water retreat



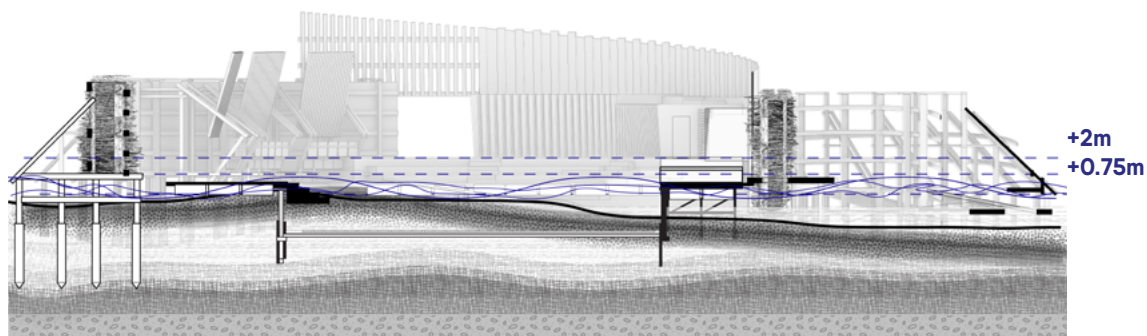
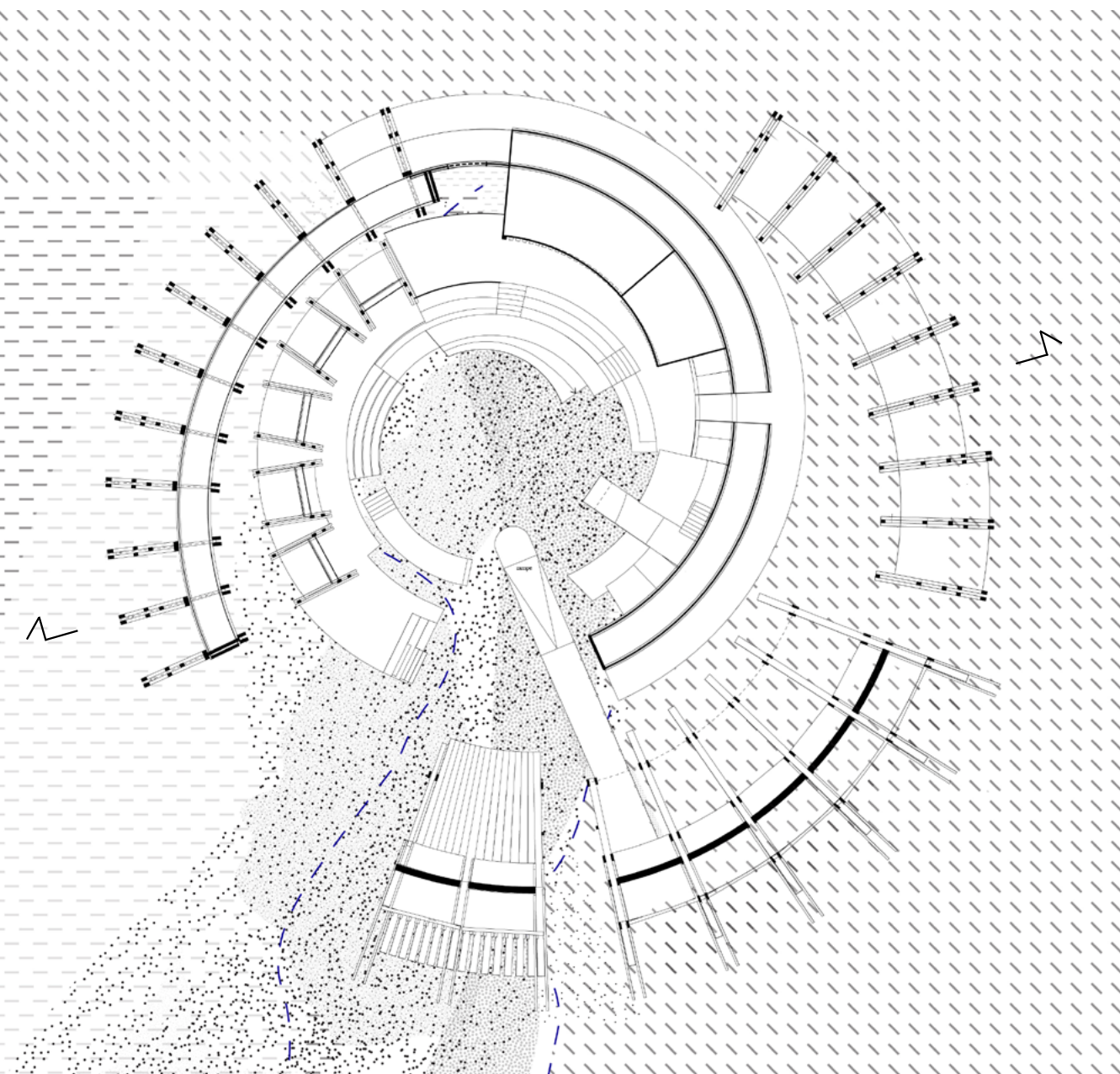


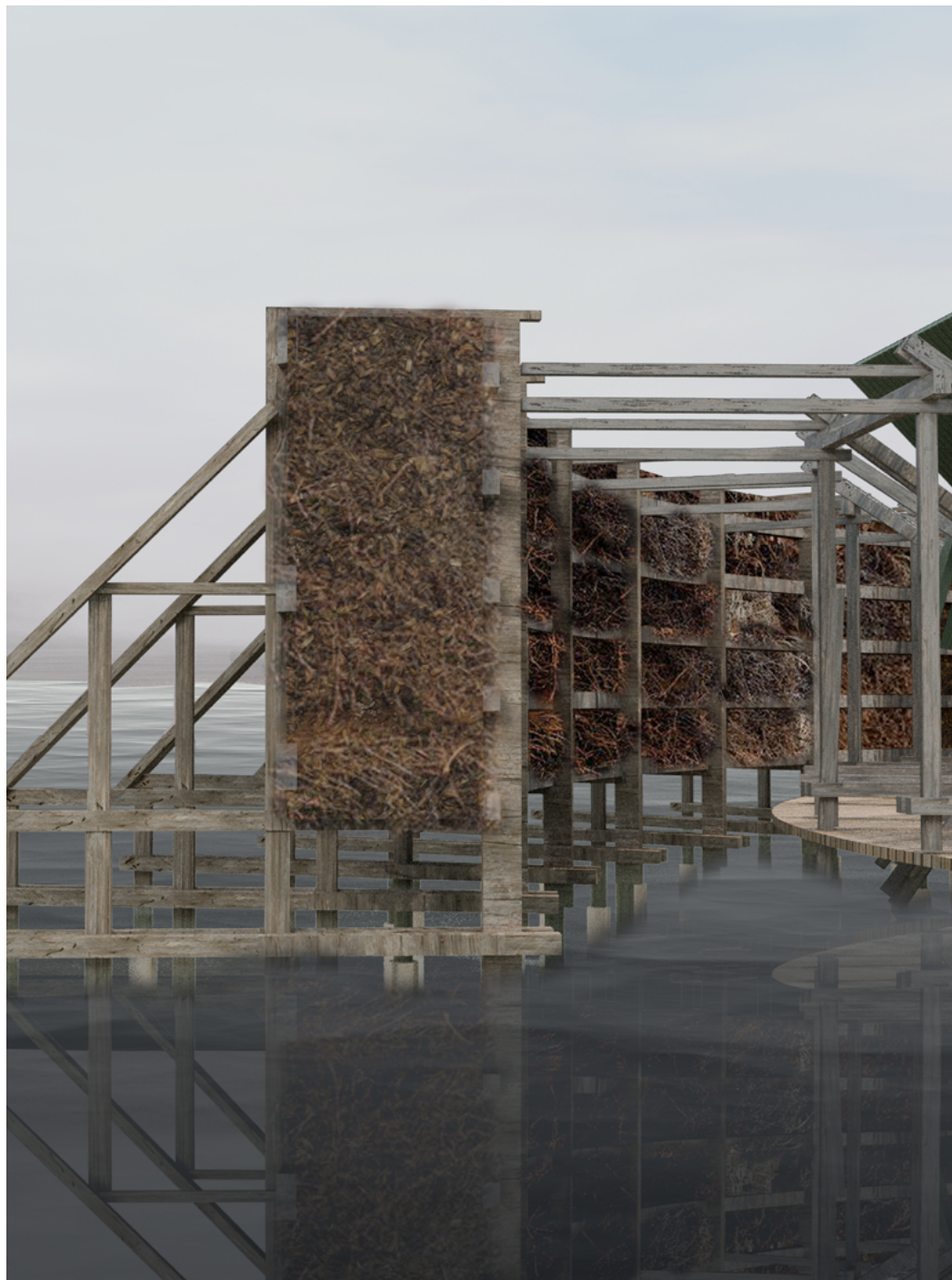
water overtaking



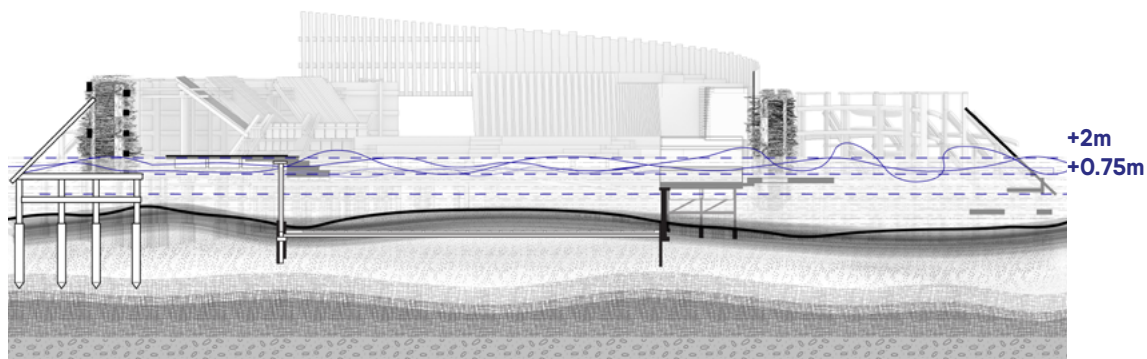
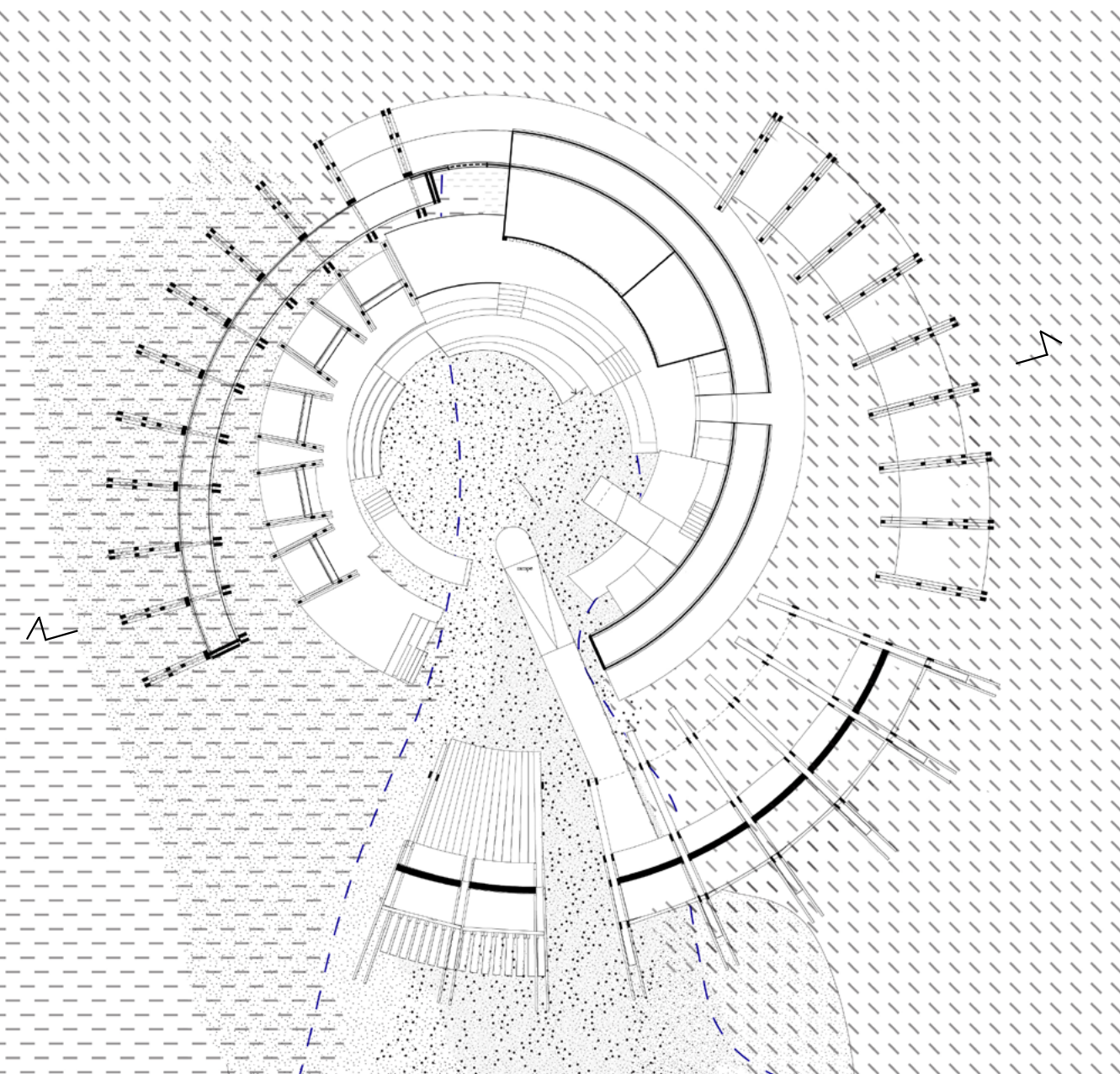


after storm



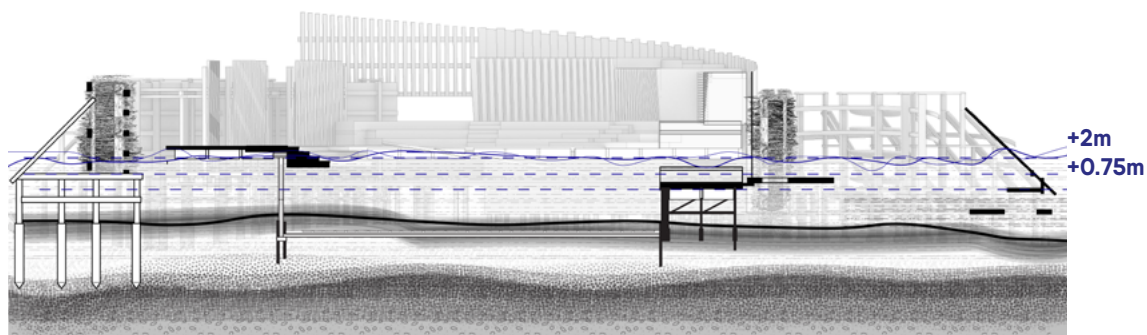
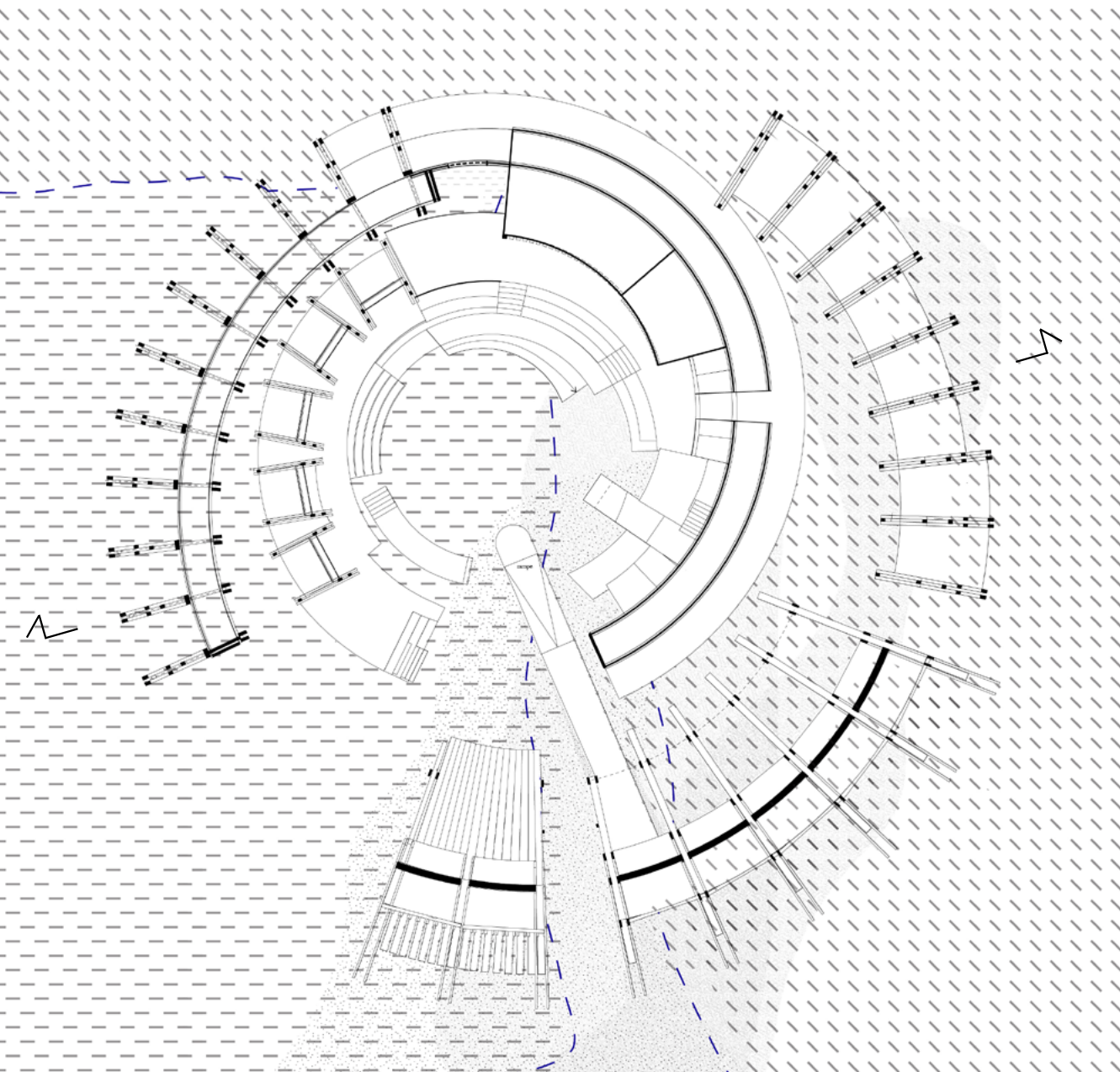


in-between is still walkable





start swimming now



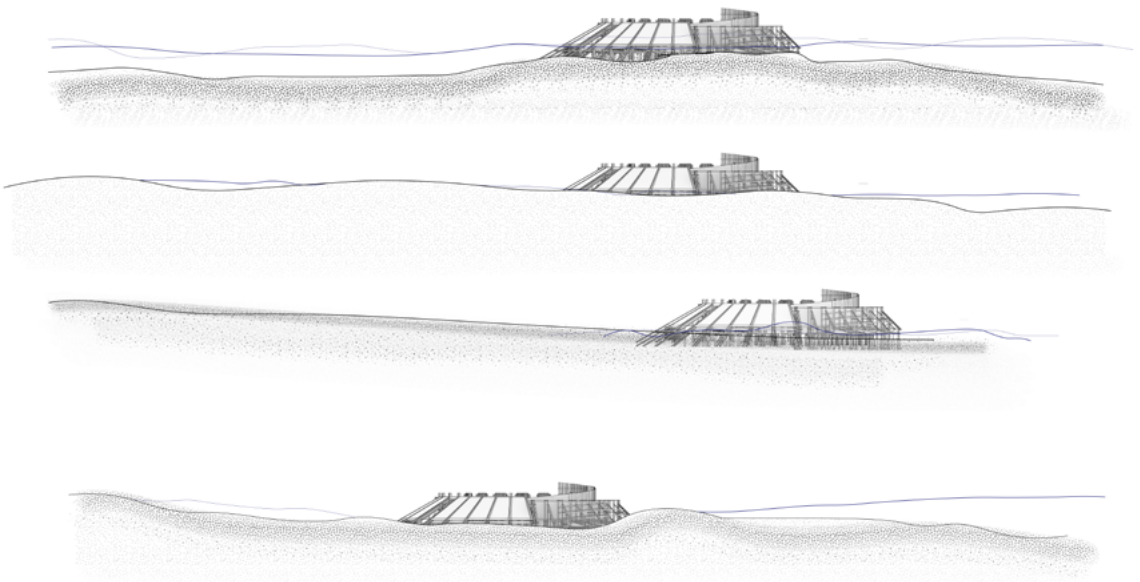


giving back the coast line for water sports



cadrage towards Torpedo Launch Station and coast

FROM FAR AWAY



(fig. 8.01) **sections through broader context**

FROM FAR AWAY



-206- *exposed | water retreat | spring | water temp. 5°C*



no influence



after storm



flooded | water level +2m | summer | water temp. 18 °C

FROM CLOSE



*there is no water
you're stepping on dry sand*



*level of water is very low
you're stepping on wet sand*

should I enter?



*level of water above your ankles
while entering you're slightly cold*



*level of water above your knees
to enter you have to swim*

What if the structure could naturally capture
ephemeral moments, even if only briefly?

While we're in search of change and
movement, everything outside undergoes
inevitable transformations during winter, yet
internally, the water ceases to remain in its
liquid state...

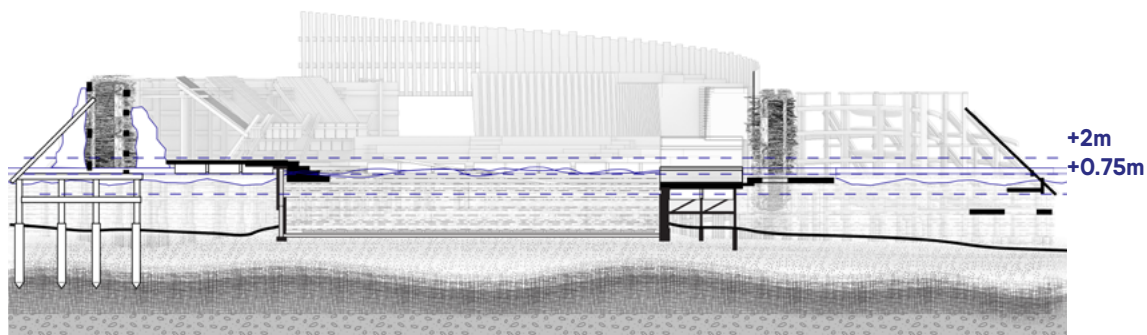
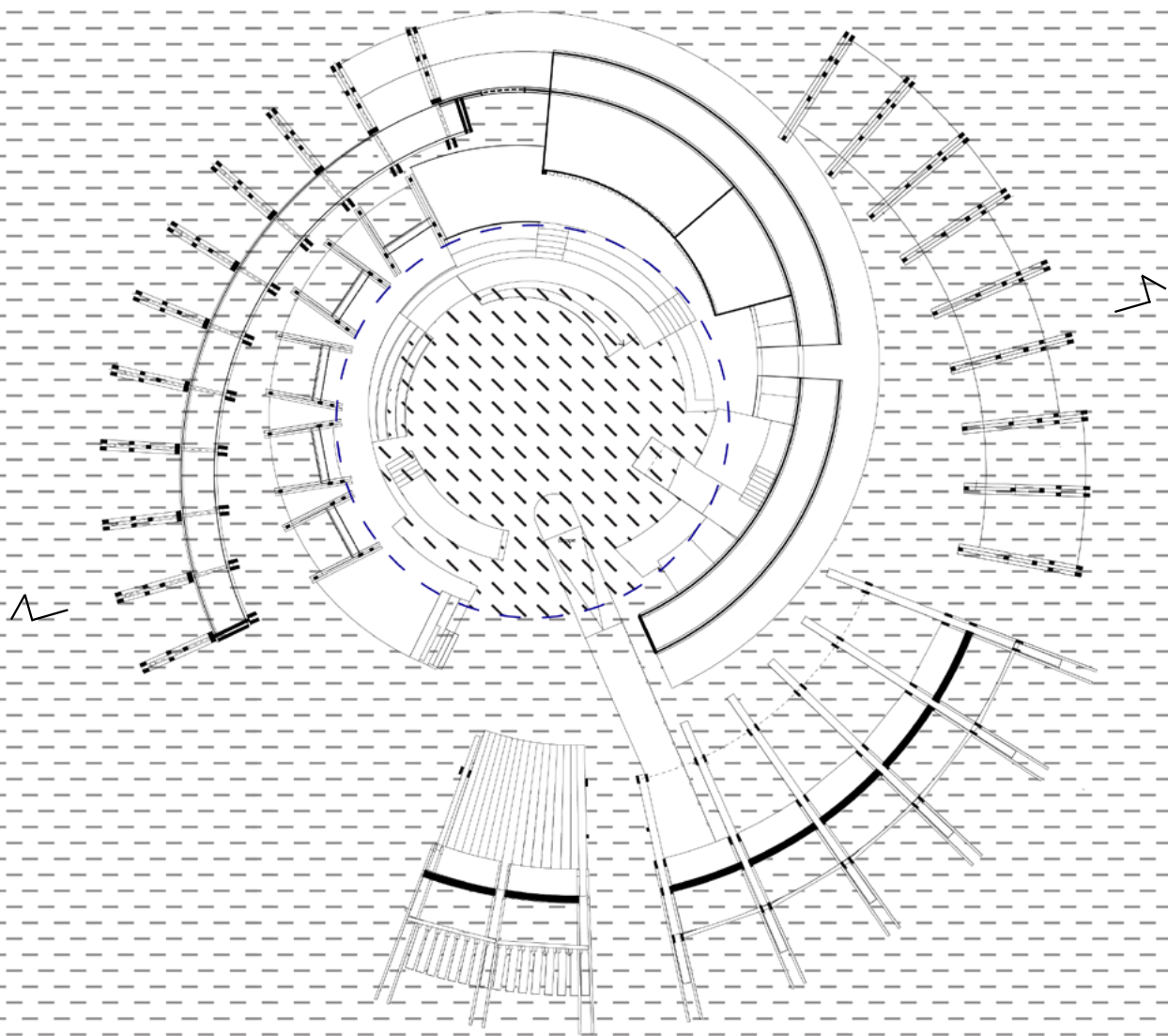
...SOMEDAY...

(fig. 8.02) **thermal inner plate on the
other side of the iodine extraction
wall | phenomenon happening twice
a year | collage**





*the land stops before entering the structure
state in-between*



acknowledgement

This thesis would not have come to fruition without support of numerous individuals over the past two years of my journey. To my my parents, for enabling me a future for me that is far beyond than I could have ever envisioned for myself. To my close friends and older brother, as a constant source of motivation, for a constant encouragement to bring my ideas to life.

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To all those who have contributed to this journey, your support and encouragement have been instrumental in the completion of this thesis. Thank you.

images

(fig.1.02) Strzelecki, M., Stachnik, Ł., Yde, J. C., & Małecki, J. (2023). Post-Little Ice Age glacial lake evolution in Svalbard: Inventory of lake changes and lake types. *Journal of Glaciology*, 69(277), 11. <https://doi.org/10.1017/jog.2023.34>

(fig.1.03) Google Earth. Sattelite Image of Europe. Access on 16.05.2024

(fig.1.04) Google Earth. Sattelite Image of Rewa. Access on 18.05.2024

(fig.1.05) The collage of photos by Szymon Nitka (<https://www.znajkraj.pl/>); access in 03.2024; created by the author

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(fig.6.08) naszbaltyk.com access: 22.03.2024

(fig.6.13) Valentina Marticorena Angela (2024): Fluidisation of sand beds is achieved through the suspension of its particles in a gas.

(fig. 7.12) <https://www.kopalnia.pl/kopalnia-wiedzy/budowa-tezni-solankowej-jak-wyglada-i-z-czego-sie-sklada-ihzx>

Note: The collages or other graphics are basing on mostly, drone, aerial photography provided by b_a_l_t_y_k - polish photographers: Agata Logiewa and Wojtek Radwański.
Graphics created by the author, unless the description states otherwise.

movies

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**The cover represents the photography of
reappearing land as of the end of March 2024
Site: Rewa, Poland**

*Only unfolding reveals the reappearing land's true state,
not implying the regular coast features.*

JUSTYNA MARIA
PAWELCZAK



