THE BOATYARD 2.0

BOOK 1

Master Thesis
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Ma4 Ark24
Spring 2016

Department of
Architecture,
Design &
Mediatechnology

Aalborg Universitet

READER'S GUIDE

Dear reader,

This is a guide for you on how to proceed. The thisis is divided in two parts. Part one represents the introduction and the analysis.
The second part includes design process, presentation and appendix.
I propose you to begin with part one and continue on to part two.
Enjoy.

- Julie Klok

To Signe, Martin, Ann, Helle, Lars and Jakob

THE BOATYARD 2.0

Master Thesis

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ABSTRACT

This master thesis outlines a design proposal for remodeling The Boatyard in Skive, Denmark. The site deals with flooding several times a year, which has made the ground porous and maneuvering with heavy vehicles and boats difficult.
The project investigates the possibilities for dealing with raising sea levels and explores how architecture might utilize water as a design parameter and alter the perception of floods from a natural disaster to a gesture.

CONTENT

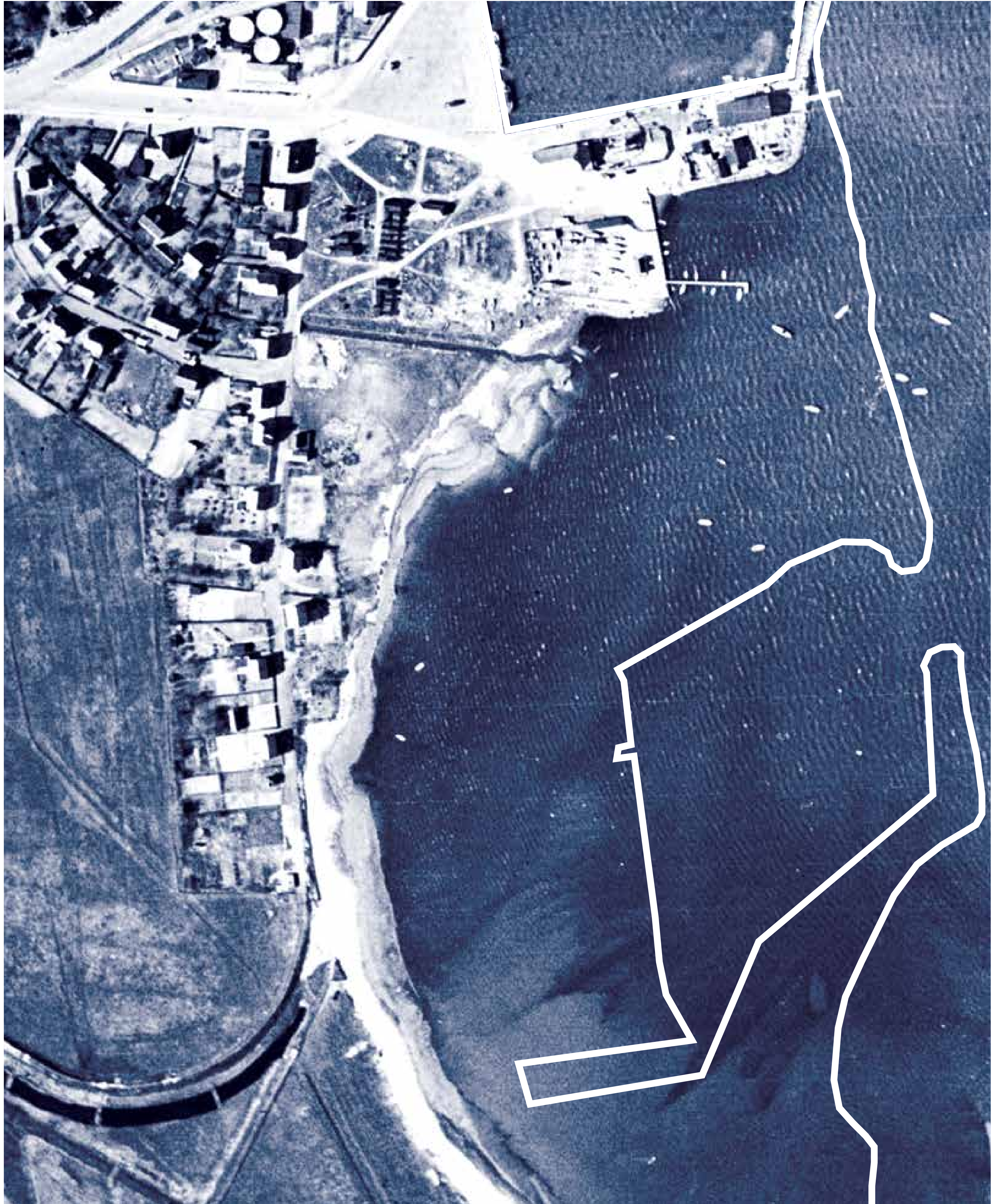
INTRODUCTION

INTRODUCTION

In the central part of Jutland, Denmark, in middle of the Limfjord lies Skive, a city of about 20.000 inhabitants. [www.statistikbanken.dk] The proximity to the fjord and the many fishermen, made the foundation for a boatyard. The first real boatyard opened around 1910, and in the course of the next hundred years six different boat builders and owners have run the boatyard. In 2004 the buildings were sold to Lars and Helle Klok, who in 2008 also took over the boat builder workshop, that until then had been rented and driven by the previous owner.

In 1933, at the time, boat builder Povl Petersen, founded Skive Sail club, it all began with thirteen boats at the dock outside the boat builder workshop. In the late 1960's a part of the Fjord, south of the sail club and former boatyard, was filled with fjord bed, probably from digging a channel for lager vessels to sail in. Soon after a smaller harbor was build in the new landscape and The Boatyard moved. The original idea was to place a marina for the sail club; they however got a site further north that have shown to be a perfect place for a marina. [Carlo Jansson, 1993:56]

Over the course of the years The Boatyard has been rebuild and expanded several times, due to a fire in the 1990's and flooding several times over the years, thus gives The Boatyard an architectural chaos. The Boatyard 2.0 is a project that will seek to change this characteristic and will work with the Fjord.



◂8.1 Skive Sail Club 1936
9.1 Skive Fjord before infill ▸

MOTIVATION

Springtime at the boatyard; the soundscape is a mixture of power tools, hammering, and scraping. Boat owners walking around in overalls with antifouling covered faces and hands, asking about a boat thingy that you never have seen before, knowledge are shared and stories from the world seas are told – That is the atmosphere of the boatyard. As the summer comes closer the life slowly moves toward the water, boats are launched in the water, and there's a life at the dock, the whole place ooze of coziness.
The little space between the sheds becomes the frame for many evenings with grilling and people having a good time together.

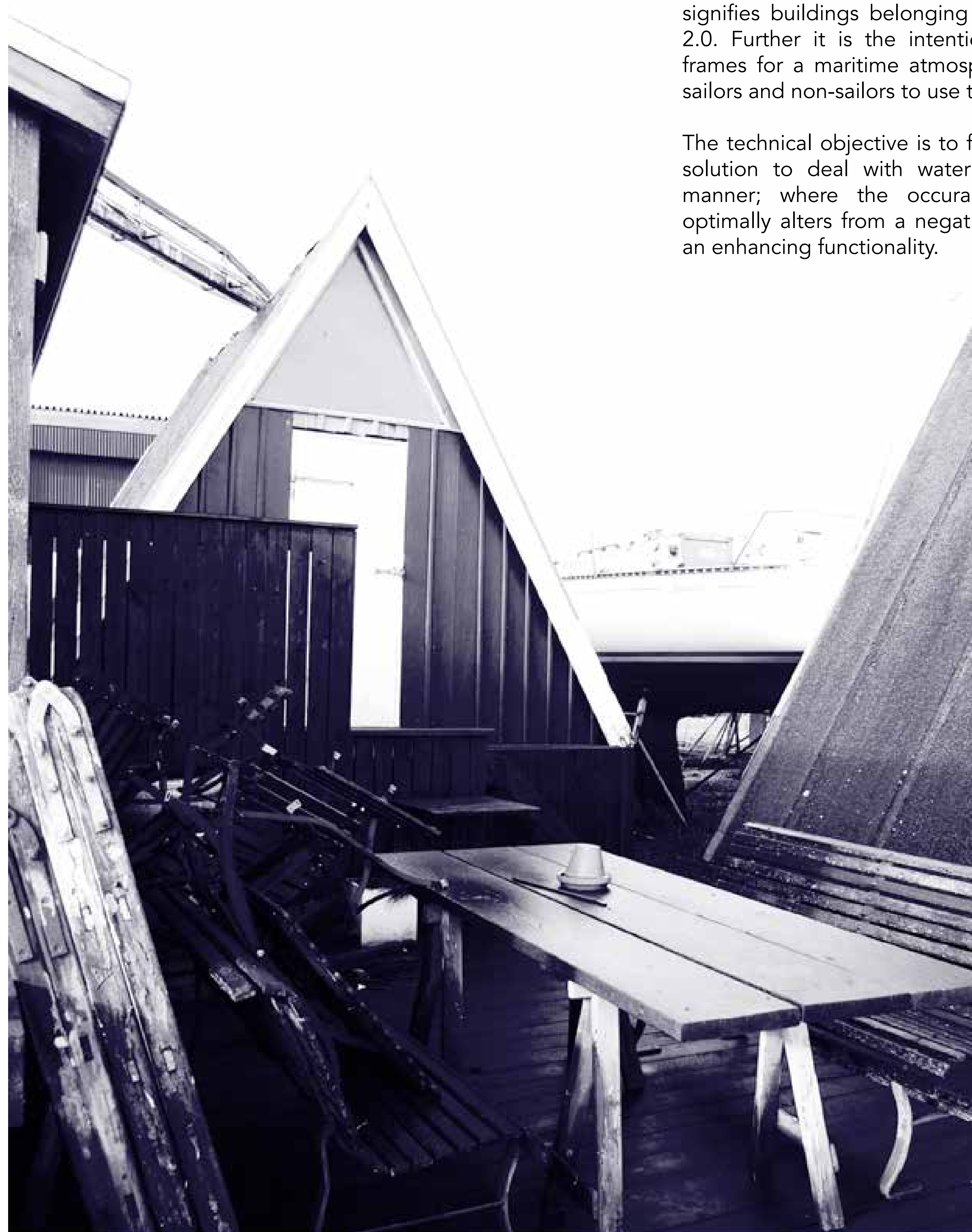
As a sailor and the daughter of the boatyard owners, this project lies very close to my heart. Experiencing the high water level several times a year makes me wonder that there must be ways to cooperate with the water instead of shutting everything down and wait for the water to lower again.
In 2015 the storm Egon left more damage than ever. The many previous flooding's had left the ground porous and the water undermined the wall protecting the shop and the workshop facilities and caused damage on machines and materiel.
It is a fact that the water levels are expected to increase in the future and risk for flooding will become more frequent, thus a solution is needed that minimizes flooding preparations and lost work [Skive Kommune 2014]

Is it possible to design an integrated solution for utilizing water as a design parameter, that secures a functional workspace even during storms and high tide?

OBJECTIVES

The architectural objective is to create a coherent boatyard that unifies the buildings, and visually signifies buildings belonging to The Boatyard 2.0. Further it is the intention to create the frames for a maritime atmosphere that invites sailors and non-sailors to use the site.

The technical objective is to find an integrated solution to deal with water in an including manner; where the occurance of a flood optimally alters from a negative experience to an enhancing functionality.



◂11.1 Atmosphere by the water

METHODOLOGY

The methodical approach to this thesis project forms the base for the execution of the project. The overall methodology applied to the thesis project is the Integrated Design Process in Problem-Based Learning defined by Mary-Ann Knudstrup. [Knudstrup, 2004:1]
The method links knowledge from architectural- as well as engineering fields, ensuring an integrated building process. Thus achieving competencies in design, functionality and aesthetics as well as competences in technical solutions. By using the Integrated Design Process, the professional knowledge of architecture and engineering is integrated and optimized. Combined with Problem-Based Learning, the philosophy of Aalborg University, the project evolves from a definition of a problem and works toward an integrated solution.
This method is applied to the Architecture & Design education at Aalborg University. [Knudstrup, 2004:3] [Knudstrup, 2005:895]

The Integrated Design Process is a complex process, which consists of five phases; five iterative loops that ensure a process where technical as well as aesthetic aspects are addressed. Other methods are applied throughout the process to reach knowledge and solve the problem statement. The five phases as well as secondary methods are described below:

Problem formulation/ project idea

A problem statement is formulated with basis in the motivation. The motivation for the project derives from a personal interest, experiences and wonders about a boatyard and its challenges together with preliminary studies of water levels in the future; forming the base for the problem statement. The problem statement leads to the following phase – the analysis phase. [Knudstrup, 2004:3] [Knudstrup, 2005:895]

Analysis phase

In the analysis phase several methods are applied. To set the framework for the project theoretical studies and both phenomenological and literary case studies, are made.
Initial design parameters are pointed out, for the purpose of having a design focus in the sketching phase. A program is formed on the basis of a brief, stating visions for the site and ends in a room program, thus will frame the base of the project. [Knudstrup, 2004:3]
The analysis phase further includes studies of the site pointing out special qualities of the site and the sense of place; the genius loci, by registrations of the surrounding area and incorporates several mappings; diagrammatic mappings together with photo registrations and user profile, also indicating themes to be addressed in the sketching phase. The analysis phase ends with a vision for the project.
[Knudstrup, 2004:3] [Knudstrup, 2005:895]

Sketching phase

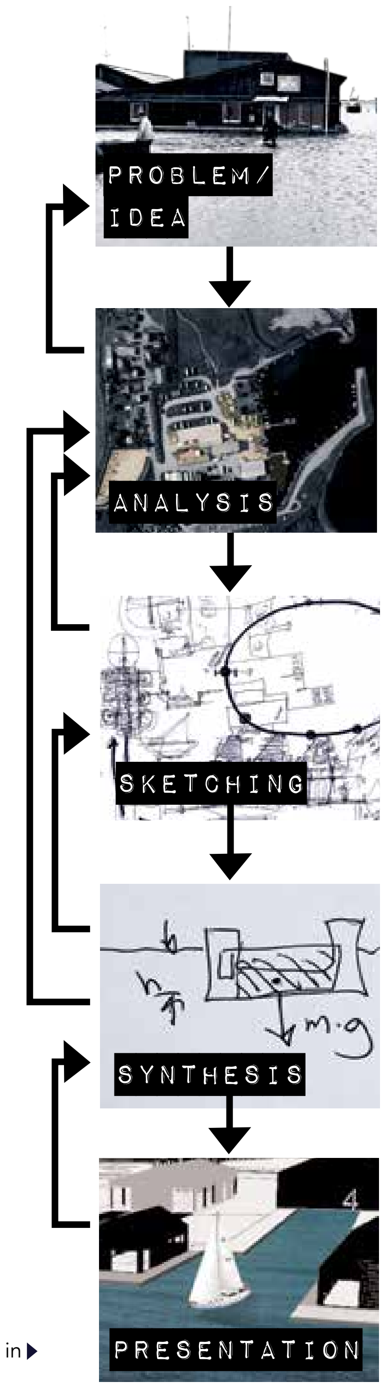
Architectural ideas are tested, developed and linked together with technical aspects to solve the problem statement. A variety of tools and methods are applied such as sketching on tracing paper, model building, together with digital tools more related to technical experiments and tests of a design; that being simulation of the construction as a parametric model. Tests of different parameters can be executed to develop the design. Architectural representations as plans, sections, perspective and details are further used to investigate the design in a site-specific context. [Knudstrup, 2004:3] [Knudstrup, 2005:895]

Synthesis phase

The qualities and results found in the previous phase are in the synthesis phase tied together and new qualities may be added to form the final result and thus meeting the demands set forth in the aims and program. Methodically that means to digitally refine the drawings and thus have a precise representation of the design together with the last iterations of optimizing the parametric model of the construction. [Knudstrup, 2004:3] [Knudstrup, 2005:895]

Presentation phase

The final result is presented in a various architectural means, showing the process as well as the atmosphere of the final result. This is shown in a report, physical models, drawings, digital models and a poster. [Knudstrup, 2004:3] [Knudstrup, 2005:895]



13.1 Diagram: Integrated Design Process in Problem-Based Learning

ANALYSIS

FRAMEWORK

"The material, detail and structure of a building is an absolute condition. Architecture's potential is to deliver authentic meanings in what we see, touch and smell; the tectonic is ultimately central to what we feel" Steven Holl [https://mitpress.mit.edu]

This quote initiates the framework of tectonic in architecture for this master thesis. The section will immerse in the origin of the term tectonic and further try to understand the importance of detail and juxtapose theory with examples of the works of architects to enhance the understanding. The section will end with thoughts on atmosphere and its role in architecture. The tectonic framework will be utilized in the design process as the base for creating tectonic architecture.

Why study theory of tectonic architecture? As Steven Holl points out in the quote above, material, detail and structure are parts of a whole that unifies as tectonic architecture.
In the crafting of a boat, the importance of detail, material and structure is crucial for the boats ability to sail and stay afloat; A boat is the perfect example of what tectonic is and seems to be relevant when redesigning a boatyard. The architecture should reflect the production outcome from within and thereby achieve the credibility to the work produced at the boatyard.

ON TECTONIC IN ARCHITECTURE

Tectonic has been widely discussed among architectural theorists for the past century.
The architect, Ware Professor of Architecture at Columbia University, architectural historian and critic, Kenneth Frampton argues that the tectonic does not necessarily favor any particular style, but favors site and type, and serve to counter the tendency for architecture to derive its acceptability from some other discourse. [Frampton 1995:2] Between 1843 and 1852, architect Karl Bötticher, published works defining tectonic as a distinguishing between Kernform and Kunstform, the structural and the representational. [Frampton 1995:4][Foged 2014:139]

Die Vier Elemente der Baukunst published in 1851 by Gottfried Semper, architect and architectural historian, elaborated on Bötticher's theory. Additionally his theory was based on a Caribbean Hut he had seen in the Great exhibition in 1851, the primitive dwelling was divided into the four basic elements;

1) Earthwork
2) The hearth
3) The framework/roof and
4) The lightweight enclosing membrane.

Semper notes that *according to how different human societies developed under the various influences of climate, natural surroundings, social relations and different racial dispositions, the combination in which the four elements of architecture were arranged also had to change.* [Semper, 1851:103] So by looking back to the primitive cultures he derives the four elements of architecture.

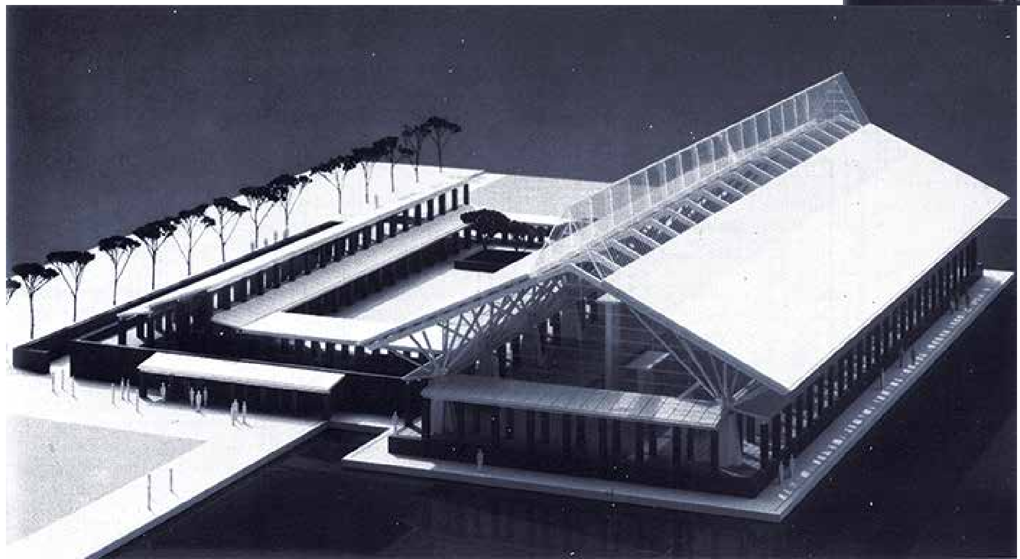
The framework will continue with dissecting the different elements of tectonic architecture that makes a whole.

Study of A tectonic Case

Tectonic architecture is signified by its ability to become a whole; tectonic architecture is honest, often signified in clear structural principles and its relation to the site. As for example in the case of Jørn Utzon's unrealized project, the public swimming pool at the Peblinge Lake in Copenhagen from 1979. The structural system is very easy read as the columns tree like structure is exposed. As in many of Utzon's projects this project also reads the site and combines site and function. By placing the swimming pool in the water enclosed by the building, with a framed view, it is in harmony with the lake just outside. Utzons inspiration in nature is in this project very clear. Additionally is the inspiration from the architecture of China and Japan, including basic elements from Chinese garden design such as; vegetation; a tree placed in the enclosed courtyard, water; the swimming pool. [Rogers E.B. 2001:282-299]

If the project was realized, probably more similarities could be found.
Entering an enclosed courtyard letting the visitor step out of the busy capitol of Copenhagen into the silence of the courtyard. The courtyard smoothly creates the transition from noisy city life to the tranquility and recreational act of swimming. The building further transitions from an enclosing wall to framed views, leaving out the city and letting in the nature.

Aligning the Peblinge Lake project with Bötticher's interpretation of the term tectonic. Saying that tectonic is a complete system binding all parts of a Greek temple into a single whole including the relief sculptures, [Frampton 1995:4] inspires to work with the site of The Boatyard by perceiving both architecture and landscape as a whole. Thus let the project become tectonic.



▲ 17.1 Model photo: Peblige Lake Proposal, structure
◀ 17.2 Model photo: Peblige Lake Proposal, courtyard

Thoughts On Atmosphere

"We perceive atmosphere through our emotional sensibility – a form of perception that works incredibly quickly, and which we humans evidently need to survive." [Zumpthor 2006:13]

This is how architect Peter Zumpthor writes in his book *Atmospheres*, where he creates the image of atmosphere through nine elements, evidently of what moves us – of what creates atmosphere.

Atmosphere is about experiencing architecture, which is different from person to person from time to time, but is also an important factor for creating good architecture. Good atmosphere comes with the life that moves into, in and out of the buildings and is created in between and inside the buildings. What the architect can do is to create gestures that invites to life and interaction with the architecture, as well as analyze which materials invites people to stay, thus help architecture become attractive. In architect and professor Steen Eiler Rasmussen's book

Experiencing Architecture he asks:

"Can you hear architecture? Most would immediately think: architecture creates no sound therefore you cannot hear it. But it dose not either create any light and yet you can see it."[Rasmussen 1957:227]

He is uttering the factor that to experience architecture all senses are used; the senses register the space and relate to light, acoustics and materials and the result is the atmosphere.

"We are connected with the world through our senses. The senses are not merely passive receptors of stimuli, and the body is not only a point of viewing the world from a central perspective. Neither is the head the sole locus of cognitive thinking, as our senses and entire bodily being directly structure, produce and store silent existential knowledge. The human body is a knowing entity. Our being in the world is a sensuous and embodied mode of being, and this very sense of being is the ground of existential knowledge." [Pallasmaa 2009:13]

Zumpthor, Rasmussen and Pallasmaa agrees that we experience architecture through our senses and thus we experience atmosphere. That leads me to wonder; what is it that provides the boatyard its certain identity, the certain atmosphere that seems to be present and what many of the users often expresses? To me, it is the visual footprints that shows humanly interaction with the site, buildings and nature. The pieces of wood left to be worn by the weather, it is the old paint bucket that somebody forgot, the two old beer cases turned upside down, covered with a piece of wood; indicating that somebody was in need for a place to sit. It is the things that shows people are present, but not only is it the things people leave behind, it is in combination with the buildings, the boats, the nature, the sounds, the smells and the light. It is the temporary arrangements of objects that makes the exact space unique.

▲ 19.1 Photo: Atmosphere at The Boatyard
19.2 Photo: People by the pier ▶

20.1 Photo: Detail, Storefront for Art & Architecture
21.1 Photo: Facade, Storefront for Art & Architecture

On The Importance of a Detail

Atmosphere and tectonic is about 'Gesture' and 'Principle'. Atmosphere is the emotional perception of a space or a place, it is about how to perceive those gestures the space or place gives. Tectonic is the principle that creates that space and the detail is the link between the two.

Utilizing the method Analyzing Through Scale, a detail is analyzed in a case study. The method is developed by Marie Frier Hvejsel in her PhD thesis; *INTERIORITY – A critical theory of domestic architecture*. The method applies five aspects to analyze the chosen detail: *Realm, Function, Emotion, Construct and Principle* [Hvejsel 2010:84]
The aim for the case study is to analyze a detail in existing architecture and achieve an understanding of the architectural whole. [Klok 2013:1]

"By zooming in and utilizing the furniture scale as a critical developer it is the intention to foster a detailed view at architecture in general; an understanding of the fact that the smallest of details are decisive to our sensuous experiences of our surroundings, even in large-scale urban structures." [Hvejsel 2014:14]

The case studied is the facade of Storefront for Art & architecture in New York. The case study analyzes the detail's 'Gesture' and 'Principle', as well as discussing the theory of Kenneth Frampton [Frampton 1995] and addresses arguments on the detail; pointed out by Marco Frascari architect and architectural theorist. [Frascari 1984]
The theory is supported by statements from an interview with architect Steven Holl and artist Vito Acconci, [The Architecture Foundation, 2009] readings about the project and lastly analyzed with own observations and drawings.

Analyzing through scale

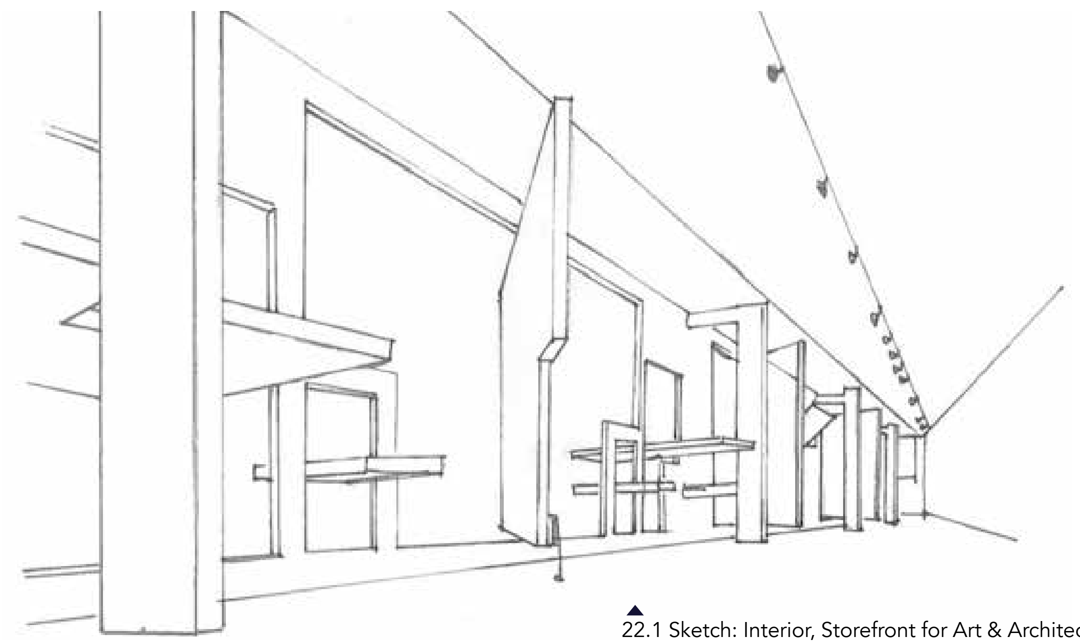
The thirteen meter long façade of Storefront for Art & Architecture, a gallery space in Manhattan, New York, is the result of collaboration between the artist Vito Acconci and the architect Steven Holl. The detail analyzed is the rotating panels of the façade.

In 1982 a small gallery opened in the city of New York, the gallery was for art and architecture, it later moved to a storefront space with cheap rent at the intersection of three neighborhoods that today is the *realm* for Storefront For Art & Architecture – a gallery and event space in the heart of Manhattan, New York.
In 1992 it was time to restore the aging façade of Storefront for Art & Architecture, the façade had changed from glass to plywood and a new face to the gallery was needed. Steven Holl and Vito Acconci designed the new façade. They sought to introduce improbability and to puncture the otherwise static façade by installing pivoting panels that would blur the boundaries of inside and outside.
The interior was left white – a blank canvas for the artist or architect to interpret.

In an interview Holl utters what the project meant for him:

"the architecture at that time (1992) became iconic and empty and that storefront was a connection with the body. Sense of space in relation of the body is the key." [Storefrontnews.org] [The Architecture Foundation 2009] [Klok 2013:4]

The panel's immediate *function* is to create entrance from the public streets outside to the private galley space inside. The rotations of the panels provide a third dimension to the façade of Storefront for art & architecture; it becomes a special element, as much as a gateway for people and light to enter the gallery space. It punctures the façade of the small exhibition space and let the exhibition interact with the public space.
The panels have overall two different functions; vertical pivoting panels, functions as gateways to the gallery and the horizontal pivoting panels 'gestures' a place to sit, a place to lean or a place to place something.



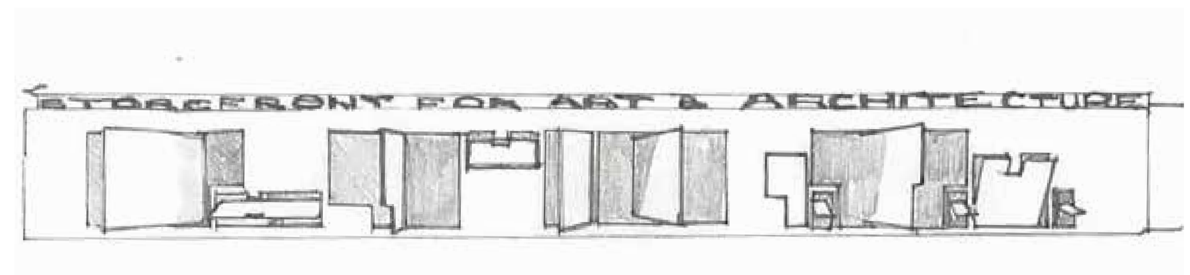
22.1 Sketch: Interior, Storefront for Art & Architecture

When locked in an open position: the panels generate an in-between space that invades the public space and blurs the clear line between public and private. It is like a storage box that unfolds; provoking passersby to consider what is going on.
The exhibiting artists and architects at Storefront for Art & Architecture customizes their works to the space, meaning that the panels often have parts of the exhibition attached to it. Depending on the direction of the passersby or visitors arriving at the exhibition or the way the panels are rotated that day; this affects the view and the experience. [www.storefrontnews.org]

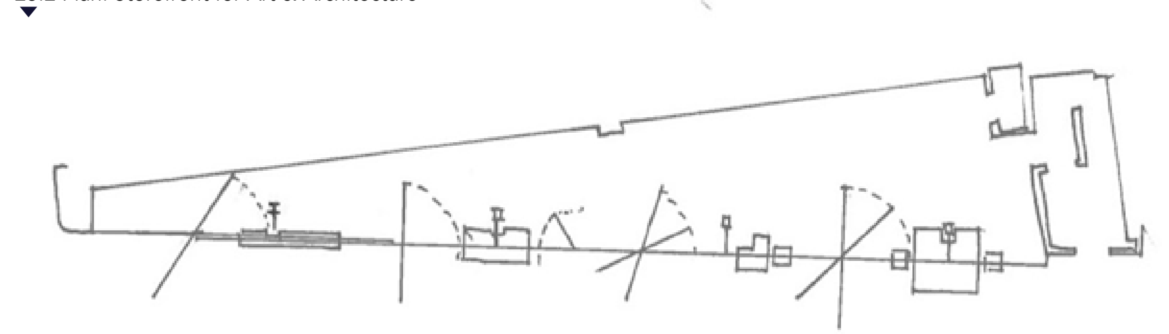
Every panel has its own 'gesture'; its own function and can change from day to day, hour to hour, depending on the person who rotates them and the current exhibition.
The 'gestures' can be described as here where; a direct interaction with the panels, characterizes the horizontally pivoting panels, and provokes to sit, lean and touch, where as an alluring 'gesture' characterizes the vertically pivoting panels, by suggesting a flow, a reveling or a direction.[Klok 2013: 2]

The *Emotionally* effect is best described by the first experiences of the place:

When walking towards the Storefront for Art & Architecture, in summer it is almost magnetic – the open panels allures you closer, the gesture invites you in, encourages you to explore what is on the other side of the wall, to take part in the exhibition or simply just to consider the architecture, when one have to alter the path to avoid collision with it, since the rotated panels occupy the public space at the sidewalk.
What felt magnetic and alluring in summer seems closed, gray and impervious in winter. Although getting closer cracks between wall and panel appears and challenges the curiosity in people to peek inside. [Klok 2013:3]



23.1 Sketch: Facade, Storefront for Art & Architecture
23.2 Plan: Storefront for Art & Architecture

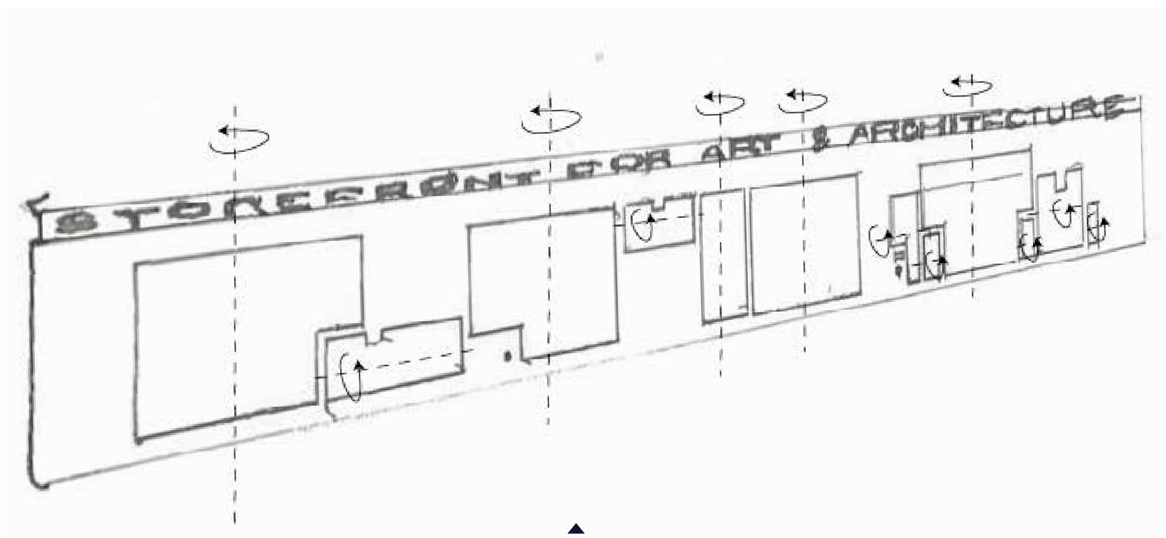


In an interview Steven Holl and Vito Acconci are asked about the biggest failure in the project, Acconci answers that the space is really good for spring and summer, but terrible for fall and winter. Architecture should keep you from getting cold and wet. Holl contradicts and turns the failures into emotions. He recalls that in the night when the panels are closed, the view you get through the cracks is a camera obscura of New York and it is mesmerizing. [The Architecture Foundation, 2009] [Klok, 2013:3] For Acconci, the details is recalling a leaking emotion of unsealed joints, in contrary to Holl who sees the poetic and the beauty that lies in the cracks and joints. [Klok 2013:3]

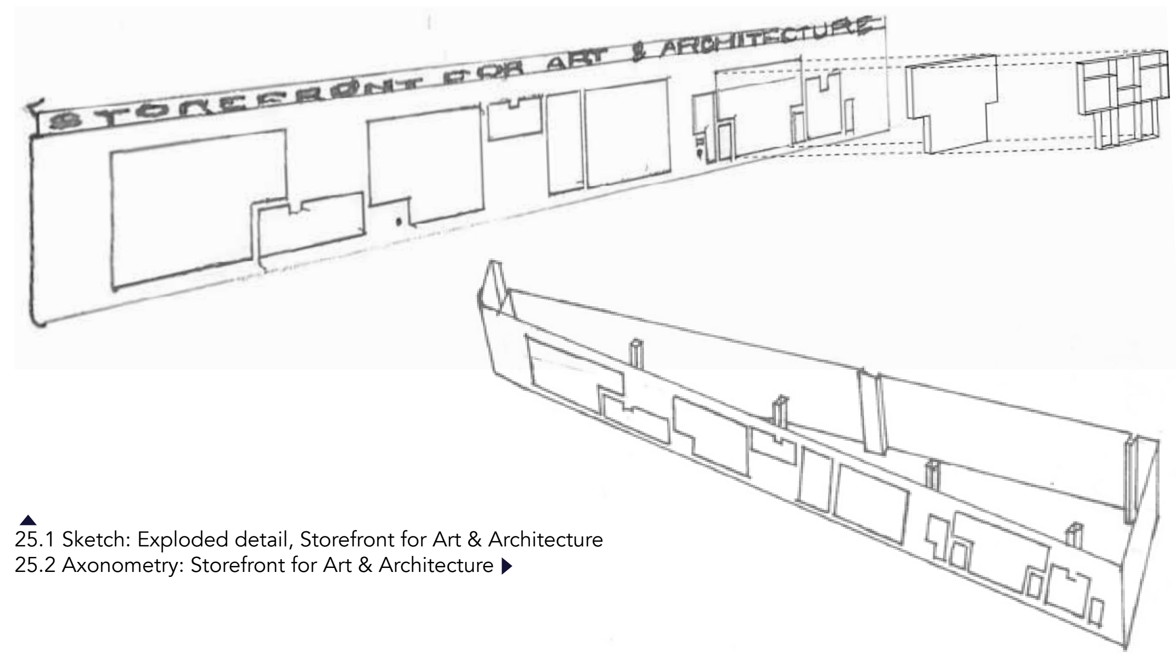
The importance and the poetic of a detail have captivated many architects as well as architectural theories throughout times; Besides Steven Holl, Marco Frascari was one of them and the detail inspired him to write the paper; The Tell –The –Tale Detail, in which he indicates the role of details as generator; *"..the architectural detail can be defined as the union of construction.."* [Frascari 1984: 23] later in his paper he defines the meaning of a detail:

"Dictionaries define "detail" as a small part in relation to a larger whole. In architecture this definition is contradictory, if not meaningless. A column is a detail as well as it is a larger whole, and a whole classical round temple is sometimes a detail, when it is a lantern on top of a dome. … it is possible to observe that any architectural element defined as detail is always a joint. Details can be "material joints,"… or they can be "formal joints"… the connection between an interior and an exterior space. Details are then a direct result of the multifold reality of functions in architecture."
[Frascari 1984:24]

The *construction* of the façade is based on a metal frame with infillings of lightweight concrete. The panels are hinged and rotate horizontally or vertically. The joint is a rather simple rotation joint and is left blotted and visible. The façade was installed in front of the old, and thus stole fifty centimeters of the sidewalk. Consequently, the loadbearing members are not a part of the actual façade,



24.1 Sketch: Rotation of panels, Storefront for Art & Architecture



25.1 Sketch: Exploded detail, Storefront for Art & Architecture
25.2 Axonometry: Storefront for Art & Architecture

but placed behind it, and functions as a part of the interior. The shape of the panels considers the bearing members and utilizes them in their rotation. Thus gives the incision an immediate understanding of the panel's joining, however, additionally reads as collision avoidance and a thorough consideration to the place. The panels are provided with a simple locking system, pins inserted in the floor – for its most extreme position. Rotation of the panels is done by a simple low-tech push. Thus indicating a low budget and a short timespan. The façade was only supposed to last for two years; in 2008 the facade was stripped and restored to be resistant for the New York life. . [Klok 2013:5]

The *principle* that enables the 'gesture' is the rotating joint. The person initiating the action is using the 'principle' to create the 'gesture', thus tells the tale of the architecture.
[Klok 2013: 6]

"The art of detailing is really the joining of materials, elements, components, and building parts in a functional and aesthetic manner" – Marco Frascari [Frascari 1984:24]

This quote by Marco Frascari underlines the point that the study tries to underline and explore, namely that the joint or the details is an important aspect of tectonic theory and praxis and must be considered and explored in the design process. The case study further explores the theme: openness versus closeness, which is important for the development of the design of the boatyard. The current buildings at the boatyard seem closed, dark and introvert, and first when the gates are opened what happens inside is visible. A preliminary design principle is to work with this openness versus closeness in the design proposal. The principle can be envisioned in many ways, whether it is pivoting walls in a quay house making in-between spaces and diffusing public/private spaces or openings in the façade of a workshop and boat storage facilities, maybe even combined?

Conclusion

The study in tectonic and its relating themes details and atmosphere has lead to ***design parameters*** that suggests design exploration with ***Structures, Openness vs. Closeness*** in different levels as well as thoughts on how to work with the atmosphere of The Boatyard.

"We put everything in relation to ourselves. Our surroundings influence us through their relative size, light, shade, color etc. Our condition depends entirely on whether we are in a city or out in the countryside, on whether the space in which we find ourselves is large or small. Our reactions to these circumstances are at first quite unconscious, and we only register them on memorable occasions, for instance in the sublime enjoyment of a detail or a happy alliance with the surroundings or by a pronounced feeling of distaste."
[Jørn Utzon, 1948: 06]

◀26.1 Photo: Detail, Storefront for Art & Architecture
27.1 Photo: Atmosphere by the shop ▶

PROGRAM

The following program is firstly introduced with a description of The Boatyard and the life around it. The program is further supported by introduction to the site, the user profile and an insight in the district plan, as well as a description of the current situation at the site. This should utilize an image of the project as a whole. The program ends in a room program where the different functions are described. Thus leads to a further site analysis.

About The Boatyard

The Boatyard is the title of a boatyard placed at an earlier neglected area in the dinghy and fishing harbor in Skive. The Boatyard has been undergoing a perceptible renovation and renewal in the past ten years.

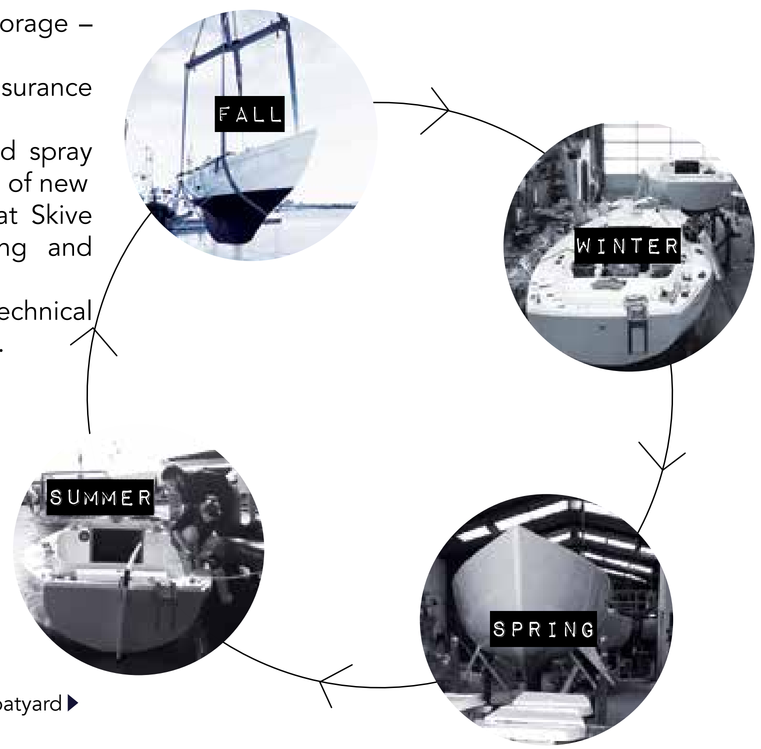
Main activities at the Boatyard is as follows:

- Launching and lifting of boats
- Indoor winter storage in ca. 2500 M^2 storage buildings
- Outside winter storage
- Service jobs in combination with storage – wash, polishing, motor service etc.
- Renovation jobs, repairing of insurance claims, transformations etc.
- Sail maker – reparation of sails and spray hoods, and manufacturing and sales of new
- Other crane service – crane jobs at Skive Harbor in connection with loading and unloading of boats
- Boat equipment shop – sales of technical equipment, paint and care products.

Life at The Boatyard

The life at a boatyard changes throughout a year; as the act of sailing is only a lesser part of owning a boat. The life cycle of a year at the boatyard is described in the diagram below.
The Boatyard owner's vision for the future of The Boatyard reflects on this life cycle – being able to take care of everything except sailing the boat, but still create the frames for recreational surroundings when the boat is in the water.

- Fall; the boat is lifted, washed and cleaned and moved to storage – inside or outside.
- During winter; different services are made; renovations or simple maintenance
- In spring; the hull and keel of the boat is painted and the last repairing are made.
- Summer; the boat is polished, launched, rigged and ready to sail.



28.1 Diagram: Life at The Boatyard

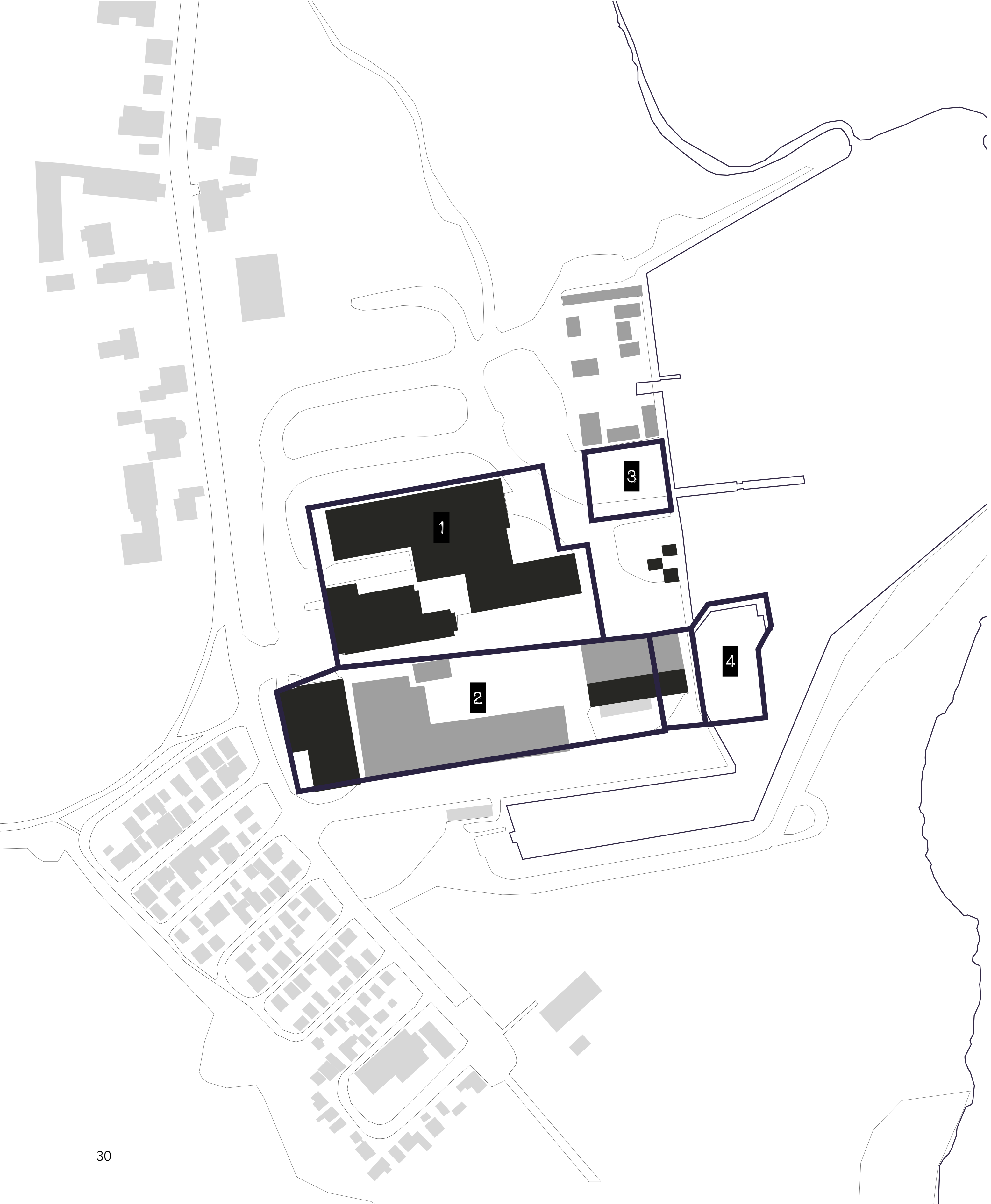
Current situation

Several times every year the boatyard gets flooded, due to winter storms. In 2015 the flooding had more damage than ever, the water undermined the protection wall and flooded workshop and shop facilities, causing the boatyard damage on machines and materiel.

The boatyard is placed on a site that is fill on top of old fjord bed, which makes it relatively porous. This means that in periods with high water level the site gets soft and difficult to maneuver with heavy vehicles and boats.
The boatyard is placed outside the seawall that is protecting companies and houses in the area. When the water level, often caused by storms, rises above normal water level, in some incidents have been up to 1,88 m over normal water level, water floods most parts of the site and all normal work is stopped.

The workshop spaces and shop are protected by a wall with space for shutters to be put in when there are predictions for water level rise. However, the capillary breaking layer under the buildings is now so porous because of frequent flooding that the water has gone through the layer and rises inside the wall, causing damage on inventory as machines, shop inventory, walls, floors and everything that has been in contact with fjord water. In the past year alone this have happened five times, in a height of 20-70 cm. The storms also damage the large boat storage buildings, due to heavy wind. [VÆRFTET, 2015]
This calls for a rethinking of the site and its water proofing method.

29.1 Photo: Storm Egon 2015, The Boatyard



The site

Today the site has about 3500 m2 building masse, where heated area, as shop, workshops, offices etc. account for 550 m2 the remaining 2950 m2 is for winter storage of boats and masts. The site where most buildings currently are situated is about 10.000 m2, additionally the boatyard posses another site at about 3650 m2, a 720 m2 building site by the pier and an area of 1300 m2 with building permission in the harbor basin.

There is a wish for additional functions at The Boatyard in the future; twelve quay houses, new shop facilities by the water and ten single boathouses for winter storage.

User profile

The boatyard has a wide span of users, in all ages, with all types of jobs and family constellations.
Observations from users at the boatyard show that; at the boatyard everyone is equal no matter if it is a social security recipient, a student or a CEO of a large company. The size of the boats may vary, but when in overalls, experience is shared and equality rules.

District plan

Only buildings in connection to the boatyard, workshop, craft, sales, export and storage firms, storage for boats or the like harbor related businesses are allowed to be build at the site.

Parts of the boatyard facilities are build in a height of 9,25 meter, while main parts of the remaining buildings have a height of 7 meters, the district plan determine that new buildings for the boatyard and storage must not exceed a height of 7 meters (plot 1-3), while minor buildings as the production school facilities; Marienlyst, Fjord and Wooden Ship Center and the future quay houses must not exceed a height of 4,5 meters (plot 4). Only one storage building is allowed (with building height variation in the different building plots).
Facades and roofs must be in discrete colors/ earth colors and reflective roof materials are not allowed.

- Building plot 1: Gross area ca. 2600 m^2 [Boatyard]
- Building plot 2: Gross area ca. 2600 m^2 [Indoor boat storage]
- Building plot 3: Gross area ca. 300 m^2 [Shop/ café]
- Building plot 4: Gross area ca. 500 m^2 [Quay houses]

For each plot no more than 75% of the ground area can be build.
New buildings require a minimum of 2 meter DDN [Dansk Normal Nul] plinth elevation, if the buildings should be replaceable at flooding damage according to "laws of storm flood and storm damage". [Skive Kommune, 2007]

30.1 Diagram: District plan

ROOM PROGRAM

The room program is utilized from the current functions and the wish for expansion of recreational functions by the water. An alteration of the room program may occur in the design process, as well as a separation of functions that currently exists in a co-relation, is a possibility.

Workshop Facilities

The workshop facilities are a part of the heart, the center of the boatyard. It is here the main part of the work is executed.
Today it functions as an open workshop, separated in rooms without doors.
The facilities have been flooded several times, caused by a porous capillary break layer, latest in February 2016 and prevent work at the boatyard. Machines and materials are currently stored elsewhere.

The need in the future is still to have the smaller workshops in close relation to the boat builder workshop, with easy access, however, provided possibility for closing off. Additionally, a varnish room is needed, dust free, with good daylight, mechanical ventilation and with shelve space for the varnished elements.

The boat builder workshop should have easy access to the water, preferably a strait connection, easing the transport from workshop to water launching.

The Boat Equipment Shop

The shop is a social generator as well as the center of the boatyard. The shop distributes the different services provided.

Office

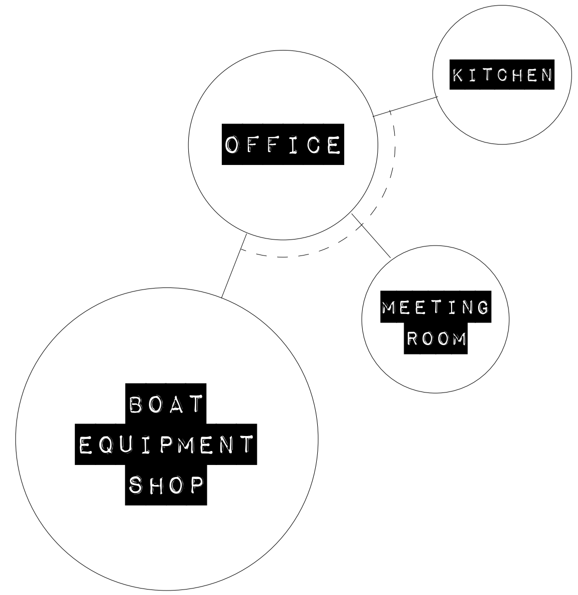
The office facility must be in relation to meeting room, kitchen and toilet facilities, as well as the shop and should have a view to the assets of the boatyard, the water and the boats.

Winter Storage

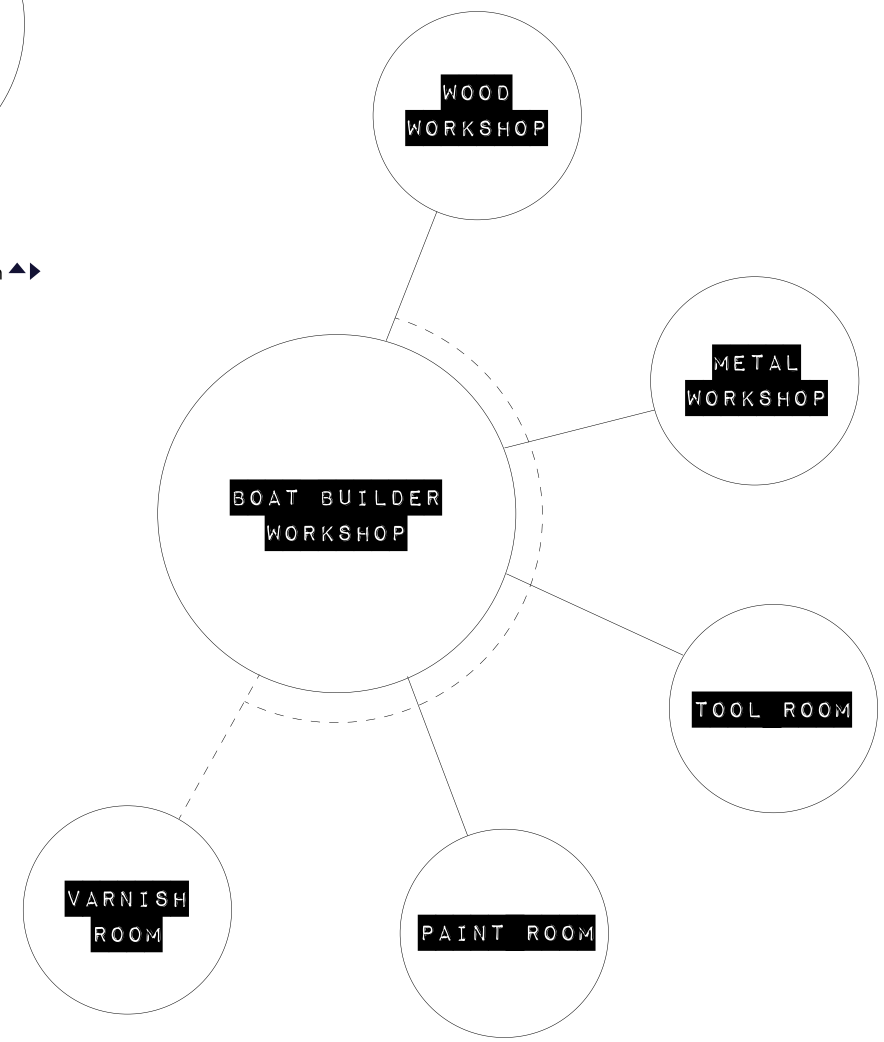
The four winter storage buildings are unheated buildings with space for boats. Minor works on the boats are executed here in springtime.
During summer periods the buildings are mostly empty, however one of the storage buildings facilitates every year a party for over a hundred sailors. A summer transformation should thus be included in the redesign of the buildings.
Winter storage includes the mast shed, where masts are stored in multiple layers. The placement by the water is ideal, due to the short distance to the mast crane.

Quay Houses

A project of twelve quay houses have been in planning since 2008, however, never realized. The purpose is to create recreational atmosphere by the pier. The use is up to the users, can be storage for fishing gear, small workshop for a boat owner or simply function as an allotment shack. Therefore, two proposals for interior design should be included in the project.



33.1/ 33.2 Room Organization



ROOM PROGRAM

Function	Quantity	Properties	M² Today	M² Future
Boat builder Workshop	1	Daylight, Orientation according to infrastructure Concrete floor Mechanical Ventilation Heated	460	500
Wood workshop	1	Concrete floor Mechanical Ventilation Heated	(30)	30
Metal workshop/Motor service	1	Concrete floor Mechanical Ventilation Heated	(30)	30
Tool room	1	Heated	(8)	8
Paint room	1	Mechanical Ventilation Good daylight Dust free Heated	(8)	8
Varnish Room	1	Mechanical Ventilation Good daylight Dust free Heated		15
Sail maker workshop	1	Daylight Floor space Heated	20	30
Shop	1	Daylight and should be visible from the water as the shop keeper sometimes is needed by the water	120	120
Storage	1	Electrical light	20	20
Office	2	Good daylight and view of the facilities	30	30

Function	Quantity	Properties	M² Today	M² Future
Meeting Room	1	View towards the assets of the site – boats and water	Part of the office	15
Lunch Room	1	Daylight - view to workshops	15	15
Kitchen	1		Part of the office	10
Toilet/shower	2		7	10
Winter storage (boats)	4	View to site Unheated	2950	3500
Mast shed	1		275	275
Crane house	1	By the water	ca.10	ca. 10
Shed for diesel oil	1	By the water	10	10
Storage Shed	2 (12 M²)	By the water	24	24
Quay Houses	12 (27 M²)	Unheated		324
Total				

SITE ANALYSIS

The site analysis should give a deeper insight in the site and its surroundings. The surrounding organizations and their relation to The Boatyard is firstly describes. Next have several mappings been made to understand the local climate as well as the functionality of the site. The site analysis is supported with a site registration look book of photographs combined with short descriptions of the site.

The Boatyard is placed among other maritime related organizations, associations and private people. A description of these has been made to acquire an understanding of the surrounding area, and the milieu in the immediate connection to the site. Common for all of them, including The Boatyard is the frequent flooding.

Skive Sail Club

As the closest neighbor Skive Sail Club has their outdoor winter storage for boats in relation to the boatyard. This has a significant influence on the boatyard, when many of these sailors use the service provided by The Boatyard. Most get their boat lifted and launched, use the shop for purchasing paint, equipment etc. They also benefit from the social environment that is created at the boatyard.
The Boatyards history had a significant influence on the founding of Skive Sail Club; in 1933 thirteen boats at the dock by the boatyard was the beginning of the club. The club was founded at the time Boatyard run by Poul Pedersen. The thirteen boats have become a sail club with a large marina, north from the site and a lot more than thirteen boats.[www.skivesejlklub.dk]

Marienlyst Fjord and Wooden Ship Center

Marienlyst is an activity center, a cluster of eleven fishing and fjord houses and eighteen dinghies. The center provides different activities regarding communication of maritime craftsmanship, work disciplines and tradition and is facilitated by the production school Marienlyst. The center is together with The Boatyard, a part of the active experience activities offered by The Municipality of Skive. [www.krydstoldjagt.dk]

The Boat Gild of 1967

The fist boat-community in Skive, established by members from the sail club in 1967, hence the name. The house is the first indoors boat winter storage build at the site, previous with a slipway that now is closed.

Skive Boat Houses A.M.B.A.

Skive Boat Houses, is private owned single boathouses for winter storage of single boats.

The Anglers

The anglers have a shed for handling of their catch, conveniently placed close by the dinghy harbor.

Skive Marine Association

A social meeting place for marine veterans.

Klondike

Mostly anglers have their own allotment shack-like house here. A place filled with self-build atmosphere. Besides the single allotment shacks they have a clubhouse for socializing.

37.1 Diagram: The site and its surrounding functions▶

MAPPINGS AND SITE REGISTRATIONS

Mappings are used for pointing out features of the site that needs consideration and aspects that will influence the design process. Both climatic and functional mappings have been made to do so. Climatic mappings are a part of the initial analysis of the site and will have influence on organization and placement of future functions. The functional mappings give an insight in the flow at and around the site and clarify the organization of functions of buildings belonging to The Boatyard.
The mappings are supported by photo documentation of the site at and it surroundings. The registrations should give an insight in the atmosphere, the architecture and landscape by the site. This is visualized in a look book in between the mappings.

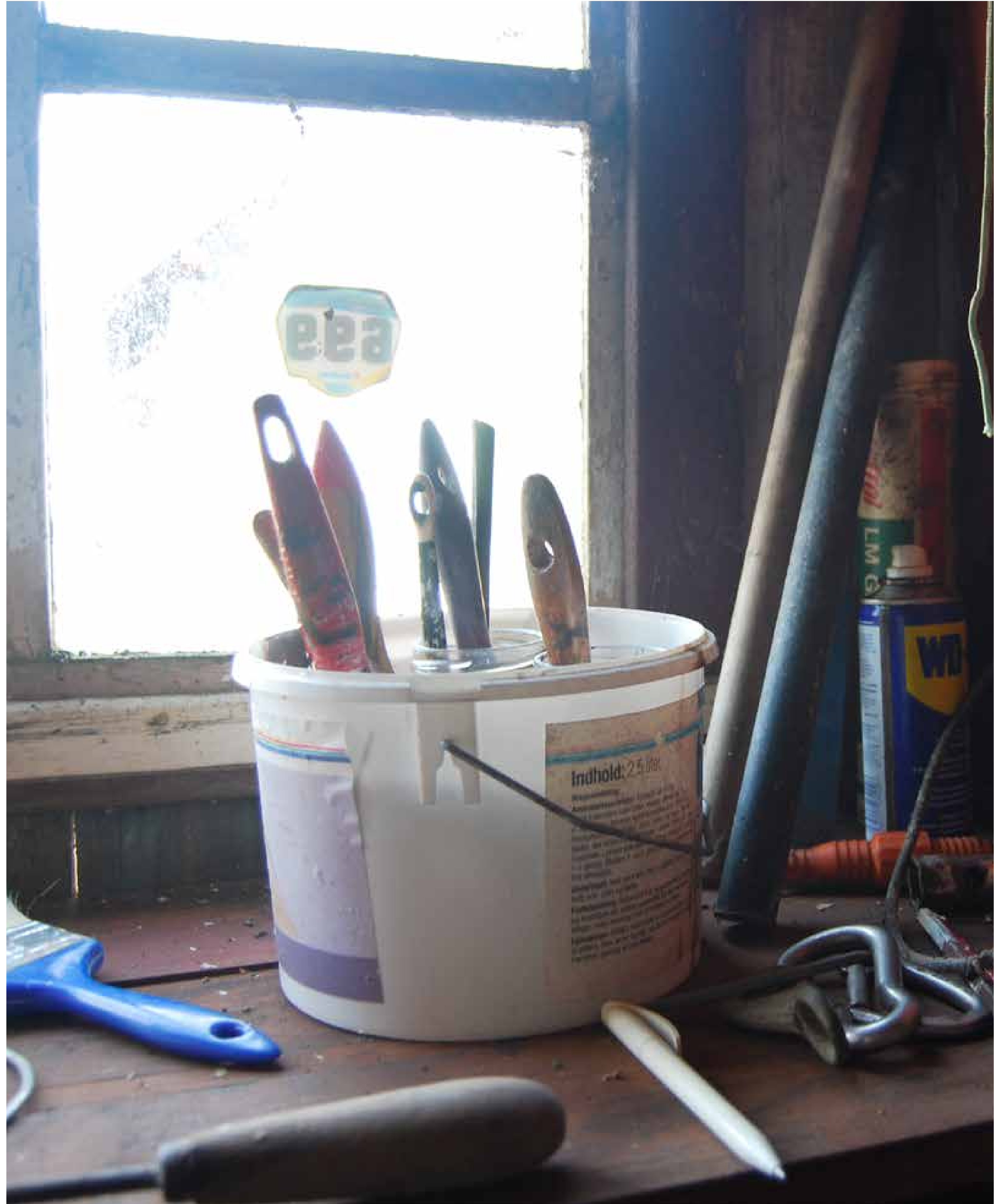
0.1 Lookbook: First view of Klondike and first glimpse of The Boatyard - viewed from the pedestrian bridge.

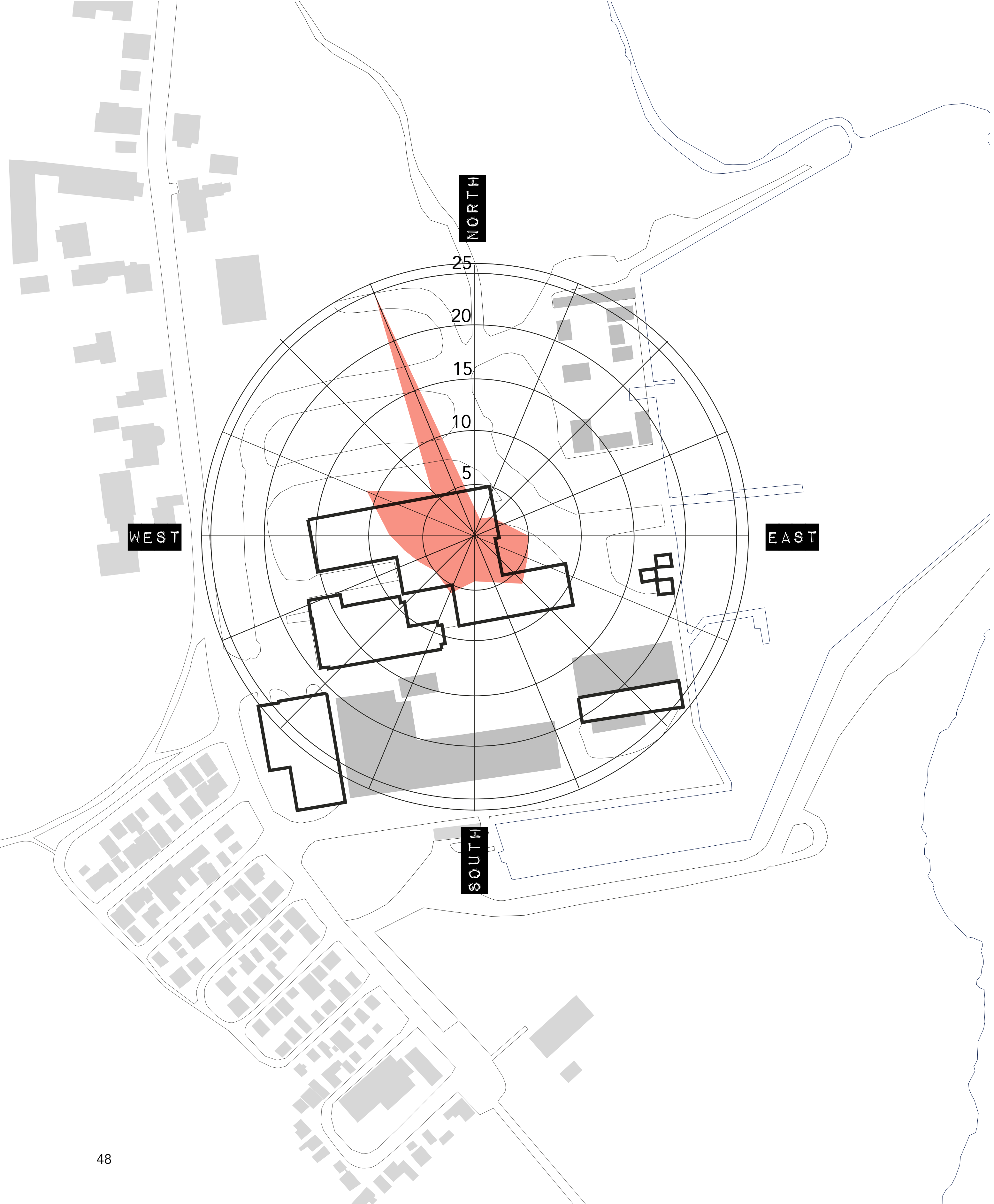
0.2 Lookbook: View of Klondike seen from Fjordvej; all streets are named after different fish species. ▶

0.3 Lookbook: The oldest house at Klondike, the current owner inherited the house in 1970 from his brother. Klondike was founded in the late 1960's.

0.4 Lookbook: The size of the house does not allow a lot of space for anything else but fishing nets.

0.5 Lookbook: - And tools for maintenance
of both house and fishing gear.





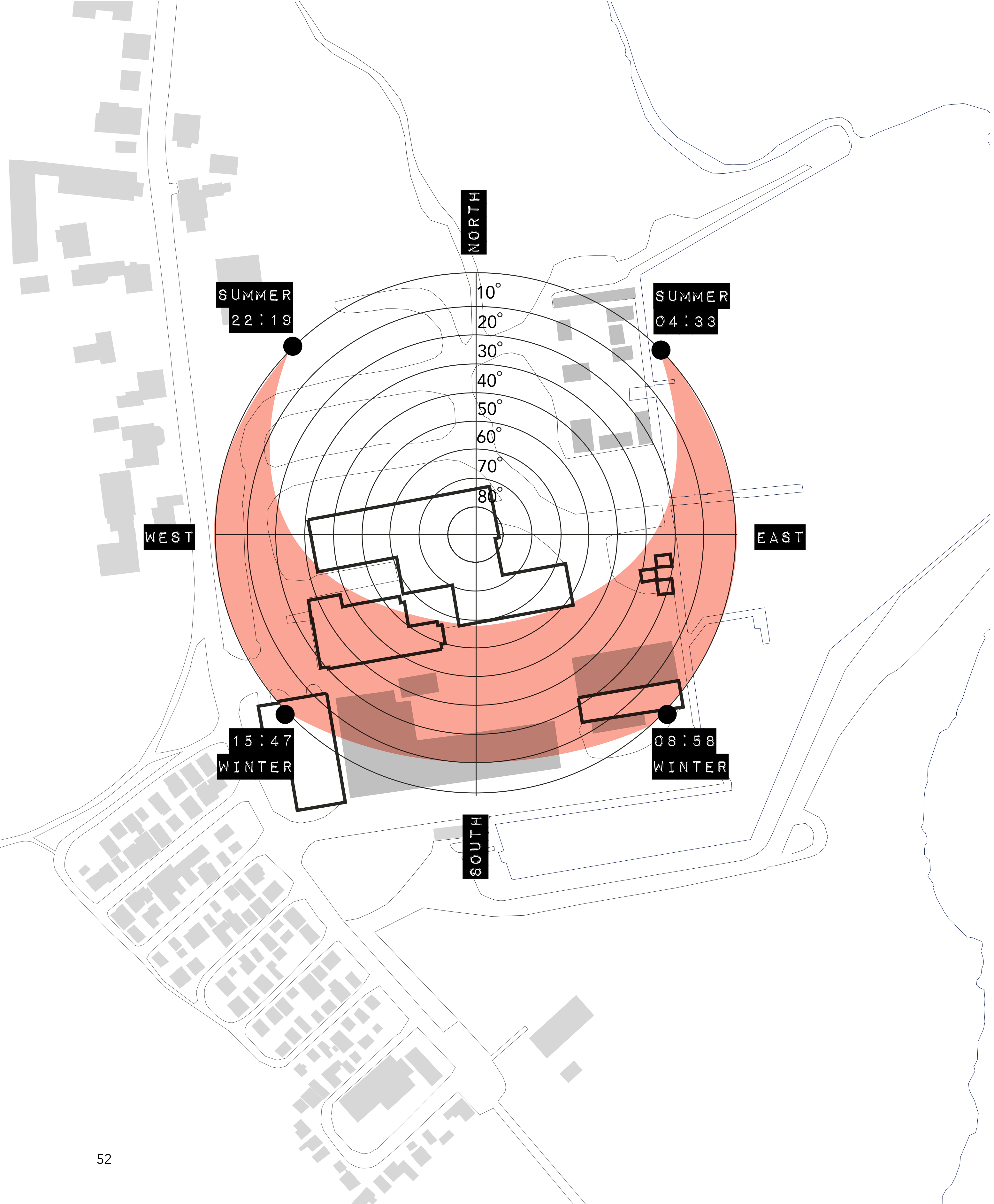
Wind

Wind have a dominant feature on a site, if the wind speed is high, it is pleasant to have a place to be in lee for the wind. At The Boatyard the average wind is between 9 – 12 kts equaling ca. 3 - 8 m/s. Gentle to moderate breeze, on land the gentle breeze is signified by leaves and small twigs move, pennants are moving, on sea by wavelets, and scattered whitecaps. A gentle breeze on land is signified by dust and paper rising, small branches begin to move. On sea a moderate breeze is signified by small waves with frequent whitecaps. [www.dmi.dk] As shown in figure 37.2 the dominant wind direction in the sailing season, April is a North/Northwest shifting to a Western to West/Northwestern wind in May to September. In the end of the sailing season in October it goes southwest. [www.windfinder.com]

40.1 Diagram: Wind
41.1 Weather data for Skive

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	Year 1-12
Dominant wind direction													
Wind probability >= 4 Beaufort (%)	36	37	57	45	40	51	49	38	35	56	34	29	42
Average wind speed (kts)	9	10	12	10	10	11	11	10	10	12	9	9	10
Average air temp (C)	4	8	7	10	14	17	19	21	16	10	6	6	11

0.6 Lookbook: By the pier, the mast crane and shed for diesel oil.



Sun

The site is oriented towards the water – towards east, with entrance from west.

The terrace in front of the shop is provided with sun in the afternoon and lies in shadow for the rest of the day. The shop is a gathering space and must be provided with a place to sit outside; thus must be considered in plans if moved elsewhere. A moving towards the water could possibly provide a terrace in front of the shop with possibility for sunlight throughout the day.

◀52.1 Diagram: Sun

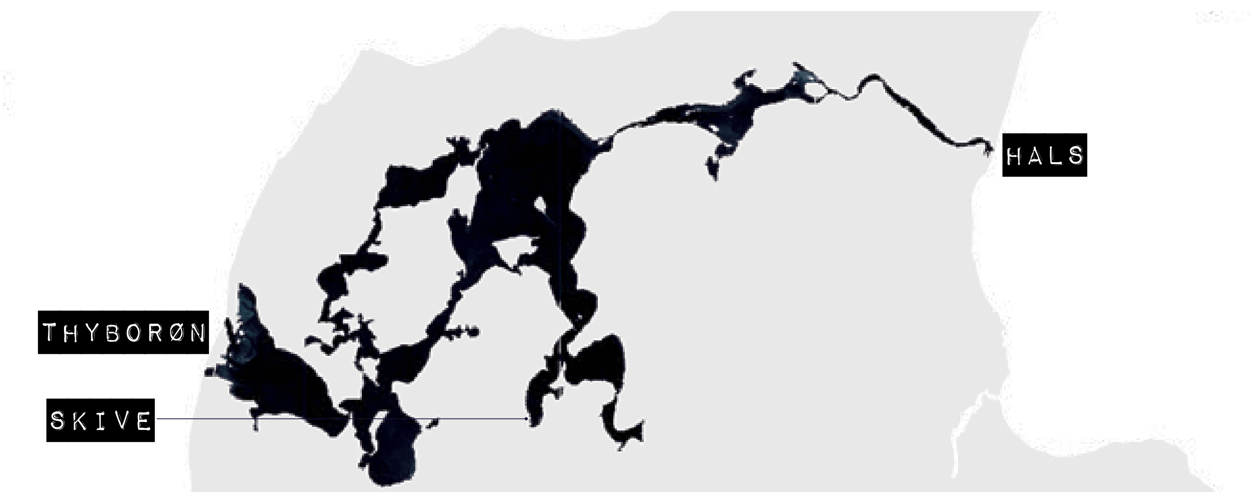
0.6 Lookbook: Arrival at The Boatyard from Fjordvej

Water

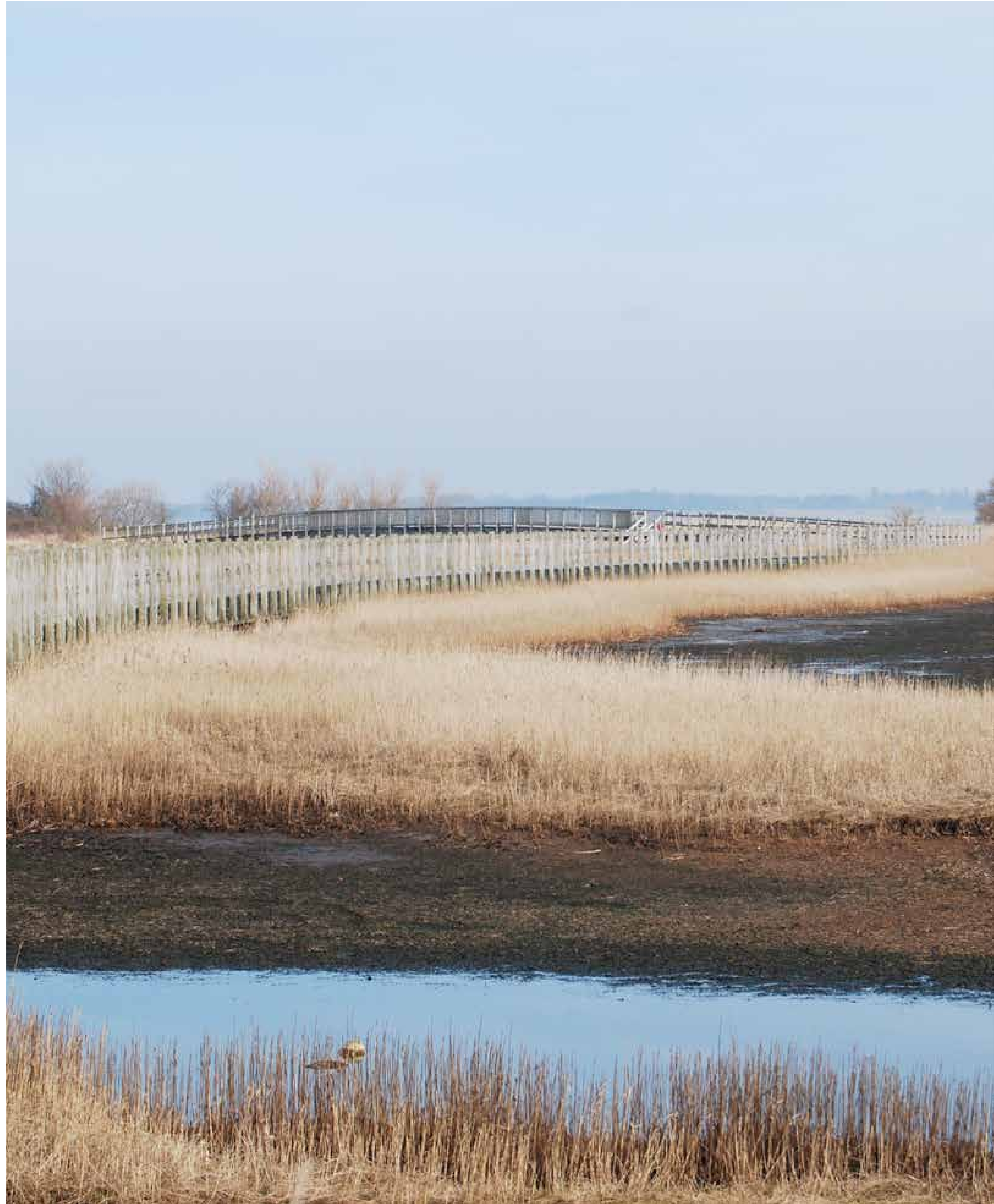
The site and surrounding functions lies outside the seawall that protects the city and the nearby housing area. Thus leaving the site exposed for flooding. As mentioned earlier, the site gets flooded several times a year due to storms. A nature-made opening by Thyborøn, in west allows water from the North Sea flood the fjord, with the only outlet by Hals in east, through the rather small strait. [www.naturstyrelsen.dk] The water mapping shows how flooding affects the site in different heights. As earlier mentioned, the highest measured water level was 1,88 m, as the consequence of the storm Egon in 2015. Flip through the pages and watch the water flood the site.

The flooding damage and tear the buildings as well as leave a large amount of days where the work at The Boatyard involves keeping water out of the workshop and shop instead of working with the boats which is not a tenable situation.

56.1 Diagram: The Limfjord ▼
57.1 Diagram: Water levels at the site ▶



0.7 Lookbook: By the entry to The Boatyard Harbor, view towards northeast over the fjord. ▶



0.8 Lookbook: View from pedestrian bridge over the wetlands, south of the site, connecting access from Viborgvej.▶

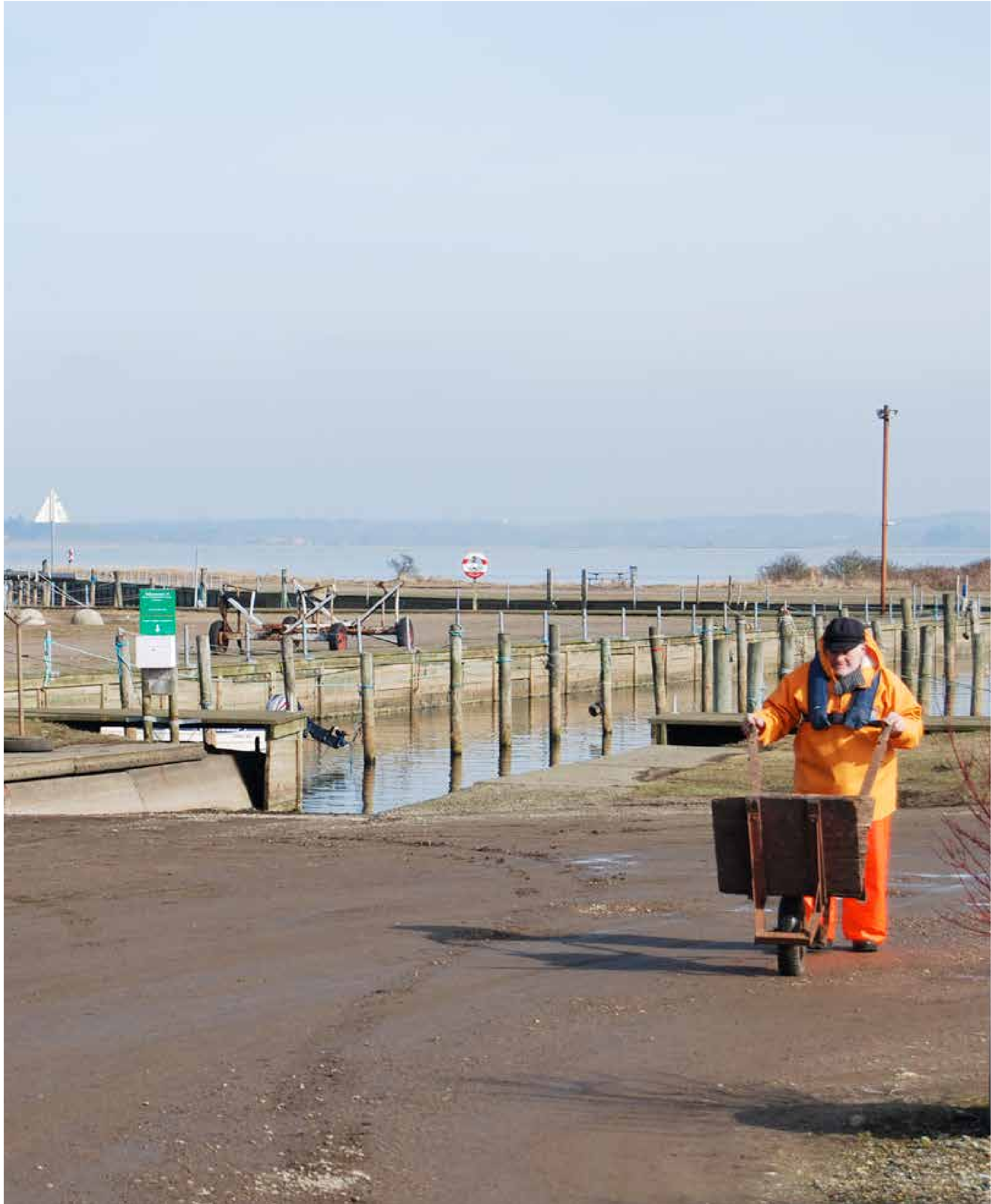
0.9 Lookbook: Old fishing boat.

Infrastructure & Parking

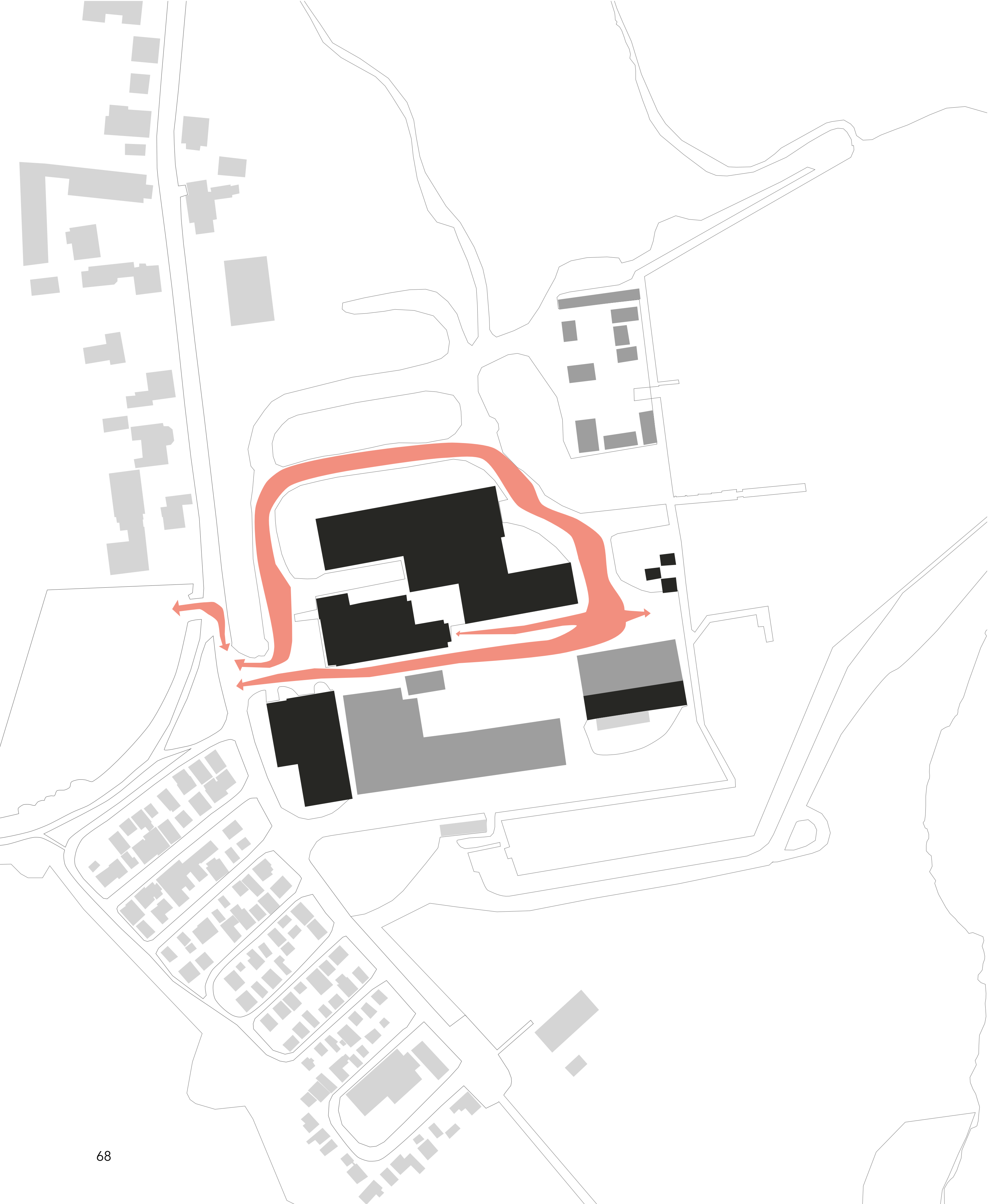
Fjordvej is the main road connecting the site to the city of Skive; the road is paved with asphalt. Fjordvej ends in a gravel-paved path that continues into a pedestrian bridge connecting the southeren area of the site over the wetland and Karup Stream to Viborgvej
The paths adjoin from Fjordvej is paved with gravel, also the case of the situation at The Boatyard. The gravel ensures the water masses from the frequent flooding to drain quickly. However leaves the site soft and makes maneuvering with heavy vehicles difficult. In more dry periods, cars and other vehicles airs dust, that lies on boats and parked cars.

There is no actual parking spot at The Boatyard; many park in front of the shop at first, but move and park their car close by their boat, to minimize time transporting tools and gear. As long as it is possible to pass by the parked car, parking is allowed everywhere.

◀64.1 Diagram: Infrastructure



0.10 Lookbook: With Klondike in the back - view towards the fjord. The angler's harbor, and the owner of the oldest house at Klondike, who also is the architect of the harbor design, from 1969.

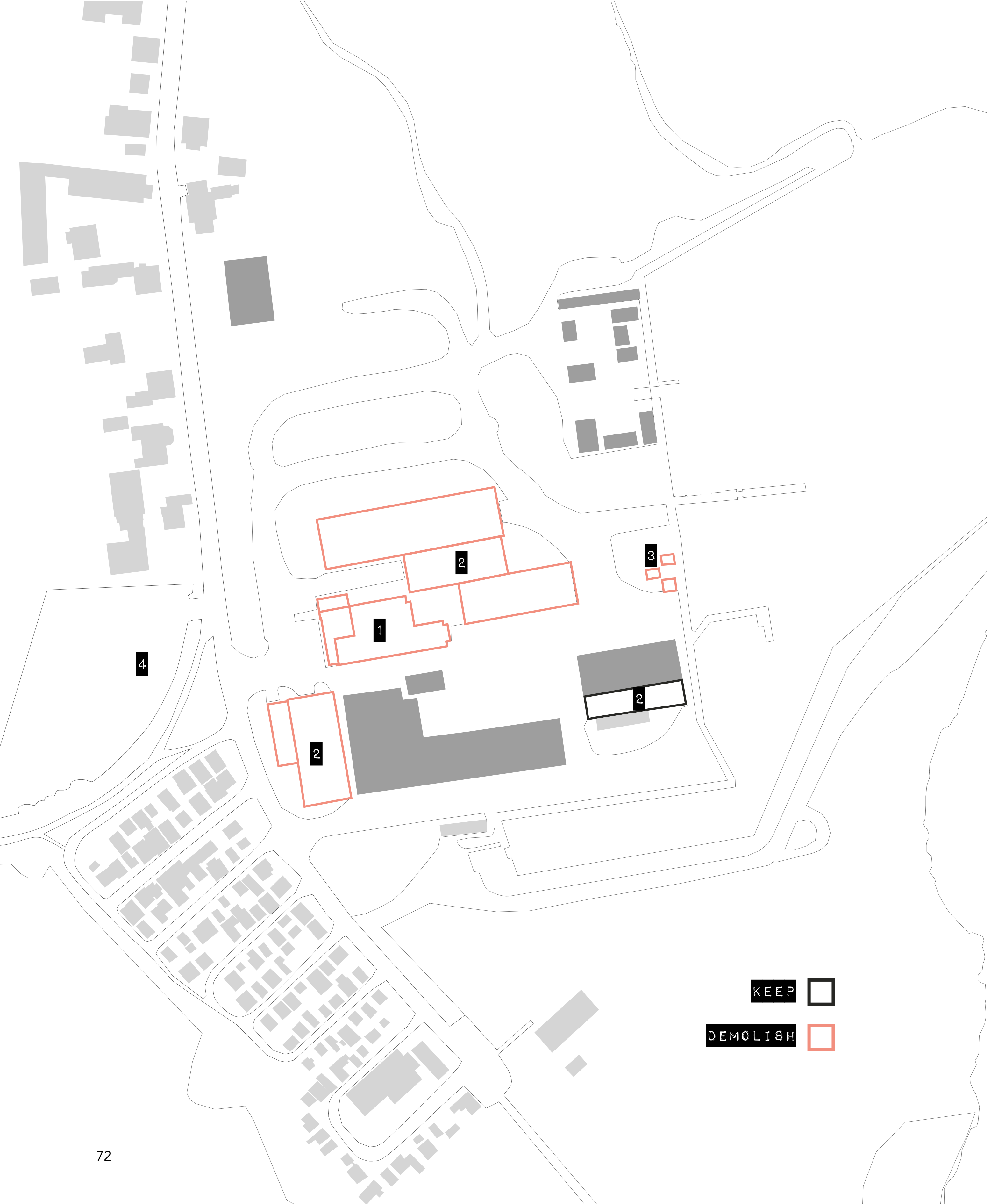


Flow

The flow at The Boatyard has a huge influence on how the heavy vehicles maneuver at the site. The turn from the Western outdoor winter storage square is difficult, further leaves the current flow a large amount of waste space that can be utilized by The Boatyard and by Skive Sail Club for outdoor wither storage of more boats, than there is space for today.
The direct flow from the boat builder workshop to the pier is important to ease the transport back and forth.

◀64.1 Diagram: Flow.

0.11 Lookbook: The Boatyard viewed from the pier. ▶

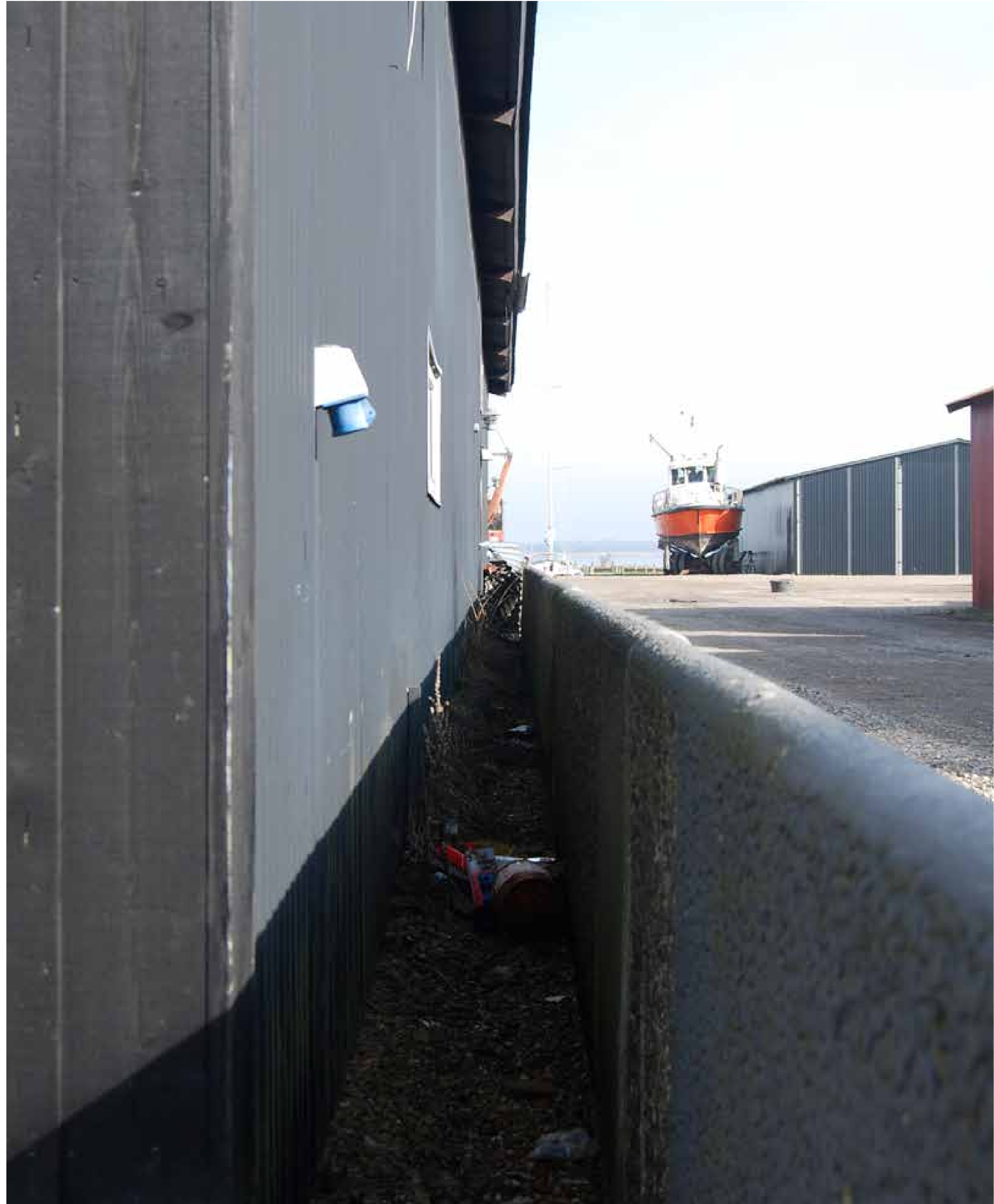


◀72.1 Diagram: Functions

Functions

The functions at the site can be divided into three enclaves: 1. The workshop facilities: shop and office – functions that are enclosed by a water protection wall. 2.The winter storage buildings: unheated, gravel paved halls for storage of boats and masts. 3.The sheds by the water: storage of tools and the beginning of a maritime milieu by the water. And lastly 4. Outdoor winter storage for boats.

The buildings are in different condition; most of them not worth remodeling. Therefore, in this project every building is demolished, with the exception of one building. See diagram 62.1. This building is the current mast shed and is shared with The Boat Guild of 1967. As earlier mentioned this building is also the oldest building at the site and is the only one build in wood.



0.12 Lookbook: The boat builder workshop and the wall that formerly kept the water from flooding.

0.13 Lookbook: Mast shed

0.14 Lookbook: Temporary self-made support for boat. ▶

Conclusion

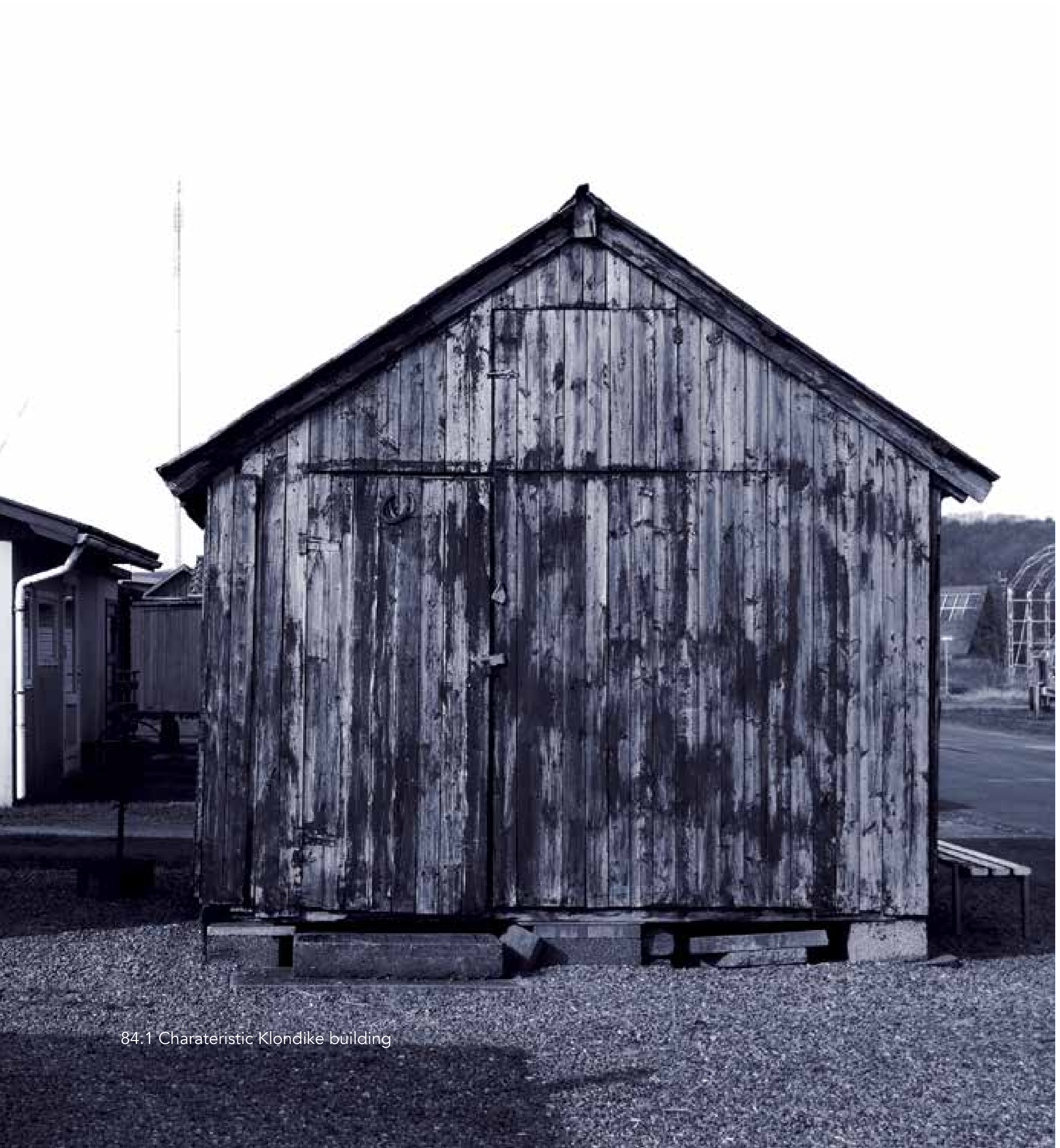
The mappings give an insight in the current situation at the site both cosmetically and functionally. The frequent flooding of the site demands design solutions that explore integration of water both on a landscape level and architecturally, thus becoming an asset for The Boatyard.
As it has been decided to demolish nearly every building and that the area of the site is mostly defined by the footprint of the current buildings, the new building plots keep an historical value and build on those plots. The flow mapping suggests to rethink the flow at the site that could have influence on organizing the new buildings.

The site registrations and site map in the beginning of the site analysis show the proximity to the surrounding site, the design proposal should consider the architecture of the surroundings as The Boatyard 2.0 will be in close relation here to.

The site analysis will end with design parameters and a vision that will lead towards the design process.

◀0.15 Lookbook: View of Skive Boathouses A.M.B.A. the dinghy harbor and in the far back of The Boatyards winter storage buildings.

0.16 Lookbook: Klondike is characterized by being a place for anglers, with buoys and places for drying nets.


84:1 Charateristic Klondike building

Water vs. Landscape
Water should play a significant role in informing the building design; it should be a catalyst for an interesting harbor milieu instead of an obstacle and stopping point. The tension between water and landscape should be explored.

Tectonic Structures
The tectonic approach inspires to a project that works with honest easy readable structures and site-specific materials.

Open vs. Closed
An architectural extrovert expression should be present instead of the current introvert. The architectural level of openness should be changeable according to its use and function.

The vision is to work with a tectonic approach that architecturally as well as aesthetically relates to the surrounding architecture at the site. Especially taking water into consideration and exploring its full potential.

THE BOATYARD 2.0

BOOK 2

Master Thesis
by Julie S. Klok
Ma4 Ark24
Spring 2016

Department of
Architecture,
Design &
Mediatechnology

Aalborg Universitet

READER'S GUIDE

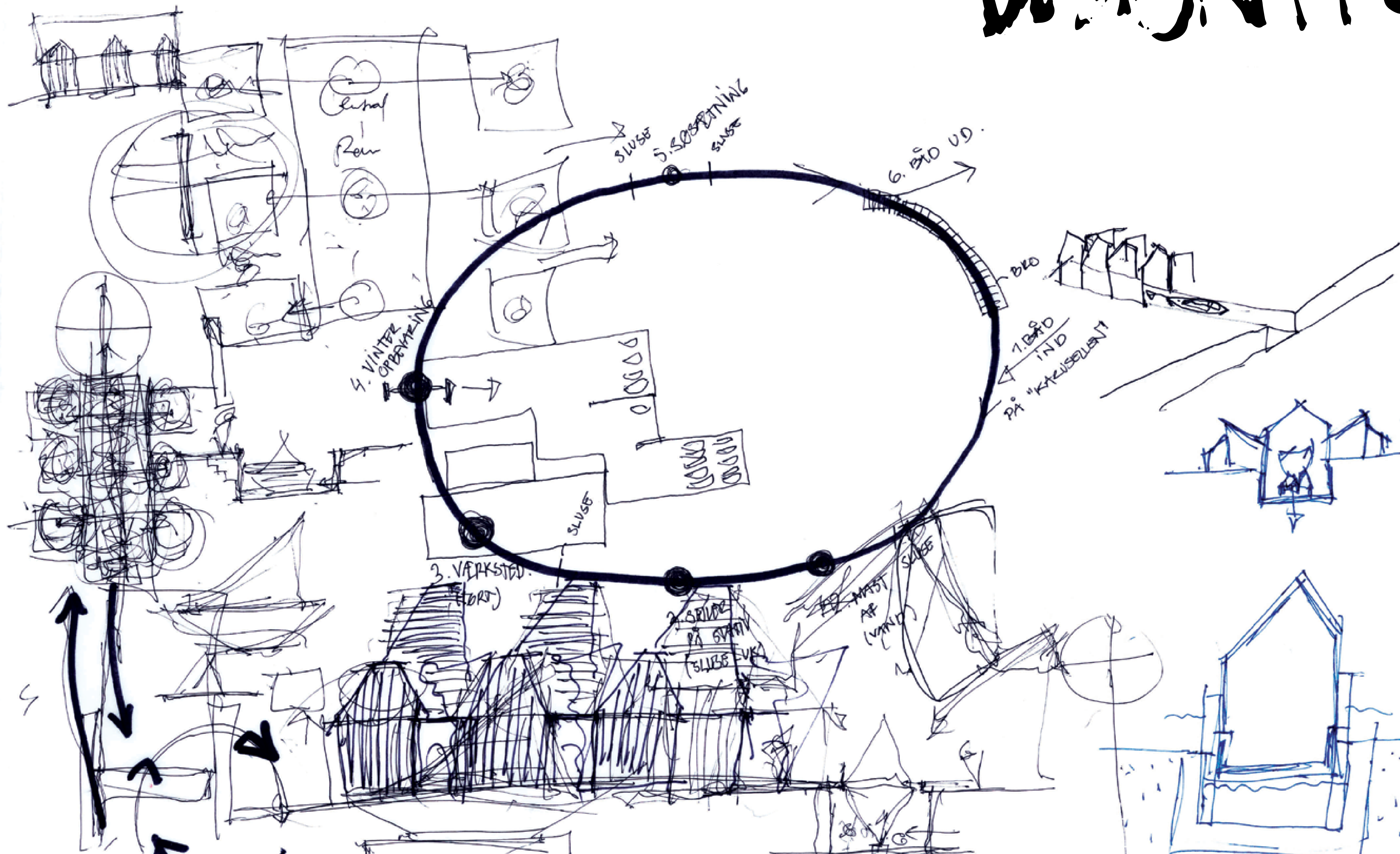
Dear reader,

This is a guide for you on how to proceed. The thisis is divided in two parts. Part one represents the introduction and the analysis.
The second part includes design process, presentation and appendix.
I propose you to begin with part one and continue on to part two.
Enjoy.

- Julie Klok

CONTENT

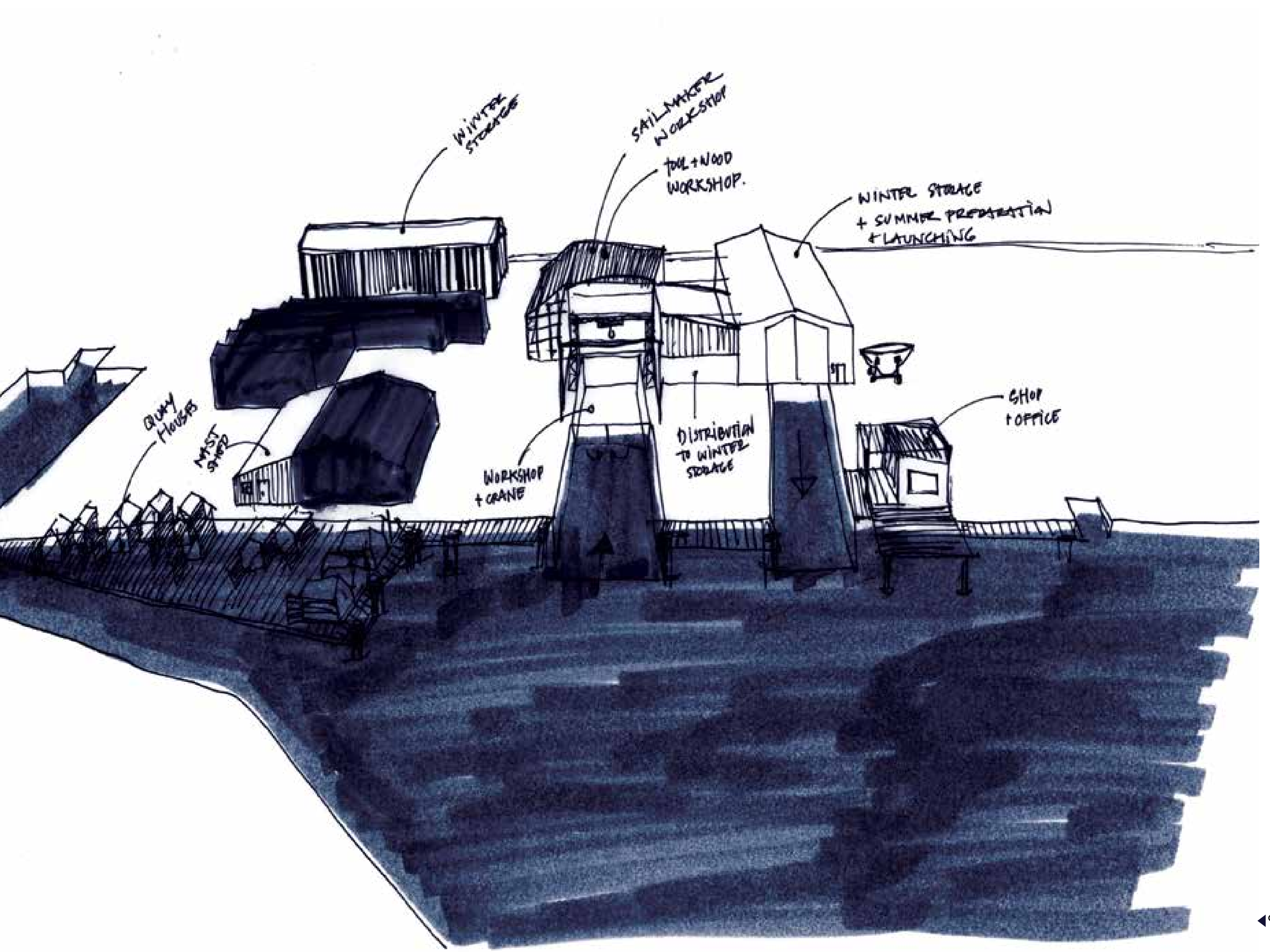
DESIGN PROCESS



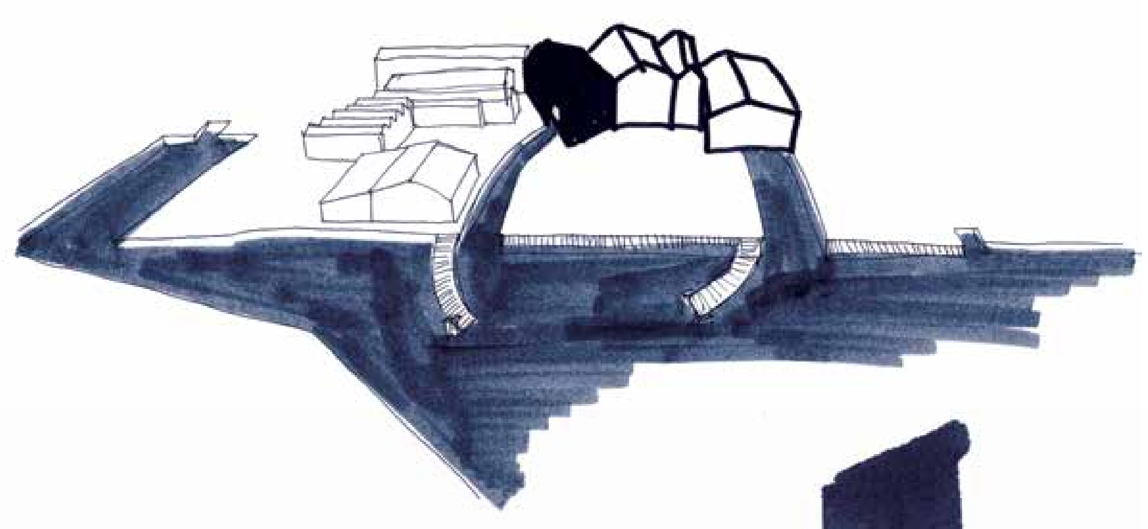
Initiating Concept
Water vs. Landscape
Tectonic Structures
Open vs. Closed
Final States of Process

DESIGN PROCESS

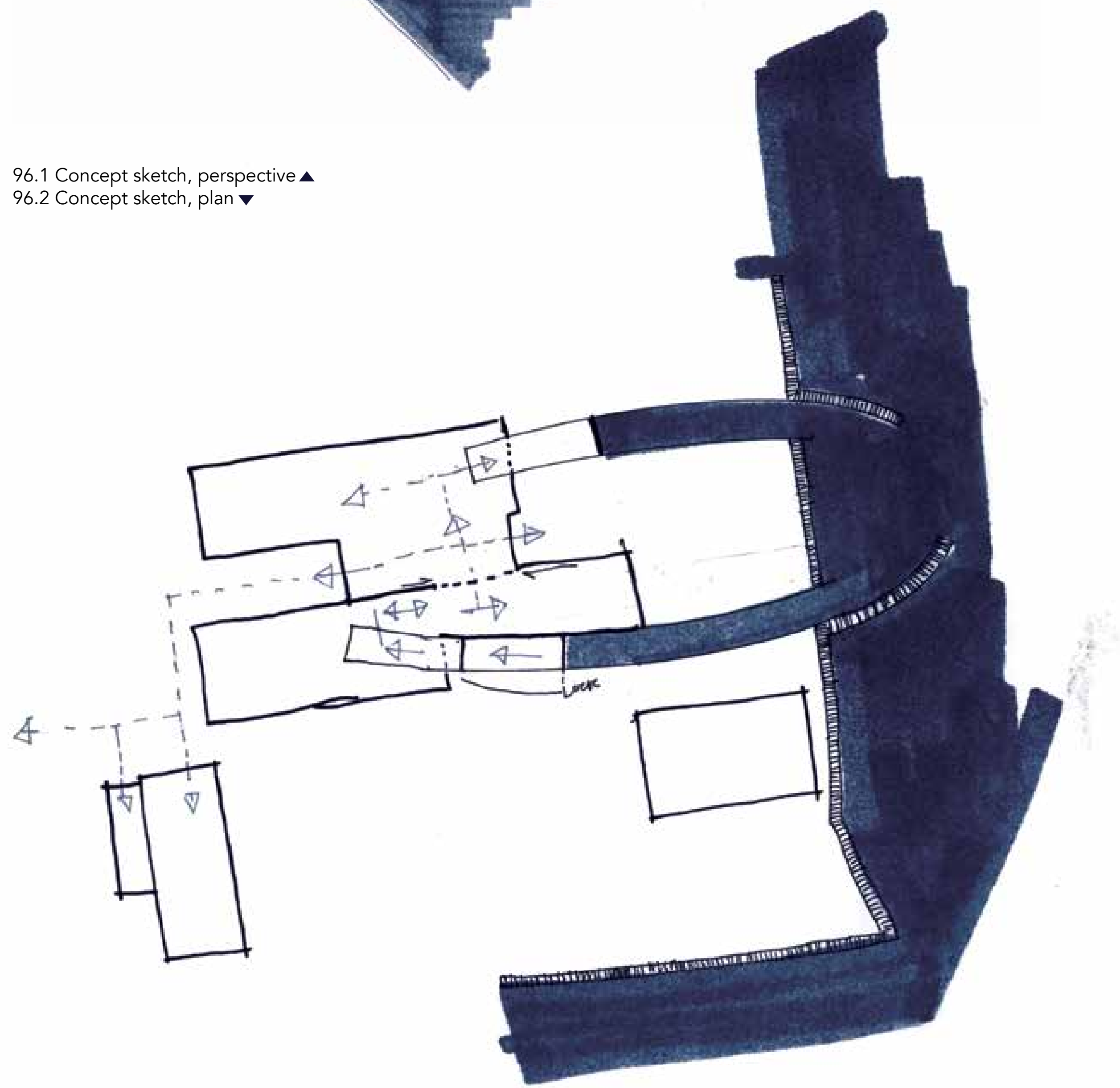
This chapter shows a selection of material from the several iterations that have happened over the course of the project period and what has been the shaping elements for the final design. The iterative process may seem linear, however has been messy and circular as a design process should be. Throughout the course of the process information have been added and development the analysis.
Different parameters have been crucial when developing the design as a one person group. I have sought critique for development through supervision, mid term review, conversations, own conclusions and comparing the design with the analysis, design parameters and vision. The following will guide the reader through the design process themes, these mainly derived from the design parameters.



◀94.1 Sketch: Function placement



96.1 Concept sketch, perspective ▲
96.2 Concept sketch, plan ▼

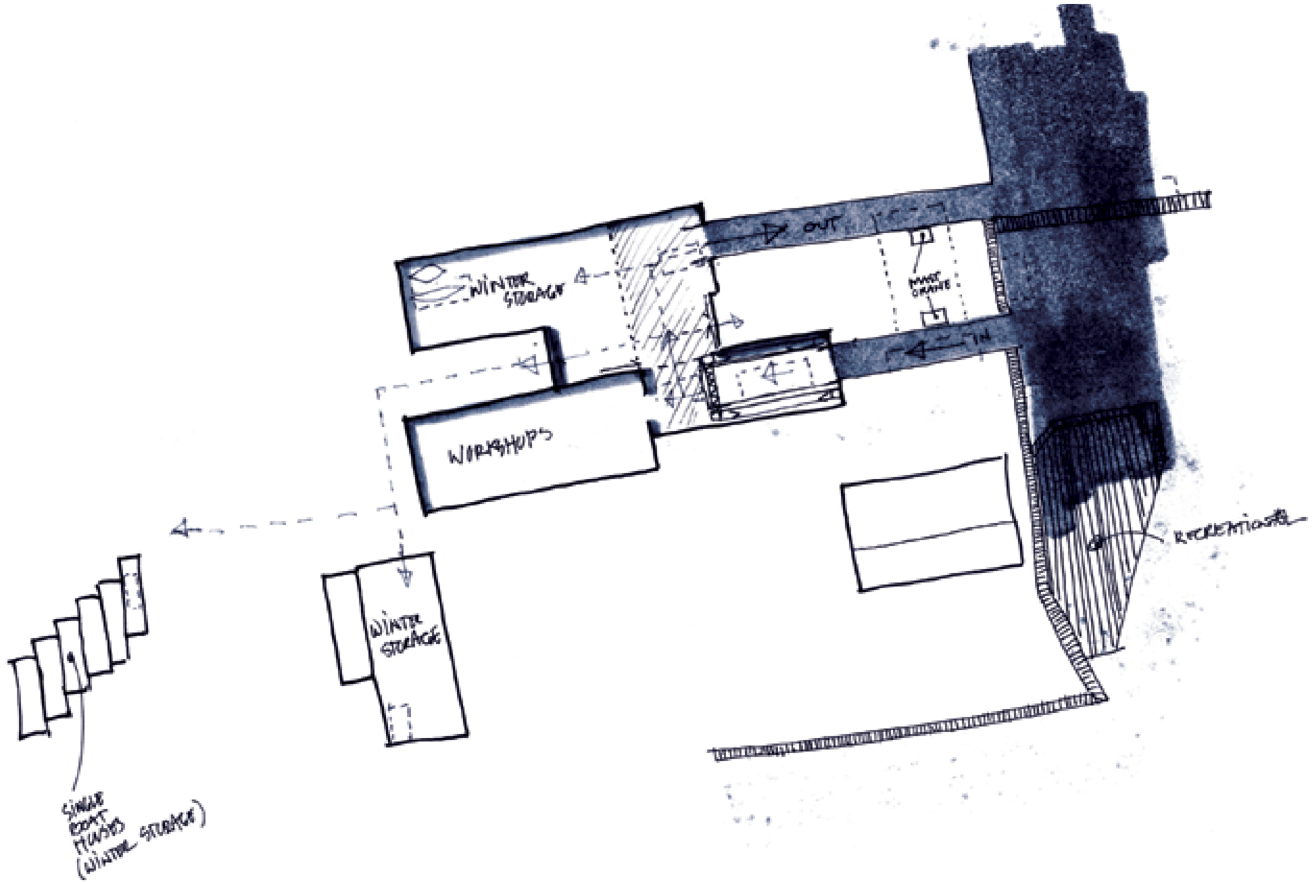


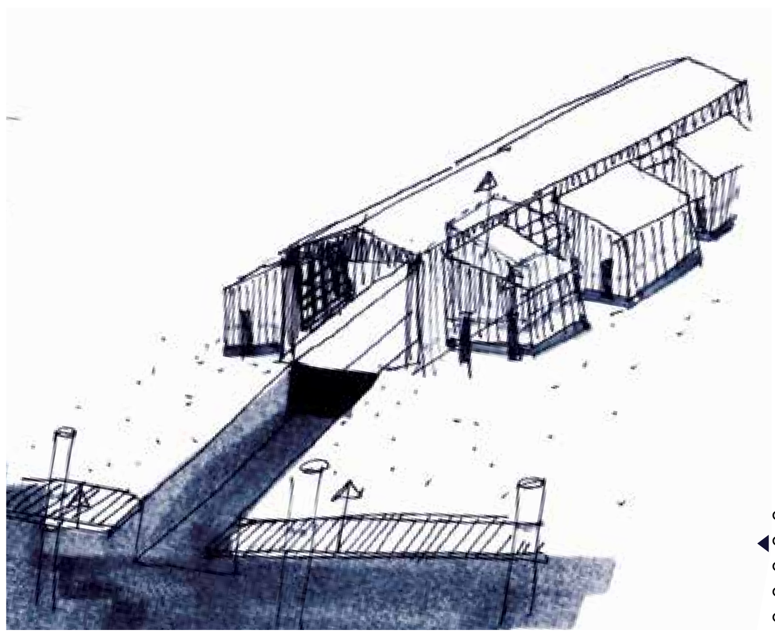
Initiating Concept

Inspired by the life at The Boatyard and the owner's future vision, the initiating concept was developed. The owner's vision is to create a full service center for boat owners and the concept takes departure in exactly that.
A production line at a factory became a metaphor for that and was the inspiration for the concept.
1. The boat comes in and the workshop facilities take care of the problem. 2. The boat get stored for the winter and launched in the spring. 3. The boat sails and uses the recreational facilities at the harbor.

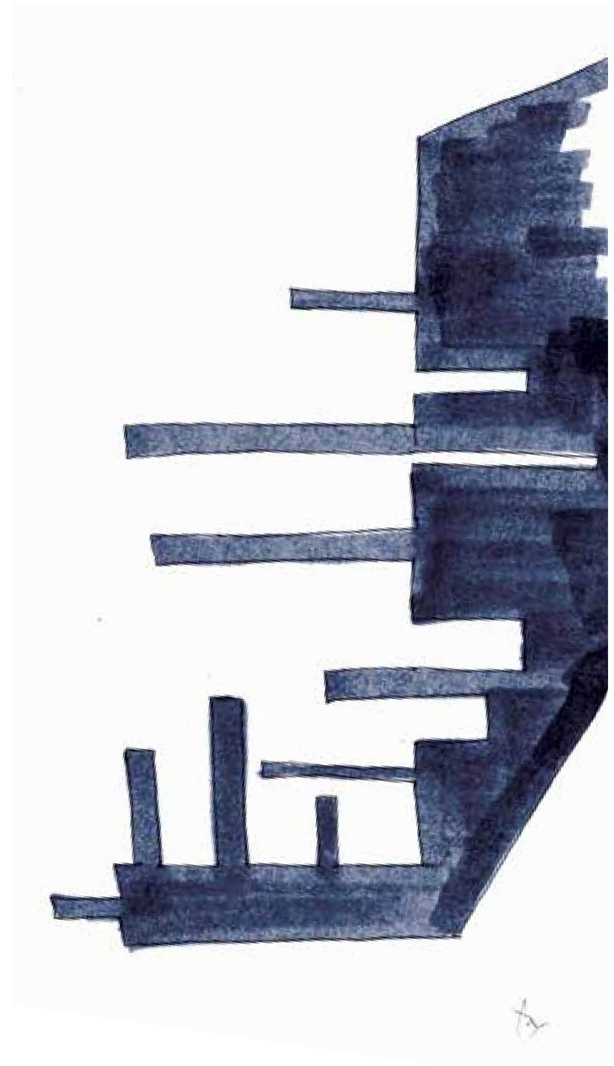
The concept works with both landscape and buildings together as a whole. In the following sections the iterations is shown divided into the different design parameter themes.

▲97.1 Initial concept model





98.1 Concept sketch, plan development ▲
◀98.2 Concept sketch, perspective
99.1 Concept sketch, water and landscape▶
99.2 Concept sketch, buoyant building▶
99.3 Concept sketch, facade expression▶

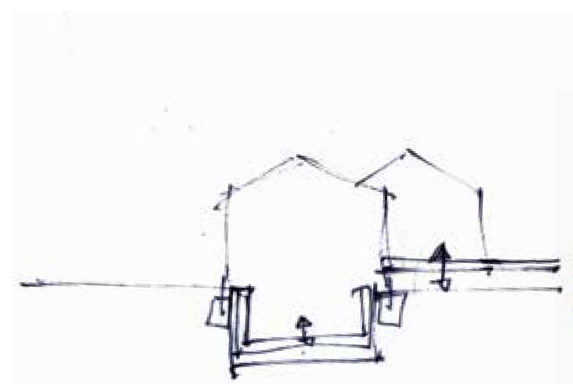


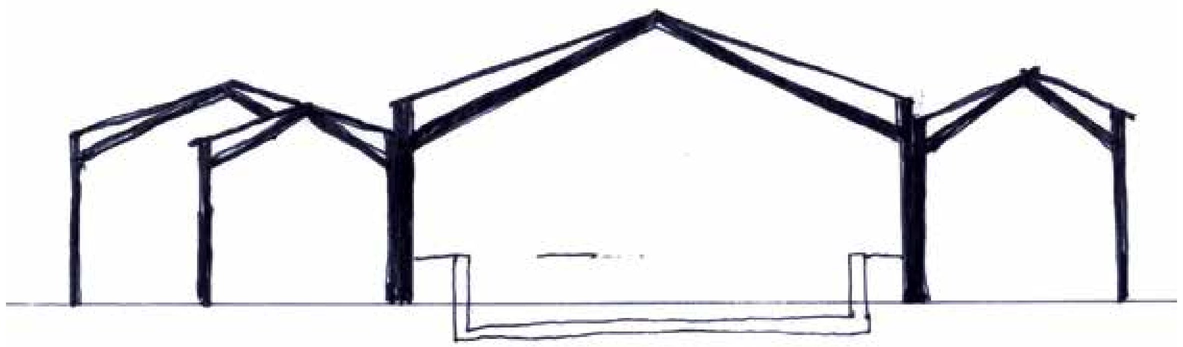
Water vs. Landscape

The concept model inspired to several sketches exploring the circular motion of "the production line", dragging water into the workshop and out the winter storage halls.
In development of the design the circular canals were abandoned as there were no particular reason for the circular movement, other than being a literally extraction of the initiating concept, as a result the canals were straightened.

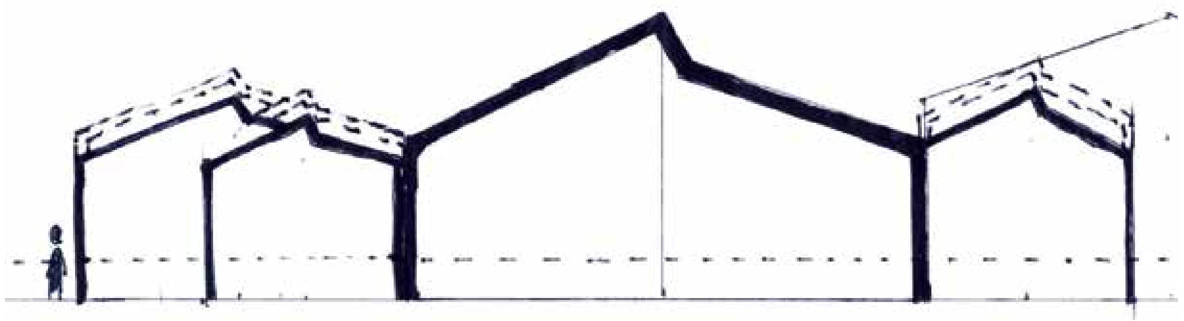
The straight canals lead to the final concept for the water and the landscape; as two puzzle pieces fitting together. Utilizing the water's entering the buildings as a force, letting the boat sail into the workshop, then pumping out the water and repair the boat. Then store it and launching the boat in a rather old-fashioned manner, from a rail system into the water. But what would happen in the case of a flood? New questions and research were made of amphibious buildings and how that works.

The concept is based on the number of things that happen when the Fjord floods the landscape. First there is an interaction between water and landscape, a change in the scenery. When that happens the buildings react, some stay and gets flooded, others react and become part of the dynamic of the landscape, by floating. Buildings are normally static, but are added a dynamic feature as a method to work with the static/dynamic balance.

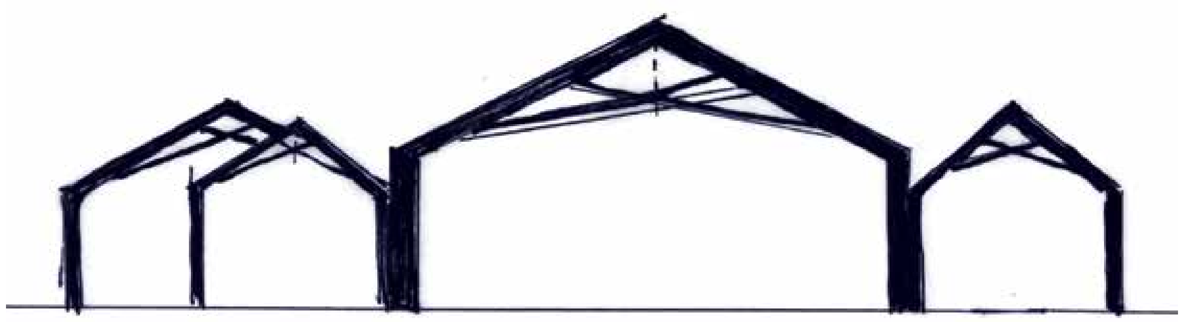




100.1 Sketch: exploration of structural principle ▲

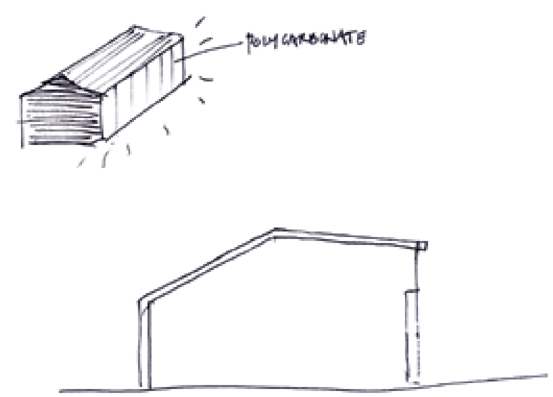


100.2 Sketch: exploration of structural principle ▲
100.3 Sketch: exploration of structural principle ▼



Tectonic Structures

The development of the structural system was mainly made through sketches and models. The most common roof structure on and around the site is the saddle roof; thus a reaction to this became to explore the possibilities and alterations of the shape through a simple shape model study. As a simple shape study was not comprehensively, it was developed in sketches, where several things were explored. The structure according to flooding events was one of the parameters; this gave demands to the structure's weight and material, in close relation to site registrations. Where the immediate building material on the surrounding buildings and the current is metal sheets on slim steel construction, the boat guild's house from 1967, a wooden structure with wooden cladding is the best kept building at the site. The allotment shack-like houses at Klondike build in wood, serve as another inspiration for construction and cladding material.
The structural inspiration derived from boats, a daylight parameter and from a newly renovated, hundred year old boathouse, some of which were tested in model. The latter being the structure further processed in the final design. This structure was the strongest, when tested in model, both in strength and in expression. The scissor truss has an authenticity and an expression of everlasting strength. The scissor truss asked for a parametric test of length, geometry and was experimented in a digital parametric model. The idea of applying the structure to all the buildings arose; this would test the scissor truss in many different combinations, sizes and roof angles. Another parameter was that the structure in the amphibious buildings should be dimensioned to resist loads but be slim and as light as possible to float. Resulting in calculation iterations; as the structure was developing and detailed.



◀101.1 Sketch: exploration of structural princip

Open vs. Closed

As a reaction to the analysis that the boatyard should become more extrovert than the current introvert expression lead to a study of openings, how to open a wall? The study was further inspired by the case study of a detail – the pivoting walls in the façade of Storefront for Art And Architecture p.22.

Six models with different methods to opening were developed. The different methods had its own characteristic and quality was implemented differently, in the different buildings.

Model one worked with the issue of privacy, and was directed at the quay houses. The pivoting opening would allow the building to be a closed box when not used, and unfold when in use – the unfolding walls would screen for neighbors and wind and open for a view.

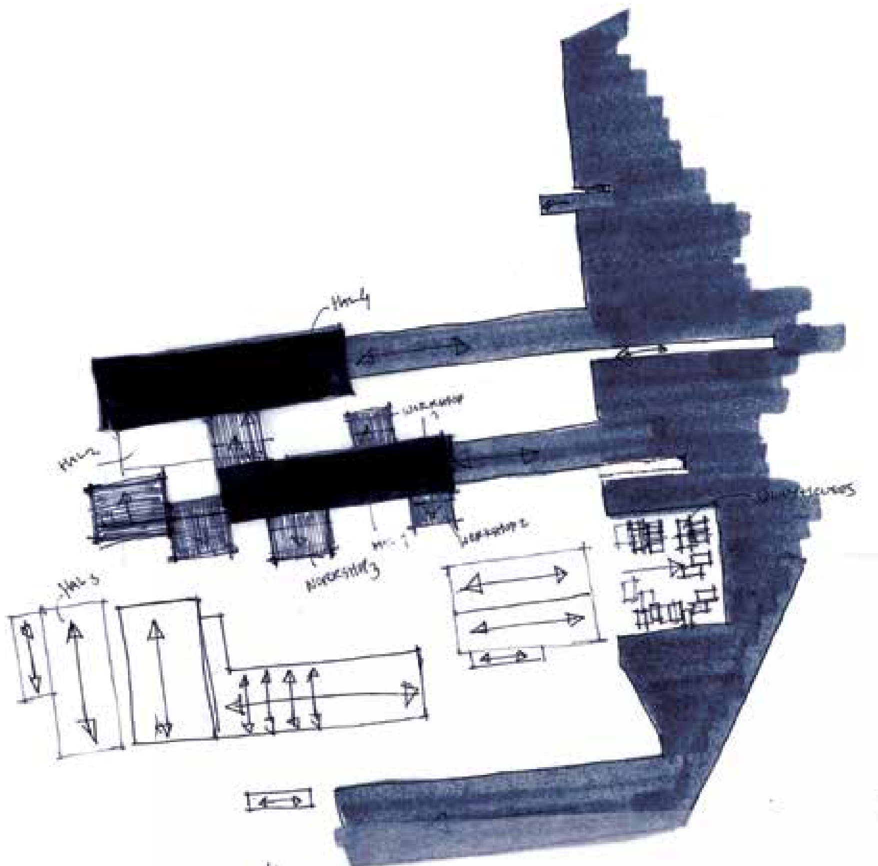
Model two worked with the same theme, but creating new special qualities in an extra covered space with in the existing space, when the wall would pivot in the middle.

The theme for model tree, were to minimize space of the open walls and at the same time maximize the opening. This solution would be ideal for the large gates as these otherwise fills in the landscape and are difficult to maneuver. Another advantage is that if needed only a section of the gate could open. The fourth model, also explored the folding walls, but as the folding wall would become a shade.

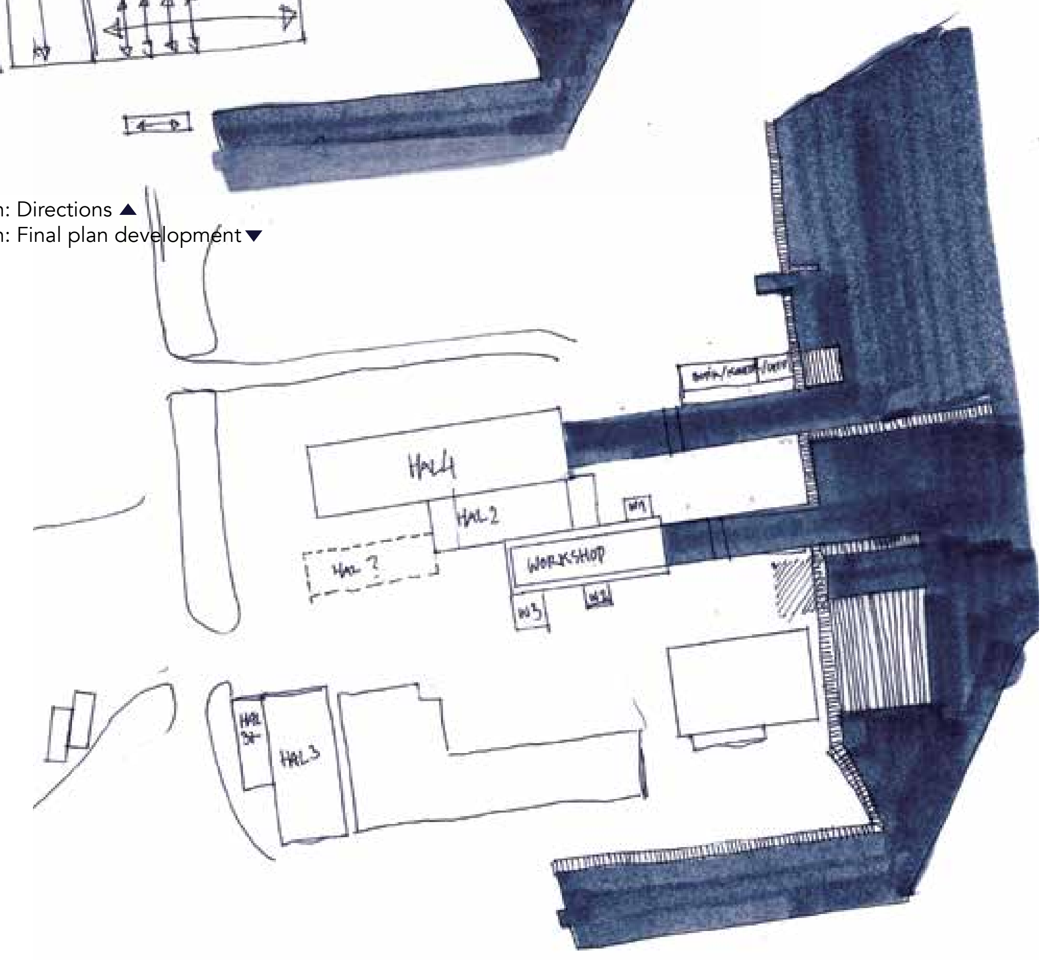
The main theme for the fifth model was sliding doors. Sliding doors the quality of minimizing space in the entering or exiting space, but demand the equivalent wall space. This feature could also be an interesting design factor if the sliding door of a solid material would slide in front of or behind a window, the daylight characteristic would change the space. The sixth model further investigated pivoting panels, more directly inspired by the case study of Storefront for Art and Architecture. Both vertically and horizontally the opening panels were more regular window and door sizes, further exploring how the building could become extrovert by unfolding the furniture on the outside wall and would allow a not so common incoming daylight inside as a chair would unfold on the outside.

The different features from this study will be implemented in the final design.

102.1-6 Detail model study: Open vs. Cosed

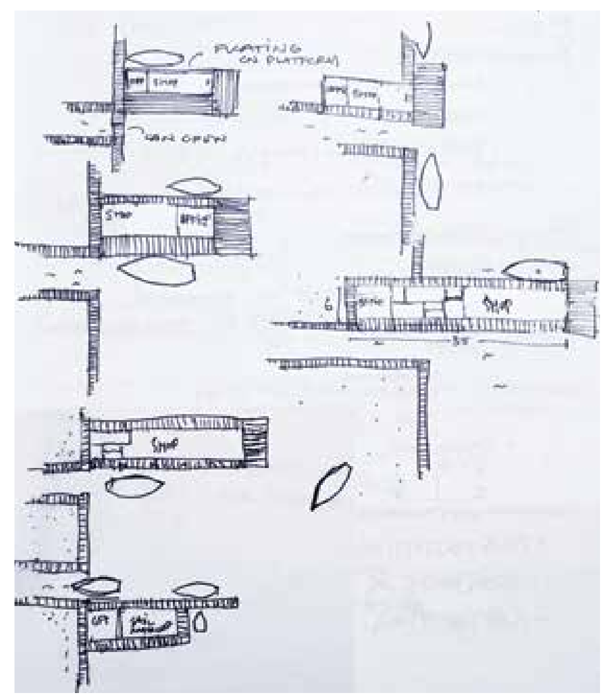


104.1 Sketch: Directions ▲
104.2 Sketch: Final plan development ▼



Water vs. Landscape part 2
Final development of site

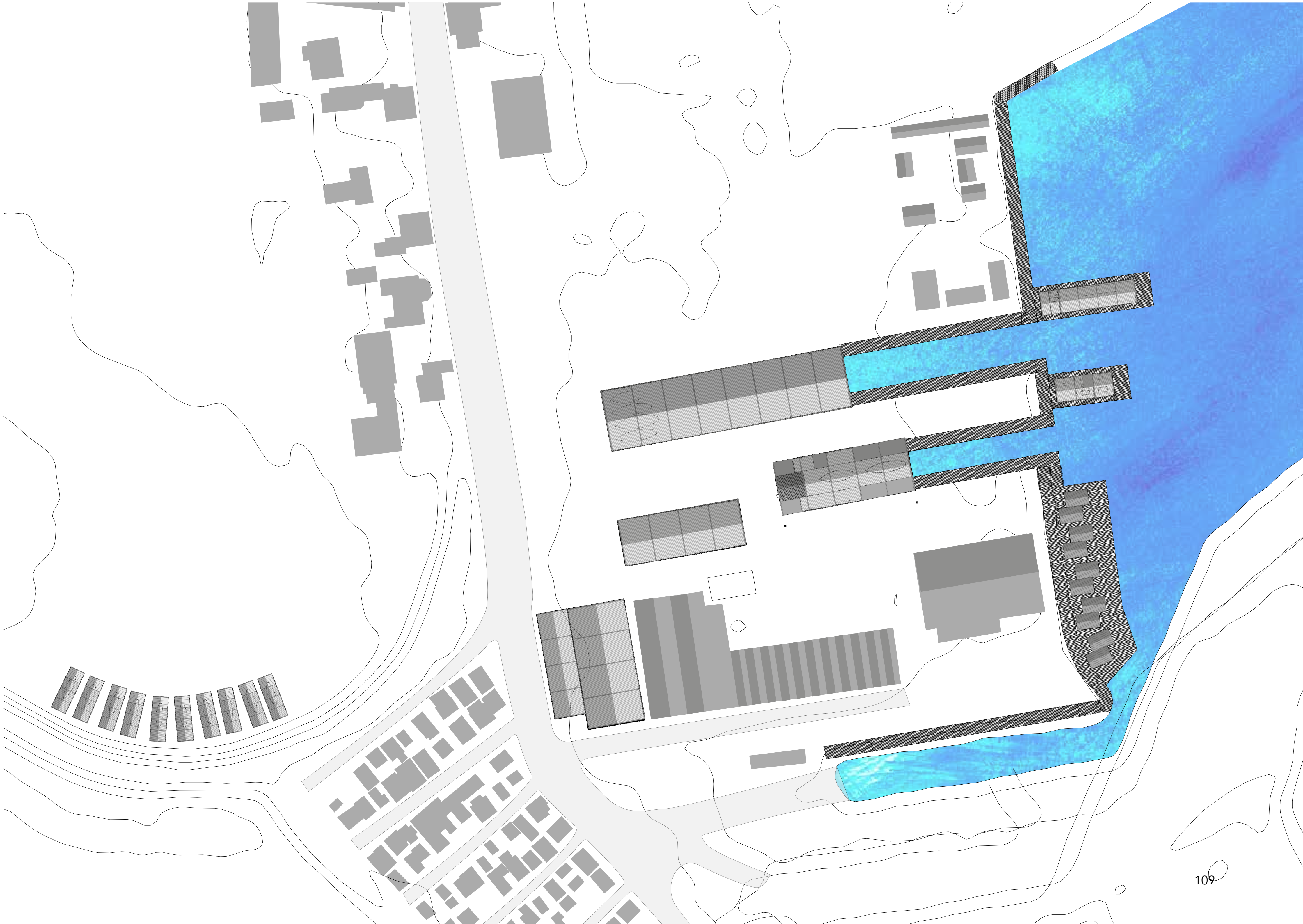
The final iteration for the site plan involved moving a building, thus opens the site and makes the waterfront accessible from all sides. Further the wood-, metal-, varnish and paint workshop were placed within the boat builder workshop as the detachment of these created more obstacles than gains.
The sail maker workshop was moved to the water; as people working here would be more sedentary and the new placement would offer other qualities and characteristic to the space, with view to the harbor and closeness to the office.
In addition to the move of the sail maker workshop; the ca. thirty-five meter long building with office, storage and boat equipment shop was reduced in size; the length of the building created a problem of the freedom to move in the harbor basin; witch conflicts with the purpose of being a boatyard; therefore the office were moved and placed together with the sail maker workshop. This placement gives the office a central placement at the boatyard; being able to watch ships going into the boat builder workshop and boats being able to dock right next to the building.
All the functions by the water are placed on floating platforms; that includes office, meeting room, sail maker workshop, shop and quay houses, allowing the buildings to move with the tide.



◂105.1 Sketch: placement of functions in the fjord

PRESENTATION

Master Plan
Concept
Floor Plans
Sections
Materials
Conctruction
Facades
Details

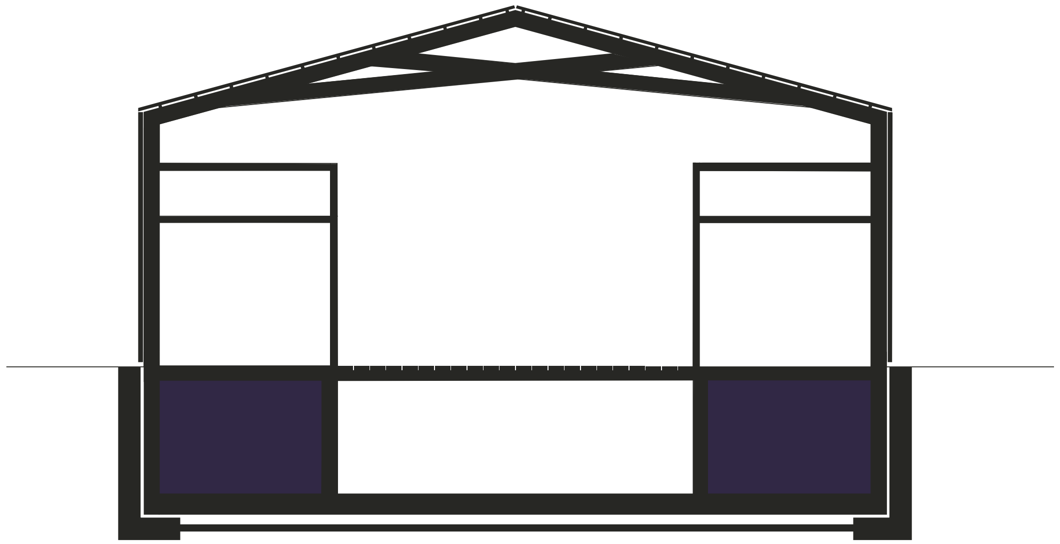


107.1 Render: Canal to boat builder workshop ▲
109.1 Master plan, no scale, see drawing 1 in drawing folder ▶

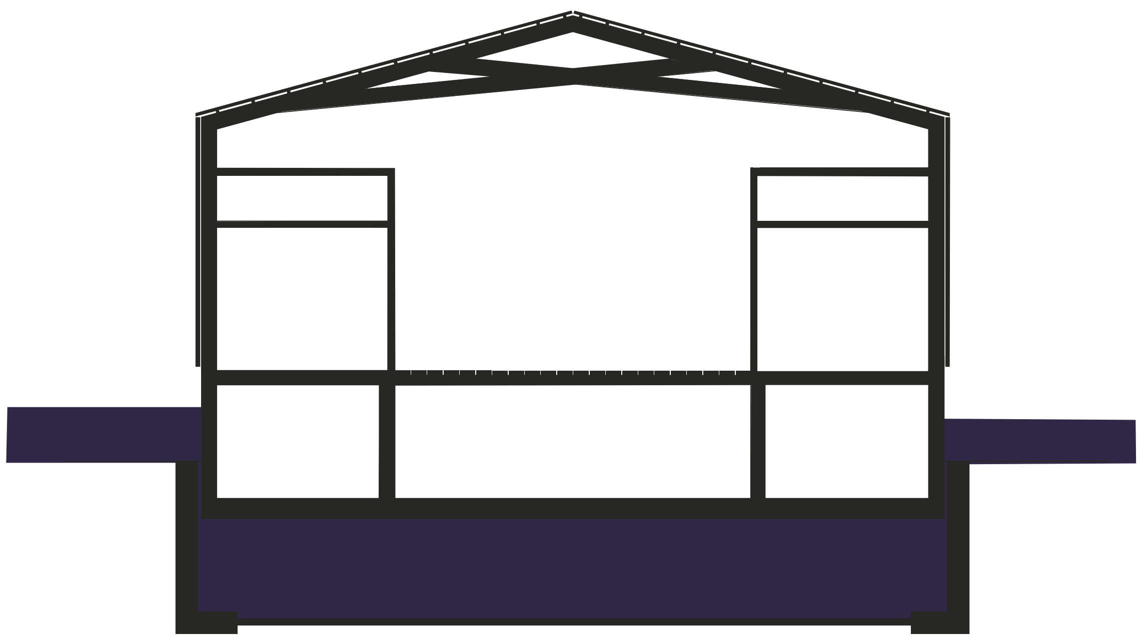
CONCEPT

The concept is based on a chain of reactions that first and foremost is symbolized with the unifying of landscape and architecture. The chain of reactions begins with a storm, the storm causes a flood, the flood takes over the landscape, and the buildings react to the flooded landscape by floating.

◀110.1 Photo collage: Concept



112.1 Diagram: Boat builder Workshop in resting position ▲
112.2 Diagram: Boat builder Workshop in flood situation ▼



AMPHIBIOUS ARCHITECTURE

When the term amphibious is applied to living creatures, it refers to an organism that withholds the quality of a twofold nature; a capability that enables the animal to live both under water and extended periods on dry land.

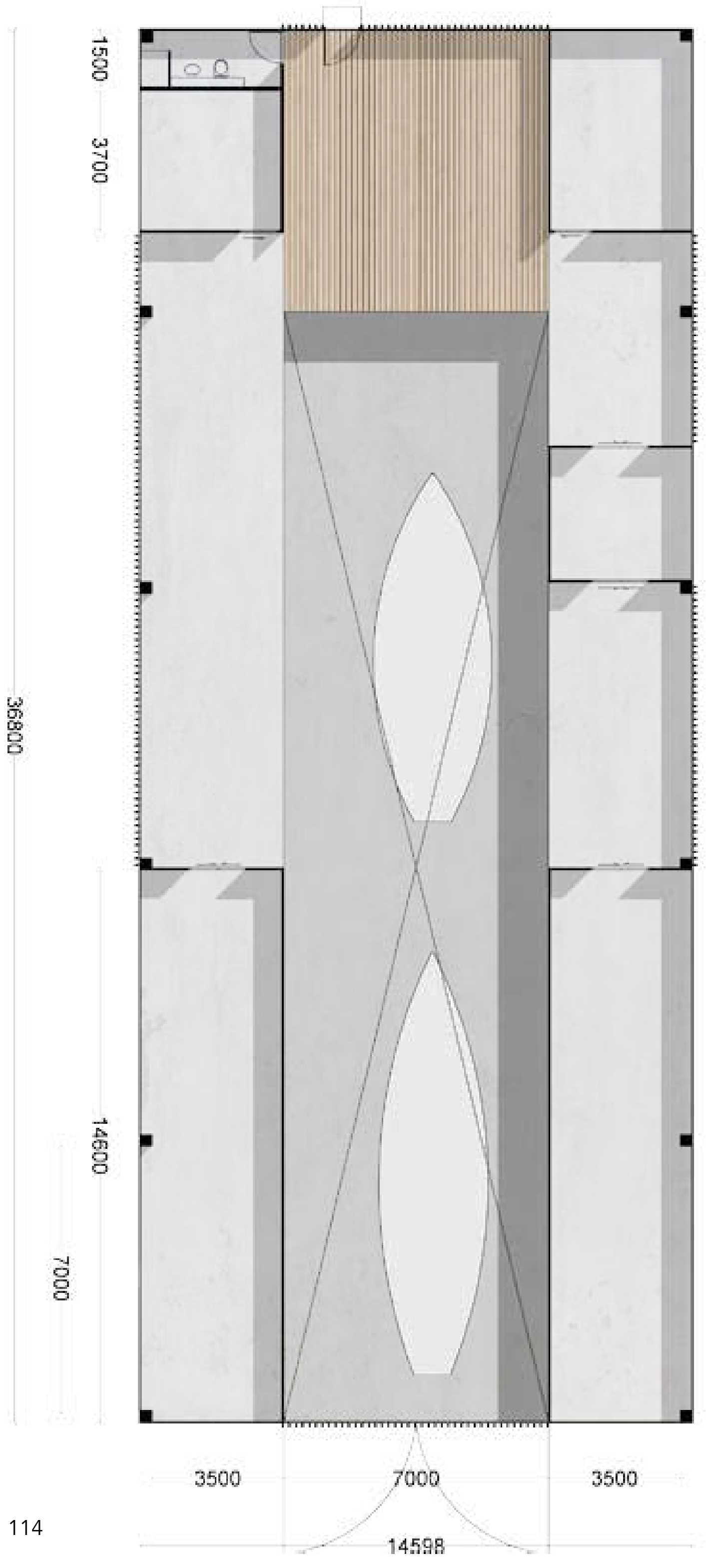
The dualistic life pattern has by a biomimicry approach become translated and innovated into an architectural effect that seeks to solution the challenges of high tide.
An amphibious building is a building that rests on the ground but whenever a flood occurs, the entire building floats. It rises up in the dock, buoyed by the water [Baca Architects, 2014].
The amphibious characteristic would benefit The Boatyard 2.0 due to the sites dependency on functionality, both during normal-, high tide periods and floods.
The amphibious effect is represented in this project due to this specific efficiency when sea level rises. The effect is applied in the boat builder workshop, which rests on a base in the ground. The district plan requires new buildings a minimum of 2 meters DDN plinth elevation. [Skive Kommune, 2007] This requirement is possible to deviate from when the building is amphibious.

How It works

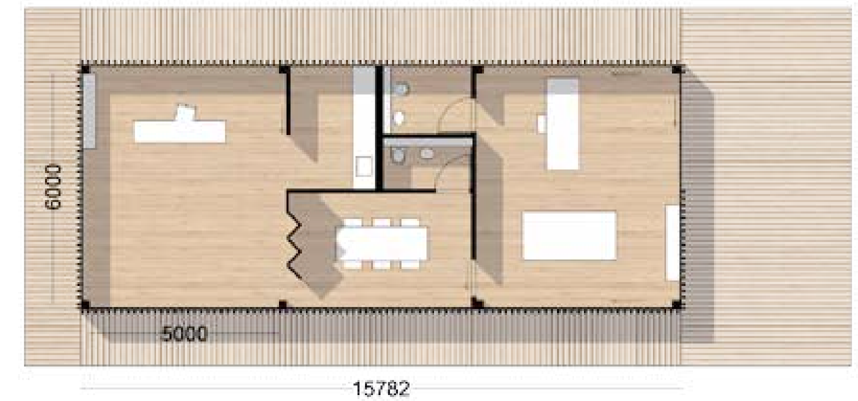
The base for the boat builder workshop is connected to a canal with fjord water. The boat builder workshop is equipped with two water tanks; one in each side of the building. The size of the tanks corresponds to the size of the dock in the middle. Each tank is divided into smaller compartments to avoid sloshing. Sloshing means any motion of the free liquid surface inside its container. [WCEE, 1:2012] The tanks are further equipped with a punctuated tube. When it freezes in wither, air is blown into the tube, creating small air bubbles that makes enough motion in the tank to prevent the water from freezing.
In periods with normal tide, these tanks are filled with water, securing the building stays in a resting position. See Illustration 108.1
When a boat enters the workshop, a series of actions occurs.
Before the boat enters the workshop, a stand is prepared and marked. Then valves are opened and water enters the dock. When the water level is equal on both sides, the gate is able to open. The dock is then transformed from dry-dock to wet-dock and the boat is capable of sailing into position. The gates then close and the water is drained from the dock back to the canal. The boat stand is inspected to make sure it is secured correctly. Hereafter it becomes possible to do the necessary work on the boat.
When the work is done and the dock is cleaned for tools and scrap materials, the valves are opened and the dock fills with water, which makes it possible for the boat to leave the workshop.

In the case of high tide the water from the tanks are drained, for the building to float the dock also needs to be emptied. The building will under these circumstances float and the waterline is in a height of 1.8 m on the outer wall. See illustration 108.2. For calculation of buoyancy see appendix A – Buoyancy Calculation

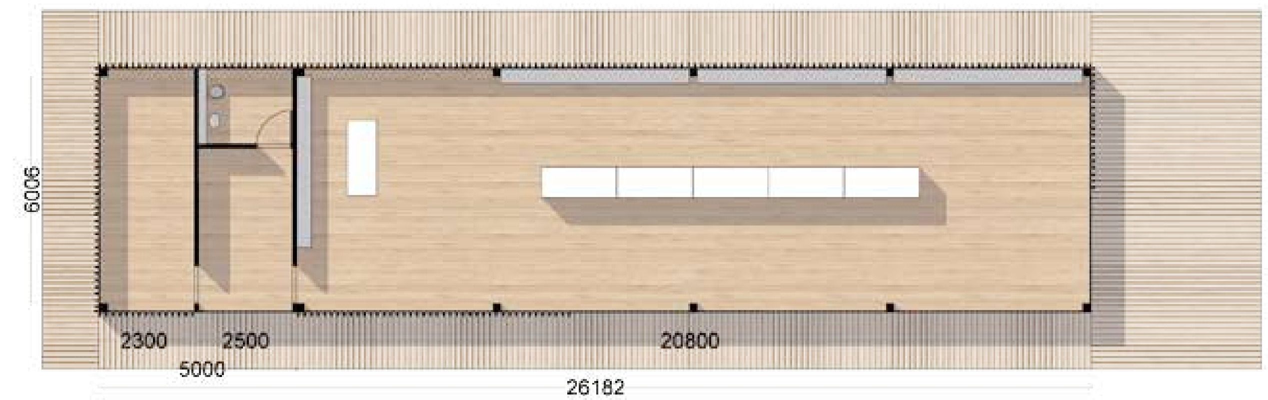
FLOOR PLANS



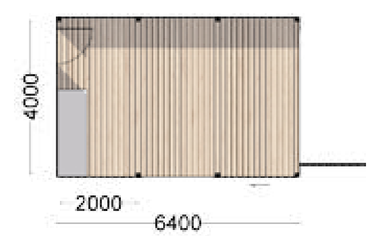
◀114.1 Plan: Boatbuilder workshop 1:200

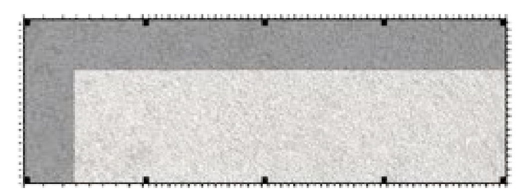


115.1 Plan: Office, meeting room, kitchen and sail maker workshop, 1:200 ▲



115.2 Plan: Boat Equipment Shop and storage, 1:200 ▲





115.3 Plan: Quay House, 1:200 ▲
115.4 Plan, Boathouse, 1:200 ▶

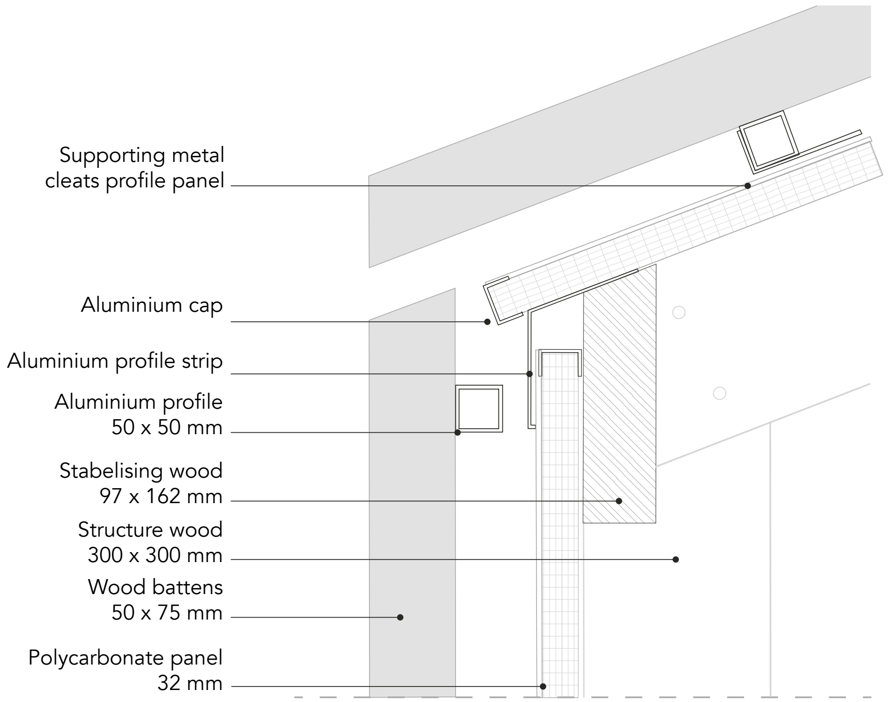
MATERIALS

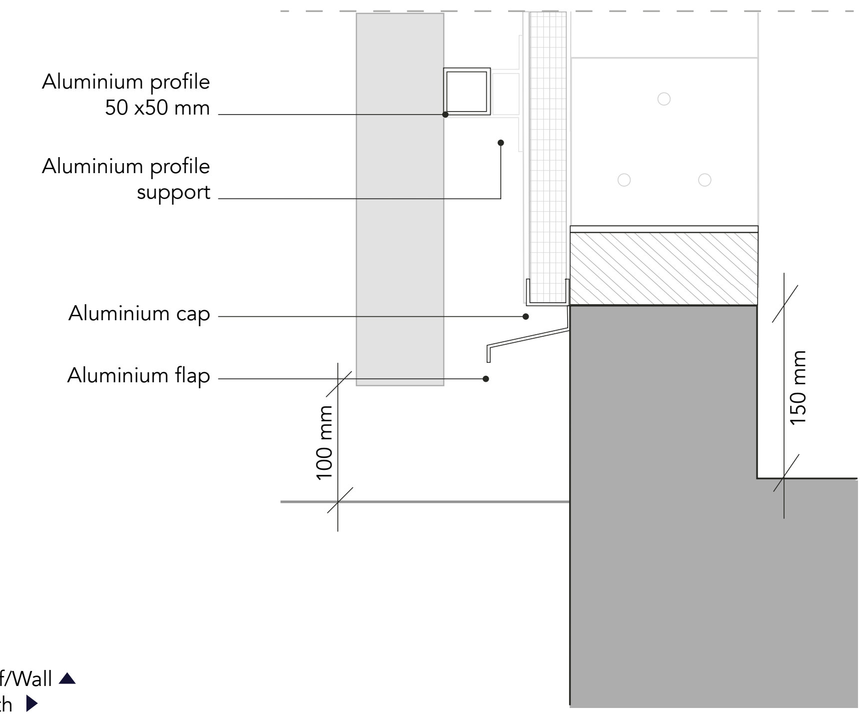
For the experience of the buildings and the atmosphere the materials are important. The aim for the atmosphere is to draw reference to a maritime feeling and at the same time achieve a degree of transparency for light to enter the buildings.

Wood, Polycarbonate and Concrete

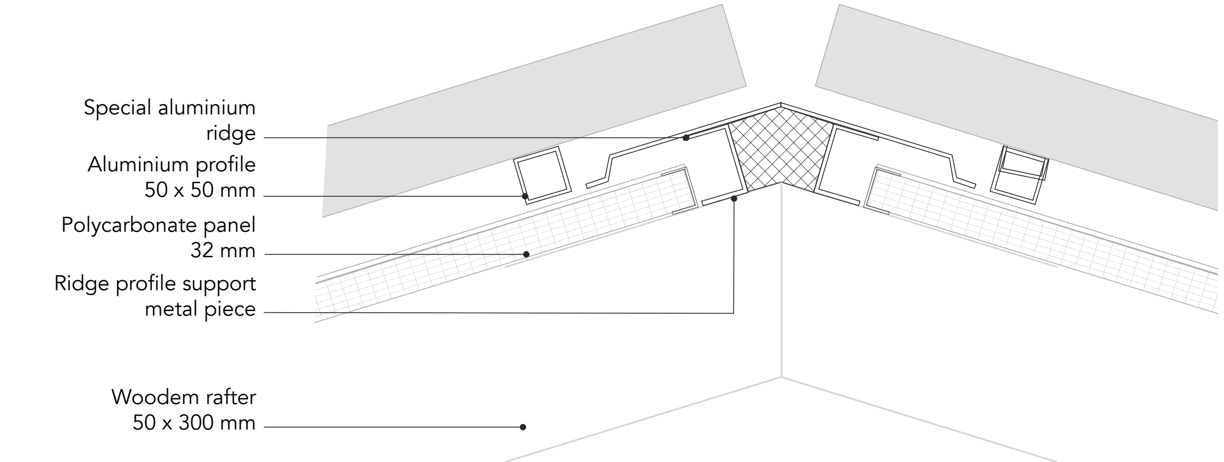
The palette of materials has been limited to a small number of untreated materials: wood, polycarbonate and concrete.
As the most visible material, untreated larch wood has been chosen for the façade material. Larch wood is ideal for facades as the life span is 10-15 years and from nature is tolerant of biological degradation [Andreas Bergstedt , p.2], [www.bolius.dk]. The untreated wood has mainly been chosen to protect the environment from chemical coating. Besides from being a sustainable choice of material, a desired visual expression emerges when the façades rather quickly turns grey. The wood surfaces are exposed to different elements such as sunlight, rain, snow, sleet and hail. These factors will give the façade a unique patina according to the exposure of the different surface. [Detail, 172:2012] The wooden staves are combined with a polycarbonate surface underneath that allows a diffused light to enter the spaces. Polycarbonate has a long list of advantages as a façade material, among these are that polycarbonate is a highly insulating material, for 40 mm panels, a u-value up to 0.25 [www.extechinc.com] and that there are LEED credits available for 100% recyclable polycarbonate. The façade cladding further allows the structure to become a visible element in the interior.
To elevate the wood from the ground, the buildings have a concrete plinth. Se detail 118.2
To visually mark the identification of the different buildings, inspiration has been drawn from the way boats are being identified; with the characteristic sail number. The graphical expression has been utilized as cut outs in the wood. For navigational purposes, the storage buildings have been provided with identification marks. These marks aim to secure a functional solution to wayfinding and ensure comprehensible communication between boat owners and administrational staff. As the equipment shop, office, sail maker and workshop each have a name these buildings do not have a number or any specific identification.

116.1 Material: Larch
116.2 Material: Polycarbonate
116.3: Concrete

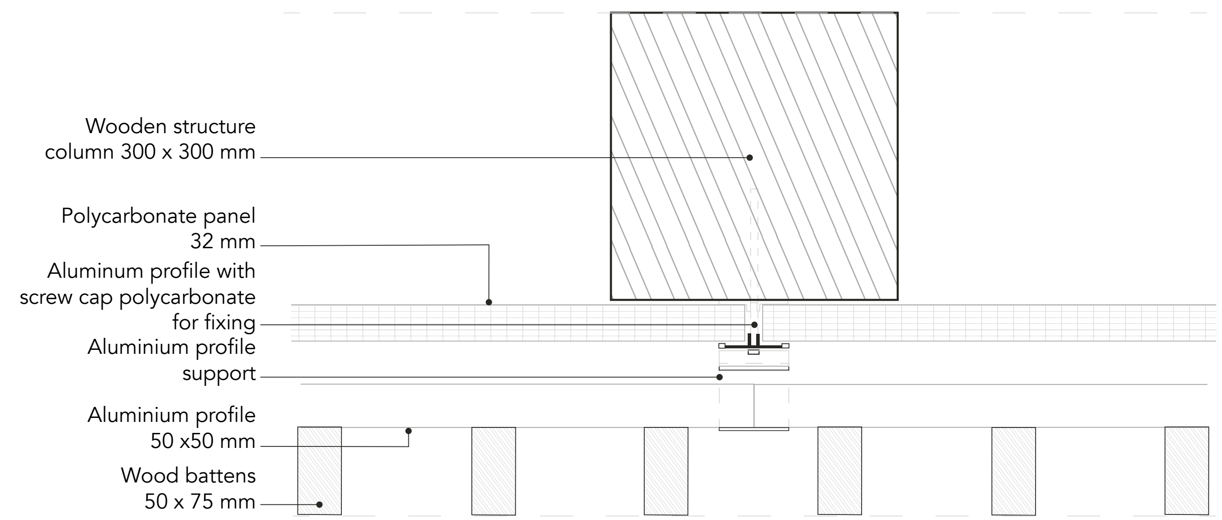




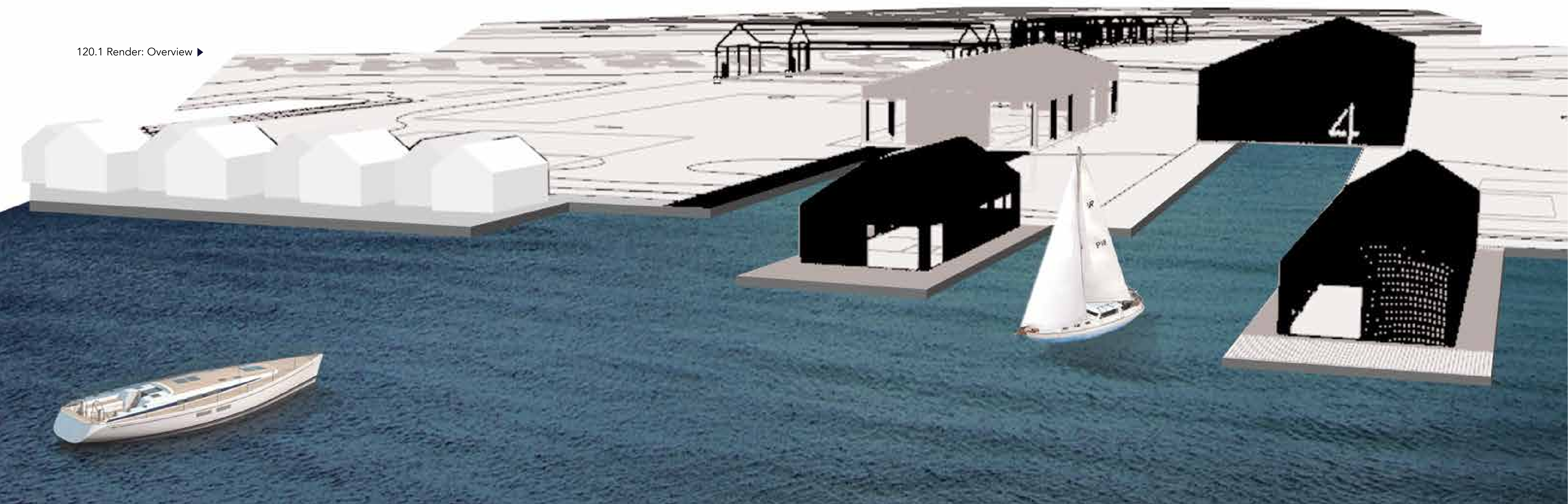
118.1 Detail: Roof/Wall ▲
118.2 Detail: Plinth ▶

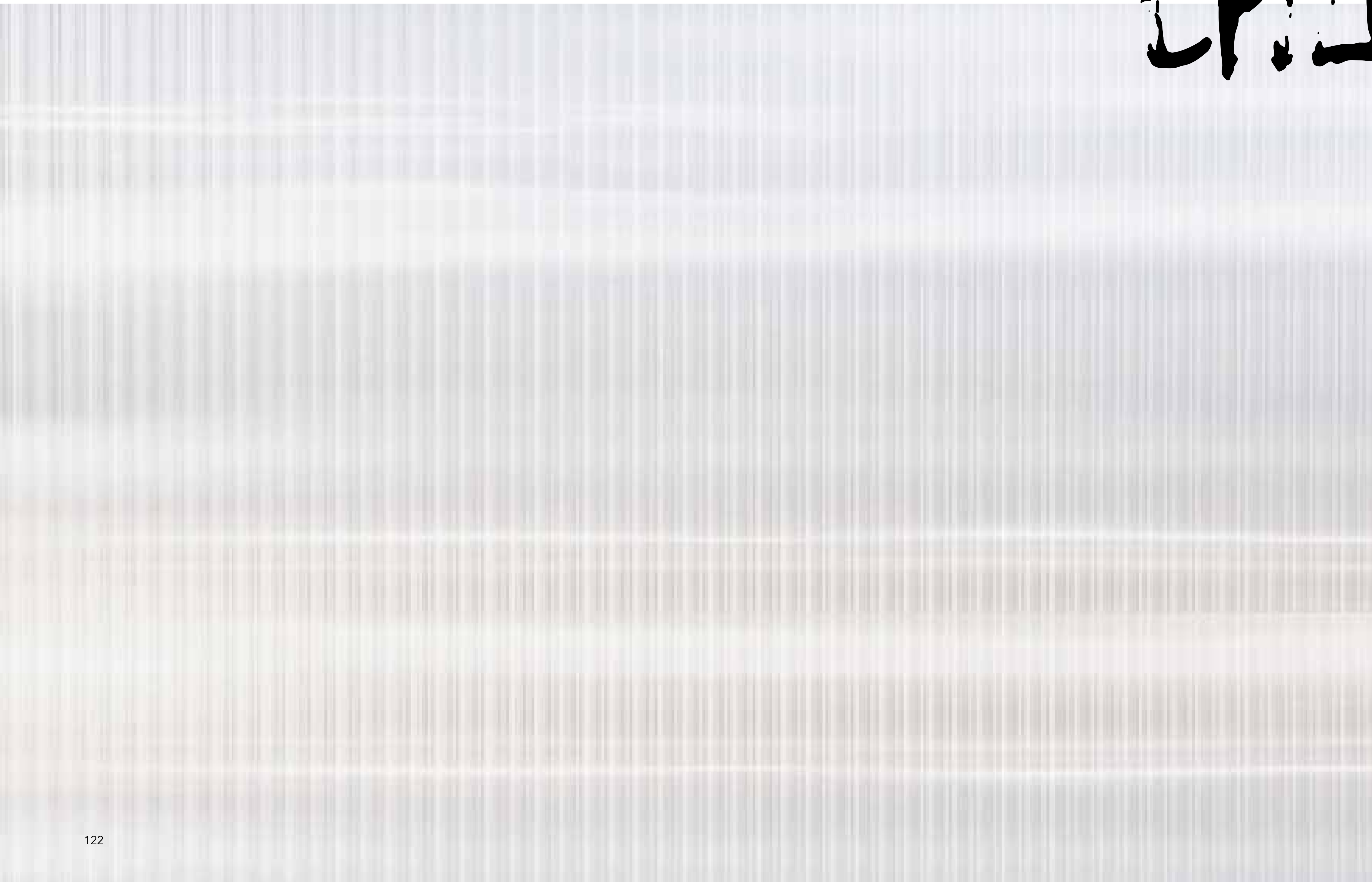


▲ 119.1 Detail: Ridge
▼ 119.2 Detail: Facade section



120.1 Render: Overview





EPILOGUE

Conclusion
Reflection

CONCLUSION

The Boatyard 2.0 is the answer to the need for rethinking industry by the waterfront, in times with more frequent high tides. Situated in and by the water in the city of Skive, the buildings become part of the landscape and secure workflow despite weather conditions. The project places itself in the discussion of how to adapt to the changing weather conditions that we are facing these years, by employing its largest disadvantage to its gain.

Amphibious Tectonic Architecture

In a time with increasing tides, amphibious architecture is explored as a method to live with and not against nature. Amphibious buildings have the advantage of being able to rise from its dock when a flood occurs. An amphibious construction combines standard components from construction and maritime industries to create an integrated solution to flooding [Baca Architects, 2014]. By allowing nature inside the architecture – architecture and landscape becomes a whole, thus becoming tectonic architecture. Further enhanced by a clear structural principle.
The buoyant effect contributes a new feature to the landscape, a new dynamic.

Atmosphere, Place and Materials

By multiplying the structural principle to all the buildings, only changing details in the cladding gives The Boatyard 2.0 its unique identity. Taking construction inspiration from an old boathouse and using wood as a general material together with polycarbonate gives the buildings a certain transparency and if lit up at night let The Boatyard 2.0 become a lighthouse in the fjord. Additionally The Boatyard 2.0 places functions by the waster and creates the frames for recreational spaces.

REFLECTION

In the process of executing this project I have sought a way to combine landscape and architecture as a whole, through a tectonic approach. This challenge has required a symbiosis of architectural as well engineering skills.
The contrariety between the two professions, architecture and engineering, has at times manifested itself as challenging to unify. Thus I ended up experiencing a state where the boundaries became fluid and the two poles became a unity; where the technical parameters benefitted the architectural and vice versa. This resonates with the concept of the project: wholeness.

The idea of working with amphibious architecture derived from a life as a sailor and the irony that lies in a boatyard that gets flooded. Furthermore, there is something somehow poetic and cyclic in the process of seeking solutions to challenges caused by nature, with innovations created and engineered by nature. That specific binary characteristic of amphibious organisms is one of nature's core design tasks, due to its existential value. The amphibious organisms that sought out of the water and developed survival skills on land are the very reason life developed on earth. This thought reflects the process of working with a place that is dependent on and threatened by nature.

Much of my attention has been given to the boat builder workshop as a result to this. I am aware that more attention could have been paid to the other buildings to fully optimize their potential, especially on a structural level.
In retro perspective, the personal motivation that initiated this project has been both a rare insight that has benefitted the intuitive knowledgebase, but nevertheless has the personal involvement occasionally manifested itself as a struggle to keep distanced. Reflecting on a process that has been driven by intuitive interest and personal motivation, extracts the self-development that has occurred during the project. Personal and professional weaknesses and strengths have become tangible and the possibility to observe my own shortcomings and forces, offers me the possibility to manage time in a more reflected manner in future projects.

The challenges of rising sea levels, seems as a highly relevant issue to address by architecture as the difficulty will continually increase and demand for architecture to adapt these circumstances. I've found that a biomimicry approach in architecture is interesting, as it utilizes the innovations of nature and inspires sustainable solutions. It has provided an extra dimension to my understanding of approaches to architecture and engineering, which has become a newly found base for further future exploration.

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ILLUSTRATION LIST

the site, connecting access from Viborgvej.

0.9 Lookbook: © Klok, J.S., 2016. Old fishing boat.

64.1 Diagram: Infrastructure, own illustration

0.10 Lookbook: ©Klok, J.S., 2016.With Klondike in the back - view towards the fjord. The angler's harbor, and the owner of the oldest house at Klondike, who also is the architect of the harbor design, from 1969.

68.1 Diagram: Flow, own illustration

0.11 Lookbook: ©Klok, J.S., 2016.The Boatyard viewed from the pier.

72.1 Diagram: Functions, own illustration

0.12 Lookbook: ©Klok, J.S., 2016.The boat builder workshop and the wall that formerly kept the water from flooding.

0.13 Lookbook: ©Klok, J.S., 2016. Mast shed

¬¬0.14 Lookbook: ©Klok, J.S., 2016. Temporary self-made support for boat.

0.15 Lookbook: ©Klok, J.S., 2016. View of Skive Boathouses A.M.B.A. the dinghy harbor and in the far back of The Boatyards winter storage buildings.

0.16 Lookbook: ©Klok, J.S., 2016. Klondike is characterized by being a place for anglers, with buoys and places for drying nets.

84.1: Photo: ©Klok, J.S., 2016.Charateristic Klondike building
86.1: Photo: ©Klok, J.S., 2016. Atmosphere by the pier
92.1 Sketch: Design process, own illustration
94.1 Sketch: Function placement, Own illustration
96.1 Concept sketch: perspective, own illustration
96.2 Concept sketch: plan, own illustration
97.1 Model photo: ©Klok, J.S., 2016. Initial concept model
98.1 Concept sketch: plan development, own illustration
98.2 Concept sketch: perspective, own illustration
99.1 Concept sketch, water and landscape, own illustration
99.2 Concept sketch, buoyant building, own illustration
99.3 Concept sketch, façade expression, own illustration
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102.1-6 Detail Model study: Open vs. closed, own photo
104.1 Sketch: direction, own illustration

104.2 Sketch: final plan development
105.1 Sketch: placement of functions in the Fjord
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109.1 Master plan: own illustration
110.1 Photo collage: concept, own illustration
112.1 Diagram: Boat builder Workshop in resting position, own illustration

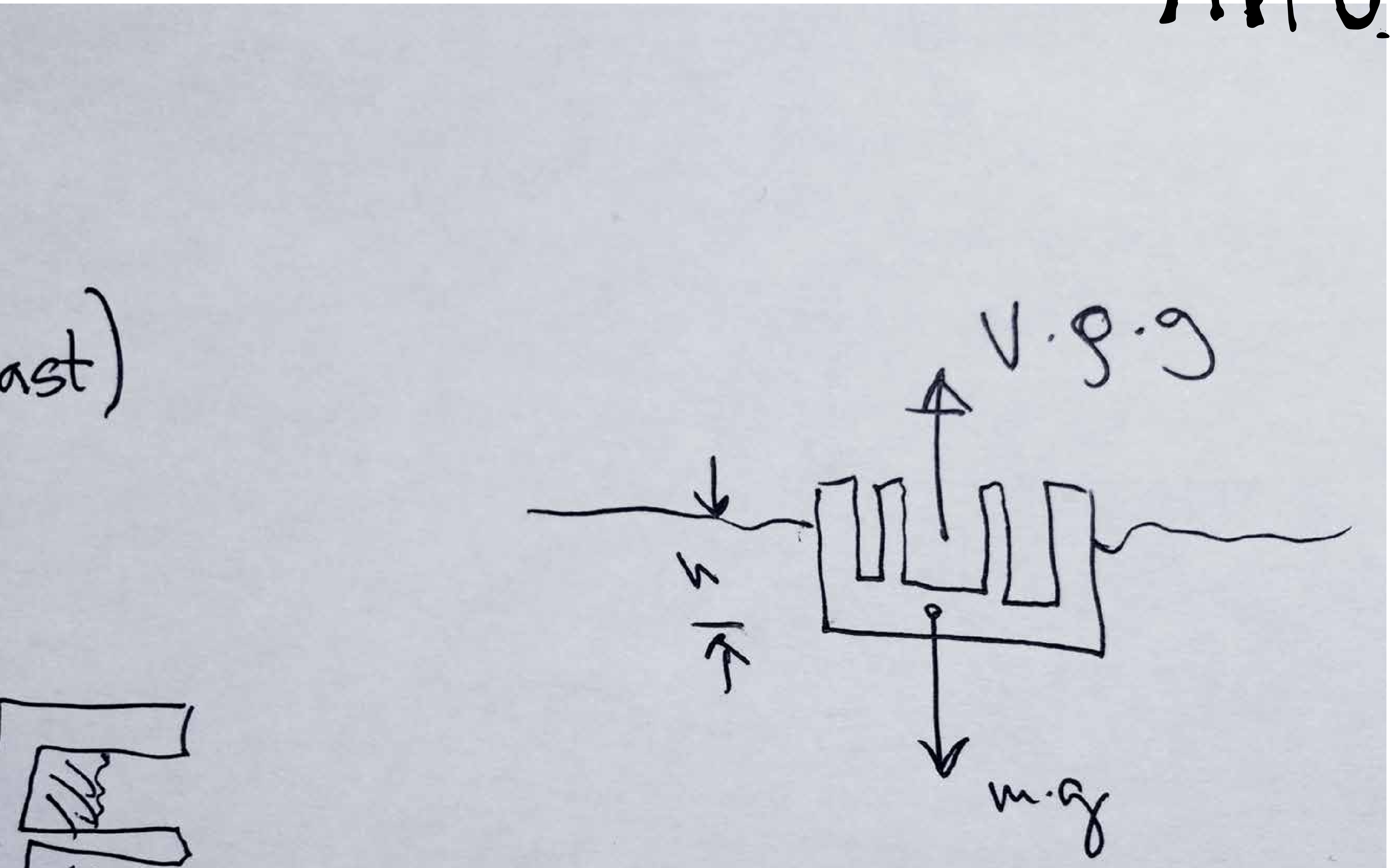
112.2 Diagram: Boat builder Workshop in ood situation, own illustration

114.1 Plan: Boatbuilder workshop 1:200, own illustration

115.1 Plan: Of ce, meeting room, kitchen and sail maker workshop, own illustration

115.2 Plan: Boat Equipment Shop and storage, 1:200, own illustration
115.3 Plan: Quay House, 1:200, own illustration
115.4 Plan, Boathouse, 1:200, own illustration
116.1 Material: Larch, own illustration
116.2 Material: Polycarbonate 116.3: Concrete, own illustration
118.1 Detail: Roof/Wall, own illustration
118.2 Detail: Plinth, own illustration
119.1 Detail: Ridge, own illustration
119.2 Detail: Facade section, own illustration
120.1 Render: Overview, own illustration

APPENDIX



Boyancy Construction

APPENDIX A - CALCULATION BOUYANCY

Buoyancy

$M_{total} \cdot g = \rho \cdot A \cdot h$

$h= (M_{total} \cdot g)/ \rho \cdot A_{building}$

Where;

$A_{building} = 14 \cdot 38,3 = 536.2\ m^2$

$A_{tank} = 536.2\ m^2/2 = 268.1\ m^2$

$A_{dock} = A_{building} - A_{tank} = 268.1\ m^2$

$M_{total} = M_{construction} + M_{dock} + M_{payload}$

$M_{construction}$=6705,69 kg

M_{Dock1}: (38,3m· 14m · 0,40m) · 2,7 kg/l = 579,096 ton = 579096 kg
M_{Dock2}: (38,3m · 0,8m · 3m) · 2,7 kg/l = 248,184 ton = 248184kg
M_{Dock3}: (38,3m · 7m · 0,20m) · 2,7 kg/l = 144,774ton =144774 kg
M_{Dock} = 579096 kg + 284184kg + 144774 kg = 972054 kg

$M_{payload}$= $M_{maschines}$ + M_{boats} = 26000 kg
$M_{maschines}$: Low: 4 ton, high: 6 ton
M_{boats}: Low 1,5 ton, high: 20 ton

M_{total} = 6705,69 kg + 972054 kg + 26000 kg = **1.00476e⁶ kg**

$\rho_{saltwater}$, is 1026 kg/m²

h= (1.00476e⁶ kg · 9.82) /(1026 kg/m² ·536.2 m²)= **1.8 m**

With empty tanks and maximum load, the building will float and the waterline will be in a height of 1.8 meter on the outer wall.

APPENDIX B - CALCULATION LOADS

Variable Load - Wind

The variable wind load affects the structure due to the structures direction according to the wind and its rectangular shape. The northwestern wind on the longitudinal face of the structure allows pressure and suction. The following calculations are based on Euro Code 1.1-4

Basic Wind Velocity
The basic wind velocity is defined as:

$V_b = C_{dir} \cdot C_{season} \cdot V_{b,0}$

Where;
V_b - The basic wind velocity, defined as a function of wind direction and time of year 10 meter above ground in terrain category II
C_{dir} - Wind directional factor, recommended value 1,0
C_{season} – The seasonal factor, recommended value 1,0
$V_{b,0}$ – The fundamental value if basic wind velocity, 24 m/s for most parts of Denmark [National Annex]

$V_b = C_{dir} \cdot C_{season} \cdot V_{b,0}$

V_b =1,0 · 1,0 · 24 m/s

V_b = 24 m/s

Mean Wind Velocity
$V_m(z) = C_r(z) \cdot C_0(z) \cdot V_b$

Where,
$C_r(z)$ – Roughness factor, given in 4.3.2 [EuroCode]
$C_0(z)$ – Orography factor, 1,0 unless otherwise specified 4.3.3

Roughness Factor
$C_r(z) = k_r \ln(z/z_0)$

Where
z – Height of mid-point of structure, 7 meters
z_0 – Roughness length, 0,05 m, terrain category II: Area with low vegetation such as grass and isolated obstacles (trees, buildings) with separations of at least 20 obstacle heights. table 4.1, [Euro Code p.42]
k_r – Terrain factor

$k_r = 0,19\ (z_0/z_{0,II})^{0,07}$
$k_r = 0,19\ (0,05/0,05)^{0,07}$
$k_r = 0,19$

$C_r(z) = k_r \ln(z/z_0)$
$C_r(z) = 0,19 \ln(7m/0,05m)$
$C_r(z) = 0,9$

Mean Wind Velocity
$V_m(z) = C_r(z) \cdot C_0(z) \cdot V_b$
$V_m(z) = 0{,}9 \cdot 1{,}0 \cdot 24\text{m/s}$
$V_m(z) = 22{,}53$ m/s

Wind Turbulence
$\sigma_v = k_r \cdot V_b \cdot k_I$

Where;
k_I – turbulence factor, recommended factor 1,0
Other values is known from previous

$\sigma_v = k_r \cdot V_b \cdot k_I$
$\sigma_v = 0{,}19 \cdot 24 \text{ m/s} \cdot 1{,}0$
$\sigma_v = 4{,}56$ m/s

Turbulence Intensity
$I_v(z) = \sigma_v / V_m(z)$
$I_v(z) = 4{,}56 \text{ m/s} / 22{,}56 \text{ m/s}$
$I_v(z) = 0{,}20$

Peak Velocity Pressure
$q_p(z) = [1+7\, I_v(z)]\ \frac{1}{2}\, \rho\, v_m^2\,(z)$

Where;
ρ - air density, 1,25 kg/m³, recommended value
$c_e(z) = q_p(z) / q_b$
$q_b = \frac{1}{2}\, \rho\, v_b^2$

$q_p(z) = [1+7\, I_v(z)]\ \frac{1}{2}\, \rho\, v_m^2\,(z)$
$q_p(z) = [1+7 \cdot 0{,}20)]\ \frac{1}{2} \cdot 1{,}25 \text{ kg/m}^3 \cdot 22{,}56^2 \text{ m/s}$
$q_p(z) = 0{,}767 \text{ kN/m}^2$

WIND ACTIONS

Wind Pressure on Surfaces

$W_e = q_p(z_e) c_{pe}$

Where;
$q_p(z_e)$ – Peak velocity pressure
z_e – Reference height for external pressure
c_{pe} – Pressure coefficient for external pressure

Wind Forces

The wind forces are calculated based on external wind pressure on the structure.

$F_{w,e} = c_s c_d \cdot \Sigma\, w_e\, A_{ref}$

Where;
$c_s c_d$ – A structural factor, for buildings with a height less than 15 meter, recommended value set to 1
w_e – External pressure on individual surface, at height z_e, $w_e = q_p(z_e) \cdot c_{pe}$
A_{ref} – Reference area of structure,7 m

Zone F
$A_{ref} = 1{,}4\text{m} \cdot 3{,}5\text{m} = 4{,}9 \text{ m}^2$

$w_e = q_p(z_e) \cdot c_{pe10}$

$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot -0{,}9) \cdot 4{,}9 \text{ m}^2 = -3{,}38 \text{ N/ m}^2$
$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot 0{,}2) \cdot 4{,}9 \text{ m}^2 = 0{,}75 \text{ kN}$

Zone G
A_{ref}: $31{,}3\text{m} \cdot 1{,}4\text{m} = 43{,}82 \text{ m}^2$

$w_e = q_p(z_e) \cdot c_{pe}$
$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot -0{,}8) \cdot 43{,}82 \text{ m}^2 = -26{,}89 \text{ kN}$
$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot 0{,}2) \cdot 43{,}82 \text{ m}^2 = 6{,}72 \text{ kN}$

Zone H
A_{ref}: $5{,}6 \cdot 38{,}3 = 214{,}48\text{m}^2$

$w_e = q_p(z_e) \cdot c_{pe}$
$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot -0{,}3) \cdot 214{,}48\text{m}^2 = -49{,}35 \text{ kN}$
$w_e\, A_{ref} = (0{,}767 \text{ kN/m}^2 \cdot 0{,}2) \cdot 214{,}48\text{m}^2 = 32{,}90 \text{ kN}$

Zone J

A_{ref}: 38,3 · 1,4m= 53,62 m^2

$w_e = q_p(z_e) \cdot c_{pe}$

$w_e\ A_{ref}$ = (0,767 kN/m^2 · -1,0) · 53,62 m^2= - 41,13 kN

$w_e\ A_{ref}$ = (0,767 kN/m^2 · 0,0) · 53,62 m^2= 0 kN

Zone I

A_{ref}: 5,6 · 33,8 = 214,48m^2

$w_e = q_p(z_e) \cdot c_{pe}$

$w_e\ A_{ref}$ = (0,767 kN/m^2 · -0,4) · 214,48m^2= - 65,80 kN

$w_e\ A_{ref}$ = (0,767 kN/m^2 · 0,0) · 189,28m^2 = 0 kN

$F_{w,e} = c_s c_d \cdot \Sigma\ w_e\ A_{ref}$

$\Sigma\ w_e\ A_{ref}$ = - 3,38 kN - 26, 89 kN - 49,35 kN - 41,13 kN - 65,80 kN = - 186,55 kN

$\Sigma\ w_e\ A_{ref}$ = 0,75 kN + 6,72 kN + 32,90 kN = 40, 37 kN

- 0,35kN/m^2

0,08 kN/m^2

$F_{w,e}$ = - 0,35kN/m^2

Variable Load – Snow

$S = \mu_i\ c_e\ c_{tsk}$

Where;

μ_i – Snow load shape coefficient
c_e – The exposure coefficient, 1,0, Normal topography: areas where there is no significant removal of snow by wind or construction work, because of terrain, other construction works or trees. From table 5.1 [Eurocode 1_1.3p. 42]
c_t – The thermal coefficient, 1,0 recommended value
S_k – Characteristic value of snow load on the ground, 0,9kN/m^2, recommended from the national annex

Snow Load Shape Coefficient

Angle of pitch roof α: 0° ≤ α ≤ 30°, μ_l = 0,8

α = 17°

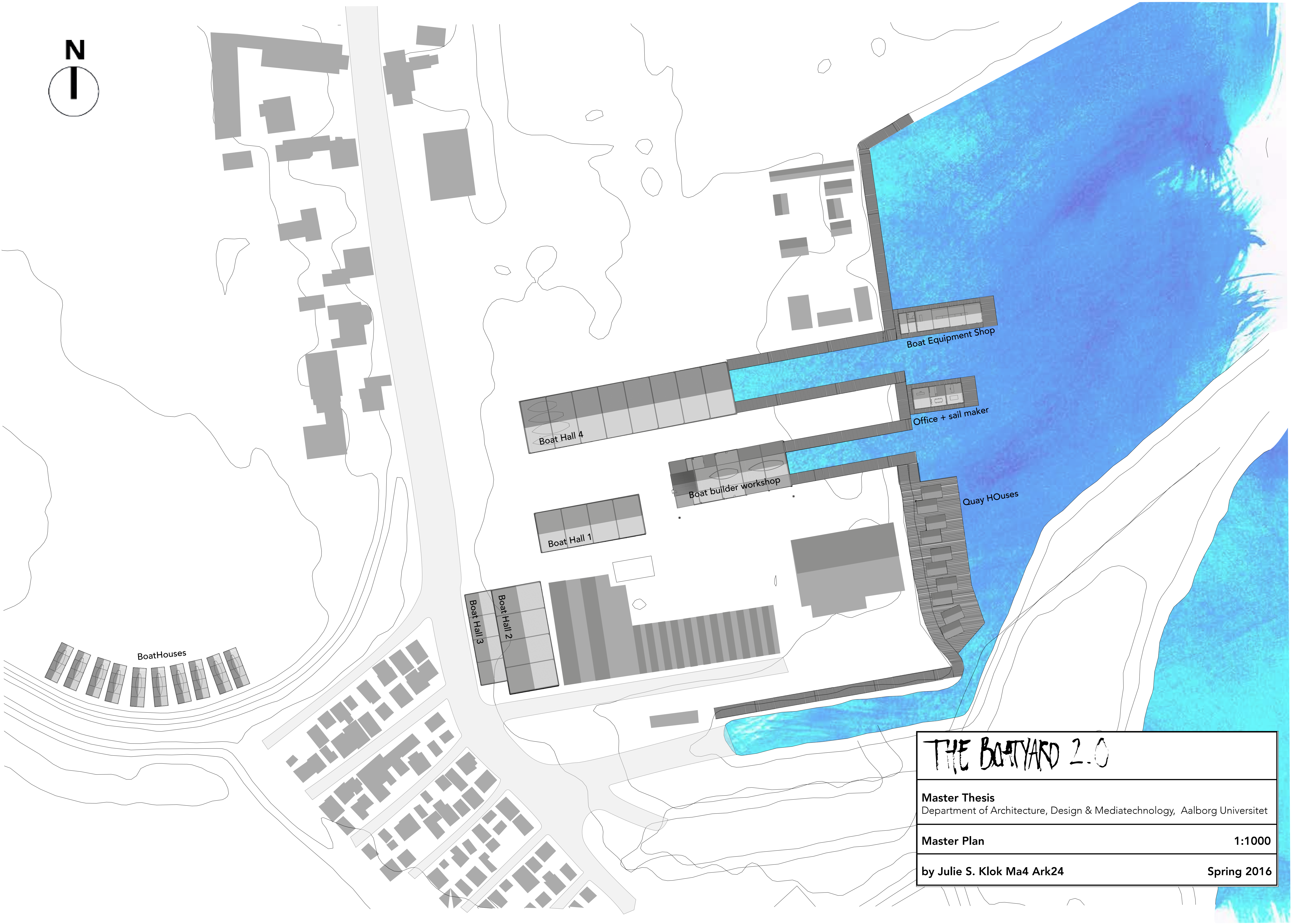
μ_l = 0,8

Snow Load

$S = \mu_i\ c_e\ c_{tsk}$

S= 0,8 · 1,0 · 1,0 · 0,90,9kN/m^2

S= 0,72 kN/m^2



THE BOATYARD 2.0

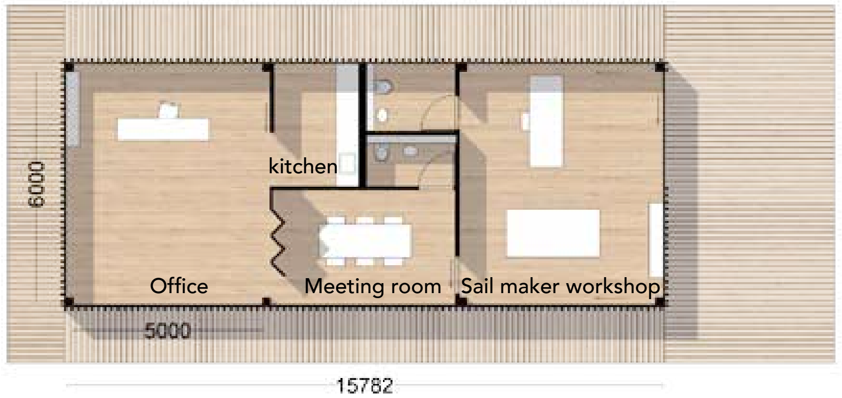
Master Thesis
Department of Architecture, Design & Mediatechnology, Aalborg Universitet

Master Plan 1:1000

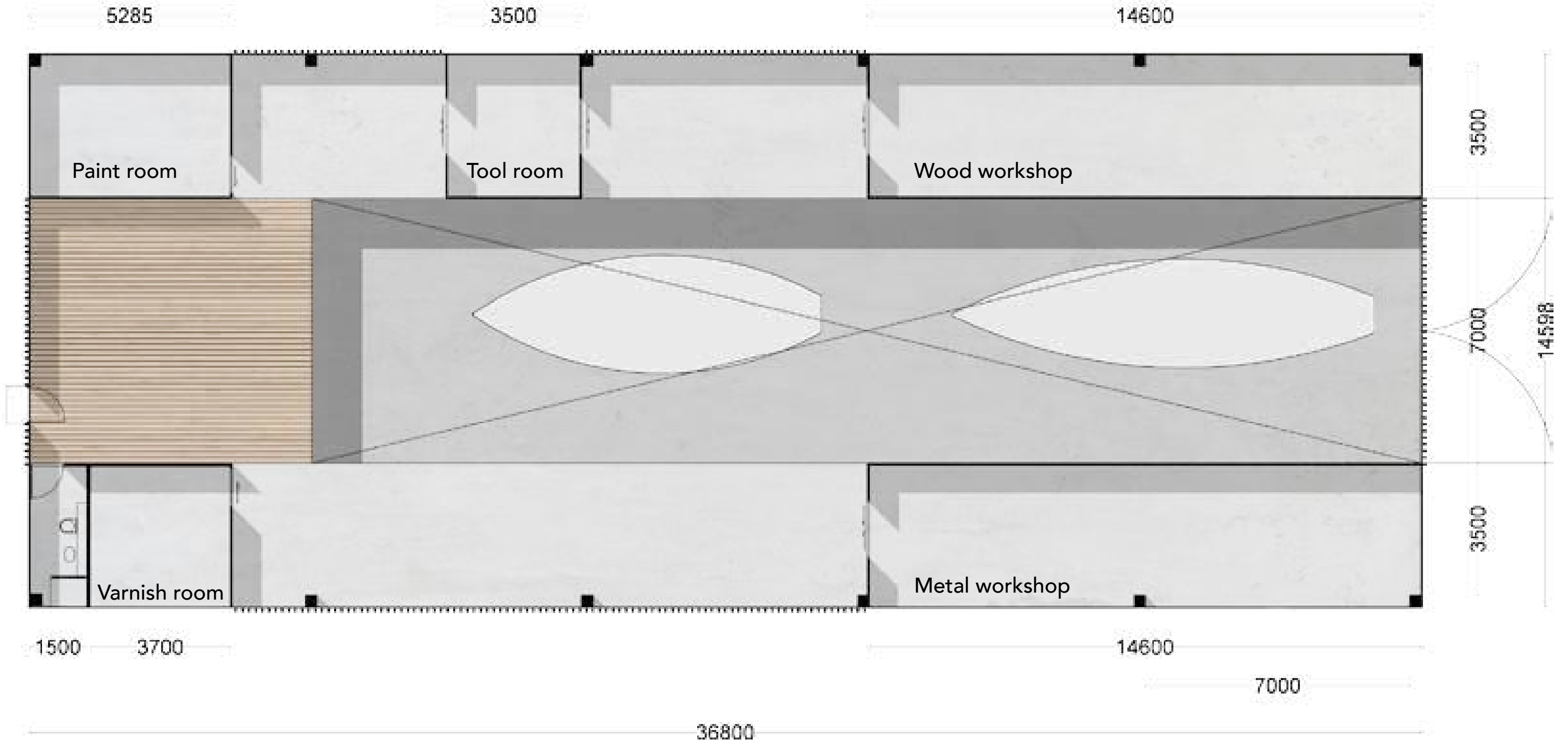
by Julie S. Klok Ma4 Ark24 Spring 2016

N

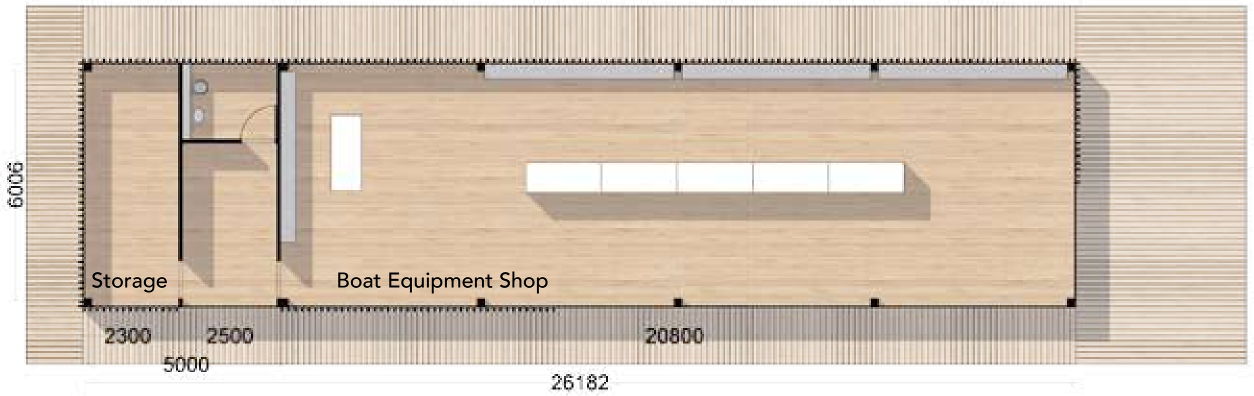
OFFICE AND SAIL MAKER WORKSHOP



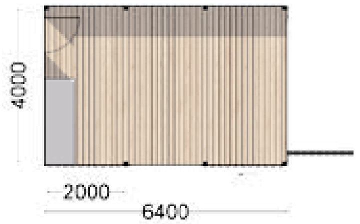
BOAT BUILDER WORKSHOP



BOAT EQUIPMENT SHOP



QUAY HOUSE



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Plans **1:200**

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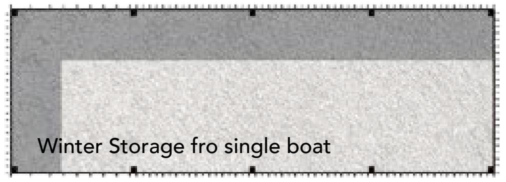
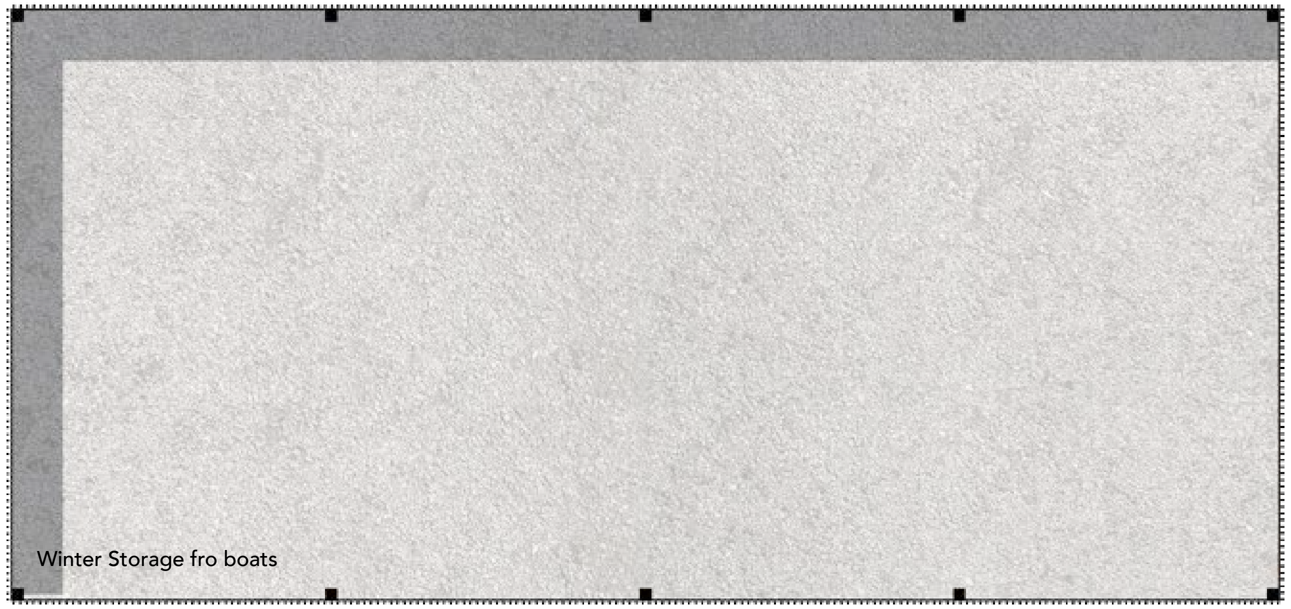
BOAT HOUSE



BOAT HALL 2



BOAT HALL 3

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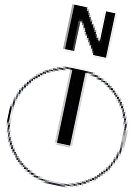
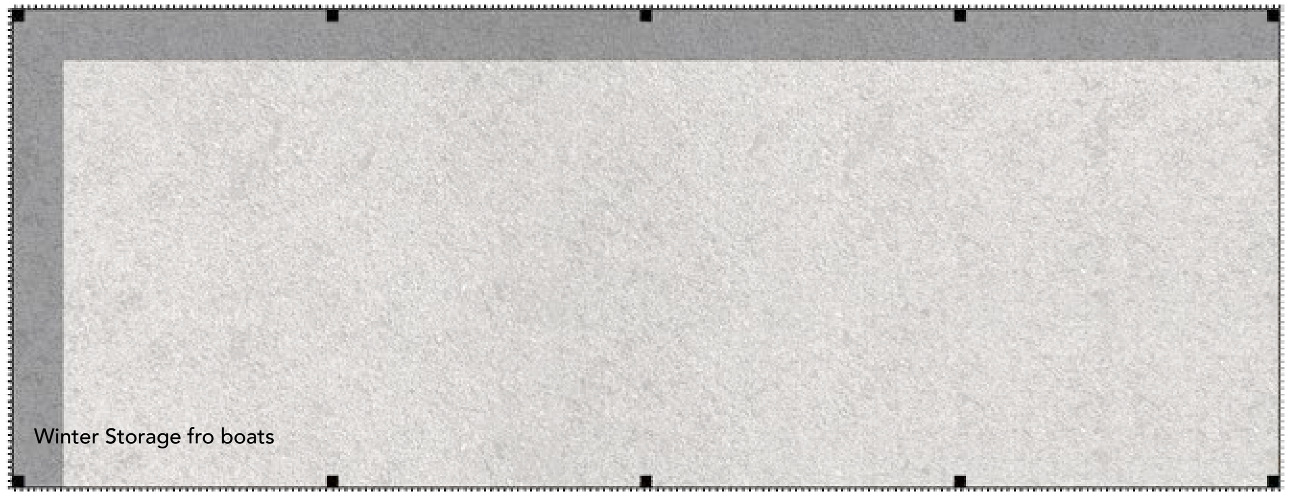
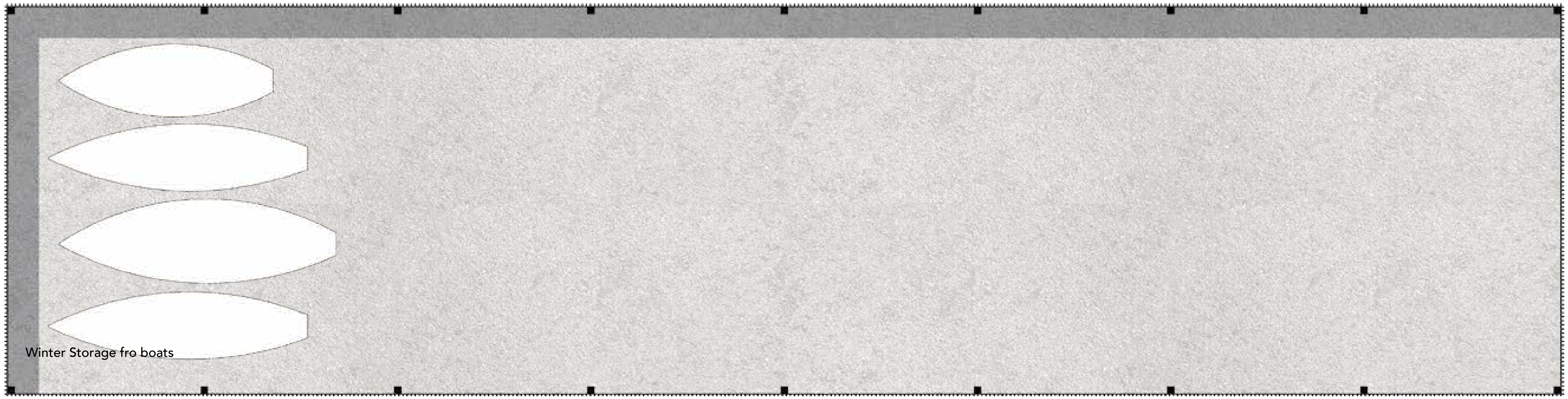


BOAT HALL 1



BOAT HALL 4



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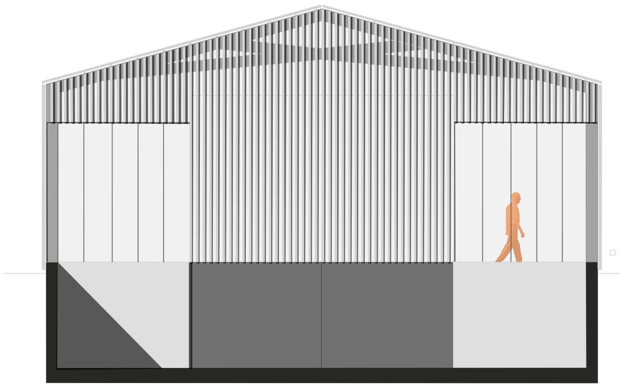
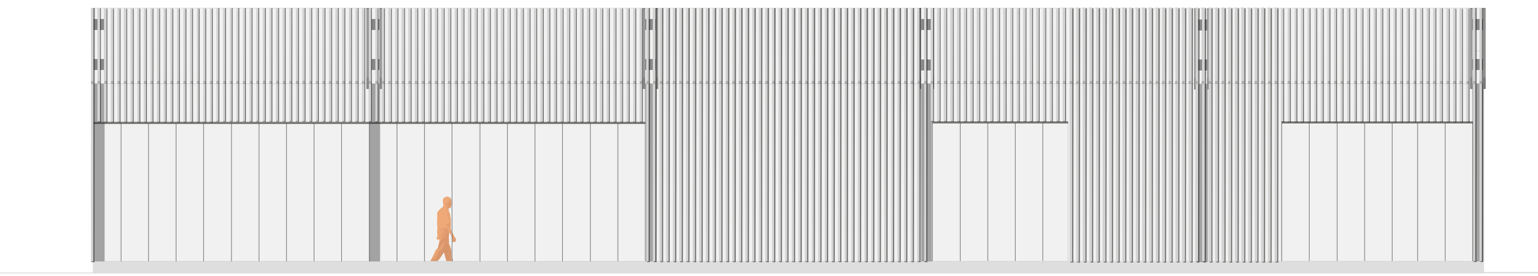
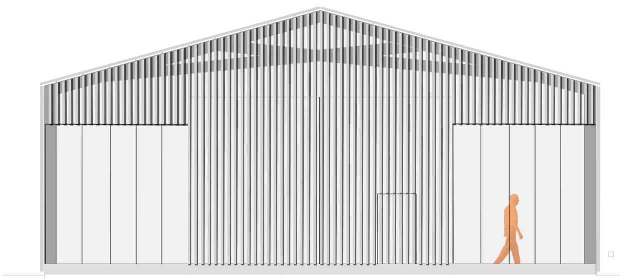


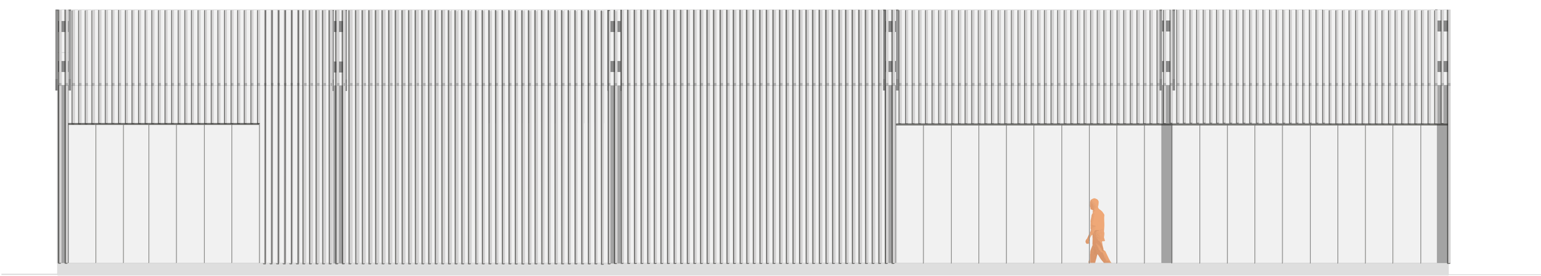
EAST



NORTH



WEST



SOUTH

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Boat Builder Workshop Elevations **1:200**

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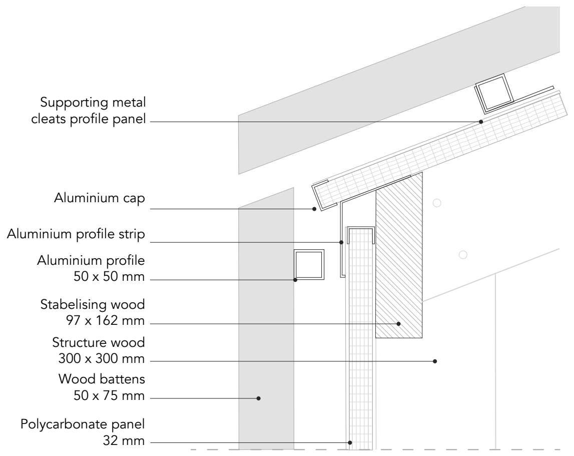
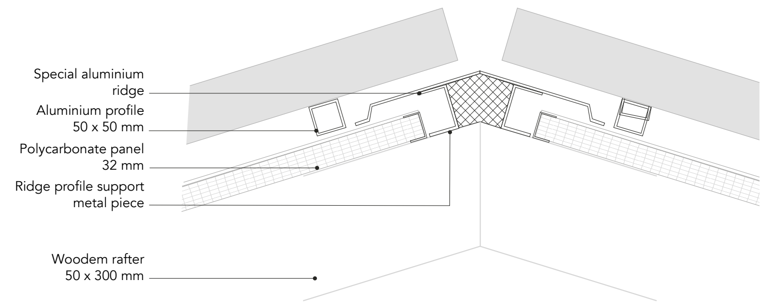
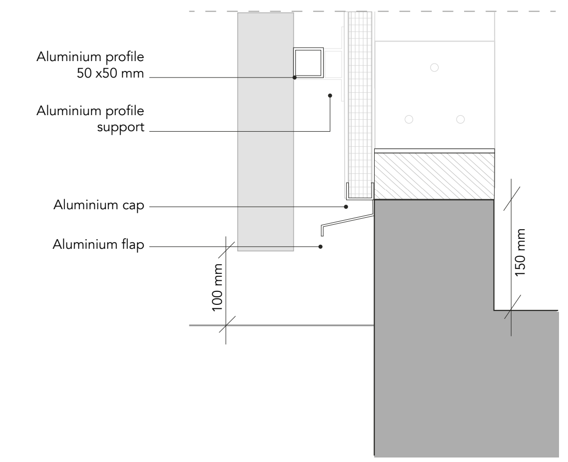
Detail: Roof/Wall



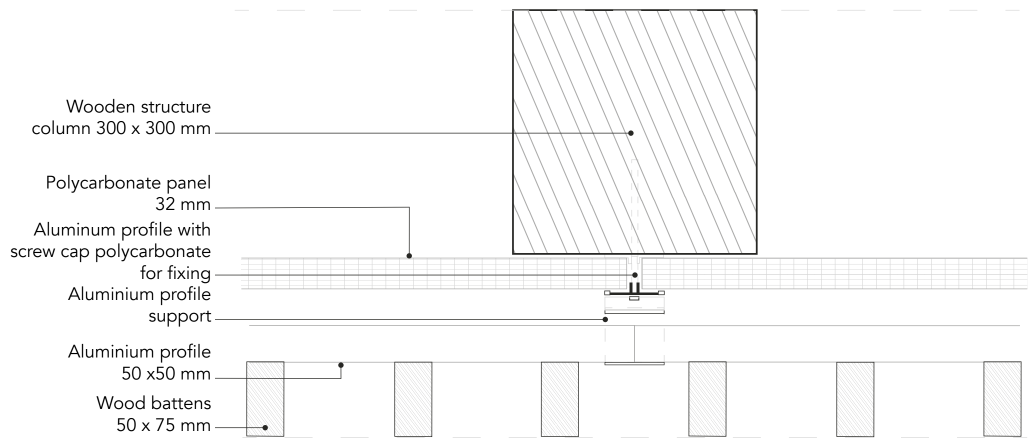
Detail: Ridge



Detail: Plinth



Detail: Facade section



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Details **1:100**

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