LIVING WITH WATER

AN EXPLORATION OF HOW A WATERFRONT HOUSING AREA
CAN BE DESIGNED WITH A HOLISTIC APPROACH TO WATER

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MASTER'S THESIS 2025

CHALMERS SCHOOL OF ARCHITECTURE
DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING

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ABSTRACT

The main purpose of this master's thesis is to explore the topic of housing by water, and how proximity to water could be used as a quality to enhance resident well-being while simultaneously handling present and future water-related sustainability challenges.

The research questions are: 1) How can a waterfront residential neighbourhood be designed with a holistic approach to water in order to enhance well-being while addressing water-related environmental challenges? 2) How can a waterfront residential block and its dwellings be designed to utilise water as a quality in order to enhance resident well-being? and 3) How can water-related environmental challenges be handled and utilised to create qualities in a waterfront residential block and its dwellings?

The thesis is structured into four parts. In the first part, a theoretical framework is created based on a literature review of the concepts water access, water and well-being, and water management; a review of eight reference projects of housing by water; as well as a review of three study trips to Copenhagen, Barcelona and Oslo. In the second part, nine design strategies – three for each key concept and three for three different scales; neighbourhood, block and dwelling – are presented based on the theoretical framework. In the third part, the design strategies are implemented in a residential design project by the waterfront in Lindholmen in central Gothenburg. The design project covers the neighbourhood, block and dwelling scale. In the fourth part, the design proposal is discussed in relation to the research questions and design strategies.

To conclude, the design strategies support the creation of an environment which can enhance well-being while addressing urban water challenges through a holistic approach to water. The design proposal demonstrates how architecture has the capacity not only to respond to environmental challenges, but also how to use them as a driving force to create qualities which enhance human well-being. The design presents a vision for how water can be integrated into the built environment in various ways on the neighbourhood, block and dwelling scales, thereby creating sustainable environments for living with water.

Keywords: waterfront housing, well-being, water-related sustainability challenges

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TABLE OF CONTENT

South Lindholmen, Gothenburg, seen from the south side of Göta River

INTRODUCTION

Humans have always lived by the water because of its vital importance to life (Barker & Coutts, 2016). Throughout history, the availability of water has been fundamental in the success or failure of civilisations. Besides its purely functional aspect, people have always been drawn to water because of its beauty and relaxing influence. The presence of water has made living near it desirable in many cultures over the centuries. From both a biological and psychological perspective, the proximity to water is extensively studied, highlighting its impact on civilisation development and human health.

With its recreational properties, water has been shown to be closely linked to increased well-being, as well as being an element which contributes positively to mental health (White et al., 2020). Research has also found a positive relationship between home proximity to water and health, showing that people that have a view to water from their home are more likely to report better general health (Garrett et al., 2019). Studies have also displayed that those visiting blue spaces such as waterfronts, rivers and ponds regularly are more likely to have good mental health.

However, due to the continued increase of global warming, the global sea levels keep rising and precipitation will also increase in the upcoming years (Dal Cin et al., 2021). The environmental challenges related to water are crucial to combat for sustainable development. Waterfront areas across the world are becoming more likely to be flooded in the future, but the general desire to live by the water remains unchanged, with almost three-quarters of the European population living in coastal and riverside urban areas.

As cities densify, centrally located waterfront areas offer attractive characteristics for uses beyond industry, such as housing and public functions (Dal Cin et al., 2021). The city of Gothenburg contains large, undeveloped central areas along the Göta River (City of Gothenburg, 2012). These areas have historically been occupied by industry and related businesses. Simultaneously, Gothenburg faces a housing shortage, and developing this central land could be a way to create attractive residential areas. Furthermore, Gothenburg is one of Sweden's most flood-prone cities (Swedish Civil Contingencies Agency, 2018), making it a suitable city to study how urban living can co-exist with water, utilising its benefits while addressing the water-related environmental challenges.

BACKGROUND

GOTHENBURG AND GÖTA RIVER

The city of Gothenburg was founded in 1621 by the Göta River inlet, which also gave the city its name. It was strategically established by the inlet of the river to defend Sweden from military attacks from the west. The city's access to the Göta River has, for different reasons, been of great importance for Gothenburg during the centuries it has existed (Petersson & Soneryd, 2022).

The Göta River runs from Vänern, the largest lake in Sweden, to the Kattegat sea with a total length of 93 km (Petersson & Soneryd, 2022). Due to Gothenburg's location by the Kattegat sea and by Göta River, and as a city where it is raining every third day on average, Gothenburg has been pointed out as one of the cities with the highest flood risk in Sweden.

Trading and shipping city

During the 1700s, Gothenburg became a central trading and shipping city (City of Gothenburg, 2023). As the importance of the harbour grew, Gothenburg's location by Göta River allowed for an expansion of the export of several goods, such as iron, wood and sugar.

The dockyard era

The first known dockyard in Gothenburg was established in the 1600s (Varvshistoriska, 2025a). The dockyard era occurred between the 1840s to 1990s, ending with the departure of the last ship built in the city. During this period, approximately 1700-1800 ships were built in Gothenburg and provided over 15 000 people with employment during the 1970s. However, towards the end of this era, the industry began to decrease due to increasing international competition.

New development along the river

As the dockyard industry declined, extensive areas of land along the Göta River were freed up for new purposes (Älvstranden utveckling, 2025). During the 1990s and 2000s, the former dockyard areas began to transform. Existing buildings were repurposed and new ones were built. Since the 1990s, 8000 new dwellings, educational facilities for 10 000 students and offices with 20 000 workspaces have been built on old industrial dockyard land along the Göta River.

The RiverCity vision

In 2013, Älvstranden Utveckling AB was given the mission to realise the RiverCity vision (Älvstranden utveckling, 2025). The RiverCity project is the largest urban development project in the Nordic countries and includes development plans for large areas along the Göta River (City of Gothenburg, 2012). The goal is to develop over 25 000 new apartments and 50 000 new workplaces, doubling the size of Gothenburg's city centre, with a timeline spanning at least until 2050. The ambition is to reconnect the city, strengthen its regional core and create an inclusive urban environment.

One of the main goals within the vision relates to water and concerns the ambition to enhance the city's relationship with the river (City of Gothenburg, 2012). Despite Gothenburg's historical and important connection to the Göta River, the link has weakened over time. To restore this connection, the RiverCity development aims to create new waterfront spaces and sustainable stormwater systems. The challenges of rising sea levels are also addressed, where the ground level along the river is suggested to rise to a safe height. This should not be designed as a barrier to the river, but rather through creative solutions which strengthen the city's connection to the water.

SUSTAINABILITY PERSPECTIVE

This master's thesis explores how water can be integrated as a design element in urban life. Rather than treating water-related sustainability challenges as threats, the thesis embraces water as a resource that can enhance well-being, a key aspect of social sustainability. The thesis also explores how an area can be flood-resilient while maintaining its water connection to create a strong identity and a flourishing neighbourhood.

Urban waterfront challenges

Sea levels are predicted to continue to rise, as are higher levels of precipitation (Dal Cin et al., 2020). With this being the point of departure for the work, the thesis integrates a sustainability perspective within these water-related fields. This includes water management strategies and the handling of stormwater, which contribute to combating one of the biggest environmental challenges of today (Barker & Coutts, 2016).

Human impact has increased the temperature in the atmosphere, oceans and land (Intergovernmental Panel on Climate Change [IPCC], 2023). When studying the 20th century, the sea levels have been observed to rise within shorter timespans. As a result of sea level rise, extreme sea level events, occurring once every 100 years today, are predicted to happen annually by 2100 in over half of the studied areas in the IPCC report (2023).

According to the IPCC report (2023), global warming is also affecting the global water cycle. This is predicted to worsen and intensify as global warming increases. This includes more extreme weather with intensify precipitation, prolonged drought and a greater impact on climate events and seasons (IPCC, 2023).

In the exhibition Water is coming (Danish Architecture Center, 2024) human co-existence with water is described as one of the most pressing challenges that the world is facing today. Climate change is affecting the natural water systems and threatens the world, ecosystems and life as it is known today. The change in the water cycle is a global challenge which needs to be taken care of in regional and local context. In July 2011, a heavy cloudburst occurred in Copenhagen, resulting in more than 150 mm of rain in less than two hours. The cloudburst displayed urban vulnerability and resulted in around 1.6 billion euros worth of damage. Since 2011, Copenhagen has been rebuilt with a climate adaptation plan, often with a nature-based approach with a greater focus on creating green recreational urban spaces.

Well-being

The third United Nations Sustainable Development Goal aims to ensure healthy lives and promote well-being for all, regardless of age (United Nations, 2015). Target 3.4 emphasises the promotion of mental health and well-being, acknowledging the growing importance of mental health for overall well-being. The Ministry of Health and Social Affairs (2025) in Sweden describes mental health issues as one of our times greatest health and societal challenges and emphasises the importance of promoting mental health.

The Public Health Agency of Sweden (2023) has compiled statistics from various sources to create an understanding of the current situation of mental health in Sweden and to describe the development during the 21st century. The report states that the majority of inhabitants in Sweden consider themselves to have good physical and mental health. At the same time, the number of children and adults that experience stress, anxiety and sleeping issues is increasing. The same trend can be observed regarding psychiatric care and the use of antidepressants. In 2022, more than one in three women and one in four men received a prescription for antidepressants (The Public Health Agency of Sweden, 2023).

The number of longer sick leaves connected to mental health issues in Sweden is increasing (Skandia, 2025). In 2010, 30% of the longer sick leaves were mental health related while in 2024, the longer sick leaves realted to mental health had increased to 46%. The higher percentage of sick leaves related to mental health issues has however maintained approximately the same level for the last eight years. The cost of long-term sick leave related to mental health issues is predicted to have a cost of 42,6 billion Swedish kronor. Considering a global perspective, World Health Organisation (2024) estimates the cost of the global economy regarding depression and anxiety to be about one trillion US dollars every year, mainly related to lower productivity.

A residential area with water character

A strategy to provide attractive and unique dwellings and public places in a central waterfront area in Gothenburg is by creating new housing in alternative locations (City of Gothenburg, 2012). The specific water connection of a site could become a symbol for a neighbourhood, improving the sense of identity and belonging among its residents (Vaeztavakoli et al., 2018).

Well-designed housing areas contribute to a higher quality of life among its residents (Gehl, 2011). A thoughtfully designed neighbourhood is expected to contribute to social sustainability in the area. A well-considered design of buildings, courtyards, public spaces and their interactions fosters an environment where people thrive and feel safe (Minoura, 2019).

Homes with high-quality housing features will also be more attractive to inhabit and will be cherished for a longer time (Burras & Terry, 2019). Well-designed housing is more likely to stand the test of time which favours ecological and economic sustainability.

AIM AND PURPOSE

The main purpose of this master's thesis is to explore the topic of housing by water, and how proximity to water could be used as a quality to enhance resident well-being while simultaneously handling present and future water-related sustainability challenges.

RESEARCH QUESTIONS

MAIN RESEARCH QUESTION

How can a **waterfront residential neighbourhood** be designed with a **holistic approach to water** in order to enhance **well-being** while addressing **water-related environmental challenges**?

SUB-RESEARCH QUESTIONS

How can a waterfront **residential block** and its **dwellings** be designed to utilise **water as a quality** in order to enhance resident **well-being**?

How can **water-related environmental challenges** be handled and utilised to create qualities in a waterfront **residential block** and its **dwellings**?

KEYWORDS

Keywords are defined in the research questions to highlight the central parts of each question. The keywords are investigated in the theoretical framework and are also translated into key concepts for the design strategies. This creates a connection between the research questions, the theory, the design strategies and the design proposal. This approach ensures that the research is present in the design, and that the design answers the research questions.

The keywords are the following:

- Waterfront residential neighbourhood
- Holistic approach to water
- Well-being
- Water-related environmental challenges
- Residential block and its individual dwellings
- Water as a quality

DELIMITATIONS

This thesis presents a new housing neighbourhood by the Göta River in three scales: neighbourhood, block and dwelling. On the neighbourhood scale, the focus is the relationship with water in the area. Public areas, non-residential buildings and the surrounding built structure are shown schematically to limit the scope.

On the block scale, one of the blocks in the new neighbourhood is presented to allow a deeper and more detailed exploration and presentation of the key principles which are applied in the neighbourhood. Common spaces are displayed on a schematic level to display their functions, but are not presented in detail.

Technical systems, the technical part of the water systems and constructional systems are not the main focus of the thesis, and will therefore only be presented at a conceptual level to show innovative solutions.

Due to the complexity of the site and the time limitations of one term, financial calculations are not included in the scope of the thesis.

The water quality in Göta River and Gothenburg has not been considered as a limitation for presenting water-related activities in the design project area.

The current detail plan and future plans for the project site are not considered as limitations in the design proposal. The current general parking norm in Gothenburg has not been seen as a restriction for the design proposal.

TERMINOLOGY

In this master's thesis, the word water mainly refers to bodies of water. To exemplify, when water access is mentioned, it describes the access to a body of water, for example a river, a sea, a lake or a canal.

A holistic approach to water refers to the comprehensive perspective on water which is implemented in the thesis. Through a holistic approach to water, the thesis investigates how architecture can respond to water-related environmental challenges, while simultaneously turning these threats into opportunities and from risks to resources, using them as a driving force to create qualities which enhance human health and well-being.

METHOD AND PROCESS

A variety of methods are used in the thesis to gain a broad perspective and a deeper understanding of the various topics. All of the methods follow a qualitative approach, as the key concepts are considered best explored through this lens.

All key concepts require a literature review, covering a range of sources and perspectives, which is essential for gathering diverse knowledge that form the basis for the design strategies, the design implementation and the design project. The literature review serves as the foundation for knowledge and research, and is complemented by other methods to strengthen, validate and further explore the findings.

Another qualitative method used is case studies of built reference projects. The literature review offers guidance and insight into finding relevant reference projects. The literature review helps to form a knowledge base to create a template for the case studies, making them comparable and easier to apply in the design work.

The case studies are partially done as study trips, where relevant projects are observed in person to create a better understanding of them. These trips also provide a broader understanding of the buildings' contexts and allow for exploration of the relationship between the built urban context and water.

The literature review, case studies of reference projects and study trips result in design strategies, which are used as a method to guide and shape the design, as well as linking it to the theoretical part of the thesis. In the design project, iterative design is used as a method to test and apply the design strategies.

Site analysis is used as a method to explore, assess and understand the chosen site. The knowledge gained from the literature review and case studies provided a solid foundation for assessing the site's potential and challenges. The site analysis also enhances the design process, allowing for more realistic sketches related to the actual site, while also fostering a more critical approach to the design.

With the same focus on creating a reality-based project, experts in various fields were contacted in order to strengthen the design and to gain a deeper understanding of the related design features.

DISPOSITION

The thesis is split into four parts. The first part is theoretical and departs from a background description of water-related environmental challenges, social sustainability in Sweden today and how housing can contribute to positive change in both fields.

A theoretical framework is created partly through a literature review focusing on the relation between water and well-being as well as the existing and future water-related environmental challenges. As a whole, the research aims to cover the chosen scales of the project – neighbourhood, block and dwelling.

The theoretical framework further consists of a review of eight reference projects of housing by water, where different qualities are analysed and discussed.

The last part of the theoretical chapter introduces the three study trips carried out to gain a deeper understanding of various waterfront developments and residential buildings in aquatic settings. The destinations of the study trips were Copenhagen, Barcelona, and Oslo. Each of the study trips are presented with an overview of the structure, main destinations, reflections and key takeaways.

The theoretical chapter is concluded with a summary of the knowledge provided in the framework.

In the second part of the thesis, the design strategies are presented. Nine design strategies are introduced; three for the neighbourhood scale, three for the block scale and three for the dwelling scale. The design strategies are created based on the theoretical framework.

In the third part, the design strategies are implemented in a residential design project by the waterfront of Göta River, on a neighbourhood, block and dwelling scale.

The context for the design implementation is Lindholmen – a riverfront area by Göta River which is currently mainly used for parking – in Gothenburg, a city where waterfront development, water-related environmental challenges and housing shortage are three critical contemporary issues.

To conclude, the design strategies and the design proposal are discussed, and the conclusions are stated in the fourth and final part of the thesis.

Sluseholmen, Copenhagen

THEORETICAL FRAMEWORK

The following section comprises the theoretical framework of the thesis. The purpose of the theoretical framework is to form the foundation upon which the design project will be built. The theoretical framework includes various research methods – a literature study, reference projects and study trips – that support the aim and purpose of the master's thesis.

The literature study focuses on the relationship between water and well-being and how the built environment can support this relationship. The literature study addresses water-related environmental challenges, such as flooding from rising sea levels and stormwater management, aiming to display innovative strategies that combat the challenges while creating environments that promote well-being. Each challenge is presented by introducing the issue, traditional methods and innovative approaches with well-being in focus, with connections to the local regulations and strategies for the city of Gothenburg and the RiverCity vision.

The first part of the literature study is focused on the relationship between water and well-being, whilst the second is centered around larger water systems and strategies that can mainly be applied on the neighbourhood and block scale. Therefore, the final section of the literature study explores how dwellings can be designed to strengthen the water connection, focusing on spatial qualities, such as indoor-outdoor relationships and views from the dwelling.

Following the literature study, the theoretical framework is further widened through a review of eight selected reference projects. All are residential projects which have a direct physical connection to the water. The projects are analysed on three scales – neighbourhood, block and dwelling – with the analysis departing from the water-related qualities.

The theoretical framework further consists of a summary of three study trips. The cities that were visited were Copenhagen, Denmark; Oslo, Norway; and Barcelona, Spain. How the cities have worked with their respective proximity to water in different ways was observed, experienced, documented and reflected upon.

To conclude the section, the findings of the theoretical framework are summarised before being used to create design strategies for the design project of the thesis.

WATER AND WELL-BEING

Water has a long history of being integrated into the built environment as an enriching element (Barker and Coutts, 2016). With its various physical and symbolic purposes, not at least in a social and recreational context, fountains and bodies of water have often been designed as focal points or spaces for bathing.

White et al. (2020) have compiled a wide variety of research regarding the connection between well-being and blue space. The review presents potential benefits of aquatic environments, focusing on the relationship between well-being, blue spaces and health.

The review references a number of studies where the relationship between living close to water and well-being has been proven (White et al., 2020). This relationship spans from viewing the water from a window to having a close distance to blue space, which provides easier access to spending time by the water.

In urban settings, blue space can mitigate modern urban mental health conditions such as depression, stress and anxiety (White et al., 2020). Today, over 50% of the global population lives in cities, a number expected to rise to 70% by 2050 (United Nations, 2018). The risk of psychiatric disorders, such as depression, anxiety and bipolar disorder can be up to 50% higher for city dwellers (Sjövall, 2020).

BIOLOGICAL CONNECTION TO WATER

A way to concretize how the built environment can support human well-being is by considering the function of the human brain (Sjövall, 2020). By integrating brain research together with an evolutionary and biological perspective, a set of more objective design tools are created, appealing to the biological foundation of humankind. The human brain has not changed significantly for tens of thousands of years. A design approach informed by brain research can therefore adapt the built environment to better suit the fundamentals of human needs.

With 99,999% of human existence spent in nature, the biological bond to it is strong (Sjövall, 2020). When interacting with nature, such as blue spaces, the human parasympathetic nervous system is activated, creating several benefits for our health. These include lower blood pressure and an anti-inflammatory influence.

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MENTAL HEALTH AND STRESS REDUCTION

The access to nature, such as blue spaces, can also strengthen mental health, enhance life quality and reduce levels of stress hormones (Sjövall, 2020). Garrett et al. (2019) presents a study displaying that those who were visiting blue spaces regularly were shown to be more likely to report good mental well-being. The people that participated in the study and were visiting blue spaces for recreational purposes were also found to report a better general mental health.

In comparison to various other contexts, blue spaces have regularly been shown to be among the most therapeutic environments (White et al., 2020). People describe themselves feeling less stressed in blue spaces. The soundscapes, the changing patterns of the water and the light have been shown to be potentially important reasons for people feeling calmer in aquatic settings (Bell et al., 2015).

HUMAN RELATIONSHIPS

Blue spaces are important environments to promote and support positive social interaction and relationships, qualitative studies in Germany (Völker & Kistemann, 2015), Ireland (Foley, 2015) and the UK (Bell et al., 2015) have found. Aquatic environments are often described as suitable settings for spending high-quality time with friends and family and are frequently chosen as favourite spots (White et al., 2020). Spending time with others has also been shown to be a strong key reason for visiting coastal waters (Elliot et al., 2018).

THE SOUNDSCAPE OF WATER

Water may in itself increase the level of sound in an environment, but whilst doing so, it has been found that the sound of water reduces stress more effectively than urban sounds, silence or stress-reducing sounds such as calming music (White et al., 2020). When added to traffic noise, the sound of water can increase the overall experience in a positive way (Rådsten-Ekman et al., 2013). If the sound from blue spaces drown out the sound of traffic, positive health effects could be achieved, despite the total sound being increased (White et al., 2020). The soundscape of nature, such as rippling water, fosters a more positive perception of our context (Sjövall, 2020).

RECREATIONAL WATER ACTIVITIES

Physical activity by the water

Living near water has been shown to increase the level of physical activity among residents (White et al., 2020). When exercising in blue spaces, such exercise sessions have been shown to be lasting for longer than in urban or green environments (Elliot et al., 2015).

In developed countries, much of the activity in blue spaces does not occur in the water, but on land, such as walking (White et al., 2020). Walking is the physical activity which occurs in blue spaces which in most cases explains the link between health and coastal proximity (Pasanen et al., 2019).

Sauna

The activity of sauna bathing is often associated with wellness and pleasure (Laukkanen et al., 2018). The well-being factor and sense of relaxation can be linked to the increased production of endorphins. It has also been proven that sauna bathing can lower the stress in everyday life.

Besides its influence on the feeling of wellness, sauna bathing is likely connected to a wide range of other health benefits (Laukkanen et al., 2018). This includes lowering blood pressure and a reduction in the risk of cardiovascular and pulmonary diseases. It could also improve the conditions of headaches, arthritis and flu.

Swimming

Outdoor swimming is a popular activity connected to water and has been proven to have a positive influence on both well-being and mental health (Overbury et al., 2023). In a scoping review by Overbury et al. (2023), research regarding the connection between well-being and outdoor swimming has been summarised.

The review by Overbury et al. (2023) displayed that the activity of swimming was considered a positive, enriching process for the majority which participated in the study. A therapeutic sense, a mindful presence, embodiment and community were some of the positive factors shown. The connection to water was also considered as positive. The reduction of mental distress and an improved mood also supports the feeling of well-being connected to outdoor swimming.

DESIGNING WITH WATER

Besides the proven connection between water and well-being, the relationship between water and humans can be described as complex and ambivalent, depending on the availability of water - sometimes too much and sometimes too little (Lohrer, 2008). Water has a wide range of qualities, spanning from its vital importance for life to purely relaxing and meditative abilities. The nature of water also contains an element of danger, as floods or drought could be deadly. The use of water as a design element is therefore a delicate matter, where several factors need to be considered.

DESIGN APPROACHES

The suitable approach of water depends on various factors such as the function it should have, the site conditions, the role and symbol it has concerning the context and architecture and how its sensory experiences are best taken care of (Lohrer, 2008). The flow and level of reference are also of great importance.

Considering the function, the quality of water and its purpose for the environment, context and humans need to be considered (Lohrer, 2008). Several functions can be combined to create more values and functions, such as rainwater management, irrigation and recreation.

Regarding the site, the existing structure, typology and unique features of the site are great references to inspire the design of water (Lohrer, 2008). The water should be designed with a consideration of the water's spatial influence on the site and architecture.

Lastly, the sensory experience is highly connected to the appearance, sound and smell of the water (Lohrer, 2008). To influence these factors, the material, colour and the depth of the design element hosting the water influence all these factors, as well as the motion it creates for the water.

SAFETY

When designing with water, safety aspects are crucial and should be addressed early in the design phase to achieve a pleasing and secure result (Lohrer, 2008). The key factors are to clearly communicate the presence of water and ensure easy accessibility. Underwater grating can protect in case of an accident and good escape routes out of the water should be incorporated.

FLOODING: FROM THREAT TO OPPORTUNITY

More than 80% of the global population lives in areas at risk of flooding and with the climate changes, this number is expected to increase, leading to more severe consequences (Charlesworth, 2016). Considering a European perspective, flooding is the most common natural hazard, causing the highest economic damage and largest amounts of casualties (Raadgever & Hegger, 2018).

To combat this, initiatives in several countries have been taken to develop and implement different types of flood risk management strategies (Raadgever & Hegger, 2018). This does not only regard traditional flood defences, focusing on keeping the water away, but also includes strategies that welcomes and integrates the water in a sustainable way.

FLOODING IN EUROPE AND SWEDEN

The EU-funded research project STAR-FLOOD compared flood risk governance in six European countries, one of them being Sweden (Raadgever & Hegger, 2018). In Sweden, the cities of Gothenburg, Karlstad and Kristianstad were chosen as case studies. Five different flood risk management strategies were identified within the project, three of them connected to strategies to apply before a flooding, one for during a flood event and the last for after a flood, focusing on recovery.

Sweden turned out to have its highest prioritisation on strategies to apply during and after a flooding (Raadgever & Hegger, 2018). The three strategies to apply before a flood event were evaluated to have a low prioritisation. Every situation needs to be considered individually, however, a mix of strategies reduce loss of lives and resources most efficiently while enabling a strong recovery. Sweden is considered to have relatively small flood risks compared to other European countries, but with the temperature expected to increase more than the global average, the risk of flooding will increase.

FLOOD PREVENTING DESIGN

Barker and Coutts (2016) provide an extensive background on the subject and introduce a variety of innovative strategies regarding flooding, categorised by different situations, scales and sites. Some of the new ideas regard the connection between the design of the built environment and flood risk management. Regarding a neighbourhood scale, Barker and Coutts (2016) suggest studying the site and consider the flood risk and land use, to understand the challenges and potential of the chosen area and take informed decisions when planning the structure.

The location of various functions should be carefully considered to achieve a safe area from a flood risk perspective (Barker & Coutts, 2016). Vulnerable functions, such as residential buildings, public services and roads, should be placed further away from the water level, with a safe distance. Floodable parks, play areas and secondary walkways could be placed closer to the water, designed with an acceptance of temporary flooding to strengthen the blue character and create a dynamic blue neighbourhood.

RECREATIONAL POTENTIAL OF URBAN RIVERS

The city of Gothenburg has established a standard requiring new waterfront buildings to have a floor level of +2.8 meters (City of Gothenburg, 2019). While this flooding strategy aligns with the RiverCity vision and Barker and Coutts (2016), it also increases the distance to the water, weakening the connection to the river.

Prominski et al. (2017) outline design strategies for urban rivers, categorising approaches based on the waterways characteristics and surrounding space. These strategies balance flood risk management with opportunities for recreation and interaction. The strategies are based on built case studies integrating at least two of three key factors: ecology, flood protection and amenity.

The design strategies focus on sustainable ways to maintain flood protection in the form of a raised ground level while creating space for the water and people to reconnect. The chosen design strategies are:

Linear spatial expansion reshapes the river bank trough terracing to create dynamic spaces while responding to changing water levels

Selective spatial expansion opens the riverbank at specific points to create a gentle access to the water

Tolerating allowing a structure to be temporarily flooded without damage, creating a dynamic environment

GÖTA RIVER: DEFEND, RETREAT, ATTACK

One of the greatest challenges and most valuable assets of the RiverCity development is its proximity to the river (City of Gothenburg, 2012). The vision states that water-related environmental challenges, such as rising water levels, should be seen as a driving force and an opportunity to create an exciting and unexpected city, with dynamic urban spaces and walkways along the river. The goal is to use climate adaptation as a means to bring the city closer to the water, where the areas within the RiverCity project are to follow the strategies of *Defend, Retreat, Attack*.

Petersson and Soneryd (2022) have studied flood risk management in relation to the RiverCity vision, exploring how to preserve the urban water values while managing the flood risks. This city's approach to the flooding has been studied in relation to three different strategies of defend, retreat and attack.

Petersson and Soneryd (2022) define the three approaches within the scope of the project. The strategy of *Defend* regards physical barriers, keeping the water out of the urban space. *Retreat* accepts the nature of flooding and avoids exploiting the city where flooding can occur. The last approach, *Attack*, considers the water as an opportunity for exploitation, making floating housing a possible structure.

Petersson and Soneryd (2022) consider various locations along the Göta River and discuss different strategies within the RiverCity scope. One of the studied sites is Lindholmen, where the city plans to develop housing and business areas, despite the risk of flooding. The vision for Lindholmen in the RiverCity project is to dissolve the boundary between city and river, aiming to create an attractive urban setting. The strategy for the site is considered to be a softer variant of *Retreat*, where the goal is to create a balanced coexistence between flood and exploitation. The strategy has reconsidered threats and opportunities connected to flooding, resulting in a strategy with an acceptance of temporary flooding with areas designed for varied water levels.

Göta River and Lindholmen, Gothenburg

STORMWATER: FROM RISK TO RESOURCE

As cities expand and climate change intensifies, managing stormwater effectively has become a crucial aspect of sustainable urban planning (Swedish Environmental Protection Agency, 2024). Sustainable stormwater management can be defined as systems that minimise the impact of contaminated stormwater and the risk of flooding, which can damage the environment, property or essential community functions. It also includes preventing the formation of stormwater runoff, purifying contaminated stormwater, supporting urban ecosystems and contributing to adapting society to future climate change. This is usually done by using nature-based solutions, creating spots and paths for the water to be absorbed, delayed and diverted. The goal is to maintain the water balance, especially in urban contexts, by handling the water close to its source and using the water as a resource.

TRADITIONAL WATER MANAGEMENT SYSTEMS

The traditional method of water management mainly consists of buried pipe systems, also known as grey water infrastructure (Ashley et al., 2020). Grey water infrastructure typically combines stormwater and sanitary systems. However, with climate change leading to increased levels of precipitation and more frequent flooding, the limitations of the traditional systems become evident. The buried pipe structure can be difficult to scale for future needs as the amount of water is predicted to increase due to climate change. The traditional systems have a limited capability, are difficult to maintain and waste opportunities for broader benefits regarding human well-being and health.

SUSTAINABLE WATER MANAGEMENT STRATEGIES

Recognising the need for more sustainable water management strategies, the Swedish government has established two goals concerning sustainable stormwater management (The Swedish Environmental Protection Agency, 2024). The goals include sustainable stormwater management in new, modified and existing built environments and require all municipalities in Sweden to have a local strategy plan for new and modified buildings by 2023 and existing buildings by 2025. These goals aim to create a sustainable approach to stormwater management, considering multiple factors with a focus on handling stormwater, maintaining water quality and protecting society from flooding.

SUSTAINABLE DRAINAGE SYSTEMS AND NATURE-BASED SYSTEMS

To address stormwater challenges, sustainable water management strategies have been developed, some also using water as a resource to benefit human health (Charlesworth, 2016). One field of water management strategies with this aim are called Sustainable Drainage Systems (SuDS). SuDS have multiple aims with a central focus on delivering a stable and durable drainage system while protecting and improving the surrounding environment, health and safety. They also aim to reduce flood-related damage and improve the quality of water.

These systems are designed to be integrated with the water cycle by understanding and working with the natural flow of water (Charlesworth, 2016). SuDS can be implemented at various scales and stages, from prevention in the form of land use planning to source and site control through the use of vegetation and permeable surfaces, aiming to manage water locally.

Land use planning could be supported by considering different situations individually within its context to determine the best and most sustainable solution (Ashley et al., 2020). The design and scale depend on the site's individual needs and complexity. It is important to consider this in relation to the surrounding pavement and built environment since these factors affect how much contamination occurs and how quickly the water flows across the site (Swedish Environmental Protection Agency, 2024).

Natural Flood Management (NFM) and Nature-based Systems (NBS) focus more exclusively on utilising natural landscapes and ecosystems to manage stormwater, aiming to maximise the value of water by using nature-based options instead of traditional buried pipe systems (Ashley et al., 2020). This could be done by integrating more nature and greenery in the urban context. This could include creating green roads, planting trees and various sizes of park areas where retention ponds could be a pleasant element of the area. This creates various benefits, for instance regarding human health, recreation, social cohesion, housing values and a safer water management system. However, blue and green infrastructure naturally requires space, which can be a challenge in urban areas, but gives a clear range of benefits when it is prioritised.

GOTHENBURG: STORMWATER STRATEGIES

MAKE ROOM FOR THE WATER

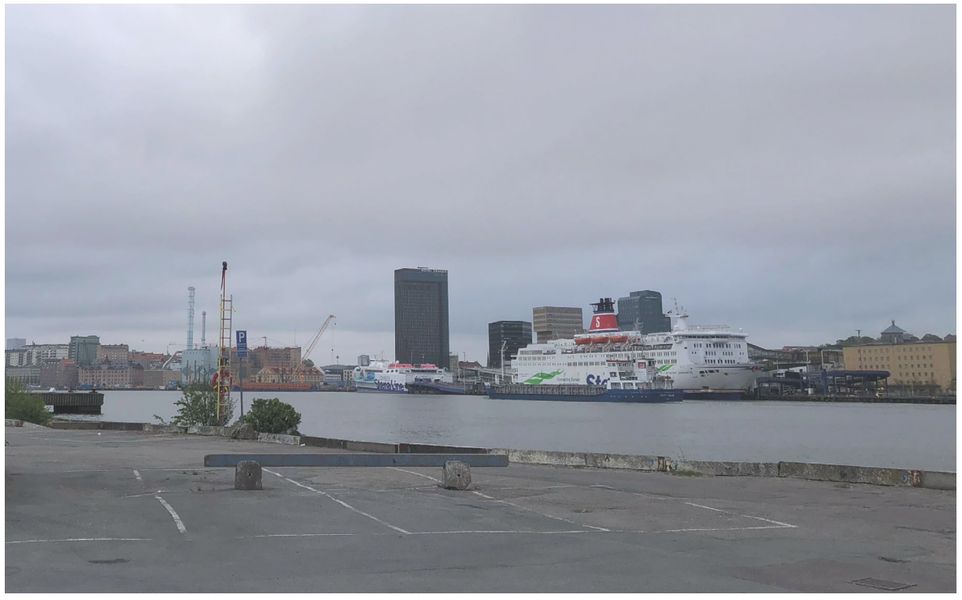
There are several suggested strategies to manage stormwater and skyfalls in Gothenburg (City of Gothenburg, 2024). The program called *Make room for the water* provides instructions on how to manage stormwater efficiently. The strategies aim to minimise the flooding risk, create attractive outdoor environments and contribute to sustainable development.

The strategies can be grouped into several key areas (City of Gothenburg, 2024). The first focuses on integrating rain gardens and vegetation to absorb, filter and delay stormwater. The second regards guiding the water, mainly away from buildings and towards green spaces using elements such as drainage ditches, but also to rain barrels to collect water for later use in watering plants with natural water. The last one focuses on the reduction of impermeable surfaces by using permeable materials for streets and roofs, including the implementation of green roofs.

THE RIVERCITY VISION & CELEBRATE THE RAIN

The RiverCity vision highlights the need to manage rain and stormwater creatively and joyfully to make it an asset in the urban space (City of Gothenburg, 2012). As extreme weather becomes more frequent in Gothenburg, the aim is to turn water management into a positive element, where features like stormwater ponds, runoff ditches and playful rain infrastructure enhance urban spaces, such as parks and playgrounds.

Another ongoing project in Gothenburg is Rain Gothenburg, which aims to make the city an international role model as a rain city (City of Gothenburg, 2025a). The project recognises that the traditional water management systems will become outdated, requiring new ways of handling the water. With an innovative approach, the project seeks to protect the city and to use the rain for creating unique experiences. The main vision is to strengthen Gothenburg's identity as a city with a creative and positive connection to its rain.



Non-permable surfaces by Göta River at Lindholmen, Gothenburg

CANALS: BLUE CONNECTIVITY AND WELL-BEING

On behalf of The city of Gothenburg, Ramböll (2015) conducted a report of stormwater solutions suitable for different situations within the city. Canals are one of the suggested solutions. Canals can be used as retention basins for both everyday rain and skyfalls with an opportunity to purify stormwater by infiltration, sedimentation and aeration. It is also considered a system with high accessiblity for maintence.

The canals offer a pedagogic blue element and can be used as design features in urban contexts, suitable for different sorts of urban environments (Ramböll, 2015). The system's open structure creates a blue character within the area it is applied in and a great opportunity for a stronger understanding of the water in an urban context (Starhe, 2004).

A COMBINED CANAL SYSTEM

According to Starhe (2004), the majority of people become disappointed when the canal only contains water when its raining. An option is therefore to combine the stormwater canal function with filling the canals with water from an adjacent body of water, making sure that the canals always contain water (Stahre, 2008). This option could ensure that the wide range of qualities water could provide exsists all the time. This option includes qualities such as the harmony water environments provides, the soundscape of water and glittering reflections of the water.

The idea of a combined canal system was implemented in the housing area Bo01 in Malmö, where a saltwater canal was created by pumping water from the sea into the canal (Starhe, 2008). The canal works as a sustainable open water management system that could take care of the stormwater while always providing the housing area with a blue character.

The streets in the Bo01 area feature a small canal system that direct water to various locations for different purposes (Starhe, 2008). On one side, the canals discharge into the sea, while on the other, the water is directed to the saltwater canal. The water is usually collected before reaching the canal, where a pump system allows the rainwater to circulate in the system, reusing the water's functions and enhancing the character. In heavy rain, water flows directly into the canal, making its stormwater function appear.

CANALS AND WELL-BEING

Vaeztavakoli et al. (2018) have explored the health aspects and therapeutic effects of urban water canals in mental, physical and social dimensions, based on residents' experiences.

Canal environments were shown to be environments which contributed to the residents feeling relaxed and comfortable (Vaeztavakoli et al., 2018). A canal could act as a symbol for a neighbourhood, improving the sense of identity and sense of place among its inhabitants. Canals have been shown to increase the feeling of pleasure and satisfaction, which positively affects the perception of health among the residents.

Vaeztavakoli et al. (2018) present the effects of canals on human health in a framework which consists of four dimensions. These are (1) the canal's ability to promote active life through encouraging activity and presence in blue spaces, (2) the canal's capability to act as a setting for relaxation and restoration, (3) the canal's possibility to be act as the core of social life in neighbourhood, fostering social interactions, and (4), that canals could be a symbolic in terms of cultural heritage and increase people's sense of identity and place.

RECREATIONAL POTENTIAL OF URBAN CANALS

The design strategies outlined by Prominiski et al. (2017) relate to the embankment walls, representing the shape of the urban canals. However, sharp walls create a distance and physical barrier to the water and makes the presence of the water more hidden.

Prominski et al. (2017) have created various design strategies, addressing both the safety regarding the water and the recreational potential of waterways, shaping an approach to canals as multifunctional environments for people. Three suitable design strategies for urban canals are:

Over the water where a structure spans out over the water level

Tolerating allowing a structure to be temporarily flooded

Adapting where the structure changes with the water level

The combined canal system, Bo01 in Malmö

WATER-CONNECTED DWELLINGS FOR WELL-BEING

WATER VIEW AND WELL-BEING

Studies have found that having a water view from one's own home positively impacts health and well-being (White et al., 2020). In a study in New Zealand (Nutsford et al., 2016), those with a sea view showed fewer cases of poor mental health. In a study made in Hong Kong (Garrett et al., 2019), those with a sea view from their home showed better general health than those who did not have it. In a study in Ireland (Dempsey et al., 2018), those with the highest levels of sea view were shown to have a lower risk of depression. The stress-reducing effect of water can also relate to its inherent qualities, such as light reflection ability, unique soundscape and dynamic wave patterns (White et al., 2020).

PRIVATE OUTDOOR SPACES AND WELL-BEING

Peters and Masoudinejad (2022) display that there is a relationship between having access to private outdoor space and well-being among residents. Private outdoor space within a dwelling, such as balconies, could have a positive impact on resident well-being and health.

Grigoriadou (2021) shows that balconies could improve well-being, as an outdoor space which offers access to natural light, fresh air and opportunities for interactions with the community and surrounding context.

RESIDENTIAL ARCHITECTURE AND WELL-BEING

There is a growing interest in the relationship between architecture and health, with the research field quickly advancing (Morichetto, 2019). Within the field of healthcare architecture, wide research has found synergies between the built environment and human health, but this relationship within the field of residential architecture is yet to be explored to the same extent.

Dwellings with high architectural quality have the potential to affect resident health in multiple positive ways and contribute to well-being (Nylander, 2021). Resident well-being has been shown to be influenced by architectural quality (Morichetto, 2019). Residential architecture has great potential to affect and enhance the everyday experience among the dwellers (Nylander, 1998). This potential is often overlooked and therefore unused. Non-measurable aesthetic qualities are of significance for the dwelling and its residents.

ENRICHED ENVIRONMENTS

The connection between architecture, or the built environment, and human health and well-being can be studied and understood through the concept of the enriched environments (Morichetto, 2019). An enriched environment could be described as an environment which offers a higher degree of multi-sensory stimulation through complexity and a diversity in sensory experiences. Morichetto (2019) presents three main concepts around which an enriched environment in residential architecture could be built up. These are *Spatial extension, Movement* and *Material and detailing*.

In terms of the relationship between the dwelling and the water, *Spatial extension* and *Movement* are the most applicable concepts.

SPATIAL EXTENSION

The term spatial extension impacts different experiences, such as the feeling of spaciousness and the way in which the architecture creates conditions for stress reduction and stress management (Morichetto, 2019). The built environment can serve as a setting which can offer different degrees of stimulation, create positive distraction and generate a sense of control within the home. The calming and stress reducing qualities of water (Sjövall, 2020) can further emphasise the importance of connecting to the outside via views or private outdoor spaces for the opportunity to engage with the soundscape of water (White et al., 2020).

Views

Morichetto (2019) have studied how residential architecture can support views to the outdoors and its significant impact. The feeling of spaciousness in a dwelling is affected by the possibilities to look out to the surroundings, which could create a sense of stimulation and fascination. The configuration of the views also impacts the experience.

The feeling of spaciousness could be enhanced if it is possible to look out in multiple directions from the same place in the dwelling (Morichetto, 2019). This is described as a diverging view. In contrast to a diverging view, a converging view is described as the possibility to see the same point or scene from multiple places in the dwelling. A room with windows in multiple directions is described as a quality which enhances the well-being among residents, as it lets in light from multiple directions and extends the views.

Variation & events

A variation and complexity in experience could be created by a variety of views (Morichetto, 2019). Axes, views through the home and views to the outside are described as important qualities which add variety to the experience, and which could enhance the feeling of spaciousness in a dwelling.

The variety of views impacts this feeling and could be designed in different ways (Morichetto, 2019). The feeling of spaciousness could be strengthened through views from one room to another, or views which pass through both interior and exterior spaces. The impression could be further strengthened if one can both see and move through a number of rooms, both interior and exterior.

Housing surveys have shown that axiality is an important quality to promote well-being (Nylander, 2021). Axiality creates a sense of expectation – it is at first experienced through sight, then through movement, from which the initial sense of expectation is confirmed (Nylander, 1998).

Interface

How the interface is designed, how the interior meets the exterior and how the dwelling is related to its surroundings affects the resident's experience (Morichetto, 2019). The variety of spaces in a dwelling is also influenced by how openings are designed and what their sizes are in relation to the interior space. Privacy and protection are important to feel safe within the home, as is a visual connection to the world outside.

Horizontal and vertical

A contrast in the views and their extension horizontally and vertically also affects the overall impression of spaciousness (Morichetto, 2019). Wider windows strengthen the sense of spaciousness, whereas a window which is extended to the floor could indicate the possibility to go outside, further strengthening the connection between the dwelling and the outside world.

MOVEMENT

Movement within a dwelling is described as an important quality to achieve an enriched environment in a residential environment (Morichetto, 2019). The quality relates to how the movement and circulation within the dwelling is programmed and designed. The variation of the movement contributes to the dwelling being experienced as stimulating.

Different experiences could be affected through different aspects of movement, such as the experiences of freedom, stimulation, spaciousness, variation and complexity (Morichetto, 2019). Movement, axiality and light within the dwelling create a contact with the present, a perception of reality (Nylander, 1998).

Variation

Varied movement in the home affects the perception of the dwelling and its functions (Morichetto, 2019). Both complexity in movement and variation in its configuration can be experienced as stimulating. A varied movement could be created through different configurations of circulation loops in the dwelling, where the loops could have different sizes, go through multiple rooms, both interior and exterior, and have different qualities based on which types of spaces the loop passes through.

Changes in direction of the movement could also create variation (Morichetto, 2019). Rhythm in the movement contributes to a varied movement and a stimulating experience. The rhythm of the movement in the dwelling is important for the subconscious experience of the architecture of the dwelling (Nylander, 1998).

Passage

Connecting indoor and outdoor through movement in the passage between the dwelling and its surroundings is another configuration which impacts the experience of the home (Morichetto, 2019). The feeling of freedom could be enhanced by creating multiple connections to the outdoors. To be able to access exterior spaces from multiple rooms could also positively impact the feeling of spaciousness and acts as a reminder and encouragement for residents to spend time outdoors. Multiple ways to reach the outside from the dwelling enlarges the perception of the home.

REFERENCE PROJECTS

The criterias for the selection of reference projects were that the project should be a residential multi-family complex and that the buildings should have a physical contact with the water, meaning that the project should have at least one facade in the water, be a floating construction or be standing on poles on the water.

The reference projects have been analysed and compared to gain a deeper understanding of their qualities. The analysis has been done on three scales: neighbourhood, block and dwelling. A specific, water-related quality has been analysed on each scale.

The analysis on the neighbourhood scale is focused on the water strategy used within the built structure. It is defined as *what strategy has been applied to integrate and manage water within the built environment.*

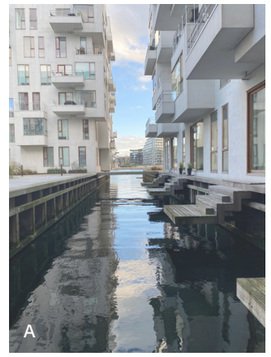
The analysis related to the block scale examines the contact with water. It is defined as *how the buildings meet the water and what the interface looks like.*

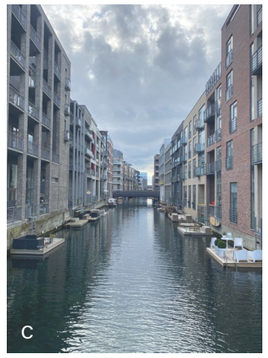
The dwelling scale analysis covers the indoor-outdoor connection. It is defined as *how openings and private are outdoor spaces designed to link indoor and outdoor.*

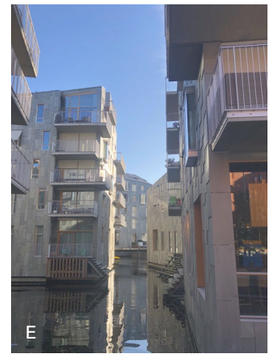
FIGURE 1 Map of Europe

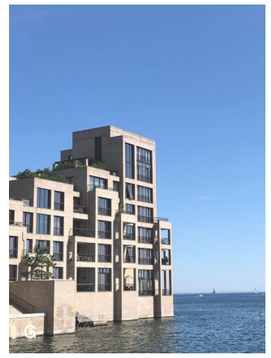
REFERENCE PROJECTS

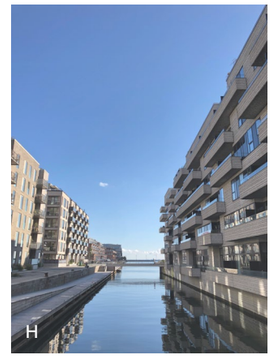
A Havneholmen
B Sømærk
C Sluseholmen
D Waterbuurt-West
E Vannkunsten
F Sluishuis
G Tuborg Salt Meadow
H The Kronløb Island











HAVNEHOLMEN

Copenhagen, Denmark / 2008
Lundgaard & Tranberg Arkitekter

Havneholmen is part of a larger masterplan revitalisation of a former commercial harbour area in central Copenhagen, which has been turned into contemporary waterfront housing and public space (Lundgaard & Tranberg Arkitekter, 2025a). The volumes in the U-shaped block are mainly standing on solid ground, approximately two metres above the water level. Parts are bordering the canal, which runs between the buildings and contribute to the courtyard. Parts of the free-standing volumes are standing directly in the water.

The canal apartments on the ground floor have direct access to the water via terraced jetties. However, this only applies for a small percentage of the homes on the ground floor. The dwellings that are part of the free standing buildings that are partially standing in the water have balconies which are cantilevered over the water. These do not have direct, private access to the water. In terms of visual connection, the U-shape of the blocks means that every dwelling has visual contact with the adjacent water in Sydhavnen.

Daylight provision and views within the dwellings are strengthened by floor-to-ceiling windows as well as bay windows. A variety of balconies create a diversity of private outdoor space and add the possibility of being outside in one's own home. The balconies are primarily cantilevered, which enables views over the water. The bay windows – which are significant motifs in the facades – provide the balconies with sheltered spaces and divide the balconies into different depths.

SØMÆRK

Copenhagen, Denmark / 2008
Vandkunsten Architects

Sømaerk was a competition win for housing in the Teglværkshavnen area, where the main concept was that the quality of the water edge was the water in itself: its reflections, long sightlines and the big skies (Vandkunsten Architects, 2025a). Half of the building volumes stand on concrete stilts in the water. The raised foundation that the volumes are built on – which houses storage space, as well as a garage – creates a distance between the ground floor and the water, with the space underneath the volume being used as a swimming deck.

No dwellings have private access to the water via jetties, although some residents could technically dive into the water from their balcony. The floodable swimming deck provides easy access to the water via the shared courtyards. Originally, the thought was for the decks to be fully available to the public, but the area has recently been limited for resident use. The felleshus – the common house which the residents share – is situated at the southernmost point of the area, just by the water.

The six lamellas follow the same principle – an access balcony along the northeast facade and private balconies facing southwest. Since the access balconies and private balconies cover the whole facades facing northeast and southwest, these become a layer or a second skin, on the building volumes. The access balconies lead to double-sided dwellings – all units have a visual connection to the water in two directions. All windows are floor-to-ceiling, further enhancing the strong connection between indoor and outdoor.

SLUSEHOLMEN

Copenhagen, Denmark / 2008
Arkitema & Sjoerd Soeters

Sluseholmen is located in Sydhavn and is built on eight artificial islands. Before its development, Sydhavn was an abandoned, timeworn area where the municipality of Copenhagen saw potential for transformation into a residential area (Arkitema, 2025a). Sluseholmen has a close relationship to the water through canals, with a safety buffer of between one and two meters below street level. It is possible to come closer to the water by crossing bridges, via stairs leading down to the canals and in a public harbour bath.

At least one side of the residential blocks is directly connected to the canal. In some blocks, ground floor dwellings have been provided with floating jetties, which are often reached via ladders, where a boat can be moored. The distance from dwelling to water varies: in the dwellings closest to the water, the distance from the interior floor to the water level is around one meter – in other locations the distance exceeds two meters. This is a great quality, but the large distance between dwelling and water in some blocks could be questioned.

Sluseholmen consists of multi-family housing and rowhouses. Most dwellings have balconies, spanning from small French balconies to larger ones, usually in a semi-recessed form. These face the canals, courtyard or street, offering different levels of privacy and water views. The windows and bay windows vary between buildings in amount and size. The variation of balconies and windows gives the neighbourhood a mixed character, though sometimes at the expense of housing quality.

WATERBUURT-WEST

Amsterdam, The Netherlands / 2011
Marlies Rohmer Architecture & Urbanism

Waterbuurt West is part of Amsterdam's urban development IJBurg, which consists of multiple artificial islands on the IJmeer lake (Marlies Rohmer Architecture & Urbanism, 2025). The project, which consists of densely placed terraced houses, is the largest floating housing area in Europe, and is situated just 15 minutes east of the city center of the Dutch capital. A water gate separates the floating housing neighbourhood from the IJmeer, meaning that the water area is its own lake, where the water is cleaner than in the adjacent sea.

As the buildings are floating, the dwellings have a direct and strong connection to the water. The distance between the ground floor and the water is minimal since the construction allows the buildings to fluctuate with the ever-changing water levels. Each row house is docked to one of the piers, which ensures that all units have at least one facade in the water. The houses are also anchored to the bottom of the lake for legal reasons, since there has to be a distinction between floating houses and house boats.

The container-like design of each building means that each home has two light, almost entirely glazed facades on each short edge. This ensures that each building gets a strong connection to the exterior and especially to the water – both visually and physically. Each of the homes has a jetty for boats to enhance the water connection, and the placement of the different building volumes also creates private exterior spaces which are used as terraces on the second floors of the buildings.

VANNKUNSTEN

Oslo, Norway / 2020
Vandkunsten Architects

Vannkunsten is located on central Oslo's waterfront and has a character inspired by the archipelagos (Vandkunsten Architects, 2025b). Water influences spatial transitions from open sea to calm inland water. To bring the water closer on a neighbourhood scale, the inland water has been locally raised. The neighbourhood also includes a public bathing area by the fjord, accessed via stairs, platforms and a jetty. A bridge in the housing area provides a way over the water.

Five of nine buildings surround a framed water area, giving them direct contact with the water. The lowest-level apartments have private water access via stairs leading down to where a boat can be moored. While this water access is a key feature for these apartments, the upper units are more physically disconnected. The small size of the framed space results in short distances, potentially reducing privacy for residents. The four northern buildings do not have direct water access.

The apartments have large windows and glazed doors, offering greater views, daylight, and a strong connection to the outside. Some apartments also feature bay windows, widening the view range and enhancing the sense of being closer to the outside. All apartments have balconies, ranging from semi-recessed to fully recessed. Some balconies wrap around the building's corner, providing a wider range of views and a stronger connection to the water – both in the smaller spaces between the buildings themselves, and the great water of the Oslo fjord, just south of the Vannkunsten buildings.

SLUISHUIS

Amsterdam, The Netherlands / 2022
BIG + Barcode Architects

Sluishuis has grown out of the traditional Amsterdam perimeter block but is highly adapted to a contemporary approach with water as its focal point (BIG, 2025). The residential building, containing 442 apartments, takes advantage of its waterfront location by the IJmeer lake by elevating one corner of the building volume, creating a sensational connection to the open water. This defines and frames the courtyard space as well as providing more apartments with views of the water.

The water can be reached from the courtyard via jetties. To further enhance the courtyard's unique quality, sailing schools and water sports encourage active water interaction. The building also provides other opportunities for engagement with water. Both visitors and residents have access to a walkway leading to the roof with expansive views of the water. The building is also surrounded by a jetty promenade with sitting decks and floating gardens, which has been specifically designed to stimulate flora and fauna in the area.

The building offers various solutions to strengthen the connection to the surrounding water. North-and-east-facing apartments have balconies that hover over the open water, while courtyard-facing apartments also establish a connection through the courtyard's integrated water and opening in the block. The apartments adjacent to the block opening have windows designed to enhance the water connection. Lastly, some dwellings have their own spacious roof terrace, creating generous private outdoor spaces oriented towards the southwest.

TUBORG SALT MEADOW

Hellerup/Copenhagen, Denmark / 2022
Lundgaard & Tranberg Arkitekter

The three buildings – which are called the coastal houses – are located on the tip of the former Tuborg factory site in Hellerup, just north of Copenhagen. The former industrial area has been turned into a new residential district within a larger nature habitat (Lundgaard & Tranberg, 2025b). Underground parking allows the buildings to be raised to a safe distance above the sea level. The nature area adjacent to the buildings improves biodiversity in the area and could act as a buffer zone for rainwater.

Two of the brick buildings plunge directly into the water, and these volumes accentuate the coastline. The residents are given access to the Öresund sea via the shared harbour just north of the coastal houses, and also via the common stairs between the buildings. However, no apartments have direct, private access to the water. Given the location of the site, the building heights and the spaces in between the volumes, all dwellings have a visual contact with the water.

All dwellings in the coastal houses have at least two terraces or balconies. The balconies are generally fully covered with the support of brick columns, whilst also pushing out from the building volumes as semi-recessed private outdoor spaces. Large, glazed sliding doors create seamless transitions between interior and exterior, almost erasing the boundary between inside and outside. Floor-to-ceiling windows are the standard in the project, further strengthening the connection between indoor and outdoor.

THE KRONLØB ISLAND

Copenhagen, Denmark / 2023
COBE & Vilhelm Lauritzen Architects

The name of the project partly reveals that The Kronløb Island is an artificial island (Vilhelm Lauritzen Architects, 2025). The project is situated in an old industrial harbour basin in the north harbour district Nordhavn, which has undergone a large-scale transformation during the past decade. The project is unique and complex. It is connected to the mainland by bridges, and the island consists of 233 apartments around a large and green courtyard (NCC, 2025). The three stories underneath the island are used for car parking – technically under water (Vilhelm Lauritzen Architects, 2025).

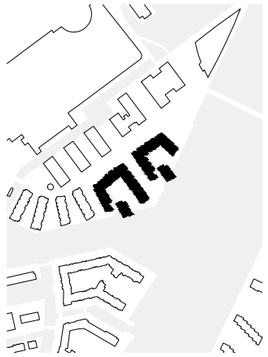
Each of the six buildings on the island have at least one facade which visually goes straight into the water. None of the apartments have direct access to the water from their home, but both residents and the public have access via the two public spaces on the island's western and eastern edges. The lamella buildings have two-carrier stairwells. The apartments in these buildings each have a facade with a direct visual connection to the water. All dwellings have a direct visual water contact.

The monolithic appearance of the buildings, where openings and balconies appear to have been carved out of a large stone block, means that the large balconies are a big part of the buildings and the dwellings. Most balconies are semi-recessed, providing an opportunity for views, privacy, sunlight and shelter. The generous sizes of the private outdoor spaces also ensure flexibility and furnishability. The roofs on each of the six buildings on the island are used as private terraces.

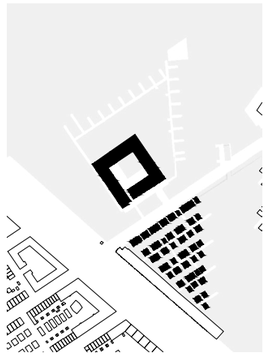
COMPARISON

Project Location Architect(s)	Completion year	Type of housing	Number of homes	Number of floors	Connection to water	Dwelling water access
Havneholmen Copenhagen, Denmark Lundgaard & Tranberg (2025a)	2008	Apartments	236	8	By the water	Yes
Sømærk Copenhagen, Denmark Vandkunsten Architects (2025a)	2008	Apartments	120	4	On the water	No
Sluseholmen Copenhagen, Denmark Arkitema (2025a) & Sjoerd Soeters	2008	Apartments, row houses	1000	4 - 5	By the water	Yes
Waterbuurt-West Amsterdam, The Netherlands Marlies Rohmer (2025)	2011	Row houses	72	2	In the water	Yes
Vannkunsten Oslo, Norway Vandkunsten Architects (2025b)	2020	Apartments	150	3 - 6	By the water	Yes
Sluishuis Amsterdam, The Netherlands BIG (2025) & Barcode Architects	2022	Apartments	442	1 - 11	By the water	No
Tuborg Salt Meadow Hellerup, Denmark Lundgaard & Tranberg (2025b)	2022	Apartments	86	3 - 13	By the water	No
Kronløb Island Copenhagen, Denmark Vilhelm Lauritzen (2025) & COBE	2023	Apartments, row houses	233*	6	By the water	No

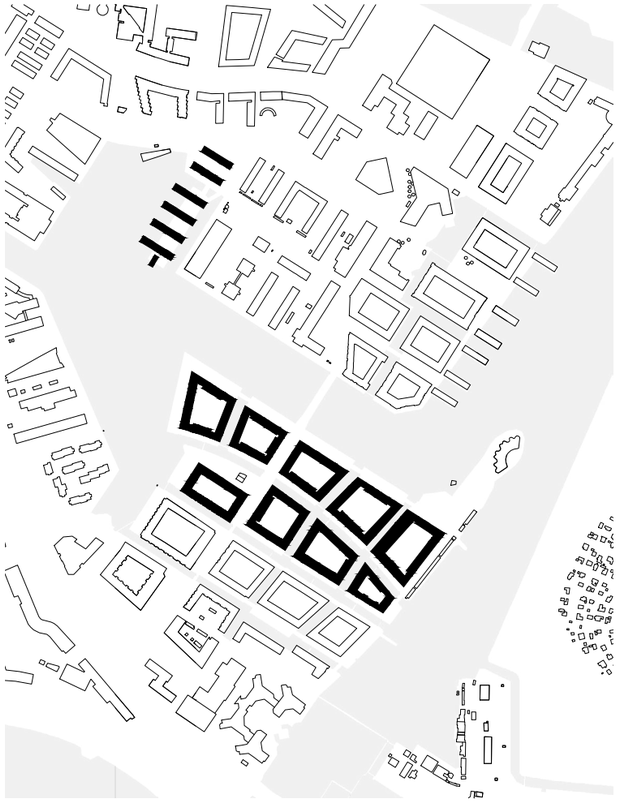
* NCC (2025)



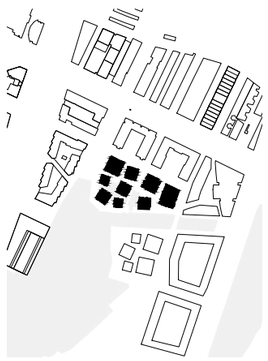
Havneholmen



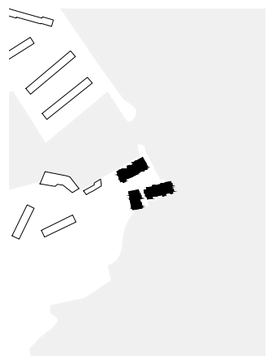
Sluishuis & Waterbuurt-West



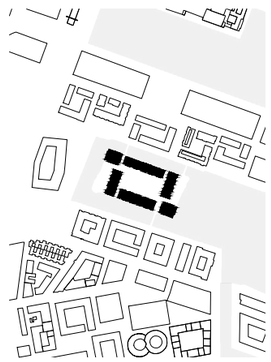
Sømærk & Sluseholmen



Vannkunsten



Tuborg Salt Meadow



The Kronløb Island

STUDY TRIPS

In order to study a few of the reference projects in detail, three study trips were conducted during the master's thesis. The cities that were visited were the Danish capital Copenhagen, located on the edge of Öresund; Oslo, the capital of Norway, located by the Oslo fjord; and Barcelona, located on the Catalan coast in North east Spain, on the coast of the Balearic Sea. The three cities all have worked with their respective proximity to water in different ways.

Given that five of the eight reference projects are located in the Copenhagen region, a trip to examine them in their respective contexts was seen as essential. On the Copenhagen seafront, there are many residential neighbourhoods that have a direct physical connection to the water, which were seen in person during the trip. The exhibition *Water is coming* at DAC, the Danish Architecture Center, was also visited.

The trip to Barcelona was initially not meant to be a study trip. However, the coastal city proved to offer several valuable projects relevant to the master's thesis. The main focus of the trip was to explore the relationship between water, architecture and people.

A trip to Oslo was also conducted. The Norwegian capital was a relevant destination due to its ongoing redevelopment of the waterfront. In Oslo, the main focus was exploring new housing areas by the water, as well as the life between the buildings.

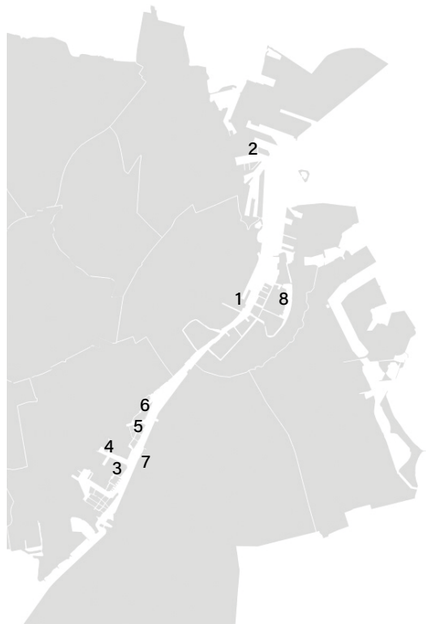
FIGURE 2 Map of Europe

COPENHAGEN

For this master's thesis, a trip to Copenhagen was essential. During the search for suitable reference projects, some of the most inspiring ones were located in Copenhagen. Since the early 2000s, Copenhagen has developed several housing areas and residential blocks adjacent to the water, offering residents direct access to the city's central waterways in various ways.

The goal of the study trip was to visit one exhibition and seven specific housing projects, but much inspiration was also drawn from spontaneous interactions with the city and its architecture. The visited area of Copenhagen offered a variety of how projects and their elements can be designed to make the most of their waterfront location. A wide range of references across various aspects of housing architecture were studied and during the trip, with new knowledge and insights gained.

The trip began with a visit to the Danish Architecture Center (DAC), where the *Water is Coming* exhibition was the main event. The next destination was Nordhavn, with The Kronløb Island as the primary project for study. However, most of the time was spent in Sydhavn, starting in the southern part with Sluseholmen. Traveling by bicycle, a number of different projects – in order: Sømærk, Sivholm and Havneholmen – were visited, where their surrounding contexts were explored before crossing Bryggebroen to visit Badvigen at Islands Brygge. After biking along the harbour quay, the day was concluded at Torpedohallen in the late afternoon.



1 DAC: Water is coming
2 The Kronløb Island
3 Sluseholmen
4 Sømærk
5 Sivholm
6 Havneholmen
7 Badvigen
8 Torpedohallen

FIGURE 3 Map of Copenhagen

REFLECTIONS

A highly inspiring trip and a true learning experience. Copenhagen offered a wide range of architecture with a strong water connection. Since the master's thesis is focused on housing, these types of projects were the primary focus. However, exploring public buildings and the spaces in between the reference projects deepened our understanding. Several elements that were studied could be applied to the intended design proposal, such as waterfront paths, public bathing areas, social spaces as well as green and blue elements with natural, integrated rainwater management.

In addition to studying housing typologies near water, various architectural elements were examined, both in housing projects and in other projects. Balconies, block structures, railings, courtyards, details and facades were studied. For this study, any of the visited projects could serve as a reference. Some features that stood out were the facades of Nordø in Nordhavn, the block structures at Islands Brygge and the schoolyard in Sydhavn.

Another key reflection from the trip was the importance of proximity to water in creating a sense of connection to the water. In many of the projects, the water was about 2 meters below the ground floor, which created a noticeable distance between residents and the water. It also became clear how water can be integrated into designs in various ways, and how different block structures influence the number of apartments that can actually enjoy water views or access.

BARCELONA

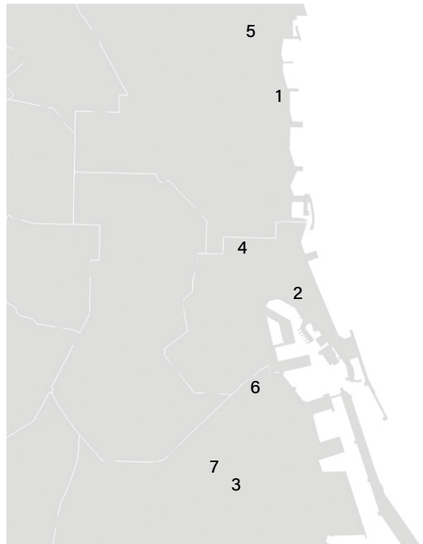
The trip to Barcelona took place in the middle of October and was not initially planned as a study trip. However, as a coastal city with both historical and contemporary architecture, Barcelona proved to offer several valuable projects relevant to the master's thesis.

The main focus of the study trip was to explore the relationship between water, architecture and people. This is a critical question in developing a strong design project for the master's thesis. The exploration was approached across different scales, from detailed elements to broader landscapes.

On a larger scale, the parks, coastline, beaches and harbours provided important insights during this trip. Several aspects were examined at this level, for instance, the intersection between the city and blue-green environments, flows, social spaces, structural organisation and water management.

On a more detailed scale, various water-related buildings were analysed. In these buildings, the choice of materials, proportions, design of water features, lighting and the surrounding context played a significant role in shaping how water is experienced.

The trip to Barcelona brought more insights than expected, providing many important reflections to consider when designing both buildings and landscapes in relation to water.



1 Waterfront Promenade
2 Port Vell Marina
3 Fountains of Placa de Les Cascades
4 Parc de la Ciuttadella
5 Parc Diagonal Mar
6 Redeia Office Building
7 The Barcelona Pavilion

FIGURE 4 Map of Barcelona

REFLECTIONS

One of the key takeaways was the delicate nature of water as a design element. When integrated thoughtfully, water can introduce life and movement to a space. This is especially evident when the context is well-considered. The success of this integration also depends on its interaction with human behavior and the surrounding environment, where water can feel inviting, accompanied by elements that encourage engagement.

Another reflection is the vulnerability of water when the design is not done with enough care and thought. If water is added merely for show, without being integrated into the design or context, it can weaken the space. When elements are designed to host water, such as fountains, the lack of it makes them lose their purpose and vitality, making the absence of water noticeable and disappointing. This absence served as a reminder of water's essential role for human life, and how a lack of water can evoke feelings of emptiness or even threat.

Water also carries different social meanings, from being a public and accessible resource, vital for all, to a more exclusive element used to signify power and wealth. This duality makes water even more complex as a design element. Its inherent attractiveness means that designers must ensure it is accessible, avoiding spaces that feel exclusive or alienating. Finally, there is the important question of water's connection to movement, whether the space feels still and enclosed, or part of a larger system where water flows continuously.

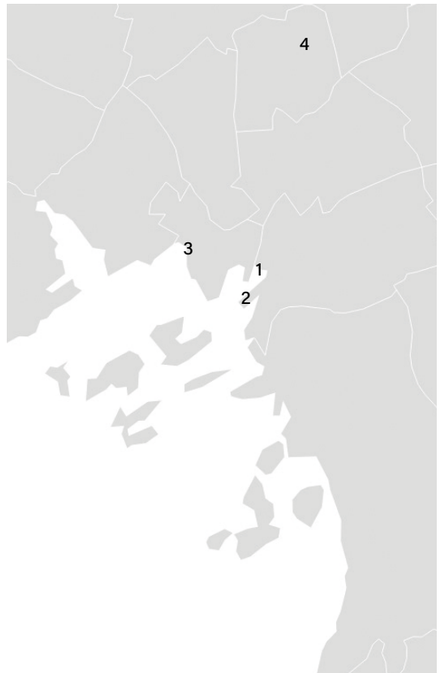
OSLO

Given its location in such relative proximity to Gothenburg, a day trip to Oslo was seen as appropriate during the master's thesis preparation courses. The Norwegian capital was a suitable destination, mainly due to its ongoing redevelopment of its waterfront, which just like in Gothenburg historically has been seen as industrial land, forming a barrier between the city and in Oslo's case, the fjord.

Another specific reason to make the trip was that one of the selected reference projects in the thesis, Vannkunsten, is situated at the waterfront in Oslo.

The day began with a short walk from Oslo's central station, over the train tracks, via the Barcode area, down to Bjørvika, one of many waterfront areas in Oslo which has undergone transformation from industrial land into urban development and is still being revitalised. After taking a closer look at Vannkunsten, its relationship to water and its neighbouring residential buildings, the walk continued out on the Sørenga peninsula.

From the harbour bath at the southernmost point in Sørenga, the walk continued along the harbour promenade via the Deichman Public Library, where the fjord was viewed from the top floor. The walk continued towards Aker Brygge before the Tjuvholmen area was explored. Following a short metro journey, the Nydalen area was the next destination to see. From Nydalen, the river Akerselva was followed back to the central station.



1 Vannkunsten
2 Sørenga
3 Tjuvholmen
4 Nydalen

FIGURE 5 Map of Oslo

REFLECTIONS

A rewarding trip to the Norwegian capital. Oslo's proximity to the fjord truly has been enhanced through the city's visions and the result is best seen on the grand harbour promenade. The water has been made accessible to the people and is clearly being enjoyed by inhabitants and visitors all year round.

The promenade is long and varied, and though there is room for improvement on some patches, it is great to see that new residential areas are being built along the coastline, meaning that even more people will get to enjoy the fjord on a daily basis in the future.

For the city planning office to re-think the city and starting to implement Jan Gehl's theories from *Life Between Buildings* has been a successful move – what impressed the most during the day in Oslo were the spaces in between the buildings, many of which work well and seem to be loved by the people. The balance between public and private can be a difficult challenge, and at Sørenga, different examples of solutions - both good and bad - are displayed.

Vannkunsten in Bjørvika became an inspiration to test and explore different typologies by the water to use the thesis site and context to the max. This particular part of the trip has encouraged laboration with typologies in the thesis work. Seeing how connected to the water that Oslo has become, it was a valuable experience to see many different ways of water integration in the city.

SUMMARY OF THE THEORETICAL FRAMEWORK

LITERATURE STUDY

When considering the well-being benefits of water, there are several ways in which these could be achieved. The water itself has several qualities that can have a positive influence, such as a calming soundscape and light reflecting abilities, creating stress-reduction and strengthening mental health (White et al., 2020). There are also certain suggested activities connected to water that can improve well-being, from viewing, visiting, exercising and spending time by the water (White et al., 2020) to swimming (Overbury et al., 2023). To make the most of the water, the design of water elements and the surrounding area is important to enhance the positive effects (Lohrer, 2008). According to Lohrer (2008), this regards both functions, sensory experience and safety.

From this part, the key takeaways regard water access and the design of spaces by the water. To be able to engage with the water and experience its positive influence, it is important to make the water accessible, both visually and physically. To support various activities, this has to be done in different ways to support people's individual needs, making as many people as possible want to engage with the water. It is also important to consider the function of the water and how the design elements surrounding the water can support the purpose and create safe access.

The second part of the literature study covers water-related environmental challenges. Regarding flooding from rising sea levels, Sweden has its lowest prioritisation on applying flood risk management before a flood event occurs (Raadgever & Hegger, 2018). Strategic planning could combat this, for instance by placing fragile functions at a safe height while allowing certain functions to flood (Barker & Coutts, 2016). This relates to the softer *Retreat* strategy suggested by Petersson and Soneryd (2022) and the city of Gothenburg's demand of a raised ground level at +2,8 meters (City of Gothenburg, 2019), complemented by the strategies presented by Prominiski et al. (2017) to reconnect with the water.

Stormwater management is also presented, where the focus regards sustainable strategies such as Sustainable Drainage Systems (Charlesworth, 2016) and Natural Flood Management and Nature-Based Systems (Ashley et al., 2020) which could handle the stormwater while providing well-being aspects. The stormwater canal (Ramböll, 2015) and combined canal systems (Starhe, 2008) are also introduced, where the well-being potential (Vaeztavakoli et al., 2018) and possible connected strategies (Prominiski et al., 2017) of canals are also presented.

The key takeaway from these parts regards a conscious planning of the area where both flooding and stormwater elements need to be carefully considered. The strategy of raising the ground level to protect the residential building is supported in several ways, while another set of strategies, such as floodable green areas or terraced spaces down to the water, can reconnect the area to the water, making sure that the values from the key takeaway from the well-being part are intact. Regarding the stormwater systems, the water should be taken care of to create blue and green spaces in the area, turning a challenge into an opportunity. Larger systems, such as canals, are an effective way of creating a blue and strong character in the area.

When considering the dwelling in relation to the water, views towards the water (White et al., 2020) and a private outdoor space to engage with the surrounding context (Grigoriadou, 2021) are important elements. Morichetto (2019) presents concepts regarding the design of views and the interface between indoor and outdoor, along with other ideas on how the entire dwelling unit can feel more spacious through variation and movement, extensive windows, and the passage as a connection between indoor and outdoor to connect the dwelling to its surroundings, for instance by being able to reach the outside from multiple rooms.

Considering the dwelling unit, the key takeaway is to work with the entire unit to embrace the surrounding water context as much as possible. The interface between the interior and exterior is of great importance to strengthen the connection. Large windows positioned to create a view towards the water, as well as a private outdoor space to further engage with the water setting, are important design features. The layout of the dwelling unit should also emphasise the outdoor connection, where sightlines, axiality, and movement can create a connection to the outside, all the way from the entrance and core of the dwelling.

REFERENCE PROJECTS

The second section of the theoretical framework regards the reference projects. The reference projects present different built examples of how multi-family residential complexes. The analysis on the neighbourhood scale focuses on the water strategy used within the built structure, both to manage he water and create a strong connection. The analysis related to the block scale examines the contact with water from the building and the courtyard. The dwelling scale analysis covers the indoor-outdoor connection.

On the neighbourhood scale, the key takeaways concern the flood risk management and how water becomes a quality in the neighbourhood. The majority of the projects have a raised ground level complemented with structures connecting the area to the water. Some examples are public baths, walkaways, social spots, green areas and terraced jetties, which become qualitative spaces for the residents and the public to interact with the water. Some projects have worked with the quality of water in an inspiring way. In Vannkunsten, the use of inland water makes the water come higher and closer, creating a stronger interaction with the water. Waterbuurt-West uses a water gate to separate the neighbourhood from the bigger lake, providing the area with more controlled, cleaner water.

Regarding the block scale, all projects are located very close to the water, with the majority having a direct connection with the water. Several projects also have a connection to the water from the courtyard, where water activities, such as bathing, swimming school and kayaking, can take place. The courtyard connection is important for the apartments situated further up from the water. The key takeaways from the block scale mainly regard the opportunities provided by direct contact with water, both for the common interior space within the block as well as the courtyard.

When considering individual dwellings, there are two categories. The first one is the apartments located on the ground floor, adjacent to the water. In projects such as Havneholmen and Vannkunsten, these dwellings have private outdoor spaces that step down towards the water, while at Sluseholmen, floating jetties are connected to the private outdoor space, further strengthening the contact with water. The second category consists of the apartments without direct water connection. For these apartments, the windows and balconies become key elements in their connection to the water. When studying all the reference projects, extensive windows, bay windows and a large number of balconies are common themes. The balconies are mainly sheltered in some way, as a semi-recessed or recessed balcony or with a bay window framing the outdoor area, creating protection from windy conditions. The quality of the balcony is also strongly influenced by its size and the capacity to provide appealing views.

STUDY TRIPS

The third and final part of the theoretical framework consists of the study trips to Copenhagen, Oslo and Barcelona. Even though many of the reference projects had been studied in advance, especially those located in Copenhagen, experiencing the buildings in their actual context added another dimension of understanding and valuable insight for the design project.

Visiting the projects in their urban setting revealed spatial qualities and an atmosphere that were hard to fully understand through drawing and images. The characters in each project varied a lot and had widely different approaches to the water. Some treated the access to water as a private and exclusive asset, while others provided more generous and inviting public spaces. When the design of a project was unclearly communicated, the zoning and intention, signs were used to communicate boundaries instead, usually giving the project a negative and less inviting impression. One key takeaway is therefore to design spaces that clearly communicate private and public zones. This should be done without creating a sense of exclusion, rather a safe environment where both the public and residents can engage with the water.

Another key takeaway from the study trips was the importance of durable facade materials. Buildings located by the water are exposed to tough weather conditions, such as moisture from the water and harsh winds. In this context, materials such as brick and stone proved to be more suitable than less durable materials. The durability also contributes to robustness suitable for a waterfront setting.

DESIGN STRATEGIES

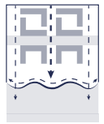
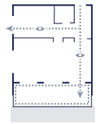
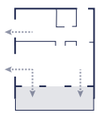
To ensure that the research questions are answered in the design proposal, the design project is based on nine design strategies which originate from the keywords in the research questions and the theoretical framework. Using this method links the research and the design, and ensures that the design proposal ultimately will answer the three research questions.

The method to create the design strategies originates from the research questions. The keywords of the research questions are the foundation of the three key concepts – water access, water and well-being, and water management. The three key concepts are turned into design strategies on each of the three scales – neighbourhood, block and dwelling.

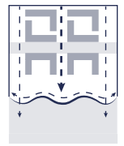
The design strategies are built on three key concepts – water access, water and well-being, and water management. The subjects have been created by using the keywords in each of the three research questions, along with the findings of the theoretical framework

The design strategies also cover the three scales of the design project – the neighbourhood scale, the block scale and the dwelling scale. The three scales are also represented as keywords in the research questions.

When the key concepts are combined with the scales, nine design strategies emerge – three related to each key concept and scale, making sure that the findings of the research are present in the design proposal.

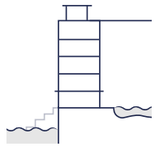
	NEIGHBOURHOOD	BLOCK	DWELLING
WATER ACCESS Water-related sustainability challenges Holistic approach to water Water as a quality Well-being	 Water for all	 Direct water contact	 Water view
WATER AND WELL-BEING Well-being Holistic approach to water Water as a quality	 Blue space variation	 Common blue spaces	 Indoor-outdoor connection
WATER MANAGEMENT Water-related sustainability challenges Water as a quality Holistic approach to water	 Adapted levels	 Blue-green systems	 Collecting the water

DESIGN STRATEGIES



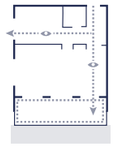
Water for all

A safe and variating access to the water for residents and the public



Direct water contact

Every building and courtyard should have direct contact with water



Water view

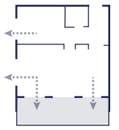
Each dwelling should have a direct view towards the water

Blue space variation

The character of the blue spaces should change to support water-related activities and water interactions

Common blue spaces

Shared spaces where the proximity to water should be physically and visually enhanced



Indoor-outdoor connection

Each dwelling should have private outdoor space of at least 10 sqm, accessible and visible from multiple rooms

Adapted levels

Raising ground and water levels, while allowing lower zones to flood to maintain water access

Blue-green systems

The water cycle should be integrated in the design to manage stormwater and to create blue-green qualities

Collecting the water

The water cycle should be integrated in the private outdoor spaces, where stormwater is collected

DESIGN PROJECT

The design project consists of designing a waterfront residential neighbourhood, with a specific focus on a block and its dwellings at South Lindholmen, an area by the Göta River waterfront in central Gothenburg. The design is built upon the design strategies, and covers the three scales – neighbourhood, block and dwelling – which have been included in the theoretical framework.

Firstly, on the neighbourhood scale, the area and its relation to water is displayed. The main principles of the design of the neighbourhood include a democratic approach to the access to the water, varied blue spaces and adapted water and ground levels to flood proof the area, while allowing its character to change with the precipitation and fluctuating water level. The connection to water is enhanced through the introduction of man-made canals in the area, extending current sightlines and flows of movement towards the river, as well as strengthening the access to the river in various ways, for example through the introduction of a public bath and a neighbourhood park on the riverfront.

How the water has been integrated in the design of the block is shown on the block scale. To connect the block to the design strategies, all buildings in the block have at least one facade which goes directly into the water. There are common blue spaces where residents can meet and where water-related activities can take place. Canals frame the courtyard and terraced bathing jetties offer direct access to the water. On the courtyards and on the roofs, blue green systems are integrated to display and use the water cycle in various ways, such as in green roofs and rain gardens.

Lastly, on the dwelling scale, the dwellings and their connection to the water are presented. The main principles for the design of the dwellings are all related to the connection to the water, which is enhanced through a direct view towards the water from each dwelling, through axiality which strengthens the indoor-outdoor connection and through semi-recessed balconies from which each resident can experience the proximity to the canals and the river. To strengthen the connection to water, rainwater is gathered on the private outdoor spaces to be used for gardening. To conclude the design, the detail section and elevation represent the design and show the materiality, construction, spatial qualities and the connection between the interior and the exterior, more precisely the connection to water.

GOTHENBURG

FIGURE 6 Aerial photo

SITE CONTEXT

South Lindholmen is an area which is situated on the north riverbank of Göta River in central Gothenburg. The area is currently mainly used as parking for the adjacent educational institutions and Lindholmen Science Park. The area and its waterfront, south-facing location has characteristics which makes it attractive for exploitation. The area currently houses a few temporary and permanent low-rise buildings which are expected to be demolished when the area is further developed.

Lindholmen is an area where historical industrial dockyard areas are mixed with modern architecture. Businesses, offices and educational facilities are the main functions. In relation to other functions, there are relatively few dwellings in Lindholmen, which is a busy area during daytime, but quieter during nights and weekends. Lindholmen can be reached by foot, bike, ferry, car, bus and soon by tram. The area will also be linked to the city centre via a pedestrian and biking bridge in the future. There are also visions to further densify the area and to add more housing, offices and preschools in Lindholmen. Karlatornet, the tallest building in Scandinavia with its 245 meters, has added a new landmark in the area (City of Gothenburg, 2025b).

CHOOSING THE SITE

A guided tour of Älvrummet, which includes a large physical model of the Gothenburg RiverCity and its planned developments, was conducted, as well as a guided tour of Lindholmen. The tours displayed different development areas which are part of the RiverCity vision and proved to be an introduction to what would later become the thesis site.

Another prominent waterfront site on the north riverbank of Göta River, Lundbyhamnen, was the proposed site for the design project during preparation courses. Following a meeting with Älvstranden AB, who own majority of the land on the north riverbank, attention turned to the South Lindholmen area. South Lindholmen has the waterfront characteristics which the design project required, and is also expected to be developed sooner than Lundbyhamnen. Further meetings with Älvstranden AB strengthened the understanding of the site, the planning process and the current plans for the area. The design proposal is not a critique of the existing plans for the South Lindholmen area, and should rather be seen as an innovative, visionary proposal for the area.

Following the meetings with Älvstranden, a visit to Varvshistoriska Föreningen was made. The association works to preserve, document and share the history of the dockyards (Varvshistoriska, 2025b). Representatives from Varvshistoriska explained the industrial history of the site and provided insights on how the area has been used throughout history. Historically, Lindholmen was an industrial dockyard area, where ships were built (Dicksson & Knutson Udd, 2016). The shipyard industry in Lindholmen began in 1844 and lasted until 1985.

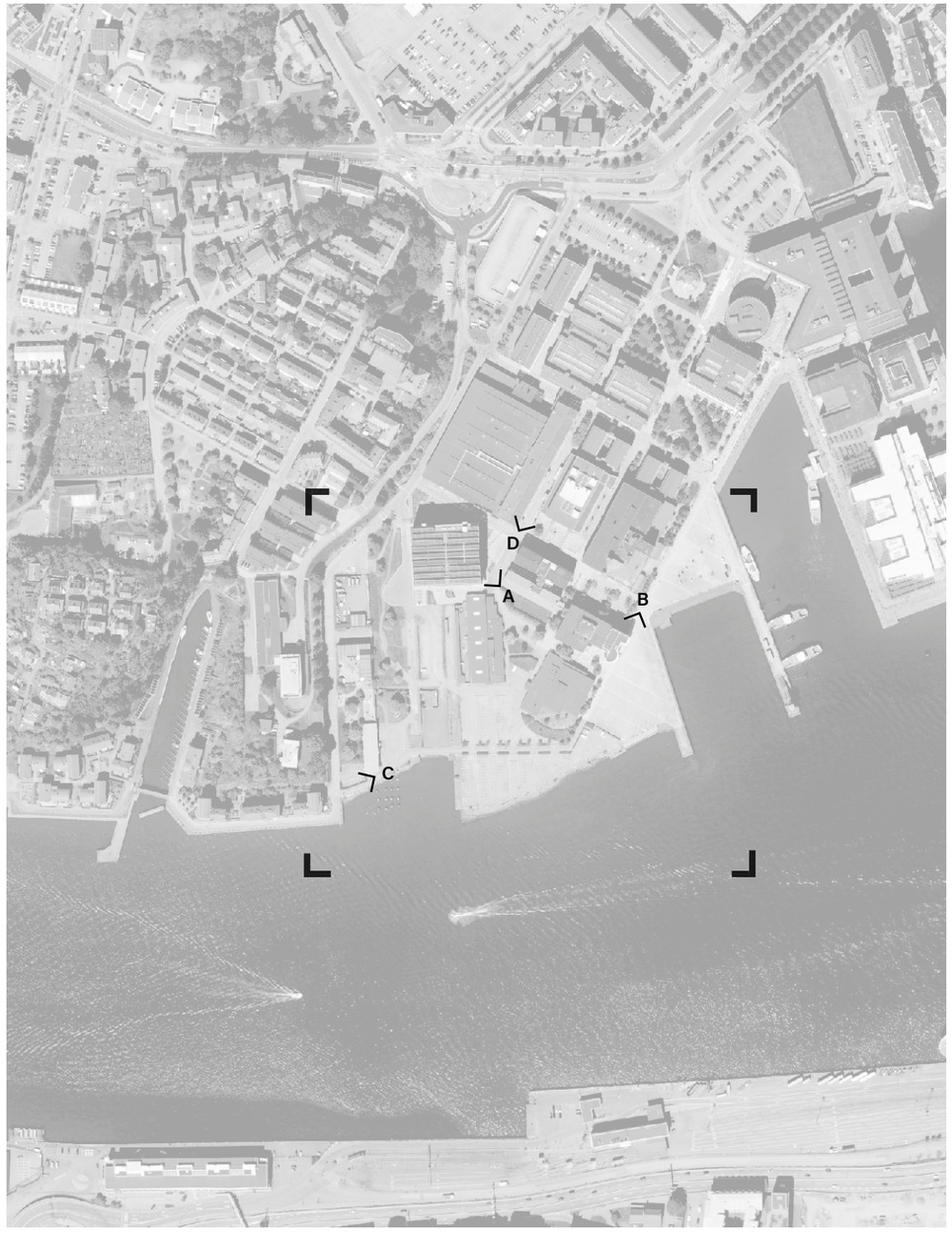
NEIGHBOURING STRUCTURES AND AREAS

The buildings that remain at South Lindholmen were mainly built in the 1940s and 1950s (Dicksson & Knutson Udd, 2016). Many of the buildings share a similar exterior design, where the main material is dark brick with light mortar. Roofs are flat and eaves are tiny or do not exist.

To the north, the area is bordered by Polhemsgymnasiet, originally a storage building built in 1945, which is today a high school (Dicksson & Knutson Udd, 2016). The building is five stories tall and the facade is predominantly clad in brown brick with light mortar, while the extensions are clad in pink plaster. Another high school building, Lindholmens tekniska gymnasium, also borders the South Lindholmen area, and was finalised in 2020 (Arkitema, 2025b). It shares the characteristic dark brick facade with light mortar, and is also five stories tall.

To the east, the South Lindholmen area is bordered by Lindholmen Science Park, a large business area with offices (City of Gothenburg, 2025b). The facades are clad in different materials and the building heights vary from between five to six floors. Lindholmspiren is also situated by the Science Park, from where the city centre can be reached via ferry. In this direction, the quay promenade along Norra Älvstranden continues towards the neighbouring area Frihamnen.

To the west, the area is bordered by Skateberget, a mountain which is perceived as a natural barrier which frames the South Lindholmen area. Certain buildings on Skateberget are protected by cultural heritage regulations (Dicksson & Knutson Udd, 2016). To the west of South Lindholmen, the quay promenade continues towards Sannegårdshamnen and Eriksberg, past four residential buildings of five stories each, clad in light brown brick, built in 1990 (Brf Lindholmsdockan, 2025).



SOUTH LINDHOLMEN

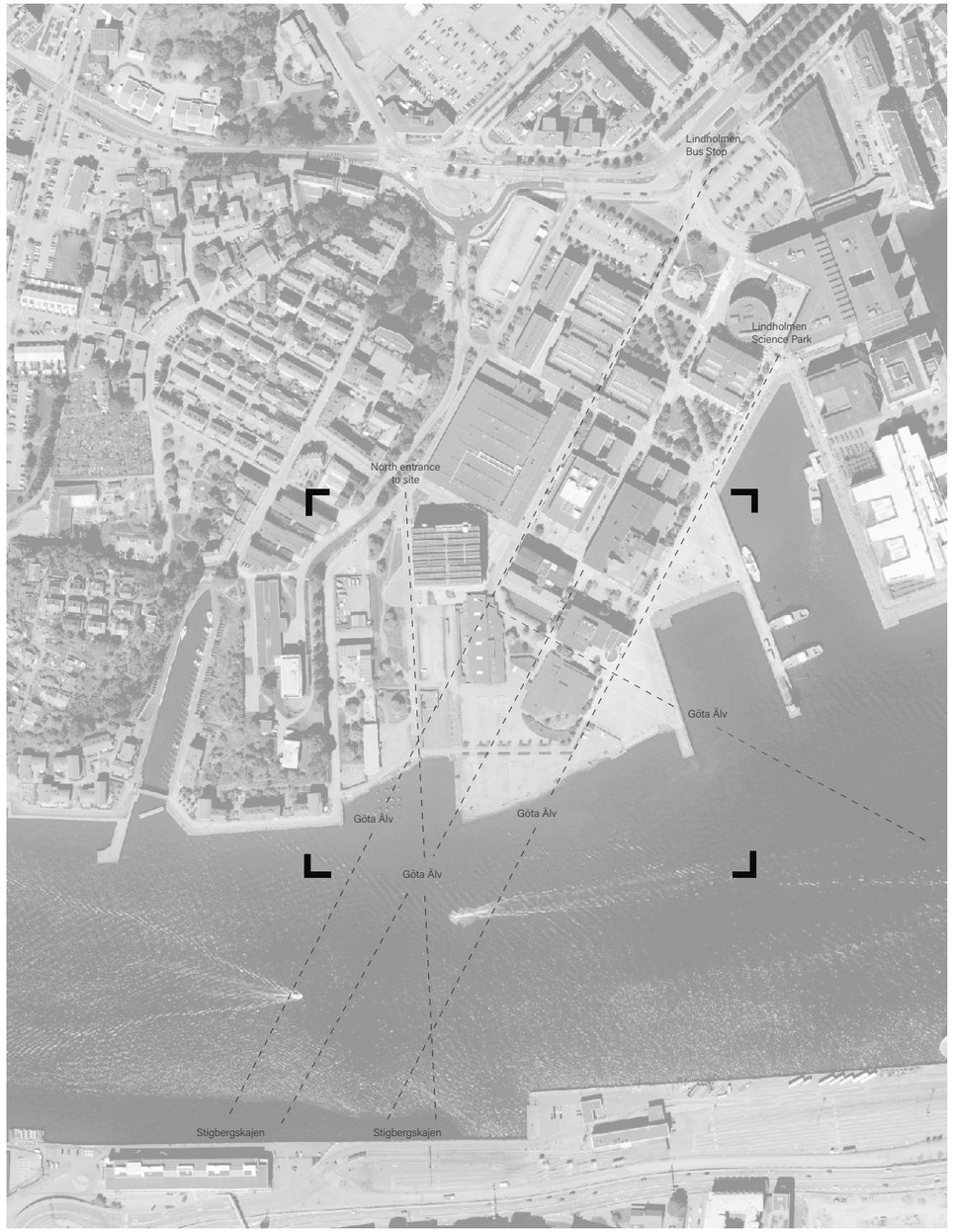
FIGURE 7 Aerial photo

A Lindholmens tekniska gymnasium

B Polhemsgymnasiet

C Brf Lindholmsdockan

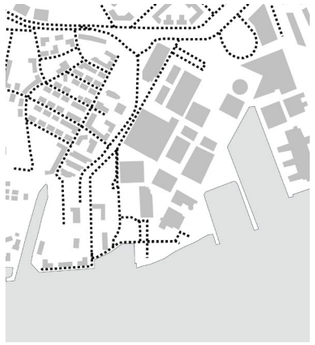
D Industrial heritage, Karlatornet in the background



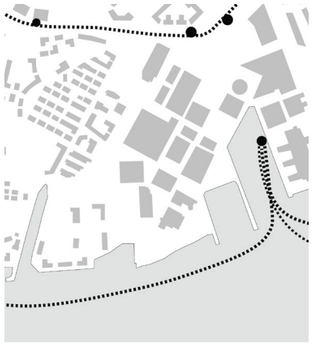
SOUTH LINDHOLMEN

FIGURE 8 Aerial photo

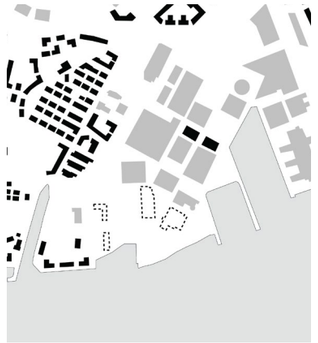
FLOW
- Pedestrian and bicycle



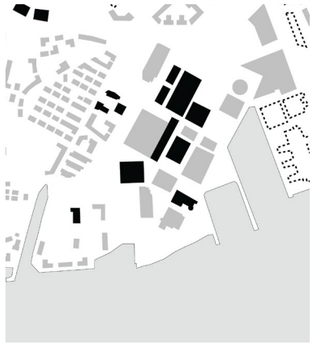
FLOW
- Car



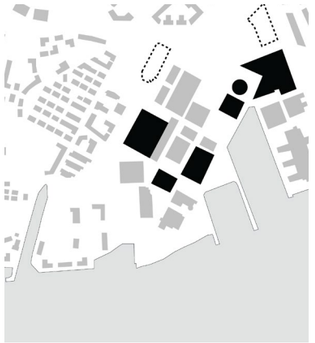
FLOW
- Public transport
- Public transport stop



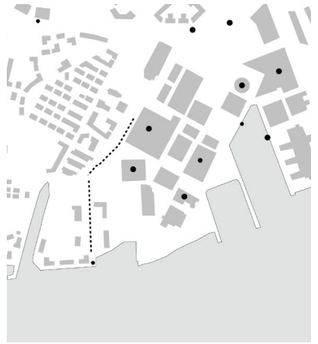
BUILDINGS
- Residential
- To be demolished



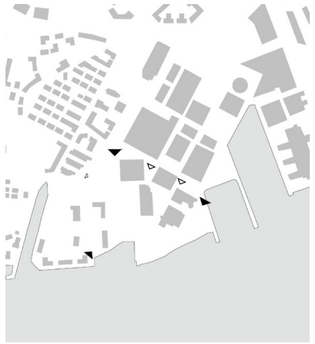
BUILDINGS
- School / Preschool
- Offices



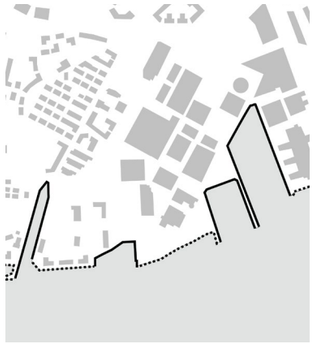
BUILDINGS
- Mixed-use
- Parking garage



NODES AND BARRIERS
- Nodes
- Barriers



SITE CONNECTIONS
- Main entrance to site
- Entrance to site



WATER CONNECTIONS
- Water basin
- Open water connection

NEIGHBOURHOOD

Water is at the heart of the new South Lindholmen area. To protect the area from water related climate hazards and to create safe access to the water, the ground level has been raised to 2.8 meters above the current sea level. Through this measure, prerequisites for strengthening the connection to water have been created.

Sightlines to Göta River have guided the design of the new South Lindholmen, and direct the flows of movement through the area. The sightlines to the river make sure that it is ever present within the neighbourhood. The connection to water is further enhanced through the addition of man-made canals with a controlled, raised water level. The introduction of canals creates a unique neighbourhood with a strong water character, which symbolises the area.

The bridges which connect the land between the canals strengthen the character of South Lindholmen. A variety of blue public and private spaces are created, where the introduction of a public bath and a partly terraced neighbourhood park on the riverfront offers diverse ways of experiencing and enjoying the river, simultaneously enhancing the contact with water. The canal system in the area has a calmer and quieter character, contrasted by the large and open Göta River.

DESIGN STRATEGIES

Water for all

A safe and variating access to the water for residents and the public

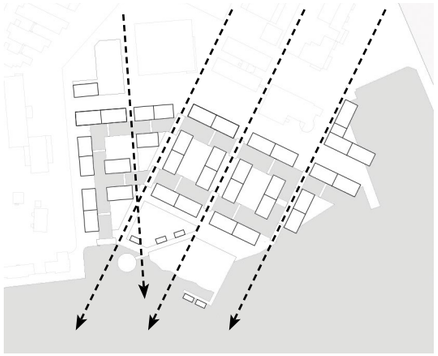
Blue space variation

The character of the blue spaces should change to support water-related activities and water interactions

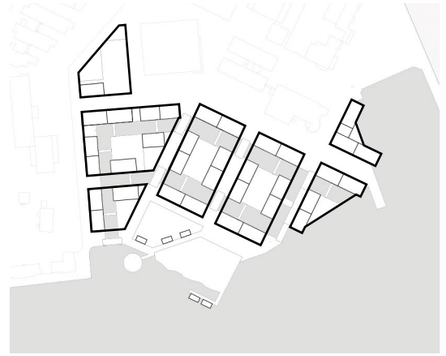
Adapted levels

Raising ground and water levels, while allowing lower zones to flood to maintain water access

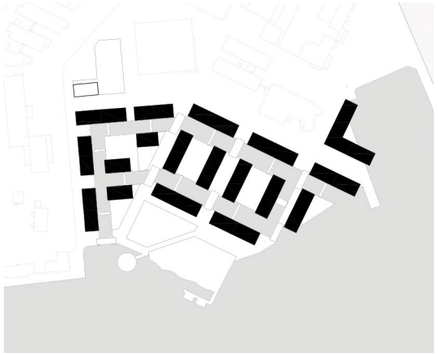
SITUATION PLAN
ROOF LANDSCAPE & BUILDING HEIGHTS



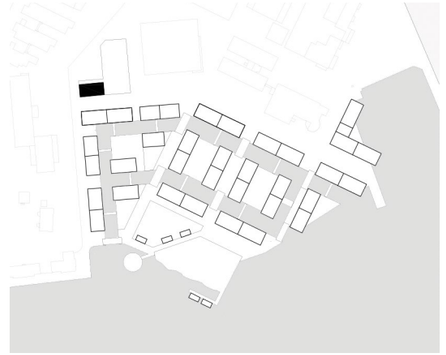
Sightlines



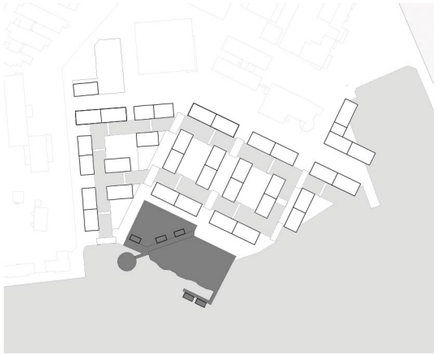
Plot structure & staircase division



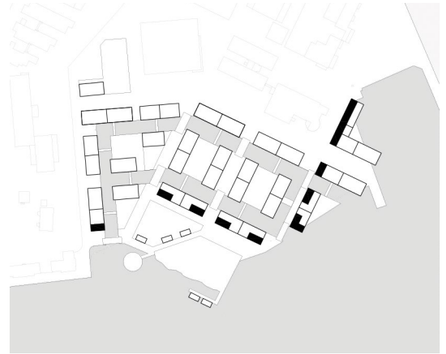
Housing



Pre-school



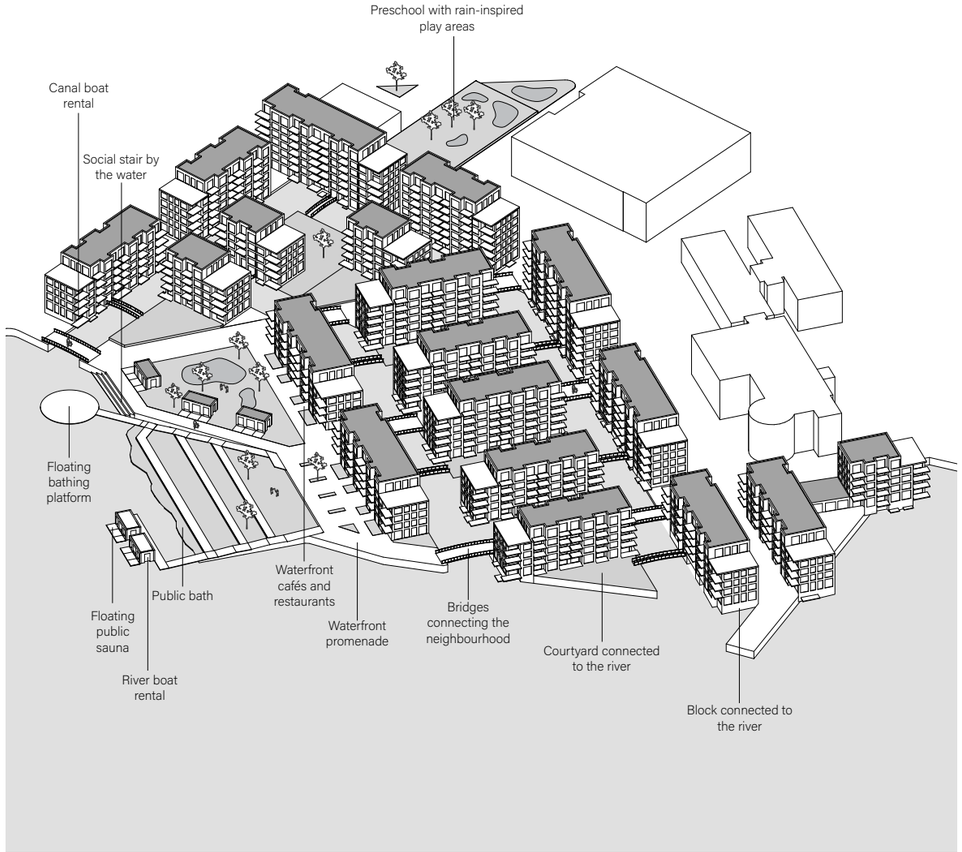
Public space

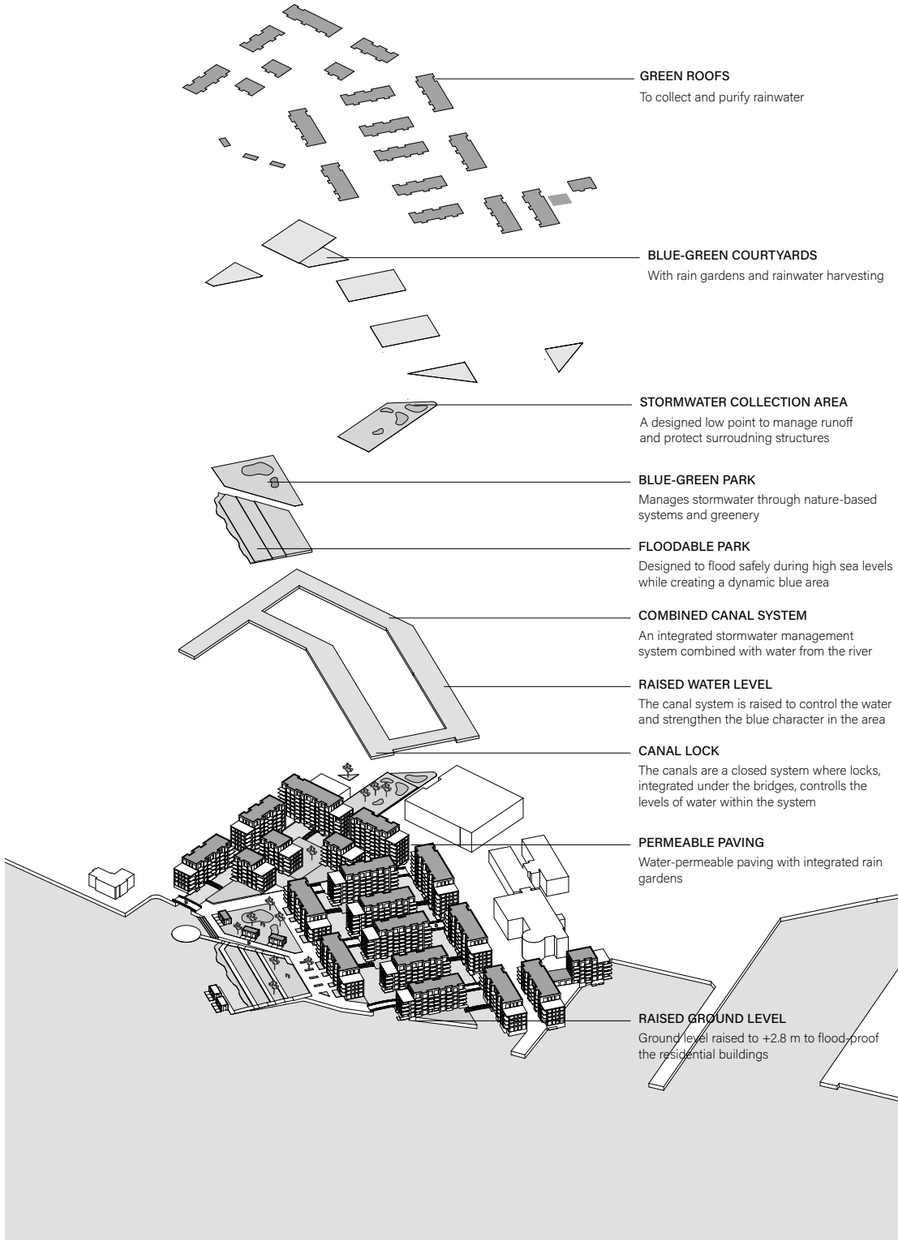


Active ground floors & quay promenade

A WATER-CENTRIC NEIGHBOURHOOD

The neighbourhood integrates water into everyday life through the built environment, linking management of water-related challenges with space that promotes well-being. The water management systems address different water-related environmental challenges while strengthening the blue character of the area. The blue identity is embraced through the creation of various spaces in connecting to water, enabling activities and interaction with the water and creating opportunities for enhanced well-being.





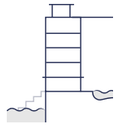
BLOCK

In the block, the water is integrated in the design in multiple ways. The plan for the area has resulted in a block structure which is visually semi-open, but spatially closed. The courtyard is spatially defined by four lamellas and by canals to the north and south. The east lamella is accessed via a footbridge, as is the courtyard from the north and south lamellas. In the passages to the courtyard, kayaking storage has been integrated to make the water connection more visible for all residents.

A main principle for the design of the block has been creating common blue spaces for the residents to share. The courtyard includes multiple blue-green functions, and the surrounding canals, with a controlled, raised water level, offer unique characteristics to the common spaces in the block. The terraced bathing jetty offers direct water access for all residents, and creates opportunities for water-related activities. On the ground floor, common rooms such as an activity room, a boat workshop and a relaxation department equipped with a sauna also offer a direct connection to the water.

In contrast to the darker brick buildings that border the area, the buildings in the block are clad in brick facades in a lighter hue, creating identity while reflecting the traditional building materials at Lindholmen.

DESIGN STRATEGIES



Direct water contact

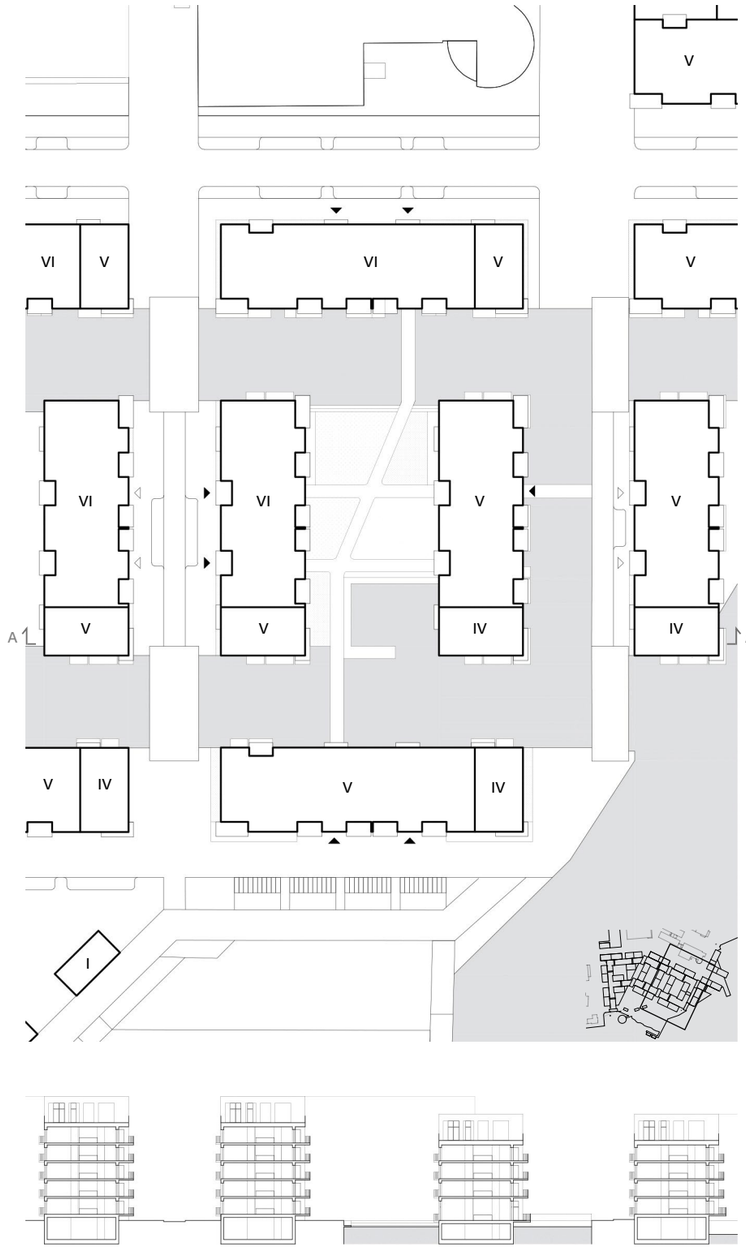
Every building and courtyard should have direct contact with water

Common blue spaces

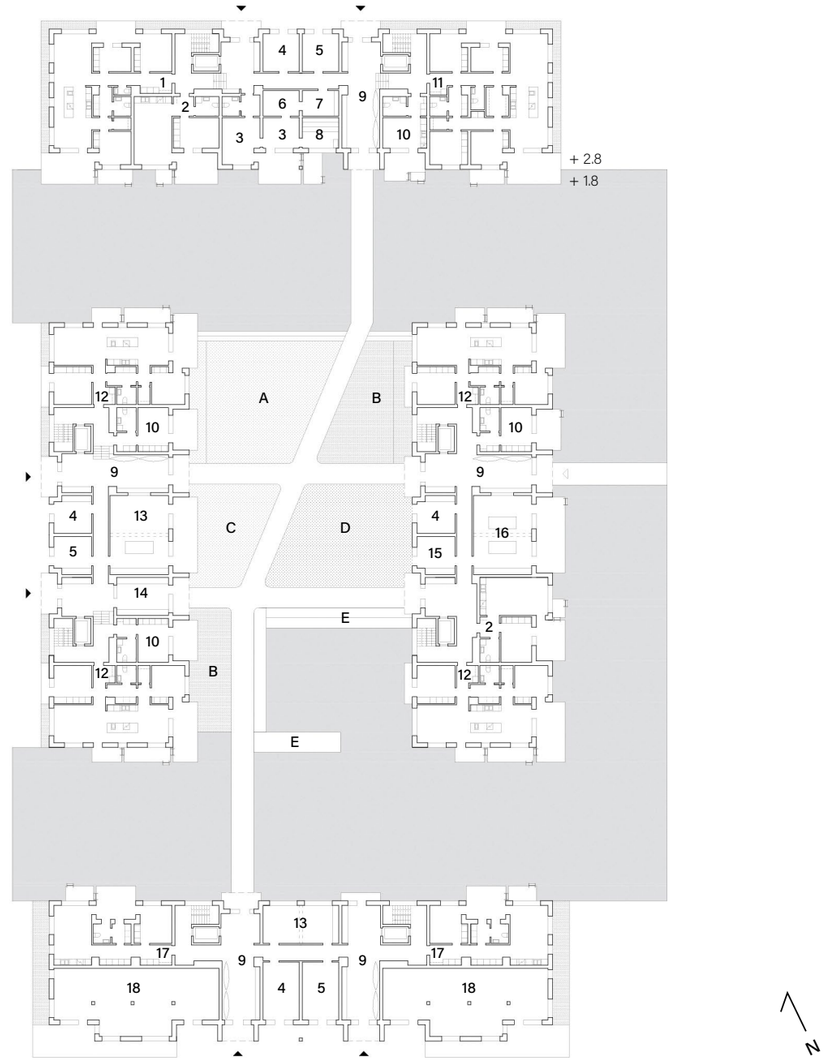
Shared spaces where the proximity to water is physically and visually enhanced

Blue-green systems

The water cycle is integrated in the design to manage stormwater and to create blue-green qualities



SECTION A-A 1:1000



GROUND FLOOR PLAN

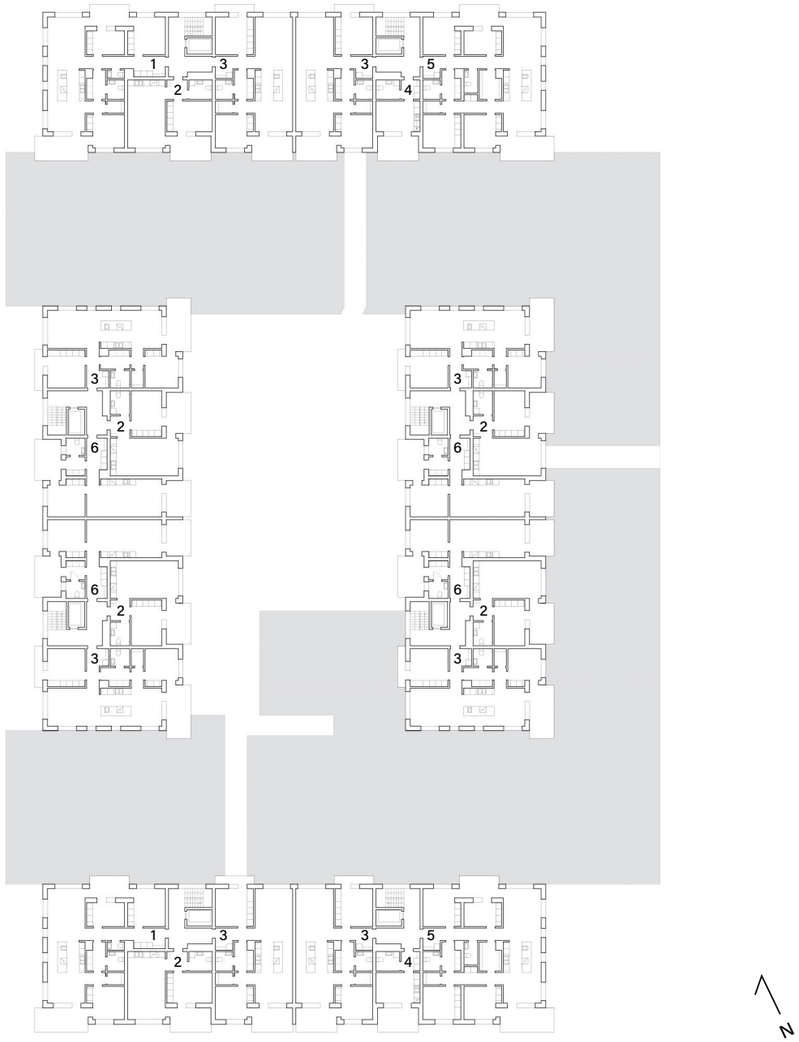
1	3 bedroom unit	**7**	Changing room	**12**	2 bedroom unit	**18**	Commercial
2	1 bedroom unit	**8**	Sauna	**13**	Common room	**A**	Green-blue play area
3	Relaxation room	**9**	Entrance passage	**14**	Laundry	**B**	Rain garden
4	Wheelchairs/prams		with kayak storage	**15**	Courtyard storage	**C**	BBQ area
5	Recycling room	**10**	Studio unit	**16**	Boat workshop	**D**	Cultivation
6	Shower room	**11**	4 bedroom unit	**17**	1 bedroom unit	**E**	Bathing deck

ILLUSTRATION PLAN 1:1000

0 5 25 (m)

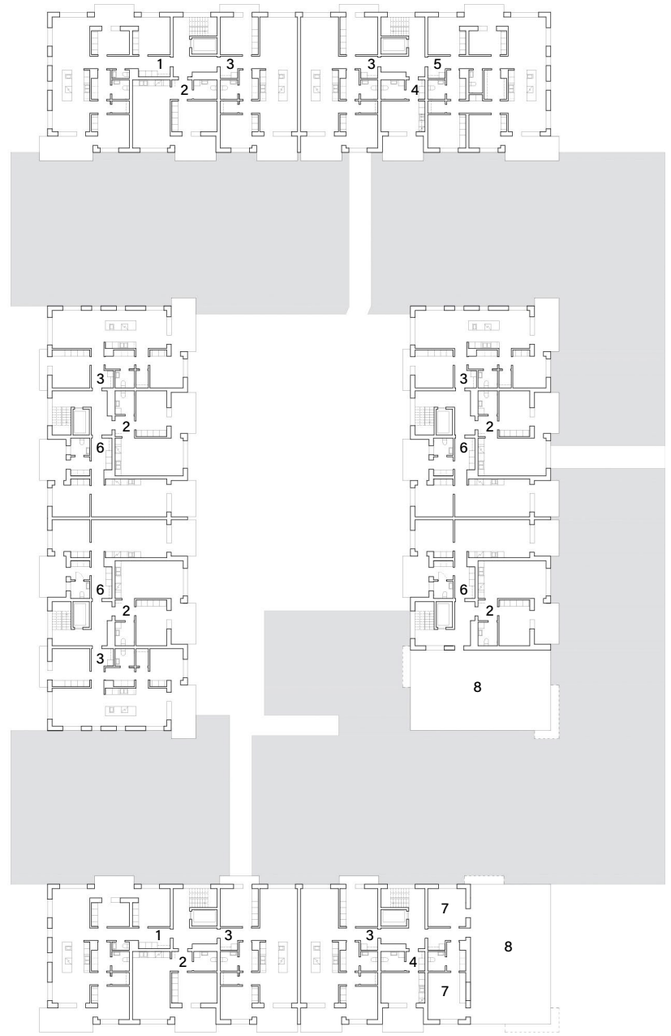
GROUND FLOOR PLAN 1:600

0 5 15 (m)



STANDARD FLOOR PLAN

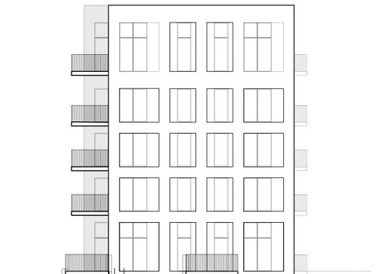
1 3 bedroom unit
2 1 bedroom unit
3 2 bedroom unit
4 Studio unit
5 4 bedroom unit
6 1 bedroom unit



5TH FLOOR PLAN

1 3 bedroom unit
2 1 bedroom unit
3 2 bedroom unit
4 Studio unit
5 4 bedroom unit
6 1 bedroom unit
7 Common room
8 Roof terrace

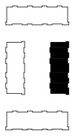
WEST FACADE



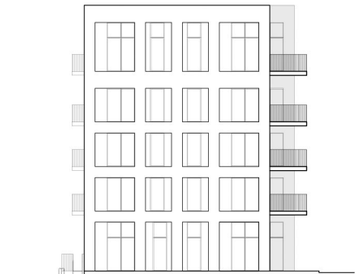
NORTH FACADE

SOUTH FACADE

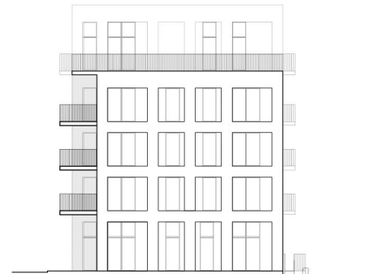
EAST FACADE



SOUTH FACADE

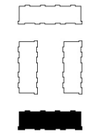


WEST FACADE



EAST FACADE

NORTH FACADE



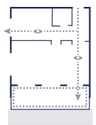
DWELLING

Every dwelling in the block is connected to the water in a variety of ways. Each dwelling has a direct view towards the water and the canals, and a majority also have a direct view towards Göta River. The views and the indoor relationship to the water outdoors are strengthened by the design of axiality and sightlines in the dwellings. These qualities have been incorporated to guide the light and movement through the dwellings, while also making the dwellings feel spatially larger.

The indoor-outdoor connection in each dwelling is further strengthened via the private outdoor spaces. From the semi-recessed balconies, the residents can experience the proximity to the canals and river from a space which becomes a natural extension of the dwelling, and which can be seen and reached from multiple rooms. Access to the private outdoor space from various rooms create a variation in movement, where interior circulation is complemented by circulation via the exterior spaces.

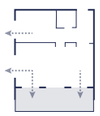
On the balconies and terraces, the stormwater is collected to be used for gardening on the private outdoor spaces. The ground floor dwellings which border the canal are equipped with floating jetties which are accessed via steps from the balconies, taking further advantage of the proximity to the water.

DESIGN STRATEGIES



Water view

Each dwelling should have a direct view towards the water

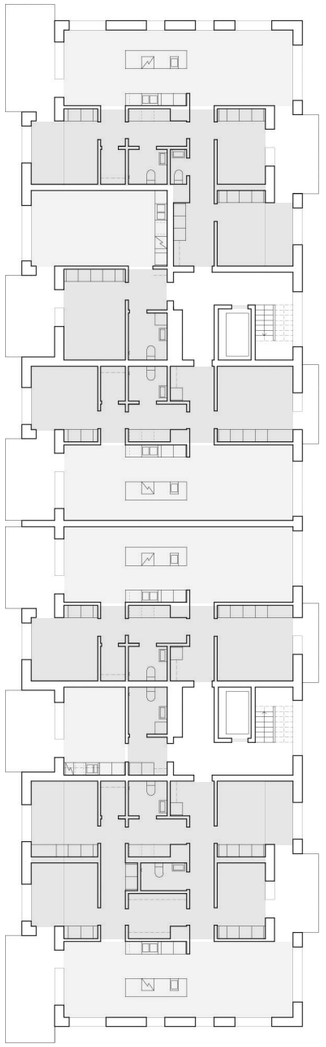


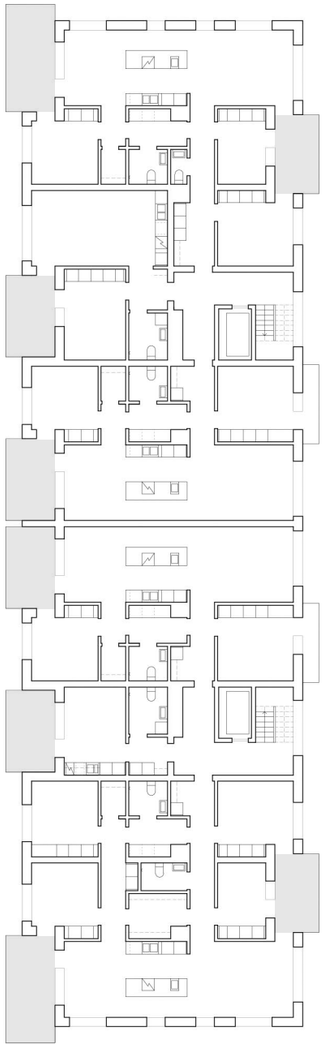
Indoor-outdoor connection

Each dwelling should have private outdoor space of at least 10 sqm, accessible and visible from multiple rooms

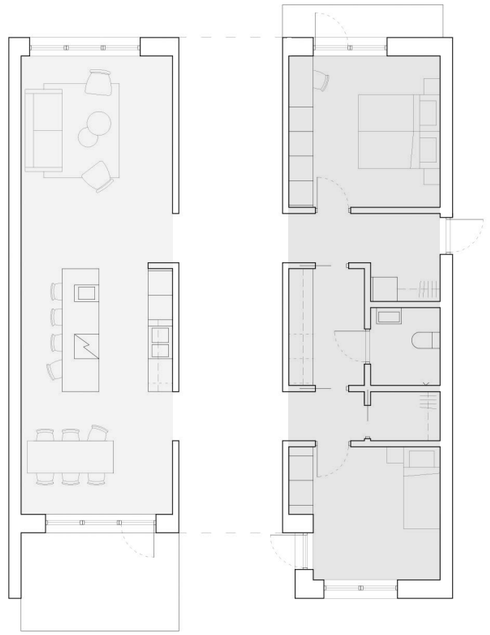
Collecting the water

The water cycle should be integrated in the private outdoor spaces, where stormwater is collected



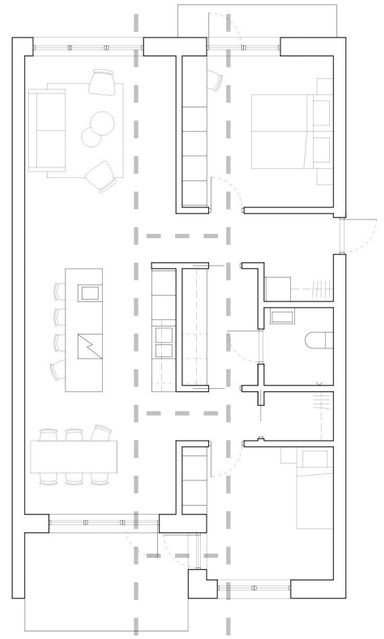


SHIP PRINCIPLES
SOCIAL & PRIVATE ZONES
SEMI-RECESSED BALCONIES



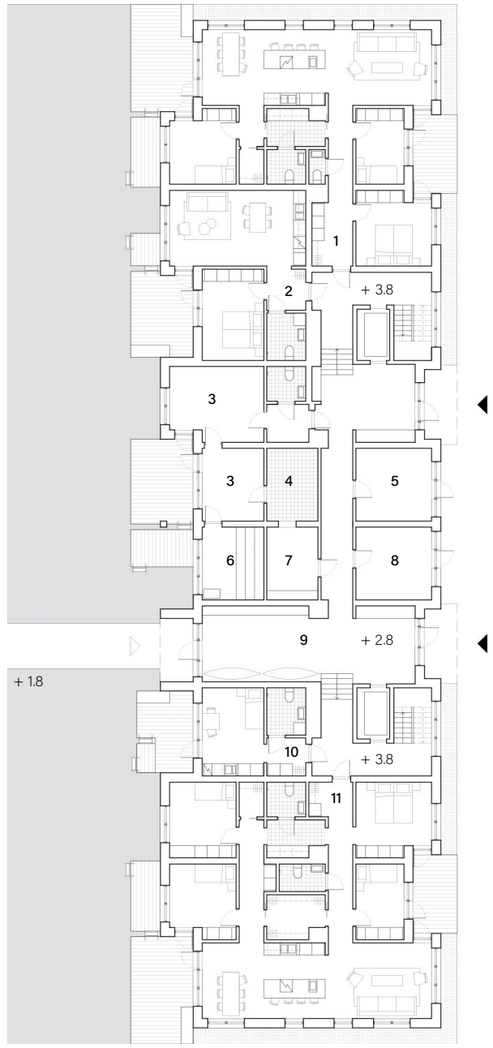
SOCIAL ZONE

PRIVATE ZONE



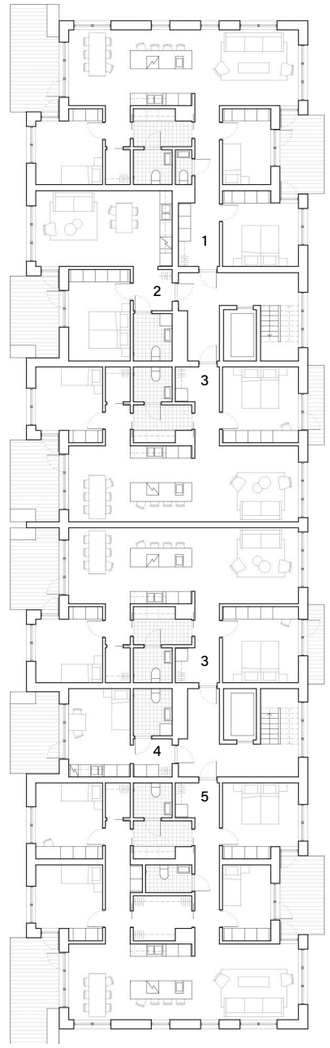
AXIALITY & CIRCULATION

DWELLING PRINCIPLES
HOUSING QUALITIES



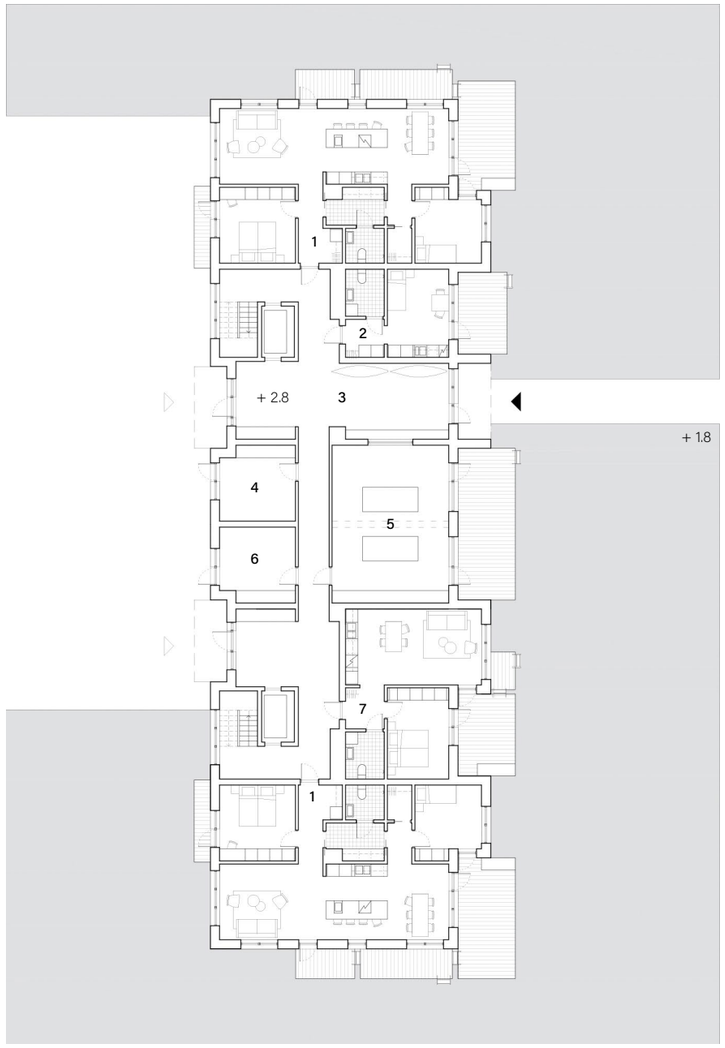
GROUND FLOOR PLAN

1	3 bedroom unit, 105 sqm	7	Changing room
2	1 bedroom unit, 48 sqm	8	Recycling room
3	Relaxation room	9	Passage with
4	Shower room		kayak storage
5	Wheelchairs/pram storage	10	Studio unit, 22 sqm
6	Sauna	11	4 bedroom unit, 132 sqm



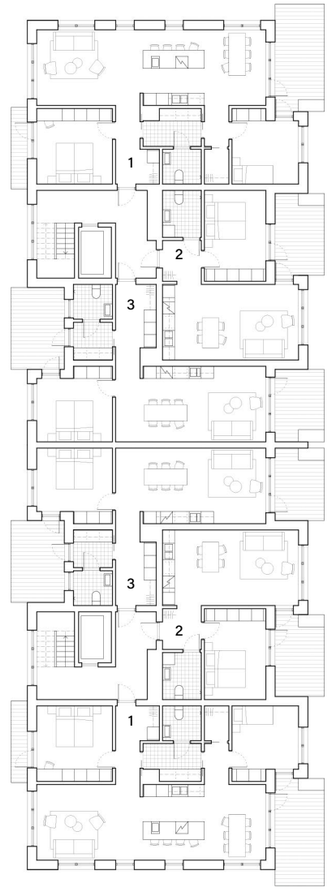
STANDARD FLOOR PLAN

1	3 bedroom unit, 105 sqm
2	1 bedroom unit, 48 sqm
3	2 bedroom unit, 88 sqm
4	Studio unit, 22 sqm
5	4 bedroom unit, 132 sqm



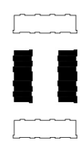
GROUND FLOOR PLAN

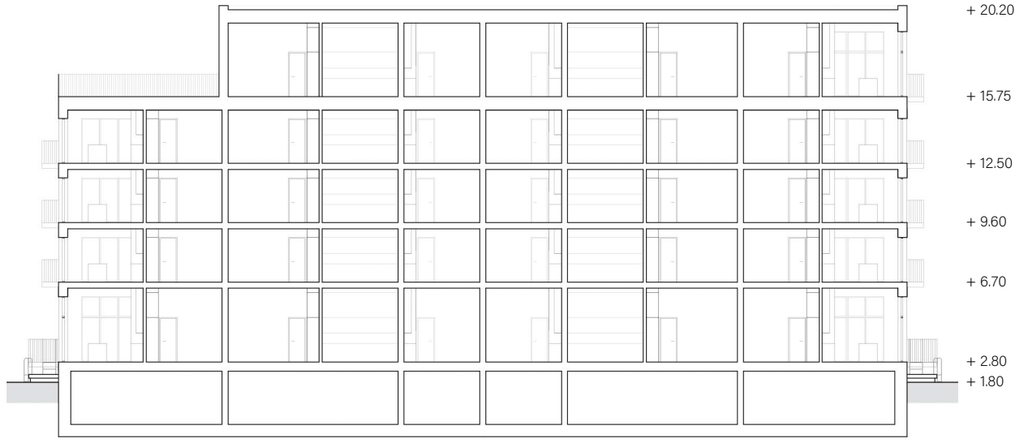
1	2 bedroom unit, 88 sqm	5	Boat workshop
2	Studio unit, 22 sqm	6	Recycling room
3	Passage with kayak storage	7	1 bedroom unit, 48 sqm
4	Wheelchairs/Pram storage		



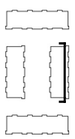
STANDARD FLOOR PLAN

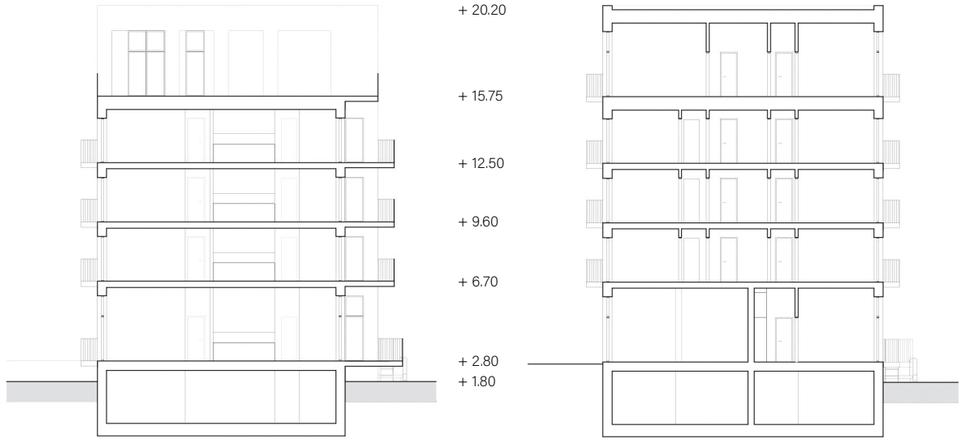
1	2 bedroom unit, 88 sqm
2	1 bedroom unit, 48 sqm
3	1 bedroom unit, 55 sqm





SECTION B-B





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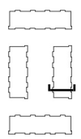

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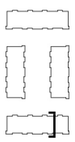
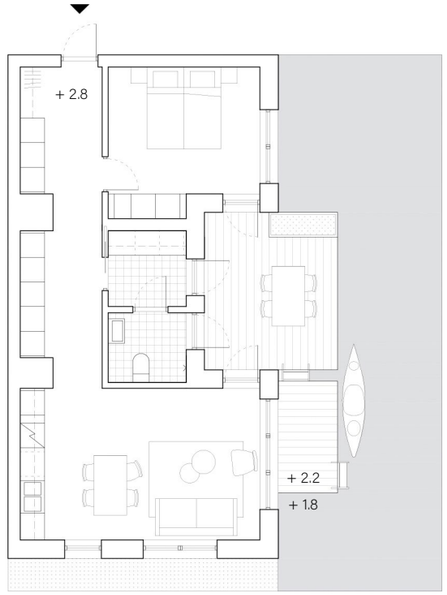
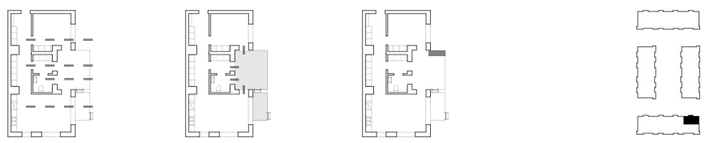




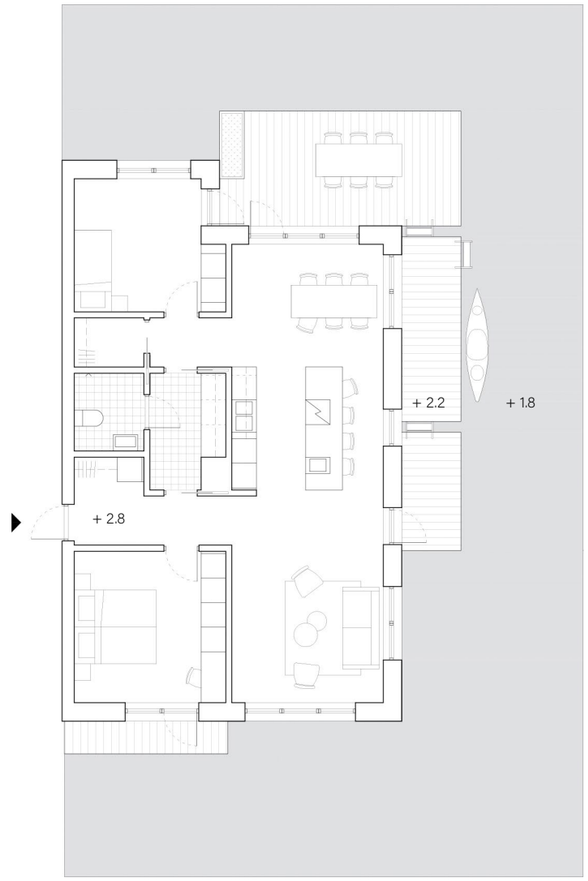
FLOOR PLAN
1 BEDROOM UNIT
58 SQM



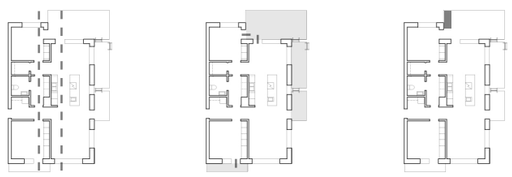
WATER VIEW

INDOOR-OUTDOOR CONNECTION

COLLECTING THE WATER



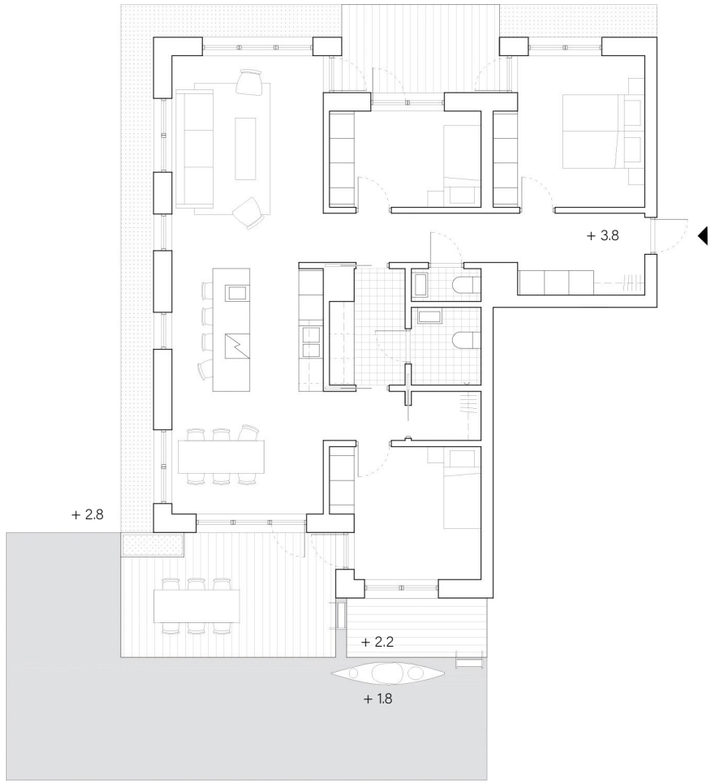
FLOOR PLAN
2 BEDROOM UNIT
88 SQM



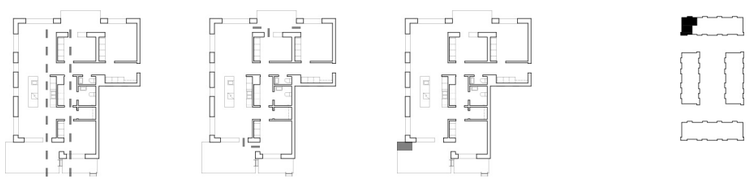
WATER VIEW

INDOOR-OUTDOOR CONNECTION

COLLECTING THE WATER



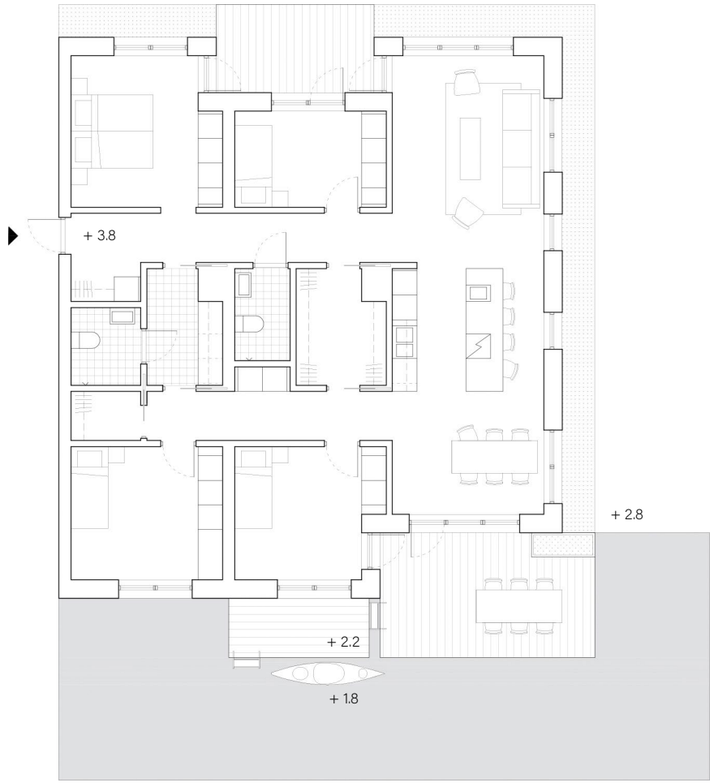
FLOOR PLAN
3 BEDROOM UNIT
105 SQM



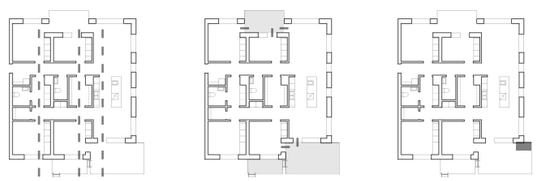
WATER VIEW

INDOOR-OUTDOOR CONNECTION

COLLECTING THE WATER



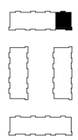
FLOOR PLAN
4 BEDROOM UNIT
132 SQM



WATER VIEW

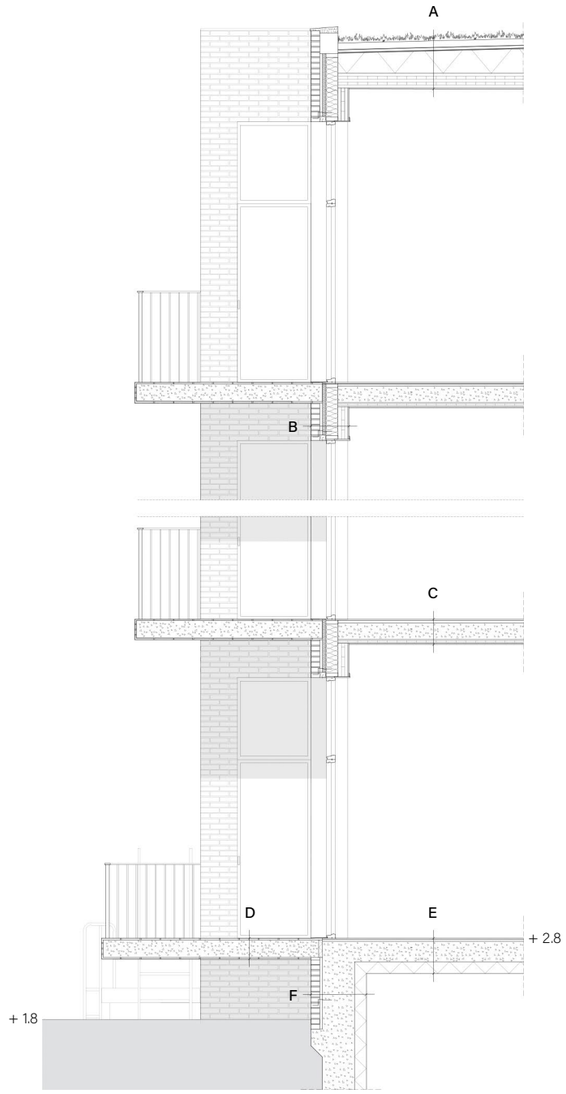
INDOOR-OUTDOOR CONNECTION

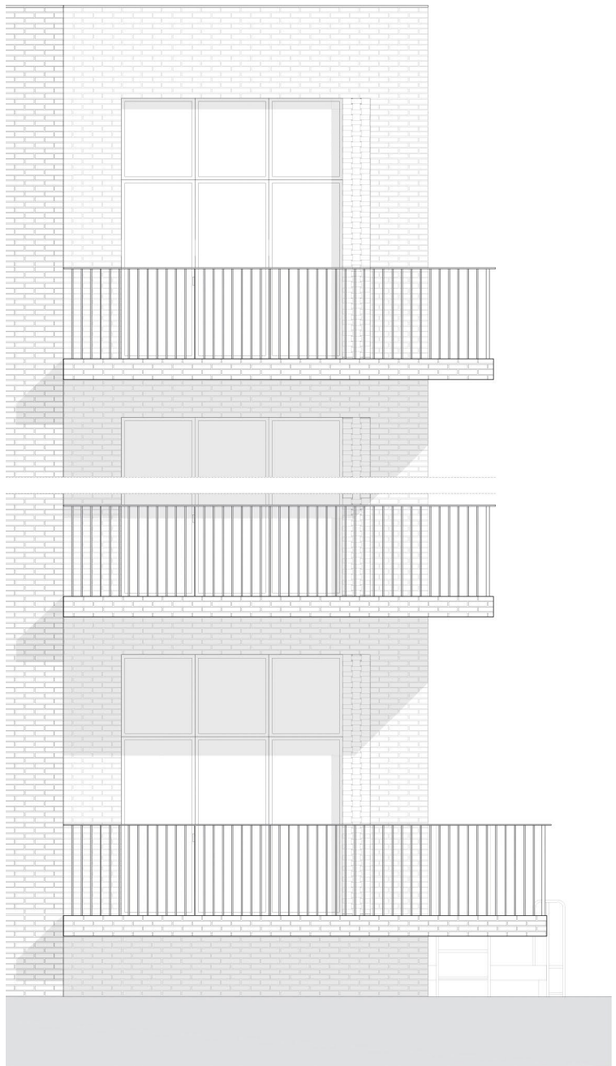
COLLECTING THE WATER

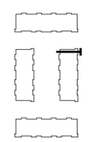


DETAIL SECTION

A	**GREEN ROOF**
80	Planted layer
5	Fiber cloth
30	Drainage layer
2x5	Bituminous sealant layer Foamglas
180	CLT
13	Gypsum board
B	**EXTERIOR WALL**
108	Brick
32	Air gap
45	Insulation
10	Wind barrier
145	Insulation Vapor barrier
120	CLT
13	Gypsum
C	**SLAB**
16	Parquet
30	Impact insulation
200	Concrete
50	CLT
13	Gypsum board
D	**BALCONY SLAB**
20	Brick
212	Reinforced concrete
20	Brick
E	**GROUND FLOOR SLAB**
16	Parquet
20	Insulation
250	Reinforced concrete
145	Insultation
F	**BASEMENT WALL**
108	Engineering brick
32	Air gap
380	Concrete
145	Insulation





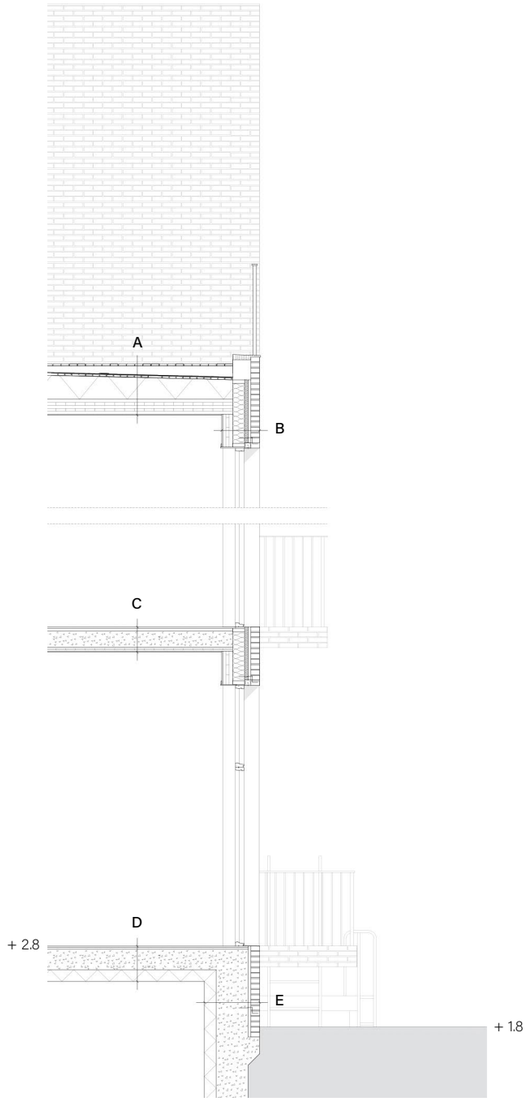


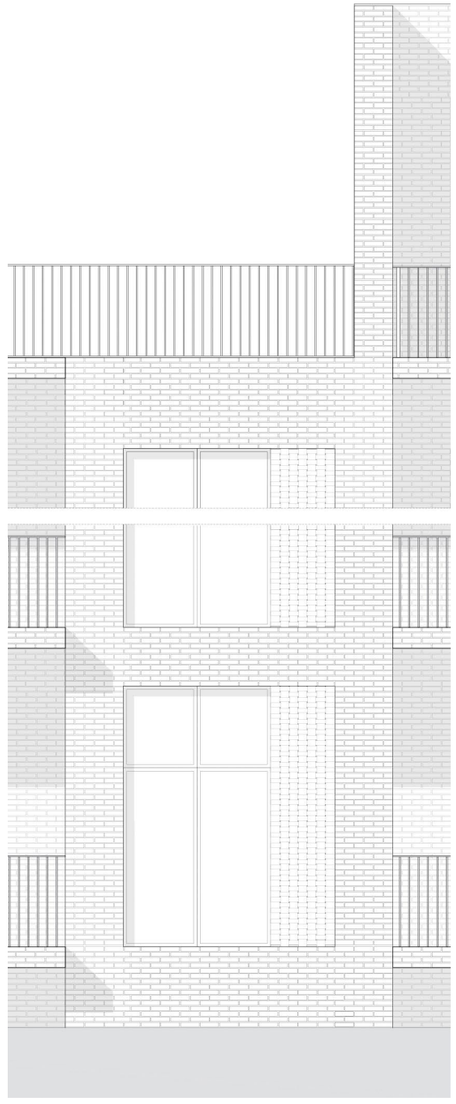
DWELLING DETAIL SECTION 1:75 0 1 2 (m)

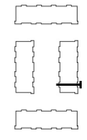
ELEVATION 1:75 0 1 2 (m) DWELLING

DETAIL SECTION

A	**TERRACE**
28	Decking
15-140	Underlayment
	Waterproofing membrane
	Bituminous
	sealant layer
	Foamglas
180	CLT
13	Gypsum board
B	**EXTERIOR WALL**
108	Brick
32	Air gap
45	Insulation
10	Wind barrier
145	Insulation
	Vapor barrier
120	CLT
13	Gypsum
C	**SLAB**
16	Parquet
30	Impact insulation
200	Concrete
50	CLT
13	Gypsum board
D	**GROUND FLOOR SLAB**
16	Parquet
20	Insulation
250	Reinforced concrete
145	Insultation
E	**BASEMENT WALL**
108	Engineering brick
32	Air gap
380	Concrete
145	Insulation







DISCUSSION

The primary aim of this thesis was to explore the topic of housing by the water and how proximity to water could be used as a quality to enhance well-being. The purpose was also to explore this in relation to the present and future water-related sustainability challenges. The research questions focus on how a waterfront area could be designed to enhance well-being while addressing water-related environmental challenges across the scales of neighbourhood, block and dwelling. The following discussion reflects on how the questions were addressed and how the design proposal answers these questions. The discussion also reflects on the process, chosen methods and possible further investigations.

FROM THEORETICAL FRAMEWORK TO DESIGN STRATEGIES

The theoretical framework provided a solid foundation for understanding the potential and challenges of residential areas by the water. The connection between water and well-being and how the built environment could support this became an important foundation for the theoretical framework. This became valuable knowledge in understanding how different strategies of handling water-related environmental challenges could provide different aspects of well-being. The theory regarding water-related environmental challenges further guided the decision of how to flood proof the area, where the impact of the different strategies on well-being and their efficiency were the two main factors. The water and well-being connection was also important when the selected reference projects were analysed and study trips were conducted to understand and compare different aspects of design.

The theoretical framework was summarised, reflected upon, and then translated into nine design strategies that could be applied in the design project. These aimed to create water access, enhance well-being and manage the water-related challenges on the three scales of the project, resulting in nine design strategies. Some of the design strategies are strongly connected to certain theoretical findings from the literature review, while some have their foundation in theory but originate from takeaways from the reference projects and study trips. The development of the design strategies has been an iterative process to test out how the design could be connected to the outcomes of the theoretical framework in the most efficient way, and vice versa.

IMPLEMENTING THE DESIGN STRATEGIES

The design proposal covers the neighbourhood, block and dwelling scales, resulting in a design proposal where the design strategies could be applied and tested.

Neighbourhood

On the neighbourhood scale, two of the aims were to create varied access to the water and to handle the water-related environmental challenges. Different strategies of flood proofing the area were initially discussed, and the decision to raise the ground level to +2.8 m in line with the city regulations (City of Gothenburg, 2019) was taken early in the project. This solved the flooding strategy regarding rising sea levels, but could be considered a contradictory solution when the aim was to integrate the water cycle through a holistic approach. Integrating the strategies presented by Barker and Coutts (2016), such as placing fragile functions at a safe height and working with other elements to reconnect to the water to create a neighbourhood designed with more of a holistic approach. In the project, this mainly includes the floodable park and floating structures.

The inner canal system was an early idea, mainly inspired by the reference project Sluseholmen, but in the beginning purely to strengthen the water character and access to water. When studying different stormwater solutions, stormwater canals and the combined canal system inspired by Bo01 in Malmö (Stahre, 2008) were explored, which were applied in the design. The reference project Vannkunsten inspired the idea of locally raising the water level to achieve a stronger water connection. The canal system could be considered a holistic approach, where stormwater management is used to create qualities to promote resident well-being.

The water access on the neighbourhood scale was created in several ways. The waterfront promenade, the floodable park, the public bath and sauna invite the public to interact with the water. The structure of the area is designed to preserve sightlines from the existing context towards the river. The water access can also be found in blue-green spaces in the area, such as the preschool courtyard and variously sized rain gardens. The canal system and the bridges also enhance the water access. The implementation of more public areas could however be considered to strengthen this further.

Block

On the block scale, direct water contact for the buildings and the courtyard was a central aim, along with creating interior and exterior common blue spaces and integrating the water cycle in the block through blue-green systems. For the first two, the canal system became a key element in fulfilling these. The canal system and the block structure were designed in parallel to enhance the water connection. By doing this, all buildings and courtyards in the area have direct water connection in the final design proposal. The initial idea was to work with closed blocks to make the block itself communicate the private and public zones. The idea of splitting the traditional closed block into lamellas and using the canal as a dividing element was an important finding in the design process. This makes the area and block partly visually open but physically closed.

The strategy of splitting the block and integrating the canal created new opportunities for the common spaces. The courtyard is framed by two buildings and linked to the others via bridges, providing the residents with private access via common interior spaces. The common spaces by the water are designed to support the connection to water and well-being, a relaxation part with sauna being one of the examples. A swimming area is also situated by the courtyard, and every building has a roof terrace to get views towards the river. The courtyard and its integrated water elements were mainly inspired by the reference projects Sømærk, Sluseholmen and Sluishuis. The canals add qualities to the courtyard, but also require space, making the courtyard relatively small, but with unique qualities.

The blue character of the block is strengthened by the integrated blue-green systems. Except on the roof terraces, green roofs collect and purify rainwater, which is partly directed to rain barrels, providing opportunities to irrigate plants and cultivations on the courtyard. The courtyard also contains rain gardens to create a lush environment for well-being benefits while managing stormwater. The implementation of blue-green systems within the block strengthens the connection to natural elements which provides several positive effects on well-being, according to Sjövall (2020). The effect of the green-blue stormwater management system in the block could be discussed considering the location by the stormwater canal, a larger system with similar purposes.

Dwelling

The design strategies for the dwelling scale consisted of views towards the water, indoor-outdoor connection and the collection of water. The dwelling scale was the most challenging scale to work with related to water. In the dwelling, the connection to the water could guide certain design decisions. However, some functions within the dwelling could not be designed using the water-centered approach which was applicable for the other scales. The dwellings on the ground floor have a different approach because of their opportunity for direct water contact via outdoor spaces, jetties and ladders.

One quality that can be achieved from the dwelling unit connected to well-being is views towards the water (White et al., 2020). Therefore, an early idea was to provide all dwellings with views towards the water. The canal system became an important design element for this scale too. When the canals are integrated within the blocks, the layout of the dwellings in the building could be adapted to create views towards the water from every apartment in the entire neighbourhood.

The indoor-outdoor connection was also an important principle, both to provide the resident with general well-being qualities and as a strategy to strengthen the connection to the surrounding context (Grigoriadou, 2021). The value of the balcony for the dwelling was an important factor when the ship strategy was created. The ship principle was inspired by the study trip to Copenhagen, namely the project Nordø, and the qualities outlined by Morichetto (2019) regarding being able to reach a balcony from several rooms in several ways. The offset ship structure also provides space for semi-recessed balconies, a typology inspired by the reference projects which create both a sheltered space and an open area with a 180-degree view. With the ship strategy and shape of the residential building, every dwelling has a semi-recessed private outdoor space.

The last design strategy integrated the balcony into the blue-green structure of the block, providing every dwelling with the opportunity to collect rainwater to irrigate balcony planting. This design strategy makes each dwelling unit a part of the larger blue-green system and can be seen as a blue quality, but is relatively small within the water management design strategies compared to the neighbourhood and block scale.

PROCESS AND METHODS

The design process was shaped by working iteratively across the scales with the design strategies as a clear connection between the theoretical framework and design. The combination of literature, reference projects and study trips has been a solid foundation in shaping the design strategies, spanning over the scales and qualities. From this, the design strategies could be tried out in the design och evaluated to see how well they responded to the purpose of the thesis. If the design strategy was not considered efficient to achieve the aim of the thesis, it was reshaped, sometimes requiring new research to support new aspects of the design.

FURTHER EXPLORATIONS

Due to the time limitation of one term, certain interesting aspects remain underexplored or unexplored. The design proposal has solutions for changing water levels, such as floodable parts and adaptable structures, but it would be interesting to explore how different extreme weather would impact the area and how it would operate during, for instance, a cloudburst. It would also be interesting to push the understanding of the systems and their connections further, but due to the limitation of scope and focus on well-being and architecture qualities, this is presented at a conceptual level.

The connection between the dwelling, well-being and water could also be further explored. During the design process, the idea of having a bath or shower on the balcony or the bathtub in the bathroom positioned towards the facade has been discussed as an interesting method throughout the process. The shower or possible bathtub in a bathroom by the facade, potentially with a view towards the water, has been applied in a few dwellings within the block. In the larger dwellings, the space by the facade has been prioritised for bedrooms and social spaces.

WATER-CONSCIOUS PLANNING

The scope of the project, spanning from a neighbourhood to a dwelling scale, has been a suitable setting for trying out different strategies, from large structural water systems to smaller solutions for the individual dwelling, combining water management with creating a built environment that supports well-being. The design proposal also aims to take care of both the challenge of flooding from rising sea levels and stormwater, while the research and reference projects rarely considered both of these water challenges, but rather one at a time.

This thesis has been carried out with the RiverCity vision in mind because of its similar interests in using water-related environmental challenges as opportunities rather than threats (City of Gothenburg, 2012). Because of the chosen site, an ongoing dialogue with representatives from Älvstranden during this thesis has strengthened the understanding of the site and its future visions. The design proposal suggested in this thesis can hopefully start a discussion regarding how water access and management can be integrated to create a residential area with well-being in focus. The combined water management systems, the canal structure and the typology with residential buildings and courtyards with direct contact could become the first of its kind in the city of Gothenburg, pushing the vision of becoming a role model city of rain and fulfilling the RiverCity vision of reconnecting the city to the Göta River.

The design project could be considered a palette of opportunities that could be applied in other projects to connect water management with well-being. Some strategies are easier to adapt, such as rain gardens, while others require larger efforts, such as stormwater canals. In the design proposal, it hopefully becomes evident that larger efforts in water management systems, such as combined canal system, can provide large qualities, spanning from creating a blue neighbourhood, blocks with direct access to the water and views towards the water from every dwelling within the area.

REFLECTIONS

During the work with the thesis, we have started to grasp the vast scale and complexity of challenges related to water and their enormous impact that will intensify in the future. On the other hand, we have also explored the huge potential in the influence of water on human well-being. As future architects, we believe that the built environment can respond to both these dimensions, turning water-related sustainability from threats to opportunities and from risks to resources, simultaneously contributing to health and well-being.

CONCLUSION

The aim of this thesis has been to explore how water and housing can coexist, to create a built environment that supports well-being while combating water-related environmental challenges. The research questions focus on how a waterfront area could be designed with a holistic approach to water, enhancing well-being while addressing water-related environmental challenges across the scales of neighbourhood, block and dwelling.

The proposed design explores how a waterfront area could be designed with a holistic approach to water. The water management strategies handle the water-related challenges of the site while also creating a neighbourhood with strong water access and a blue dynamic character. The access to water, both physically and visually, creates a built environment that supports the interaction with water in different ways, creating a foundation for the relation between water and well-being to take place and flourish.

The block and its dwellings are also designed to enhance the water proximity with its buildings and courtyards in direct contact with water. This creates various common blue spaces, on the courtyard, ground level and roof terrace, where the interaction with water is central. The dwellings are designed to strengthen the índoor-outdoor connection and create views towards the water, where every dwelling has a private outdoor space and a view towards the water.

The water-related challenges are also integrated within the block and utilised to create qualities. By different blue-green systems, the rainwater is collected, delayed and purified within the block and on the private outdoor spaces to create a lush environment designed with natural elements. The combined canal system also provided both the block and individual apartments on the ground floor with direct water access.

This design proposal demonstrates how architecture has the capacity not only to respond to environmental challenges, but also how to use them as a driving force to create qualities which enhance human health and well-being. The design presents a vision for how water can be integrated into the design of the built environment in innovative ways on the neighbourhood, block and dwelling scales, thereby creating sustainable environments – for living with water.

BIBLIOGRAPHY

Reference list

Arkitema. (2025a). *Sluseholmen | A vibrant and welcoming district where the water, city and houses form a whole.* https://www.arkitema.com/en/project/sluseholmen

Arkitema. (2025b). *Lindholmens tekniska gymnasium | Award winning school that can stand the test.* https://www.arkitema.com/en/project/lindholmens-tekniska-gymnasium

Brf Lindholmsdockan. (2025). *Välkommen till Brf Lindholmsdockan.* https://lindholmsdockan.com/

Ashley, R., Gersonius, B., & Horton, B. (2020). *Managing flooding: from a problem to an opportunity.* Royal Society. http://dx.doi.org/10.1098/rsta.2019.0214

Barker, R., & Coutts, R. (2016). *Aquatecture: buildings and cities designed to live and work with water.* Newcastle Upon Tyne Riba Publishing. 1859465315

Bell, S. L., Phoenix, C., Lovell, R., & Wheeler, B. W. (2015). Seeking everyday wellbeing: The coast as a therapeutic landscape. *Social Science & Medicine, 142*(October 2015), 56-67. https://doi.org/10.1016/j.socscimed.2015.08.011

BIG. (2025). *Sluishuis Residences.* https://big.dk/projects/sluishuis-residences-7293

Burras, N,. & Terry, F. (2019). Building for the future: Seeing building materials in terms of weathering and longevity. *New Design Ideas, 3*(2), 99-112.https://jomardpublishing.com/UploadFiles/Files/journals/NDI/V3N2/TerryF%20BurasN.pdf

Charlesworth, S. (2016). *Sustainable Surface Water Management : A Handbook for SUDS.* Newark : John Wiley & Sons. DOI:10.1002/9781118897690

City of Gothenburg. (2025a). *Rain Gothenburg - regnstaden Göteborg som en förebild.* https://goteborg.se/wps/portal/start/bygga-bo-och-leva-hallbart/vatten-och-avlopp/dagvatten-och-skyfall/rain-gothenburg---regnstaden-goteborg-som-en-forebild

City of Gothenburg. (2025b). *Om Lindholmen.* https://goteborg.se/wps/portal/start/goteborg-vaxer/hitta-projekt/stadsomrade-hisingen/norra-alvstranden/lindholmen/om-for-lindholmen

City of Gothenburg. (2024). *Gör plats för vattnet - Flerbostadshus och verksamheter.* https://goteborg.se/wps/portal/start/bygga-bo-och-leva-hallbart/vatten-och-avlopp/dagvatten-och-skyfall/gor-plats-for-vattnet/flerbostadshus-och-verksamheter

City of Gothenburg. (2023). *Göteborgs historia.* https://goteborg2023.com/goteborgs-historia/

City of Gothenburg. (2012). *Vision Älvstaden.* https://goteborg.se/dx/api/dam/v1/collections/7e8b1b3a-e30e-480b-a156-394933b22134/items/31b802b6-0515-4b26-835d-cff7ccc82855/renditions/235ebeb6-3db3-47c7-a40d-4a481dae3351?binary=true

Dal Cin, F., Hooimeijer, F., & Matos Silva, M. (2021). Planning the Urban Waterfront Transformation, from Infrastructures to Public Space Design in a Sea-Level Rise Scenario: The European Union Prize for Contemporary Architecture Case. *Water, 13*(2). https://doi.org/10.3390/w13020218

Dempsey, S., Devine, M. T., Gillespie, T., Lyons, S., & Nolan, A. (2018). Coastal blue space and depression in older adults. *Health & Place, 54*(November 2018), 110-117. https://doi.org/10.1016/j.healthplace.2018.09.002

Dicksson, I., & Knutson Udd, L., (2016). *Hamn- och industrimiljöer i Göteborg – en kulturhistorisk inventering: Eriksberg Lindholmen Götaverken Lundby.* Göteborgs stadsmuseum. https://usercontent.one/wp/www.dickssonudd.se/wp-content/uploads/2022/05/Eriksberg_Lindholmen_Gotaverken_Lundby_rapport_med_framsida_06LKU.pdf

Elliott, L. R., White, M. P., Grellier, J., Rees, S. E., Waters, R., D., & Fleming, L. E. (2018). Recreational visits to marine and coastal environments in England: Where, what, who, why, and when? *Marine policy, 97*(November 2018), 305-314. https://doi.org/10.1016/j.marpol.2018.03.013

Foley, R. (2015). Swimming in Ireland: Immersions in therapeutic blue space. *Health & Place, 35,* 218-225. https://doi.org/10.1016/j.healthplace.2014.09.015

Garrett, J.K., White, M.P., Huang, J., Simpson, N., Hui, Z., Leung, C., Tse, A.T., Fung, F., Elliott, L.R., Depledge, M.H., & Wong, M. (2019). Urban blue space and health and wellbeing in Hong Kong: Results from a survey of older adults. *Health & Place, 55,* 100-110. https://doi.org/10.1016/j.healthplace.2018.11.003

Gehl, J. (2011). *Life between Buildings: Using Public Space.* Island Press. (Original work published 1971) 9781597268271

Grigoriadou, E. T. (2021). The urban balcony as the new public space for well-being in times of social distancing, *Cities & Health, 5*(1), 208-211. https://doi.org/10.1080/23 748834.2020.1795405

Intergovernmental Panel on Climate Change. (2023). *Summary for Policymakers. In: Climate Change 2023: Synthesis Report* (Sixth Assessment Report of the Intergovernmental Panel on Climate Change). IPCC, Geneva, Switzerland. 10.59327/IPCC/AR6-9789291691647.001

Laukkanen, J. A., Laukkanen, T., Kunutsor, S. K. (2018). *Mayo Clinic Proceedings, 93*(8), p. 1111-1121. 10.1016/j.mayocp.2018.04.008

Lohrer, A. (2008). *Basics: Designing with water.* Birkhauser. 9783764386627

Lundgaard & Tranberg Arkitekter. (2025a). *Havneholmen | Contemporary Apartments by the Harbour.* https://www.ltarkitekter.dk/havneholmen-en

Lundgaard & Tranberg Arkitekter. (2025b). *Tuborg Salt Meadow | Sustainable Coastal Living in Hellerup.* https://www.ltarkitekter.dk/tuborg-syd-en

Marlies Rohmer Architecture & Urbanism. (2025). *Floating Houses IJburg NL*. https://rohmer.nl/en/projects/waterwoningen-ijburg/

Minoura, E. (2019). *Bostadsgården - Territoriell arkitektur.* Studentlitteratur AB. 9789144137186

Morichetto, H. (2019). *Bostadens arkitektur och berikad miljö.* [Doctoral thesis, Chalmers University of Technology]. Chalmers research. https://research.chalmers.se/ publication/513619/file/513619_Fulltext.pdf

Nutsford, D., Pearson, A. L., Kingham, S., & Reitsma, F. (2016). Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city. *Health & Place, 39*(May 2016), 70-78. https://doi.org/10.1016/j.healthplace.2016.03.002

NCC. (2025). *Kronløbsøen, Copenhagen.* https://www.ncc.com/our-projects/kronlobsoen-copenhagen/

Nylander, O. (1998). *Bostaden som arkitektur.* [Doctoral thesis, Chalmers University of Technology]. Chalmers research. https://research.chalmers.se/publication/912/ f ile/912_Fulltext.pdf

Nylander, O. (2021). Criteria List of Housing Architecture Properties—A Way to Promote Residential Quality? in Gromark, S. & Andersson, B. (Ed.). *Architecture for residential care and ageing communities: spaces for dwelling and healthcare.* (pp.39-52) New York, NY: Routledge. https://doi.org/10.4324/9780429342370

Overbury, K., Conroy, B. W., Marks, E. (2023). Swimming in nature: A scoping review of the mental health and wellbeing benefits of open water swimming. *Journal of Environmental Psychology, 90*(102073), 2-18. https://doi.org/10.1016/j.jenvp.2023.102073

Pasanen, T. P., White, M. P., Wheeler, B. W., Garrett, J. K., & Elliott, L. R. (2019). Neighbourhood blue space, health and wellbeing: The mediating role of different types of physical activity. *Environment International, 131*(105016), 2-11. https://doi.org/10.1016/j.envint.2019.105016

Peters, T., & Masoudinejad, S. (2022). Balconies as adaptable spaces in apartment housing. *Buildings and Cities, 3*(1), 265–278. https://doi.org/10.5334/bc.191

Petersson, J., Soneryd, L. (2022). Defend, Retreat and Attack: Urban Waters and Valuation Practices. *Water Alternatives, 5*(1), 175-192. https://www.water-alternatives.org/index.php/alldoc/articles/vol15/v15issue1/658-a15-1-9/file

Prominski, M., Stokman, A., Stimberg, D., Voermanek, H., & Zeller, S. (2017). *River.Space.Design: Planning Strategies, Methods and Projects for Urban Rivers.* Birkhauser Architecture. 9783035610420

Public Health Agency of Sweden. (2023). *Psykisk hälsa och suicid i Sverige – Statistik om nuläge och utveckling fram till 2022 (23096).* The Public Health Agency of Sweden. https://www.folkhalsomyndigheten.se/publikationer-och-material/publikationsarkiv/p/psykisk-halsa-och-suicid-i-sverige-2022/?pub=126974

Raadgever, T., Hegger, D. (2018). *Flood Risk Management Strategies and Governance.* Springer International Publishing AG. https://doi.org/10.1007/978-3-319-67699-9

Ramböll Sverige AB. (2015). U*nderlag till förslag till linje av val av dagvattenlösningar/anläggningar i olika typer av gator.* Ramböll Sverige AB. https://tekniskhandbok.goteborg.se/Arkiv/2018-1/__site/Content/File/1E_9_F%C3%B6rslag%20p%C3%A5%20dagvattenanl%C3%A4ggningar_2018-04.pdf

Rådsten-Ekman, M., Axelsson, Ö., & Nilsson, M. E. (2013). Effects of sounds from water on perception of acoustic environments dominated by road-traffic noise. *Acta Acustica United with Acustica*,*99*(2), 218-225. 10.3813/AAA.918605

Sjövall, I. (2020). *Designfullness - Så revolutionerar hjärnforskningen hur vi bor, arbetar och lever.* Bokförlaget Langeskiöld. 9789188439666

Skandia. (2025). *Hur är läget, Sverige?.* Skandia. https://www.skandia.se/48ddb2/globalassets/pdf/press-och-media/rapporter-och-debatt/hur-ar-lagetsverige/skandia_rapport_sjuknotan-2024.pdf

Stadsbyggnadskontoret. (2019). *Översiktsplan för Göteborg*
Tematiskt tillägg för översvämningsrisker. Göteborgs stad. https://goteborg.se/wps/wcm/connect/2f417497-56e2-4918-97af-ecd52aa474f7/Tematisk+tillägg+ÖP+översvämningsrisk+-+Bilaga.pdf?MOD=AJPERES

Starhe, P. (2008). *Blue-green fingerprints in the city of Malmö, Sweden*. VA SYD. https://www.vasyd.se/-/media/Dokument_ny_webb/Dagvatten/Dagvatten--och-%C3%B6versv%C3%A4mningsplaner/BlueGreenFingerprintsPeterStahrewebb.pdf

Stahre, P. (2004). *En långsiktigt hållbar dagvattenhantering.* Stockholm : Svenskt vatten. 9185159174

Swedish Civil Contingencies Agency. (2018). *Översyn av områden med betydande översvämningsrisk : enligt förordning (2009:956) om översvämningsrisker (MSB1152).* Myndigheten för Samhällsskydd och Beredskap. https://www.msb.se/sv/publikationer/oversyn-av-omraden-med-betydande-oversvamningsrisk--enligt-forordning-2009956-om-oversvamningsrisker2/

Swedish Environmental Protection Agency. (2024). *Vägledning Hållbar dagvattenhantering.* https://www.naturvardsverket.se/vagledning-och-stod/avlopp/hallbar-dagvattenhantering/?utm_source=chatgpt.com#E1825899437

The Ministry of Health and Social Affairs. (2025). *Miljardsatsning på psykisk hälsa och suicidprevention.* https://www.regeringen.se/pressmeddelanden/2025/02/miljardsatsning-pa-psykisk-halsa-och-suicidprevention/

United Nations. (2015). *Ensure healthy lives and promote well-being for all at all ages.* Https://sdgs.un.org/goals/goal3

Varvshistoriska. (2025a). *Varvshistoria.* https://varvshistoriska.se/varven/

Varvshistoriska. (2025b). *Om föreningen.* https://www.varvshistoriska.se/m%C3%A5ls%C3%A4ttning/

Vaeztavakoli, A., Lak, A., & Yigitcanlar, T. (2018). Blue and Green Spaces as Therapeutic Landscapes: Health Effects of Urban Water Canal Areas of Isfahan. *Sustainability, 10*(11). https://doi.org/10.3390/su10114010

Vandkunsten Architects. (2025a). *House on the waterfront of Copenhagen harbour.* https://vandkunsten.com/en/projects/somaerk

Vandkunsten Architects. (2025b). V*annkunsten is exclusive housing with a democratic urban touch.* https://vandkunsten.com/en/projects/bispevika

Vilhelm Lauritzen Architects. (2025). *Kronløb Island.* https://vilhelmlauritzen.com/collection-of-projects/kronloeb-island/

Völker, S., & Kistemann, T. (2015). Developing the urban blue: Comparative health responses to blue and green urban open spaces in Germany. *Health & Place, 35*(September 2015), 196-205. https://doi.org/10.1016/j.healthplace.2014.10.015

Water is coming [Exhibition]. (2024-2025). Danish Architecture Center, Copenhagen, Denmark. https://dac.dk/en/exhibitions/water-is-coming/

White, M. P., Elliot, L. R., Gascon, M., Roberts, B., & Fleming, L. E. (2020). Blue space, health and well-being: A narrative overview and synthesis of potential benefits [Review of Blue space, health and well-being: A narrative overview and synthesis of potential benefits]. *Environmental Research, 191*(110169), 14. ScienceDirect. https://doi.org/10.1016/j.envres.2020.110169

World Health Organization. (2024). *Mental health at work.* https://www.who.int/news-room/fact-sheets/detail/mental-health-at-work

Älvstranden Utveckling AB. (2025). *Vår historia.* https://alvstranden.com/om-oss/historik/

Figure list

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Figure 1 Datawrapper. (2025). Map of Europe. Retrieved from https://app.datawrapper.de

Figure 2 Datawrapper. (2025). Map of Europe. Retrieved from https://app.datawrapper.de

Figure 3 Datawrapper. (2025). Map of Copenhagen. Retrieved from https://app.datawrapper.de

Figure 4 Datawrapper. (2025). Map of Barcelona. Retrieved from https://app.datawrapper.de

Figure 5 Datawrapper. (2025). Map of Barcelona. Retrieved from https://app.datawrapper.de

Figure 6 Lantmäteriet. (2025). Aerial photo. Retrieved from https://minkarta.lantmateriet.se

Figure 7-8 Lantmäteriet. (2025). Aerial photo. Retrieved from https://minkarta.lantmateriet.se

LIVING WITH WATER

AN EXPLORATION OF HOW A WATERFRONT HOUSING AREA
CAN BE DESIGNED WITH A HOLISTIC APPROACH TO WATER

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