SOS
CLIMATE
WATER
FRONT

CLIMATE-PROOF PLANNING
CREATIVE DESIGN SOLUTIONS IN STOCKHOLM

KTH ROYAL INSTITUTE OF TECHNOLOGY, SWEDEN
INTERCULT, SWEDEN
GDAŃSK UNIVERSITY OF TECHNOLOGY, POLAND
THE CITY OF GDAŃSK, POLAND
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STICHTING CPO NOORD-HOLLAND – CPONH, THE NETHERLANDS

Stockholm is a city deeply connected to its water, but that relationship is slowly changing. Climate change is raising water levels, overtime faster than the land rises, meanwhile increased precipitation is creating challenges from inland. Urban waterfront areas, both existing and future, will need to take these new circumstances into account. However, there are both challenges and opportunities to create pleasant and sustainable developments involving multiple perspectives from stakeholders in the city and its surroundings.

SOS Climate Waterfront aims to bring students, practitioners, and researches from all over Europe and a wide range of disciplines together to create new strategies and sustainable solutions for infrastructure and urban planning. The sites explored during the SOS Climate Waterfront workshop in Stockholm in 2022 provide various challenges regarding contradicting uses, economic tension and, crucially, water levels. Lövholmen is an old industrial site located along Lake Mälaren a lake with an actively managed water level and the crucial fresh water supply of Stockholm; Frihamnen is the site of Stockholm's old free port with many cultural values; and Södra Värtan is home to an active cruise ship terminal.

In this book, the wide range of creative design solutions that have been envisioned for these sites will be presented to adapt to allow these sites to remain climate-proof.

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STOCKHOLM 2022

KTH
VETENSKAP
OCH KONST

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 823901.

MARIE CURIE ACTIONS

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Colophon

SOS CLIMATE WATERFRONT

Grant Agreement number: 823901 — sosclimatewaterfront — H2020-MSCA-RISE-2018

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ISBN
978-91-8040-654-3

TRITA
TRITA-ABE-RPT-2311

LEGAL DEPOSIT

BOOK DESIGN WWW.ITEMZERO.COM

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 823901.

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Acknowledgement

This book is the result of a huge collaborative effort of many enthusiastic individuals and groups from different cities and organizations that contributed to making the 2022 Stockholm workshop possible and successful. The event was organized by the European Funded Research Project SOS Climate Waterfront (H2020 – MSCA Rise) with partners in Stockholm: KTH Royal Institute of Technology and Intercult Productions.

First of all, we would like to thank and acknowledge the support of the School of Architecture and the Built Environment that we received from our school leadership and administration, of which without we could not join the SOS waterfront project. Thank you, Mats Wilhelmsson, and Sabina Flodén Schönherr for your great support. We are also grateful for the work done by Nils Brattgård; both the invaluable practical work during the workshop and the contributions during the editing of the report. The non-academic partner of the SOS Climate Waterfront Stockholm Team, Intercult, helped with the organization of the event, the study visit and lectures at the site of Hammarby Sjöstad, an urban neighborhood that is internationally recognized as a model for sustainable city, providing perspectives and enhancing our understanding on the role of culture in sustainable cities and the guided study visit to one of the chosen research sites: The Free Port (Frihamnen). Intercult was also in charge of the external communication of the event and production of the final digital exhibition of master plans created in Stockholm.

We further want to thank the City of Stockholm (Stockholms stad), the art institution Färgfabriken , House of Blivande, and the Ports of Stockholm for supporting the workshop through the study visits, receiving the workshop participants at their places and providing valuable inputs to the participants to be able to carry out the assigned tasks. Thank you to Emilja Geijer, Elin Fredenberg, Gudrun Walla, Inger Johansson, Saga Jernberg, Håkan Hyllengren, Maria Hammarsten, Anders Bergmark and Östen Ekengren, for your guidance during these excursions.

We would also like to thank the experts and guests lecturers that we received at KTH for delivering the valuable lectures; thank you Piotr Lorens/Gdansk City, Lars Magnus Joelsson/ SMHI, the Swedish Meteorological and Hydrological Institute, Jenny Brolin and Lea Levi/City of Stockholm, Anja Moum Rieser/ KTH and not to forget David Nilsson, the Deputy Head of ABE School and Pedro Ressano Garcia, the SOS Climate Waterfront Project Coordinator for their interesting opening lectures.

Last but not least, we would like to thank the inspiring team of the international researchers, PhD students, KTH Master Students and staff of Intercult who worked hard and passionately yet spreading a lot of joy and cheerful feelings through the whole process of developing and documenting the group's projects work. The researchers critically examined the three selected urban sites and came up with creative project proposals and outstanding research results in terms of concepts and content, with the aim of developing sustainable urban areas, considering water issues and climate change. Thank you Ana Neiva, Elena Paudice, Magdalena Rembeza, Metha Bregman, Nils Brattgård, Shea Nee Chew, An-

gelos Kottas, Tullia V. Di Giacomo, Tomasz Hoppe, Letty Mora, Sri Pascarini Agustina, Emma van der Saag, Jacek Józekowski, Karen Jonkers, Marina Causí, Androniki Fliatari, Jakub Gorzka, Malika Ashmarina, Renata Gonçalves, Paulina Bone, Claudia Mattogno, Yuxin Pu, André Prevedello, Martyna Varslavienaite, Natalia Chrysikou, Giulia Luciani, Henriette Nishimwe, Elisavet Papageorgiou, Josefin Holmström, Pixie Hård af Segerstad and Isaac Simão Santo.

The SOS Waterfront Workshop in Stockholm would not be materialized, productive and be turned into a successful research event without all of you.

Lina Suleiman, Katarina Larsen and Iwona Preis

Coordinators of SOS Climate Waterfront Stockholm Team

Table of Contents

Introduction

The waterfront of Stockholm, one of Europe's fastest-growing cities, stands at the forefront of climate change challenges. As such, there is a pressing need for innovative solutions and resilient urban design. The SOS Climate Waterfront research project gathered international experts and local representatives, coming from different disciplines to work together in May-June 2022 to discuss, explore proposals and design Sustainable Open Solutions (SOS).

This book explores three urban sites in Stockholm, holding significant implications for the city's waterfront— Lövholmen, Frihamnen, and Södra Värtan. During the workshop, SOS Climate Waterfront participants, mainly European researchers, analyzed future challenges, raised new questions, and depicted solutions, which can now contribute to cross-country comparisons in a larger EU-framework.

The three sites are not only driven by the demand for more housing but also face crucial issues related to cultural heritage, climate change, landscape ecology, and social development. Achieving a delicate balance between these aspects and economic interests presents a significant task for the city. The waterfront of Stockholm holds substantial relevance in the context of climate change and its impact on coastal areas. Thus, analysis of the Swedish context, based on data collected and on-site knowledge sustains a deeper understanding of the challenges and opportunities that lie ahead.

Stockholm is expected to be affected by the impacts of climate change, including temperature increases, changing precipitation patterns, and the potential for more frequent cloudbursts. While the rising sea level is a long-term challenge rather than an immediate concern, increasing risks of extreme weather events and flooding were taken in consideration.

Stockholm rests on two different bodies of water, at a location where the Baltic Sea (Östersjön in Swedish) with brackish water meets Lake Mälaren, which is an important provider of freshwater for the larger Stockholm area. As the lyrics of a popular contemporary Swedish song (by Robert Broberg) describe it: “the city is full of water”. However, to ensure that the ecological and chemical status will be maintained, in facing future challenges in terms of urbanisation and climate change, much attention has been paid to ensure the preservation of the water quality of the Mälaren Lake, a vital water source for two million people.

The city values its water and continuously invests in improving the situation (e.g. the new sluice at Slussen). The activities carried out in the SOS Climate Waterfront workshop in Stockholm integrated this relationship to water as well as the continuing land-rise, the balance of which adds complexity to the sea level modelling and therefore also to the anticipations and scenarios for the future.

In this book, the authors explore innovative strategies and design proposals to tackle these challenges while preserving the cultural identity and heritage value of the sites. Researchers from various European cities, supported by experts and academic

lectures, analyze extensive input materials and information, ranging from planning documents and historical records to consultation reports and city visions. By drawing upon multidisciplinary backgrounds and experiences, the researchers identify the socioeconomic and environmental qualities of each site, ultimately developing site design concepts and solutions that address climate change challenges, the maintenance of cultural identities, and the protection of biodiversity.

Throughout the book, the proposed designs emphasize the importance of finding a balance between preserving cultural heritage, the values of local communities, the stimulating economic growth, and promotion of sustainable urban development. Key elements include the reuse of existing infrastructure, the integration of green-blue schemes, the improvement of biodiversity, and the creation of vibrant and multi-functional neighbourhoods that connect people to each other and their surroundings.

While design solutions present promising approaches, their implementation and the institutional challenges that may arise in specific city contexts remain external to the results presented here. The book acknowledges the need for further research and highlights the shared recognition among the workshop participants regarding the gaps and blind spots in their findings.

The following chapters of the book delve into climate change in Sweden, the role of culture and arts in the environmental movement, and specific case studies and design proposals for each site. By exploring these diverse perspectives, this book aims to contribute to the ongoing discourse on sustainable urban design and planning, to inspire innovative approaches in addressing complex challenges faced by Stockholm in the future.

PART 1 of the book offers a comprehensive understanding of climate change in Sweden, street fishing in Stockholm, and the role of culture and arts in the environmental movement in the Nordic Region and internationally. Furthermore, the lessons from Stockholm and its surroundings in this report draw on presentations, by professionals and researchers from various fields, made during the workshop. Some of these lessons have been written into interesting articles, introduced below.

The chapter *"Climate change in Sweden"* by Magnus Joelsson from the Swedish Meteorological and Hydrological Institute (SMHI) provides an updated analysis with data and the context for discussing climate change in Sweden. The text makes the distinction between weather and climate, referring to the expression "Climate is what you expect, weather is what you get" that Mark Twain is said to have coined. Moreover, calling for actions by emphasising that the trend of climate change is expected to continue, both globally and in Sweden. What will happen in the far future still depends on our actions, now and in the future.

The contribution entitled *"Urban nature does not stop at the waterfront, neither should urban planning, a case study of street fishing in Stockholm"* raises questions about how planning and

strategies for waterfront areas in cities should consider more perspectives from a wider group of interests. It discusses how urban dwellers live with water, with a focus on recreational fishing and what this use entails. The authors (Anja Moum Rieser, from KTH Royal Institute of Technology, Wieben Johannes Boonstra and Rikard Hedling, both from Uppsala University) go beyond the human-centric view and expand the gaze to other species' needs and also incorporating the body of water in planning for the urban waterfront areas.

The chapter *"The role of culture and arts in the environmental movement in the Nordic Region and internationally"* by Elisavet Papageorgiou and Iwona Preis from Intercult, discusses artistic perspectives on sustainability and climate change. This focuses on how art and culture can raise awareness, provide inspiring actions, and promote social cohesion around sustainable practices. Drawing on experiences from projects aiming to invite and engage community dialogues, they argue that artistic strategies can challenge dominant narratives and promote alternative visions for a sustainable future.

The contribution *"Sense the Marsh"* by Thelma Dethelfsen from KTH The Royal Institute of Technology, emphasises the importance of architecture and landscape design in creating adaptive and resilient strategies to manage flooding and sea level rise. The study focuses on how designs can encourage interaction and awareness with the surroundings. Thereby highlighting the interfaces between humans and nature and raising questions about how flooding can be used as a quality and catalyst to attract more people to an area. The resulting design provides an opportunity to experience nature though the design and architectural solutions, situated on the border between human, non-human species and nature.

In **PART 2**, readers will explore the detailed design proposals developed by different groups for the urban sites in focus. These proposals aim to intertwine sustainability, cultural identity, and economic interests, offering insights into the potential for resilient and vibrant urban spaces.

By assessing existing conditions on three sites analysed in Stockholm, including *Lövholmen*, *Frihamnen*, and *Södra Värtan*, the teams participating in the workshop actively contributed to the analysis of the sites and development of design solutions for the areas, in the end forming strategies for better preparedness for future challenges and better lives for the inhabitants.

Lövholmen is located in the north-western part of Liljeholmen, one of the major developmental centres in Stockholm. The area is currently a closed-off industrial site, but the municipality's intention is to redevelop it into a mixed urban space with homes, workplaces, shops, schools, and more. It's expected that 1500 new homes will be built in the area. Many of the current industrial buildings are empty and in bad shape. While some of these will be replaced with housing, other industrial buildings have heritage value and should be protected during the development, after which a new use should be found for them.

Frihamnen is, together with the Södra Värtan project, part of the larger development of ”Norra Djurgårdsstaden”, the Stockholm Royal Seaport. Frihamnen is located to the south of Värtahamnen and is in turn strongly connected to Loudden in the south. The municipality plans for the area to contain approximately 1700 homes, 4000 workplaces and 75,000 m2 of retail and office space. Some of the existing businesses in Frihamnen will remain, but much of the existing infrastructure is planned to be removed. The harbour no longer handles freight shipping, but passenger ships will continue to depart from the harbour (Frihamnspiren).

Södra Värtan is planned to contain 1500 apartments, 20 preschool departments, 155,000 m2 of office and retail space, as well as 10,000 m2 of parks and a 600 m long waterfront walkway. The new development is intended to co-exist with the activities in the harbour, which creates challenges such as the blocking of noise stemming from the cruise ships. The walkways along the waterfront are planned to have shops and restaurants.

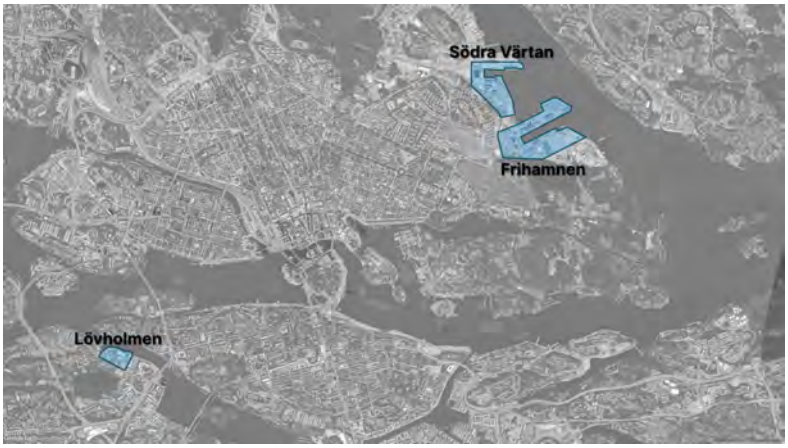

Figure 1:
A map of the central parts of Stockholm, with the locations of the three project sites highlighted. Satellite imagery from Google Earth using Google Earth Pro.

The contributions of the articles, together with the SOS Climate Waterfront teams’ analysis of the three sites in Stockholm, provides relevant and timely interdisciplinary efforts to co-create novel solutions and future strategies to manage the climate challenges ahead.

The solutions relate to the history of the urban territory, actors involved (or those excluded) and changes, over time, of planning ideals. A key theme is how to plan by creating inclusive strategies for the future by involving representatives of diverse interests, competences, and future visions for the sites. The consequences of climate change are affecting these different stakeholders and citizens in a wide range of ways, so including them in the process is crucial. This also includes the inclusion of future generations’ views on urban transformation. The largest challenge is to create new, novel solutions where these human interests, as well as those of local nature and non-human species, can be incorporated, in an effort to plan and design for a

mitigation and management of the consequences of climate change.

As we embark on this journey of exploration and innovation, we invite readers to delve into the pages of this book, where interdisciplinary research, creative design, and a shared commitment to sustainable urban development and decarbonisation strategies converge. Together, let us envision a future where cities thrive, harmoniously balancing their heritage, environment, and economic aspirations.

Part 1

Magnus Joelsson, SMHI

Climate Change in Sweden

Abstract

Since the founding of the Intergovernmental Panel on Climate Change in 1988, the public awareness of the looming climate change due to human activities has gradually grown. Today, the global climate and its causes is well described.

Also, the climate in Sweden is currently undergoing changes: Since the mid 19th century the average temperature has risen with almost double the rate of the global average and the annual accumulated precipitation has increased significantly. The number of days with snow cover has decreased and incoming solar radiation has increased since respective observations began.

The trend of change is expected to continue, both globally and in Sweden, in the near future. What will happen in the far future still depends on our actions, now and in the future.

A few introductory words

On climate and weather

Mark Twain is said to have coined the expression:

Climate is what you expect, weather is what you get.

Besides its comical claim, the statement makes a quite useful distinction between the terms "weather" and "climate". Due to the cyclical nature of the weather, what we expect is also what we have already experienced in the past. The Intergovernmental Panel on Climate Change (IPCC) defines climate as "the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years". The annual average global temperature is a climatological measure, as is the 95-percentile April wind gust in Dalarna, and the longest period without precipitation in summer in Linköping.

The given guideline for the time frame "from months to thousands or millions of years" is however a bit ungainly. What time frame should we use to describe our climate? As in all statistics, the more data we can collect for a certain measure, the higher accuracy we get. If we, for example, want to know the distribution of summer maximum daily temperatures in Malmö, and we use a too short time period to sample from, a few randomly hot summers in our period can give us an incorrect idea of what a typical summer day in Malmö can be like.

There is also an opposite problem. Climate is not constant but varies over essentially all time scales; from changes over a couple

of years caused by large volcanic eruptions to changes over hundreds of thousands of years caused by different properties of the Earth's orbit around the sun. If we, for example, sample summer maximum daily temperatures from a too long time period, the distribution will not necessarily represent the present climate. In this period we may have transitioned from a cooler dryer period to a warmer wetter period. What we perceive as a quite ordinary summer day might then be in the warm end of our climatological distribution.

The World Meteorological Organization (WMO) has decided that climatological *normals* (i.e. average values) are to be calculated over a 30-year period and that a *standard normal period* is a 30 year period where the number of first year ends with 1. For example, the current standard normal period for which we compare our observations is 1991–2020. According to this definition, we need observations from at least 30 years to understand what weather we can expect over the coming years. To understand how the climate changes over decades to centuries, we need observations from several normal periods. We therefore need long time series of observations.

On the observational records

The oldest observational weather records in Sweden are the temperature series from Uppsala, Lund, and Stockholm, which date back to the mid 18th century. More systematically, a network of about thirty weather stations was set up around Sweden on the initiative of the Royal Swedish Academy of Sciences in 1858–1860. While this first network might have been sufficient to cover the variations of "smooth" observables such as temperature or air pressure, anyone who has spent even only a couple of weeks in our temperate climate can easily realise that around thirty weather stations is inadequate to capture the variability of rain and snow in Sweden. At the end of the 19th century, a precursor to SMHI started precipitation measurements on several hundred locations in collaboration with Hushållningssällskapen (Rural Economy and Agricultural Societies). Still today, these stations remain the backbone of the SMHI's precipitation network. From 1995, around 120 weather stations have been automated, which is an important change in how we record weather data.

The number, the length, and the quality of the observational time series vary between the different observables; temperature and air pressure have the longest time series while the precipitation has the most dense network. At most, in the 1960's, there were more than 900 precipitation stations. Today this number has dropped to about 600. The quality of the 19th century precipitation observations are however questionable. Solar radiation

measurements both have the shortest time series and the most sparse network. Wind measurements are very sensitive to changes in the local surroundings, which makes it hard to draw climatological conclusions from the wind observational time series without adjusting for these changes (a process called *homogenisation*). Instead, a theoretical wind calculated from air pressure measurement has been used to study the changes in winds over the last century in Sweden. This theoretical wind is called *geostrophic wind*.

Observed climate change in Sweden

Earth's climate is basically an expression of the energy content of the atmosphere. All meteorological observables such as temperature, precipitation, and wind vary with the available energy. Energy originates from the incoming solar radiation, but all incoming solar radiation is not available for the Earth system. A portion is immediately reflected back to space. Just as a black t-shirt feels warmer than a white t-shirt on a sunny day, the share of the radiation that is reflected largely depends on the colour of the surface. Snow-covered surfaces and desert sand reflects more radiation than the open ocean and the cities' blacktop roads. The reflectivity of the planet is called the *albedo*. Moreover, the warming of the planet is enhanced from the portion of the solar radiation which is absorbed by some of the gases in the atmosphere in an effect called the greenhouse effect. Thus the climate of the planet is mainly controlled by i) the amount of incoming radiation from the sun, ii) the amount of radiation that is reflected back to space, and iii) the concentration of greenhouse gases. These points can be thought of as the planets' *radiation budget*.

The industrialisation has substantially impacted two of these three points of the radiation budget. The release of small particles into the atmosphere (*aerosol*) has had a net cooling effect due to increased albedo. The release of carbon dioxide, methane, nitrous oxide (laughing gas), and other greenhouse gases have had a warming effect. The balance between these two effects does to a large extent decide the anthropogenic (human induced) contribution to climate change. The way we use our land is also an important factor for climate change, both for changes in albedo and in bound carbon.

To quantify the climate change since the industrial revolution, observational weather records of at least one entire thirty-year period in pre-industrial time would be ideal as a baseline. Unfortunately, most of the observational records do not extend sufficiently far back in time to, with certainty, describe a climate unaffected by industrialisation.

SMHI recently released a report of the observed climate change in Sweden as far back as there are available observations (Schimanke et al. 2022). In the report, the records of five variables: Temperature, precipitation, snow, solar radiation, and geostrophic wind, were analysed. The main conclusions follow below.

The climate in Sweden has become warmer ...

In Sweden, a relatively wide range of temperatures can be observed. The lowest recorded temperature is −52.6 °C in Vuoggatjålme on February 2nd 1966, while the highest recorded temperature is 38 °C in Ultuna on the 9th of July 1933 and in Målilla (29 June 1947). Temperatures above 30 °C and below −30 °C are recorded somewhere in Sweden more or less every year. As Sweden is a fairly oblong shaped country, situated quite far north, the temperature varies both geographically and seasonally. The average annual temperature over the last normal period ranges from below −2 °C in the north, to above 8 °C in the farthest south. Sweden's average winter temperature over the same period is close to −4 °C, the average summer temperature close to 15 °C.

Changes in average temperature are perhaps the most common indicator of climate change. Besides being easy to grasp conceptually, changes in average temperature are closely linked to changes in the radiation budget, and it directly or indirectly affects essentially all other meteorological observables. Since the pre-industrial time, the global average annual temperature has risen about 1.1 °C (WMO, 2022). In Sweden, the average warming from the period 1861–1890 to the period 1991–2020 is 1.9 °C, see Figure 1. The warming is thus stronger in Sweden (and other northern regions) than the global average, a phenomenon known as the *arctic amplification*.

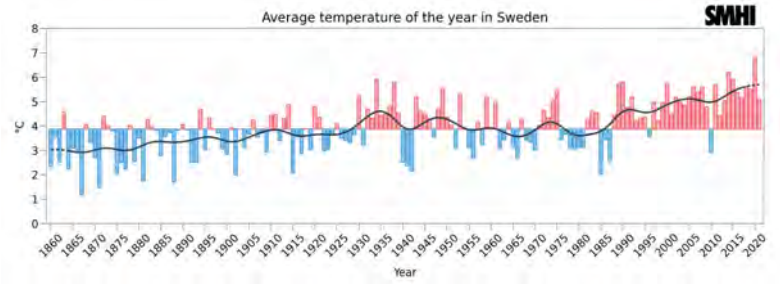

Figure 1: The bars in the chart show the average temperature per year. Red bars show higher and blue shows lower temperatures than the average for the normal period 1961-1990. The gray line shows a running mean calculated over about ten years

In Figure 1, variations at several time scales can be discernible: The fast and seemingly random variations from year to year, an about decade long wave-like pattern, and alternating cooler and warmer periods over multiple decades. The 1930's and 1940's

was, for example, an anomalously warm period (with the exception of the infamously cold years in the early 1940's), while the period from the early 1960's to late 1980's (which coincide with the reference normal period in the figure) was colder. On top of all these variations, there is an almost exponential warming. It should be mentioned that compared to what we know about the temperatures of the preceding hundred years, the second half of the 19th century was cold, with tales of bad harvest and hardship. It is in the mid 19th century the author Wilhelm Moberg lets his fictional characters Karl Oskar and Kristina leave for America in the great *The Emigrants* series, just as so many of their real-world peers. While some of these temperature variations can be attributed to natural variations such as variations of surface temperatures of the tropical Pacific Ocean (the *El Niño* phenomenon) others remain to be fully explained. The long-term warming is most likely largely an effect of the human activity (IPCC, 2021).

The rate of warming in Sweden is not the same over time and space. As a rule of thumb, the lower temperatures warm more than the higher temperatures: The spring and winter have experienced a larger increase in mean temperature than summer and autumn. Night-time temperatures, or more precisely the daily minimum temperature, has in general increased more than the daily maximum temperature. The warming is also stronger in the north, especially in wintertime.

The warming is also visible if we study in what year the current daily extreme temperature records for a certain month and weather station were set, see Figure 2.

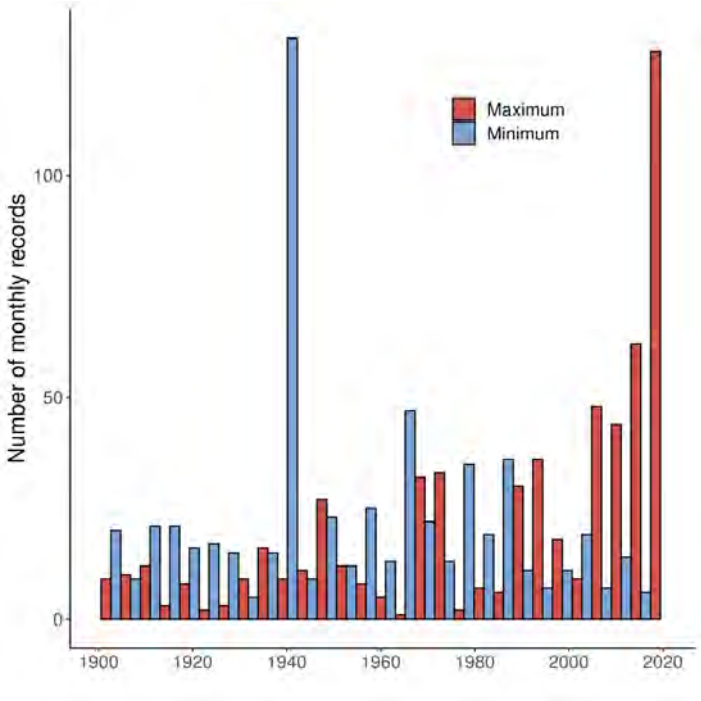

Figure 2: The number of current monthly records for daily minimum (blue bars) and daily maximum temperatures (red bars) for fifty weather stations with complete series from January 1901, sorted by the year the records were set. Every bar represents the sum of the number of records for four consecutive years

The data presented in Figure 2 reveals that 25 % of the current daily minimum temperature records were set prior to 1940, 50 % after 1950, and 25 % after 1978. Correspondingly, 25 % of the current daily maximum temperature records were set prior to 1968, 50 % after 2000, and 25 % after 2015. Extreme warm thus seems more likely today than extreme cold.

... wetter ...

Precipitation is both a vital and hazardous part of the weather. We need rain for our crops to grow, to fill our wells of fresh water, and to drive our hydroelectric plants. On the other hand, an abundance of rain can cause large damages or disturbances for example in the form of flooding or landslides. Intense snowfall can completely paralyse a society. Residents of Gävle might for example remember the snowfall in December 1998 where approximately 130 cm snow fell over the course of a couple of days.

Precipitation in Sweden has an interesting seasonal feature: The winter precipitation is highest in the west parts, both along the southern west coast and along the mountain range in the north. The summer precipitation is more spread out over the entire country, see Figure 3. This is indicative of what drives the weather in Sweden. In winter, the weather is mostly dominated by low-pressure systems bringing rain in the south from the Western Sea or snow in the north from the Norwegian Sea. In the summer,

the weather is dominated by small-scale convective systems, so called summer showers. In general, summer is the wettest season, spring is the driest.

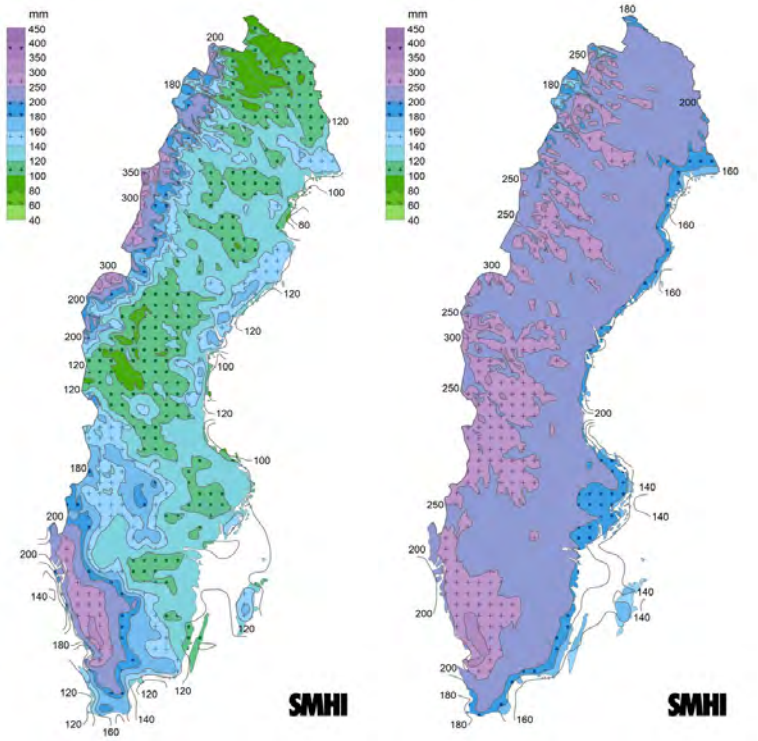

Figure 3: Normal precipitation under the winter (left) and summer (right) for the period 1991-2020

If the average annual accumulated precipitation for a number of weather stations in Sweden is illustrated in a graph, as is done in Figure 4, there are similarities with the temperature curve of Figure 1. This can be explained by the Clausius–Clapeyron relation, which states that warmer air masses can hold more water vapour and thus potentially carry more precipitation. One should note, however, that the variability of the precipitation is much larger than temperature, both in time and space.

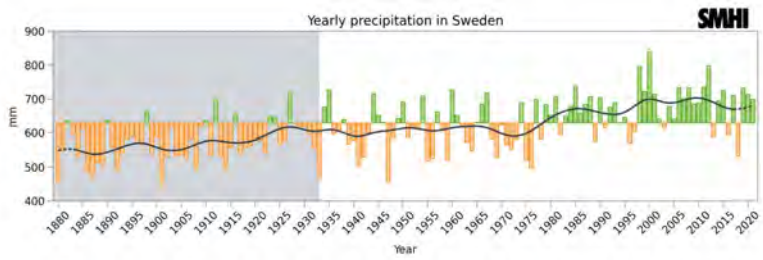

Figure 4: The bars in the graph show the total rainfall for year. Green bars show higher and orange show lower precipitation than the average for the normal period 1961-1990. The gray line shows a running mean calculated over about ten years. Observations before 1933 are considered to have lower reliability than later observations. This is marked with a gray shadow in the diagram. Caution should be exercised in any climatological conclusions based on this time period.

Precipitation in climate change is sometimes described with the phrase “rich is getting richer”. This is also the case in the Swedish context, where precipitation generally increases most in summer, and wintertime precipitation increases most in the west.

Due to its stochastic nature, trends in extreme precipitation are much harder to determine than accumulated values. There is however a significant increase in summer and spring maximum daily precipitation between the two normal periods 1961–1991 and 1991–2020, so there is some indications that extreme precipitation has become more extreme over the last 60 years.

Arguably, the most clear signals of a changed climate since the mid 20th century is the decrease in the average number of days with snow cover, see Figure 5.

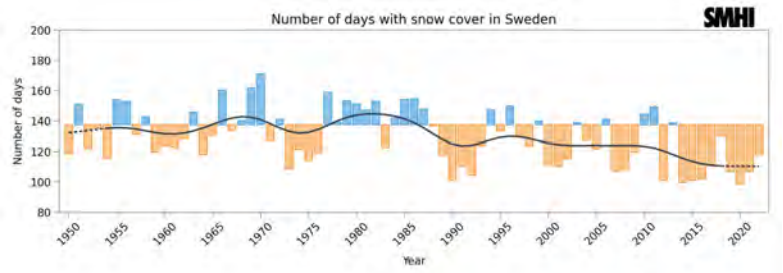

Figure 5: The bars in the diagram show number of days with snow cover in Sweden. Blue bars show more and orange shows fewer days than the average value for the normal period 1961-1990. The gray line shows a running mean calculated over about ten years. The year shown represents the year in which the season ends. That is, 2000 stands for the 1999/2000 season.

... and brighter

The solar radiation (which meteorologists like to call *global radiation*) has been measured at 18 stations since 1983. The station in Stockholm, the single longest still active time series in the world, has been measuring solar radiation since 1922. A mean over eight stations in Sweden shows a general increase from 1983 with about 10 %, see Figure 6. The causes for this increase are most likely decreases in cloud cover and aerosol loading.

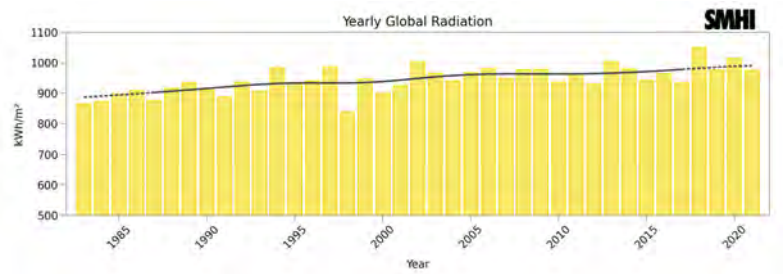

Figure 6: The yellow bars in the chart show yearly Global Radiation since 1983 calculated from eight stations. The gray line shows a running mean calculated over about ten years. The unit for solar radiation is kilowatt hours per square meter. The scale for the bars does not start at zero to clarify the variation over time.

For the geostrophic wind, very few statistically significant changes over the analysed period were found.

What to expect for the future

In the coming decades, the trends observed over the last decades with a general warming over the entire country and during vall seasons, an enhanced warming in the winter, in night-time, and in the north will most probably continue. We will likely experience longer warm spells in summer and fewer extreme cold days in winter. Similarly, we anticipate increases in precipitation, especially in the western parts of Sweden wintertime and in general summertime. It should be emphasized that all meteorological variables vary more from year to year than this long-term trend, and thus we will still have large variability in the climate. For a longer time-scale, the trends of the climate will depend heavily on human activity, in terms of land use change, greenhouse gas and aerosol emissions.

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Urban nature does not stop at the waterfront, neither should urban planning: A case study of street fishing in Stockholm

Abstract

While research on *green* urban spaces has established their important values and functions, less attention has been given to *blue* urban spaces and its importance for wellbeing of urban residents. With the project "Blue Urban Commons" (2020-2023) we wish to gain more knowledge about these blue spaces through a case study of Stockholm, Sweden. The aim with this project is to understand how urban dwellers use and depend on city waters for recreation, food, and general well-being, with a specific focus on recreational fishing. This paper consists of four parts highlighting research strands, preliminary findings and reflections concerning what issues are important for planning blue urban spaces. The first part provides an understanding of the various conditions that enables Stockholm to be an attractive city for fishing. In the second part, we present some preliminary findings regarding the diversity of fishers in Stockholm, using an ideal typical distinction between fishing for fun and fishing for food. The fact that many people fish for food in Stockholm raises several questions, such as e.g. on water pollution and their potential health consequences for fishers and the fish, which we present in the third part. We conclude with some reflections on the various goals of planning urban waterfronts and the trade-offs that it includes between food safety and security, equal access, and human and non-human wellbeing.

Introduction

The notion that urban nature has important values and functions for people living in cities is by now well accepted (Andersson et al., 2014). Nevertheless, most attention so far has been paid to *green* urban spaces; we know comparatively less about *blue* urban spaces despite their value and function for urban sustainability (Beatley, 2014; 2018).

The aim of the research project "Blue Urban Commons" (2020-2023) is to gain more knowledge about blue spaces in cities: the condition of these spaces, but also how urban dwellers use and depend on them for recreation, food, and for their well-being. The project studies fishing in the city of Stockholm, Sweden, as a paradigm case to investigate how fishermen and fisherwomen make use of the many opportunities for fishing. Questions that are asked include:

- How is aquatic biodiversity in urban blue space influenced by street-fishing, and vice versa?
- Why do urban dwellers fish in the inner city?

- How is access to and control over urban blue space distributed and organized amongst different social and cultural groups of fishers?
- How can planning and use of urban blue space (better) contribute to a sustainable and just city?

The case study of (recreational) urban fishing can elucidate as an example how access to and control over urban waters as a common resource can be sustainably managed. The project is funded through FORMAS, a Swedish Research Council for Sustainable Development, and involves researchers at Uppsala University, Stockholm University, and the Swedish University for Agricultural Sciences.

Image 1: Two fishermen fishing in Stockholm. Illustration by Tessa Joosse

Fishing in Stockholm

Just like many other capitals, Stockholm lies at the coast. But the city also borders one of the largest lakes in Sweden – lake

Mälaren. The brackish water in the center of the city forms a habitat for more than 30 fish species (Figure 1), including salmon, bream, trout, pikeperch, European perch, Northern pike, smelt, herring, and roach among others. Hence fishers and fishing have always been an important feature in the city since long (Boonstra et al., 2019, p. 5). Nowadays a very diverse group of people fish throughout the year, but especially during the warmer months. The group consists of mostly (but not exclusively) men with very different social and cultural backgrounds. They include e.g. tourists, IT professionals, families on a day out, kids and teenagers, seasonal workers, and refugees (Joosse et al., 2021, pp. 4-5).

Figure 1: Fish species in Stockholm city, created by Rebecka Svensson

To understand why so many and such a diverse group of people fish in Stockholm, it is important to understand Sweden's "Allemansrätten" (the right to roam) and citizens' relationship to accessing green and blue commons. Ideas and practices around "friluftsliv", i.e. being outdoors in nature and cultural landscapes for well-being and recreation, emerged in the 1800s, and gradually became an important aspect of Swedish national and cultural identity, until this day (Sandell & Sörlin, 2008).

During the 1930s and 1940s when the Swedish urban population grew, the notion of Allemansrätten gained popularity (Sandell & Svenning, 2011), to make it easier for urban dwellers to leave the city and engage with nature. Since then, Allemansrätten has been legislated and today it entails amongst others the right to access, walk, cycle, ride and ski, and camp (though a limited time) on any land, with the exceptions of private gardens, the immediate vicinity of a dwelling house and land under cultivation, in addition to specific restrictions for nature reserves and other protected areas (Naturvårdsverket, 2018). It also gives the right to pick wildflowers, mushrooms, and berries (provided they are not legally

protected), but not to hunt in any way (Naturvårdsverket, 2018). Though Allemansrätten gives people the ability to roam freely, it is stressed that with rights comes responsibilities, and an important phrase of Allemansrätten is "Do not disturb, do not destroy" (Bengtsson, 2004).

When it comes to fishing, Allemansrätten is more restricted, and fishing requires licenses in most lakes and certain parts of the coast. However, if using standard recreational fishing gear (such as angling with rod and reel), there are no required fishing licenses in Sweden's five largest lakes (Vättern, Vänern, Mälaren, Hjälmaren, and Storsjön), or along the coast of the Baltic Sea, The Sound, Kattegat, and Skagerrak (Swedish Agency for Marine and Water Management, 2018a). Sweden has a relatively high number of recreational fishers compared to other countries. Whereas global recreational fishing is approximately 11.5 % of the global population (Cooke & Cowx, 2004), while 13,6 % of Sweden's population fish recreationally (Swedish Agency for Marine and Water Management, 2018b), and Sweden attracts a growing number of recreational fishers from abroad.

When it comes to fishing in Stockholm, the earliest records of commercial fishing started in 1436 (Svedäng & Rolff, 2021). In the 1970s water treatment in Stockholm drastically improved the water quality and in 1985 "Fritt handredskapfiske" was introduced, which allowed fishing without licenses if one is angling with rod and reel. Certain regulations, however, still apply concerning bag limits, size limits, gear restrictions, and angling restrictions during the reproductive period (Andersson et al., 2017). In the 2000s the City of Stockholm also started releasing farmed fish in the city waters to help sustain recreational fishing while preserving the wild populations. Today the city is releasing approximately 140 000 sea trout, 12 000 salmon, 22 000 pikeperch, and 5000 pikes each year (Stockholm City Fish Welfare, 2020). The combination of restocking with farmed fish; the blend of fresh water and the brackish water creating species-abundant aquatic ecologies; and lenient regulation, make fishing in Stockholm a popular activity for many people.

In recent years, the city and fishers have noted a decline in fish in the city waters, which can be attributed due to several factors, such as climate change; growing populations of seal and cormorants (both eat fish); pollution and eutrophication; an increase of certain diseases and syndromes (e.g. the thiamine deficiency syndrome M74 that reduces salmon's reproduction); an increase of the three-spined stickleback fish that eats both certain fish species that eat algae and eats the eggs of certain predatory fish, influencing greatly the ecosystems; construction in the protected "beach" areas close to the water; and lastly due to overfishing of both commercial fishers and recreational fishers.

Fishers of Stockholm

Fishing is a rather broad term encompassing many different styles and methods (Boonstra & Hentati-Sundberg, 2018, pp. 80-81). It is common when talking of fishing to distinguish between recreational fishers and subsistence fishers (Young et al., 2016, p. 115). Recreational fishers are generally considered as fishing for leisure and release their catch back into the water when caught, so-called "catch & release", while subsistence fishers are fishing for food and livelihood reasons (Cooke et al., 2018, p. 203). Many studies of fisheries often fail to notice that both fishing styles are also performed in city environments (Boonstra et al., 2022).

Building on this common distinction between recreational fishers and subsistence fishers, and our data of interviews with urban fishers in the Stockholm area, we created a typology of *catch and releasers* (C&R) and *catch and cookers* (C&C). While this distinction is anchored in the literature, the typologies of *C&R* and *C&C* are treated as two ideal types to help interpreting our data (see Figure 2). Ideal types are heuristic tools for data analysis, they do not provide an accurate model of empirical reality. Indeed, as others have emphasized already, the distinction between fishing for subsistence or fishing for leisure can often not be drawn very clearly (see, e.g., Nyboer et al., 2022). For this reason, we stress the ideal-typical character of our typology. Many C&R fishers we spoke to also, from time to time, keep some of their catch to be eaten later, and similarly C&C fishers would also release catch back, e.g. whenever they found the species unpalatable or too small. This is to demonstrate that a rather fluent boundary separates fishing for food from fishing for fun.

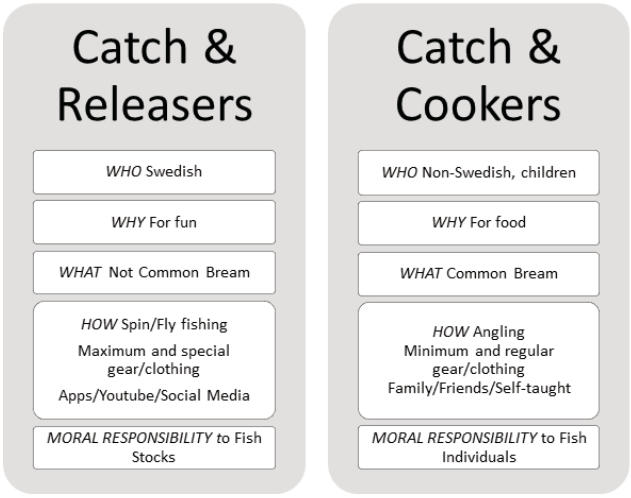

Figure 2: Ideal types of Catch & Releasers and Catch & Cookers.

The fishers of Stockholm present a great diversity among them. In our data, all but two were men, though these men represent a wide range of age groups, ethnic and cultural backgrounds,

and socio-economic positions within society. While fishing seems to be a rather male-dominated activity there is evidence that shows a growing female participation in fishing (Fennell & Birbeck, 2018, p. 504; Burkett & Carter, 2019, p. 1013). The easy access to fishing, whether for food or fun, in Stockholm might well be one of the factors contributing to this diversity among the fishers, but the freedom of access comes with certain governance challenges as to how the waters of Stockholm are and should be administered. Recreational fishing is usually regulated by restricting the amount of fish that is allowed to be kept per day and size limits of fish imposing the need for a catch & release practice (Ferter et al., 2013, p. 1320; Cooke et al., 2018, p. 204). Fishers and scholars argue that releasing catch, due to regulation or voluntary, they are contributing to conservation of fish stocks (Arlinghaus et al., 2007, p. 161). Yet, worth noting is that mortality rates post-release differs between species and are hard to estimate precisely, which implicitly also affects fish stocks in the end (Ferter et al., 2013, pp. 1324-1326). Moreover, there is also a heated debate on the question whether fish feel pain, and what this implies for the practice of catch & release (Vettese et al. 2020). The practices of catch & release and catch & cook therefore also create moral and ethical concerns among fishers and outside the fisher community (Arlinghaus, 2007, p. 161; Cooke et al., 2018, p. 206).

Waters of Stockholm

Water in cities is always a major concern because the density of human activities risk pollution with contaminants (organic pollutants such as PCBs and dioxins, and inorganic pollutants such as mercury and other heavy metals) and pathogens (such as bacteria and parasites). Moreover, pollution is especially accumulating in predatory fish like pike, or in fatty fish, such as herring.

In Stockholm water quality has improved in certain aspects, but pollution is nevertheless still a problem. Also because there constantly appear new pollutants. The Stockholm City Council (*Stockholm Stad*) has as its aim to improve the water quality in its 21 water bodies before the year 2027 according to 'good ecological and chemical status' (EU water directive). For this purpose, the city launched the 'environmental barometer' which includes a number of analyses of water quality in terms of PFOS, mercury, PCB, PBDE, HBCD (Petterson, 2022). They also analyze pollutants in bottom sediments, including copper, cadmium, lead, anthracene, fluoranthene and TBT (Nordlund et al., 2020). These studies demonstrate that the quality of the water cannot yet be labeled as 'good ecological and chemical status'. The situatedness of water bodies, e.g. close to industries or busy transport, is responsible for the different levels of pollution.

From a public health perspective the relatively high level of pollutants make consumption of fish caught in the waters of

Stockholm risky. The Stockholm City Council as well as the Swedish Public Health Authority (*Livsmedelsverket*) therefore advise to limit consumption of locally caught fish to 2-3 times per year. As a consequence, the authorities thus recommend catching and releasing the fish instead of eating it.

Despite these analyses and recommendations there is a considerable number of fishers who consume the fish they catch (see previous section). In some cases it seems that fishers are unaware of the quality of the water, in other cases this information is not considered relevant, as exemplified in the following recurring observation we made during an interview around the city center:

I ask what he thinks about the water quality? He tells me that there used to be this known politician that would go down by Parliament and take a cup in the water and drink it, to show other European countries how clean our water was. But he smiles and says this probably is not done anymore, and tells me that he thinks pregnant women and women should be careful with eating fish from here, but old boys ("grabbar") like him can eat fish frequently! (Swedish man in his 50s, fishing at Strömmen next to the Old City).

Pollution, and information about pollution, is thus an important concern that city planners need to address to safeguard ecological and public health (Knuth et al., 2008; Fisher et al., 2010; Bingham et al., 2014; Lauber et al., 2017; Lucas & Polidoro, 2019). Some add that catch-and-cooking fish can be preferred over catch-and-releasing fish from a perspective on animal wellbeing (Arlinghaus et al., 2012) and local food security (Embke et al., 2022). This makes the reduction of pollution in urban waters imperative for making cities both ecologically and socially more sustainable and resilient.

Image 2: Fishers at Nacka Strand, a popular spot to fish herring. Image by Tessa Joosse

Planning for humans and non-humans on and under water

Global data analysed by Embke et al. (2022, p. 1) show that consumption of fish caught in urban settings is increasing globally.

It is still unknown, however, how much fish caught in the city contributes to food security (Drakopulos et al., 2020, p.3), because the amount and availability of harvest data is lacking, making it hard to produce accurate estimations (Joosse et al., 2021, p.5; Embke et al., 2022, p. 1).

Nevertheless, development of urban environments and its blue spaces requires attention to safeguarding food safety and security as well as equal access. These aspects can be incommensurable and therefore hard for planners to achieve at the same time. Not in the least because of their interrelatedness, which means that if planners address one issue, (e.g. food safety) it will often have (unplanned and unanticipated) repercussions for the other issue, (e.g. equal access).

Some of these incommensurabilities and trade-offs were raised by the interviewees in our data, where they expressed concerns about current city development and how this affects the aquatic ecologies and the fish. Regular fishing spots are disappearing due to housing, industry or service developments on waterfronts in Stockholm. Interviewees e.g. highlighted how fish associations, ornithologists and environmental organizations protested against the new flood gates at Slussen due to its perceived consequences for life in and on the water.

The ecological knowledge that fishers in Stockholm have could be a valuable source of information to be used for making legitimate and prudent trade-offs between various planning goals and objectives. Yet, the question remains how to integrate such knowledge when planning for sustainable urban environments (see also Joosse et al., 2021), especially since much of that knowledge is tacit and embodied (Garavito-Bermúdez & Boonstra, 2022)

Moreover, food security is only one of the aspects urban blue spaces can contribute to. Urban blue space also offers people in the city an opportunity to engage with and experience an alternative and hidden urban reality. Making experiences of urban blue space possible, especially under the water, is a challenge. Fishing is certainly one way, but there are a number of innovative ideas that rely on other means as well. An example from the Netherlands can be used to illustrate ways of connecting people with the urban aquatic environments and its inhabitants. The projects “De paling is ook een Amsterdammer” (trans: The eel is also a citizen of Amsterdam) and “Stem voor de paling” (trans: Vote for the eel) tries to harmonize seemingly incommensurable needs of human and non-human dwellers. Here follows their description:

“The contrast between 'city' and 'nature' is no longer tenable. We are discovering more and more how rich the city is in non-human life and we also realize that we cannot live without it. It is essential that we learn to reconcile the city and its ecology and that we design in a

nature-inclusive way – also for the non-human city dweller. But to find out what the wishes of non-humans are, we will have to make an effort and learn to listen." (taken from: https://www.ambassadevandeno-ordzee.nl/projecten/in-gesprek-met-de-niet-menselijke-stedeling-stem-voor-de-paling-ii/)

Another example that supports the needs of fish while also creating a place for humans to connect with nature and its non-human dwellers, is a project just north of Stockholm city with the primary aim to support then Northern pike population. During the project's opening the initiators, consisting of the Stockholm City Council, WWF, and The Royal Djurgården Administration, explained how they had built a half-meter dam by a field called Lillsjön, enabling them to flood the field during the spring, creating a warm vegetational aquatic environment perfect for Northern pike to spawn in (i.e. lay their eggs). The water is let out in June and the pikes swim out, while ruminants graze there during the summer. The main goal has been to support pike populations, but the initiators see that from the project's first year the wetland has also contributed to an increase in biodiversity, by attracting other fish species, birds (e.g., ospreys), and various insects. In addition to this, the wetland also serves as a carbon sink and enhances the land's capacity to hold water during heavy rainfall, which is more frequently occurring in Stockholm. Wetlands in general can with time sometimes experience plant succession, requiring more tending and management to avoid overgrowth. However, in Lillsjön where the water will be drained every June, the initiators reflect that they will most likely avoid this problem of succession. As for the social aspect, the initiators have built an impressive patio for people to be able to easily observe the fish and birds in the wetland (and the grazing animals during the summer) (see image 1). At the official opening of the project, the day was introduced with a trumpeter's song, various speeches, and nature guides, while day-care children from the area stood proudly with their cut-out pike paper figures, representing the pikes in the wetland they had "adopted". The opening attracted a variety of people, locals, politicians, fishers, non-fishers, and birdwatchers, many keen and interested in the project.

It can be a challenge for us to create meaningful relationships with life below water. Yet, projects such as the one at Lillsjön or on the Amsterdam eel can help create an interest in the non-human dwellers living close to us. To do so, Driessen (2013) suggests we should tap into feelings of "awe" for fish and their mysterious life, instead of searching for similarity and familiarity with humans, which often can be the case when trying to connect with non-humans. Driessen (2013) proposes that adopting instead an "ethics of awe" can help recognize there is much with non-humans that is beyond humans, and by nurturing this awe and curiosity it can create respect and care for fish.

Image 3: Opening of the project at Lillsjön in Stockholm, and image of the newly built patio. Top images taken by Anja M. Rieser, the bottom image taken from the Stockholm City Fish Welfare Facebook page (https://www.facebook.com/fiskevard)

Conclusion

Just as planners some decade ago discovered the 'goods and services' that nature in the city provides, they are now discovering that urban nature does not stop at the waterfront (Beatley, 2014; 2018). It continues in, on and under the water. Although it is much harder to observe and understand what goes on there, we have highlighted in this paper that there are ways to get to know the blue urban commons. One of these is observing and talking to people that spend time by, on and in the water, such as fishers. But next to fishing, we have to also consider alternative ways of connecting. New ways of thinking about species as fellow city inhabitants, new technologies (e.g. underwater cameras), and the creation of new nature places can help to relate city dwellers to urban blue space. These experiences might allow us to handle the incommensurable goals of urban planning and to have us co-exist in and engage sustainably with our environment.

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Cultural Perspectives on Climate Change

Abstract

The focus of the paper is the intersection between culture, art, and sustainability and how artistic perspectives can contribute to addressing climate change in waterfront areas.

The methods that are used in this paper rely on a range of academic reports and papers that explore the different dimensions of sustainability and the challenges of achieving a sustainable society in the context of climate change in the northern European countries, focusing on the role of art; how it enhances waterfront preservation and its capacity to foster social engagement.

Through the involvement of Intercult as a principal partner, the paper illustrates the ways in which art can inspire and engage experts and communities to take meaningful action to promote sustainability and cultural heritage especially in waterfront areas. The projects aim to increase cultural activity in urban waterfront areas, encourage policy change and investment in cultural initiatives, generate cross-disciplinary collaborations, and create capacity-building opportunities. They seek to develop urban waterfront areas that are more inclusive, accessible, and environmentally responsible through collaborative efforts with local communities, artists, policy-makers, and other stakeholders. The projects also emphasise the importance of environmental education and the use of emotions and creativity to engage audiences and promote new ways of doing and being. By engaging residents and other stakeholders, these projects have been able to ensure that the needs and priorities of the community are reflected in the final design, resulting in more inclusive and equitable outcomes.

Figure 1: Image by Elisavet Papageorgiou

By demonstrating the benefits of bringing together diverse perspectives and expertise, these projects offer valuable insights for creating more vibrant, inclusive, and environmentally responsible urban waterfront communities that are better equipped to cope with the challenges of climate change.

Introduction

Climate change has moved from a purely theoretical subject to an apparent reality in everyday life. As the American environmentalist Bill McKibben (2005) pointed out, people never really understood climate change. "But oddly, though we know about it, we don't know about it. It hasn't registered in our gut; it isn't part of our culture. Where are the books? The plays? The goddamn operas?" he wondered. It is undisputed that art can translate the often incomprehensive scientific facts into human emotions (Anker, 2004) and break the intangible issue of climate change into small personal components (Moser, 2014). In everyday life, culture and art generate economic and social capital therefore, they are important for the economy, as well as for human health and well-being, social cohesion renewal and perhaps most importantly, shape urban identity (Blessi et al. 2012). Nevertheless, the potential of culture to promote environmentally sustainable cities remains largely unexploited (Bulkeley, 2005).

Methods and Materials

The methods and materials employed in this paper encompass a range of scholarly reports and papers, as well as case study cultural and interdisciplinary projects. Several key references will be employed in this paper, including reports from the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Environment Programme (UNEP), as well as scholarly papers from leading experts in the field. These sources were utilised to provide a comprehensive understanding of the topic at hand, with a particular focus on the intersection of art and sustainability.

In addition to the academic literature, case study cultural and artistic projects, in which Intercult played a key role as a primary partner, were also utilised as a key source of information. These projects offered a practical, real-world perspective on the ways in which art can be used to promote sustainability and cultural heritage, providing valuable insights into the methods and techniques employed by artists, as well as the challenges and opportunities associated with such endeavours.

Overall, the combination of scholarly reports and papers, along with case study artistic projects, provided a rich and multifaceted foundation for the research presented in this paper. By drawing on both theoretical and practical sources, we were able

to offer a nuanced and insightful analysis of the ways in which art can contribute to the achievement of sustainability goals.

Interconnecting Aspects of Sustainability: Mapping the Links to Sustainable Development

Sustainability is a multifaceted concept that involves balancing economic, social, cultural, and environmental aspects to ensure that the needs of the present generation are met without compromising the ability of future generations to meet their own needs. The Sustainable Development Goals (SDGs) provide a framework for achieving sustainability across different dimensions.

Environmental sustainability is one of the key dimensions of sustainability, which focuses on maintaining ecological balance and preserving natural resources for future generations. Brandt (2018) defines environmental sustainability as "the preservation of natural systems and their functions and the protection of biodiversity and ecosystems from human-induced impacts." The framework for environmental sustainability includes reducing resource consumption and waste, reducing carbon emissions, and promoting renewable energy (Sarkis, 2012). The SDGs encompass various objectives pertaining to environmental sustainability, including Goal 13 that endeavours to mitigate the impacts of climate change and Goal 15 which aims to safeguard and rehabilitate ecosystems and biodiversity. David Gritten and John Innes (2019) highlight the impact of SDGs on forests and people, emphasising the importance of forest conservation and sustainable forest management to achieve environmental sustainability.

Social sustainability focuses on promoting equity, social justice, and human well-being. The concept of social sustainability is defined as the ability of a social system, such as a nation, to function continuously at a predetermined level of social well-being (Littig et al., 2010). Meanwhile, a comprehensive social sustainability framework emphasises the importance of promoting social cohesion, equity, diversity, and participation (Dale et al., 2005). The SDGs aim to achieve the eradication of poverty through Goal 1 and pursue gender equality via Goal 5. Nonetheless, the realisation of social sustainability necessitates addressing systemic issues like inequality, discrimination, and social exclusion.

Economic sustainability focuses on creating a resilient and stable economic system that provides for the needs of present and future generations. Rogers et al. (2021) define economic sustainability as "the ability of an economy to provide for the well-being of current and future generations without undermining the

natural, social, and human capital on which economic activity depends." Kaivo-oja et al. (2018) present a framework for achieving economic sustainability, which encompasses the advancement of economic growth, poverty reduction, and the promotion of sustainable consumption and production. This framework is consistent with the SDGs' Goal 8, aimed at promoting sustained, inclusive, and sustainable economic growth, and Goal 12, aimed at promoting sustainable consumption and production patterns.

Cultural sustainability focuses on preserving and promoting cultural diversity and heritage. Cultural sustainability is characterised by the capacity of a cultural system to operate in a dynamic and evolving manner, while simultaneously preserving its cultural diversity, heritage, and values (Derr et al., 2016). It involves preserving cultural landscapes, promoting traditional knowledge and practices, and respecting cultural rights and diversity. The SDGs include several goals that address cultural sustainability, such as Goal 11, which seeks to make cities and human settlements inclusive, safe, resilient, and sustainable, and Goal 16, which aims to promote peaceful and inclusive societies.

Figure 2: The interconnectivity of cultural Sustainability (Image by Elisavet Papageorgiou)

Cultural sustainability is crucial to achieving overall sustainability and is closely linked with environmental, social and economic sustainability. It involves preserving and promoting cultural heritage and diversity and recognizing culture's impact on values and identities (Reddy, 2016). Cultural sustainability can support economic sustainability by fostering cultural tourism and pre-

serving cultural assets, environmental sustainability through traditional practices and knowledge, and social sustainability by promoting inclusion and dialogue, addressing inequalities, and supporting community well-being through cultural practices (Higgins, 2019).

The Crucial Role of Culture and Artists in the Environmental Movement

The role of culture and artists in the environmental movement has been the subject of numerous studies and reports. In recent years, there has been a growing recognition of the potential of cultural activities and artistic expression to promote environmental sustainability and inspire action on climate change.

Several studies have highlighted the importance of artists in raising awareness and inspiring action on climate change. In a study conducted by the Pew Research Center (2015), it was found that art is a powerful tool for raising awareness about environmental issues and that artists can play a key role in shaping public opinion on climate change. Art can help disseminate scientific information while facilitating engagement and activating emotions which aids communication between researchers, practitioners, and citizens (Arce-Nazario, 2016; Chandler et al., 2010, Curtis et al., 2012; Marks et al., 2016).

Culture has also been identified as a critical factor in shaping values, beliefs, and behaviours related to environmental sustainability. Cultural values play a crucial role in shaping attitudes towards the environment and that cultural change is necessary to achieve sustainable development (Dietz et al., 2005). A report by the United Nations Environment Programme (2013) emphasised the need for cultural transformation to achieve sustainable lifestyles and consumption patterns.

Artistic expression can communicate the impacts of climate change on communities and ecosystems, making environmental issues more tangible and urgent to the public. Art can evoke emotions and inspire empathy, making climate change more accessible to a broader audience (Lindgren et al., 2018) while artistic projects can inspire innovative solutions to the climate crisis (Intergovernmental Panel on Climate Change, 2014).

Cultural institutions, such as museums and galleries, have also been recognized as important actors in promoting environmental sustainability. They could play a crucial role in promoting ecofriendly practices and sustainability education (Vatovec et al., 2015). Moreover, cultural heritage sites, such as museums, can highlight the history of environmental degradation and preserva-

tion efforts (International Council on Monuments and Sites, 2017).

Moreover, Curtis and colleagues were among the first to study whether art can be used as a tool for climate communication and how artworks portray environmental problems and affect public understanding (Curtis, 2009, 2010, 2011; Curtis et al., 2014). After conducting several studies on different artworks and art events, they concluded that environmental art can encourage pro-environmental behaviour through 1) communicating information in engaging ways, 2) creating empathy towards natural spaces, and 3) including art in sustainable projects to make them more attractive and engaging for the public.

Harnessing the Power of Art and Culture for Waterfront Preservation and Climate Change Mitigation

The integration of art and culture can play a significant role in enhancing waterfront preservation and addressing the effects of climate change. Promoting sustainable practices in art and cultural events is one such approach that can help mitigate the negative impacts of climate change. By incorporating environmentally friendly policies and practices in such events, we can reduce waste, energy consumption, and carbon emissions. This can be achieved by using sustainable materials, promoting public transport, and reducing single-use plastics, among other initiatives (UN Environment, 2018).

Another effective strategy is to incorporate themes of climate change into art and cultural exhibitions. Art is a powerful medium for communicating complex issues such as climate change. Through exhibitions and installations that highlight the impacts of climate change, we can raise awareness among the public and inspire action. Public installations that raise awareness of coastal hazards and resilience can also be effective in promoting sustainable practices (ICOMOS, 2013).

Creative placemaking is another strategy that can be used to revitalise vulnerable waterfront communities. Creative placemaking involves using arts and culture to transform public spaces and promote community engagement. By engaging local artists and cultural organisations, we can create vibrant and resilient waterfront communities that are better able to cope with the effects of climate change (Leitner et al., 2013).

Cultural tourism is another approach that can help promote local adaptation efforts. By developing cultural tourism that highlights local adaptation efforts, we can promote sustainable practices and raise awareness among tourists. Cultural tourism can

also help generate economic benefits for waterfront communities and promote local cultural heritage (Mika, 2016).

Encouraging artists and cultural organisations to adopt environmentally friendly policies is another critical step towards enhancing waterfront preservation and addressing climate change. By adopting policies and practices that reduce waste, energy consumption, and carbon emissions, we can reduce the negative impacts of cultural events and exhibitions (UNESCO, 2015).

Finally, collaborating with scientists, activists, and other stakeholders is essential in educating the public on climate impacts and solutions. By bringing together different groups of stakeholders, we can develop more comprehensive and effective approaches to enhancing waterfront preservation and addressing the effects of climate change. Such collaboration can help raise awareness, promote sustainable practices, and inspire action (IPCC, 2018; The Ocean Conference, 2017; World Bank, 2019).

The Integrated and Sustainable Nordic Region

The Nordic region has been a leader in sustainable development and green growth, with a high level of social trust and economic equality (Nordic Council of Ministers, 2019). The region has made significant progress in achieving the Sustainable Development Goals (SDGs), particularly in the areas of renewable energy, sustainable transportation, and circular economy (Nordic Council of Ministers, 2016). These achievements are reflected in the region's healthy populations with long life expectancy, which is among the highest in the world (Nordic Council of Ministers, 2019).

The Nordic region is also considered a good starting point for creating sustainable, green, and socially responsible societies. The region has implemented several policies and initiatives aimed at promoting sustainability, such as carbon pricing, eco-labelling, and sustainable public procurement (Nordic Council of Ministers, 2016). However, ensuring everyone's involvement, especially those who may have difficulty adapting to rapid societal change, remains a challenge. The United Nations (2015) has emphasised the importance of inclusive and participatory approaches in achieving the SDGs, which requires the engagement of all stakeholders, including marginalised and vulnerable groups.

Examining International Projects in Waterfront Areas

Through an examination of a range of international cultural projects conducted by Intercult and partners, this section illustrates the ways in which art can inspire and engage individuals and communities to take meaningful action to promote sustainability and cultural heritage, especially in waterfront areas.

The **"Memory of Water"**, a Creative Europe funded project, was an artist-led collaboration exploring post-industrial waterfronts, within the framework of community development and urban planning. The artists involved in the project, collaborated with diverse stakeholders such as citizens, community groups, politicians, and urban planners, to foster inclusivity by organising a series of culturally-enriching events and artistic interventions in the cities of Levadia, Gdańsk, Stockholm, Limerick and Govan. The participating partners from six countries collaborated on a programme including City Labs, international residencies, and a filmed documentary. The full programme of 23 interconnected activities was developed to meet three priorities: audience development, capacity building and transnational mobility.

The aim of the project was to engage local communities in six cities and to share information about the regeneration process, while finding new ways to move forward together. The residency themes focused on memory and heritage, access and inclusivity for under-represented communities, and environmental responsibilities and impacts. The project placed a significant emphasis on sustainability and the dissemination of its results through an extensive network of partners and the River//Cities Platform Foundation, led by Iwona Preis from Intercult. The River//Cities Platform Foundation has set out to increase the impact of culture on the sustainable development of European urban waterfronts for the benefit of their citizens. To achieve this aim, the foundation has identified several main objectives. These include increasing cultural activity in urban waterfront areas, encouraging policy change and investment in cultural initiatives, generating cross-disciplinary collaborations, and creating capacity-building opportunities.

By engaging local communities and emphasising sustainability, the project and the foundation have contributed to the development of urban waterfront areas that are more inclusive, accessible, and environmentally responsible. Through their collaborative efforts, the River//Cities Platform and the project partners have sought to create positive and lasting change in the communities they serve. (Intercult, n.d.a)

Memory of Water and River//Cities identified the specific needs of cities and their communities located near water sources, initiating artistic response and creative dialogue between local artists, local communities, and citizens across several European coastal and river cities. In this project, it was discovered that socially engaged, interventionist artistic practice can be very powerful in sparking cross-sectoral dialogue, developing the capacity of communities, policymakers and politicians to break out of the structures of accepted narratives and invent new, innovative solutions to those problems. The interventions made a real difference on the ground to planning and policy. Moreover, the works of art had a crucial educational effect, as in environmental education, evidence suggests that it is better approached through emotions and generally through art because creativity engages the learners during the learning process: opening hearts and minds to new ways of doing and being (Kyriazakos, 2019).

Figure 3: Govan docks intervention by Mary Conroy (Photo credits: Fablevision)

Figure 4: SIMKA performance in Stockholm (Photo credits: José Figueroa)

Figure 5: “Let the river take it” community action in Levadia (Photo credits: Intercult database)

Figure 6: Intervention from Mary Conroy in Gdansk (Photo credits: Intercult database)

Figure 7: Oskar Gudehn performing in Stockholm (Photo credits: José Figueroa)

The **Connecting Georgia** project, which took place from 2019 to 2020, was led by artists and aimed to explore post-industrial maritime heritage in the context of urban planning and community development. It sought to connect Batumi, a city in Georgia, with other European cities and was linked to the Creative Europe-funded Memory of Water project, which involves six partners in Europe. Connecting Georgia was financed by the Swedish Institute, Third Country Participation in the Baltic Sea Region.

Through co-creation and research involving artists from Stockholm and Batumi, Connecting Georgia intended to initiate a larger international dialogue about the challenges of urban planning and urban development in waterfront cities with post-industrial cultural heritage. Due to the Covid-19 pandemic, the project had to adapt its plan of having two Swedish artists living in Batumi to include more digital exchange of ideas and exposure. The pro-

Figure 8: Mural from Siegfried Vynck in Levadia (Photo credit: Intercult database)

ject aimed to investigate the impact of artists on planning of waterfronts with post-industrial cultural heritage.

Ten artists in total participated in the project, with each developing an artistic intervention that explores post-industrial cultural heritage, social sustainability, and urban development. The project concluded with a hybrid (partly physical, partly digital event) City-Lab in each city, which served as a platform for citizens, artists, experts, non-governmental organisations, and the public sector to come together and create ideas, tools, and technologies that address local challenges in a European context. (Intercult, n.d.b)

The **SOS Climate Waterfront project**, running from 2018 to 2023, is a collaborative effort that brings together experts from various domains to develop comprehensive strategies for sustainable urban development in vulnerable waterfront areas. Through an interdisciplinary methodology, the project aims to bridge the gap between urban and landscape planning, architectural design, and technology in water-related strategies. The project disseminates its results through international and regional networks and fosters a think tank that involves culture, academia, business, politics, and the environment.

Intercult's involvement in the project brings a crucial cultural aspect to the initiative. Intercult's expertise in intercultural and international communication contributes to promoting a more holistic and inclusive approach to urban development, taking into account the social and cultural dimensions of sustainability. Intercult is closely collaborating on communications of SOS with the pan-european River//Cities platform foundation. This leads to more effective and equitable solutions that benefit all members of the community, including those who may have been marginalized or excluded from traditional planning processes.

Overall, the integration of cultural diversity and cross-cultural communication in the SOS Climate Waterfront project highlights the importance of recognizing and valuing cultural differences in addressing complex environmental challenges. The project's interdisciplinary methodology and multinational collaboration provide a unique opportunity for cultural exchange and cross-cultural learning. This exchange of knowledge and ideas among diverse groups of experts with different cultural backgrounds can lead to a more comprehensive understanding of the challenges posed by climate change and water management in different regions. By embracing cultural diversity, the project can promote a more inclusive and sustainable future for waterfront areas and their communities.

Figure 9 (following page): SOS workshop in Gdansk (Photo credits: Intercult database)

Figure 10 (following page): SOS conference in Stockholm (Photo credits: Intercult database)

I_Improve was a joint project involving six European partner organisations aimed at promoting creative changes in their own operations and those of others. The partners embarked on a guided tour to explore innovative methods used in different countries to use culture to effect change, open up communities and places, invite and engage, and make an impact. The project sought to identify innovative, digital, and easily adoptable methods that can be transferred to the partners' businesses and realities.

The project was created as a response to the need for informal learning among cultural creators. The international and intercultural context provided a space for the flow of ideas, the exchange of thoughts, and the creation of mutual understanding and learning. Learning and creation took place in different settings, including a disused shipyard in Gdansk, an enclave of old buildings in Vilnius, a dementia clinic in Ostend, the water banks of the Danube in Vienna and a theatre venue in Södertälje. The aim of the project was to change the cultural organisations by making them more adapted to challenges in today's European and local societies, more modern, and engaged.

The project was a journey of change-making, with new goals, challenges, and methods that open paths to new audiences. Though difficult, the project promises to be a rewarding path to walk. (Intercult, n.d.c)

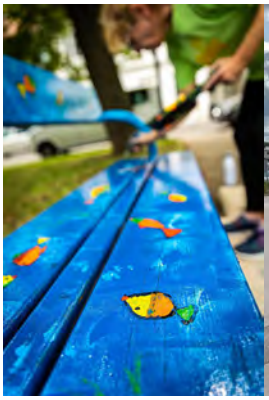

Figure 11: Benchmarking in Vienna (Photo credits: Bernd Herger)

Figure 12: Benchmarking in Stockholm (Photo credits: Intercult database)

Figure 13: Method roulette - Outcome of the project (Photo credits: Laimikis)

Figure 14: Creation of a game in Arsenale Venice (Photo credits: Intercult database)

The **Nordic Talks** event, organised by Intercult, was a sub-event of the SOS Climate Waterfront conference in Stockholm, funded by the Nordic Council of Ministers & Nordic Council. The talks brought together climate change experts, architects, urbanists, artists, and activists to discuss the future of cities in the Nordic context. The talks aimed to raise awareness, inspire change, and propose actions for a holistic goal that unites different social and political struggles.

The Nordic Talks' first session highlighted climate adaptation solutions for urban waterfront areas, emphasising the role of researchers and citizens in reducing car use and CO2 emissions (Intercult, 2020a). The second session focused on culture and artists in building social resilience, while the third proposed bottom-up solutions and engaging communities in sustainability efforts through art and culture (Intercult, 2020b).

The Nordic Talks event was part of something bigger. The first talk was linked as an associated event to the “Stockholm +50” international meeting hosted by Sweden and Kenya in Stockholm. The Talks were also relevant for Intercult’s active involvement in “We Don’t Have Time”, a review platform and social media network for those engaged in tackling climate issues. Overall, the Nordic Talks event provided a platform for experts, researchers, citizens, and artists to come together to discuss and create a common agenda for the future of our cities within the Nordic context.

Conclusion

In conclusion, sustainability is a complex and multi-faceted concept that requires addressing environmental, social, economic, and cultural dimensions. The Sustainable Development Goals provide a comprehensive framework for achieving sustainability across different dimensions, including waterfront resilience and addressing the effects of climate change. Artistic perspectives on sustainability offer significant opportunities for addressing climate change. Art and culture can provide a platform for raising awareness, inspiring actions, and promoting social cohesion around sustainable practices. Furthermore, artistic strategies can challenge dominant narratives and promote alternative visions for a sustainable future.

The projects presented in this paper highlight the importance of cross-disciplinary collaborations, capacity-building, and community engagement in promoting sustainability and cultural heritage in urban waterfront areas. These projects provide valuable insights and serve as a model for creating more vibrant, inclusive, and environmentally responsible urban waterfront communities that can better cope with the challenges of climate change.

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Thelma Celine
Dethlefsen, KTH

Sense the Marsh

Managing flood risk and reconnecting with nature

Abstract

This paper briefly outlines the outcome of an architectural thesis done by Thelma Dethlefsen at the Royal Institute of Technology (KTH) in 2022. It investigates the importance of architecture and landscape design in creating adaptive, and resilient strategies to flooding and sea level rise. The project focuses on the Tøndermarsk area near the Wadden Sea in Denmark and investigates designs that encourage interaction and awareness with the surroundings. It explores how we can embrace the uncertainty of flooding, spatial multi-functionality and change over time and use flooding as a quality and catalyst to attract more people to the area, promoting sustainable waterfront areas. It is a project that engages with the interaction between humans, nature and non-human actors.

The study was guided by one key question: *How can flooding and circular principles in architecture become catalysts for rural revitalisation and resilience?*

Study background

The Danish Meteorological Institute estimates the sea level rise around Denmark to be 30 - 60 cm between 2005 and 2100. Consequently increasing the river discharge and flooding in Denmark. Denmark with its 8750 km long coastline has adopted a strong water risk management. Dikes, canals, locks and pumping stations became the framework on which society is built, and this heavily influenced the perception of water and the way we live and interact with it.

This study focuses on the area encompassed by the river Vidå in Tøndermarsken and in specific the northern area of Margrethe Kog, in Tønder municipality. It is the municipality in Denmark which is most at risk of flooding and despite having a large ecological value and scenic landscape, it has experienced a 12 % decline in population since 2000. The area is created by the sea and shaped by people, and this co-existence is unique.

It is part of the Wadden Sea National Park. The Wadden Sea is the largest tidal flat system in the world, spanning across 500 km of coastline along Denmark, Germany and the Netherlands. Its existence is crucial for migratory birds and biodiversity on a global scale. It is vital that we protect the nature and biodiversity of the area.

More people are living in cities than ever before, thus the gap between humans and the natural world is increasing. There is a tendency to spend more hours inside than outside. In order to want to protect nature we need to reconnect with it.

Figure 1 (following page): Information concerning the study area

WATER THREAT

8,750 km of Coastline

DECLINING NATURAL AREAS

62 % Agriculture
14 % Nature
0.5 % Untouched Forest

UNIQUE BIODIVERSITY

Biodiversity on a global scale is reliant on the Wadden Sea

FLOODING + DECLINING POPULATION

Backlash from the River Vidå and increase in North Sea water levels
Declining population by 0,6 % yearly

UNESCO HERITAGE SITE

Important bird habitat

We are facing an unpredictable and uncertain future due to climate change. In recent years there has been a focus on large scale preventive measures. However, there is lacking research on how to build for uncertainty. Human history on the site shows that with the sea as both friend and foe, people's livelihoods as fisherman, eel farmers, reed harvesters and artists depended on the water, and settlements were made that adapted to the landscape and natures cycles. Inhabitants through time have placed their farms on raised dry sandy areas called "Geest" or built artificial elevations "Værfts" to be safe during storm surges and extreme floodings. When flooded the farms would stand on small islands and inhabitants would use boats to sail around. There is a need to learn from history and start to acknowledge that some areas will flood and use this as a resource and catalyst to make architecture that tries to reconnect with water and nature in a sustainable way.

This project builds on the following guiding principles, assumed by the author of this paper for designing the site in a sustainable approach:

- *Flooding and sustainable principles in architecture can become catalysts for rural revitalisation and resilience.*
- *Landscape and ecology become providers of catalytic strategies that can embrace uncertainty, multi-functionality and change over time.*
- *The interaction between humans and nature can be encouraged through design.*
- *Architectural and landscape strategies can help create an adaptive, resilient and robust response to flooding.*

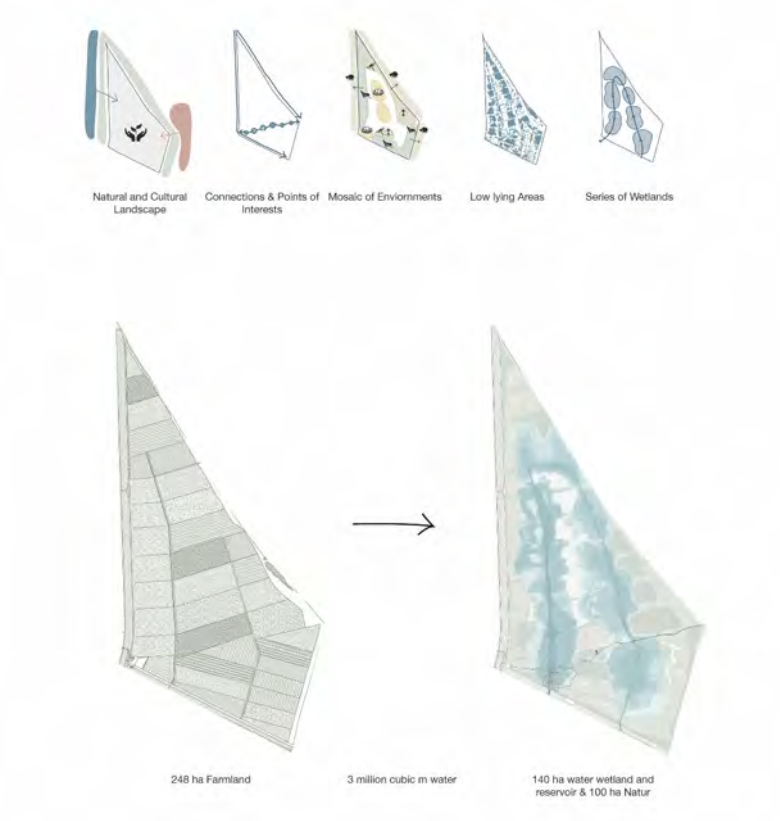
The Site Concept

Figure 2: Drawings showing the change in coastline from the 1500s until now, highlighting how people have tried to reclaim land to protect themselves from water

Figure 3 (following page): Land use of study area

Climate change is increasing the challenges of rising sea levels, storm surges, changes in rainfall, and rising groundwater. To meet these challenges this project suggests a so-called nature-

based coastal defence with absorbent wetland bodies and adaptable architecture as a solution. In contrast to the hard defence with reflective borders like dikes, this is an approach that does not resist the water but rather acknowledges it and recognises it as an asset and force of nature. This way we can help create resilient waterfront environments where both nature and humans thrive.



To alleviate the flooding from the river Vidå the 248 ha area of agricultural land in Margrethe Kog north will introduce a series of wetlands that can absorb the 3 million cubic meters of water from the river. Along with the wetlands, a mosaic of environments will provide different conditions and habitats for the birds to thrive in: shallow waters, meadows, grasslands, sea shores, open landscapes and tall grasses. It is a bird mecca, where in one day you will be able to spot 60 000 barnacle geese. The change in coastline highlights hat it is a merging point of a natural and cultural landscape.

Figure 4: Design strategies for the site

Figure 5; Conversion of agricultural land to wetlands for flood prevention

Figure 6: Isometric showing how the structures expand out into the wetland; a combination of floating and static units. The timber structures are built for disassembly and with local materials to blend in with the natural environment

The site will enhance and make the local unique landscape accessible by boardwalks and tie in with hiking trails and the urban development of Højer Town. It should thereby encourage Tøndermarsken to become an even more attractive place to visit, live and work in.

As a visitor, your experience of the place will depend on what time of year you visit. This will encourage locals and tourists to return as their experience will never be the same.

The Design and Program

The program of the place is to create a dynamic learning landscape that changes depending on when you visit and offers a visual understanding of the change in water levels. Different routes take you around the site; some become flooded during the autumn, winter and high tide, highlighting the ever-changing landscape. Some routes are floating to allow the visitors the sensation of flowing with the water, others are static and thereby emphasise the change in water level. The series of buildings include a restaurant and Tasteland that promote the knowledge of the local edible flora and fauna. Overnight stay units are provided for ornithologists or bird enthusiasts who wish to study the birds on site. A bird watching tower enables you to get up close to birds but also watch them from afar. A water pavilion lets you take in and observe the rain falling through the roof. The entrance pavilion provides a swimming spot for the locals and viewing platform of the salt-lake across the river. The info-centre provides experiences of oyster catching, bird watching, and spreading awareness about sea level rise and climate change.

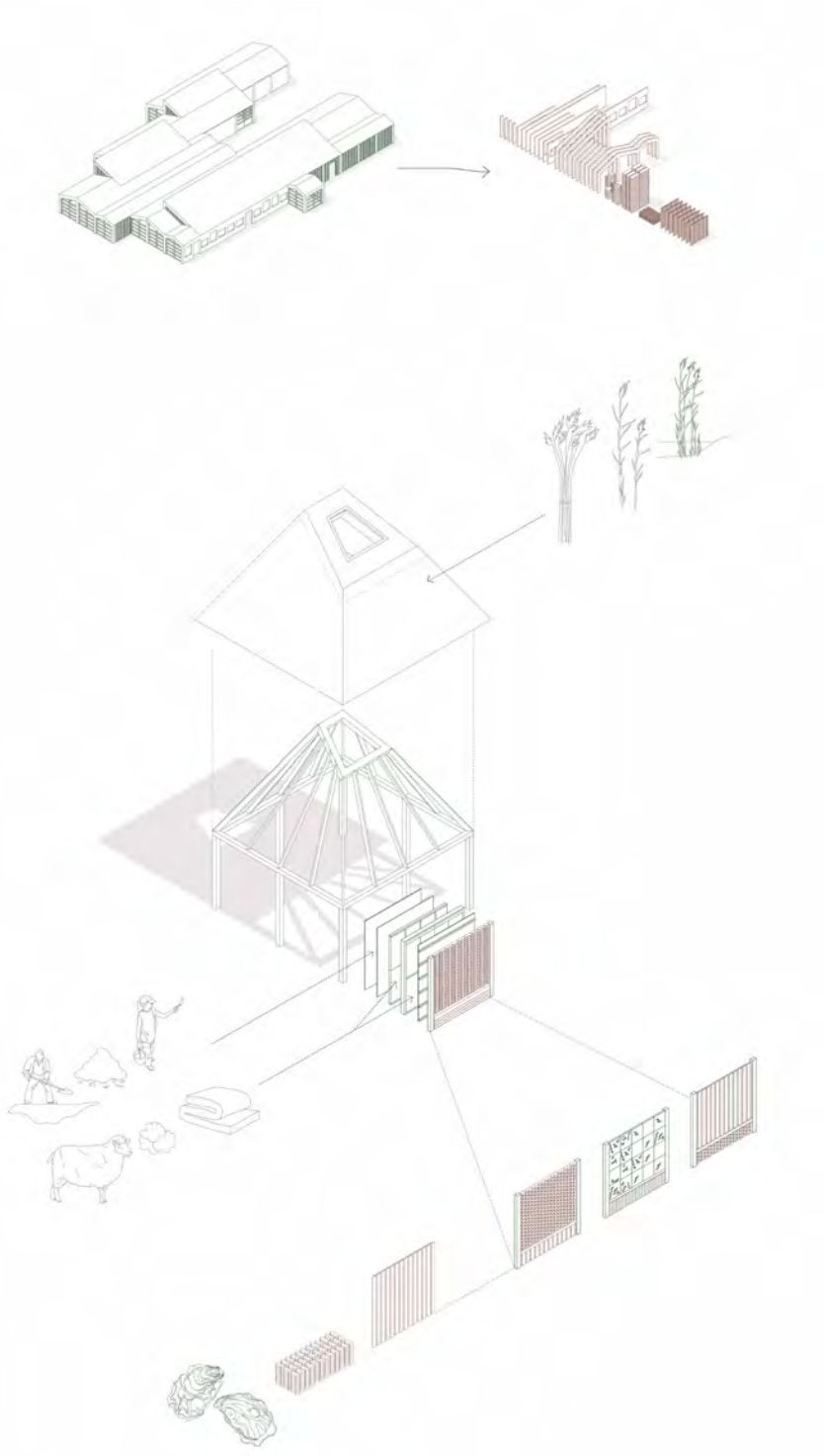
The importance of adopting a sustainable approach to architecture is crucial going forward. We must see every building as a depository of resources that culminate in the reduce, reuse and recycle loop. A goal must be to get rid of the idea of waste, and regard discarded material as a resource instead. The Wadden Sea and Tøndermarsken provide unique raw materials that can be harvested and used in sustainable construction. Locally grown straw is used for the roof. Clay extracted on site is used for the finish of the interior walls, and sheep wool for the insulation. The facade concept is inspired by old patchwork traditions in its flexibility where the wall infill can vary depending on what materials are at hand. The facade units reflect the marsh and promote habitats on the exterior side.

We need to take care of the nature present and make sure that the architecture added has little interference. The two buildings currently on the site, a restaurant for sale since 2008, and an information center will be selectively demolished, and materials such as glass, concrete frames, timber cladding, and pavement bricks will be re-used. Each structure has a window in the roof, to encourage a connection with the outside environment.

Figure 7: Diagrams showing the concepts for the different paths and ways of interacting with the water; i.e. floating paths, flooded paths, board walk etc.

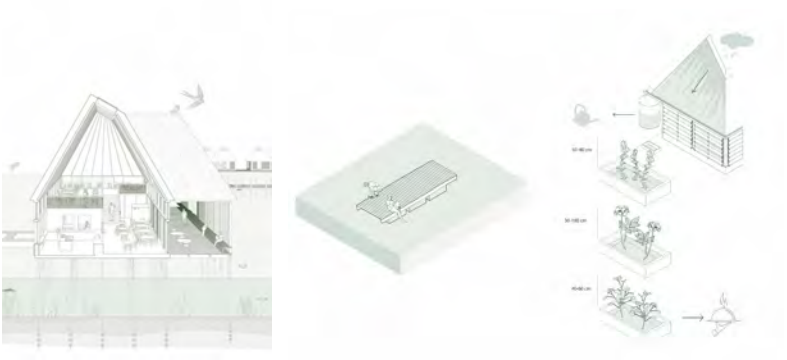
Figure 8: Render showing the structures from the south, extending along a pier and reaching out into the nature, allowing visitors to explore the area. The structures are supposed to mimic the landscape around them, causing little visual disturbance; i.e. the thatch roofs blend in with the reeds growing along the river

Figure 9 (following page): Building materials from the carefully demolished buildings will be reused



Seasonality

The theme of seasonality has been a strong driving design force. The exterior environment changes drastically over the course of a year and the architectural structures and their functions should do the same. The menu in the restaurant will depend on the local edible flora and fauna and change on a weekly basis. This will encourage visitors to come back and try something new throughout the year. The Tasteland is an engaging learning landscape and laboratory, where it is possible to learn how to prepare local edible flora & fauna, that you can then go collect outside later. Rainwater will be collected and used to water the edible plants grown in the Tasteland greenhouse to promote it being a self-sufficient and a sustainable business.



Other examples of how the design alters with time includes the oyster table; in low tide the oyster table is used for talks and as a meeting point on the mudflats. In high tide the oysters will cleanse the water and help raise awareness about the changing water levels. One oyster can filter about 190 litres of water per day.

There will be a series of outside, inside and semi-outside spaces to allow visitors to explore the area in all kinds of weather conditions and occupy the spaces accordingly.

Figure 10 (prior page): Perspective Section of the Floating Tasteland

Figure 11: Perspective Section of the Restaurant

Figure 12: Rainwater Harvesting to grow edible local plants to use in the tasteland laboratory

Inside/ Outside Spaces

Flooded path in winter vs. Summer path

Low Tide vs. High Tide Oyster Tables

Co-existence of humans and non-human actors

The co-existence between people, architecture, non-human actors and nature is of growing importance; there is a need to design with and for nature as well as humans in order to make more resilient solutions and environments that can adapt through time. Instead of introducing architecture and removing a piece of nature, the built environment could provide habitats for flora and fauna as well as humans. The bird watching tower includes different size bird homes in the façade to encourage birds living in the façade and humans to observe them from up close. Material studies and wall unit experiments with colour were made to attract birds and insects; specific colours attract specific species and encourage them to inhabit the wall.

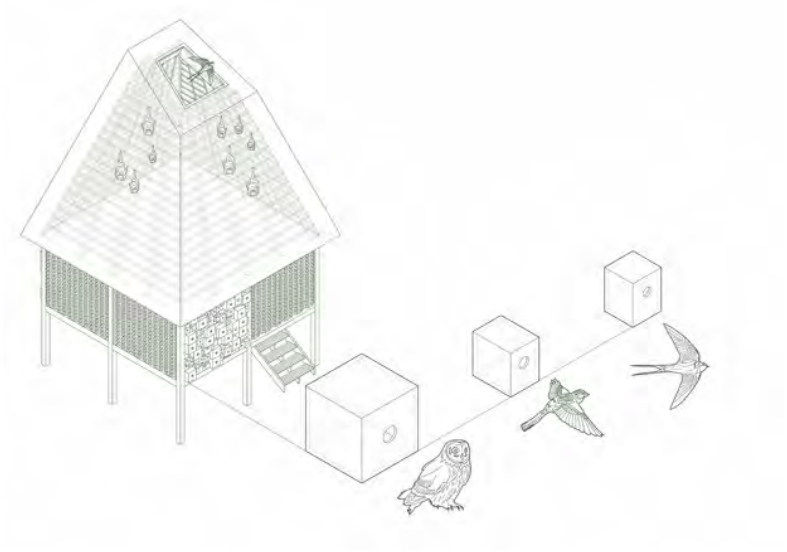


Figure 13 (prior page): Changing uses over the seasons

Figure 14: Inside the Tasteland - a cooking class for a local school class

Figure 15: Bird Watching Tower: Different size bird homes for different species

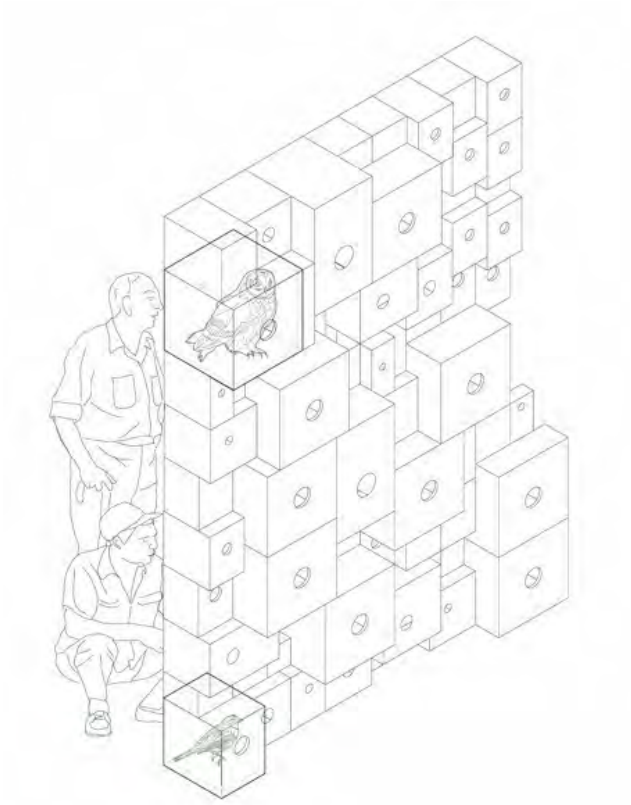


Figure 16: Bird watching from up close

Figure 17: Material studies

Figure 18: Example of facade element made of reuse timber and ecological wall made with crushed oyster shells. Through the seasons it will provide habitats for different species and visually reflect the seasons

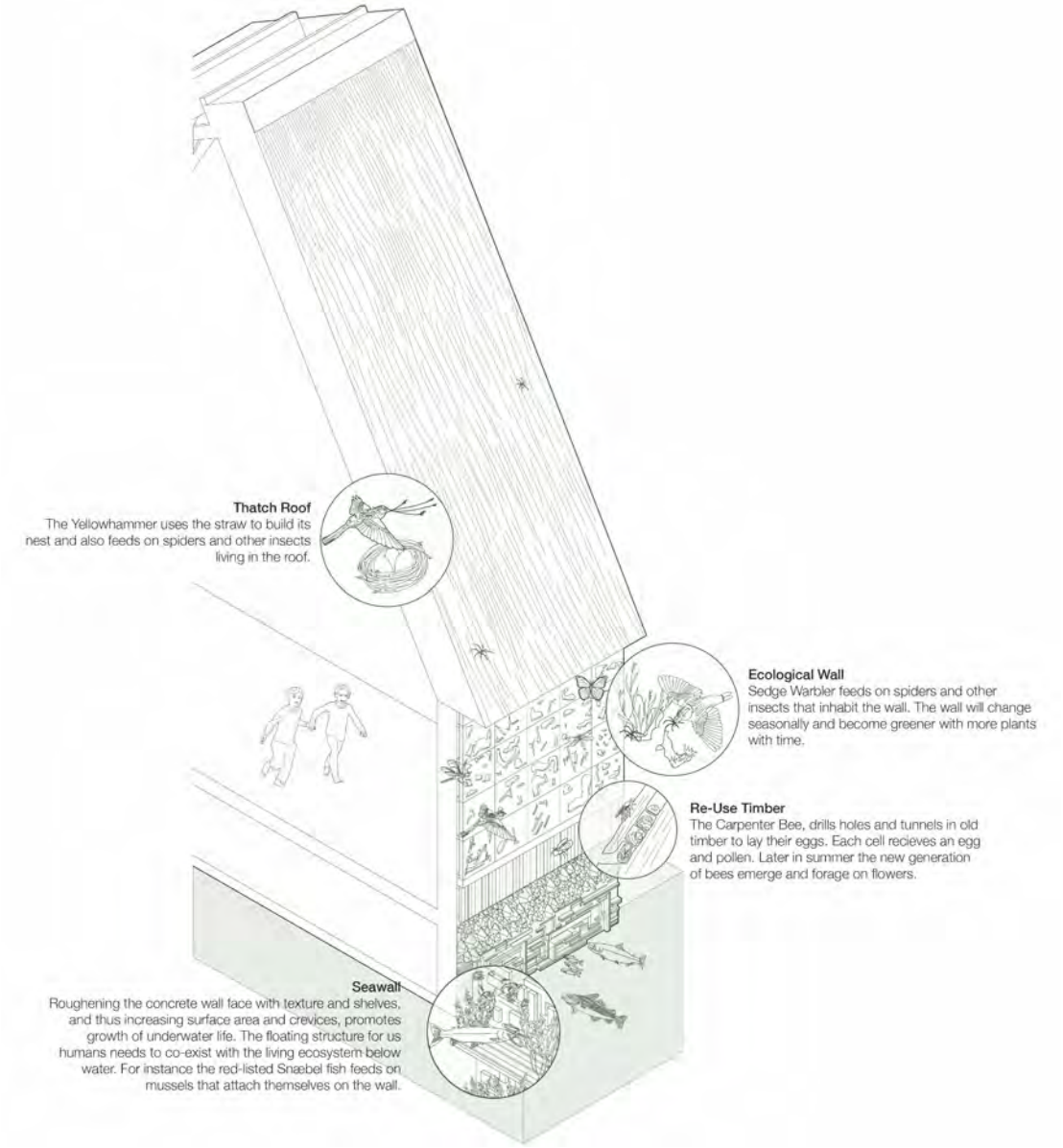
Figure 19 (following page): Facilities creating a connection to nature

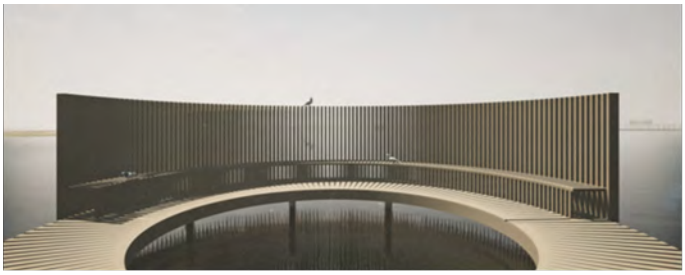
Figure 20: (following page): Façade section showing home on both sides of the wall

Bird Watching House on a gloomy day

Bird-Eye Perspective

Swimming Pavilion


Thatch Roof
The Yellowhammer uses the straw to build its nest and also feeds on spiders and other insects living in the roof.
Ecological Wall
Sedge Warbler feeds on spiders and other insects that inhabit the wall. The wall will change seasonally and become greener with more plants with time.
Re-Use Timber
The Carpenter Bee, drills holes and tunnels in old timber to lay their eggs. Each cell recieves an egg and pollen. Later in summer the new generation of bees emerge and forage on flowers.
Seawall
Roughening the concrete wall face with texture and shelves, and thus increasing surface area and crevices, promotes growth of underwater life. The floating structure for us humans needs to co-exist with the living ecosystem below water. For instance the red-listed Snæbel fish feeds on mussels that attach themselves on the wall.



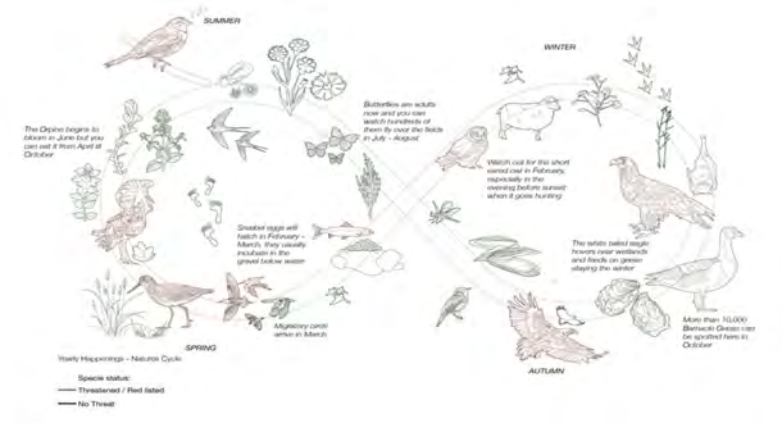
Bird Watching Pavilions placed around the site with different levels of visibility to hide from the birds and be able to come up close

Water Pavilion – listening to the rain

Water Pavilion – watching the rain fall through the roof opening

Pavilions are placed around the wetlands for visitors to respectfully and peacefully enter the nature and observe the life of the birds and other species around them.

Visitors are encouraged to come by even when it is raining. All your senses will be used when walking through the area. You will be able to hear the water falling through the opening in the roof of the water pavilion and dripping down into the water below. The theme of water is celebrated and used as an asset to create experiences on the site.



In conclusion, to be able to meet the challenges that rising sea levels and flooding pose, we need to design architecture and structures that can change and adapt to the environment around them. For instance, wetlands that can absorb the excess water or structures that can float or engage with the movement of the water. Our architecture can suit the needs of humans and simultaneously provide habitats for non-humans. We must begin to acknowledge the flooding and see it as a possible asset to be able to create resilient solutions for waterfront environments.

Figure 21 (prior page): Renders of different types of pavilions to allow visitors to observe nature

Figure 22: Yearly happenings – Natures Cycle

Part 2


Lövholmsvägen
Lövholmsvägen
Lövholmsvägen
Lärarhögskolan
Liljeholmen

Group 1
Ana Neiva,
Elena Paudice,
Magdalena Rembeza,
Metha Bregman,
Nils Brattgård,
Shea Nee Chew

Intertwining

Mending Nature and Memory

Site: Lövholmen

Intertwining

Mending Nature and Memory

Abstract

Lövholmen urban waterfront is currently undergoing major changes from a historic industrial area to a modern living neighbourhood. In this transition, there is a tension between the site's history and the economic interests provided by a site so close to the city centre. A good future for Lövholmen should achieve a balance between these economic interests, the ecology in the area, and the importance of social areas and history.

Even today, many people are active in various creative fields in the buildings in Lövholmen. Builders want to demolish these old, partly unused buildings and build new ones, while others wish to preserve the unique buildings and industrial history for their special character. The industrial history has left other marks too; the soil is contaminated by industrial waste and needs to be decontaminated before the land can be used again. Balancing the historic and environmental interests while also creating opportunities for new development with opportunities is the key issue in Lövholmen.

We envision an artistic neighbourhood, facilitating unexpected collaborations where artists, innovators, and investors work together with a common goal of creating an area known for its strong artistry. Producers and the investors share in business revenues to allow for a development that may not initially bring big returns, but over the long term can, through cooperation, become a Stockholm landmark. By seeing the area as a field or living lab, new partners can further be found in universities and various trial projects by civil engineering businesses, with a potential to reduce costs in construction and decontamination of the soil.

Drawing from the pre-existing infrastructures, the master plan mends local identity and memory, focusing on connections to Stockholm's city centre, a cultural square, housing, offices, and commercial buildings that are intertwined with nature through green, artistic corridors and microclimatic areas. To that end, several of the industrial buildings get new uses with social and artistic focus. The street network consists of resilient and permeable areas, facing the risks of climatic change without compromising

the safety of the residents and visitors. The waterfront itself is also used in new ways. New paths are constructed as art walks following the historical coastlines, once altered through the shipping of produced goods, and a closer connection to lake Mälaren is formed through floating pontoons that create a protected area for swimming in the summer.

Our vision transforms Lövholmen into a gathering place with attractive destinations for all people in Stockholm, focusing on the connection between nature and arts, a *mending of memory and nature*

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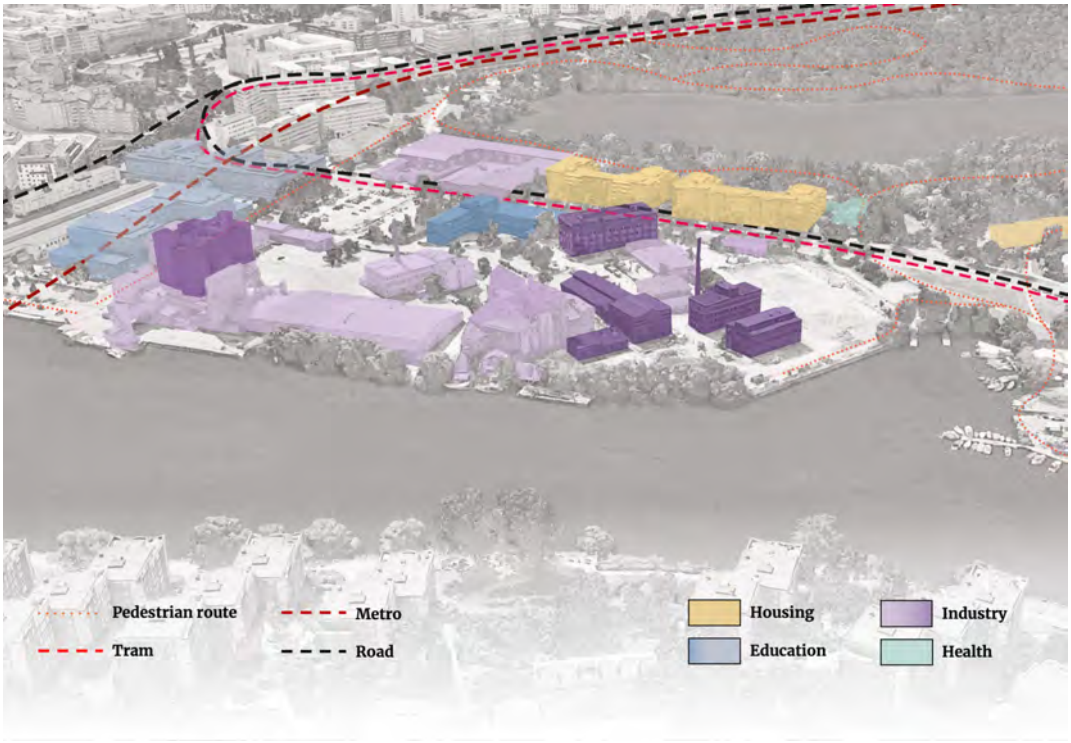
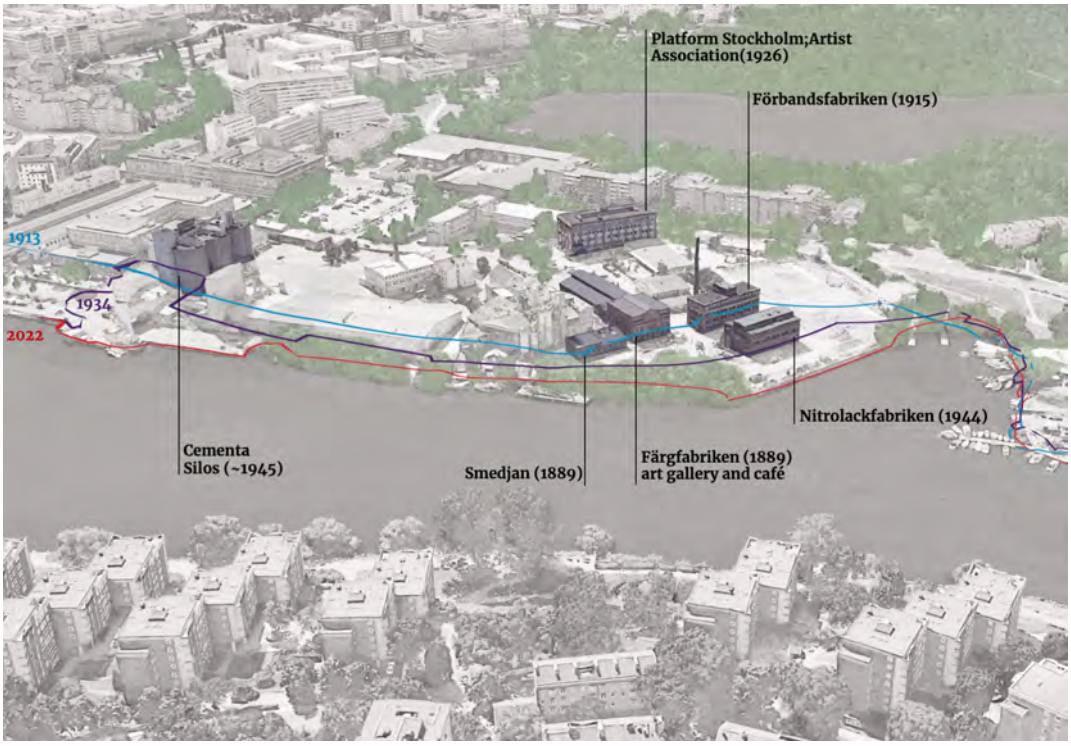

Pedestrian route
Metro
Tram
Road
Housing
Industry
Education
Health


Platform Stockholm;Artist Association(1926)
Förbandsfabriken (1915)
1913
1934
2022
Nitrolackfabriken (1944)
Cementa Silos (~1945)
Smedjan (1889)
Färgfabriken (1889) art gallery and café

Valuing industrial memory

Reuse industrial buildings

Safeguard the quality of water and soils

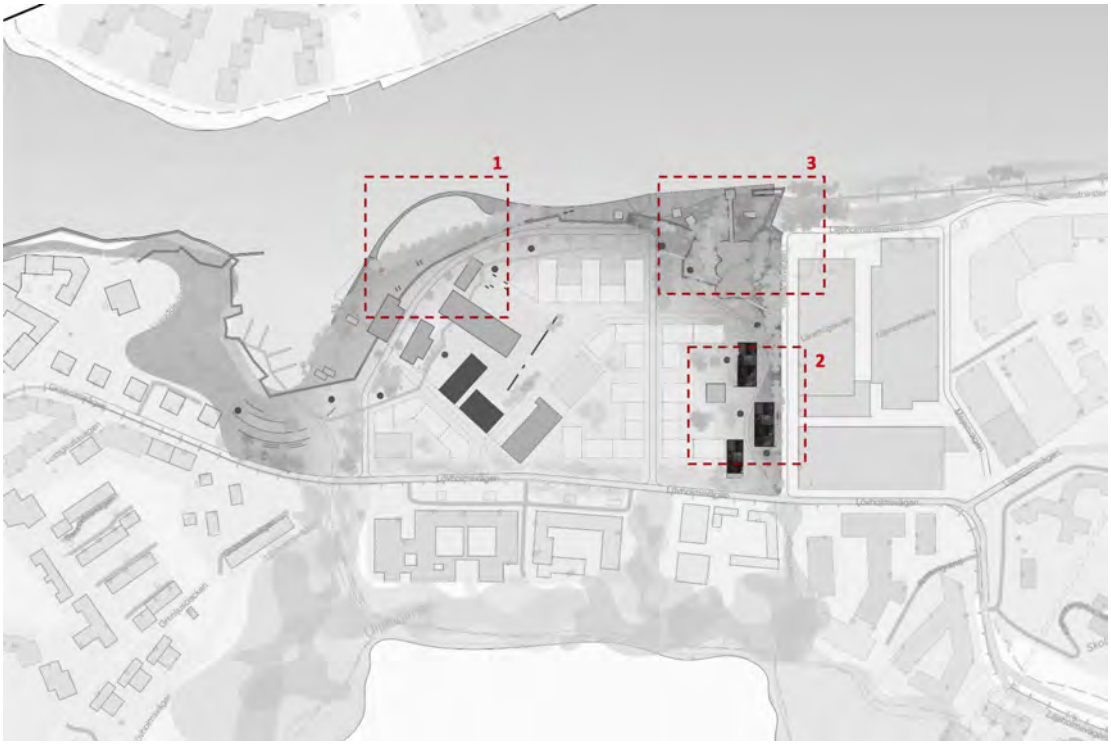
Pan phytodepuration interventions

Create an inclusive and comfortable area

Create areas suitable for living all day (Witer)

Create an environmental continuity

Create large green areas (urban Forest)


1
3
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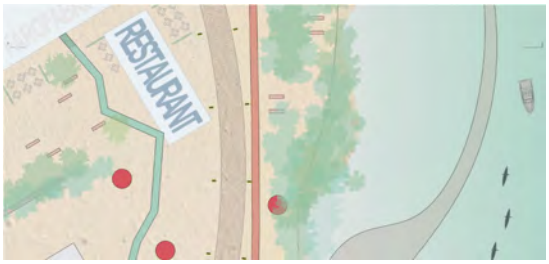
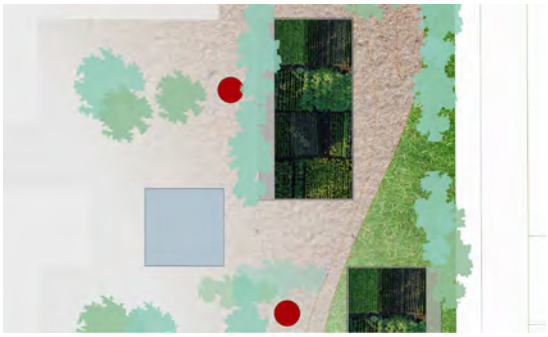
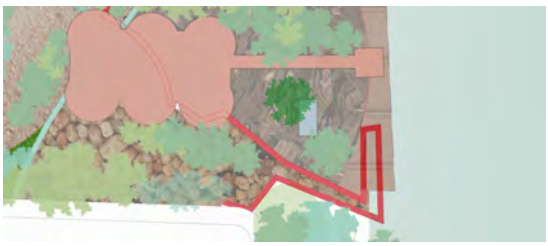
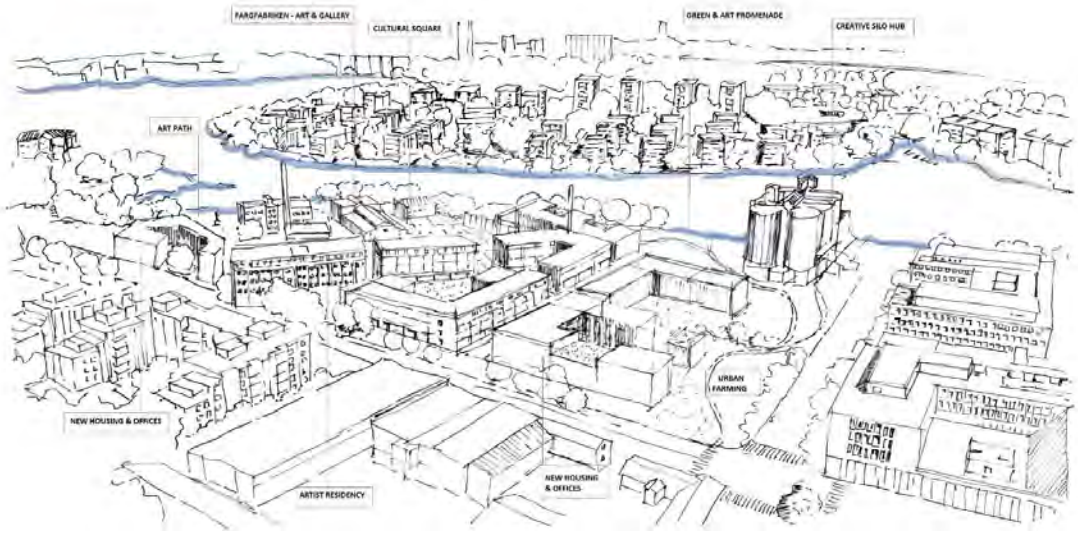






Top: Location 1
Middle: Location 2
Bottom: Location 3


FARGFABRIKEN - ART & GALLERY
CULTURAL SQUARE
GREEN & ART PROMENADE
CREATIVE SILO HUB
ART PATH
URBAN FARMING
NEW HOUSING & OFFICES
ARTIST RESIDENCY
NEW HOUSING & OFFICES

Group 2
Angelos Kottas,
Tullia V. Di Giacomo,
Tomasz Hoppe,
Letty Mora,
Sri Pascarini Agustina

Lövholmesnästet

Site: Lövholmen

LÖVHOLMESNÄSTET

Abstract

Lövholmen is a neighbourhood in southern Stockholm that until the 1860s was a largely undeveloped rural area. After the railway was pulled past Liljeholmen in 1860, the area became an important industrial site until the first decade of 2000. Within the urban development program from June 2008, new housing is planned in Lövholmen. Starting in 2014, "Gehl Architects" office was hired by the City of Stockholm and the property owners of the site to join a long-term process to develop a masterplan framework that was finally turned down in 2020.

The understanding of the "sense of the place" (dynamic structure, heavy industrial presence, and strong connection to the seafront) was the start of the project, linking it to the urban identity of the area.

The inspiration arose when we were informed that some years ago, opposite of Lövholmen, they tried to pass a resolution concerning killing the seagulls and destroying their nests. The seagulls were considered annoying by the people who were swimming and having picnics on that part of the island. We consider this act inhuman and hateful toward the wild fauna of the place. Therefore, the idea occurred to create a nest as a shelter for people.

LOGO

The logo is inspired by a bird nest and a string figure as one of the worlds' oldest games that illustrate both simple and complex figures. The name of the project was decided to be Lövholmesnästet, which combines the words Lövholmen and Näste (nest in Swedish). It is a way to address connections, to build relationships and to create safe spaces.

THE LÖVHOLMESNÄSTET PROJECT

The main aims of the project are:

- preserving cultural heritage
- safeguarding natural resources
- creating interconnection between people.

The Project is driven by a "red ribbon" that is used to create a space to host art, theatre, working spaces, playgrounds, and flexible uses. This element is removable, as part of flexible urban design. The red colour is chosen following the Swedish tradition of using bricks or painted wood (red due to the existing iron mines) and moreover as a reference to the paint factory that used to be in Färgfabriken. The "red ribbon" interacts with the buildings, creating and embracing spaces. From the environmental point of view, Lövholmesnästet considers the following green infrastructures to improve biodiversity and to respond to climate challenges:

- a rainwater garden and storage
- green roofs
- orchards and community gardens

STRENGHTS

•Good location;
•Good transport (near tram and metro);
•Unused land that can be redesigned;
•Close to residential buildings;
•Close to the waterfront;
•Buildings that have to be saved;
•proximity to the hospital;
•A lot of population in working age.

WEAKNESSES

•Contaminated soil
•Factory still open and running;
•Lack of connection with Reimersholme;
•Buildings that have to be saved;
•Close to residential buildings;
•Close to the waterfront;
•No visual connection to the water;

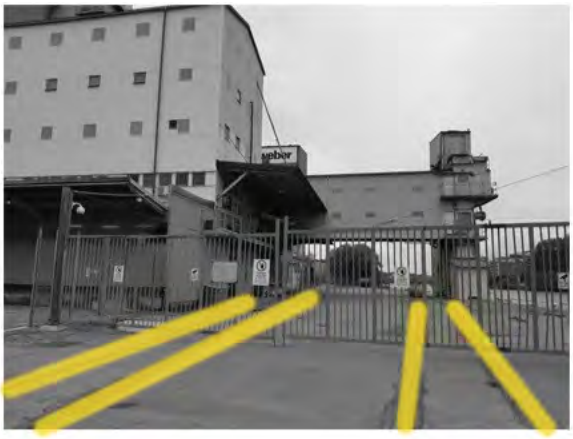
OPPORTUNITIES

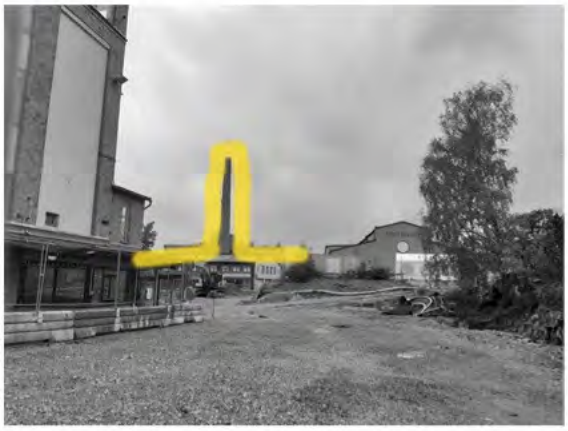
•Potential to become a multifunctional area where integration of many different groups can happen;
•It can become a special place to spend a day with the whole family;
•IT can be built as a sustainable place;
•IT can respond to various social needs;

THREATS

•There are several places in Stockholm with the same function;
•Noise pollution from Lövholmesnästet can be a problem for the nearby residents;
•Lack of connection with Reimersholme can make the place unattractive;
•It is planned as a sustainable place so building it and implementing all of the ideas can be expensive;


GOALS
A
PRESERVING CULTURAL HERITAGE
B
SAFEGUARDING NATURAL RESOURCES
C
INTERCONNECTION BETWEEN PEOPLE
multifunctional spaces
Keeping traces of the past
Improving Social index
Green and blue infrastructures
NEST that welcomes everybody

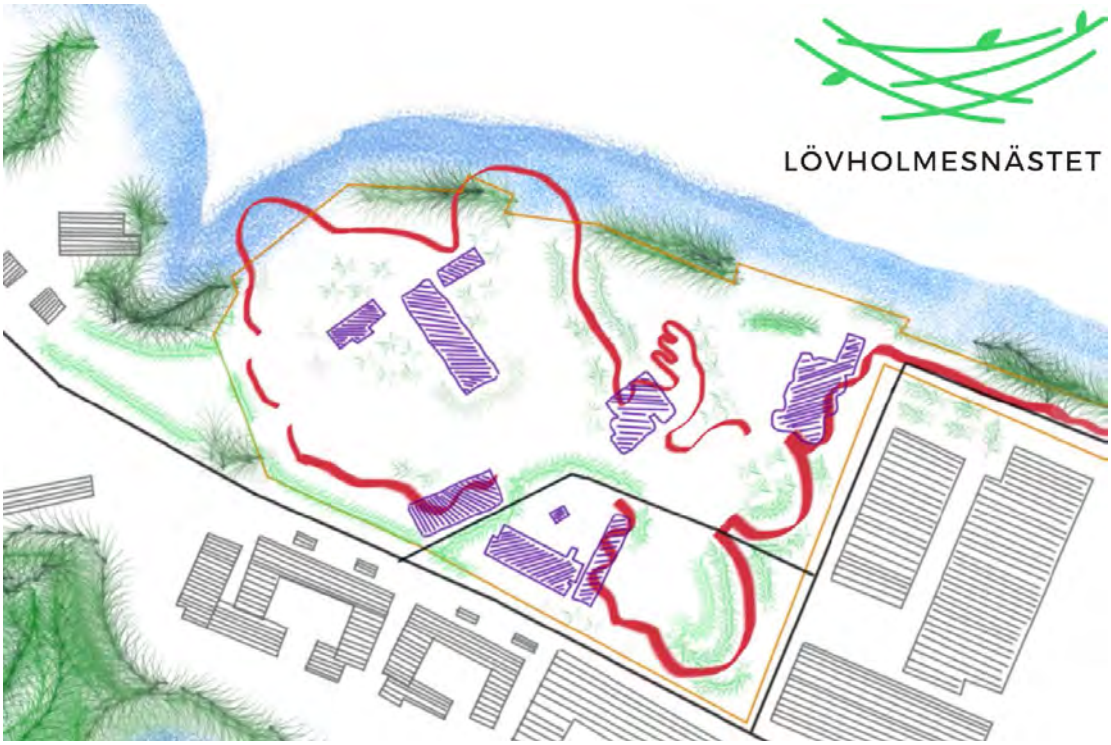




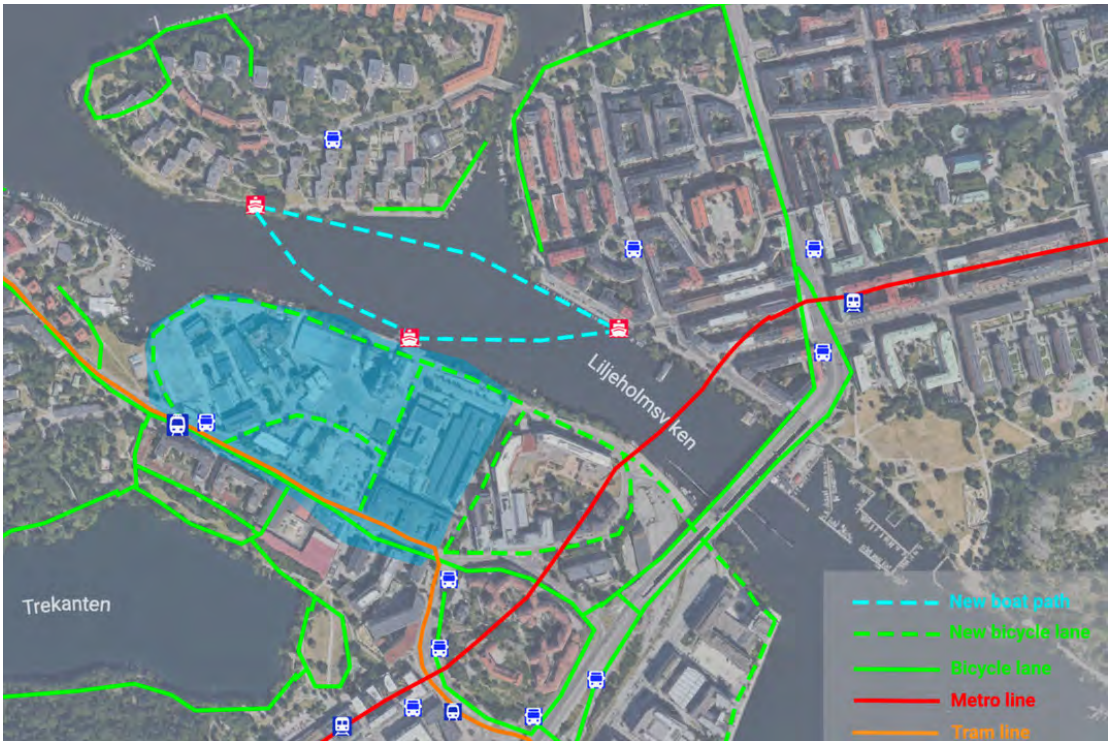
Safeguarding natural resources

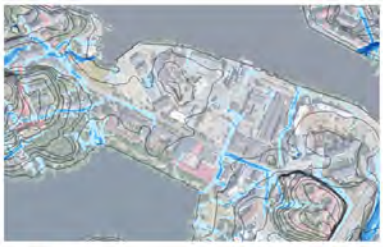
LÖVHOLMESNÄSTET

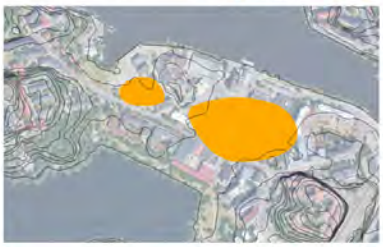
Preserving cultural heritage

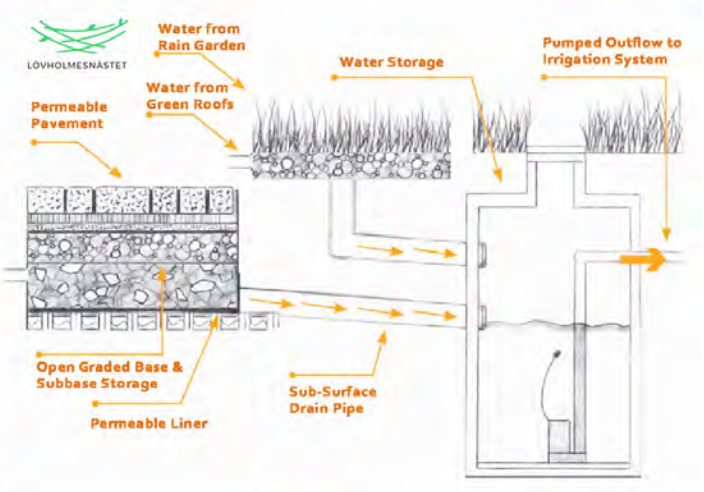

LÖVHOLMESNÄSTET

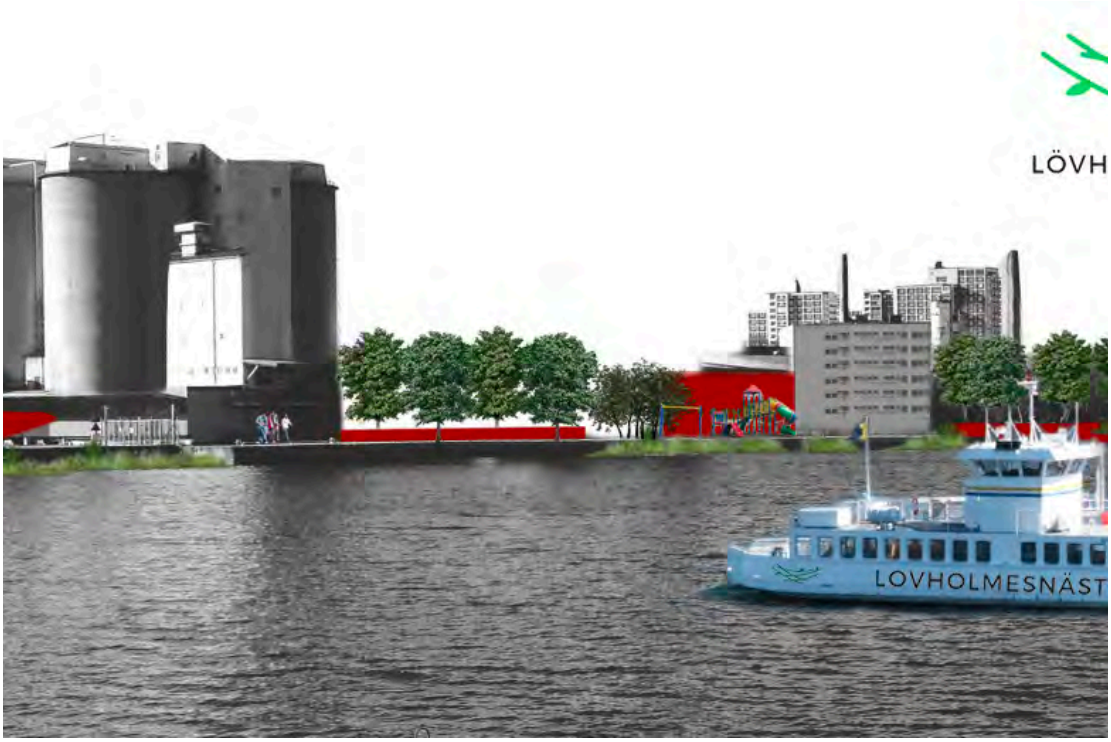

LÖVHOLMESNÄSTET
Legend
Green corridor
Permeable pavement
Recreational green areas
Rain gardens


Liljeholmsviken
Trekanten
New boat path
New bicycle lane
Bicycle lane
Metro line
Tram line






LOVHOLMESNÄSTET
Water from Rain Garden
Water from Green Roofs
Permeable Pavement
Water Storage
Pumped Outflow to Irrigation System
Open Graded Base & Subbase Storage
Permeable Liner
Sub-Surface Drain Pipe


LÖVH
LOVHOLMESNÄST


LÖVHOLMESNÄSTET


LÖVHOLMENMÅSTET
KINDERGARTEN

Group 3
Emma van der Saag,
Jacek Józekowski,
Karen Jonkers,
Marina Causí

The Arc

Site: Frihamnen

Abstract

Site Analysis

The municipality of Stockholm is planning to develop and densify a few areas in Stockholm. One of these is the harbour of Frihamnen situated in the north of Stockholm, in an area called The Royal Seaport. The harbour is mostly occupied by cruise ships and freight ships, transporting passengers and cargo from and to the city of Stockholm. The site is sparsely populated with only some housing to the west of the site, little to no greenery and a few historical buildings. Additionally, Frihamnen has some cultural and commercial activities, mostly situated on the pier. Southwest there is a cultural centre with a collective art studio, Blivande, which we believe is an important actor in the area. They organise workshops and host social activities in Frihamnestorget.

As a harbour, Frihamnen is affected by cruise ships that cause noise pollution, air pollution, and block the waterfront view. Globally, the cruise ship industry is also known as a great polluter not only when the cruise ships are in use but even as they are being disassembled, usually in terrible conditions in ship graveyards in Pakistan or Bangladesh. Therefore, we believe rethinking the end use of these ships is not only interesting for Frihamnen, but also for the cruise ship industry.

Vision and Goals

The main thinking tool we used during our project was the concept of Doughnut Economics, invented by Kate Raworth. This concept represents the space in which humanity can thrive while living within our planetary boundaries and social boundaries. This concept intrigued us because it not only includes planetary limits, but also includes human needs. Thus, the dual focus on social and environment is the main driver in our project.

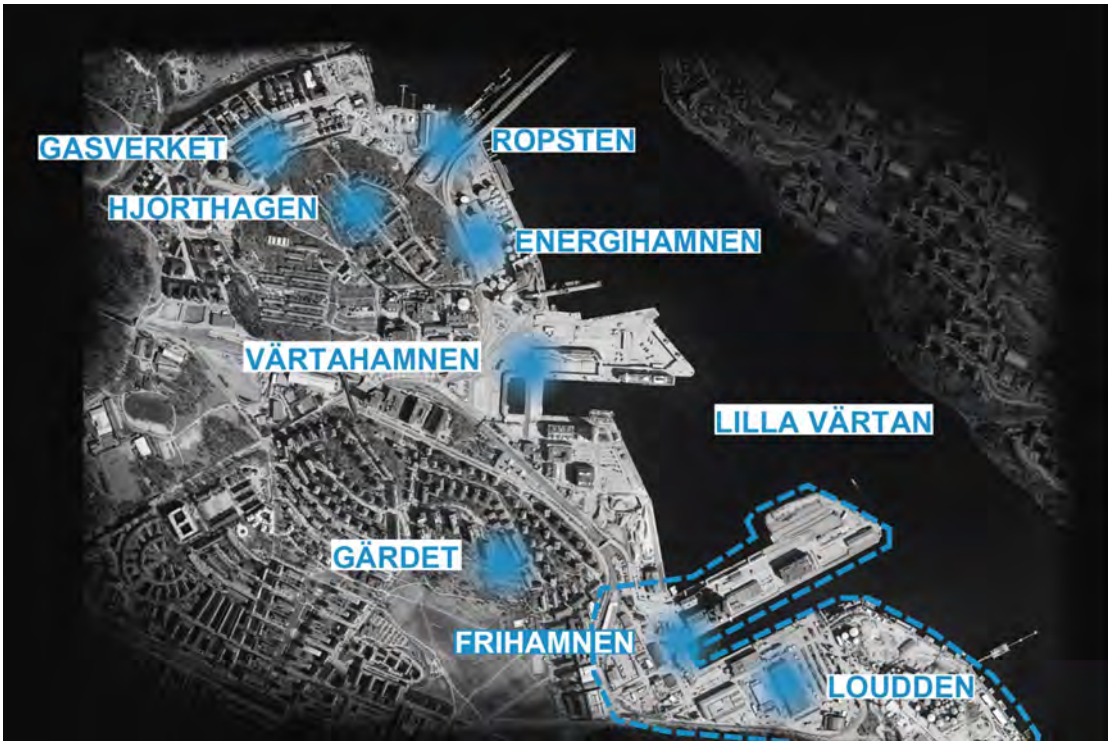
Proposed Solutions

Based on our analysis of the site, the challenges and our goals, we developed the following solutions. For an overview of the whole planned site, please look at our masterplan.

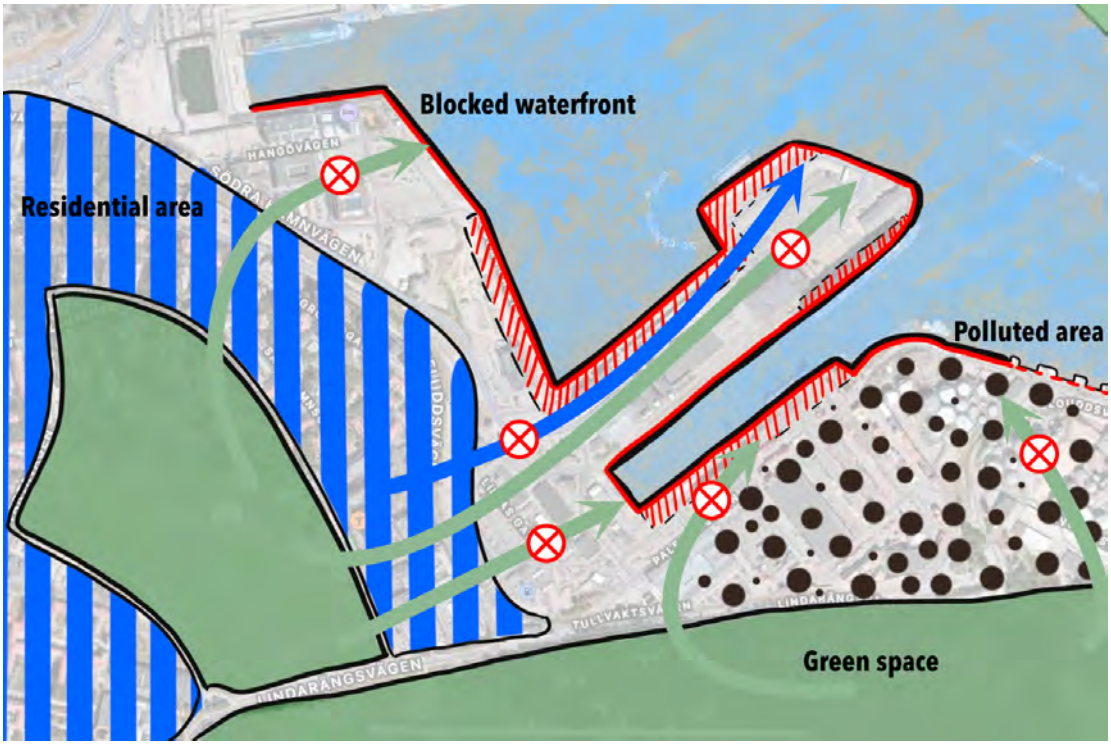
1. **Re-use cruise ships as affordable housing.** We believe cruise ships have great potential in becoming housing after their time as a cruise ship is over. Buying a cruise-ship second hand is relatively cheap and has a lot of space. Even when we include a 50% increase in costs of the cruise ships for renovations, the price per square metre is still below that of the average apartment in Stockholm.
2. **Boost biodiversity.** By connecting the surrounding woods and park with a softened waterfront, the harbour would turn into

the ideal habitat for feeding, nesting and sheltering of ducks, waders, and gulls.

3. **Restore historic landmarks into vibrant social hubs.** We want the site to become a multi-functional neighbourhood in which there is still industrial and economic activity while having residential and social activities. The historic landmarks and the refurbished silos will make the neighbourhood recognizable and attractive for both locals and outsiders.
4. **Connecting the city.** Through a cable car, inhabitants, visitors, and tourists coming and going from cruise ships could quickly come and go from the harbour without disturbing traffic and while having a great view.


GASVERKET
ROPSTEN
HJORTHAGEN
ENERGIHAMNEN
VÄRTAHAMNEN
LILLA VÄRTAN
GÄRDET
FRIHAMNEN
LOUDDEN


INDUSTRIAL AREA
GREEN AREA
INDUSTRIAL AREA
RESIDENTIAL AREA
CREATIVE AREA
GREEN AREA
GREEN AREA



Challenges

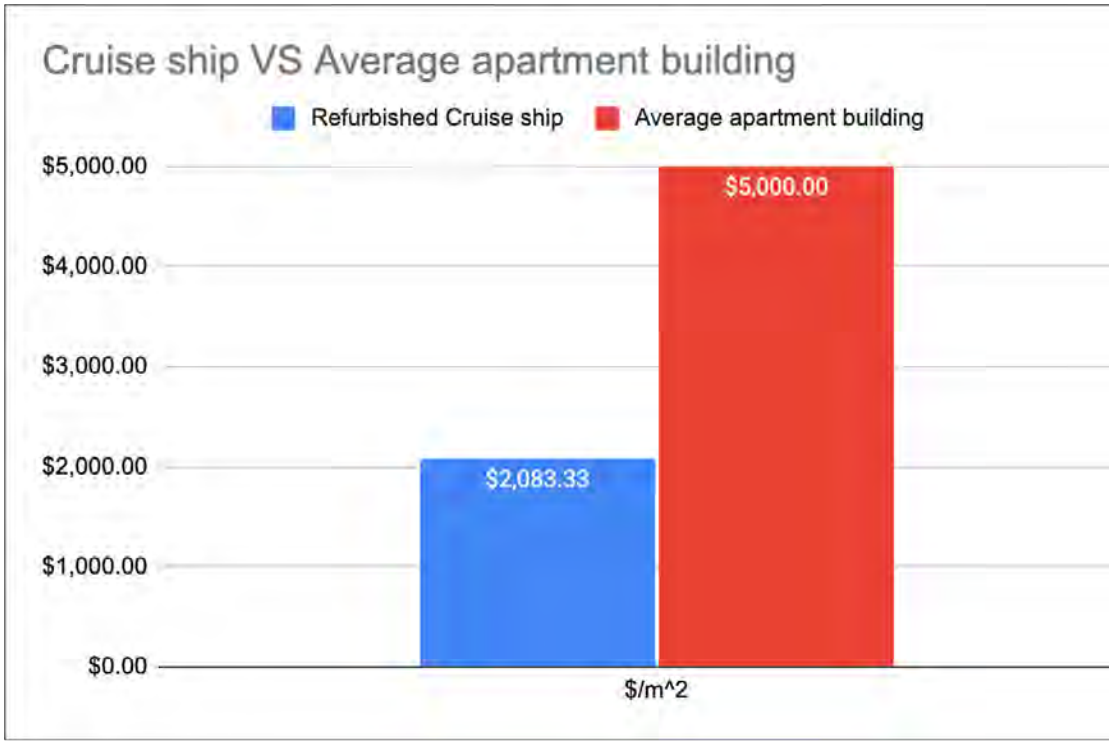
The burden of Cruise Ships

- Most ships are demolished in India, Bangladesh, and Pakistan in ship graveyards. The ships are broken down and parts sold.
- Largest Ship Breaking Yard is in India, Alang → 15 cruiser lines were disassembled (2020-2021).
- One of the most dangerous jobs in the world.

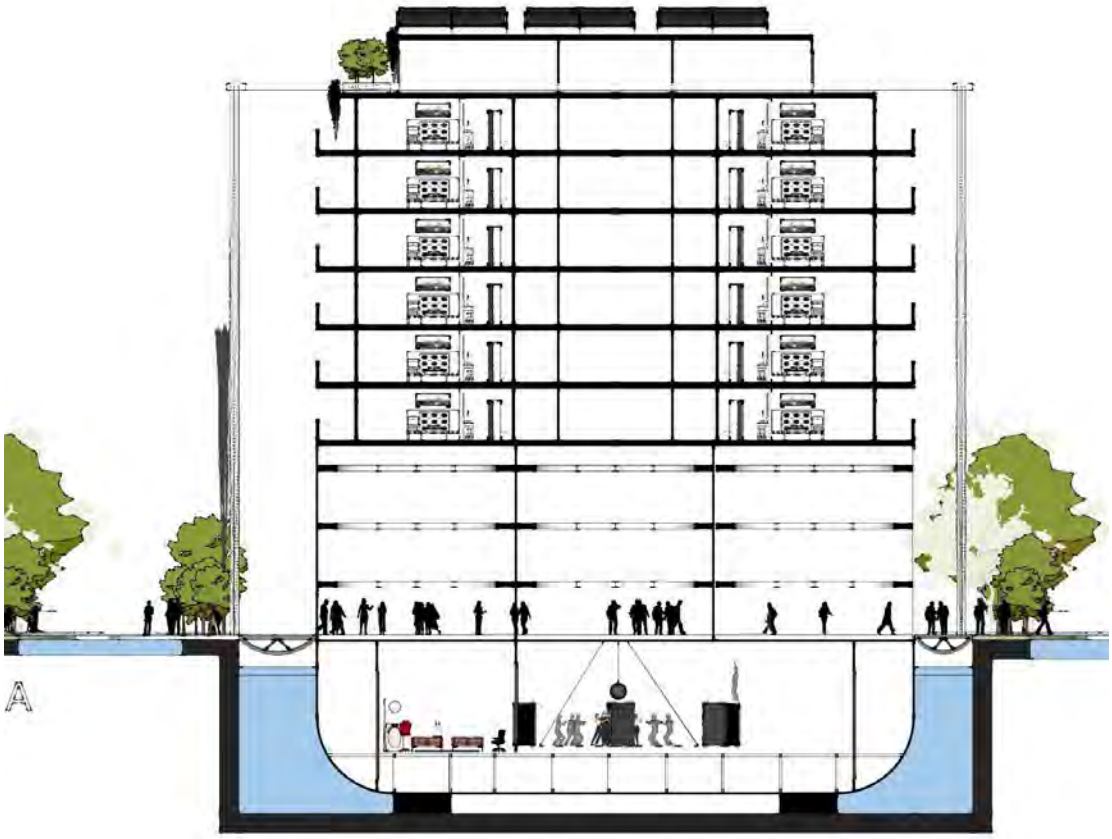
Our Vision

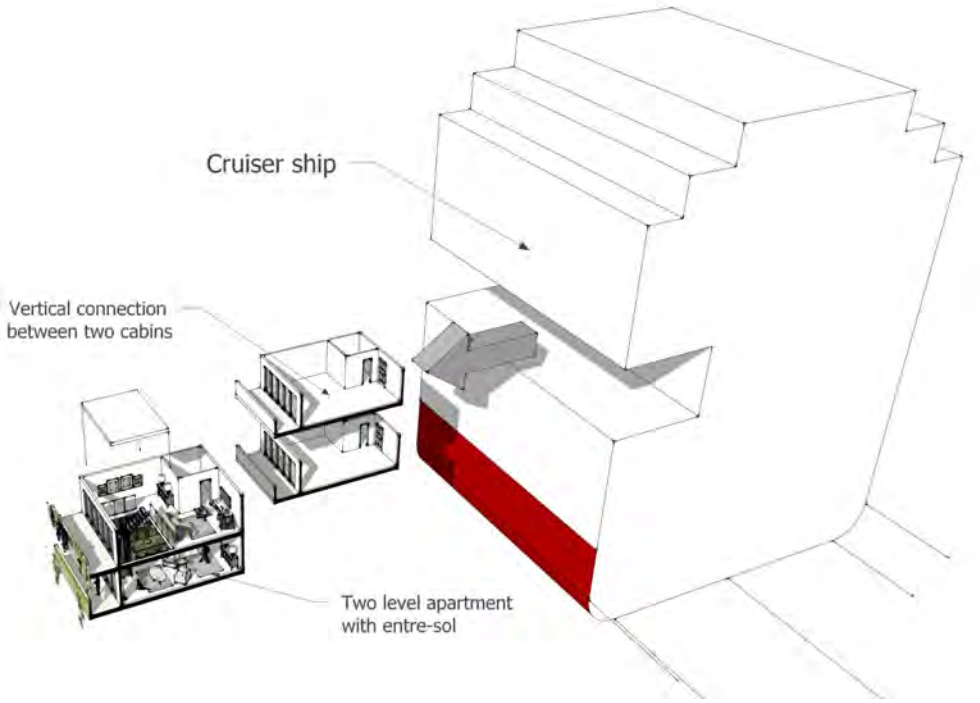
a. Goals with a planetary perspective:
   a. Give biodiversity a boost within the limitations of the area
   b. Develop a CO2 neutral housing area, that also can be maintained in a CO2 neutral way
   c. Maximize the use of locally found materials for building activities

a. Goals with a human perspective
   b. Affordable housing for 35.000 dwellings
   c. Attractive area with access to the waterfront
   d. Improve the relation with the city center of Stockholm
   e. Economic activities in the area for as many people as live there
   f. Vital living area, using social indexes for a balance between public and private space, green and build areas, social, recreational and cultural space, education and health
   g. Create an iconic area in Stockholm




New cruise ship harbour
Old cruise ships refurbished as housing
Culture and Art neighbourhood
New social area (cafés, restaurants, shops)
New residential area


A


Cruiser ship
Vertical connection
between two cabins
Two level apartment
with entre-sol

Group 4
Androniki Fliatari,
Jakub Gorzka,
Malika Ashmarina,
Renata Gonçalves

Innovative GArdens

Site: Frihamnen

Abstract

The ‘INnnovative GArdens’ form a welcoming landscape both for tourists and residents, providing a connection between land and water. The green areas will benefit from artificial ponds that facilitate rainwater retention, by collecting the neighbourhood runoff, and as a result, reduce flood risk. The suggested plan prioritizes pedestrians and access to public transportation and aims to relocate Blivande (a society and community meeting point, headquarters for some non-profit organizations and a remarkable place located in a traditional Swedish building) and revitalize existing buildings, in order to preserve them.

INGA's concept goes beyond innovative gardens; in Swedish, the word (‘inga’) means ‘none’. We suggest a sustainable landmark with the statement ‘No pollution, no vibration, no noise, no demolition’ - a landmark where we use natural fibres and renewable energy sources aiming at self-sufficiency of the area and energy supply for cruise ships, that could also result with noise and vibration reduction caused by moored ships.

The use of rainwater enables the improvement of the green area and the formation of lakes with the water coming from the neighbourhood, reducing the risk of flooding and contributing to the preservation of the environment. The facility of this system directly implies the reduction of implementation and maintenance costs.

Frihamnen has great potential for energy generation throughout the year: solar and wind energy supply can alternate with the change of seasons. Our project plan is solidly based on the potential use of solar and wind energy (‘new energies’, or ‘clean energies’), and carefully studied data on weather conditions (insolation, wind direction and wind speed, in particular). The use of natural fibres is planned for acoustic isolation purposes. Wind power generation is provided by a wind turbine module located on top of the existing silos structure.

The silo's structure is proposed to be transformed into a Landmark - a "welcome centre" for tourists with space for information, boat and museum ticket sales, restrooms, and cafés on the first floor. On the upper floors, above the proposed energy structure, there are some small apartments for rent, a restaurant, and a terrace with a 360° view that gives plainly the name to the Lighthouse.

FRIHAMNEN

S

Strength

- Location - waterside
- Blivande - community
- Topography

- Ferries and cruiser ship lines

W

Weakness

- Transport access
- Industry
- Weather conditions
- Lack of green
- Not a friendly area
- Noise, vibration etc.
- Sharp border between land and water
- No recognizable point

O

Opportunity

- Ongoing master plans
- Empty space

- Location - waterside
- Blivande - community
- Topography

- Weather conditions
- No recognizable point

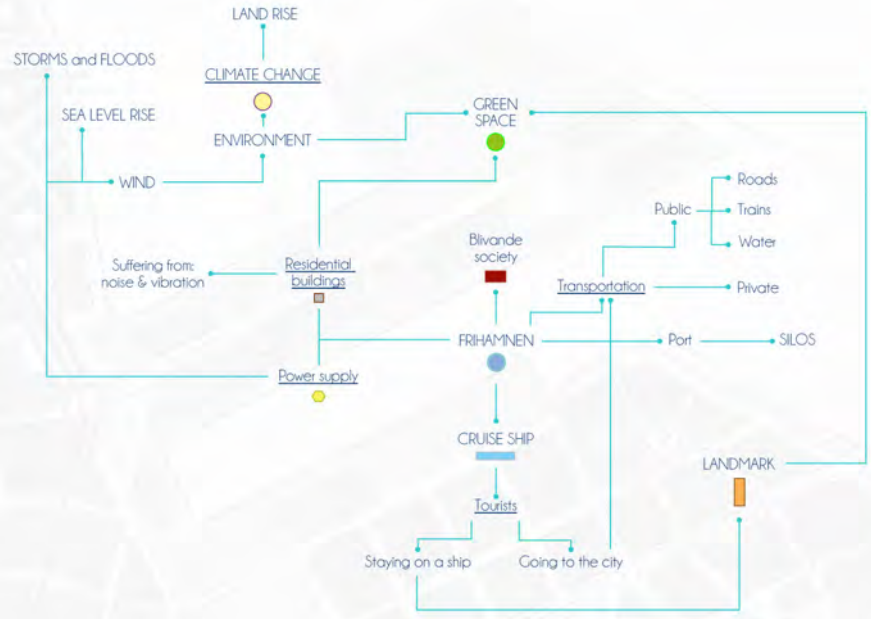
- Sea level, rain water

T

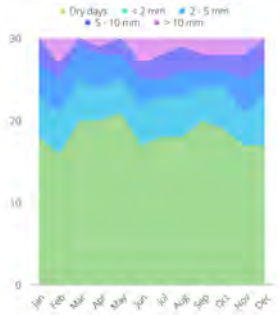
Threat

- Water depth
- Ferries and cruiser ship lines
- Sea level, rain water

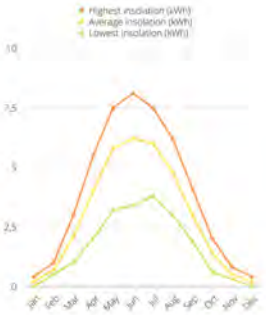
BRAINSTORMING



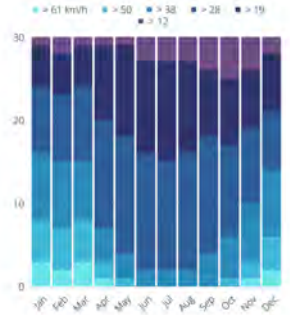
Average precipitation amount



Average daily incident shortwave solar energy



Average wind speed



Source: https://weatherspark.com/

WHY THE PIER?

CONNECTION BETWEEN WATER AND LAND

HIGHEST POTENTIAL

UNDEVELOPED AREA

SOLUTIONS?

Mobility enhancement

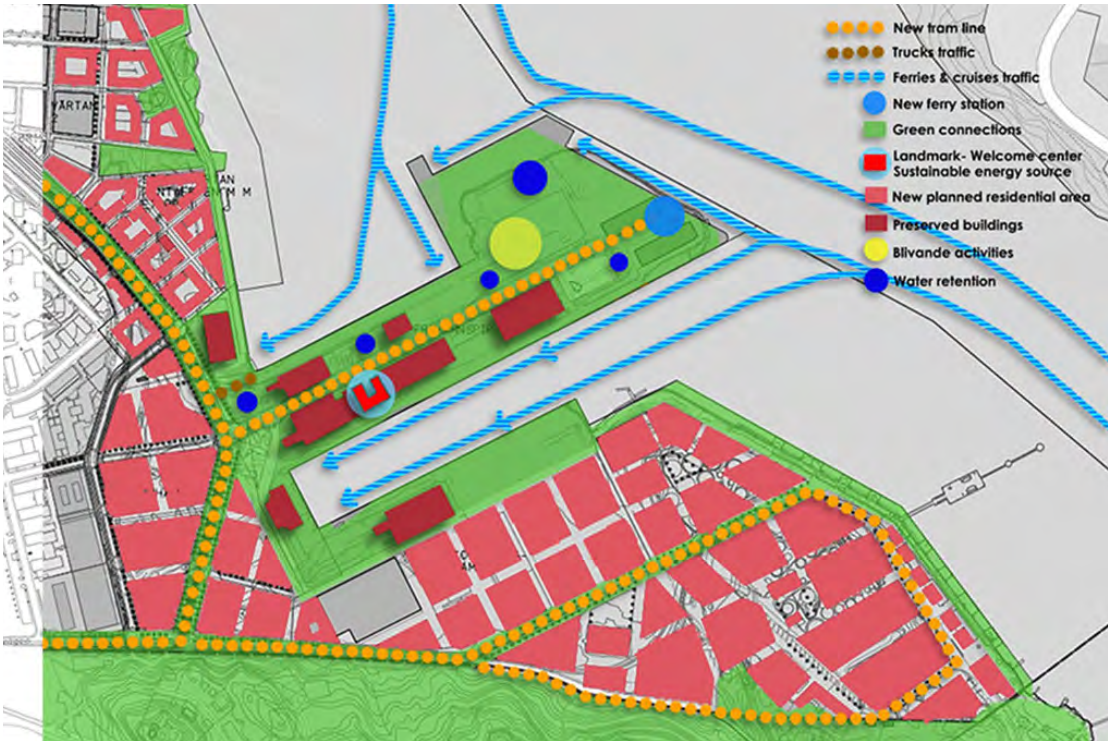
Environmental upgrade

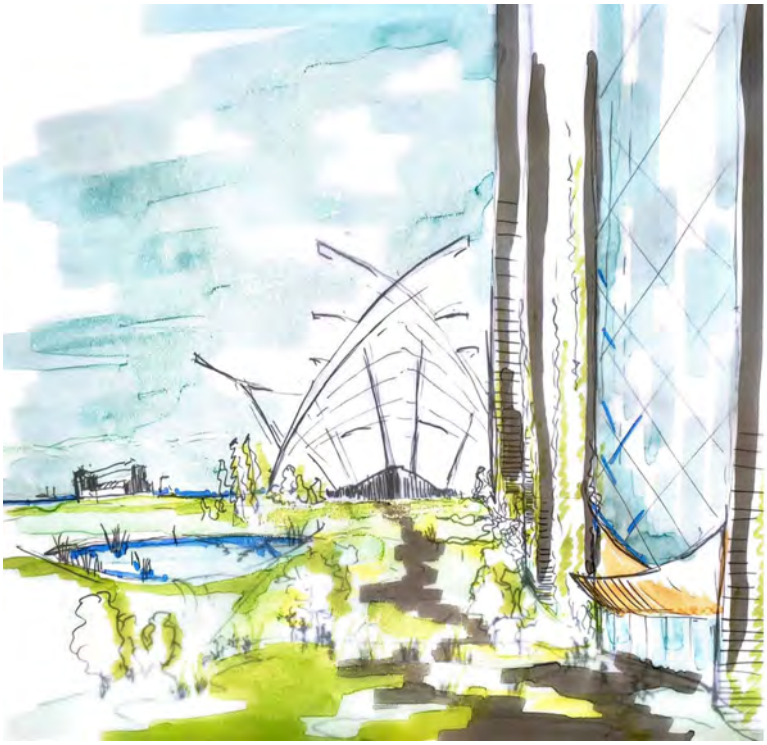
Promotion of local culture & identity

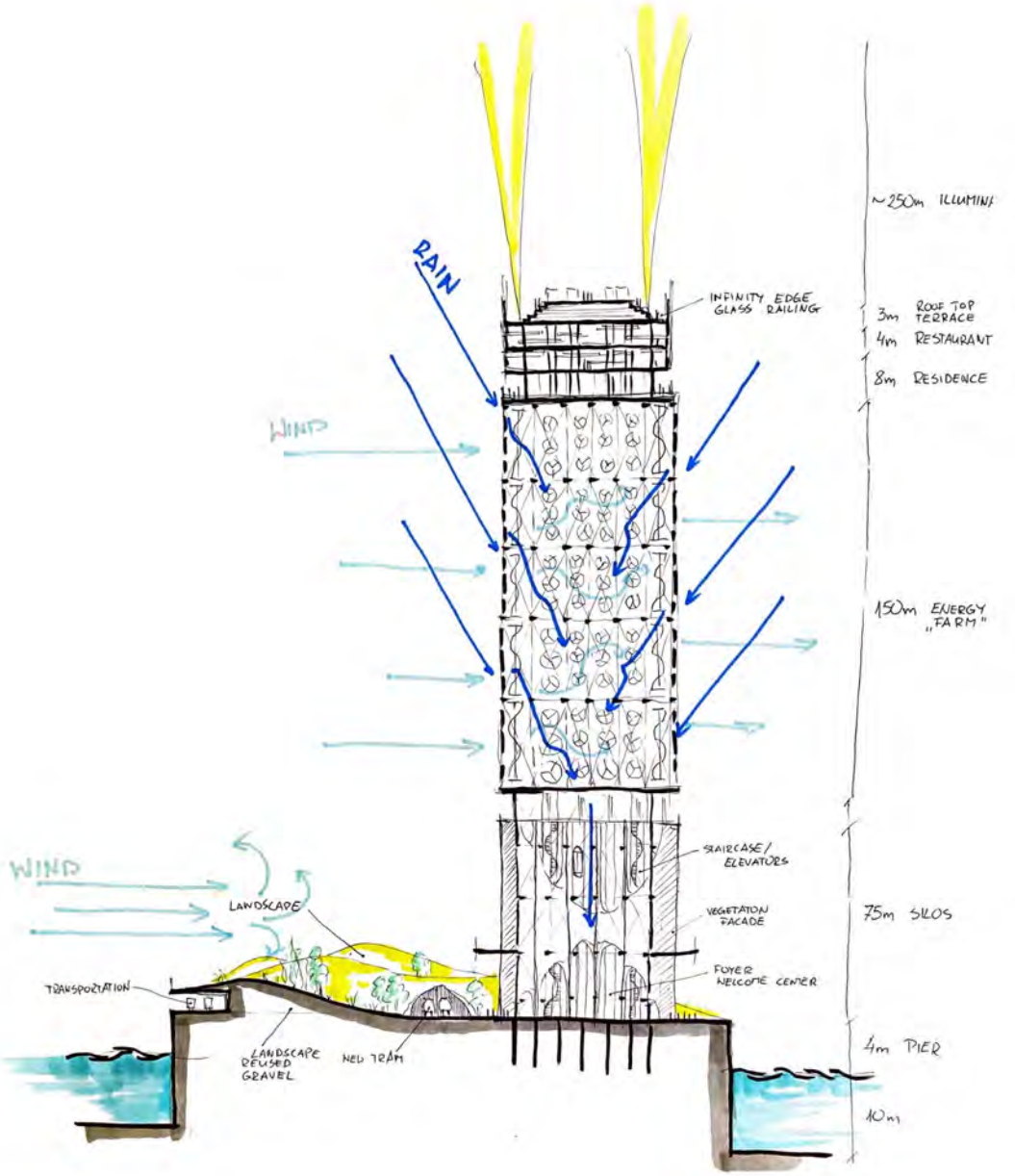
Economic development

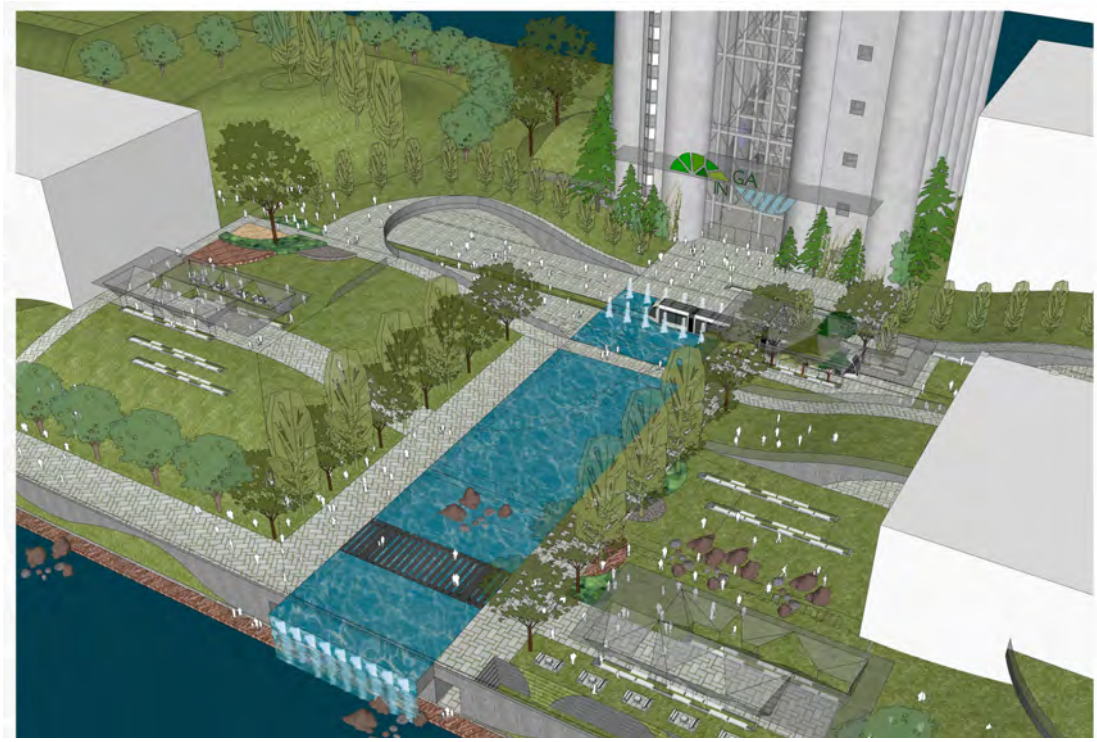
Social inclusiveness

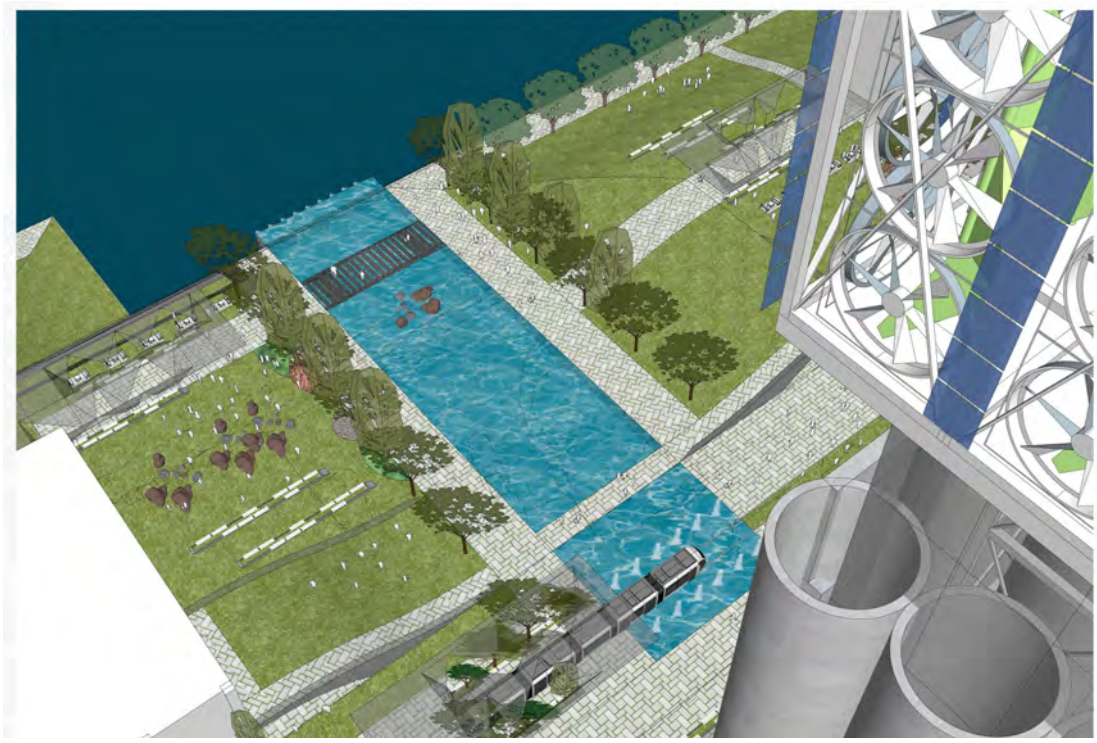
Promotion of health & well-being


New tram line
Trucks traffic
Ferries & cruises traffic
New ferry station
Green connections
Landmark- Welcome center
Sustainable energy source
New planned residential area
Preserved buildings
Blivande activities
Water retention



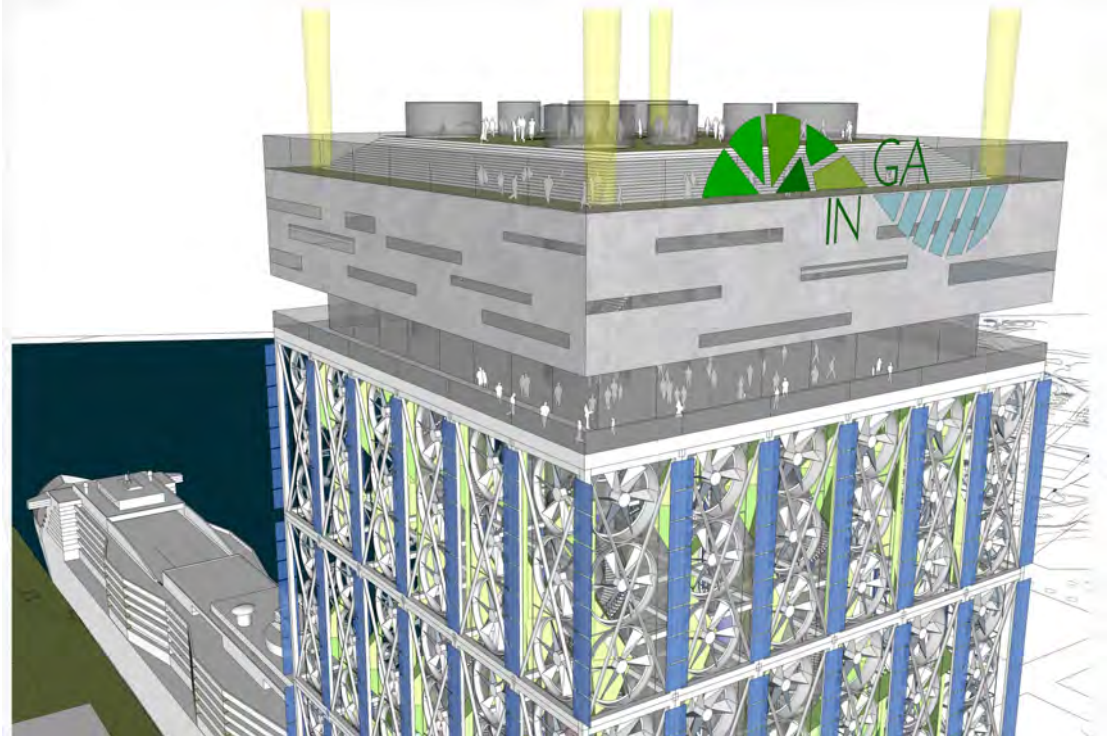

~250m ILLUMINI
RAIN
INFINITY EDGE GLASS RAILING
3m ROOF TOP TERRACE
4m RESTAURANT
8m RESIDENCE
WIND
150m ENERGY "FARM"
WIND
STAIRCASE / ELEVATORS
LANDSCAPE
VEGETATION FACADE
75m SILOS
TRANSPORTATION
FOYER WELCOME CENTER
LANDSCAPE REUSED GRAVEL
NEU TRAM
4m PIER
10m

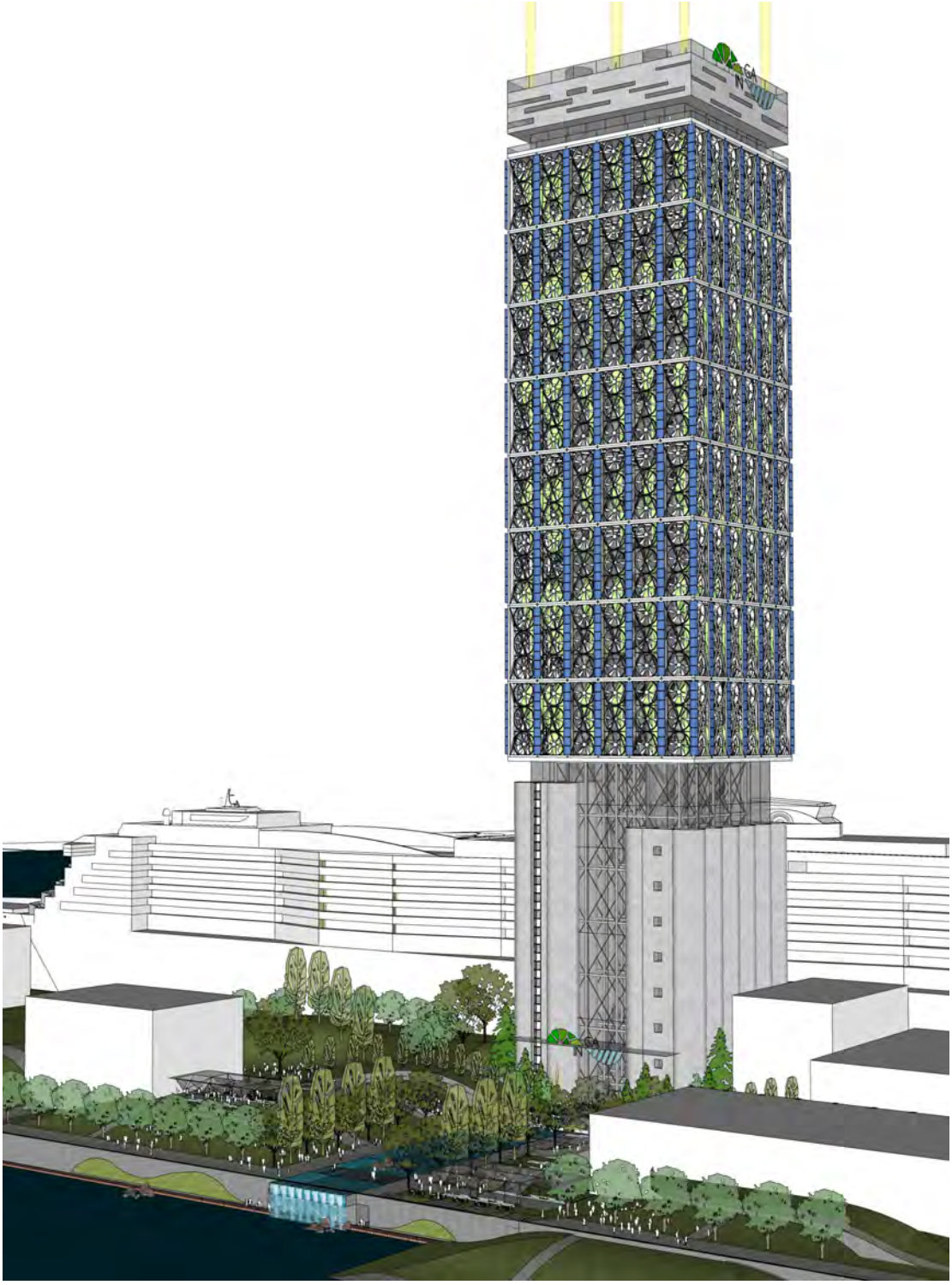


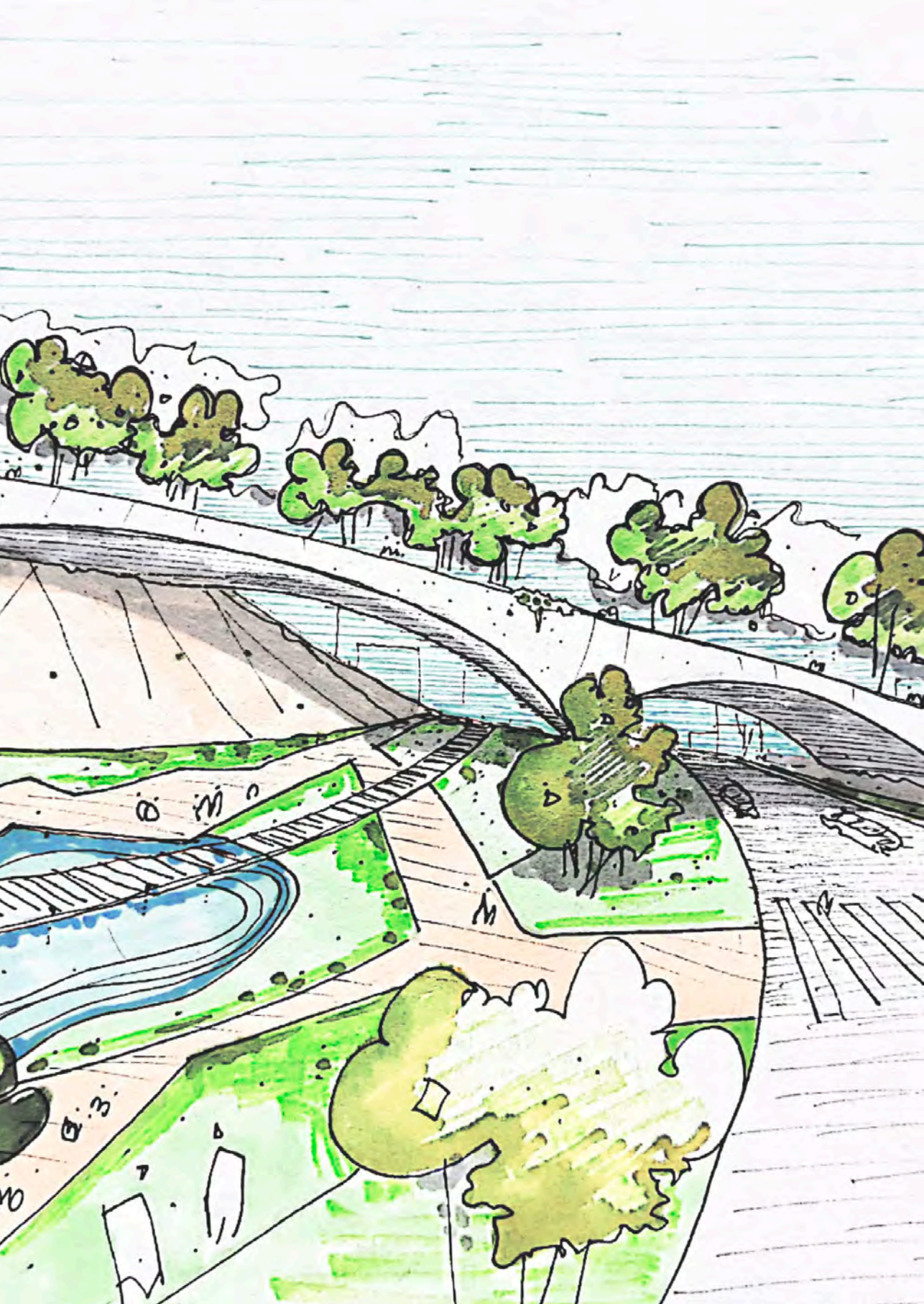


Editors note: One part of the group's results was a 3D model with a flyover view showing the proposed development. On these two pages and the next are several still frames from the video, which unfortunately cannot be shared in full


GA
IN


GA
IN





Group 5
Paulina Bone,
Claudia Mattogno,
Yuxin Pu,
André Prevedello,
Martyna Varslavienaite

EMBRACING

Site: Södra Värtan

Abstract

Värtahamnen is in the east of the city as a part of Stockholm Royal Seaport, a big transformation project at the border of the Baltic Sea just in front of Lidingö isle.

Currently the site is completely mineral, but lies between two large natural parks north and south. However, the area suffers from the lack of urban and green connections caused by some infrastructural barriers, such as railways and roads, and some differences in altitude. The waterfront is scarcely usable, nor does it generate relationships with other public spaces.

Our approach moves within the structure of existing urban plans and incorporates their fundamental principles: the holistic approach and the long-term vision to support sustainability on the planet.

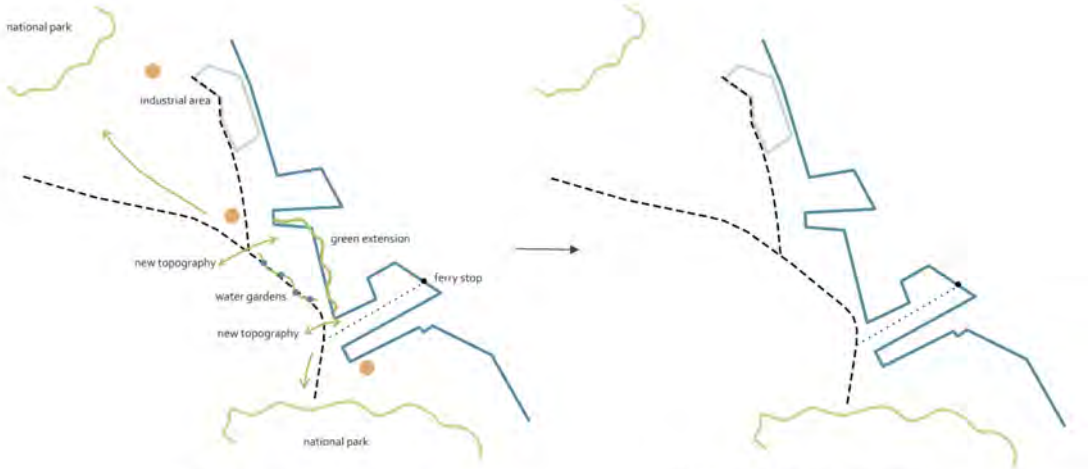
We assume the draft proposed by the municipality by introducing some modifications to make the future neighbourhood more attractive and liveable, starting with green and blue infrastructures that can entice people to walk and cycle, as well as contributing to reducing the climate impact. We are imagining a vibrant city centred on people, open and inclusive, at every stage of life, safe and healthy.

We will give big room to water and welcome any flooding according to an efficient hydraulic engineering system capable of being resilient to face environmental emergencies. So, we will provide storm gardens and floodable parks. The new role assigned to green and blue infrastructures enhances the site and strategically rediscovers the identity of the city settlement system.

We have noticed that the mineral and natural areas are very contrasting and clearly divided. For this reason, our long-term vision is to spread the natural over the artificial and to realize a walkable district. How?

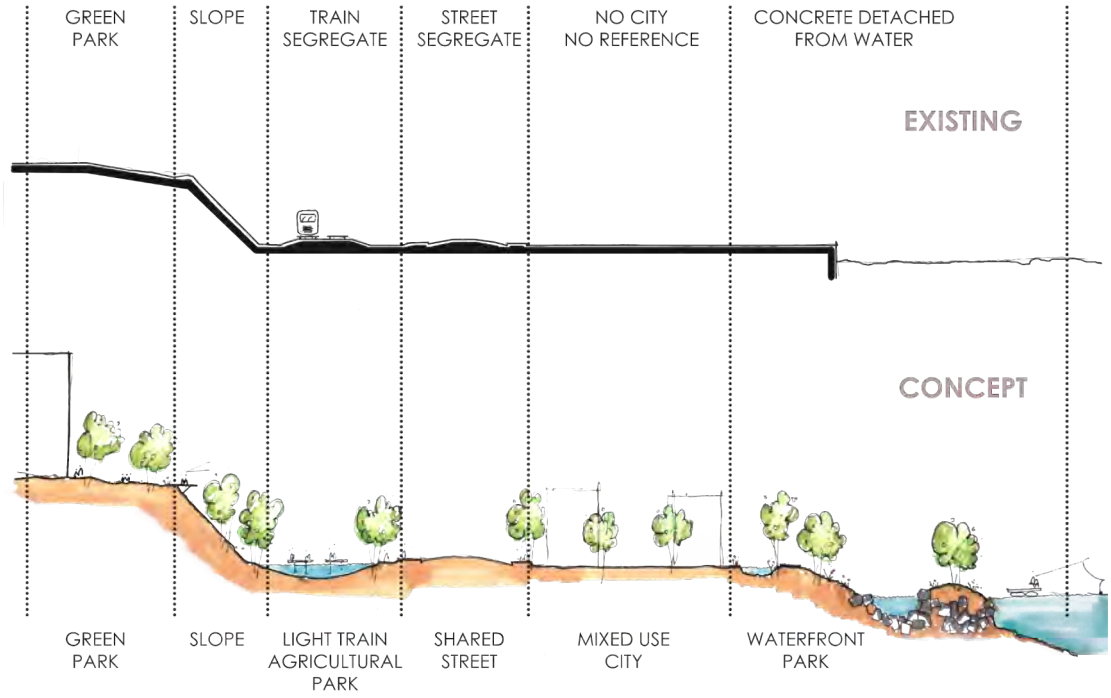
- A new green curved shoreline will reshape the waterfront to get closer to the water and allow the porosity of the city. The new waterfront is spread over several levels in a terraced manner, like a paddy field, to protect the territory and regulate floods.

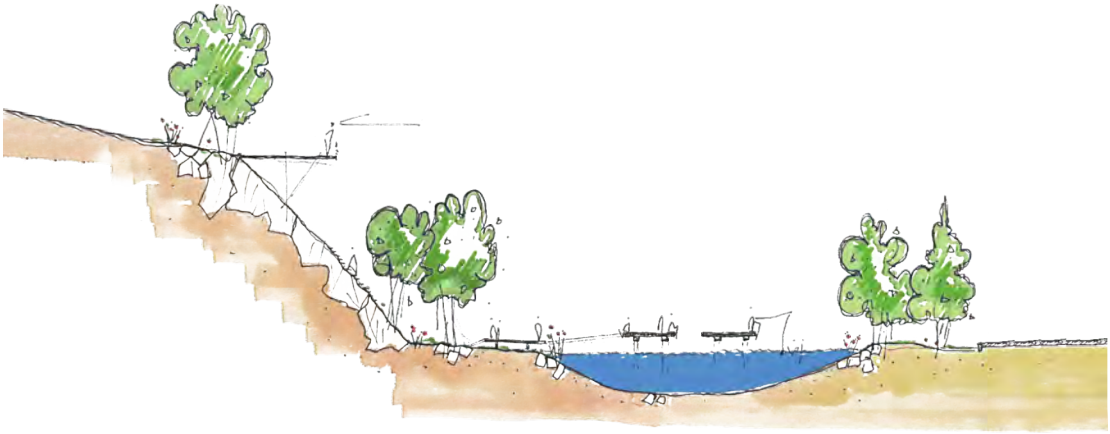
- The abandoned railway becomes a light rail in a linear garden with orchards and urban agriculture, rain gardens and ponds.
- A new connection between the existing ferry and the light rail will shape a public realm for all ages and abilities.
- A new landscape re-establishes the morphological continuity between two different heights of the ground, today dramatically separated: green escarpments connect Värtahamnen to the district of Gärdet and to the city center.
- Green and blue infrastructures embrace all the district as a buffer against climate change. Mixed activities, all around the attractors make a city vibrant and socially cohesive.

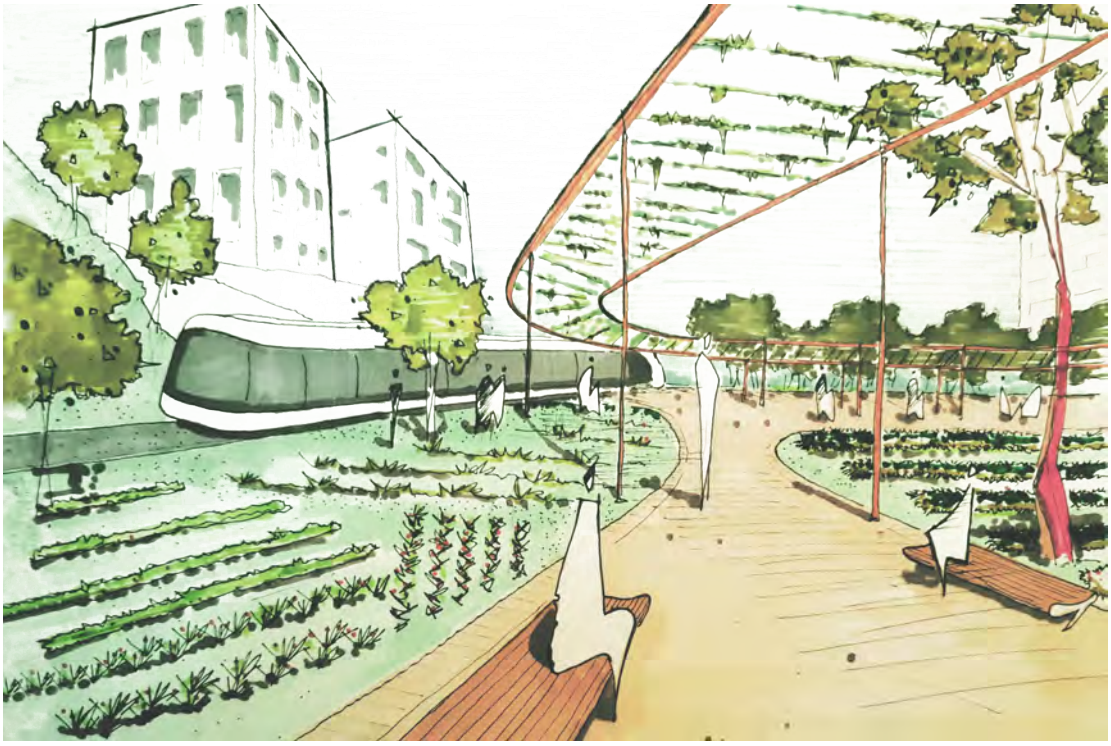


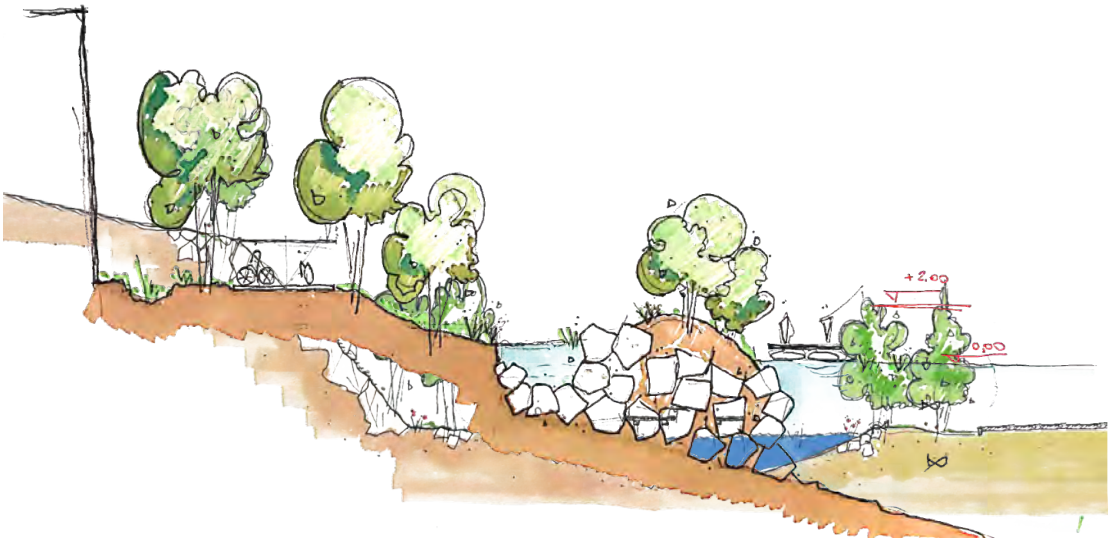
ARTIFICIAL AND NATURAL CONTRAST

SPREADING OF THE NATURAL OVER ARTIFICIAL


GREEN PARK
SLOPE
TRAIN SEGREGATE
STREET SEGREGATE
NO CITY NO REFERENCE
CONCRETE DETACHED FROM WATER
EXISTING
CONCEPT
GREEN PARK
SLOPE
LIGHT TRAIN AGRICULTURAL PARK
SHARED STREET
MIXED USE CITY
WATERFRONT PARK



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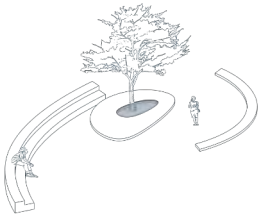
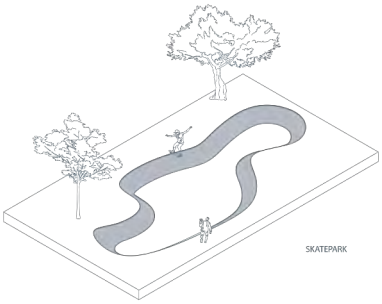
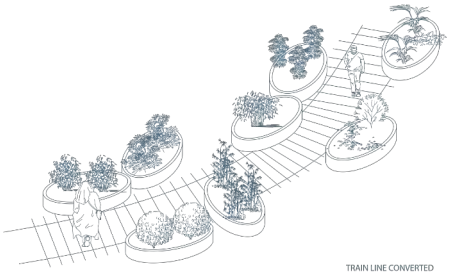


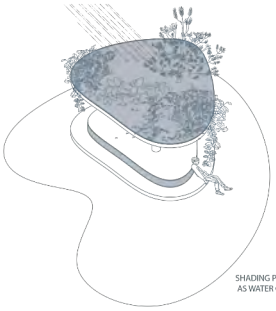
PUBLIC SEATING



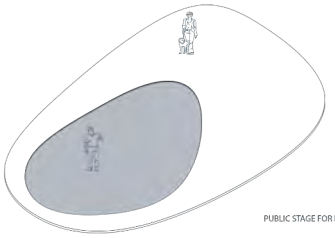
SKATEPARK



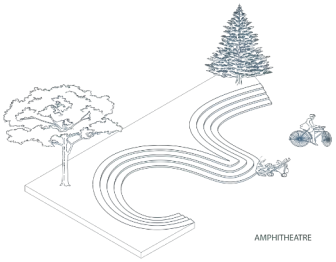
TRAIN LINE CONVERTED
TO COMMUNAL GARDEN



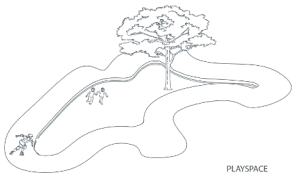
SHADING PLACES WORKING
AS WATER COLLECTORS



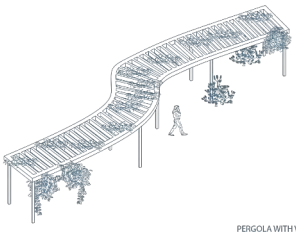
PUBLIC STAGE FOR EVENTS



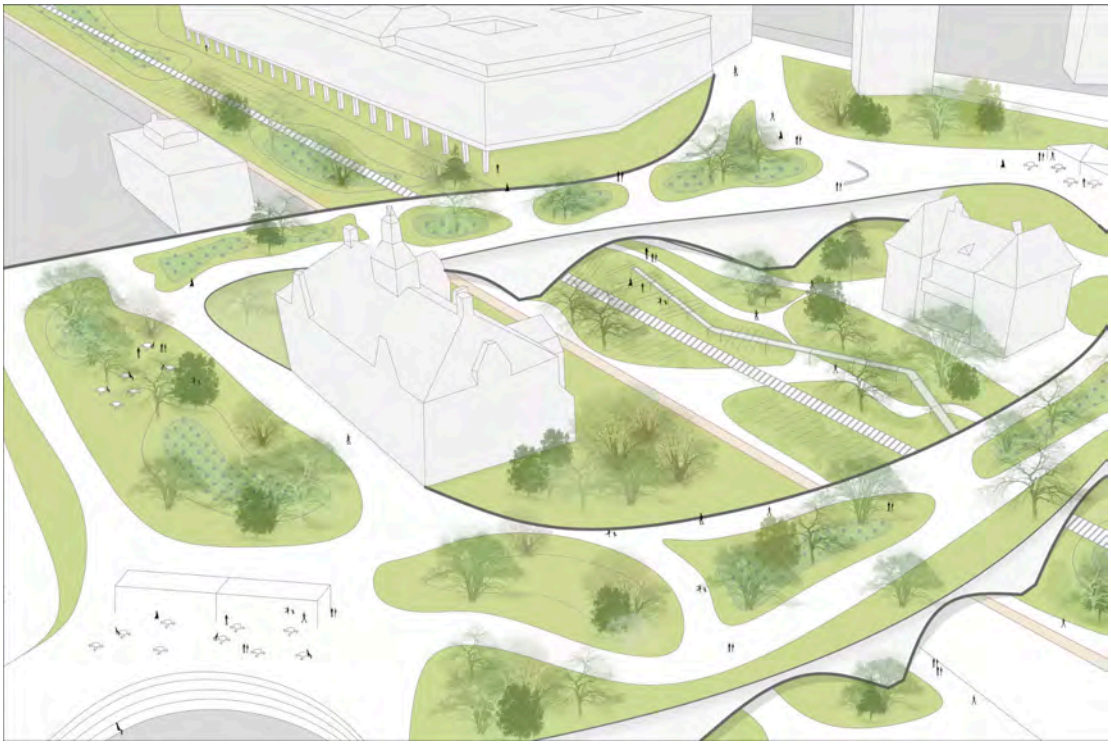
AMPHITHEATRE



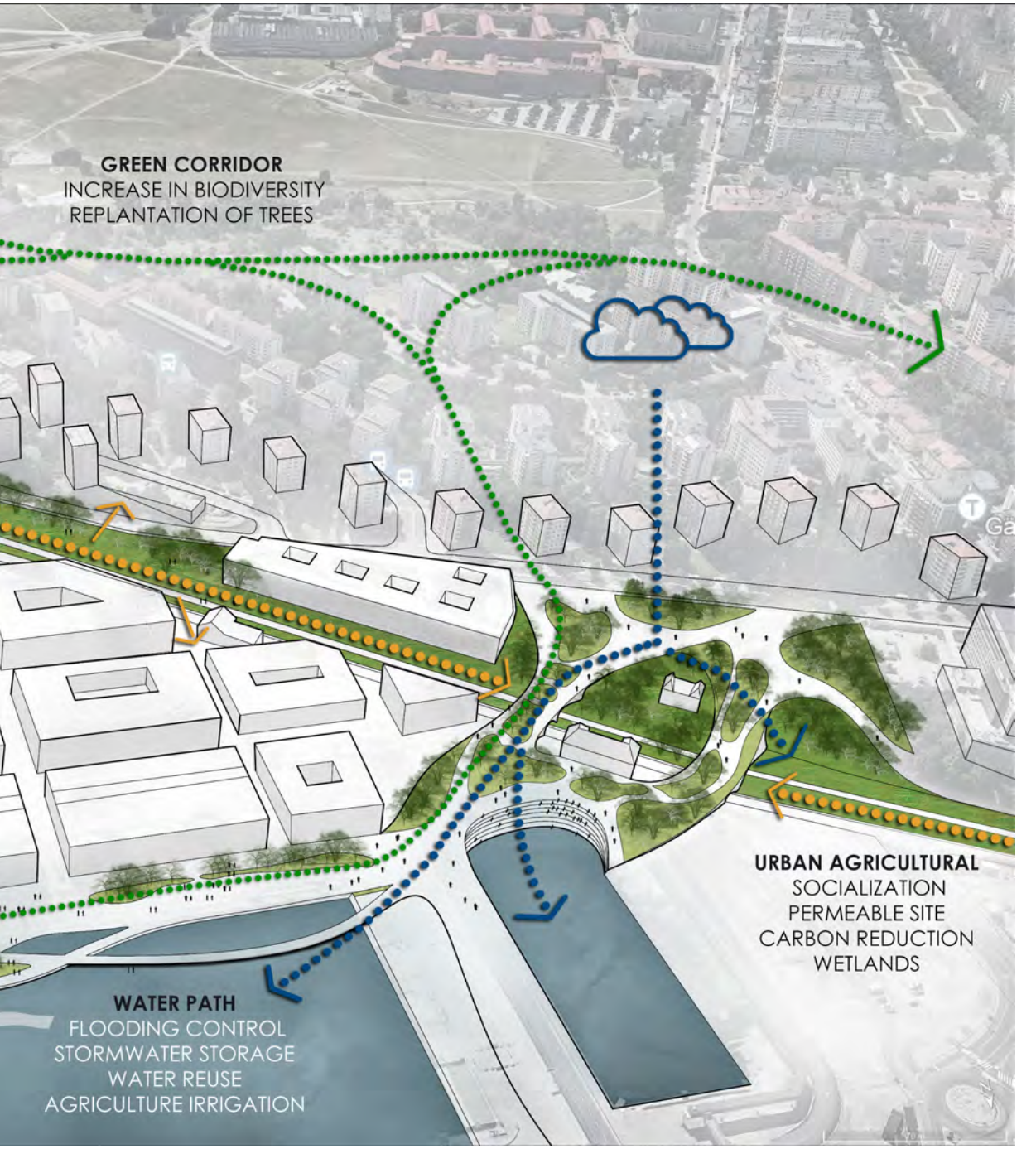
PLAYSPACE



PERGOLA WITH VEGETATION




150.000 m²
GREEN AREA
EXPANSION
5.000
NEW TREES
NOISE SHIPS AND WINDS
PROTECTION WITH
VEGETATION AND
MATERIALS
RESILIENT WATERFONT
SEA LEVEL FACING
PERMEABLE FRONT
PROTECTED SEA EDGE
BIOSWALE


GREEN CORRIDOR
INCREASE IN BIODIVERSITY
REPLANTATION OF TREES
URBAN AGRICULTURAL
SOCIALIZATION
PERMEABLE SITE
CARBON REDUCTION
WETLANDS
WATER PATH
FLOODING CONTROL
STORMWATER STORAGE
WATER REUSE
AGRICULTURE IRRIGATION

Group 6
Natalia Chrysikou,
Giulia Luciani,
Henriette Nishimwe,
Elisavet Papageorgiou,
Isaac Simão Santo

HAZARTS

Site: Södra Värtan

HAZARTS

Abstract

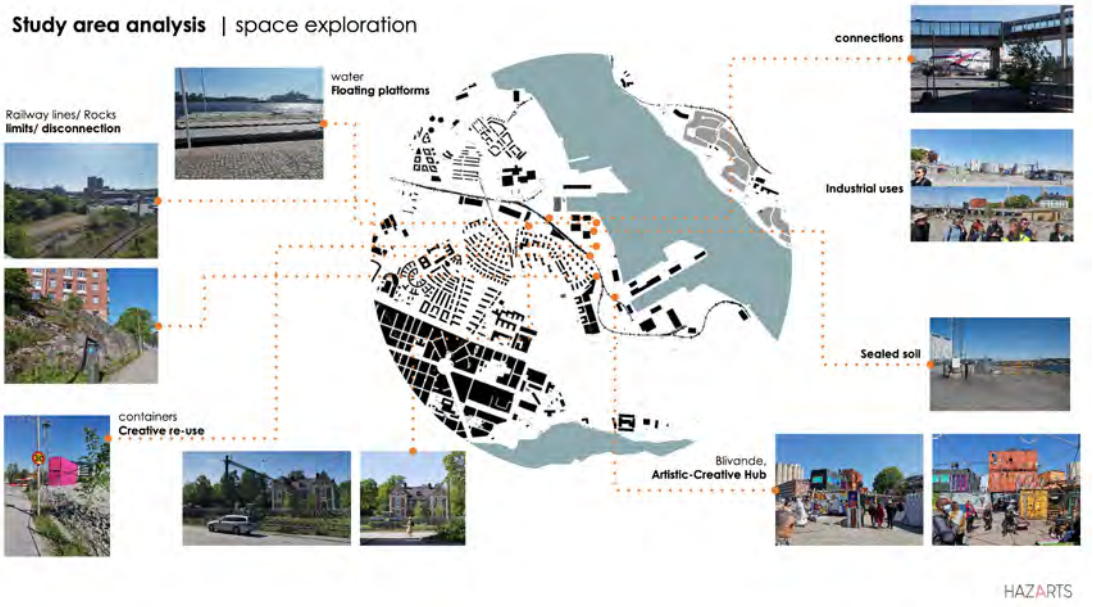
If the city of Stockholm is literally made of islands, the area of Värtahamnen can be described metaphorically as an island in perception. Lower than its surroundings, with a hard border marked by a dismissed railway, it is disconnected from the city – despite being a short distance from the centre – and the nearby green areas, thus contributing to keeping the waterfront and some buildings of historical interest out of the social and urban fabric. Moreover, issues concerning the sealed and contaminated soil, the flooding risk, and the presence of industrial uses and port activities strengthen its character as a place of contrast and transition.

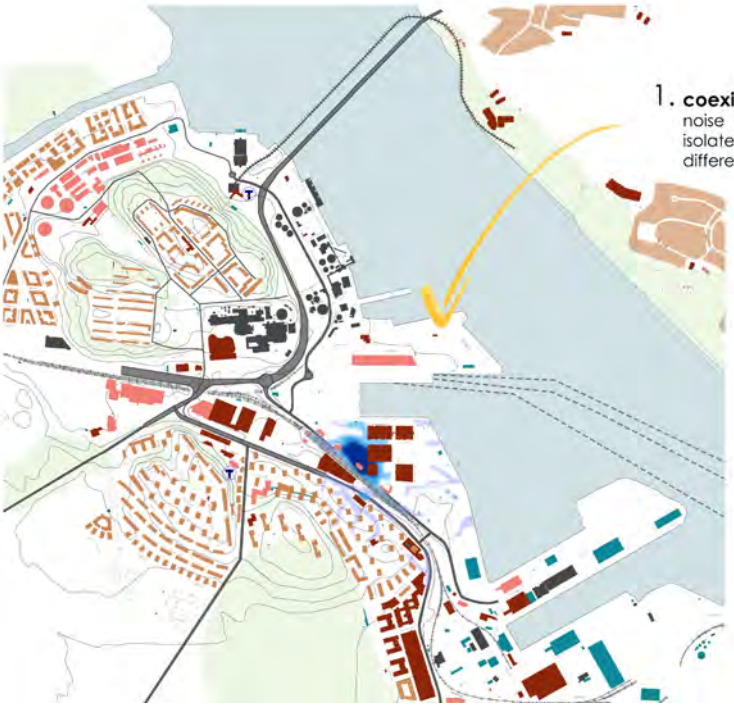
Being aware of the centrality that the port activities have at present and are going to maintain in the future – also due to the increasing number of passengers reaching Stockholm by sea – the renewal project starts with the idea of transforming Värtahamnen from a transit space into a place to stay for tourists and local people. The cultural and artistic dimension is therefore emphasized with the aim of turning it into a creative harbour for different cultures to meet, connect, learn, and create with respect to humans and nature. HAZARTS incorporates our vision for a neighbourhood where our vulnerability to risks and hazards is displayed through art, with a focus on the importance of education and awareness of the many interrelations we depend on to build resilience and adaptation.

This intermediate undefined space opens to the water and the Baltic Sea, and is transformed into a flexible, adaptable, and multifunctional public space that restores the cohesion with the city, the green areas, and the sea by

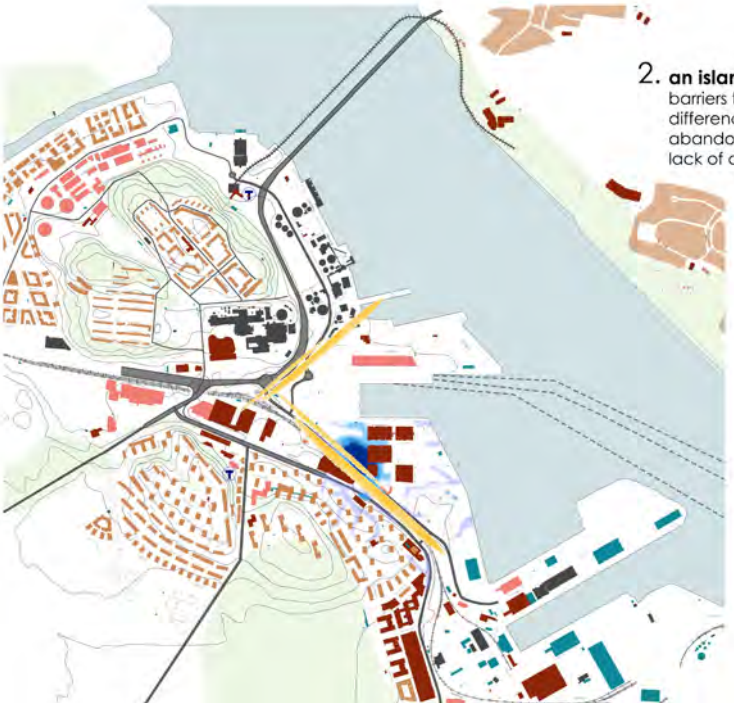
- introducing pedestrian paths and a public transport node;
- preserving and integrating its heritage into the new development as part of a cultural corridor, allowing for creative reuse;
- integrating green-blue adaptable infrastructures that welcome different forms of change connected to water (tourism/floods/sea level rise/land uplift), and finally

- becoming the breeding ground for the development of cultural and artistic activities to stimulate a new attitude towards change, vulnerability, coexistence, and mutual interdependence.


Study area analysis | space exploration
connections
water
Floating platforms
Railway lines/ Rocks
limits/ disconnection
Industrial uses
Sealed soil
containers
Creative re-use
Blivande,
Artistic-Creative Hub
HAZARTS

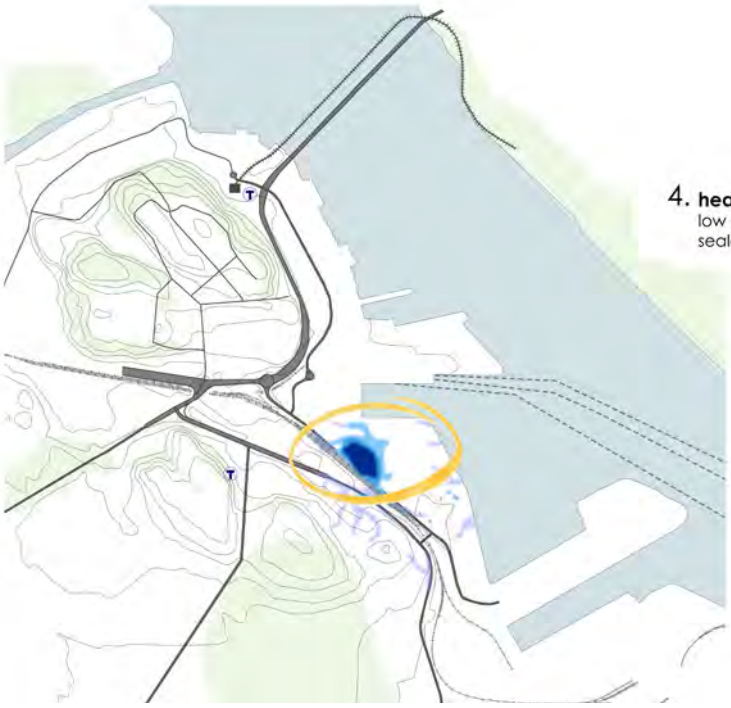


1. **coexistence with port activities**
noise
isolated transit space
different fluxes during the year

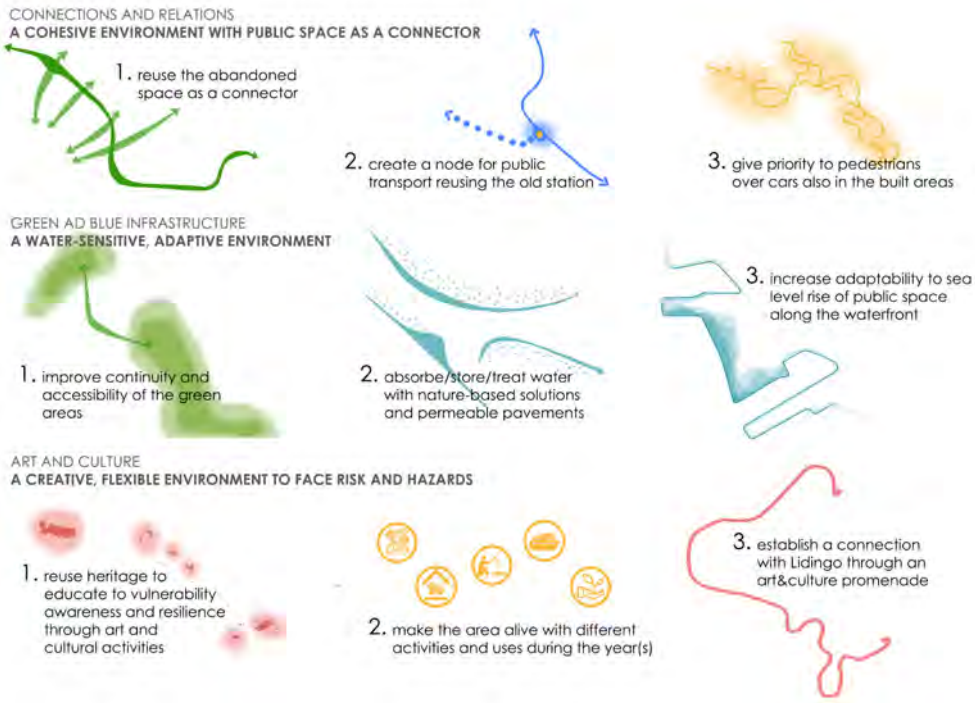


2. **an island in the city**
barriers to the surrounding neighbourhoods:
difference in height
abandoned railway
lack of connection to the centre

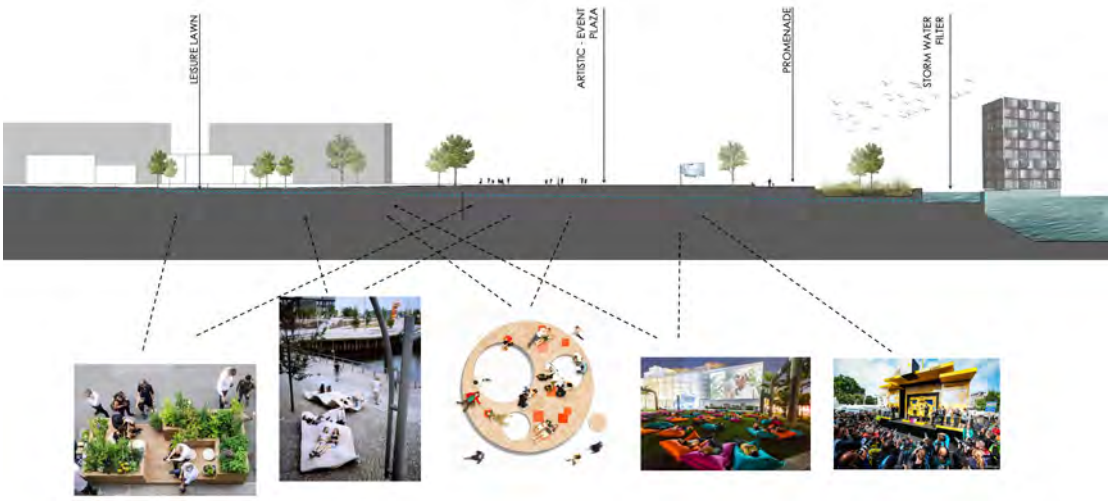
3. **discontinuity of the green infrastructure**
interruption of one of the main
green wedges of the city



4. **heavy rainfall**
low points close to existing buildings
sealed soil


CONNECTIONS AND RELATIONS
A COHESIVE ENVIRONMENT WITH PUBLIC SPACE AS A CONNECTOR
1. reuse the abandoned space as a connector
2. create a node for public transport reusing the old station
3. give priority to pedestrians over cars also in the built areas
GREEN AD BLUE INFRASTRUCTURE
A WATER-SENSITIVE, ADAPTIVE ENVIRONMENT
1. improve continuity and accessibility of the green areas
2. absorbe/store/treat water with nature-based solutions and permeable pavements
3. increase adaptability to sea level rise of public space along the waterfront
ART AND CULTURE
A CREATIVE, FLEXIBLE ENVIRONMENT TO FACE RISK AND HAZARDS
1. reuse heritage to educate to vulnerability awareness and resilience through art and cultural activities
2. make the area alive with different activities and uses during the year(s)
3. establish a connection with Lidingo through an art&culture promenade


VÄRTA
BUSSA
TUNNELB


LEISURE LAWN
ARTISTIC - EVENT PLAZA
PROMENADE
STORM WATER FILTER


WATER PLAZA
BIOSWALE
LEISURE LAWN
STORM WATER
FILTER
COMMERCIAL PLAZA
PROMENADE

Conclusion

The three urban sites that are included in this research project, Lövholmen, Frihamnen and Södra Värtan, are driven by the need for expanding settlements and increased housing in Stockholm, one of the fastest growing cities in Europe. They also face common but diverse challenges for sustainable urban planning that consider cultural heritage, climate change impacts in terms of water quality and quantity, improving landscape ecology, and developing social and vibrant neighbourhoods, all of which should be balanced with economic interests.

The water bodies directly adjacent to the planning areas do not reach good ecological or chemical status, which the city has to deal with. Protecting the water quality of the Mälaren Lake is especially important due to its role as a water source for two million people. It therefore has a special water protection area set up which covers large parts of western Stockholm. In addition, these sites have industrial histories and buildings and shipping activities and thus have place identities and cultural heritage components and values that need to be preserved. Stockholm will be also affected by climate change in terms of temperature increase of 3-5 degrees, lower soil moisture, and increase of rainfalls rates of 20-30% and more cloudburst (defined as 50mm per hour or 1mm per minute), even though the rising sea level is not a pressing but a long-term challenge. Even though, a sea level rise is projected at a global scale, in Sweden, the land is technically rising about around 5 mm yearly, faster than the sea level rise, and as such, the sea level has been decreasing[1]. Stockholm municipality expect sea levels to rise by about 50cm by 2100 and even further.

In developing these sites, the city has to reverse the negative impacts of urbanisation and integrate climate adaptation measures and interventions that consider flooding due to extreme weather events, heavy intense rain and cloudbursts while improving the quality of water bodies and creating pleasant waterfronts. Dealing with the described challenges is envisioned by preserving and developing the city's green-blue structure, and adding a new buffer and permissive urban spaces for mitigating the impacts of subsurface pipe-networks and impermeable surfaces.

How can we deal with the described challenges above, maintain cultural identity and heritage value, achieve economic and sustainability goals, and reconcile social conflict over use of urban space are key issues that the participates in the workshop that was carried out in May-June 2022. The design proposals developed for these sites are presented in Part 2 of this book.

Supported by experts-lead and academic lectures, site visits, and various sources of input materials and information such as comprehensive, structural and detailed planning documents; his-

1: Hieronymus, M., & Kalén, O. (2020). Sea-level rise projections for Sweden based on the new IPCC special report: The ocean and cryosphere in a changing climate. *Ambio*, *49*(10), 1587–1600. https://doi.org/10.1007/s13280-019-01313-8

torical records; building and flood maps; development maps and city visions; and consultation reports, researchers from several European cities analysed the input information for sustainable site designing. Research coming from multi-disciplinary background and departing from different experiences defined the socioeconomic and environmental qualities and disadvantages of each site to which accordingly, site design concepts and innovative solutions that maintain the sites cultural identities and deal with socioeconomic and climate change challenges were developed and illustrated.

As the designs and illustrations reveal, there is no single solution of interpreting and transforming reality and visioning the future of city development. However, a common dominator of all the proposed designs is the significance of finding a balance between maintaining cultural heritage and place identity and economic interests, re-use of existing infrastructure (cruise ships closed-off industrial buildings, and abandoned railways), connecting people to people, people to the built environment and the waterfronts to human settlements, preserving the fauna of a place and improving biodiversity, and developing climate-proof, porous, vibrant and a multi-functional neighbourhoods, all of which is to be materialised by means of green-blue schemes and artists planning tools and designs.

Whether these design solutions can be implemented; what type, magnitude and scale of institutional challenges that do exist in each particular city context that hinder the implementation; and what they share in common remain knowledge gaps and blind spots of research that have not be covered by the research task of the participants in workshop of which all of us involved recognise. The creative design solutions presented is a step towards a dialogue on approaches for climate-proofing urban areas while recognising that is necessary to use a combination of skills and perspectives from different actors, including citizens, to face challenges from consequences of climate change for urban waterfront areas.