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**POLITECNICO**  
MILANO 1863

# Designing Nature as Infrastructure

A Spatial Strategy for Enhancing Resilience  
and Livability in Copenhagen  
through Nature-Based Solutions





Figure 0.1 Sandkaj, Århusgadekvarteret. By Cobe and Sleth  
Source: The Copenhagen Way 2025

# Abstract

English

Copenhagen is often hailed as a pioneer city in climate change adaptation and green infrastructure deployment. However, ongoing urbanization and redevelopment have intensified the urban heat island effect and heavy rainfall flooding, while also exacerbating competition for public space. This thesis constructs a structured, spatially based framework to guide the selection, prioritization, and design of Nature-Based Solutions (NBS) in Nordhavn, Copenhagen. The goal is to enhance climate resilience and improve the livability of urban daily life.

The study integrates a review of NBS frameworks and reference projects, policy and planning analysis, GIS-based spatial analysis mapping, and multi-criteria evaluation combining spatial analysis with design. This framework operates at multiple scales: macro- and meso-scale prioritization informs community strategies, while micro-scale solutions are tested in Nordhavn, which includes “Green Loop” concept, Nordhavnstippen park and sustainable neighborhood in Levantkaj , designed to improve green connectivity, promote slow mobility, and create inclusive waterfront public spaces.

To evaluate multifunctionality, this study compared types such as constructed wetlands, bioretention basins, rain gardens, ecological forests, and soft shoreline buffers with assessment criteria adapted from the UNaLab , Nature-based Solutions Technical Handbook Factsheets. Results indicate that continuous micro-scale units provide systemic cooling and ecological connectivity, while finely distributed measures deliver localized infiltration, flood buffering, and environmental enhancement; the most effective strategy integrates both within a connected network. This thesis concludes that combining data-driven prioritization with spatial design enables Nature-Based Solutions (NBS) to serve as a comprehensive infrastructure for enhancing climate resilience.

Key Words: Nature-Based Solutions; Climate Resilience; Spatial Analysis; GIS-based Framework; Copenhagen



# Acknowledgements

Italian

Copenhagen è spesso citata come una città all'avanguardia nell'adattamento ai cambiamenti climatici e nell'implementazione di infrastrutture verdi e blu. Tuttavia, la continua densificazione e i processi di riqualificazione urbana aumentano l'esposizione alle isole di calore e al rischio di allagamenti pluviali, intensificando al contempo la competizione per lo spazio pubblico. Questa tesi sviluppa un quadro strutturato e spazialmente fondato per guidare la selezione, la prioritizzazione e la progettazione delle Nature-Based Solutions (NBS) nelle aree di Nordhavn, Nordhavnstippen e Levantkaj a Copenhagen, con l'obiettivo di rafforzare sia la resilienza climatica sia la vivibilità urbana quotidiana.

La ricerca integra una revisione dei principali framework NBS e di progetti di riferimento con l'analisi delle politiche e degli strumenti di pianificazione, la mappatura tramite GIS e una valutazione multicriteriale che collega l'analisi spaziale alla proposta progettuale. Il framework viene applicato a più scale: a livello macro e meso, la prioritizzazione spaziale orienta le strategie di quartiere; a livello micro, le proposte vengono testate a Nordhavn e Nordhavnstippen, includendo il concetto di "Green Loop" per migliorare la connettività ecologica, la mobilità lenta e la qualità inclusiva dello spazio pubblico sul waterfront.

Per verificare la multifunzionalità, i criteri di valutazione sono adattati dalle schede tecniche del Nature-Based Solutions Technical Handbook di UNaLab e utilizzati per confrontare diverse tipologie, tra cui constructed wetlands, bioswales, rain gardens, foreste ecologiche e soft coastal edges. I risultati evidenziano che elementi continui su micro-scala contribuiscono al raffrescamento sistemico e alla connettività ecologica, mentre misure distribuite e puntuali garantiscono infiltrazione locale, mitigazione del rischio di allagamento e qualità spaziale; le strategie più robuste combinano entrambe le tipologie all'interno di una rete connessa. La tesi conclude che l'integrazione tra prioritizzazione basata sui dati e progettazione spaziale consente alle NBS di operare come infrastruttura integrata per la resilienza climatica.

Parole chiave: Soluzioni basate sulla natura; Resilienza climatica; Analisi spaziale; Framework basato su GIS; Copenhagen

This thesis marks the completion of an important academic journey. Coming to Europe to pursue this master's program has been a meaningful experience that allowed me to grow academically and personally. The opportunity to study abroad in Sweden and to complete an internship in Copenhagen strongly influenced my understanding of urban resilience, public space, and Nature-Based Solutions, and shaped both the direction of this thesis and my future academic interests.

I would like to sincerely thank my thesis supervisor, Professor Israa Mahmoud, and my co-supervisor, Doruntina Zendeli, for their guidance, support, and valuable feedback throughout the thesis process.

I am also grateful to the professors and instructors of the master's program for their teaching and critiques. Special thanks go to the friends I met during this journey in Europe, whose support and companionship made this experience more rewarding. Finally, I would like to thank my family for their continuous encouragement, patience, and trust throughout my studies.

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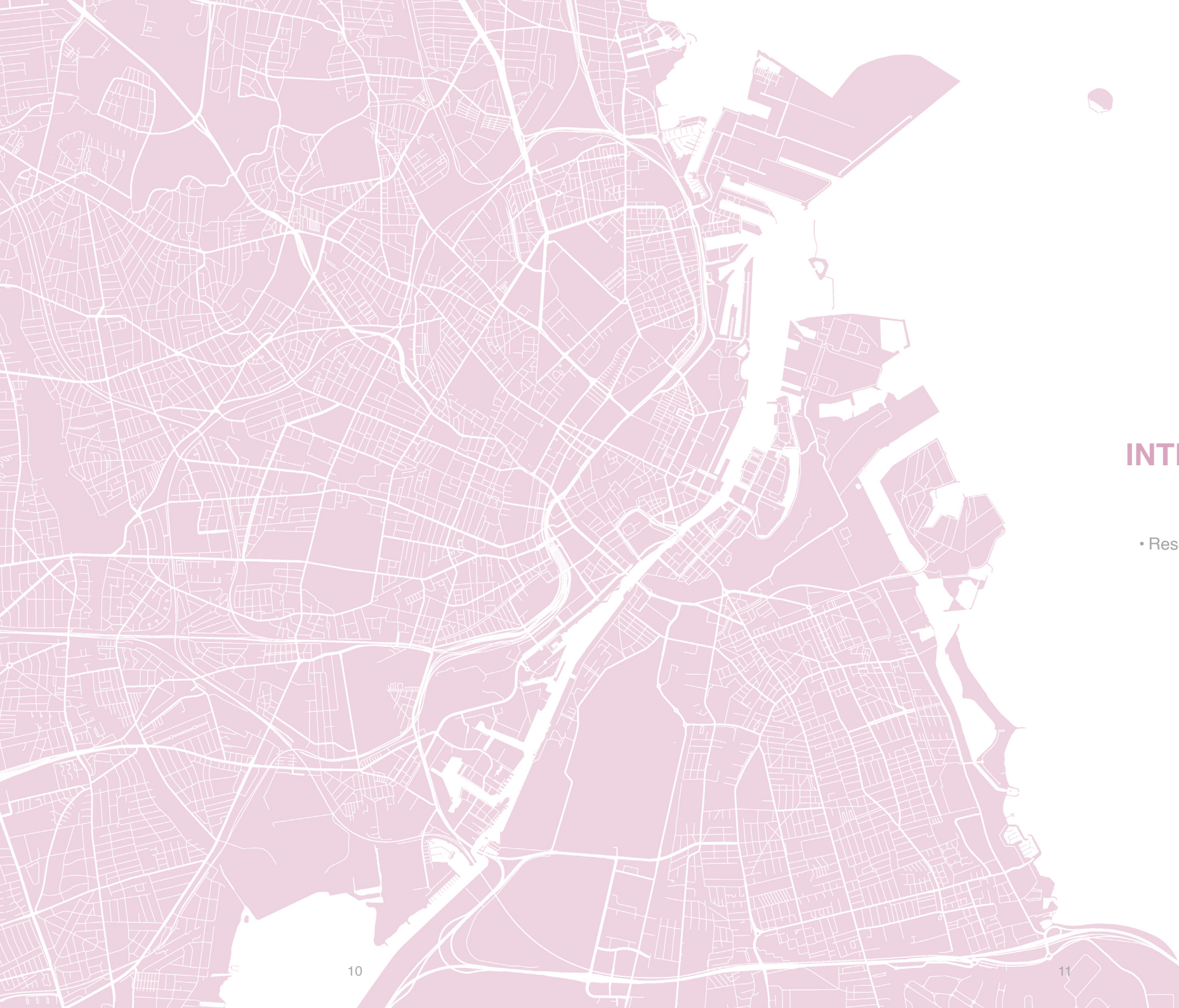
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## PART I

# 01

## INTRODUCTION

- Background
- Research Questions & Aims
- Methodology

## 1.1 Background

Today, urban areas worldwide are increasingly vulnerable to environmental challenges and climate change impacts such as global warming, flooding, urban heat island effects, and biodiversity loss—all of which threaten cities' resilience and long-term sustainable development. To address these challenges, cities are integrating nature-based solutions (NBS) into their planning and development strategies to enhance climate adaptation, improve ecological health, and elevate human well-being.

Globally, Copenhagen, Denmark's capital, exemplifies this approach. Recognized as the 2014 European Green Capital for its excellence in eco-innovation and sustainable transportation, Copenhagen is celebrated for its commitment to becoming a model for the green economy in Europe and globally, alongside its promising dissemination strategies (European Commission, 2012). As a leading city in planning quality and sustainable development (Oliveira, 2017), Copenhagen integrates blue-green infrastructure and climate adaptation measures. These elements are crucial for addressing urban resilience challenges and achieving long-term environmental development goals.

Despite Copenhagen's reputation for NBS and well-established processes, the practical application of NBS still faces key issues regarding strategic prioritization, spatial positioning, and evaluation. Specifically, how to select NBS projects in urban environments remains unclear—what criteria guide project siting and type, and how to measure outcomes from the perspectives of climate resilience and sustainability. Filling these gaps is vital for refining Copenhagen's strategy and replicating its model in other cities.

## 1.2 Research Questions & Aims

### Research Questions

Copenhagen has taken a leading role in implementing nature-based solutions (NBS) as part of its broader climate adaptation and sustainable development agenda. While some policy documents and guidelines provide direction for such interventions, selection criteria remain fragmented and are not systematically applied across different spatial contexts.

Based on this, this thesis asks:

**How can a structured and spatially grounded framework be developed to guide the selection and prioritization of Nature-Based Solutions in Copenhagen, by synthesizing existing planning strategies and contextual analysis?**

### Aims

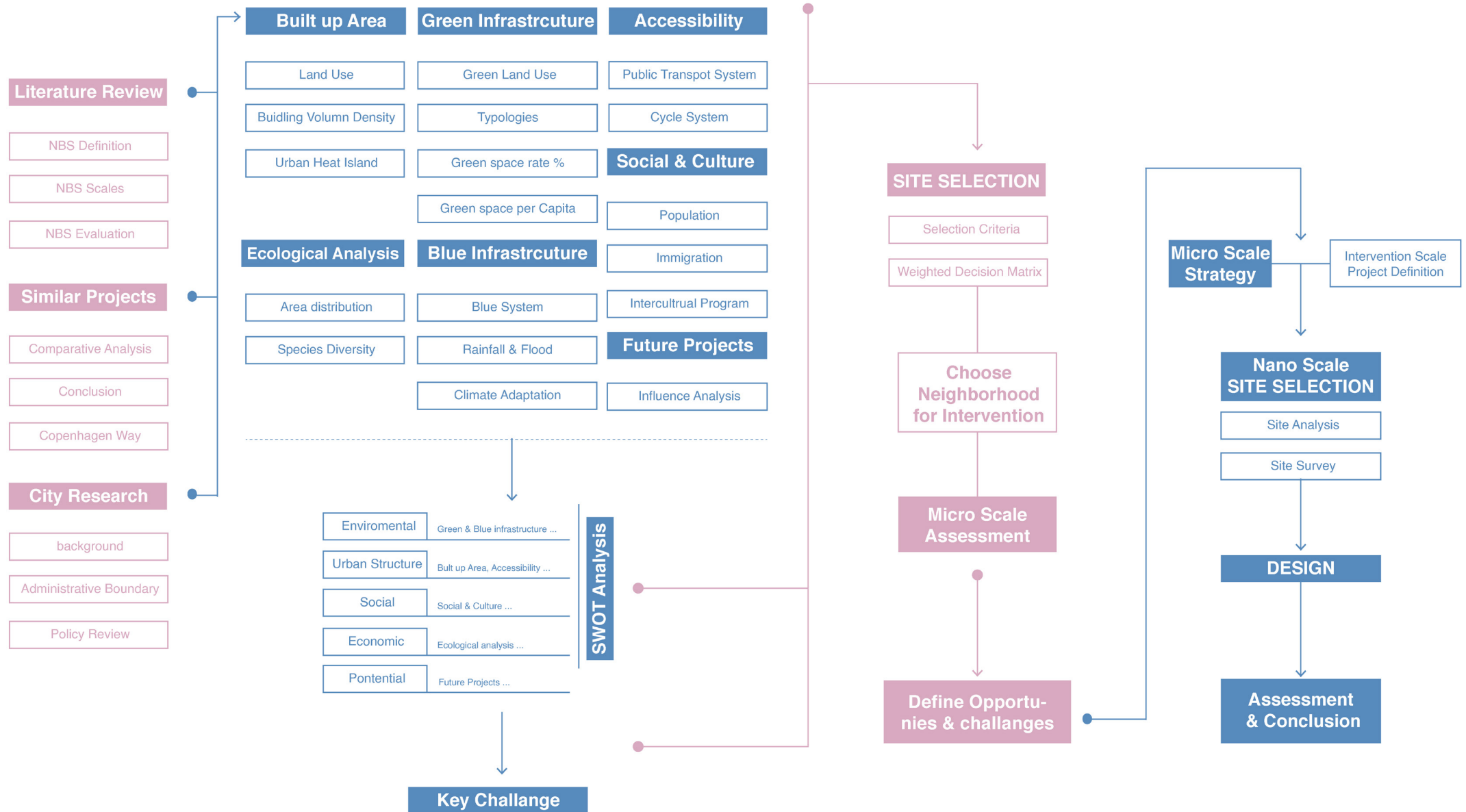
The aim of this thesis is to develop a structured framework to guide the selection, prioritization and design of Nature-Based Solutions (NBS) in Copenhagen, supporting the city's broader goals of climate resilience and sustainable urban development.

To achieve this aim, the thesis will:

- Study reference projects to understand their spatial logic, implementation process and evaluation criteria.
- Review Copenhagen's planning policies and climate adaptation strategies related to NBS
- Conduct a GIS-based spatial analysis to map urban conditions and assess site suitability for NBS.
- Propose site-specific NBS strategies based on the analysis and evaluate their potential impacts.



# 1.3 Methodology



This study uses a mixed-method approach including policy planning analysis and spatial assessment techniques. Considering the complexity of urban systems and the multitude of factors influencing climate resilience, this methodology enables to establish a clear and replicable framework for Copenhagen to identify, prioritize, and design nature-based solutions (NBS).

## Similar Projects

To better understand how NBS are applied in practice, the research includes a comparative study of four successful projects in Copenhagen: Grønningen, Sankt Kjelds, Jomfrusti Kvarteret and Enghaveparken. These projects represent a range of urban conditions- from dense residential areas to large-scale park redevelopment- and illustrate how NBS can respond to different spatial, ecological and social challenges.

## Policy and Planning Content

This stage focuses on the review of key planning and policy documents including the Finger Plan, the Copenhagen Way, the Cloudburst Management Plan and other documents that guide the development of Copenhagen. This step helps clarify how NBS are currently framed within the city's governance structure and planning system and identifies relevant values and strategies.

## GIS-Based Spatial Analysis

Geographic Information Systems (GIS) were adapted to comprehensively understand Copenhagen's urban structure. By analyzing layers such as urban structure and morphology, environmental and physical context, population distribution, and transportation accessibility, a spatial profile of the city was constructed. Additionally, specific indicators such as climate vulnerability (flood risk zones and heat island effect areas), ecological potential (green space coverage), socio-spatial needs (population density and social vulnerability), and planning compatibility (underutilized land and redevelopment zones) were assessed to support the identification and prioritization of locations suitable for Nature-Based Solutions (NBS). At this stage, analysis can be conducted at varying scales including macro-, meso-, and nano scales.

## Site Selection and NBS Design

Based on the suitability map, high-potential areas will be identified. After assessing each site's unique physical, ecological and social characteristics, tailored NBS design is proposed considering green-blue connectivity, local land use and morphology and integrated with planned infrastructure projects. This ensures that each intervention responds directly to contextual opportunities and constraints.

## Impact Evaluation

The effectiveness of each NBS strategy is evaluated across three main dimensions: climate resilience, ecological value and urban sustainability, which reflects the various roles NBS can play in tackling environmental and social challenges in the city.



## 02

### Literature Review

- From Ecology to Infrastructure
- Scale in Urban Design & Planning Practice
- Indicators & Evaluation of NBS

This chapter reviews key theoretical and methodological foundation on Nature-Based Solutions (NBS). It explains core NBS concepts, explores NBS applications across varying urban scales, and reviews existing NBS impact assessment methodologies. Through these introductions, it clarifies current research approaches to understanding, planning, and evaluating NBS while identifying research gaps that inform the analytical framework used in following sections.



## 2.1 From Ecology To Infrastructure : The Meaning Of Nature-Based Solutions

The concept of Nature-Based Solutions can be traced back to ecological engineering in the 1960s, which mainly focused on ecosystem design. After merging the ideas related to different issues such as urban sprawl, agricultural problems, land-use planning, water resource management, industrial design challenges, and resilience to climate change, NBS has become a comprehensive method using natural processes instead of technical systems to deal with social challenges such as climate change, human health, food and water security, and disaster risk reduction. The European Commissions explain it as “actions inspired by, supported by or copied from nature that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways”.(European Commission, 2015, p. 5)

In addition, the United Nations Environment Assembly of the United Nations Environment Programme Fifth session (UNEA5) also stresses that NBS should support sustainable development: “address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits”(UNEP, 2022), which makes NBS have more flexible applications in various types of landscapes. In rural regions, they support the management of forests, wetlands, rivers, and farmland to enhance water, food, and climate security; in cities, green and blue infrastructures are adapted to reduce heat, improve health, and generate social and economic value. Each approach works with natural systems to address local problems while also benefiting humans and the environment.

Together, these definitions expand the scope of NBS beyond environmental management to include social inclusion and adaptive governance.

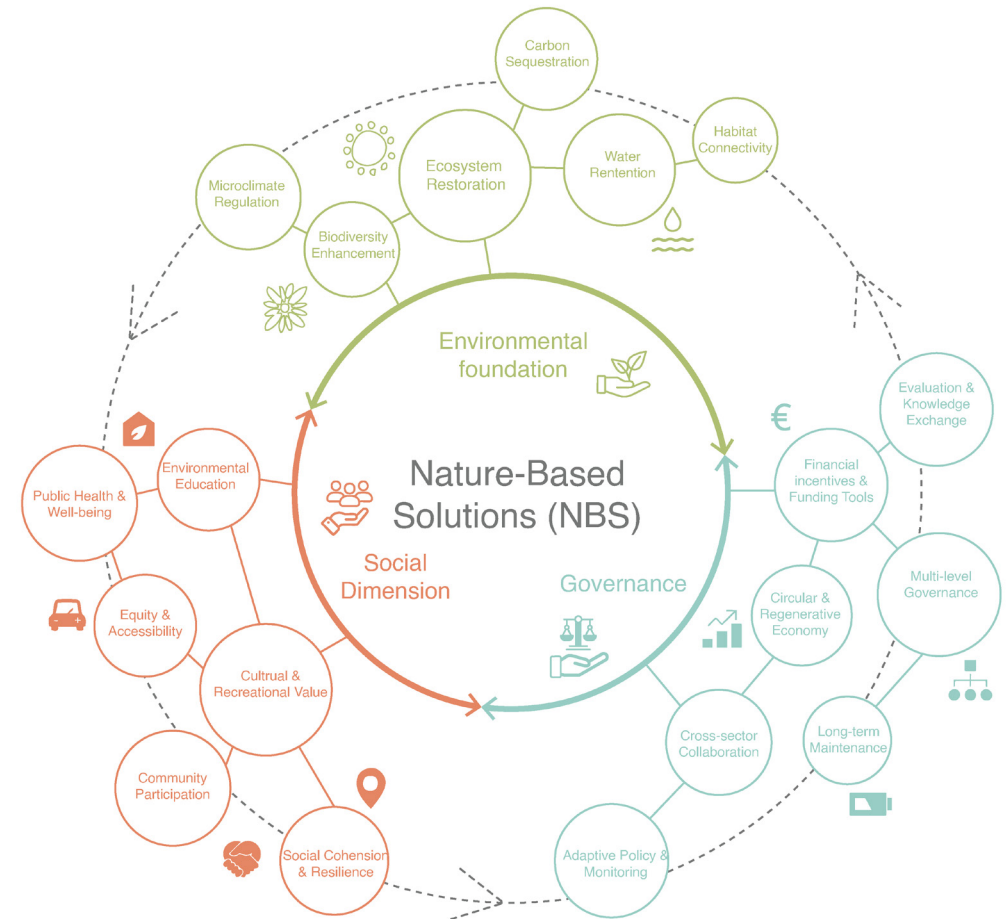


Figure 2.1 Evolution and integration of NBS  
Source: Author's illustration.

## 2.2 NBS Scale In Urban Design And Planning Practice

When applying NBS to the real urban fabric, it is necessary to consider the type of intervention that could be used, how it could be operated, and who will be involved during the process. From this perspective, scaling actions could be a good solution. Instead of setting fixed criteria, shifting from different scales clarifies the purpose for actions: for the Nano scale (building or plot), focusing on facilitating and manipulating natural processes makes it mainly struggle for individual results; for the Micro scale (Neighborhood or urban district), the aims are retrofitting and receiving green and blue sources; Meso-scale (city region ) projects pay attention to enhance performance of existing systems; Macro scale address managing and assigning ecological flows and spaces. (Mahmoud & Israa, 2024) The difference between them is not only about size, but also a combination of design goals, management needs, planning tools, and governance.(Raymond et al., 2017)

The scale also influences the objects. Erickson and Lloyd-Jones (2001) point out that the urban areas for design activities in the built environment change from courtyard, street, or square, quarter, city, and metropolitan regions as the design scale increases, which is applicable equally during NBS implementation: it could range from a private garden or building roof, to street trees or community garden, finally to the urban forest or ecological corridor depending on the level of NBS. Additionally, the scale also affects the planning process. Small-scale projects are quicker and easier to implement, mainly focusing on themselves. Large-scale actions, on the other hand, aim to improve the entire water system or green network, which requires higher costs and coordination. Based on this, the different-scale actions form a comprehensive network, where small-scale actions are akin to individual points, and their combination can be regarded as a connection for the entire system.

REGULATION & COORDINATION

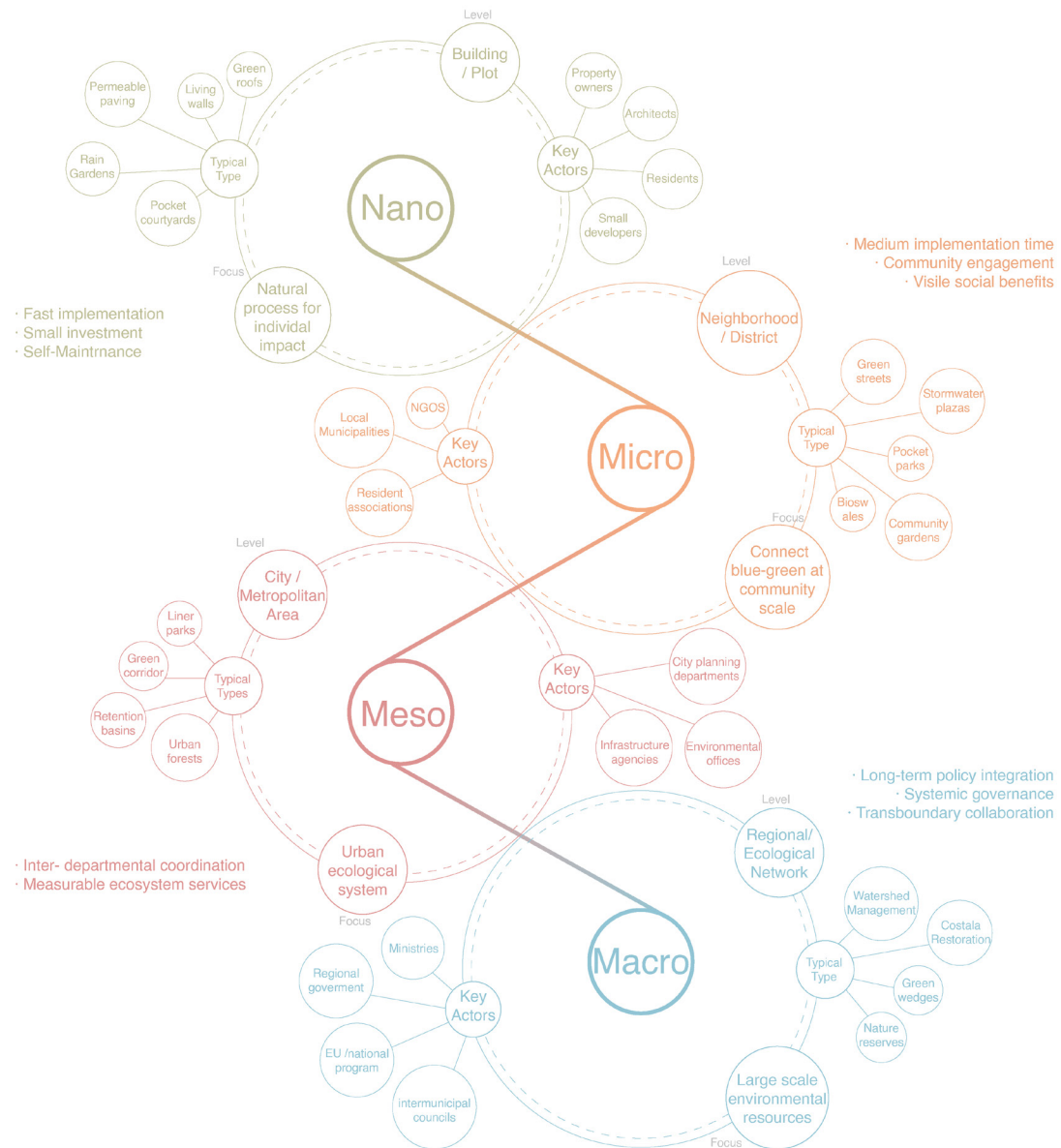


Figure 2.2 Different scales and characters for NBS application  
Source: Author's illustration.

Scaling the actions also makes it easier for designers to set priorities. Small-scale projects usually address individual retrofits, like rain gardens or green roofs, and large-scale actions more stress the synergistic effect from a structural level, such as stormwater corridors or a green-blue infrastructure network, which means physical conditions are not the only elements should be considered during the design process, but also consider where the sites sit within the city's structure. (Kabisch, Korn, Stadler & Bonn, 2017). From this perspective, a suitable NBS location should not be chosen solely based on vulnerability or land use; the role it plays in the broader system should also be taken into account. In the project examples part, it also reflects how scale influences both the types of NBS and the logics behind planning.

## 2.3 Indicators and Evaluation of NBS

Over the past few years, numerous studies have explored how cities select suitable locations for implementing NBS. Rather than proposing a single model, ELKIPSE (Raymond et al., 2017) integrates policy and practical experience, and offers a more comprehensive overview of how to plan, adapt, and evaluate NBS in urban settings,

The report explores a more flexible, context-sensitive approach based on findings—assessing the types of challenges cities face, potential changes in specific areas, and the benefits NBS can deliver. Thus, technical scoring systems are not the sole factor cities should consider, as urban challenges extend beyond environmental risks or insufficient greening to encompass physical, political, and social factors. For instance, physical challenges (e.g., lack of shade) and social pressures (e.g., demand for public space) may drive street retrofits, creating opportunities for urban intervention. Therefore, the report frequently describes NBS as an embodiment of “opportunism.” Projects utilizing vacant lots, residual roadside areas, or abandoned school grounds may only address the issues at hand, but it is precisely because these sites offer flexibility and are already integrated into broader discussions.

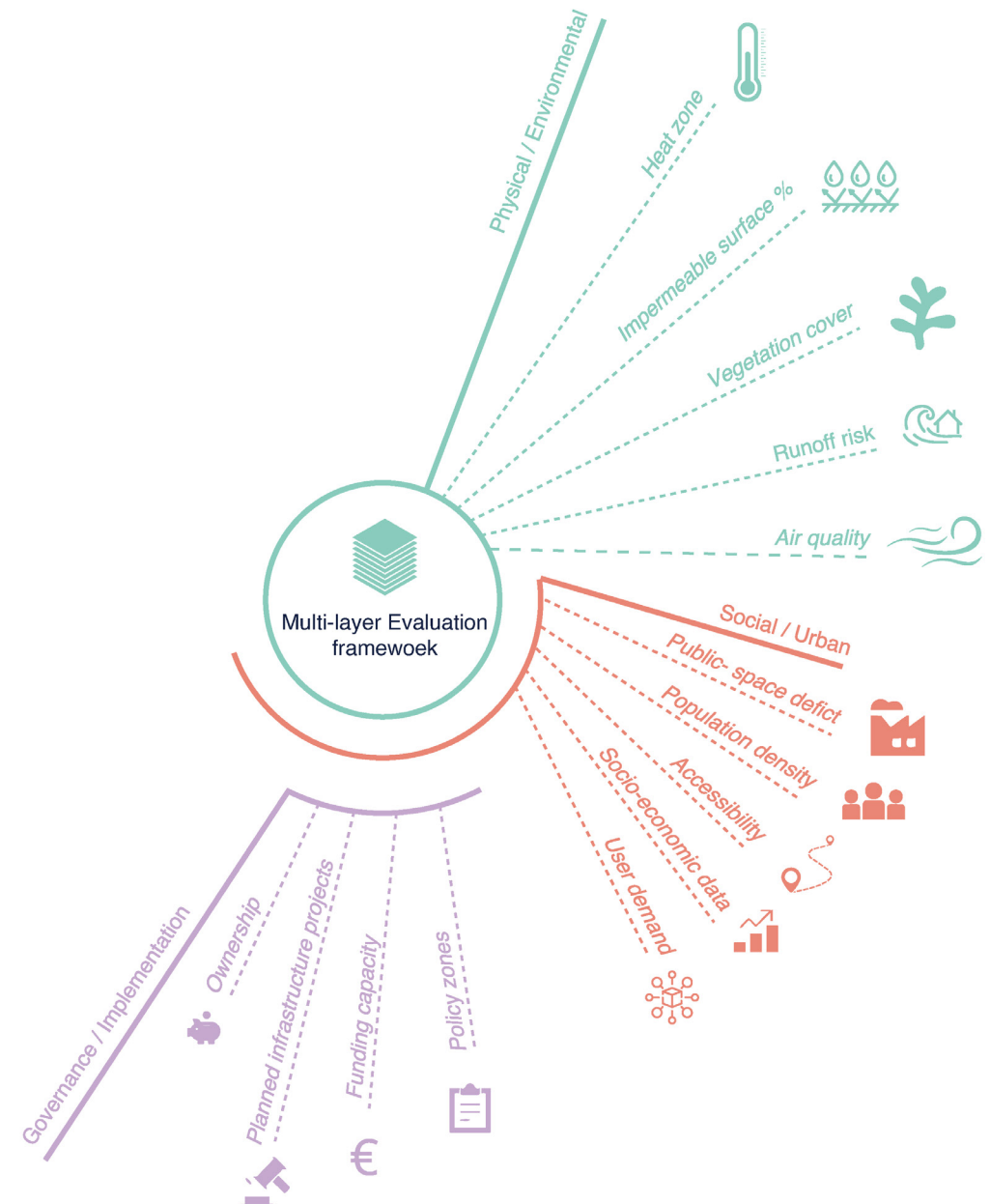


Figure 2.3 Multi-layer evaluation framework for NBS  
Source: Author's illustration..



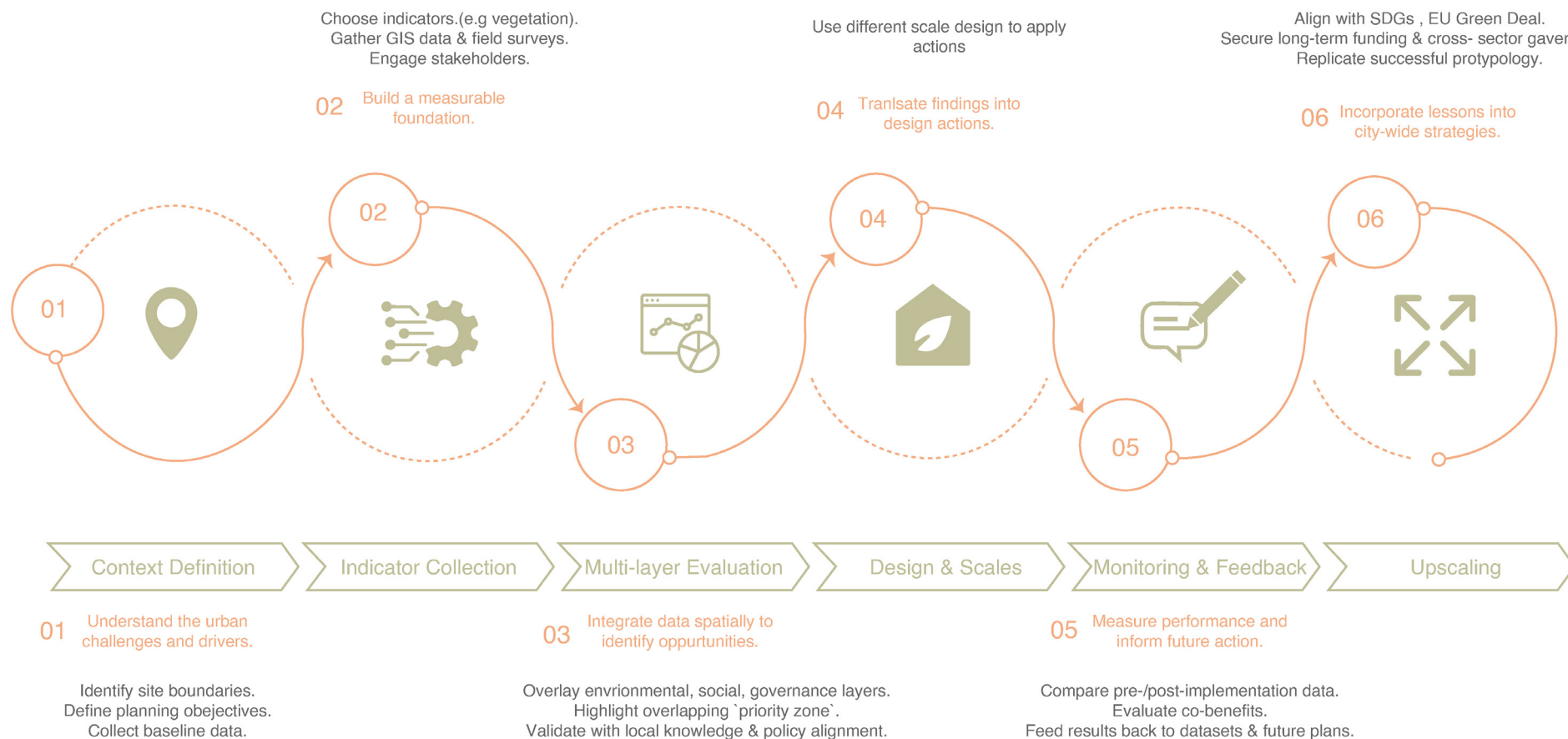
The report also emphasizes that using mapping tools to make the selection process more dynamic is important for NBS, but not in isolation. The first step is to utilize geospatial data, such as heat zones, vegetation coverage, or road layout, to gain a basic understanding of the site. Then, the local knowledge, like maintenance history, land ownership, public perception, and ongoing plans, should also be merged into this comprehensive map. Many projects fail or get delayed because of the ignorance of these non-visible conditions. Therefore, the report suggests that layered evaluations, including GIS data, consultation, stakeholder, and field observation should be adapted. Some examples in the report are not chosen based on risk level alone, but also on multifunctional purposes, aligning with other infrastructure and policy goals.

Figure 2.4 Workflow of NBS planning and evaluation.

Source: Author's illustration based on Raymond et al. (2017), Kabisch et al. (2016), and Ahern (2011).

In addition, the report points out that scale and site type could also influence the site selection. For example, small spaces like traffic islands can be valuable if they are well-placed. Large spaces like post-industrial areas may take years to implement actions due to legal and financial constraints, which shows the site selection is not about size alone, but about timing, function, and fit within the existing system. For this perspective, the NBS actions in Copenhagen have more potential considering that the city already works with layered plans- water, mobility, green structure, and climate resilience. In this way, they could be connected across existing systems and programs to achieve more effective results instead of working in isolation. (Raymond et al., 2017)

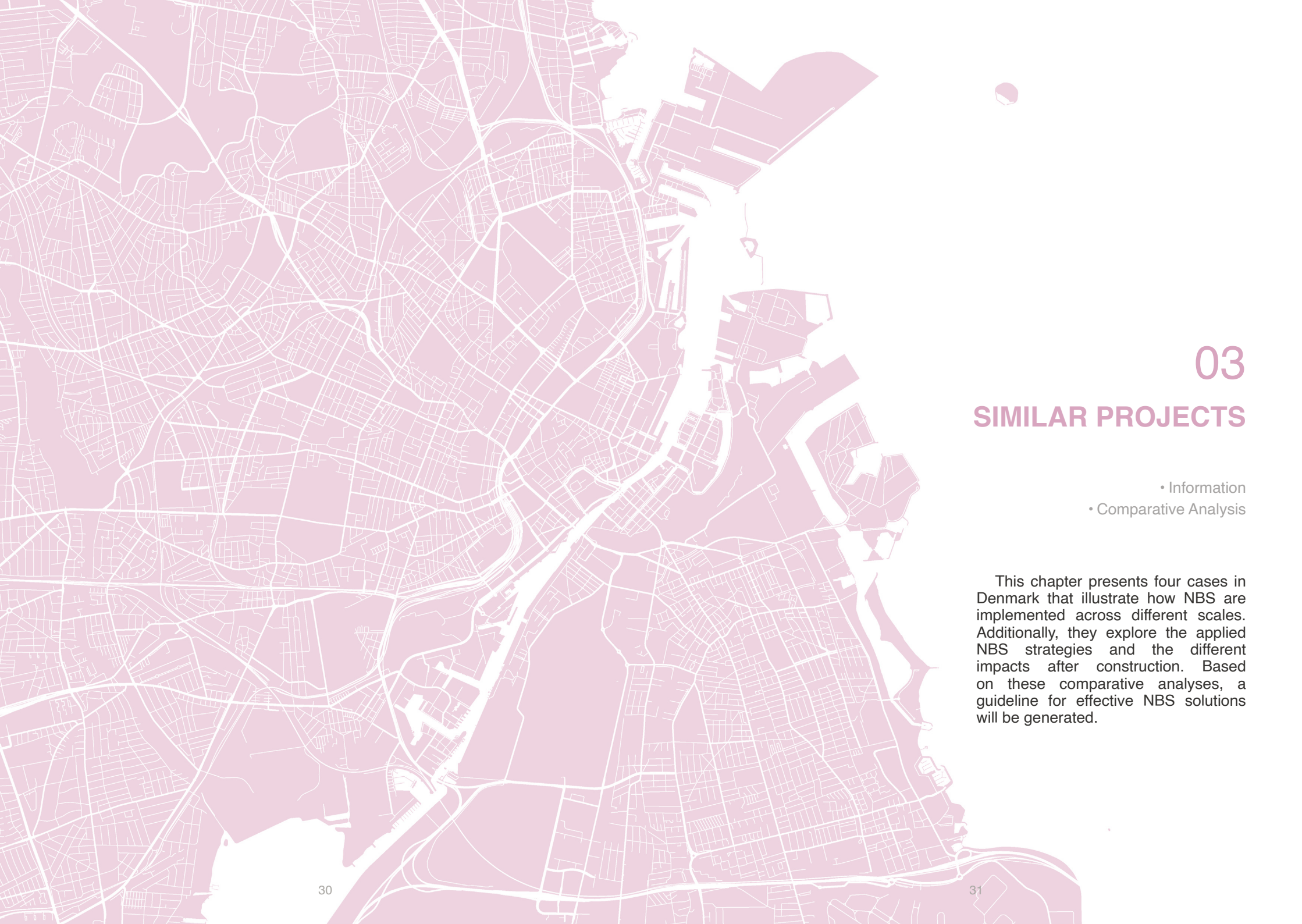
In other words, good site selection could happen where these systems intersect, like where a street prone to flooding meets a redevelopment zone.



## Conclusion

The research focuses on the five main fields, including **environmental performance, urban structure, accessibility, social context, and adaptation potential**. In each specific field, some spatial factors will be addressed for the evaluation framework, such as green-blue cover, heat, flood, population density, mobility, and retrofitting opportunities.

All the indicators will compose a comprehensive matrix to give weighted scoring, reflecting the complex nature of NBS performance. The set of adopted indicators will be introduced in subsequent chapters for site selection and comparison, ensuring that NBS opportunities are compared in an integrated, transparent, and context-sensitive way.



# 03

## SIMILAR PROJECTS

- Information
- Comparative Analysis

This chapter presents four cases in Denmark that illustrate how NBS are implemented across different scales. Additionally, they explore the applied NBS strategies and the different impacts after construction. Based on these comparative analyses, a guideline for effective NBS solutions will be generated.



## 3.1 Information

### 01 Grønningen-Bispeparken

Type: Climate Adaption; Landscape Architecture

Location: Copenhagen, Denmark

Architect: SLA

Year: 2020-2024

Grønningen, located in the Bispeparken social housing district of Copenhagen, is one of the city's most prominent nature-based climate adaption projects. The area, historically prone to pluvial flooding, was selected through the city's cloudburst master plan. Its vulnerability and social composition made it a priority zone for adaptation interventions.

The project covers around 20,000 m<sup>2</sup> and integrates 18 sculpted retention basins, redesigned lawns, diverse planting schemes and multifunctional public spaces, which can retain up to 3000 m<sup>3</sup> of storm water during intense rainfall. The park protected and kept surroundings house and infrastructures safe and dry while a major thunderstorm hit Copenhagen flooding several major highways and infrastructures on September, 2024.

In terms of ecosystem services, Grønningen contributes to stormwater regulation, temperature mitigation and biodiversity support through native vegetation. It also enhances social cohesion by providing inclusive spaces in a socially diverse neighborhood especially the open view towards Grundtvig's Church- one of the best known churches in the city.



Figure 3.1 (top left) , (top right), (bottom)  
Respectively: Normal status, Public park, Buffer basin for rainwater.  
Source: SLA architecture, <https://www.sla.dk/cases/gronningen/>.





## 02 Sankt Kjelds Quarter

Type: Climate Adaption; Urban Public Space

Location: Copenhagen, Denmark

Architect: SLA

Year: 2015-2019

Sankt Kjelds, is known as the first climate-adapted neighborhood in Copenhagen. Selected as a pilot zone for decentralized NBS strategies, it exemplifies the transformation of a grey, car-oriented district into a green, multifunctional public environment. Its location in a flood-prone, highly impermeable area made it ideal for green retrofitting.

The project consists of green street, permeable plaza, over 500 newly planted trees and a strong emphasis on co-design with residents. While not defined by a single intervention, the combine works across the quarter span over 60,000 m<sup>2</sup>, creating a connected network of green infrastructure.

Its effectiveness is evaluated through heat reduction (canopy cover and albedo changes), infiltration capacity and increased biodiversity. Beyond its technical success, the project illustrates how local participation and public- private governance can strengthen climate resilience at a neighborhood scale.



Figure 3.2 (top) , (bottom left), (bottom right)

Respectively: Overview, Green urban spaces, Rainwater bed.

Source: SLA architecture, <https://www.sla.dk/cases/sankt-kjelds-square-and-bryggervangen/>.



### 03 Jomfrusti-Kvarteret

Type: Climate Adaption; Parking; Public space

Location: Copenhagen, Denmark

Architect: Urban Power

Year: 2016-2027

Recurring flooding makes much of Jomfrusti's central area unsuitable for development. Designated as an integrated climate adaptation project zone, the area aims to transform flood-prone zones into resilient communities featuring blue-green infrastructure.

The projects introduce a continuous stormwater park on former industrial land, aiming to connect the city center with the harbor. Instead of expanding the sewer system, the project uses a series of open retention basins, bio-retention ponds, and vegetated swales, to collect rainwater and channel it during extreme rainfall events.

The project provide this area with ecological park, new streets, green corridors, and recreational trails. Through participatory design and phased implementation, Jomfrusti will evolve into a vibrant, fully functional district that merges climate adaptation with urban renewal.

Figure 3.3 (top), (bottom)

Respectively: Jomfrusti before intervention; overview

Source: Urban Power, <https://urbanpower.dk/project/jomfrusti-district/>.







## 04 Enghaveparken

Type: Climate Adaption; Public park.

Location: Copenhagen, Denmark

Architect: COWI, THIRD NATURE and Platant

Year: 2021-2020

Enghaveparken is Copenhagen's largest climate-adaptation project and the first to fully integrate water management in a listed historic park. Completed in 2019, the transformation turns a 1920s neoclassical park into a layered blue-green system capable of holding up to 22,600 m<sup>3</sup> of stormwater during extreme rainfall events.

The design introduces a “climate sequence” for shifting between dry and wet conditions, which consider both daily recreational use and cloudburst protection. A surrounding levee and hydraulic gates enclose the park during heavy rain, while sunken sports fields, basins, and gardens temporarily store floodwater. In dry periods, these same features appear as lawns, playgrounds, and gardens, keeping the park fully usable.

Apart from flood management, the project also adapts new planting schemes and permeable surfaces to urban microclimate and public life.



Figure 3.4 (top left) , (top right), (bottom)

Respectively: Overview, Water management, Adaptive use.

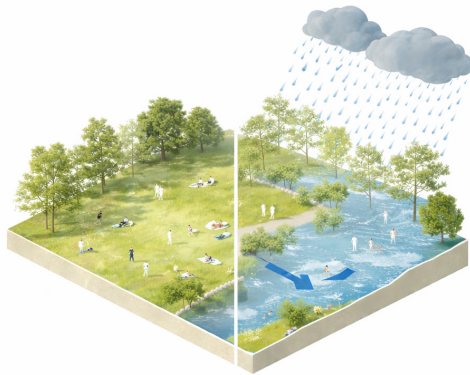
Source: SLA architecture, <https://www.sla.dk/cases/gronningen/>.

## 3.2 Comparative Analysis

This section presents several NBS typologies applied in these projects, which mainly addresses specific challenges, such as flooding, urban heat or biodiversity loss. But they are not used as isolated elements. The projects combine multiple strategies to reinforce each other, creating more robust solutions that enhance overall urban resilience.

Figure 3.5 NBS typologies applied in the similar projects.  
Source: Author's illustration.

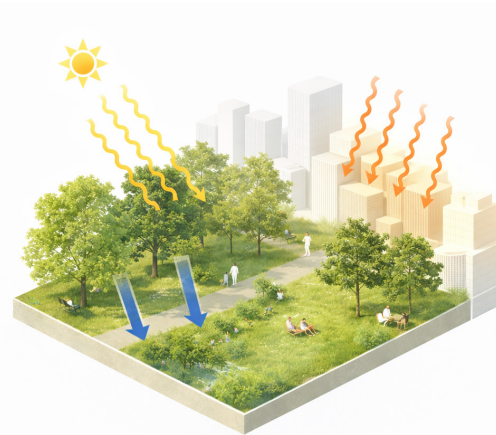
- 01 Grønningen-Bispeparken
- 02 Sankt Kjelds Quarter
- 03 Jomfrusti-Kvarteret
- 04 Enghaveparken



### Floodable Multifunctional Landscapes

01 04

Lawns and open green areas designed to function as everyday public space under normal conditions, while safely flooding during cloudburst events.



### Urban Greenery

02 03 04

Trees, shrubs, and vegetated areas that reduce heat stress, improve thermal comfort, and create shaded, cooler environments for daily use.



### Stormwater retention basins

01 03 04

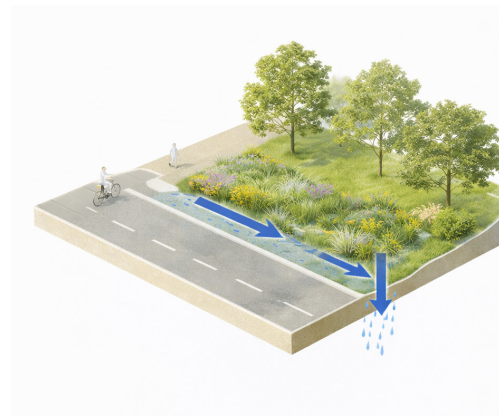
Sculpted depressions and basins that temporarily store and delay rainwater during heavy rainfall, reducing pluvial flooding and pressure on the sewer system.



### Permeable & Water-Tolerant Surfaces

02 04

Surfaces and materials that allow infiltration and temporary inundation, reducing runoff and surface damage., keep same isometric block



### Rain Gardens And Bioretention Beds

01 02 03

Planted depressions that collect runoff from roads and pavements, supporting infiltration and pollutant filtration.

|                              | Design Strategy                                                                                                                                                                                                                                                                                                 | Positive Impact                                                                                                                                                                                                                                                                                 | Negative Impact                                                                                                                                                                                                                                                                                                   |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01<br>Grønningen-Bispeparken | <ul style="list-style-type: none"> <li>• Sculpted social basin- plaza when dry</li> <li>• Rain channels</li> <li>• Micro-topographic water flow</li> <li>• Community-shaped basin design</li> <li>• Multiuse retention lawns</li> <li>• Visible water pathways</li> <li>• Integrated art and ecology</li> </ul> | <ul style="list-style-type: none"> <li>• Local flood protection</li> <li>• Strong social inclusion</li> <li>• Native biodiversity boost</li> <li>• Resilient housing district</li> <li>• Improved air quality</li> <li>• Visible water awareness</li> </ul>                                     | <ul style="list-style-type: none"> <li>• High maintenance cost</li> <li>• Safety concern near basins</li> <li>• Complex water management</li> <li>• Potential mosquito growth</li> <li>• Limited night activity</li> <li>• Noise from nearby roads</li> </ul>                                                     |
| 02<br>Sankt Kjelds Quarter   | <ul style="list-style-type: none"> <li>• Green street retrofitting</li> <li>• Distributed rain gardens</li> <li>• Tree-water cascade network</li> <li>• Infiltration pavements</li> <li>• Flexible retention plazas</li> <li>• Pedestrian–water paths</li> </ul>                                                | <ul style="list-style-type: none"> <li>• Urban flood mitigation</li> <li>• Cleaner air and cooler streets</li> <li>• Active mobility support</li> <li>• Rich tree canopy</li> <li>• High local participation</li> <li>• Improved biodiversity</li> <li>• Stronger community identity</li> </ul> | <ul style="list-style-type: none"> <li>• Expensive maintenance</li> <li>• Slow tree establishment</li> <li>• Uneven infiltration zones</li> <li>• Limited parking capacity</li> <li>• Difficult winter maintenance</li> <li>• Traffic adjustment issues</li> </ul>                                                |
| 03<br>Jomfrusti-Kvarteret    | <ul style="list-style-type: none"> <li>• Continuous rainwater corridor</li> <li>• Open canal network</li> <li>• Modular basin system</li> <li>• Regenerative industrial reuse</li> <li>• Green spine urban layout</li> <li>• Phased flood adaptation</li> </ul>                                                 | <ul style="list-style-type: none"> <li>• Reduced flood risk</li> <li>• Ecological connectivity</li> <li>• Brownfield regeneration</li> <li>• Civic participation</li> <li>• Climate-aware identity</li> <li>• Long-term adaptability</li> </ul>                                                 | <ul style="list-style-type: none"> <li>• Long implementation time</li> <li>• Risk of sediment blockage</li> <li>• High initial investment</li> <li>• Conflicts with adjacent traffic</li> <li>• Flood corridor safety issues</li> <li>• Dependence on public funding</li> </ul>                                   |
| 04<br>Engaveparken           | <ul style="list-style-type: none"> <li>• Dual-use climate park</li> <li>• Flood–recreation sequence</li> <li>• Hydraulic gate control</li> <li>• Layered water basins</li> <li>• Visible water circulation</li> <li>• Heritage park adaptation</li> <li>• Subsurface water storage</li> </ul>                   | <ul style="list-style-type: none"> <li>• City-scale flood safety</li> <li>• Daily–storm dual use</li> <li>• Biodiversity restoration</li> <li>• Cultural heritage renewal</li> <li>• Improved public life</li> <li>• Enhanced microclimate</li> <li>• Educational visibility</li> </ul>         | <ul style="list-style-type: none"> <li>• High construction cost</li> <li>• Complex gate operation</li> <li>• Limited accessibility in floods</li> <li>• Risk of mechanical failure</li> <li>• High water management needs</li> <li>• Uneven ground for recreation</li> <li>• Restricted event capacity</li> </ul> |

To better understand how public open spaces can respond to challenges related to climate change, social cohesion, and biodiversity, I analyzed and compared four cases based on their design strategies and the impact after construction.

Based on the analysis listed on the left, it is very clear that a successful public space should have good dialogue with the local community or neighborhood, which means the starting point of this space is to prioritize local needs and wishes. Considering the differences between these elements, such as population, climate status, funding, and size, applying different scales makes it easier and more efficient to create strategies for intervention.

Additionally, the local climate will provide designers with its own environmental benefits. Focusing on long-term development, maintaining these spaces increases the project's demands, meaning they can showcase ethnic diversity with local characters while also considering maintenance costs.

Table 3.1 Comparative analysis about similar projects.  
Source: Author's illustration.



# 04

## Copenhagen

### Meso Scale

- Information
- Built up Areas
- Green & Blue Infrastructure
- City Diagnosis
- Accessibility
- Social & Cultural Context
- Future Projects
- SWOT Analysis
- Site Selection

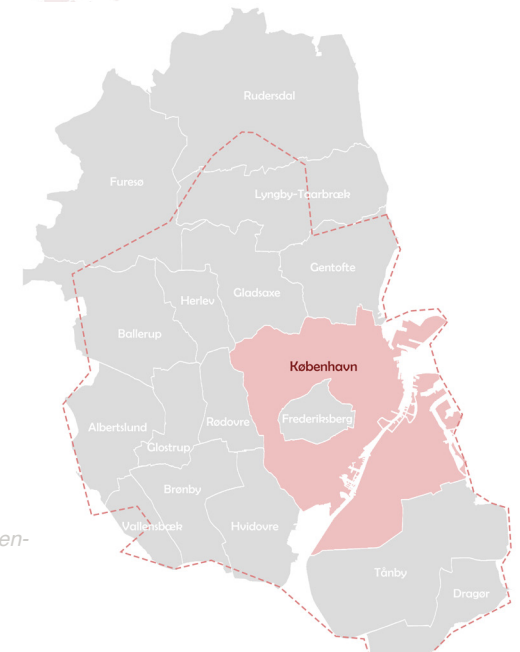
This stage of the project involves analyzing and understanding the spatial and social context in Copenhagen on a larger scale. Beginning with a brief introduction about the city's development and related policies, this stage aims to develop NBS selection criteria based on various data and methods. Considering the number and scale of each neighborhood divided by the municipality, two sites will be selected for the next research phase based on the selection criteria.

## 4.1 COPENHAGEN

### 4.1.1 Location

As the figure shows, Copenhagen, the capital of Denmark, is located between the North Sea and the Baltic Sea, making it a vital gateway for trade, cultural exchange, and political cooperation between Central Europe and the Scandinavian region.

The Greater Copenhagen area, also known as Metropolitan Copenhagen, is a large commuter belt that has a “densely populated core surrounded by suburban settlements”. This definition can be traced back to the Finger Plan, which has given the city several fingers of train lines, railroads, and metro lines to realize urbanization from central Copenhagen.

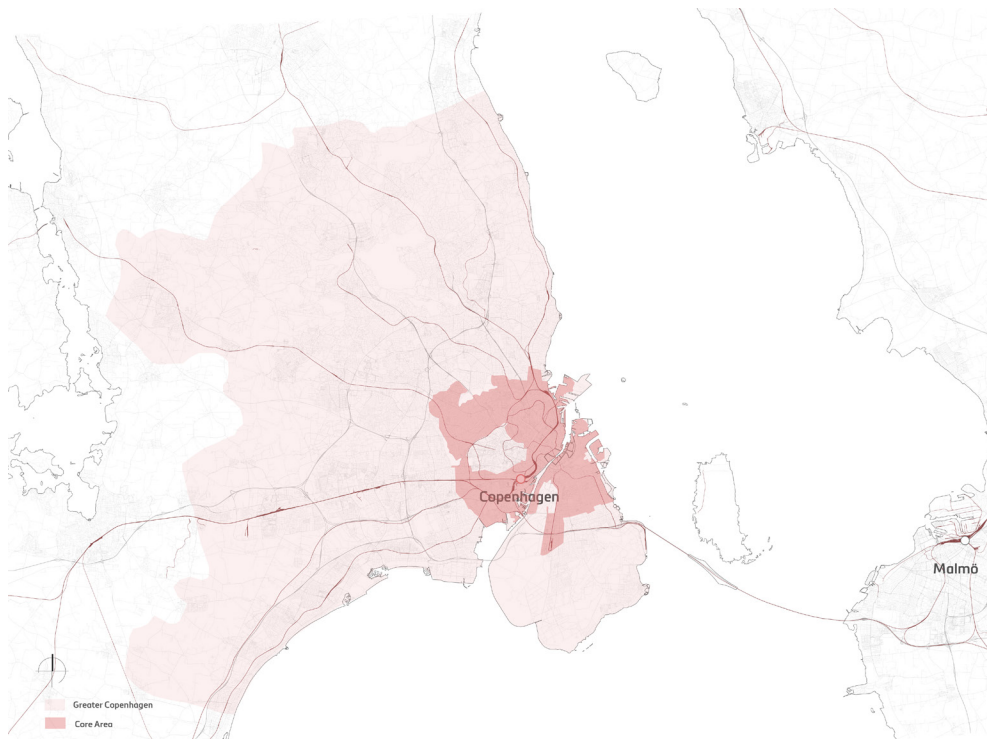


*Drawing 4.1 (top) , (bottom)  
Respectively: Location of Denmark, Copen-  
hagen and surroundings Municipalities.  
Source: Author's illustration.*

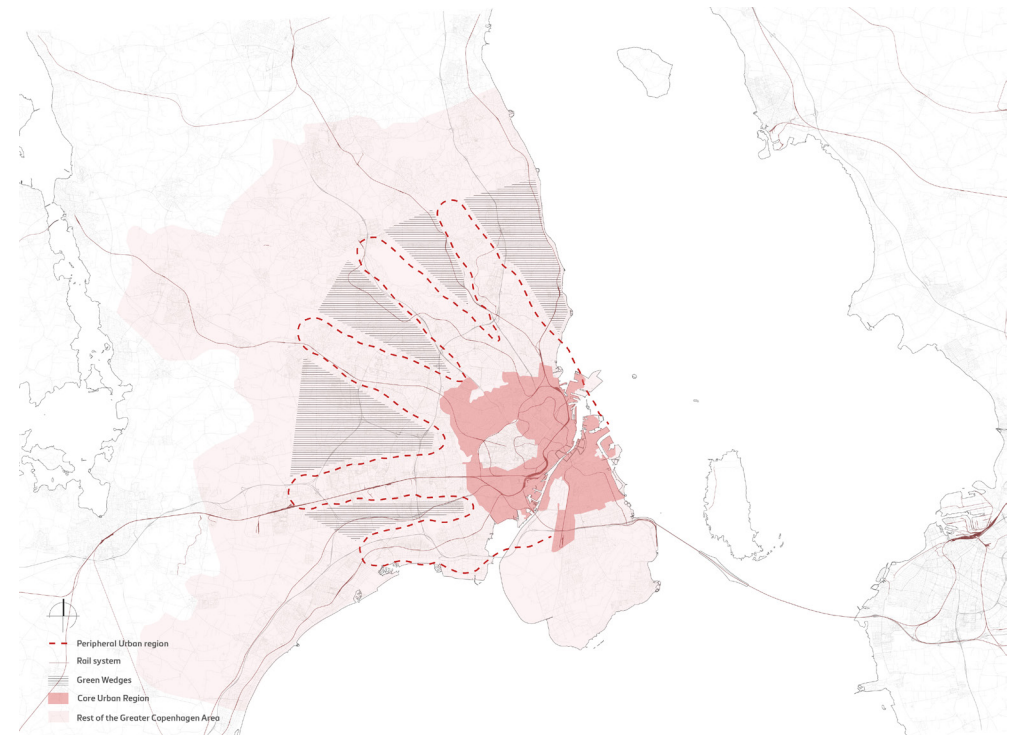


This pink area marks the boundaries of Copenhagen Municipality (København Kommune), where the historic city center is also located. Other neighboring municipalities, such as Frederiksberg, Gentofte, and Hvidovre, as guided by the Finger Plan, stretched from the central area and interconnected with each other. The map also points out that Frederiksberg, which has the largest population density of the municipalities\cite{Frederiksberg}, is enclosed by the Copenhagen Municipality. From this perspective, the urban contexts between these boundaries will be much more complex.

Additionally, one railroad passing through Amager continues to Malmö (a city in Sweden) by bridge. The spaces between the fingers, also called the green wedge, provide the city with regional outdoor recreational areas and agricultural zones.



*Drawing 4.2 The border of Copenhagen.  
Source: Author's illustration.*



*Drawing 4.3 Urban structure with Finger Plan.  
Source: Author's illustration.*

This pink area marks the boundaries of Copenhagen Municipality (København Kommune), where the historic city center is also located. Other neighboring municipalities, such as Frederiksberg, Gentofte, and Hvidovre, as guided by the Finger Plan, stretched from the central area and interconnected with each other. The map also points out that Frederiksberg, which has the largest population density of the municipalities\cite{Frederiksberg}, is enclosed by the Copenhagen Municipality. From this perspective, the urban contexts between these boundaries will be much more complex.

Additionally, one railroad passing through Amager continues to Malmö (a city in Sweden) by bridge. The spaces between the fingers, also called the green wedge, provide the city with regional outdoor recreational areas and agricultural zones.



## 4.1.2 Municipality Subvision

### Urban Distract Scale



Drawing 4.3 Urban district boundaries in Copenhagen.  
Source: Author's illustration..

As this figure shows, there are ten official districts in Copenhagen Municipality. Each of them has its own characteristics based on the built environment and social functions.

As an independent municipality, Frederiksberg shares the same metro line and other public spaces with the surrounding districts. With mixed-use and dense housing and friendly amenities, such as Copenhagen Business School and Frederiksberg Gardens, this district provides huge convenience for local people's lives.

Indre By, the core of the whole city, serves as a vibrant centre for tourism, commercial, and cultural activities, with plenty of landmarks and government institutions. Additionally, its waterfront areas also provide an immense social value for humans. For example, Nyhavn, a 17th-century waterfront, canal, and entertainment area, attracts thousands of tourists every day.

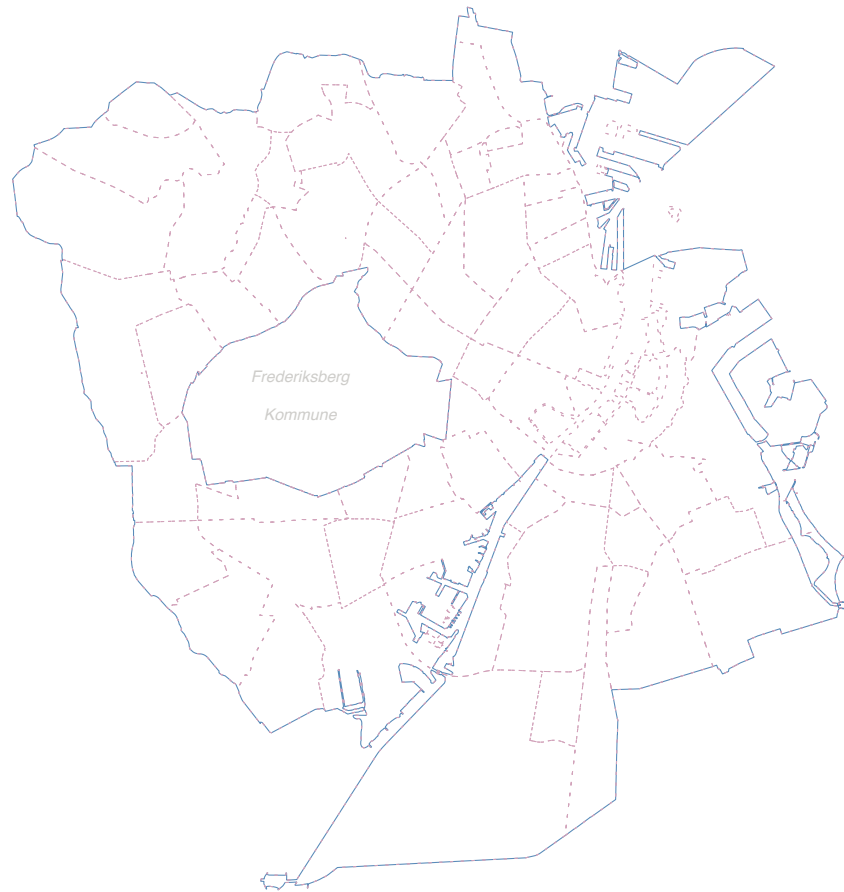
Vesterbro and Kongens Enghave have been transformed from industrial and working-class areas to more suitable living neighborhoods, through creative regeneration projects like the Meatpacking District. It provides residents with more entertainment options. Moreover, the Central Station makes it easier for residents to go to other districts and suburban areas.

Nørrebro is known for its dense and multicultural communities and vibrant street life. Also, the heavy bike traffic along the street makes it more suitable for a low-carbon life. To the North, Østerbro is a quieter and more residential area with green space and coastal resources like Nordhvan. Larger housing stock makes it a more family-oriented residential district. In contrast, the western and outer districts, including Valby, Vanløse, Brønshøj-Husum, and Bøgebjerg, show more of a suburban characteristic. Transformed from industrial areas, these districts remain a mix of lower or mid-density communities with ample open space. Meanwhile, there are some new ongoing projects about not only public transport access but also densification and modernization, aiming to attract more population and good connections with core areas.

As an artificial island, Amager plays an essential role in the Copenhagen urban structure, not only because of the strait connected to Sweden, but also because the airport Kastrup, the Nordic countries' largest airport, is also located here. The whole island is divided into two parts, the west and the east, which have different characteristics. Amager Vest, characterized by centralized and high-rise modernism and designed around metro stations, has more potential to give large projects like Ørestad and Bella Center. And in the peripheral area, there are huge green spaces and unused spaces. In contrast, Amager Øst remains more traditional and lower-rising residential neighborhoods. Meanwhile, there is a strong link between it and the coastline and green infrastructures, which makes it easy for residents to use this entertainment space, like Amager Strandpark and Øresunparken. Together, these two districts play a growing role in Copenhagen's expansion, especially for housing, urban ecology, and climate adaptation.

## Urban Distract Scale

Based on urban boundary delineation, Copenhagen is subdivided into 67 neighborhoods (kvarterer). This map displays the administrative boundaries of each neighborhood, with each serving as a unit for urban analysis, planning, and social spatial data management. It provides the municipality with a finer scale to support planning processes related to housing, transportation, green infrastructure, and climate adaptation.



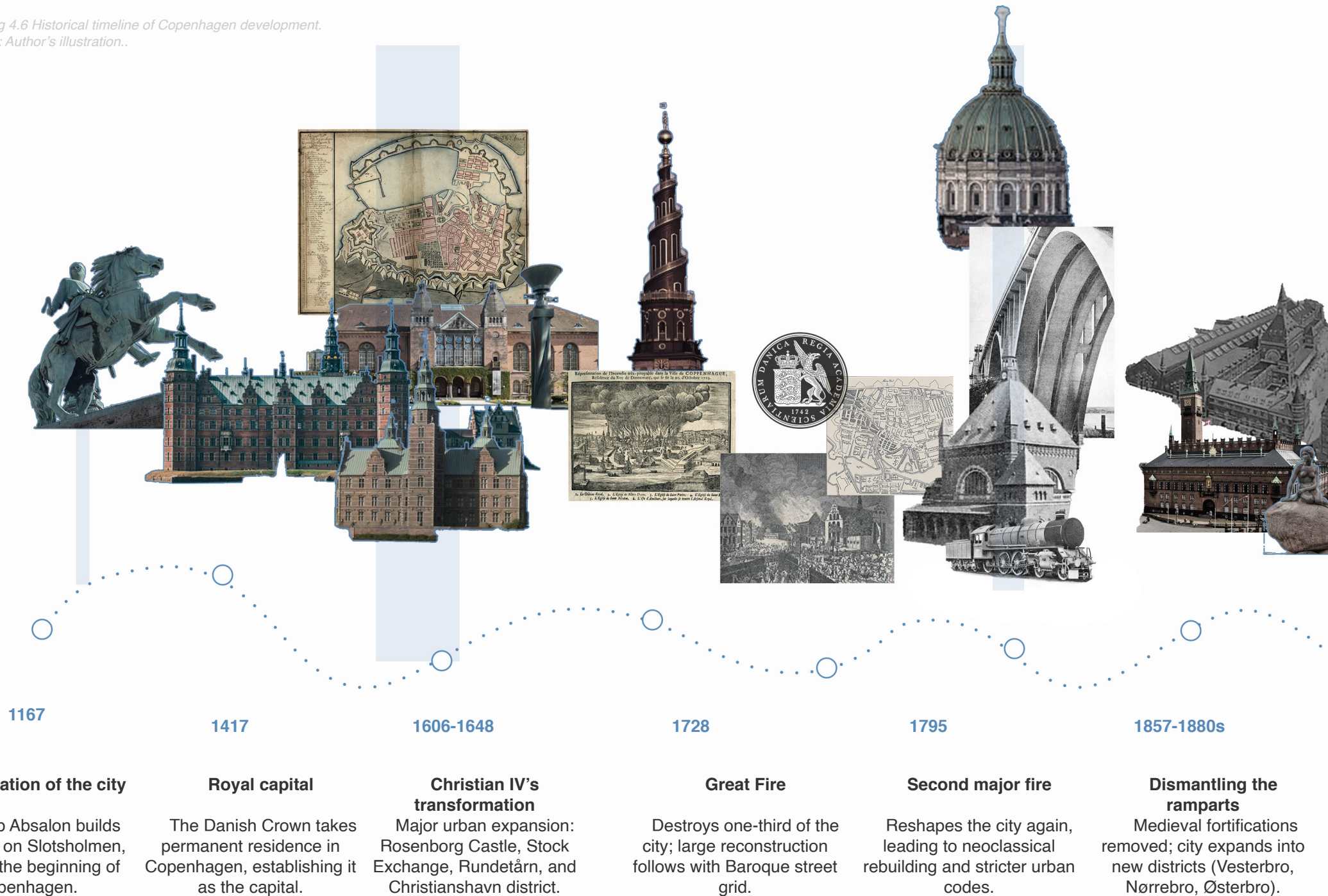
*Drawing 4.5 Neighborhood boundaries in Copenhagen.  
Source: Author's illustration..*

## 4.1.3 Historical Development

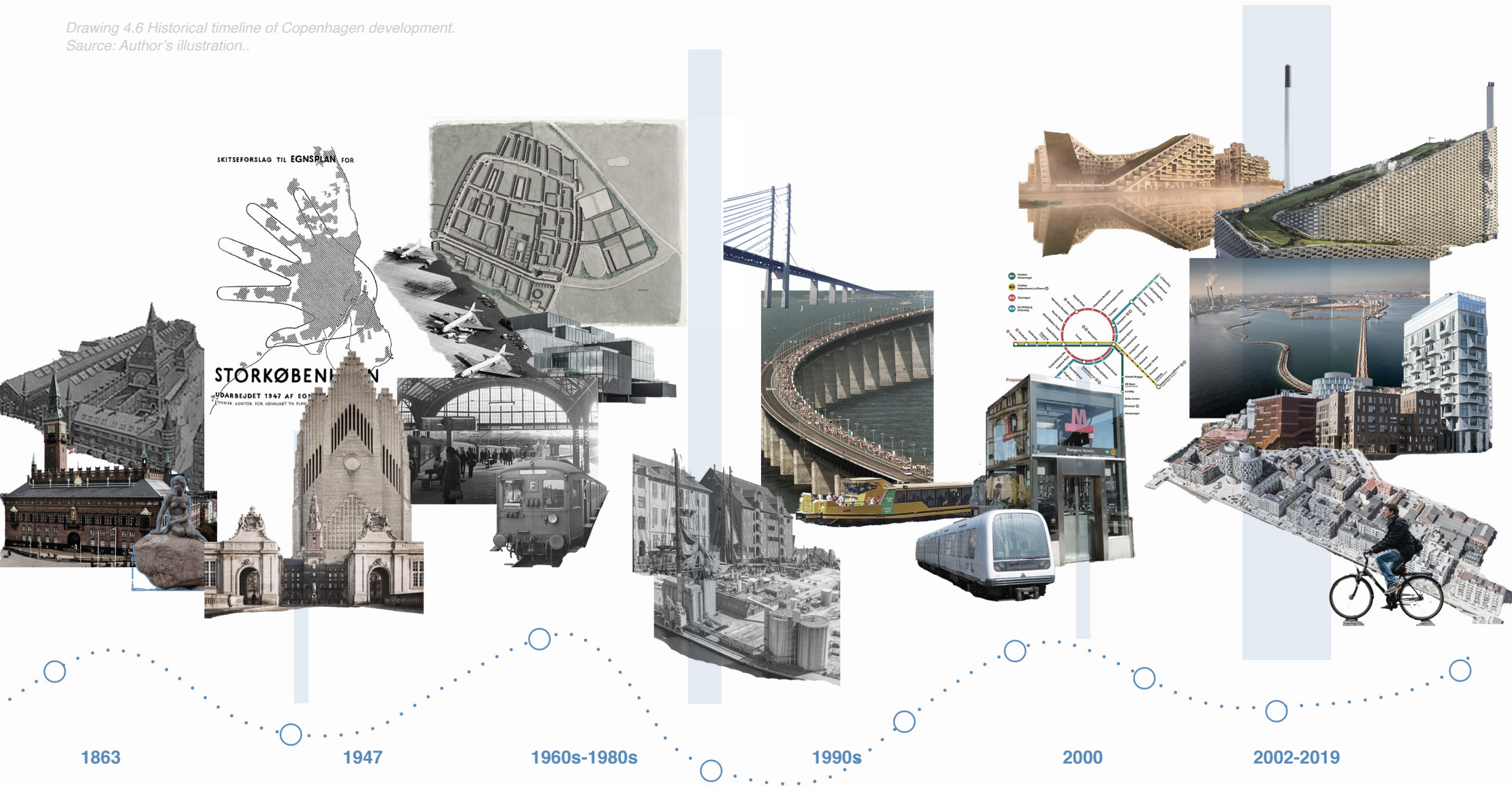
Copenhagen began as a fishing village in the 12th century and became a fortified trade city. The city demolished fortifications in the 19th century, resulting in plenty of newly developed neighborhoods, such as Vesterbro, Nørrebro and Østerbro. After World War II, the screws were tightened on further urbanising the metropolitan area with the Finger Plan, which provided a form of public transportation to connect people to each other through the metropolitan area. The city was attacked by an extreme cloudburst in 2011 and suffered substantial damage. Now it focuses much of its development on climate adaptation and resilience.

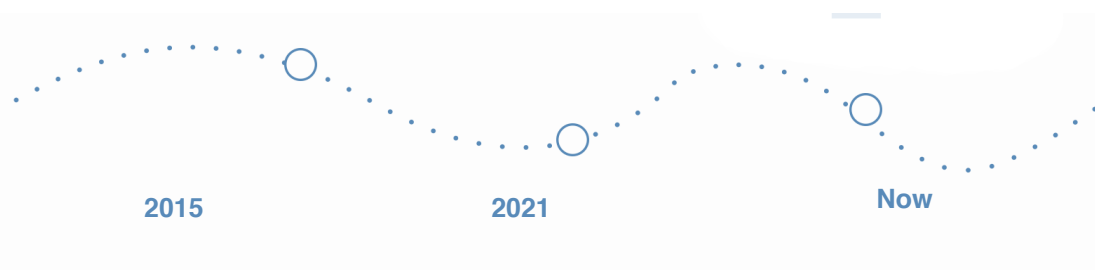
Today, Copenhagen is recognized worldwide for its environmental leadership and human-focused urbanism. The existing cycling infrastructure and renewable energy systems provide the foundation upon which the city plans to become the world's first carbon-neutral capital city by 2030.

Drawing 4.6 Historical timeline of Copenhagen development.  
Source: Author's illustration..









#### **Nordhavn redevelopment**

Model sustainable district with smart mobility, energy systems, and blue-green infrastructure.

#### **Lynetteholm approved**

Artificial island for climate adaptation, storm surge protection, and future urban expansion.

#### **Copenhagen: carbon-neutral by 2030**

Global model for sustainable urbanism, climate adaptation, and cycling infrastructure.

## 4.1.4 Policy Review

### Finger Plan

The Finger Plan, initiated in 1947, has remained central to the planning and development of the Greater Copenhagen metropolitan area. It emphasizes sustainable development, transportation, and green space preservation.

#### 1947-1950s

The plan, developed by the Regional Planning Office, stressed a structure where urban development is concentrated along city finger linked to the railway system and radial road networks and where the city fingers are separated by green wedges which are kept exempt from urban development. The idea was to balance the urbanization and green spaces. However, no statutory authority made it never formally adopted until later revisions.

#### 1960s-1970s

Corresponding to rapid population and urbanization, the plan improved and “Principle Draft for a Regional Plan” introduced secondary urban centers in 1960, and in the 1970s, the Greater Copenhagen Council further adapted the plan with specific regional guidelines, combining transportation corridor and hubs.

#### 1980s

The plan was revisited due to urban sprawl and the decline of industrial sectors. The 1985 and 1989 Regional Plans re-established a focus on Copenhagen as the primary urban center. Meanwhile the principles of locating urban developments near transportation hub was strengthened.

#### 2000-2007

The Capital's Development Council was responsible for regional planning until 2007. During this period, the plan was under reconsideration to reduce urban sprawl and preserve green wedges, and a fourth green ring around city was added. Besides planning was transferred to individual municipalities with aligned with the Finger Plan's principles.

#### 2013

Based on the original 1947 plan, The finger Plan 2013 remains main strategies and makes several updates to address modern urban challenges such as climate change, population growth and the need for improved infrastructure. It provides a vision for sustainable development and growth while managing urban expansion, improving the transportation infrastructure and maintaining green spaces and ecological areas between urban development.

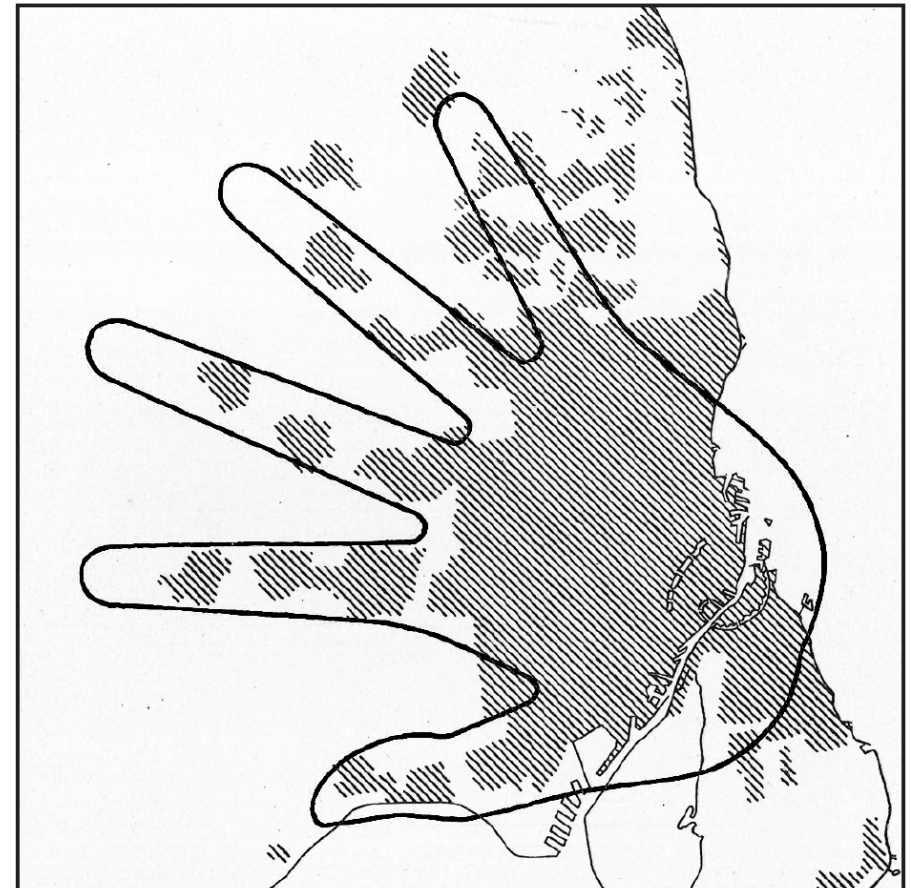


Figure 4.1 First Finger Plan 1947  
Source: Danish Ministry of the Environment, <https://naturstyrelsen.dk/>



One of the most significant updates is expanding public transportation infrastructure. With the aim to enhance the capacity and accessibility of train and subway lines, the plan introduces Transit-Oriented Development (TOD), creating more opportunities for residential, retail, office, and service facilities to be developed near public transit stations and hubs. This will ensure the public transit system remains efficient and fully utilized.

In light of the 2011 heavy rainfall disaster, the plan also places greater emphasis on green and blue infrastructure, ensuring urbanization aligns with sustainable development and climate adaptation. For example, the plan preserves green belts between urban areas, maintains existing parks, and expands green spaces to improve air quality and biodiversity. And it implements concrete measures such as utilizing green roofs, rain gardens, permeable pavements, and other stormwater management techniques to absorb excess rainfall and mitigate the impacts of urban flooding.

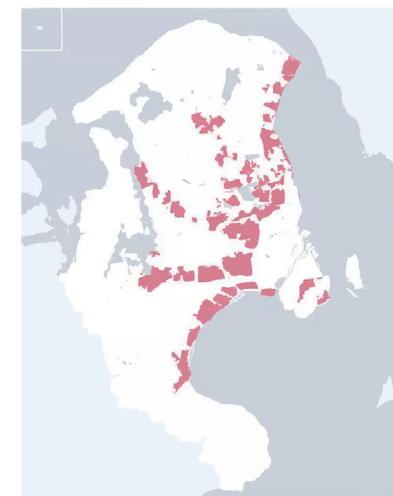
Even though the planning was transferred to individual municipalities and based on an assessment of the development of whole area, it should be under the control of principles according to Finger Plan, which divided the Greater Copenhagen Area into four types of geographical area and also set out basic principles for each part.

### **The Core Urban Region(the palm of the hand)**

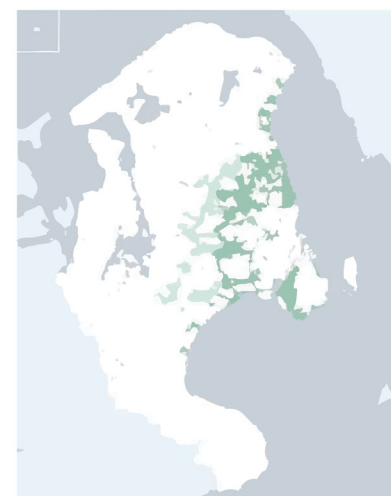
The core urban region encompasses the central urban municipalities of Copenhagen, Frederiksberg and Gentofte, as well as the nearby suburban districts located within the 3rd ring road. Within this area, there are large possibilities for urban regeneration, which must strengthen public transport services. For example, urban functions that are intensive based on the area use, job density or size should be placed near stations, with high building densities required.



Core Urban Region



Peripheral Urban Region



Green Wedges



Rest of the Greater Copenhagen Area

Figure 4.2 Individual element in Finger Plan.  
Source: Danish Ministry of the Environment, <https://naturstyrelsen.dk/>

## The Peripheral Urban region(the city fingers)

The peripheral area consists of existing urban areas (developed and undeveloped) along radial rail lines between cities such as Helsingør, Hillerød, Farum, Frederikssund, Roskilde and Køge and Amager. Development in these area must maintain a clear boundary between urban and rural land. Besides nature, landscape, and drinking water must be considered as urban development interests.

## The Green Wedges

These are the areas of open spaces between city fingers and coastal wedges, which serves as regional outdoor recreational areas and agricultural zones. The Plan pointed out that green wedges must not be converted into urban zones or used for urban recreational facilities, which means the primary of use of them is for non-urban outdoor recreation that must remain largely undeveloped. In some cases, climate change adaptation facilities could be introduced such as rainwater retention basins without damaging recreational and nature-related values.

## The Rest Of The Greater Copenhagen Area

This region includes areas outside core urban region and peripheral urban regions, as well as rural districts and small urban communities. Urban development in this region should be local in nature with stressing small scale development that serves local needs.

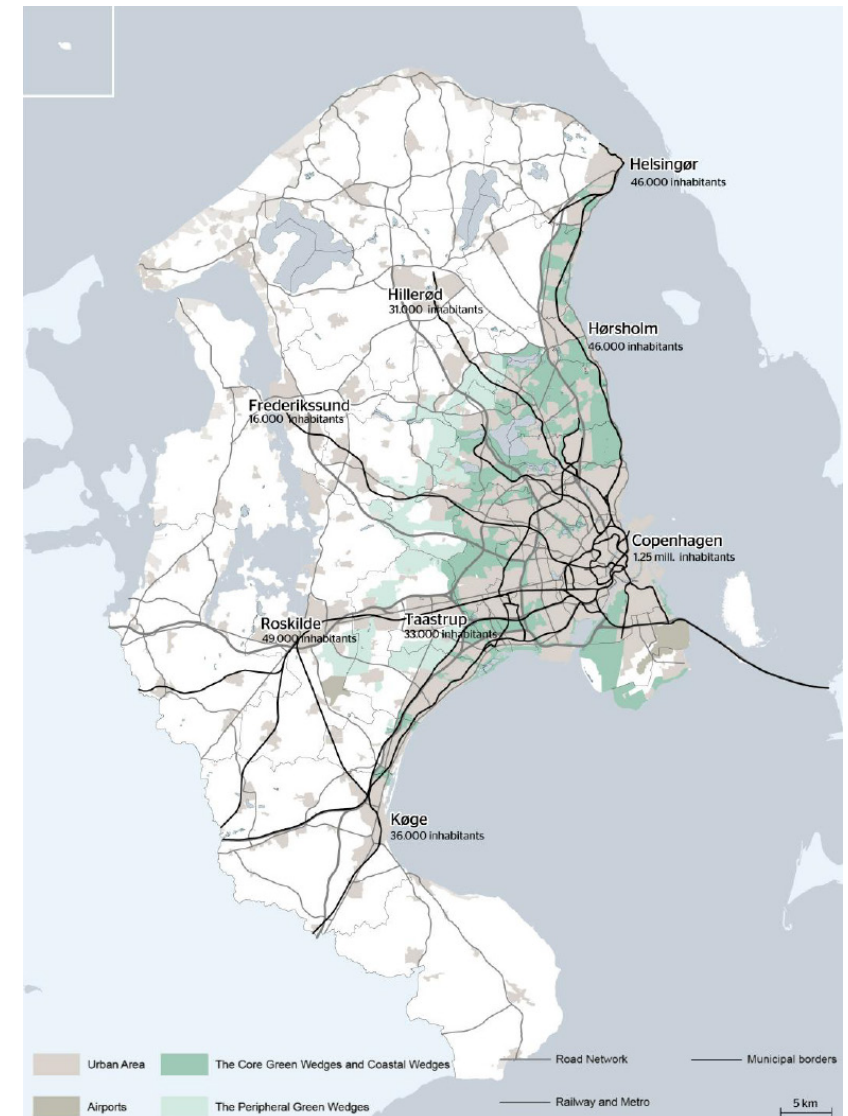


Figure 4.3 New masterplan of Fingerplan.  
Source: Danish Ministry of the Environment, <https://naturstyrelsen.dk/>

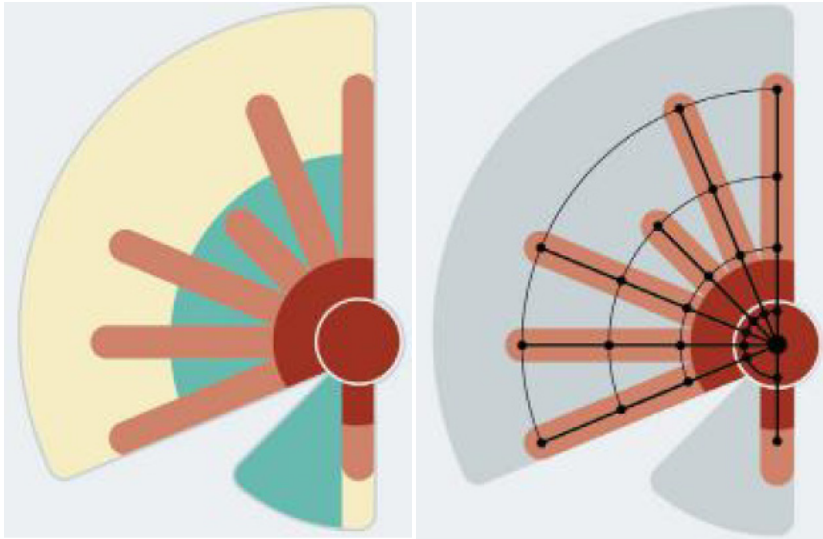


Figure 4.4 (left) , (right)

Respectively: Finger City structure: city and green spaces; city and transport.  
 Source: Danish Ministry of the Environment, <https://naturstyrelsen.dk/>

Both two illustrations depict the model of the Finger City structure, where urban growth is concentrated in specific “fingers” extending from the city center, separated by green spaces, and linked by a public transportation network. This planning concept aims to emphasize the use of space and transportation, while minimizing urban sprawl and maintaining green and recreational areas for public use.

In summary, the Finger Plan guided urban development along the railway corridor while protecting the green wedges between the corridors. Today, new challenges such as climate adaptation, housing pressures, and emerging travel patterns bring more requirements for the original development model.

Therefore, the “Finger Plan 2.0” competition, initiated by the Institute of Danish Architects, has opened discussions about the future structural direction of the region. All shortlisted proposals emphasize building a more sustainable area, in which landscapes and water bodies will play a greater role, and connections between suburbs and the city center will be strengthened.

In this context the “Finger Plan 2.0” proposes the development of the city should move beyond simple growth control and proactively address current challenges.



## Cloudburst Management Plan 2012

Acted as a wake-up call, the Cloudburst Management Plan (CMP) was developed to address the increasing climate challenges especially for extreme rainfall events and flood issues. The plan focuses on building resilience of the to these events by enhancing its infrastructure, improving water management, and implement adaptive measures to prevent flooding and mitigate its damages in the future

Considering Copenhagen has neither the capacity nor the economy to implement all measures at once, CMP operates with a minimum time frame of 20 years, which makes it necessary to rank the initiatives in order of priority to implement. In this period, high risk areas, areas where measures are easy to implement, areas with ongoing urban developments projects, and area where synergistic effect can be gained are essential elements to be considered. All these ares are based on dividing of water catchment areas.

A water catchment area is an area where all precipitation will flow along the same route at extreme rainfall events, determining which way the water will flow. The figure shows the flow routes in Copenhagen. Starting at the point where the lines are thin and becoming proportional to the quantities of water flowing into them, all flow routes end in the sea though the long distance traveled in some cases.



Figure 4.5 Waterflow routes in Copenhagen.  
Source: The City of Copenhagen, <http://www.kk.dk/climate/>.

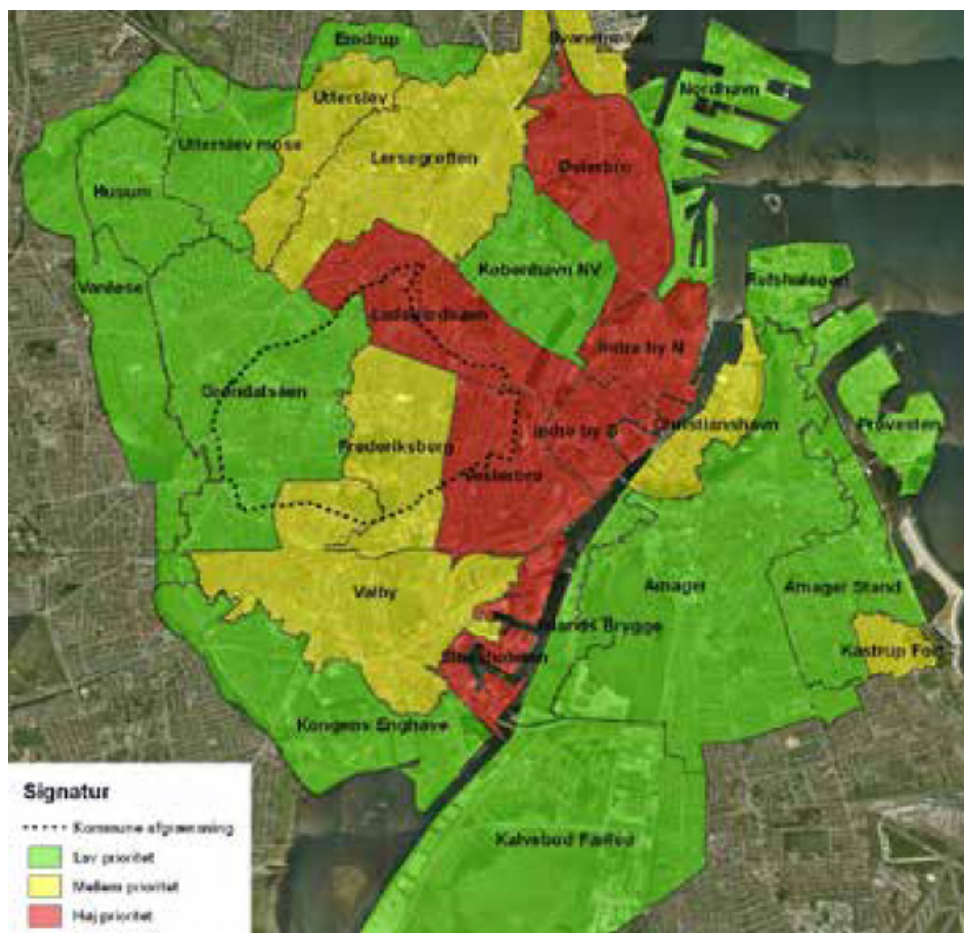


Figure 4.6 Prioritising adaptive measures Zones.  
Source: The City of Copenhagen, <http://www.kk.dk/climate/>.

When identified the areas most vulnerable to flooding, each water catchment is assessed by four elements: risk, implementation, coherence with urban development project and synergistic effect, which means the areas with a high flood risk where measures are easy to implement and will achieve good synergistic effects with urban design projects will be given a higher priority. The result of a weighted ranking is shown in the map with from low to high three levels based on these four elements. It reflects an outward development from the city center to periphery with priority levels decreasing accordingly.

Based on the distribution of prioritising areas, CMP adopts an integrated approach to managing both stormwater and wastewater which is redirecting and storing excess water in different areas of the city. Specifically, aiming at surface drainage, water flows smoothly off the roads, roofs and other surfaces not to make it accumulate and flood areas. Besides, green spaces (parks, sports field) and underground systems (tunnels, pipes) to store excess water during heavy rainfall. Also the key is to move water away from built-up area to the sea using new stormwater pathways, canals, and urban waterways. Additionally, separation of wastewater and stormwater makes it easier to direct excess water to storage systems or natural drainage systems without compromising the capacity to handle the sewage.

CMP also relies on the involvement of Copenhagen's residents. Property owners are encouraged to protect their own properties from flood damage by implementing measures such as backflow valves and adjusting their houses to be more flood-resistant, which creates a comprehensive and durable flood management strategy.

In summary, Copenhagen's Cloudburst Management Plan represents a forward-thinking, proactive approach to climate adaption with a focus on green solutions, collaborative governance and sustainable infrastructure. While it takes decades to fully implement, its comprehensive nature and emphasis on long-term sustainability makes it a crucial part of Copenhagen's future in the face of climate change.



## 4.1.5 Copenhagen Way: Integrate Nature, Governance, And Systems

### What Is Copenhagen Way

“The Copenhagen Way” can be seen as the outcome of the city’s urban transformation over the past three decades. This transformation, through long-term planning and systematic collaboration, closely links climate resilience, quality of urban life, and economic competitiveness. This plan, jointly developed by BLOXHUB, Ramboll, and Urban Partners (2025), demonstrates how the city has transformed from post-industrial decline in the 1990s into a global benchmark for sustainable and resilient urban planning. Rather than presenting a single master plan, it showcases an integrated approach to governance and collaboration across climate adaptation, energy transition, transportation, and social inclusion.

### Why We Need Copenhagen Way

The document notes that Europe’s share of the global GDP has fallen from almost 30% in 1992 to around 17% in 2022 (BLOXHUB et al., 2025), highlighting the mounting challenges faced by urban Europe: resource depletion, rising energy costs, climate shocks, and growing inequality.

In this context, the report describes Copenhagen as a testing ground for how cities in Europe can remain liveable and competitive. Rather than adopting a project-based approach to environmental design, Copenhagen provides a systemic model of urban resilience that integrates nature-based infrastructure, renewable energy and mobility planning within the same governance framework, which supplies both ecological performance and social value for the city’s development, thereby directly supporting the United Nations’ Sustainable Development Goals. (SDG 11, 13, and 17)

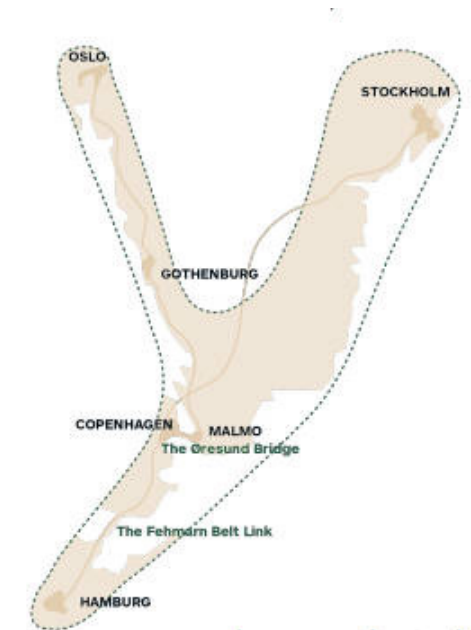


Figure 4.8 (top) , (bottom) Relationship between copenhagen and other European cities.

Respectively: The Y Innovation Corridor, The Fehmarnbelt Tunnel.

Source: The Copenhagen Way 2025;

<https://www.sn.dk/art578337/ringsted-kommune/erhverv/kamp-om-grunde-er-begyndt-femern-forbindelsen-varsler-erhvervsboom/>



## How The Copenhagen Way Works

The Copenhagen Way (BLOXHUB et al., 2025) report has outlined some of the fundamental mechanisms of Copenhagen way, which could be an aspect of how Copenhagen governance and spatial planning facilitate NBS and sustainable transitions.

### **Integrate governance and long-term planning.**

The Copenhagen transformation is founded on sustained political dedication and cooperation. The Copenhagen governance has created public-private collaborations such as By & Havn, which reinvests land value capture into public initiatives such as parks, waterfronts, and the metro system that captures profits from urban growth funding to be used for climate adaptation and mobility. This is a self-sustaining cycle that allows for more potential to be achieved in governance.

### **Nature as infrastructure**

Copenhagen has incorporated nature as part of its infrastructure. For instance, the cloudburst management plan connects streets, parks, town squares, and water spaces to create an infrastructure that retains stormwater, improving biodiversity and recreational value. The Skt. Kjelds Quarter and Enghaveparken integrate flood protection with everyday life. This is an example of multifunctionality in NBS

### **Cross-sector collaboration**

The Copenhagen Way is created by bringing together different stakeholders, such as municipal departments, private developers, and citizens. BLOXHUB is an example of cross-sector collaboration that brings together researchers, businesses, and governance. This speeds up creative innovation while reducing conflict between design experimentation and implementation.

### **Social Inclusion And Co-Creation.**

Citizen participation is a key element of the system, particularly when strategies and projects are translated at the community level. During this phase, activities such as workshops and surveys will be conducted, and the voices of all participants will be heard. This will ensure that a sense of belonging is created among the citizens, and behavior change towards sustainable living is promoted.

### **Scalability And Transferability**

Although some projects are site-specific, the Copenhagen Model offers a replicable process for these projects with the transparent governance, clear metrics, and public-private partnerships. This transformation can be scaled according to city size. Departments need only understand their roles and how to leverage their strengths.

*"Denmark cannot do this alone. Nordic and European collaboration is essential."*

*----Majbritt Skov, Deloitte Economics*

*The Y Region would unite over 14 million people and some of Europe's most dynamic urban economies into a shared ecosystem. Imagine Northern Europe not as isolated hubs, but as one integrated innovation corridor, physically connected through high-speed rail and projects like the Fehmarn Belt Link, digitally linked by advanced networks, and powered by coordinated energy systems. With aligned regulations, investment frameworks, and cross-border research partnerships, this corridor could pool talent, accelerate commercialisation, and scale green and digital solutions at a pace that no single city could achieve alone.*

*----STRING. (2019, September). The Scandinavian 8 Million City.*

## Beyond Copenhagen: Lessons For Broader Application

The Copenhagen Way (BLOXHUB et al., 2025) says that the success of NBS also depends on how it is set up. This means that it should focus more on integration —linking physical changes (such as green spaces) with social and governance mechanisms (such as partnerships, financing, and co-creation). But, as the report says, the problem is still how to make this work in cities that have similar resources and ways of governing.

It gives both inspiration and warning. It reminds us that effective NBS implementation requires a clear data system, management across different sectors, and ways to measure performance. This thesis aims to make all of these things official through a transferable, GIS-based plan for NBS.



Figure 4.9 Map of Copenhagen's post-industrial sites.  
(some already developed, others underway, and some still prospective)  
Source: Map by COBE, from the book *Urban Living Room* (2016) Rights: COBE

## 4.2 BUILT UP AREAS

### 4.2.1 Land Use

The map illustrates the distribution of the main function in Copenhagen.

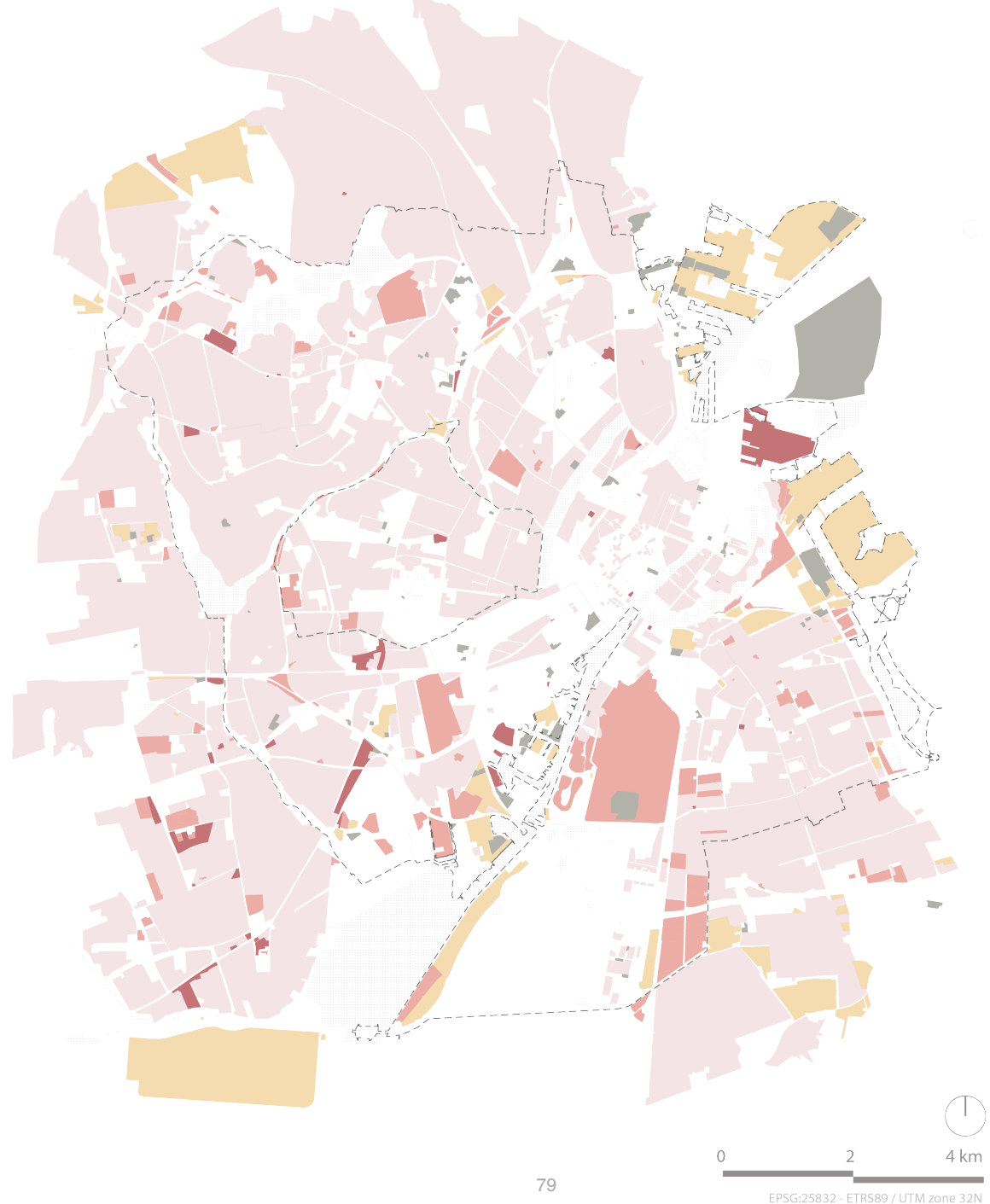
The residential area is mainly located in the inner part of the city, specifically in the Indre By area. The commercial area with mixed-use functions is mainly concentrated in certain areas to ensure easy access to the inhabitants. The industrial area mainly includes the peripheral area of the city, specifically the Nordhavn area. The South Island in Copenhagen includes an airport, which can be reached through public transport. The recreational area is evenly distributed across the city to ensure easy access to inhabitants.

The development area in Copenhagen includes the waterfront area, specifically the area in Nordhavn, which will be transformed into a new mixed-use area through extensive reclamation.

#### LEGEND

- Municipal Boundary
- Industrial Areas
- Construction Area
- Residential Areas
- Commercial Areas
- Recreational Areas

Drawing 4.7 Built-up area in Copenhagen .  
Source: Author's illustration based on information from GeoDanmark.





4.2.2 Building Volumn Density

To enable easier comparisons, a grid with cells of 250 meters by 250 meters was created over the whole area of the municipality. For each cell, the total volume of buildings (calculated by multiplying the floor area by the height) was calculated and then divided by the area of the cell to obtain a value measured **in cubic meters per square meter (m³/m²)**. This is essentially the density of the buildings in each cell, namely the volume of buildings per unit area. The results show that the areas with high-density building development are Amager, Nørrebro, and Ørestad, which may lack sufficient green areas, potentially resulting in overheating.

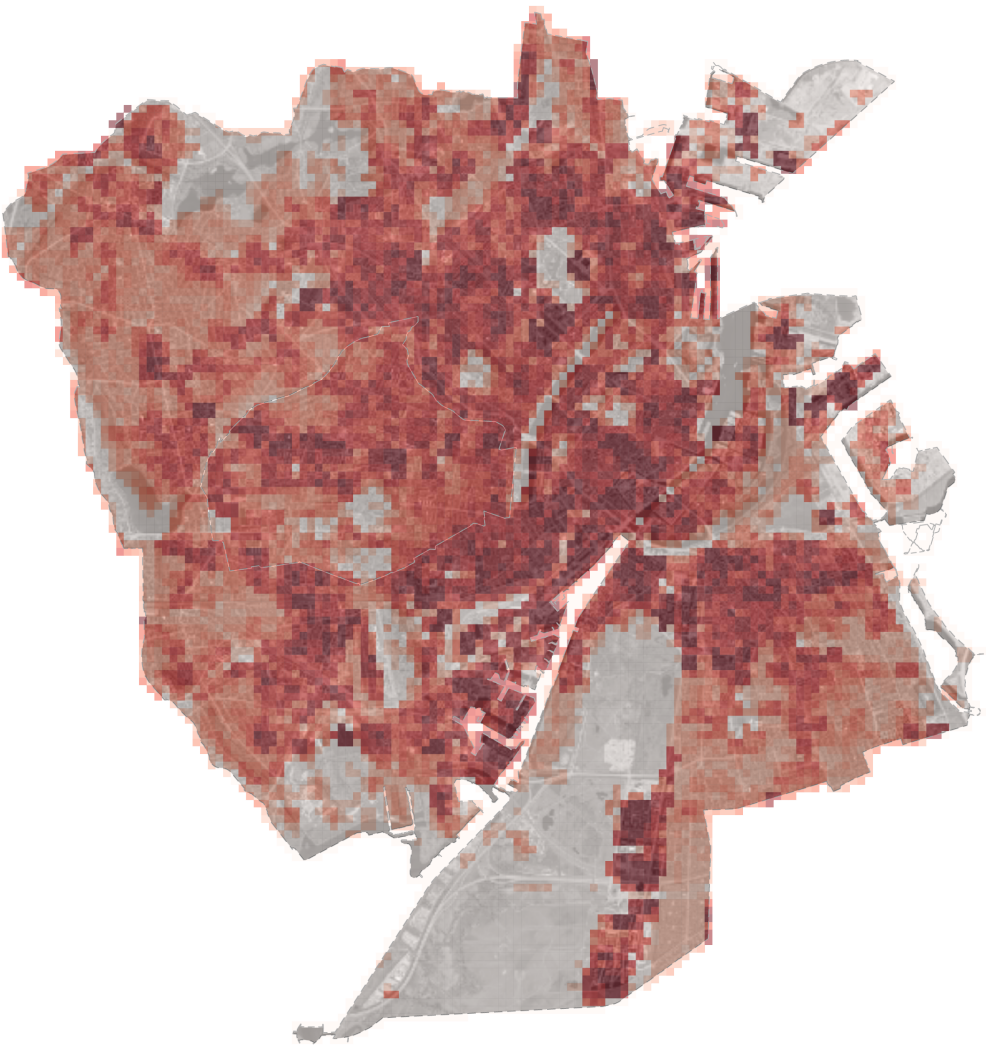
LEGEND

|  |                |
|--|----------------|
|  | 0 - 0.29       |
|  | 0.29 - 0.89    |
|  | 0.89 - 1.38    |
|  | 1.38 - 1.97    |
|  | 1.97 - 3.03    |
|  | 3.03 - 4.42    |
|  | 4.42 - 5.85    |
|  | 5.85 - 7.46    |
|  | 7.46 - 9.31    |
|  | 9.31 - 11.71   |
|  | 11.71 - 16.23  |
|  | 16.23 - 162.57 |

--- Municipal Boundary

Measured in m3/m2

Drawing 4.8 Building volume density in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.



## Building Height Distribution



This map shows the spatial distribution of building heights in Copenhagen. The data is based on the city's database, which distinguishes between low-rise buildings (1-2 stories) and high-rise buildings (3 stories and above).

Closed residential buildings for 5-7 stories predominate in the city center. In the waterfront area, public buildings and office buildings above 30 meters in height can be found. High-rise building clusters can be found in the new town area of Ørestad, Amager Vest, and the Western Industrial Area. These high-rise buildings are often accompanied by transportation hubs and supporting facilities. In the peripheral area and the island regions, low-rise buildings predominate.

*Drawing 4.9 Building height distribution in Copenhagen.  
Source: Author's illustration based on information from Copenhagen Kommune.*

# 4.3 GREEN & BLUE INFRASTRUCTURE

Drawing 4.10 Green land use in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.

## 4.3.1 Green Areas And Agricultural Land

A majority of Copenhagen remains unexploited in terms of open space. Forests, coastal areas, farming regions, and other green spaces are mostly located along the boundaries of Copenhagen, especially in the south.

Public green space, which includes parks, lawns, and play areas, can be found throughout Copenhagen. Though there are larger open spaces and forests in the outer regions, such as Amager and Brønshøj, the green space in the inner regions remains smaller compared to the rest of the city. Though there have been attempts to improve green space, the increasing population and density of Copenhagen continue to heighten the need for quality green space.

Copenhagen's future development hinges on maintaining and strengthening the balance between the built and natural environments. Protecting farmland and enhancing multifunctional green spaces are essential for ensuring long-term ecological resilience, improving urban microclimates, and providing public access to nature.

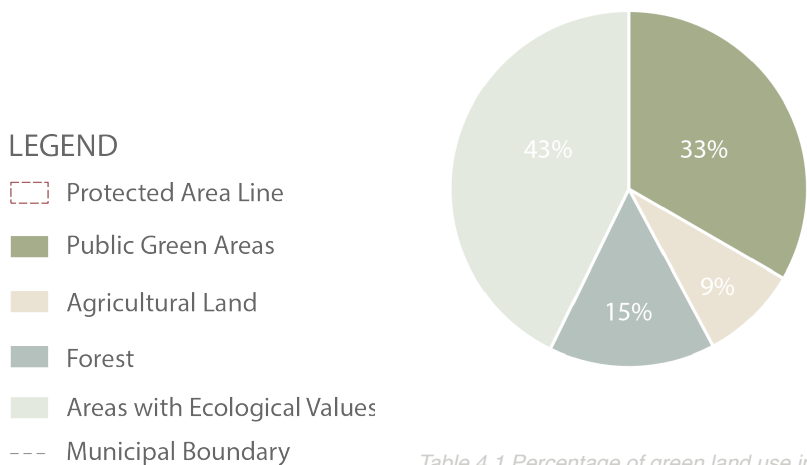


Table 4.1 Percentage of green land use in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.





4.3.2 Green Area Typologies

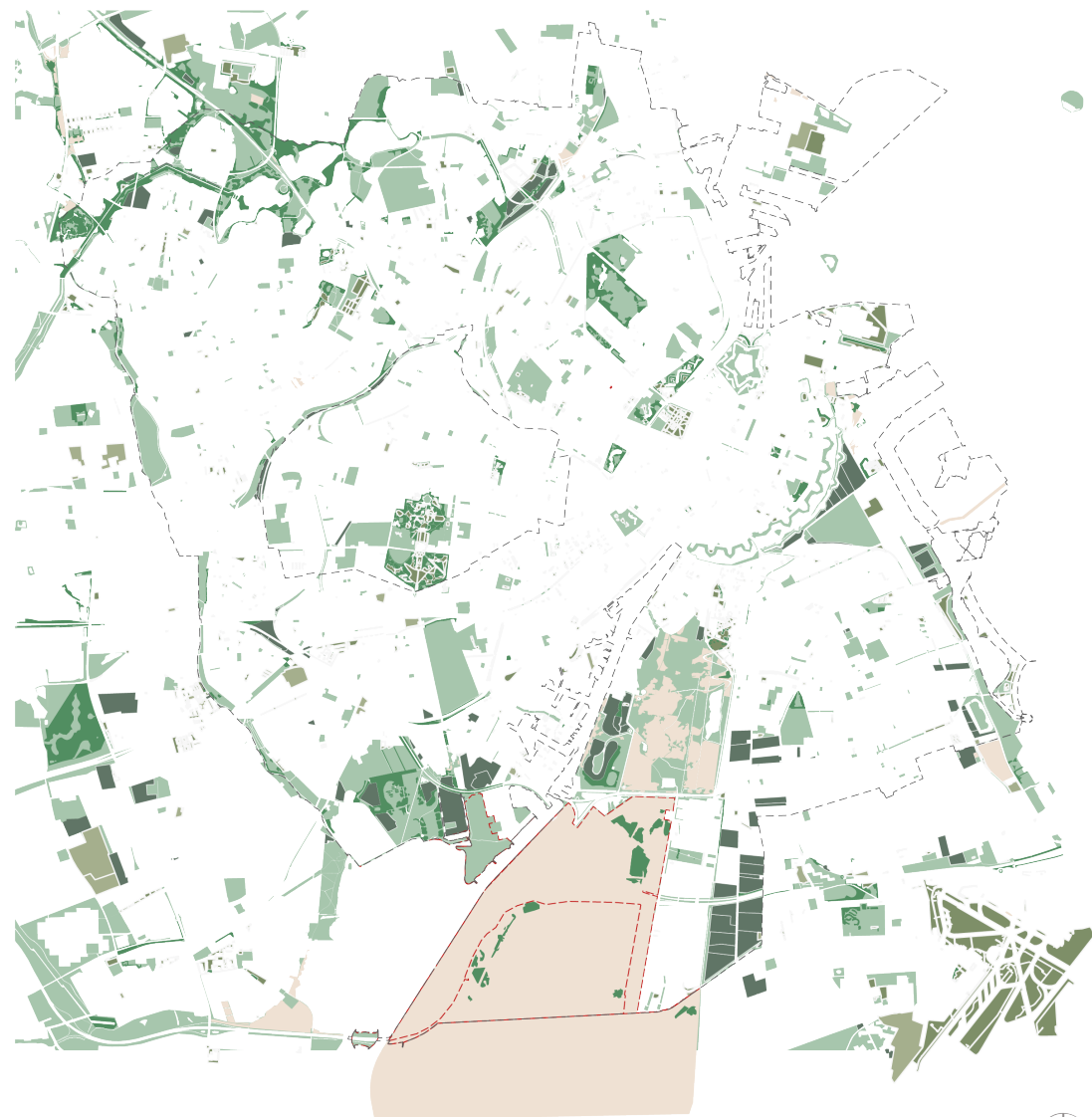
The green infrastructure in Copenhagen varies in terms of function and type. The percentage maps show that grasslands and parks are the dominant types of green infrastructure in Copenhagen. The majority of these are located in the southern ecological zone. Forests are mainly located in Ørestad and the northwest, acting as a boundary between urban and rural areas.

Parks, allotments, and green infrastructure act as important recreational areas in Copenhagen, especially in the central part of the city. Many of the royal parks and gardens have been maintained in this area, hence their importance as recreational spots.

LEGEND

- Allotments
- Greenfield
- Park
- Meadow
- Grass
- Shrubbery
- Protected Area Line
- Municipal Boundary

Drawing 4.11 Spatial distribution of green typologies in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.



4.3.3 Green Space Rate

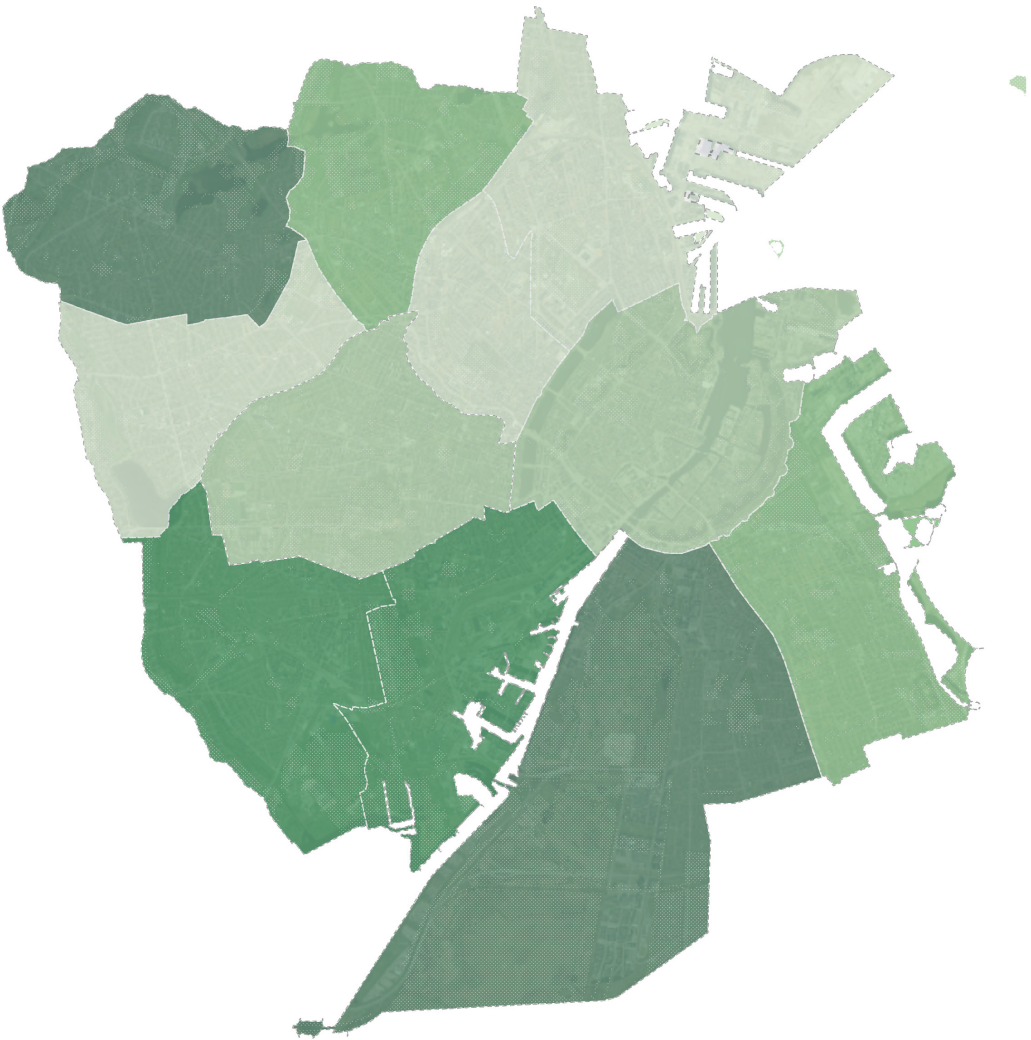
Drawing 4.12 Green space per local committees  
Source: Author's illustration based on information from GeoDanmark.

Green Space per Local Committees

In Copenhagen, there are 12 local committees that act as a link and facilitate dialogue between inhabitants of different districts and politicians at Copenhagen City Hall. The above map illustrates that outer districts such as Amager Vest, Brønshøj-Husum, and Bispebjerg have the highest percentage of green space, which is above 25%. These districts have large parks, forests, and open spaces that extend to the edges of the town. On the other hand, districts such as Inder By and Vesterbro have the lowest percentage of green space due to high-density structures.

LEGEND

- 12,4 - 14,3 %
- 14,3 - 18,5 %
- 18,5 - 23,2 %
- 23,2 - 26,5 %
- 26,5 - 50,5 %
- Municipal Boundary



Green Space per Neighborhoods

At the neighborhood scale, the variations become clearer. The green ratio in the perimeter block area is relatively low, just like in Christianshavn or other historical neighborhoods. The green ratio in the suburban area shows a relatively higher rate of integrating garden spaces with courtyard spaces. The newly developed area, such as Ørestad, also shows moderate green coverage.

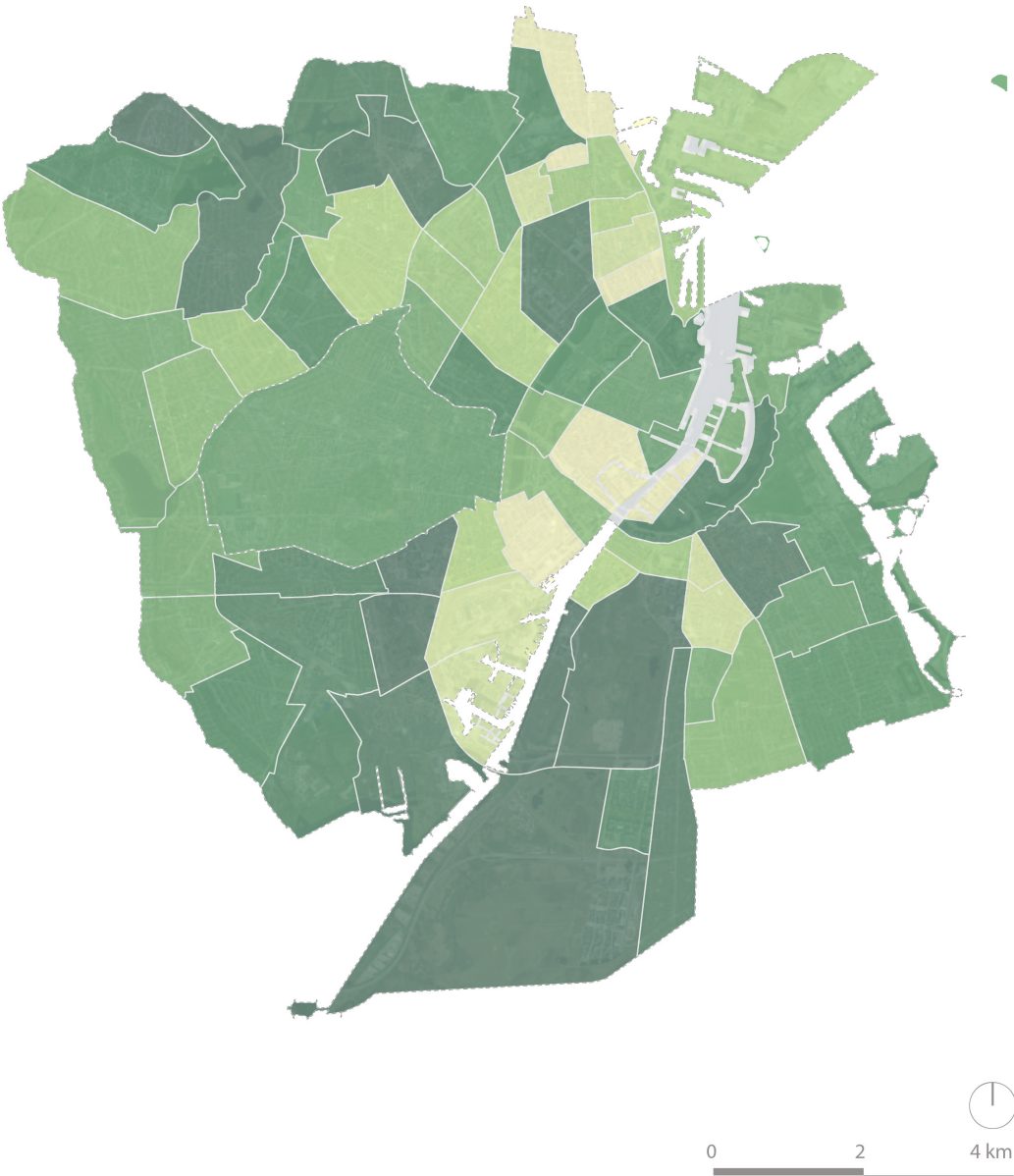
This shows that the problem of green coverage in Copenhagen is still a concern. Improving green coverage at the neighborhood level is very important in building resilience to future heat stress events.

LEGEND

- 0,2 - 1,3
- 1,3 - 3,2
- 3,2 - 5,5
- 5,5 - 9
- 9 - 12,1
- 12,1 - 17,3
- 17,3 - 20,7
- 20,7 - 26,2
- 26,2 - 30,4
- 30,4 - 40,1
- 40,1 - 56,4
- 56,4 - 99

----- Municipal Boundary

Drawing 4.13 green space per neighborhood.  
Source: Author's illustration based on information from GeoDanmark.





4.3.4 Green Space Per Capita

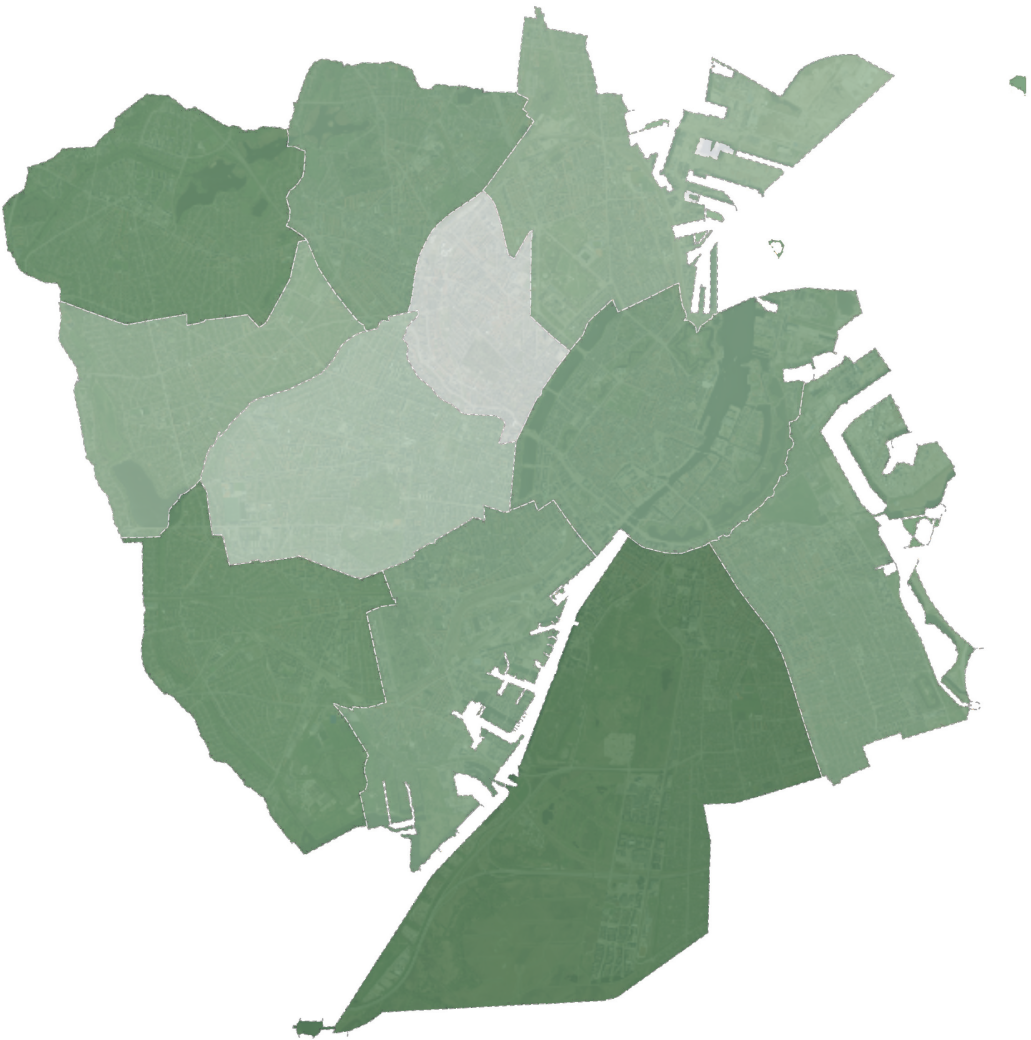
Drawing 4.14 green space per person in the local committees scale.  
Source: Author's illustration based on information from GeoDanmark.

Local Committees Scale

This analysis is based on the World Health Organization's suggestion of at least 9 m<sup>2</sup> of green per person. The district level shows that the outer areas/distribution have the highest green ratios, which are above 25 m<sup>2</sup> per person. The central districts, such as Nørrebro, have less green space, which is because of the high population density.

LEGEND

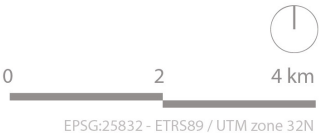
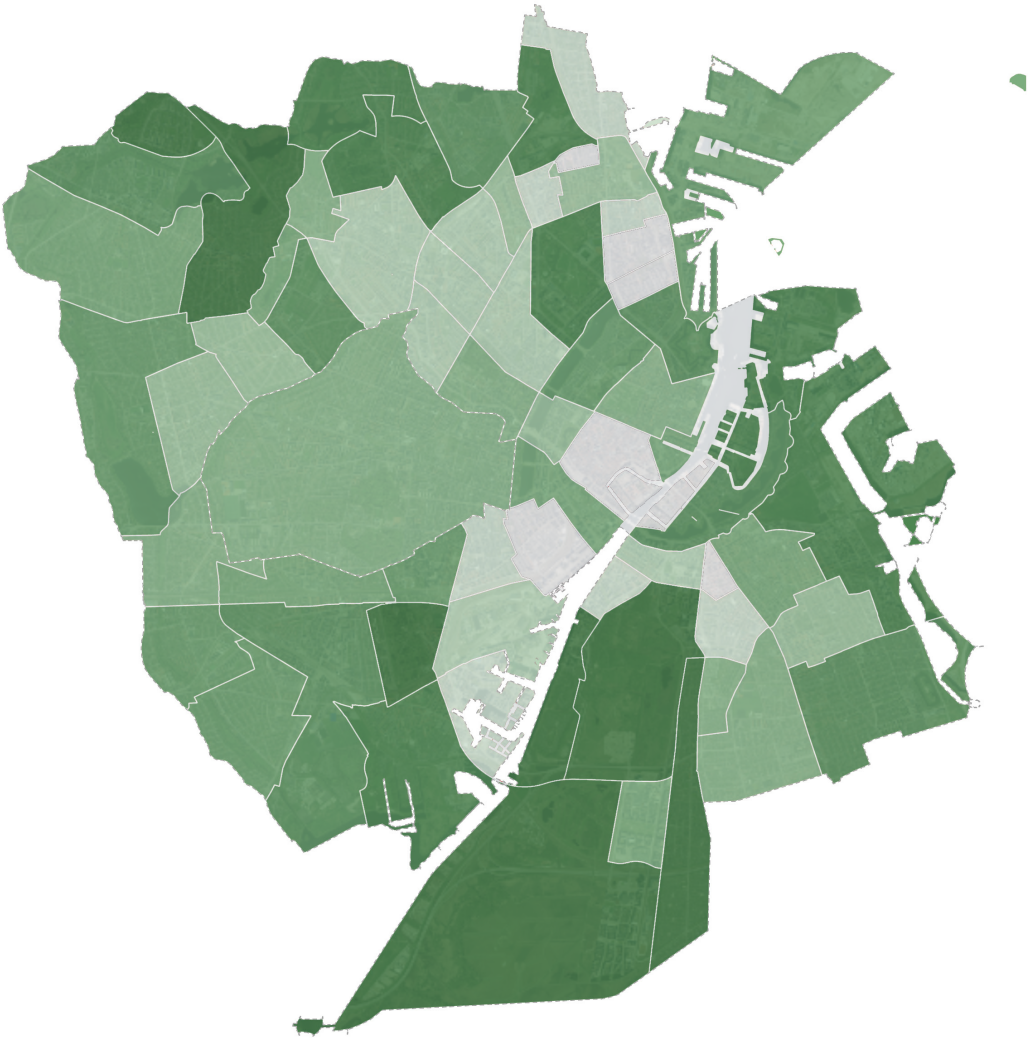
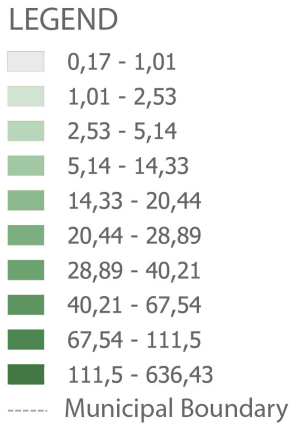
- 6,4 - 6,4
- 6,4 - 15,2
- 15,2 - 23,4
- 23,4 - 28,6
- 28,6 - 58,5
- 58,5 - 107,7
- Municipal Boundary



Neighborhoods Scale

The neighborhood scale points out that the population has lower than recommended access to open space in Sundholmsvejs, the medieval city, Vesterbro East and Ventral, Osterport, Arhus Stree, and Lynbyvej. These neighborhoods offer potential for implementing new green public spaces.

Drawing 4.15 Green space per person in neighborhoods scale.  
Source: Author's illustration based on information from GeoDanmark.



### 4.3.5 Blue System

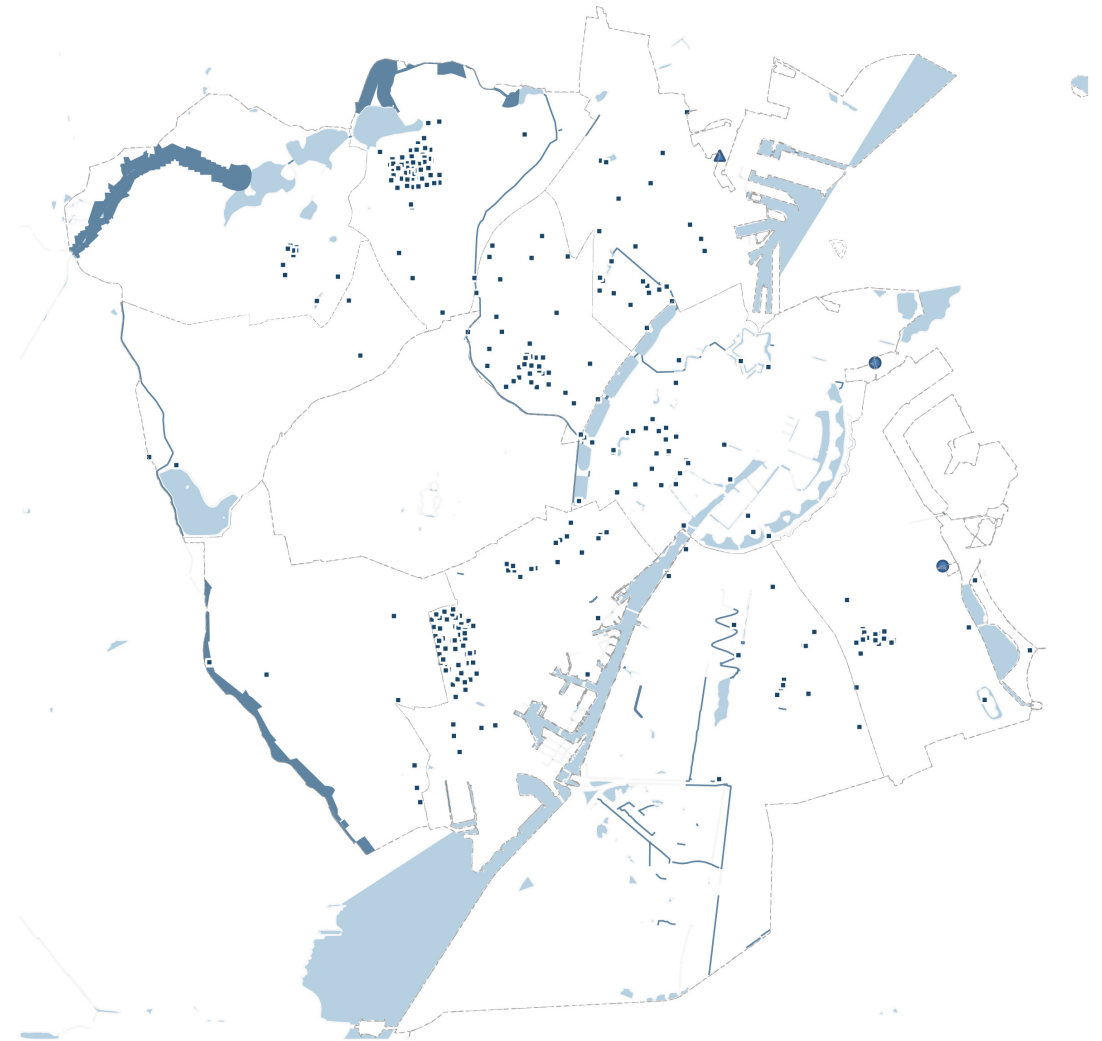
Copenhagen's Blue System comprises harbours, lakes, canals and coastal zones. These areas are integral to the city's visual identity and play a crucial role in water management, recreation, and maintaining ecological balance. The city's main bodies of water include the central lake chain — Sankt Jørgens Sø, Peblingesøen and Sortedams Sø — which marks the edge of the historic city centre. There are also extensive coastal waters along Kalvebod Fælled and Amager Strandpark. Smaller streams and protected river zones mainly stretch across the western and southern edges of the municipality, providing natural corridors for biodiversity and flood control.

As well as their technical role, Copenhagen's blue areas provide residents with drinking water. Waterfront promenades, harbour baths and accessible lakesides also provide opportunities for recreation and socialising. Residents particularly enjoy the waterfront spaces in the summertime, when many festivals are held around the water bodies.

#### LEGEND

- Drinking water Point
- Fuel
- ▲ Sanitary & Dump
- Natural water bodies
- Protection river area
- Natural water way
- District Boundary
- Municipal Boundary

Drawing 4.16 Blue infrastructure in Copenhagen  
Source: Author's illustration based on information from GeoDanmark.





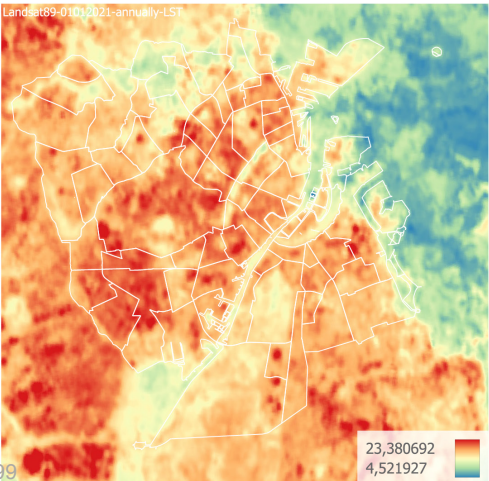
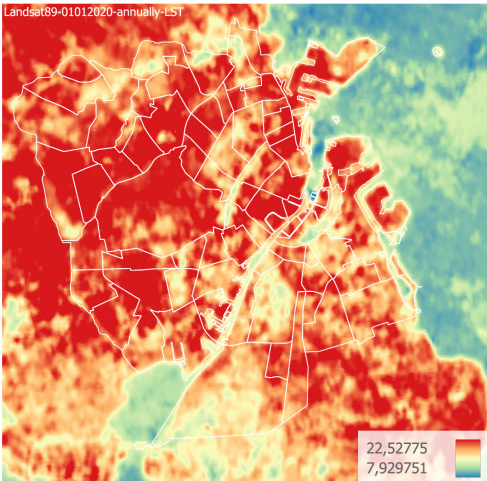
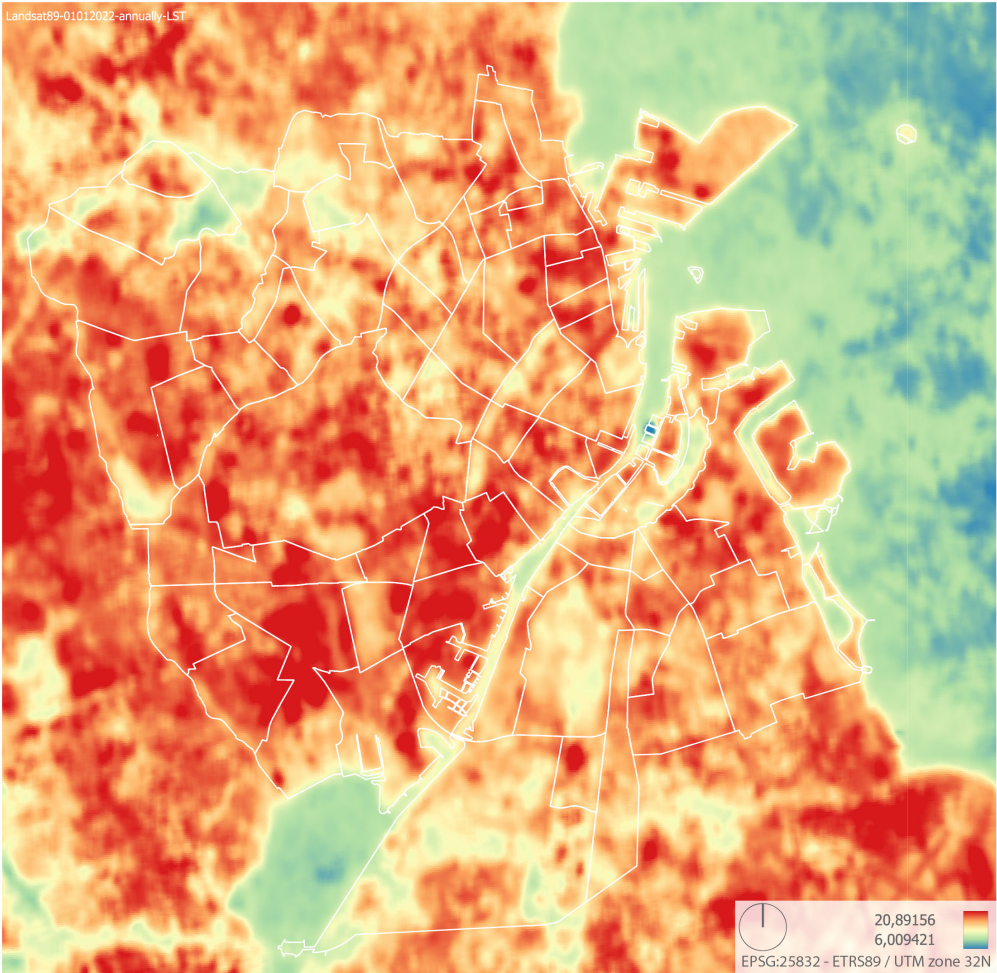
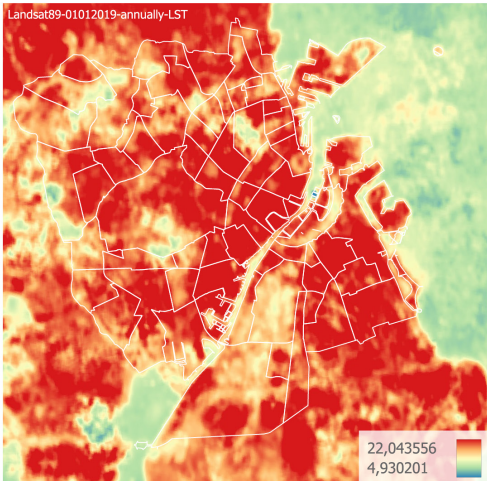
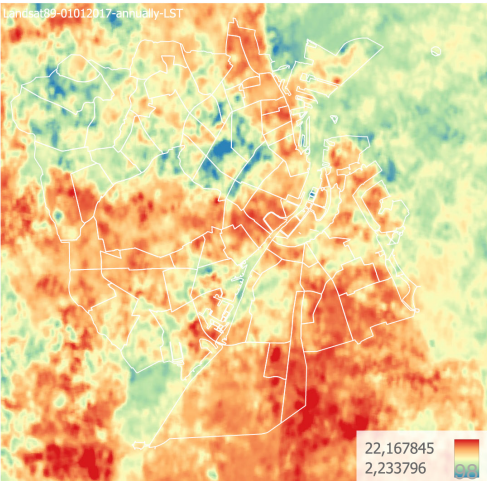
# 4.4 City Diagnosis

## 4.4.1 Urban Heat Island

Like most cities, Copenhagen is challenged by the urban heat island effect. These maps show land surface temperature variations annually between 2017 and 2020. Even though the city has close to 100,000 trees, higher temperatures occur in dense urban cores like Indre By, Vesterbro, and Nørrebro, as well as major transport corridors and industrial zones.

The UHI maps are based on Landsat 8/9 TIRS, with a 30 m resampled spatial resolution and annual mean temperature values from 2017 to 2022. (Data Source: DHI A/S, Agem Alle 5, DK-2970 Hørsholm, Denmark.)

Figure 4.10 Urban heat island in Copenhagen.  
Source: Author's illustration based on information from DHI Satlas Team



4.4.2 Rainfall and Flood

Rainfall

On average, Copenhagen receives around 600–700 mm of rain per year, with the highest number of rainy days occurring in July and August. In recent years, both the intensity and frequency of rainfall have increased, leading to localised flooding in low-lying districts and along waterfront areas. These patterns highlight the growing importance of Copenhagen’s Cloudburst Management Plan, which uses blue-green infrastructure to safely retain, delay and channel stormwater through parks, streets and open water corridors.

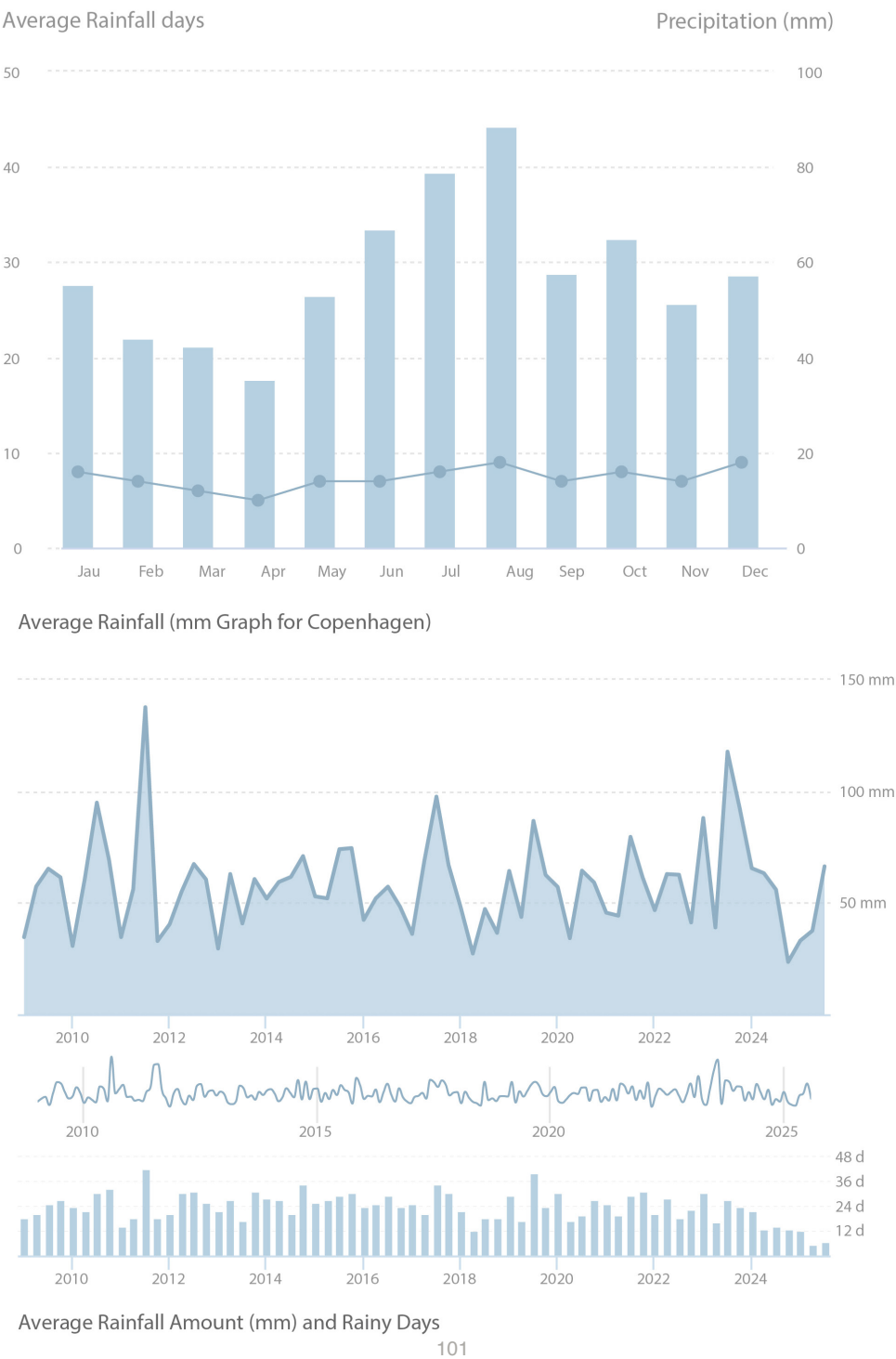
Flood

Like many other coastal cities, Copenhagen is facing challenges related to unpredictable rainfall and flooding. The three maps illustrate the potential extent of flooding during a 100-year rainfall event in 2010, 2060 and 2110. This is based on data from GeoDanmark, which was prepared for the city’s Climate Adaptation Plan.

The data, derived from GeoDanmark’s hydrological simulations based on a high-resolution LiDAR elevation model, estimate surface water depths across the city with a 10-meter grid resolution. The results reveal a clear spatial pattern: the harborfront, reclaimed land, and lower industrial areas are the most exposed, while the inner and northern districts remain relatively elevated and secure.

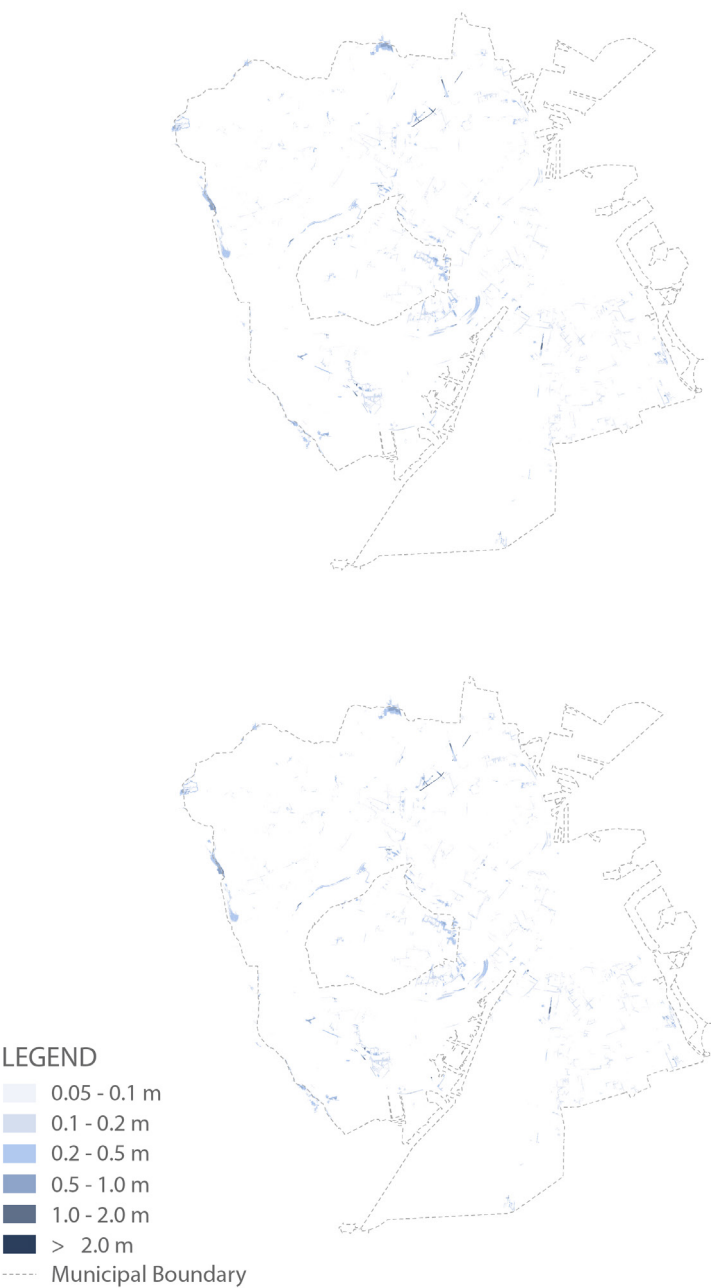
The gradient from light to deep blue captures not only water depth but also the city’s topographic memory — how historic coastlines and filled lands continue to define vulnerability today. This understanding is essential for linking Copenhagen’s flood-risk zones to long-term adaptation strategies and the placement of blue-green infrastructure in the urban fabric.

Table 4.2 Average rainfall amount monthly (mm) and rainy days in Copenhagen.  
Source: Author’s illustration based on information from Weather Spark, Denmark.

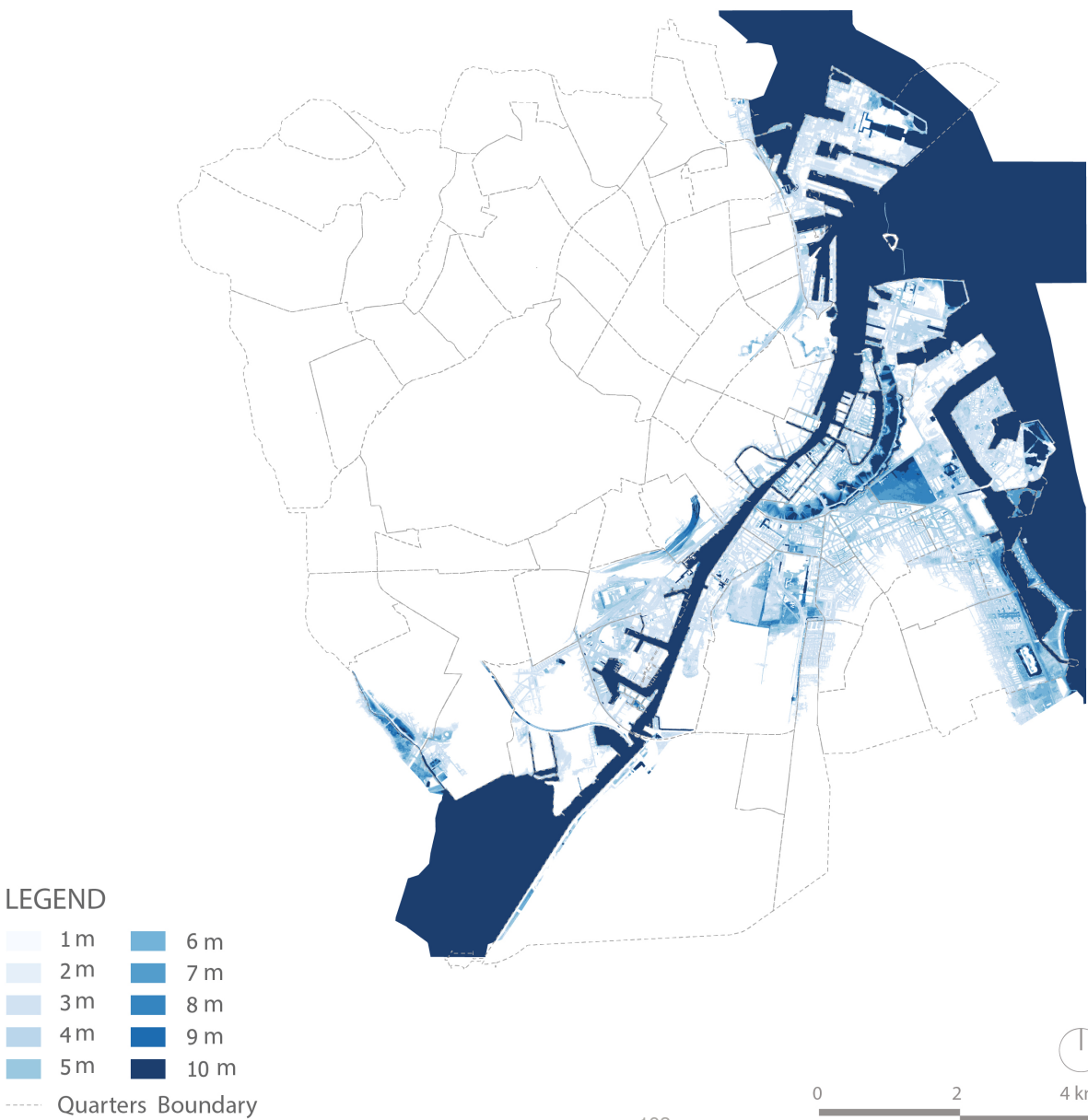




Drawing 4.17 Flood during 100-year rainfall in 2010 (top), 2060 (bottom)  
Source: Author's illustration based on information from GeoDanmark.



Drawing 4.18 flood during 100-year rainfall in 2110  
Source: Author's illustration based on information from GeoDanmark.





4.4.3 Climate Adaptation Projects

Cloudburst Catchments

Under the Cloudburst Management Plan, Copenhagen has been divided into seven major cloudburst catchments. The plan is designed to use blue-green infrastructure, such as retention basins, open canals and green corridors, to manage extreme rainfall within each catchment. A catchment area is the zone in which all rainwater follows the same flow path during heavy rainfall before eventually draining into the sea, sometimes after travelling long distances across the urban landscape.

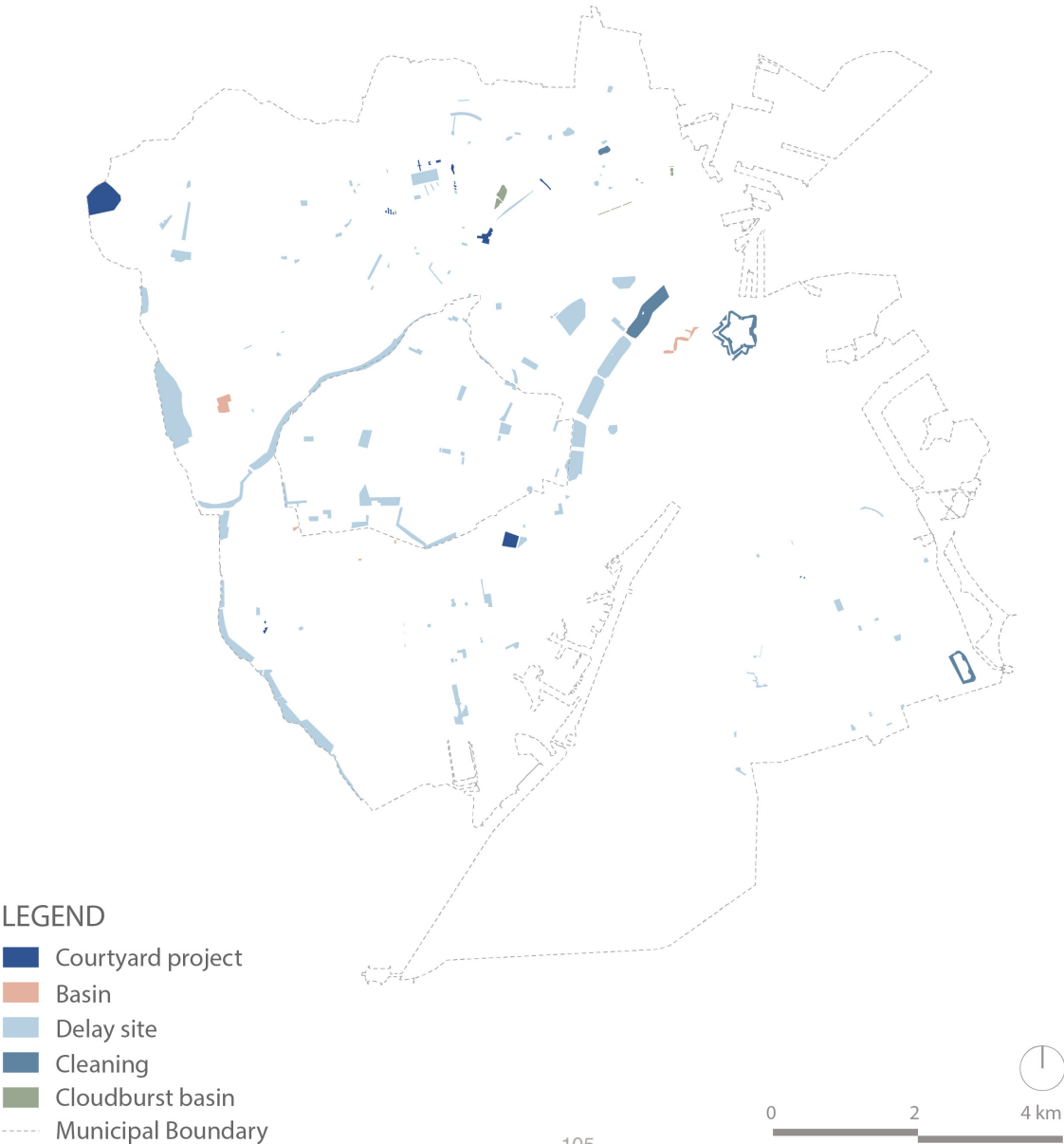
Adaptation Projects

This map shows the distribution of future adaptation efforts under the Cloudburst Management Plan in each catchment. These projects mainly consist of a courtyard, a basin, and a temporary basin, which aim to use minimal intervention while striving for more effective and localized impacts. In addition, some areas will focus on cleaning existing waterbeds to improve their capacity to handle rainfall and rising flood risks. Most of the projects are situated near water bodies and natural systems.



Drawing 4.19 Seven cloudbust catchments in Copenhagen.  
Source: Author's illustration based on information from Copenhagen Kommune.

Drawing 4.20 Future adaptation projects in Copenhagen  
Source: Author's illustration based on information from GeoDanmark.



# 4.5 ACCESSIBILITY

## 4.5.1 Public Transport System

The city has a well-developed infrastructure of transport systems, including the metro and the railway system. This has been incorporated into the daily lives of the people. The city has been primarily designed as the core of the Greater Copenhagen Area under the Finger Plan.

The above maps have depicted the infrastructure of the city. The airport is in Amager; the journey to the city takes only 10 minutes by the metro line connecting the airport to the city. Regional railway lines connect the city to other municipalities and the interregional cross-border to Malmö, Sweden.

With the presence of such infrastructure, the fragmentation of the green spaces is also a problem.

LEGEND

●

Rail staion

●

Metro station

+

Rail line

—

Metro line

—

Main roads

—

Second roads

■

Airport

■

Rail infrastructure

---

Municipal Boundary

Drawing 4.21 Public transport network in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.



024 km

EPSG:25832 - ETRS89 / UTM zone 32N

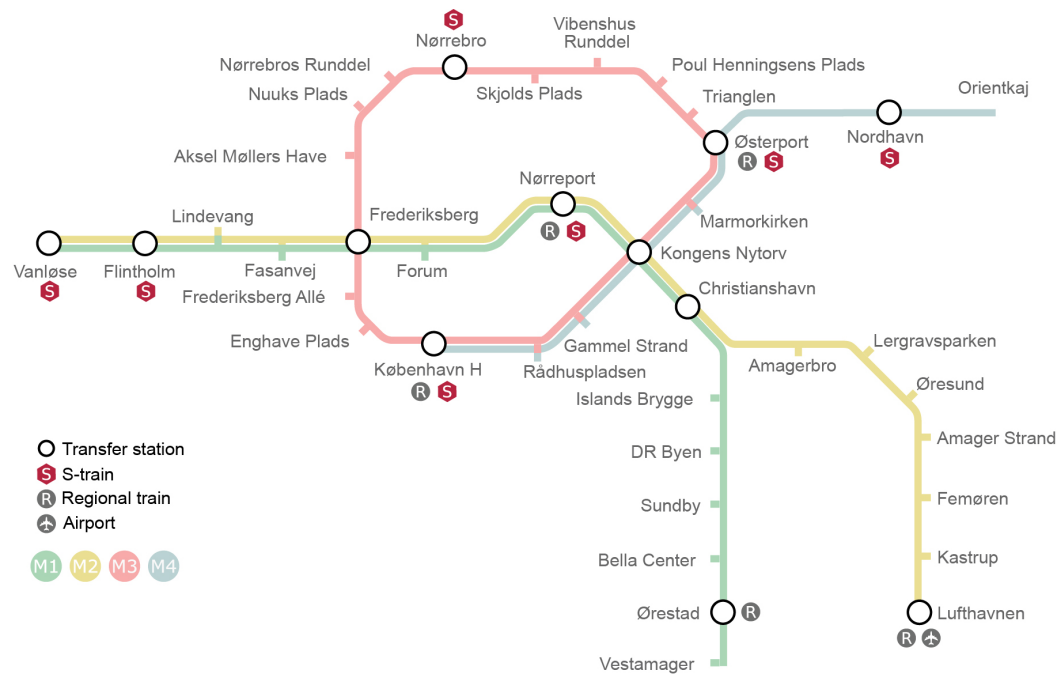


Figure 4.11 Metro System in Copenhagen  
Source: Copenhagen Municipality.

## Metro System

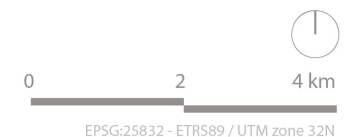
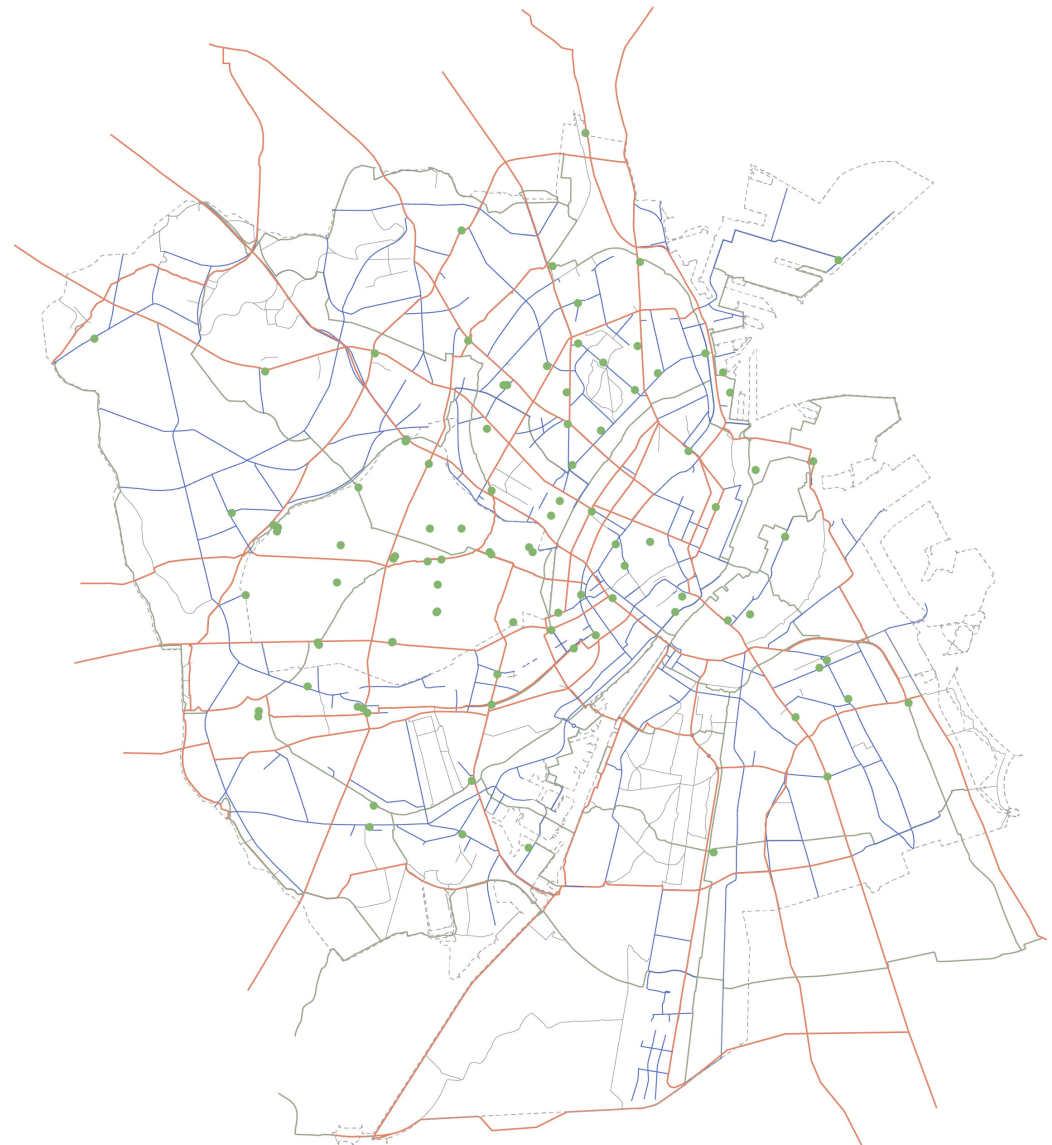
It should be noted that the metro system in Copenhagen is more developed, not only because it operates 24 hours a day but also because it includes a special ring route in the city center, which is supposed to facilitate the traffic during rush hours and also assist tourists. This system links the central and densely populated areas with the newly developed districts such as Nordhavn, Ørestad, and Amager Strand.

## LEGEND

- Cycle station
- Cycle option
- Cycle path
- Green Cycle Route
- Super Cycle Highway
- Municipal Boundary

## 4.5.2 Cycle Network

Drawing 4.22 Cycle system in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.





Copenhagen’s goal is to achieve a high level of ambition in terms of 75% of all trips being made using walking, cycling, or public transport, while leaving a maximum of 25% for car travel. This is the basis for the development of a hierarchical cycle network consisting of cycle highways, routes, and paths, as well as rest areas. It can be for long-distance commuters from the suburbs or for daily life leisure activities.

Moreover, Copenhagen’s approach is to manage the timing of all the traffic lights on bike routes to ensure a “green wave” that is synchronized to the speed of a bike. This ensures that a bike cannot hit a red light and thus makes the experience faster and more attractive than driving a car.



Figure 4.12 Different cycle road path in Copenhagen.  
Source: Bike Copenhagen.

## 4.6 SOCIAL & CULTURAL CONTEXT

### 4.6.1 Population Density

The population of Copenhagen has been increasing steadily over the last decade, with the population growing to almost 660,000 by 2024 and projected to reach almost 780,000 by 2060. This growth creates a demand for further urban development and the need for affordable housing, which contradicts the desire to preserve the green space.

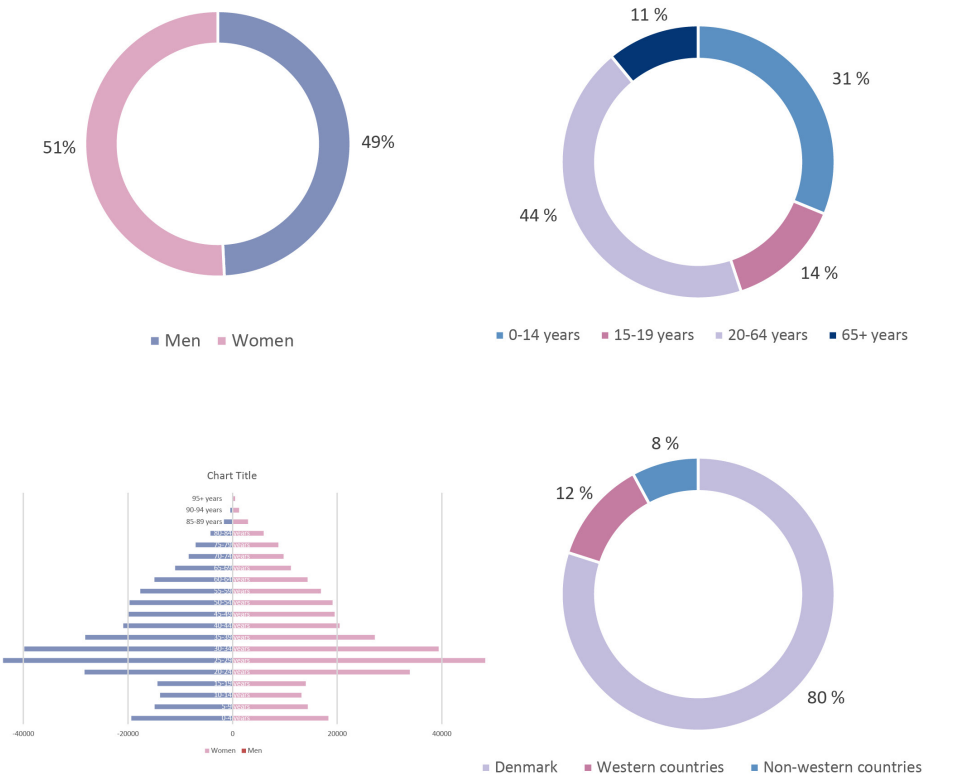


Table 4.3 Population composition including age, sex, and nationalities in Copenhagen.  
Source: Author’s illustration based on information from Copenhagen Kommune.

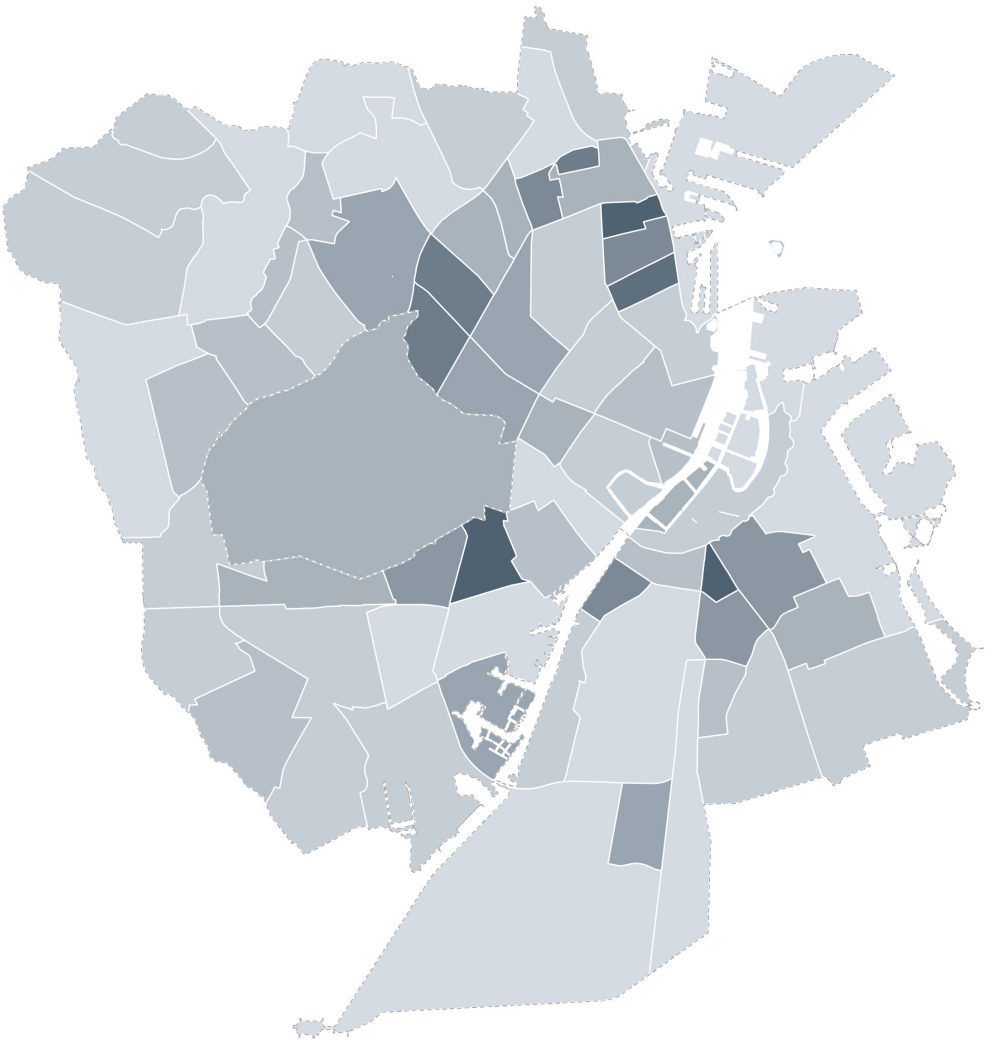
The map shows that the highest concentrations are found in the compacted perimeter blocks like Vesterbro, Nørrebro, and Amagerbro. In these areas, providing quality open green space for the densest neighborhoods could improve the quality of life, help regulate the microclimate, and provide refuge from heat stress.

Drawing 4.23 Population density per neighborhood.  
Source: Author's illustration based on information from GeoDanmark.

LEGEND

|               |
|---------------|
| 1105 - 4422   |
| 4422 - 7738   |
| 7738 - 11055  |
| 11055 - 14371 |
| 14371 - 17688 |
| 17688 - 21005 |
| 21005 - 24321 |
| 24321 - 27638 |
| 27638 - 30954 |
| 30954 - 34271 |

----- Municipal Boundary



4.6.2 Immigration & Intercultural Programs

Being the most livable city in the world, Copenhagen is the destination for many people with varying migration backgrounds. Around 22% of the population are migrants from other European countries and non-Western countries. The map indicates that the highest rates of immigrants are recorded in Vesterbro South, Ørestad City, Husum North, and Amager.

To facilitate the integration process, the local authorities have developed a wide network of language schools, cultural centers, and meeting points to increase the participation and integration of migrants and locals alike. Intercultural Houses (IHC) and language cafés are some of the programs developed to facilitate the integration process.

Most of the facilities are concentrated in the city center, including the language schools, which could be beneficial to all inhabitants. Family Integration Support is also spread across the entire city, integrating education, labor, and the community.

This strategy helps strike a balance between social inclusion and local identity, making diversity an integral part of the city's fabric.

LEGEND

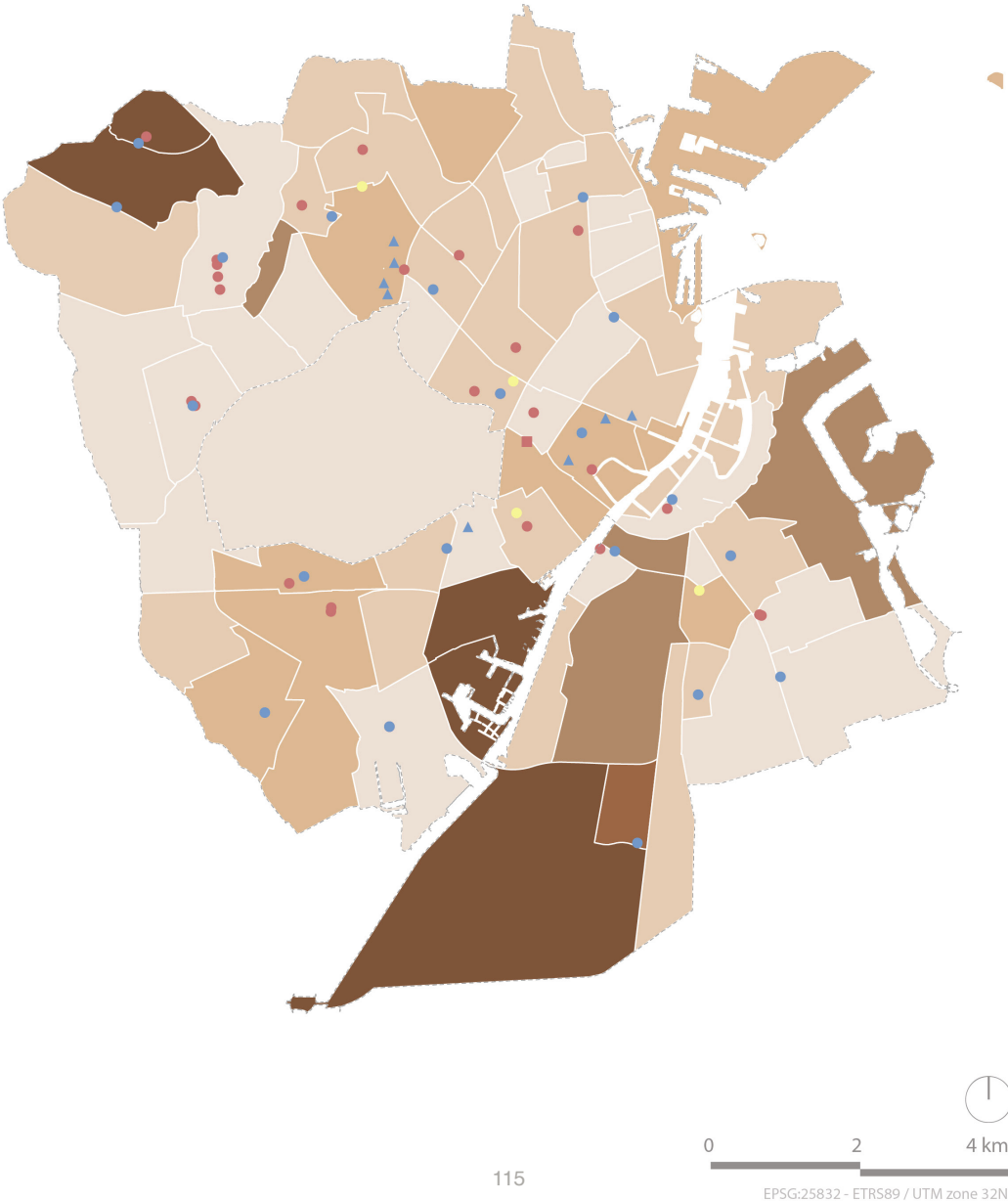
- IHC
- Culture house
- Language Cafe
- Official School
- Famili programs

Immigration rate

- 9,2 - 15,6
- 15,6 - 22
- 22 - 28,4
- 28,4 - 34,8
- 34,8 - 41,2
- 41,2 - 47,6

----- Municipal Boundary

Drawing 4.24 Immigration rate and culture programs distribution in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.





# 4.7 CURRENT & FUTURE PROJECTS

## Urban Districts

Copenhagen has many ongoing and planned projects aimed at strengthening resilience, improving mobility, and enhancing public life. Many of these initiatives focus on integrating natural systems into urban structures, primarily through the creation of new parks, coastal protection measures, and public squares. Some former industrial and harbour areas are also being transformed into mixed-use districts with green corridors and blue spaces, such as Enghave Brygge, Nordhavn and Amager Fælled.

Table 4.4 Information on current & future projects about urban districts.  
Source: Author's illustration based on information from Copenhagen Kommune.

| Legend                                                                            | Type        | Number | Name                           | Expected Start | Expected End | Status       | Description                                                                                                                                                                                             | Link                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|-------------|--------|--------------------------------|----------------|--------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Squares     | 1      | Det centrale byrum             | 2018.10        | 2024.04      | Finished     | A new, green and unifying urban space that will blur land registry boundaries by bringing together private and public areas and inviting neighbors                                                      | <a href="https://www.kk.dk/omraadeformylse/folehavekvarteret">https://www.kk.dk/omraadeformylse/folehavekvarteret</a>                                                                                   |
|                                                                                   |             | 2      | Karens Minde Aksen             | 2016.10        | 2022.12      | Finished     | It combines beautiful nature and modern solutions for handling rainwater. The park is designed to protect Copenhagen from flooding and was developed in collaboration with local citizens.              | -                                                                                                                                                                                                       |
|                                                                                   |             | 3      | Sundbyvester Plads             | 2018.06        | 2022.06      | Finished     | Gathering point                                                                                                                                                                                         | <a href="https://www.kk.dk/omraadeformylse/sundby">https://www.kk.dk/omraadeformylse/sundby</a>                                                                                                         |
|                                                                                   |             | 4      | Degnestavnes legeplads         | 2020.03        | 2021/2024    | Finished     | The area renewal will upgrade existing playground equipment in 2021. The playground will be climate-adapted and function as a delay area during cloudbursts; this project will be completed in 2024.    | <a href="https://www.kk.dk/omraadeformylsenordvest">https://www.kk.dk/omraadeformylsenordvest</a>                                                                                                       |
|  | Park        | 5      | Hans Tavsens Park og Korsgade  | 2025 fall      | 2028 spring  | Construction | It will be transformed into a coherent green area that supports both current and new recreational activities and invites new nature experiences. And it will be able to collect cloudburst water.       | <a href="https://www.kk.dk/borger/bolig-og-byggeri/anlaegsprojekter/hans-tavsens-park-og-hans-tavsens">https://www.kk.dk/borger/bolig-og-byggeri/anlaegsprojekter/hans-tavsens-park-og-hans-tavsens</a> |
|                                                                                   |             | 6      | Grønningen-Bispeparken         | 2018.05        | 2023.05      | Finished     | It combined climate and urban space project. The green areas north and south will be upgraded to a safe and local gathering place.                                                                      | <a href="https://www.sla.dk/cases/gronningen/">https://www.sla.dk/cases/gronningen/</a>                                                                                                                 |
|                                                                                   |             | 7      | Sundby Kirkegård               | 2018.12        | 2023.08      | Finished     | Together with residents and local stakeholders, work has been done to create new meeting places, connections, art, better housing and new networks in the neighborhood.                                 | <a href="https://www.kk.dk/omraadeformylse/sundby">https://www.kk.dk/omraadeformylse/sundby</a>                                                                                                         |
|                                                                                   |             | 8      | Englandsparken                 | 2018.12        | 2023.10      | Finished     |                                                                                                                                                                                                         | <a href="https://www.kk.dk/omraadeformylse/sundby">https://www.kk.dk/omraadeformylse/sundby</a>                                                                                                         |
|                                                                                   |             | 9      | Sundby Idærpark                | 2020.03        | 2023.10      | Finished     |                                                                                                                                                                                                         | <a href="https://www.kk.dk/omraadeformylse/sundby">https://www.kk.dk/omraadeformylse/sundby</a>                                                                                                         |
|                                                                                   |             | 10     | Pio Parken                     | 2016.10        | 2023.03      | Finished     | Pio Parken is a new park that brings together the outdoor areas of Ellebjerg School. The urban nature has been strengthened through the planting of many different species of plants, bushes and trees. | <a href="https://www.kk.dk/nyheder/pio-parken-er-forvandlet-og-nu-skal-den-indvies">https://www.kk.dk/nyheder/pio-parken-er-forvandlet-og-nu-skal-den-indvies</a>                                       |
|  | Nature Area | 11     | Kulbaneparken                  | 2017.05        | 2021.12      | Finished     | Experience Kulbaneparken, where nature, play and history come together in exciting ways.                                                                                                                | <a href="https://www.kk.dk/brug-byen/byens-groenne-oaser/parker-og-groenne-omraader/kulbaneparken">https://www.kk.dk/brug-byen/byens-groenne-oaser/parker-og-groenne-omraader/kulbaneparken</a>         |
|                                                                                   |             | 12     | Harrestrup Å i Vigerslevparken | 2013.02        | 2027.04      | Construction | Harrestrup Å is to be transformed from a sewage canal into a natural watercourse and recreational area with nature experiences on and along the river. It will be designed to handle cloudbursts.       | <a href="https://www.kk.dk/borger/bolig-og-byggeri/anlaegsprojekter/harrestrup-aa-i-vigerslevparken">https://www.kk.dk/borger/bolig-og-byggeri/anlaegsprojekter/harrestrup-aa-i-vigerslevparken</a>     |
|                                                                                   |             | 13     | Artillerivej                   | 2018.12        | 2022.05      | Finished     | The plan is for the school garden to be visited by schoolchildren from the School at Islands Brygge, who will use the school garden as an extra classroom for outdoor education.                        | <a href="https://bogl.dk/skolehaven-islands-brygge/">https://bogl.dk/skolehaven-islands-brygge/</a>                                                                                                     |

Drawing 4.25 Current & Future projects about urban districts in Copenhagen.  
Source: Author's illustration based on information from GeoDanmark.

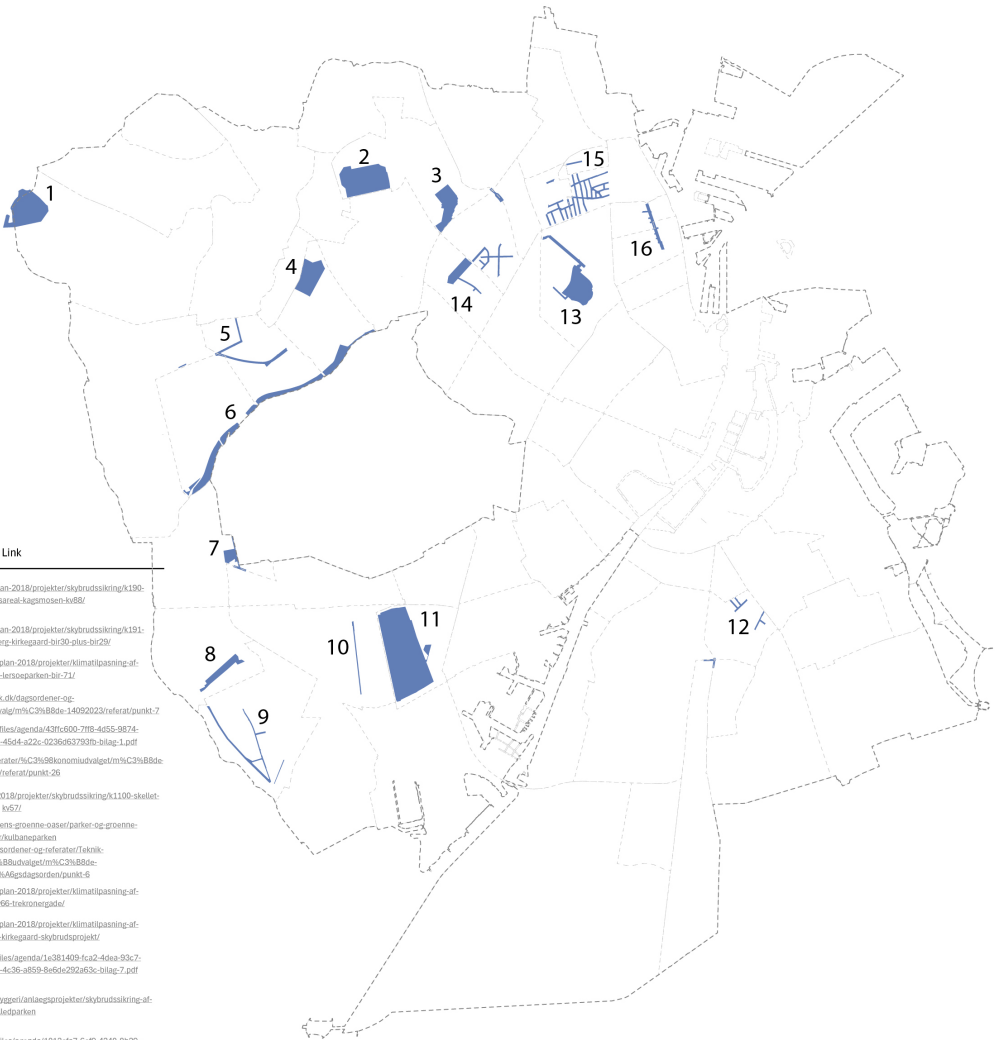


On the other hand, the city also expands its climate adaptation network; in particular, there are significant efforts made along the waterfront to address the risk of flooding. As part of the guidelines, the Cloudburst Plan also proposed the implementation of new basins, coastal reinforcement, and the use of landscaped solutions to address the issue of stormwater, which also promotes the concept of adapting to the effects of sea level rise and flooding due to heavy rainfall.

Table 4.5 Information on current & future projects about climate adaptation.  
Source: Author's illustration based on information from Copenhagen Kommune.

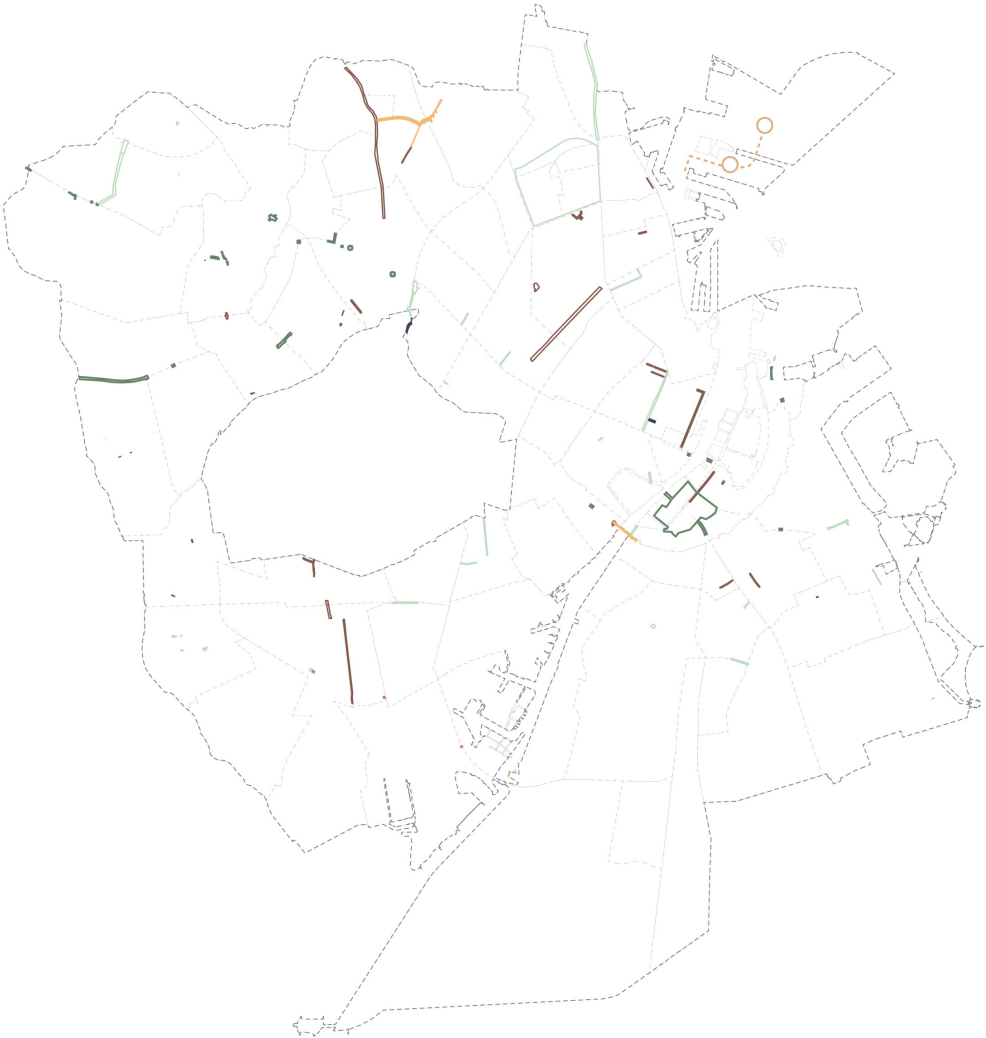
| Legend                        | Type | Number | Name                                     | Expected Start | Expected End | Status   | Description                                                                                                                                                                                                                                                                                      | Link                                                                                                                                                                                                                                                                              |
|-------------------------------|------|--------|------------------------------------------|----------------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Climate Adaptation</div> |      | 1      | Kagsmosen                                | 2013.02        | 2027.03      | Ongoing  | Cloudburst protection of Kagsmosen. (KV88)                                                                                                                                                                                                                                                       | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k190-oversvoemmesareal-kagsmosen-ky88/">https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k190-oversvoemmesareal-kagsmosen-ky88/</a>                                               |
|                               |      | 2      | Bispebjerg Kirkegaard                    | 2021.04        | 2026.08      | Ongoing  | Cloudburst protection of Bispebjerg Kirkegaard. (BIR29 & BIR30)                                                                                                                                                                                                                                  | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k191-skybrudsprojekt-bispebjerg-kirkegaard-bir30-plus-bir29/">https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k191-skybrudsprojekt-bispebjerg-kirkegaard-bir30-plus-bir29/</a>   |
|                               |      | 3      | Lersøparken, skybrudsprojekt             | 2016.05        | 2026.11      | Ongoing  | Cloudburst protection of Lersøparken. (BIR 7.1)                                                                                                                                                                                                                                                  | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/k247-lersøparken-bir-7.1/">https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/k247-lersøparken-bir-7.1/</a>                                                   |
|                               |      | 4      | Bellahej Camping og Hulgårdsvej          | 2023.12        | 2026.08      | Ongoing  | Cloudburst protection of Bellahej Camping. (BIR4.2 og BIR4.3)                                                                                                                                                                                                                                    | <a href="https://www.kk.dk/dagsordener-og-referater/Van%C3%BB8e%20Lokaltvalg/m%C3%BB8e-14092023/referat/punkt-7">https://www.kk.dk/dagsordener-og-referater/Van%C3%BB8e%20Lokaltvalg/m%C3%BB8e-14092023/referat/punkt-7</a>                                                       |
|                               |      | 5      | Sallingvej                               | 2018.02        | 2026.07      | Ongoing  | Cloudburst protection and restoration of Sallingvej. (KV51)                                                                                                                                                                                                                                      | <a href="https://www.kk.dk/sites/default/files/agenda/43f6600-7f8b-4655-9b74-e9106e4a0944/91803b44-b093-46d4-a22e-0236953790b-bilag-1.pdf">https://www.kk.dk/sites/default/files/agenda/43f6600-7f8b-4655-9b74-e9106e4a0944/91803b44-b093-46d4-a22e-0236953790b-bilag-1.pdf</a>   |
|                               |      | 6      | Grøndalsparken, skybrudssikring          | 2017.06        | 2030.01      | Ongoing  | Cloudburst protection and restoration of Grøndalsparken, skybrudssikring. (KV53)                                                                                                                                                                                                                 | <a href="https://www.kk.dk/dagsordener-og-referater/%C3%98konmudivalg/m%C3%BB8e-06122023/referat/punkt-28">https://www.kk.dk/dagsordener-og-referater/%C3%98konmudivalg/m%C3%BB8e-06122023/referat/punkt-28</a>                                                                   |
|                               |      | 7      | Skellet (Gåsebæksvej)                    | 2022.01        | 2026.02      | Ongoing  | Cloudburst protection and restoration of the Skellet. (KV57)                                                                                                                                                                                                                                     | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k1100-skellet-ky57/">https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/k1100-skellet-ky57/</a>                                                                                     |
|                               |      | 8      | Kulbaneparken                            | 2017.06        | 2020.05      | Finished | Establishment of Kulbaneparken - cloudburst protection, urban space and staffed playground.                                                                                                                                                                                                      | <a href="https://www.kk.dk/brug-byen/byens-groenme-caser/parker-og-groenme-caser/kulbaneparken">https://www.kk.dk/brug-byen/byens-groenme-caser/parker-og-groenme-caser/kulbaneparken</a>                                                                                         |
|                               |      | 9      | Kirsebærhaven og Gl. Køge Landevej       | 2020.12        | 2026.07      | Ongoing  | Cloudburst protection of Vigerslevvej, Kirsebærhaven and Gammel Køge Country Road. (KV37A og KV39)                                                                                                                                                                                               | <a href="https://www.kk.dk/dagsordener-og-referater/teknik-%20og%20m%C3%B8devalg/m%C3%BB8e-26052025/til%C3%A6gdsdagsorden/punkt-6">https://www.kk.dk/dagsordener-og-referater/teknik-%20og%20m%C3%B8devalg/m%C3%BB8e-26052025/til%C3%A6gdsdagsorden/punkt-6</a>                   |
|                               |      | 10     | Trekronergade                            | 2020.08        | 2024.04      | Finished | Cloudburst protection of Trekronergade and speed reduction on Trekronergade at Freinetskolen. (KV66)                                                                                                                                                                                             | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/ky66-trekronergade/">https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/ky66-trekronergade/</a>                                                               |
|                               |      | 11     | Vestre Kirkegård, skybrudsprojekt        | 2013.02        | 2024.09      | Finished | Cloudburst project in Vestre Cemetery. (KV69)                                                                                                                                                                                                                                                    | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/ky69-vestre-kirkegaard-skybrudsprojekt/">https://planer.kk.dk/spildevandsplan-2018/projekter/klimatilpasning-af-koakken/ky69-vestre-kirkegaard-skybrudsprojekt/</a>                       |
|                               |      | 12     | Kornblomstvej (AM28)                     | 2023.02        | 2026.07      | Ongoing  | Street trees and greening on Kornblomstvej in synergy with cloudburst project                                                                                                                                                                                                                    | <a href="https://www.kk.dk/sites/default/files/agenda/1a381409-fca2-4dea-93c7-b3d12e8926c/66898346-0601-4c36-a859-8e5de292a63c-bilag-7.pdf">https://www.kk.dk/sites/default/files/agenda/1a381409-fca2-4dea-93c7-b3d12e8926c/66898346-0601-4c36-a859-8e5de292a63c-bilag-7.pdf</a> |
|                               |      | 13     | Cloudburst protection in Fælledparken    | 2017.05        | 2026 winter  | Finished | The Municipality of Copenhagen is working to protect the city against flooding during future heavy rains. The community park will continue to be a green gathering point with space for play, ball games, relaxation and fellowship.                                                             | <a href="https://www.kk.dk/borger/boelig-og-byggeri/anlaegsprojekter/skybrudssikring-af-faelledparken">https://www.kk.dk/borger/boelig-og-byggeri/anlaegsprojekter/skybrudssikring-af-faelledparken</a>                                                                           |
|                               |      | 14     | Mimersgade (BIR8.3)                      | 2021.12        | 2029.08      | Ongoing  | Cloudburst protection and restoration of Mimersgade as well as street trees, more urban nature and cycle paths on Hamletsgade                                                                                                                                                                    | <a href="https://www.kk.dk/sites/default/files/agenda/1d131cfa7-6cf9-4240-b03b-d8969e2418/64070cee-632c-49c3-a2f4-fc1a49e90ee-bilag-1.pdf">https://www.kk.dk/sites/default/files/agenda/1d131cfa7-6cf9-4240-b03b-d8969e2418/64070cee-632c-49c3-a2f4-fc1a49e90ee-bilag-1.pdf</a>   |
|                               |      | 15     | Ydre Østerbro Vest, klimatilpasning      | 2016.05        | 2026.04      | Ongoing  | In the coming years, we will renew the streets in the Climate District in Østerbro so that they can handle the increasing amounts of rain in the future. At the same time, the plan is to reduce through traffic in the neighborhood so that cyclists and pedestrians can feel safer in traffic. | <a href="https://www.kk.dk/borger/boelig-og-byggeri/anlaegsprojekter/et-formyet-og-fredeligt-klimakvarter">https://www.kk.dk/borger/boelig-og-byggeri/anlaegsprojekter/et-formyet-og-fredeligt-klimakvarter</a>                                                                   |
|                               |      | 16     | Strandboulevarden, skybrudsprojekt (OS1) | 2015.04        | 2026.03      | Ongoing  | Handling of everyday rain and cloudburst water is handled on the surface of Strandboulevard, including water from side streets. This is done in context with the existing boulevard character, traffic flow, parking spaces, solutions for existing trees and accessibility.                     | <a href="https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/os1-strandboulevarden-del-1/">https://planer.kk.dk/spildevandsplan-2018/projekter/skybrudssikring/os1-strandboulevarden-del-1/</a>                                                                   |

Drawing 4.26 Current & Future projects about climate adaptation in Copenhagen  
Source: Author's illustration based on information from GeoDanmark.



As the map also shows, mobility and accessibility are equally prioritized. The extension of metro lines and improvements to hierarchical traffic systems aim to create a more connected and low-carbon city.

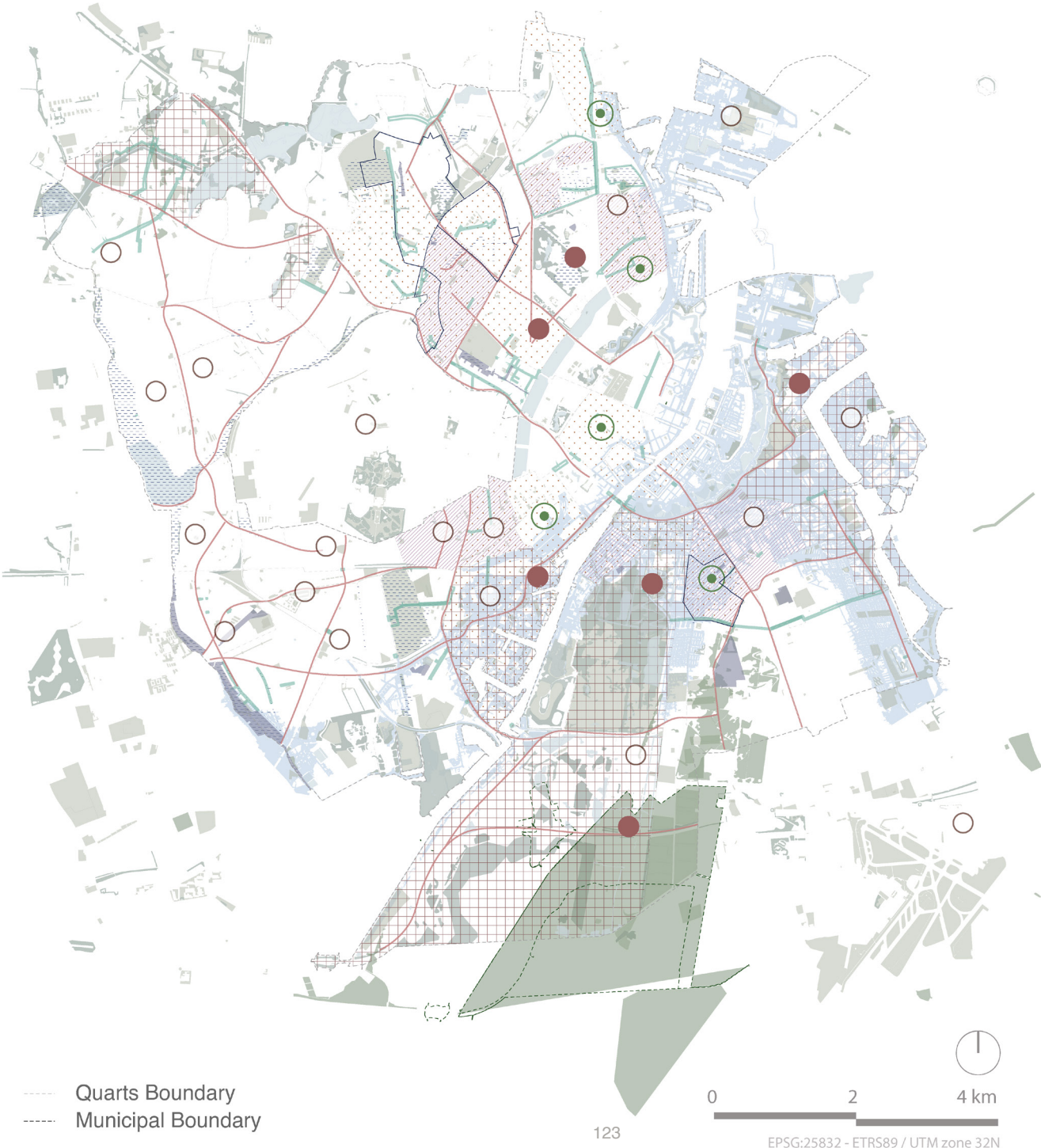
- Metro Stations
- Metro Line
- Bridge or Tunnel
- Bus Traffic
- Cycle Traffic
- Parking Facility
- Traffic Safety
- Standard Improvements
- Quarts Boundary
- Municipal Boundary





# 4.8 SWOT ANALYSIS

This diagram builds on the spatial SWOT analysis of Copenhagen and translates it into a visual representation of the environmental conditions in the city. It incorporates the findings from the previous diagrams, which included the heat islands, vegetation cover, building density, flood risk, and social factors.



Drawing 4.26 SWOT analysis based on previous analysis.  
Drawing 4.27 SWOT distribution in Copenhagen.  
Source: Author's illustration .

By conserving existing green and blue spaces and establishing regulations to prevent their transformation into commercial and residential areas, Copenhagen provides all residents with high-quality shared spaces that include water bodies, forests, and public green zones. Particularly for the large ecological zone in Amager, this protected area not only maintains numerous ecological features but also supports the natural system, offering significant benefits to the local community.

However, as one of the biggest cities in Scandinavia, Copenhagen also encounters challenges with advanced technology. More high-rise buildings are worsening the urban heat island effect for residents, and increasing building volume density makes the neighborhood more crowded and causes a lot of inconvenience for people. Moreover, well-developed transportation infrastructure also brings significant issues like noise and air pollution. All these elements influence citizens' daily lives.

On the positive side, Copenhagen has many abandoned and neglected areas, often hidden between residential or commercial zones. Some of these have already been designated as redevelopment areas, and more localized projects will be established to improve quality. This way, more district functions will be enhanced, and services for the surrounding neighborhoods will be better. Additionally, the municipality also pays attention to climate adaptation to address environmental challenges. Under the guiding documents, such as the cloudburst management plan, various climate projects are underway. In the future, many traffic renovations will take place, including multiple mobility systems.

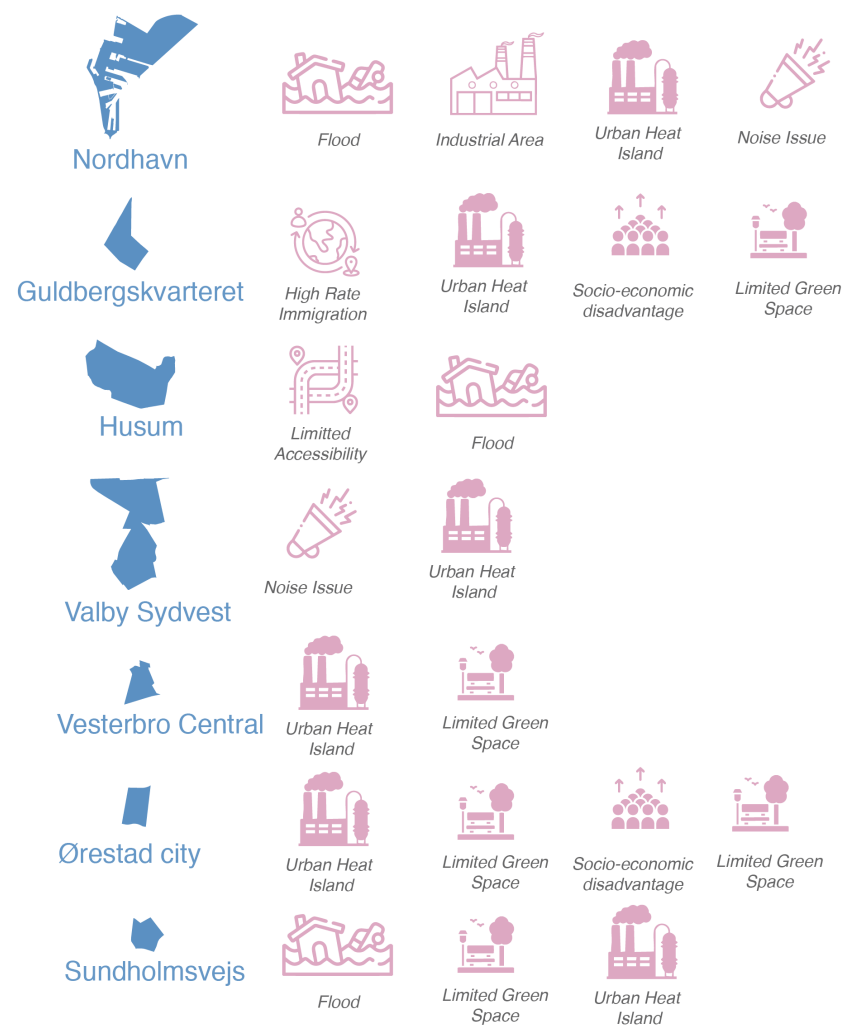
These upcoming projects will present both opportunities and challenges. Like the regeneration of Nordhavn, moving from industrial areas to mixed-use areas will provide more housing for citizens, but it needs to be well planned with the distribution of green spaces and the construction of a new metro line. Moreover, some areas are prone to flooding, which increases the requirements for governments and urban designers to consider various elements before deciding.

In one word, Copenhagen, like other cities, also faces conflicts over demand for more commercial buildings and the need to preserve open spaces for green regeneration. The biggest threats stem from rapid urbanization and population growth, which impact citizens' quality of life.

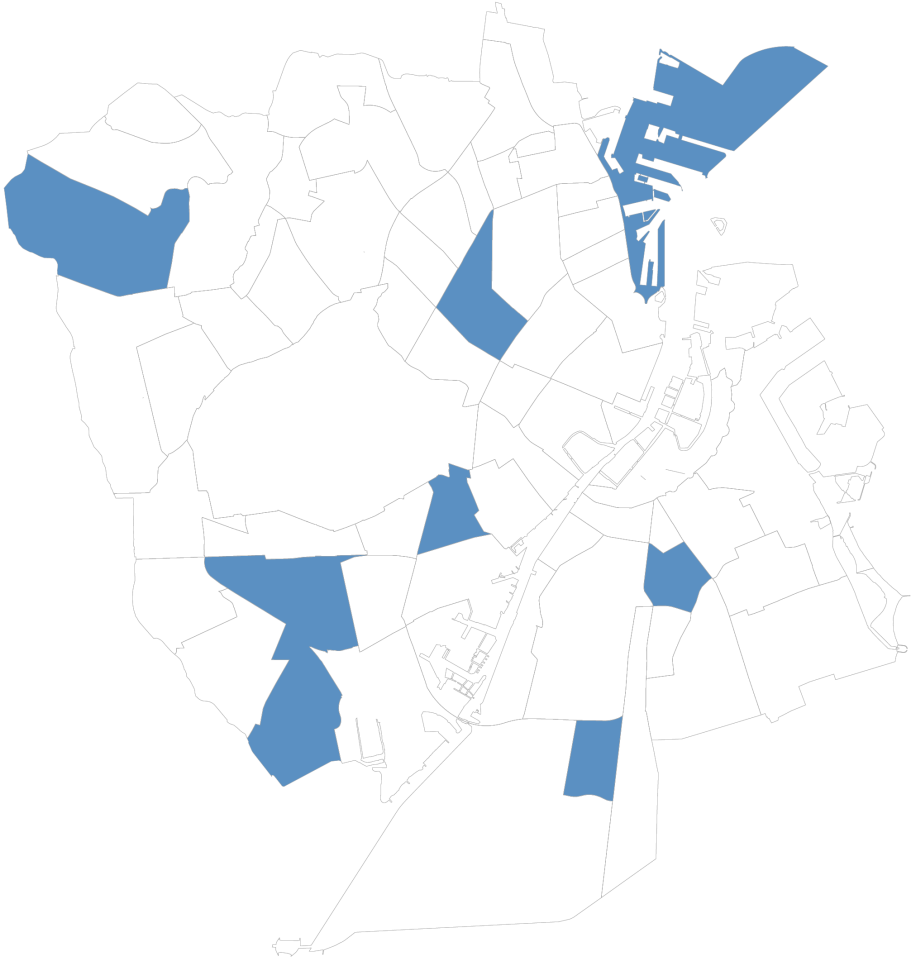
## 4.9 SITE SELECTION

Following the SWOT analysis, seven areas were identified as potential intervention areas: Nordhavn, Guldbergskvarteret, Husum, Valby Sydvest, Vesterbro Central, Ørested City, and Sundholmsvej. These areas face a variety of social, economic, and environmental problems.

# Site Selection



Drawing 4.28 Key challenges of each potential intervention area.  
Source: Author's illustration .



Drawing 4.29 Potential intervention areas based on city-scale analysis.  
Source: Author's illustration .



### **Vesterbro Central (Inner-city west, just outside Indre By)**

Vesterbro is an area just to the west of the central city and is one of the iconic ‘-bro’ areas of Copenhagen. From being a rather run-down part of town, it has evolved into a vibrant cultural center with lots of cafés, galleries, and nightlife. However, there are also issues with gentrification, lack of green space in some areas, and the maintenance of social diversity in the public space.

### **Guldborgskvarteret / Panum (Central Nørrebro)**

Guldborgskvarteret is an area in the northern part of the central city, north of the lakes, and is part of the Nørrebro district. It is a vibrant and culturally diverse area around the street Guldborgsgade and the Panum Institute. The area is famous for its local cafés, tiny business initiatives, and high level of community spirit. The area faces the same issues that affect all inner-city areas, such as the effects of increasing rents and the need to balance the maintenance of social diversity with the increasing attractiveness of the area.

### **Valby Sydvest / Sydhavnen (Southern and Southwestern edges)**

On the southern edge of the central city, the Sydhavnen area borders the harbor and features a mix of harbor industries and redeveloped waterfront areas. The Valby Sydvest area is further south and west, with a mix of old residential and industrial areas. The redeveloping areas are growing rapidly, and there are concerns with balancing the increased connectivity and access to public amenities with the maintenance of the social fabric.

### **Ørestad City (South Amager, along the Øresund coast)**

Ørestad is an area developed in the latter half of the 20th century on reclaimed land on the Amager Island. It is well-connected by metro and boasts modern architecture and large-scale mixed-use buildings. Although it is an ambitious and well-designed urban development, it has been criticized for being rather ‘sterile’ and lacking the fine details and local facilities and human scale that would make it a better place to live and work.

### **Nordhavn (Northeastern waterfront, beyond Østerbro)**

Nordhavn is a former harbor area that has been designated as a redevelopment zone for flagship projects. It is located on the northeastern waterfront of Copenhagen, beyond Østerbro. It is intended to be an example of sustainable, high-density urban living with energy, cycling, and mixed-use strategies. Flood resilience, integration with the harbor, and social inclusion are major considerations for Nordhavn.

### **Sundholmsvej (Amager district, southeast Copenhagen)**

Situated in the Amager district between Islands Brygge and Amagerbro, Sundholmsvej is located on low-lying ground near the inner harbor. It is a mixed area of welfare and service buildings, new residential projects, and new public projects. Due to its low-lying position, Sundholmsvej is becoming increasingly prone to flooding, particularly from the coast and cloudbursts. Sundholmsvej, which is part of the Amager district, has the dual task of improving flood resilience and preserving social character, as well as enhancing green and public space.

### **Husum (Northwest Brønshøj-Husum district)**

Husum is located 7 km northwest of downtown Copenhagen. It is a residential area situated between Vestvolden and Utterslev Mose. It contains residential areas, including housing estates and homes, and has several environmental issues, including stormwater management and green corridors.

Selection Criteria

| Scoring                 |                           |                        |        | Table 4.6 Score matrix according to selection criteria.<br>Source: Author's illustration. |       |                   |                 |              |               |                      |
|-------------------------|---------------------------|------------------------|--------|-------------------------------------------------------------------------------------------|-------|-------------------|-----------------|--------------|---------------|----------------------|
| High 1 ■ ■ ■            |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
| Medium 0.5 ■ ■          |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
| Low 0 ■                 |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
|                         | Environment Performance   | Indictator             | Weight | Nordhavn                                                                                  | Husum | Vesterbro Central | Sundholm -svejs | Ørestad city | Valby Sydvest | Guldbergs -kvarteret |
|                         |                           | Green-Blue Coverage    | 0.08   | ■ ■                                                                                       | ■ ■   | ■ ■ ■             | ■               | ■            | ■ ■ ■         | ■ ■                  |
|                         |                           | Heat Island Intensity  | 0.10   | ■ ■                                                                                       | ■ ■   | ■ ■ ■             | ■ ■ ■           | ■ ■ ■        | ■ ■ ■         | ■ ■                  |
|                         |                           | Flood Risk             | 0.12   | ■ ■ ■                                                                                     | ■     | ■ ■               | ■ ■ ■           | ■            | ■             | ■                    |
| Ecological Connectivity |                           |                        |        | 0.05                                                                                      | ■ ■ ■ | ■ ■               | ■               | ■ ■ ■        | ■ ■ ■         | ■                    |
| (0.35)                  |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
|                         | Urban Structure           | Land Use Diversity     | 0.07   | ■                                                                                         | ■ ■   | ■                 | ■ ■             | ■ ■ ■        | ■ ■           | ■ ■                  |
|                         |                           | Population Density     | 0.09   | ■ ■                                                                                       | ■ ■   | ■ ■ ■             | ■ ■ ■           | ■ ■ ■        | ■ ■           | ■ ■ ■                |
|                         |                           | Building Volumn        | 0.09   | ■ ■                                                                                       | ■     | ■                 | ■ ■ ■           | ■            | ■             | ■ ■                  |
| (0.25)                  |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
|                         | Accessibility             | Public Transport       | 0.05   | ■ ■ ■                                                                                     | ■ ■   | ■ ■ ■             | ■ ■             | ■ ■ ■        | ■ ■ ■         | ■ ■                  |
|                         |                           | Cycle Connectivity     | 0.05   | ■ ■                                                                                       | ■ ■   | ■ ■ ■             | ■ ■ ■           | ■ ■ ■        | ■ ■ ■         | ■ ■ ■                |
| (0.10)                  |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
|                         | Social & Cultrual Context | Green Space per Person | 0.03   | ■ ■                                                                                       | ■ ■   | ■                 | ■               | ■            | ■ ■ ■         | ■                    |
|                         |                           | Social Mix             | 0.01   | ■ ■                                                                                       | ■ ■   | ■ ■               | ■ ■ ■           | ■ ■ ■        | ■ ■           | ■ ■                  |
|                         |                           | Community Facilities   | 0.01   | ■                                                                                         | ■ ■   | ■ ■ ■             | ■ ■             | ■ ■          | ■ ■           | ■ ■ ■                |
| (0.05)                  |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
|                         | Adaption & NBS Potential  | Adaption Projects      | 0.08   | ■ ■ ■                                                                                     | ■ ■ ■ | ■ ■ ■             | ■               | ■            | ■             | ■ ■                  |
|                         |                           | Retrofit Suitability   | 0.17   | ■ ■ ■                                                                                     | ■ ■   | ■                 | ■ ■             | ■ ■ ■        | ■ ■           | ■ ■ ■                |
| (0.25)                  |                           |                        |        |                                                                                           |       |                   |                 |              |               |                      |
| Score                   |                           |                        | 1      | 0.695                                                                                     | 0.435 | 0.525             | 0.66            | 0.595        | 0.485         | 0.56                 |

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## Main Subjective Weight

The weighting focuses on the ability of urban spaces to be influenced or designed for Nature-Based Solutions (NBS), with an emphasis on architectural and morphological adaptability. The analysis shows that Urban Structure and Adaptation & NBS Potential are the most influential factors, as they indicate the ability of the current design to support adaptation and retrofitting. The factors of Environment Performance represent the environmental arguments for adaptation, while Accessibility and Social & Cultural Context serve as secondary considerations to ensure that the adaptation fits with the community.

In this system, the weight of the factors is as follows: 0.35 for Environment Performance, representing the total weight; 0.25 for both Urban Structure and Adaptation & NBS Potential, representing the need for adaptation; 0.10 for Accessibility, representing secondary considerations; and 0.05 for Social & Cultural Context.

## Category-Level Explanation

- **Environment Performance (0.35)**

Environmental factors serve as the foundation for which NBS interventions are necessary. Among these factors, Flood Risk (0.12) and Heat Island Intensity (0.10) stand out the most, as these factors directly relate to the climate adaptation issues NBS attempts to alleviate. Green-Blue Coverage (0.08) assists in understanding the existing capacity, and Ecological Connectivity (0.05) maintains green and blue spaces connected to each other. The importance of this factor is lower, as it assists in site adaptability but does not determine it.

- **Urban Structure (0.25)**

This category reflects the need to evaluate the physical and morphological adaptability of the urban fabric.

Indicators such as population density (0.09) and building volume (0.09) are prioritized because they define how easily existing urban forms can be retrofitted or reorganized to host NBS interventions.

Land Use Diversity (0.07) remains a relevant metric for identifying multifunctional and flexible urban environments, though its relevance is slightly lower because it represents potential rather than direct spatial capacity.

- **Accessibility (0.10)**

Accessibility indicators are assigned moderate weightage because they influence the integration and functioning of NBS once implemented. Public Transport and Cycle Connectivity are assigned the same weightage, 0.05, because both are important in developing accessible and inclusive green-blue systems.

- **Social & Cultural Context (0.05)**

This part is more focused on how malleable urban space is, without as much emphasis on the social and cultural context. While figures like Green Space per Person (0.02) and Social Mix (0.02) refer to issues of inclusiveness and fairness to an extent, this is not as important to this part of the analysis. Community Facilities (0.01) is given the least weighting as it is mostly about social experience rather than practical feasibility.

- **Adaptation & NBS Potential (0.25)**

This category is directly linked to the research goal of identifying where and how nature-based solutions can be incorporated into the landscape. The highest value of all indicators is associated with Retrofit Suitability (0.17), as it assesses how easily existing infrastructure can be adapted to accommodate nature-based solutions. The Adaptation Projects (0.08) indicator complements this by identifying locations where existing initiatives for NBS implementation are already supported.

## Conclusion

The final score is highest for Nordhavn, with an overall value of 0.695. The score reflects its good performance on environmental issues, flexible urban layout, and high potential to retrofit with Nature-Based Solutions (NBS). The district has significant climate challenges and opportunities for improvement, which make it an ideal candidate for further analysis.

**As such, Nordhavn is selected as the area of primary focus for further analysis and design development.**



## Micro Scale

- Information
- Built up Areas
- Green & Blue Infrastructure
- Culture, Education & Recreation
- Accessibility
- Environmental Challenges
- Future Projects
- Current Conditions
- Combined Analysis
- Deisgn Guideline

This chapter introduces the Nordhavn neighborhood, the selected site for the micro - scale strategy. It provides a brief overview of its historical transformation, urban development, current context, and environmental challenges. Additionally, it emphasizes the green blue infrastructure, the existing open spaces, different types of cultural and recreational amenities, and proposed future projects. Finally, it concludes with a synthesis map that will guide the definition of NBS strategies based on SDG (Sustainable Development Goals).



# 5.1 Nordhavn

Nordhavn is one of the largest redevelopment projects in Northern Europe. It is transforming a former industrial harbour into a dense, mixed-use, climate-adaptive urban district. Building on Copenhagen's long planning tradition, the development combines sustainable mobility, energy-efficient buildings and robust public space strategies. Designed to accommodate 40,000 residents and 40,000 workers, the district will form a major extension of the city along the waterfront.

I chose Nordhavn because it is a prime example of Copenhagen's latest approach to sustainable urban development. As the district is still under construction, it is possible to study directly how climate adaptation, blue-green infrastructure and new mobility systems are integrated into real planning decisions. Nordhavn also offers a variety of different scales, from large infrastructural features to housing clusters, providing an ideal testing ground for the application and evaluation of Nature-Based Solutions within an active urban transformation process.

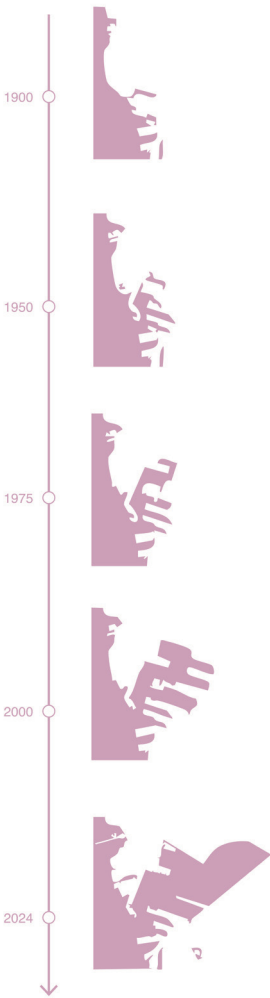


Figure 5.1 Historical development of Nordhavn.  
Source: City / By & Havn program: Program for Ny park i Nordhavn (2024).

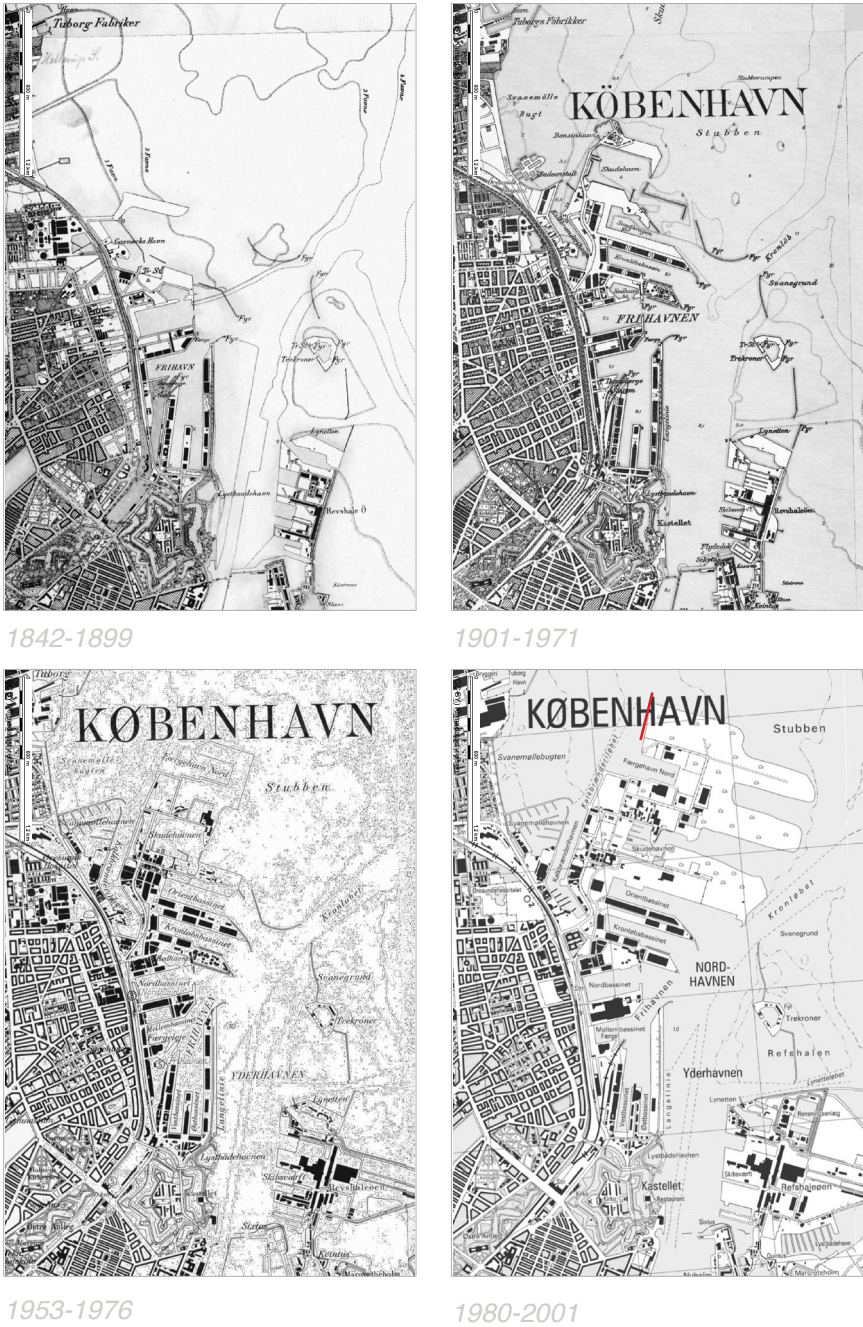


Figure 5.2 City map showing the historical development of Nordhavn  
Source: <https://historiskekort.dk>.

## Late 19th Century

As Copenhagen expanded its port infrastructure, Nordhavn began to take shape. The Freeport area was developed to support the growth of maritime trade, marking the district's transformation from a coastal fringe to a strategic industrial harbour.

## Mid 20th Century

Throughout the mid-1900s, Nordhavn expanded to include new basins, warehouses and rail links, strengthening its position as one of Copenhagen's primary industrial gateways. Large areas were dedicated to shipping, logistics and fuel storage, creating a landscape characterised by cranes, silos and harbour engineering.

## 2009 - 2017

Following the political agreement of 2005 and the masterplan of 2008, Nordhavn entered its active redevelopment phase. Significant projects such as the UN City, the Silo, new housing blocks and improved transport links indicated a shift towards creating a mixed-use, sustainable neighbourhood on former industrial land.

## Now & Future

Today, Nordhavn is one of Europe's largest urban development areas. It is aiming to accommodate 40,000 residents and create 40,000 jobs. The district is continuing to evolve, with new metro connections, energy-efficient buildings and climate-adapted public spaces reflecting Copenhagen's long-term vision for a resilient, waterfront city.

## Late 19th Century Industrial Harbour Begins

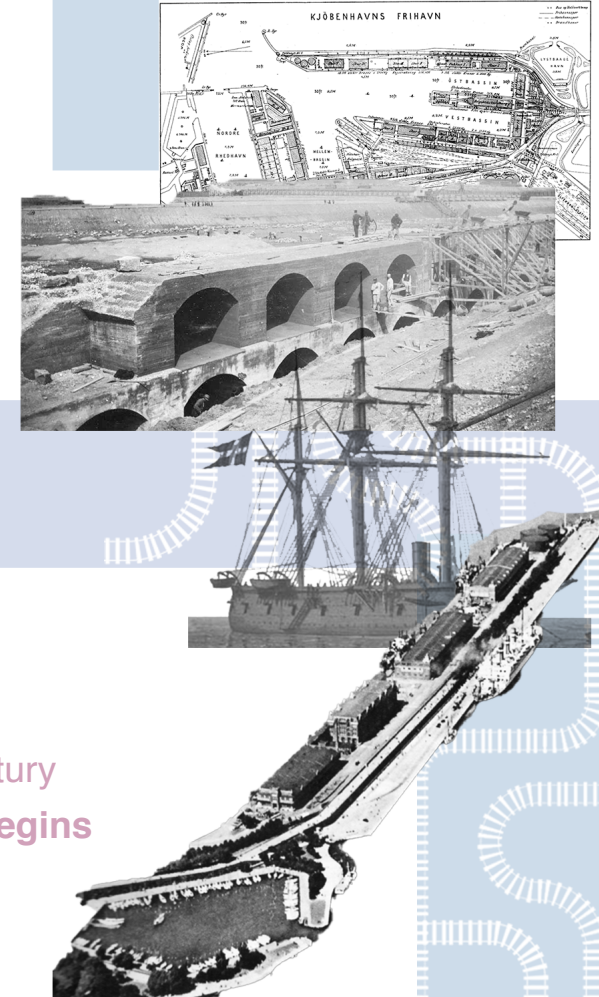


Figure 5.3 Key historical elements in the development of Nordhavn  
Source: Author's illustration.

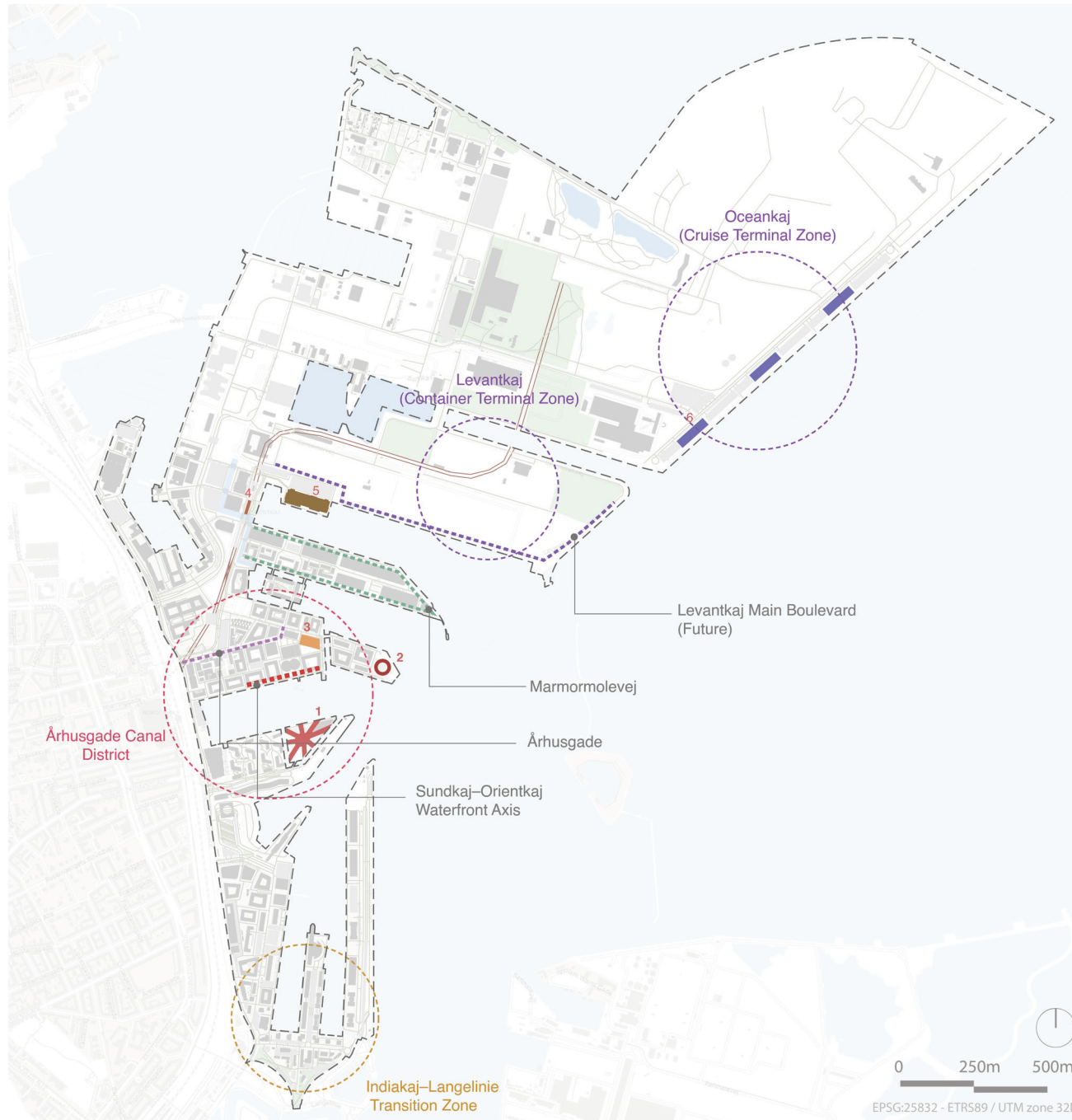


## 2009–2017 Transformation from Industry to Urban District

Figure 5.3 Key historical elements in the development of Nordhavn  
Source: Author's illustration.



Drawing 5.1 Current context of Nordhavn.  
Source: Author's illustration.



## 5.2 BUILT UP ANALYSIS

### 5.2.1 Context Analysis

#### Landmarks Buildings

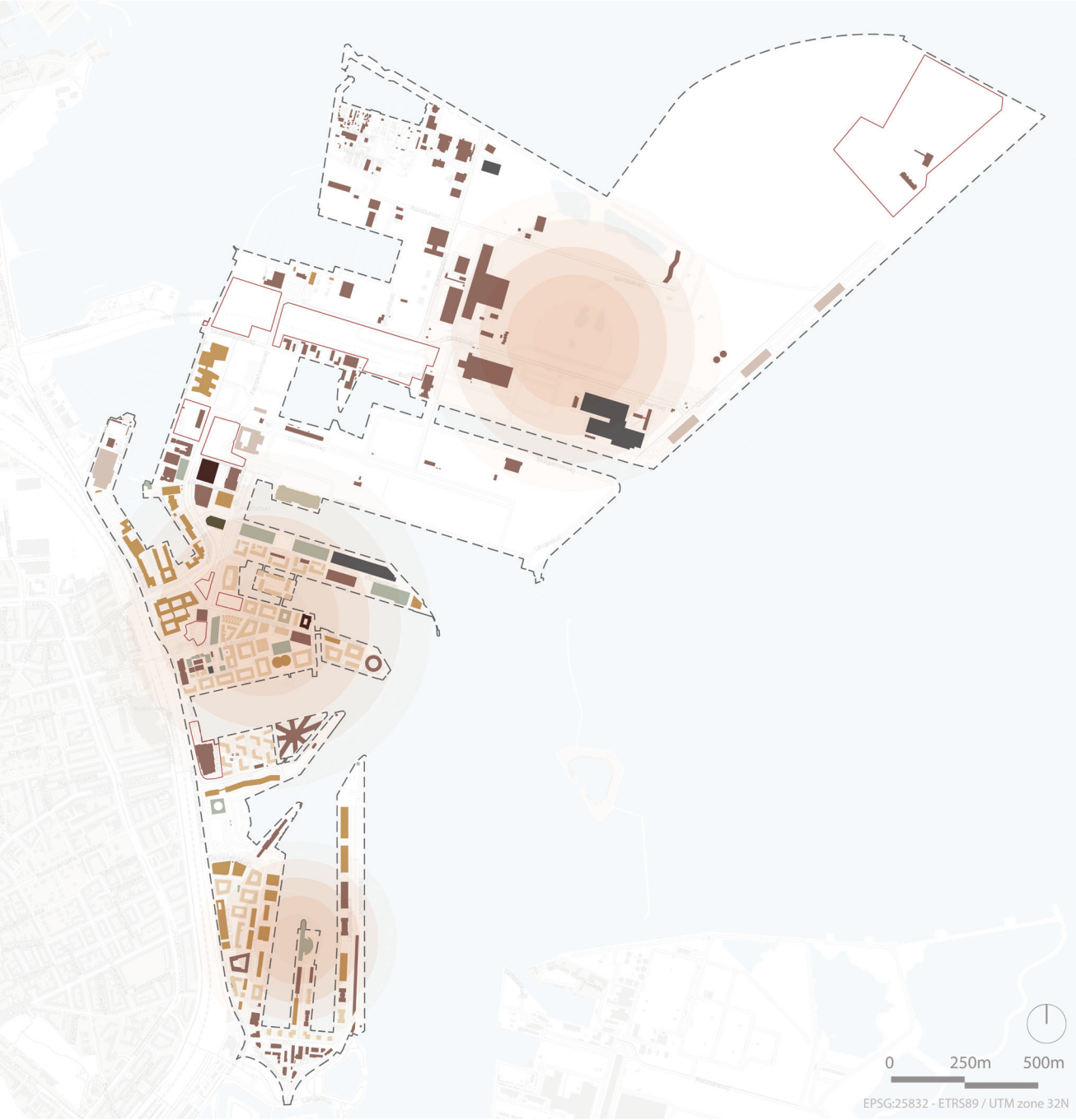
1. UN City (FN Byen):  
One of Nordhavn's main global-scale institutions.
2. Tip of Nordø:  
A prominent waterfront tip in Nordhavn featuring a circular reused industrial hall and new public-facing functions.
3. Lüders Parking House + Rooftop Playground  
A parking house with a popular public rooftop playground that adds social activity to the Århusgade district.
4. Orientkaj Metro Station (M4)  
The northern end station of the M4 line, linking Nordhavn's new waterfront neighborhoods to the rest of Copenhagen.
5. Copenhagen International School (CIS)  
A prominent waterfront school with a distinctive green façade that anchors daily activity in Nordhavn.
6. Cruise Terminal at Oceankaj  
Copenhagen's primary cruise terminal, handling large international ships at the northern edge of Nordhavn.

#### Urban Axes

- Århusgade  
The main commercial spine of Nordhavn, connecting the metro station with the district's central public spaces and mixed-use blocks.
- Sundkaj–Orientkaj Waterfront Axis  
A continuous public waterfront route linking housing blocks, bathing zones, and the M4 station along Nordhavn's eastern edge.
- Marmormøllevej  
The main street serving the Marmormølle peninsula, linking office developments, waterfront spaces, and future public connections.
- Levantkaj Main Boulevard (Future)  
It will function as the primary east–west spine of the new district, structuring mobility and development in the next phase of Nordhavn's expansion.



Drawing 5.2 Built area and building functions of Nordhavn.  
Source: Author's illustration.



### 5.2.2 Building Functions

The area of Nordhavn offers a varied mix of uses, which reflects the evolution of the area from being a working harbor to becoming a new urban area. The built-up area combines residential, office, school, educational, and other facilities. At the same time, large areas of the harbor area remain in use as industrial sites or in development. Especially in the northern part of the area, there are still large logistics, warehouse, and construction sites that continue to bring life to the harbor economy.

Legend

---

Boundary

Housing

Commercial

Education

Hotel

Industrial

Office

Pakring

Warehouse

Mixed Use

Construction



### *South: Finger Harbour Transformation*

This area has undergone a transition from a working finger harbour into a mixed urban district. Former storage yards and service buildings have been replaced by housing, offices, and active ground floors, while the quays have been transformed into public promenades. This change is indicative of Nordhavn's overarching strategy of transforming industrial waterfronts into pedestrian-friendly neighbourhoods.

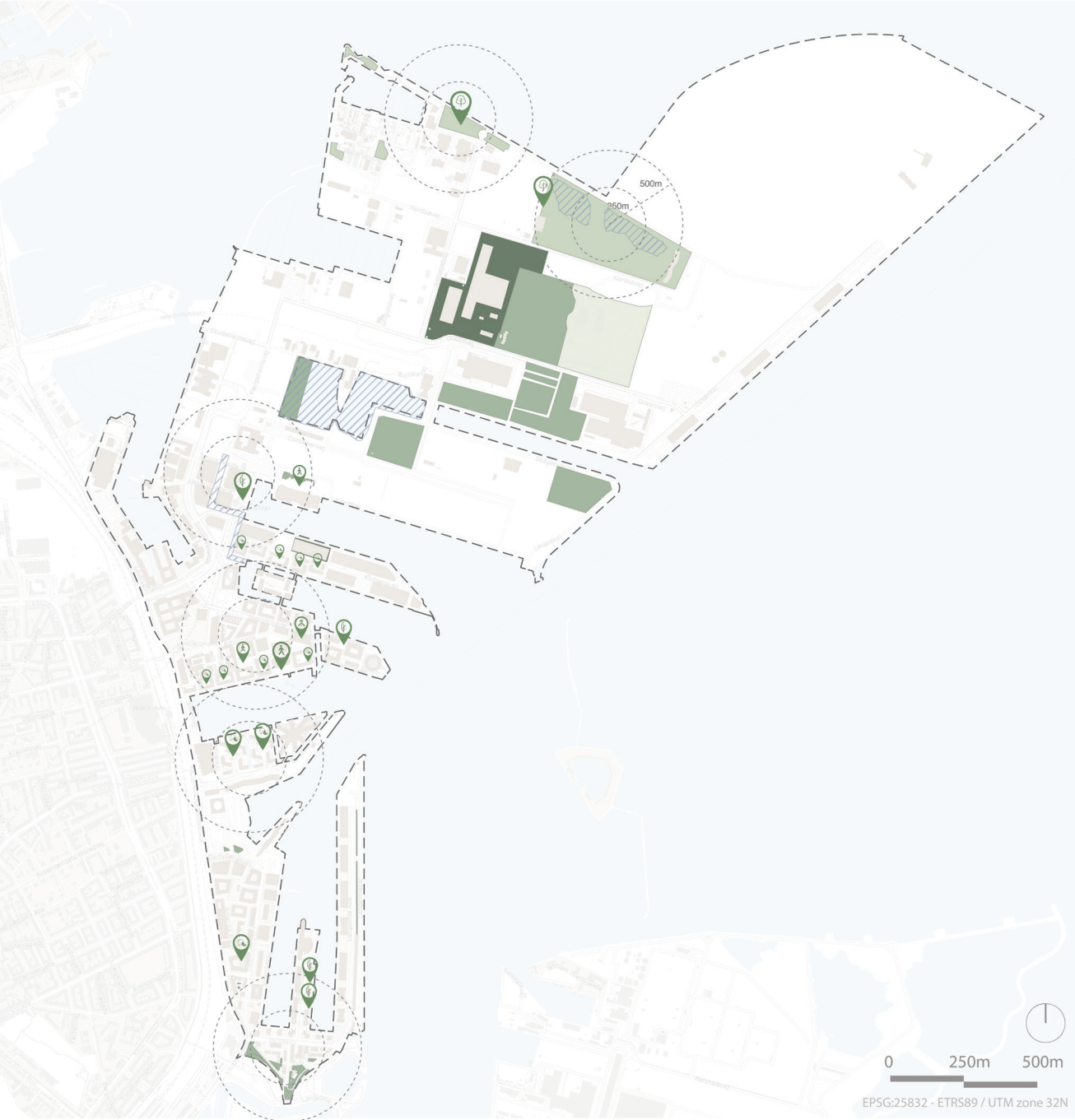
### *Middle: Århusgade - First completed District*

Århusgade is the main day-to-day street, with grocery stores, cafés, bakeries, and small offices filling the ground floors. Buildings like the Lüders Parking House, which has a public rooftop playground, add another social layer, bringing people up onto new types of shared spaces. It was developed first, so it's become the gold standard for how future phases of Nordhavn are expected to work.

### *North: Industrial Area with Plans Development*

The northern part continues to be an area of active harbour activities, with plenty of large storage halls, container terminals, and spacious access roads. The long-term goal, however, is to open up this area when the central areas have reached full development. Levantkaj stands out as the area to accommodate a new mixed urban neighborhood. The new planning processes, such as SLA's winning concept for a coastal park in the northern part of Nordhavn, show how these industrial edges will eventually open up to public use. In the long term, these edges will eventually give way to a more balanced mix of parks, urban streets, and new public waterfront areas.

Drawing 5.3 Green infrastructure in Nordhavn.  
Source: Author's illustration.



### 5.3 GREEN & BLUE INFRASTRUCTURE

In the south, in the Århusgade, Sundkaj, and Fortkaj areas, the green spaces have already been included in the urban planning. There are parks, pocket parks, courtyards, playgrounds, and waterfront recreation spaces all around the completed residential blocks. These form a network of public spaces that you can walk to every day. The Lüders rooftop garden is certainly a talking point, as is the sports facilities and harbor baths, which is perfect for a workout outdoors just by the canal.

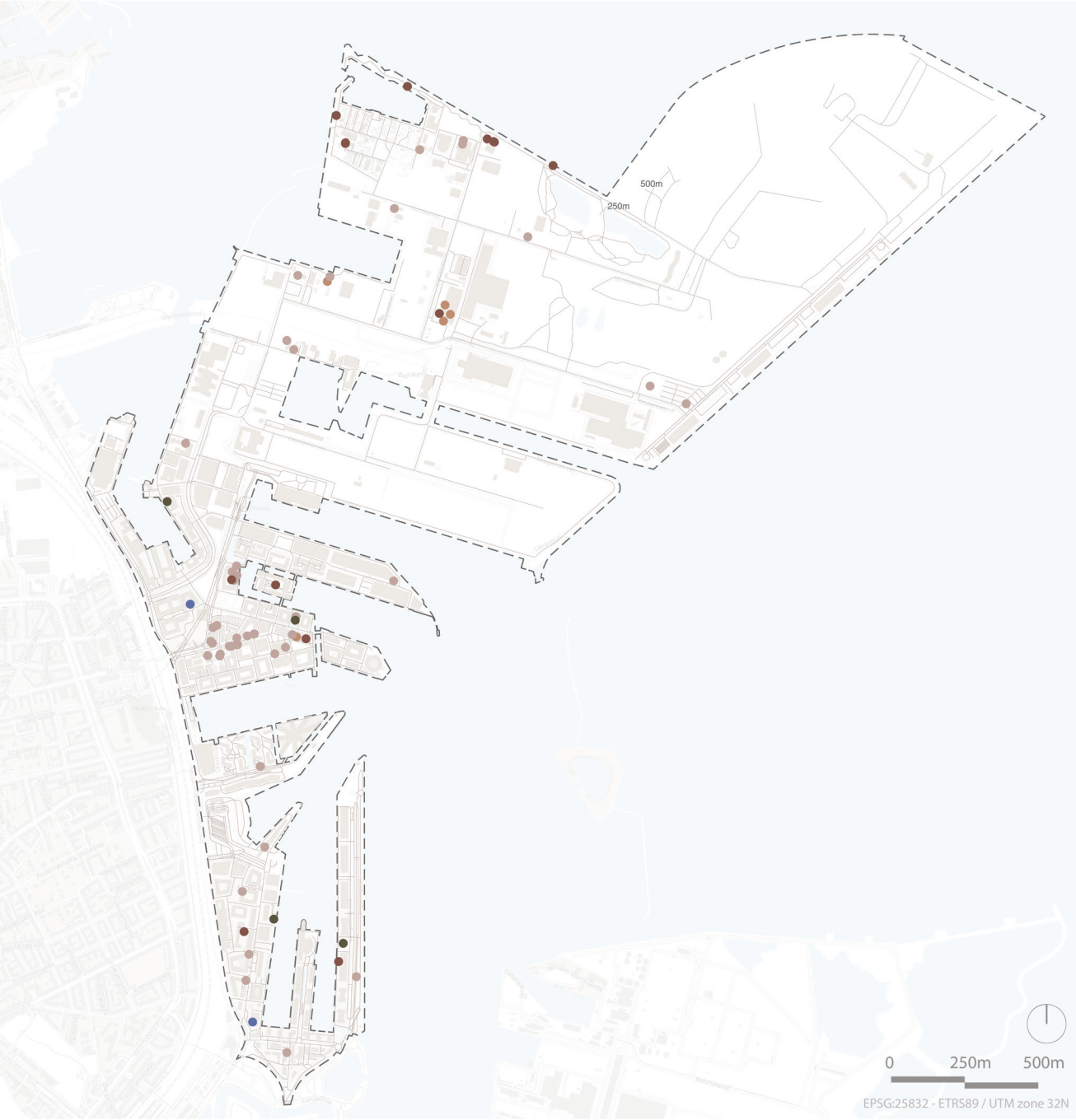
Further north, the green spaces are more fragmented. Much of the area is still undeveloped or used for things related to the harbor, which is shown on the map as large areas of brownfield, grass, or open land. These areas are not yet public parks, but they have a lot of potential for development as green spaces in the future.

Currently, Nordhavn has compact and well-planned green spaces in the south and large undeveloped areas in the north. As development continues in the area, the green spaces in the district's future are expected to build on these foundations and extend the current network of green spaces across the entire district.

#### Legend

- |                                                                                                          |                                                                                                   |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
|  Park               |  Boundary    |
|  Pocket Park        |  Water Body  |
|  Community Garden   |  Brownfield  |
|  Public Roof Garden |  Grass       |
|  Sport Area         |  Greenfield  |
|                                                                                                          |  Meadow      |
|                                                                                                          |  Walkability |

Drawing 5.4 Cultural, educational, and recreational interesting points of Nordhavn.  
Source: Author's illustration.



### 5.4 CULTURE, EDUCATION AND RECREATION

The availability and spread of cultural, educational, and recreational facilities in Nordhavn mirror the level of development in this area.

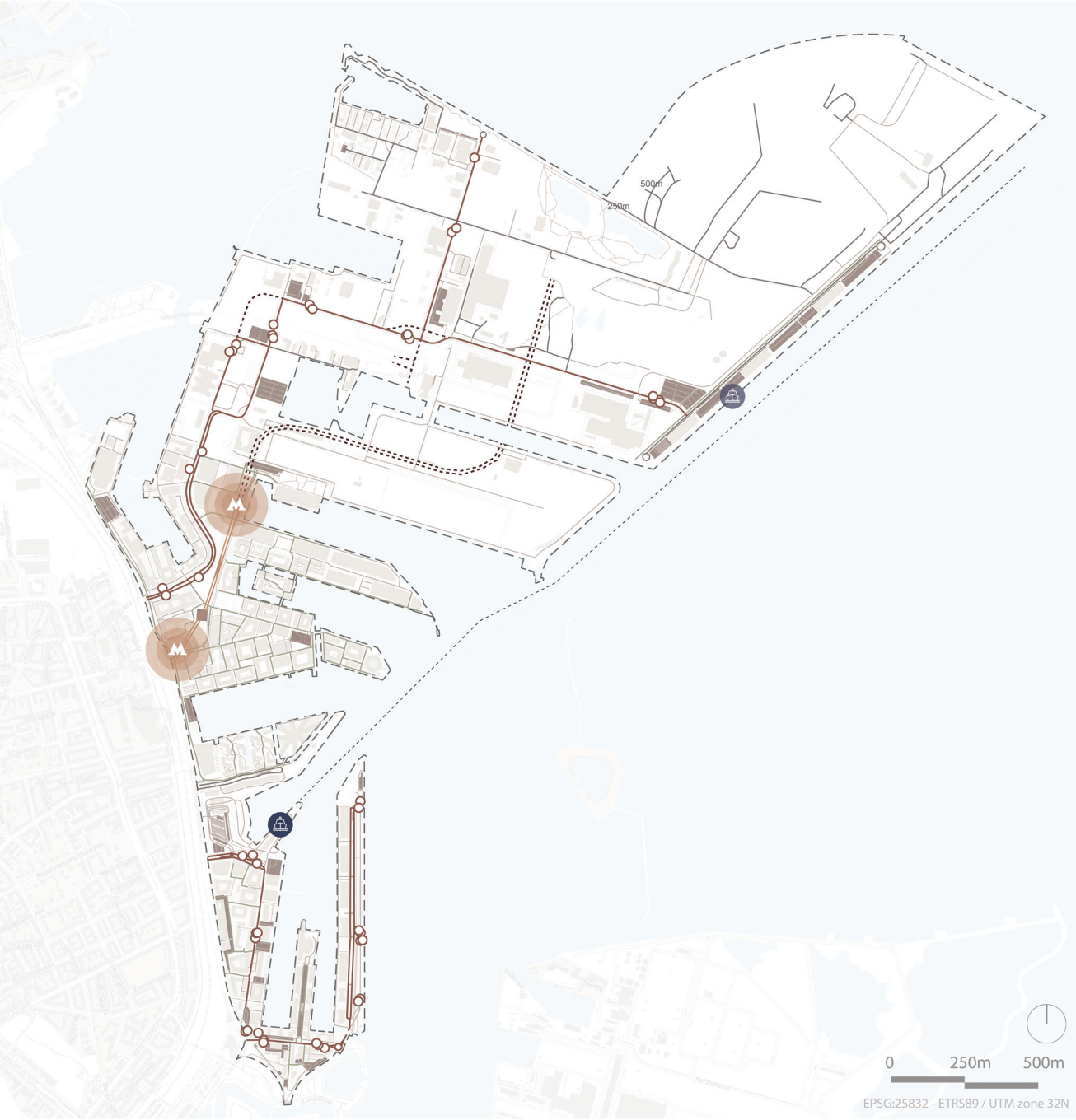
The majority of community-oriented facilities, such as sports facilities, cafes, small commercial centers, and the primary school, can be found in the southern part of the area around Aarhusgade and Sundkaj. This area offers the highest concentration of daily activities, which are supplemented by playgrounds, local shopping, fitness centers, and the Lüders rooftop sports facility, creating a lively community space within walking distance of most residents.

In the northern part of the area, the situation looks different. Cultural and educational facilities are spread out here, and only a few isolated community centers can be found in the midst of large industrial and construction sites.

- Legend**
- Boundary
  - Sports
  - Education
  - Leisure
  - Commercial
  - Community Center



Drawing 5.5 Current transport system of Nordhavn.  
Source: Author's illustration.



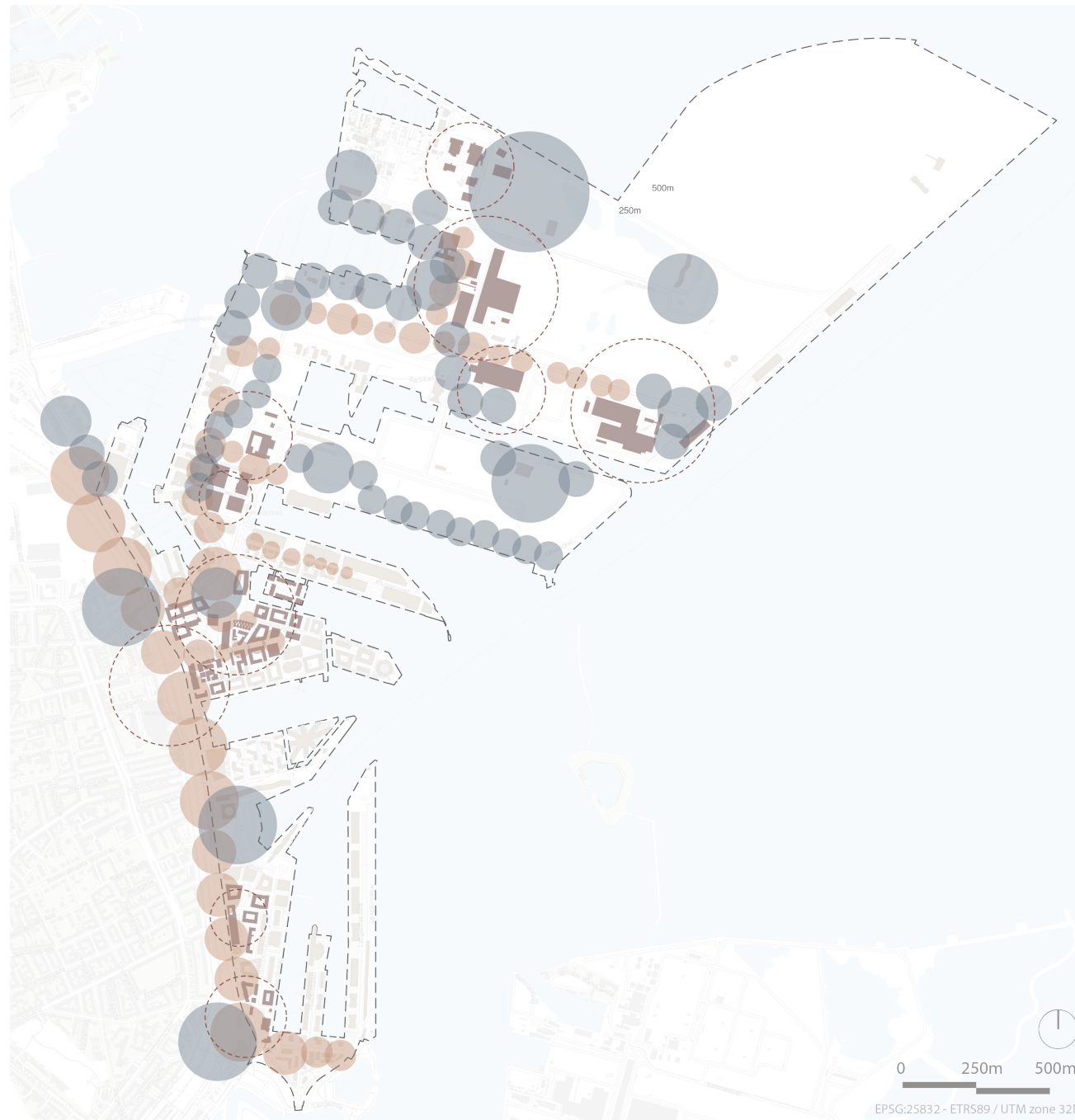
### 5.5 ACCESSIBILITY

The M4 metro line is the most important transport route in Nordhavn, with Orientkaj and Nordhavn stations providing fast, reliable access to the city centre. There are bus routes, ferry connections and a network of cycle paths that stretch across the peninsulas to support this infrastructure. Most of the houses and businesses are really close to a bus or train stop, so public transport is a big part of life in the area.

Despite its strong structure, the area still has transitional characteristics. The industrial roads in the north are not yet well-integrated with pedestrian and cycling routes. Large blocks of undeveloped land disrupt north-south connections, and the perimeter roads near the container terminals create long edges that reduce walkability, which may generate a sense of disconnection between the northern part and the more active mixed-use neighbourhoods in the south.

#### Legend

- Bus Stop
- Ⓜ Metro Station
- ⚓ Port Station
- ⚓ Ferry Station
- Parking
- Boundary
- Metro Line
- Street Road
- Path
- Service
- Bus Line
- Port Line
- Proposed Line
- Track Line



## 5.6 ENVIRONMENTAL CHALLENGES

From the map, it can be seen that there are a number of areas that are still at a great risk of being flooded due to their lower height and location near the harbour. There are a number of paved and unpaved surfaces in the new areas, which can get hotter during the warmer season. The residential areas located in the southern part of the area are more compact and are showing signs of being more vulnerable to the urban heat island effect.

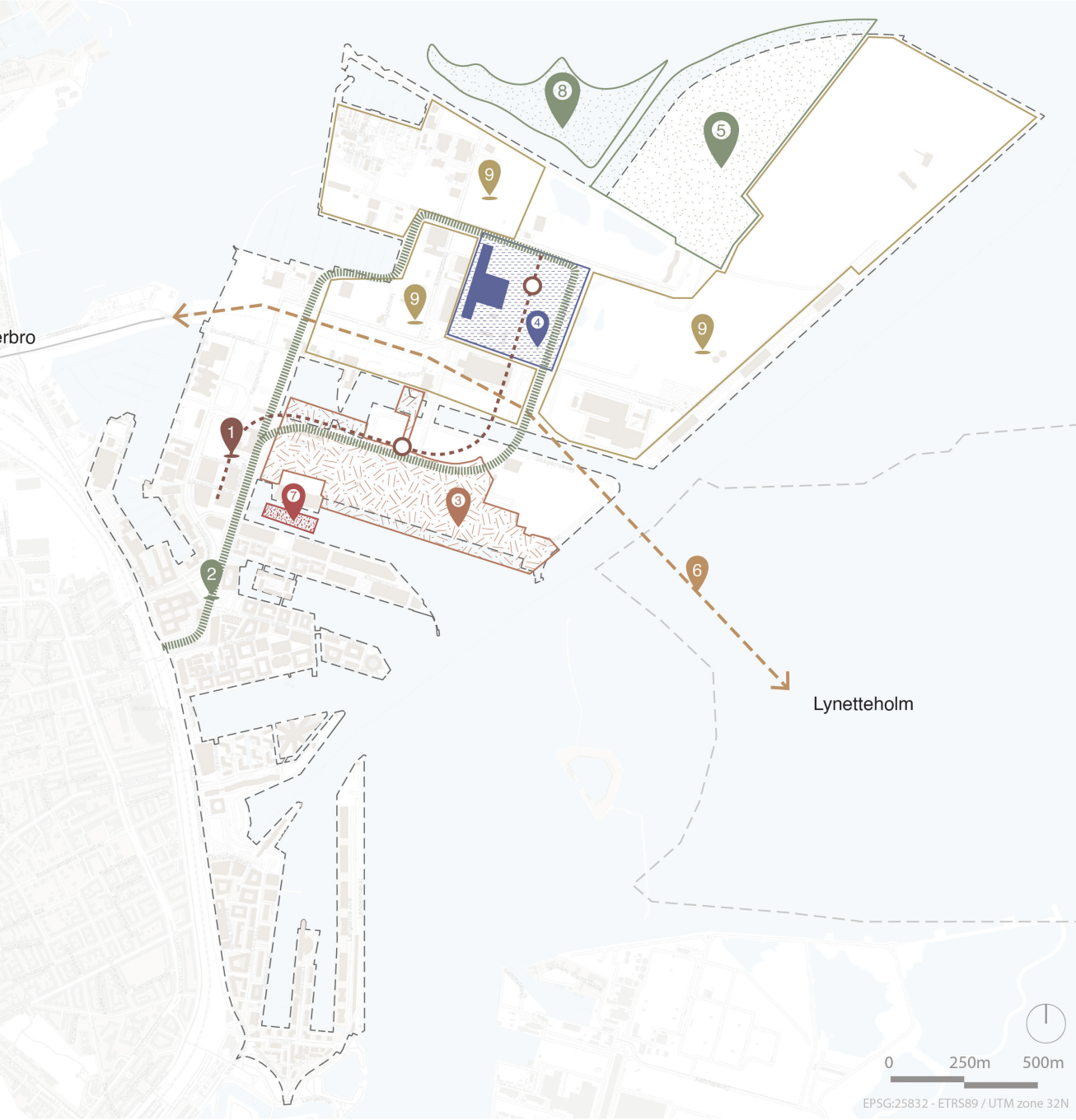
### Noise level:

It can be said that the area around Nordhavn is also vulnerable to the noise level, which can be a major environmental pressure on the area. The construction activities and the service road running through the central spine area produce the same level of noise, which affects the current residential areas and the new construction areas to be developed in the future. The areas located in the northern part of the area, where industry still dominates, have a lot of open space and the noise level produced by industry, which can be a major environmental pressure on the area. The residential areas located in the southern part of the area have to deal with a higher level of urban noise caused by the normal transportation such as lifted metro and car.

### Legend

- Boundary
- Flooding Area
- Noise Pollution
- Overheat Area
- Vulnerability to UHI

Drawing 5.7 Future projects in Nordhavn.  
Source: Author's illustration.



## 5.7 FUTURE PROJERCTS

### Future Projects

- 1 Metro Extension (M4 – Nordhavn North)**
    - Planned extension of the M4 Copenhagen Metro line further into Nordhavn after 2026.
    - New stations (including Levantkaj and northern Nordhavn) supporting future neighbourhood development and transit-oriented growth.
  - 2 Green Loop**
    - A planned continuous green mobility loop that connects neighbourhoods across Nordhavn through walking and cycling routes integrated with public spaces and climate-adaptive landscape elements.
  - 3 Levantkaj**
    - Next major mixed-use quarter in Ydre Nordhavn
    - Large mixed-use district (housing, offices, institutions, culture).
  - 4 Tunnel Factory / Tunnelfabrikken**
    - Conversion of the former tunnel element factory (ØTC) into Tunnelfabrikken, envisaged as a "cultural hotspot" and "urban ecosystem" with culture, workspaces, education, sports and urban farming.
  - 5 Nordør – New Coastal Nature Park**
    - Nordør – New Park in Nordhavn", a ~30-hectare coastal nature park on the outer tip of Nordhavn. It is described as Copenhagen's first new large-scale park in a generation.
  - 6 Østlig Ringvej (Eastern Ring Road)**
    - Planned major eastern ring road tunnel (Østlig Ringvej) linking Nordhavn with Lynetteholm and broader road infrastructure.
  - 7 Nordhavn Islands**
    - A planned series of floating public islands in Nordhavn designed as a water-based urban landscape for recreation, learning, and everyday activities, strengthening the connection between the city and the harbour.
  - 8 Strandholmen – Rekreativ Holm**
    - A planned recreational island at the northern edge of Nordhavn, designed as a landscape for bathing, promenade, water sports, and nature-based leisure, forming part of the wider Nordør coastal park system.
  - 9 Future Neighbourhood Development Areas (Ydre Nordhavn)**
    - Planned residential and mixed-use neighbourhoods to be developed in later phases of Nordhavn's long-term masterplan.
- Boundary



Over the next years, Nordhavn will be shaped by several strategic developments that mark its transition from an active harbour to a fully integrated urban district. Levantkaj is going to be the next big mixed-use neighbourhood, with housing, offices, cultural facilities and public spaces replacing today's port areas. The old tunnel factory in the centre of the district is going to be turned into Tunnelfabrikken, a cultural and community centre with workspaces, sports facilities, food culture, and community programmes. Further north, the creation of Nordør – the New Coastal Nature Park will introduce a 30-hectare landscape of coastal nature, recreation, and ecological restoration, becoming Copenhagen's first large-scale park in decades.

In addition to those projects, a series of mobility and infrastructure upgrades will be implemented in Nordhavn. The metro network will be expanded, bus routes will be improved, and future tunnel connections will be established to strengthen links between new neighbourhoods, the city centre, and nearby districts such as Østerbro. Together with the planned Green Loop and improved cycling paths, these changes will create a more connected, accessible, and resilient district

Figure 5.4 Strukturplan for Nordhavn.  
Source: City of Copenhagen (n.d.) ; Københavns Kommune



Figure 5.5 Nordhavn Islands (top), Tunnel Factory(middle), Nordør(bottom).  
Source: CF Møller Architects; By & Havn; SLA.

## 5.8 CURRENT CONDITIONS

### Existing & proved projects

#### Orientkaj Metro Station - Entrance



Figure 5.6 Current condition of Orientkaj Station.  
Source: Author's photograph.

The station entrance is shaped by elevated concrete structures and wide paved surfaces, creating a strong infrastructural character. Direct contact with the water and new planting along the quay offer openness and views, but the space functions mainly as a transit zone. Shelter, microclimate comfort, and spatial definition at ground level remain limited.

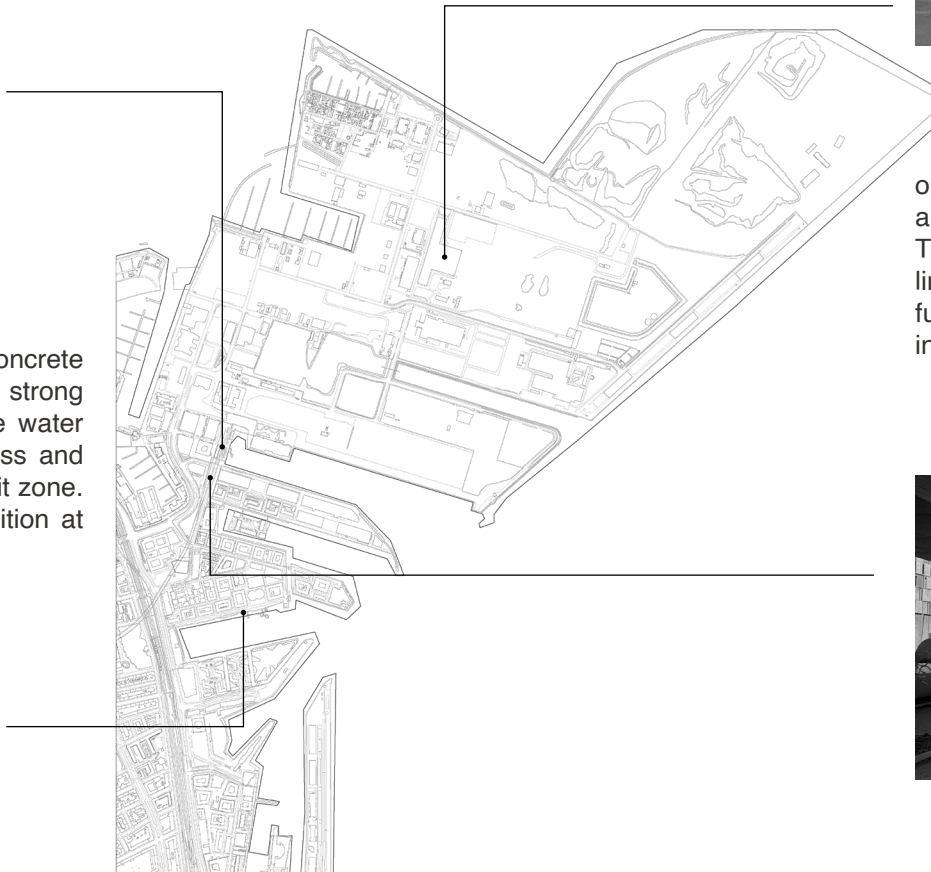
#### Sandkaj – Waterfront Promenade



Figure 5.7 Current condition of Sandkaj  
Source: Author's photograph.

#### Strandholmen

Strandholmen is a reclaimed landfill area that remains largely undeveloped, with the project not yet initiated on site. While the aim is to transform the area into a mixed-use island with strong public access to the waterfront, the site currently functions as an open, transitional landscape.



Sandkaj is characterized by a wide, linear waterfront promenade with direct access to the harbor. The space is dominated by hard surfaces and exposed edges, offering strong visual openness but limited climatic protection. While it functions as an active public waterfront, opportunities remain to enhance shade, vegetation, and water-based climate adaptation along the quay.

#### Tunnelfabrikken



Figure 5.8: Current condition of Tunnelfabrikken  
Source: Google Maps.

The area currently consists of fenced open land with spontaneous vegetation and an industrial character dominated by the Tunnelfabrikken building. Public access is limited and the space is largely inactive. A future project is planned to transform the site into a central area within Nordhavn.

#### Under-bridge Spaces (Metro)



Figure 5.9 Current condition of under-bridge spaces.  
Source: Google Map.

The area currently consists of fenced open land with spontaneous vegetation and an industrial character dominated by the Tunnelfabrikken building. Public access is limited and the space is largely inactive. A future project is planned to transform the site into a central area within Nordhavn.



## Skudehavnen – Marina Area



Figure 5.10 Current condition of Skudehaven  
Source: Author's photograph.

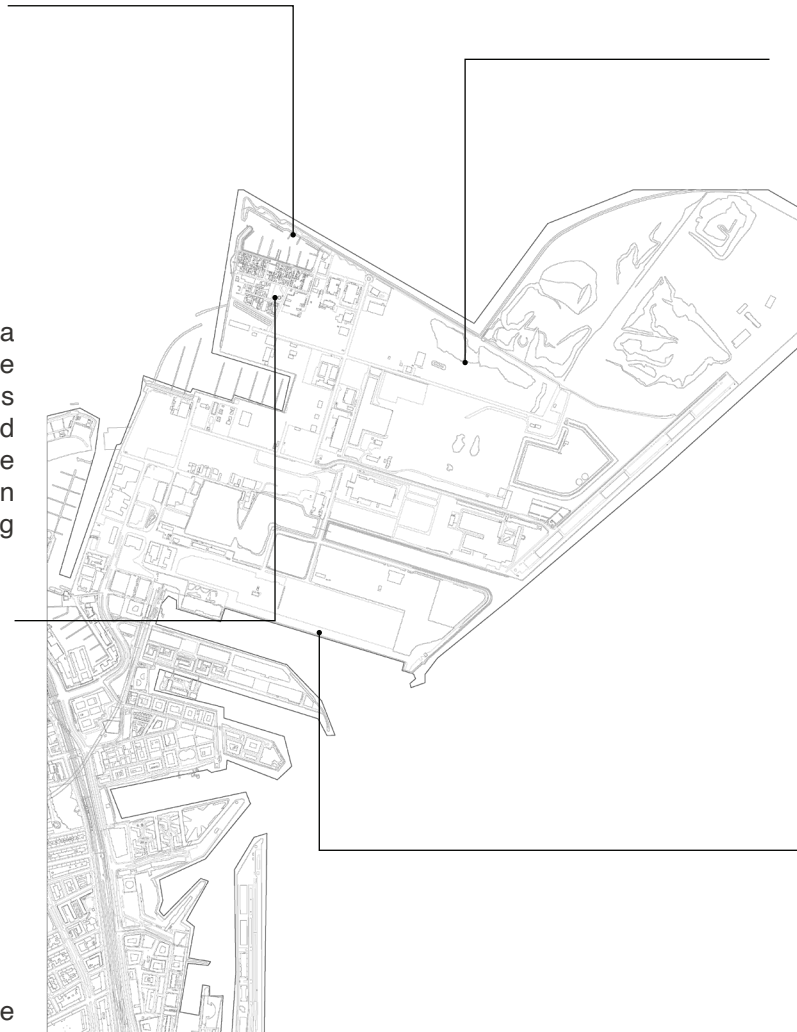
The area currently functions as an active marina with pontoons, moored boats, and protective stone embankments. Public access is limited to narrow paths along the edge, and the space is primarily oriented toward harbor use rather than everyday public life. While the water structure is well defined, opportunities remain to improve accessibility and integration with surrounding open spaces.

## Østersøvej Workshop Area



Figure 5.11 Current condition of Østersøvej.  
Source: Google Maps.

The area is currently characterized by small-scale workshops, storage buildings, and fenced plots with limited public access. The urban fabric is dense and fragmented, reflecting its ongoing industrial and semi-temporary use. While active, the space offers little public realm quality and remains weakly connected to the surrounding waterfront and open space network.



## Nordhavntippen



Figure 5.12 Current condition of Nordhavntippen.  
Source: Google Map.

Nordhavn Tippen is described as having open, undisturbed land with spontaneous vegetation and two existing lakes on the site. The land is a reflection of its previous use as an industrial site and a landfill, making it a raw and irregular topography. While the land is visible from roads around the area, it is not accessible due to fencing, and it is currently an inactive open space.

## Levantkaj

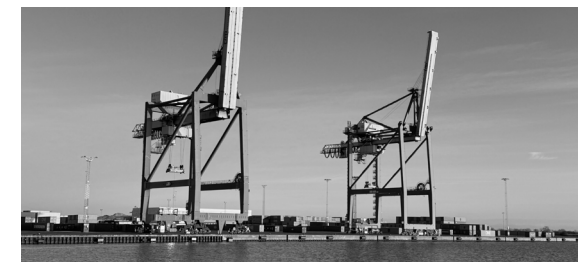


Figure 5.13 Current condition of Levantkaj.  
Source: Google Maps.

Levantkaj is dominated by port infrastructure such as container storage, cranes, and extensive paved surfaces. The area functions primarily as an active logistical zone with restricted public access and minimal greenery. Despite its waterfront location, it remains largely mono-functional and industrial in character.



## Skudehavnen Lakes Area



Figure 5.14 Current condition of Skudehaven Lake.  
Source: Author's photograph.

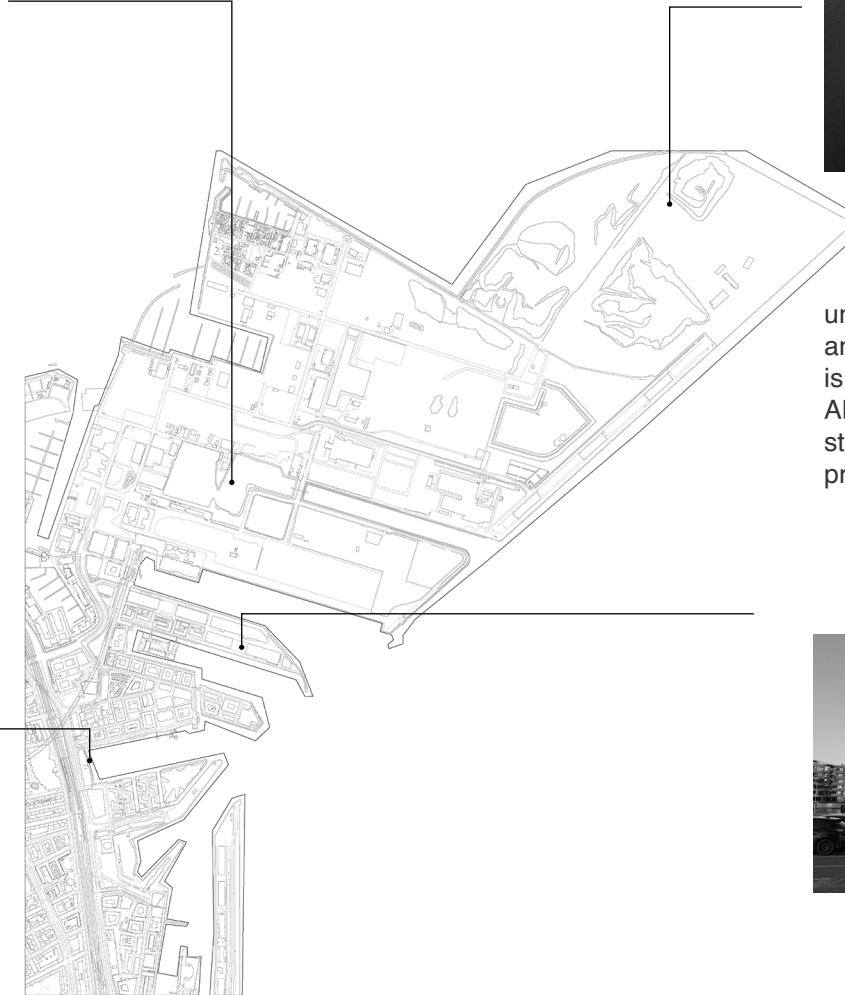
The region is dominated by two large water basins, which are flanked by industrial buildings, storage spaces, and remaining green areas. The region is not easily accessible, and the areas surrounding the water basins are primarily used for service functions and act as buffers rather than public spaces. Although the water basins bring blue elements into the region, their connectivity to the urban environment is not strong.

## Nordhavn Metro Station



Figure 5.15 Current condition of Nordhavn Metro Station.  
Source: Author's photograph.

It can be observed that the area around the Nordhavn Metro Station has large open plots and parking lots, which signifies that it is still in the early stages of development. Although this is a major hub for mobility, it is still fragmented, acting as a transitional space for transport.



## Nordør Coastal Park



Figure 5.16 Current condition of Coastal Park.  
Source: Google Map.

The area is currently an open and undeveloped landscape, with exposed terrain and limited public infrastructure. Vegetation is limited, and spatial definition is minimal. Although the area is open to the public, it is still in an interim state, as a future landscape project is planned for the area by SLA.

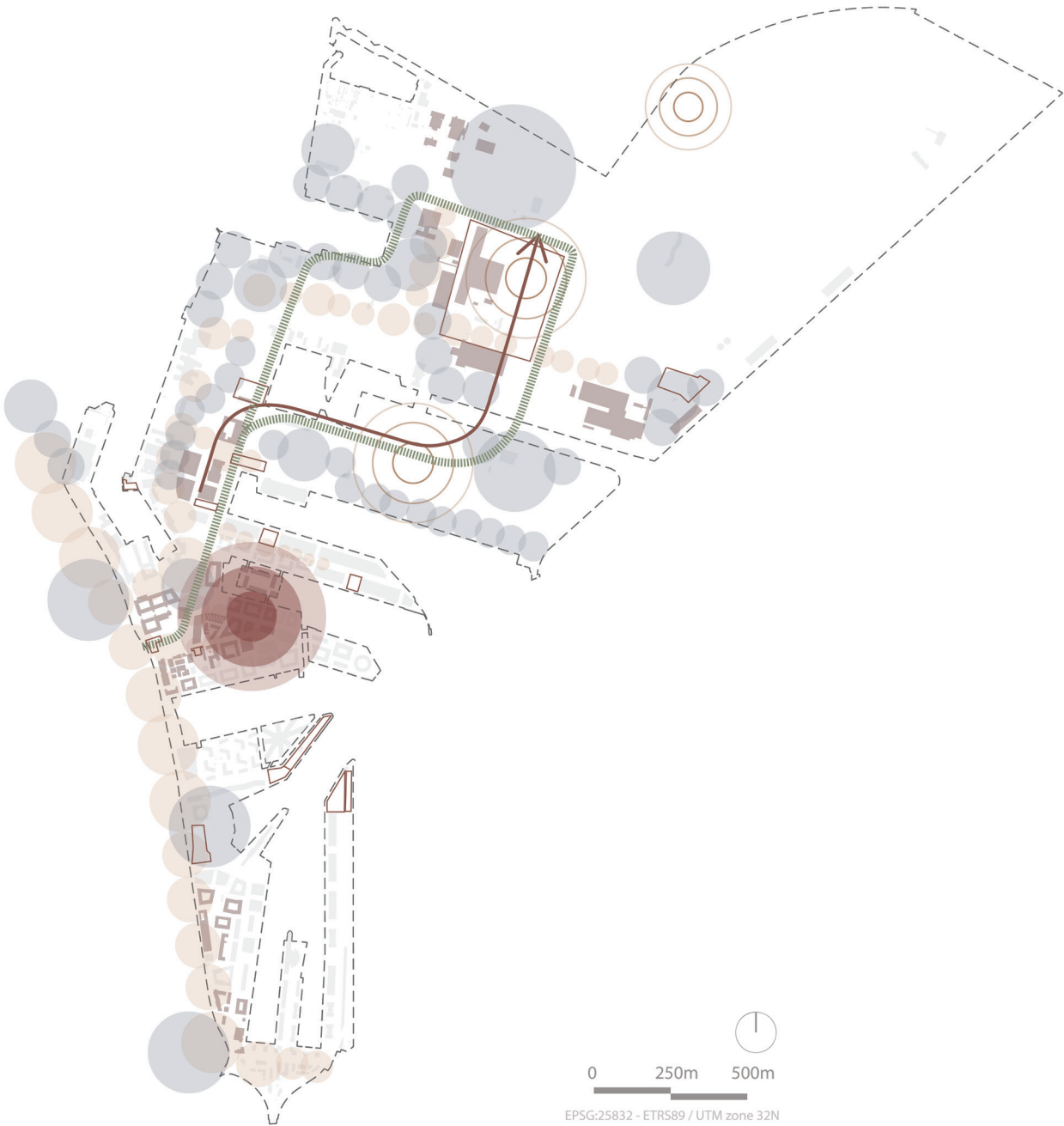
## Sundkaj Parking Area



Figure :Current condition of Sundkaj parking area.  
Source: Author's photograph.

The current use is that of a large surface parking lot, with hard pavement and indistinct spatial definition. Surrounding buildings, including warehouses, offices, and creative offices like BIG, provide a mixed industrial-professional character to the space. In spite of its location on the water, it is primarily a car-oriented space that lacks public space qualities.

5.9 COMBINED ANALYSIS



The combined analysis also reveals how the environmental risks, social activities, and projects overlap and define the areas that require intervention.

Flooding and noise are still mainly concentrated along the harbour routes, while the southern parts are now starting to suffer from overheating due to the denser population. The central and northern parts still lack sufficient cultural and recreational offers, while the large areas of the port are still undeveloped, restricting movement and access to public spaces.

The future projects of the Green Loop, new links for mobility, Levantkaj, Tunnelfabrikken, etc., will eventually balance everything out. But it's important to have better north-south connections and a more balanced distribution of green spaces for improving resilience.

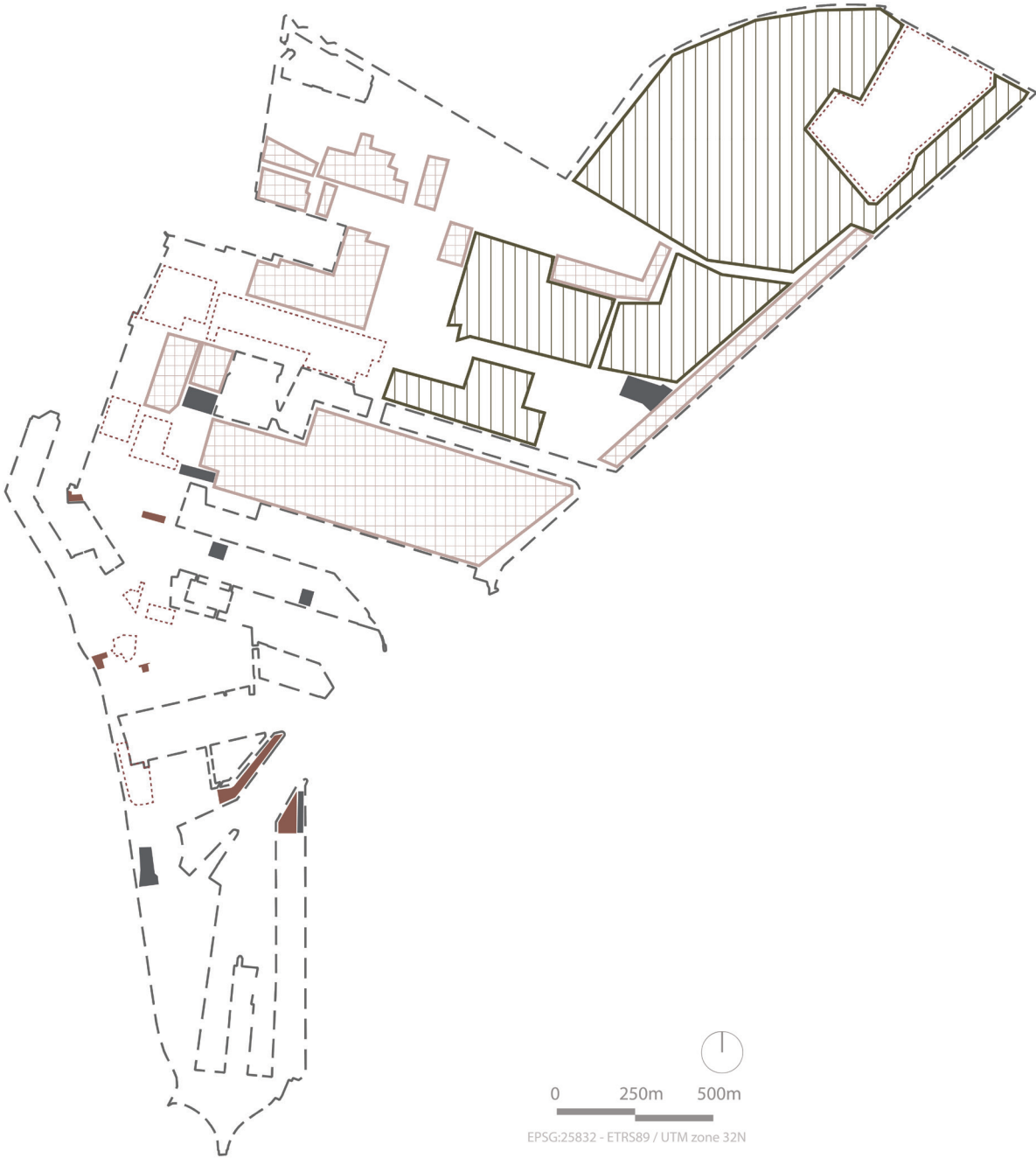
- Legend**
- Neighborhood boundary
  - New Connection
  - ||||| The Green Loop
  - Flooding Area
  - Noise Pollution
  - Areas with development plan
  - Areas with concentrated culture, education and recreation facilities
  - Residential Area with risks of UHI
  - Potential Lots

Drawing 5.9 Vacant lots distribution in Nordhavn.  
Source: Author's illustration.

Vacant Lots Distribution

Nordhavn's got a bit of everything - vacant lots, temporary industrial areas, undeveloped land, and leftover parking zones.

The biggest continuous vacant and undeveloped areas are up in the far north, where they're planning to develop port-related uses and expand the city. There are a few temporary industrial blocks and empty plots around the middle of Nordhavn, between the new developments, and they often act as transitional spaces. In the south, there are just a few scattered lots and some parking pockets, which is normal for a district this advanced in its development.



- Legend**
- Boundary
  - Vacant Lots
  - Current Parking
  - ▨ Temporary Industria
  - ▨ Undeveloped Land
  - ⋯ Construction



## 5.10 DESIGN GUIDELINE

### Sustainable Development Goals

|                                                                                     |      |                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | 3.4  | By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.                                                                                                                                                            |
|                                                                                     | 3.6  | By 2020, halve (50% less) the number of global deaths and injuries from road traffic accidents.                                                                                                                                                                                                                       |
|    | 10.2 | By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status                                                                                                                                 |
|                                                                                     | 11.2 | By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.                 |
|                                                                                     | 11.3 | By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.                                                                                                                                         |
|                                                                                     | 11.4 | Strengthen efforts to protect and safeguard the world's cultural and natural heritage.                                                                                                                                                                                                                                |
|                                                                                     | 11.5 | By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations. |
|    | 11.7 | By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and Persons With Disabilities.                                                                                                                                      |
|                                                                                     | 12.2 | By 2030, achieve the sustainable management and efficient use of natural resources.                                                                                                                                                                                                                                   |
|  | 12.5 | By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.                                                                                                                                                                                                                    |
|                                                                                     | 13.1 | Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.                                                                                                                                                                                                        |
|  | 15.5 | Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.                                                                                                                               |
|  | 15.9 | By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.                                                                                                                                                              |

### Design Objectives

|                                                                                       |                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>Improve community health and social inclusion</b><br>Transform Nordhavn's temporary industrial sites into green recreational spaces and community facilities to enhance residents' quality of life.                                                                                                                            |
|    | <b>Preserve cultural heritage and local identity</b><br>Adapt and reuse Nordhavn's historic port structures (e.g. silos, warehouses) as cultural venues, community hubs or unique housing, retaining their industrial character.                                                                                                  |
|    | <b>Ensure inclusive and participatory public spaces</b><br>Co-create new parks and plazas with local residents and stakeholders to reflect community needs, improving civic participation in planning.                                                                                                                            |
|    | <b>Foster sustainable mobility and connectivity.</b><br>Implement Nordhavn's "Green Loop" – a continuous network of bicycle lanes, pedestrian paths and public transit links – to connect all parts of the district with minimal environmental impact.                                                                            |
|   | <b>Build climate resilience against flooding and heat risks.</b><br>Integrate blue-green infrastructure – such as stormwater parks, bioswales and permeable surfaces – across Nordhavn to absorb rain and prevent street flooding.                                                                                                |
|  | <b>Restore urban nature and biodiversity within the city fabric.</b><br>Establish a connected green network linking Nordhavn's parks, the Green Loop, and a new 30-hectare coastal nature park to serve as ecological corridors.                                                                                                  |
|  | <b>Advance sustainable resource use and move toward a zero-waste district.</b><br>Apply circular economy principles in Nordhavn's development: recycle demolition materials and prioritize low-carbon construction, and integrate clean energy technologies (solar panels, wind turbines, district heating) into building designs |

## Design guideline for NBS Intervention



### Adapt To Local Hydrology

Design terrain and materials to work with natural drainage patterns and seasonal rainfall variations.

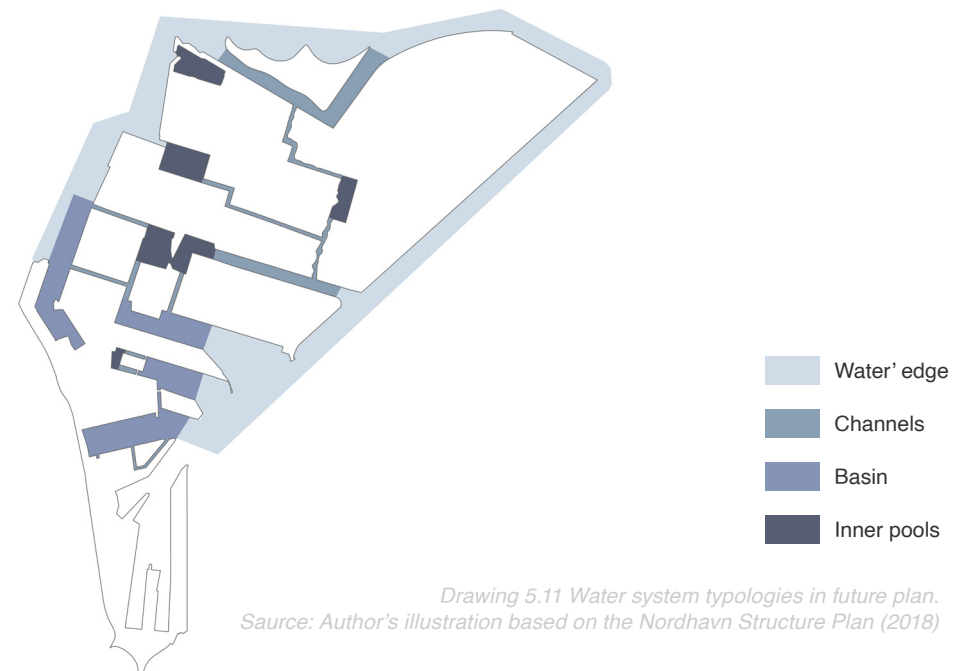
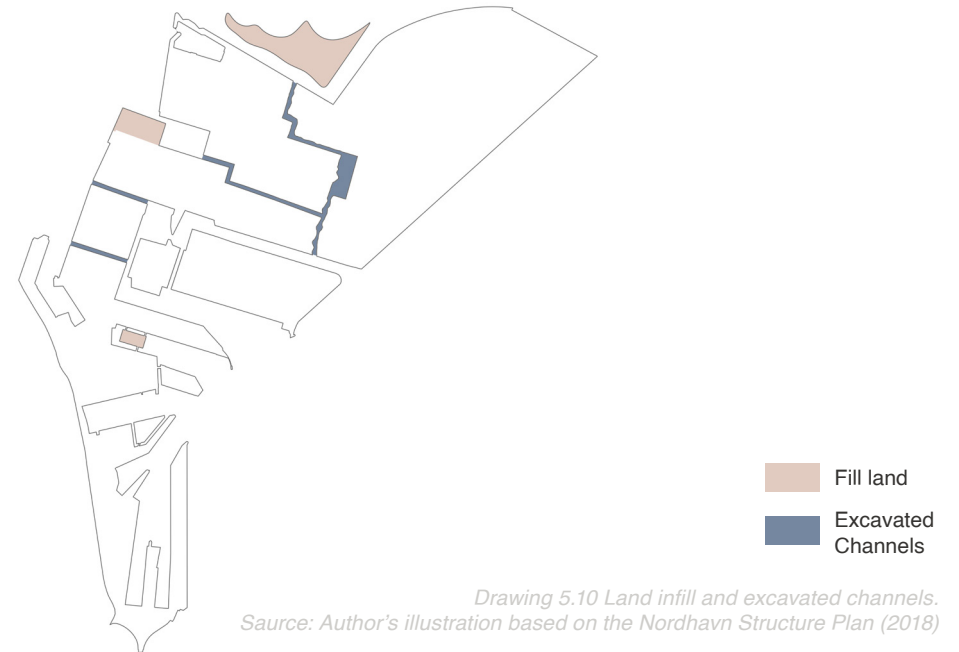
According to the Nordhavn Structure Plan (2018), parts of the site are created by land infill. New channels are created to bring water further into the city. The channels provide more access to water and flood adaptation by allowing water to be stored.

The water system comprises water edges, channels, basins, and inner pools. Each of them has a different function. The channels are used to bring water into the district. The basins are used to store water. The inner pools are also used for leisure and water storage. This provides flood adaptation by slowing down the flow of water during heavy rainfall and enhances the presence of water in everyday urban spaces.



### Build climate resilience against flooding and heat risks.

Integrate blue-green infrastructure – such as stormwater parks, bioswales and permeable surfaces – across Nordhavn to absorb rain and prevent street flooding.





### Strengthen Blue-Green Connectivity

Link parks, streets, and retention zones through visible water routes and vegetation corridors.



### Enhance Climate Resilience Through Layers

Introduce flexible topographies, storage basins, and infiltration systems that adapt to both dry and wet periods.

The green structure is developed through two main approaches, combining large-scale landscape connections with finer green elements integrated into the urban fabric.

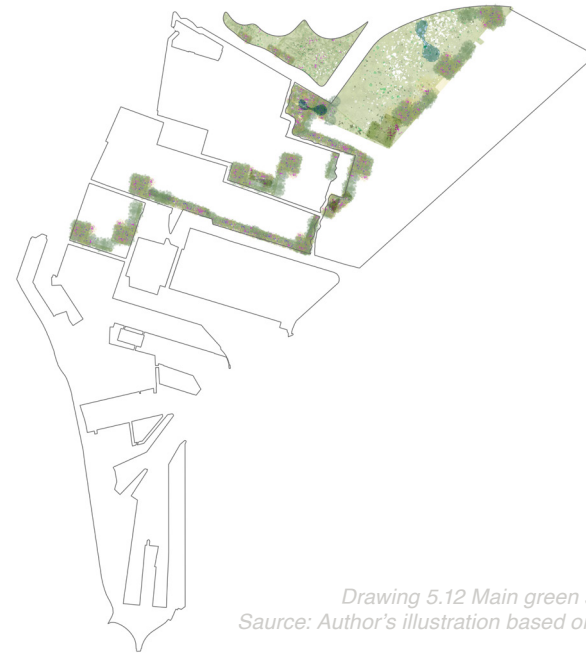
Nordhavns Park and Strandholmen are connected to form the main recreational green areas of Nordhavn. These spaces are further linked to the rest of the district through continuous green connections, extending the green structure towards the southern parts of the city.

Another approach is a series of green stripes running from east to west. These stripes combine blue and green elements to create cross-site connections, link edge to edge, and introduce a varied urban landscape where water and greenery are closely integrated into everyday spaces.



### Foster sustainable mobility and connectivity.

Implement Nordhavn's "Green Loop" – a continuous network of bicycle lanes, pedestrian paths and public transit links – to connect all parts of the district with minimal environmental impact.



Drawing 5.12 Main green space connections in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



Drawing 5.13 Striped green connections in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)





### Promote Inclusive Accessibility

Ensure all spaces support diverse users—across age, mobility, and social background.

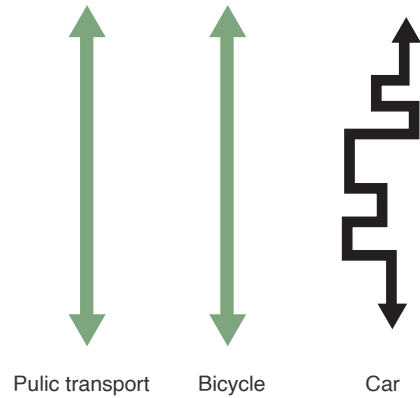
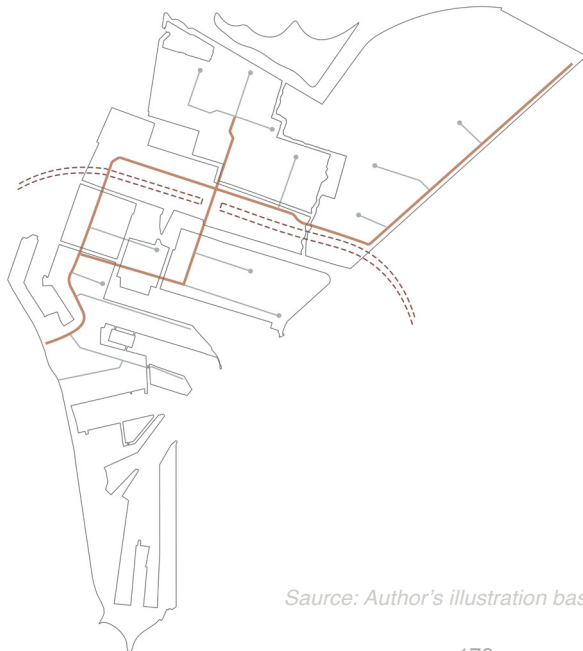


Figure Diagram showing mobility system.  
Source: Nordhavn Structure Plan (2018)



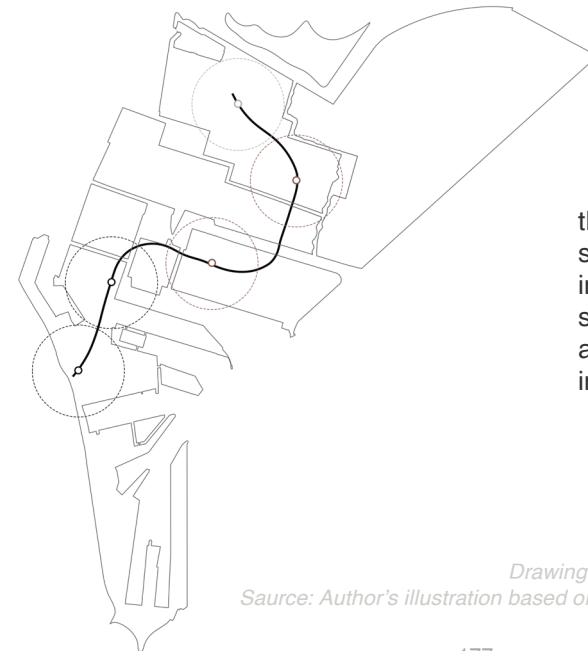
The Green Loop is the primary infrastructure for public transport, cycling, and walking in Nordhavn, while at the same time creating a continuous landscape of green.

Drawing 5.14 Green loop mobility system in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



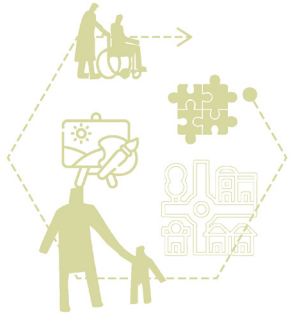
Nordhavn is planned with a well-defined road network, with main roads entering from Sundkrogsgade to the south and Nordhavnstunnel to the west. Sundkrogsgade is the main road, with smaller local roads serving to distribute local traffic within each neighborhood. This ensures accessibility while at the same time minimizing traffic pressure in the neighborhoods.

Figure Diagram showing road structure.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



The Metro line serves as the primary public transport system. Metro stations are integrated as key urban spaces, functioning not only as transit nodes but also as important public areas.

Drawing 5.15 Metro system in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



### Preserve And Express Cultural Identity

Identify the preserved value points and use art, materials, and programming that reflect local stories and social diversity.

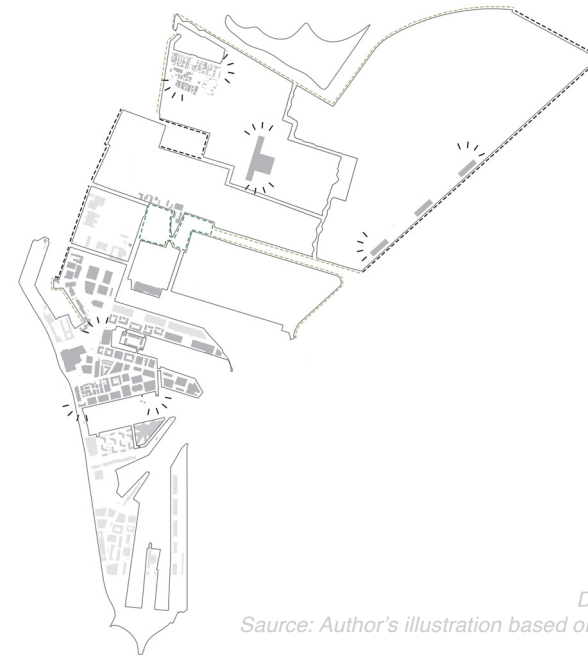
The existing edges, including hard urban edges, natural waterfront edges, and stone edges, all play a role in how buildings, landscape, and water come together. They create different spatial qualities, with evidence of the area's industrial and maritime past.

In this area, various important destinations will be defined. These include parks, waterfront, cultural, and urban destinations in general. These destinations are then linked together with routes like street, greenspace, and water links along the edges, with art, materials, and programming added to tell local stories and celebrate diversity.



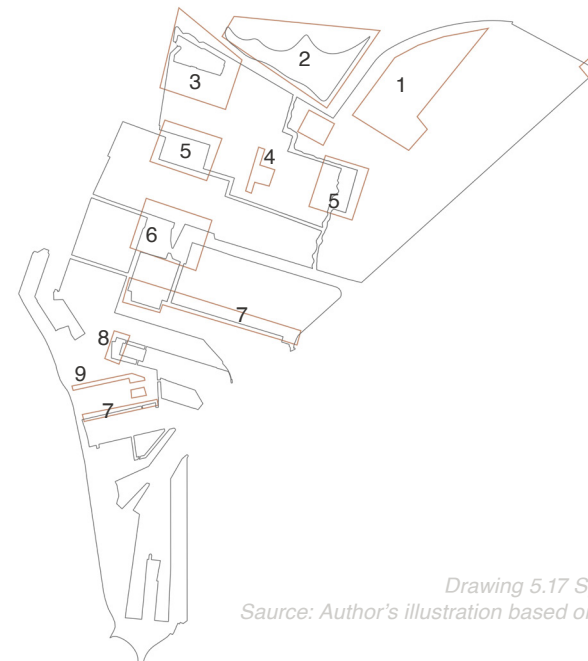
### Preserve cultural heritage and local identity

Adapt and reuse Nordhavn's historic port structures (e.g. silos, warehouses) as cultural venues, community hubs or unique housing, retaining their industrial character.



- - - Hard edge
- ... Natural edge
- - - Stone edge
- Existing buildings

Drawing 5.16 Existing urban structure.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



- 1 Nordør park
- 2 Strandholmen
- 3 Fishmarket
- 4 Tunnel Factory
- 5 Inner Pool
- 6 Park
- 7 Leisure Road
- 8 Waterfront Platform
- 9 Shopping Street

Drawing 5.17 Special destinations in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)



### Integrate Multifunctional Uses

Combine recreation, stormwater management, and biodiversity within the same spatial framework.

In the future, Nordhavn will be divided into a number of islands. This division is the basis for the development of different neighborhoods that are characterized by unique spatial features.

The islands are further divided into zones that determine the manner in which development plots are arranged or structured. This map integrates four main layers that describe the framework of the zones or islands. The existing buildings are the foundation of the framework and represent the existing urban environment. The second layer highlights buildings of interest, such as buildings that are suitable for renovation or that are of unique character or heritage.

The third layer represents the development blocks of the Levantkaj I area, based on the “Startrede gørelse: Levantkaj I – Principper for udarbejdelse af forslag til lokalplan og forslag til kommuneplantillæg” (City of Copenhagen, 2023). The fourth layer of the framework represents the block division of the Nordhavn Structure Plan (2018), indicating that the plan is preliminary and requires further development or refinement.



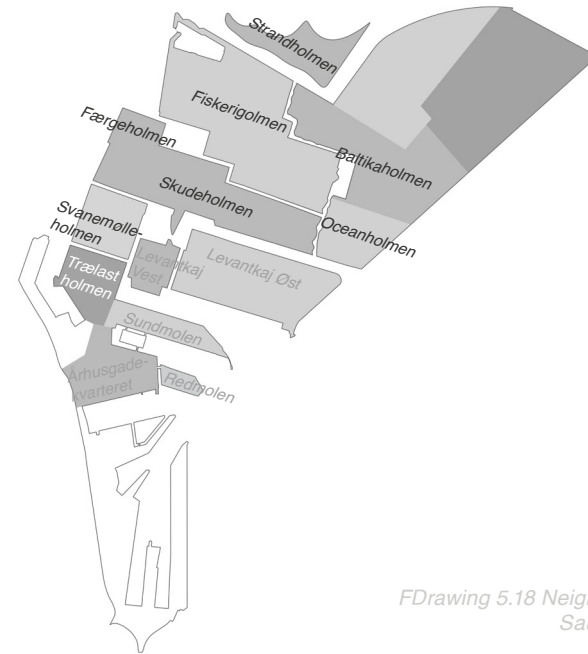
### Improve community health and social inclusion

Transform Nordhavn’s temporary industrial sites into green recreational spaces and community facilities to enhance residents’ quality of life.

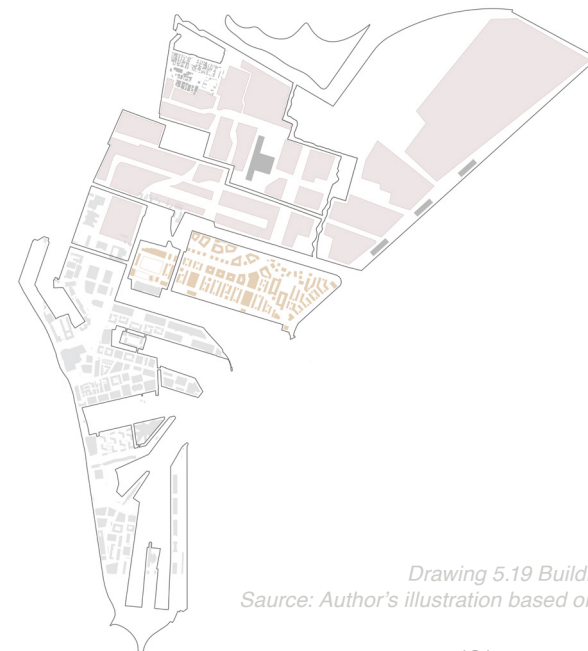


### Co-Create With Residents

Actively engage local communities to shape design goals and ensure the projects reflect real neighborhood needs.



FDrawing 5.18 Neighborhoods division in the future plan.  
Source: Nordhavn Structure Plan (2018)



- Existing Buildings
- Interested Buildings
- Blocks in Levantkaj I
- Blocks in NSP

Drawing 5.19 Building fabric functions in the future plan.  
Source: Author’s illustration based on the Nordhavn Structure Plan (2018)



## Public transport access



## Work & everyday economy



## Daily shopping & services



## Sports & well-being



## Community & culture

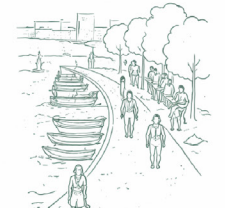


5 min

## Education & Childcare



## Green space (everyday nature)



## Blue space access

Figure 5.18 5-min city activities in Nordhavn.  
Source: Author's illustration with AI

The 5-minute city concept essentially means that daily living happens within a short distance of walking or cycling. With reference to Nordhavn, this concept focuses on the different metro stations that act as the core node of each neighborhood.

With this concept, small pocket parks and other functional elements will then be strategically distributed around each metro station. This ensures that all the activity hub will be created along the way of daily living. With this concept, small urban spaces will improve the livability of each small living unit.



#### **Ensure inclusive and participatory public spaces**

Co-create new parks and plazas with local residents and stakeholders to reflect community needs, improving civic participation in planning.

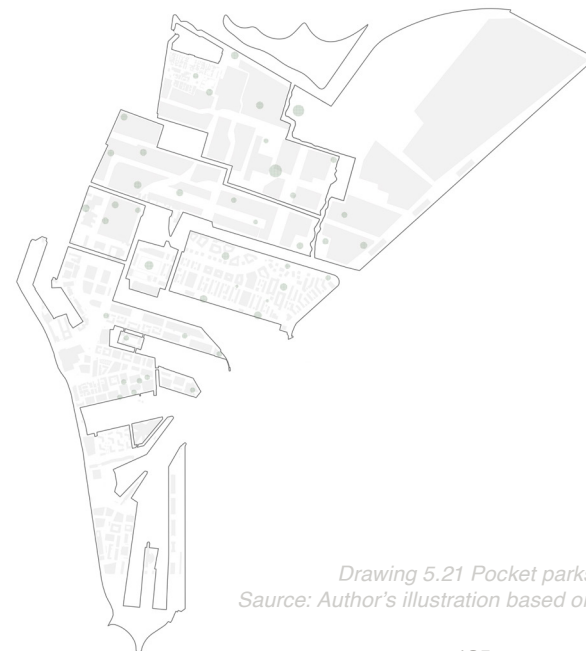


#### **Restore urban nature and biodiversity within the city fabric.**

Establish a connected green network linking Nordhavn's parks, the Green Loop, and a new 30-hectare coastal nature park to serve as ecological corridors.



*Drawing 5.20 5-min neighborhood with metro in the future plan  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)*



*Drawing 5.21 Pocket parks and open spaces in the future plan.  
Source: Author's illustration based on the Nordhavn Structure Plan (2018)*



### Prioritize Ecological Performance

Select native species, create habitat gradients, and monitor long-term biodiversity and cooling benefits.



### Balance Design Quality And Maintenance

Combine durable materials with manageable upkeep, ensuring visual appeal and long-term usability.

The Green City of the Nordhavn district combines the concept of climate-friendly infrastructure with everyday urban living. New forms of public mobility such as the lifted metro, cycling, or car-sharing are introduced to minimize the use of cars while reducing CO<sub>2</sub> emissions. At the same time, greenery is integrated into the buildings and the open spaces to handle rainwater runoff, the microclimate, and biodiversity. This creates a CO<sub>2</sub>-friendly district that combines performance with livability.



### Advance sustainable resource use and move toward a zero-waste district.

Apply circular economy principles in Nordhavn's development: recycle demolition materials and prioritize low-carbon construction, and integrate clean energy technologies (solar panels, wind turbines, district heating) into building designs

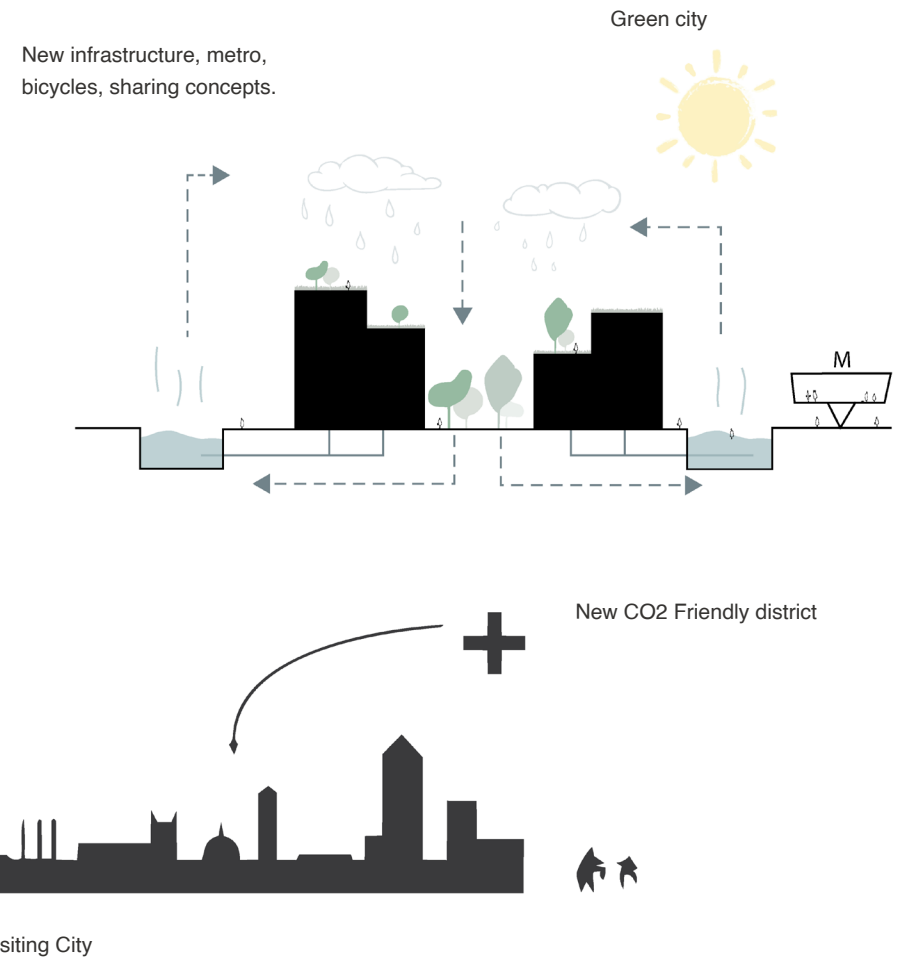
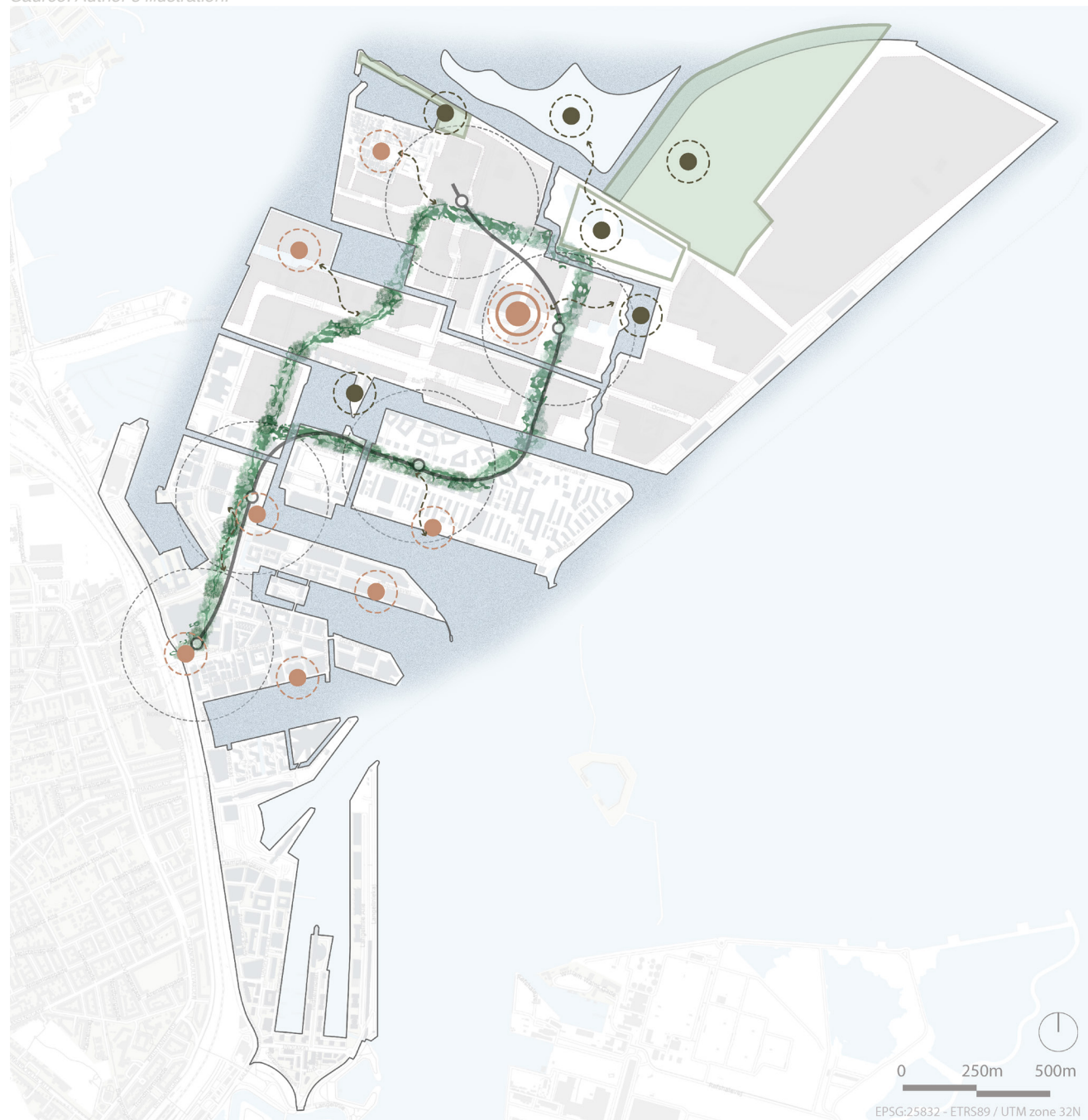


Figure 5.19 CO<sub>2</sub>-friendly city in Nordhavn.  
Source: the Nordhavn Structure Plan (2018)



Drawing 5.22 Conclusive guideline distribution in Nordhavn.  
Source: Author's illustration.



## Conclusive Guideline

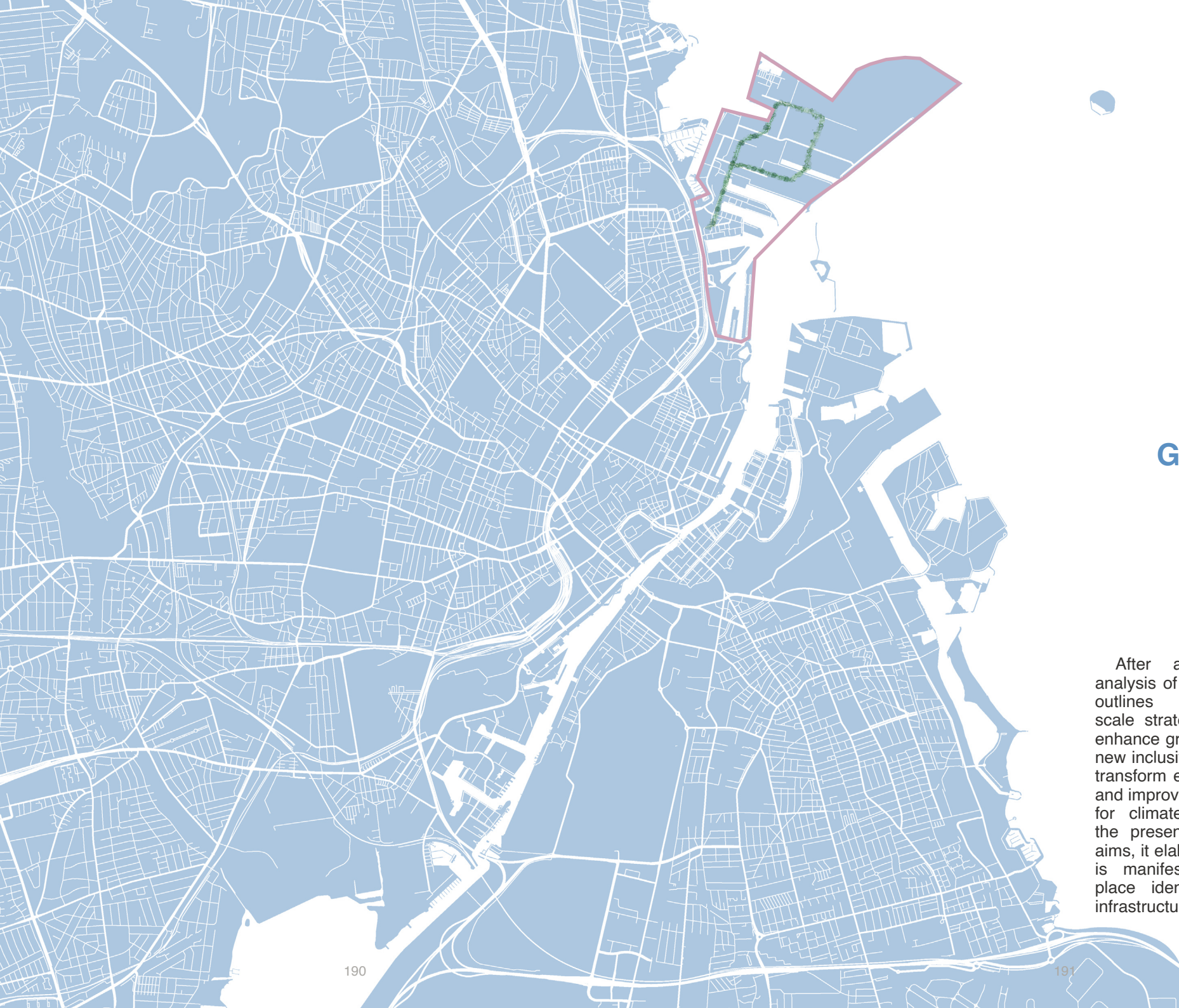
The aim of the plan is to enhance the green connections, balance new development with environmental resilience, and support daily life in Nordhavn.

It links new districts like Levantkaj and the Tunnelfabrikken area to the Green Loop, creating one big network of parks, public spaces, and environmentally friendly routes. In the north, they're reclaiming empty industrial plots to create new parks and green spaces, while in the south, they're creating new community spaces and public areas to increase social activities. At the same time, it's tackling important environmental challenges like flooding, overheating, and noise with blue-green solutions on the main streets.

### LEGEND

- Boundary
- Metro Extension
- ||||| The Green Loop
- > Green Connection along Green Loop
- Green & Biodiversity Regeneration
- Community Outdoor Hubs
- Cultural Centre





## PART II

# 06

## GREEN LOOP

Micro Scale

- Strategy
- Masterplan
- NBS Strategies
- Mobility System

After a thorough systemic analysis of Nordhavn, this chapter outlines the neighborhood--scale strategy design strategy to enhance green connectivity, create new inclusive urban public spaces, transform existing industrial areas, and improve new streets and parks for climate resilience. Following the presentation of the general aims, it elaborates on how strategy is manifested on three levels: place identity, green and blue infrastructure, and slow mobility.



## 6.1 STRATEGY

As per the above analysis and the design guidelines, the current map represents a synthesized spatial strategy that incorporates the approved or ongoing projects into the continuous Green Loop.

The green loop aims at improving the connectivity of the green spaces, public routes, and the water areas of the city.

The water element has also been integrated into the spatial framework of the area to improve the adaptation of the environment to the effects of the climate, thus improving the blue connections or the island-like spaces that can be developed.

### LEGEND

#### Existing Conditions

-  Leisure Projects
-  Future Green Projects

#### Connectivity

-  Water Connectivity
-  Main Green Mobility
-  Green Connectivity

#### Public Space Regeneration

-  Underused public spaces according to analysis





## 6.2 Masterplan



- 1 Green Loop Mobility
- 2 Urban Park
- 3 Nordør Park
- 4 Tunnelfabrikken Center
- 5 Levantkaj Neighbourhood
- 6 Social Harbour

0 100 200m

Drawing 6.2 Masterplan framework of Nordhavn.

Source: Author's illustration, based on the Nordhavn Structure Plan (2018).

This masterplan is developed based on the Nordhavn Structure Plan(2018) – Revision of the Structural Plan from 2009, and adapted to support the subsequent node-based design explorations.

The masterplan is structured around a continuous loop that integrates public mobility, blue-green infrastructure, and public space as a unified system. Water bodies and canals subdivide the site into a series of smaller islands, creating spatial units that are inherently suited to climate adaptation.

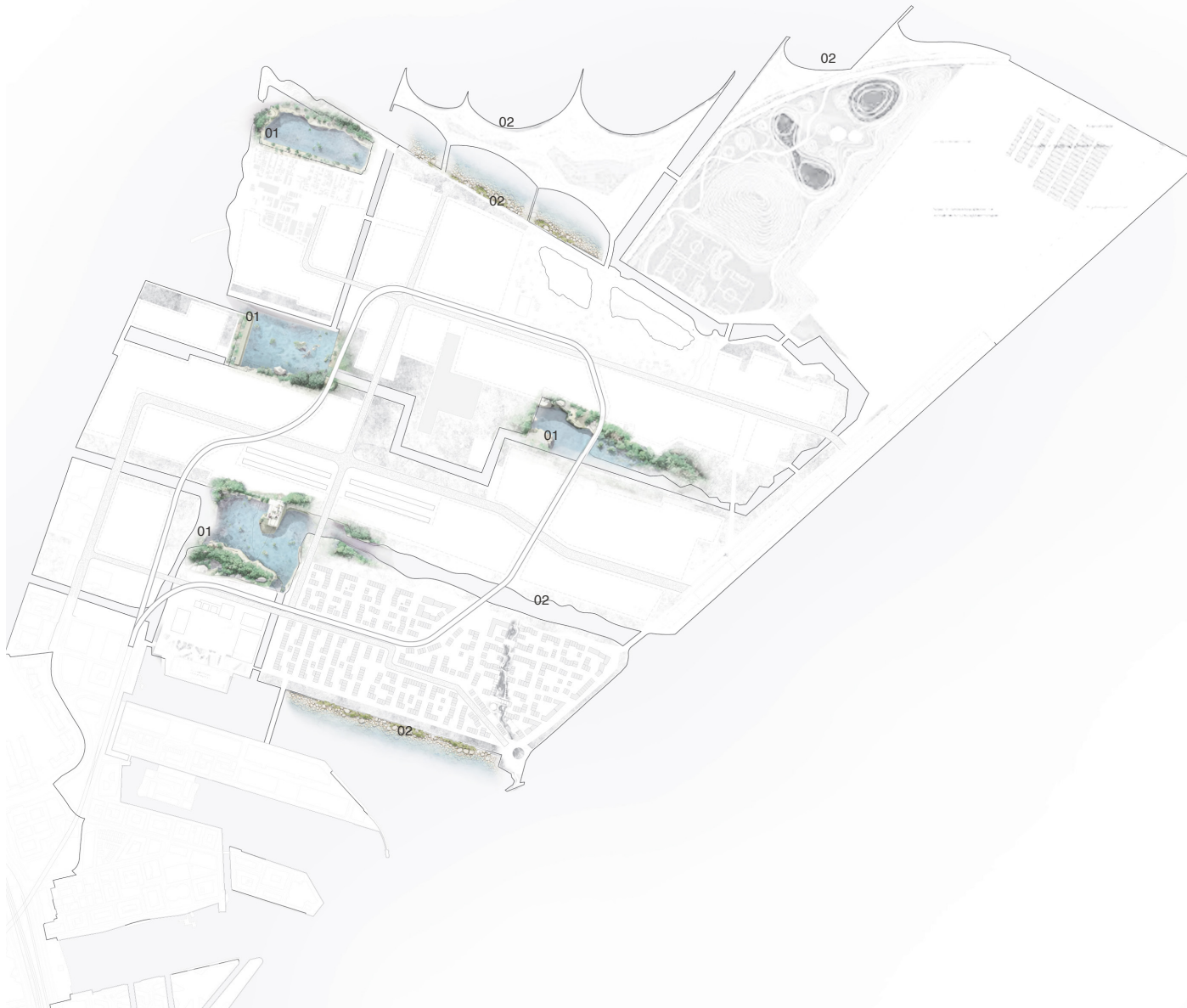
This island-based structure allows blue-green elements to be distributed across the site, supporting flood mitigation, stormwater retention, and the reduction of urban heat. Instead of treating water as a boundary, the masterplan uses it as a structuring element that links mobility, landscape, and urban form.



## 6.3 NBS Strategies

NBS were selected according to the particular environmental and spatial structure. Generally, they address the issues of stormwater management, flood resilience, urban cooling, and biodiversity, while at the same time supporting public living.

As for the water management, it is mainly focused on the areas along the waterfront, where “inner blue pools, soft coastal edges, and permeable surfaces” manage water flow, creating public spaces along the harbor.

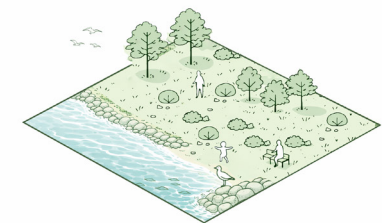


Drawing 6.3 NBS typologies proposal I in Nordhavn.  
Source: Author's illustration.



### NBS 01 Inner Blue Pool

Stores and regulates stormwater, reduces flood risk, improves microclimate, and creates accessible public water spaces.



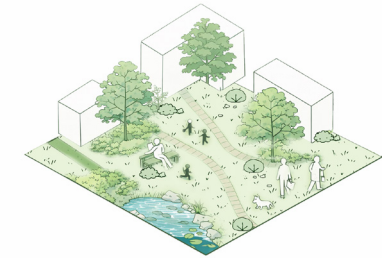
### NBS 02 Soft Coastal Edge

Reduces wave impact and flood risk, supports coastal biodiversity, and improves water quality along the shoreline.



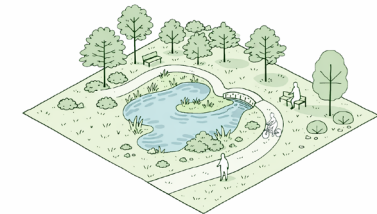
Drawing 6.4 NBS typologies proposal II in Nordhavn.  
Source: Author's illustration.

Large open and underused areas are transformed into urban parks, ecological forests and open grounds that strengthen the green network, support ecological functions and provide recreational spaces.



### NBS 03 Pocket Park

Provides small green space that improves microclimate, supports biodiversity, and enhances everyday social life.



### NBS 04 Urban Park

Provides large-scale green space that supports biodiversity, urban cooling, rainwater infiltration, and everyday recreation.



### NBS 05 Ecological Forest

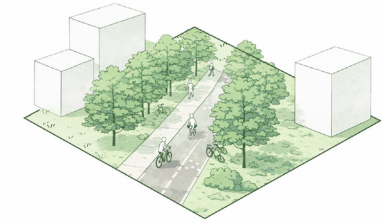
Provides habitat for biodiversity, strengthens ecological connections, improves air quality, and supports the urban microclimate.





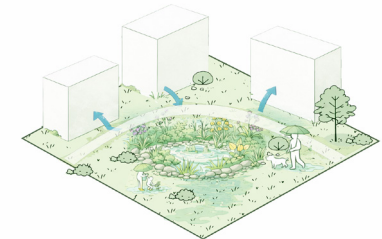
Drawing 6.5 NBS typologies proposal III in Nordhavn.  
Source: Author's illustration.

In denser urban areas, smaller-scale interventions such as urban garden, green corridor will be used for improving microclimate and comfort within building clusters.



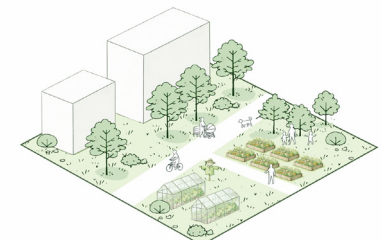
### NBS 06 Urban Garden

Supports local food production, improves soil and microclimate, enhances biodiversity, and encourages community participation.



### NBS 07 Rain Garden

Collects and infiltrates rainwater, reduces surface runoff, and improves local biodiversity and microclimate.

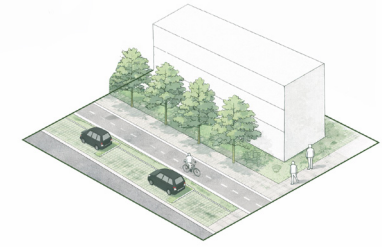


### NBS 08 Green Corridor

Connects green spaces through shaded walking and cycling routes, improves microclimate, and supports everyday low-carbon mobility.

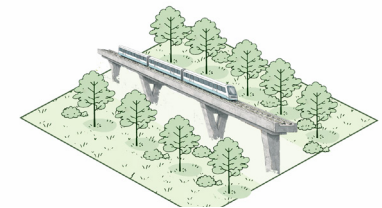


Drawing 6.6 NBS typologies proposal IV in Nordhavn.  
Source: Author's illustration.



### NBS 09 Permeable Parking

Allows rainwater to infiltrate through the surface, reducing runoff and supporting groundwater recharge.



### NBS 10 Green Noise Barrier

Reduces noise pollution, improves air quality, and provides additional habitat through planted vertical surfaces.

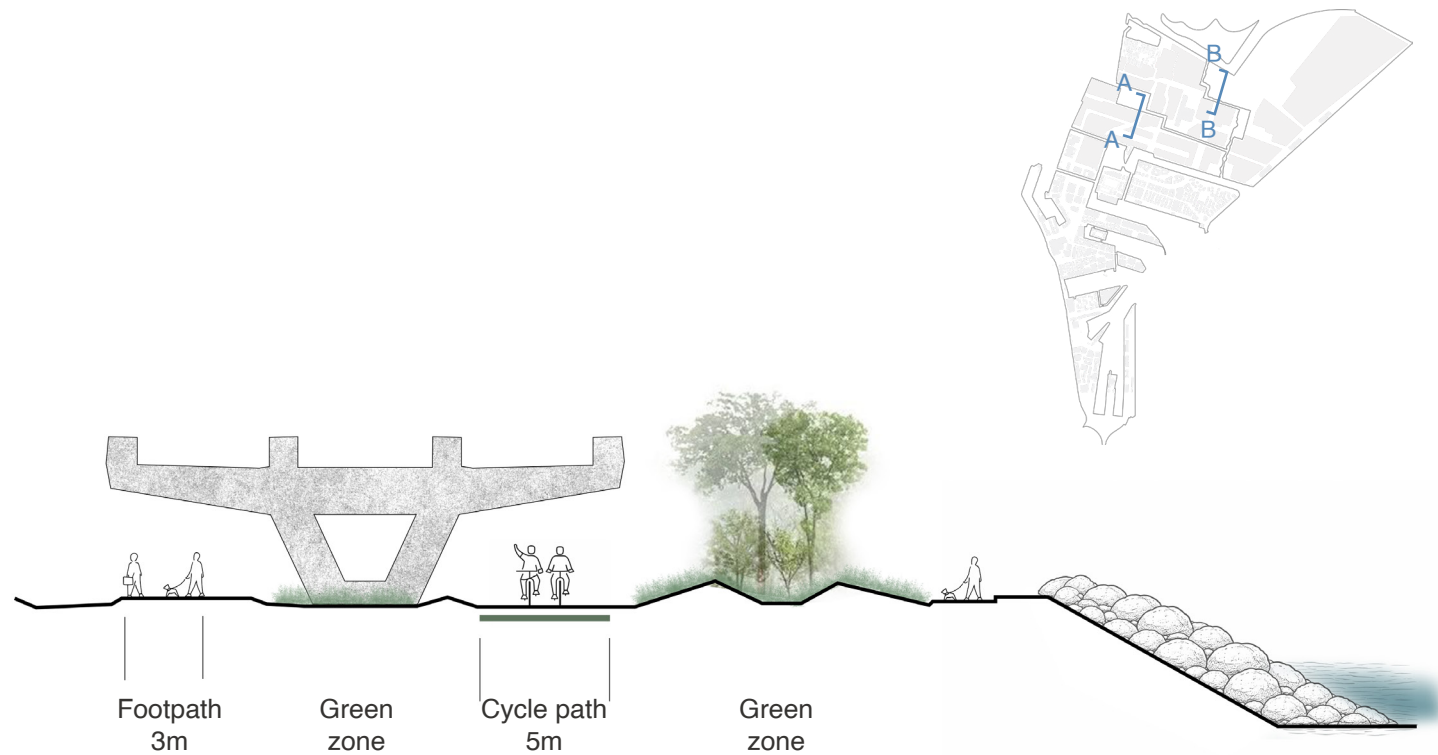
The Green noise barrier can improve noise comfort in buildings along the mobility system.

## 6.4 Mobility System

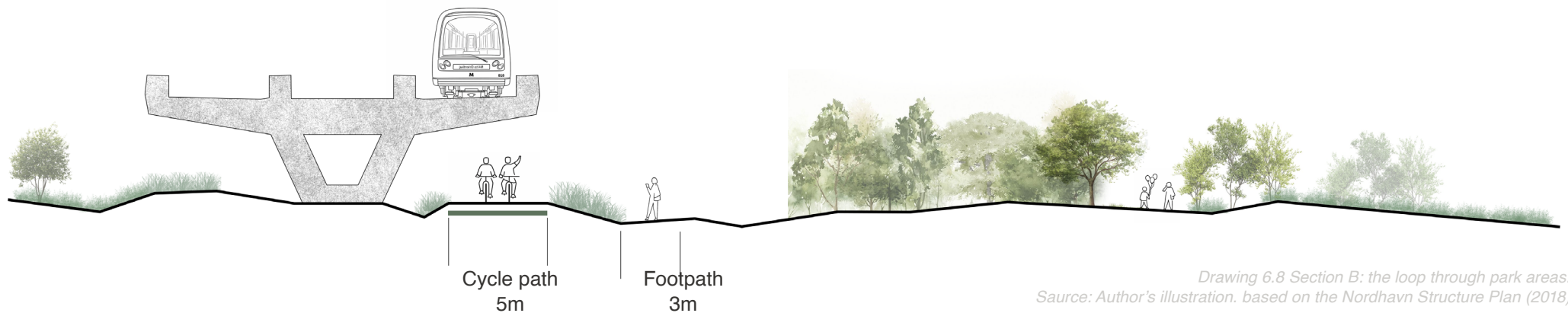
The mobility system is centered on a green-blue loop that connects slow-moving travel, public transportation, and daily life in public spaces.

It celebrates soft modes like walking and cycling, with metro stations functioning as local mobility hubs. The green-blue loop is dynamic, adjusting to the city's changing circumstances, passing through parks, squares, densely populated residential areas, and along water edges. As a result, spaces designed for moving people become spaces to rest, play, and interact with others.

Parts of the green-blue loop are emphasized to illustrate how areas for moving people blend with natural spaces, including plant life, shaded areas, soft ground, and spaces that react to water.

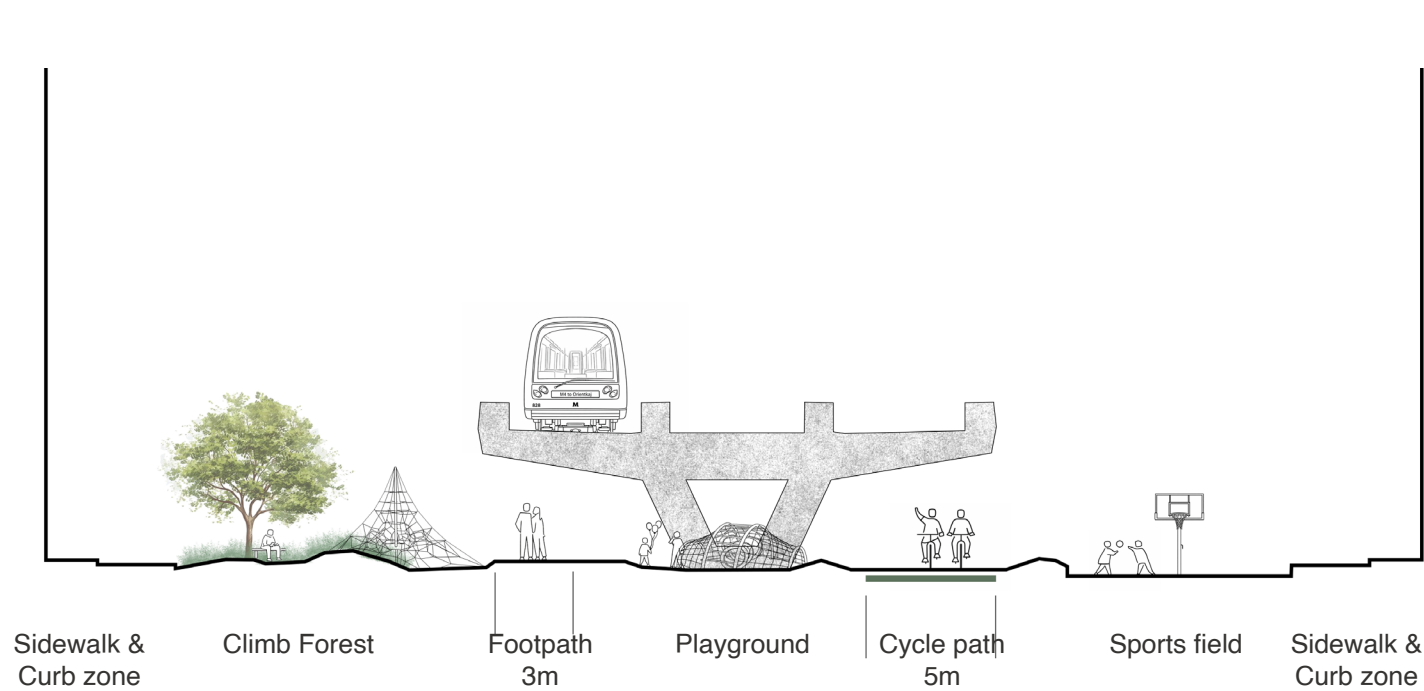


*Drawing 6.7 Section A: the loop along water  
Source: Author's illustration, based on the Nordhavn Structure Plan (2018)*



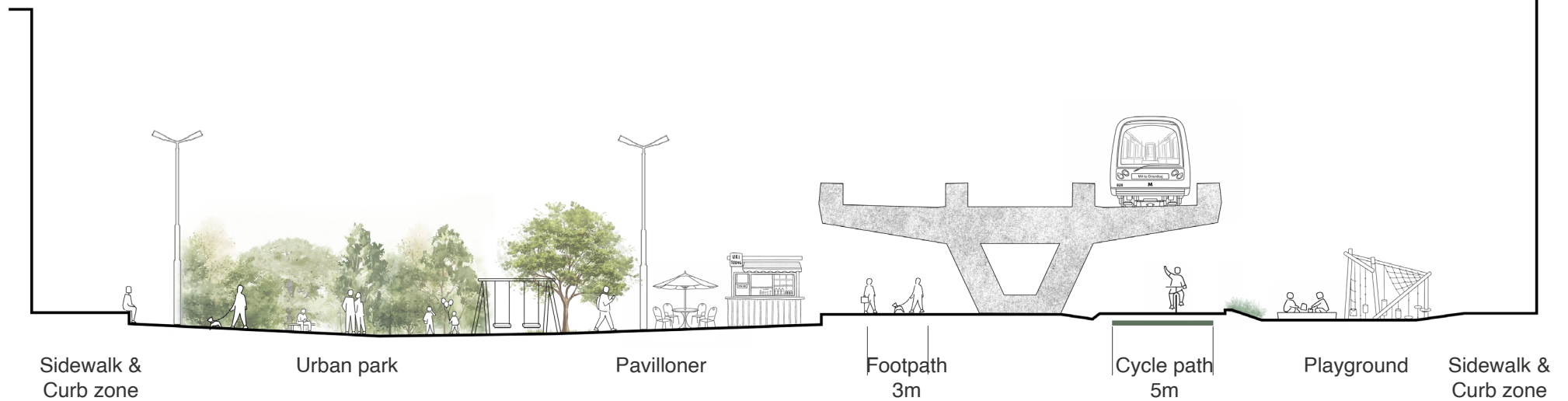
*Drawing 6.8 Section B: the loop through park areas.  
Source: Author's illustration, based on the Nordhavn Structure Plan (2018)*



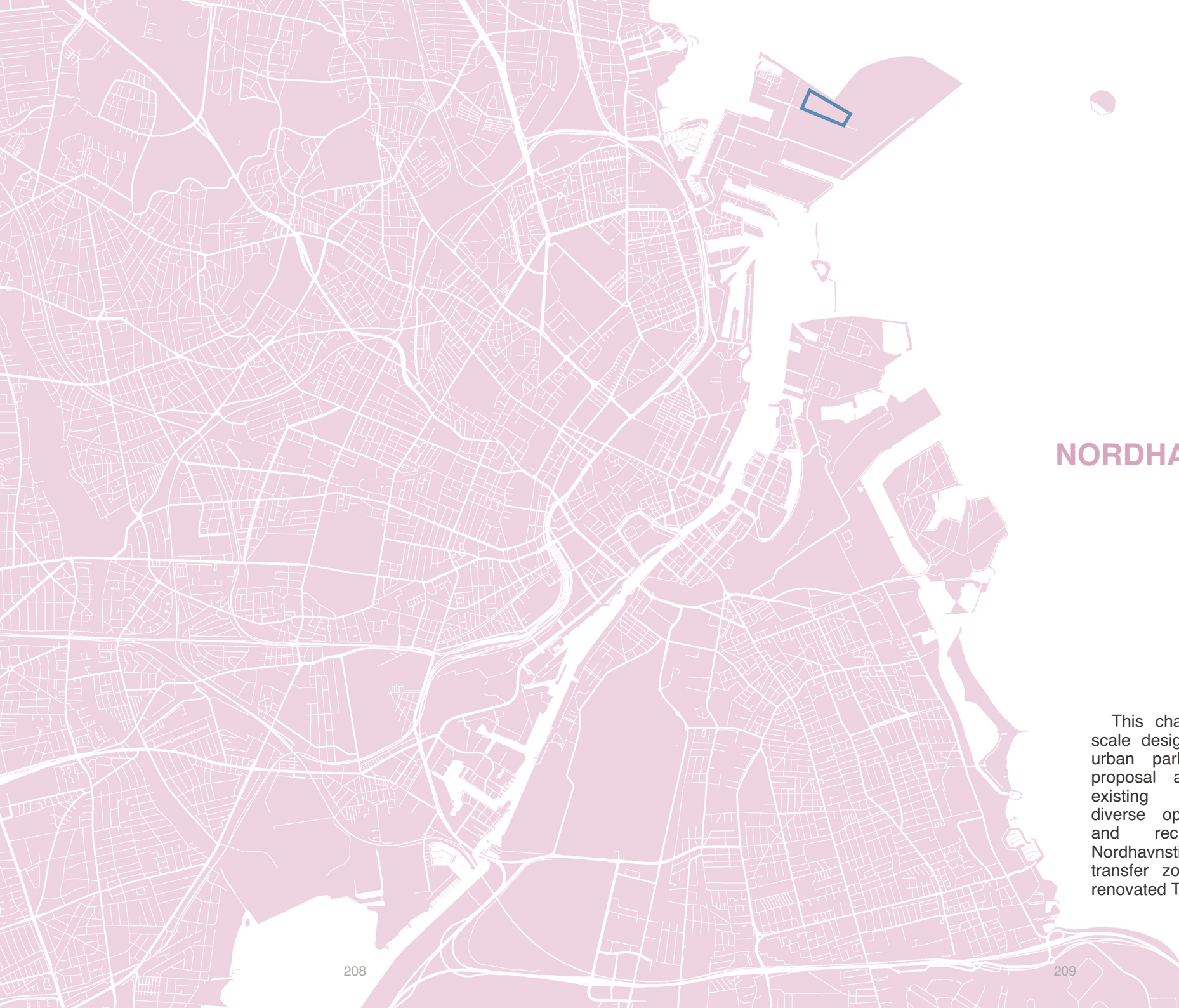


This loop reinforces Nordhavn's 5-minute city structure by linking everyday destinations through a readable, accessible and landscape-based network.

Drawing 6.9 section C: the loop through local public places.  
Source: Author's illustration, based on the Nordhavn Structure Plan (2018)



Drawing 6.10 Section D: the loop through urban context  
Source: Author's illustration, based on the Nordhavn Structure Plan (2018)



# 07

## NORDHAVNSTIPPEN

### Nano Scale

- Site Analysis
- Design Concept
  - Masterplan
- Section Design
- Program & Activities
- Visualizations

This chapter presents a nano scale design proposal for a new urban park in Nordhavn. The proposal aims to improve the existing urban wetland with diverse opportunities for leisure and recreation. Additionally, Nordhavnstippen will be the new transfer zone that connects the renovated Tunnelfabrikken



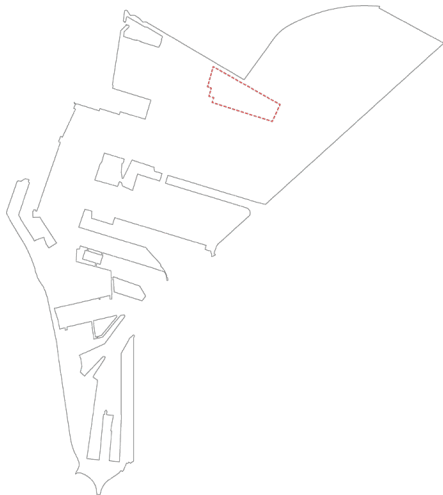
## 7.1 Site Analysis

### Historical Development

In the 1990s, Nordhavnstippen was primarily used as a dumping site for surplus soil and building materials. The area had an irregular shoreline and little ecological importance at this time. By the late 1990s, the reclaimed land had settled and two areas had filled with water. The water bodies had developed into brackish lakes as a result of tidal effects and rainfall.

As industrial activities decreased, vegetation started to colonize the area by natural succession. From the 2010s onwards, the ecological importance of Nordhavnstippen became apparent. The important areas were later included under the Danish regulations on the protection of nature.

Today it is a semi-natural area within the Nordhavn district.



Drawing 7.1 Site location in Nordhavn.  
Source: Author's illustration



Figure 7.1 historical development of Nordhavnstippen.  
Source: <https://kort.plandata.dk/spatialmap>





## Nordhavnstippen Today

Nordhavnstippen is a publicly accessible natural area supported by By & Havn for temporary outdoor and recreational use. Access is limited to marked areas, and movement across the site takes place at individual responsibility due to uneven ground conditions resulting from land reclamation. The area contains valuable habitats and wildlife, requiring careful and low-impact use. Dogs are required to be kept on a leash, and fishing from the shoreline is permitted. Activities such as open fires, grilling, overnight stays, and organized events are not allowed in order to protect the ecological qualities of the site.

# VELKOMMEN TIL NORDHAVNSTIPPEN

Pas godt på området, og nyd det. Efterlad det en smule renere, end da du kom!

By & Havn støtter i en midlertidig periode rekreative friluftsaktiviteter på Nordhavnstippen.



### AFGRÆNSNING OG FÆRDEL I OMRADET

Det er det markerede areal der er offentligt tilgængeligt. Der drives virksomhed, og udføres løbende anlægsarbejde på tilstødende arealer. Respekter derfor skilte og hegn.



### FÆRDEL PÅ EGET ANSVAR

Jorden er opfyldt, og der kan være skarpe genstande, sten m.v., hvis du bevæger dig ind i området. Al færdsel i området er på eget ansvar.



### SPORLØS FÆRDEL

For at alle kan få en god oplevelse, skal du efterlade området, som du fandt det - eller gerne endnu pænere.

Tag dit skrald med hjem, eller benyt skraldespanden ved indgangen. Sådan passer vi bedst på både dyr og planter.



### HUNDE I SNOR

Der er et rigt fugleliv i området, og mange fugle har bygget rede i det høje græs. Hold derfor altid din hund i kort snor.



### NYD OMRADET MED ANSVAR

Der er et rigt og ynglende dyreliv i området. Ophold dig derfor ansvarligt. Det er ikke tilladt at holde fest, eller spille højlydt musik.



### FISKERI TILLADT

Det er tilladt at fiske fra stensætningen på kysten. Undlad dog at fiske i søerne, da de er et ynglested for grønbroget tudse, der er en beskyttet dyreart.



### ILD OG GRILL

Det er ikke tilladt at lave bål, afholde fester eller overnatte i området.



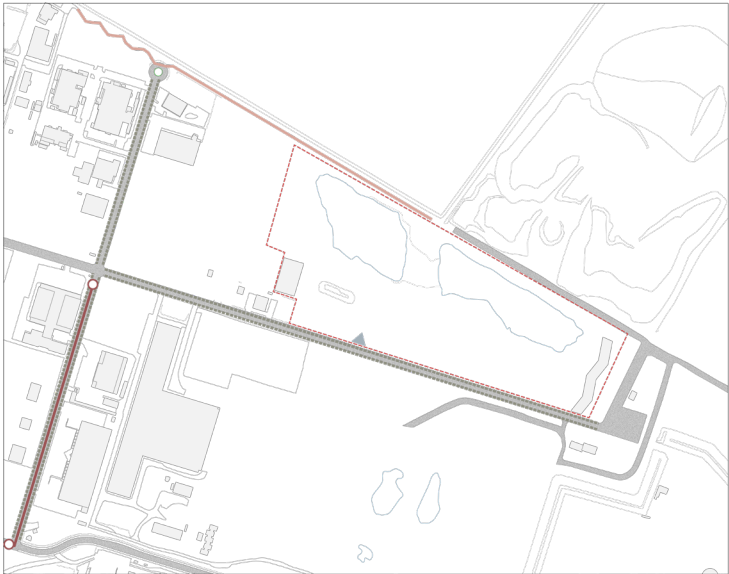
### INFORMATION & KONTAKT By & Havn

→ [info@byoghavn.dk](mailto:info@byoghavn.dk)  
→ [Byoghavn.dk/nordhavnstippen](https://byoghavn.dk/nordhavnstippen)

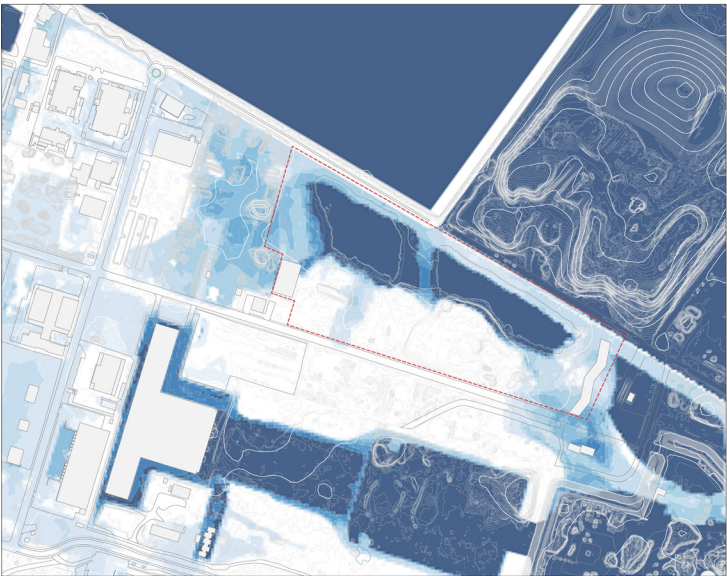
Site Diagnosis



- BUILDING FUNCTION**  
**LEGEND**
- Office
  - Commercial
  - Unuse
  - Mix-use
  - Education
  - Resteraunt
  - Warehouse
  - Site Boundary



- ACCESSIBILITY**  
**LEGEND**
- Active Roads
  - Existing Entrance
  - Bus Stop
  - Bike Lines
  - Bus Lines
  - Seaside Path
  - Site Boundary



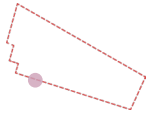
- TOPOGRAPHY & FLOOD**  
**LEGEND**
- 2.5 m Contour
  - 0.25 m Contour
  - Lake
  - Site Boundary
- |     |      |
|-----|------|
| 1 m | 6 m  |
| 2 m | 7 m  |
| 3 m | 8 m  |
| 4 m | 9 m  |
| 5 m | 10 m |
- \* Flood during 100- year rainfall in 2110.



- LOCAL POSITION**  
**LEGEND**
- Tunnelfabrikken
  - Open Space
  - Naturpark Nordhavn
  - Site Boundary
- \* This position defined by Copenhagen Municipality.

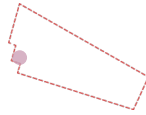
Drawing 7.2 Current state of the site and its diagnosis.  
Source: Author's illustration





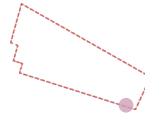
#### ① Site Entrance

Figure 7.3 Current condition of site entrance.  
Source: Author's photograph



#### ② Existing Structure

Figure 7.4 Current condition of existing buildings.  
Source: Author's photograph

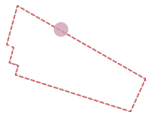


#### ③ Existing Building

Figure 7.5 Current condition of existing buildings.  
Source: Author's photograph

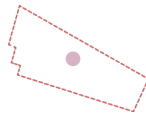
### Current Condition

Nordhavnstippen is currently an openly accessible, semi-natural landscape with minimal programming. The area is currently accessible with simple routes and information, but much of the space is left undisturbed to conserve biodiversity. Two brackish lakes with spontaneous vegetation are defining features of the space.



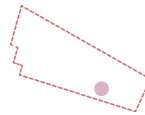
#### ④ Seaside Path

Figure 7.6 Current condition of seaside path.  
Source: Author's photograph



#### ⑤ Lake & Wetland

Figure 7.7 Current condition of the inner lake.  
Source: Author's photograph



#### ⑥ Graze Zone

Figure 7.8 Current condition of the graze zone.  
Source: Author's photograph



## 7.2 Design Concept

### Movement Flow

The **movement structure** is determined by the site's position as a connective landscape node within the upper level of the planning framework. Nordhavnstippen is situated between the refurbished Tunnelfabriken cultural center to the south and the Nature Park to the north, while also maintaining direct connection to the waterfront.

This makes a continuous looped movement system that connects cultural programs, open spaces, and the coastal edge.

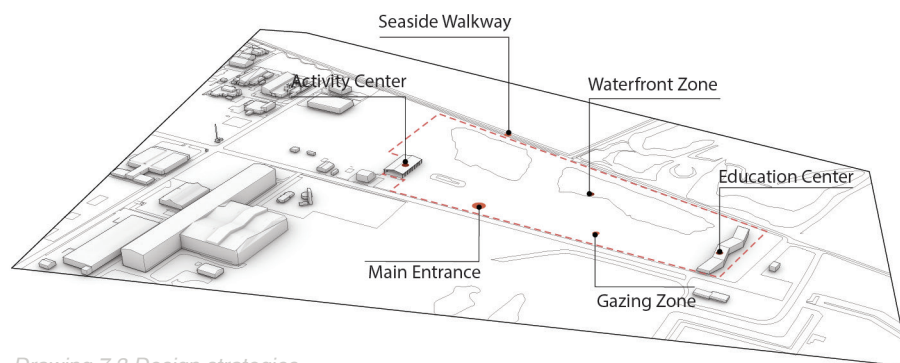
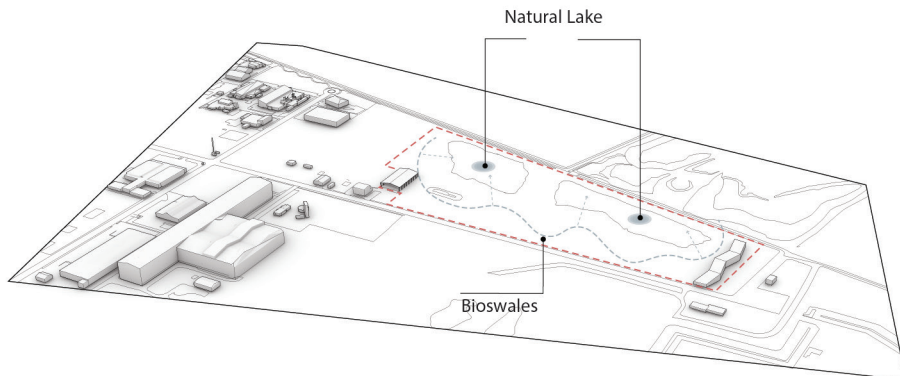
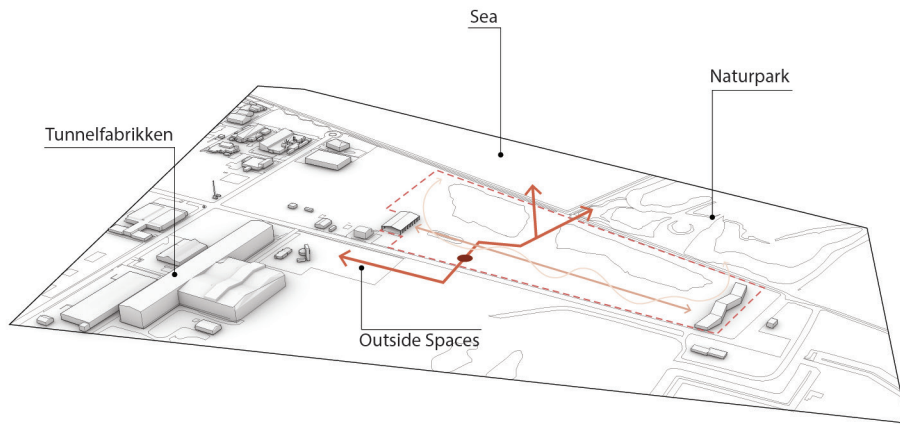
### Water Features

The water strategy builds on the site's existing natural conditions and protection rules. Two existing natural lakes are retained as core landscape elements. Based on this framework, bioswales are introduced along the path network, allowing water management, movement, and ecological functions to operate together.

### Community Hubs

The choice of community centers is mainly based on the reuse of existing structures and spatial anchors on the site.

The activity center is located around an existing open steel structure. The open steel structure provides spatial flexibility to meet future needs to host large-scale events. The education center reuses an existing building with a unique roof shape. The roof shape is enhanced by the addition of a green roof system to create a stronger relationship with the landscape. The main entrance remains at its current location to maintain existing logic. In addition, the seaside walkway and lakeside waterfront areas provide more social opportunities.





## 7.3 Masterplan



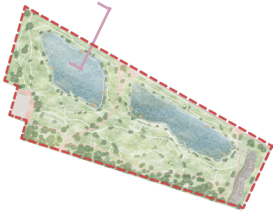
- 1 Entrance Square
- 2 Activity Center
- 3 Education Center
- 4 Gazing Zone
- 5 Waterfront Platform
- 6 Transition Square
- 7 Seaside Promenade

0 10 50m

Drawing 7.4 Masterplan of Nordhavnstippen.  
Source: Author's illustration



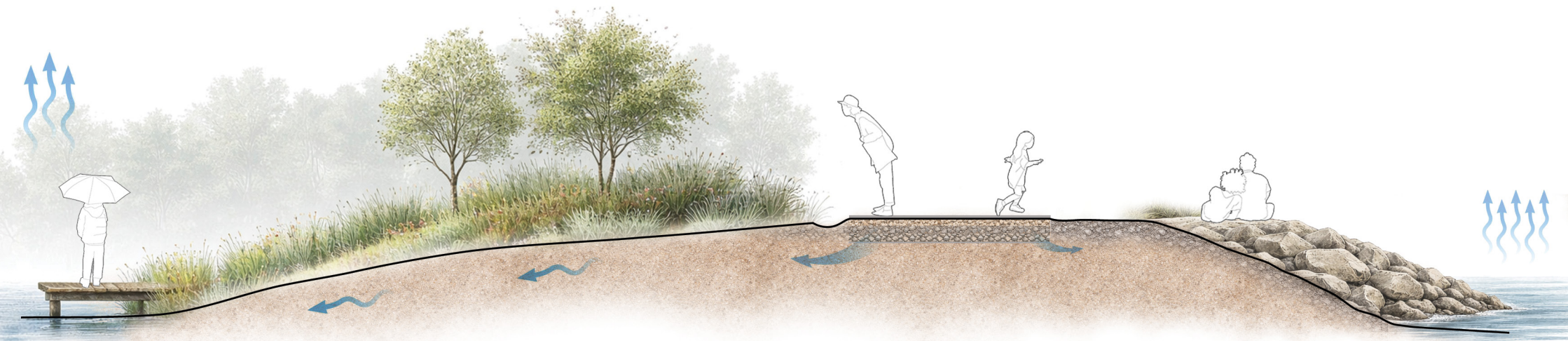
## 7.4 Section Design



This section illustrates the permeable walkway as a gradual transition and its placement between the existing lake and the coastal edge. The path is composed of natural aggregate materials that enable rainwater to penetrate into the soil.

The gentle slopes on the lake side with meadow vegetation and tree cover will reduce the speed of water runoff and increase ecological connectivity. The stone-based soft edge on the seaside will provide shoreline stability while enabling wave action and informal use.

*Drawing 7.5 Permeable path as a gradual transition in the site*  
Source: Author's illustration





## 7.5 Programs & Activities

Drawing 7.6 Nodes' activities I.

Source: Author's illustration

\* The map of Nordor (north park) is from <https://www.sla.dk/cases/nordor-new-park-in-nordhavn/>

### Activity Center

The reused open structure hosts flexible programs such as small events, learning activities, markets, and rest spaces, supporting both organized use and spontaneous gathering.



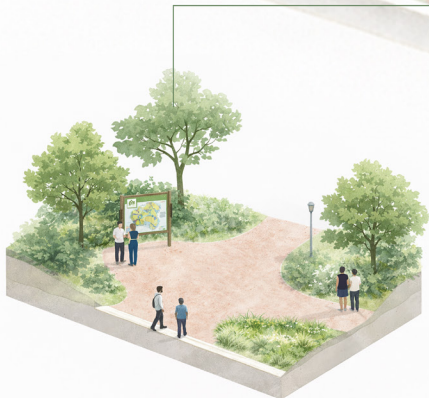
### Education Center

The education center reuses an existing building with a unique roof shape. The roof shape is enhanced by the addition of a green roof system to create a stronger relationship with the landscape.



### Entrance Square

A open space allows gathering, meeting, and transition from the surrounding urban fabric into the green system.





### Seaside Promenade

This node creates a continuous waterfront path, which facilitates walking, resting, and other forms of daily recreation along the waterfront. The soft stone edge allows for gradual transitions between land and water.



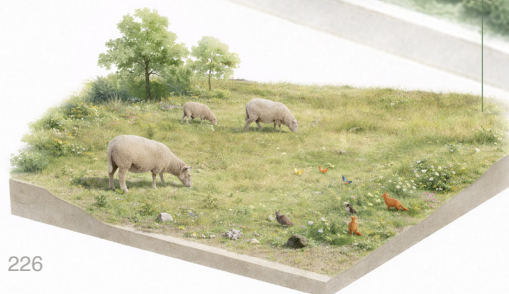
### Transition Square

A paved open surface is combined with planting to slow down movement, support informal activities, and allow short stays. It links paths, program areas, and nordør park.



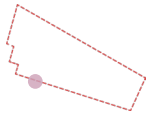
### Gazing Zone

This node is a semi-natural meadow managed through controlled grazing. Low-intensity grazing maintains open grassland, supports biodiversity, and reduces maintenance while creating a calm, pastoral landscape.





## 7.6 Visualizations

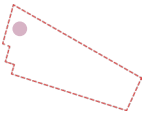


The expanded path and information board signal the boundary between urban fringe and semi-natural landscape. This node welcomes visitors to the character and regulations of the landscape, while subtly encouraging circulation into the internal path network without disturbing existing vegetation.

Figure 7.9 Renderings showing main entrance.  
Source: Author's illustration





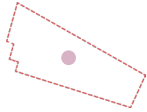


The node acts as a transition zone or corridor to connect the natural landscape of the site with the main activity center, located within a reused steel structure. The route is designed with a permeable route alignment that incorporates shallow water channels to collect surface runoff.

The meadow landscape, along with low-intensity grazing, is beneficial for biodiversity maintenance and landscape management. This node incorporates stormwater management, habitat, and daily activity, with a route that transitions visitors from natural spaces to a more active community space.

*Figure 7.10 Renderings showing the activity center.  
Source: Author's illustration*





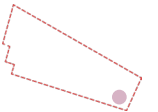
This node is centered around the existing brackish lake. The lake helps in stormwater retention and seasonal water level fluctuations. Additionally, it supports bird and amphibian life.

This design consists of wooden platforms and soft paths, which allow for public access in a controlled way. It seeks a balance between ecological needs and daily use, without intensification of human impact.

Figure 7.11 Renderings showing brackish lake node.  
Source: Author's illustration







The node revolves around the reuse of an existing distinctive building, which will be used for educational and community activities. The landscape allows for outdoor learning, sport, and daily leisure activities through lawns, paths, and seating areas. Permeable materials, swales, and small water elements will manage surface water runoff while emphasizing ecological connectivity.

Figure 7.12 Renderings showing the education center.  
Source: Author's illustration





The soft coastal edge is created through the gradual transition from hard surfaces to gravel, vegetation, and stone, preventing erosion while improving the environment. The path facilitates daily activities such as walking, running, cycling, and fishing while maintaining views of the water.

*Figure 7.13 Renderings showing the seaside promenade path.  
Source: Author's illustration*





## CLUSTER DESIGN IN LEVANTKAJ

### Nano Scale

- Site Context
- Reference Masterplan Framework
- Cluster Selection
- Cluster Design
- Visualizations

This chapter will introduce a nano-scale design intervention in Levantkaj, which has been developed within an existing masterplan framework.

The overall urban structure is based on a masterplan proposal developed for the site of Levantkaj by Juul Frost Architects, which serves as a spatial reference. Instead of presenting the masterplan as a solution, it is used as a framework for design exploration.

Starting with the framework, the chapter will specifically address a selected building group, where nature-based solutions are used at the building scale, linking the theme of the thesis with the design.

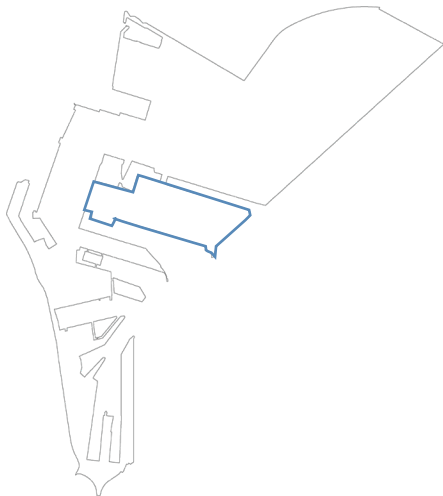


## 8.1 Levantkaj --Site Context

### Historical Development

The Levantkaj area developed from land reclamation. It was mainly utilized for industrial activities related to the harbor, including storage, logistics, etc., with spatial organization influenced by large plot divisions and hard surfaces.

Around 2008, with the City of Copenhagen launching their development strategy for Nordhavn, Levantkaj was recognized as a mid-term development area because of its location in relation to harbor activities. After the completion of districts in the southern part around 2017, development activity is now shifting northward, leading to a new phase in the development of Levantkaj, with a competition for a masterplan launched by public authorities to stimulate new development in the area.



Drawing 8.1 site location in Nordhavn.  
Source: Author's illustration

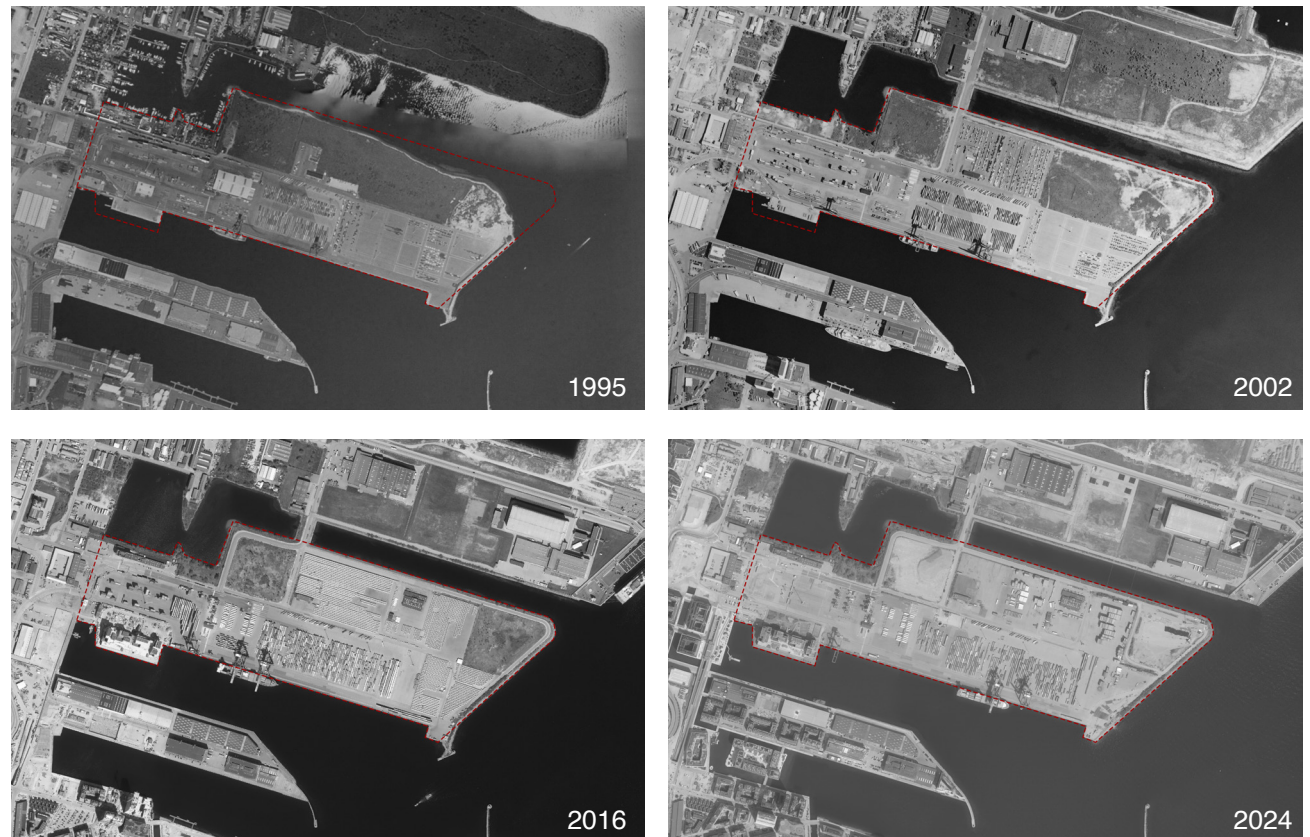


Figure 8.1 Historical development of the site Levantkaj.  
Source: <https://kort.plandata.dk/spatialmap>



## Current Conditions

### Industrial Function

With the aim of operational efficiency, the site emphasizes stacking, loading, and vehicular movement. Additionally, it also has extensive, continuous, and paved container storage areas. This gives rise to a predominantly mono-functional industrial space with minimal spatial diversity, as well as the absence of spaces that are public- or nature-oriented.

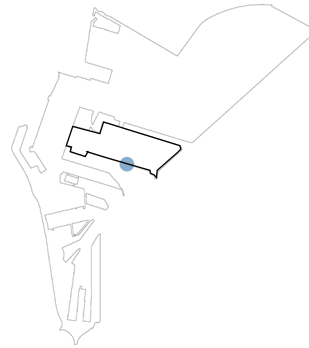


Figure 8.2 Containers in the site

Source: By&Havn, <https://byoghavn.dk/levantkaj-i-nordhavn-faar-platin-i-baeredygtighed/>

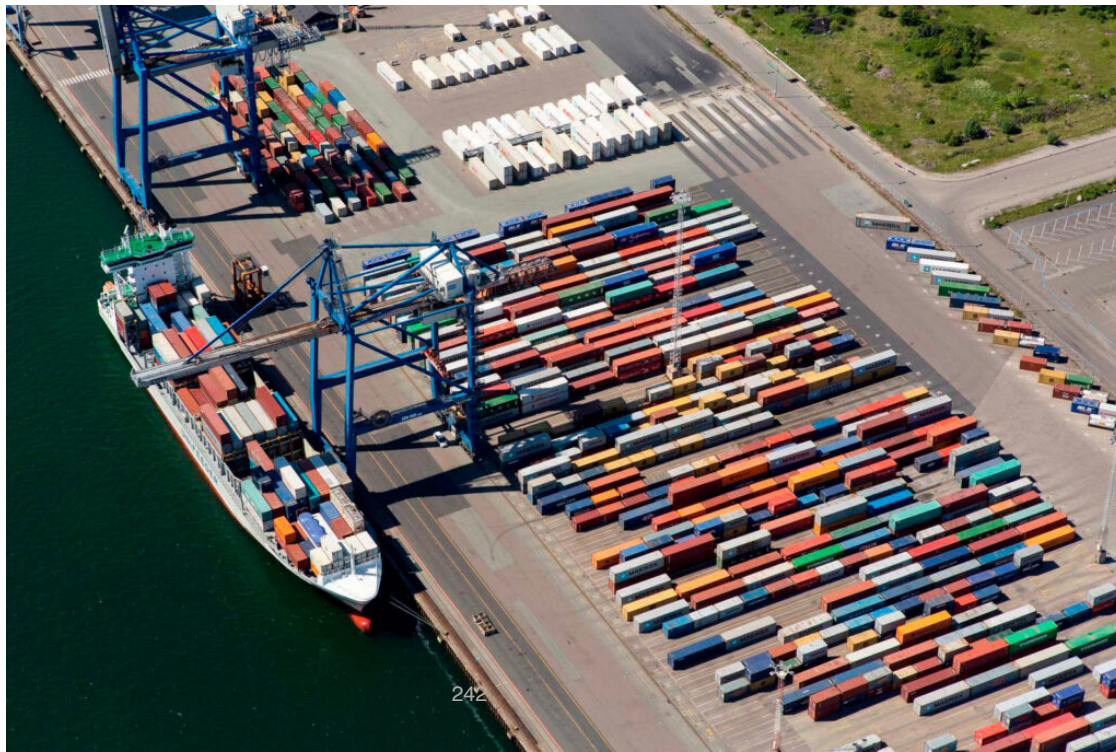


Figure 8.3 Southern edge of the site

Source: Google maps

On the southern side, large containers, along with gantry cranes, dominate the waterfront area. The quay is fully engineered to facilitate maritime activities, thereby creating a hard edge between land and water. However, the hard edge does not allow interaction with the water environment.

**Nothern Edge**

The region in the north is characterised by a number of artificial water basins and open green spaces. In comparison with the southern harbour edge, this region presents a lower degree of operational intensity and a more scattered spatial composition. Water surfaces, service roads, and vacant land form a discontinuous landscape that lacks public accessibility and spatial connection with the surrounding urban areas.

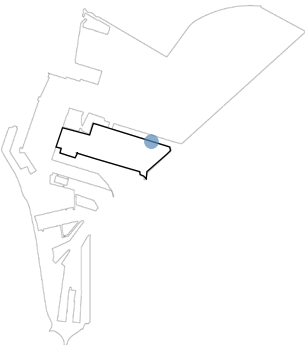


Figure 8.4 Northern edges of the site.  
Source: Google maps

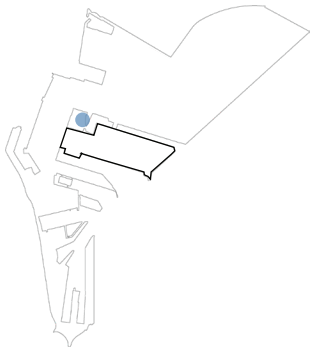


**Nothern Lake**



Figure 8.5 Southern edge of the site.  
Source: Gppglemap

The water body is influenced by harbour infrastructure and land reclamation practices. It is still hydraulically connected to the harbour system, with engineered edges and road infrastructure. Although no longer used for harbour activities, it now serves as a remaining industrial water space in the Levantkaj area.





## Planning & Development Context

As part of the overall development process in Nordhavn, Levantkaj is seen as a subsequent development area after the completion of the development in the southern harbour districts. In this regard, a masterplan competition was organized by the City of Copenhagen to address the future development of the area. The competition led to a winning entry, which defined the direction for development in the area, marking the beginning of the development process in Levantkaj.

**While it is not considered in terms of a design basis in this project, it is seen as an important planning reference for the area.**

*Figure 8.6 Illustrative perspective from the adopted masterplan proposal for Levantkaj, showing the intended spatial atmosphere and relationship between water, landscape, and urban development.  
Source: Entasis Architect & By&Havn*





## 8.2 Reference Masterplan Framework

The masterplan framework developed by Juul Frost Architects. The unique feature of the masterplan designed by Juul Frost Architects is its integration with landscape, water systems, and urban structures. Along with responding to the Green Loop at a district scale, two continuous blue-green corridors have been proposed, which will connect water areas with inner neighborhood areas. It emphasizes the relationship between movement, landscape, and water.

The proposed framework at a block scale includes a perimeter block arrangement that creates a semi-open courtyard, thereby allowing landscape to extend into the interior of the urban fabric. This will help integrate nature-based solutions at public and semi-private levels while providing a clear urban structure.

The framework is relevant for the current project because of its transferable spatial principles. The combination of **blue-green corridors, courtyard-based blocks, and accessible waterfronts** offers a robust basis for exploring nature-based solutions at the cluster and building scale.

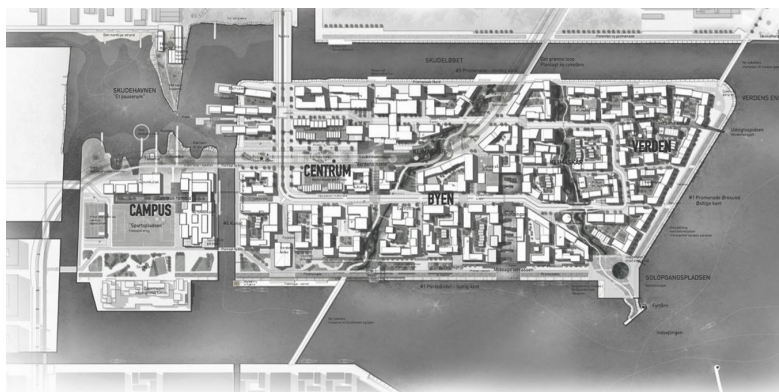
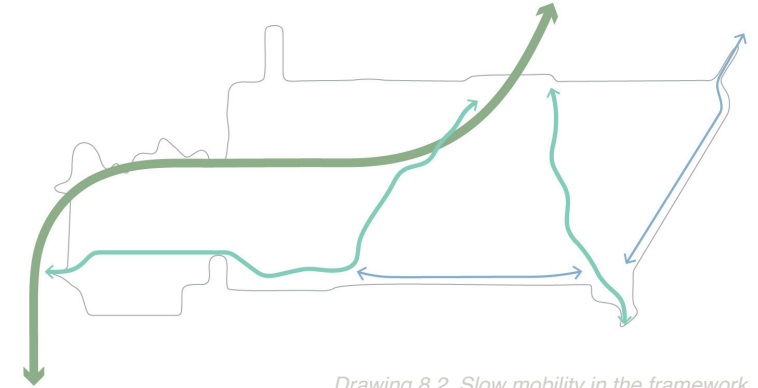


Figure Reference masterplan proposal adopted as a spatial framework.  
Source: Juul Frost Architects.

Blue-green & public mobility corridors forming the primary spatial framework across the site.



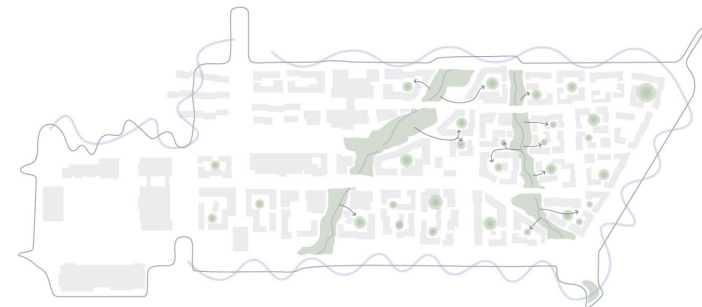
Drawing 8.2 Slow mobility in the framework.  
Source: Author's illustration

Perimeter block structure forming semi-open courtyards as a spatial framework for integrating landscape within the urban fabric.



Drawing 8.3 Perimeter block structure and green yard in the framework.  
Source: Author's illustration

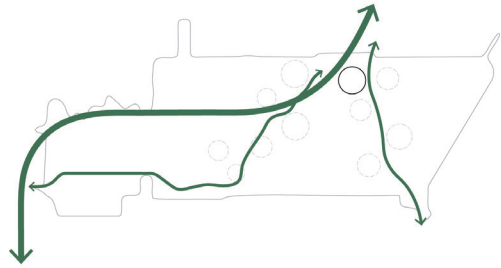
Landscape and water infiltration from the waterfront into the urban fabric and courtyards.



Drawing 8.4 Blue-green elements connections in the framework.  
Source: Author's illustration

## 8.3 Cluster Selection

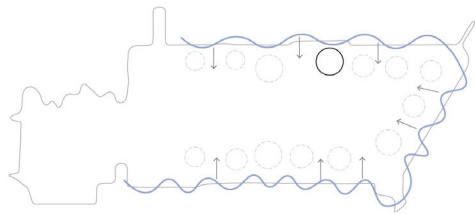
### Selection Criteria



Drawing 8.5 Proposed cluster located at the intersection of blue-green slow-mobility corridors.  
Source: Author's illustration

#### Relation to blue-green corridors

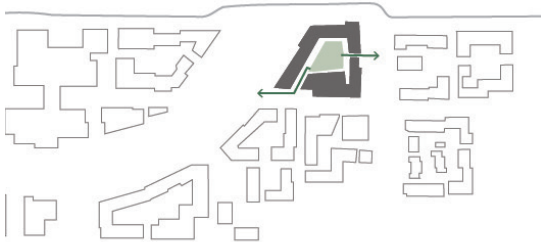
It is directly connected to the blue-green slow-mobility corridors identified in the masterplan framework, allowing landscape, water, and pedestrian movement to intersect at the site.



Drawing 8.6 Proposed cluster mediating between the waterfront public space and the inner urban fabric.  
Source: Author's illustration

#### Proximity to waterfront & public spaces

The location benefits from close proximity to the waterfront while remaining embedded within the urban fabric. This dual condition creates opportunities to link public waterfront spaces with semi-public interior courtyards and residential spaces.



Drawing 8.7 Proposed courtyard-based block structure enabling building-scale NBS integration.  
Source: Author's illustration

#### Courtyard-based NBS integration

The block configuration at this location provides favourable conditions for a courtyard-based structure, allowing blue-green elements to extend from the public realm into semi-open courtyards.

### Design Scope & Interpretation

This project uses the Levantkaj masterplan (Juul Frost Architects) as a spatial reference point, but not as a design model. The design scope is focused on the **selected cluster**.

The overall spatial logic of connectivity, waterfront integration, and courtyard-based blocks is maintained, but the building form is adapted to explore nature-based solution opportunities.

This approach provides design flexibility within an established structural framework to explore nano-scale NBS opportunities



## 8.4 Cluster Design

### *Courtyard as NBS Carrier*

According to the reference masterplan framework and selection, a housing cluster with a courtyard is proposed as a design solution at the building scale for Levantkaj.

The housing cluster will include a semi-open inner courtyard, which will be the main spatial and ecological core. It provides an open link between the Green Loop mobility system, an ecological corridor, and a waterfront landscape.

As an NBS carrier, the courtyard will offer people artificial water infiltration, urban gardening, and biodiversity-enhancing planting. The cluster will thus interpret the blue-green principles at the district scale as a compact and socially vibrant living environment.

*Drawing 8.8 Axonometric view of the proposed housing cluster with integrated courtyard landscape*  
Source: Author's illustration.







## Spatial Structure

These built volumes create a small semi-open yard while still maintaining connectivity to the surrounding landscape systems.

To the east, the block is oriented directly toward the blue green corridor, which allows for ecological continuity from the outside into the site. To the west, a pocket park provides a transitional space that serves to mediate the cluster/green loop system, while also providing a buffer from infrastructure-related impacts. To the north, the waterfront promenade/platform provides a strong public interface, connecting the cluster to the larger coastal open space system.

*Drawing 8.9 Masterplan showing the spatial organization of the cluster. 1:1000*

*Source: Author's illustration.*





- 1 Cultivation Garden
- 2 Social Pub
- 3 Rawhouse (1F) 85 m2
- 4 Rawhouse (2F) 95 m2.
- 5 Apartment
- 6 Blue-green Corridor
- 7 Shed

Drawing 8.10 Groudffloor Plan 1:250  
Source: Author's illustration.



## Public-Semi-Private Gradient

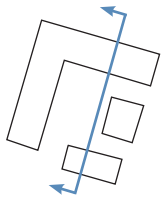
This section highlights the gradient from public spaces along the waterfront to semi-private spaces within the yard.

The inner courtyard features rainwater infiltration areas, permeable surfaces, and planting beds that collect rainwater runoff from the roof. This reduces the discharge of rainwater runoff while also benefiting the local water cycle and improving the microclimatic conditions.

Urban gardens and trees are also used to improve biodiversity while providing shade for outdoor spaces.

*Drawing 8.11 Courtyard functioning as an NBS carrier within the public–semi-private spatial gradient, 1:300.*

*Source: Author's illustration.*



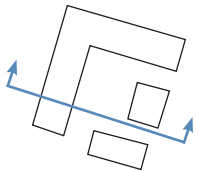


*Cluster as a Blue-Green Mediator*

The cluster acts as a connective interface within the existing urban fabrics. It opens to a pocket park on the west side and directly interfaces with the green loop mobility system. It also allows pedestrian and cycling traffic to pass through the courtyard and blue-green corridor on the east side.

The internal yard serves as an NBS carrier. Water, vegetation, and traffic are received from both sides of the cluster and then transferred to permeable surfaces, vegetation areas, and semi-open areas.

*Drawing 8.12 Cluster as a blue-green mediator within urban fabric, 1:300.  
Source: Author's illustration.*





## 8.5 Visualization

Semi-open courtyard includes urban gardening, permeable surfaces, and plantings to enable the retention of rainwater, control of microclimatic conditions, and social activities.

The extension of the block towards the blue-green corridors will enable the courtyard to become an interface between ecological processes.

*Figure 8.8 Rendering showing courtyard-based housing life.  
Source: Author's illustration.*







The green-blue corridor is a system of continuous landscapes that integrates surface water management, biodiversity support, and slow mobility. As an open water body, a planted swale, and a soft-edge path system, it allows for movement while also acting as an ecological spine within the district.

As it crosses the housing cluster area, the logic of space and environment is extended into the semi-open courtyard.

*Figure 8.9 Rendering showing the green-blue corridor and the housing cluster.  
Source: Author's illustration.*



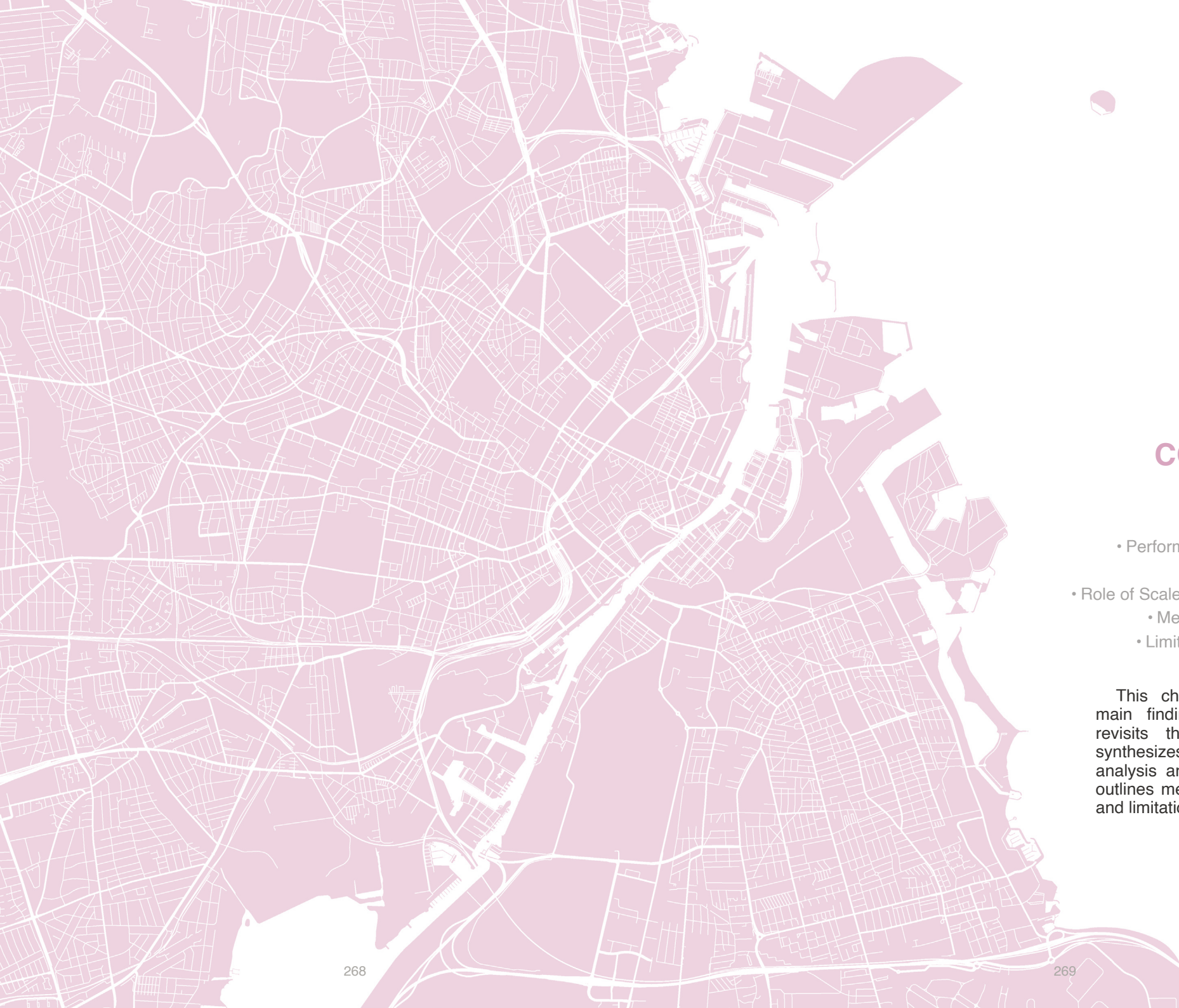
This small park serves as a transition space between the residential cluster and the Green Loop mobility corridor. It will be a shared space for social interaction.

Moreover, the multi-layered plantings, soft ground coverings, and gentle slopes will serve as a green space transition from the residential cluster to the adjacent metro infrastructure. This will facilitate a reduction in noise levels, microclimatic comfort, and biodiversity.

*Figure 8.10 Rendering showing pocket park between cluster and Green Loop.*  
Source: Author's illustration.







# 09

## CONCLUSION

- Responding to the RQ
- Performance & Multifunctionality
- Potential Impact
- Role of Scale & Spatial Configuration
- Methodological Reflections
- Limitations & Future Outlook

This chapter summarizes the main findings of the thesis. It revisits the research question, synthesizes key insights from the analysis and design phases, and outlines methodological reflections and limitations.

## 9.1 Responding to the Research Question

This thesis has been developed to explore which framework may guide the selection and prioritization of NBS in Copenhagen for better climate resilience and urban livability. With the incorporation of spatial analysis and multi-criteria evaluation and site-specific design, the framework has effectively been developed to respond to the initial question posed.

As discussed above, at the meso scale, the study has clearly shown that GIS-based spatial analysis may provide a strong foundation to support the identification of areas in which NBS may be most needed and most effective. By incorporating various environmental risks, ecological conditions, and accessibility to green spaces and social conditions, the framework may move beyond isolated and opportunistic and support a more strategic evaluation and prioritization process.

When it comes to the micro and nano scales, more detailed spatial analysis and site-specific design in Nordhavn and Nordhavnstippen have been proposed. Moreover, the framework guides the proposal of NBS typologies and their spatial configuration.

In one word, the framework established a strong link between **data-driven analysis and spatial design**. It supports the development of more effective and sensitive NBS planning and contributes to climate resilience and urban livability in Copenhagen.

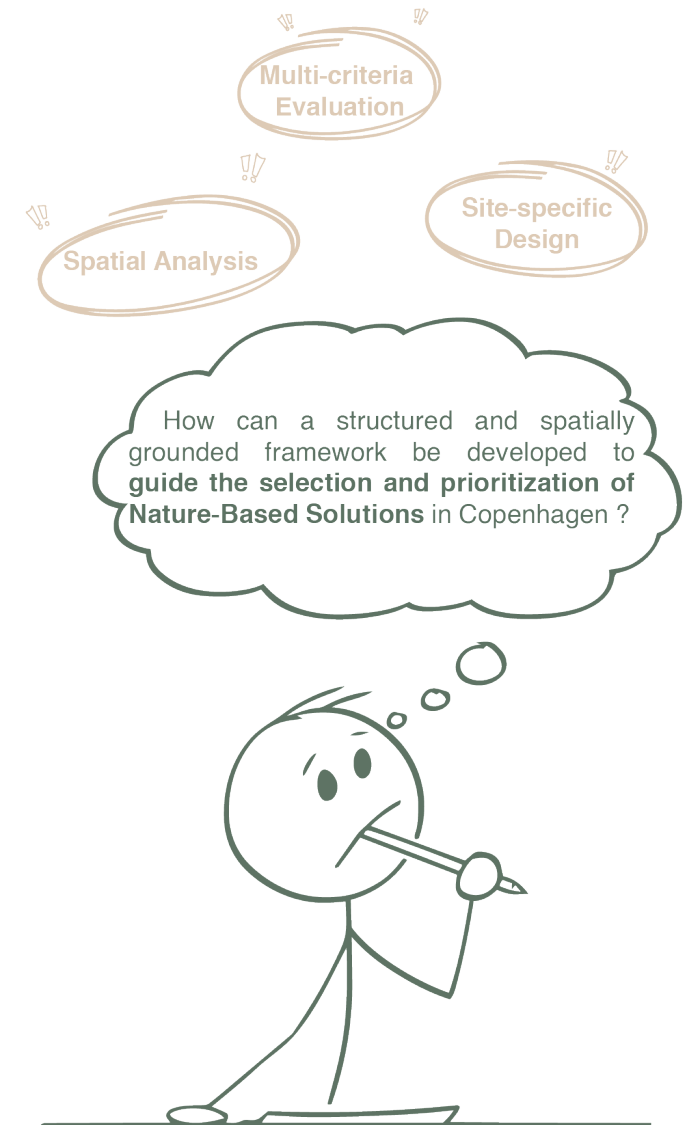


Figure 9.1 Research Question  
Source: Author's illustration



## 9.2 Performance & Multifunctionality

The performance of the proposed NBS is evaluated using an evaluation framework inspired by the **UNaLab project**. It is used to express the potential contribution of different interventions to climate adaptation, biodiversity, and social cohesion.

This framework considers interventions along several relevant functional dimensions, including climate, water, air, biodiversity, amenity, and CO<sub>2</sub> sequestration. Using these dimensions, the approaches developed in the earlier design stages are examined in terms of their potential multifunctional performance, as opposed to single-function approaches.

*Table 9.1 Performance and functions of the proposed NBS I.*  
Source: Author's illustration based on the Unalab, <https://unalab.eu/en/documents/unalab-nbs-technical-handbook-factsheets>.

The **constructed wetland** has shown good results in managing water and climate resilience in retention, filtering, and bio-remediation. It also has biodiversity, amenity and educational value.

The **bioswale** has shown its effectiveness in the management of local water management through conveyance, infiltration, and retention. The strength of the bioswale lies in its small-scale application.

|                                                                                                                           | Very Good | Good | Not Applicable | Constructed Wetland | Bioswale |
|---------------------------------------------------------------------------------------------------------------------------|-----------|------|----------------|---------------------|----------|
|  <b>Climate Resilience</b>             |           |      |                |                     |          |
| Transpiration                                                                                                             | ●         | ○    |                | ○                   | ○        |
| Shading                                                                                                                   | ○         | ○    |                | ○                   | ○        |
| Evaporation                                                                                                               | ●         | ●    |                | ●                   | ○        |
|  <b>Water Management</b>               |           |      |                |                     |          |
| Water Conveyance                                                                                                          | ●         | ○    |                | ●                   | ○        |
| Water Infiltration                                                                                                        | ●         | ○    |                | ●                   | ○        |
| Water Retention                                                                                                           | ●         | ○    |                | ●                   | ○        |
| Water Storage                                                                                                             | ●         | ○    |                | ●                   | ○        |
| Water Reuse                                                                                                               | ●         | ●    |                | ○                   | ○        |
| Water Filtering                                                                                                           | ●         | ○    |                | ●                   | ○        |
| Water bio-remediation                                                                                                     | ●         | ●    |                | ●                   | ○        |
|  <b>Air Purification</b>               |           |      |                |                     |          |
| Deposition                                                                                                                | ○         | ○    |                | ○                   | ○        |
| Air biofiltration                                                                                                         | ○         | ○    |                | ○                   | ○        |
| Noise reduction                                                                                                           | ○         | ○    |                | ○                   | ○        |
|  <b>Biodiversity</b>                 |           |      |                |                     |          |
| Habitat Provision                                                                                                         | ●         | ●    |                | ●                   | ○        |
| Connectivity                                                                                                              | ●         | ●    |                | ●                   | ○        |
|  <b>Amenity Value</b>                |           |      |                |                     |          |
| Beauty                                                                                                                    | ●         | ●    |                | ●                   | ●        |
| Usability                                                                                                                 | ●         | ○    |                | ○                   | ○        |
| Social Interaction                                                                                                        | ●         | ●    |                | ○                   | ○        |
| Education                                                                                                                 | ●         | ○    |                | ○                   | ○        |
|  <b>CO<sub>2</sub> Sequestration</b> |           |      |                |                     |          |
| CO <sub>2</sub> Sequestration                                                                                             | ○         | ○    |                | ○                   | ○        |

|                                                                                                                  |                               |                                   |                                   |                                   |                                   |
|------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <div> <div></div> <div></div> </div> <div> <div>Very Good</div> <div>Good</div> <div>Not Applicable</div> </div> |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> <div>Climate Resilience</div> </div>                                                           |                               | Pocket Park                       | Ecological Forest                 | Urban Garden                      | Rain Garden                       |
| <div> <div></div> </div>                                                                                         | Transpiration                 | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Shading                       | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Evaporation                   | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
| <div> <div></div> <div>Water Management</div> </div>                                                             |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> </div>                                                                                         | Water Conveyance              | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water Infiltration            | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water Retention               | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water Storage                 | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water Reuse                   | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water Filtering               | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Water bio-remediation         | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
| <div> <div></div> <div>Air Purification</div> </div>                                                             |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> </div>                                                                                         | Deposition                    | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Air biofiltration             | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Noise reduction               | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
| <div> <div></div> <div>Biodiversity</div> </div>                                                                 |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> </div>                                                                                         | Habitat Provision             | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Connectivity                  | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
| <div> <div></div> <div>Amenity Value</div> </div>                                                                |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> </div>                                                                                         | Beauty                        | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Usability                     | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Social Interaction            | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
|                                                                                                                  | Education                     | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |
| <div> <div></div> <div>CO<sub>2</sub> Sequestration</div> </div>                                                 |                               |                                   |                                   |                                   |                                   |
| <div> <div></div> </div>                                                                                         | CO <sub>2</sub> Sequestration | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> | <div><div></div><div></div></div> |

The **pocket parks** have strong localized climate regulation and amenity value, making them useful for daily living and social interaction. Their biodiversity and water management performance is average but effective.

The **ecological forest** has a strong performance in climate resilience and biodiversity, especially in shading, evapotranspiration, and habitat creation. In addition, it can provide air purification and CO<sub>2</sub> sequestration on a larger spatial scale.

Table 9.2 Performance and functions of the proposed NBS II.  
Source: Author's illustration based on the Unalab, <https://unalab.eu/en/documents/unalab-nbs-technical-handbook-factsheets>.

**Urban gardens** have both social and ecological components, with a moderate performance in terms of their environment, although they are essential in daily urban life.

The main purpose of **rain gardens** is to provide water management, including infiltration, retention, and filtration. They have a low performance in terms of amenity and biodiversity.



- Very Good
- Good
- Not Applicable



#### Climate Resilience

Transpiration  
Shading  
Evaporation

#### Green Corridor

#### Soft Coastal Edge

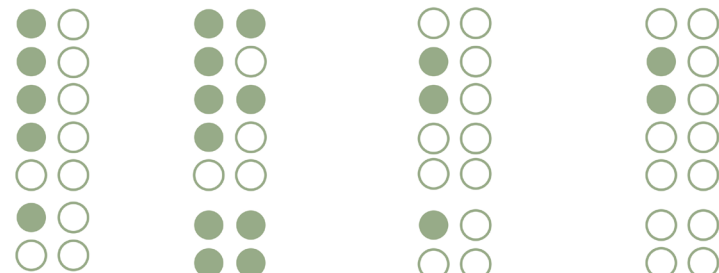
#### Permeable Paving System

#### Green Noise Barrier



#### Water Management

Water Conveyance  
Water Infiltration  
Water Retention  
Water Storage  
Water Reuse  
Water Filtering  
Water bio-remediation



#### Air Purification

Deposition  
Air biofiltration  
Noise reduction



#### Biodiversity

Habitat Provision  
Connectivity



#### Amenity Value

Beauty  
Usability  
Social Interaction  
Education



#### CO<sub>2</sub> Sequestration

CO<sub>2</sub> Sequestration



**Green corridors** have a strong performance in biodiversity and connectivity, and also play a role in climate regulation. Their main value is connecting ecological and social space across an urban area.

**Soft coastal edges** have a high performance in water management, especially with regard to infiltration, retention, and bio-remediation. It also plays a role in climate adaptation and has an amenity value by integrating ecological processes with public space.

Table 9.3 Performance and functions of the proposed NBS III.  
Source: Author's illustration based on the Unalab, <https://unalab.eu/en/documents/unalab-nbs-technical-handbook-factsheets>.

**Permeable paving systems** are mainly beneficial in terms of water management. Their ecological and social contribution is low. They are effective as distributed technological measures.

**Green noise barriers** have the advantages of noise reduction, air purification, and climate regulation. Their ecological contribution is moderate. They also have the added amenity value of improved environmental quality.

# 9.3 Potential Impact



Drawing 9.1 Functions and impacts of main design solutions.  
Source: Author's illustration



## 9.4 Role of Scale & Spatial Configuration

The study has clearly shown that the efficiency of NBS depends on the scale and the spatial arrangement.

At the meso scale, the continuous forms of green infrastructure play an important role in mitigating the effects of climate change. The efficiency of the green infrastructure is systemic because it has an effect on the environment beyond its boundaries. However, it is also clear that large-scale strategies are not sufficient on their own to fulfill the requirements of daily life.

At the micro or nano scale, bioswales, pocket parks, permeable pavement, and reet trees, etc., have a role to be played with the efficiency and better performance for daily life use.

The study has also shown that the most efficient strategies are the combination of different scales of intervention within one spatial system. Thus, it is not just the scale of intervention that is important; it is also the spatial logic of the interaction between the green infrastructure and the city.

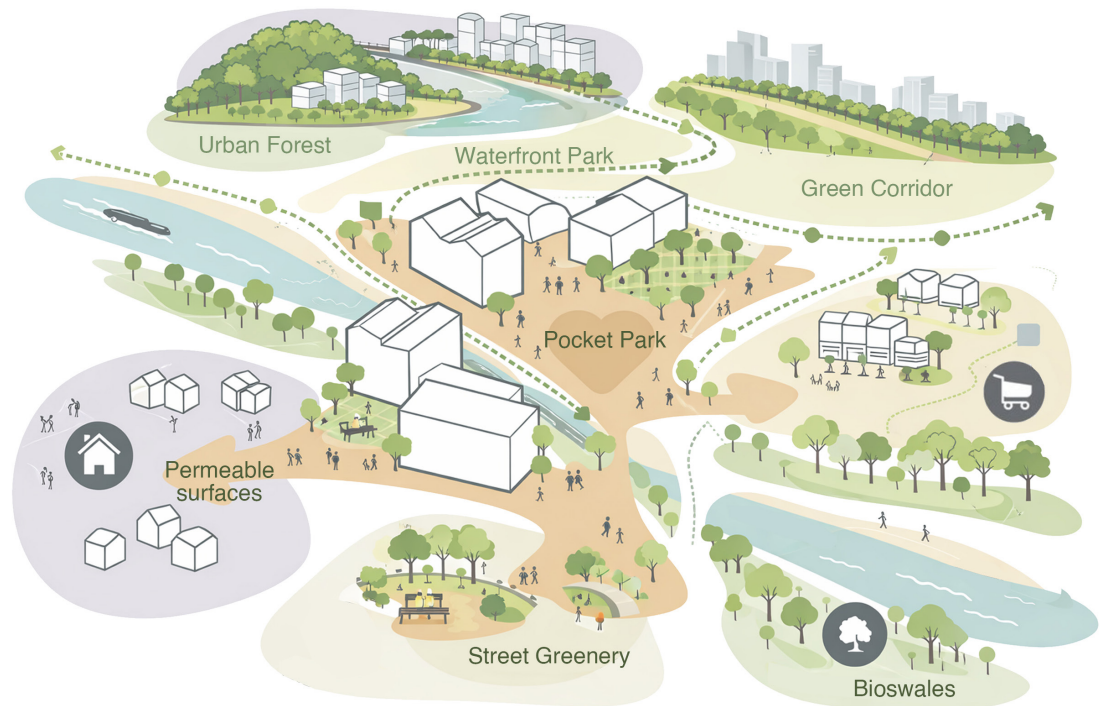


Figure 9.2 Different scale NBS elements in a connected spatial system.  
Source: Author's illustration

## 9.5 Methodological Reflections

Thus, this research also proves the potential of spatial analysis combined with multi-criteria evaluation and design exploration in one methodological framework. The use of GIS-based spatial analysis as a decision support tool allows us to structure and make transparent the process of selecting areas based on environmental and social conditions rather than intuition.

Meanwhile, the application of this framework in Nordhavn also proves that it is possible to move from analytical results to spatial design without limiting flexibility. Design here serves as an interpretative tool to test the results of spatial analysis in a specific urban context.

Even though it is difficult to measure many of the impacts of NBS on human experience, it should be noted that despite this limitation, this methodology offers a flexible structure to support decision-making in early stages of planning.

## 9.6 Limitations & Future Outlook

It has to be noted that this research has certain limitations. The assessment of NBS relies on spatial analysis and certain assumptions used in the design process. As a result, it cannot be verified to what extent the proposed solutions will actually perform in an environmental or social manner.

Secondly, certain complex issues are also oversimplified to enable a spatial assessment process. The proposed designs are meant to be exploratory in nature rather than being used as final designs.

It has to be noted that despite certain limitations, this research has proposed a structured framework which can be used to support early-stage decision-making on Nature-Based Solutions. The framework proposed in this research can be further enhanced by future research.



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