In the Middle of Delfland

The cultural landscape where agriculture and recreation coexist

P5 Carmen Jansen op de Haar - 30 juni 2023

Metropolitan Ecologies of places

1st mentor: Kristel Aalbers
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Delegate: Robert Nottrot

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[Photo 1] Rotterdam panorama (Corpel, 2012)

Editor's Note.

I am pleased to present this comprehensive and insightful project on implementing integrated and sustainable land use planning in the BPL MD region. This graduation project exemplifies the field of urbanism and sustainability. Throughout this project, I wil and landscape architecture. I demonstrate a deep understanding of this beautiful landscape's characteristics and how it must balance human needs with environmental preservation. By emphasizing the significance of integrated land use planning, the project highlights the potential for transforming the BPL MD region into a thriving and biodiverse area that benefits both humans and nature.

The societal value of this project cannot be overstated. By creating space for water storage, improving the livability of meadow birds, and balancing recreational activities, the proposed plan aims to enhance the quality of life for local communities while safeguarding the natural environment.

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Urbanism

TU Delft BK Bouwkunde

TU Delft BK Bouwkunde

[Photo 2] De Ha

reweg met grenspaal "De Bonte Paal" op de grens Schiedam - Delfland, (Roover, 1964)

ABSTRACT

This graduation project explores the implementation of integrated and sustainable land use planning as a crucial strategy for transforming the BPL MD region into a thriving and biodiverse area that benefits both humans and nature. By emphasizing landscape identity, water storage, livability of meadow birds, and balancing recreational activities, this project proposes a comprehensive design that ensures the long-term health and well-being of both the environment and communities. A new perspective on the open polder landscapes in the metropolitan region of Rotterdam and The Hague in 2070 is created. Creating three zones, with local food and recreation on the outskirts and a nature center at the heart. These zones create water buffers, improve diverse recreation opportunities, and improve quiet zones for meadow birds. This new design for the BPL MD could be used as inspiration for the future of this region. In addition, this research provides new insights into combining climate change and cultural heritage in such a historically significant location.

[Photo 3] Swamp area (Provincie Zuid Holland, z.d.)

[Photo 4] Reed along water (Provincie Zuid Holland, z.d.)

Van Krabbeplas tot Woudsepolder,
van Mandjeska' tot Boonervliet,
het wintervoer ligt hier op zolder,
de kikker huist hier in het riet.

Dit grazige land met zijn greppen en vlieten
en kreekruggen waar boerderijen staan,
met trekkades waar de paarden liepen
en kwakels om over het water te gaan,
waar de wind vrij waait uit alle streken,
het geluid tot aan de einder draagt,
waar de mist in de avond als een deken
het water ontstijgt en het vee vervaagt.

Weids is dit land met zijn vaarten en tochten
waar wilgen geknot langs de paden staan;
voortdurend wordt hier met het water gevochten –
laat dit land niet ten onder gaan.

Want – dit is het land tussen kassen en steden,
de gastvrije grond waar verleden en heden
langs Gaag en Schie elkaar ontmoeten,
waar stad en land elkaar begroeten.

Sta op uit de veren
er is heel wat te doen,
nóg rust hier de hemel
op een bedje van groen.

(Ineke van Gils, unknown)

Contents.

Blackwhite view openess
polder landscape

Photo 6 by Johan Gerritse
Accessed 11.4.23

'The landscape with its visible polder structures, surrounded by a skyline of cities belongs to the treasure of 2 million people.

[Photo 5]: Mwade by author

'Holierhoekse polder'
Midden Delfland

Photo by author

Preface of thesis project

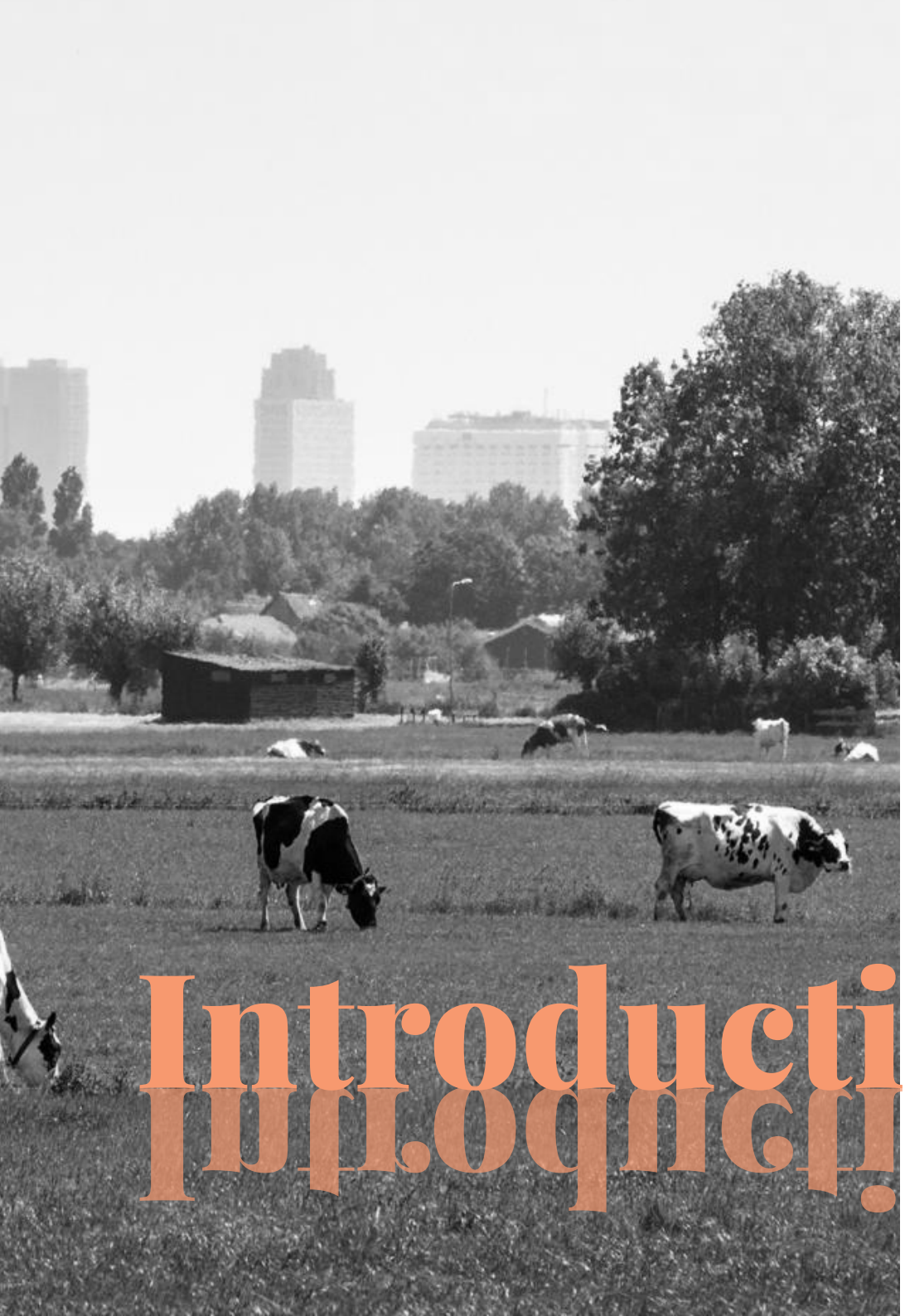
Designing in the present, with awareness of the past, for a future which is essentially unknown.

This report is made during urbanism's graduation period in 2022–2023 at the university of the TU Delft. This research aims to combine agriculture and recreation in the 'Bijzonder Provinciaal Landschap Midden Delfland' (BPL MD) while supporting the landscape's characteristics in the face of climate change and urbanisation. This study will investigate how integrating agriculture, and recreation can contribute to sustainable land use practices and enhance the visitor experience—exploring the three worlds of work, leisure, and nature in the historical open peat landscape to identify potential challenges and opportunities.

Due to the uncertainty of the future, this research will determine the maximum potential of the location before designing the landscape to realize that potential. This approach involves the unpredictable, including the various impacts of urbanisation and climate change. By determining the maximum potential of the location, this research aims to create a sustainable and resilient landscape that can adapt to future changes. It will also help minimize the negative impacts of urbanisation and climate change on the environment while strenghten the landscape identiy.

By optimizing water storage capacity, enhancing meadow bird habitats, and promoting diverse recreational opportunities, the open polder landscape can effectively adapt to the challenges of climate change and population growth, ensuring its continued relevance to users and residents. Additionally, exploring innovative agricultural practices like the food swamp and wet cultivation allows us to beneficially harness the potential of excess water, transforming it from a perceived threat to a valuable resource. Moreover, creating distinct zones with unique qualities will further enhance the inherent characteristics of this exceptional landscape, enriching the overall experience for all who interact with it. Through these measures, we can cultivate a future-proof landscape that strikes a harmonious balance between environmental sustainability, agricultural innovation, and the diverse needs of its inhabitants.

[Photo 6] Meadow and skyline (Gemeente Midden Delfland, 2021)



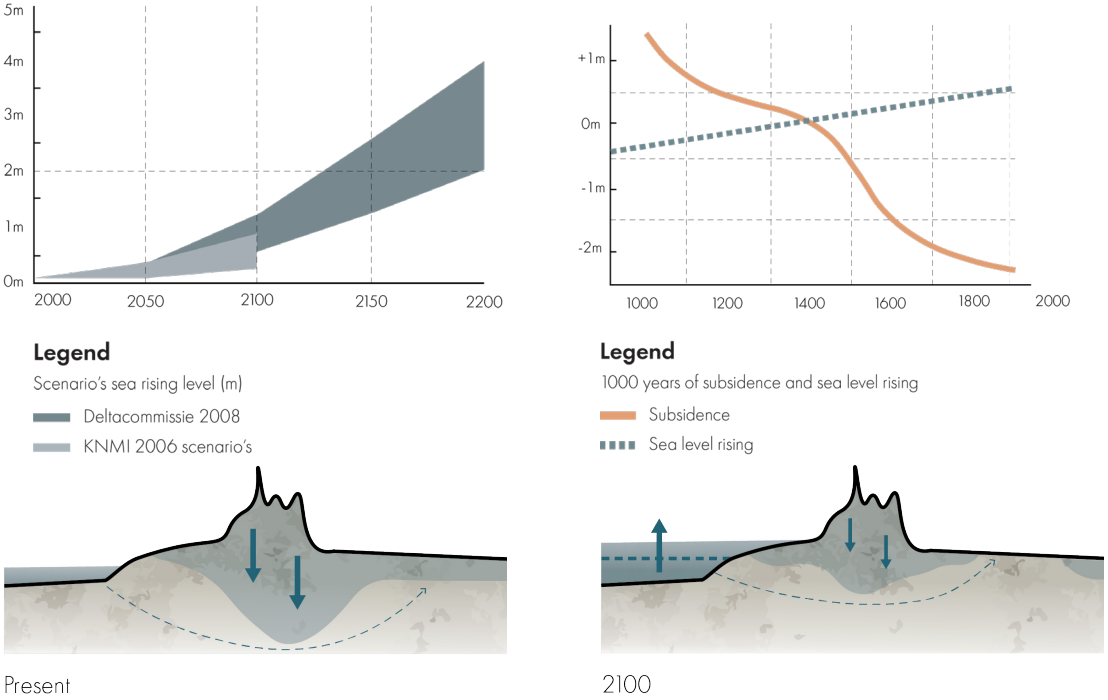
Introduction

1.1 Introducing the challenges

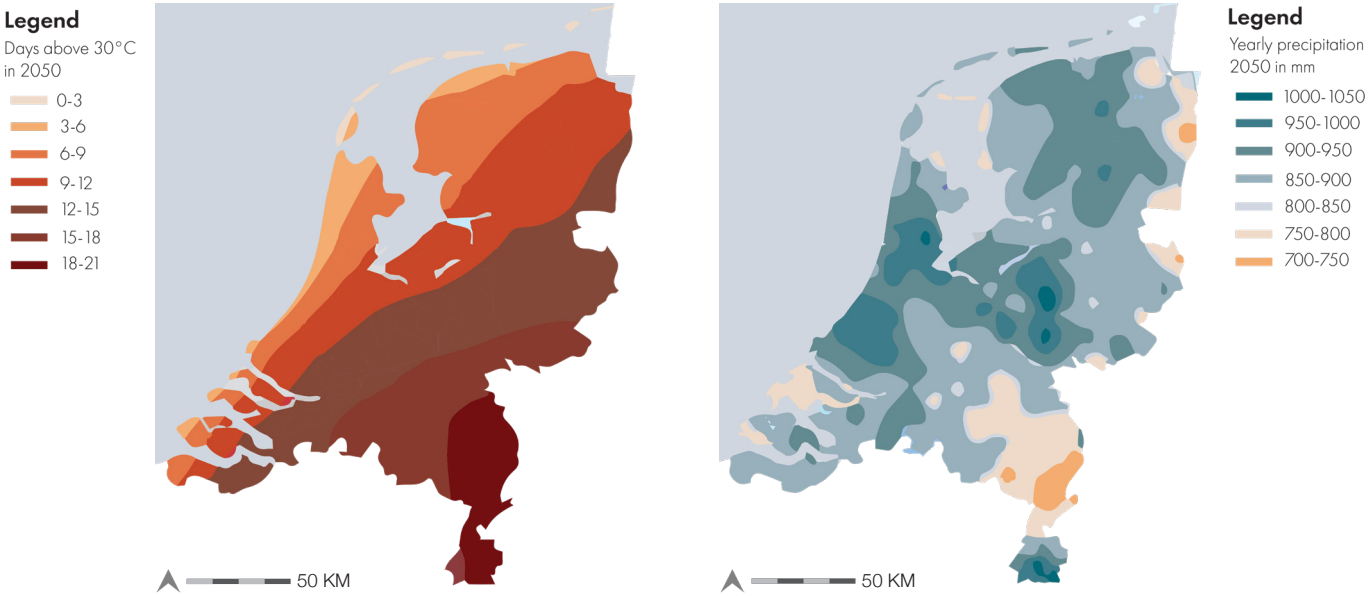
The Netherlands is facing multiple significant challenges that need to be tackled. During the summer of 2022, the three most important issues people faced in the Netherlands were inflation, climate change, and housing shortage (Statista, 2022). During this research, climate change and the rapid population growth will be seen as the biggest challenge in the region of PBL MD. The synthesis report of global climate research by the IPCC explained the urgency of meeting the Paris climate agreement goals to enable adaptation to climate change. The greenhouse gas emissions on a global scale need to be reduced immediately. The report also highlighted the potential consequences of failing to meet these goals, including more frequent and severe natural disasters, food and water scarcity, and displacement of millions of people. Governments and individuals must take immediate action toward reducing greenhouse gas emissions to mitigate these risks (IPPC, 2023).

1.1.1 Climate change

"Climate change" refers to the long-term warming of the planet. This warming is caused by the increase of certain gases in the atmosphere, such as carbon dioxide, that



[Fig. 1]: Made by author (KNMI - KNMI'14-klimaatscenario's, 2014)



[Fig. 2]: Made by author (Zeegers, 2018 & GIS)

trap heat from the sun. These gases are called greenhouse gases, and they are produced by human activities such as burning fossil fuels and deforestation. As the concentration of greenhouse gases in the atmosphere increases, more heat is trapped, causing the earth's temperature to rise (Wallace, 2009).

The effects of climate change are wide-ranging and include rising sea levels, more frequent and severe weather events, and changes in water availability. These changes can negatively impact the environment and human society, including more frequent and severe natural disasters, damage to crops and other forms of agriculture, and harm to human health (IPCC, 2014).

The number of greenhouse gases released into the atmosphere must be reduced to address climate change. This can be done through a variety of means, including increasing the use of clean energy sources such as solar and wind power and reducing our reliance on fossil fuels. It is also essential to protect and preserve natural systems, such as forests, which can absorb carbon dioxide from the atmosphere and help mitigate the effects of climate change (Griscom et al., 2017). Besides, peat should be conserved, as peatlands store large amounts of carbon, and their degradation can release it into the atmosphere, contributing to global warming.

The Netherlands is particularly vulnerable to the effects of climate change due to its low elevation and the fact that about half of the country is located below sea level. As sea levels rise due to climate change, the Netherlands is at risk of flooding (Zonneveld, 2008). In addition, the country is likely to experience more extreme weather events, such as heatwaves and heavy rainfall, (Koningsveld van et al., 2008).

[Fig. 3] Extreme weather, made by author

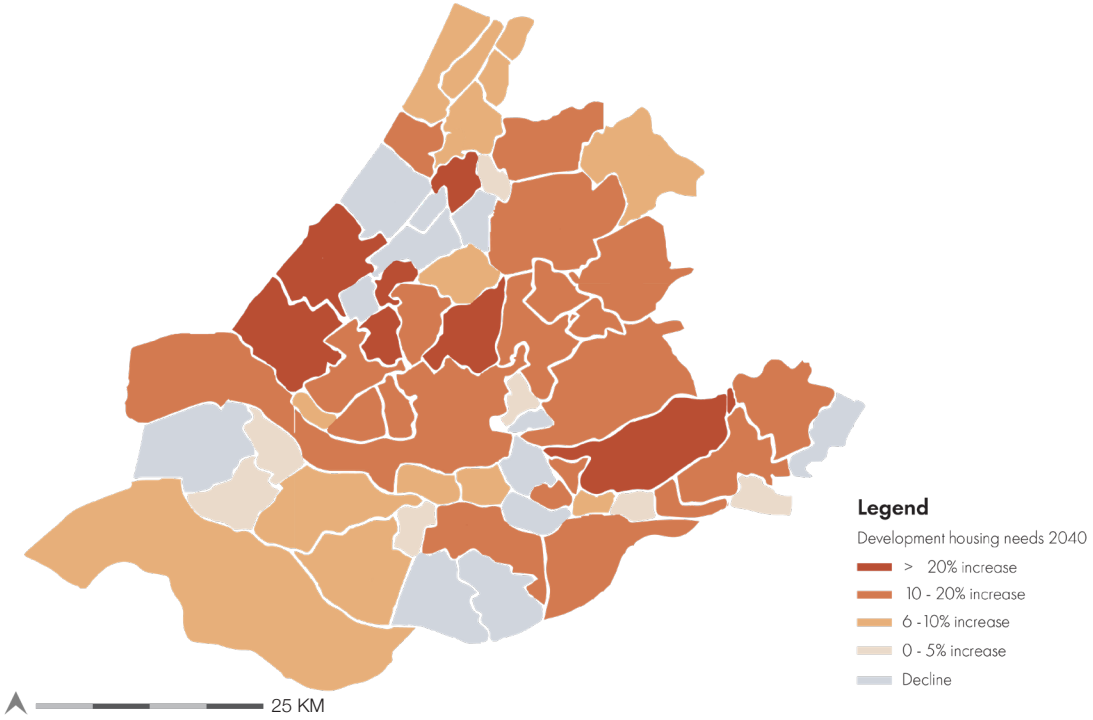
[Photo 8] Grassland during summer (Google maps, 2021)

[Photo 7] Prolonged drought (Hoogheemraadschap Delfland, 2022)

1.1.2 Urbanisation

The urbanisation challenges in the Netherlands are increasing, despite the fact that the Netherlands is already a highly urbanized country. A majority of the Dutch inhabitants live in cities or in the suburban centers around the cities (PBL, 2022). According to a quick scan from Rijksoverheid (Kwink groep, 2022), the metropolitan region of Amsterdam and the southern Randstadt are urbanizing the most. At the same time, space is the scarcest in these places, which creates a lot of pressure on the land. Between 2010 and 2030, approximately 230.000 new homes will be needed in the province of South Holland, 80.000 of these have already been built, which means that a task for another 150.000 homes remains necessary. Between 2030 and 2040, an additional 60.000 homes must be built (Province Zuid Holland, 2022).
Not all of these new dwellings will fit into the (contemporary) cities, which means the rural land needs to make room. However, urbanisation is a problem for the quality of rural land (Wang et al., 2021). As a result, in order to address this problem of urbanisation, it is important to consider ways to balance the development of these new dwellings between the cities and rural areas.

[Fig. 4] Made by author (QGIS,2022)

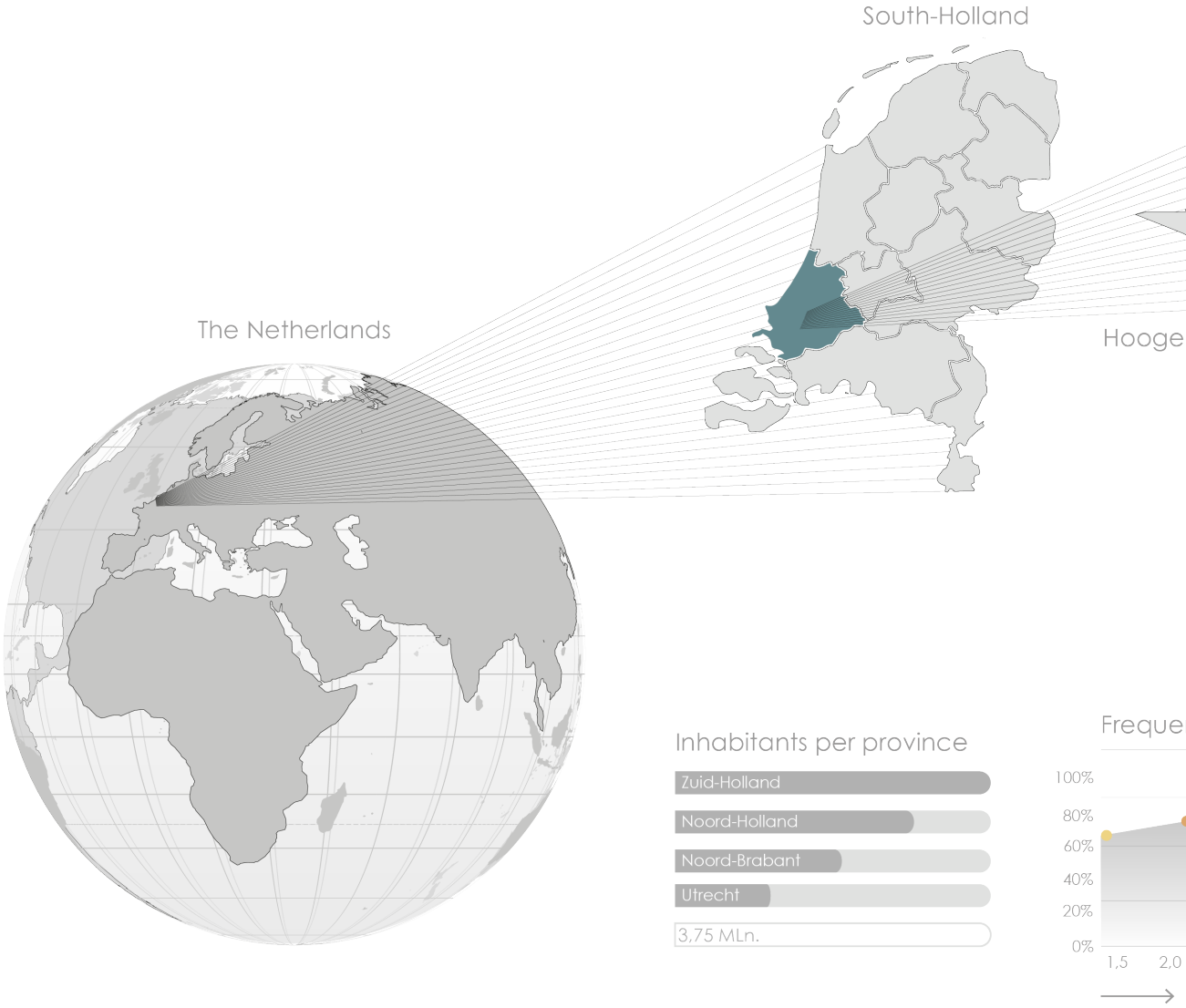


[Fig. 5] Made by author (QGIS,2022)

As cities expand, they often consume surrounding agricultural land, which can lead to a loss of fertile soil and a decline in food production (Ustaoglu et al., 2017). Especially in the Netherlands, this is a concerning problem because 54 percent of the total surface is agricultural land (CBS, 2016). Urbanisation also leads to an increase in air, water, and noise pollution, which can have negative impacts on the quality of the land, plants, and animals that live there (Moore et al., 2003). This causes habitat destruction, as a result of which biodiversity declines.

Rural land is often converted into urban areas to accommodate housing, infrastructure, and commercial developments. This conversion reduces the availability of agricultural land and natural habitats, leading to the loss of productive farmland and disruption of ecosystems. The remaining rural areas may experience higher utilization to compensate for the reduced land availability. This spread of urban areas beyond their designated boundaries, can contribute to the overuse of rural land. It leads to fragmented development patterns, inefficient land use, and increased commuting distances. The expansion of infrastructure to support urban sprawl further consumes rural land and places additional pressure on natural resources (Lee, 2016). Overall, urbanisation can have negative impacts on the surrounded landscape, and it is important to consider these impacts when planning for urban growth (Azous, 2001).

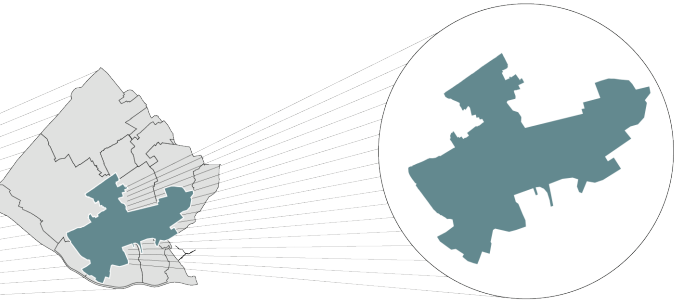
1.2 Introducing the location



[Fig. 6] Made by author (Feiten en cijfers, 2023)

BPL MD

Bijzonder provinciaal landschap Midden Delfland



heemraadschap Delfland

Agriculture

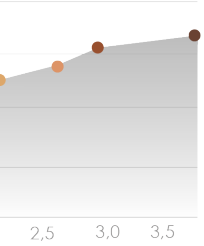
Forest and open land-scape

Work & Housing

Inland water

Other

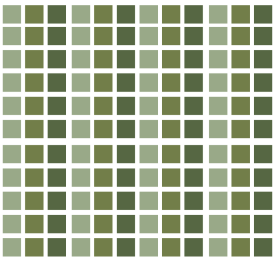
ncy distribution



Population MLn.

South-Holland
North-Holland
Noord-Brabant
Gelderland
Utrecht

Nature per inhabitant



Drenthe

South-Holland

North-Holland

1.2.1 The province of South Holland

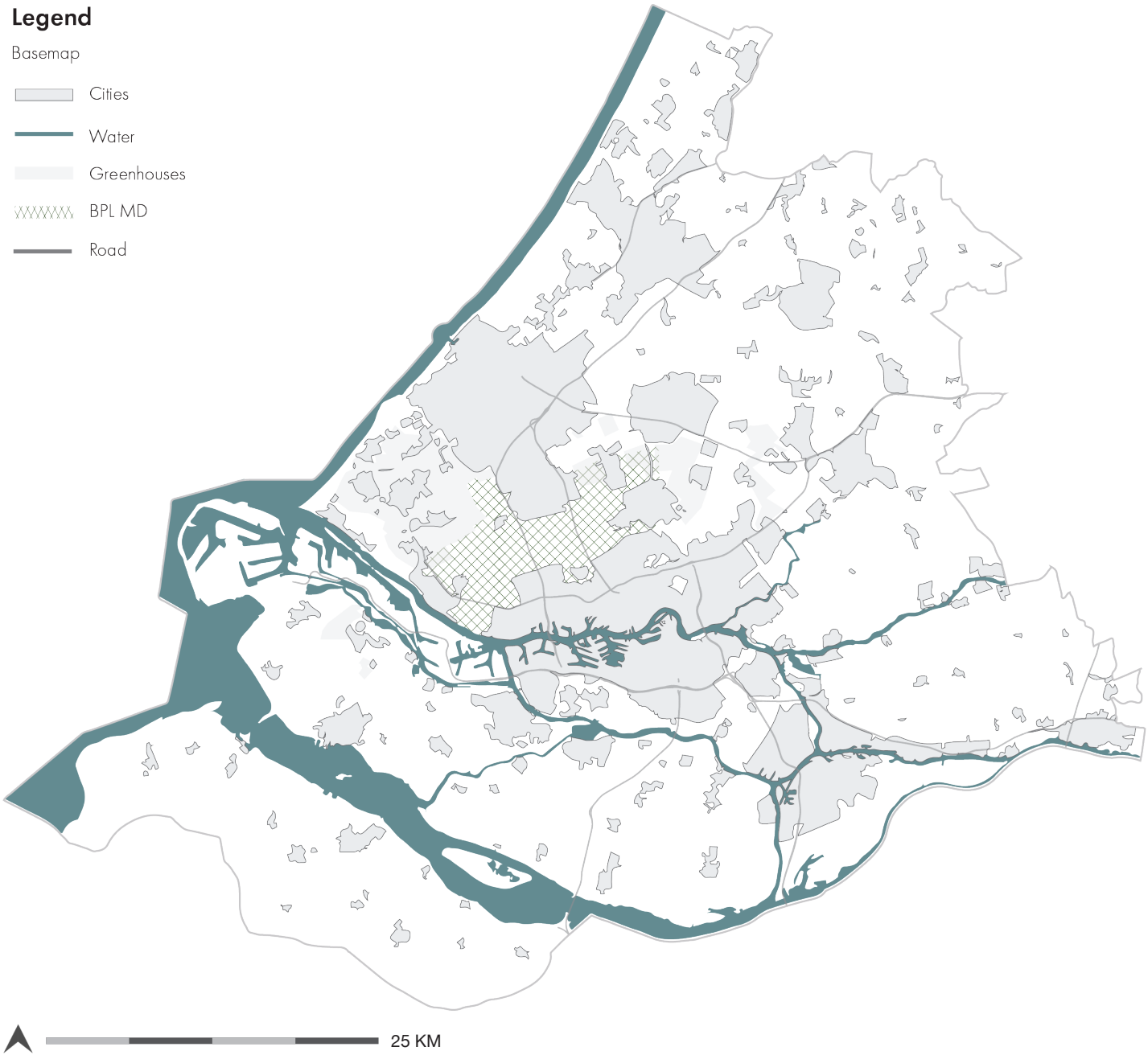
The Province of South Holland is a strategically located fertile delta, mostly below sea level. The Province is unique in the combination of coastal, peat, and river delta landscape. These are all connected to major water structures: the sea, river, and estuaries. They each have their characteristics of soil, water, and land use which are continuously changing (Provincie Zuid-Holland, 2021). The six most significant climate challenges the Province of South Holland faces are heat stress, water damage, foundation damage, salinization, flooding, and peat oxidation (Schrama et al., 2021).

Spatial interventions are needed in the province of South Holland to increase sustainability, address the housing shortage, and adapt to climate change. Those Interventions will have a significant impact now and in the future. The Province of South Holland is the most densely populated Province of the Netherlands, with 3,7 million inhabitants in an area of almost 3000 km2 (Provincie Zuid-Holland, 2009). This densely populated Delta province has a growing need for living, working, and recreation. At the same time, space needs to be reserved to protect the area against extreme weather conditions, and agricultural land needs to stay suitable for producing food. Because of these spatial needs, there is high pressure on the vital landscape between cities and rural land. This pressure can lead to conflicts between different land uses and interests. It requires careful planning and management to ensure the landscape remains sustainable and productive for future generations. Therefore, it is essential to balance urbanisation, agricultural production, and the conservation of natural resources.

The Province of South Holland envisions a future where it effectively addresses the challenges posed by heavy precipitation and increased recreational users while maintaining a sustainable and resilient environment. In response to serious precipitation events, the province aims to enhance its water management systems, including drainage and water storage infrastructure, to mitigate the risk of water damage and flooding (Provincie Zuid-Holland, 2021).

Regarding the increasing number of recreational users, the province recognizes the importance of providing diverse and accessible recreational opportunities while preserving its landscape's natural and cultural values. The vision involves developing and managing recreational areas that cater to the needs of different user groups, ensuring a balance between recreational activities and the protection of sensitive ecosystems (Provincie Zuid-Holland, 2021). This may involve creating designated areas for specific activities, improved infrastructure for recreational access, and promoting sustainable tourism practices to minimize environmental impacts.

The Province of South Holland aims to strike a balance between effective water management, sustainable recreation, and preserving its unique natural and cultural heritage. the province envisions a future where its landscape remains resilient, enjoyable, and accessible for residents and visitors (Gedeputeerde Staten, 2021).


Legend
Basemap
Cities
Water
Greenhouses
BPL MD
Road
25 KM

BPL Midden Delfland.

The last piece of open polder landscape in the province of South Holland

Midden Delfland is a municipality in the province of South Holland. The region is a peat meadow surrounded by Rotterdam, Delft, and the Hague. Midden Delfland was created on 1 January 2004 by reclassifying the area (Ijsselstijn, 2016). Former municipalities Maasland and Schipluiden were combined into one municipality. It consists of the three villages Den Hoorn, Maasland and Schipluiden and the two hamlets (buurtschappen) 't Woudt and De Zweth. These three villages stayed relatively small compared to the surrounding cities, such as Vlaardingen, Schiedam, and Maassluis. These cities are much more urbanized. In the Westland, there is more development in the form of greenhouses.

Over many centuries, BPL MD has been transformed from a swamp area in the Delta into a varied polder landscape. Peat rivers flowed through the site, and the sea caused clay deposits on the peat and created a structure of creeks containing sand deposits. To drain the swamp, ditches were trenched to create agricultural soils. This stimulated the settling of peat, and the soil dropped. Sand and clay settled less, wherefore creek ridges were formed, and the first villages arose.

Arable farming became more difficult on peat soils due to the rapid subsidence, which led to a shift from arable agriculture to livestock farming. The cattle, which lived on the peat landscape around Delft, supplied Delfland for centuries with dairy. These dairy products were then sold on the Delft market and traded within and outside the Netherlands. The clay and sand soils offered opportunities for the development of horticulture. These areas were mainly the gardens of medieval monasteries and early modern estates. Suitable cultivation soils in clay areas were obtained by excavating and moving sand soils. This transfer was not possible on the wet peat. This landscape remained unchanged until after World War II, when they started building explosively.

To prevent cities from growing together, Midden Delfland became the buffer zone in the 1950s. In the 1970s, the buffer zone

[Fig. 7] Characteristics of BPL MD, made by author

became a region only for nature, recreation, and dairy production. BPL MD is one of the only parts of Westland that still consists of an open landscape. At the end of the 20th century, Westland was almost entirely built with greenhouses, residential areas, and highways. BPL MD's open landscape is crucial for preserving biodiversity and ecological balance in the region. Efforts are being made to protect and maintain this area as a green lung amidst the urbanisation of Westland. The Province of South Holland designated Midden-Delfland as a Special Provincial Landscape (BPL) on 14 November 2017 based on the Nature Act and the Special Provincial Landscape bid book.

To conclude, the landscape of BPL MD embodies a harmonious blend of open polder expanses, winding waterways, historical houses, ditches, and iconic pollard willows, forming a unique and picturesque setting that reflects the region's rich cultural heritage and natural beauty.

Bijzoner Provinicaal landschap Midden Delfland

In 2017, Midden Defland was designated as an exceptional provincial landscape in the middle of the metropolitan region of Rotterdam and The Hague. An exceptional provincial landscape is a landscape that is unique in the province in which it is located. It can consist of characteristic fields, hills, rivers, forest areas, towns, and villages, all connected by historic oaths and roads. It can have a rich cultural history, with sights that characterize a particular province. An exceptional provincial landscape is more than just scenery; it is a unique heritage that reflects the lifestyle and history of its inhabitants (koelman, 2021). Exploring a provincial landscape's cultural and historical significance can provide a deeper understanding of the region's identity and its people. It can also offer a glimpse into how the past has shaped the present and the future for the area.

The territorial municipalities determine the boundaries for the exceptional provincial landscape of Midden Delfland. The basis for the border is the former national buffer zone and the current green buffer zone. This green area contrasts with the surrounding urban area (Nuijten & Aalpoel, 2017). The site has an agricultural core, where the cows are the pasture, and the farmer is the primary manager of the landscape. The presence of cows in the agricultural core contributes to the maintenance of the green area and provides a source of food production. Additionally, the farmer's management practices could positively affect biodiversity and ecosystem services in the surrounding area if they have the proper knowledge.

[Photo 9] Sailing Westlander on the Foppenplas (Midden Delfland, 2020)

[Photo 10] Middelvliet Foppenpolder (Midden Delfland, 2020)

[Photo 11]Schipluiden centre quay (Dries, 2022)

[Photo 14]: Geese (Dries, 2019)

[Photo 12] Water and Knotwilgen (Midden Delfland, 2020)

[Photo 13] Waterstructures (Google maps, 2022)

1.3 Characteristics of the landscape.

BPL MD is distinguished by its remarkable spatial characteristics, which shape the region's captivating landscape. The open polder landscape stands as a defining feature, comprising vast expanses of flat and fertile land that have been reclaimed from the sea over centuries. This expansive terrain, devoid of significant topographical variations, creates a sense of openness and provides panoramic views that stretch to the horizon. From almost every perspective, the skyline of Rotterdam or Delft is visible. For example, visitors may take a bike tour through the polder landscape, passing by grazing cows, sheep, or horses. Along the way, they can enjoy unobstructed views of the nearby cities and observe the intricate network of canals and dikes that make up the region's water management system. The open polder landscape serves as a canvas upon which the other elements of BPL MD's spatial composition come to life.

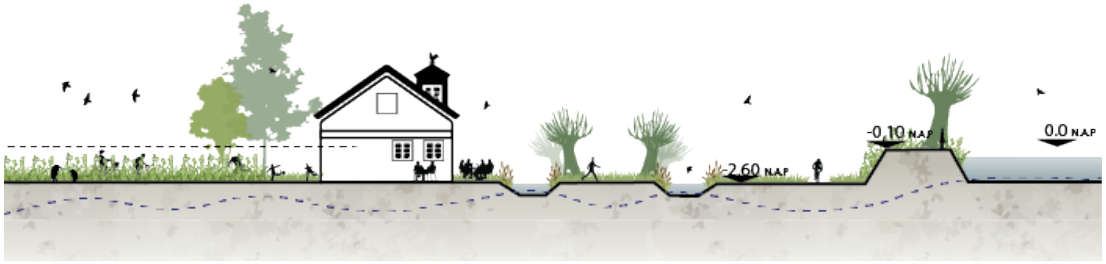
The contrast between the borders of Rotterdam, Schiedam, and Vlaardingen and the agricultural landscape of BPL MD is quite distinct. While the urban areas of Rotterdam, Schiedam, and Vlaardingen are characterized by densely built-up environments, infrastructure, and a bustling urban lifestyle, BPL MD presents a rural and agricultural landscape. Concrete structures, urban amenities, and a high population density dominate the urban landscape. The focus is primarily on accommodating urban living needs, such as housing, employment, and services. In contrast, BPL MD represents a traditional agricultural landscape. The area is

[Fig. 8] Birdview BPL MD, made by author

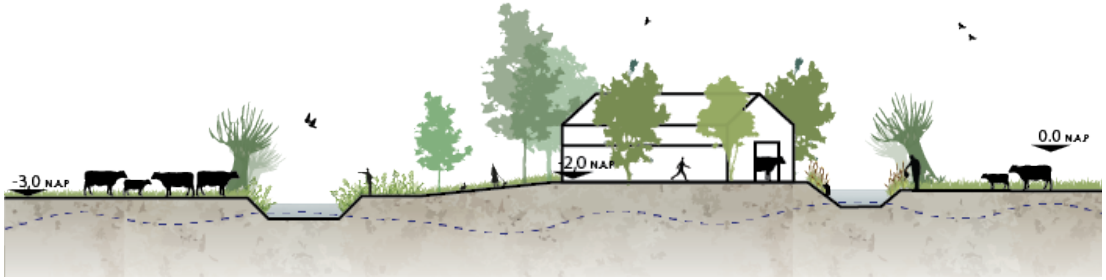
primarily dedicated to agricultural activities, including livestock farming, crop cultivation, and dairy production. The landscape features open fields, meadows, grazing land, and waterways. It is characterized by a more tranquil and rural ambiance, with wide open spaces and a closer connection to nature.
The agricultural landscape of BPL MD reflects a different pace of life and a strong connection to the land. It is shaped by farming traditions and practices that have been passed down through generations.

A green border that frames and enhances the overall landscape is created by the recreational parks and forests that surround the open polder landscape in BPL MD.The forests around the open polder landscape offer a different natural setting. By surrounding the open polder landscape with recreational parks and forests, a green border is created. This green border serves multiple purposes. It acts as a transition zone between the more intensively used urban areas and the rural agricultural lands, providing a visual and physical separation. The presence of green spaces helps to preserve the scenic beauty and natural character of the open polder landscape. Moreover, the green border promotes the connectivity of ecological corridors.

One of the key elements contributing to the region's charm is its network of waterways and canals. Historically, these water features played a crucial role in drainage, irrigation, and transportation, shaping the cultural and economic development of BPL MD. From 1645, barges transported people and cargo via the boezems from Delft to Rotterdam. The intricate web of watercourses creates a visually appealing pattern, connecting



[Fig. 9] Section polder quay (boezemvaart), made by author

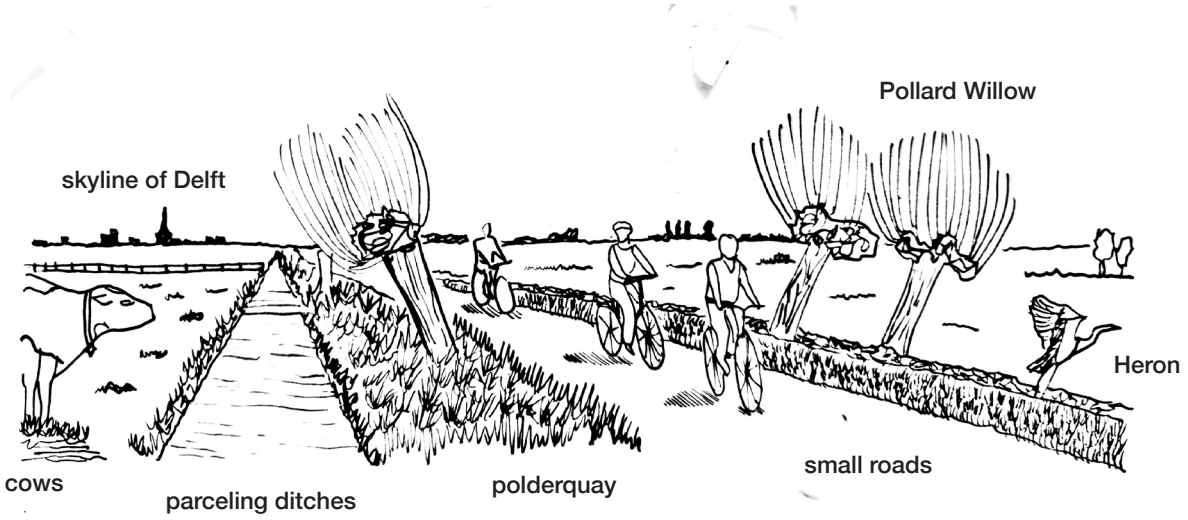


[Fig. 10] Regional flood defense (boezemlint), made by author

villages, farmlands, and natural areas. In the past, even more, ditches were visible in the landscape, but many have been filled in or altered over time. Despite this, the remaining canals continue to be an essential part of the region's identity.

Various lines run through the area, which can be distinguished in the polder and sewerage lint. The sewerage line is located along the higher-lying Boezem Vaart. The polder lines are at the ground level of the polder, which is lower compared to the boezemvaart. Another characteristic of Midden Delfand is the difference between the front (mining base), back, and side of the polder. The line in front of the polder contains the oldest structures, making it the most valuable edge. The back of the polders is mostly without buildings, which enhances the open landscape. One of the advantages of polder lines and sewerage lines is that there is always a clear view of the openness of the polders. This openness is an essential part of the rural character and helps to maintain the connection between human life, agriculture, and nature.

The creek ridge in BPL MD is formed through a natural process of sedimentation and erosion over time. It is a raised strip of land that runs parallel to the waterways or creeks in the area. The creek ridge primarily comprises clay, silt, and sand deposits left behind by water flow over many years. Visually, the creek ridge appears as a distinct elevated feature, often with a gentle slope on both sides. Houses were primarily constructed on the creek ridge because of the level of flood protection the ridge's elevation offers. The creek ridge also holds historical and cultural significance. It represents the natural features that have shaped the landscape and influenced human settlement and land use patterns over time. The presence of the creek ridge has influenced agricultural practices, land division, and the layout of roads and settlements in BPL MD. Its formation and characteristics contribute to the landscape's

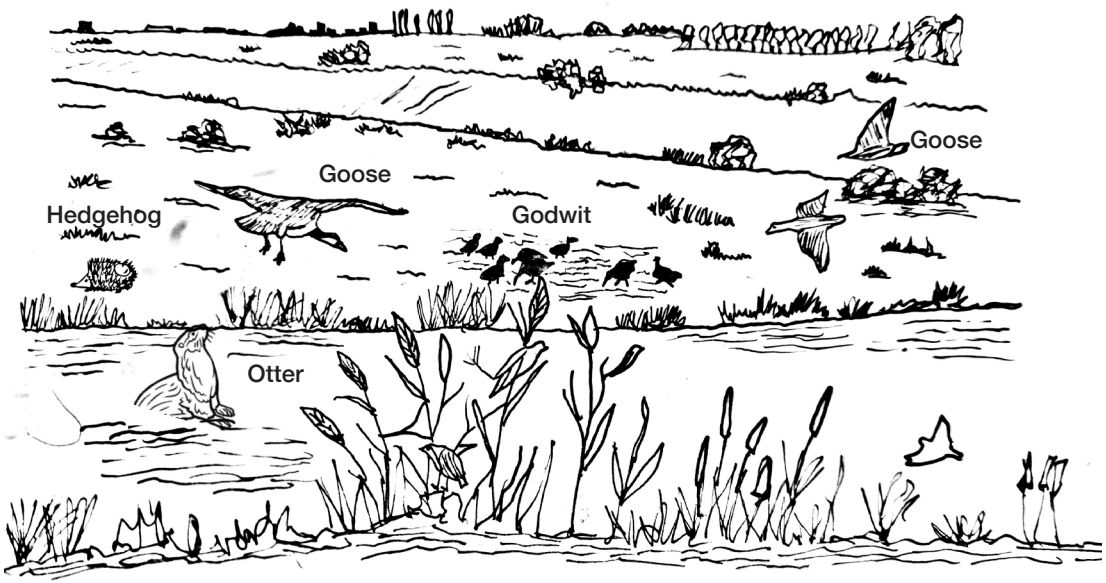


[Fig. 11] Characteristics, made by author

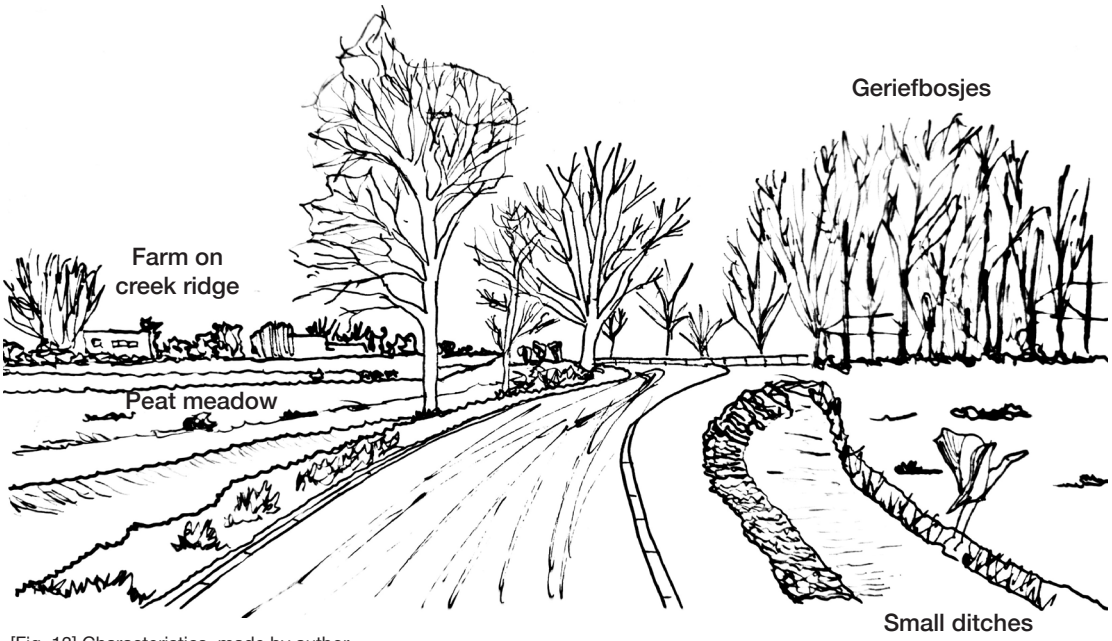
unique charm and ecological value.

Alongside the waterways and scattered throughout the landscape, historical houses on old small roads offer glimpses into BPL MD's heritage. These buildings, often characterized by traditional designs and materials, reflect the region's cultural history and provide a sense of continuity with the past. Taller trees surround the farmyard to protect it from weather conditions. Windmills between those houses can be found, previously used for grinding the polders. These historical landmarks and natural scenery make it a must-visit destination for those interested in Dutch culture and history. Preserving and highlighting these historical landmarks can contribute to the overall sense of place and enhance the region's identity.

Another typical characteristic is the Pollard Willow, which bestows a distinct and captivating identity upon the region. These majestic trees, with their characteristic gnarled trunks and gracefully pruned branches, contribute to the area's visual charm and cultural heritage. The tradition of pollarding, a centuries-old practice of trimming the branches of willow trees to encourage new growth, has shaped the unique appearance of the pollard willows in BPL MD. The pollard willows have both practical and aesthetic significance. Historically, they served as a sustainable source of timber for various purposes, including fuel, fencing, and traditional crafts. The regular pruning of the trees provided a continuous supply of wood and contributed to the maintenance of waterways by preventing the overhanging branches from obstructing navigation. This interplay between human intervention and the natural landscape is a testament to the symbiotic relationship between the people of BPL MD and their surroundings. Pollard willows in



[Fig. 12] Characteristics, made by author



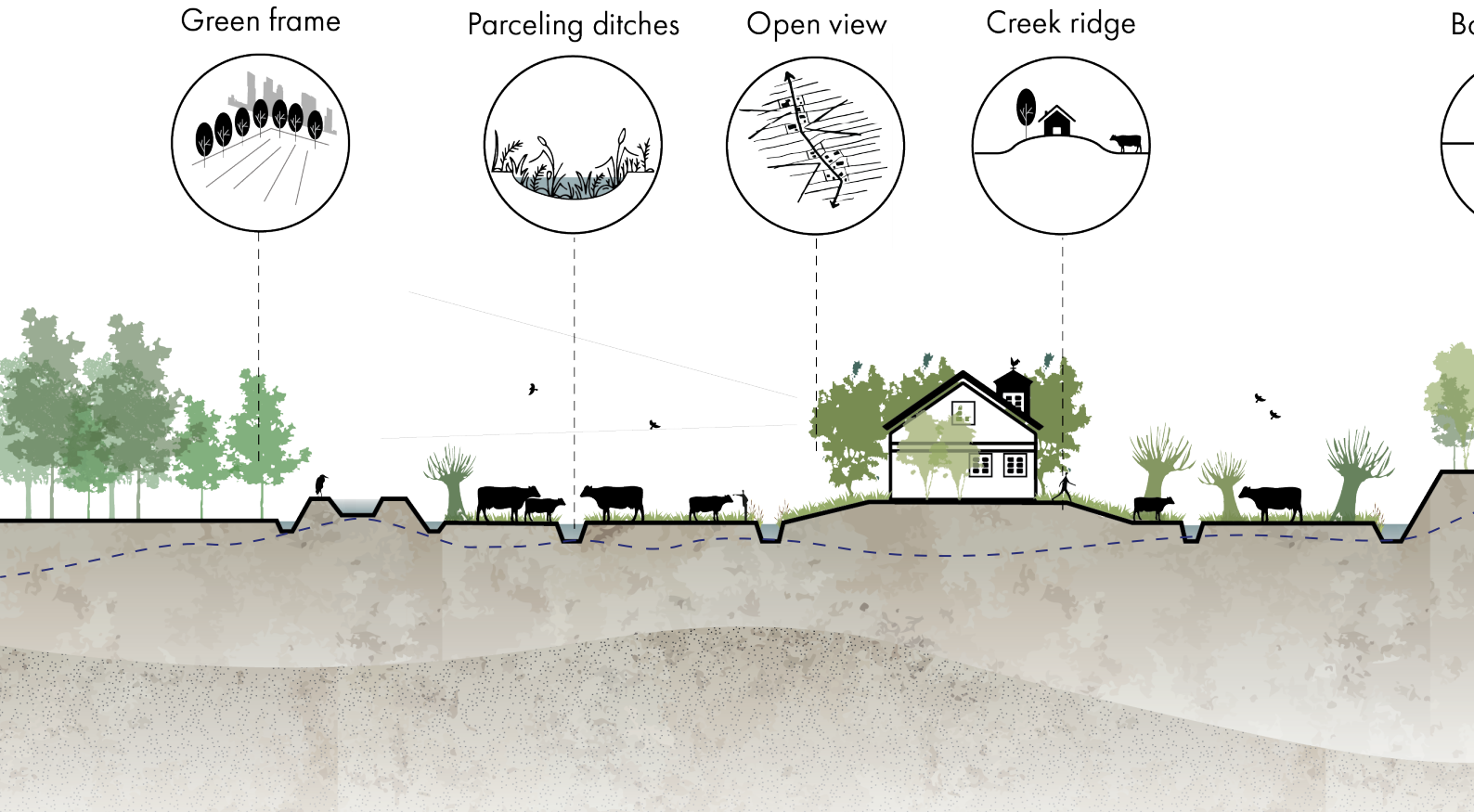
[Fig. 13] Characteristics, made by author

BPL MD contribute to the overall sense of place and reinforce the region's cultural and environmental values. They evoke a sense of timelessness, connecting the present-day landscape with its historical roots. Along with the Pollard Willows, there are other small groups of trees called "Geriefbosjes," from which the coppice that was used inside and outside the house was once cut.

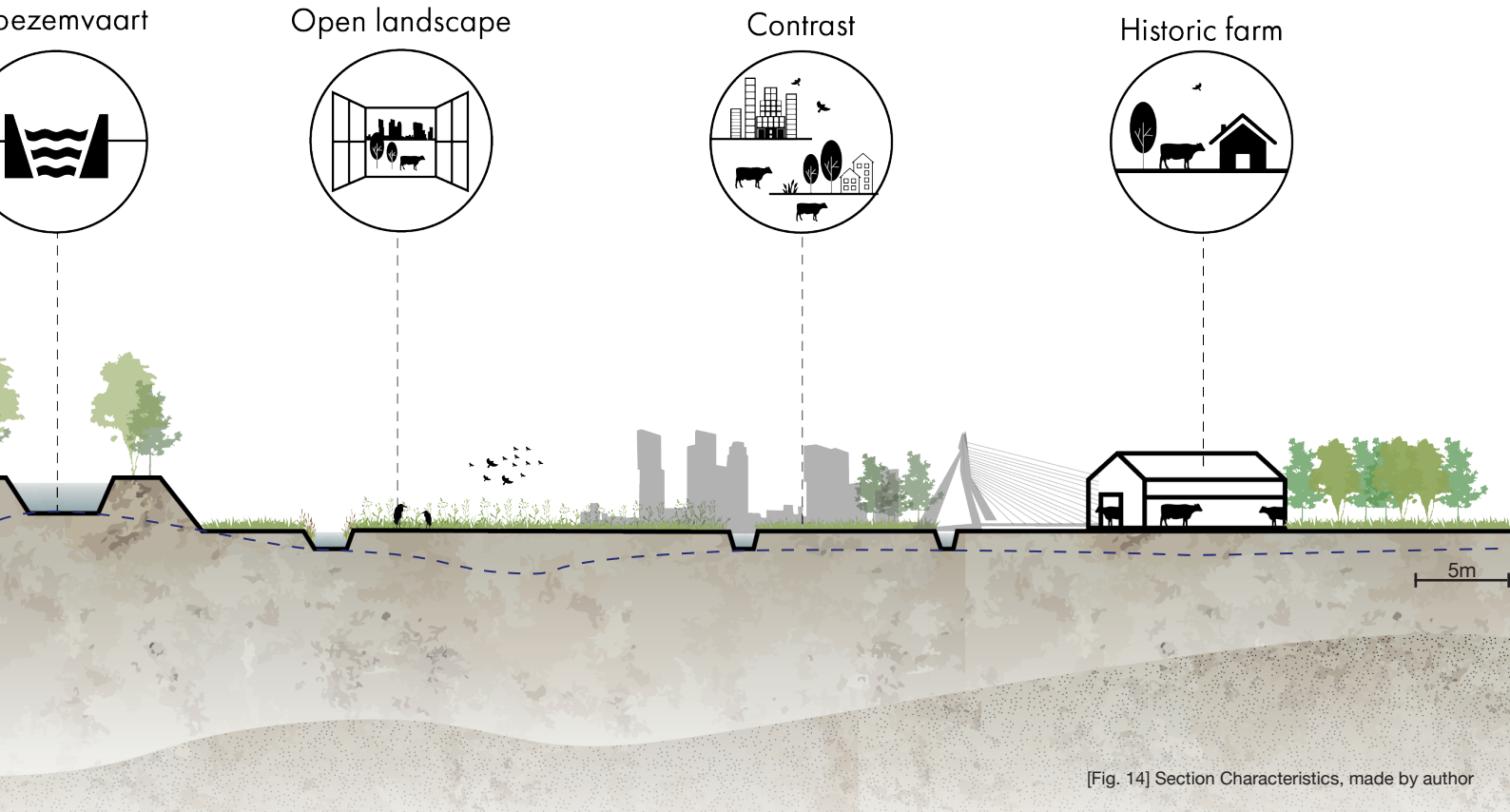
BPL MD's landscape has changed over the years, influenced by urbanisation, agricultural practices, and land-use policies. Rapid urban expansion and infrastructure development have posed challenges to preserving the open polder landscape and traditional features. While crucial for food production, intensive agriculture has led to biodiversity loss and reduced conventional spatial qualities. To counteract these changes, a balanced approach is necessary, one that seeks to protect and enhance the region's unique polder structure where people can see how milk is made. By recognizing the significance of BPL MD's spatial characteristics, understanding their evolution, and implementing strategic measures, the region can preserve its unique identity and contribute to sustainable and resilient development.

[Photo 14] Godwit (Kef, 2015)

[Photo 15] Boezemwater (Gemeente Midden Delfland, 2021)



[Photo 16] Bridge (Gemeente Midden Delfland, 2021)



[Fig. 14] Section Characteristics, made by author

1.4 Agriculture.

The open polder landscape of BPL MD has a rich agricultural history that has shaped the region's identity and land use patterns. Over the past years, the agricultural landscape has significantly changed, influenced by various factors. This paragraph explores the historical changes in the agricultural landscape of Midden Delfland, examines the visible traces of these changes in the present-day landscape, and delves into the significance of dairy farming and the iconic image of cows in the meadow (Gemeente Midden-Delfland, 2021).

The landscape was created through extensive land reclamation efforts, transforming marshy areas into arable land for agricultural use. Drainage systems and canals were established to regulate water levels, enabling agrarian practices. Many farmsteads and historic buildings scattered throughout BPL MD are tangible reminders of the region's agricultural heritage. These structures reflect traditional architectural styles and demonstrate the historical importance of farming in the area. The intricate network of ditches, canals, and water management systems in BPL MD highlights the historical significance of land drainage and water control for agricultural purposes. These features are still visible and actively maintained today. The remnants of old field patterns and hedgerows provide insights into the historical layout of agrarian land use. Midden-Delfland farmers have been giving food since Roman times. Potions, vegetables, and fruits were grown from milk, butter, and cheese. Many farmers used to have only 10 to 12 cows. With these, the farmer earned enough money to live and did not need a servant. Today, most farmers have around 100 cows, and the presence of cows in the landscape contributes to its visual appeal and cultural identity. Dairy farming contributes to preserving open spaces.

The question is how dairy farming in BPL MD should or can continue. Scaling up is costly, and intensification is hardly possible. The option exists to put sustainability above maximum production. So instead of betting on milk champions with 10,000 L of milk, we focus on a cow with a slightly lower production, using less concentrate and more roughage from our own farm. There are also all kinds of initiatives that increase the quality of the area: from recycling farmers to farmland trails, from crossing paths to a collective for agricultural animal management, and from pollard ploughs to a meadow bird pact.

[Photo 17] Cow

in meadow (Boerin in Midden Delfland, n.d.)

'Plasdras hebben ze er van gemaakt en allemaal riet groeit er, ik vind er persoonlijk weinig aan. Die wandelpaden er doorheen vind ik allemaal prachtig. Het is mooier geweest toen het nog open was.' - Anton van der Ende

"Het landschap zelf is niet heel erg veranderd, het groen is hetzelfde gebleven. In een weggetje waar nu nog 10 boeren zitten zaten er vroeger 100 met 10 koeien. Nu zitten er 10 boeren met 100 koeien." - Maarten Moerman

'Ik zie liever een kleurrijke omgeving met bloemetjes en gras dan alleen maar dat rare bruine riet, ik vind daar echt niks aan.' - Anton van der Ende

'Kijk eens eromheen, het stelt toch eigenlijk nisk meer voor? Het is een heel klein beetje grasgebied en overal liggen paden en overal is recreatie. Dat hoeft voor mij absoluut niet ook nog op het boeren terrein.' - Paul Oosthoek

'Ik ontvang wel eens groepen en dan laat ik ze het land zien, beetje om mensen te koppelen aan het platteland. Heel midden Delfland is al heel toegankelijk, vind ik.' - Paul Oosthoek

"Diepere wortels door bijvoorbeeld kruidenrijk gras maken het land steviger, maar de bodem is hier te zuur." - Bas van den Berg

"Het stuk grond is voor mij gewoon een productiemiddel, er moet gewoon voer groeien, goed onderhouden, het moet niet onder water staan." - Maarten Moerman

1.5 Recreation.

The region of BPL MD not only holds a rich agricultural heritage but also offers diverse recreational opportunities for both locals and visitors. This chapter explores the recreational functions within BPL MD, their historical evolution, and their effects on the region's spatial quality. It further discusses the changing recreational landscape over the years and addresses the area's future needs, considering the growing population and the preservation of the landscape.

BPL MD has a long-standing tradition of offering recreational activities to its residents and recreants. Over the years, recreational functions have expanded to include various outdoor activities like hiking, cycling, boating, and nature observation. The region's abundant natural and cultural assets, including open landscapes, waterways, historic sites, and nature reserves, provide the foundation for recreational experiences.

The development of recreational infrastructure, including trails, cycle paths, and water routes, has improved accessibility within BPL MD. This has allowed people to explore and appreciate the region's natural and cultural landscapes, enhancing their spatial experience. Integrating recreational functions alongside agriculture has contributed to a diverse and dynamic land use pattern. However, there is also a conflict between these two because recreation interferes with farmers' work. For example, the popular cycle route through BPL MD passes through working farms and can disrupt the farmers' daily routines. Additionally, some

[Fig. 15] Drawing recreation

farmers have expressed concerns about safety for both cyclists and livestock.

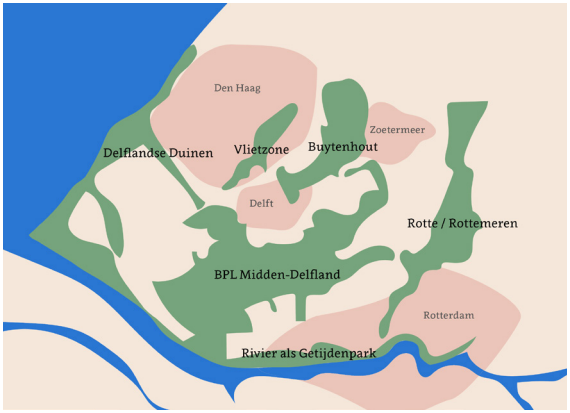
Over the years, recreational areas within BPL MD have evolved in response to changing demands and preferences. The primary purpose of the Midden-Delfland Reconstruction Act, enacted in March 1977, was not only to protect the area from urbanization and improve the organization of the peat meadow region but also to incorporate recreational activities alongside its agricultural function. This change in purpose has significantly influenced the character of Midden-Delfland. Once it became evident that housing and industrial development would be halted, property owners, including farmers and stable owners, felt more confident in renovating or selling their outdated properties. As a result, Midden-Delfland has seen an increase in the number of tastemakers, offering regional products for purchase or providing accommodations. Consequently, the region has experienced a rise in visitor numbers.

However, the surge in recreational use also has its drawbacks. The increased activity has led to more congestion, which increases the likelihood of annoyance and vandalism. For example, speedboats encroach on the riverbanks, and motorcycle and moped riders disturb meadow birds by crossing the meadows during breeding season. Moreover, the pressure on the natural environment and its values has intensified. Striking a balance between utilization, preservation of the landscape, and protection of nature is challenging due to varying preferences and desires. Some visitors seek tranquility, while others prefer a pleasant picnic with a group. Conflicting attitudes towards dogs also arise, as some allow them to roam freely while others fear them. People have different interests, such as walking, cycling, horseback riding, or mountain biking. Additionally, there is an increasing demand for areas dedicated to sports, relaxation, and contemplation.

Addressing the needs of new user groups, particularly those focused on health, goes beyond simply opening up roads and pathways. As the number of recreationists and tourists in the area continues to grow, it becomes necessary to make clear choices. Accommodating all desires within the same area is often not feasible. To guide recreational activities in the right direction, it is important to encourage desirable behavior through information, zoning, and signage. Informing visitors about the natural, cultural, and landscape values present in the area, as well as how they can help preserve them, can help prevent damage and nuisance. Additionally, visitors can be made aware of the expected code of conduct. Zoning and design measures can also be implemented to minimize disturbances and steer recreational activities appropriately. This approach ensures that Midden-Delfland remains appealing to everyone while preserving its unique provincial landscape. Former industrial sites, such as abandoned farms and mills, have been repurposed into recreational spaces, preserving their historical and cultural value.

With a growing population, the future of recreational functions in BPL MD needs to address the increasing demand for leisure activities. This includes the provision of well-maintained infrastructure, facilities, and services to accommodate diverse user

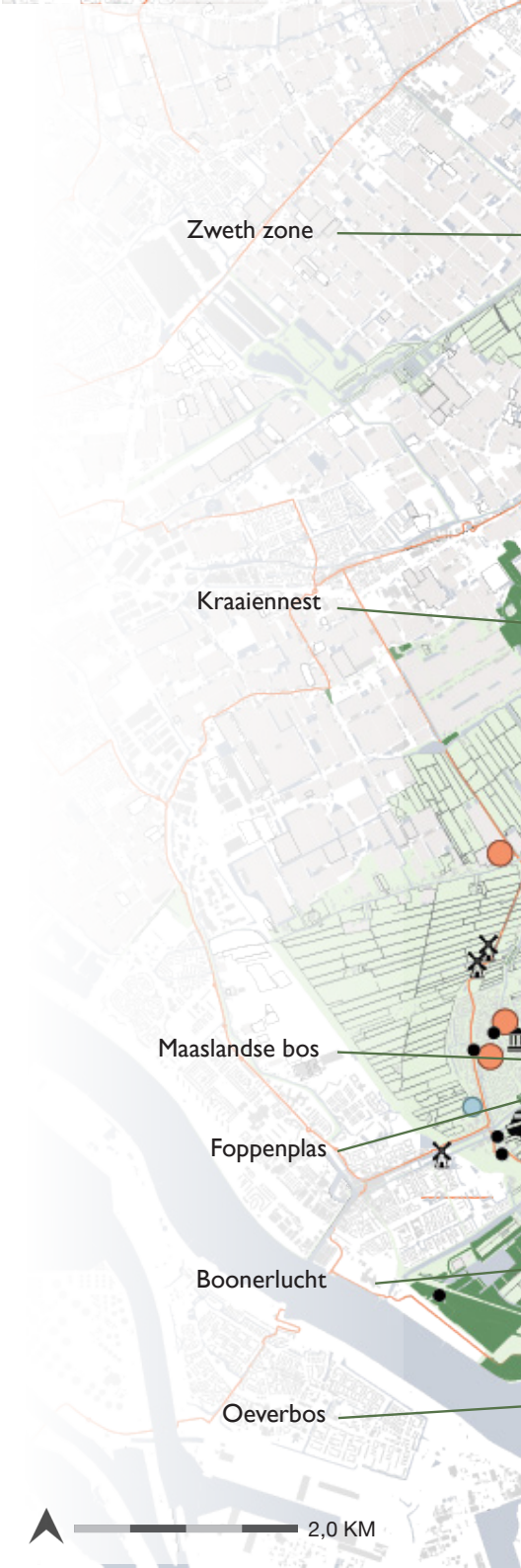
groups. Future planning should focus on preserving the unique landscape character of BPL MD. This entails safeguarding open vistas, protecting cultural heritage, and balancing recreational activities and the region's agricultural functions.

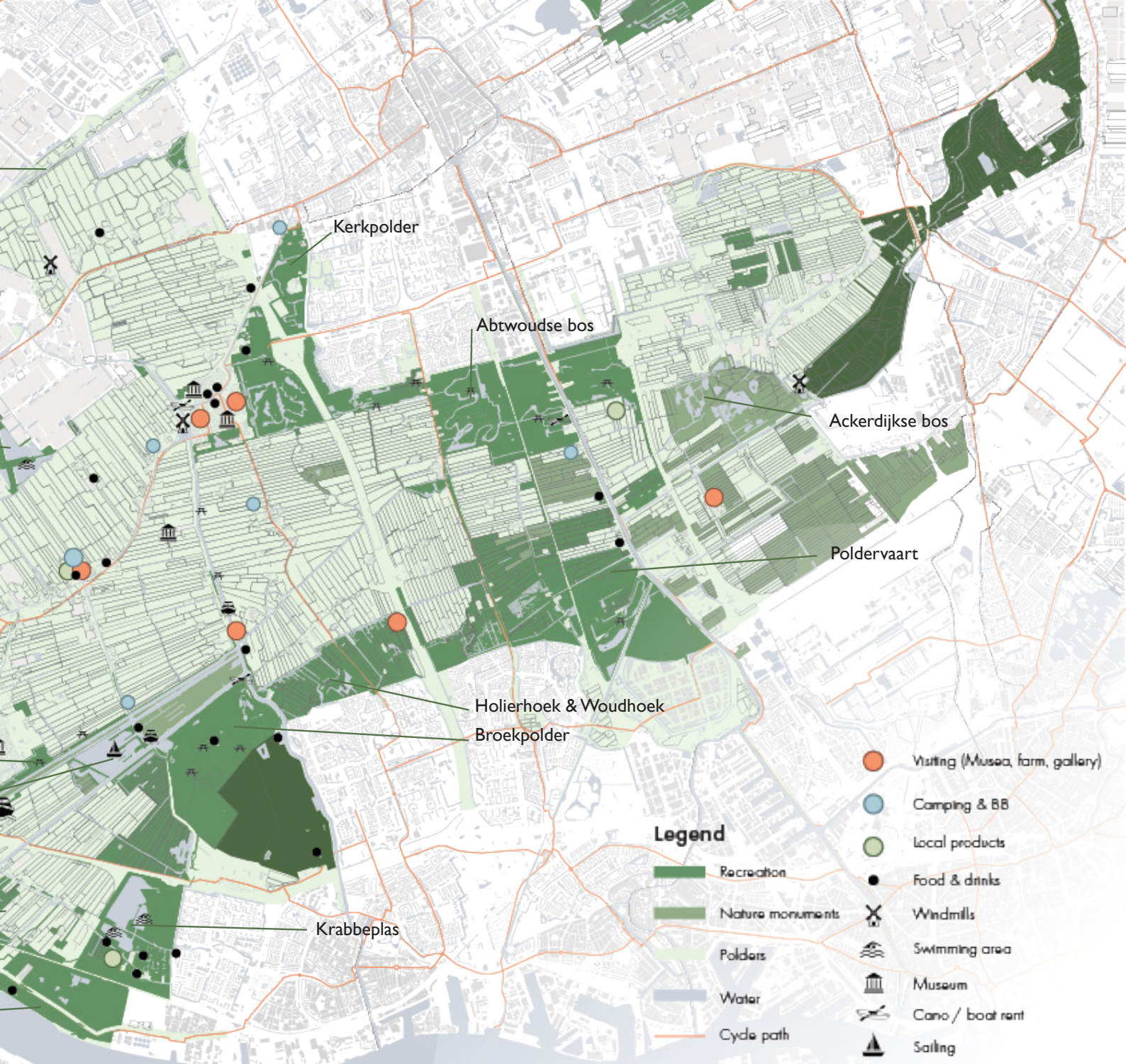


[Fig. 16] Regional parks (Stichting landschapsfonds Hof van Delfland, n.d.)

1.5.1 Recreational areas

Abtswoudse Bos: The Abtswoudse Bos is ideal for a walk or a bike ride.
Ackerdijkse Bos: Recreational area Ackerdijkse Bos is a young and attractive area.
Boonerlucht: Recently constructed area with a large pond in the centre. The walking and cycling paths offer many possibilities.
Broekpolder: Wooded area with an extensive system of cycling and walking paths. Experiencing nature, walking and cycling are the main forms of recreation.
Foppenplas: On the Foppenplas, water sports enthusiasts can indulge themselves.
Holierhoek, Woudhoek and Oost-Abtspolder: Holierhoek, Woudhoek and Oost-Abtspolder together form a green strip to the north of Vlaardingen-Holy and Schiedam.
Kerkpolder: Wooded landscape containing the centuries-old Tanthofkade. Also many sports facilities.
Kraaiennest: The Kraaiennest is located between the greenhouses of De Lier with footpaths and lakes.
Krabbeplas/Zuidbuurt: In summer, the Krabbeplas is a paradise for swimmers, surfers and sunbathers.
Maaslandse Bos: Woody young area located next to the Noordvliet (Maassluise Trekvaart). Ideal for a walk in combination with the polder landscape of Midden-Delfland.
Oeverbos/Rietputten/Volksbos: Oeverbos: park-like layout with many playing meadows along the Nieuwe Waterweg. Volksbos: varied area with many breeding birds and butterflies. Rietputten: natural area with large number of marsh plants and birds.
Poldervaart/East Abtspolder: Poldervaart: recreational area along the Poldervaart. Oost Abtspolder: area is being landscaped and will at least be accessible to walkers and cyclists.
Woudse Bos: Small-scale park-like area with beautiful walking and cycling paths.
Zweth Zone: An elongated recreational area along the Zweth running from the Vliet in Rijswijk to the Wollebrand near Naaldwijk.





[Fig. 17] Recreation, made by author (Google maps, 2022)

1.6 The landscape

PROBLEM

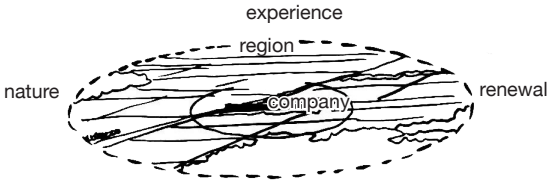
- Lack of space
- Decline in landscape quality
- Legitimacy of agriculture

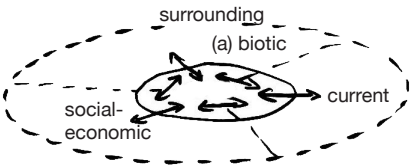
SOCIAL NEEDS

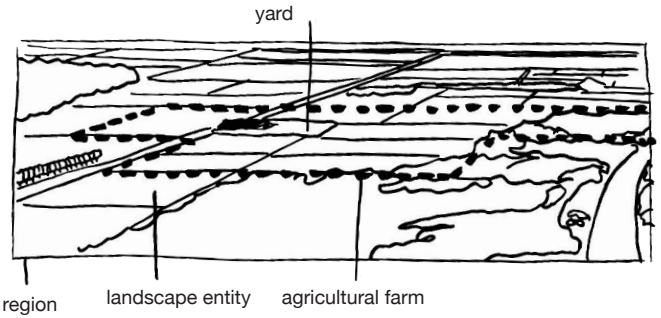
- Local/regional
- Room for nature, water and recreation
- Sustainable agriculture
- Landscape is the priority

STRATEGY

- Landscape as guiding support
- Green services
- Multifunctional landuse
- Innovative agriculture







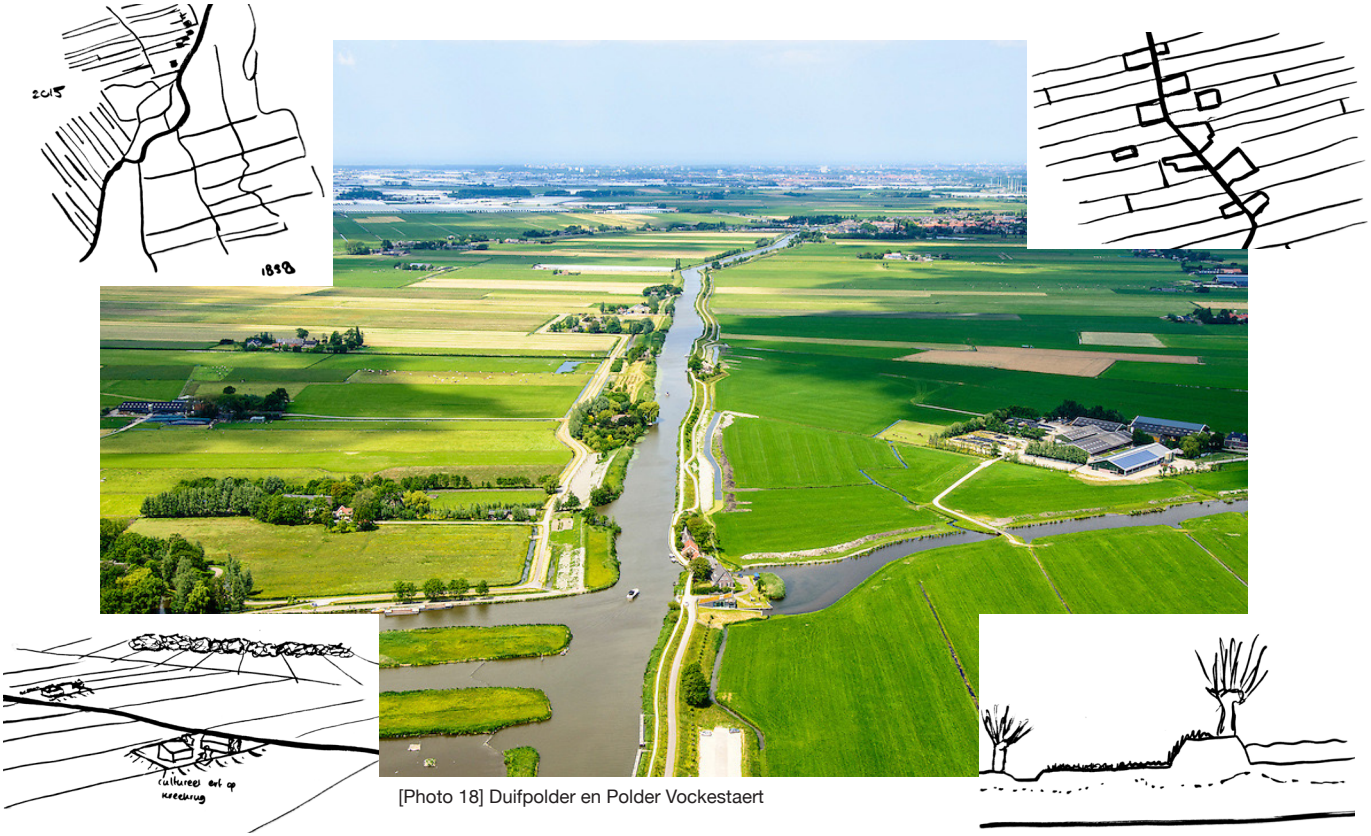
[Fig. 18] Landscape strategy, made by author (Hendriks & Stobbelaar, 2003)

Historical cohesion

The expression of a moment in history in landscape patterns and landscape elements. in the valuation of cultural-historical elements, the criteria of age, coherence, rarity and typicality are often used (Renes, 1992; Hendrikx 1999)

Horizontal cohesion

The expression of functional/agronomic, ecological and hydrological relationships in the spatial composition of landscape elements and patterns, such as buildings, roads/paths and plantings. Horizontal patterns may have a more natural character (Lorzing, 1982)



[Photo 18] Duifpolder en Polder Vockestaert

Seasonal cohesion

The expression of a moment in the year in colours and shapes of natural elements and in activities. According to Van der Schouw and De Veer (1981), concrete landscape features such as vegetation and argrarian land use show the most striking seasonal effects.

Vertical cohesion

The expression of local natural features such as soil, geomorphology and water in relief, water features, vegetation and land use. Vertical relationships are key to landscape diversity (Kuiper, 1998)

[Fig. ?]: Made by author (Hendriks & Stobbelaar, 2003)

Problem descrip

[Photo 19] Cows in meadow (Gemeente Midden Delfland, 2021)

2.1 Problem field.

2.1.1 Precipitation and drought

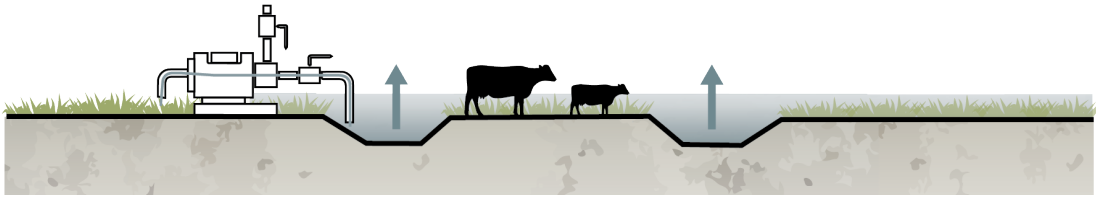
Climate change can have various negative impacts on different regions of the world. In general, it can lead to rising sea levels, more extreme weather events, and changes in precipitation patterns, all of which can significantly impact coastal areas like BPL MD. One of the main concerns in the province of South Holland is the potential for flooding due to rising sea levels. The low-lying region is already at risk of flooding from storm surges and high tides. As sea levels continue to rise, the frequency and severity of flooding events will likely increase, which could have severe consequences for the local economy and communities. This also applies to BPL MD, but it's not the most pressing issue to be concerned about; instead, the threat will come from the heavy precipitation (Hoogheemraadschap Delfland, 2020).

Heavy precipitation is considered one of the biggest problems in BPL MD due to its potential impact on the region's low-lying and predominantly flat landscape. The area's low elevation, coupled with its proximity to rivers, estuaries, and the sea, makes it vulnerable to the effects of heavy rainfall. When heavy precipitation occurs, BPL MD faces several challenges. Firstly, the excess water from extreme rainfall can overwhelm the existing drainage systems, leading to localized flooding. The region's flat topography hampers the natural flow of water, necessitating artificial drainage networks to regulate water levels. However, these drainage systems can become overwhelmed during extreme rainfall events, resulting in water accumulation and potential inundation.

Additionally, heavy precipitation contributes to soil saturation, which can negatively impact agricultural activities in BPL MD. The region's agricultural landscape relies on well-drained soils to support crop growth and livestock farming. Excessive rainfall can impede soil drainage and hinder agricultural operations, potentially leading to crop damage, decreased productivity, and difficulties managing livestock and grazing areas. Furthermore, climate change is expected to make heavy precipitation events more frequent and intense. This poses a long-term challenge, as the region needs to adapt and develop resilient strategies to manage increased rainfall and mitigate the associated risks (Bessembinder, Wolters & Van Hove., 2013).

At the same time, the soil in BPL MD is declining, mainly because water is pumped out of the polders to keep them dry and to keep the soil suitable for dairy production. However, when large amounts of water are pumped from the ground, the underlying soil and rock can become less supported, leading to subsidence. On soils with peat, the decrease can be up to 1 cm per year (Bodemdaling Delfland, 2022).

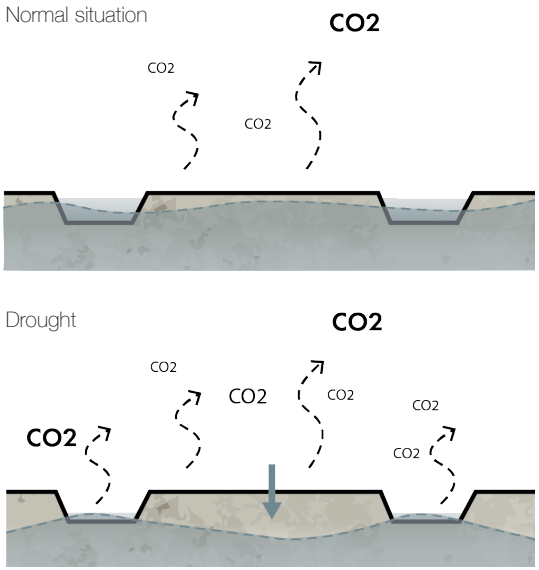
When peat comes into contact with air, it decomposes or oxidizes. This releases many greenhouse gases, including CO2, contributing to global warming. Peat oxidation also



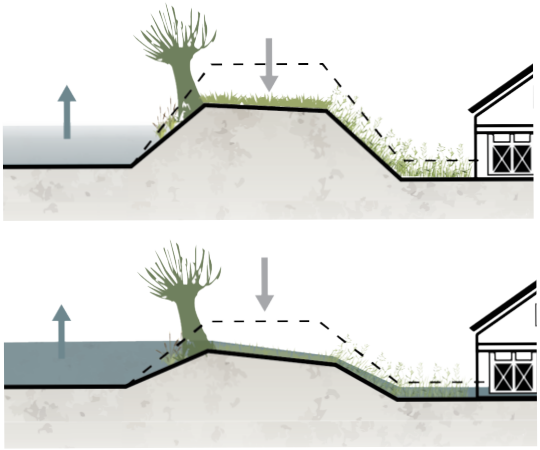
causes problems in other ways; drought creates lows and hollow parcels. Subsidence is accelerated by depletion, while areas with subsidence are at the same time extra vulnerable to flooding (Gemeente BPL MD, 2021). Drought leads to decrease of the groundwater level, resulting in oxidation.

Drought and precipitation are closely related in BPL MD as they play key roles in the region's water balance and agricultural activities. In Midden Delfland, the relationship between drought and precipitation is such that prolonged periods of below-average or insufficient precipitation can lead to drought conditions. Conversely, excessive or intense precipitation events can also contribute to drought-related challenges. In some cases, heavy rainfall can lead to surface runoff and reduced infiltration into the soil, causing water to flow quickly over the land instead of replenishing groundwater reserves. This can limit the availability of water during drier periods and exacerbate the effects of drought. Therefore, maintaining a balanced and sufficient level of precipitation is crucial for preventing drought conditions and ensuring sustainable water resources in BPL MD. It requires effective water management strategies, including water storage, efficient irrigation practices, and monitoring rainfall patterns to mitigate the impacts of drought and extreme precipitation events.

Due to the settlement of the soil, the dikes on soft soil and the hinterland are getting



[Fig. 20] Decrease water level (Watervisie, z.d.)



[Fig. 19] Sinking water quay, made by author (Watervisie, z.d.)

[Fig. 21] Precipitation trend, edited by author (Klimaatverandering Zuid Holland, z.d.)

lower. This has an impact on the dike-safety of these areas, as the height of the dikes is no longer sufficient to protect them from flooding. That is why space must be reserved around these dikes to be able to raise the height of the dikes. By reserving this space around dikes, the height can be increased by creating additional storage capacity to safely control water levels and prevent flooding.

Overall, climate change poses a serious threat to Midden-Delfland and the surrounding areas and it is important that steps are taken to mitigate its impacts.

Legend

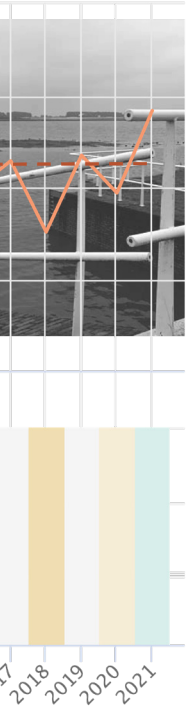
Meanly yearly precipitation 1979-2023
The province of South Holland

Linear trend climate change

Precipitation trend

1200mm
Heavy precipitation

Drought
600mm



[Photo 20] Akkerdijksepolder flooded (Bas van den Berg)

[Photo 21] Akkerdijksepolder now, made by author

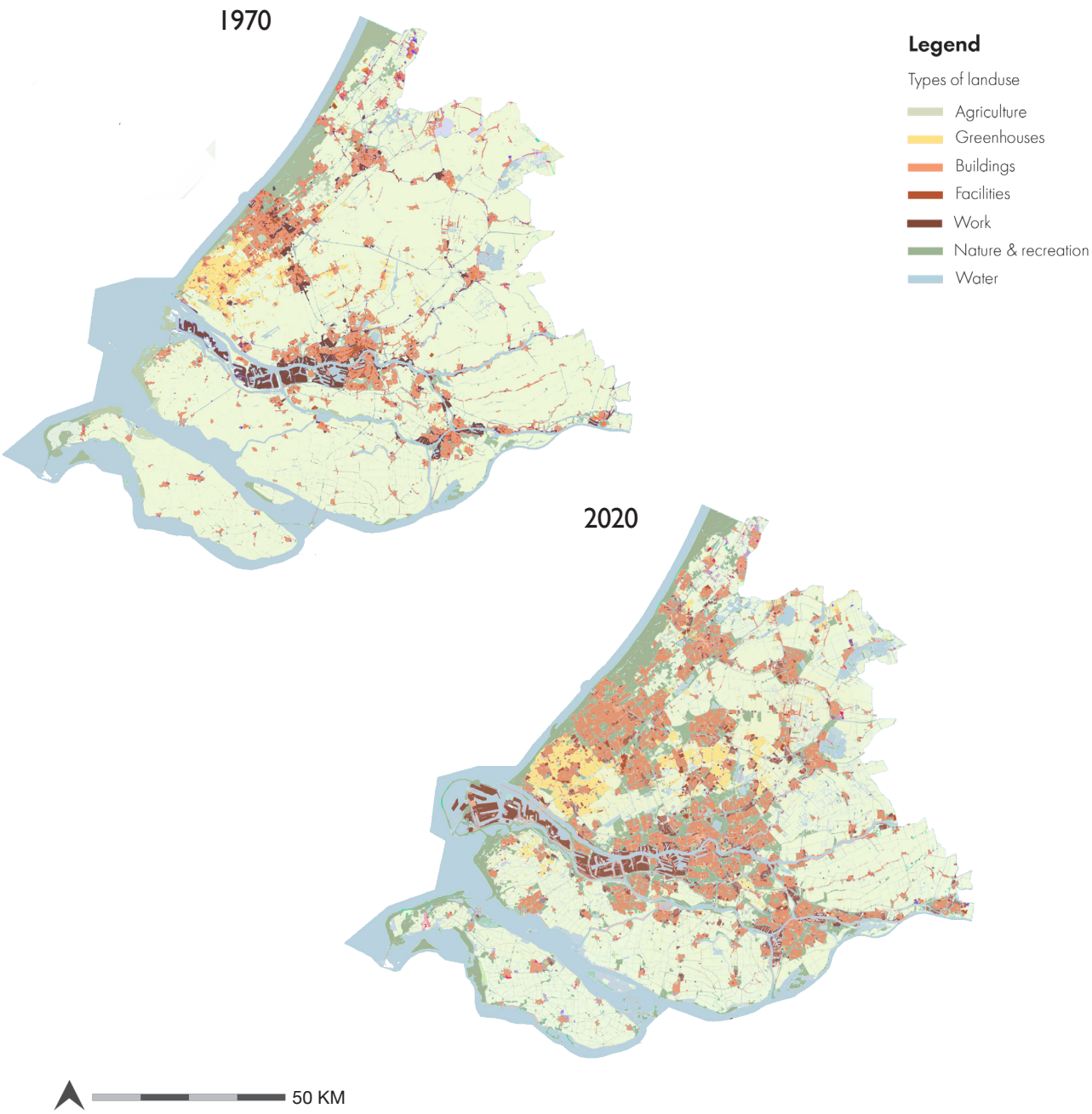
2.1.1 Landuse change

An important driver of space changes is the housing shortage. Until 2040, there is a housing need for 250,000 new homes in South Holland. This will be given a spatial interpretation through densification, restructuring, and inner-city transformation (CBS, 2016). With the arrival of these new dwellings, the pressure on the surrounding landscape is increasing. In the second half of the last century, you saw an enormous growth in urbanisation, and a big part of the greenery disappeared. Highways, rail lines, high-voltage cables, and roads cross the area, and the encroaching city is not far away. 2 million people live directly around the nature reserve.

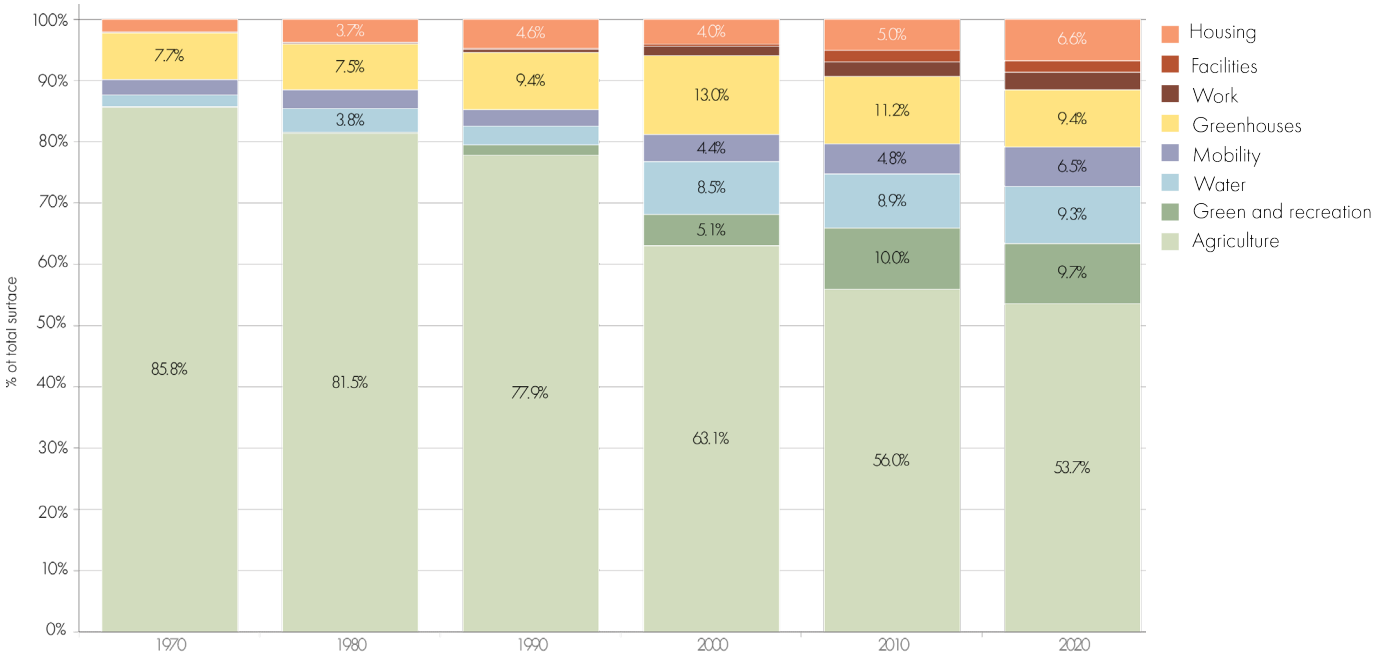
BPL MD is unique with its traditional peaty meadows, cows, and windmills. Initially, the entire 8000 ha hectares of the area were used for dairy farming, but now there is only 4,000 hectares left. Land-use changes in this region significantly impact the landscape's spatial qualities. The conversion of agricultural land to other land uses, such as urbanization or infrastructure development, can alter the natural and cultural characteristics that define the region. BPL MD is known for its open polder landscape, characterized by expansive agricultural fields, meadows, and waterways. When land-use changes result in the loss of agricultural land, the distinct open character of the landscape can be compromised. The introduction of built-up areas, roads, and structures can disrupt the visual continuity and openness of the polder landscape. Land-use changes also lead to the fragmentation of the landscape. Large-scale agricultural fields may be divided into smaller parcels for development purposes. This fragmentation can disrupt the continuity of the landscape and impact the ecological connectivity between different areas. It can impede the movement of wildlife and limit the functionality of ecosystems.

Furthermore, the landscape is intertwined with its cultural heritage, including historical farms, windmills, and other traditional structures. Land-use changes that neglect or remove these cultural elements can result in a loss of historical identity and diminish the cultural value of the landscape. To maintain and enhance the spatial qualities of the landscape, careful consideration of land-use changes is essential.

With an increased population and more housing on the city's outskirts, more people will want to recreate in BPL MD. When too many people use the recreational functions in this region, there is a risk that the region's identity can become diluted or lost. An excessive influx of visitors can lead to overcrowding in the recreational areas. This overcrowding can result in a loss of the peaceful and serene atmosphere that characterizes the region. The natural beauty and tranquillity of the landscape may be compromised, diminishing the area's unique identity. Increased visitor numbers can place significant pressure on the natural resources and infrastructure of BPL MD. The demand for facilities such as parking, trails, and amenities may exceed the area's carrying capacity. This strain on resources can lead to the degradation of the landscape and a decline in the overall quality of the recreational experience.



[Fig. 22] Urbanisation 1970-2020, edited by author (Provincie Zuid Holland, 2022)



[Fig. 23] Distribution landuse 1970-2020, edited by author ((Linhares et al., 2022)

BPL MD is an agricultural landscape where farming plays a vital role. The increased presence of recreational users can create conflicts with agricultural activities. Activities such as walking, cycling, or picnicking in areas close to farming operations can disrupt the daily operations of farmers and potentially harm crops or livestock. This conflict can lead to tensions between different user groups and compromise the harmonious coexistence of agriculture and recreation.

The identity of Midden Delfland is deeply rooted in its agricultural heritage and open polder landscape. When recreational functions become dominant and overshadow the agricultural character, the authentic identity of the region can be eroded. The traditional practices, cultural heritage, and rural charm that define BPL MD may fade away, giving way to a more generic recreational environment.

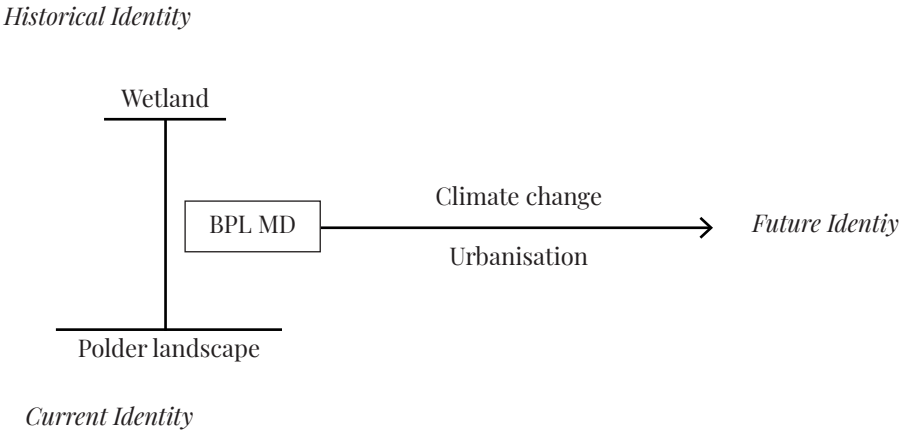
To prevent the loss of identity, it is crucial to manage recreational activities sustainably and strike a balance between the number of visitors and the area's capacity. Visitor management plans, zoning regulations, and carrying capacity assessments can ensure that the recreational functions do not overwhelm the landscape and compromise its unique identity. By preserving the agricultural heritage, respecting the needs of farmers, and promoting responsible and respectful visitor behavior, BPL MD can maintain its identity as a distinctive and authentic rural landscape.

[Fig. 24] Increase in population, edited by author ((Linhares et al., 2022)

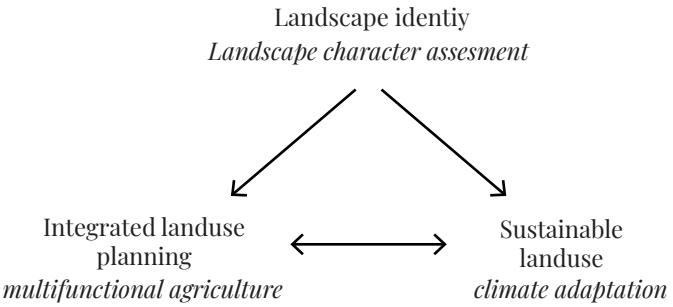
2.2 Problem statement

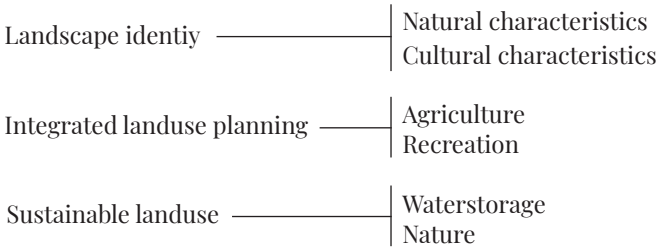
The problem statement emerges from the problem field, which refers to the broad context or area of concern where issues or challenges exist. In the case of BPL MD, the problem field is the intersection of urbanization, climate change, and agricultural land use. It encompasses the various challenges and complexities associated with these factors and their impact on the region's landscape, environment, and community. The problem field helps establish the broader context and sets the stage for defining a specific problem statement that encapsulates a particular issue.

Problem field	Climate change	Extreme droughts
		Extreme precipitation
	Urbanisation	Increasing demands (recreation)
		Excessive landuse



The chosen region has a complex history in which the influence of people can be clearly seen in the landscape. This layered landscape with an intriguing system of elements,





patterns, and structures from different time layers creates a unique environment. Over time, agriculture and recreation shaped the landscape into what it looks like today (Aalpoel & Nuijten, 2017).

However, two pressing issues are changing the characteristics of this peat meadow landscape: 'climate change' & 'urbanisation'. Due to urbanisation, the peat meadow landscape is diminishing, and as the population grows, more people will seek recreation in this area (Ustaoglu & Williams, 2017). This will eventually disrupt the BPL MD. Furthermore, climate change is causing shifts in water levels, soil subsidence, and biodiversity declines (Erkens & Kooi, 2018). These factors are having an increasinly devastating effect on the spatial characteristics of the landscape.

As a result of urbanisation and climate change, it is becoming more difficult to maintain a healthy and resilient peat meadow landscape (Koningsveld et al., 2008). This makes it more complicated for agriculture and recreation to continue operating. When spatial characteristics of the landscape of BPL MD deteriorate, the region's value deteriorates as well.
To keep BPL BPL MD's delicate ecosystem sustainable, agricultural practices and recreational activities must be adapted and redesigned. This new design should take into account the spatial qualities of the landscape, including it's vegetation and terrain, as well as its's cultural and historical context (Lee et al., 2006). Such adaptation could include implementing more diverse ways of farming, such as wet cultivation or dairy farming on high water levels. Additionally, recreation activities should be regulated to prevent overcrowding and overuse of resources

Urbanisation and climate change tendencies present problems that take time to change. However, it is possible to reverse the unsustainable trend in agriculture into a future resilient approach while improving recreational opportunities. This graduation report's main objective is to make a new design for BPL MD where agriculture and recreation become the pillars for a new resilient and appealing open polder landscape while enhancing and strengthening the landscape identity. Therefore, the research for this graduation report will focus on agriculture and recreation.

2.3 Time frame

Creating a new vision for BPL MD set explicitly in 2070 instead of 2050 or 2100 demonstrates a thoughtful and strategic approach to long-term planning. primarily because climate change won't be as extreme in 2050 as it will be in 2070. However, 2100 would be too far off to create a realistic design. Here are a few reasons why this particular timeframe has been selected:

Setting the vision for 2070 strikes a balance between being practical and forward-thinking. It allows for implementing significant changes over several decades while considering the time required for planning, policy-making, and executing large-scale projects.

By opting for a 2070 vision, there is room for the municipality to learn from and adapt to ongoing changes and developments in technology, environmental science, and societal needs. It allows feedback loops and the opportunity to refine interventions based on real-time data and insights.

Consistency with long-range planning: Many urban development and sustainability plans, at both local and global levels, often span several decades. Aligning the vision with existing long-range goals ensures continuity and coherence with other strategies and frameworks.

Demographic considerations: A 2070 vision considers potential demographic shifts, such as population growth, changing age structures, and evolving social dynamics. By considering these factors, the vision can incorporate solutions that address the needs and aspirations of future generations.
Technological advancements: A 2070 timeframe allows for integrating anticipated technological advances that may not be fully realized by 2050. This includes innovations in renewable energy, transportation, agriculture, and urban planning, which can be harnessed to create a more sustainable and technologically advanced future.

Choosing a 2070 vision reflects a deliberate decision to balance long-term planning, adaptability to emerging trends, and anticipation of future challenges and opportunities. It provides a pragmatic yet forward-looking perspective that can guide decision-making and actions in the coming decades.

[Photo 22] Gemeente Midden Delfland (2019)

search approach

3.1 Research aim

The research aim of this project is to develop a comprehensive design proposal for the cultural landscape of the BPL MD that effectively integrates historical elements, existing landscape features, and future changes. This will be accomplished through the maximization method. The maximization method aims to create a design that harmoniously balances different themes while preserving historical and cultural values with the demands of modern agriculture and recreational activities. The research will explore the evolution of the landscape over time, analyzing its key characteristics and identifying opportunities to enhance its landscape qualities. The ultimate goal is to propose a design that respects the region's rich history and ensures its long-term sustainability, providing a blueprint for the preservation and enjoyment of the cultural landscape by future generations.

3.2 Research question

MAIN RESEARCH QUESTION:

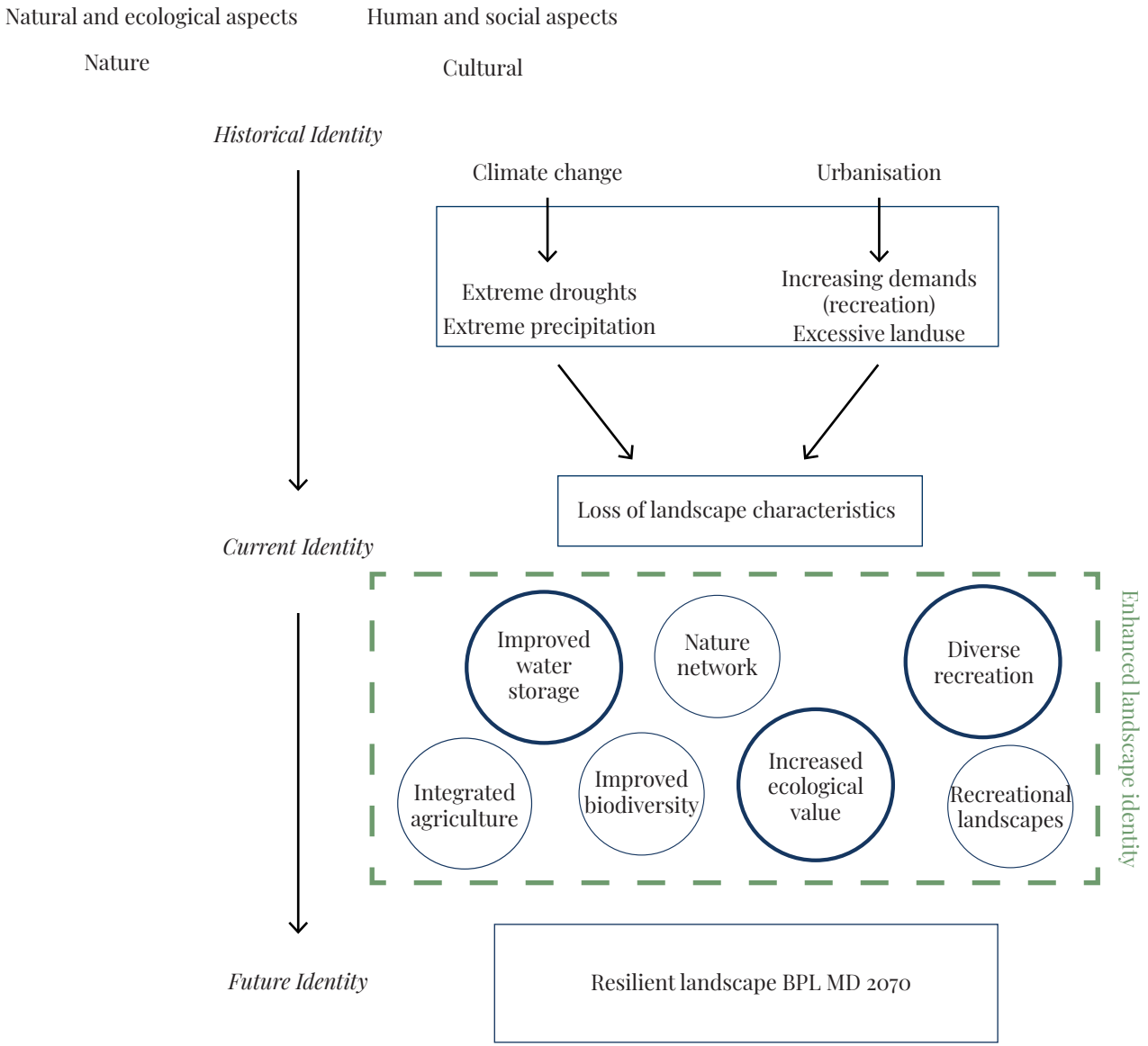
"How can the landscape characteristics of BPL MD effectively be preserved and strenghtened to respond to the challenges of climate change and population growth towards 2070 while simultaneously meeting the evolving needs of its users and preserving its agricultural and recreational functions?"

BPL MD = 'Bijzonder Provinciaal landschap Midden Delfland'

3.3 Hypothesis

To preserve and strengthen the existing landscape characteristics of BPL MD towards 2070, both agricultural and recreational activities should be carefully managed. Agricultural activities should be conducted to protect the soil and water quality, while recreational activities should be planned to ensure that existing natural features are not destroyed. A new spatial design should be developed that integrates the needs of agricultural and recreational users and those of wildlife, plants, and other species. This design should also create buffers between areas used for different purposes and ensure that the agricultural and recreational activities do not conflict. Such a design should also include measures to prevent the overuse of resources, such as land and water.

3.4 Conceptual framework



3.5 Research design

To answer the research question, a series of sub-questions is formed, each of which leads to a certain outcome. Those desired outcomes lead to an answer to the main question. The final outcome will be a design strategy based on the maximization method and research through design. Those methods can be classified into three types of approaches: theoretical, analytical, and experimental.

RQ: 'How can the landscape characteristics of BPL MD effectively be preserved and strenghtened to respond to the challenges of climate change and population growth towards 2070 while simultaneously meeting the evolving needs of its users and preserving its agricultural and recreational functions?'

SQ1. How did the agricultural landscape change over the past years and how will it look in the future?

SQ2. How did the recreational landscape change over the past years, and how will it look in the future?

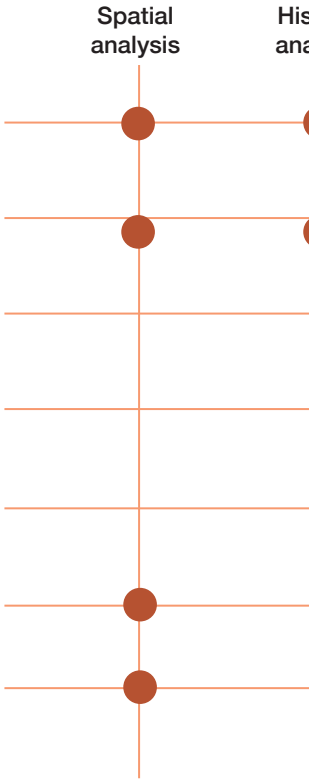
SQ3. What are the most important (spatial) landscape characteristics of the peat meadow landscape of BPL MD at the moment?

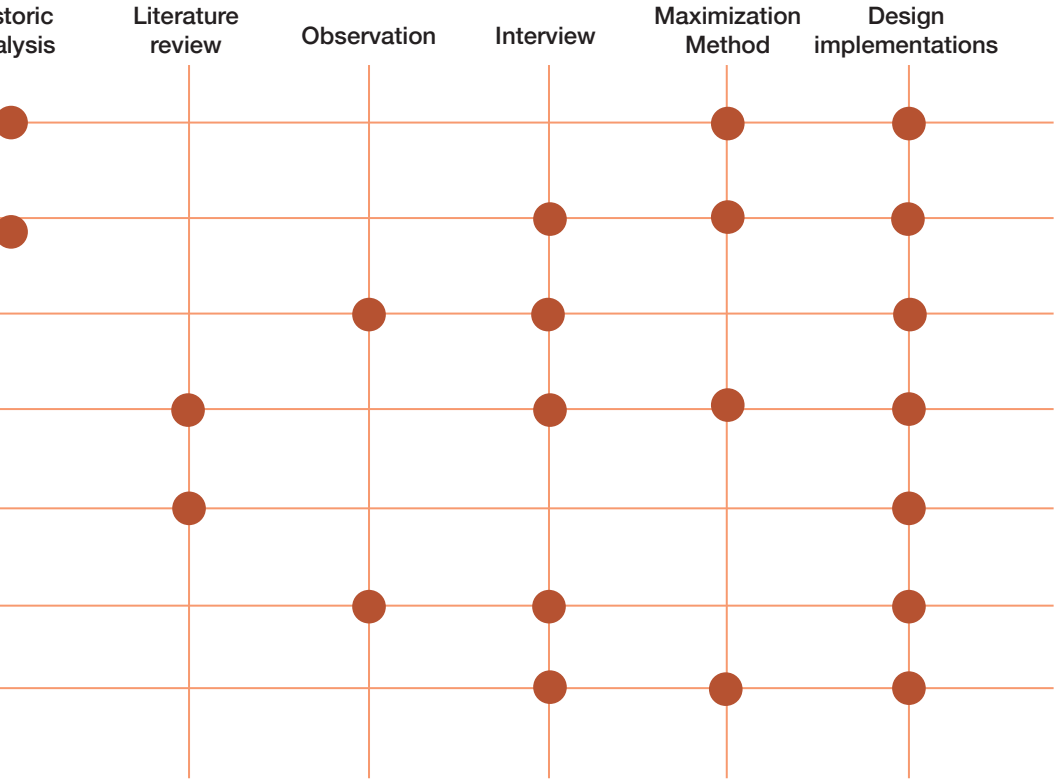
SQ4. How can water storage be integrated as a critical component of sustainable land use practices to mitigate climate change?

SQ5. What are the anticipated needs and preferences of the population in BPL MD towards 2070, and how might they impact the landscape characteristics of the region?

SQ6. What recreational and agricultural new functions could be implemented in BPL MD?

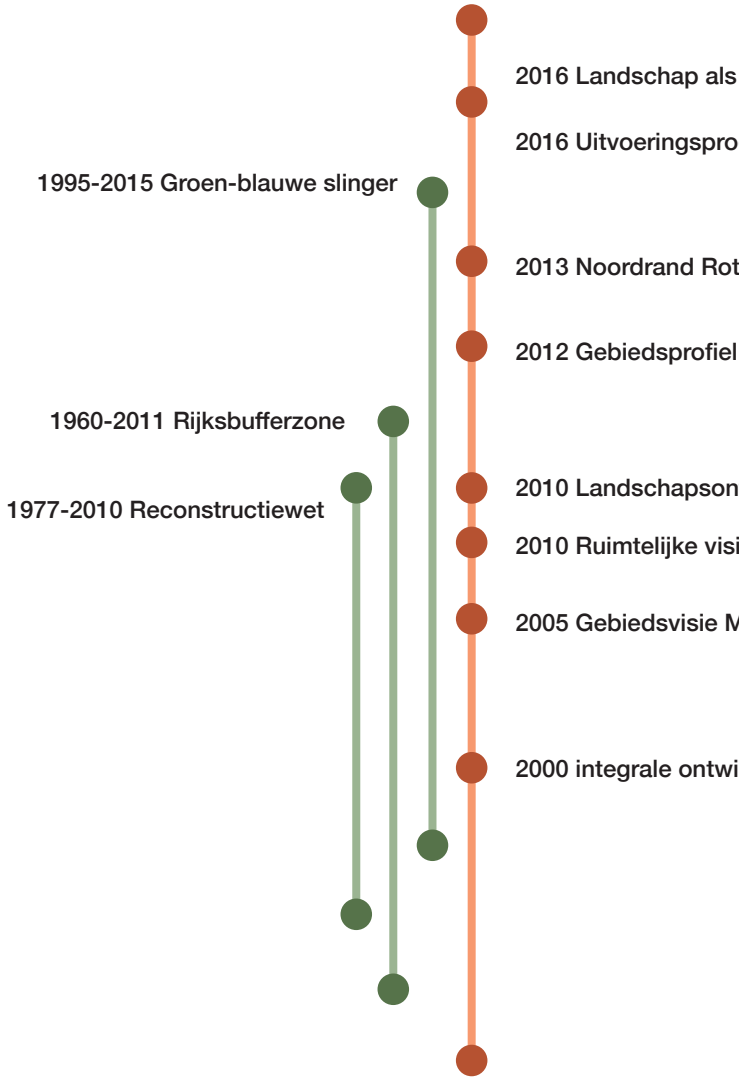
SQ6. What strategies and interventions can be implemented to enhance the ecological diversity and resilience of the landscape in BPL MD?




storic
alysis
Literature
review
Observation
Interview
Maximization
Method
Design
implementations

3.6 Practice framework

Before beginning with the research and design during this graduation project, it is critical to have a thorough understanding of the region's theoretical and practical frameworks. The existing policies that are crucial as a backdrop to work within the Netherlands and the "Metropolitan Region of Rotterdam and The Hague" are depicted in the graphic on the right. Since 1960, policies from several sectors in the Netherlands and the area have been consolidated into a single document: the Rijksbufferzone. The Rijksbufferzone serves as the basis for decision-making in urban and regional development, providing a detailed framework for spatial planning.



vestigingsfactor in de metropoolregio Rotterdam-Den Haag

gramma Hof van Delfland

tterdam

Midden Delfland

twikkelingsprespectief Midden Delfland 2025

ie Hof van Delfland

Midden Delfland 2025

kkeling tussen Delf en Schiedam

3.7 Methods

The methodologies utilized in the research can be classified into three types of approaches: theoretical, analytical, and experimental. They give mutual confirmation, making the results believable and robust. The theoretical course examines the research question from an academic perspective, analyzing the existing literature and related theories. The statistical approach utilizes various research tools, such as surveys and experiments. Finally, the practical approach employs a hands-on approach by observing a particular situation or phenomenon. A list of outcomes is constructed using these deductive and inductive procedures. All of these contribute to the result: the design approach. The methods are detailed in greater detail in the following paragraphs.

Literature review
Identifying the research problem to narrow down the relevant literature. Using online databases such as google scholar, research gate, web of science etc. Data is also gathered through books, articles, papers, reports etc. After identifying the relevant literature, selecting the most appropriate studies is essential. Finally, the findings must be reported in an organized and structured way.

Historical analysis
This study is carried out by organizing historical spatial and chronological material, such as pieces of historic maps, old photos and historical narratives. This approach establishes a crucial understanding of the historic layer of MRDH (Metropolitan region Rotterdam and The Hague). Furthermore, this approach provides insight into BPL MD's history, which explains the existing spatial organization of the landscape.

Spatial analysis
This strategy includes a lot of QGISDA analysis. A thorough investigation on several scales is needed to comprehend the spatial order and events occurring. The scales defined in the scope of the research include the province of South Holland and the MRDH on a regional scale and BPL MD on a local scale. Therefore, the GIS-data analysis and mapping conducted in this study will enable one to interpret and analyze the spatial order of land use in agriculture and recreation, including changes over time. To do so, a detailed overview of land cover and land use changes over the past century will be required.

Maximization method
The maximization method is used to design urban spaces that optimize specific objectives while satisfying various constraints. This technique can be used to maximize a range of factors, such as the number of green spaces, the accessibility of public transport, or the amount of mixed-use development, while also satisfying constraints related to zoning, land use regulations, and available resources. The area's metabolism is the main focus of the maximization method across various times and scales. This strategy focuses on urban design, where flows create the basic structure for the plan. Based on the location, metabolic flows or themes are "maximized." By looking for the most sustainable spatial

interventions for each theme and combining these themes, a foundation for an urban design that focuses on an improved metabolism and climate is produced. Step-by-step instructions are provided for examining the setting and themes.

Observation
Observation is critical for ensuring that outputs are appropriate for the project's specific setting. This strategy entails collecting empirical data on both space and people. The intriguing aspect of seeing space is that it considers the unavoidable relationship with time. Space is inherently a temporal phenomenon, constantly undergoing changes that impact the people who inhabit it. Also, agriculture and time are deeply entwined as the patterns of cultivation are inseparable from the idea of a cycle of seasons, which measures time in an ongoing and predictable way.

Design interventions
Design interventions aid in the direction and guidance of a design throughout the design process. At each stage of the process, a design should be considered and reviewed in the context of a shared set of principles. When followed, design principles can be used to evaluate the effectiveness of a spatial design.

Interview
Interviews can be a powerful tool for conducting research, as they gather insights directly from individuals with firsthand knowledge of a particular topic. Through interviews, you can gain a more in-depth understanding of a topic by learning how people think, feel, and act. In addition, interviews can help researchers uncover hidden perspectives and unexpected findings that may not have been revealed through other forms of research. The main advantage of interviews as a research tool is that they allow participants to engage in conversations and explore topics in more detail than surveys.

Mapping
Maps can be used as a basis for design research in various ways. The maps can be used to track and analyze trends in recreation and agriculture and identify areas of opportunity for improvement or development. Maps also provide a way to visualize data and identify patterns to help inform the design process. Additionally, maps can be used to understand a project's physical and social context and to inform the design of a space or an environment. Maps can be a valuable tool in helping to define the scope and objectives of a design project, as they provide an understanding of the existing conditions in an area.

Research meth

[Photo 23] Foppenplas (Midden Delfland, n.d.)

4.1 Maximization method

In this graduation report, the maximization method is used to create a new design for the BPL in between Delft and Rotterdam for 2070. The proposed design aims to optimize the use of available space while considering the potential impact of climate change on the region. The maximization method focuses on the area's metabolism through different time and scales. This approach focuses on urban design, where flows establish the framework for the design. Metabolic flows or themes are "maximized" based on the location.

An example of the maximization method being used in urban design in combination with landscape architecture is the work of Wu et al. (2018), who used the method to optimize the design of a greenway system in a densely populated urban area in China. The authors formulated an objective function that maximized the total length of the greenway system while satisfying constraints related to the existing built environment and topography. They also incorporated multiple criteria related to landscape architecture, such as the continuity and accessibility of green spaces, the preservation of natural features, and the incorporation of cultural elements. The maximization method allowed the authors to explore different design scenarios and find the optimal configuration of the greenway system that balanced the trade-offs between multiple objectives and constraints. The resulting design provided a high-quality green space that improved the ecological and social resilience of the urban area. Overall, the combination of the maximization method with landscape architecture principles can lead to more effective and sustainable urban design solutions that balance multiple objectives and stakeholders' needs.

A foundation for an urban design that focuses on an improved metabolism and climate is produced by looking for the most sustainable spatial interventions for each theme and combining these themes. The location and themes are examined in clearly defined steps.

The maximization method consists of 4 steps:

1. analysis,
2. maximization,
3. optimization and
4. integration.

Analysis of relevant spatial conflicts and resulting integrated spatial interventions are the outcomes. The relationships between various themes are examined to determine which support and which conflict. The optimisation phase involves combining themes. Additional themes are integrated during the integration phase.
For the maximization phase of this research the themes are:

- Ecology
- Accesibility
- Water

Water is a critical resource in urban environments, and optimizing water management can help create a more sustainable and resilient urban design. This can involve

maximizing water storage and infiltration while also addressing issues such as heavy precipitation, water pollution and drought (Munoz-Erickson et al., 2015).

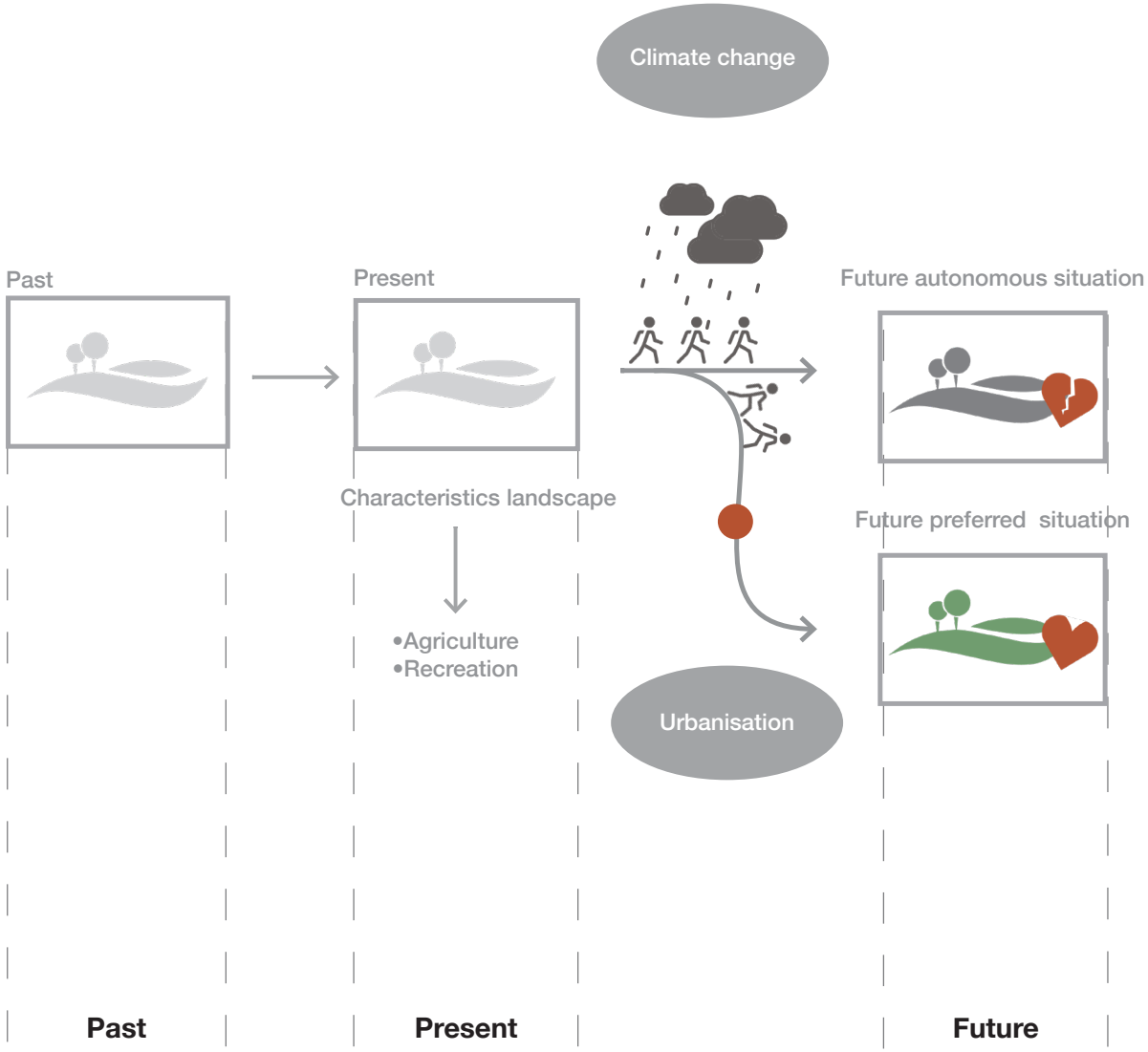
Ecology is another important theme that can be optimized using the maximization method. Incorporating ecological principles into urban design can help create more resilient and adaptive urban ecosystems. This can involve maximizing biodiversity, preserving or restoring natural habitats, and enhancing ecological connectivity (Ahern, 2013).

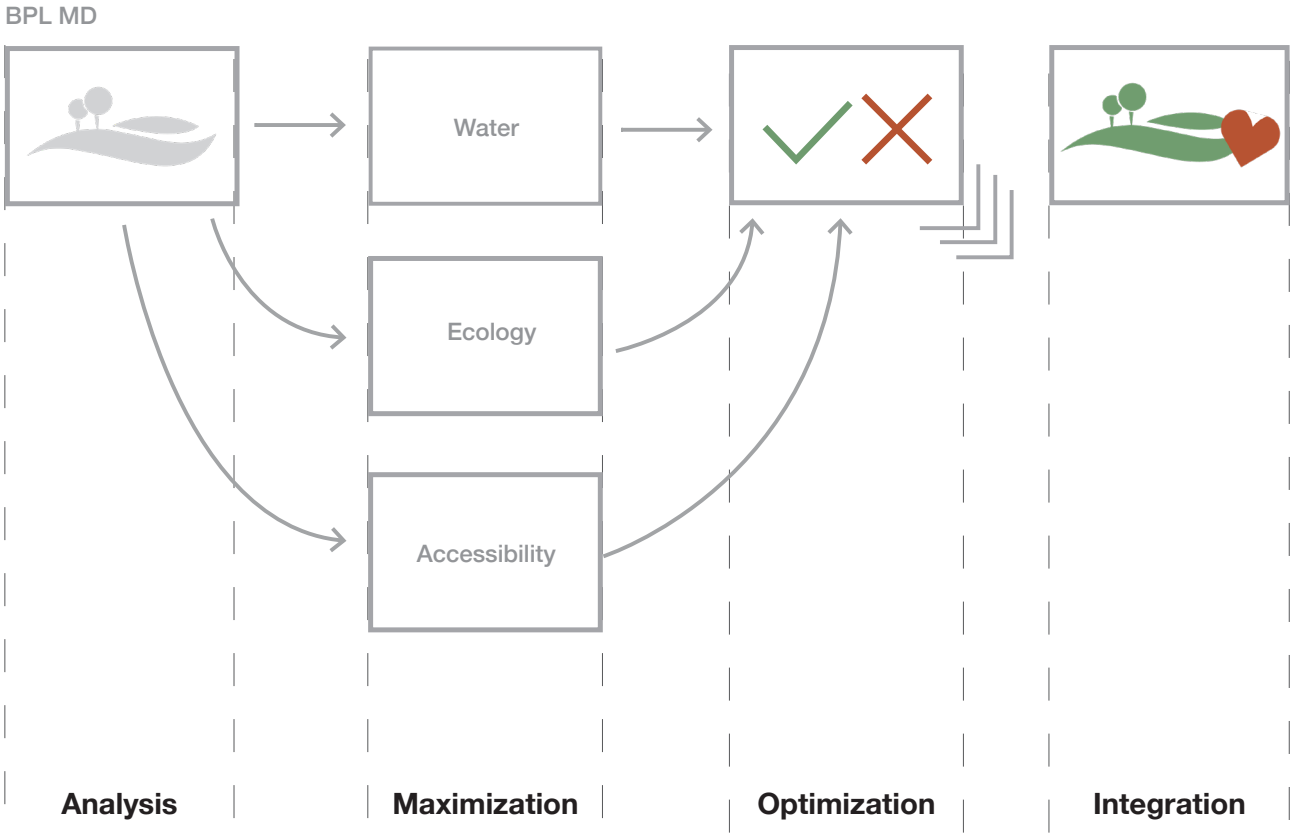
Accessibility is a critical theme that must be balanced with the region's natural and agricultural characteristics. Accessibility must be tailored to the specific needs and preferences of various stakeholders, including recreational users and farmers. By prioritizing accessibility, urban design can become more equitable and inclusive for all members of the community. This approach may involve maximizing accessibility in recreational areas while also addressing mobility issues faced by farmers (Wan, 2018).

By combining these three themes, you can create an urban design that is sustainable, resilient, and equitable, and that considers the complex relationships between people, nature, and water in urban environments.

The first step is to analyze per theme the current situation, the autonomous future situation; what challenges exist, and what opportunities exist? Investigating each of the three themes, as well as the appropriate current practices and potential future developments for the location. Combining the measures in a way that they complement one another and result in the creation of a single coherent solution. This approach will ensure that all aspects of the location are considered and that the final solution is comprehensive and effective. It also allows for flexibility in adapting to changing circumstances or new information that may arise during the investigation process.

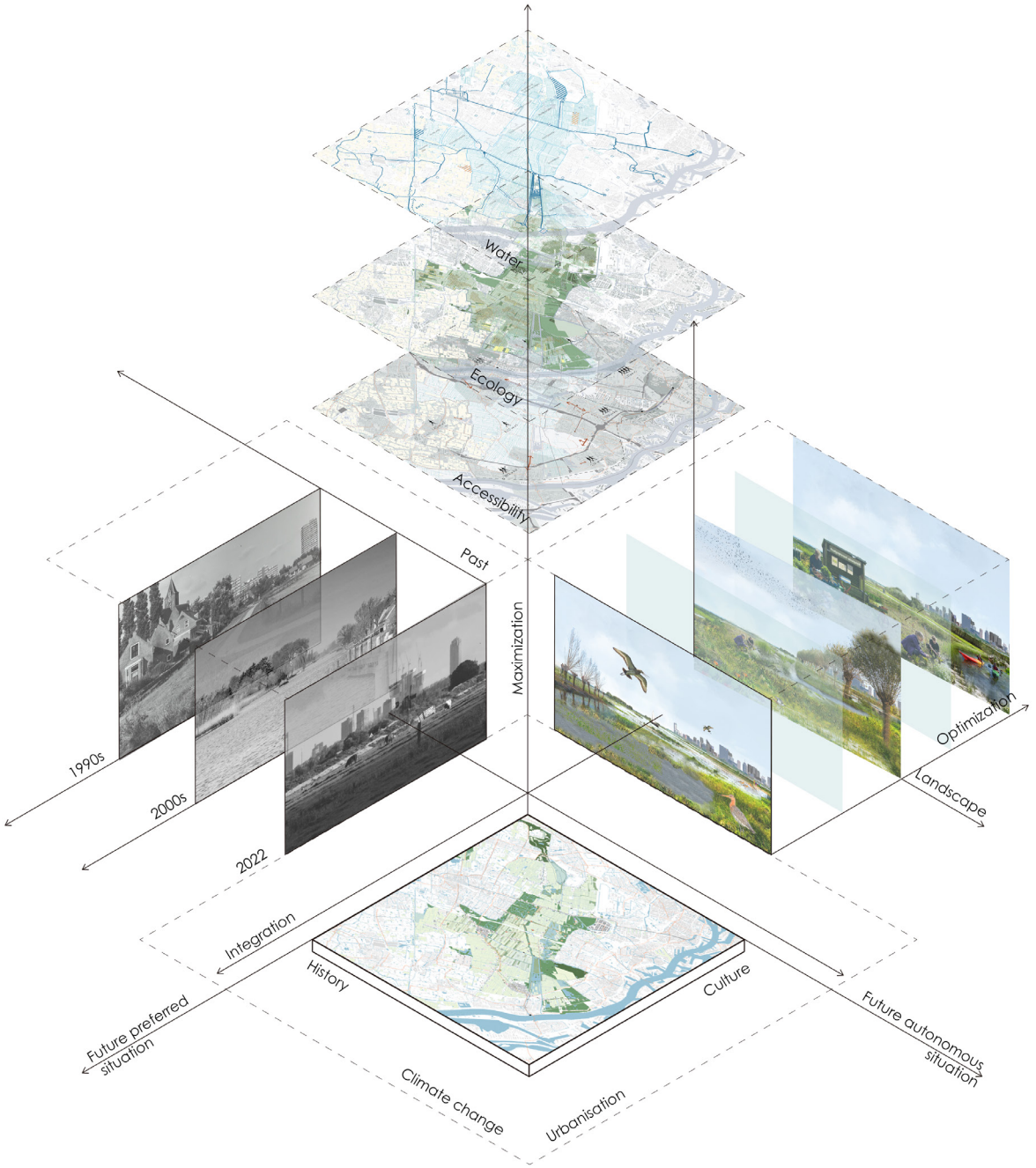
The next step is optimization of the maximization phase's outcomes, which will result in a new outline for the BPL landscape. During the optimization phase, the various themes must be combined in the most effective way. Given that some measures will compete with one another, decisions must be made.


Climate change
Past
Present
Future autonomous situation
Characteristics landscape
•Agriculture
•Recreation
Future preferred situation
Urbanisation
Past
Present
Future



[Fig. ?]: Made by author (Aalbers, 2023)

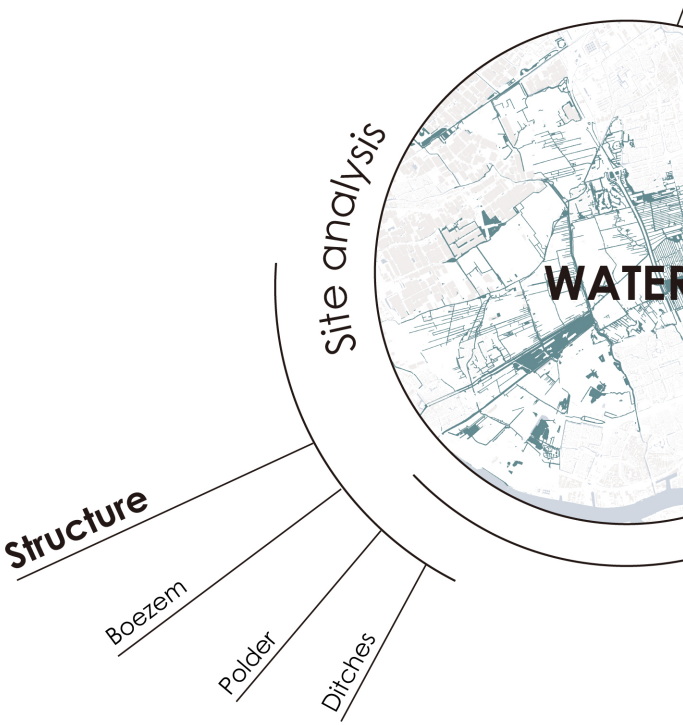
Maximizing through different layers

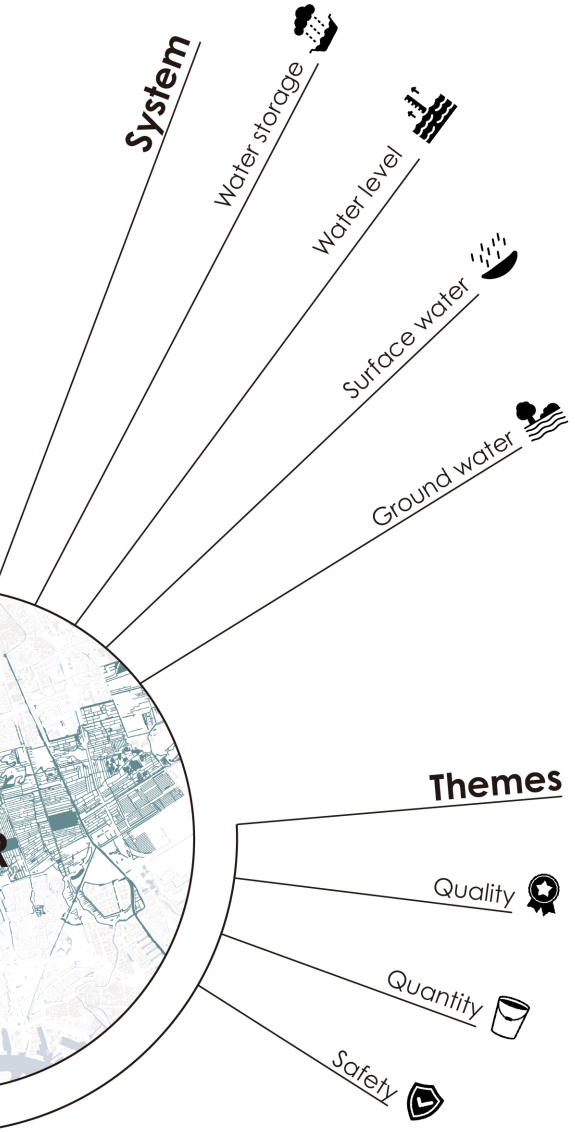


[Fig. 25] Max method, made by author

4.2 Water

To effectively analyze water as a theme in the maximization method, it is important to gather comprehensive data on water resources in the region. This may involve collecting information on factors such as water quality, water flow, and water storage capacity. Water is a critical theme in the maximization method, particularly in regions such as BPL MD that are vulnerable to the impacts of climate change. Through effective water analysis and management, it is possible to balance the competing needs of different stakeholders while ensuring the long-term sustainability of the region's water resources.





Goal 1

Creating more space for water storage

Goal 2

Raising water level in the different polders

Goal 3

Improving water quality

Goal 4

Strengthen the existing water structures

4.2 Water

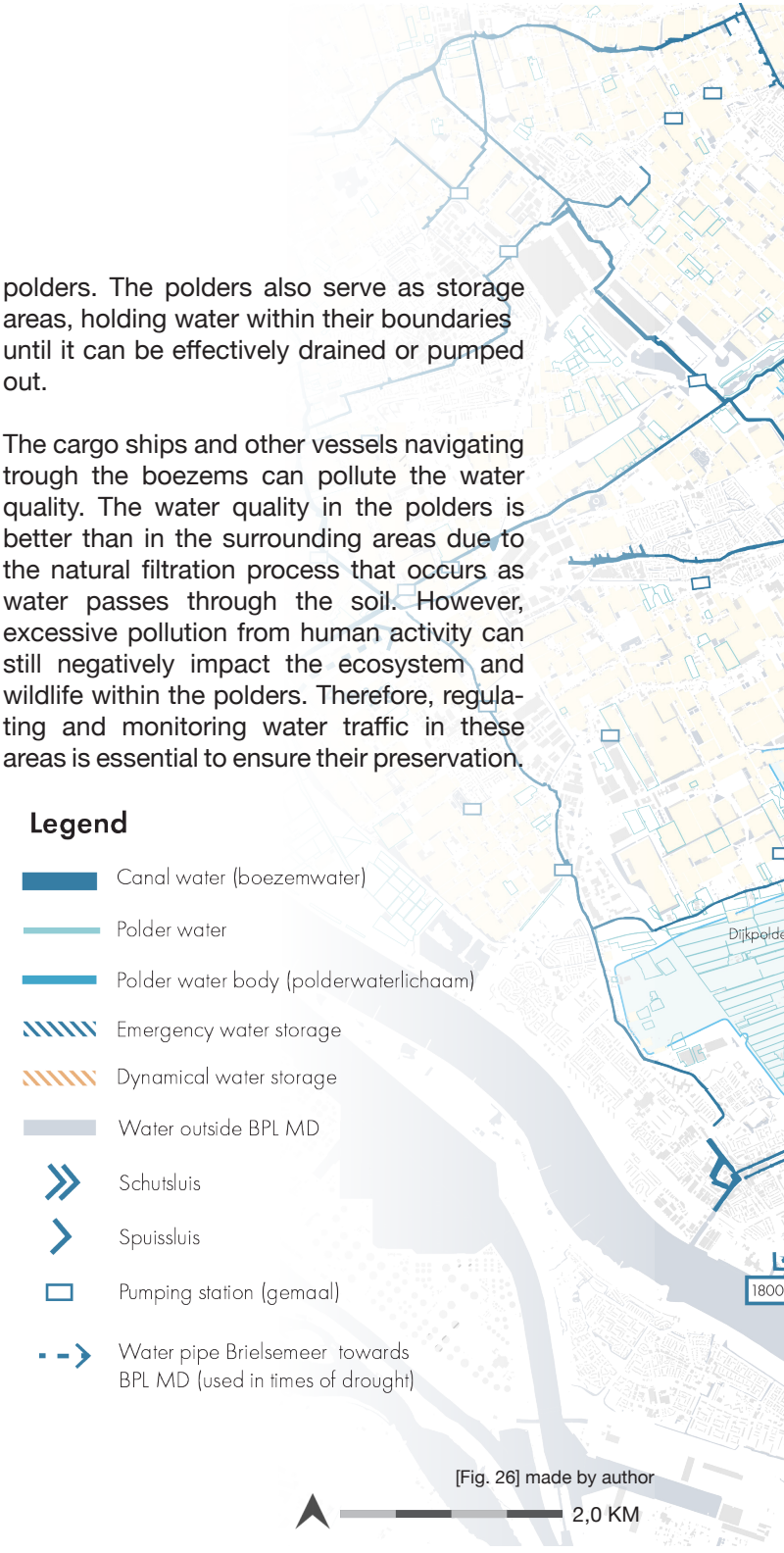
4.2.1 Analysis

BPL MD is located in the western part of the Netherlands and is characterized by a complex water management system. The region consists of polders, low-lying areas enclosed by dikes or embankments. These polders rely on an intricate network of water-boezems and drainage systems to regulate water levels.
The polder water management system in BPL MD involves a combination of pumping stations, canals, and ditches. Pumping stations are used to remove excess water from the polders and transfer it to the water-bodies or the nearby rivers or canals. Canals and ditches act as drainage channels, helping regulate water levels within the polders and facilitating water flow toward the pumping stations.

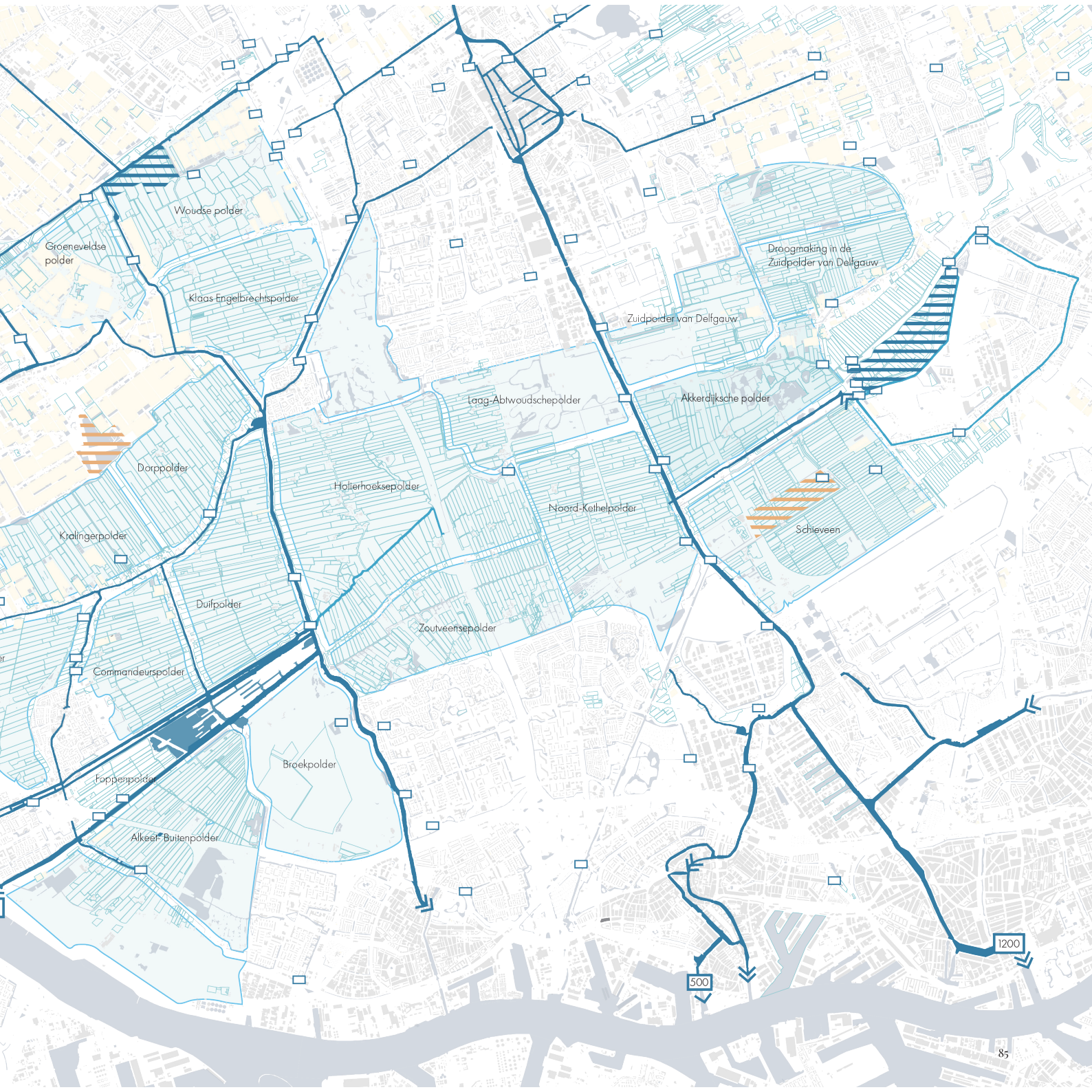
The freshwater supply in BPL MD primarily relies on rainfall and surface water from rivers. Rain replenishes the water levels in the polders and contributes to the overall water balance. Surface water from rivers, such as the Schie and the Vlaardingse Vaart, maintains water levels in the canals and ditches and provides fresh water for agricultural activities. In periods of heavy drought, water from the Brielse Meer is used for the area.

Water storage in BPL MD is primarily achieved through the waterboezems and the polders themselves. During heavy rainfall, waterboezems act as temporary storage reservoirs, reducing the risk of flooding in the polders. The polders also serve as storage areas, holding water within their boundaries until it can be effectively drained or pumped out.

The cargo ships and other vessels navigating trough the boezems can pollute the water quality. The water quality in the polders is better than in the surrounding areas due to the natural filtration process that occurs as water passes through the soil. However, excessive pollution from human activity can still negatively impact the ecosystem and wildlife within the polders. Therefore, regulating and monitoring water traffic in these areas is essential to ensure their preservation.



[Fig. 26] made by author


Woudse polder
Groeneveldse polder
Klaas Engelbrechtspolder
Droogmaking in de Zuidpolder van Delfgauw
Zuidpolder van Delfgauw
Laag-Abtwoudschepolder
Akkerdijksche polder
Dorppolder
Hollierhoeksepolder
Noord-Kethelpolder
Schieveen
Kralingerpolder
Duifpolder
Zoutveensepolder
Commandeurspolder
Broekpolder
Foppenpolder
Alkeef-Buitenpolder
1200
500

4.2 Water

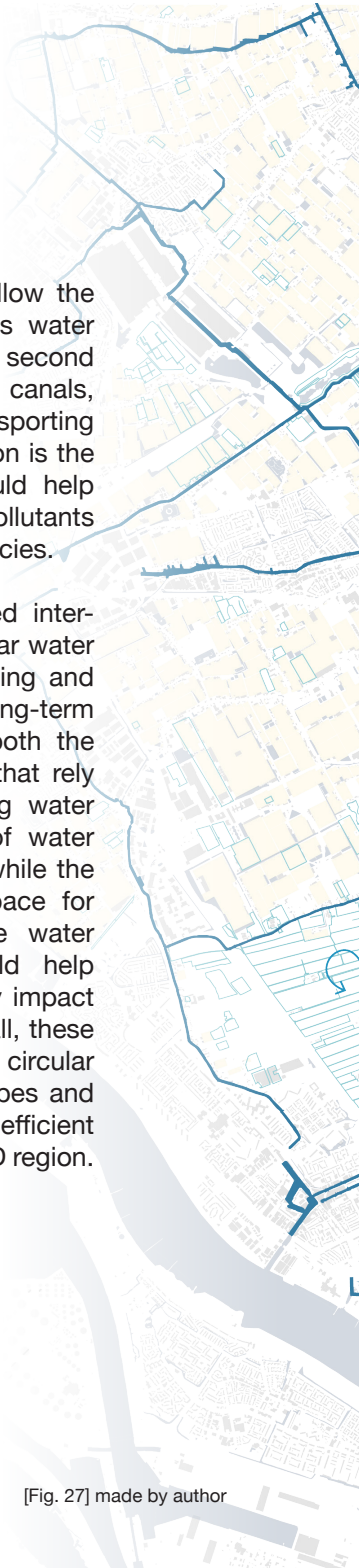
4.2.2 Maximization

The map on the right shows the proposed interventions for maximizing the water theme in BPL MD. These interventions aim to address the challenges of increasing rainfall in winter and extreme droughts in summer while improving water quality and creating more sustainable water use practices.

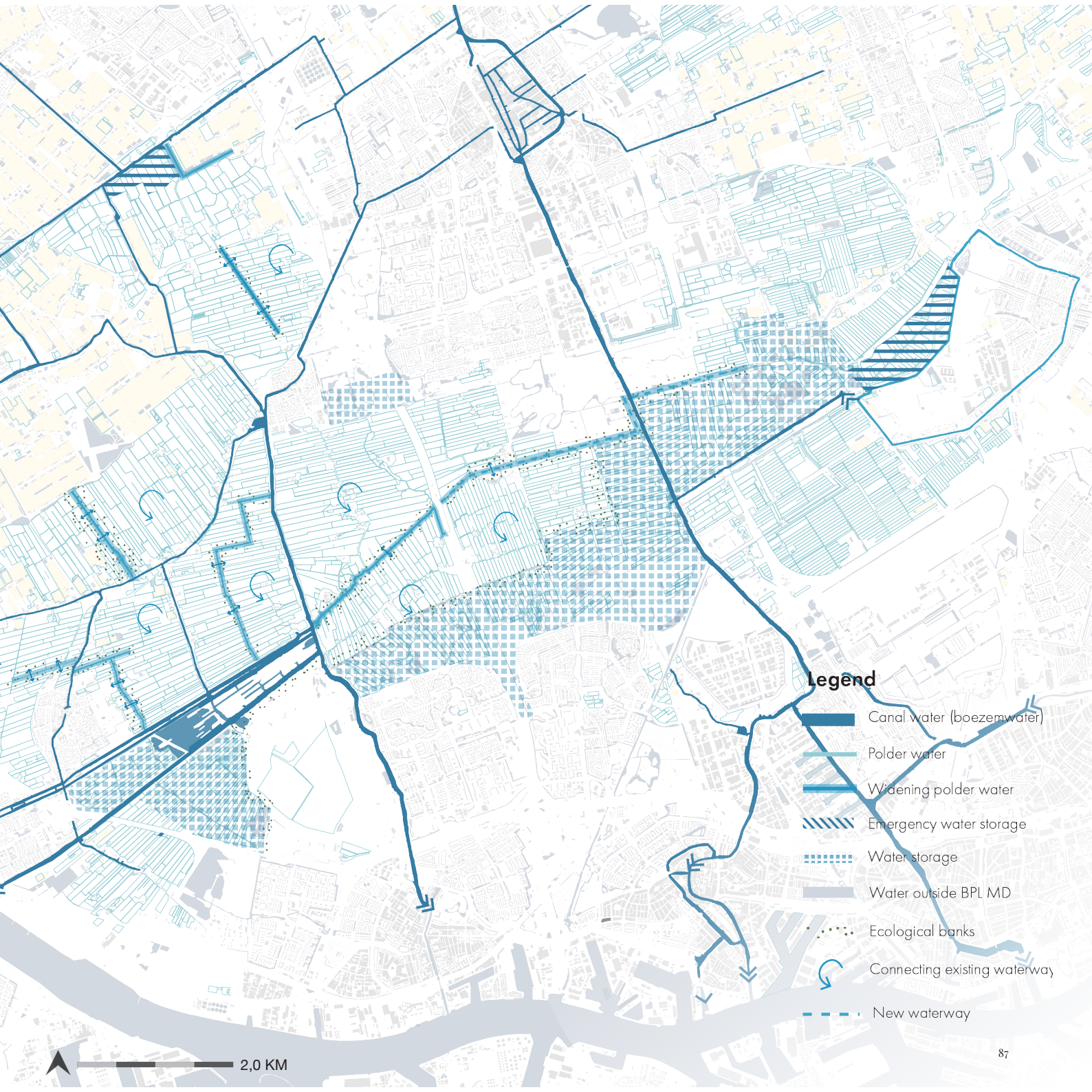
The concept of a circular water system in the polder landscapes has gained increasing attention in recent years. One approach to achieve this circular system is disconnecting the regional water system (boezems) from water in the polders, creating a separate water system. This would allow for more efficient and sustainable use of water resources within the polders. Additionally, creating more surface water for circulation and purification by connecting existing waterways in the landscape and creating new ones can help achieve this circular system. Furthermore, improving water quality can be done by using nature as a cleaner. Water can be purified and treated sustainably by creating natural systems such as wetlands, eco-banks, and natural filters. Finally, creating water storage in the landscapes for buffering during heavy rainfalls or drought can help regulate water flow and supply in the region.

The proposed interventions for maximizing the water theme in BPL MD aim to address the challenges of increasing rainfall in winter and extreme droughts in summer while improving water quality and creating more sustainable water use practices. The first proposed intervention is the creation of large water buffers, which would allow the region to capture and store excess water during periods of heavy rainfall. The second intervention is widening existing canals, increasing storage capacity, and transporting water. The third proposed intervention is the creation of eco banks, which would help improve water quality by filtering pollutants and creating habitats for aquatic species.

The combination of these proposed interventions and the concept of a circular water system would require careful planning and implementation. However, the long-term benefits would be significant for both the environment and the communities that rely on these water resources. Creating water buffers would provide a reserve of water for use during periods of drought, while the wider canals would offer more space for recreational activities and regulate water levels. Creating eco banks would help improve water quality and positively impact the region's ecological health. Overall, these interventions would help achieve a circular water system in the polder landscapes and would ensure a more sustainable and efficient use of water resources in the BPL MD region.



[Fig. 27] made by author

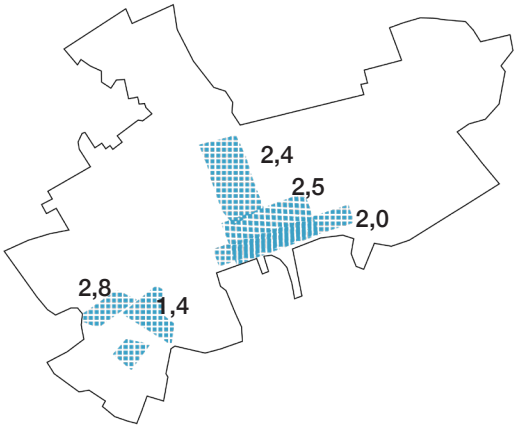

Legend
Canal water (boezemwater)
Polder water
Widening polder water
Emergency water storage
Water storage
Water outside BPL MD
Ecological banks
Connecting existing waterway
New waterway
2,0 KM

4.2 Water

4.2.3 Optimization

Recent research has indicated that implementing a water buffer is crucial for effective water management. Increasing the amount of water in this area would have the greatest impact on the landscape. This strategy involves the creation of green spaces around water bodies to enhance their recreational value and provide additional benefits such as flood control and water purification (Van den Belt, 2018). The water buffer can also help mitigate the impact of climate change on water resources by reducing the risk of flooding during heavy rainfall events and regulating water levels during droughts (Brouwer et al., 2019). Moreover, the water buffer can provide a habitat for various plant and animal species, promoting regional biodiversity (Brouwer et al., 2019). To ensure the water buffer's success, trees must halt the rapid evaporation of water from the buffer and maintain its storage capacity (Van den Belt, 2018). Implementing a water buffer is crucial for effective water management and promoting sustainable regional development.

According to Coen Kramer BPL MD necessitates a water buffer encompassing 3% or 4% of its total surface area. However, since this research primarily pertains to the year 2070, the figure of 3% has been adopted instead. Given that the BPL MD encompasses an area of roughly 80 km2 or 8000 ha, it necessitates a water buffer of 240 ha. For the water buffer to be effective, it needs to be at least 1.5 meters deep; otherwise, it would evaporate too quickly. The majority of the BPL MD's surface is predominantly utilized or agricultural activities, which can considerably impact the water balance and quality. As a result, ensuring that the water buffer is sufficient to support sustainable agriculture while safeguarding the environment is of utmost importance.



[Fig. 28] made by author

4.2.4 Waterproof landscape

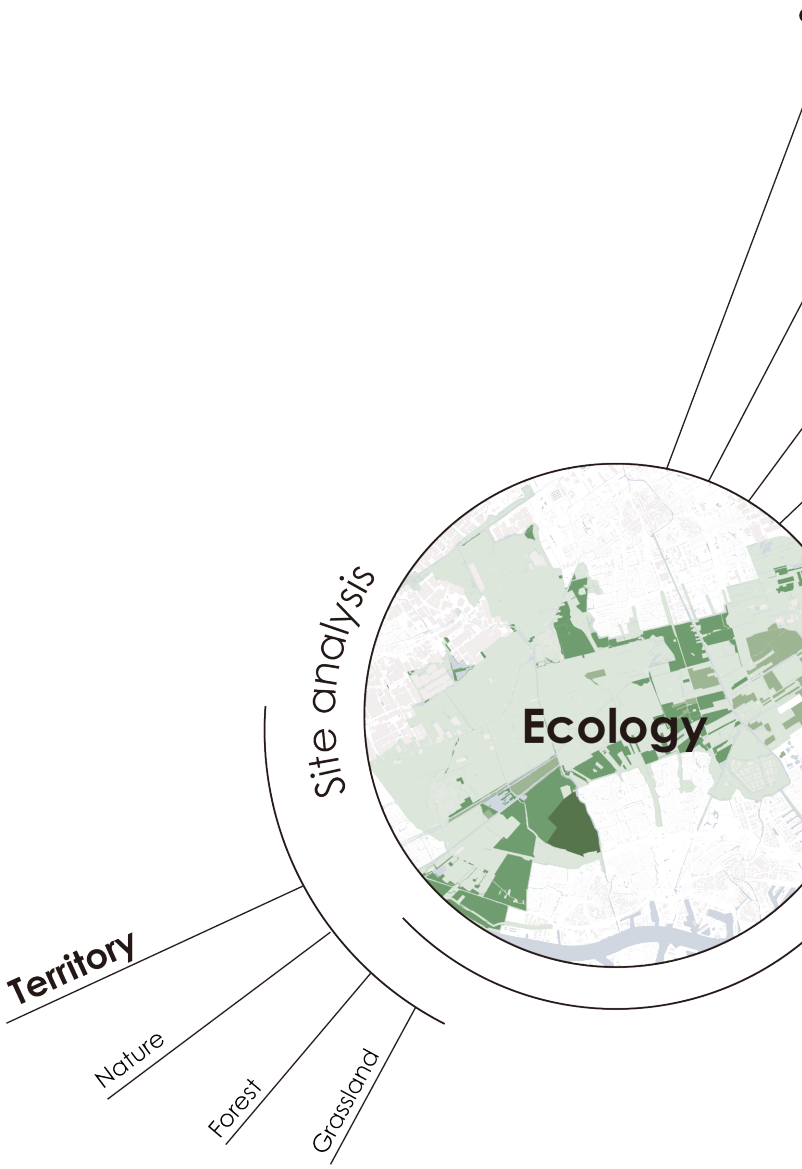
‘Creating room for quantity and quality of water’

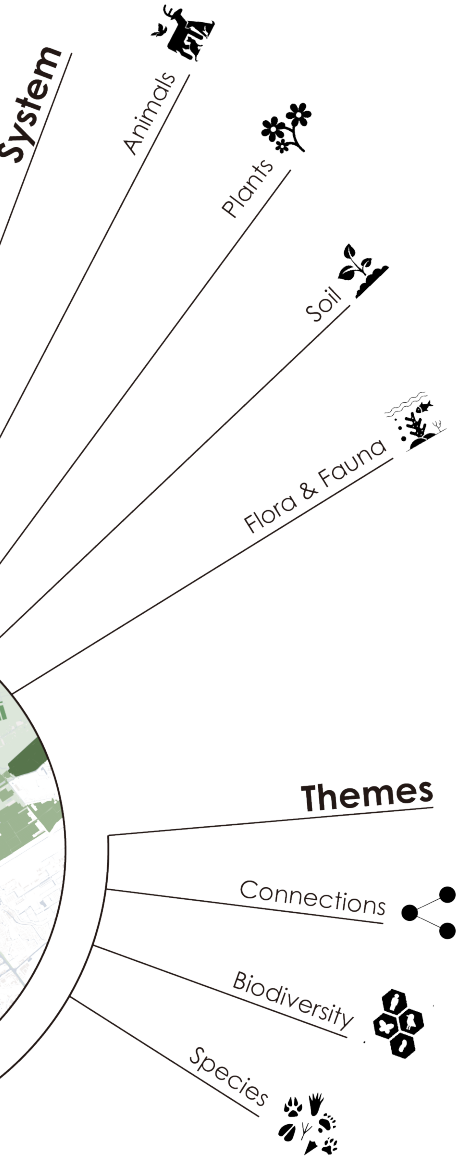
[Fig. 29] made by author

4.3 Ecology

Ecology is the second theme in the maximization method of the project, as it aims to protect the last remaining open grassland in the south of Holland. The research recognizes the significance of preserving the natural habitat of meadow birds, as their population needs to increase and be protected. These birds live in grasslands and require wet grass for their survival. Hence, the maximization method focuses on implementing measures to conserve the grasslands, including raising water levels and enhancing the natural habitats of the meadow birds.

This research also emphasizes protecting green and natural areas from further urban development. Without such protection, these areas could risk being built on, losing vital habitats and ecological diversity. Therefore, the maximization method promotes sustainable land use practices, such as creating green spaces and enhancing the ecological health of water bodies. By implementing these measures, the project aims to safeguard the region's environmental integrity and promote the coexistence of humans and nature.





Goal 1
Improved connection between nature networks

Goal 2
Stimulating biodiversity by creating different biotopes

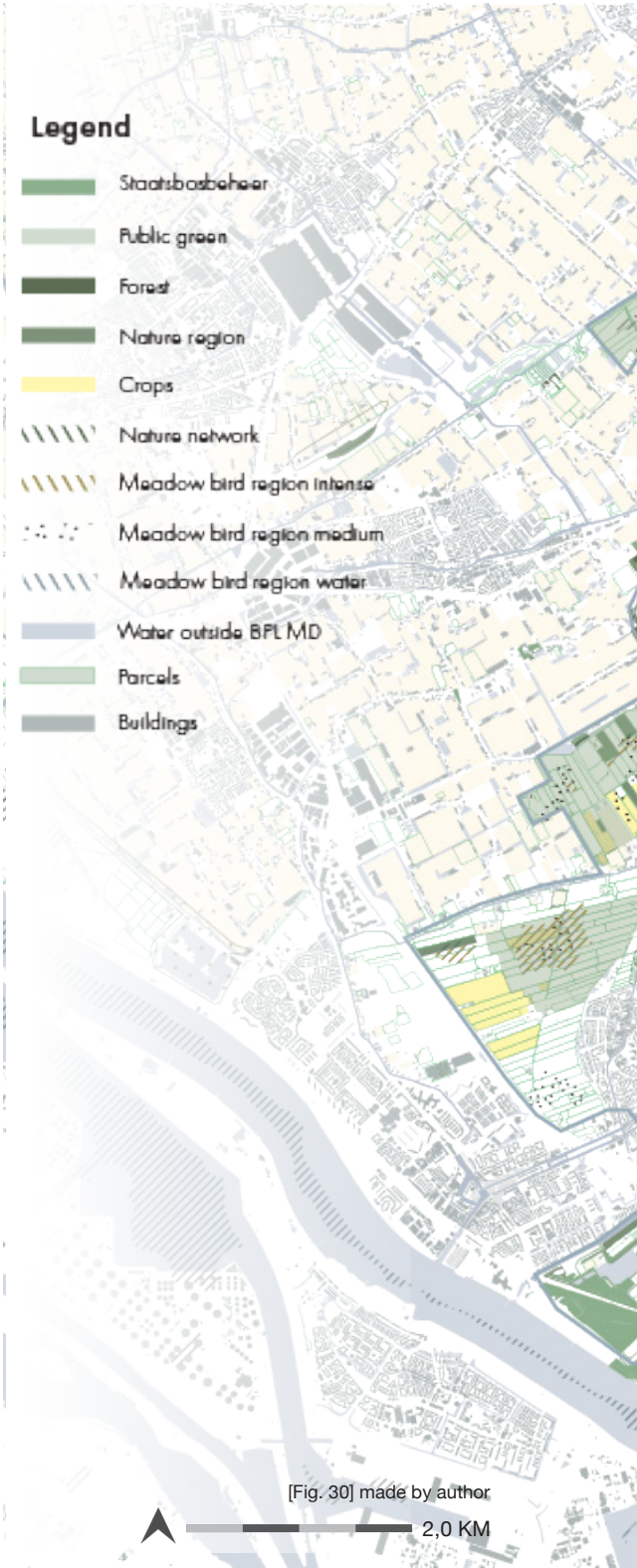
Goal 3
Reducing disturbance of nature, more quiet zones

Goal 4
Increase species richness by nutrient poor soils

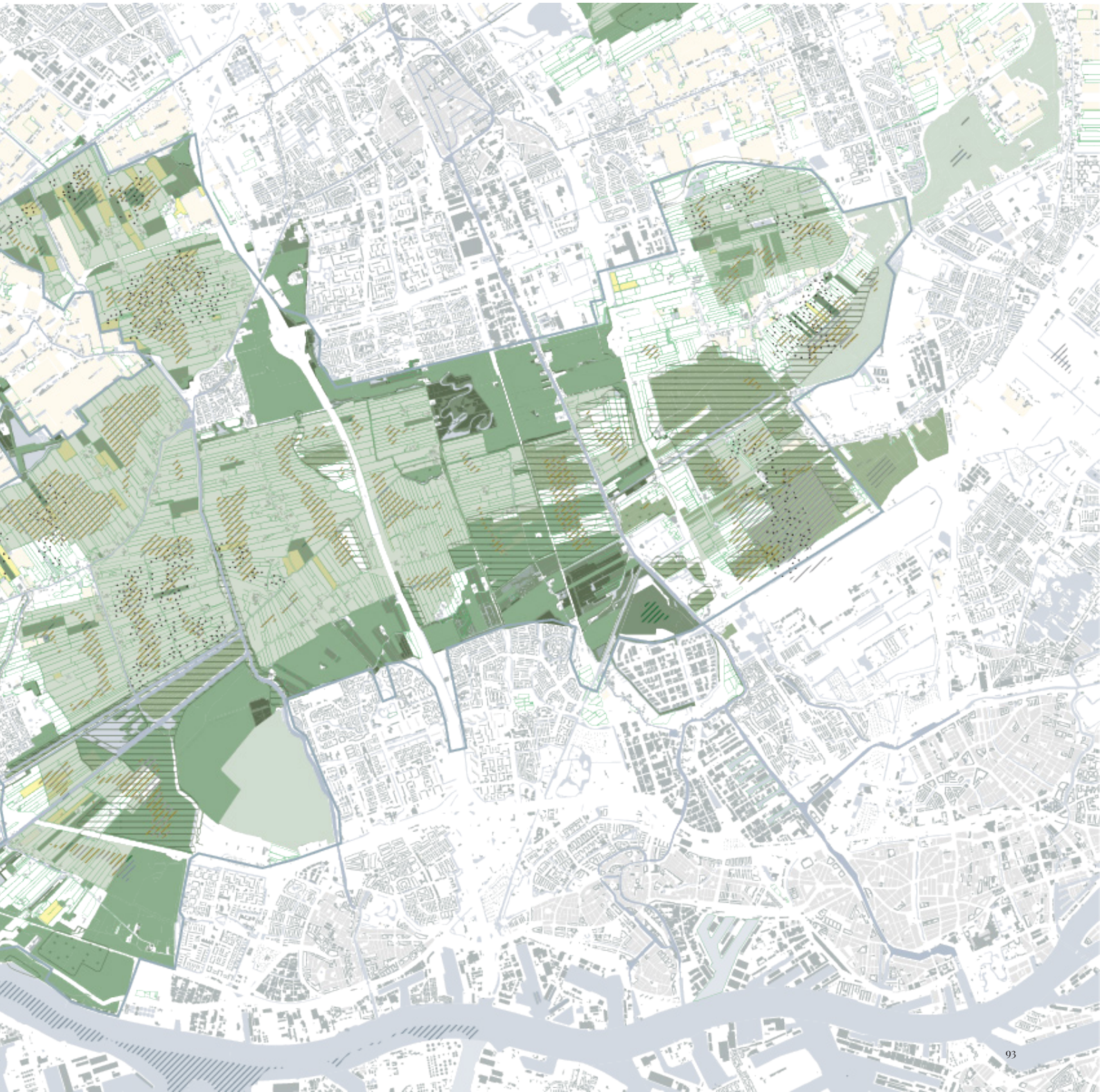
4.3 Ecology

4.3.1 Analysis

The map on the right shows the green structures in the BPL MD region. The area is mostly agricultural land, and forests can be found on the borders. Those forests are made for recreation and can be divided into the green from Staatsbosbeheer, Nature monuments, and public green. The intensive recreational areas are placed in the forests, and the agricultural land is used by meadow birds.



[Fig. 30] made by author



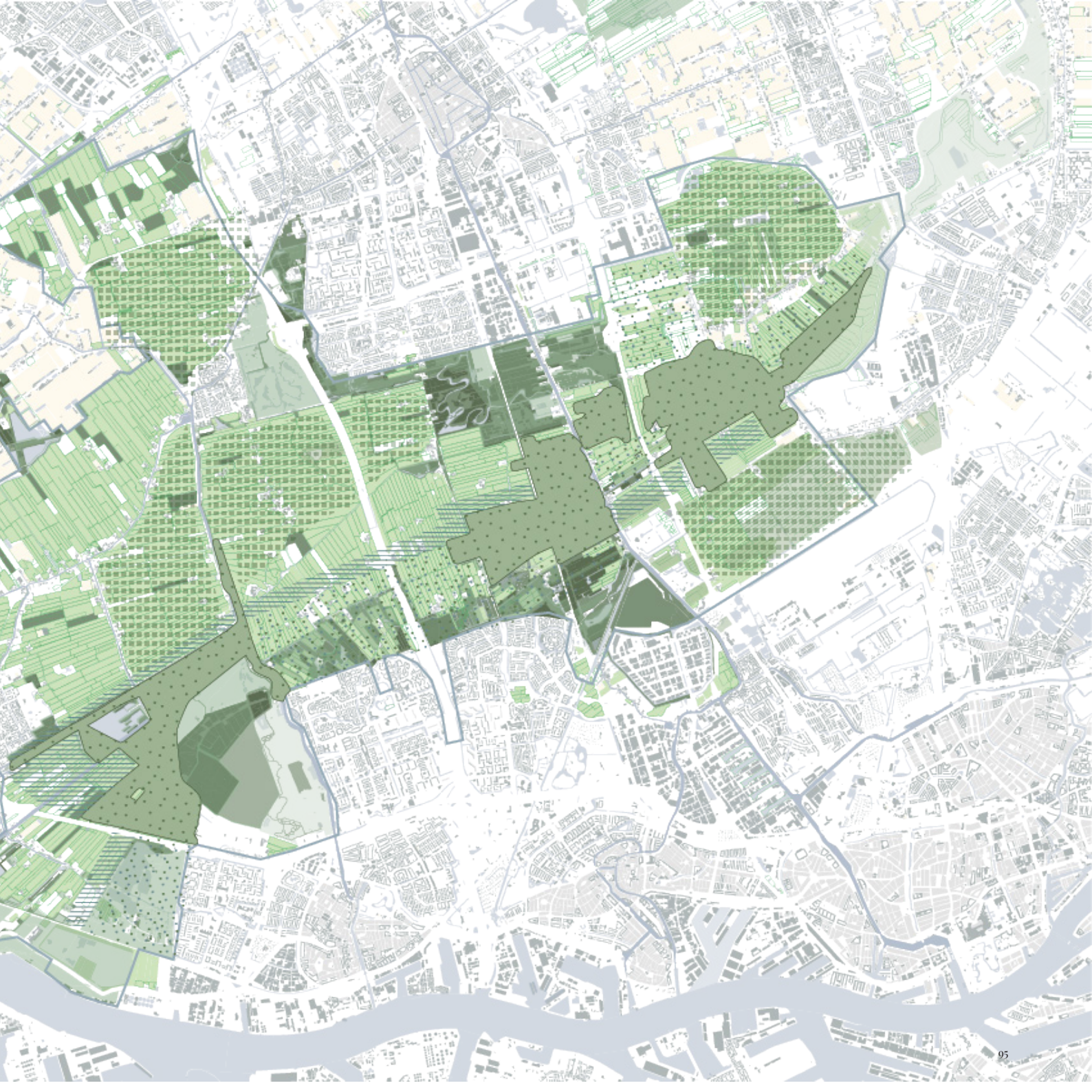
4.3 Ecology

4.3.2 Maximization

The ecology theme of the maximization method aims to improve the connections between nature networks, stimulate biodiversity by creating different biotopes, reduce the disturbance of nature, and increase species richness. Achieving these goals requires a spatially feasible approach considering the region's unique ecological characteristics. Those ecological characteristics include a diverse range of habitats, such as grasslands, wetlands, and water bodies which support a variety of plant and animal species. The grasslands are significant for bird species such as the Grutto and Kievit. Wetlands such as the Ackerdijkse Plassen and the Zuidpolder provide habitat for various waterfowl species.

Interventions should be taken that enhance connectivity between areas with high biodiversity. Furthermore, creating different biotopes tailored to specific species' needs can help increase species richness and provide refuge for rare or threatened species. To reduce the disturbance of nature, interventions should be taken to minimize human impact and protect sensitive habitats. Finally, increasing species richness requires a comprehensive approach that combines different strategies, including habitat restoration, invasive species control, and ecological monitoring. Adopting a science-based approach that integrates environmental knowledge with spatial planning principles makes achieving a more sustainable and resilient regional ecosystem possible.

[Fig. 31] made by author



4.3 Ecology

4.3.3 Optimization

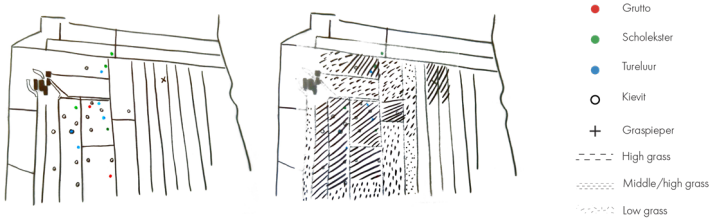
Creating an optimized area for meadow birds in the open polder landscape of Midden-Delfland involves various factors that contribute to their habitat requirements. First, there should be an assessment of the existing habitat conditions in the area. Identifying the species of meadow birds that inhabit the region and understanding their specific habitat preferences, such as nesting requirements, foraging areas, and shelter. For example, Bas van den Berg has the Kievit, Grutto, Tureluur, Scholekster, and Graspieper on his land.

Meadow birds thrive in areas with diverse vegetation types. The design should incorporate a mix of grasses, herbs, and flowering plants to provide a variety of food sources, nesting sites, and shelter. Incorporating native plant species, as they are more likely to support a diverse range of bird species.

Meadow birds often rely on grazed grasslands. Therefore, these birds prefer grazing management techniques, such as rotational grazing, to maintain the vegetation's height and structure. Collaborate with local farmers or landowners to establish a grazing plan that benefits both the birds and the agricultural activities in the area.

Many meadow birds require wetland habitats for foraging and nesting. Integrating wetland features, such as shallow ponds or small water bodies, into the design will improve the stay of meadow birds. These features can attract water-associated insects and invertebrates, which are an essential food sources for meadow birds. Another option to stimulate the birds is the incorporation of suitable nesting habitats, such as grassy patches, clusters, or reed beds, to provide secure areas for breeding.

Meadow birds live in a quiet area and shouldn't be disturbed. Reducing disturbances in the area to create a favorable environment for meadow birds is therefore important. Designating buffer zones or restricted access areas to minimize human and livestock intrusion, especially during critical breeding and nesting seasons, which are in May, June, and July. In summary, collaborating with local farmers or landowners to establish a grazing plan that benefits both the birds and agricultural activities, integrating wetland features, providing suitable nesting habitats, and reducing disturbances in the area are all important steps in creating a favorable environment for meadow birds. Designating buffer zones or restricted access areas during critical breeding and nesting seasons is also crucial to minimize human and livestock intrusion.



[Fig. 32] made by author

4.3.4 Ecological landscape

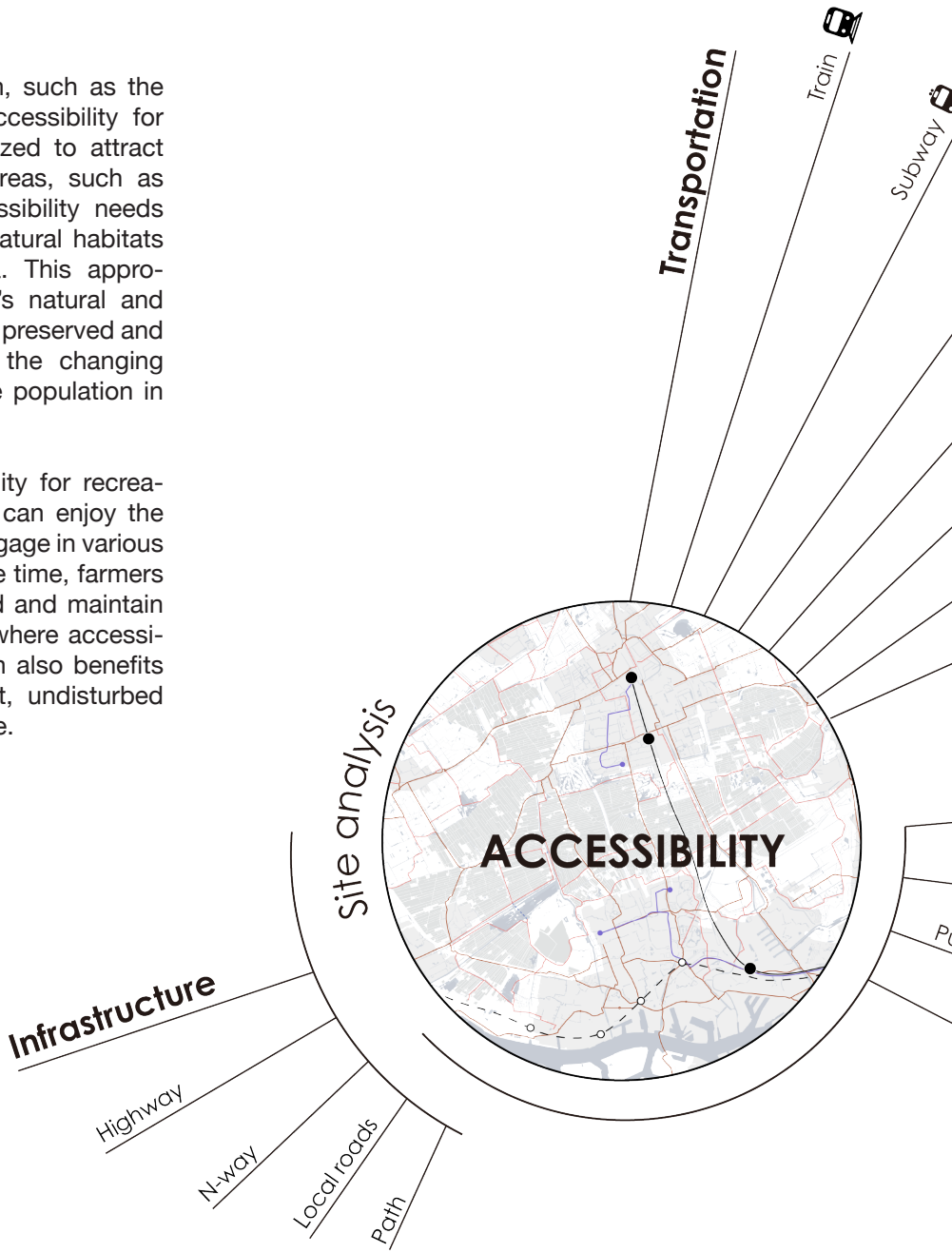
‘Increasing biodiversity for improved meadow bird livability’

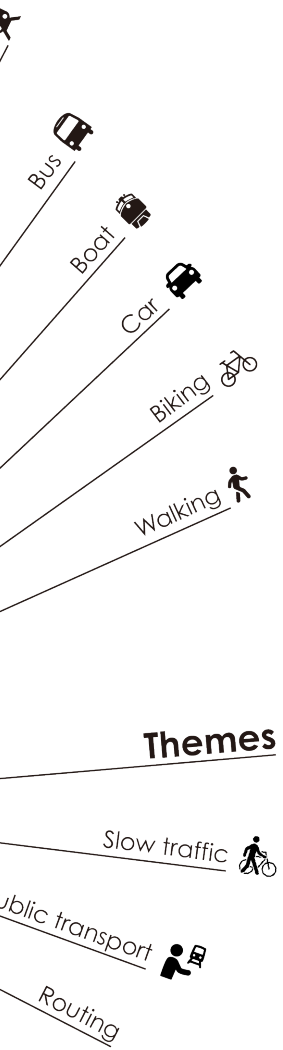
[Fig. 33] made by author

4.4 Accessibility

In certain areas of the region, such as the borders of the city, good accessibility for intensive recreation is prioritized to attract visitors. However, in other areas, such as the quiet nature zone, accessibility needs to be limited to protect the natural habitats and biodiversity of the area. This approach ensures that the region's natural and agricultural characteristics are preserved and strengthened while meeting the changing needs and preferences of the population in 2070.

By providing good accessibility for recreation in certain areas, visitors can enjoy the region's natural beauty and engage in various outdoor activities. At the same time, farmers can continue to produce food and maintain the rural landscape in areas where accessibility is limited. This approach also benefits animals by providing a quiet, undisturbed environment in the nature zone.




Bus
Boat
Car
Biking
Walking

Themes

Slow traffic
ublic transport
Routing


Goal 1
Improve and increase of slow traffic roads
Goal 2
Selective accessibility
Goal 3
Improved connection between borders
Goal 4
Stimulating specific route types

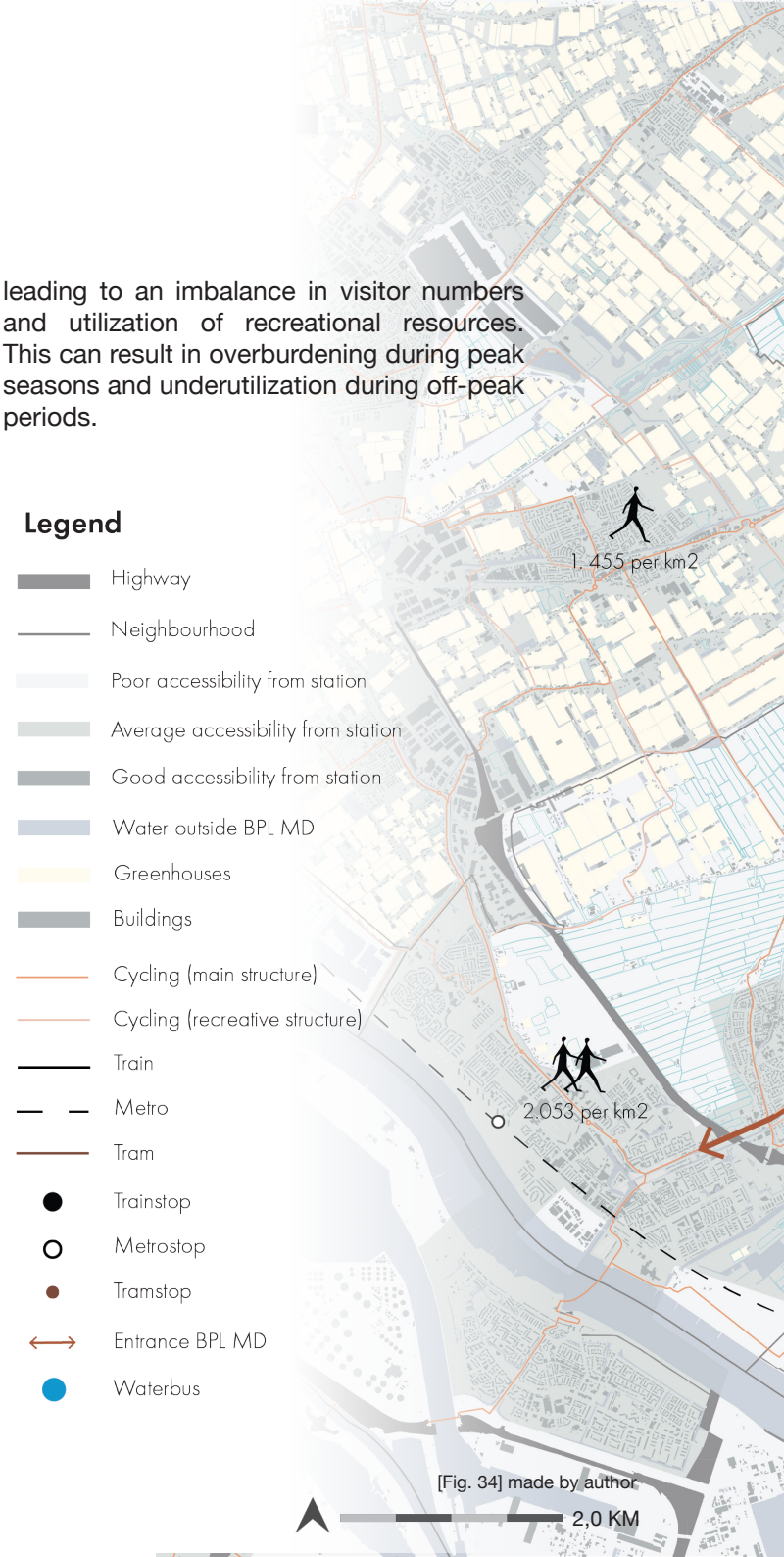
4.4 Accessibility

4.4.1 Analysis

Currently, multiple recreation routes, including cycling and pedestrian paths, traverse the landscape of Midden Delfland. However, these routes often conflict with the farmers working in the agricultural areas. Additionally, the intended target group does not always utilize recreational sites, leading to misuse or disturbance of the natural environment and farming activities.

Besides, the region needs more specific recreational infrastructure. This could improve the availability and accessibility of recreational opportunities for residents and visitors. Secondly, the range of recreational activities in the region can be limited, leading to a need for more diverse options for individuals with different interests and preferences. This can result in decreased satisfaction and engagement in recreational pursuits. Also, recreational activities can have adverse effects on the natural environment. Issues like littering, habitat disturbance, and soil erosion may arise if the region's recreational areas need to be appropriately managed and protected.

Furthermore, multiple user groups engaging in different recreational activities can lead to conflicts. For example, disputes may arise between hikers and cyclists sharing the same trails or between motorized and non-motorized water sports enthusiasts on water bodies. Lastly, the region needs more awareness of the historical and cultural landscape. Some recreational activities might be highly dependent on specific seasons, leading to an imbalance in visitor numbers and utilization of recreational resources. This can result in overburdening during peak seasons and underutilization during off-peak periods.



[Fig. 34] made by author


3.200 per km2
3.606 per km2
1.563 per km2
1.342 per km2
1. 455 per km2
4.022 per km2
3.338 per km2
2.821 per km2

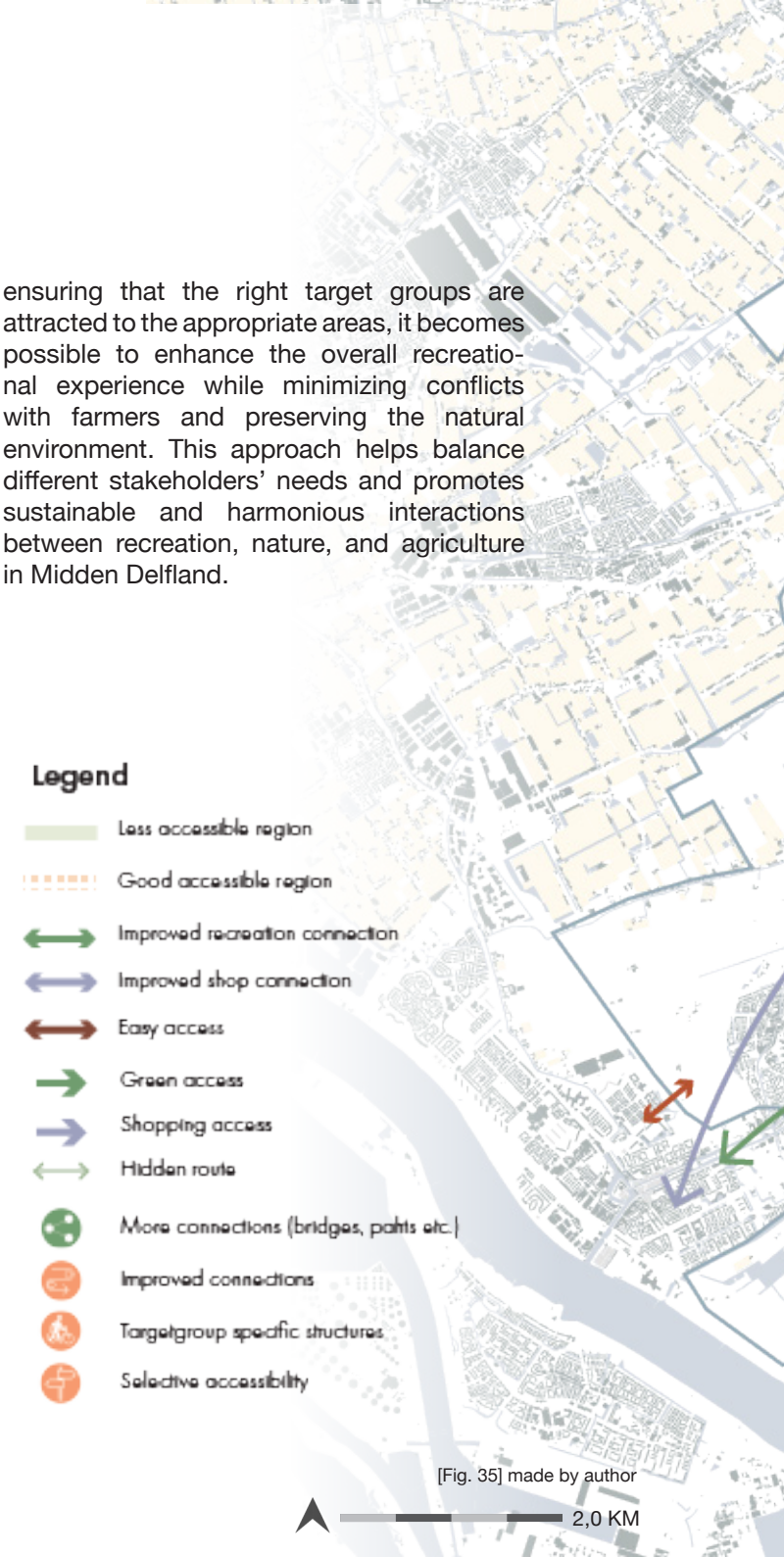
4.4 Accessibility

4.4.2 Maximization

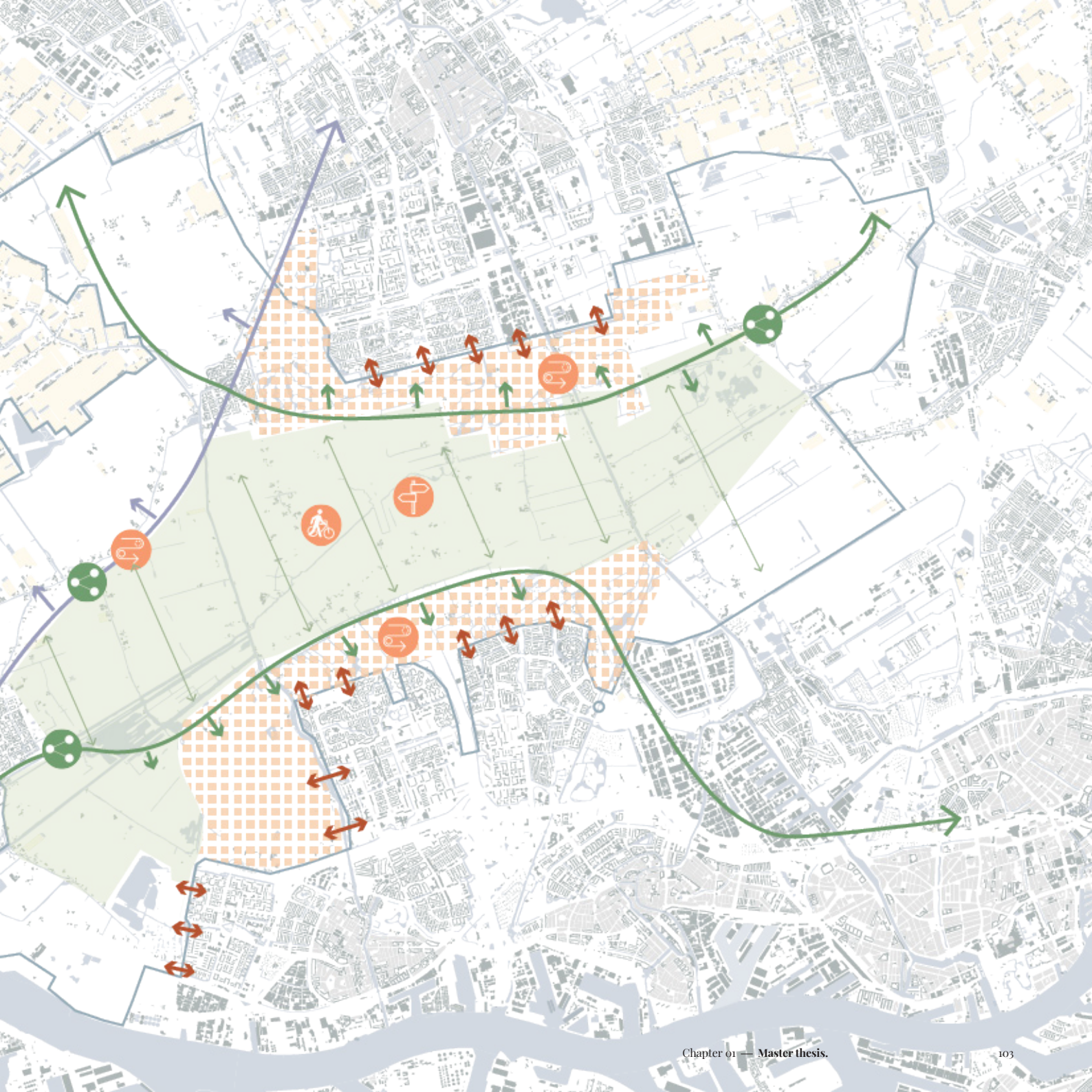
Improving the access points and entrances to the active recreation areas is essential to address these issues. By designing better gates and entrances, it becomes possible to control and manage the entry of active recreation enthusiasts, ensuring they can enjoy the facilities without disturbing the surrounding nature or interfering with agricultural operations. This includes implementing measures to prevent unauthorized access, such as installing gates that can be opened by cyclists or pedestrians but restrict vehicle entry.
Furthermore, the other connections and routes in the landscape should be redesigned to attract the appropriate target audience and promote responsible use. This can be achieved by clearly signposting and marketing the routes to specific groups, emphasizing the unique features and experiences that cater to their interests.

Furthermore, the other connections and routes in the landscape should be redesigned to attract the appropriate target audience and promote responsible use. This can be achieved by clearly signposting and marketing the routes to specific groups, emphasizing the unique features and experiences that cater to their interests. For example, promoting nature trails and bird-watching spots to attract nature enthusiasts or highlighting farm tours and agricultural experiences to engage visitors interested in farming practices.

By optimizing the recreational routes and ensuring that the right target groups are attracted to the appropriate areas, it becomes possible to enhance the overall recreational experience while minimizing conflicts with farmers and preserving the natural environment. This approach helps balance different stakeholders' needs and promotes sustainable and harmonious interactions between recreation, nature, and agriculture in Midden Delfland.



[Fig. 35] made by author



4.4 Accessibility

4.4.3 Optimization

The existing connection between the city and the landscape serves as a foundation, but there is room for further strengthening and enhancement. It is equally important to establish a more robust and symbiotic relationship between recreation and nature, with a strong emphasis on respecting and appreciating the inherent qualities of the natural environment. To facilitate this, specific types of routes can be strategically implemented to establish a meaningful connection.

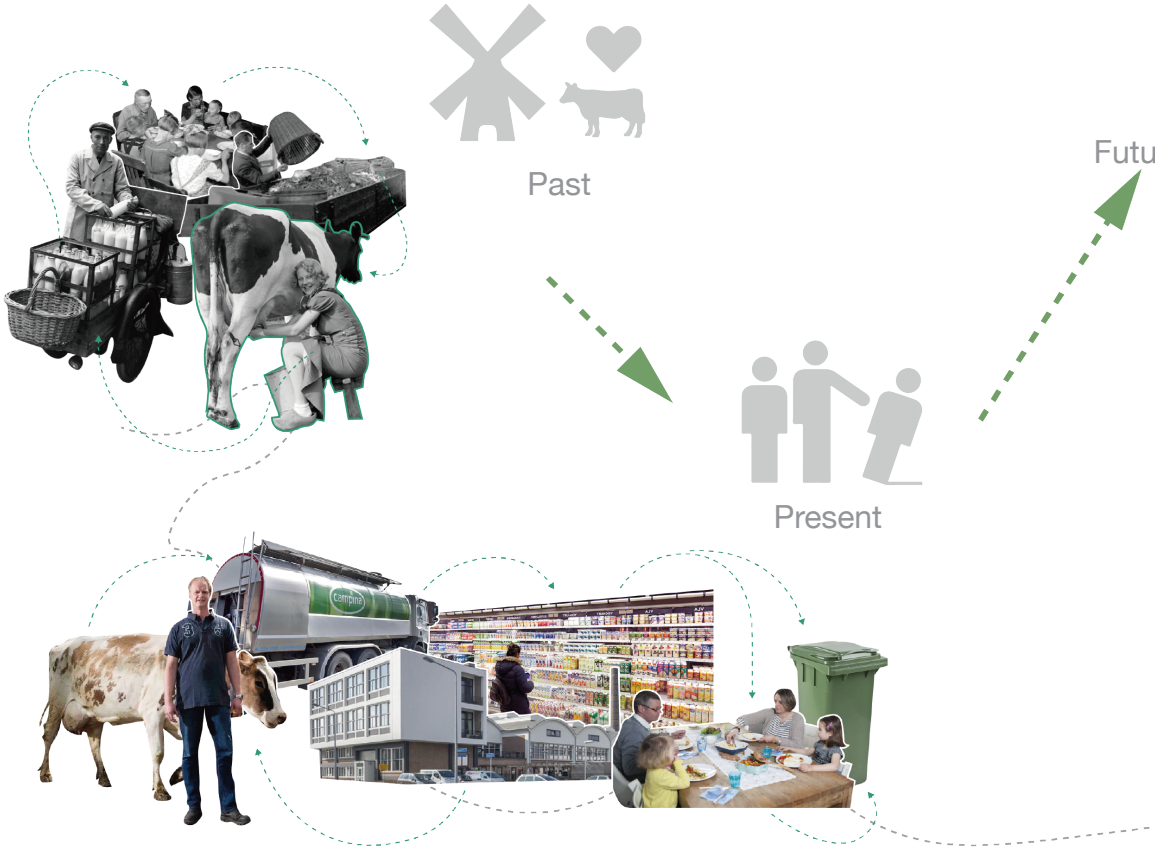
In order to achieve a balanced and sustainable approach, it is essential to designate certain areas of agricultural land as off-limits to recreational activities. This ensures that the farmers can continue their vital work without disruption or interference. By delineating these protected zones, the integrity and productivity of the agricultural landscape can be preserved while still allowing for recreational opportunities elsewhere.
The aim is to create a cohesive and integrated experience where the city, landscape, recreation, and nature seamlessly intersect. This can be achieved through careful planning and design, including the development of designated routes and pathways that showcase the unique natural and cultural features of the region. These routes should encourage responsible and mindful engagement, fostering an appreciation for the environment and promoting a sense of stewardship among visitors.
A harmonious and mutually beneficial relationship can be cultivated by reinforcing the connection between the city and the landscape and establishing a stronger bond between recreation and nature. This approach recognizes the importance of preserving the agricultural heritage while providing opportunities for people to engage with and appreciate the natural landscape. Ultimately, it aims to strike a balance that respects the needs and aspirations of urban dwellers and the rural environment.

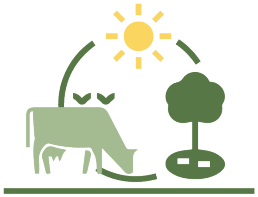
4.2.4 Recreational landscape

‘Balancing intensive and extensive recreation’

[Fig. 36] made by author

4.5 Interview farmers





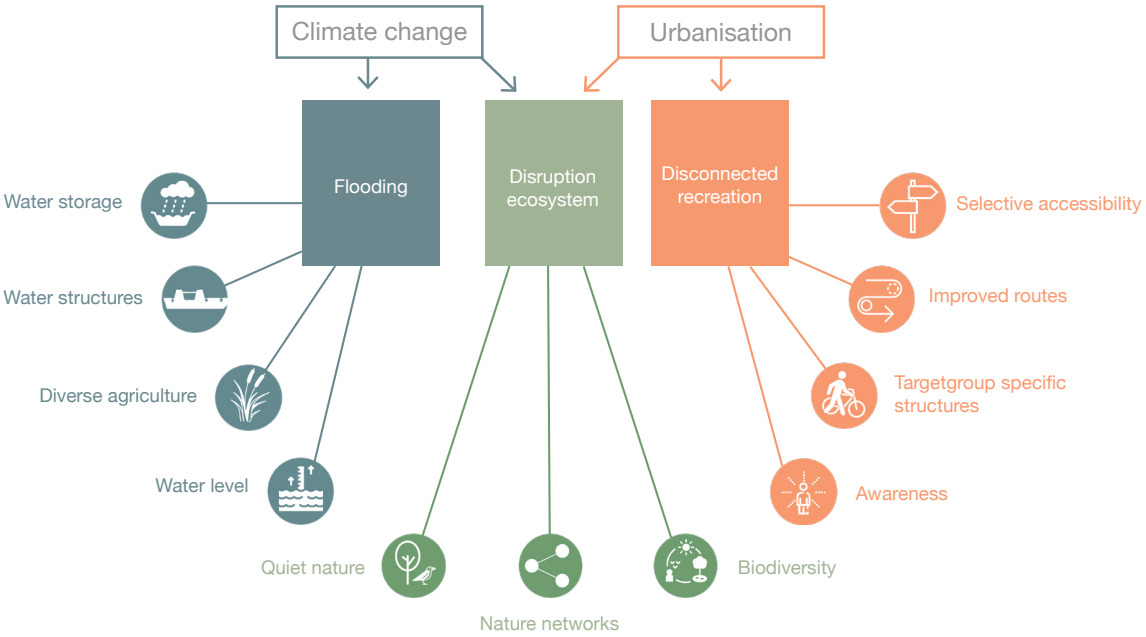
Healthy ecosystem

Landscape preservation

Culture & history preservation

Creating awareness

4.6 Optimization combined



4.6.1 Goals

1. Maximizing water potential
‘Creating room for quantity and quality of water’

2. Ecological restoration
‘Increasing biodiversity for improved mead bird livability’

3. Creating recreational diversity
‘balancing intensive and extensive recreation’

Waterproof landscape

Water storage

- Water buffer
- New ditches
- Bigger canals

Water structure

- Swamps
- Land grading
- Constructed wetlands

New agriculture

- Crop rotation
- Wet cultivation
- Foodswamp
- Buffer strips
- Eco banks

Biodiversity

- Diverse habitats

Nature networks

- New nature
- Buffer zones
- Diverse vegetation

Targetgroup specific structures

- Themed routes
- Activities in landscape

Selective acces

- Borders

Ecological landscape

Biodiversity

- Seasonal greenery
- Diverse habitats
- Protection zones

Nature networks

- New nature
- Buffer zones
- Diverse vegetation

Quiet nature

- Timezones
- Restricted acces
- Barriers

Water structure

- Swamps

New agriculture

- Buffer strips
- Eco banks

Selective acces

- Borders
- Attrective gates

Targetgroup specific structures

- Themed routes
- Activities in landscape

Awareness

- Birdwatching
- Organized tours
- Workshops

Recreational landscapes

Selective acces

- Borders
- Information signs
- Attrective gates

Improved routes

- Slow traffic routes (cycling & walking)
- Place to stay
- Low impact bridges
- Boardwalks

Targetgroup specific structures

- Themed routes
- Activities in landscape

Awareness

- Birdwatching
- Organized tours
- Workshops

Water storage

- Water buffer

New agriculture

- Wet cultivation

Biodiversity

- Seasonal greenery
- Diverse habitats

Nature networks

- Diverse vegetation

4.7 Demands

Midden Delfland has an surface area of 50km2 while BPL MD has a surface area of 80km2.

4.7.1 Recreational demand

Midden-Delfland is a highly popular destination for recreational activities, attracting approximately 4.2 million annual visits (±200,000) according to a study by Enting & Ziegelaar in 2001. The majority of these visitors, around 157,000 (±7,500), come from neighboring cities such as Vlaardingen, Schiedam, Maassluis, Rotterdam-Northwest, Delft, Schipluiden, Maasland, De Lier, and Naaldwijk.

The current recreational space in BPL MD amounts to 183 hectares which is 3,9% of the surface of Midden Delfland. The required amount of recreational space is 220 hectares, resulting in a shortage of 37 hectares (CBS, 2011). To meet the recreational demands of the region, it is estimated that an average of 0.0014 hectares of recreational space is needed per person.

Looking ahead to 2070, it is projected that the number of people utilizing the region for recreation will increase to 408,200. To accommodate this growing demand, it will be necessary to provide approximately 570 hectares of recreational space. However, if this area is used excessively, the quality of the space may suffer. So, rather than constructing more hectares of recreational space, it might be decided to make some areas more dense. This calculation is based on Midden Delfland, however in this report the region BPL MD is used. Therefore the next numbers will be less accurate. BPL MD is around 80km2 whereof 352 hectares is needed for 204.100 people. In 2070, 53.000 people will use this area to recreatie and this means 914 ha of recreational area is needed.

4.7.2 Water demand

At the moment BPL MD has 120 ha of water storage which is 1,5% of the total surface. In the year 2100, the landscape will require 574 hectares of surface water to meet its water needs. In 2070, BPL MD needs 330 hectares of water, which accounts for approximately 57% of the water demand projected for 2100. This implemented water surface addresses the challenges of capturing rainfall and retaining water during periods of drought.

To achieve this, it is crucial to allocate space for the creation of buffer zones. These buffer zones should have a depth of 1.5 meters to prevent immediate evaporation of the water. Additionally, these buffers need to be connected to the boezemwater (a regional water system) using a pump. This connection enables the water to be pumped out during periods of heavy rainfall, effectively managing excessive water levels. Furthermore, the buffer can be closed off when it is necessary to conserve the water for future droughts.

By implementing this in the design, substantial progress can be made towards meeting

the water requirements of the landscape in 2100. The creation of water bodies, coupled with the establishment of buffer zones and a pump connection to the boezemwater, will contribute to a more sustainable and resilient water management system.

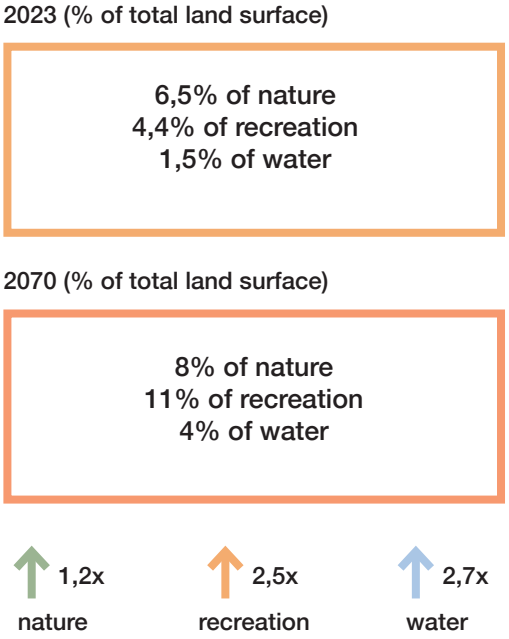
4.7.3 Ecological demand

In 2010, there were 93 hectares of forest and open nature land, which is 2.0% of Midden Delfland. In BPL MD, this is 149 hectares of forest and open nature land. In 2018, there were 520 hectares of natural area with management type moist meadow bird grassland.
- 37 ha herb-rich grass
- 5 ha swamp
- 5 ha high water level in ditches
- 38 ha of extensive pasture
which reaces a total of 85 hectares.

The naturevalue of certain types of vegetation (Melman et al., 2005):
ditch banks = 39,9
swamp = 41,6
semi-wetgrasland = 52
parcels = 31,3
trench = 36,5

To increase the variety of habitst , improve ecological corridors, encourage the growht of native plant species and protect wildlife mainly the swamp, semi-wet grassland and the ditch banks should be improved and extended. The swamp area will be highly increasued due to the implementation of waterbufferzones, this will be increased by 20 ha. The herb rich grassland will be doubled

and will reach 80 ha. The ditch banks wil improved by 45 ha and the extensive pasture will increase by 10 ha. This leads to a total of 675 hecaters of natural land in 2070.



[Photo 24] Recreation in grassland (Midden Delfland, 2021)

Designing

5.1 Concept.

The design for the polder landscape of BPL MD incorporates three key concepts aimed at achieving sustainable land use and enhancing the multifunctional purpose of the area while preserving its characteristics (Deelstra, Boyd & Van Den Biggelaar, 2001). These concepts include “The 3 Borders,” “Three Different Areas,” and “Three Themes.” This chapter explores the significance of these concepts, highlighting their importance in promoting ecological restoration, maximizing water potential, and creating recreation diversity. This chapter provides a comprehensive understanding of why these concepts are crucial for the sustainable development of the polder landscape.

The 3 Borders: Delft, Rotterdam and De Lier on the border of the polder landscape. “The 3 Borders” focuses on establishing connections between the city, greenhouses, and land, while integrating agriculture and recreational activities. This approach fosters a harmonious relationship between urban areas, agricultural practices, and the natural landscape. Research has shown that such combined land use planning can have numerous benefits, including enhanced ecological connectivity (Benedict & McMahon, 2006), improved food production efficiency (de Roo et al., 2018), and increased recreational opportunities (Fischer et al., 2012). By incorporating agriculture and recreational elements into the border areas, the design promotes sustainable and multifunctional use of land, ensuring the preservation of valuable ecosystems while meeting the recreational needs of the local community.

Three Different Areas: Eco Center, Local AgriCorner, and Recreational Border. The concept of “Three Different Areas” divides the polder landscape into distinct zones, each with its specific focus and purpose. The Eco Center is the core of the polder landscape, a quiet, peaceful zone where nature is the main character and humans are guests. This zone is all about promoting ecological restoration and biodiversity conservation.

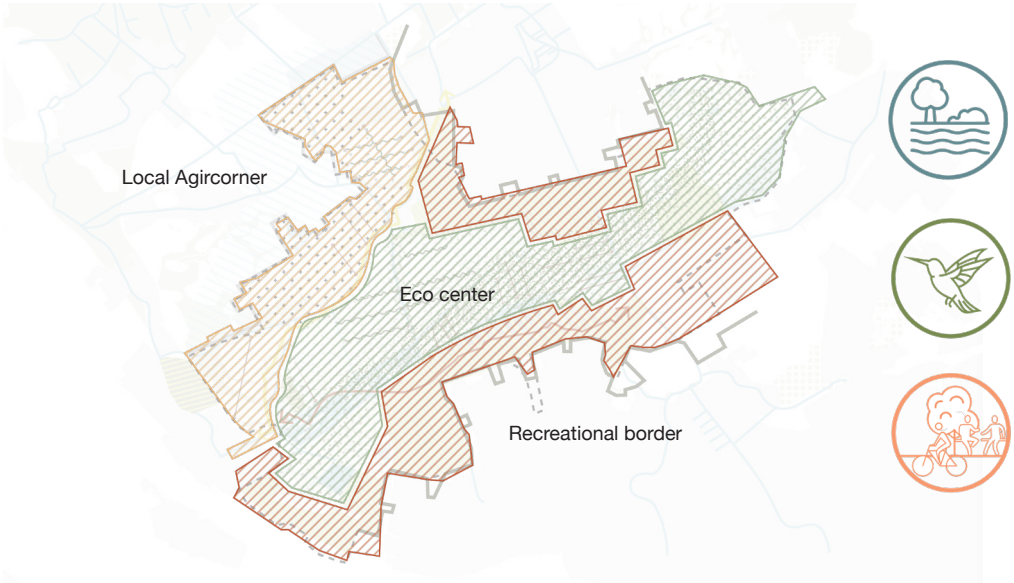
The Local AgriCorner aims to support local agriculture, fostering sustainable farming practices and promoting the consumption of locally produced food. The local Agricorner also tries to solve the conflict between recreant and the farmer by offering farm tours and farm-to-table experiences, allowing visitors to experience the agricultural lifestyle while respecting the farmers’ work. For example, multiple farms will offer a guided tour of their dairy operation, where visitors can learn about milk production and even help milk the cows, providing an interactive and informative experience while still maintaining the daily routines of the farmers.

Finally, the Recreational Border offers diverse leisure activities for residents and visitors, encouraging physical activity, social interaction, and the enjoyment of nature. This approach aligns with the principles of integrated landscape planning, which emphasize the importance of recognizing and respecting the multiple functions and values of different land areas (Tress et al., 2013). The concept ensures a balanced and sustainable use of

the polder landscape by designating specific zones for various purposes.

Three Themes: Maximizing Water Potential, Ecological Restoration, and Creating Recreation Diversity. The “Three Themes” concept focuses on addressing critical aspects of sustainable development within the polder landscape. Firstly, maximizing water potential involves managing water resources effectively, including creating water buffers and storage facilities. This theme aligns with water-sensitive urban design principles, emphasizing integrating water management practices into the urban landscape (Fletcher et al., 2019). Secondly, ecological restoration aims to restore and enhance the natural habitats within the polder landscape, promoting biodiversity conservation and the provision of ecosystem services. This theme is crucial for maintaining ecological balance and safeguarding the long-term sustainability of the area (Dudley et al., 2010). Lastly, creating recreation diversity acknowledges the importance of offering a wide range of recreational opportunities to cater to the diverse preferences and needs of the local community. This theme aligns with social sustainability principles, promoting inclusive and equitable access to recreational activities (Agyeman, 2013).

Those three concepts are vital for the new design of the polder landscape BPL MD. Through the integration of agriculture, recreation, and ecological restoration, these concepts offer a holistic approach to land use planning, aiming to achieve a future-proof environment.



[Fig. 37] made by author

5.2 Vision map.

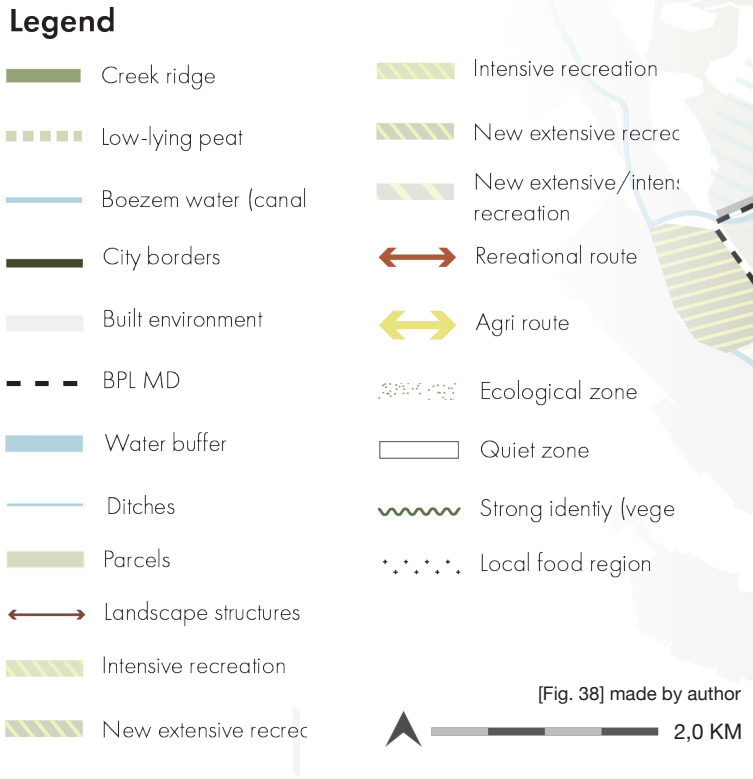
The most critical research methods used for this vision are the interviews, the maximization method, and the field trip. The interviews involve gathering insights and opinions from different farmers. The maximization method is a quantitative approach that helps identify the most effective use of resources to achieve the vision. Finally, the field trip allows for firsthand observation of the area and its unique characteristics. By utilizing these research methods, a vision can be developed with a comprehensive understanding of the needs and opportunities in the area. This vision can then be used to guide decision-making and planning processes for the development and improvement of the site.

Additionally, involving community members in the research process can lead to a more inclusive and equitable vision that reflects the diverse needs and perspectives of those the development will impact. In this graduation report, the vision will lead to 3 designs and examples of possible implementations. It is crucial to conduct additional research on the farmer's properties if the design becomes a reality. The updated design will ensure that all farmers within the study's property boundaries are adequately protected from potential risks and hazards. Additionally, the implementation of this design will have positive effects on the local ecosystem and, because of that, also on sustainable farming practices.

The vision map shows a more detailed plan according to the three concepts. The most important aspects of this map are:

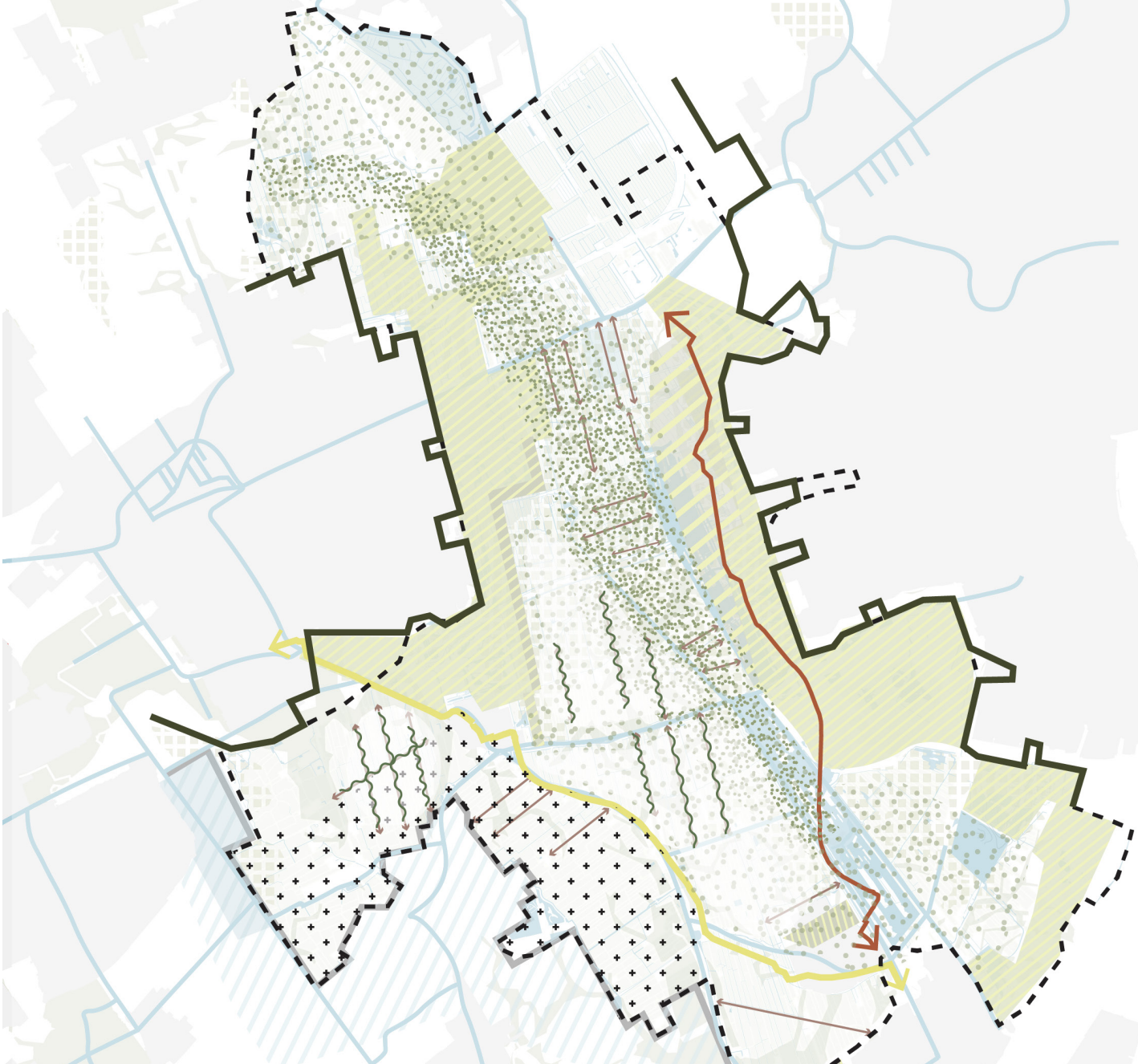
- The newly placed water buffer.
- The quiet zones for meadow birds.
- The intensive recreation route
- The local shopping route.
- The different vegetation types.
- The stronger character of the Gaag.

T
he water buffer will help to prevent flooding in the area, while the quiet zones will provide a safe haven for meadow birds to thrive. The intensive recreation and local shopping routes will also offer residents and visitors opportunities for leisure and commerce within the polder.



[Fig. 38] made by author

"From south to north, the transition of recreation in BPL MD spans from vibrant intensity to serene tranquility, gradually leading to the heart of the region's peaceful nature core."



5.3 Maximizing water potential

'Creating room for quantity and quality of water'

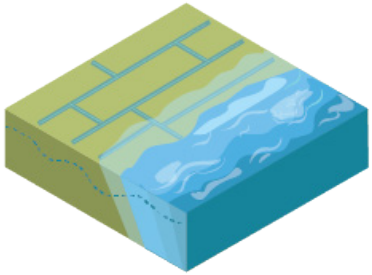
Maximizing water potential and implementing effective water management strategies in the landscape can have significant spatial impacts. There are multiple ways to improve the water system in this area. Creating water buffer zones involves designating specific places to store excess water during heavy rainfall or flooding. These buffer zones can be designed as natural or engineered features, such as wetlands, retention ponds, or floodplains. Spatially, these buffer zones can result in the creation of new water bodies or the expansion of existing water features.

Storing water in the landscape can enhance water accessibility for various purposes, such as irrigation, recreation, and ecological restoration. Water availability can be better managed and distributed throughout the landscape by creating water storage facilities, such as reservoirs or water basins. This improved access to water resources can positively impact the spatial arrangement of agricultural areas, recreational spaces, and natural habitats. Water bodies, whether natural or created for water storage purposes, can enhance the landscape's aesthetic appeal, and create recreational opportunities. Lakes, ponds, and canals can serve as focal points within urban areas, offering tranquil spaces for leisure activities, waterfront development, and community gathering. These water features can transform the spatial experience, providing visual interest and a sense of serenity.

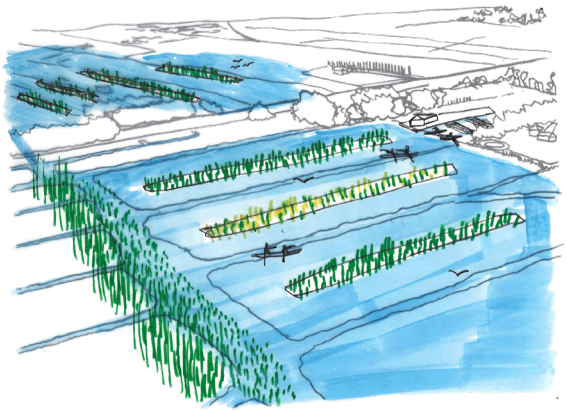
Water buffer

The first intervention to increase the amount of water in the BPL MD is creating a water buffer. The definition of a water buffer is an area in which water can be stored. To implement water buffers in the open landscape, it is essential to identify suitable areas that can accommodate water storage and provide ecological benefits. This involves analyzing the landscape's hydrological characteristics, such as groundwater levels, soil types, and drainage capacity. Furthermore, the design of water buffer structures should consider the specific needs of the polder landscape. Different water buffering structures, such as lakes, floodplain areas, or controlled drainage systems, can be implemented depending on the topography and land use. The design should maximize water storage capacity while minimizing the environmental impact.

The water buffer will be used differently at different times of the year. To have enough room to store water during periods of heavy rain, the water buffer should be kept at its maximum, meaning water needs to be pumped out during the winter. So, during the winter, water will need to be pumped out. The buffer is specifically designed to hold water after this wet period, so extra water is available during dry summers. This helps to ensure a consistent water supply throughout the year and reduces the risk of flooding and droughts. In addition, this more extensive water buffer also allows for different types of vegetation, creating a diverse ecosystem that supports various flora and fauna.

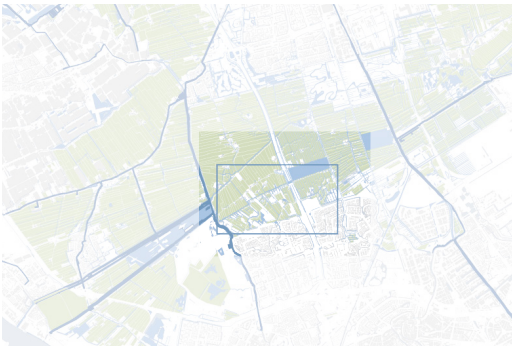


Location of implementation



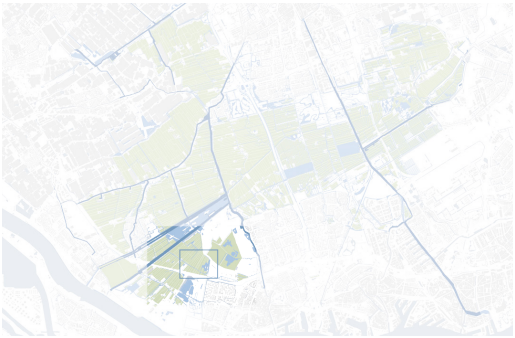
[Fig. 39] made by author

Different types of water buffers

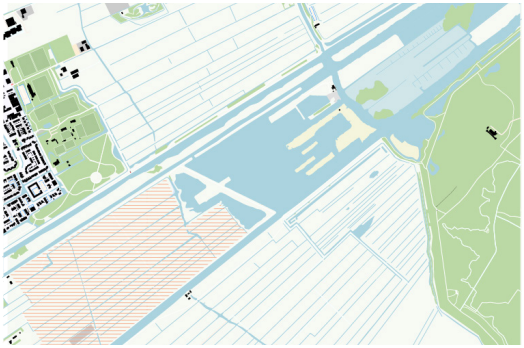


1. Waterbuffer Holierhoekse Polder

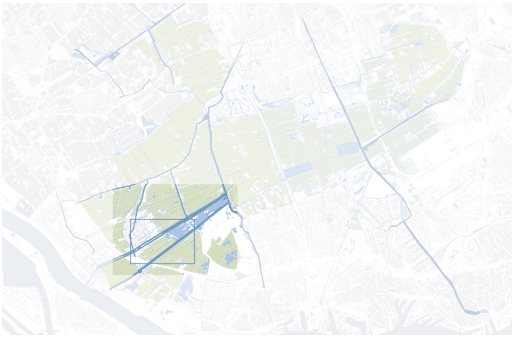
220 ha



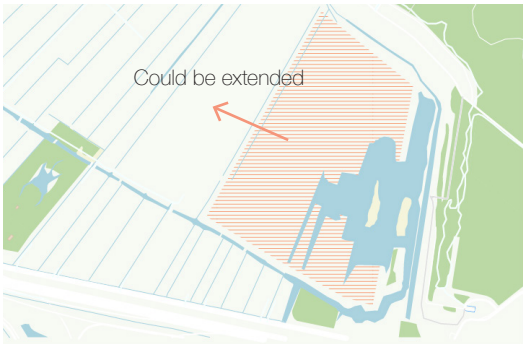
2. Extended Foppenplas



60 ha



3. Recreational South



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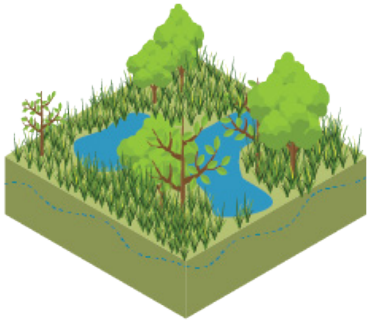
[Fig. 40] made by author

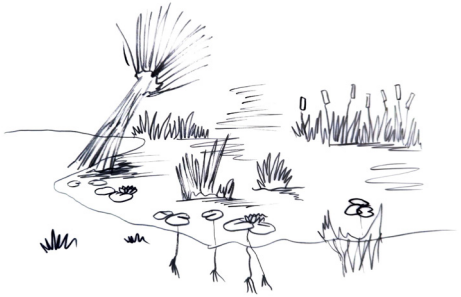
Swamp area

Swamps are permanent or temporary shallow waters rich in aquatic plants (Akkerman, Fiselier, & Hosper., 1990). Swamps can be used for water purification, however they can also serve for nature development, restoration, and creation of natural values. High-rising marsh vegetation can also play a role in highlighting existing and/or developing new landscape structures (Toet et al., 1988). Implementing a swamp area involves creating and managing a wetland ecosystem within a specific location. The presence of water-saturated soils characterizes swamps and is typically dominated by vegetation that is adapted to such conditions.

Selecting suitable plant species is crucial in creating a swamp area. These plants should be adapted to wet conditions, such as cattails, sedges, bulrushes, and water lilies. The vegetation plays a vital role in regulating water levels, stabilizing the soil, and providing habitat for various organisms. The spatial arrangement and distribution of vegetation within the swamp area contribute to its visual appeal and ecological functioning. Overall, the spatial qualities of a swamp area include the presence of wetland pools, zonation of vegetation, textural contrast, and the provision of habitat for various organisms. A swamp area can become a visually captivating and ecologically valuable landscape component by carefully designing and implementing these spatial qualities.



Location of implementation



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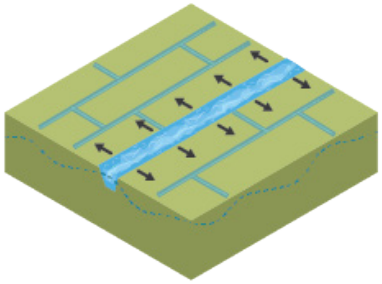
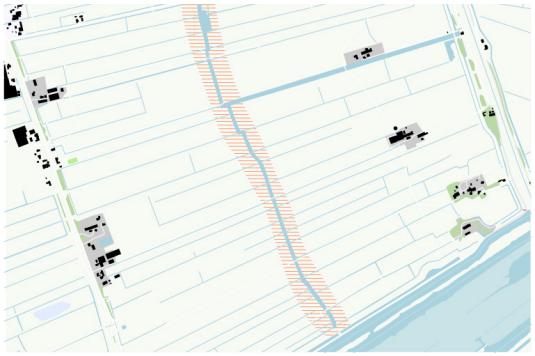
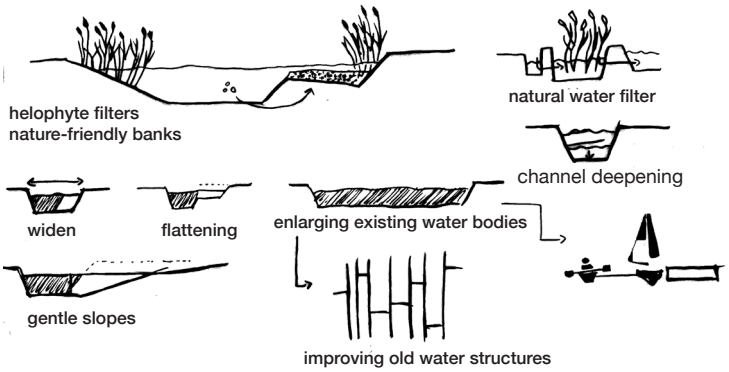
Widen Ditches

The second intervention to increase the amount of water in the BPL MD is widening the ditches. There are a lot of small ditches throughout the polder landscape; there used to be even more, but many of them have been filled in. These ditches ensure that excess rain and groundwater are drained away. Widening the ditches in polders increases their cross-sectional area, allowing them to hold larger volumes of water during heavy rainfall (Teurlincx et al., 2018). This increased water storage capacity helps prevent rapid water accumulation in the polder area. Additionally, the broader ditches also provide a habitat for aquatic plants and animals, contributing to the overall biodiversity of the area.

Wider gutters enhance the drainage efficiency of the polder system by enabling faster water flow and evacuation. During intense rainfall, the widened ditches provide a larger conduit for water to drain out of the polder area, effectively reducing water levels and preventing waterlogging. This helps maintain optimal soil conditions for agricultural productivity and minimizes potential flood damage to infrastructure and properties. With climate change leading to more frequent and intense rainfall events, widening ditches can help increase the resilience of polders against extreme weather. The expanded capacity of the ditches enables them to accommodate larger volumes of water, reducing the risk of flooding and associated damages. This adaptation measure aligns with the concept of climate-resilient design, which aims to enhance the ability of landscapes to cope with changing climatic conditions.







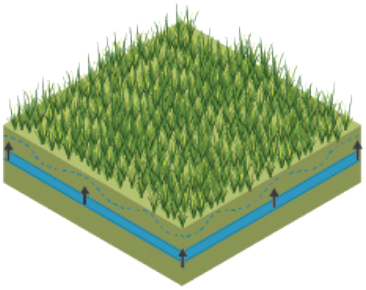
[Fig. 42] made by author

Higher water level

The third intervention is raising the water level in different polders to enhance water storage capacity. Raising water levels in polders increases their ability to store water during heavy rainfall or flooding. This helps reduce the risk of waterlogging, which can harm agriculture, infrastructure, and ecological systems. Increasing water storage makes the polder landscape more resilient to extreme weather events.

Higher water levels can also create or restore wetland habitats within the polder landscape. Wetlands support diverse plant and animal species, contributing to increased biodiversity and ecological resilience. Wetlands provide habitats for waterfowl, amphibians, and aquatic plants while offering opportunities for ecological restoration and conservation.

Besides, raising water levels can also lead to improved water quality in the polder landscape. Higher water levels promote better water circulation, which helps reduce stagnant water and the accumulation of pollutants. This can positively impact aquatic ecosystems, promoting healthier habitats for fish, invertebrates, and other aquatic organisms. Higher water levels in the polder landscape can enhance its visual appeal and create new recreational opportunities. Water bodies and wetlands can provide scenic views, attract wildlife, and offer opportunities for activities such as boating, fishing, birdwatching, and nature appreciation. These recreational amenities can contribute to the overall livability and attractiveness of the landscape.



Location of implementation

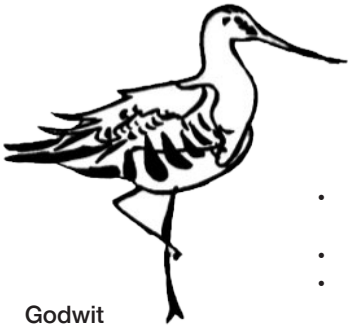
[Fig. 43] made by author

5.4 Ecological restoration

'Increasing biodiversity for improved meadow bird livability

The meadow bird is the most important species in this region, and therefore it needs to be protected, and its environment needs to be improved. Besides the meadow birds, the biodiversity needs to increase in order to maintain a healthy ecosystem. This can be achieved through preserving natural habitats, increasing different types of vegetation, creating ecological banks and stimulate wet cultivation (Teurlincx et al., 2018).

Preserving and restoring natural habitats is paramount for meadow bird conservation and overall biodiversity enhancement. This involves safeguarding existing grasslands, wetlands, and meadows from urbanisation and agricultural intensification. Protecting these habitats provides meadow birds with sufficient nesting areas, foraging grounds, and shelter. Conservation efforts should include measures to prevent habitat fragmentation and promote connectivity between different natural areas, allowing for the free movement and genetic exchange of meadow bird populations.



- looking for food in swamp meadow
- herb-rich grass
- high water level

Godwit

- tiny ditches
- plants that grow under and above water

Dragonfly (Grasjager)

- flowerfull meadow

Meadow bumblebee

- shallow wate
- sensitive

Natterjack toad

- sweet waer
- slow current

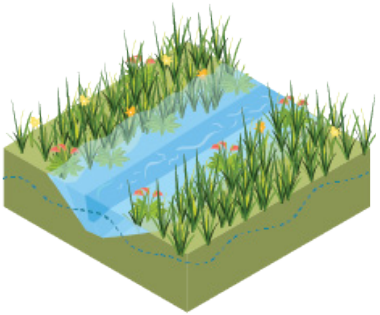
Bitterling

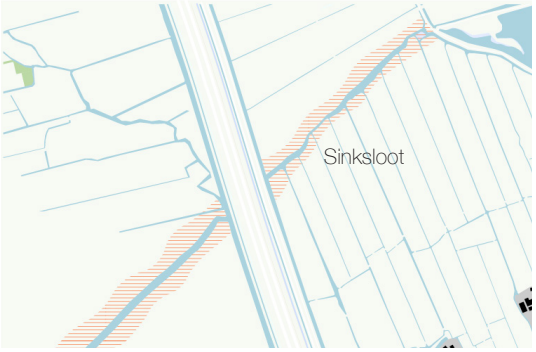
[Fig. 44] made by author

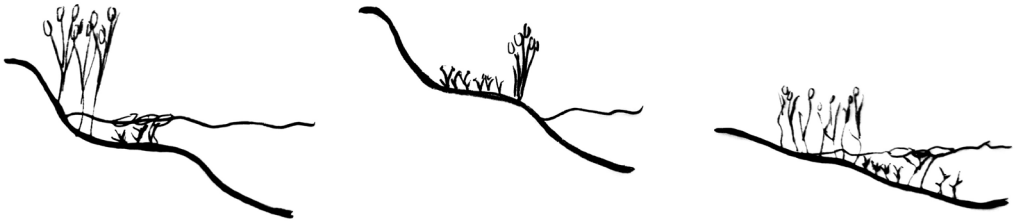
Ecological banks

The ecological bank is designed to mimic natural habitats, creating a diverse and thriving ecosystem within the polder. The ecological bank serves as a place for various plant and animal species, fostering biodiversity within the polder landscape. Its spatial design incorporates a range of microhabitats, such as wetlands, meadows, and woodlands, providing suitable conditions for a wide array of flora and fauna (Van Breukelen et al., 2003).

The ecological bank is carefully designed to blend harmoniously with the surrounding landscape, integrating seamlessly into the polder's spatial fabric. Its diverse vegetation, including native grasses, wildflowers, and shrubs, adds visual interest and texture to the scenery. The bank's varying elevations and contour lines create a dynamic topography that enhances the overall aesthetic appeal of the polder landscape. It helps mitigate the impacts of urbanisation and agricultural activities by filtering runoff water, reducing erosion, and improving water quality. (BoerenNatuur, 2021)







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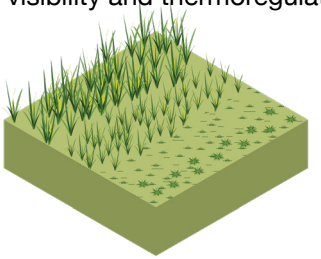
Variation in vegetation

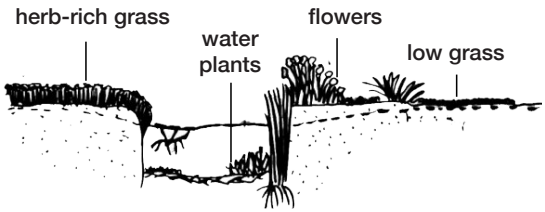
A diverse range of plant species within grasslands promotes biodiversity and ecological balance. Plant species offer various food sources, shelter, and nesting sites for insects, birds, and small mammals. This diversity supports a complex web of interactions and relationships within the ecosystem, contributing to its overall health and resilience. Variation in vegetation provides various ecosystem services that benefit the environment and human populations. Plant species have varying capacities for soil stabilization, nutrient cycling, and water retention.

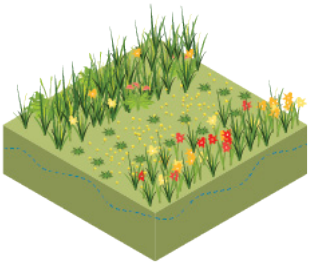
The presence of a variety of flowering plant species within grasslands supports pollinators, such as bees, butterflies, and other insects. Pollinators play a crucial role in plant reproduction, facilitating the transfer of pollen between flowers and ensuring the production of seeds and fruits. A diverse range of flowering plants provides abundant nectar and pollen sources, thus attracting and supporting a thriving population of pollinators. Besides, vegetation variation enhances grasslands' visual appeal and recreational value. Different colors, textures, and heights of plants create an attractive and dynamic landscape that residents and visitors can enjoy. Grasslands with diverse vegetation offer opportunities for nature observation, hiking, and other recreational activities.

Furthermore, variation in vegetation, and the differences in heights are essential, particularly for meadow birds. Meadow birds rely on insects, worms, and other invertebrates as their primary food sources. The various sizes of grass support a greater abundance and variety of insects, providing a more extensive foraging ground for meadow birds. Meadow birds build their nests in the grasslands, and varied vegetation offers them suitable nesting habitats. Different plant heights, densities, and structures allow meadow birds to select nest sites that offer protection and camouflage. Tall grasses and dense patches of vegetation provide shelter from predators, while shorter and more open areas allow for improved visibility and thermoregulation.



different heights



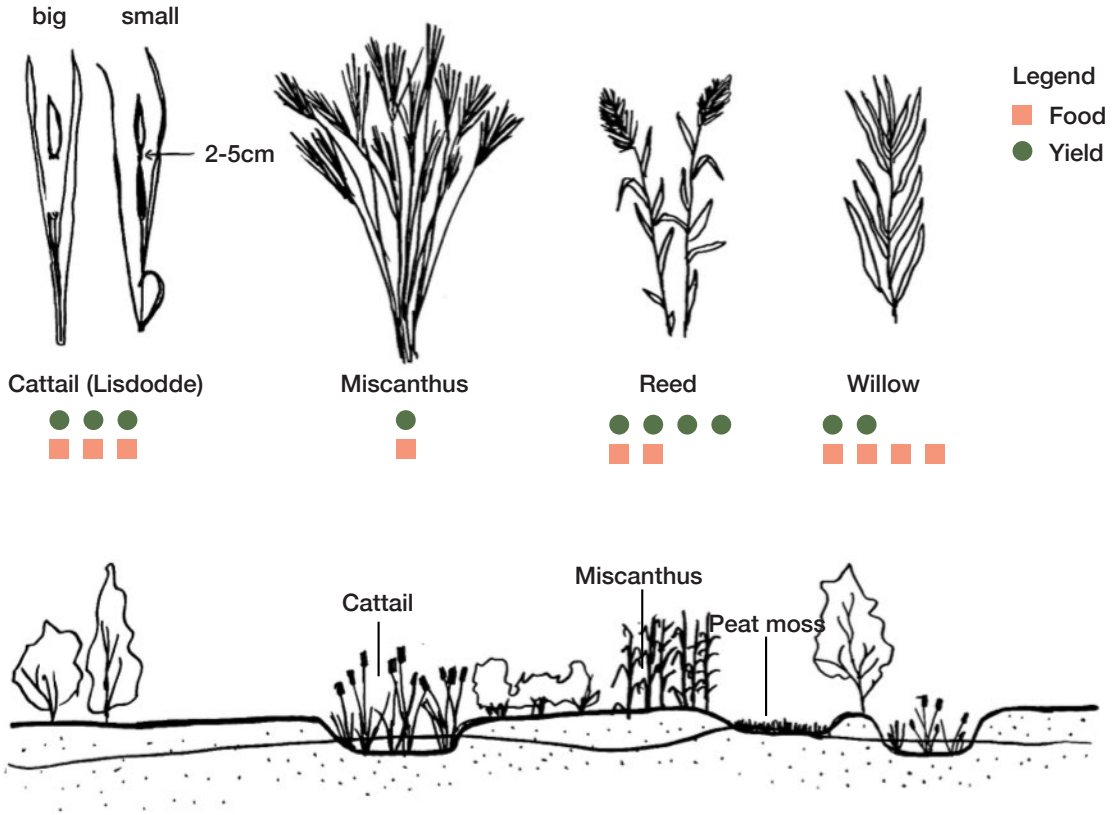


different types

[Fig. 46] made by author

Wet cultivation

Wet cultivation holds promise as a beneficial solution for polder landscapes in the future. This method involves intentionally maintaining a higher water level in low-lying polder landscapes, creating moist or semi-aquatic conditions suitable for specific crops. Wet cultivation systems make or restore wetland habitats within agricultural landscapes (BoerenNatuur, 2021). These wetland areas can support various plant and animal species, including waterfowl, amphibians, and insects. Wetlands serve as vital breeding grounds for many species and contribute to the ecological balance. They can also act as buffer zones, filtering and purifying water, reducing nutrient runoff, and mitigating the impacts of pollutants. Wet cultivation plays a role in sustainable water management. By maintaining higher water tables, farmers can retain water during periods of excess rainfall, reducing the need for external irrigation. This practice can help alleviate water scarcity during dry periods and contribute to overall water conservation. Wet cultivation also



[Fig. 47] made by author

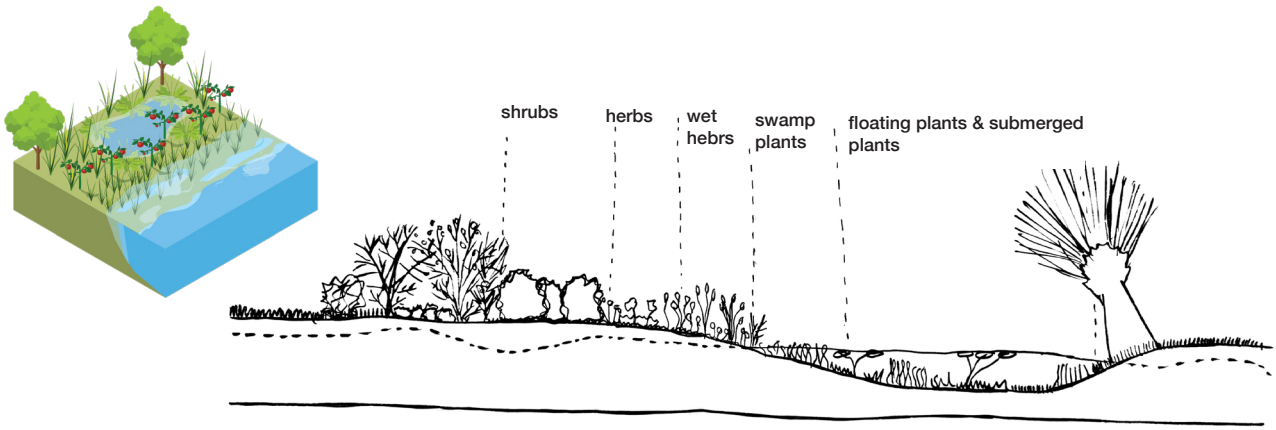
promotes groundwater recharge, which can help maintain aquifer levels and mitigate the effects of drought.

According to Youri Egas, growing rice in the peat landscape could be possible. Last summer, the first test was done, and the first rice grew. Youri Egas asserts that rice could be grown in a peatland environment. The first test was carried out last summer, and the first rice plant grew. The success of this experiment could pave the way for sustainable food production in areas that were previously considered unsuitable for farming.

All of the various crop types have other traits, though. Cattails can only be partially grown underwater and can grow up to 1.5–3 meters tall. Miscanthus can reach heights of 4 m. Reed thrives in dry conditions, grows to 2-4 meters, and requires regular maintenance to avoid causing a nuisance.

Another type of wet cultivation is the foodswamp. More and more places in the Netherlands are combining food production and nature for a more resilient and biodiverse environment and healthy food. A well-known example is the food forest. Many places in the Netherlands are naturally quite wet. Water levels are often artificially low to accommodate naturally wet (agricultural) land. A food swamp consists of different planting types: trees and large shrubs to actual aquatic plants. The highest and driest parts are nut trees and shrubs, and lower on the plot fruit bushes. The wetter part's low fruit bushes and perennials can withstand wet feet. And the true aquatic plants are submerged.
This creates a varied system in several layers. This promotes biodiversity and counteracts pests and infections as much as possible. The plants are chosen so that we can harvest them all year round.

Overall, wet cultivation offers a sustainable and climate-resilient approach to farming in polder landscapes. By embracing the natural hydrological conditions and incorporating wetland elements within agricultural systems, farmers can foster ecological sustainability, enhance soil fertility, and adapt to changing climate patterns while maintaining agricultural productivity.



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5.5 Creating recreation diversity
'Balancing intensive and extensive recreation'

In the new design for BPL MD, a key focus is to create diverse recreational opportunities that cater to different preferences and interests, ranging from intensive to extensive recreation. This approach recognizes the need for variation to accommodate the diverse range of people who will visit and enjoy the area. By offering different types of recreational experiences, the landscape of BPL MD will undergo a transformation that enhances its appeal and ensures inclusivity for all.

Intensive recreation zones will be designed to provide engaging and dynamic experiences for those seeking active and adventurous pursuits. These areas may include facilities for sports activities such as cycling, horseback riding, and water sports. Well-maintained trails, bike paths, and waterways will be developed to facilitate these activities, offering visitors opportunities to immerse themselves in the thrilling aspects of outdoor recreation. But also tractor driving, farmerfestivals, pole vaulting etc. By integrating these elements into the landscape, the design will encourage an energetic and vibrant atmosphere, attracting enthusiasts and thrill-seekers alike.

On the other hand, extensive recreation zones will offer a more tranquil and relaxed experience, appealing to those seeking solace in nature and the serenity of the surroundings. These areas will prioritize the preservation and enhancement of natural habitats, allowing visitors to engage in activities such as birdwatching, nature walks, and picnicking. The landscape will feature well-maintained walking paths that wind through meadows,w wetlands, and woodland areas, providing a sense of tranquility and a chance for introspection. These spaces will encourage a deep connection with the natural environment and provide an escape from the demands of urban life.

To ensure diversity in recreation, the design will also incorporate mixed-use areas that blend elements of intensive and extensive activities. These spaces will offer a fusion of opportunities, allowing visitors to engage in a range of activities based on their preferences. For instance, a mixed-use zone may feature a multi-purpose field for sports activities, surrounded by natural areas where individuals can relax, observe wildlife, or simply enjoy the beauty of the landscape. These zones will cater to a broad spectrum of interests and provide a sense of flexibility, enabling visitors to curate their recreational experiences based on their desires.

The transformation of the landscape will involve natural features, such as water bodies, woodlands, and meadows, will be preserved and integrated into the recreational spaces, maintaining the authenticity and ecological value of BPL MD. Consideration will also be given to accessibility, ensuring that recreational areas are inclusive and welcoming to people of all abilities and age groups.
By creating diverse recreational zones, BPL MD will become a destination that offers something for everyone.

Zoning

Differentiating zones into active and resting areas can be a beneficial approach to creating diverse recreation opportunities. This concept allows for a balance between more intense recreational activities and tranquil, nature-oriented experiences. Creating distinct active and resting zones caters to individuals' varied preferences and needs. Some seek active and energetic recreational activities like sports, cycling, or group games. These activities promote physical fitness, social interaction, and a sense of vitality. On the other hand, some individuals prefer quieter, contemplative experiences in nature, such as walking, birdwatching, or simply enjoying peaceful surroundings.

Designating resting areas provides opportunities for relaxation, solitude, and connecting with the natural environment. By incorporating active and resting zones, urban design can offer a range of recreational experiences for a diverse user base. The active and resting zones are designed to harmonize with the surrounding landscapes in BPL MD. For instance, active zones are located closer to urban areas or along designated recreational corridors, allowing easy access for residents and visitors. These areas feature sports fields, playgrounds, cano, events, pole vaulting etc. On the other hand, resting zones are integrated into more tranquil and natural areas in the middle of the polder landscape. They are designed with walking paths, seating areas, and observation points, encouraging visitors to immerse themselves in the scenic beauty and serenity of the landscape.
Designating resting zones in areas with high ecological value can help protect and preserve sensitive habitats and species. By promoting low-impact activities and minimizing disturbance in these areas, the urban design contributes to ecological conservation efforts. Resting zones can be strategically placed near important wildlife habitats or areas of ecological significance, allowing visitors to appreciate nature while minimizing their impact on fragile ecosystems. This approach supports the principles of ecological restoration and biodiversity enhancement in BPL MD.

Appropriate facilities and amenities can support the active and resting zones to enhance the recreational experience. Active zones may require infrastructure such as cycling paths and facilities like changing rooms, equipment rental, or refreshment areas. Resting zones can include amenities like benches, picnic areas, information boards, and accessible trails. Additionally, the design should consider providing suitable parking areas, restroom facilities, and wayfinding signage to ensure convenience and accessibility for visitors. However the quiet zone and should not have facilities because it should not attract people.

By incorporating active and resting zones into the urban design for BPL MD, a diverse range of recreational opportunities can be offered, accommodating various preferences, promoting health and well-being, and fostering a harmonious coexistence with the natural landscape.

Active Recreation Zone: This zone is designed for high-energy activities and sports. It may include sports fields, basketball or tennis courts, skate parks, or fitness areas. The focus is on providing spaces for physical exercise, team sports, and engaging recreational activities.

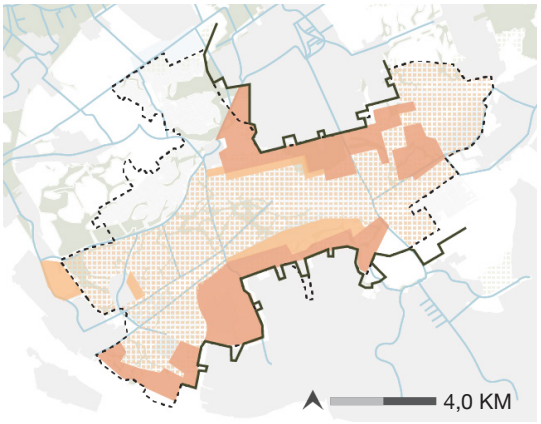
Passive Recreation Zone: This zone is dedicated to more relaxed and low-intensity recreational activities. It may feature picnic areas, benches, walking paths, and open spaces for leisurely activities like reading, picnicking, or simply enjoying nature. The emphasis is on creating a tranquil and calming environment for individuals to unwind and connect with the surroundings.

Nature Exploration Zone: This zone provides opportunities for people to engage with the natural environment. It may include nature trails, interpretive signage, observation points, and nature-themed play areas. The aim is to encourage visitors to explore and learn about the local flora, fauna, and ecosystems.

Water Recreation Zone: This zone caters to water-based activities. It may include swimming areas, boating or kayaking facilities, fishing spots, or waterfront promenades. The focus is on providing access to water bodies and creating a space for recreational activities centered around water.

Cultural and Heritage Zone: This zone celebrates the cultural and historical significance of the area. It may include heritage sites, museums, art installations, or cultural event spaces. The emphasis is on showcasing the local heritage, promoting arts and culture, and providing educational and enriching experiences.

Children's Safe Zone: This zone is specifically designed for children's recreation. It may feature playgrounds, interactive play structures, sandboxes, and areas for creative play. The focus is on providing a safe and stimulating environment for children to engage in imaginative play and physical activities.



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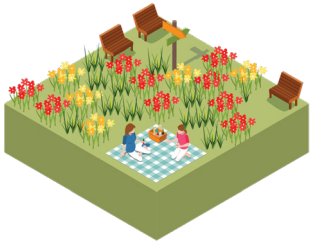
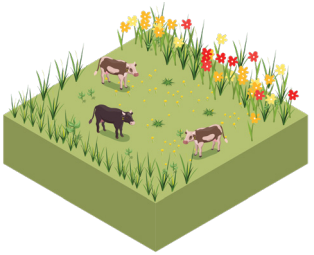
1. Active recreation

2. Passive recreation



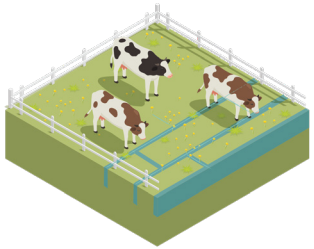
3. Cows in nature



4. Nature exploration

5. Water recreation

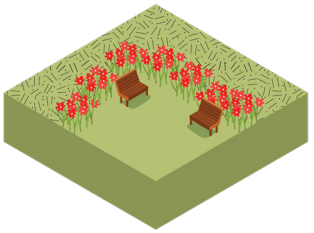
6. Farm visiting



7. Culture & heritage

8. Children's safe

9. Quiet zone



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Variety of activities

In the new design, various activities are planned to provide a range of experiences and engagement with the landscape of BPL MD. Each activity offers a unique opportunity for visitors to connect with nature, agriculture, and local culture. Here is an explanation of some of the activities:

Bird Spotting: Visitors can engage in bird watching and spot various bird species that inhabit the meadows and wetlands of BPL MD. This activity allows people to appreciate the diverse birdlife and learn about their habitats.

Meadow Bird Safari: This activity provides a guided safari experience where visitors can observe and learn about meadow birds in their natural habitat. It offers a chance to see these birds up close and understand their behavior and importance in the ecosystem.

Farmers Market: The farmers market brings local farmers and producers together, allowing visitors to buy fresh, locally sourced products. It promotes the connection between agriculture and the community and will enable people to support local businesses.

Pole Vaulting: Pole vaulting provides a unique and thrilling sporting activity in the open landscape. Participants can learn and practice the pole vaulting technique under professional guidance, adding a recreational and adventurous element to the experience.

Sandwich Making: This activity allows visitors to create sandwiches using local farm ingredients. It promotes the concept of farm-to-table dining and offers a hands-on culinary experience.

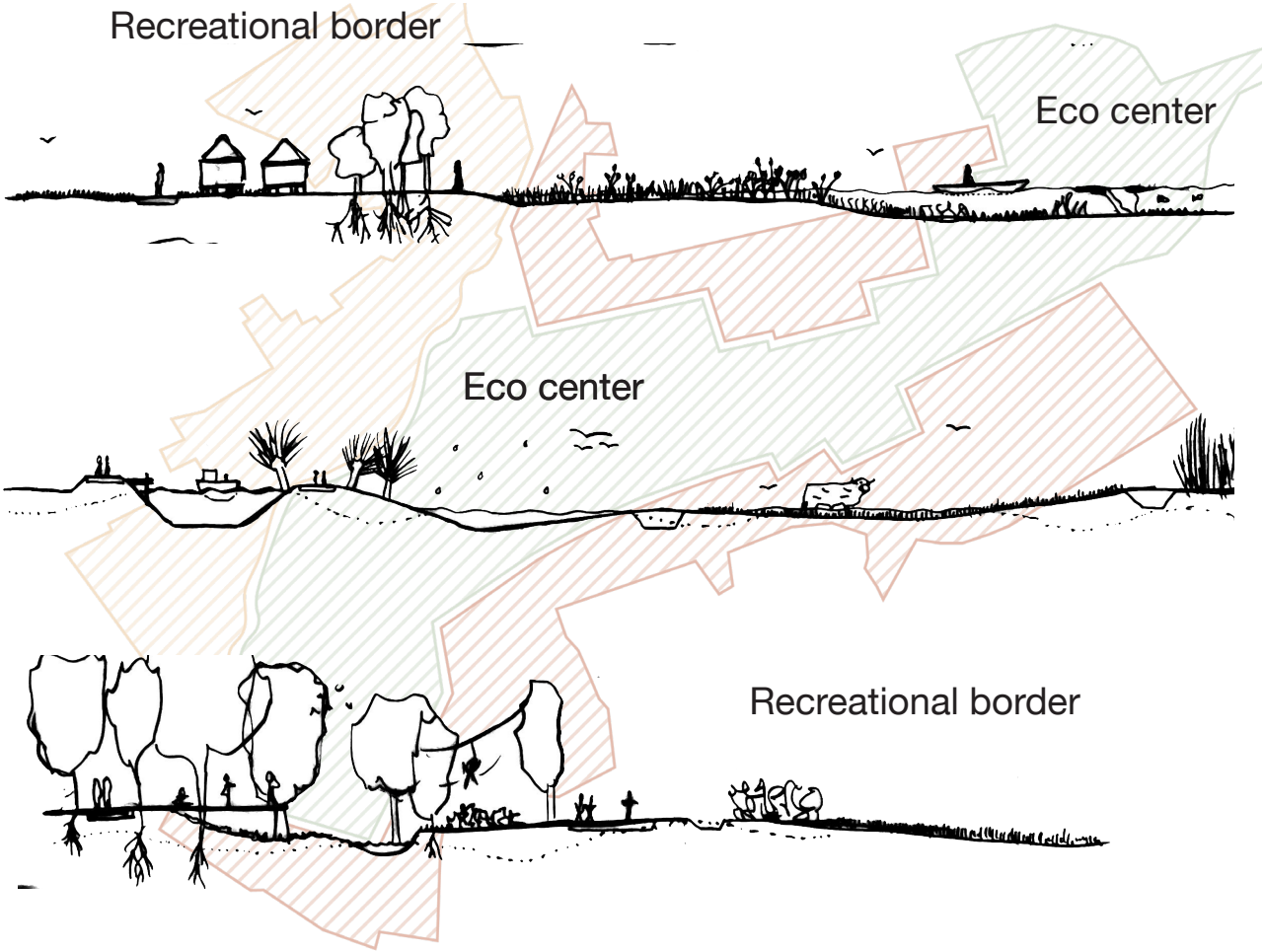
Weed Picking for Tea: Participants can gather selected weeds and plants that can be used to make herbal teas. This activity promotes awareness of local plant species and their traditional uses, providing a unique tasting experience.

Cow Canoeing: Visitors can explore the waterways of BPL MD by canoe, allowing them to appreciate the region's natural beauty from a different perspective. It offers a tranquil and immersive experience in the water-rich landscape.

Nature Walks: Guided nature walks provide opportunities for visitors to learn about the diverse flora and fauna of BPL MD. Expert guides can educate participants about the area's ecological importance and highlight specific points of interest along the walking trails.

Tractor Driving: Tractor driving experiences offer a hands-on activity for visitors, allowing them to experience the agricultural lifestyle firsthand. Participants can learn about the operation of tractors and their role in farming practices.

Old Church Path Walking: This activity involves walking along historical paths leading to the region's old churches. It provides an opportunity to explore the cultural heritage of BPL MD, appreciate the churches' architecture, and learn about their historical significance.



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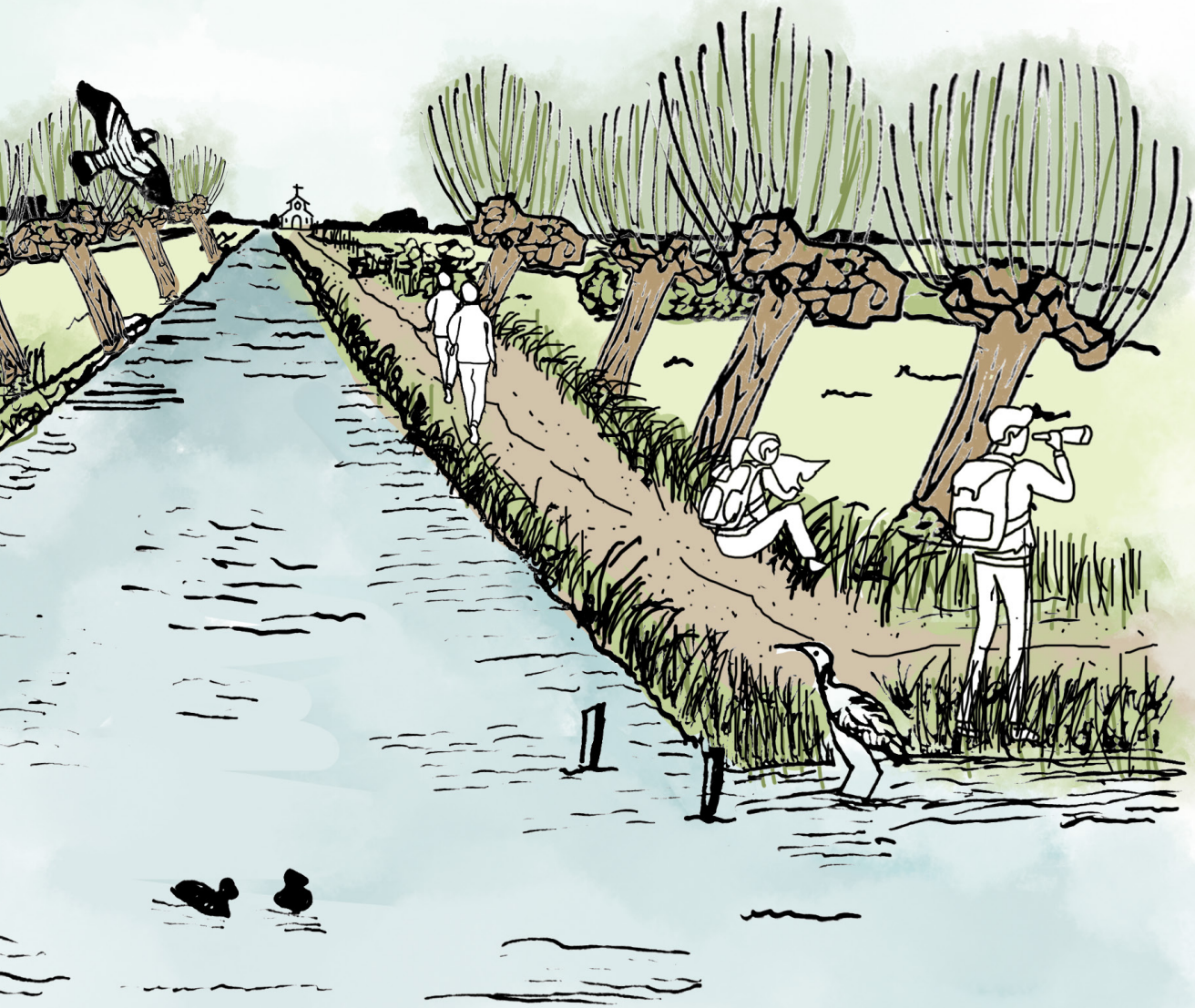
Design.



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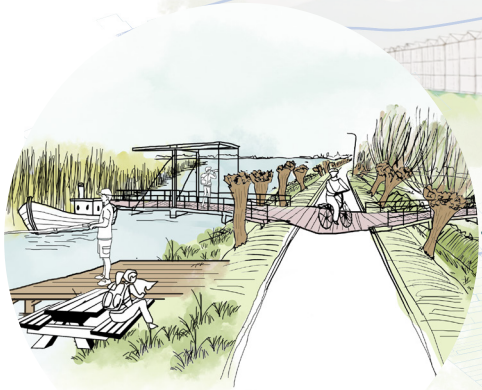


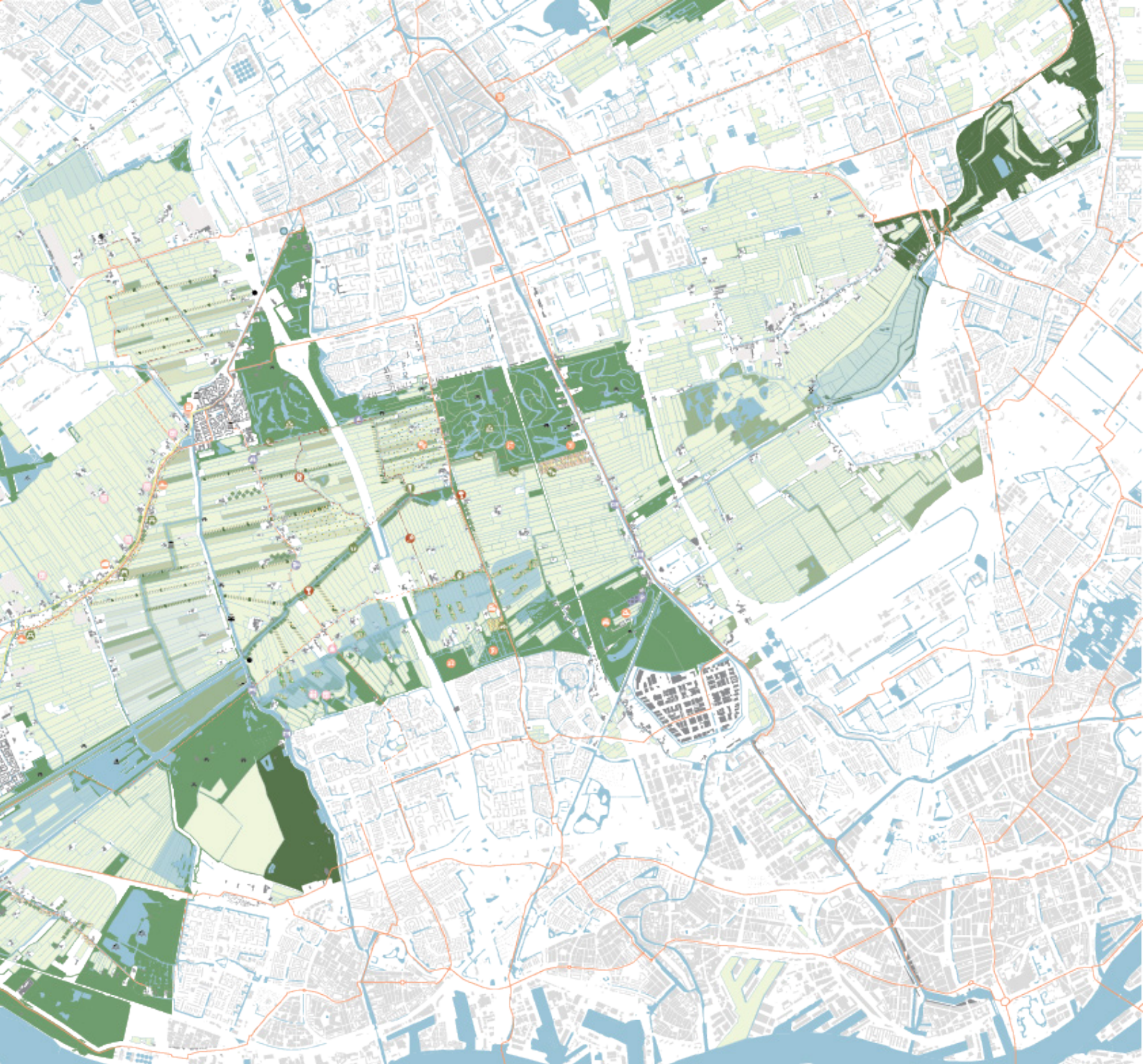
[Fig. 53] made by author

Legend

- Water buffer
- Improved cycling route
- Improved Gaag
- Improved pedestrian path
- Herb-rich green belt
- Diverse vegetation
- Flower rich region
- Knotwilgen
- Ecological bank
- Food swamp
- Wet cultivation
- Variation in grass height
- Increased waterlevel
- High grass
- Meadow bird zone
- Extensive recreation strip
- Wild flower region
- Parcels
- Existing recreation
- Nature region
- Existing water
- Built environment
- Existing cycling route

- picknick
- flower zone
- swamp area
- picking garden
- resting zone
- ecological banks
- watching tower
- wet cultivation
- cheese making
- farmers market
- scaffolding
- nature playground
- paul vaulting
- cow canoe
- farmers festival
- climbing forest
- tractor driving
- meadow bird safari
- swamp routing

- sandwichbar
- coffee
- toillet
- local (food)shop
- parking
- biking route
- wakling path
- connecting bridge
- knotwilgen
- church path
- view open landscape
- historical farm



[Fig. 54] made by author

5.6.1 Vliet tot watergebied

The design focuses on connecting the eco region and the recreational border, two distinct areas with different purposes. The ecoregion serves as a quiet zone dedicated to meadow birds and extensive recreation. At the same time, the recreational border offers opportunities for intensive recreational activities such as farmer festivals, canoeing, playgrounds, cafes, and tractor riding. To provide entertainment for every type of recreant, there should be more recreation on the city's outskirts. Fewer individuals will enter the quiet area as more individuals prefer to use the activities available on the borders. This will help to distribute the crowd and prevent overcrowding in one location, making it a more enjoyable experience for everyone. Additionally, promoting eco-tourism and outdoor activities such as hiking and camping can attract more visitors to explore the natural beauty of the surrounding areas.

For those seeking a guided journey into this eco region, a meadow bird tour will be available, allowing them to explore the area under the guidance of experts. This tour provides valuable insights into the diverse bird species inhabiting the region. The design for the meadow bird area focuses on respecting and following the old significant structures within the region. By aligning with the core lines of the site, the design aims to maintain the historical integrity of the landscape. The grass heights will be varied and diverse to accentuate these core lines and create a favorable environment for meadow birds. This variation in grass height adds visual interest and provides suitable habitats for different species of meadow birds. The design also incorporates different types of grass, further enhancing the ecological diversity and attractiveness of the area.

Alternatively, visitors can follow a small pedestrian path leading to a watchtower. From this vantage point, they can observe the birds in their natural habitat, gaining a unique perspective on their behavior and interactions. This offers a tranquil and meditative experience, connecting people directly with the wildlife.

Additional quiet seating areas will be created in the northern part of the eco zone, where it borders the Abwoudse Bos. These spots provide serene locations for visitors to relax, unwind, and appreciate the tranquility of the surroundings. Furthermore, efforts will be made to enhance the connections between the eco region and the adjacent forest, fostering a seamless transition between these two natural habitats. To amplify the allure of the Abwoudse Forest, the water level will be raised, creating captivating floating paths. These unique pathways provide an enchanting experience, allowing visitors to meander through the forest while closer to the water's surface.

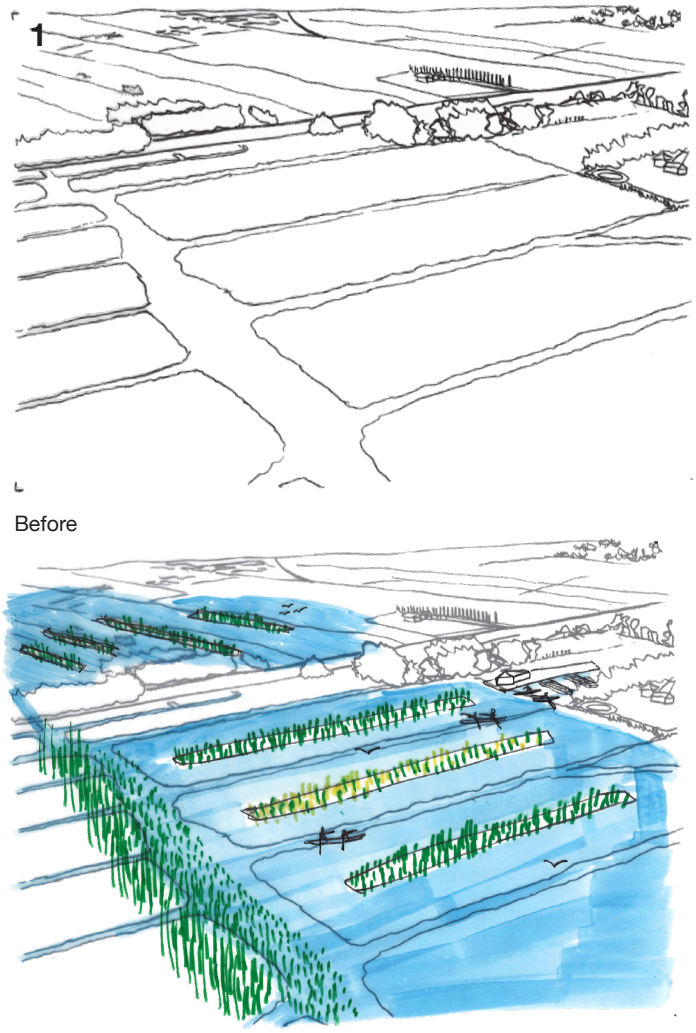
A significant water buffer is introduced to create a connection between the eco region and the recreational south. This water buffer serves a dual purpose of water storage and facilitating the relationship between the ecoregion and the recreational border. This waterbuffer is 220 ha and will be a minimum of 1,5 m deep. At the same time it's a transitional zone, providing a natural pathway linking the

[Fig. 55] made by author

two regions. Within the water buffer, strips of land are incorporated to create new habitats and showcase the old structure of the area. These strips of land offer additional areas for wildlife to thrive and enhance regional biodiversity. The wet cultivation on the borders of the water buffer further supports ecological diversity and promotes the growth of specific plant species.

The design also includes ecological banks, which contribute to the overall functionality and aesthetics of the water buffer. These banks serve as natural barriers, managing water levels and creating variation in the landscape. The differences in water level heights introduce a dynamic element to the environment, promoting the development of diverse ecosystems within the water buffer.
By integrating these design elements, the project establishes a connection between the ecoregion and the recreational border while addressing water storage needs. It creates opportunities for wildlife, provides spaces for intensive recreational activities, and ensures the preservation of ecological balance within the region. This design approach aims to strike a harmonious balance between environmental conservation and human enjoyment of the natural surroundings.

The second part of this design aims to extend and enhance the Foppenplas, a specific water area in the BPL MD . A vital aspect of the design involves creating a more extensive water region within the leg of the Foppenplas, expanding its size and ecological significance. Additionally, efforts will be made to establish a stronger connection between the Vlietlanden and the Zweth by constructing new bridges that lead to the



[Fig. 56] made by author

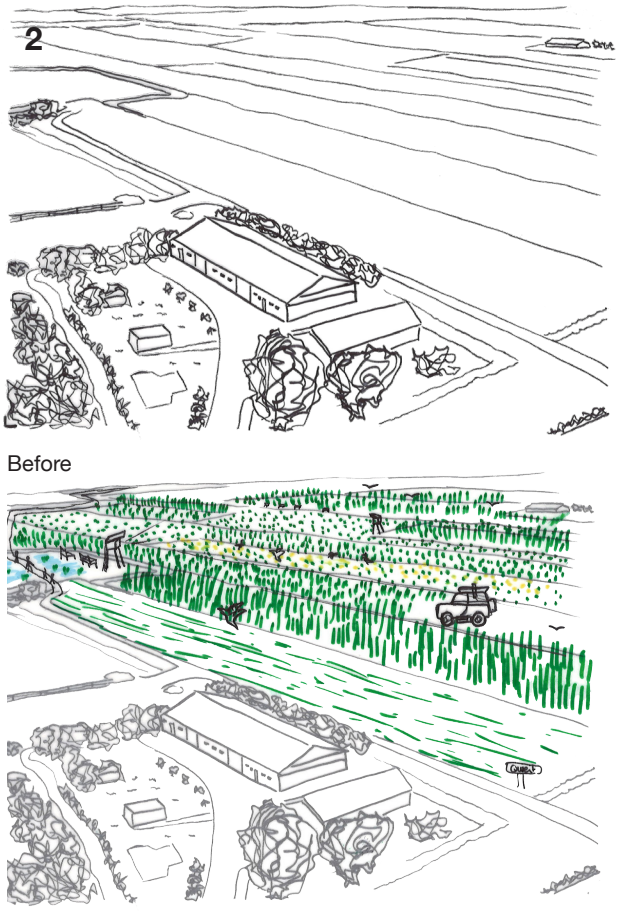
- Big water buffer is created (220 ha)
- Strips of land for new habitat and showing the old structure
- Wet cultivation on the borders
- Ecological embankments
- Canoe facilities

[Fig. 57] made by author

new water buffer on the opposite side of the Vlaardingerskade.

Adjacent to the water buffer, a food swamp will be established, providing a unique environment for cultivating new herbs and vegetables. This food swamp will contribute to local food production while promoting ecological recreation. Within the recreational area, a sandwich bar will be introduced, allowing visitors to create their sandwiches using the products grown in the food swamp. This concept promotes a direct connection between visitors and the local produce, offering a unique and sustainable culinary experience.To enhance the overall accessibility and experience within the area, a new pedestrian path will be created. This path will be exclusively designated for nature enthusiasts who appreciate and respect the natural surroundings, offering them an opportunity for long, immersive walks. The Willemoordseweg will be enriched by the introduction of willow trees, enhancing its visual appeal and aligning with the natural aesthetics of the area. Additionally, the design seeks to accentuate the historic farms in the vicinity through carefully curated vegetation, highlighting their significance within the landscape.

Furthermore, a new cycling path will be established along the Zoutveenseweg, providing a dedicated route for cyclists to explore the recreational area and enjoy the scenic beauty of the surroundings. Overall, this design extends the Vliet, enhances connectivity between different regions, promotes ecological diversity by establishing a food swamp, and provides an enjoyable experience for nature lovers and recreation enthusiasts alike.

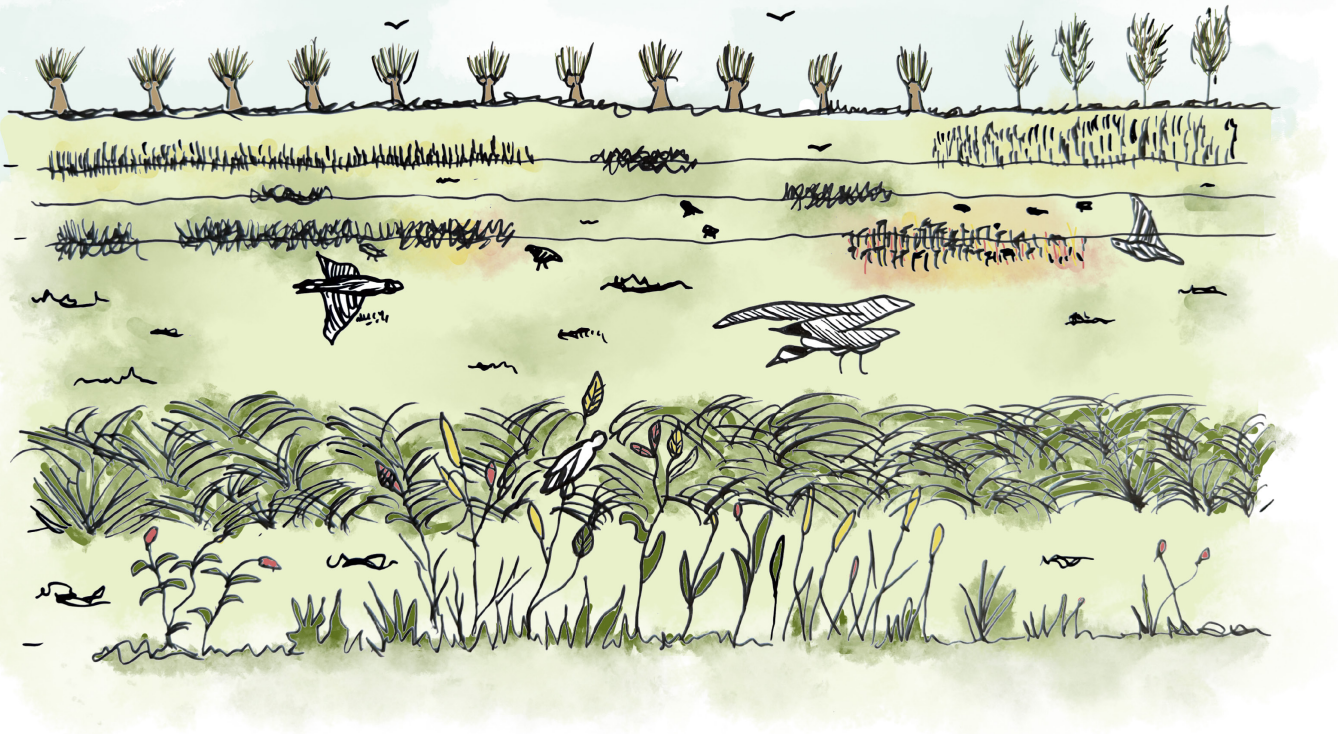


Before

After

[Fig. 58] made by author

- Observation tower
- Strip cultivation
- New pedestrian route
- Observation tower
- Meadow bird safari
- Variation in grass heights



[Fig. 59] made by author

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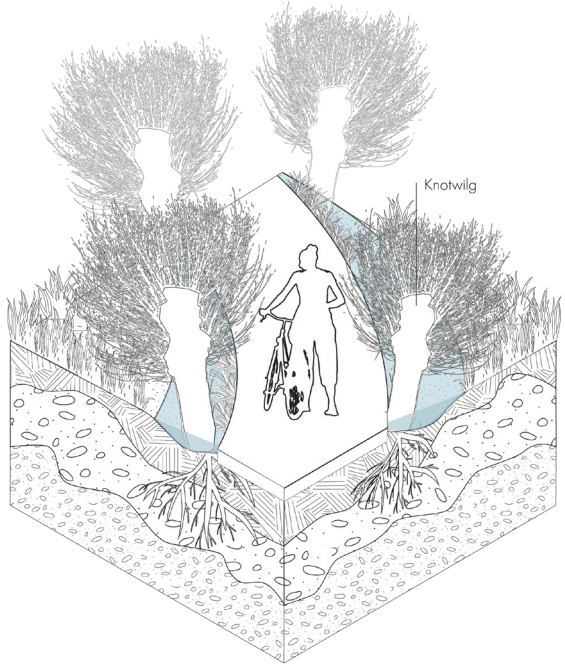
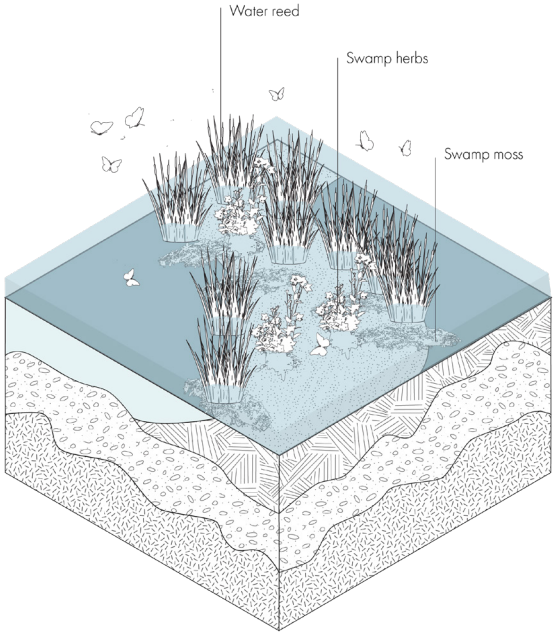


Car free cycling



Low peat swamp

[Fig. 62] made by thor

5.6.2 Graag naar Gaag

The location of this design is centered in the Agricorner, which is a vibrant region where local food is the main theme. This design aims to create an exciting experience centered around the activities of a farm, such as the cheese-making process and milk production. The region's main attraction is a biking route that connects various local food shops and runs alongside the historical Gaag waterway. The design intends to enhance the character and significance of the Gaag by introducing new vegetation that reinforces its identity.

Different types of pavement materials are employed to emphasize the connection between the cycle path and the local shops. These variations in pavement serve to visually highlight the relationship between the path and the nearby shops, making it easier for visitors to navigate and locate the desired food establishments. To facilitate a pleasant and convenient shopping experience, the design incorporates seating areas and tables where individuals can take a break while purchasing groceries. These resting spots provide a comfortable space for visitors to relax and enjoy their surroundings while supporting local businesses.

The design incorporates colorful vegetation further to enhance the visual appeal and distinctiveness of the Gaag. This vibrant plant selection aims to strengthen the visual impact of the waterway, creating a lively and engaging atmosphere for visitors.

To aid wayfinding and provide clear information to visitors, the design includes signage indicating the types of local food shops available along the route. These signs help guide visitors and promote a sense of exploration and discovery as they navigate the region.
Additionally, the design incorporates lighting features on the historical bridge, ensuring visibility and safety during nighttime activities. These lights serve a functional purpose and contribute to the bridge's aesthetic appeal, highlighting its historical significance.
Lastly, a jetty is included to provide docking space for boats. This feature offers an alternative means of transportation and allows visitors to access the region via water, expanding the accessibility and appeal of the overall experience.

The design also incorporates a significant transformation of the Zoutveenseweg, a historically concrete road congested with fast-moving cars. The redesign focuses on shifting the road's central role towards accommodating pedestrians and cyclists while relegating cars to a secondary position. This approach aims to create a safer and more inviting space for sustainable modes of transportation.To underscore the road's new purpose and enhance its appeal, more willow trees and herbaceous grasses will be introduced along the route. These additions serve multiple functions:
Visually emphasizing the road
Enhancing its natural ambiance
Contributing to the overall ecological integrity of the area

By redesigning the Zoutveenseweg as a

[Fig. 63] made by author

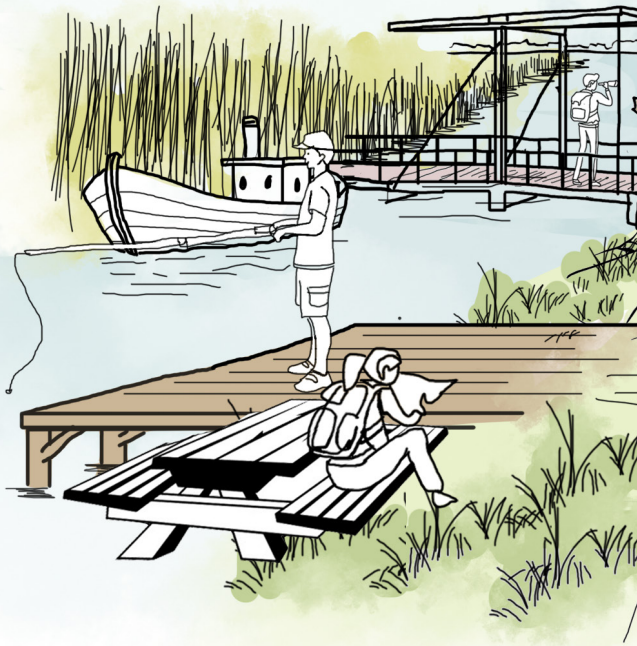
pedestrian and cyclist-friendly pathway, the design recognizes the importance of preserving the tranquility of the adjacent quiet zone. The road is intended primarily for nature enthusiasts, residents, and those seeking a peaceful connection with the surrounding environment. This approach ensures that the road aligns to promote nature appreciation and provide a safe and enjoyable experience for individuals engaging in non-intensive recreational activities.

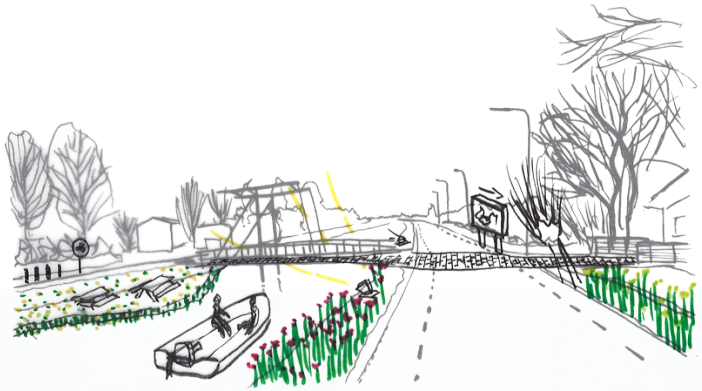
In the northern part of the region, the design entails widening the Voddijkpad, a ditch with a significant historical presence. This expansion serves a dual purpose: increasing water storage capacity and maintaining the area's historical significance.
By widening the Voddijkpad, more space is created to accommodate additional water storage. This modification is a proactive measure to address potential water management challenges and mitigate the risk of flooding. The increased capacity allows for better water retention during periods of heavy rainfall, helping to maintain a balanced water ecosystem within the region.

The choice to focus on the Voddijkpad for this water storage expansion is rooted in its historical significance. This structure has played a prominent role in the area's past, and its preservation and adaptation align with the design's overall goal of honoring and integrating historical elements into the landscape.

Overall, this design creates an engaging environment where visitors can experience the activities of a farm, explore local food shops, and enjoy the historical Gaag

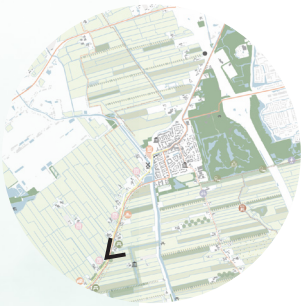
3





- Different types of pavement to emphazise the connection between cycle path and local shop
- Seats and tables for taking a break during buying groceries
- Colourfull vegetation for strenghten the Gaag
- Clear sign that shows what kind of local food shop can be found
- Lights on the historical bridge
- Jetty to dock a boat

After



waterway. It promotes connectivity, convenience, and visual enhancement while embracing the region's unique agricultural and historical characteristics.

4

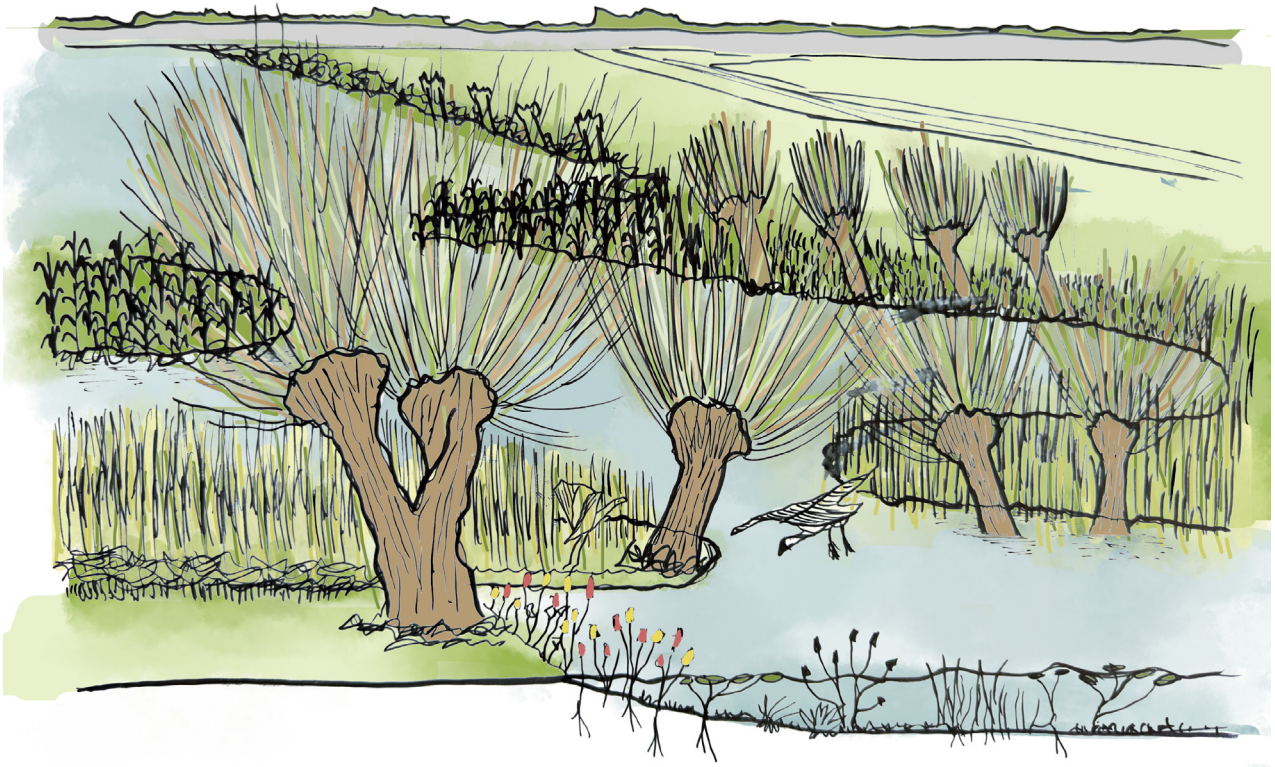
Before

After

[Fig. 64] made by author

- Car is guest
- More space for cylcist and pedestrian
- Extra Pollard willows
- Signs which exmplain history of old farms
- More vegetation to emphasize the Zoutveenseweg

[Fig. 65] made by author



[Fig. 66] made by author

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5.7 BPL MD 2070

Fifty years ago, the government displayed a strong commitment to preserving an open and distinct landscape amidst the bustling cities. The BPL MD, designated as a national buffer zone, emerged as a result. The reconstruction law aimed to establish new areas for nature and recreation within the agricultural zone. However, the central government has since withdrawn its role as protector, placing the responsibility solely on BPL MD. To ensure the continued protection of the surrounding towns, the area must offer something truly exceptional in return, motivating them to invest more in expensive urban development within the city centers rather than opting for cheaper solutions in the pastures.

Looking ahead to 2070, the landscape paints a vivid picture. Embracing contrast remains a key aspect. The sight of Rotterdam's skyline harmonizes with cows grazing in the meadow, creating a dramatic interplay. By 2070, this interplay between high urban edges and open polders will be even more pronounced. The contrast will endure, safeguarding the untouched greenery. Sustaining this contrast demands more than maintaining clear ranches around the BPL MD; it necessitates preventing cluttering and fragmentation. Most polders will retain their size to amplify their distinct characteristics. Additionally, the remaining missing links in cycle paths connecting cities and land will be repaired by 2070. Obstacles such as the Schie and A13 will be overcome with new bridges and improved connections. Cultural attractions will emerge, and agricultural estates will entice visitors with local products. The green boundaries of recreational areas will offer greater variety, match amenities, and be managed with vigor or left rugged and natural.

In order to preserve the peat meadow landscape, polder levels need to be elevated, and agriculture must adapt. The true value of BPL MD within the metropolis lies not in global milk production but in its species-rich grasslands, meadow birds, and regional products. Focusing on both the internal and external aspects of the landscape is vital. Danger can arise from within this region, not just from external sources.

[Fig. 68] made by author

Conclusion and

Reflection

[Photo 25] Windmill at the Gaag (Midden Delfland, 2021)

6.1 Conclusion

The primary purpose of this graduation project is to research and design the transition of agricultural open peat landscapes in the metropolitan region of Rotterdam and The Hague to create a resilient, nature-friendly, and attractive landscape while supporting the landscape characteristics. This new landscape can address issues that will surface in the years leading up to 2070, such as ecosystem depletion, rising water levels due to climate change and, equally important the lack of recreational landscapes due to urban growth.

To research & design this transition of the open polder landscape, the following research question was developed: **'How can the landscape characteristics of BPL MD effectively be preserved and strenghtened to respond to the challenges of climate change and population growth towards 2070 while simultaneously meeting the evolving needs of its users and preserving its agricultural and recreational functions?'**

This study employs a scientific approach to address a specific research question and devise practical solutions for the challenges arising from interconnected themes. It started with an analysis encompassing a historical perspective, examining the changes in the landscape over time and identifying its characteristics and features. By delving into the past and tracing the evolution of the landscape, a comprehensive understanding of its current state is achieved. These characteristics are the main pillars of this project, as they must be preserved. Understanding and keeping the characteristics of this landscape is crucial for maintaining ecological balance, cultural heritage, recreational opportunities, environmental services, and overall aesthetic value. By recognizing the significance of these characteristics, appropriate measures can be taken to ensure their conservation and sustainable management for the benefit of both present and future generations.

The methodology which is used encompasses several techniques with varying levels of importance, where one stands out as the primary research method, namely the maximization method. This approach begins with an analysis conducted at a regional scale, providing insights into the existing conditions. Those can be categorized into three themes: water, ecology, and accessibility.

Moreover, the analysis reveals potential solutions that maximize the region's landscape. Different subthemes arose during this phase, such as maximizing water potential, ecological restoration, and creating recreational diversity. The report comprehensively illustrates the possibilities of combining these solutions during the optimization phase, presenting a cohesive overview. Notably, the report emphasizes the advantages of synergistic integration of solutions from diverse themes. The Local Agricorner, the Eco Center, and the Recreational Borders were the three distinct zones that appeared during the optimization phase each with unique qualities.

The Eco Center is a quiet zone for meadow birds and extensive recreation. It's a tranquil sanctuary, carefully preserved for the flourishing of meadow birds and extensive recreation. It serves as a haven where these meadow birds can thrive undisturbed. Moreover, the Eco center welcomes individuals seeking solace and rejuvenation through extensive recreation. Here, visitors can immerse themselves in the vastness of the landscape, such as a quiet walk. The ecoregion embodies the delicate balance between preserving precious ecosystems and providing a space for humans to connect with nature peacefully and sustainably.

The Recreational Border presents a vibrant and accessible space for various intensive recreational activities. From farmer festivals to canoeing, playgrounds to cafes, and even tractor riding, this region offers ample opportunities for individuals seeking thrilling and engaging experiences. Located conveniently near the city borders, the Recreational Border boasts short travel times, making it easily accessible to locals and visitors alike.

The Agricorner is a distinct region that primarily focuses on farm experiences and local food shops. It serves as a hub for people seeking the agricultural aspects of the area and engaging with the local food culture. At the heart of this region lies the old cultural Gaag, which acts as the central route connecting various farm establishments and local food shops.

During the maximization method, several interviews have been conducted with stakeholders in the field to gather insights on the practical implementation of their views. The stakeholders' feedback has been considered to ensure the proposed solutions are feasible and meet their needs. Furthermore, the report highlights the potential impact of implementing these integrated solutions on the overall performance and sustainability of the landscape.

There are 3 main goals for BPL MD

1. Maximizing water potential

Recognizing the importance of water storage as a critical component of sustainable land use practices is crucial. Integrating water storage solutions, such as water buffers, widening the ditches and creating swamp areas can enhance water management, support higher water levels and mitigate flood risks. By incorporating water storage into the landscape, BPL MD can adapt to changing climate conditions while maintaining its agricultural and recreational functions.This design creates 330 ha of water, which is 2,7 times more then there is right now.

2. Ecological restoration

The meadow bird is the most important species in this region, and therefore it needs to be protected, and its environment needs to be improved. Besides the meadow birds, the biodiversity needs to increase to maintain a healthy ecosystem. This can be achieved through preserving natural habitats, increasing different types of vegetation, creating ecological banks and stimulating wet cultiva-

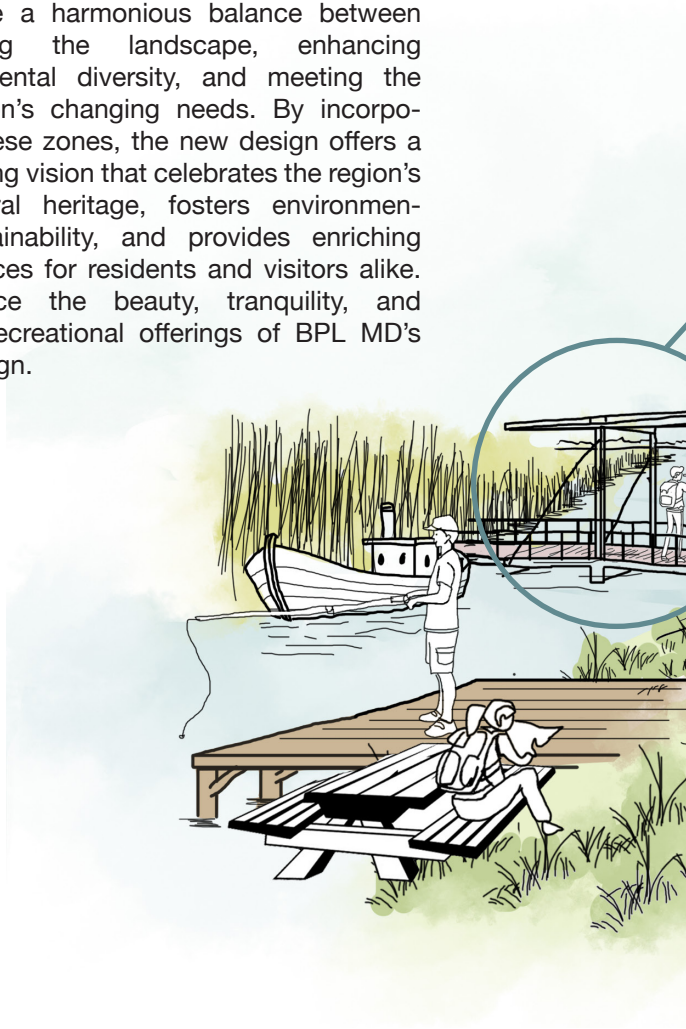
tion. This leads to a total of 675 hecaters of natural land in 2070, which means 1,2 times as much as it is now.

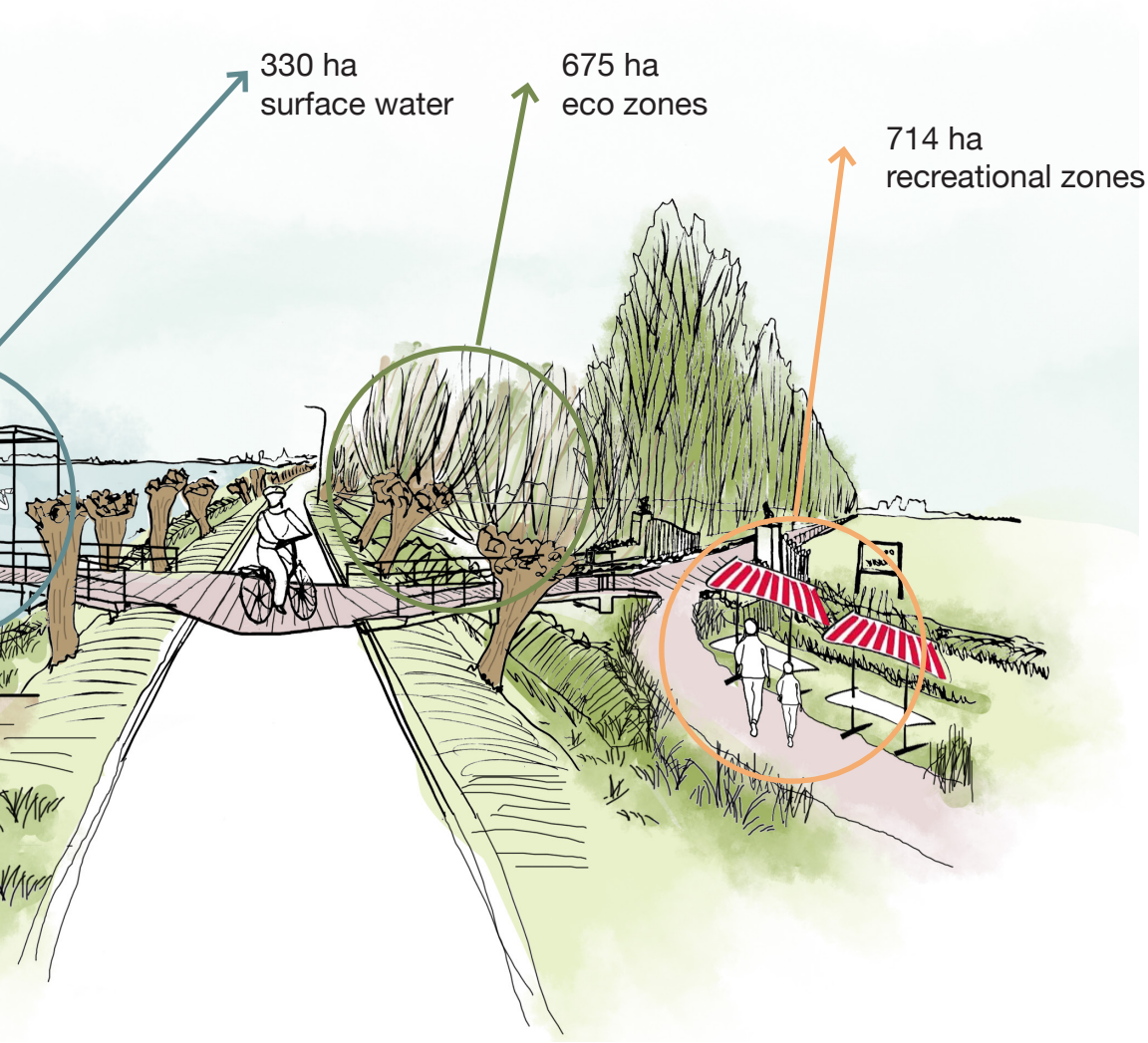
3. Creating recreational diversity
Preserving and strengthening the landscape characteristics of BPL MD requires collaboration among various stakeholders. There should be different types of activities for different kinds of stakeholders. Some places should not be accessible, and other places should be improved in accessibility. In 2070 there will be 30% more people living in the surrounding area's of BPL MD which means a recreation demand of 914 ha is needed. However 11% of recreation will have a negative effect on the region, therefore the design will consist of 9% of recreation.

The different goals will be achieved through different implementations, and those will be placed in specific areas in the region. It's essential to understand the variation in goals within different seasons. For example, variation in vegetation gives different looks in winter and summer. Additionally, the success of these implementations will depend on factors such as weather patterns and the involvement of local communities in maintaining them.

Overall, it is clear that implementing integrated and sustainable land use planning is crucial for transforming BPL MD into a thriving and biodiverse region that benefits both humans and nature. This design can bring about significant positive change by emphasizing the landscape identity, creating space for water storage, improving the livability of meadow birds, and balancing intensive and extensive recreation. This new plan ensures the long-term health and well-being of both the environment and communities.

The new design for BPL MD introduces three distinct zones: the Local Agricorner, the Eco Center, and the Recreational Borders. Each zone has specific goals, including optimizing water storage, restoring ecological habitats for meadow birds, and providing diverse recreational opportunities. This design aims to create a harmonious balance between preserving the landscape, enhancing environmental diversity, and meeting the population's changing needs. By incorporating these zones, the new design offers a compelling vision that celebrates the region's agricultural heritage, fosters environmental sustainability, and provides enriching experiences for residents and visitors alike. Experience the beauty, tranquility, and vibrant recreational offerings of BPL MD's new design.





[Fig. 69] made by author

6.2 Discussion

The maximization method served as the primary research approach for this study, enabling a comprehensive examination of various interventions and their potential impact on BPL MD. Through the maximization method, an extensive range of possibilities was explored, allowing for an in-depth evaluation of the envisioned future for the region in 2070. However, it is essential to acknowledge the limitations of the maximization method. While it allowed for a comprehensive assessment of various interventions, it heavily relied on available data and assumptions, which may introduce uncertainties in the analysis. Additionally, the maximization method involves simplifications and generalizations, which may overlook nuances and context-dependent factors critical to decision-making processes.

For example, the maximization method has been done on a scale of 1:55.000. At the same time, the final designs have been made on a scale of 1:7.500. This means that the design is based on assumptions that are less detailed and may not accurately reflect the actual conditions of the area. Involving stakeholders and experts can provide valuable insights and perspectives that may be overlooked by relying solely on the maximization method. The water buffer is a specific example, and the maximization method revealed the best location for this buffer. However, it's possible that this location wouldn't be as good as the conclusions said if a water management expert dug into the specifics.

Despite the strengths of the maximization method in exploring different aspects of the envisioned vision, an area that requires further examination is the political issue surrounding the restrictions imposed on farmers. Agriculture in BPL MD is deeply intertwined with political dynamics, as policy decisions significantly impact farmers' practices, land use, and economic viability.

Political issues, such as regulatory frameworks, agricultural subsidies, and governance structures, can shape the context within which farmers operate. Neglecting the political dimension limits a comprehensive understanding of farmers' challenges and potential barriers to adopting sustainable practices. Future research should explore the political landscape and its influence on farmer restrictions in BPL MD to address this gap. This can involve engaging with policymakers, farmers' associations, and other stakeholders to understand the decision-making processes, identify potential conflicts of interest, and propose strategies for enhancing collaboration and effective governance.

2070 has been chosen as the research timeframe. However, once the design had been created, it was discovered that it could also be used in 2050. Furthermore, selecting a timeframe of 2070 can lead to uncertainty and unpredictability. The world is constantly changing, and predicting climate change can significantly alter the development trajectory. Given the pressing challenges related to climate change, some may argue that a more immediate timeframe, such as 2050, is necessary to prioritize and address these

urgent issues. Setting a vision for 2070 may restrict the ability to adapt and respond to unforeseen circumstances or paradigm shifts in the intervening years. A shorter timeframe would allow for more agility and flexibility in incorporating emerging trends, technologies, and priorities. Debating the choice of a specific timeframe for the vision allows for critically examining assumptions, preferences, and practical considerations. It ensures that the chosen timeframe aligns with the realities of the present and future challenges while balancing the need for long-term planning with adaptability and responsiveness.

Based on extensive consultations with the farmers, they are generally receptive to changes as long as they do not adversely affect their agricultural enterprises. The interviews with the farmers revealed their willingness to accommodate modifications along the borders of their land, including improvements such as enhanced cycling infrastructure alongside main roads or the introduction of new trees and taller grasses along their property boundaries. However, it is essential to note that the exact boundaries of the different land parcels have yet to be determined due to a lack of comprehensive data. A complex ownership structure exists because the land in question is divided into numerous fragmented pieces with multiple owners. The current design incorporates a rough approximation of the land borders, but it is recommended that further research should be undertaken to identify the boundaries of each parcel precisely. This research is essential to avoid disruptions to the farmers' ongoing business activities and ensure that the design implementation proceeds without infringing upon their operations.

While the design presents a positive future outlook, it is crucial to acknowledge the potential for extreme scenarios that could significantly impact the area. Two such extremes are the risk of flooding and the possibility of extensive urban development. Considering the uncertain nature of future circumstances, exploring and incorporating different design options that account for these potential outcomes is imperative.
By incorporating different design options for these extreme scenarios, the region can plan for various potential futures. This proactive approach ensures the design remains adaptable, flexible, and resilient in uncertain and evolving circumstances. By carefully considering the possibilities of flooding and urban development, the design can effectively mitigate risks and provide sustainable solutions for the long-term prosperity and well-being of the region.

6.3 Recommendations

Numerous innovative ideas and potential solutions have emerged during this graduation project, requiring further research to explore their feasibility and impact fully. Among these ideas, specific areas have been identified for in-depth investigation, with the BPL MD being a particularly intriguing subject for further exploration.

The first recommendation for further research is to examine the relationship between rising water levels and dairy farming. This entails investigating how the water levels in the specific parcels of BPL MD can be effectively elevated to benefit dairy farming practices. Understanding the potential methods and implications of raising water levels will contribute to devising sustainable strategies supporting agricultural activities and ecological objectives.

Additionally, the concept of a “food swamp” has garnered considerable interest and merits further exploration, particularly within the high-density region of MRDH, where a substantial population relies on food production. Researching the implementation and scalability of a food swamp in this region is crucial. A food swamp involves creating wetland environments that facilitate the growth of edible plants, allowing for a local and sustainable food source. By assessing the viability of food swamps on a larger scale and understanding the necessary infrastructure and management requirements, it is possible to enhance food security and promote self-sufficiency within the region.

Another area that warrants research is the optimal plant variation for achieving visual aesthetics and biodiversity goals. Conducting a comprehensive plant study will enable a deeper understanding of the most suitable plant species and combinations to enhance the landscape’s visual appeal while fostering biodiversity. Especially the qualities during winter and summer seasons should be considered, as they can significantly impact the landscape’s overall appearance. Additionally, factors such as soil type, sunlight exposure, and climate should be considered when selecting plant variations to ensure their long-term viability and environmental success. Identifying the ideal plant variation will create a harmonious and sustainable environment that attracts both human residents and wildlife.

Lastly, exploring rice cultivation as a form of wet cultivation has the potential to redefine the region’s identity. Investigating the feasibility, techniques, and implications of rice cultivation in the wetland areas of BPL MD can lead to a distinctive agricultural identity that aligns with the natural characteristics of the region. This research would entail studying the viability of rice cultivation, including considerations such as water management, soil suitability, and market opportunities.

Furthermore, conducting a thorough stakeholder analysis in the future would be recommended. While the initial phase involved interviews with five farmers, expanding the scope of the study to include all farmers in the BPL MD would provide a more repre-

sentative and inclusive picture. Engaging with a broader range of farmers makes it possible to capture a wider spectrum of perspectives, experiences, and concerns related to the proposed changes and interventions. This will ensure that the design and plans adequately consider the needs and aspirations of the farmers.

In addition to the farmers, it is equally essential to interview the residents who live on the borders of BPL MD. These inhabitants have a unique vantage point and can offer valuable insights regarding their regional recreational needs and desires. Understanding their perspectives on the current recreational opportunities and the amenities they feel are lacking will contribute to developing a more inclusive and responsive design.

Conducting a comprehensive stakeholder analysis, encompassing the perspectives of farmers and residents, will foster a deeper understanding of the diverse stakeholders involved in the BPL MD region. It will provide crucial insights into these stakeholders' various interests, concerns, and desires, ensuring that the design and future plans align with their expectations and aspirations.

Researching these areas will enrich our understanding of the potential opportunities and challenges associated with innovative ideas and solutions proposed during this graduation project. By delving deeper into these topics, valuable insights can be gained, paving the way for informed decision-making and sustainable strategies that contribute to the long-term success and resilience of BPL MD.

6.4 Reflection

During the last couple months, the research & design of this graduation report has taken a different approach than was presented during P2. Instead of scenario planning, the maximization method became the project's most significant focus, providing more accurate results. This graduation project's maximization method examines three themes that serve as the research's foundation. The analysis of these three different themes demarcates the subject but does result in less extensive research. Water, ecology, and mobility are the chosen themes in this graduation project. Energy, landscape, nature, culture, etc., are recommended themes to be researched in future studies to broaden the scope of the subject and provide a more comprehensive understanding of the topic. However, focusing on the chosen three themes allows for more in-depth analysis and a more precise presentation of the findings.

Throughout my research journey, I decided to transition from the familiar territory of scenario planning to the unexplored realm of the maximization method. At first, this change presented its fair share of challenges as I grappled with understanding and implementing this new approach. Consequently, it consumed some valuable time that I had initially underestimated. However, as I persevered and delved deeper into the maximization method, I soon discovered its value and realized how it significantly enhanced my project.

One of the strengths of the maximization method lies in its ability to facilitate a layered approach to analysing the landscape. As I painstakingly placed layer upon layer, I gradually developed a profound grip on the intricate details and complexities of the region. This method allowed me to examine various elements and factors comprehensively, enabling me to unearth connections and interdependencies that may have otherwise eluded me.

What I initially perceived as a stumbling block eventually became a powerful tool for gaining insights and making informed decisions. The maximization method offered a holistic framework that enabled me to view the landscape from multiple angles and perspectives. It illuminated the critical points that demanded attention, providing a solid foundation for my design proposals. Looking back, embracing the maximization method was a transformative experience. Although it required a learning curve and additional time investment, its benefits outweighed the initial challenges. The method enabled me to unravel the intricacies of the landscape, fostering a deeper understanding and appreciation of its unique characteristics.

The study's methodology is based on predictions of trends and issues in the Netherlands through 2070 (predictive research). Suppose the actual trajectory of these trends takes a different course. In that case, consideration must be given to the regional perspective and design to determine which aspects of these trends can still be implemented in the BPL MD. Because of this, the maximization method is used in this report as an outline.

The solutions provided in the maximization phase and the possible combinations in the optimization phase can still be used with updated predictions of future trends. No distinction has yet been made between different seasons at this project stage. This is a task that needs to be completed in the upcoming weeks. In the future scenarios of 2070, there will undoubtedly be a distinction between winter and summer; this needs to be considered and included in the maximization method.

Furthermore, the research which has been done mainly focusses on the possible positive solutions. However, it could become a trend where humans stop using the landscape for recreation, or the whole region will be flooded. Therefore, it is essential to consider the potential negative impacts on the landscape and plan accordingly to mitigate them. Alternatively, solutions should be explored if the current plans are not feasible in the long run.

This report is created from an urbanist perspective on water, ecology, and mobility within the themes of agriculture and recreation. A researcher specializing in water management or biology would likely have access to more scientific data and produce a different result for this study. For example, the best location for water storage could be different from the perspective of a water engineer. However, the urbanism perspective provides a unique insight into how these topics intersect and impact the urban environment, which a water and ecology scientific approach may need to capture fully. Therefore, this report offers a valuable contribution to more profound research. Implementing integrated and sustainable land use planning is fundamental to urbanism and urban planning. It involves designing and managing regions' physical layouts and functions to create a harmonious relationship between human activities and the natural environment. The idea of transforming an area, such as the BPL MD, into a thriving and biodiverse area that benefits both humans and nature aligns with the goals of urbanism. Urban planners and designers strive to create a sustainable landscape that provides a high quality of life while minimizing negative environmental impacts. In this case, the focus on landscape identity, creating space for water storage, improving the livability of meadow birds, and balancing intensive and extensive recreation demonstrates an integrated approach to land use planning. It involves considering various elements such as biodiversity, water management, and recreational opportunities in the design and development of the region. The topic of this master thesis aligns with the core principles and objectives of urbanism, emphasizing the importance of integrated and sustainable land use planning for transforming regions into thriving and biodiverse areas that benefit both humans and nature.

The solutions of this research are combined in a new design for the open peat landscape. An ecology-based landscape with attractive borders and the possibility for sustainable agriculture is very reliant on the location of the metropolitan region. This region is maintained by farmers themself, which means that

the development and maintenance of the landscape require funds. However, both the province and the state have exited from the recreation board of BPL MD, which caused a structural lack of funding. Besides, the municipality assumes that the farms which are maintaining the land will stay in this area, which is only sometimes the case in future scenarios. The municipality's vision should be understood, but a design should also be a way of thinking in the extremes.

The involvement of local farmers as maintainers of this landscape led me to conduct interviews with them. In retrospect, my personal involvement and emotional connection with the farmers may have influenced my design approach, potentially leading to a less extreme and innovative outcome. This reflection aims to explore the implications of this involvement and shed light on the delicate balance between incorporating stakeholder perspectives and pushing boundaries in design.

The interviews with the farmers allowed me to gain valuable insights into their attitudes, challenges, and aspirations for the landscape. These encounters fostered a connection, as I empathized with their relationship to the land, way of life, as well as their concerns. This personal involvement undeniably influenced my design decisions as I became more conscious of the farmers' needs and desires. While incorporating these considerations can lead to a more inclusive design, it also presents a potential limitation by restraining the extent of innovation and pushing boundaries. While this consideration undoubtedly brought value and authenticity to the design, it is essential to reflect on whether it compromised the level of innovation and the potential to create groundbreaking solutions. However, it can also be well argumented that the farmers especially being landowners could be key to a sustainable solution. Striking the right balance between honoring stakeholders' perspectives and pushing boundaries remains a challenge in design processes.

At its core, design is about pushing boundaries, exploring new ideas, and challenging the status quo. It thrives on the ability to envision possibilities that go beyond conventional norms. However, in the case of the BPL MD, the involvement of farmers as maintainers introduced a new layer of responsibility. Their role in preserving the landscape and their unique knowledge of the land needs to be respected and integrated into the design.

Recognizing the potential limitations of personal involvement, it is crucial to emphasize the iterative nature of the design process. Regular feedback loops with various stakeholders, including farmers, would have provided an opportunity to test ideas, challenge assumptions, and explore alternative design directions.
Reflecting on my experience, personal involvement and emotional connection with stakeholders can be both a strength and a potential limitation in the design process. While empathy and understanding are essential, guarding against self-imposed constraints that might hinder innovation is necessary. Future design projects should strike a balance by actively seeking feedback, encouraging diverse perspectives, and fostering an iterative approach that allows for continuous improvement.

Research is underway on high-water farming (Boeren op Hoogwater). The outcome of this research could be a valuable addition to this graduation report. The research aims to explore the feasibility of farming on wet grassland and develop sustainable strategies to mitigate the water level's impact on cows' agricultural production. The findings could contribute to developing innovative solutions for the BPL MD.

This graduation project asks for a new collaboration between governmental agencies, non governamental organisations, landowners and other stakeholders. More knowledge could have been gained from doing interviews with different stakeholders. In this case, there would have been more feedback on the design created for the landscape. The same goes for recreationists; they could have indicated what they missed in the landscape and what they would have liked to improve. This feedback would have been valuable in creating a more comprehensive and inclusive design that meets the needs of all stakeholders. Additionally, it would have allowed for a more holistic approach to the project, considering the perspectives and experiences of those using and interacting with the landscape.

Engaging in interviews with various stakeholders during my graduation project revealed my passion for interacting with people, listening to their diverse perspectives, and fostering meaningful discussions. This experience illuminated the contrast between my enjoyment of these interactive exchanges and the isolated nature of working alone behind a computer, which dominated much of my project. Although realizing my inclination towards human interaction may have highlighted a weakness in my previous approach, I recognize the inherent value in this discovery. Through this project, I gained valuable insights into my strengths and weaknesses as a designer, and it has helped me understand the type of designer I aspire to be—one who actively engages with stakeholders, embraces collaboration, and thrives on exchanging ideas. This self-awareness will undoubtedly shape my future endeavours, directing me toward projects prioritizing human interaction and multi-stakeholder engagement, ensuring a fulfilling and impactful design journey.

While working on my thesis project, I entered with the awareness of a pitfall that had hindered me in the past: the tendency to make decisions too late. Armed with this knowledge, I was determined to avoid repeating the same mistake and to be more proactive in my decision-making. However, upon reflecting on my experience, I have come to a surprising realization—I prefer researching extensively and postponing decisions for as long as possible.

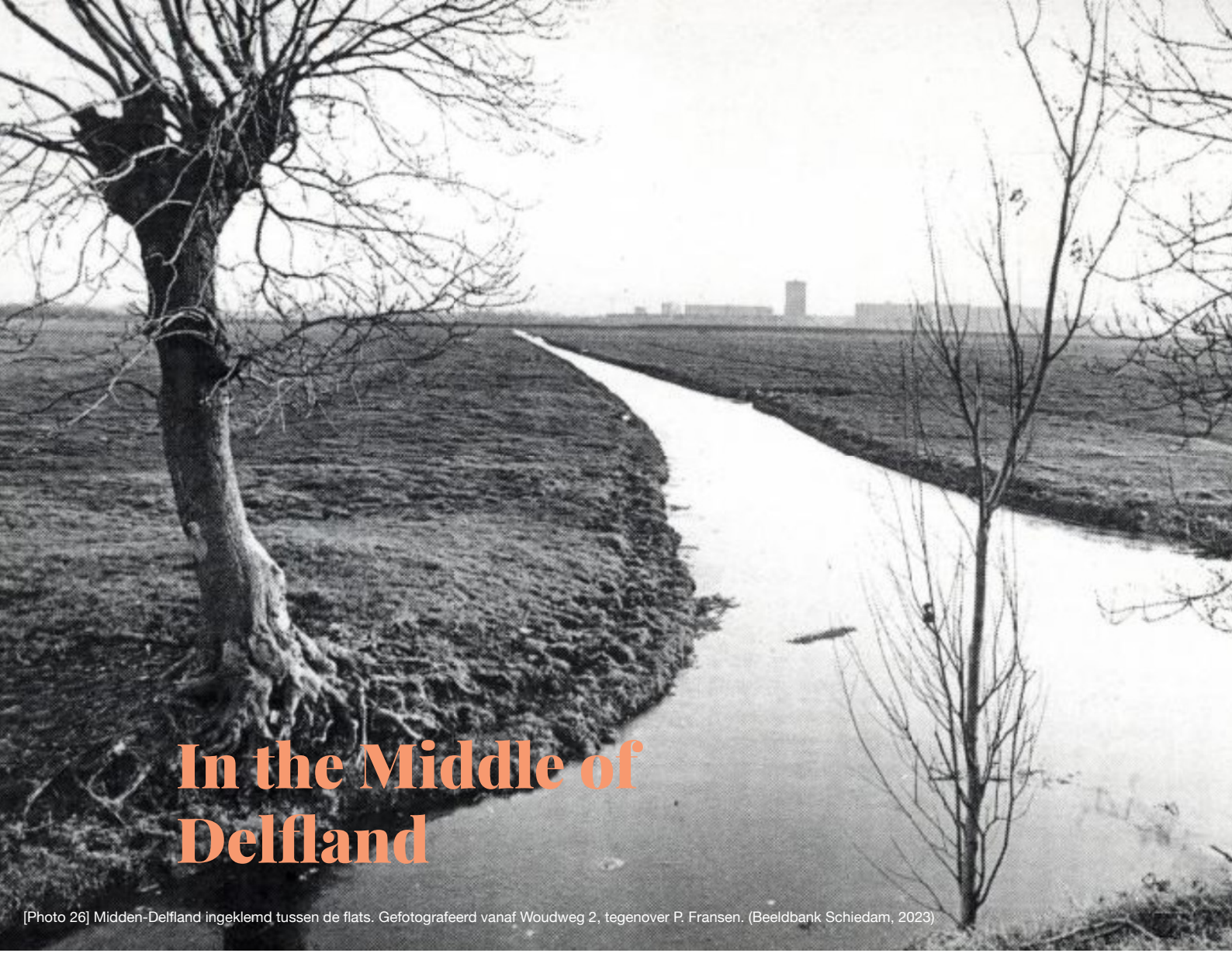
This inclination to delay decisions stems from my desire to gather as much information as possible, believing that having more data will lead to better choices. There is a sense of comfort in accumulating knowledge and an underlying fear of making the wrong decision due to insufficient information. As a result, I continually seek additional data, convinced that more time spend on research will result in a more informed and ultimately superior design outcome.
However, this approach has its drawbacks. By constantly pursuing more information,

I inadvertently create a cycle of prolonged decision-making that can hinder progress and impede the design process. While gathering data is undoubtedly essential, there comes a point where the quest for more knowledge becomes counterproductive, leading to a delay in acting and allocating adequate time for the actual design work.

Recognizing this pattern and its consequences is essential for a designer's growth. It is crucial to balance research and decision-making, understanding that any project will always have uncertainty. Embracing a mindset acknowledging the value of informed decision-making without succumbing to analysis paralysis is vital. Learning to trust my judgment and having confidence in my acquired knowledge are essential skills to develop. It requires recognizing that there will never be a perfect moment, or a definitive answer and that progress is often achieved by making decisions based on the available information and iterating as necessary. In other words, I need to learn to create a "burning platform" in order to force myself to timely decisions.

Moreover, I must be able to shape my opinions on diverse subjects autonomously. While acknowledging the value of considering others' viewpoints, I should not feel obligated to adopt them indiscriminately. Listening to alternative perspectives is crucial, but I should strive to reach well-founded conclusions. It is essential to recognize that possessing a differing opinion does not inherently diminish its validity or merit.

I intend to address this challenge by implementing strategies that help me balance research and decision-making. This may involve setting clear milestones and deadlines for myself, engaging in collaborative discussions with peers and mentors to gain perspective, and establishing a decision-making framework that considers the available information and the time needed for design implementation. Ultimately, embracing the complexity and uncertainty inherent in the design process is essential for personal and professional growth.



In the Middle of Delfland

[Photo 26] Midden-Delfland ingeklemd tussen de flats. Gefotografeerd vanaf Woudweg 2, tegenover P. Fransen. (Beeldbank Schiedam, 2023)

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I would like to acknowledge the support of my friends and family who have provided encouragement, motivation, and helpful discussions throughout this project. Their unwavering support have been a source of inspiration.

Glossary I (concepts)

Agricultural landscapes in this report focus on landscapes where dairy farming is the primary production.

Geriefbosjes A geriefbos is a small forest where coppice was harvested in the past and used in and around the house.

Climate Change in this report focuses on the effects of extreme rainfall and more extended periods of drought that impact the characteristics of the landscape, the freshwater variability in the agricultural landscapes and the effects on ecological zones.

Drought: Drought is a prolonged period of abnormally low precipitation, resulting in water scarcity and moisture deficiency in the soil and vegetation. Drought conditions can significantly affect agriculture, ecosystems, and water resources in BPL MD.

Ecology is the relationships among living organisms, including humans, and their physical environment

Future-proof agriculture - An economically viable agriculture with less greenhouse gas and nitrogen emissions, higher biodiversity and water quality and attention to animal welfare.

KWA Klimaatbestendige WaterAanvoervoorziening - Climate resilient water supply facility

KRW Kwaliteit Richtlijn Water - Water quality guideline

Helophyte filter is a sand filter that is generally planted with reeds. The actual treatment of the water is done by bacteria living in the roots. The reeds serve principally to aerate the roots and to capture nitrates and phosphorous.

Hoogheemraadschap Delfland the water board of

Metabolic flows - analyze how urban areas function with regard to resources

MRDH Metropool regio Rotterdam Den Haag - Metropoltain region Rotterdam The Hague. A compact network supported by the participating municipalities and other partners connects knowledge. Together they are working on a sustainable and internationally competitive metropolitan region with an attractive landscape and an infrastructural network that connects residential areas, work locations and facilities well.

NAP All heights in the Netherlands are measured relative to the same level, the Normal Amsterdam Peil (NAP). A NAP height of 0 m is approximately equal to the average sea level of the North Sea.

Open landscape is the open unobstructed space

PBL means 'Bijzonder Provinciaal Landschap', the Dutch translation of 'exceptional provincial landscape'.

PBL MD means 'Bijzonder Provinciaal Landschap Midden Delfland'

Peat land is a wet landscape that is characterised by waterlogged organic soils made of dead & decaying plants.

Precipitation: Precipitation refers to the amount of water that falls from the atmosphere to the Earth's surface in the form of rain, snow, or other conditions of moisture. Adequate and timely precipitation is crucial for supporting agricultural activities in BPL MD, as it provides the necessary water for crop growth and replenishes water sources such as rivers, canals, and groundwater.

Polder landscape is a low-lying tract of land that forms an artificial hydrological entity, enclosed by embankments known as dikes.

Purifying nature removing bad substances from something to make it pure. For example plants help to purify water.

Resilience in the literature has a wide range of meanings. Adaptation is often organized around resilience as bouncing back and returning to a previous state after a disturbance. More broadly the term describes not just the ability to maintain essential function, identity and structure, but also the capacity for transformation.

Staatsbosbeheer is the largest forest and nature manager in the Netherlands.

Subsidence - the gradual caving in or sinking of an area of land.

Urbanisation is the trend of more and more people moving towards the cities of Rotterdam and The Hague in 2070.

Water level is the water level that the water board maintains for an area. In the region of BPL MD the waterlevel is between -1,00 and -6,00 < NAP

Wet cultivation

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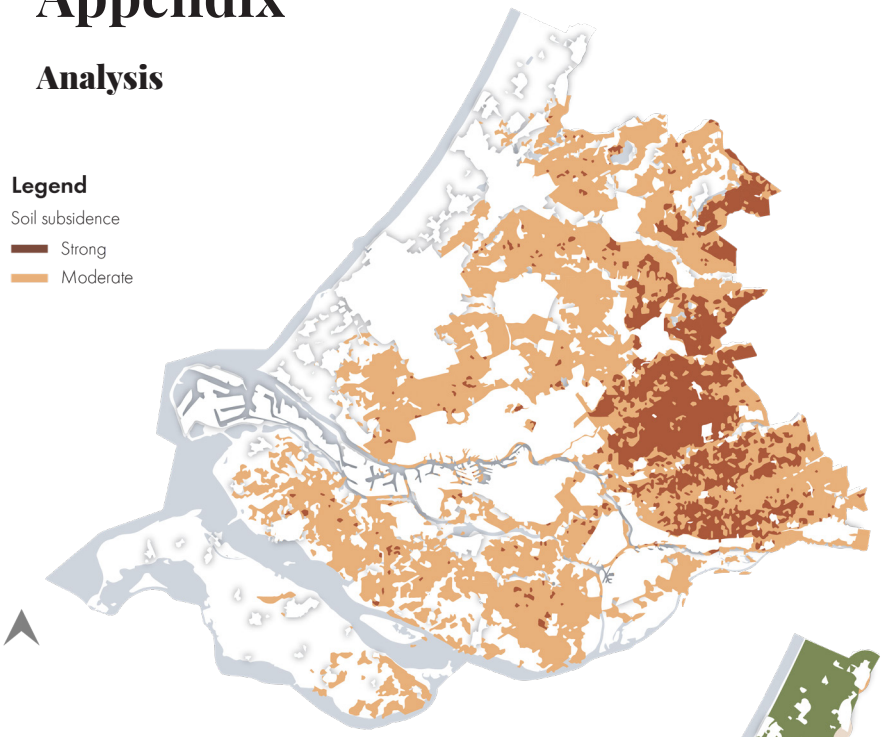
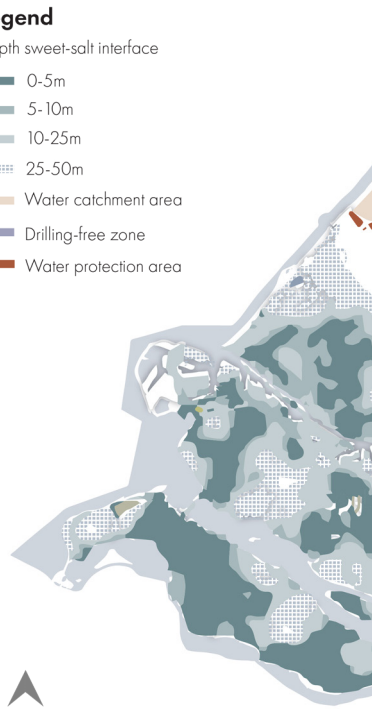
Interviews

Anton van der Ende
Bas van den Berg
Ingrid ter Woorst
Kees Boks
Maarten Moerman
Mellanie Vellekoop
Paul Oosthoek

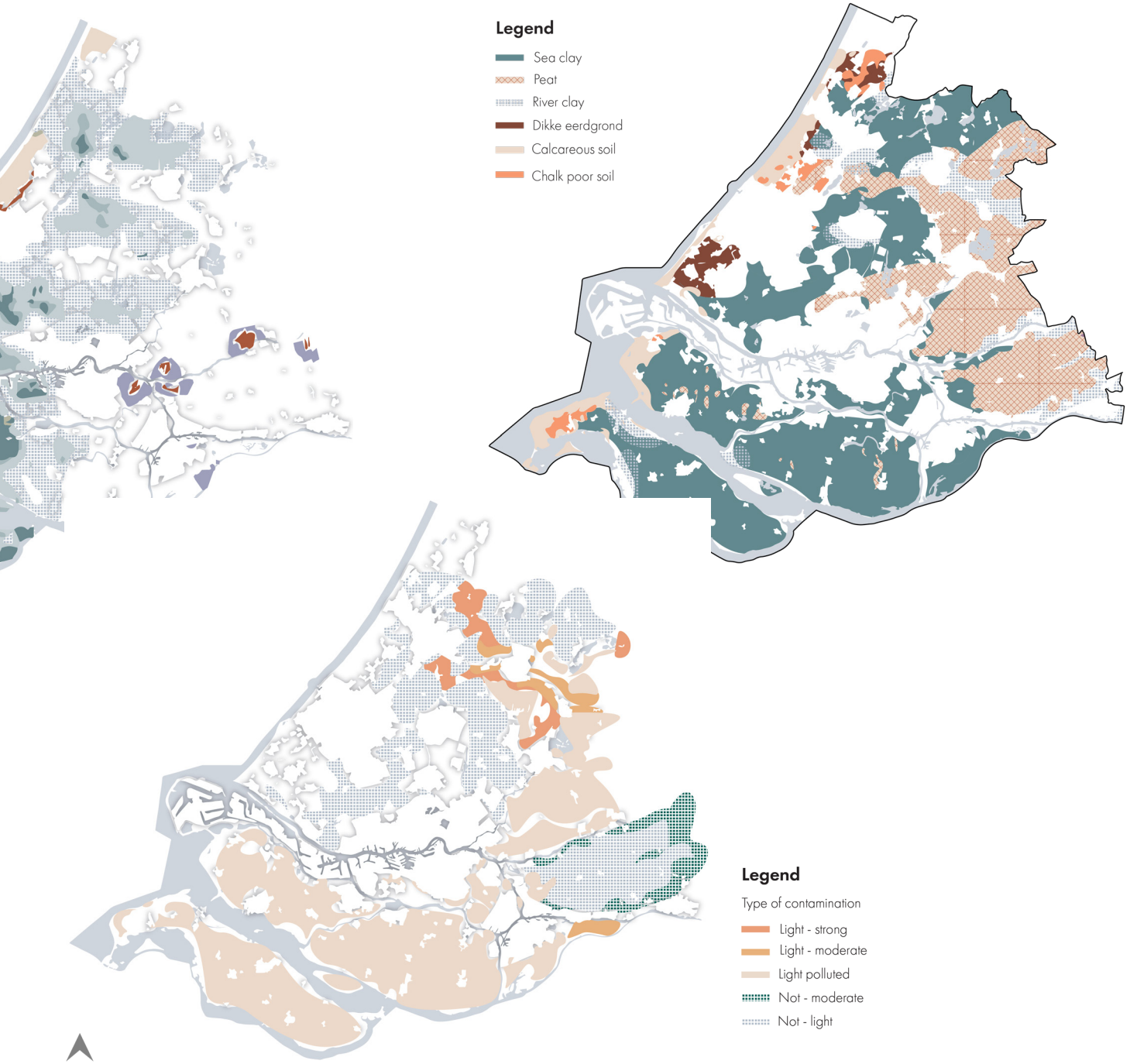
Appendix

Analysis



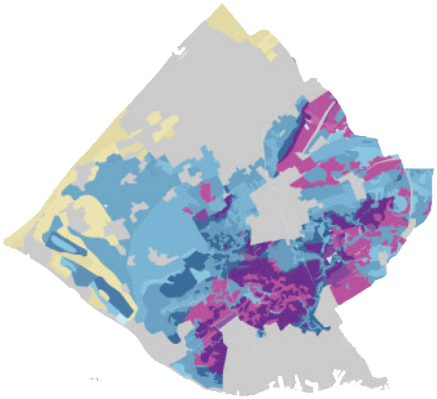


[Fig. ?]: Qgis


Legend
Sea clay
Peat
River clay
Dikke eerdgrond
Calcareous soil
Chalk poor soil
Legend
Type of contamination
Light - strong
Light - moderate
Light polluted
Not - moderate
Not - light

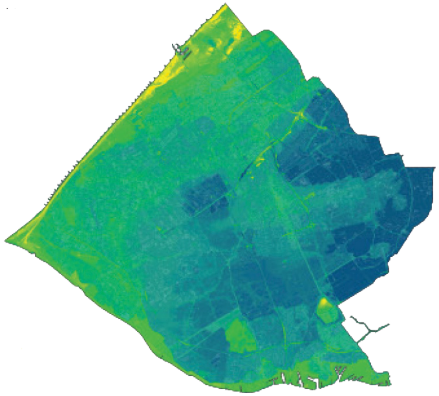
Ananlysis

Soil



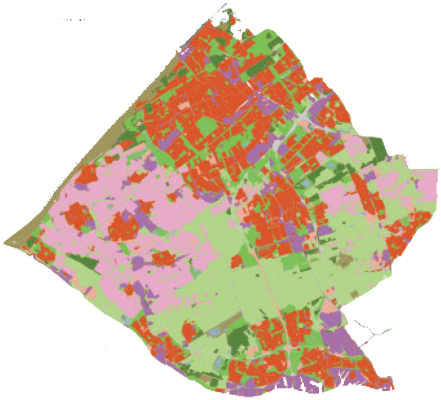
[Fig. ?]: BOFEK (2012)

Elevation map

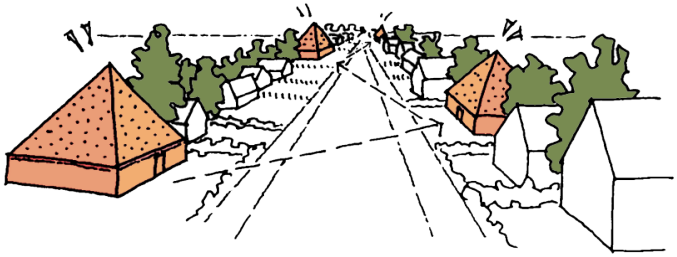


[Fig. ?]: AHN

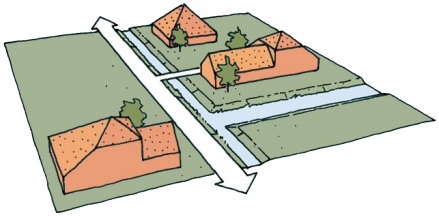
Landuse



[Fig. ?]: CBS Grondgebruik (2012)



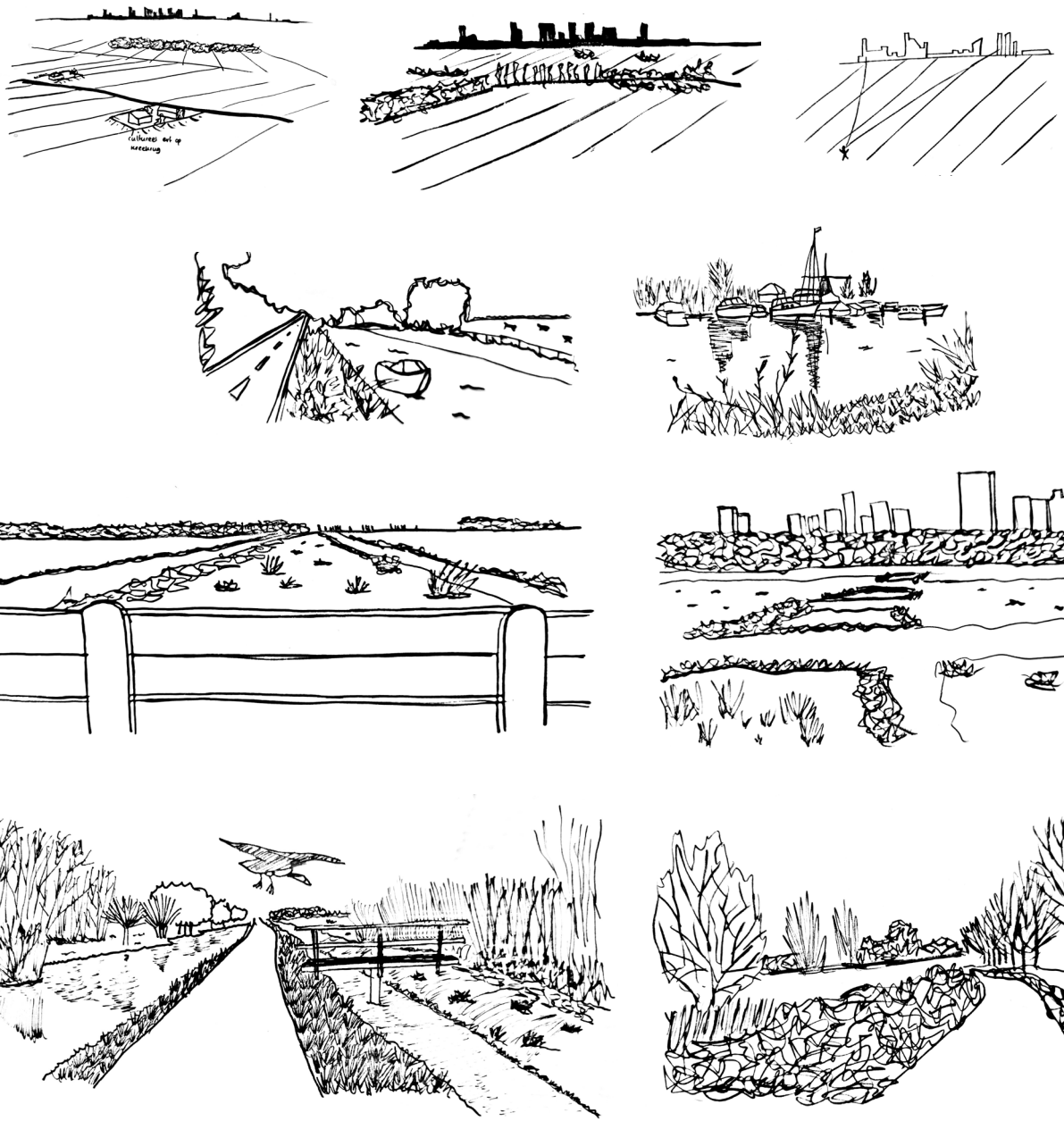
[Fig ?]: Historic farms (Provincie Noord Holland, 2018)



[Fig ?]: Polderlint (Provincie Noord Holland, 2018)

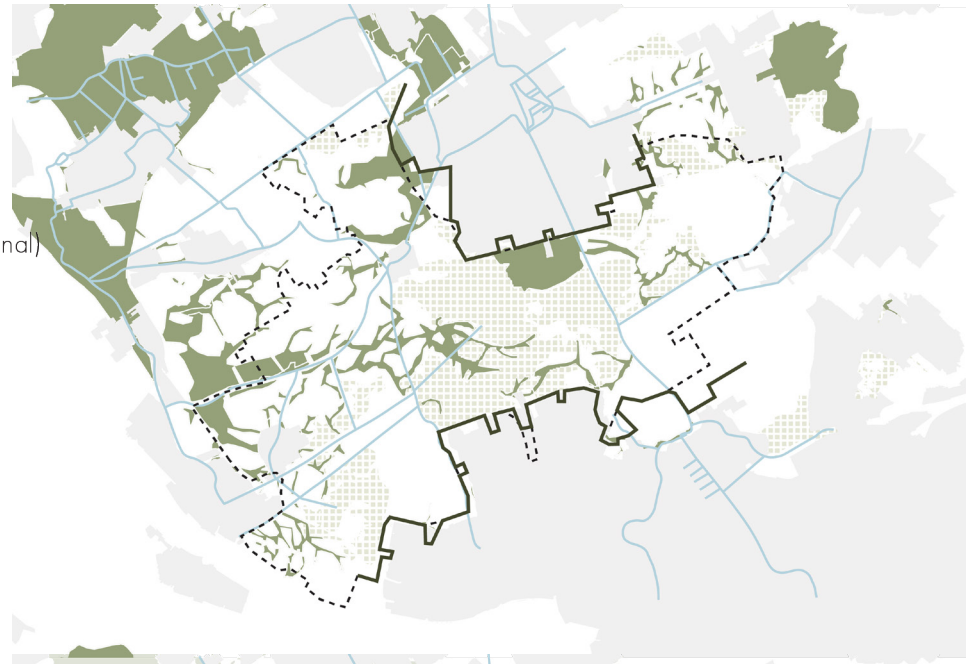
[Fig ?]: Open view (Provincie Noord Holland, 2018)

Sketches



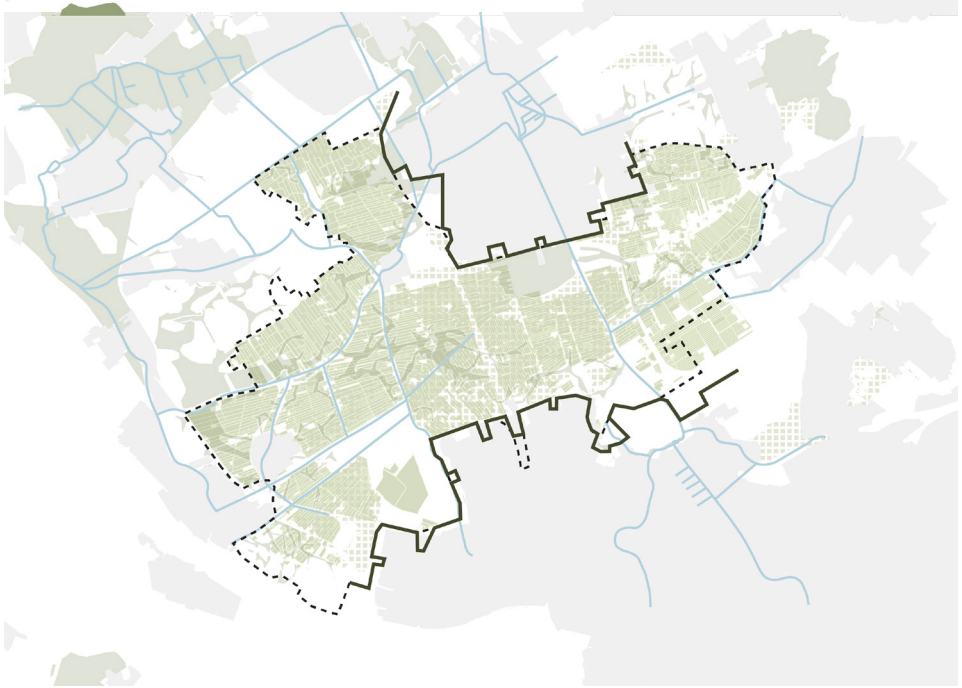
Legend

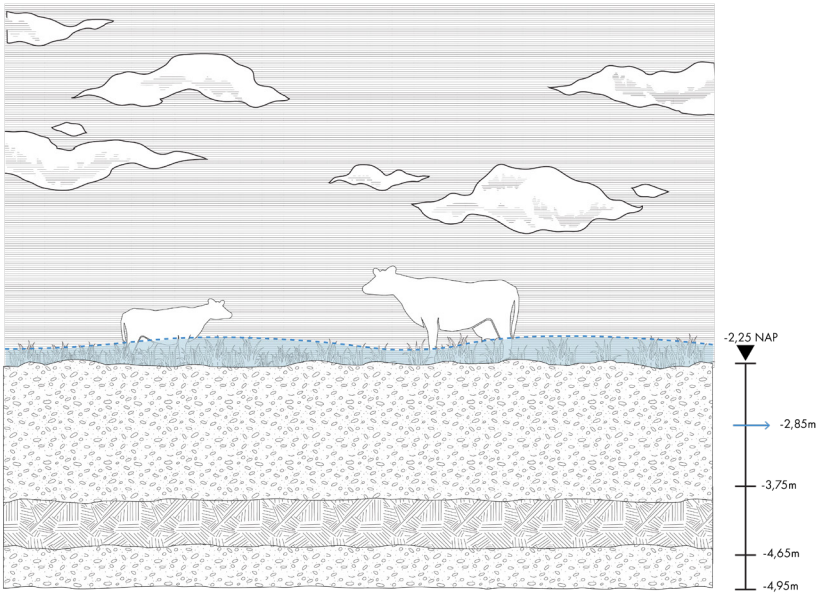
- Creek ridge
- Low-lying peat
- Boezem water (canal)
- City borders
- Built environment
- BPL MD

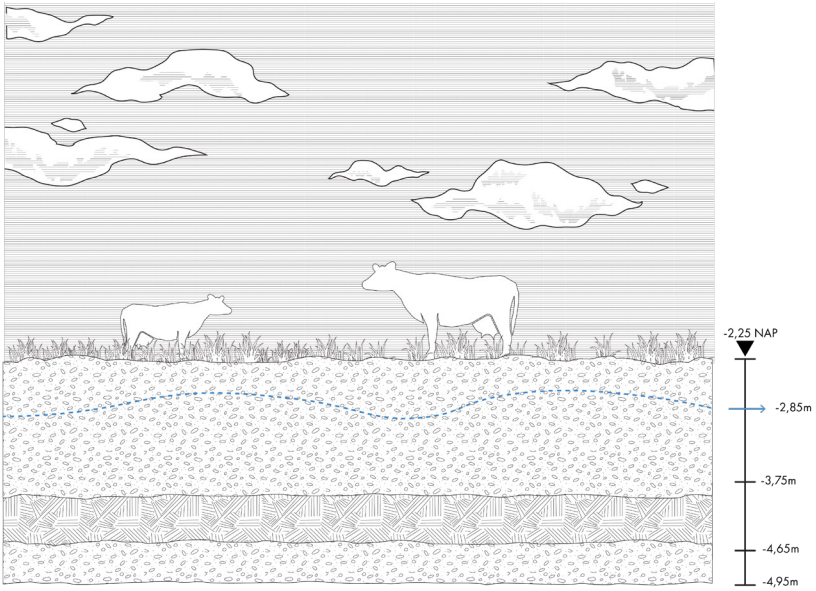


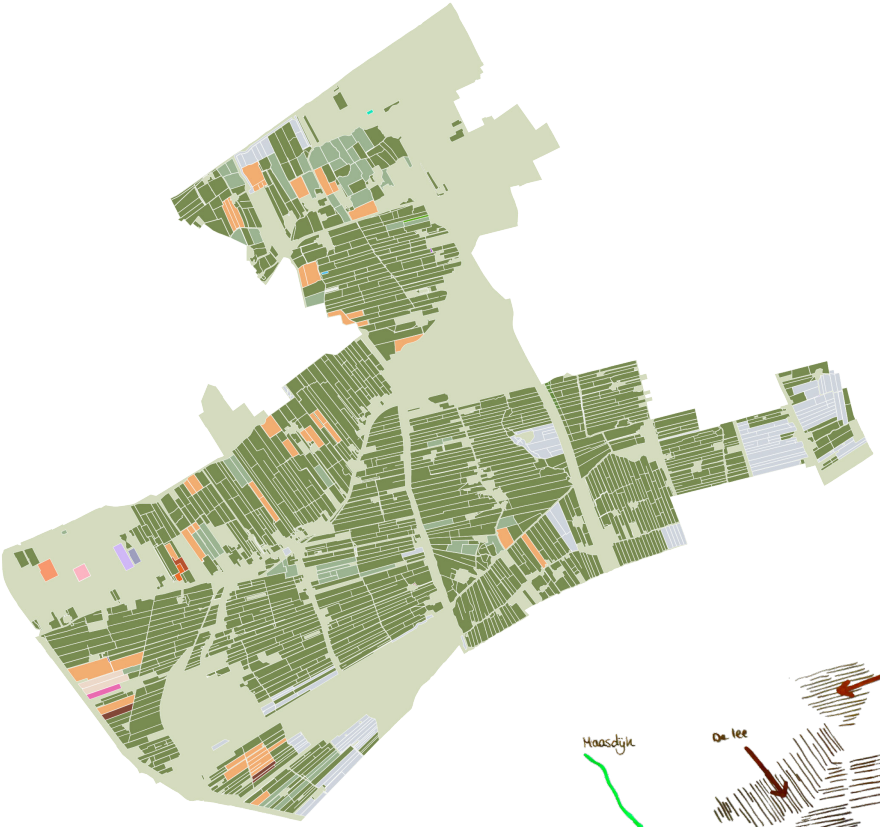
Legend

- Creek ridge
- Low-lying peat
- Boezem water (canal)
- City borders
- Built environment
- BPL MD
- Water buffer
- Ditches
- Parcels




-2,25 NAP
-2,85m
-3,75m
-4,65m
-4,95m


-2,25 NAP
-2,85m
-3,75m
-4,65m
-4,95m

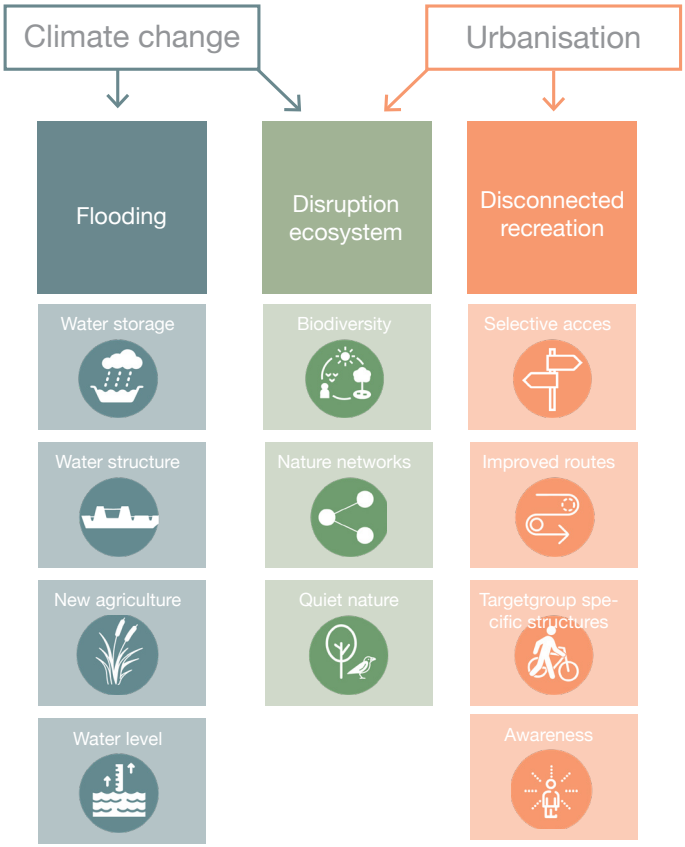


Legend

Function parcels

- Grass, natural (agriculture)
- Grass, lasting
- Grass, temporary
- Corn
- Beans
- Beets
- Flowers
- Apples
- Seeds
- Crops
- Chrysant

Maximization



Water storage

- Water buffer
- New ditches
- Bigger canals

Water structure

- Swamps
- Land grading
- Constructed wetlands

New agriculture

- Crop rotation
- Wet cultivation
- Foodswamp
- Buffer strips
- Eco banks

Biodiversity

- Seasonal greenery
- Diverse habitats
- Protection zones

Nature networks

- New nature
- Buffer zones
- Diverse vegetation

Selective acces

- Borders
- Information signs
- Attrective gates

Improved routes

- Slow traffic routes (cycling & walking)
- Place to stay
- Low impact bridges
- Boardwalks

Targetgroup specific structures

- Themed routes
- Activities in landscape

Awareness

- Birdwatching
- Organized tours
- Workshops

Quiet nature

- Timezones
- Restricted acces
- Barriers

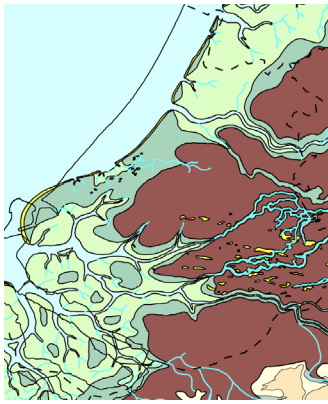
Soil

Historical changes

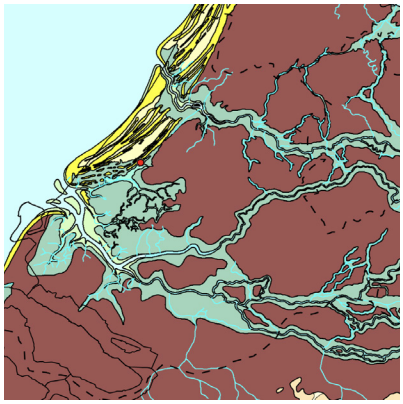
During the early Middle Ages, the inhabitants of South Holland decided to extract peat from bogs, creating new farmland. However, this practice also brought about a long-standing struggle with water management, as the drained land gradually sank below the water table. In the 18th and 19th centuries, efforts were made to reclaim peat ponds, deep pools formed by peat extraction, which was a vital fuel source during the Golden Age. The high demand for peat threatened nearby villages and towns, necessitating reclamation efforts. While these polders and reclaimed lands provided additional land, they also increased the region's vulnerability, as a breach in the dikes could lead to significant disasters. This vulnerability was evident in 1953 when the devastating flood disaster caused numerous casualties and extensive damage in South Holland (Harm et al., 2014).

South Holland primarily consists of polders, and until the 1980s, water management within these polders was the responsibility of numerous district water boards. Since 1814, the province of South Holland has overseen water management activities carried out by these water boards. However, the number of water boards has steadily decreased due to economies of scale. As of 2005, none remain within the management area of the Hoogheemraadschap van Rijnland, which encompasses approximately 200 former water boards (Harm et al., 2014).

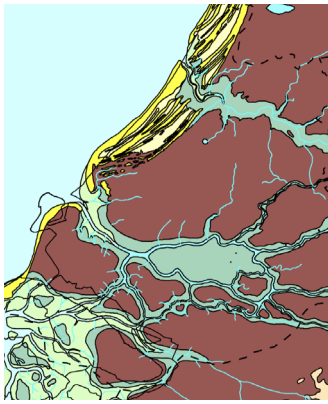
9000vc



5500vc



500vc



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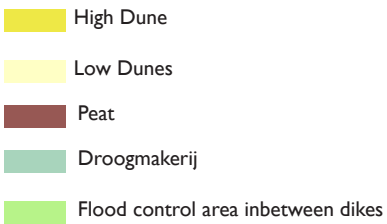
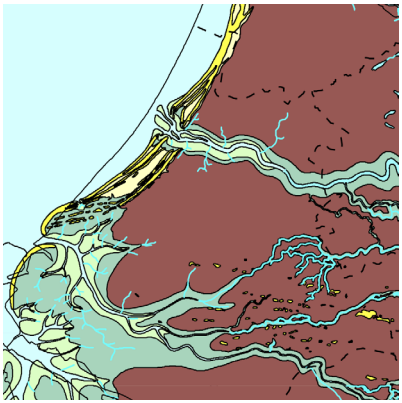
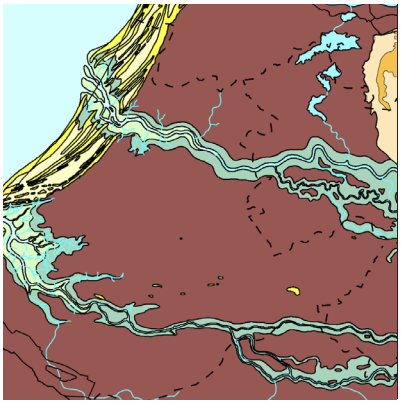
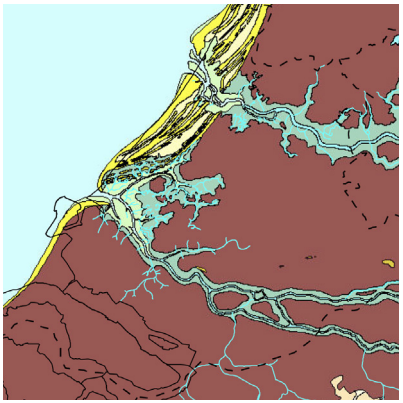




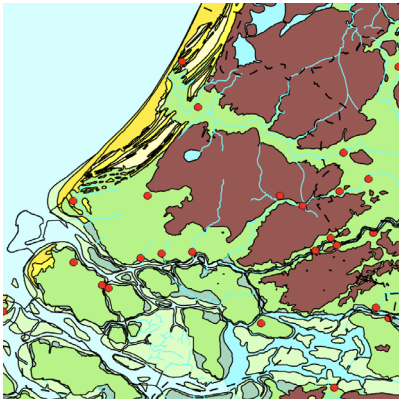
3850vc



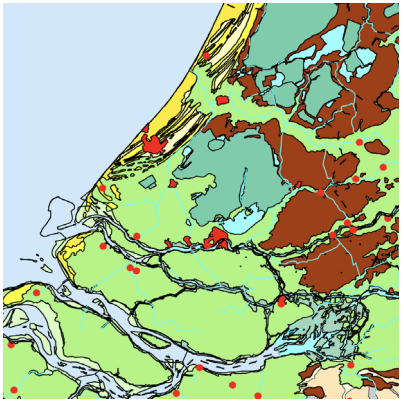
2750vc



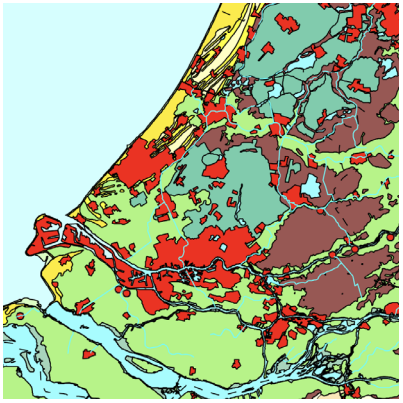
1500vc



800nc



1850nc



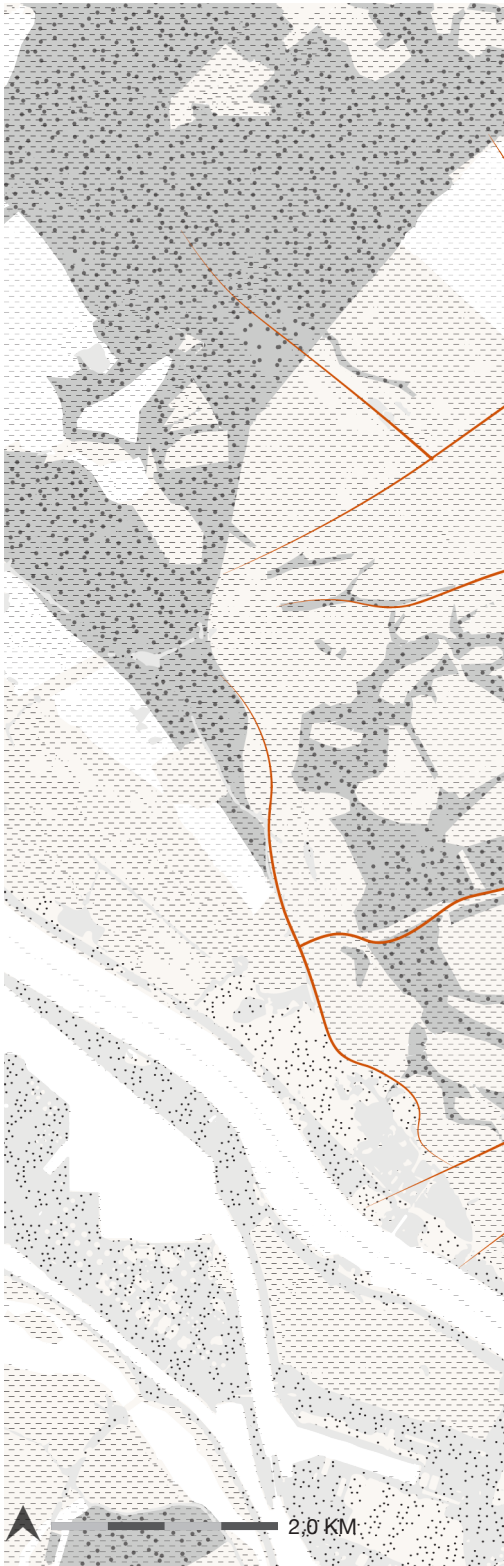
2000nc

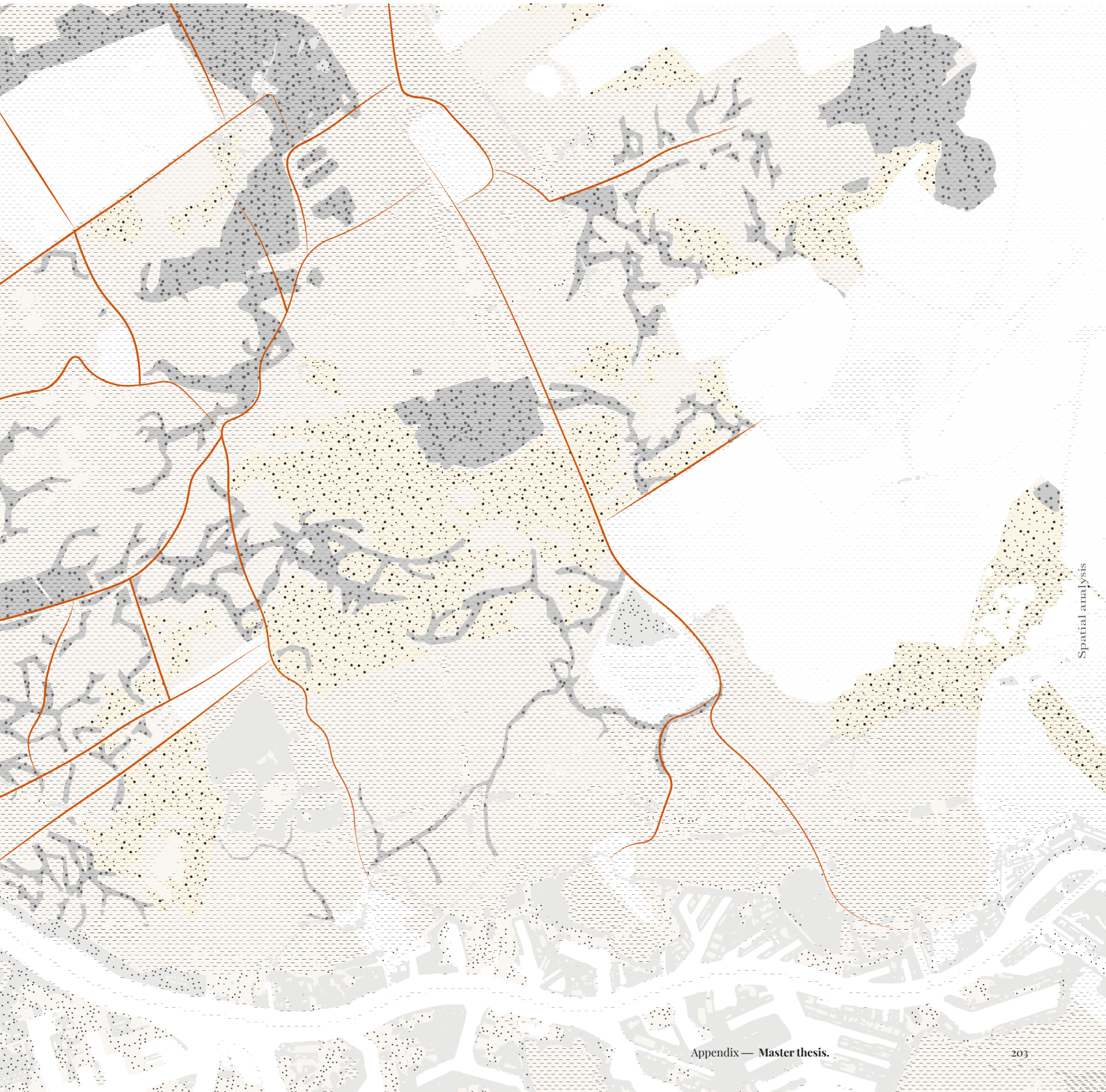
AP

50 KM

Height and soiltypes

The creek ridge, the highest point in this region, can be seen clearly on the map as it cuts through the landscape. Farms were constructed on these ridges because they were safe from flooding. Furthermore, you see the firm structure of the canals (boezems) running through the area. The lowest part of the region is in the east.





Layers of soiltypes

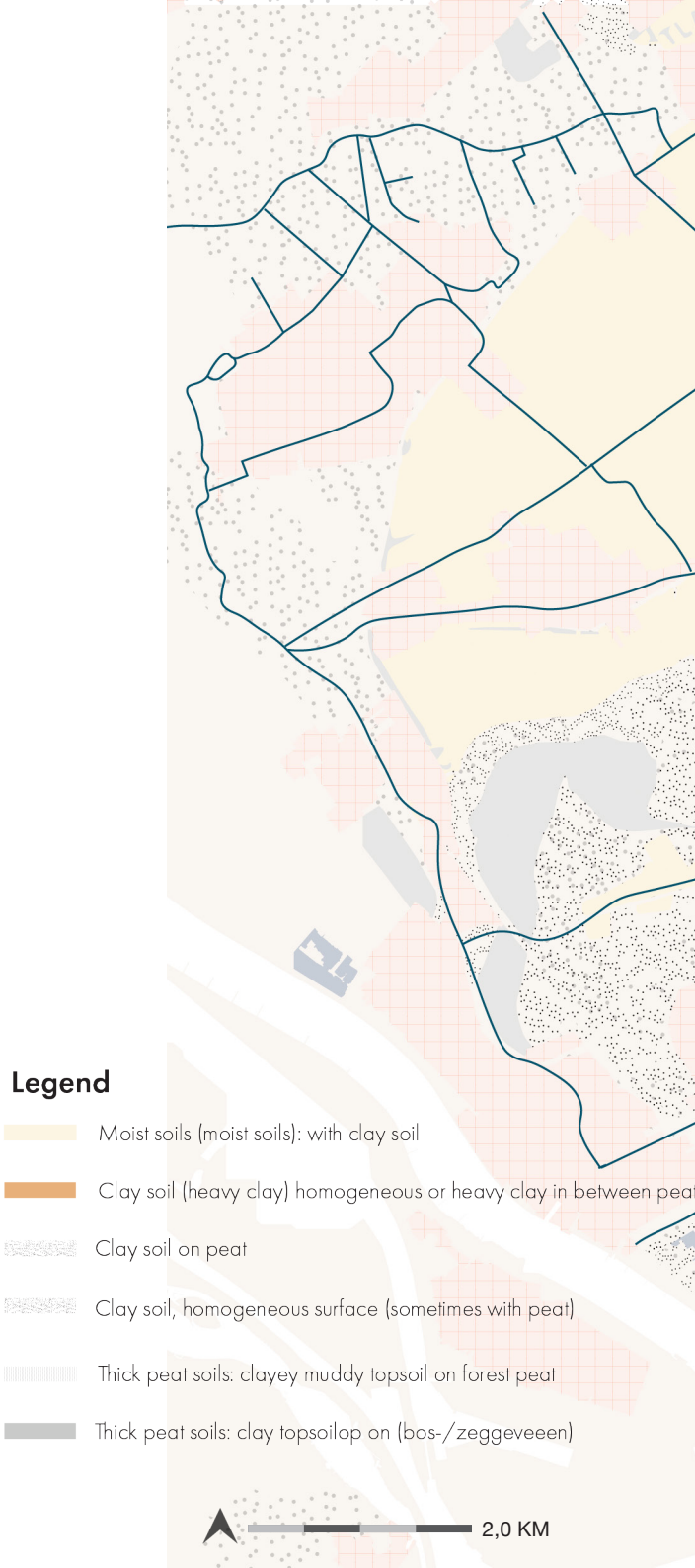
In the BPL MD, two main soil types can be found, which are peat and clay. Those have different structures and combinations of minerals. Peat soils are high in organic matter, while clay soils are heavy and dense. Moist Soils: These soils are typically found in areas with a high water table or near water bodies. They have a high moisture content and are often associated with wetlands and marshy areas. Moist soils are fertile and support the growth of diverse vegetation, including wetland plants and grasses.

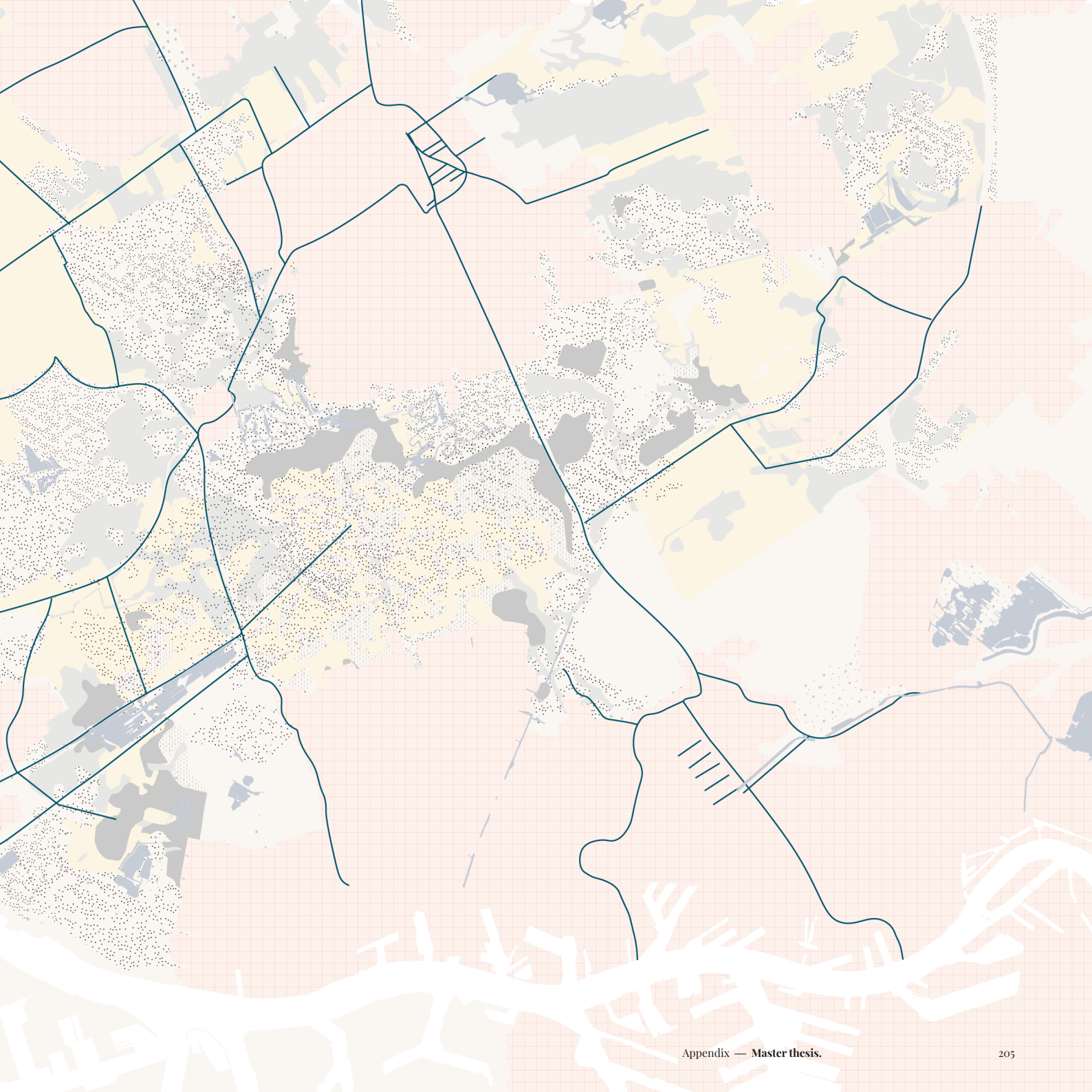
Clay Soil: Clay soils are prevalent in the higher-lying areas of BPL MD. They are formed from the deposition of fine particles water carries over time. Clay soils have a high water-holding capacity and are heavy and compact.

Peat Soil: Peat soils are formed from the accumulation of decomposed organic matter in soggy conditions. They are commonly found in lower-lying areas and have a high organic content. Their dark color and spongy texture characterize peat soils.

Thick Peat with Soil: This soil type refers to areas where a thick peat layer is present with a layer of soil on top. The peat layer provides organic matter and nutrients, while the soil layer offers better drainage conditions.

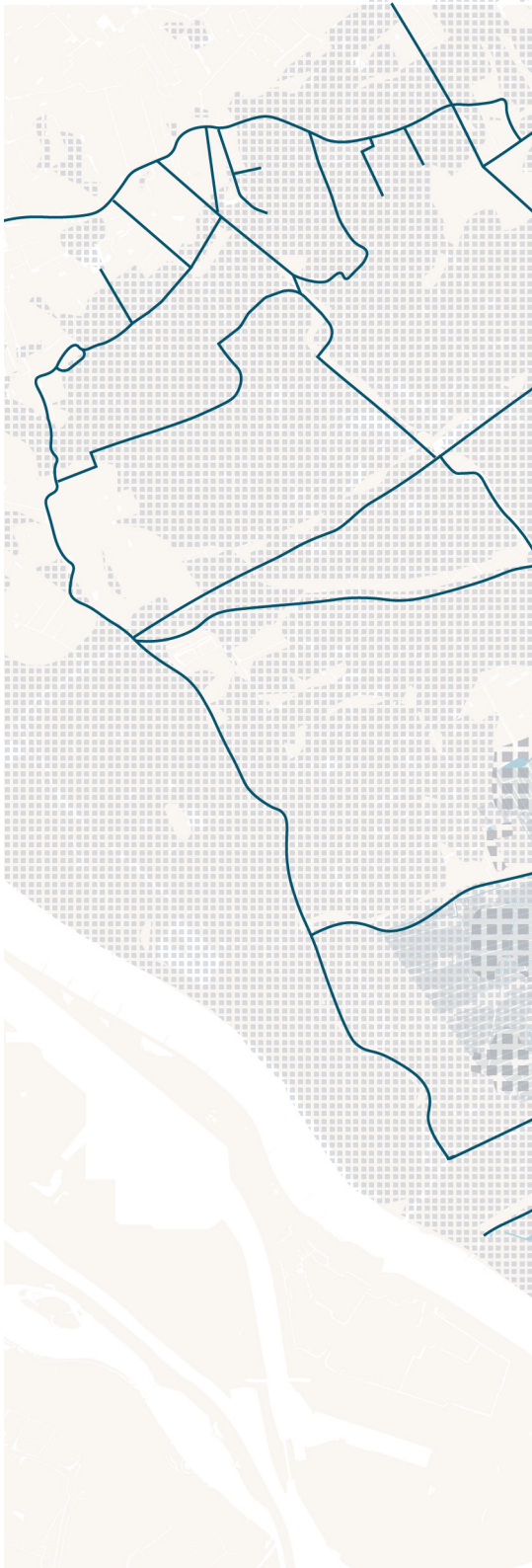
Understanding the different soil types in BPL MD is essential for farmers and land managers regarding drainage systems and soil management practices (Provincie Zuid Holland, 2023).





Soil subsidence

Soil subsidence in BPL MD is most pronounced in historically drained and reclaimed areas through peat extraction and land reclamation processes. These areas typically exhibit higher subsidence rates due to the compression and consolidation of the underlying peat layers. The specific parts of BPL MD most affected by soil subsidence can vary. Still, generally, the areas closer to former peat ponds or areas with extensive agricultural activities may experience more significant subsidence. Additionally, the proximity to water bodies and the age of the polder can also influence the extent of soil subsidence. It is essential to conduct detailed geotechnical and hydrological investigations to identify the specific locations within BPL MD prone to soil subsidence and implement appropriate mitigation measures accordingly.

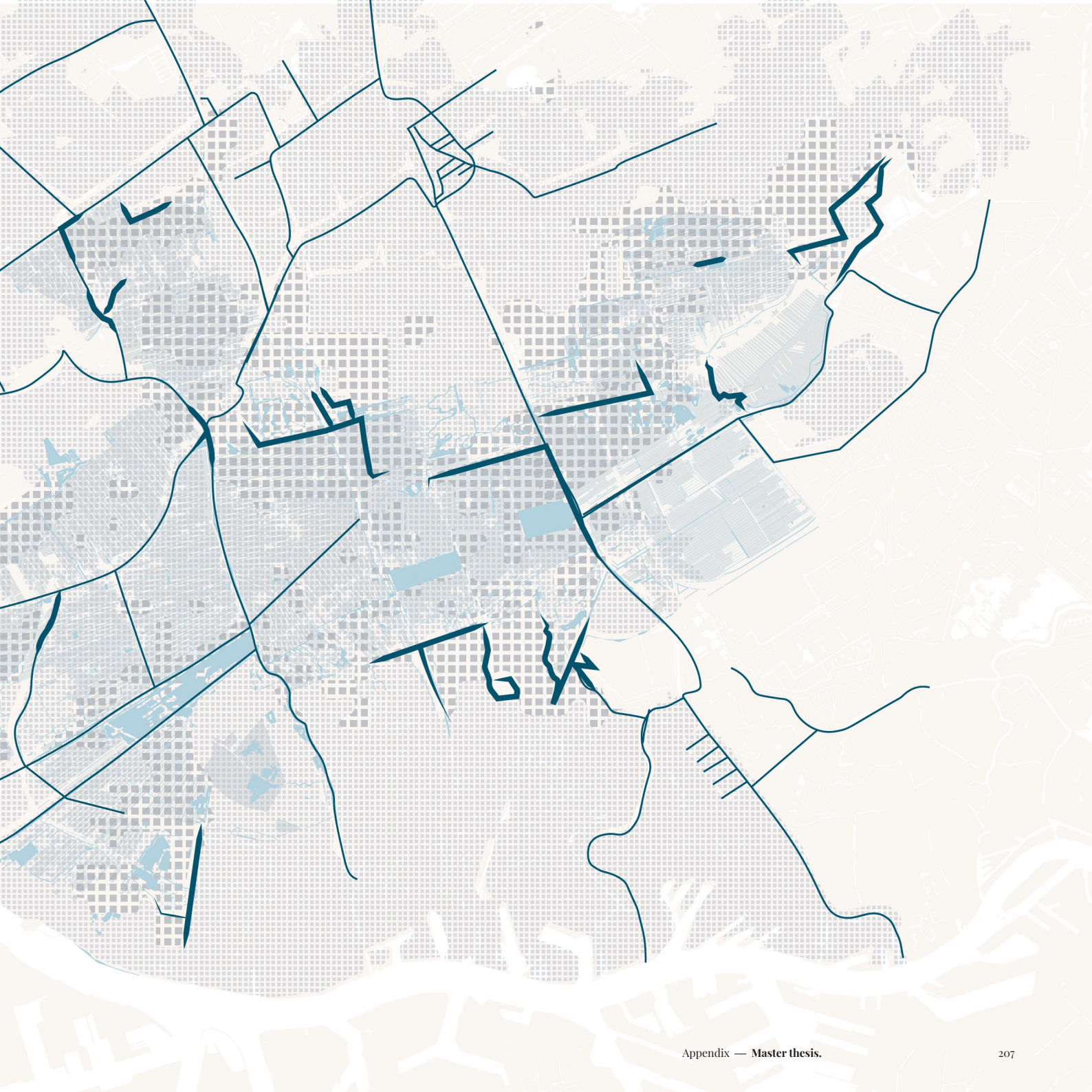


Legend

Subsidence sensitive region 0 - 15m

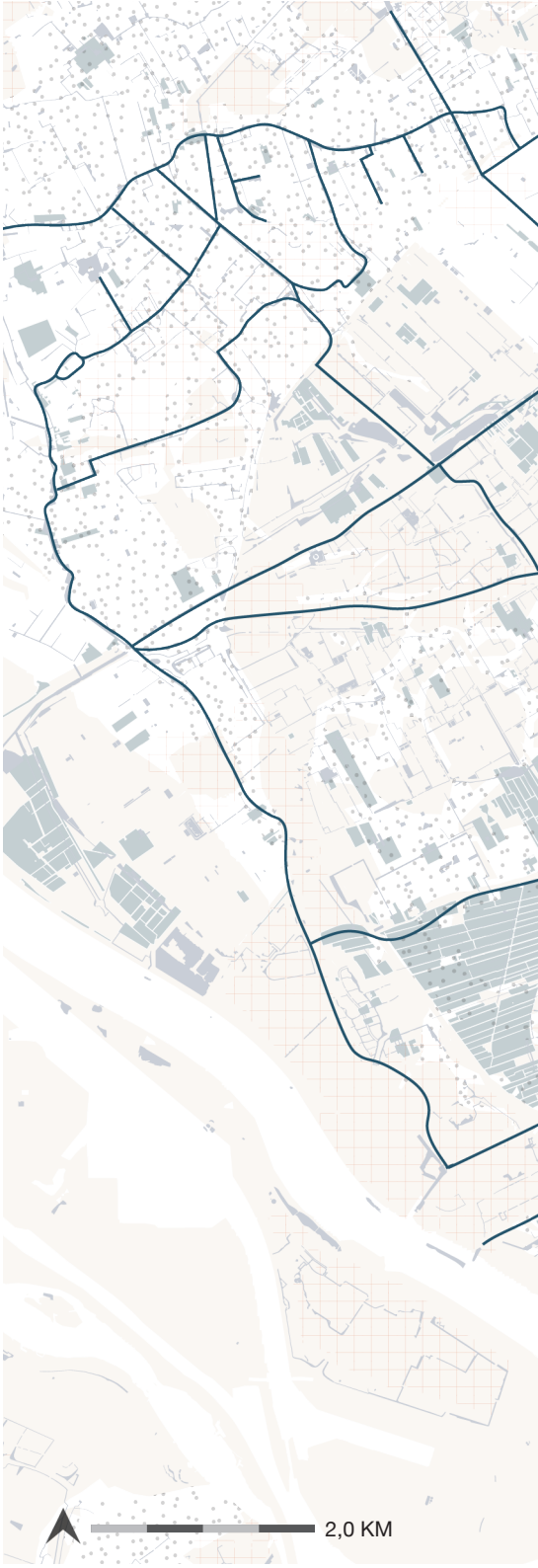
Peat oxidation

Sagging weir



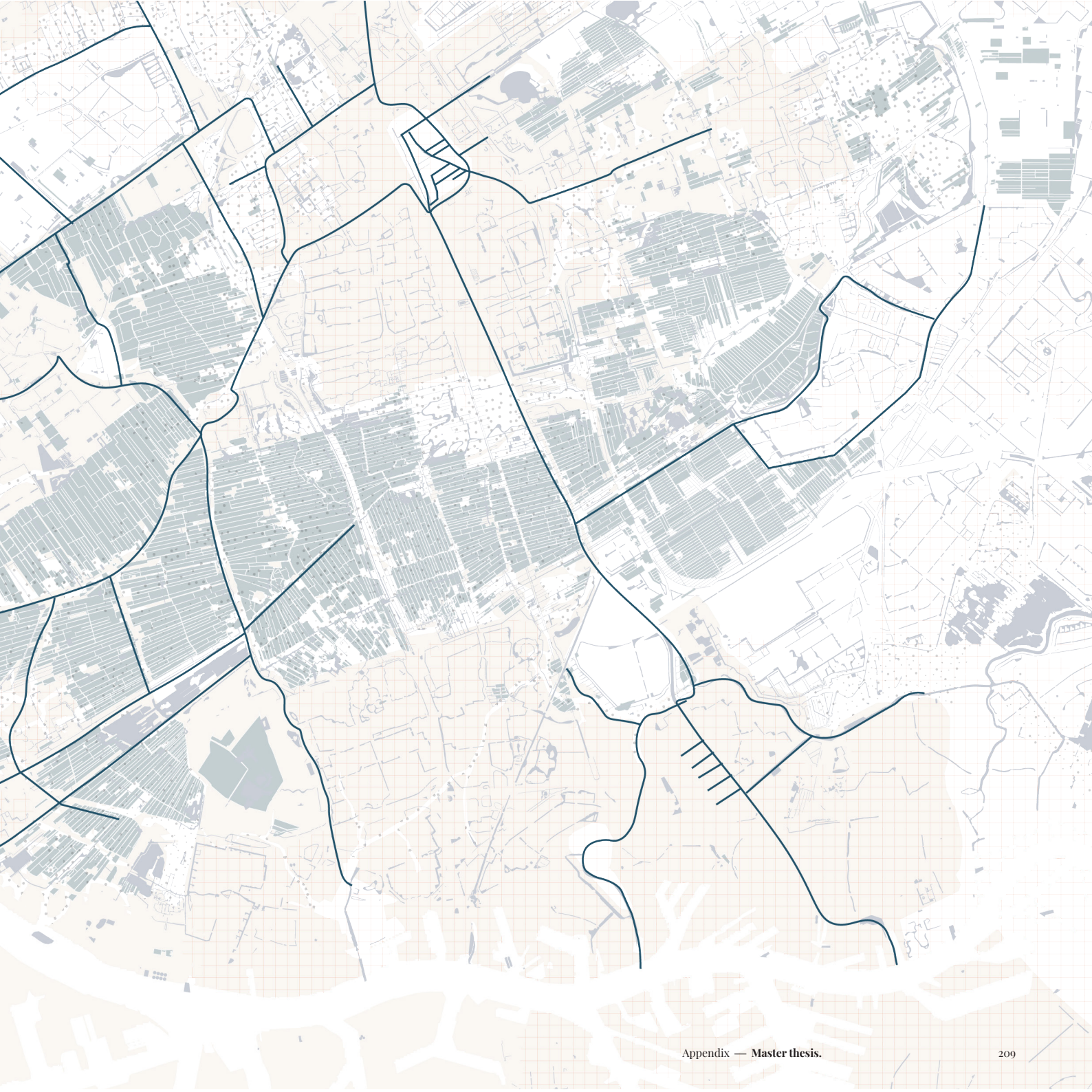
Water

Water is essential in BPL MD due to its unique geographic characteristics and historical context. The region is situated in a low-lying area, below sea level, characterized by a network of waterways, canals, and drainage systems.



Legend

- Urbanized zone
- Parcels
- Kreekrug
- Sea clay
- Boezemwater

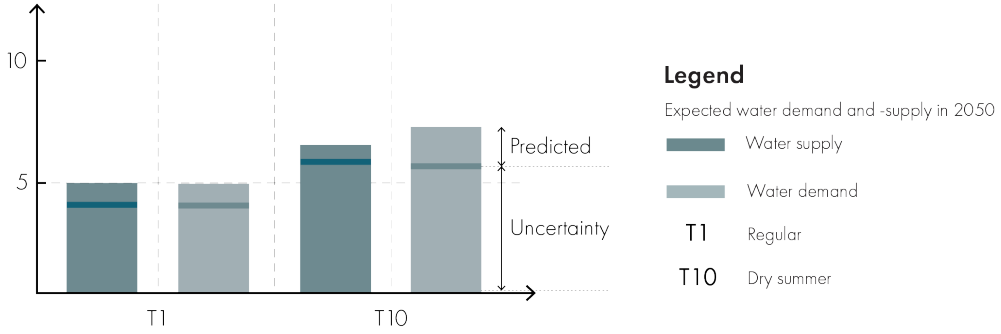


Increasing water demand

In 2070, the water demand is expectedBPL, MD,crease, mainly due to rising water demand for water level management due to climate change (up to 20% for this part of water demand). The water supply will be sufficient for the expected water demand in an ordinary year. Water demand during a dry year (once every ten years) is uncertain and may be more or less than 1.5 m³/s. In the future, this demand will increase, last longer, and occur more frequently. A shortage may occur as the water demand increases and the water supply does not change. Additional water will be needed during fish migration between February and June, especially during drought. During a dry spring this means 0.4 m³/s water, which is approximately 2480,000 m³ per year (Toekomstbestendige zoetwatervoorziening Delfland 2050: Ontwikkelingen, doel en aanpak op hoofdlijnen, 2020). Delfland has three guiding principles to achieve a future-proof water supply. First, maintain and increase the robustness of the existing supply facilities from the Brielse Meer and KWA. Second, boosting the internal water supply and circularity within the area. Last, reducing the dependence on existing functions for fresh water. The second goal in particular can be spatially incorporated into the new vision for BPL MD 2050.

Currently, the ministry says that nitrogen emissions must be reduced by 50% by 2030, meaning that 74% of the area of nitrogen-sensitive nature is below the critical deposition value. However, the law still states the year 2035. According to a calculation by PBL in collaboration with TNO, CE-elft, and RIVM, the potential nitrogen reduction within agriculture can be achieved if it decreases by 654 mol/ha/year in 2030 (“Program for Nitrogen Reduction and Nature Improvement 2022–2035,” 22AD). In South Holland, it will have to decrease by 1 million tons of CO2/ year by 2030, which amounts to 25% of the national amount of oxidizable peatland.

By 2070, agriculture must be largely climate



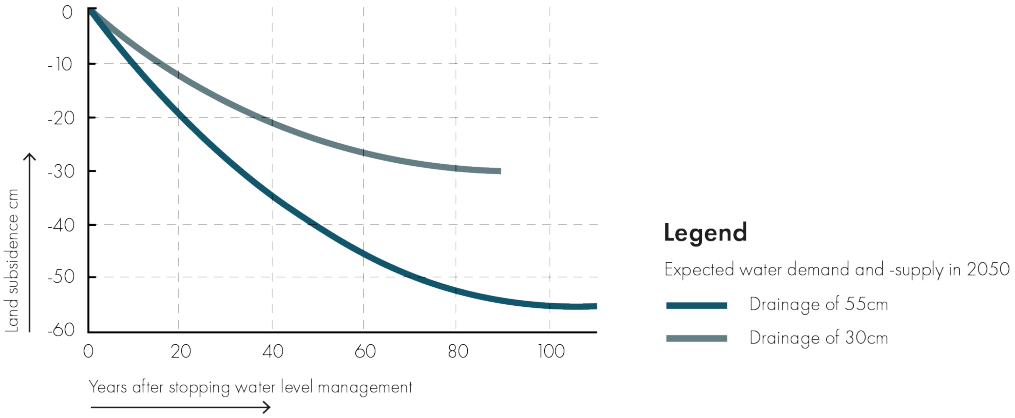
Made by author (KNMI - KNMI’14-klimaatscenario’s, 2014)

neutral, meaning that greenhouse gases (though firmly reduced) must be compensated for by capturing CO2 in the soil and nature. In the west of BPL MD, the soil consists of more clay than in the central and east of the region. Therefore, the west is less sensitive to soil subsidence than the central and east. The Province of South Holland has an amount of 22 million euros available to take climate mitigation measures on peat soils (Ligtenberg et al., 2021). These measures include underwater drainage, level fixation, or alternative land use.

Underwater drains are below the lowest ditch level, allowing exchange between ditch water and groundwater from parcels. This way, groundwater is quickly replenished during dry periods and quickly drained during wet periods. The ditch water level can be raised by 10–20 cm due to underwater drains without wetting the ground. As a result, the ground-level decline can be halved under optimal conditions.

Level fixation also ensures that subsidence will decrease in the future. Eventually, a puddle or wetland situation will arise. This situation can reduce land subsidence with 30 to 55 cm of drainage. In BPL MD, this can cause that; eventually, agriculture will no longer be possible due to too wet spots. According to Fiselier et al. (2012), there are also soils where drainage will change very slowly and agriculture will remain possible.

The third measure would be alternative land use. Changes outside and within agriculture are two general options for alternative land uses. It is possible to shift the function of agriculture to nature. Developing wet crop services such as carbon sequestration, water purification, and wildlife habitat while also generating income for farmers However, transitioning to these alternative land uses may require policy support and financial incentives to overcome barriers such as a lack of infrastructure and market demand.

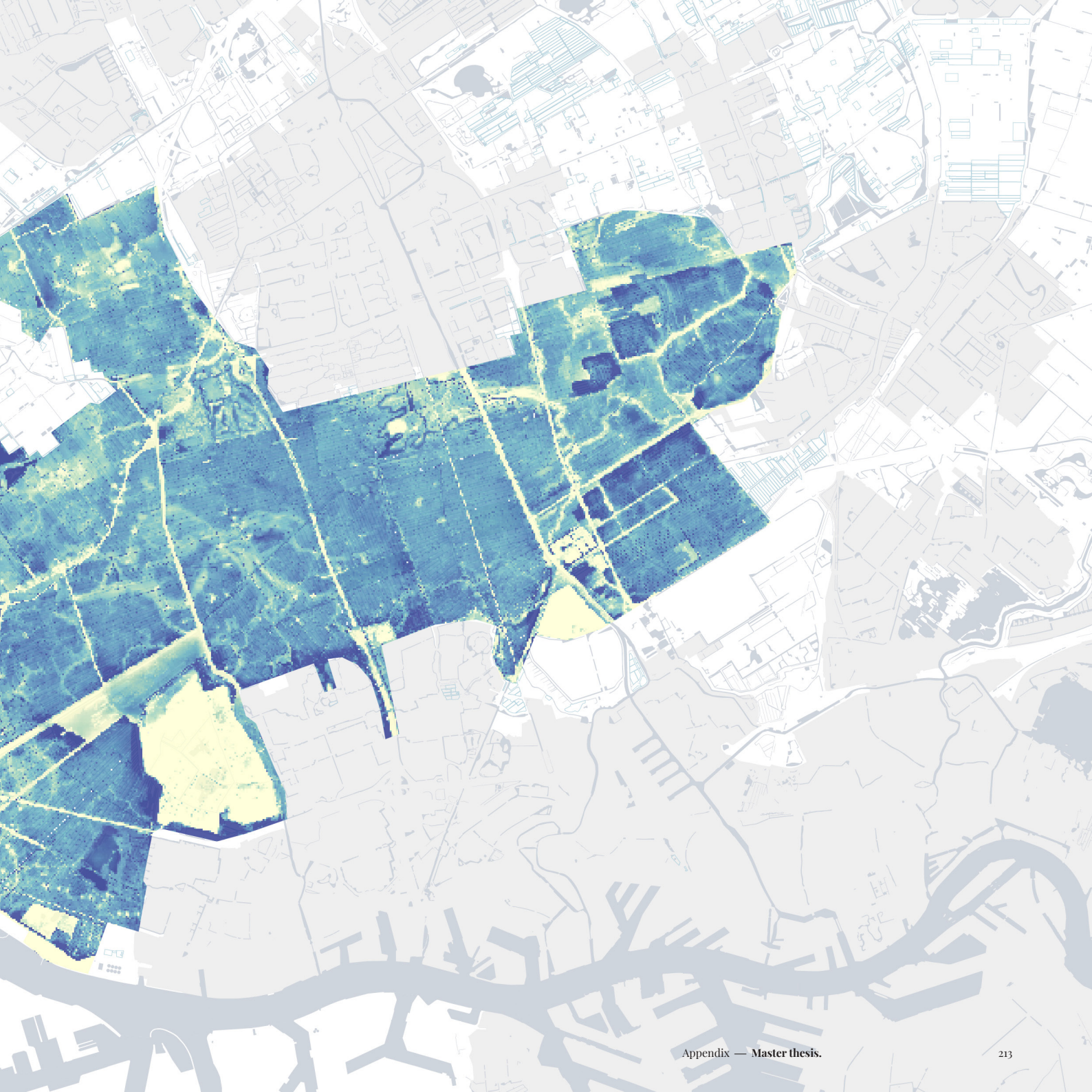


Made by author (KNMI - KNMI'14-klimaatscenario's, 2014)

Lowest groundwaterlevel 2050

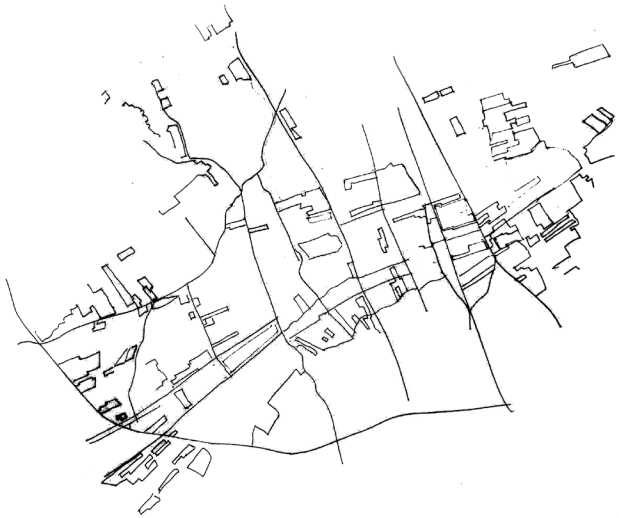
Predicting the specific effects of changes in groundwater levels in BPL MD in the year 2050 is challenging due to the uncertainties and variables involved. However, changes in groundwater levels can have several potential impacts on the region.

It's important to note that the specific effects of changes in groundwater levels will depend on various factors, including the magnitude and rate of change, the resilience of ecosystems and infrastructure, and the adaptive measures implemented to mitigate or respond to these changes. Integrated water management strategies, sustainable land use planning, and proactive adaptation measures can help minimize potential negative impacts and enhance the resilience of BPL MD to future groundwater level changes.



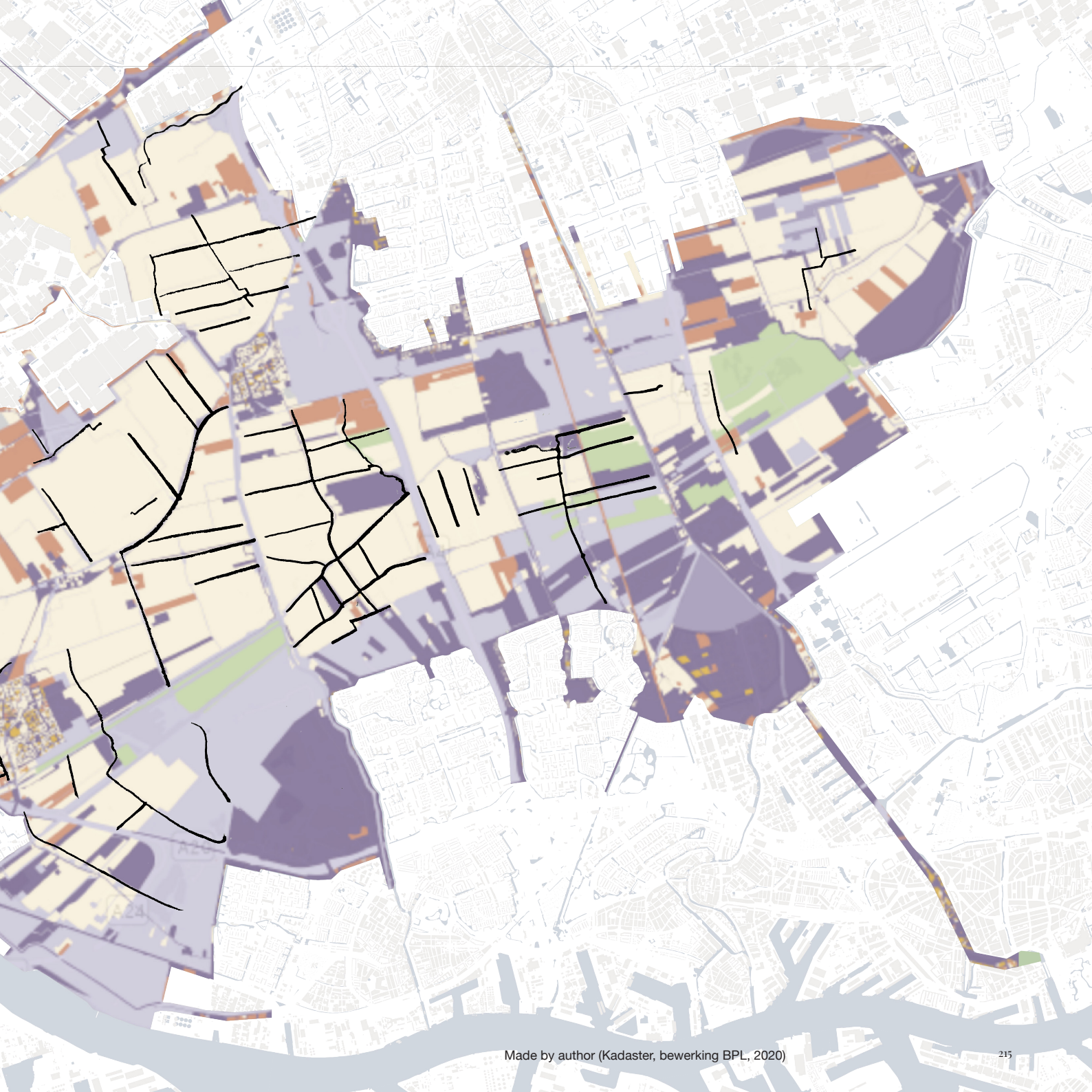
Land ownership 2020

To understand how the land is divided, it's essential to analyze the borders of the specific parcels. Those borders could serve as new routes or locations for design implementations. The black lines, visible on the right, are remarkable and visual structures.



Legend

- Natural persons
- Company
- Public (water board, the state)
- Public (province)
- Public (municipality)
- Buildings
- Water



Made by author (Kadaster, bewerking BPL, 2020)