

# TOWARDS PRODUCTIVE NEIGHBORHOODS



**Keywords:** housing crisis, agricultural transition, industrial urban areas, transformation, local ecologies, inclusive neighborhoods, affordable housing.



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# INTRO DUCTION

The Netherlands has been faced with a pressing housing crisis for several years, and the agrarian crisis has become more prevalent in the media and known to the general public. While these complex dilemma's unfold, it is hard to grasp how we have ended up with two crises which seems to occur simultaneously. This research report takes the liberty to delve into these issues in the pursuit of potential solutions.

The underlying mechanisms that contribute to the problems are analyzed through various research methods. Historical research provides a broader understanding and gives context to the recent developments, while publications, news articles, interviews, divergent opinions by authorities in the field, and numerical data and statistics provide a deeper understanding of the origins and implications of the problems. Both crises require a long-term vision, accompanied by spatial solutions that can provide in a suitable transition for both dilemma's. The research aim is to find space that can provide and facilitate for these transitions, potentially allowing for new mixed neighborhoods where various functions could benefit from each other's presence by establishing local and circular ecologies. Researching the types of land-use in the Netherlands resulted in a remarkable finding; the presence of industrial areas in the nation is significant. With 1,000 km<sup>2</sup>, industrial areas account to more than the majority of the big cities in the Netherlands combined. While scattered all over the country, big portions of large cities such as Amsterdam and Rotterdam have industrial areas. More specifically, industrial urban areas, in close proximity to city centers. As industrial activities migrate to the harbor areas, these industrial urban areas become more interesting and relevant to redevelop. Two case studies are analyzed to understand the potential of industrial urban areas. The first case study looks into a smaller area development, accompanied by an in-person interview with the developer of the area. The second case study is accompanied by an interview with a regional planning specialist from the municipality of Rotterdam and explores the redevelopment of a large industrial harbor district, also nearby the city center. Industrial urban areas often have large buildings with inherent historical and spatial qualities, these buildings usually have the potential to be transformed for various purposes. Because the re-use of existing structures is a sustainable approach, the research also investigates how industrial buildings can be transformed into mixed-use housing communities. A personal interview was arranged with the partner of Mei architects and planners, whom was closely involved in the transformation of Fenix I. This is an exemplary project in Rotterdam, where a historical industrial building is transformed into a mixed-use building with a housing complex on top. The case study and interview discuss the range of strategies that were fundamental for the success of Fenix I. To re-imagine the future of dwelling, historical events have been studied to understand how the government and pioneers have dealt with crises in the past. Recent new forms of planning, developing and living are explored with the case studies 'Kalkbreite' and the 'Hunziker area' by the cooperation 'Mehr als Wohnen', these projects could be considered proof that development of inclusive and affordable housing communities is possible, although it requires an alternative approach. The main research question is answered through the coalescence of four chapters, providing findings and strategies for diverging scale levels.

In the first chapter, the Dutch housing crisis is introduced by placing recent events into a broader historical framework. This helps to understand the origins of housing in the Netherlands and reveals that a housing crisis is not a new phenomenon but rather a recurring event. To understand the actuality of the problem, various slogans from political parties are gathered to show the apparent urgency and the response from the political spectrum. To develop a broader understanding of the underlying problems, research and publications by recognized authorities in the field of housing development have been studied to highlight various contrasting perspectives on the housing crisis. This chapter tries to find answers to the first research question: **“Why do we face a housing crisis?”**, in order to understand the underlying mechanisms and fundamental problems. Truly understanding the original causes of the housing crisis allows for a more informed decision-making process when developing a vision for housing in the Netherlands. In pursuit of resolutions for the housing crisis, this chapter revolves around asking open questions. Such as; ‘why do we need to build one million homes?’ ‘Where can we build one million homes?’ ‘For whom should we build these new homes?’ And ‘how should we develop them?’. With these questions in mind, a quantitative research strategy was utilized to understand the bigger context of the problem through numerical data. Various data sources were consulted and compared to find patterns, causal relationships and trends that could include clues and solutions for the complex problems at hand. By diving deeper into the underlying issues, a better understanding is developed to enact appropriate methods and strategies to contribute to potential solutions for the housing crisis. This first chapter ends with conclusions and strategies that could help to mitigate the Dutch housing crisis.

The second chapter focuses on the countryside, and specifically addresses the agrarian crisis in the Netherlands, since it had a significant influence on the built environment. An introduction to recent developments, including ‘protests by farmers’ and ‘banned construction activities by the highest Dutch court’ outlines the actuality of the problem. While farmers are restricted, projections show that we will need to find ways to compensate for the shortage of food production in the nearby future. If many farmers stop producing, how can we compensate for the loss of food production? To understand the DNA of the Dutch landscape, a lot of data is gathered to map out the functions of the agrarian landscape related to production. In order to measure and quantify the value of the landscape, two value systems are discussed; the monetary value system, and the ecological value system. When compared to locations in the Netherlands responsible for the production of various (agricultural) goods, interesting relationships unfold. The soil composition of the Netherlands is also unraveled to show the diversity of the landscape, but also the danger a specific soil type involves; peat soil. Due to irrigation, very large peat soil landscapes are subsiding, specifically close to big western cities. This causes the peat soil to oxidate, which causes major emissions into the atmosphere every year, which calls for more sustainable methods to re-envision these peat landscapes. Towards the end of this chapter, alternative peat landscapes are shown and also modern methods of

urban farming as an alternative are discussed. This chapter aims to find answers to the question; **“What does an agricultural transition entail?”**. By unraveling the workings of the Dutch landscape, a more profound understanding of the Dutch landscape is established, which can help to determine how the built environment could respond effectively to the agricultural transition. This second chapter closes with concluding thoughts and a set of strategies to utilize the landscape and urban areas more optimally and holistically.

In response to the first two chapters, the third chapter explores the presence of industrial areas in the Netherlands. Due to the significant amount of land cover, these areas could potentially offer spatial solutions for the various transitions that have been set in motion. One of them being the agrarian transition, where a lot of target groups, companies and activities will have to migrate away from the countryside as a result of the regeneration of various unsustainable (peat) landscapes. The other being the housing crisis, which could also be considered a transition, due to new rules and regulations regarding where to build and how to build. To reduce national emissions, circularity and sustainability criteria have been put in place to foster a new building culture, where sustainability and circularity are prioritized. The re-use of existing urban areas and existing buildings and resources also contributes to sustainable urban planning methods by reducing the need for excessive infrastructure and extra facilities. Therefore industrial urban areas - with infrastructure already in place and usually situated in close proximity to city centers with many facilities - could offer spatial opportunities to accommodate for these transitions. To understand how industrial urban areas can be developed in a holistic way - where social factors, economic factors, sustainability and circularity principles are considered - a selection of case studies have been analyzed. The case studies focus on areas that are currently under development and are on the cutting edge of pioneering thinking in urban planning and development. To deepen the understanding of the processes behind the developments, two interviews have been conducted. One with the developer of an industrial urban district close to the city center, where key aspects such as historical context, preservation, urban integration, mixed-use development, social participation and financial feasibility were discussed. The second interview, with a regional planning specialist from the municipality of Rotterdam, provides more insight into the involvement of the municipal bodies and important ambitions that were considered during the development such as; regional planning, collectivity, circularity, innovation, mixed-use development, smart mobility, energy and ecology. This chapter aims to find answers to the question; **“how can industrial urban areas be redeveloped into mixed-use neighborhoods?”**. This third chapter is concluded with the findings and strategies to redevelop industrial urban areas into mixed-use neighborhoods.

The fourth chapter investigates how the conventional form of dwelling could be re-imagined. Because challenges in the built environment are not new phenomena, the chapter explores how society has responded in the past to similar challenges. An investigation into how the government responded to the housing crisis after the second world war, gives insight on what is needed to achieve the realization of one million homes. By simply looking at the past, this chapter illustrates the implications and consequences of focusing on quantity. After the reconstruction era, with the realization a large volume of many monotonous dwelling types over several decades, a need for authenticity arose which sparked fascinating responses from the field of art and architecture. The artistic imagination and expression of the future by Constant Nieuwenhuys in 'New Babylon' is described, followed by the response from the governing bodies to the mass-produced housing stock. In the seventies an experimental housing program was rolled out to give room for new and innovative ideas for dwelling, in contrast to the mundane dwelling prototypes that were abundant in the country as a result of the reconstruction era. One of the many results of this experimental housing program was the development of various ideas by structuralist architects, such as Piet Blom. In this chapter, the Kasbah is described; a visionary idea by the architect to challenge the way we conduct spatial planning, where various layers offer conditions for the dwellers to socially interact and live in dwellings that are more tailored to their different needs.

Besides looking for answers in the past, a contemporary intervention has been studied; Fenix I by Mei architects and Planners. This is a transformation of a historical, industrial building into a mixed-use building where 'a new layer of history' was added, by introducing dwellings on top of an existing building. This development was a product from the financial crisis in 2008, which allowed for a different approach to developing and designing for residents. Because the housing market suffered from the crisis, not many citizens were interested in buying property, as they saw the price of their real-estate decline over the years following the crisis. This triggered a response; instead of standard housing, a new holistic way of developing was considered and this resulted in the transformation of Fenix I. The combination of commercial and cultural functions in the re-used industrial building with working and living on top, results in a new, unique ensemble that has become a pioneering example for the transformation of cultural heritage. An in-depth interview was done with one of the partners from Mei Architects and Planners; Robert Platje, who is also a building technologist and was closely involved during the transformation of Fenix I. In the interview, topics such as history, preservation, place making, urban integration, architectural expression, technical challenges, and inclusive and flexible dwelling configurations were discussed. The first part of this chapter aims to establish an understanding of how pioneers have reacted to the various crisis and challenges of their time and how on a larger 'architectural scale', innovative and new ways of thinking can be developed to combat challenges.

The second part of this chapter focuses more on the level of the dwelling and new social constructs and co-living principles, allowing for affordable housing while fostering spatial and social qualities. Two recent case studies are investigated to understand how new forms of developing can aid social inclusion and affordability while ensuring spatial qualities. The first case study is the large development of 'Kalkbreite', a re-development of a historical tram depot in the city of Zurich. Local residents formed a cooperation and through a long process of participation in collaboration with the city of Zurich, they managed to build a mixed-use housing complex, providing space for 400 users. The development is characterized by the rich layering of various spaces; public, collective, communal and private. The resulting accessibility and thresholds are enriching and unique for the experience of the users of the building. A comprehensive collection of co-living clusters allows for optimal inclusion; a boarding house, clusters for young people, families, elderly, short-stay, and flexible 'joker rooms'. Smaller private residential units are clustered around shared communal spaces, characterized by their spaciousness and allowing for community building. The anchoring of the re-development in the larger neighborhood and the smaller interior scale approach with many different living clusters provide an innovative framework for the redevelopment of (industrial) buildings into mixed-use (affordable) housing communities. Both the interview and case study 'Fenix I' and 'Kalkbreite' provide answers to the question: ***“can industrial buildings be transformed into mixed-use housing communities?”***

The final case-study looks into a recent development by a very large cooperative body (Mehr als Wohnen) in Zurich in the Hunziker area. The cooperative, in collaboration with the City of Zurich, developed a master plan for a collection of 13 housing blocks, consisting of around 380 homes, which facilitate an affordable, sustainable, and socially inclusive neighborhood for approximately 1400 residents. The participatory process behind the development is described, showing the importance of the participation of residents in the formation of (new) communal living environments. One of the residential blocks, Haus A by Duplex Architekten, is analyzed because of the unique spatial arrangement. The floor plan provides a framework for communal living, where afford ability is guaranteed through cooperative development and co-living, while spatial qualities are intrinsically present and promote social engagement among residents. The case studies on cooperative housing provide new insights to affordable and socially inclusive developments and provide answers to the question ***“How to realize affordable housing types without losing essential qualities?”***.

Together, these chapters aim to answer the overarching research question:

***“Can industrial urban areas be redeveloped in response to the agricultural transition and mitigate the housing crisis with inclusive, affordable housing communities?”***

## RESEARCH QUESTION

### NATIONAL STRATEGIES

I

WHY DO WE FACE A HOUSING CRISIS AND  
WHAT DOES AN AGRICULTURAL TRANSITION ENTAIL?

II

### URBAN STRATEGIES

CAN INDUSTRIAL URBAN AREAS BE REDEVELOPED  
INTO MIXED-USE NEIGHBORHOODS?

CAN **INDUSTRIAL URBAN AREAS** BE **REDEVELOPED** IN RESPONSE TO  
THE **AGRICULTURAL TRANSITION** AND MITIGATE THE **HOUSING CRISIS**  
WITH **INCLUSIVE, AFFORDABLE HOUSING COMMUNITIES**?

CAN INDUSTRIAL BUILDINGS BE RE-PURPOSED INTO  
MIXED-USE, INCLUSIVE HOUSING COMMUNITIES?

III

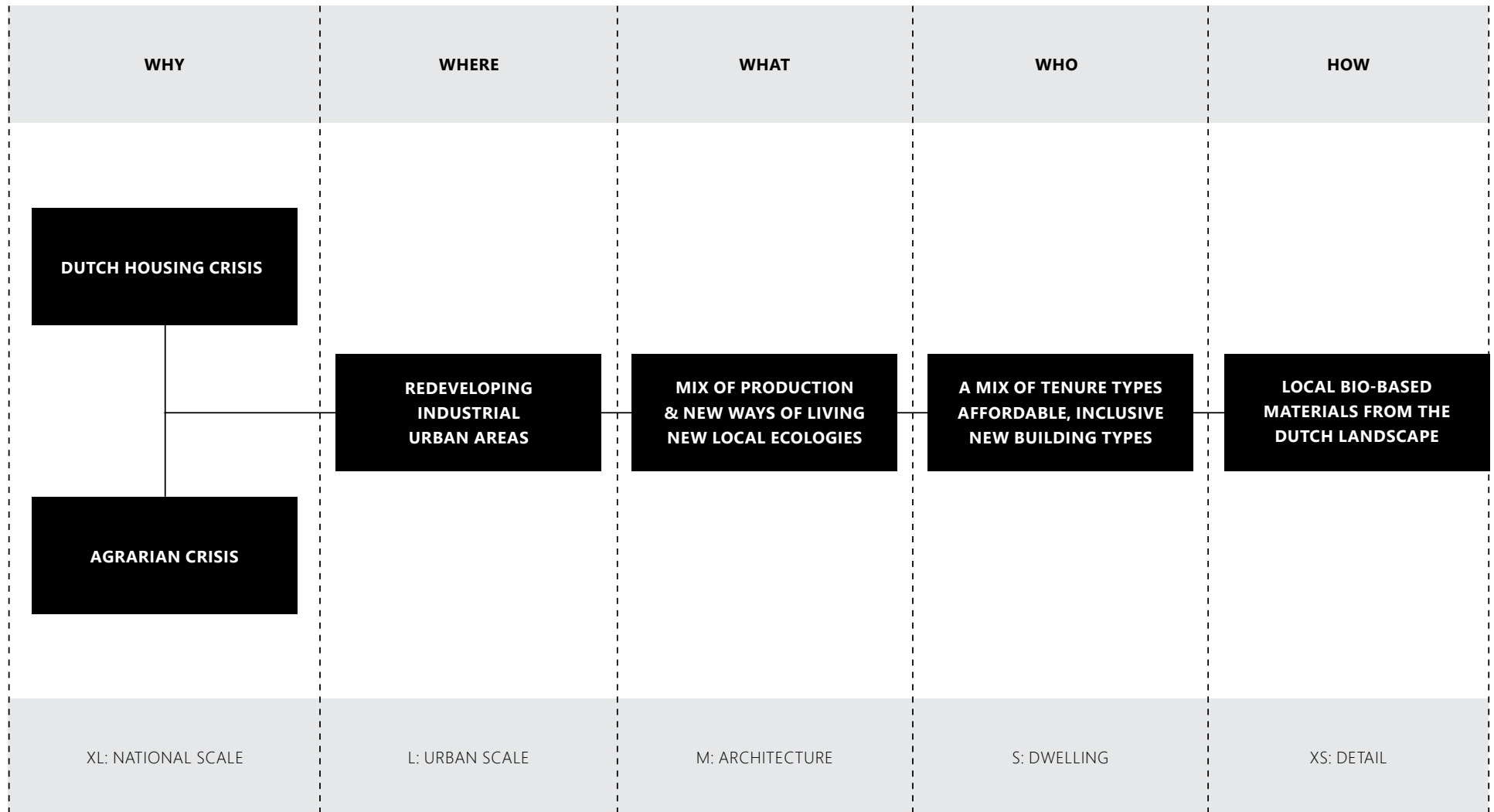
### BUILDING STRATEGIES

IV

### DWELLING STRATEGIES

HOW TO REALIZE AFFORDABLE HOUSING TYPES  
WITHOUT LOSING ESSENTIAL LIVING QUALITIES?

## RESEARCH SCOPE



**DESIGN BY RESEARCH**

**RESEARCH BY DESIGN**

### PERSONAL MOTIVATION

The Advanced Housing Design Graduation Studio explores how **housing design** can successfully **address current societal challenges** such as social polarization, demographic change, global warming, and environmental impact.

The studio departs from an analysis of what “**inclusion**”, “**affordability**” and “**housing needs**” allude to in urban and architectural discourse in general, as well as in the specific context of **the Dutch Delta** today.

Understanding how we can design a future where we can **provide** people with **suitable housing**, while addressing pressing **societal issues** has become of **pivotal importance** for new generations.

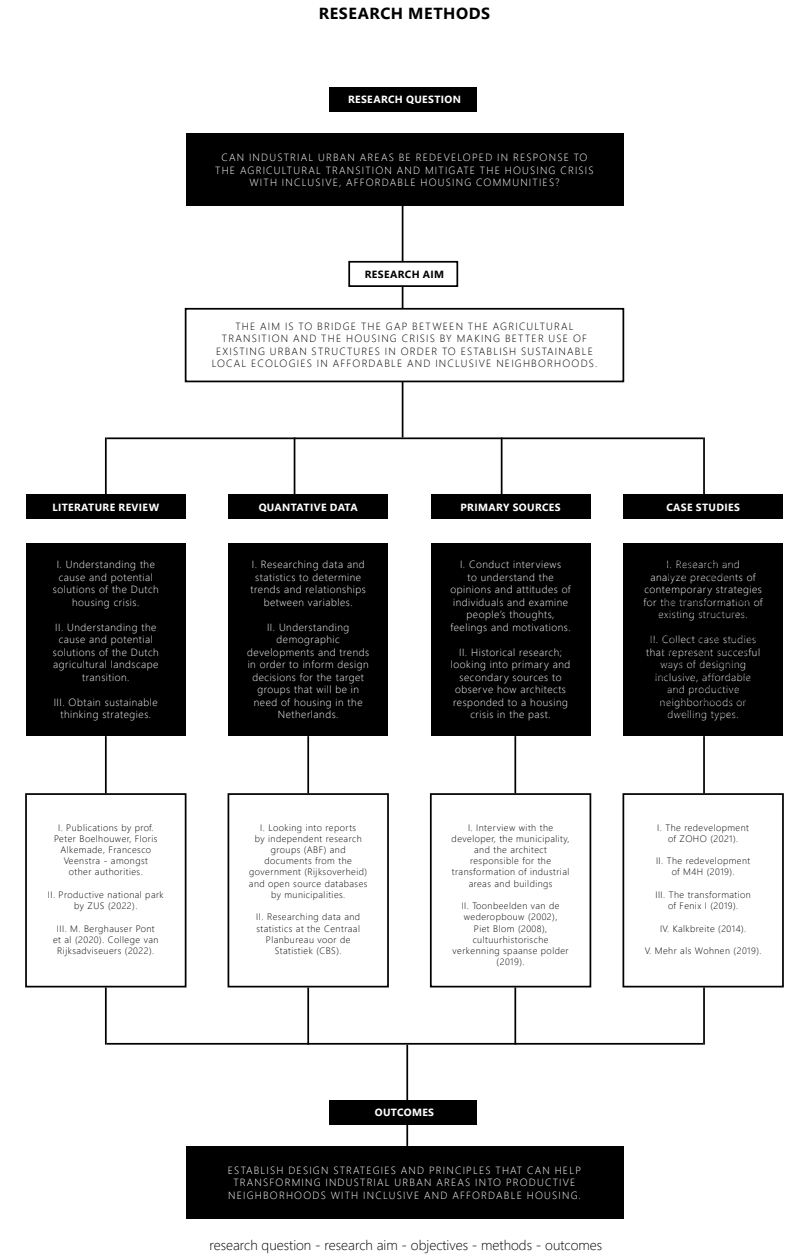


Figure 1. Research methods applied during research (Illustration by the author, 2024).

# I. THE HOUSING CRISIS

*“Why do we face a housing crisis?”*

**“WE NEED TO BUILD 1 MILLION HOMES”. (BY 2030)**  
- ACCORDING TO MOST DUTCH POLITICAL PARTIES



Figure 2. National map of the Netherlands (2021).



## THE DUTCH HOUSING CRISIS

The housing crisis is not a new phenomenon, throughout recent history there have been various periods that inflicted tension on the housing stock. One of the first occurrences of a housing shortage was during the industrial revolution. During the second half of the nineteenth century, a lot of farmers migrated to urban areas to look for job opportunities during the new industrial age. Cities started expanding beyond their city walls; housing was built by local initiatives and citizens. Because there was a lack of regulations, the living conditions and building qualities were quite severe (Van der Woud, 2010). The growing resistance against the poor living conditions grew, which led to a historical moment: 'De woning wet van 1901', officially making public housing a responsibility of the government, while municipalities would take on a regulatory role. This enabled a considerable development for the built environment and led to qualitative neighborhoods and housing corporations that developed affordable housing (Van der Lans, 2013).

After world war II, with all the destruction that was caused, the reconstruction of the Netherlands was instigated through a 'Marshall plan', led by the United States; European countries received financial support to rebuild their nations. During this reconstruction period (1940-1960) the Netherlands built 1,5 million homes. This impressive effort was achieved by directing all attention to the realization of affordable, mass-produced homes to alleviate the housing shortage (Broekhoven, 2021). During the 80's, a significant shortage of housing had accumulated. Due to the onset of the urban sprawl, city centers were neglected and a lot of deprecated buildings were designated for demolition to make place for infrastructural planning (major roads, metro's lines and office buildings). Speculation on the housing market, in combination with a great number of vacant buildings led to violent protests. The coronation riots of April 30, 1980 are among the largest peacetime disturbances or riots in Dutch history. During the succession to the throne and investiture of Queen Beatrix on Queen's Day 1980, the streets of Amsterdam had turned to an unrecognizable chaos, under the slogan 'No home, no coronation! The government sped up the production of housing and investors and corporations received subsidies to develop housing (Dogger et al., 2013).

After the financial crisis of 2008, the government adopted a pro-cyclical policy, which led to a structural deficiency in housing production between 2008 and 2018 (Boelhouwer, 2018). As a result of a changing demography and the tension between supply and demand, together with rising rent prices due to the liberalization of the housing market (Woningwet, 2015), living cost and finding an appropriate house had become increasingly more difficult. During the pandemic, labor and material cost had risen drastically, and together with increasing sustainability targets and restrictions, this led to a stagnation in housing production (CBS, 2023). This resulted in various protests in 2021, where this issue was addressed by a large number of protesters, ages ranging from younger generations to elderly people (NOS, 2021).



Figure 3. Cabinet Pierson, formulators of 'de Woningwet' (1898).



Figure 4. Rotterdam Blaak, destruction caused by WWII (1945).



Figure 5. Riots during the succession day of Queen Beatrix (1980).

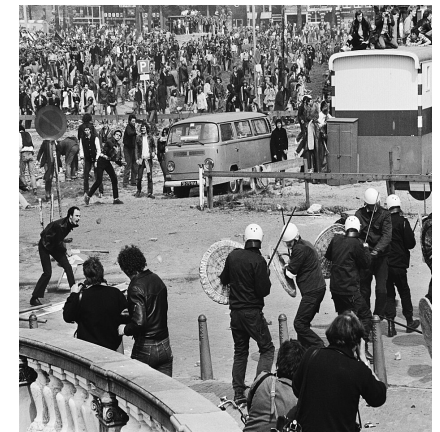


Figure 6. Demonstrations to bring attention to the need for affordable public housing (2021).



## FROM LEFT TO RIGHT, THE FULL SPECTRUM AGREES

With the ongoing imbalance between housing supply and demand, it was inevitable that housing would be a big theme for the elections of 2023. The full spectrum, from the social left liberals, to the conservative right wing, all agree that we need to build. The various political agendas provide an insight in the divergent ways to consider and approach the Dutch housing crisis.

The social-left party, GroenLinks-PvdA, considers housing to be a public responsibility of the government, holding the obligation to promote public housing and answer to the public interest of affordable housing. The party proposes to establish a new Housing Fund, to enable a significant increase in the realization of affordable and sustainable homes. The party aims to build 100,000 houses every year, which should include at least 40 percent of social housing and 40 percent for the median housing segment. The party also pleads for the return of a Minister of Housing and Spatial Planning (GroenLinks-PvdA, 2024).

D66 is considered to be a progressive-left party, they have clarified that they would be willing to take on the challenge to solve the housing crisis, by building one million homes in ten years time. The party mentions the need for urban expansion, with the focus on large new housing projects, specifically outside or in between cities. They want to promote the chain and flow of households by building housing types for smaller households. To make housing more affordable, they propose to change the average mortgage range to an extended 40 year period (D66, 2023).

The conservative-right Christian Democratic Party (CDA), has formulated various ambitions for the housing crisis. The first being the production of one million homes, with an emphasis on starters, families and elderly- but also a prioritizing available housing for residents that work in vital sectors. The party promotes careful expansion of large cities and also the development of villages across the country. According to CDA, there is also much need for housing outside of big cities. Another remarkable ambition is to shorten the building cycle (from plan to realization) and make this process shorter and more efficient (CDA, 2023).

The progressive-right party, VVD, one of the most prominent parties in the coalition reign of the past decade, also accentuates the need to build in large quantity. Making areas more green and dwellings climate adaptive could reduce living cost and energy consumption, with a focus on developing outside existing cities. The party suggests that a national Master plan would be necessary to define how we allocate the necessary housing and other important functions. The party also strives for the elimination of unnecessary regulations and policies. Proper access to neighborhoods should be accommodated by improving mobility and parking. (VVD,2023).



***"Building 100.000 affordable new houses every year."*** (Social left)



***"We are going to build one million homes"*** (Progressive left)



***"Build, build, build. Let's accelerate!"*** (Conservative right)



***"Build, build, build!"*** (Progressive right)

Figure 7. Slogans by the various political parties ranging from progressive left to conservative right (2023).

## WHAT DO EXPERTS SAY ABOUT THE DUTCH HOUSING CRISIS?

While most political parties have directed their focus and attention to the housing crisis, experts in the field have been vocal as well. Specifically about the initial factors that have led to the housing crisis we find ourselves in today.

The highly respected rapporteur, Balakrishnan Rajagopal, from the United Nations performed an independent analysis on the cause of the housing market and potential solutions for it (Balakrishnan Rajagopal, 2024). Rajagopal concluded that the housing crisis has slowly unfolded due to incorrect policymaking and decisions that led to the liberalization of the housing market. According to the UN, human rights to adequate housing should be anchored in the constitution and national laws.

The Director and chief economist at de Nederlandsche Bank, Olaf Sleijpen, points out that the mismatch in housing supply and demand is a big issue (InFinance, 2022). The friction between the two is especially aggravated by the constant artificial stimulant of demand, while the housing supply is not increasing. The stimuli are, paradoxically, measurements that were introduced to mitigate the housing crisis and make the market more accessible. Examples of these measurements include: ‘The jubelton’; a one time tax-free transfer of up to 100.000 euros from parents to their children (this resulted in ridiculous over-bidding), lowering of interest rates for mortgages (made it possible to get a higher mortgage, which drove up the housing prices) and tax-reductions for starters. All these measurement have had the opposite effect that was desired and resulted in more competition and friction on the housing market.

The ‘bullhorn’ of the housing market, Friso de Zeeuw expresses his concerns regularly in essays and debates. In his essay ‘We need young civil servants with guts to solve the housing shortage’ (de Zeeuw, 2021), he explains that there are various factors that interfere with a smooth development of the housing market. He points out that due to material scarcity and requirements that become more strict and limiting, it becomes more difficult for developers to realize new buildings. A lack of vision for strategic locations and climate-related regulations also play a big role in hindering the development of new housing.

Peter Boelhouwer, professor of housing systems at TU Delft, pleads for a concise and holistic approach (Boelhouwer, 2023). Political parties should not change their direction due to new elections, but be very clear on the policies they make so that long-term developments can be set in motion. We can mitigate the housing crisis with short-term solutions; using the existing housing stock more effectively with flex contracts or realizing temporary housing. Boelhouwer also explains that housing should become a priority; the real focus should be the development of durable dwellings that can serve many generations to come, which requires financial dedication and an overarching vision.



**Balakrishnan Rajagopal**  
UN Special Rapporteur  
on the Right to Housing  
Ex-professor at MIT  
Law and development

*“The **housing crisis** is a result of decades of bad policy choices and leaving housing to the market forces. The Netherlands must better anchor the international **human right to adequate housing** in the Constitution and national laws.”*



**Olaf Sleijpen**  
De Nederlandsche Bank  
DNB Director and  
Chief economist

*“It is **crucial to stop stimulating demand**. That is the basis of the **mismatch**, and society will benefit if it disappears. There is no doubt that this must happen **gradually** to avoid major income shocks. And this also means that the **tax benefits** that homeowners now receive should be **returned to citizens** in a different way.”*



**Friso de Zeeuw**  
Advisor spatial planning.  
Ex-Professor Area  
Development, MBE  
Department, TU Delft.

*“Due to the sharp **increase in construction costs**, many plans are no longer financially feasible. **Investors drop out due to the stricter requirements** on the rental sector. Many municipal plans are now being rejected, for example, because the **location is not optimal**. We also have a bouquet of other show stoppers, of which **nitrogen** is the main one.”*



**Peter Boelhouwer**  
Professor of Housing  
systems, Department of  
Management in the Built  
Environment, TU Delft.

*“Political parties change policy too quickly. **The housing market requires a long term and a fixed direction**, not constantly changing interventions. If we want to solve the problem of the stagnant housing market, **more money will have to be spent**. Homes are not **built** for the first resident, but for **two hundred years**. As a **society** you have to **invest** in that.”*

## WHAT ARE EXPERTS IN THE FIELD CONCERNED WITH?

While politicians mainly focus on quantity, practicing professionals are concerned about quality and underline the importance of a thorough understanding of the complex housing market, to make informed decisions. The previous Chief Government Architect, Floris Alkemade, reveals in his “open letter to the ministry of maak” (Alkemade, 2022), that the the political slogans to build one million homes is an indication that there is a fundamental misunderstanding of the housing market, and all the complexities it embodies. Alkemade reminds us that the unaffordability of housing is not due to a deficiency, but rather due to the liberalization of the housing market, which has made housing expensive. A crucial point he brings up as well is that the current building stock is characterized by mis-matches and vacancies. A lot of potential solutions lie in utilizing the existing building stock better instead of producing new buildings.

The Dean of Delft University of Technology, Dick van Gameren, expresses his concerns about the housing market. In the interview “1 million homes, but what kind of homes?” Van Gameren warns that we should not put all of the emphasis on the quantity but also consider the quality of housing. He also states that we should not make the same mistake as before, and build an abundance of the same building types, without taking changing societal needs into consideration (Jongeneel, 2018). As the demographic composition changes, so do the societal needs which should be accommodated with suitable building types.

What remains a big discussion, is where we should be building. According to developers we should build in the polders, because that is easy, cheap and efficient- but many argue for densification as it brings many benefits. Sanne van Manen, senior associate at Mvrdv and member of Platform Woonopgave, pleads for densification. Instead of using extra resources to create new neighborhoods from scratch, why not upgrade the existing built environment? (Platform woonopgave, 2023) This could allow for a sustainable (re)development of the building stock, existing facilities and public space- improving the quality of life for many people in the city.

The newly appointed Chief Government Architect, Francesco Veenstra, has been working on a report ‘the 22nd century starts now’ (Cra, 2021), together with the ‘board of government advisors’. In this research, Veenstra urges us to look ahead, not a few years but rather a few decades, not to come up with Utopian visions, but to formulate practical solutions we can work on right now that will reward us later on. For the big and complex issues we face, we need to re-invent the way we think and operate. We should consider a new way of building, where soil and water conditions are leading in deciding where we build. And reconsider how we should build; with biobased materials that allow for a sustainable, circular economy of materials, so that future generations can benefit from our decisions.



**Floris Alkemade**  
Previous partner OMA  
Previous Chief  
Government architect

*“The number of one million seems to radiate both necessity and welcome decisiveness, but all things considered, it is primarily an indication of a **fundamental inability to properly understand the complex housing market.**”*



**Dick van Gameren**  
Dean of the faculty of  
architecture, TU Delft  
Previous architect at  
Mecanoo Architects

*“We should not make the same **mistake** as before and **build many of the same houses, without taking the changing needs and requirements into consideration.** Only building the same houses lead to a one-sided living environment. We have to **build a variety of building types.**”*



**Sanne van Manen**  
Platform woonopgave  
Platform wederopbouw  
Senior associate at  
mvrdv architects

*Densification of existing neighborhoods is **cheaper** and yields more than filling up polders. Densification provides, **increased quality of life**, means to **make existing buildings more sustainable**, and an **upgrade of existing facilities and public space.***



**Francesco Veenstra**  
Government architect  
Founder of VAKWERK  
Architecten in Delft

*Soil and water should be leading when building in the Netherlands, a **new building culture** is needed and new forms of housing are needed, which are also **‘biobased’**: made from ecological and natural materials, responsibly grown, harvested, used and reused.*

# ONE MILLION HOMES

**"WE NEED TO BUILD 1 MILLION HOMES". (BY 2030)**  
- ACCORDING TO MOST DUTCH POLITICAL PARTIES



Figure 8. National map of the Netherlands (2021).

# THE ORIGIN OF 1 MILLION HOMES

In 2021, ABF (an independent research institute) was ordered to make an inventory of the needed planning capacity for the Ministry of the Interior Affairs and Kingdom Relations, regarding the housing crisis. The number of one million homes is based on this research report (ABF, 2021). The number of new houses that would need to be build is composed by four categories.

The first category is aimed at reducing the housing shortage, which is a structural deficiency of 3,5% that has been build up over the past decade due to policymaking and not meeting the target of building 100.000 houses per year. Over the past ten years, the average of newly built homes has been around 85.000 per year, which leads to a structural deficiency of 3,5% over a span of ten years.

The second category is the largest one; (projected) population growth, requiring almost half a million new homes. This population growth is not due to Dutch families increasing in size, but because an increasing stream of migrants and expats that have come to the Netherlands and are expected to migrate to the Netherlands until 2030. Although it is very difficult to estimate future migration numbers, the past decade has told us that the amount of migrants is increasing steadily, with 2022 as a peak record with more than 400.000 immigrants in a single year (CBS, 2023). An important aspect to consider is that most expats and immigrants are small households, usually consisting of singles or couples.

The third category addresses the buildings that will be demolished, either because they don't meet the sustainability requirements and it is cheaper to demolish and build new developments or because of structural decay and safety reasons. Many of the buildings that will be demolished are dating back to the reconstruction period (1940-1960) to mitigate the housing shortage due to the second world war. Dwellings were built very rapidly, and cost-efficiently due to prefabricated systems that were used for their construction. This could be an important indication that can inform us to take the focus on the quantify dwellings into careful consideration.

The fourth category describes the change in composition of Dutch households, which are shrinking in size due to divorce, progression in age or other. This category indicates that this demographic group doesn't increase in size, but still requires more (smaller) homes to be accommodated for. With 243.000 estimated homes, this group contributes a significant portion to the overall number of one million.

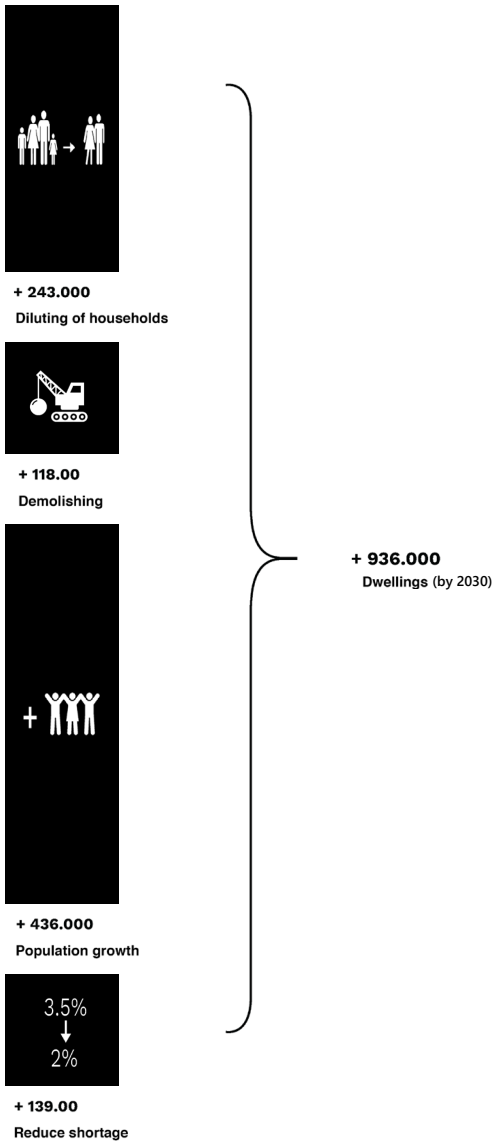


Figure 9. ABF Research (2021), Platform Woonopgave (2023).

## THE LIBERALIZED HOUSING MARKET

Between 1945 and 1985, the government embodied a crucial role in subsidizing various parties that provided the society with housing. Independent investors and corporations received subsidies to produce affordable housing. However, subsidizing the housing market became too expensive for the government during the 80's, and they had to develop a new strategy to make the housing market more independent whilst remaining affordable for citizens (Van Bockxmeer, 2023). Enneüs Heerma (from the Christian Democratic Party) took office as State Secretary in 1986, with the assignment to put an end to the high subsidies. A vision was developed that affordable housing should not come from the state, nor from the market, but it should be owned by independent organizations with a social purpose. In the period between 1986 and 1995, the government had reduced their subsidies to a minimum in exchange for the guarantee that corporations and investors could receive low-interest loans to develop housing. With this new contract, for the first time a maximum income threshold was established; the corporations only allowed citizens with a minimum income to rent social housing. A big portion of the housing stock would be rented out against higher fees.

In 2013, the new minister of public housing, Stef Blok, introduced a series of drastic changes. First of all, a 'levy' was established; a high tax for landlords providing social housing. This cost housing corporations a total of around 12 billion euros. The intention was that corporations would charge higher rents and sell more of their housing stock to compensate for this tax. However, the most important consequence of the measure was that the new construction of social housing had decreased by 50 percent (Gwen van Eijk, 2021). From 2015 onwards, the WOZ value also counted when determining the rent. Particularly in places where house prices were high, landlords could now transfer their social housing to the private sector. Private landlords in particular made use of this opportunity. This resulted in a decrease of 100,000 social rental properties owned by housing corporations, between 2013 and 2021 (Aedes, 2023). Meanwhile, minister Blok attended major real estate fairs abroad, to promote the Dutch housing market internationally. His aim was to attract investors who could invest in the Dutch housing market, taking over some of the tasks of the housing corporations. This was an endeavor that has led to a sevenfold increase in the amount of investments in Dutch rental properties, with more than a quarter coming from foreign investors. The downside was that investors consider housing a commodity and have not been able to develop affordable housing for the middle class, whom earn just too much to validate for social housing. This was partly because land prices and construction cost have risen significantly, and it is not in the interest of (foreign) investors to develop affordable housing if it doesn't yield much profit. Consequently, cost for rent in the private sector has increased tremendously, with spending more than fifty percent of your disposable income on housing (Van Bockxmeer, 2023).

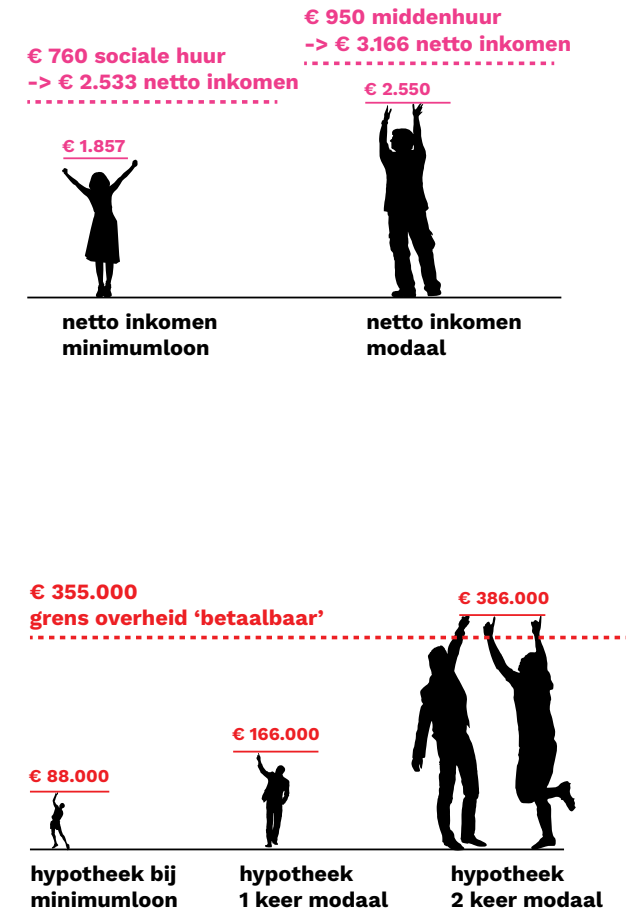


Figure 10. Platform Woonopgave (2023).



## DEMOGRAPHIC DEVELOPMENTS

The current demographic composition of the Netherlands portrays the typical signs of the mushroom-type civilization, also called a 'restrictive pyramid' indicating a declining population- where the elderly age groups are growing in numbers in comparison to the declining numbers of the younger age groups. This development usually indicates a structural decline in recent birthrates and a previous period that was characterized by rapid growth or an increase in birthrates which can lead to challenging societal issues. In most developed countries, the welfare system is set up to provide for the elderly needs which is financed through taxation by the working class. This can lead to significant financial pressure for the working class, which can in turn trigger lower birthrates, leading to a smaller group of the prospective population that can carry the financial weight of the care for the elderly generations. After the second world war, birthrates in the Netherlands increased significantly and big families became the norm, leading to a 'baby boom' - a period that is characterized by sustained high birthrates. In the 1980's birthrates declined and households became much smaller. In the population pyramid of 2023, we can observe that this period has translated to a reduction of the age group between thirty five and fifty years old. The millennial and generation-z, however, are displayed in bigger numbers (CBS, 2023). The graph also shows that younger generations and older generations are over-represented in our society, which could be translated directly to the housing market which is subject to supply and demand. A demographic composition, with the indication of age groups usually gives an indication for the type of households that are present in a society. In the Netherlands we have a lot starters (18-30 yrs) much less families (30-55 yrs) and a lot of so called 'empty nesters' (55-75 yrs), characterized by a household that is composed of parents with children that usually already live independently. Finally, we also have a relatively big elderly population (75-100 yrs) that is mostly characterized by small households of one or two people. In the coming decades, the biggest group; the 'empty nester', will shift up in the pyramid and become more dependent on the welfare and healthcare system, where a suitable type of dwelling would be necessary to accommodate for their needs. The numbers, however, inform us that this group is 'stuck' in their original family home and that they do not have suitable alternatives that would accommodate for their future needs. The population growth in comparison to the growth of 'single households', indicating a person that lives alone, is both shocking and alarming (CBS, 2023). The graph shows that this number has been growing since the 1960's and is still increasing every year. The growth of the number of single households could be correlated with the development of individualization that took off in the sixties; leading to more divorce rates, women that decided to live independently, and religious groups that slowly reduced in size. In 2023, the amount of single households seems quite widespread, but is most present under the elderly group (70+ yrs) and starters (20-30 yrs), as can be seen in figure 13.

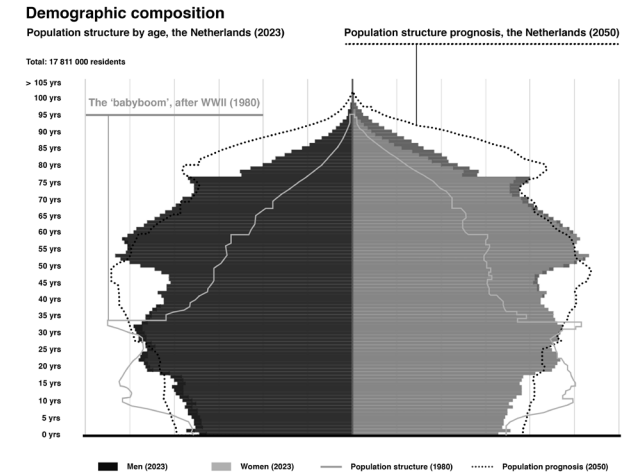


Figure 11. Demographic composition of the Netherlands (CBS, 2023).

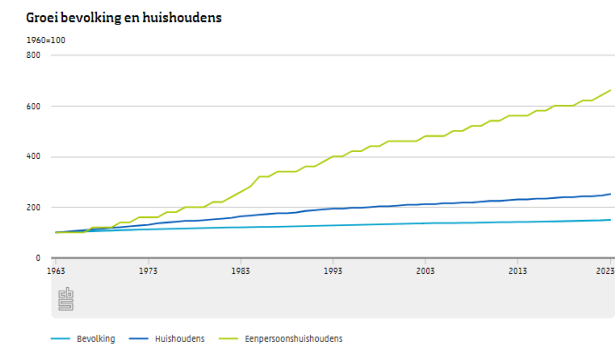


Figure 12. Growth of single households in the Netherlands (CBS, 2023).

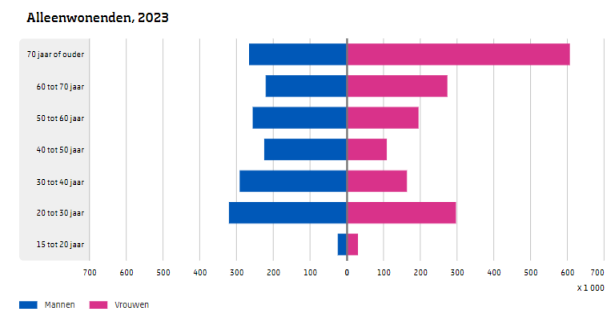


Figure 13. Demographic age groups living alone in the Netherlands (2023).

# SUPPLY VERSUS DEMAND

In this chapter, the current housing supply is compared to the current composition of households in the Netherlands, to understand where potential friction takes place. In figure 14, a deconstruction of the Dutch households shows that only 26% consists of families, while 74% is composed of smaller households. Single households (consisting of 1 person) is the biggest household group in the Netherlands with 39%, followed by couples; 28% and finally single parent households with 7% (consisting of one person with one or more children, usually due to a relational break-up or divorce). The current composition of households is not reflected in the existing housing stock, which shows that 65% of the existing housing stock in 2020 consisted of family homes, while only 35% amounted to other (smaller) homes. Especially with the development of new housing, it would be obvious to adjust the new supply to the biggest group of the populous. Surprisingly, that was not the case; in 2021, more than half of the newly built homes were family homes, while less than half of the newly built homes were other (smaller) homes (KAW, 2020). This is alarming, and illustrates that there is a significant misunderstanding of the housing market and a serious mis-match between supply and demand. Expanding the supply of family homes increases the relative scarcity of smaller homes, and as a result increases the prices of smaller homes, which in return drives up the average housing price. Another consideration is the size of dwellings in the Netherlands, which could perhaps be re-evaluated or re-designed. Due to the nature of the existing building stock, the average square meter size for housing is relatively large in the Netherlands. Although the majority of the population consists of smaller households, the majority of the existing building stock consist of large houses (figure x shows that 80% of existing houses are bigger than 75 square meters). Perhaps existing buildings could easily be split up in two smaller dwellings without compromising too much on the living qualities. The buildings already exist, and the space is already available- maybe it is just a matter of redistributing space and dwellings more efficiently. While building new homes seem to be our salvation, running the numbers and looking ahead 30 years from now will urge us to reconsider. If we are able to build 65,000 homes per year in the coming 30 years, then the newly built dwellings will only make up 20% of the total housing stock in 2050 (KAW, 2020). The remaining 80% consists of housing that was built before 2020, with only 5% of the homes built between 1995 - 2019, 15% built before 1945 and the biggest category, with 60% consists of homes built between 1945 - 1994. Considering that a portion of the buildings built before 1945 up until 1994 will be demolished, due to poor building conditions, subtracts even more from the (future) housing stock. The task of adapting the post-war buildings to modern standards can offer many opportunities and relief for the housing shortage. The re-use and transformation of existing buildings is important, and the mere 20% of newly built homes underlines the importance of careful consideration for the types of homes we will develop for the coming 30 years; in terms of size, type, location and how they could accommodate appropriately for the changing composition of households.

Households in relation to the housing supply, the Netherlands (2020 - 2021).

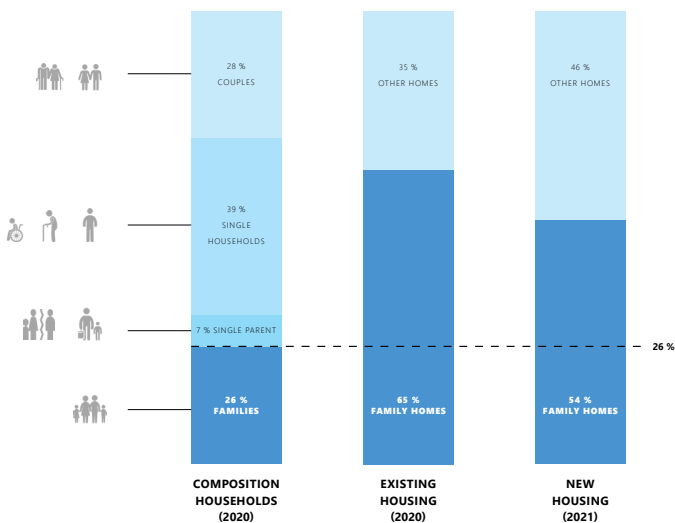


Figure 14. Overview of supply and demand: households versus housing stock versus newly built housing types in the Netherlands (2020).

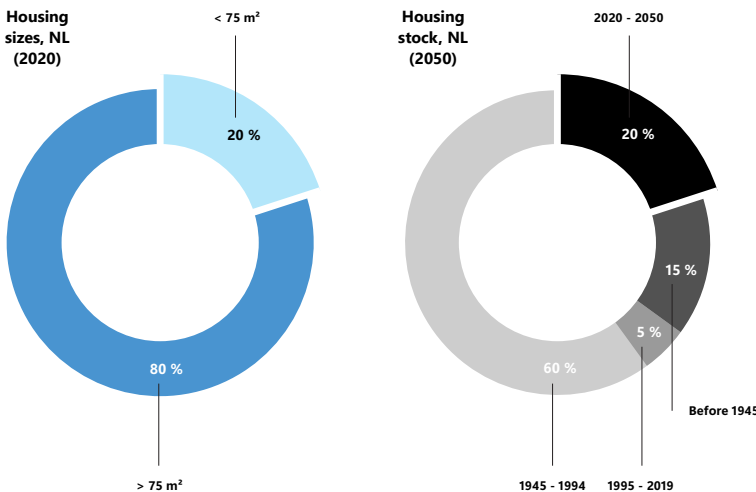


Figure 15. A) The housing sizes in the Netherlands (2020). B) The estimated housing stock composition by the year 2050 (KAW, 2020).



## INVISIBLE SPATIAL FACTORS

As a natural part of the housing market, there have always been moving chains. These can be described as a series of consecutive moves, due to the construction of a new home or because an existing home has become available. This process is set in motion by a moving resident or because of a deceased inhabitant. This results in a flow of households, moving from one type of home to the next. The length of a moving chain is characterized by the number of links in the chain; the longer people live in the same home, the shorter the chain becomes (CBS, 2023). Usually residents live in a home that fits their needs and spatial requirements, which is mostly linked to their stage in life. Moving from a bigger to a smaller home, naturally provides availability for new generations to take their residence in specific dwelling types. There is also a big difference in the velocity of moving houses when it comes to age groups. Moving is measured most, approximately 20 percent, between the ages 15-35, while the age group between 45-85 shows a significantly lower number of 4 percent (CBS, 2022). In the Netherlands, there is a big demographic group (60 - 80yrs) that still lives in the traditional family home they raised their children in, although their children have already moved out. The majority of this demographic group have already paid-off their mortgage, so their monthly expenditure is very low. Because moving out means a raise in monthly cost, and potentially a smaller home, moving out is not an obvious option for these residents. The neighborhood they live in has been familiar to them, and the addition of (new) suitable homes on the housing market is limited (de Vries, 2021).

Sprinco Urban Analytics investigated the housing utilization rate to understand what percentage of people lives in dwellings that are 'too big' in relation to the size of their household. The research shows that, especially the elderly group (55 - 80 years old) occupy dwellings that are considered too large for the size of their household, while younger households often live too small. (Sprinco, 2020). The numbers in the graph (figure 17) show that the age group between 15 - 35 years old have the tendency to relocate frequently due their changing needs, while moving house becomes rare for the age group 55 - 85 years old; this group tends to live in the same home for several decades, only when really necessary (due to healthcare) elderly people seem to relocate after 85 years old, mostly unwillingly to an elderly healthcare home (CBS, 2020). Improving the (new) housing options and conditions for the age group 55 - 85 years old, could set a moving chain in motion; where many of the existing family homes become available for younger households, while the older age groups can move to a more appropriate dwelling that is adjusted for their current and future (healthcare) needs. Platform woonopgave calculated that, when this age group could be accommodated for, this could result in a number of 1.400.000 homes (Platform woonopgave, 2023).

**“MOVING CHAINS: A CRUCIAL, BUT FORGOTTEN POLICY INSTRUMENT.”**

**“HOUSING MARKET UNAPPEALING FOR ELDERLY PEOPLE: “THEY WANT TO MOVE, BUT IT IS NOT POSSIBLE.”**

Figure 16. Quotes from various interviews with older age groups (De Vries, 2021).

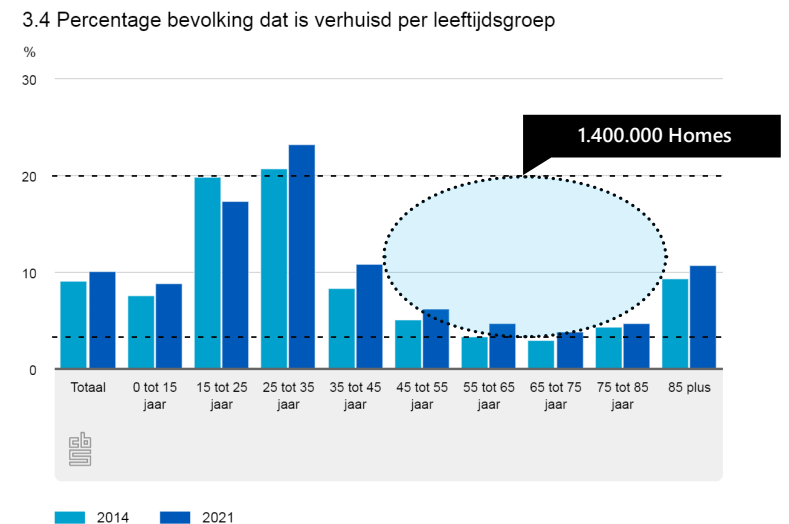


Figure 17. The percentage of 'moving households' by age group in the Netherlands (CBS, 2020).

## DENSIFICATION OR THE URBAN SPRAWL?

Currently, the government plans to realize homes across the nation, and the dedicated areas for development also have different characteristics; in city centers, in the peripheral, in smaller towns, in the landscape (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2023). Important factors to consider would be the existing stock in the Netherlands and how new dwellings could compensate for the lack of certain building types in specific areas. The demographic composition and prognosis for migration (to cities). The water system and soil type in different areas (such as the polder landscapes) which makes constructing buildings more, or less suitable. Considering future climate change and regulations could also be informative for the suitability of new dwellings in a specific location. But although the deals and locations for the realization of new homes have been announced, the reasoning behind it remained unclear (Platform Woonopgave, 2023).

There has been a lot of discussion about where to build; in the (polder) landscape it is fast and easy to build for developers (the logistic of trucks and cranes are less of an issue) because conventional building methods can be used to build family homes relatively quickly. However, the newly built homes are usually not climate adaptive but rather built traditionally. The new addition for facilities and infrastructure is also an important consideration, as this requires a lot of extra resources, energy, emissions, time and money. Building in the city can be very difficult for developers; logistics can be tough and spatial requirements can be challenging. However, the additional need for infrastructure or (a lot of) facilities won't be necessary as urban areas usually have this already in place. For developing in the municipality of Utrecht, a 'barcode' has been developed, which gives an indication of the ration between newly added housing and necessary facilities (figure x). When this would be translated to 10 hectare of dwellings, almost double the amount of facilities would be needed to provide a 'livable environment' (DUIC, 2021).

In 2020, a comprehensive paper was published providing a systematic review of international research on urban density and its potential benefits and drawbacks for sustainable urban development. The study reviews and compares 330 peer reviewed journals. Almost half of the studies focus on transport in areas with higher density, and have shown a strong correlation between the use of sustainable modes of transport and fewer greenhouse gas emissions, indicating that densification contributes to sustainable urban development. The study also showed a positive correlation between the economics and densification. Ecology, social impact and health showed mainly negative correlations with higher density (Berghauser Pont et al, 2020). This underlines the importance of building within cities, to promote sustainable mobility and economic sustainability. However, it seems that ecology, social impact and health implication should be very carefully considered when developing plans for the densification of an urban area. The inclusion of greenery, biodiversity, public space, and social facilities should be incorporated.

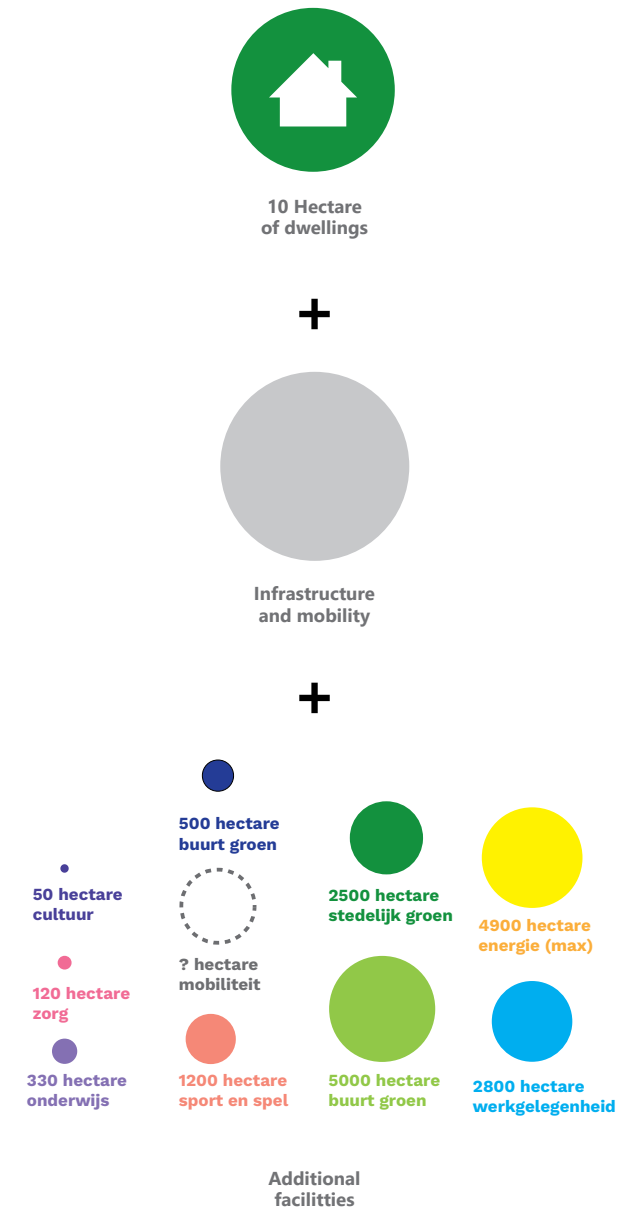


Figure 18. The development of dwellings requires a lot of (new) resources and facilities (Platform Woonopgave, 2023).

## TOWARDS A NEW BUILDING CULTURE

As the study by KAW indicates, there is a significant portion of the existing building stock that could be redeveloped or re-purposed (KAW, 2020). When adding new dwellings to the building stock, careful considerations need to be made in order to make sure that the dwellings will serve the large part of the population that is in need of a home. Key aspects to consider are inclusiveness (suitable homes for young and old, singles and couples, and divorced families) and affordability. Traditional developing is mainly profit driven, therefore alternative forms of developing ought to be explored. While corporations used to build a lot of smaller, affordable homes, their budgets have not allowed for an increase in the production of homes in recent years. A form of housing commons is self-management, where a tenants association are allowed to overtake (most of) the responsibilities of a housing corporation. In this construct, residents feel more involved, in charge and connected and become more proactive in the management and maintenance of their homes and building. A special feature of such constructs is that in some cases residents will have the chance to also be involved in the commissioning of new developments (Lengkeek, 2022). Another alternative form of developing is ‘Collective Private Commissioning’, where a group citizens can form a collective that can commission a housing project. In this model, the (future) users of the property are in charge and involved in the planning and development of the dwellings. After realization, the project is legally split up in individual ownership parcels. Often this form results in projects that promote that shared use of spaces, services and products. Special needs (for example for disabled or elderly people) can be taken into consideration due to the high degree of participation. This often results in projects where the ratio between investment and outcome is considered better than conventional developing methods (Lengkeek, 2022). The most liberating form of developing is through a cooperation. This is a unique construct, because all the rights of the property belong to the cooperation. A building is developed by the cooperation as a collective, and will then be rented out to the members of the cooperation. This also means that the collective can rent out developed space and accumulate profit to maintain and improve the living conditions of the cooperation. Because the ownership of the property belongs to the cooperation, which has no profit driven ambitions, housing can be rent out to the residents against very low rents. The cooperative model ensures that the living conditions and cost of living is controlled by the residents instead of the government or the market. Instead of being individual owner of a property, in this construct there is a collective ownership, which means that in these types of development often a lot of emphasis is placed on communal spaces and collective spaces that provide room for interaction. Decisions to choose for sustainable materials or appliances becomes more relevant as the larger community can benefit from the investments (Lengkeek, 2022).

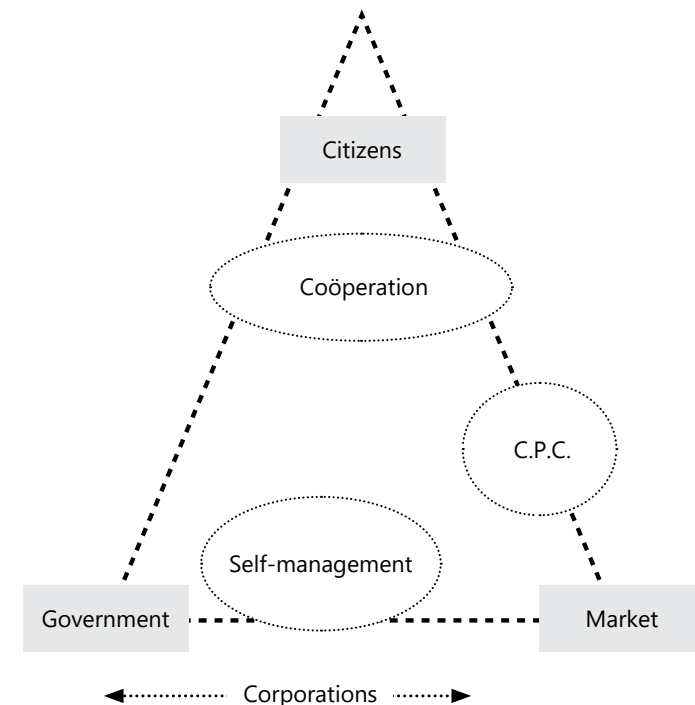


Figure 19. Diagram illustrating the economic orientation of different forms of housing (Lengkeek A., 2022).

# FINDINGS & STRATEGIES

## *“Why do we face a housing crisis?”*

- *Due to policymaking and governance.*
- *Due to a continuously changing political agenda.*
- *Due to short-term solutions instead of long-term decisions.*
- *Due to a structural deficiency in housing production.*
- *Due to the liberalization of the housing market.*
- *Due to the depreciation of buildings leading to demolition.*
- *Due to the production of monotonous dwelling types.*
- *Due to the structural growth of smaller households.*
- *Due to a growing population in size and diversity.*
- *Due to a mis-match in supply and demand of housing.*
- *Due to the global economy and the pandemic.*
- *Due to restrictive measurements and regulations.*
- *Due to the traditional way of (speculative) developing.*

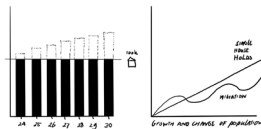
This first chapter aims to find answers to why we are faced with a housing crisis. Insights are gathered by studying history and the nature of housing in the Netherlands. While public housing has been a responsibility of the government for more than a century, recently the market forces have overtaken and dictated the development of the real-estate market. Various experts in the field underline the immense implications this had on the housing market, which was strongly correlated with economic developments, policymaking and governance. The decision making and political agenda of the government have led to the liberalization of the housing market, with a stagnation of housing production, increase in foreign investments, and surging real-estate prices. Short-term solutions are possible; decisive political governance, more efficient use and transformation of the existing housing stock, and the construction of temporary housing (Boelhouwer, 2024).

Other experts in the field plead for a long-term strategy and point out that the current approach, with the focus on quantity, indicates a fundamental misunderstanding of the problem at hand. They urge to approach the problem more holistically, by focusing on more than just quantity - especially when it comes to new dwellings that are added to the housing stock. These new dwellings should be strategically designed and developed to serve a part of the populous that is in urgent need of housing. Due to the demographic developments, the monotonous nature of housing needs to be reconsidered; as the demographic composition changes, so should the housing stock. The majority of the current housing stock consists of family homes, while the majority of the population consists of smaller or single households, which illustrates a painful mismatch in supply and demand. New dwellings that will be added to the housing stock should therefore not be, once again, family homes. Instead, new dwelling types should accommodate for the largest group of the population (smaller households) of which a significant amount of people are starters and elderly. When age progresses, so do complications, loneliness, and the need for healthcare, therefore dwellings should be equipped to accommodate for an ever growing elderly population. This can translate to accessibility, both on an urban level (in close proximity to facilities, greenery and public transport) as on an interior level (dwellings accessible by elevators and wheelchairs and equipped with social spaces). To combat affordability, new forms of developing need to be considered to circumvent the profitable exploitation of real-estate. Corporations should start developing more social housing and new types of development (collective private commissioning, cooperations and community land trust constructs) should be subsidized and promoted by the government. Due to regulations around sustainability, a new building culture can emerge where a combination of bio-based materials and appliances can make the new addition of dwellings to the housing stock more climate adaptive. To conclude, besides short-term solutions which can provide temporary relief, relevant principles like accessibility, affordability (through new forms of development), climate adaptation, the social inclusion (of important target groups) and flexibility (for adaptation to the evolving demographic composition) are important considerations for long-term developments.

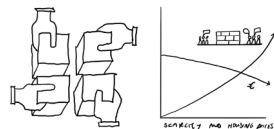
## Strategies



*Governance and policies should be coherent and foster long-term developments*

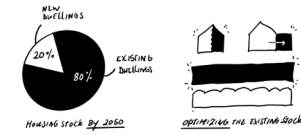


*Extra capacity of housing should be considered instead of a structural deficiency*

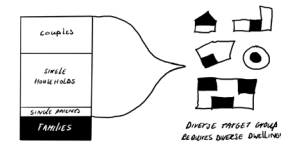


*Non-speculative forms of developing should be promoted facilitated and subsidized*

## Strategies



*Better use of the existing building stock; splitting, extending, transformations*



*A larger diversity of dwellings should accommodate for a diverse demographic*



*Production and use of local materials could be more (financially) sustainable*

Figure 20. Concluding strategies for the Dutch Housing Crisis (Illustrations by the author, 2024).

# II. THE AGRARIAN CRISIS

*“What does an agricultural transition entail?”*

NO<sub>x</sub>, CO<sub>2</sub>, CH<sub>4</sub>

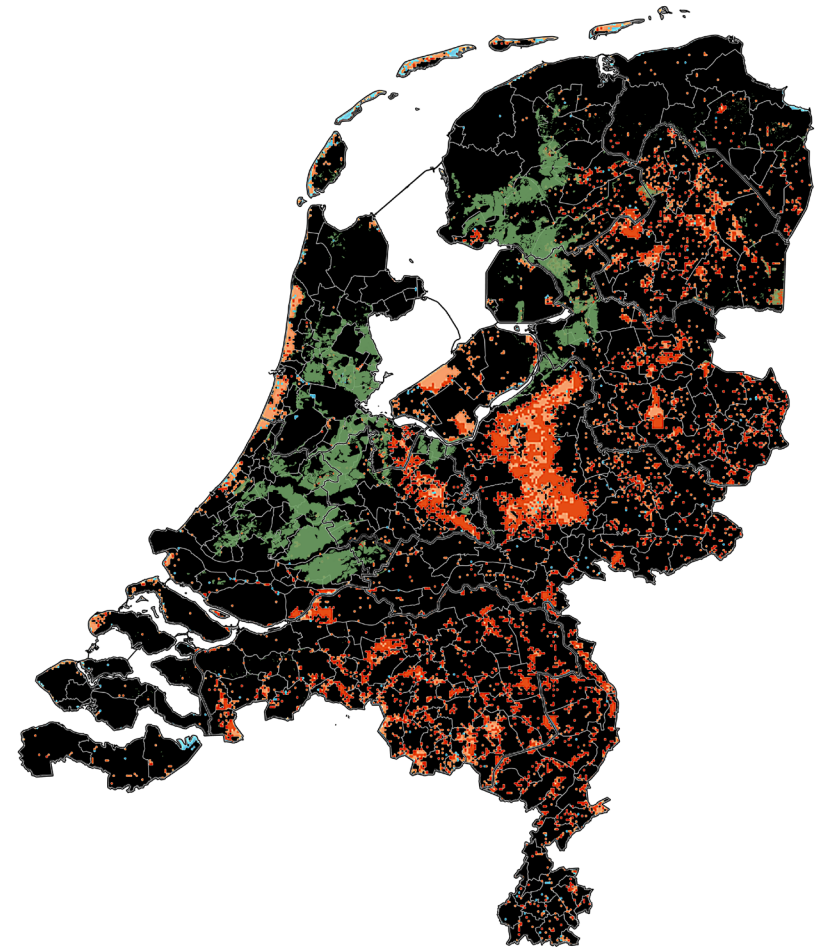


Figure 21. Illustration of eutrophication and potential sequestration in the Netherlands (2021).



## FROM DEPOSITION TO OPPOSITION

To mitigate the effects of climate change, a global need for the reduction of emissions has been established in 2015 during the Paris Agreement, where 195 countries signed a deal to set ambitious targets to substantially reduce global greenhouse gas emissions to hold global temperature increase to well below 2°C, recognizing that this would significantly reduce the risks and impacts of climate change in the future (The Paris Agreement, 2015).

The Netherlands, was behind on achieving the objectives based on the European guidelines, so in 2019 the highest Dutch court banned all construction activities which could lead to increased nitrogen emissions. The intention was that the provinces would expedite the cabinet's nitrogen targets into so-called area-oriented policies. Besides the nitrogen targets, all provinces needed to achieve climate and water guidelines, since the Netherlands also did not comply with the EU directive for water quality, because too much nitrate leaches into the groundwater. Additionally, agriculture produced too many greenhouse gases, for example due to the methane emissions from cows and because a lot of nitrous oxide and CO<sub>2</sub> is released from the soil in the peat meadow areas (Wageningen world, 2022). In 2022, the Dutch Minister for Nature and Nitrogen announced the need for a nation-wide 50% reduction rate of nitrogen emissions, by 2030. An indicative map was published to inform the provinces about the target reduction rates. Nature reserves and forested areas were most vulnerable for the deposition of nitrogen, and farming areas seemed to be targeted with high reduction rates (NOS, 2022). This led to disagreement with provincial governments, drastic delays in the built environment, and it instigated a big revolt of the farmers across the country, resulting in protests with tractors forming barricades on crucial highways, as farmers expected financial losses (NOS, 2022). The NO<sub>x</sub> reduction chart received critique from experts, professor de Vries, from Wageningen University & Research, explained that the map was misleading, because it solely focused on nitrogen reduction, while future restrictive measures in the areas of water quality and CO<sub>2</sub> reduction should also be included (de Vries, 2022).

To reduce nitrogen deposition in vulnerable areas, the government started to acquire agrarian land, with a budget of 7,6 billion euros. Once the government buys the land from farmers, they hold the authority to limit the user rights of the land, leasing the land back to the farmers without the ability to use the land for farming purposes (RTL, 2022). While we still imagine green, lush fields when we think of farming, significant portions of the agrosector have evolved into artificially optimized indoor production machines. Where monitoring and breeding hundreds of animals or thousands of plants have become the new norm (AMO, 2020). This chapter unravels the DNA of the Dutch landscape and looks ahead, to explore potential alternatives, solutions and futures for sustainable farming and food production in the Netherlands.

## THE AGRARIAN CRISIS

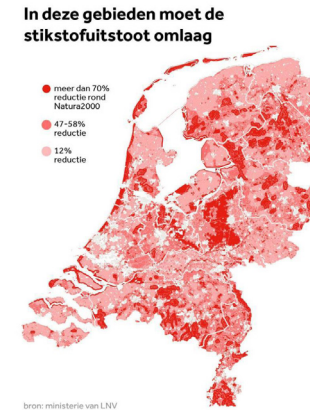


Figure 22. NO<sub>x</sub> Reduction chart (NOS, 2022).



Figure 23. Tractors blocking the highway; a form of protest (NOS, 2022).

## Uitkopen vanwege stikstof: hoe sneller een boer stopt, hoe meer geld hij krijgt

Door Stephan Koole en Marieke van de Zilver  
30 maart 2022 18:30 • Aangepast 30 maart 2022 18:50



Figure 24. The government and municipalities buy farmlands to control the national carbon budget (RTL, 2022).



Figure 25. The countryside is evolving into an artificially optimized indoor production machine (AMO, 2020).

## WHAT DO EXPERTS SAY ABOUT THE AGRARIAN CRISIS?

Nitrogen professor Wim de Vries and his research group have developed a model that calculates all emissions of nitrogen compounds and greenhouse gases from agriculture, and inventoried what actions farmers can take. Some technical measures include; less nitrogen in livestock feed, manure separation, no more plowing and low-emission stables. For 2030 these technical measures can offer some relief, but to get closer to the goals for 2050, a combination of technical measures and a reduction of the livestock would be necessary. But sacrificing our livestock seems less effective than one might expect; even if the livestock herd would be reduced with 50 percent, this would only result in a 35 percent nitrogen reduction and 21 percent greenhouse gases reduction by 2050. Therefore, a combination of technical measures and a smaller livestock reduction is a favorable scenario (de Vries, 2022).

Katrien Termeer, professor of Public Administration in Wageningen, also advocates careful processes, both nationally and locally, where the government works together with stakeholders towards future-proof, sustainable agriculture. Termeer advocates an agricultural agreement focused on seven transition paths for sustainable agriculture. For example, there are paths that lead to highly productive high-tech agricultural systems that minimize emissions with precision technology, energy generation and circular principles, but also a transition path to further growth of organic agriculture, and routes to multi-functional companies that, in addition to food, also provide care, recreation or ecosystem services (Termeer, 2022).

Edo Gies, regional development specialist at Wageningen Environmental Research conducted a study for the Ministry of LNV on how the provinces can reach their nitrogen, climate and water quality targets. He concluded that most of the initiatives should come from ministries and governments, whom should be very clear about what they expect from the farmers and how the farmers can expect suitable support. And for the climate challenge (CO2 emissions), Gies suggests that the waterlevels in the peat meadow area should be raised, to lower the emission of greenhouse gasses from the subsiding, oxidating peat landscape, but the responsibility lies with the provinces and regional water authorities (Gies, 2022).

An interesting perspective about the 'Agrocluster' is provided by a report that the former minister of agriculture, Dr. Cees Veerman worked on during his active years. The document illustrated the monetary value of the agricultural landscape, measured by the capital it generates. When considering the future, the monetary value the agrarian sector provides for the country shouldn't be underestimated or forgotten. The research has provided a new insight; the more land-based the agriculture, the lower the added value per hectare. The stables and acres were not generating most monetary value, but instead other agrarian chains; the supplying and processing chains and the trade and distribution of provisions (food). Especially 'Westland', known for its indoor horticulture provided much value per hectare (Veerman, 2004).



**Prof. Wim de Vries**  
Professor of  
Environmental Systems  
Analysis at Wageningen  
University & Research.



**Prof. Katrien Termeer**  
Professor of Public  
Administration and  
Policy, Wageningen  
University & Research



**Ir. Edo Gies**  
Regional development  
specialist at Wageningen  
Environmental Research



**Dr. Cees Veerman**  
Former Minister of  
Agriculture, Nature and  
Food Quality (02-2007).  
Wageningen University.

*"The most realistic calculated scenario is the **combination of feasible technical measures** and a **25 percent reduction in livestock** numbers. This variant leads to an ammonia reduction of almost **50 percent** and **25 percent fewer greenhouse gases**- then agriculture approaches the ammonia target and will meet the climate target for 2030, but the sector will **only achieve half of the climate target for 2050**."*

*"Farmers should initiate the transition, but the **government** can offer a more **coherent policy** and room for **action perspectives**. For example, by removing obstructive legislation, enable revenue models with money from the European agricultural policy, adjust land policy, and make better use of competition rules for sustainable entrepreneurship. **Chain parties** such as banks, feed suppliers and supermarkets must **also contribute to the transition**. We cannot put everything on the farmers' plate."*

*"I suggest a **reflexive interactive design approach**, by researcher Bram Bos of Wageningen Livestock Research. He sat down with **farmers and critical organizations** to design new stable systems. This united various goals; less environmental pollution, more animal welfare, health benefits and a good revenue model. The discussion partners have to think about how they can **unite multiple contradictory goals with new ideas**."*

*"We see that **most money is not earned on the land and in the stables**, but in the other agrarian chains; the supplying and processing industries and the trade and distribution of provisions (food). Within agriculture and horticulture we see this pattern in the form of an inexorable law: **the more land-based the agriculture** - think of arable farming and dairy farming - **the lower the added value per hectare**."*



## WHAT ARE EXPERTS IN THE FIELD CONCERNED WITH?

While politicians and experts mainly focus on the status quo, practicing professionals are concerned with the future of the countryside. More specifically the potential solutions that we should be exploring to re-invent the way we farm, produce, distribute and spatially position and combine agrarian functions with the landscape and urban areas. The previous Chief Government Architect, Floris Alkemade, shares his perspective regarding the agrarian transition during a public debate with specialists from the agrarian field. Alkemade pointed out that the challenges we face are not only regarding nitrogen emissions, but also about water quality and sustainable food production. A correct approach would be to embrace a holistic perspective, understand how various factors influence each other, and find new agrarian revenue models for farmers (Alkemade, 2022).

Rem Koolhaas, founder of OMA and writer of the book 'Countryside, a report', describes an interesting development; the radical transformation of the countryside—where tradition, culture and landscapes have made place for industrialization, automation and optimization. This global phenomenon seemed to have escaped our gaze during the extensive focus on the development of urban areas in the past decades (Koolhaas, 2020). The new and futuristic conditions of the countryside require to be considered and evaluated, when planning for an agricultural transition. Especially when the inherent qualities of the landscape have been replaced by mega factories and high-tech apparatus.

To understand which developments are necessary for the future of the Netherlands, Kristian Koreman, co-founder of ZUS, is working on a visionary plan for 2070; a national strategy to develop a more resilient Dutch landscape. With his research he has looked into major trends related to the changing landscape of the Netherlands. Factors such as land subsidence, salinization, increasing extremities in rainfall and droughts, mass migration and rising sea levels have indicated that the current polder landscapes will not be sustainable long term (Koreman, 2016). Meaning we have to re-imagine and envision the future of the Dutch landscape in ways it will respond appropriately to the challenges we face today and in the future.

The newly appointed Chief Government Architect, Francesco Veenstra, doesn't only urge to think about a new building culture, but also pleads for an agricultural transition, where the production of healthy food can be secured. In the proposal, 'the 22nd century starts now' (Cra, 2021), Veenstra suggests that our current agricultural landscape could be transformed into parks where the production of circular and raw materials take place, which we can use for our new building culture. This transition would also enable the landscape to be more bio diverse, suitable for recreation, and climate adaptive, while still providing opportunities for people to do meaningful work in the agrarian landscape of the future.



**Floris Alkemade**  
Previous partner OMA  
Previous Chief  
Government architect

*If we want to live without leaving a trace of destruction, we must **embrace a holistic perspective**. Not view our food production separately from housing, urban architecture, nature or infrastructure. But **bringing all things together and discovering how they influence each other**. Questions then do not become unsolvable or more complicated, but rather more logical. That requires a **different revenue model**."*



**Rem Koolhaas**  
Founder of OMA - AMO  
Professor, Harvard GSD  
Co-writer of the book  
'Countryside, a report'.

*"In the past decades, I have noticed that while much of our energies and intelligence have been focused on the urban areas of the world—under the influence of global warming, the market economy, American tech companies, African and European initiatives, Chinese politics, and other forces—the countryside has changed dramatically."*



**Kristian Koreman**  
Co-founder ZUS  
Curator of IABR  
Independent school  
for the city

*"Under the name Delta 3000, we have looked at all the major trends, such as ongoing land subsidence, salinization of the soil, increasingly heavy rainfall and major droughts, mass migration and sea level rise. In our view, **many of our polders are not sustainable in the long term**."*



**Francesco Veenstra**  
Government architect  
Founder of VAKWERK  
Architecten in Delft

*"Agriculture has a major task in the field of food production, landscape and nature, in fact, that task is crucial. This requires a **transition**: the focus must be shifted to **an agricultural system that produces healthy food** and other **circular raw materials** and at the same time contributes to **biodiversity, climate adaptation, meaningful work and pleasant landscapes**."*

## EUTROPHICATION

Most of the farmers with cattle; such as cows, pigs and chickens, are located in the east of the country. The map on the right shows the eutrophication in the Dutch landscape. Eutrophication is an indicator for over-fertilization. The deposition of nitrogen through the air, as a result from fertilizing, can have detrimental effects on ecosystems. Certain species will out-compete and overtake important plant species when the soil is depleted. When the nutrients in the ground are poor and when the nitrogen load becomes too high, weeds tend to ‘exterminate’ crucial species. This has an effect on the other flora and fauna in the regions as well, and ecosystems that are interdependent have the risk to disappear. The eutrophication map indicates in which areas the maximum threshold is reached. Because natural habitats, such as the ‘Veluwe’ and the ‘Utrechtse heuvelrug’, have rich ecosystems, they can be vulnerable for the deposition of nitrogen, which can be seen in the over representation of reds in the map (CBS, 2021).

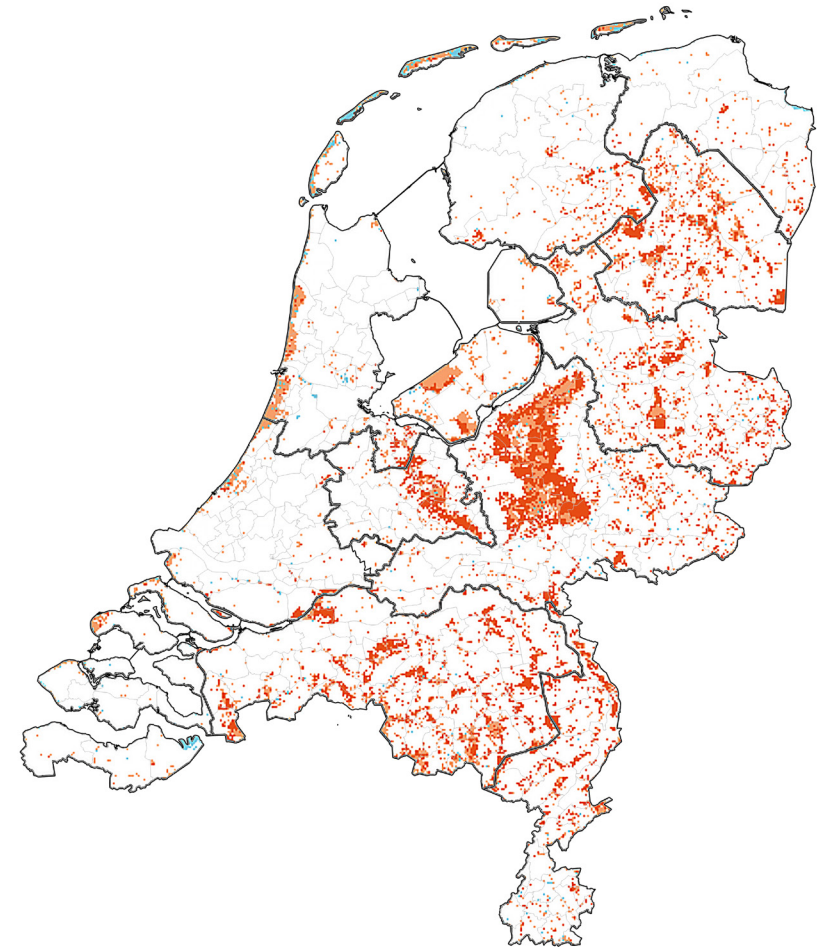


Figure 26. Eutrophication in the Netherlands (2021).

## PRODUCTION OF FOOD

The Netherlands has large areas of the land dedicated to food production. The chart on the right is a representation of the areas where food crops are grown (figure 27). Agricultural crops include food crops such as potatoes and grains, open ground horticulture and flower bulbs (all excluding products from greenhouse horticulture). Growing crops is important for the supply of local food in the Netherlands. A lot of crops that are grown on the land are consumed in the cities. This allows for local and healthy food for relatively affordable prices. The superfluous products are designated for export, which provides income through trade. Due to the population growth, the demand for food continues to rise. Good soil quality with the correct structure and water management, good nutrient management and healthy soil life is essential for growing crops. In 2018, 17.3 million kilos of food crops were produced on Dutch soil: 15.7 million kilos of arable crops, 1.4 million kilos of horticultural crops and 186 kilotons of flower bulbs (CBS, 2021). Additionally, Dutch agricultural areas also provide another important product for the agricultural sector; animal feed crops, which consists of grass, hay and maize. The total amount of animal feed crops almost supersedes the production of flowers and food crops combined. In 2018, the added value of agriculture in the Netherlands was 6.7 billion euro (CBS, 2021). The greenhouse horticulture in the Netherlands is also responsible for the production of a significant amount of products. The contribution of the horticulture chain to the Dutch economy in terms of GDP was in 2021 1.6 percent. Companies in the horticulture chain contribute 23.6 billion euros to the Dutch economy (CBS, 2023).

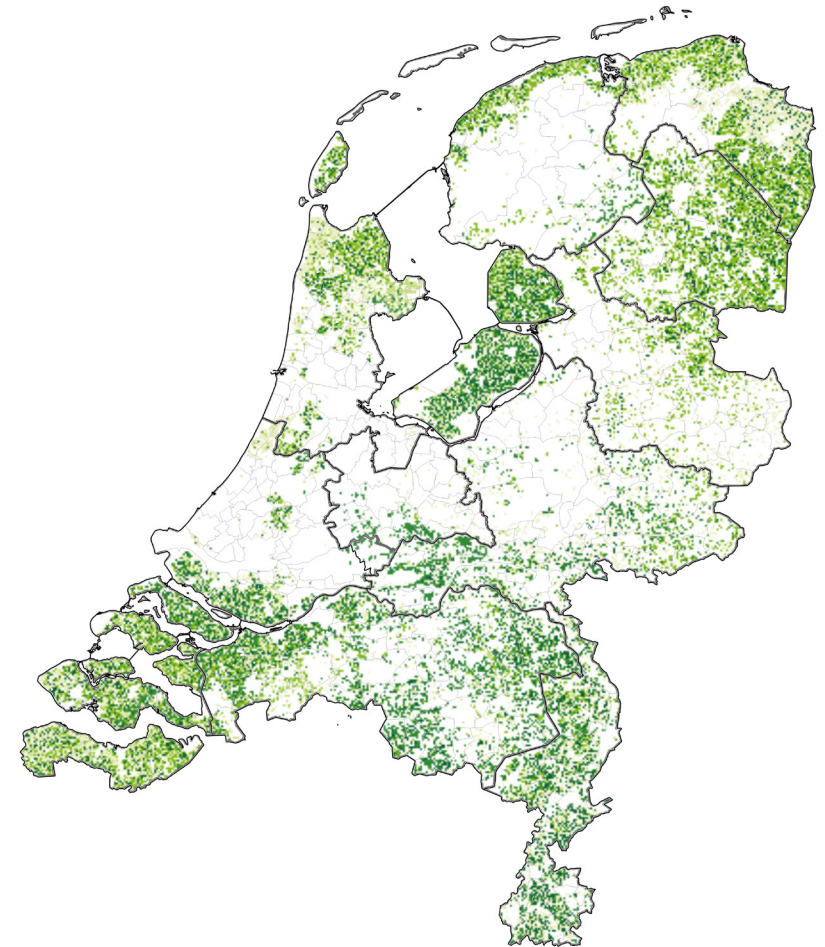
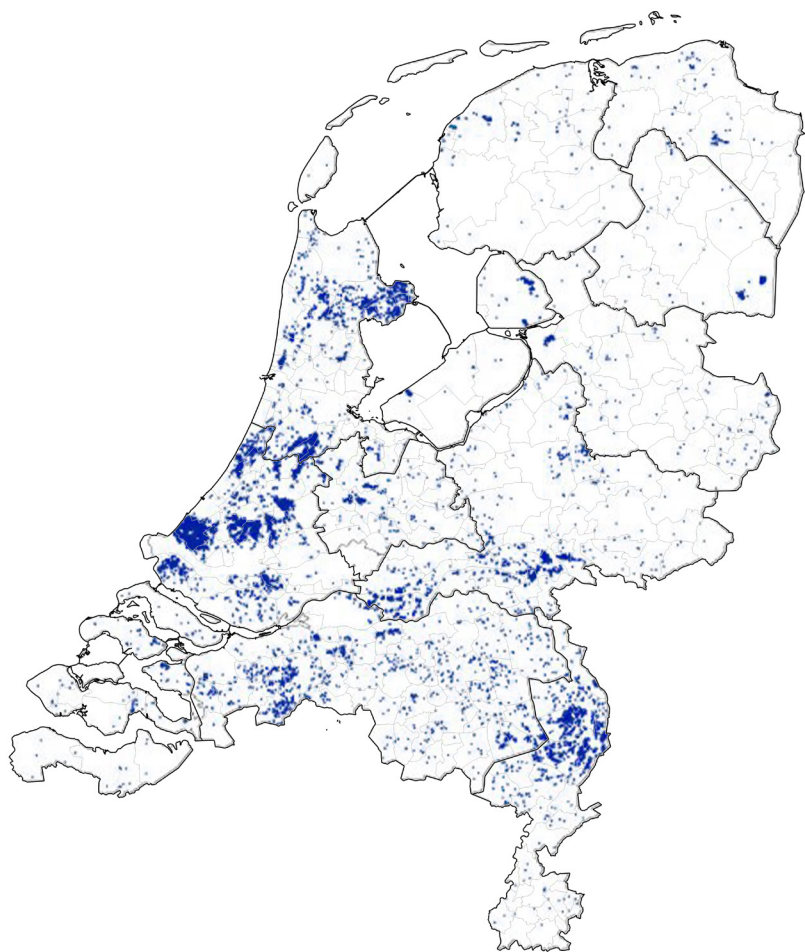
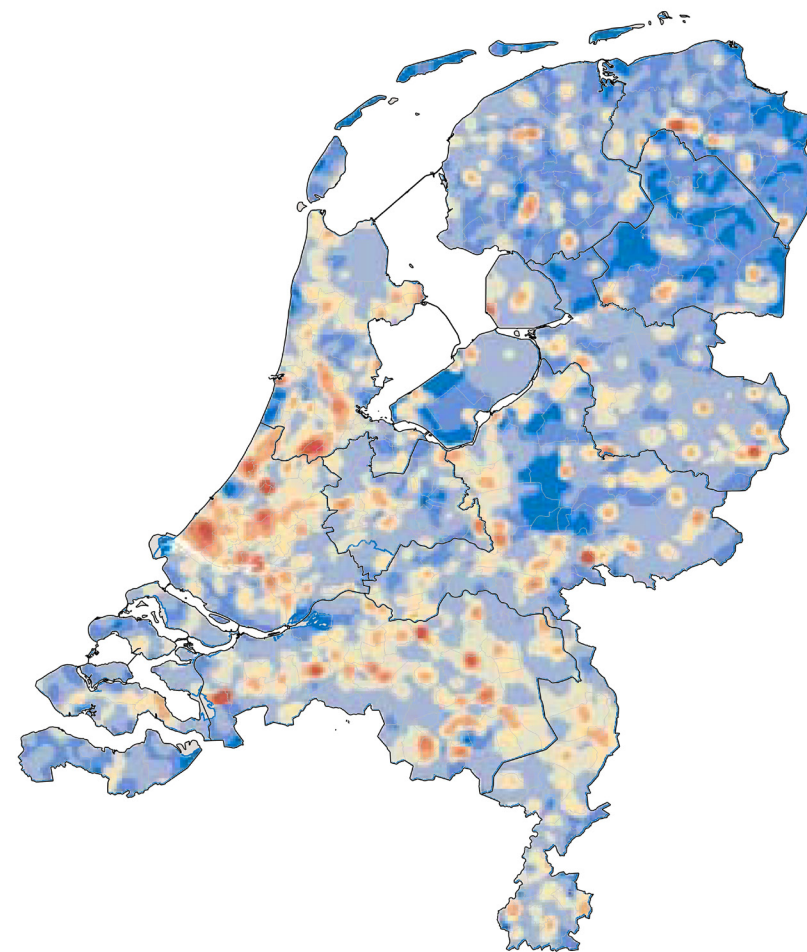


Figure 27. Production of food crops in the Netherlands (2021).



**Figure 28.** *Greenhouse horticulture in the Netherlands (2021).*



**Figure 29.** *A representation of the monetary value of the agrocluster in the Netherlands (2004).*



## ECOLOGICAL AND MONETARY VALUE SYSTEM

The value of the Dutch landscape can be measured in different ways; by looking at the economic value it provides for the country through the production of resources, providing job opportunities and through the export of products. The monetary value of the agrocluster is displayed in figure 29. In 2004, the minister of agriculture, nature and food quality commissioned a report on the economic value the agrarian landscape provides. This led to the following conclusion:

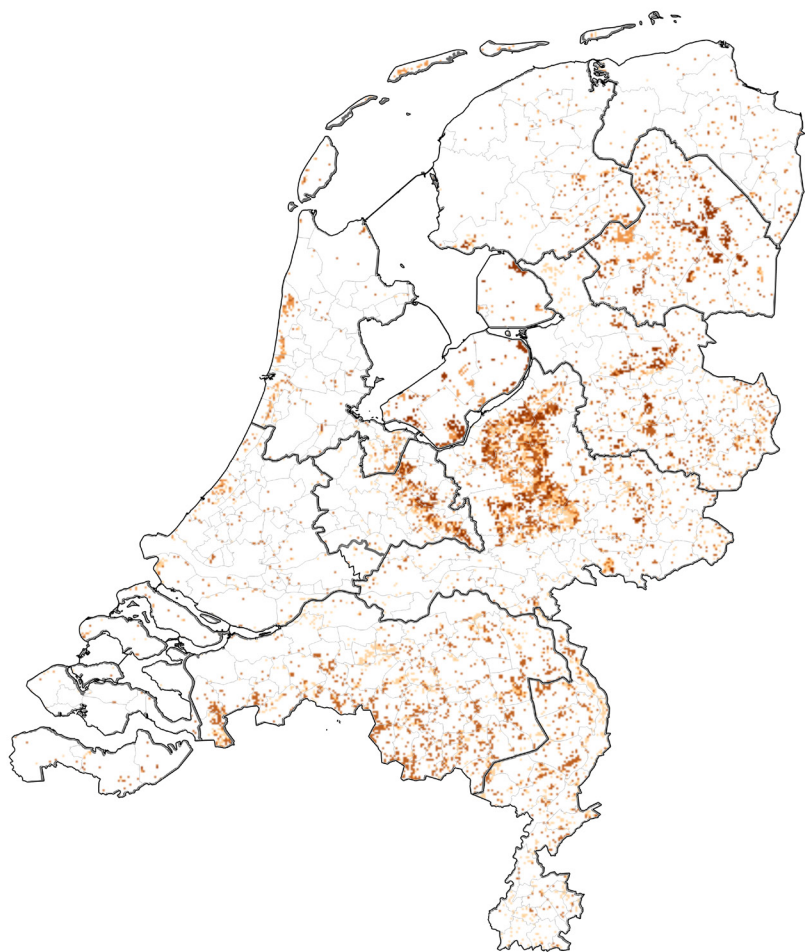
*“We see that most money is not earned on the land and in the stables, but in the other agrarian chains; the supplying and processing industries and the trade and distribution of provisions (food). Within agriculture and horticulture we see this pattern in the form of an inexorable law: the more land-based the agriculture - think of arable farming and dairy farming - the lower the added value per hectare.”*  
- C. Veerman (2004).

When observing the chart, it does show a significant difference in color intensity between the agrarian hinterlands and the Westland (where most greenhouse horticulture is located). It indicates that the efficiency in relation to ground coverage is much higher in these areas. The yield of greenhouse products is also more frequent. However, these areas are essentially considered urban areas, as there is no outdoor nature present anymore in these areas; all land is covered by greenhouses. This brings up the question, are there other ways to measure the value of the landscape?

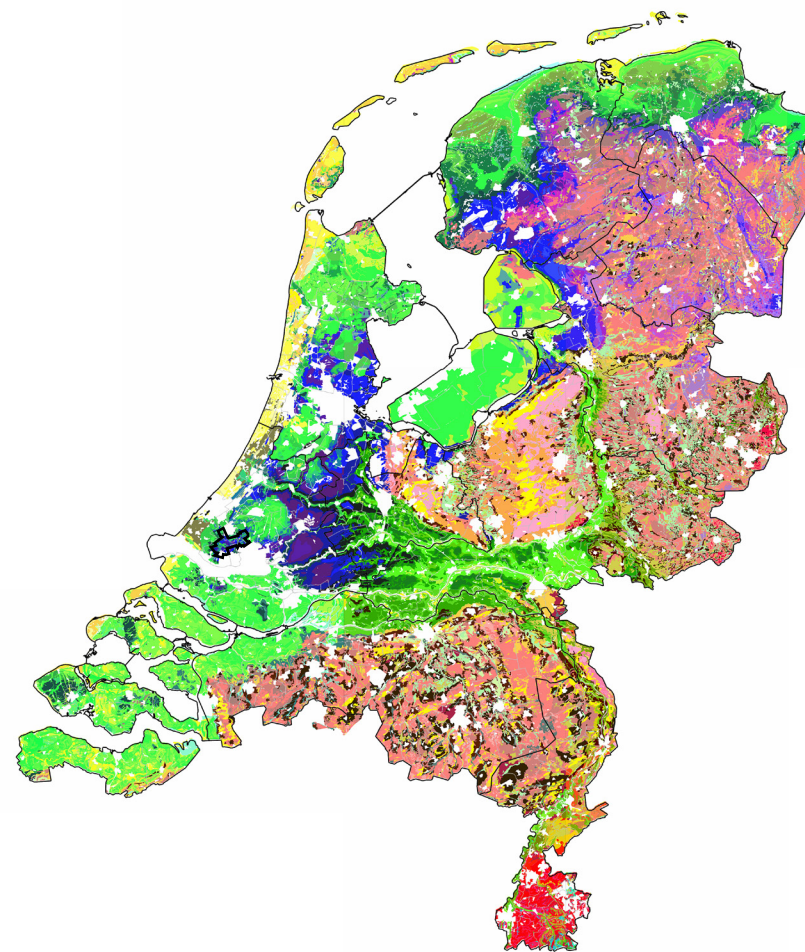
Another mode of measurement is looking at the ecological value the landscape provides. The ecological value is determined by measuring the presence of ecology and biodiversity, the sequestration of CO<sub>2</sub>, coastal protection such as the dunes, the positive effects on the well-being of citizens, and the extraction of natural resources from the landscape such as wood (from production forests). Through the monitoring of the ecosystem services, the intensity and usage of ecosystems by the population can be measured (CBS, 2021). The value that all ecosystems combined have is expressed in the illustration on the right, the areas containing more blue indicate very high added ecological values and the areas that are light green are considered to be of less ecological value (figure 30). The areas that seem to be of most value are nature reserves, or large forested areas, but also the coastal areas with the dunes. While in the forested areas, the production of wood takes place, while in both (blue indicated) areas a rich biodiversity can be found in addition to the leisure, tourism and well-being it provides for citizens. When considering the restriction or transition of agrarian functions, careful consideration should be paid to both value systems.



Figure 30. A representation of the ecological value of the landscape in the Netherlands (2021).



**Figure 31.** Wood production forests in the Netherlands (2021).



**Figure 32.** The rich and divergent soil composition in the Netherlands (2021).

## THE DUTCH PEAT LANDSCAPE, THE CULPRIT OR THE SAVIOR?

Ecosystems can store, but also emit CO<sub>2</sub>; a large area of the Netherlands is covered with peat landscapes. The peat soil consists of 'dead' plant material, which is a residue material from thousands of years ago and has been preserved under wet conditions with the absence of oxygen. These peat landscapes have been used for farming (mainly cattle) for hundreds of years. These wetlands were manually transformed into usable landscapes; through extensive water management, the irrigation of the peat landscapes has led to the subsidence of the peat soil. As peat is irrigated, it dries out, oxidizes and subsides. During the process, vast amounts of CO<sub>2</sub> are emitted, while salination also becomes an issue. Every year, the Dutch peat landscape emits about 6 mega tonnes of CO<sub>2</sub> (CBS, 2021). While this is a very large amount (the total emissions related to ammonia are also 6 tonnes of CO<sub>2</sub> per year) it shows that the transformation of these landscapes could offer opportunities to be redeveloped. Especially considering that most production takes place at the brim of the country, bringing production closer to cities could lower emissions by transportation and foster local ecologies and local distribution chains. When the peat landscape is compared to the monetary valuesystem of the landscape and the ecological valuesystem, it shows that in both frameworks the peat landscape has no significant value. These are vast grasslands with little biodiversity, not much leisure, extensive and unsustainable water management systems, and a subsiding soil composition. There is no significant production capacity in these landscapes (other than cattle) that contributes to major economic benefits. These areas seem to offer an opportunity to bring down emissions through a more holistic approach.

## 5000 KM<sup>2</sup> OF SUBSIDING PEAT SOIL LANDSCAPES

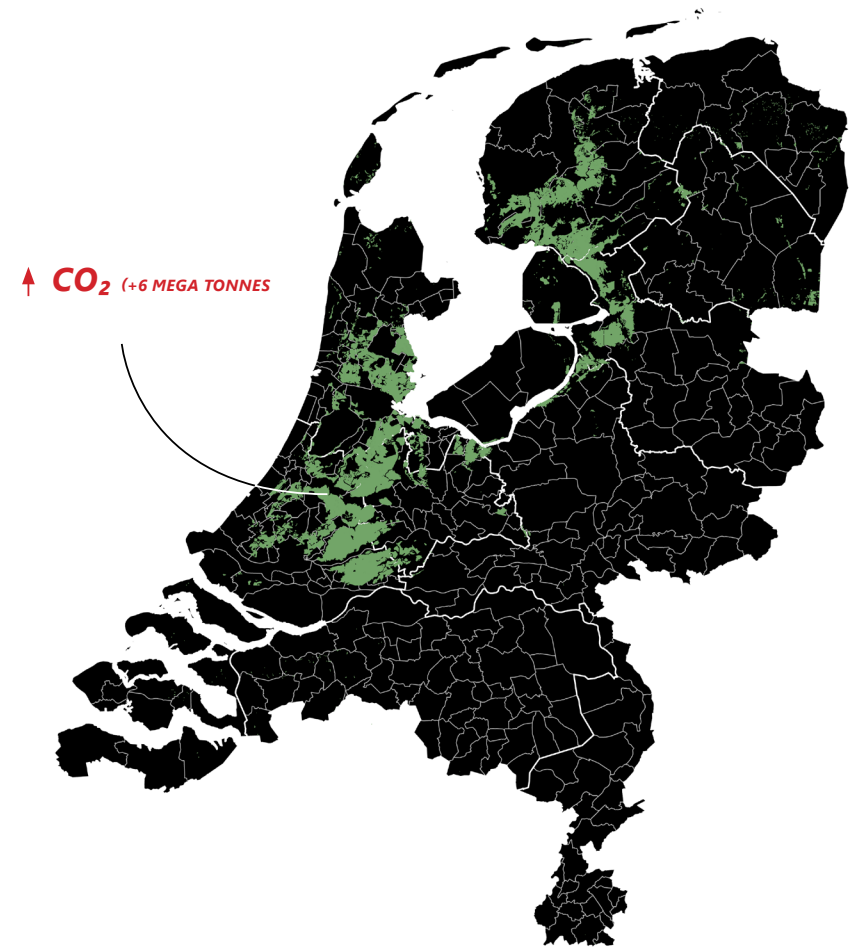


Figure 33. A representation of the subsiding peat soil landscape in the Netherlands (2021).

# THE AGRARIAN TRANSITION

TOWARDS  
(RE)PRODUCTIVE  
LANDSCAPES

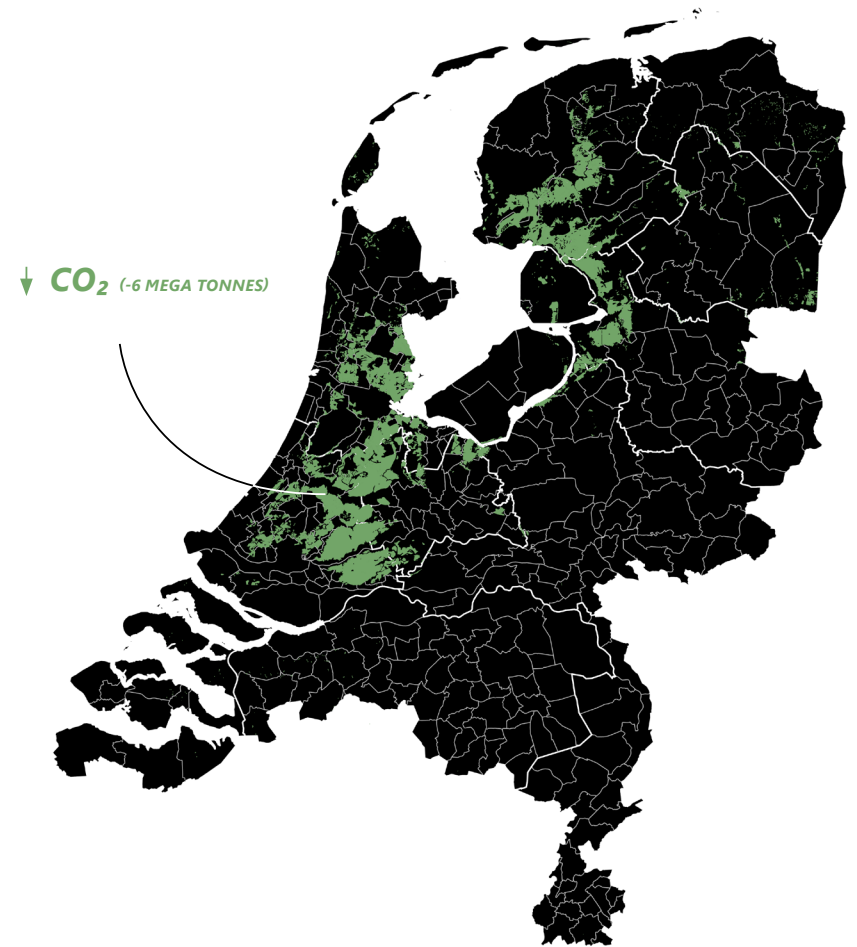


Figure 34. A representation of the subsiding peat soil landscape in the Netherlands (2021).



## ROTTERDAM AS A SPONGE CITY IN 2050

In 2021, the Delta Urbanism Interdisciplinary Research Program, at Delft University of Technology, invited various academia, experts and practitioners to re-think and re-design the Dutch delta landscape. The research and design task of this studio, Redesigning Dutch Delta's, revolved around a shared scope; sea level rise, climate adaptation, subsidence, sustainability transitions, housing shortage and boundary conditions of the context for a desired society (RDD, 2021).

One of the research outcomes was a proposition to develop Rotterdam into a 'sponge city'. The team consisted of; De Urbanisten, Lost Landscapes, and Royal Haskoning DHV. The team delved into the potential consequences of rising sea levels in the coming decades, such as; salt intrusion, fragmented nature, sedimentation, subsidence, and significant floods and droughts- their team developed methods on how to prepare cities appropriately for rising sea levels.

Their research and findings resulted in two strategies. The first strategy is to make the city of Rotterdam more water resilient, by designating a large natural fresh water reservoir and having dedicated overflow areas (the polder landscape) and a shortened, but more efficient dyke system to foster urban densification. The second strategy illustrates the potential to transform the harbor area of Rotterdam in the coming decades; moving the industry more towards the sea and redeveloping the area closer to the city into an ecological buffer zone, with softer waterfront, more biodiversity and marine life that can flourish. As mobility (boats) become more sustainable, the river and harbor areas close to the city could become a valuable extension of the urban landscape.

The fresh water bodies and qualifiers would be able to be harnessed to mitigate extremities between wet and dry periods. As part of the water treatment proposal, very large 'peat soil' polders are utilized for filtering and storing water. The reason these peat polders are flooded, is to reduce the CO<sub>2</sub> emissions that these areas cause. Due to irrigation these peat landscapes subside, causing oxidation and leading to large emissions. However, when flooded, the peat can be used to treat the water before filtration, and wet peat is the most effective in storing CO<sub>2</sub>. With a polder of 12 hectares, 8 megatons of CO<sub>2</sub> could be stored yearly. As a comparison; the city of Rotterdam produces 3 megatons of CO<sub>2</sub> per annum (RDD, 2021).

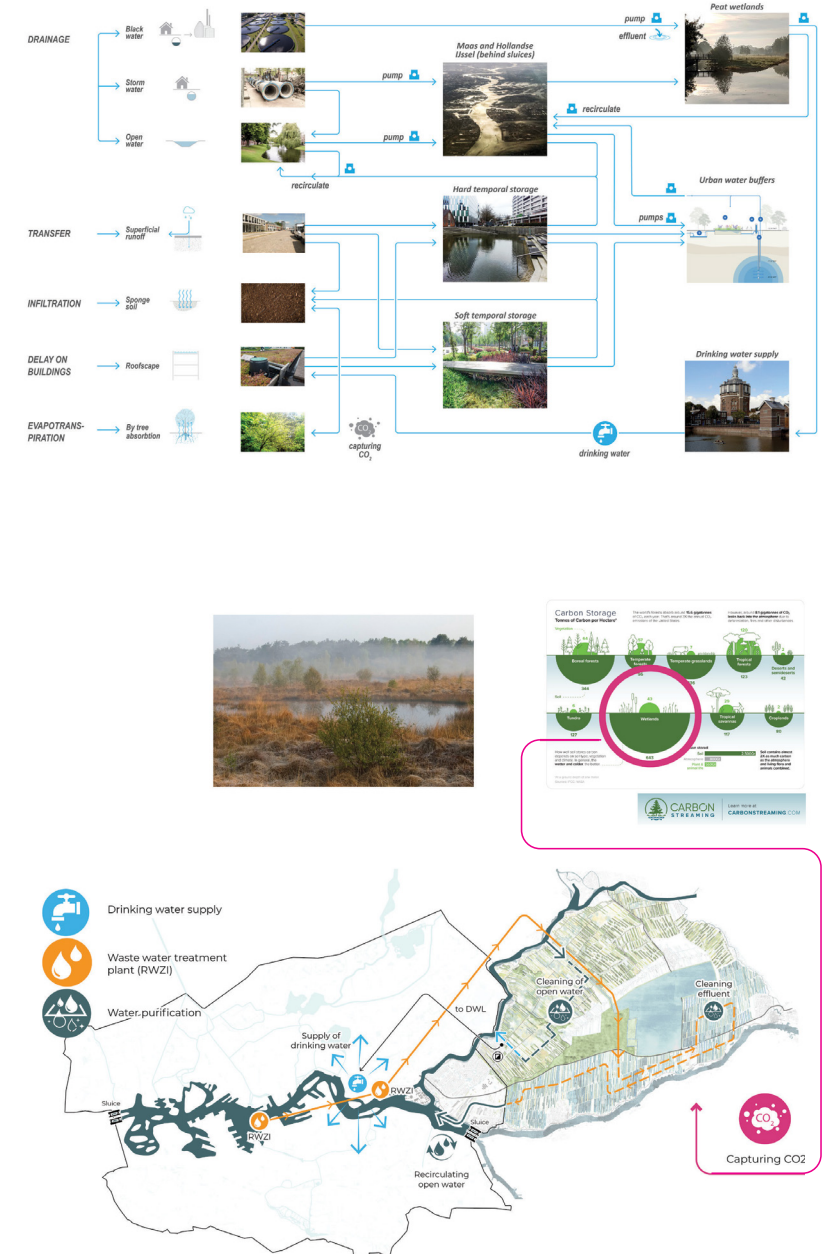


Figure 35. The polderlandscape with peat soil could significantly reduce emissions while filtering and storing water (2021).





Figure 36. A representation of the emission-absorbing, ecological leisure wetlands in contrast to the dense and modern city skyline (RDD, 2021).



NATIONAL PRODUCTIVE PARK MIDDEN-DELFLAND

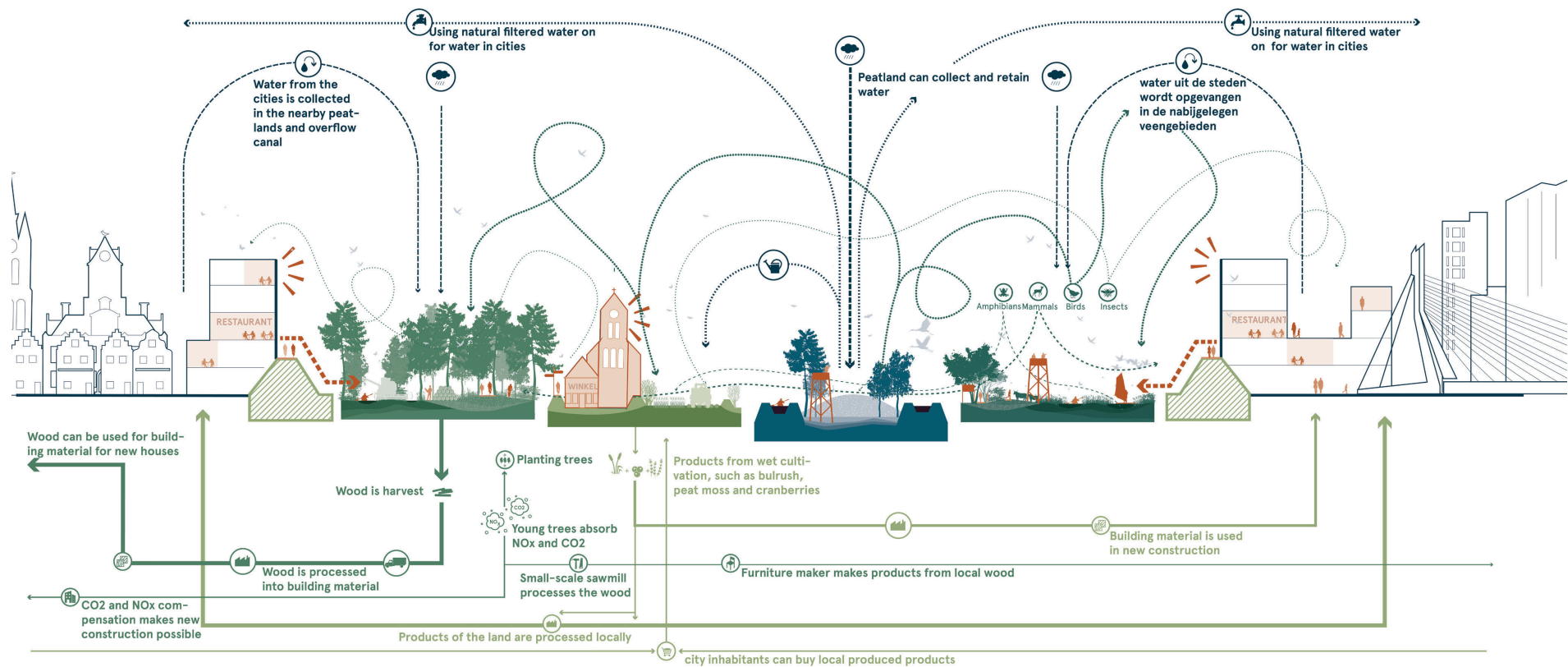


Figure 37. A representation of the flow of services and resources in the new Productive Landscape of Midden-Delfland (RDD, 2021).

## NATIONAL PRODUCTIVE PARK MIDDEN-DELFLAND

As a part of the same Interdisciplinary Research Programme, another team consisting of ZUS, Flux and Sweco, looked into the Dutch polder landscape; unfolding the problems, but also the potential the polder landscape holds. The research of this team focused on the vast landscape of Midden-Delfland, which is the remaining landscape that is situated between the city of Rotterdam and Delft. This area is characterized by large open polders, various meters below sea level, where grass grows on a mix of soil types, and big portions of the soil consists of peat, which is subsiding due to the irrigation of the land. Infrastructure such as a train tracks, and vital highways traverse the landscape, connecting the big cities in the larger area. The team posed questions such as; “should we build housing in the polder landscape below sea level? “ And “How is the water system in a deep polder under pressure of sea level rise and peak rains?” Also, “what does drought and soil subsidence mean for agricultural areas and how will this influence the desired functions in the future?” (RDD, 2021).

Because the landscape is situated between large cities, the urbanization pressure is very high- with many plans to expand the cities into the polder landscape to meet the need for housing, logistics, agriculture, infrastructure and energy production. Due to more extreme rainfall and the harsh surfaced areas of nearby cities, water retention is a big challenge and this puts a big strain on the water drainage system of Midden-Delfland. Due to the peat soil in Midden-Delfland, and the irrigation system there is soil subsidence with oxidation that causes significant amounts of CO<sub>2</sub> emissions. The research team calculated that this landscape emits 35,000 ton of CO<sub>2</sub> per year. The first proposal of the team is to make the polder landscape more wet; the process of peat subsidence and oxidation can be stopped and the peat soil can recover and grow, so the peat soil can start store CO<sub>2</sub> again instead of emitting the compound. This would reduce the emissions to 0 ton per year, and when this is combined with new forest development, around 15,000 ton of CO<sub>2</sub> could be stored yearly. By studying the water management system of the polder, the team discovered that this system is working at its maximum capacity and is not future-proof, considering that the weather conditions will be more extreme as time progresses. As a second solution, the team proposes that a big portion of the landscape can be used as a water storage and overflow area. This helps to support the water management systems and provides safety, precipitation from wet seasons can be stored and re-used during times of drought. The current water infrastructure needs to be enhanced and passive, durable systems would need to be put in place for water regulation, which could reduce the need for dykes, pumps and sluices in the coming century.

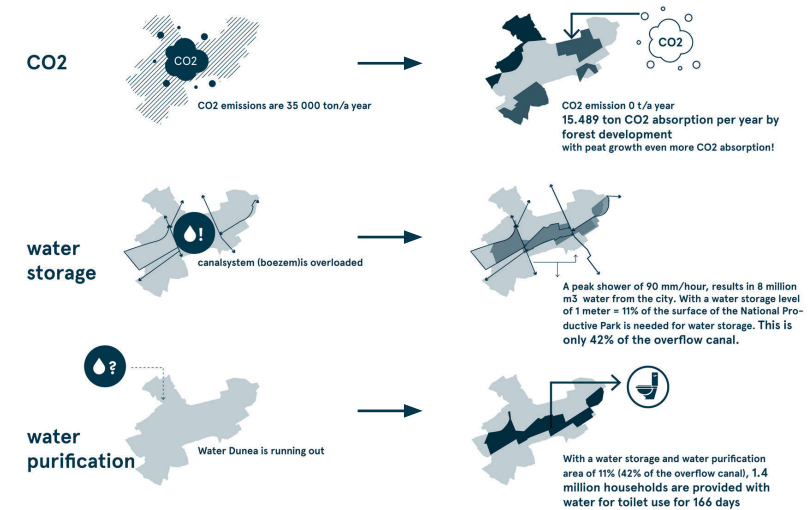


Figure 38. The polderlandscape with peat soil could significantly reduce emissions while filtering and storing water (2021).

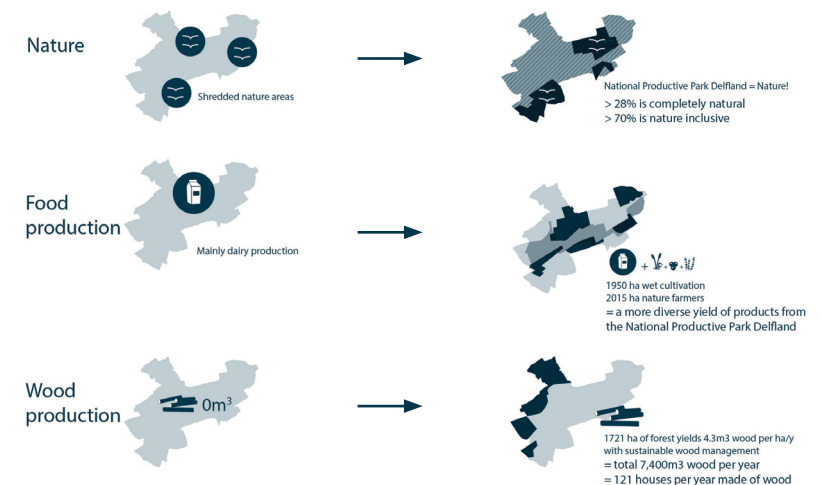


Figure 38. The polderlandscape could be transformed into a productive landscape: food production, bio-based materials and recreation (2021).

## NATIONAL PRODUCTIVE PARK MIDDEN-DELFLAND

The team also looked into the current characteristics and usage of the land to understand how it could be improved. The landscape is characterized by large areas covered with grass, which is not very bio-diverse or nature inclusive. Therefore, the proposal is to change the landscape into a nature inclusive habitat with a few completely natural areas, to boost the biodiversity of the landscape.

The grassland is constantly pumped dry, to keep the grassland usable for farmers that mainly focus on dairy production, with cows grazing in the fields. A more diverse palette of food production is proposed; from dairy, to wet cultivation farming, resulting in a more diverse yield of products from the landscape.

With the polder becoming a more nature inclusive landscape, designated areas for forestry are proposed, large areas with clay soil could accommodate for the growth of various plants and trees that could be harvested as local materials to build homes in the nearby cities. The team calculated that with 1721 hectares, a total of 7,400m<sup>3</sup> wood could be harvested yearly. This would mean that 121 houses could be built from locally grown wood and materials every year.

The research proposes that the adjacent city edges will be designated to for new buildings, certain urban areas area also marked as options with potential to densify. Some if these designated areas are: the Hague Airport, where in the future housing could be realized if the airport becomes obsolete or underused. Other areas designated for densifications are industrial urban areas, both on the side of Delft as on the side of Rotterdam. The industrial area 'de Spaanse Polder' is marked as an area with space and potential to be (re)developed. The revenue generated by urban densification could be used to redevelop the landscape of Midden-Delfland. The aim is to develop a landscape for the coming century that integrates crucial aspects; the reduction and storage of CO<sub>2</sub>, water management including water storage and filtration, the production food, and the plantation of a forest where local materials can be harvested that can be used as circular building materials in the nearby cities (RDD, 2021).



Figure 39. A productive park: watermanagement, food production, recreation, nature and the production of local bio-based materials (2021).





Figure 40. A master plan for the new Productive Landscape of Midden-Delfland (RDD, 2021).





## VERTICAL FARMING: CONTINUOUS YIELD AND SMALL FOOTPRINT

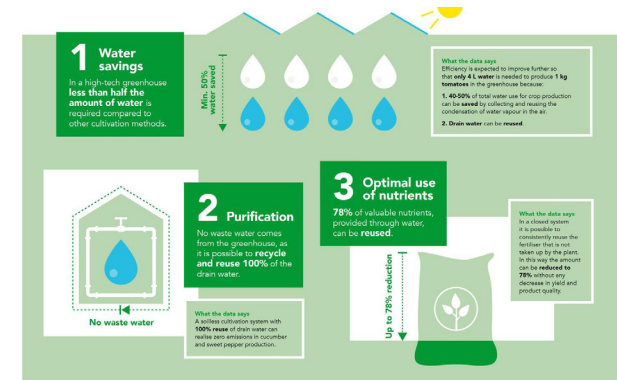
Vertical farming is an (urban) farming methods with consistent and frequent yield. Due to the indoor farming options, it allows for the production of food in close proximity to customers. This can boost local production and supply chains and lower emissions caused by transportation. Due to high-tech equipment and optimization techniques, the usage of resources can also be minimized. For example, high-tech greenhouse methods allow for the reduction of water by more than 50%, all the used water can be recycled and 78 percent of the nutrients provided through water can be absorbed by the plants.

Due to the small footprint that is required with indoor farming, a reduction of land-use is possible, making the agrarian landscape available for other purposes. Because the plants grow indoors, there is no need for pesticides either. Due to the controlled climate, the yield is more consistent and quality can be guaranteed. Soil less cultivation allows for ultimate freedom when it comes to farming; vacant buildings or existing buildings can be used for indoor farming. A well-planned vertical farm is located close to its consumers. This allows them to deliver fresh plants on short notice. It makes vertical farms very competitive in the fresh produce market.

### How the high-tech greenhouse protects and saves water



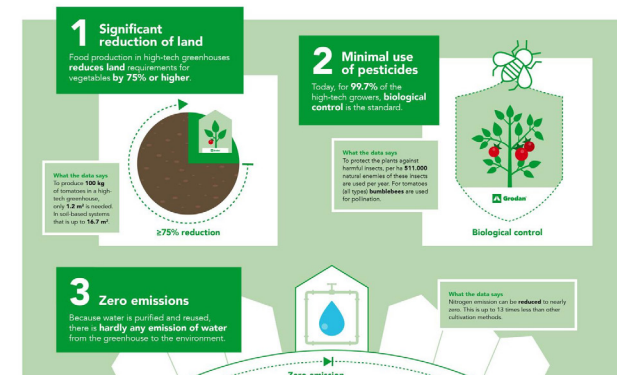
Want to know more?  
Go to [www.grodan.com](http://www.grodan.com)  
or contact [Sander van Gulderinge](mailto:Sander.van.Gulderinge@grodan.com),  
[sander.van.gulderinge@grodan.com](mailto:sander.van.gulderinge@grodan.com)



### How the high-tech greenhouse optimises land use



Want to know more?  
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[sander.van.gulderinge@grodan.com](mailto:sander.van.gulderinge@grodan.com)



### How the high-tech greenhouse ensures access to fresh food, anytime, anywhere



Want to know more?  
Go to [www.grodan.com](http://www.grodan.com)  
or contact [Sander van Gulderinge](mailto:Sander.van.Gulderinge@grodan.com),  
[sander.van.gulderinge@grodan.com](mailto:sander.van.gulderinge@grodan.com)

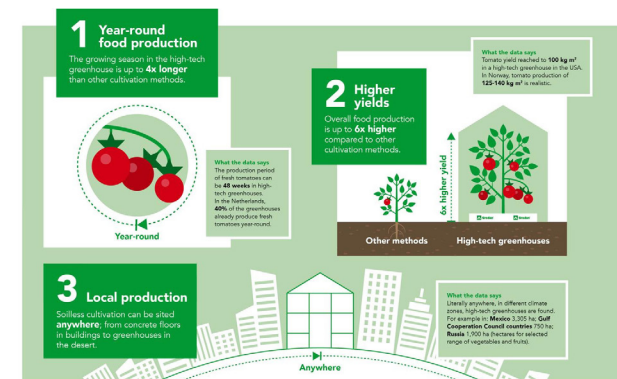


Figure 41. High-tech greenhouse principles (Grodan, 2021).





Figure 42. Vertical farming facility at Wageningen University and Research (WUR, 2021).

# FINDINGS & STRATEGIES

## *“What does an agricultural transition entail?”*

- *Realistic expectations regarding the reduction of eutrophication.*
- *Realistic expectations regarding emission reduction (from farmers).*
- *Government should facilitate the transition to regenerative farming.*
- *Holistic approach to the reduction of emissions (in bigger sectors).*
- *More reduction of emissions in the industrial and mobility sectors.*
- *Consideration of the monetary and ecological value of the landscape.*
- *Re-developing polluting peat landscapes into production landscapes.*
- *New landscapes for water management and CO2 sequestration.*
- *Reducing logistics, more local production and distribution chains.*
- *Establishing a better connection between landscape and city.*
- *Necessary spatial solutions facilitating the agrarian transition.*
- *Highly efficient, technologically driven urban farming.*

The Dutch landscape is unraveled through a collection of maps, illustrating the character of the country. To develop a more holistic approach to the agrarian transition, this chapter analyzes the value of the Dutch landscape through two value systems; the monetary value system and the ecological value system. Parameters contributing to the quantification are the production of resources, the presence of ecological systems and the soil composition. Together, these factors form an important point of departure for the agricultural transition.

While all attention seems to be focused on the farmers and the need to undergo a transition to a more sustainable way of farming, this won't solve all the problems regarding the national emissions. “The most realistic scenario would be a 50 percent ammonia reduction and 25 percent fewer greenhouse gases, which would only be half of the needed capacity for the climate target of 2050 (de Vries, 2022).” A broader perspective is needed to understand in which sectors we could optimize. For example, the agrarian sector contributes to 15 percent of the total emissions in the Netherlands, while the mobility sector contributes to 19 percent of the total emissions. Car usage and cargo transport contributes to 21 tonnes of CO2 yearly, while the emissions related to ammonia are only 6 tonnes of CO2 per year. In other words, re-organizing and optimizing mobility and developing more local clusters for production and distribution could facilitate a significant reduction of CO2. Promoting densification could also decrease the need for daily commute, when people can find an affordable house close to their work in the city area. The agrarian sector also uses a significant amount of natural gas (6.2 tonnes of CO2 in 2022), of which the greenhouse horticulture is a big contributor, while there are more sustainable forms of urban farming available nowadays that use much less energy, and allow for local production and distribution. Such examples are vertical farming in urban areas with optimized LED lighting and moderated watering systems. Another significant contributor to the national emissions are the peat landscapes, which due to irrigation oxidate and emit around 6 tonnes of CO2 every year. These peat landscape have little monetary and little ecological value and would therefore be perfect areas to redevelop into more regenerative landscapes, where biodiversity is guaranteed, water-management can be optimized and the local production of food and sustainable bio-based materials could provide cities with local resources.

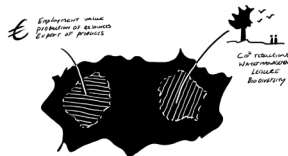
To conclude, other than focusing on the reduction of ammonia and methane, we should be focusing on a more holistic approach to bring down emissions, which have less impact on one specific group in society but rather benefits society at large. The transformation of the peat soil landscape can provide a regenerative farming area, suitable for leisure and the production of local materials and resources. The strategic densification and transformation of cities could accommodate for the agrarian transition and establish local circular production and distribution chains where the exchange of resources between various functions could be facilitated.



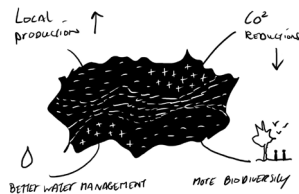
## Strategies



*The government should facilitate the transition to regenerative farming*

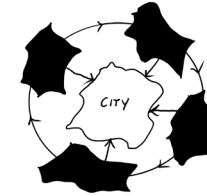


*Consideration of both the monetary and the ecological value of the landscape*

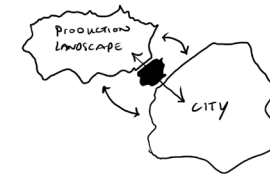


*Redeveloping polluting peat landscapes into climate-adaptive production parks*

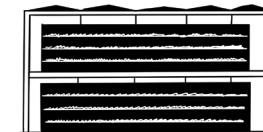
## Strategies



*Optimizing logistics: more local production/distribution chains for lower emissions*



*Provide spatial solutions for the agrarian transition, in dedicated (urban) areas*



*Consider food production with very efficient, technologically driven urban farming methods*

Figure 43. Concluding strategies for the Agrarian Crisis (Illustrations by the author, 2024).

# III. INDUSTRIAL URBAN AREAS

*“How can industrial urban areas be redeveloped  
into mixed-use neighborhoods?”*

**1000 KM2 OF INDUSTRIAL ESTATES** IN THE NETHERLANDS  
A LOT OF SPACE TO LIVE AND WORK



Figure 44. A representation of the industrial areas in the Netherlands (2021).

## INDUSTRIAL PRESENCE

Initially, the settlement of industrial areas took shape in the form of harbors, because industry was directly linked to logistics and transport. In the Netherlands this resulted in the formation of large harbor areas that were closely connected to the sea. During the end of the ninetieth century, the process of regional and urban planning, became more professionalized and various planning strategies were applied for the development of industrial areas. In the beginning, a ‘scattering strategy’ was applied, resulting in a distribution of smaller industrial sites across the country. Later on the ‘clustering strategy’ was applied, after it became obvious that clustering of similar functions would enhance production and logistics (van de Wall, 2020).

Due to history and the importance that the delta economy provided the nation with, a significant portion of the country is covered by industrial areas. Cities with big harbors, such as Amsterdam and Rotterdam, have large harbor areas, which are specifically designed for trade and logistics. But besides industrial harbor areas, these cities also have industrial urban areas, in close proximity to the city center. In many of the prominent cities of the Netherlands, there are significant industrial urban areas adjacent to city centers, providing potential spatial solutions for urban intensification. The largest cities in the Netherlands in terms of land coverage are Amsterdam (243 km<sup>2</sup>) and Rotterdam (132km<sup>2</sup>), other big cities fall within the range of 60km<sup>2</sup> - 100km<sup>2</sup>. When the land coverage of all of the major cities in the Netherlands are added up, this results in about 976km<sup>2</sup>. This is still less than the approximate 1,000km<sup>2</sup> of industrial areas that are present in the Netherlands. Redeveloping industrial areas in small towns may not be feasible, but large areas in big cities such as Amsterdam, Rotterdam, Utrecht etc. could offer space for mixed-use development; areas that could provide spatial solutions for both the housing crisis and the agrarian transition. As an example, in the municipality of Rotterdam, there is 73km<sup>2</sup> of industrial harbor areas (which is as big as a city) and about 15km<sup>2</sup> of industrial urban areas, which is 3 times as much space as the entire city center of Rotterdam. Imagine that only 10 percent of these areas can be re-developed (1,500,000m<sup>2</sup>) this is as big as the city center of Delft. The same way of thinking could be applied to other prominent cities in the Netherlands that are in need of housing and that could provide solutions for the various transitions we face, which all require space. Industrial urban areas hold a lot of spatial potential, re-developments could improve existing industrial urban areas. A mix of functions in these areas could establish new local ecologies while upgrading the existing urban environment. This way current residents in the vicinity, but also future generations can benefit from the long-lasting processes that could be set in motion.

To investigate how industrial urban areas could be redeveloped into mixed-use neighborhoods, a selection of case studies are developed. Through analyzing the strategies, methods and outcomes of recent developments, a better understanding is established of the potential of industrial urban areas. Through various interviews, better insights are acquired regarding the considerations and strategies that can be applied when re-developing an industrial urban area into a mixed neighborhood.

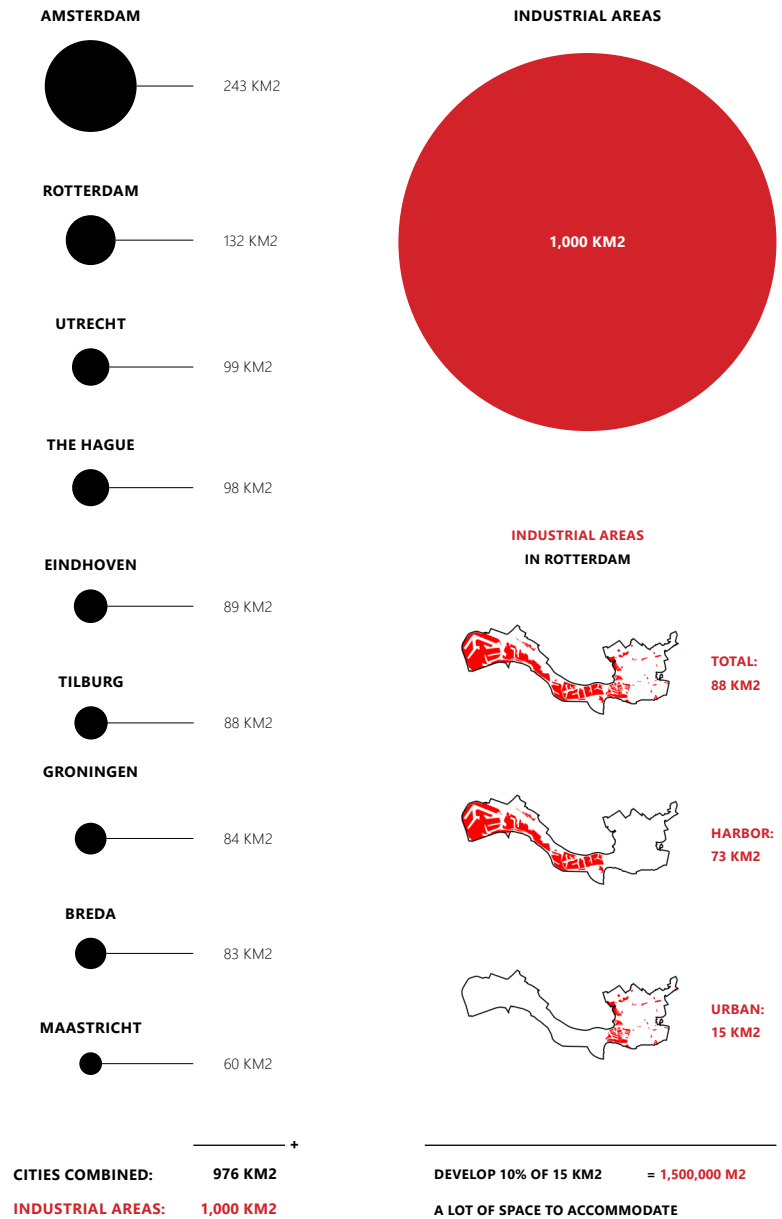


Figure 45. Illustration of the land coverage of urban areas in the Netherlands in comparison to the presence of industrial areas (BAG, 2024).



# ZOHO KWARTIER

*The redevelopment of an old industrial urban area into a vibrant mixed-use neighborhood.*

**Timeframe:**

2019 - ongoing

**Location:**

Rotterdam, The Netherlands

**Size:**

75.000 m2 (including 600 dwellings by 2035)

**Client:**

Municipality of Rotterdam and Havensteder

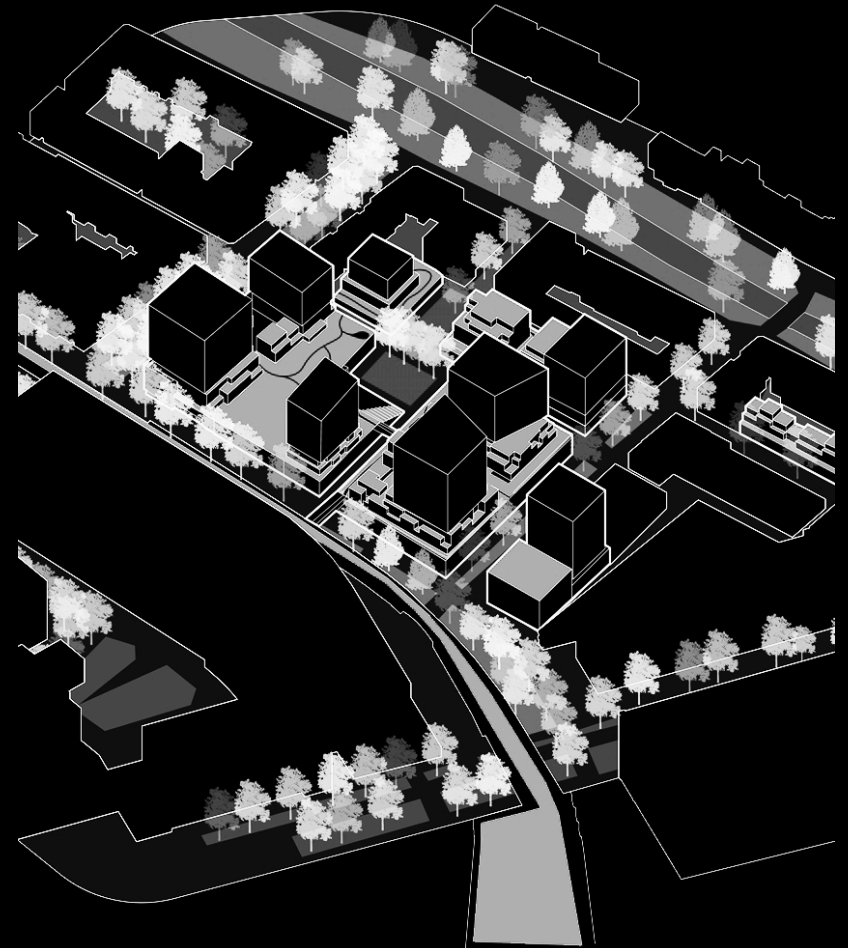
**Developers:**

Leyten and Stebru

**Planners and architects:**

Echo Urban Planners, Orange Architects, Studio Nauta, MoederscheimMoonen Architects, More Architecture, Space Encounters, INBO, MTD Landschapsonwerp.

*\* Interview about the development of ZOHO, with Tjerk ten Doeschate, developer at Leyten.*



## ZOHO - FROM DUST TO DEVELOPMENT

At the heart of the ZOHO district in Rotterdam, I have interviewed Tjerk ten Doeschate, developer at Leyten; an independent real estate developer and investor, and one of the main partners in the development of the new ZOHO district in Rotterdam. Leyten has an expertise in the sustainable development of inner-city areas with a focus on affordable rental housing and urban facilities. While we were sitting in the *ZOHO HUB* — a social information point for partners, stakeholders and local residents at the heart of the neighborhood — ten Doeschate told me more about the challenges and the process behind the transformation of the district, starting with an introduction to the historical context the district is characterized by.

The ‘Zomerhofkwartier’ in Rotterdam, also called the ZOHO district, a former small-scale urban industrial area, is being redeveloped by Leyten into a mixed-use neighborhood with attention for history, the diverse urban context, and consideration for the current and future residents and users of the district. The area is outlined by a historical event; the bombing during the Second World War. The district is encircled by the remarkable urban ‘fire threshold’, which encircles areas in the center of Rotterdam that have fallen victim to the bombing and spread of fire during WWII. This is displayed with red lamps in the ground which subtly illuminate during the evening. After the bombing in Rotterdam, the city center was devastated, many areas and buildings had to be re-built to boost and re-start the Dutch economy after the war. The ZOHO district was designated to be an area where light industry could take place, with production and office spaces close to the center. This development could stimulate urban activity and allow for the housing of temporary businesses in close proximity to the center.

After the reconstruction of the city center, the industry and offices that were located in the district underwent an increase in scale. The industry moved to the periphery, to allow for growth and expansion. The migration of the industry and offices resulted in a gradual decline of the ZOHO district where the deterioration of buildings started to become a concern. The big housing corporation; PWS (which after a merger would be known as Havensteder) bought a number of properties in the district with the ambition to develop them to counteract the spatial decline of the area. During this time a lot of spaces were rented out for relatively low rents, to creative entrepreneurs and artists, which instigated a positive development of the area. The new occupants were united and very active and involved in the neighborhood and started to improve the urban conditions by making the neighborhood more green and social. In 2008, the financial crisis unfolded and this resulted in a change in the development of properties and areas. Partly due to a number of scandals that had taken place within large social housing corporations, significant restrictions were imposed on corporations and they had to focus mainly on their core task; housing, and no longer on area development. This led Havensteder to sell this district and the real estate, and together with the municipality they organized a tender, to look for a party that could take over the area for redevelopment.

1940



Figure 46. Remains of the 'Zomerhof straat' (Stadsarchief, 1940).

1960



Figure 47. New plan for the 'Zomerhofkwartier' in 1960 (E. van Es).

1961



Figure 48. Demolition of the 'Zomerhofkwartier' (Stadsarchief, 1961).

1964



Figure 49. Light industry and offices characterized the area (1964).

# THE REDEVELOPMENT OF ZOHO

After the economic crisis, new ways of developing and building arose. An exemplary project in the vicinity is the ‘Luchtsingel’ by Zones Urbaines Sensibles (ZUS). This has been the world’s first crowdfunded public infrastructure project, connecting crucial urban areas through a three-dimensional cityscape, made out of wood. By the means of Online applications, citizens were stimulated to contribute to the low-budget development. Starting with 25 euros, donors could have their personal message engraved on one of the wooden planks that would make up the bigger structure. The four-hundred meter bridge ensures better connectivity and spatial activation of initially separated areas (ZUS, 2014). Connecting to the former elevated train tracks, the Hofbogen, accessibility will be extended into the neighborhood with a green elevated park on top of the old train tracks which runs deep into the northern neighborhoods of Rotterdam. One of the first important areas the future ‘high line park’ passes is the ZOHO district. Future urban planning will have to take these co-existing developments into consideration.

While the municipality was developing a tender to redevelop the area, the local entrepreneurs had united and written a manifesto for ZOHO. Meanwhile, they were collectively working on small improvements in the neighborhood. Their strategy was to develop the area ‘bottom-up’, instead of ‘top-down’ where everything would be wiped clean without considering the existing neighborhood. After the economic crisis, this community continued to improve the neighborhood with limited resources, a special phenomenon called ‘slow urbanism’. Although the neighborhood would still deal with vacancy and an absence of housing, this bottom-up approach resulted in a very vibrant ZOHO district, where artists would take advantage of low rents, pop-up stores would arise, community centers would accommodate for residents and office spaces were filled with creative entrepreneurs.

*“The entrepreneurs were allowed to contribute to the tender conditions and ultimately received a vote in the assessment committee. Which is special, because they were able to contribute to the memorandum of principles. In other words, they influenced the requirements that were placed on all market parties proposing a plan. Which led to ideas to foster the activity and creativity that was present in the area. This is an unusual, but innovative way of working.” - T. ten Doeschate (2024).*

This resulted in a tender that required a very mixed neighborhood, full of activity and creative entrepreneurs. With the requirement to bring back commercial functions, office space, and social spaces in combination with inclusive living. Another prerequisite of the tender was that a part of the available square meters for offices would be rented out for reasonable prices, to invite the creative entrepreneurs to stay in the area and make sure the character of the district won’t be lost. Leyten, in collaboration with Stebru made a plan for the tender. They collaborated with a variety of architects and urban planners to foster the qualities of the ZOHO district.

2014



Figure 50. The ‘Luchtsingel’ by ZUS, to rejuvenate the area (2014).

2014 - 2018



Figure 51. The ZOHO district as an artistic, trendy urban area (2018).

2019 - Ongoing



Figure 52. Connecting to the ‘Luchtsingel’ (Orange architects, 2019).

2019 - Ongoing



Figure 53. The new densified ZOHO district (Orange architects, 2019).



## THE PROPOSAL

The tender conditions informed the team that the existing urban context was very important in the development of the ZOHO district. The conditions prescribed awareness for various special buildings, although not monuments, they were characteristic for the area and should therefore be treated with care. The concept of the team revolved around the preservation and enhancement of the existing urban fabric. The plan that the team developed consisted of three layers. The first layer represents the existing urban fabric with the typical post-war reconstructive architecture, this layer includes commercial buildings and social meeting places. This layer is an urban laboratory of social functions, hence the name the 'Lab layer'. The second layer is called the 'land layer', and relates to the brick architecture of the historical pre-war buildings in the area. The 'Lab layer' is covered by a green roof landscape, providing the 'Land layer' with greenery and connects the ZOHO district to the elevated 'luchtsingel' which runs parallel to the project and is also under development. The proposed roof park could be easily connected to this elevated park in the future. The third layer is called the 'city layer', where high white volumes are placed on top of the second layer. The higher and lighter building volumes refer to the metropolitan area in the center of Rotterdam, just behind the district.

*"The combination of layers provides an urban framework that strongly refers to the context, which results in a valuable concept."* - T. ten Doeschate (2024).

Sustainable development and reducing emissions were important ambitions for the team. Ten Doeschate explains that, sometimes preservation can be cheaper than demolition, because everything that is preserved, no longer has to be built. Therefore the team examined the buildings that were present in the area to understand the opportunities. To determine which buildings could be preserved, several factors were taken into consideration. Firstly, the historical value; whether or not a building is a monument affects how it can be redeveloped. A second important factor is the cultural value; where a building represents an important identity of the neighborhood. This can also translate into social value, where residents and users of the area could be attached to certain buildings or facilities in the area. It's also important to investigate if a building is suitable for transformation, since that could provide benefits, as long as the cherished character of the area is preserved, explains ten Doeschate. The urban assignment and ambitions are also relevant to consider; if the area needs to increase significantly in density, the existing buildings can not always accommodate for the new capacity. That was the case in ZOHO, where many extra layers had to be added on top of existing buildings. This required technical considerations and calculations to see if the existing structures could accommodate for the many new layers and higher volumes. In many cases the preservation of buildings was not feasible, so completely new structures or local new structures will have to be built to guarantee the structural integrity of the newly added volumes. A selection of existing buildings could be preserved or transformed.

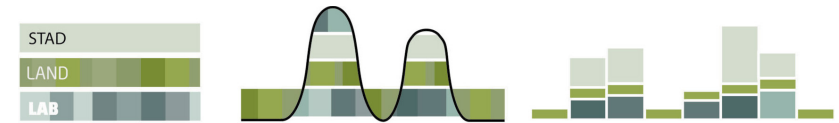


Figure 54. Concept diagram to illustrate the layering of various programs in the new ZOHO plan (2019).



Figure 55. Elevation of the proposed plan, showing the three layers (labs, land and city) in the context (2019).



Figure 56. Conceptual collage of the proposed layers in the new plan; Labs on the ground floor, stone podiums and light towers (2019).

## THE PROCESS

The ZOHO district is a relatively big project, where various building blocks will be redeveloped, various programmatic functions need to be incorporated and the public space will be redesigned as well. Many stakeholders are involved, such as the municipality, a housing corporation, developers, urban planners, landscape architects, and various architecture firms and contractors. Besides the developing parties, there are also many stakeholders to be managed on the receiving end; entrepreneurs that are currently situated in the area, residents that live close by and smaller local communities. This required a strategic and streamlined approach.

During the development of the project, a delegation was assembled consisting of local residents, tenants, the municipality, and the housing corporation (Havensteder). Every quarter, the group meets up to discuss the planning and the process. Next to the quarterly meetings, a curation group was established where topics related to the current inhabitants and entrepreneurs in the area are discussed. An example of discussion topics is the current occupancy of the commercial functions and available workspaces. Together with the neighborhood a set of criteria was formulated to determine which target groups are eligible, and which groups will get priority for the new workspaces. Decision making and reaching unanimity is often a big challenge, as opinions and interests of the various stakeholders can be different. The opening of a physical meeting space for the team and the neighborhood was a great move. The ZOHO HUB is a physical space in the heart of the district, where all the stakeholders are welcome to visit, discuss concerns, inform about the development and get a better understanding of the to-be-developed neighborhood. A large physical model of the area helped a lot in the communication with various stakeholders.

*“What is great about the ZOHO HUB, which we have established in the neighborhood, is that you learn to better understand how different people think about the new plans, and that also provides the opportunity to discuss concerns and ideas with residents.” - T. ten Doeschate (2024).*

While the area is under development, the team from Leyten is present at the HUB once a week for interaction with the stakeholders. In the run-up to the zoning plan, information evenings with drinks and discussions were organized regularly. Some people were critical of the new, high volumes that would be added to the area, and other residents were very enthusiastic about the new developments and couldn't wait for it to be finished. Under local entrepreneurs uncertainty prevails as they are depending on temporary rental contracts, so investing in their business is usually not an option, but on the other hand the temporary nature of the contracts allows companies to benefit from the low rents. An important reason for phasing the project is to always have work spaces available during the development. There was also interest from the Minister of Housing and Spatial Planning, whom visited the ZOHO HUB during the development for a tour and presentation in 2023.



Figure 57. The process started interactively, exploring physically how the identity of the district could be fostered while redeveloping (2019).



Figure 58. A very big, circular physical model was built for interactive brainstorm sessions with the team and also for the neighborhood (2020).



Figure 59. The Minister for Housing and Spatial Planning visited the ZOHO HUB in Rotterdam for a tour and presentation (2023).



## THE RESULT

The collaboration of many stakeholders has resulted in a plan that takes the history, urban context and local inhabitants into consideration. Consisting of three layers, the new plan blends well into the urban environment, while enriching the existing urban fabric. The tender conditions have prescribed a specific density, to make the development of the area financially feasible, which resulted in the addition of higher volumes in the proposal of the new plan. The new dwellings will add a new dynamic to the area which could enable more social cohesion and social activities. Space has also been left between the higher volumes for airiness, sight lines and light to enter the plan. At ground level, the ambition is to make it a car-free zone and to create refined public space. The roof garden creates a second ground level, allowing residents to live close to the center in green surroundings. In the past, a corner building, one of the largest plots, was painted with blue and white stripes, this building is characteristic for the district and the facade panels will be brought back into the new plan. The plan also includes space for bars and restaurants. The housing corporation (Havensteder) will buy a significant amount of the new houses, so there will be many affordable houses in the area (around 50%). The other half of the new housing stock will be geared towards the free rental sector and buy-to-live sector. There will also be a homeless shelter and assisted living facilities. The new ZOHO district will be developed in phases, ensuring a predictable and smooth development.

*“A larger plan or area development is usually developed in phases, firstly because you cannot build everything at the same time in terms of logistics, and secondly to spread the financial risk.” - T. ten Doeschate (2024).*

The development in phases allows for flexibility while developing; because the development will take a lot of years, the specific demand of the real estate market might change as well. While there could be more demand for small homes in the first phase, there may be more demand for larger housing types in later phases and there should be room to adjust the construction plans accordingly. Selling hundreds of homes at once to an investor or corporation is not a realistic scenario, therefore phasing helps with financing the development. In addition, public space also needs to be re-developed; installation of utilities will happen first and when construction activities are finished, public space will be arranged. This is done at the end of the process, so that the landscape design remains in tact and can be used immediately. Ten Doeschate explains that it is an important step in area development to have a zoning plan established and make sure it is irrevocable. In the case of ZOHO, the zoning plan had to be adjusted together with the municipality in order for the new development to attune to the requirements. The team has made the new zoning plan for ZOHO available for inspection in September (2023) and comments have been submitted. In case of an objection, the Council of State will assess the zoning plan. If there are no objections to the zoning plan, the zoning plan will become irrevocable in the summer of 2024. Then, the development of the district can continue.



Figure 60. A roof landscape is situated on top of the first layer of the buildings, providing green public space for residents and visitors (2020).



Figure 61. The existing public space is upgraded, with a commercial plant, providing room for social encounters and rooftop accessibility (2020).



Figure 62. Some of the remarkable buildings are kept, with creative workspaces to maintain the characteristic atmosphere of the area (2020).



# MERWE- VIERHAVENS

*The redevelopment of an industrial urban harbor district into a mixed-use neighborhood with circular ecologies.*

**Timeframe:**

2019 - ongoing

**Location:**

Rotterdam, The Netherlands

**Size:**

220.000 m2 (Including 5.000 dwellings by 2035)

**Client:**

Municipality of Rotterdam and  
Programmabureau Rotterdam Makers District

**Developers:**

To be determined

**Planners and architects:**

Delva Landscape Architecture and Urbanism, Site Urban Development,  
Skonk, Goudappel Coffeng, Plusoffice Architects, Kettinghuls,  
A2 Studio (artist impressions)

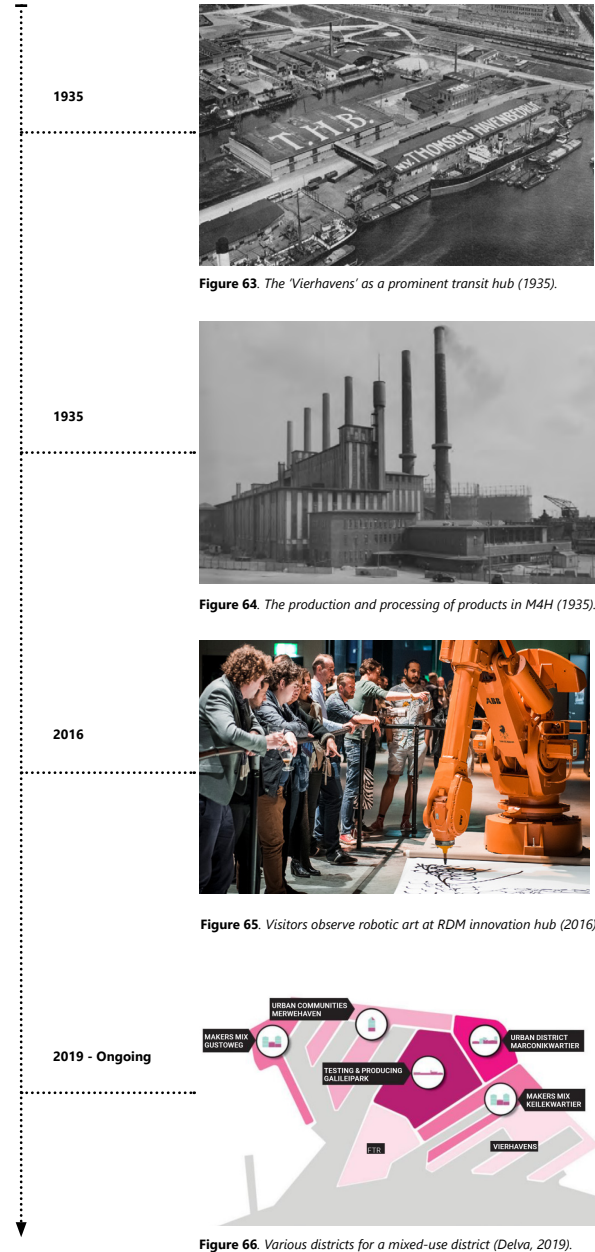
*\* Interview about the development of Merwe-Vierhavens (M4H),  
with Walter de Vries, regional planner at the Municipality of Rotterdam.*



# M4H - FROM HARBOR TO MAKERSDISTRICT

At the headquarters of the municipality of Rotterdam, I interviewed Walter de Vries about the development and planning of the Merwe-Vierhaven district. Walter de Vries, graduated from TU Delft, has been working on the intersection of urban planning and regional planning at the Municipality of Rotterdam since 2008. Seated at one of the sub-volumes of *De Rotterdam* building — with magnificent views over both the city and the harbor area — Walter described his involvement in the formulation of a vision for M4H. During our meeting he told me more about the factors that have contributed to the unique spatial framework that was developed in collaboration with various stakeholders and partners during the extensive process.

Between 1910 and 1932, the ‘Vierhavens’ and the ‘Merwehaven’ were developed as inner-city harbor districts. Due to the abundant trade and harbor activities, more space was required to facilitate far trade and transit. On the south side of the river, various large harbor districts were constructed for the transit and storage of large bulk materials such as coal and ores. Local entrepreneurs and the director of municipal works developed a vision for the northern river shore; one of the biggest harbors which could foresee in the transit of general cargo, such as fruit and juices. The new harbor was a success; the amount of new ships entering the harbor was multiplied by a hundred. However, during the second world war, the harbor district was damaged severely and had to be reconstructed after the war. Due to the important trading position, this area received a form of urgency in reconstruction over the city center of Rotterdam. During the seventies and eighties, the harbor district underwent a flourishing time, and was transformed into a fruit district, and the area was also known under the name of ‘Rotterdam Fruit port’. This development was accompanied by the development of a modern distribution center for fruit, fresh vegetables and juices. The district attracted a lot of factory workers, and the neighborhood around the area developed with a lot of social housing to accommodate for the factory and harbor workers. Towards the twenty first century, the employment opportunities decreased due to industrial automation and international competition. This led to a gradual decline and change in character of the area; companies moved out and vacancy became more present (Drift, 2017). As industrial functions moved out, contemporary and creative functions moved in. Together with the RDM campus on the opposite of the river, this larger urban harbor district developed into an innovative makers-district. New technology such as robotics and material studies were conducted, and large research and educational institutions are situated in the RDM district. The success of the transformed RDM district into an innovative research and educational campus sparked the idea to develop the M4H district into a mixed harbor area with the inclusion of various programs. The municipality, together with various stakeholders and partners, developed a spatial framework for M4H. The area is divided into several districts to allow for production, innovation, work, leisure and living. The plan will be developed in phases, into a mixed-use innovation district in the coming decades.



## THE PROPOSAL

The harbor of Rotterdam is vast, and continuously in development; as it expands more into the sea, it gradually retreats from the urban borders (Delva, 2019). Areas that were previously used for storage, production and logistics, have now become creative districts for innovative companies. A good example is the RDM district, a site that was previously used for the construction-and-reparation of large ships. In 2004, the redevelopment of this area started, which resulted in a mixed district for various functions; companies, educational institutions, and innovative entrepreneurs that help in the innovative transition of the larger harbor area. In the previous decade, the strong dependency of the port on fossil fuel became a prominent point of discussion, especially with the global sustainability goals that need to be attained to (The Paris Agreement, 2015). The port of Rotterdam is therefore in need of innovation, to reduce emissions and to innovate the industrial processes of the harbor. Areas like the RDM campus contribute to the growth of innovation in the harbor area, and while it can't expand, the partly vacant harbor area on the opposite of the campus could offer spatial solutions. While the RDM campus is not very well connected to the city center or to cities in the vicinity, the Merwe-Vierhavens (M4H) is very well connected to the city center of Rotterdam and other important cities like Schiedam, Delft and the Hague. Therefore, the ambition to redevelop the M4H district into a mixed-use innovation district was set in motion.

*“The port is very much based on fossil energy, both logistics and chemistry in the harbor area need to become more sustainable. That is a huge operation which should be completed within the coming thirty years. This requires innovation and knowledge and well-trained people, pioneers and new start-up companies that will drive that innovation.” - W. de Vries (2024).*

The M4H innovation district is situated at the edge of the city, where it meets the outer brim of the Port of Rotterdam. The M4H district is large, comparable in size to the city center of Rotterdam, and with various connections and mobility already in-place. The industrial residue space between the larger port and the city is quite outdated, but due to the location and context it is a suitable area for redevelopment. The area is characterized by a combination of large buildings that were initially used for industrial purposes, various monuments and also smaller building blocks and towers close to the metro station. This area, as a transition zone between port and city, offers an interesting place for the mix of various building types- from larger buildings to smaller blocks that blend well into the existing context. The spatial framework invites parties that are interested in developing in this area. It provides clear guiding principles, informing parties about the scope they should operate in, and it informs about future ambitions for the area. The spatial framework also contains principles for the development of infrastructure and public space in and around the district. These principles are fundamental for the zoning plan and assure a qualitative development of the M4H district (Delva, 2019).

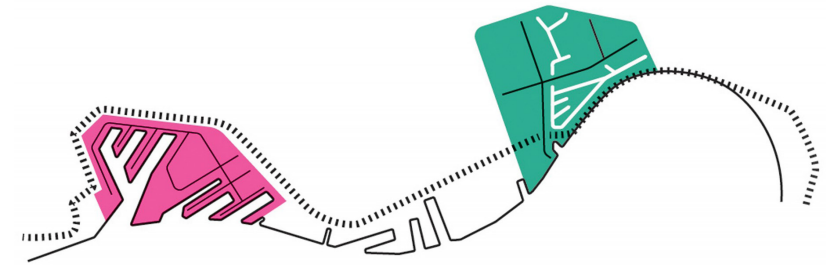


Figure 67. The M4H innovation district is comparable in size to the city center of Rotterdam and they are well connected (Delva, 2019).

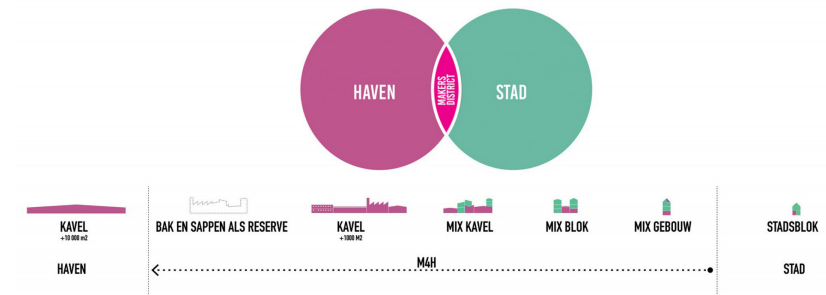


Figure 68. At the interface between city and port, outdated port areas offer the perfect conditions for an innovation environment (Delva, 2019).

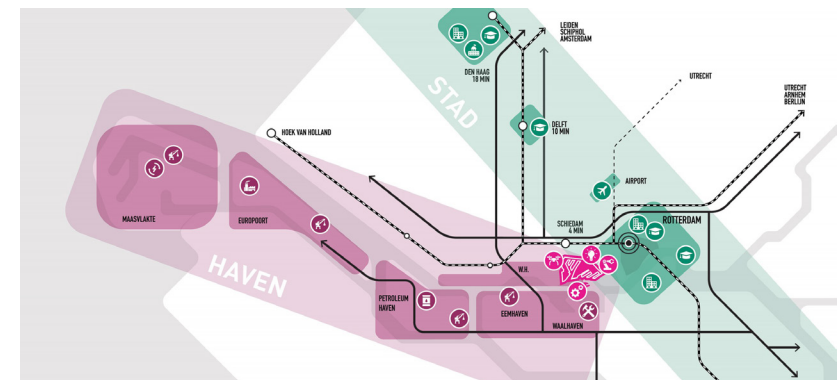


Figure 69. The Makers District is located where city and port meet and benefits from the best of both worlds (Delva, 2019).



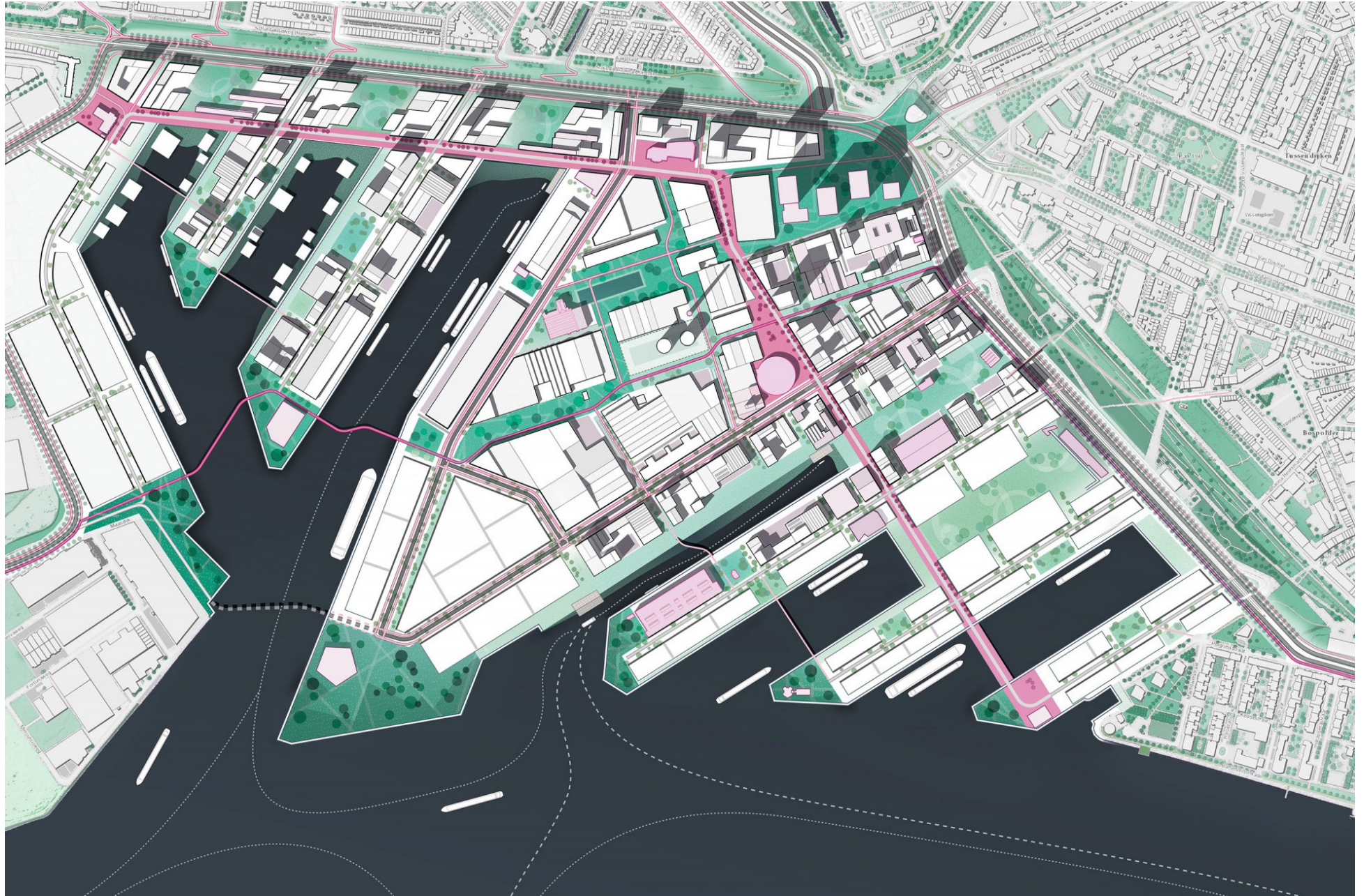


Figure 70. A spatial framework for the industrial urban area Merwe-Vierhavens (M4H) in Rotterdam (Delva, 2019).



## SPATIAL PREREQUISITES

The redevelopment of an industrial urban area requires a considerate approach, hence spatial prerequisites were formulated to ensure a proper development of the district. First of all, the authenticity of the district is fostered by minimizing demolition, and to carefully consider what can be retained or transformed. In terms of industrial heritage, special attention is paid to buildings, quays, bollards, and historical traces like old railway lines. These assets will be preserved and where possible highlighted so that the history of the area can continue to reflect in the public space design, and in this way make the historical DNA of the district visible. De Vries explains that the municipality has a special department for architectural history and culture, and they performed a ‘cultural-historical exploration’ of the M4H district. During the process, iconic buildings in the area and monuments are mapped out, for consideration during the redevelopment of the area. A distinction is made between monuments and iconic buildings; iconic buildings can not be demolished without good reasoning and are suitable for transformation. Monuments can not be demolished and should be preserved, but subtle transformations are possible to retain the cultural-historical character of the area. Secondly, the identity of the area is maintained by respecting the existing user group of the area. There are many innovative makers that were already situated in the area, whom are crucial for the innovative identity of the area. Originally they were working in large industrial halls for relatively low rents, this can not change suddenly as it will affect the main target group of the area which is vital for its identity. Together with the municipality of Rotterdam, Delva (landscape architecture and urbanism) developed various design principles for the area, which are strongly related to the original character of this old harbor area. For example, the new building heights will have to conform to the existing building heights to ensure a consistent ensemble. There will be a mix of large and small grain developments which suits the mixed nature of the area. The maximum height will be related to the original harbor crane height of about one hundred meters, but this deviation in height is only allowed if the development will add significant value to M4H. A special requirement to accommodate suitable space for innovative makers in the district is the flexibility of plinths with a minimum clear height of 6 meters. The organization of mobility is also an important point of departure for the urban plan, where the transition to a more collective form of transport is considered. Mobility is optimized by separating fast traffic from slow traffic, introducing a refined network for cyclists and pedestrians, collective (smart) mobility such as vehicle sharing and water transport, and finally the optimization of parking. This will be removed from the street scape and multi-functional local hubs are build to accommodate for parking, but also for logistics, water collection, and waste services. This leads to a comprehensive collection of public spaces and buildings that reflect the cultural and historical significance of the district.

*“There will be a diverse palette of environments in Merwe-Vierhavens, which will lead to a vibrant industrial innovation district.” - W. de Vries (2024).*

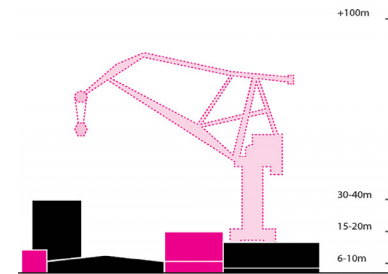


Figure 71. Building heights: derived from the context (Delva, 2019).

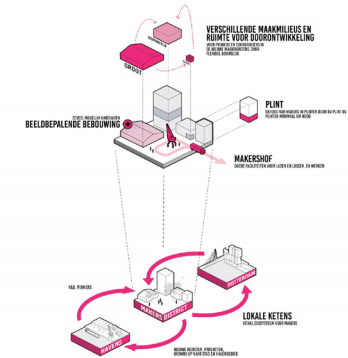


Figure 72. Urban grain: A mix of buildings and ecologies (Delva, 2019).

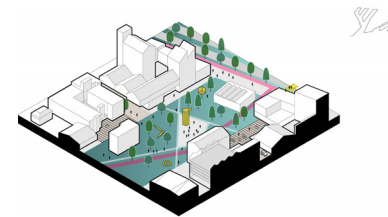


Figure 73. Public parks: room for activities (Delva, 2019).

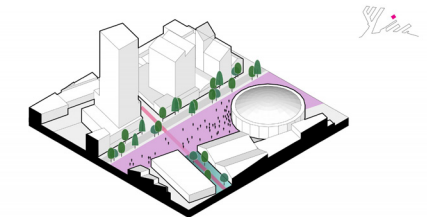


Figure 74. Public squares: highlighting historical buildings (Delva, 2019).

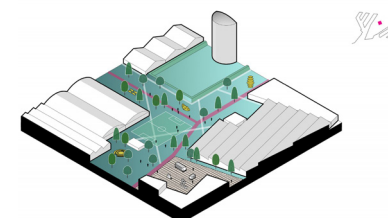


Figure 75. Public facilities: room for sports (Delva, 2019).

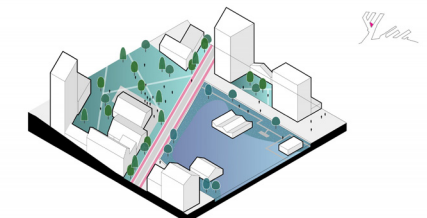


Figure 76. Borders: Prominent axis and soft water edges (Delva, 2019).

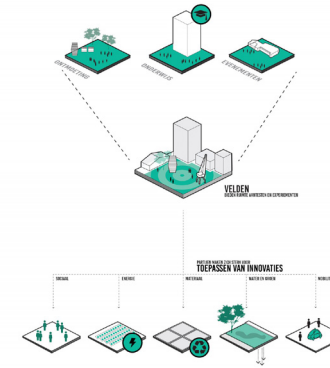


## SUSTAINABILITY AND CIRCULARITY PRINCIPLES

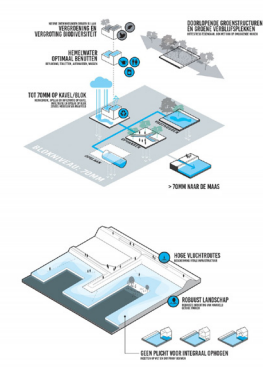
For the overarching vision of the area, guiding principles were formulated to give direction to a future-proof development of M4H. The vision was centered around collectivity, with the ambition to establish local ecosystems and ecologies in the area, to make better use of the programmatic mix and to instigate a symbiosis between functions. One of the main strategies is to upgrade the existing public space by introducing greenery, which has many positive effects for the environment; reducing the urban heat island effect, improving local biodiversity, and it adds qualitative spaces for social interactions. Due to the close proximity to the river, water management is an important principle; buildings will be developed that can withstand wet and dry periods, tidal parks will have soft edges towards the water, and there will be retention and storage of water in the area (Delva, 2019).

*"In the past, we transformed the Dutch Delta into a Port region, which is characterized by hard edges, cranes and warehouses. Now we want to soften the character of the industrial district and bring back some of the original delta dynamics. We want to focus on water quality, greening, heat stress, biodiversity and recreation." - W. de Vries (2024).*

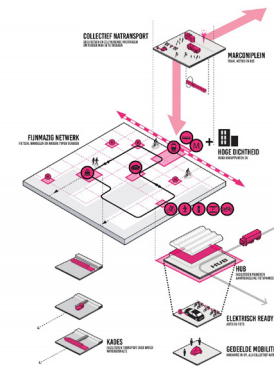
The team also developed guiding principles for sustainable mobility; sharing mobility and the collective use of infrastructure and logistics is proposed. Various Hubs will be developed that host shared parking places, but also delivery and pick-up points for companies and residents. The hubs will provide sharing mobility and electrical charging of vehicles. Besides mobility, the Hubs will also accommodate in the efficient and circular use of residue streams. These buildings can be a central point in the circular material economy of the district. Materials collected after demolishing or disassembling of buildings can be collected and sorted in the hubs. Various materials or systems could be re-used in the development of the district. New materials that arrive for the to-be-developed buildings can also be stored in the Hubs for efficient execution of the building processes. The new buildings will have a 'material passport', which will promote the re-use of the materials in a circular way towards the end of their natural life-cycle. The re-use of waste materials (for example black water) could be present as well; useful materials could be recovered from the black water before it is disposed. The engine behind all the processes is the production and distribution of energy in the district. Energy will not solely come from the grid, but will also be locally produced by the means of energy roofs-and-facades which can be covered with solar panels. Energy can also come from geothermal sources in the ground and the use of the water of the river for thermal storage. Dedicated areas where energy is harvested from waste materials in the form of bio-mass and heat could also be included due to the mixed nature of the area. The Hubs are the 'batteries' of the district, where energy can be stored electric mobility can be accommodated with the necessary resources (Delva, 2019).



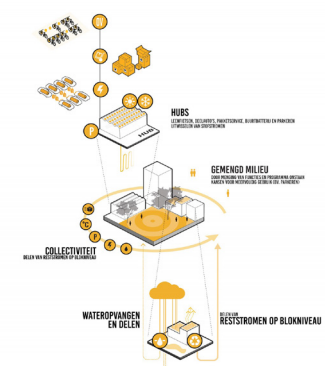
**Figure 77.** Local biodiversity and green public space (Delva, 2019).



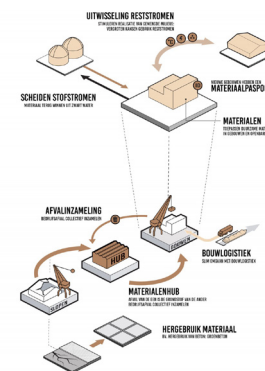
**Figure 78.** Local water management and retention (Delva, 2019).



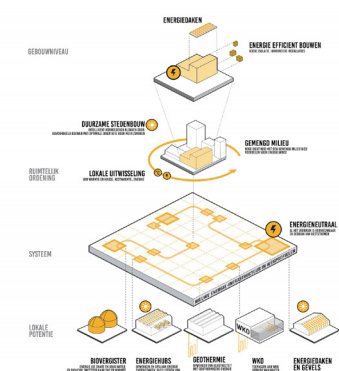
**Figure 79.** Local (collective and shared) mobility (Delva, 2019).



**Figure 80.** *Local ecologies exchange resources (Delva, 2019).*



**Figure 81.** Local (residual) flows of materials (Delva, 2019).



**Figure 82.** Local (sustainable) energy production (Delva, 2019).

## THE RESULT

The development of the M4H district is rolled out over a span of thirty years and will happen in phases. Until 2035, the ambition is to add 5,000 new dwellings to the district, and in the years that follow this number could grow to 10,000 dwellings. For the development of the district, the municipality of Rotterdam has been in close contact with the government. This has to do with the enhancement of the public transport connection between Leiden-Dordrecht. The train track which now consists of a double track will be upgraded to four tracks to improve the mobility and connectivity of the major cities that are connected to this axis. On this axis, various strategic areas for development and densification have been appointed. This transportation axis connects important cities in the larger region of South-Holland. These cities provide important facilities such as renowned companies and universities. Cities such as Rotterdam, with the Erasmus University, Schiedam, with important industry and companies, Delft, known for Delft University of Technology and many innovative tech-companies, but also the Hague and Leiden with crucial institutions and universities. Along the axis, there are plans to add new stops to make several areas more accessible, one of these new stops could be the 'Van Nelle Station', providing more accessibility to the Spaanse Polder district. Another important location that is connected to this axis and that has been appointed for strategic redevelopment is the M4H district. The government will contribute to the development of the expansion of the public transportation axis, and together with the adjacent municipalities will discuss how certain districts could be developed and densified. The government also partly supports the development of the designated areas to make the developments financially feasible within the given time frame.

*Building in cities is complicated, there are always vested interests, so contracts have to be bought out or you have to get the soil remediation done. Building in the polder landscape can be quick and easy, but it is not sustainable in the long term. It takes up far too much space and it definitely does not result in the best cities in terms of mobility and energy. - W. de Vries (2024).*

The result is a vibrant mix of buildings, programs and functions, with a central focus on collective use and optimizing local ecologies to make the area sustainable and circular. An innovative makers district, with a view on the harbor and well-connected to the city center of Rotterdam and other important cities in the larger region. The development allows for an upgrade of the existing urban space, which will make the large urban industrial district more climate-adaptive and future-proof. The area contributes to the mitigation of the housing crisis, while adding quality and value to the current citizens and new residents. Culturally significant buildings and monuments will be revived and re-purposed to make better use of the existing built environment. The original Dutch Delta finds its way back into the urban harbor district, characterized by soft green boulevards that give access to the waterfront while improving biodiversity and introducing new local biotopes and ecologies.



Figure 83. Concrete harbor edges are converted to green boulevards that cool down the area and provide leisure and activities (2020).



Figure 84. A diverse mix of building types make up the new skyline of the industrial area, with greenery and access to the waterside (2020).



Figure 85. Remarkable buildings and monuments are preserved as icons, contributing to the character and vibrant public space in M4H (2020).

# FINDINGS & STRATEGIES

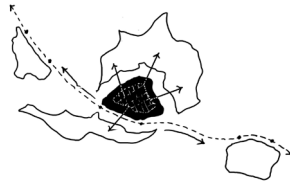
## *“How can industrial urban areas be redeveloped into mixed-use neighborhoods?”*

- *By creating a stronger regional network through re-development.*
- *By the involving governing bodies, to allow for legislative procedures.*
- *By the division in districts, allowing industry to mix with other functions.*
- *By (tender) prerequisites, to ensure incorporation of relevant ambitions.*
- *By historical and cultural analysis, for preservation and transformation.*
- *By performing financial assessments during the development.*
- *By urban integration through prescribed building sizes and heights.*
- *By social participation and respecting the identity of the area.*
- *By allowing for local ecologies that foster circularity and collectivity.*
- *By upgrading public space with greenery, squares and functions.*
- *By collective mobility and energy production and distribution.*
- *By providing an area that is accessible and pleasant to live in.*

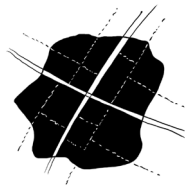
Both the housing crisis and the agrarian crisis require spatial solutions. The agrarian transition will need to make place for many functions and people that are forced to migrate from the countryside. This also offers opportunities; a careful reconsideration of the existing urban fabric and ‘finding space’ to accommodate for the necessary transitions. The construction of housing in urban areas allow for a more efficient use of existing buildings and facilities, while upgrading the urban environment. The need for extra infrastructure, and additional mobility is also minimized and more sustainable methods of transportation (public transport, electric and shared mobility, cycling) can be promoted. Especially considering the amount of emissions the transportation sector contributes to the national emissions, densification offers a framework for sustainable urban development. Although space to build is scarce in cities, industrial urban areas offer a lot of ground cover. Industrial areas that are situated close to the city often are as big, or even bigger than city centers. The only challenge is the redevelopment of these industrial urban areas. To gain a better understanding of suitable ways to redevelop industrial urban areas into mixed-use neighborhoods, two case studies have been analyzed. In combination with the conducted interviews this led to a collection of strategies and principles for the sustainable development of industrial urban areas. A recurring theme when developing industrial sites, is the history. Often, these sites date back very far and offer unique stories and authenticity. Before developing an area it is important to understand the history of the area, so that cultural preservation can be considered. Making a cultural-historical exploration and inventory of objects and buildings that could or have to be preserved is advised. To understand how the urban development fits into the larger region, it is important to define how the redevelopment of an area is connected to other urban regions. This can establish a stronger regional network and lay the foundation for sustainable future planning where various regions (or cities) could benefit from. On the urban level, the integration is very important. Because of the historical and cultural context, an urban assessment needs to be made to establish a spatial framework and prerequisites for the building heights and sizes. A sustainable approach is to assess what buildings could be re-used and which would need to be demolished, this process goes hand-in-hand with the financial feasibility of the development and the cultural-historical value of the real estate. Industrial urban areas are usually characterized by a lot of harsh materials; concrete, stone, metals, and not much green. That makes these areas perfect to redevelop and upgrade by introducing more greenery, biodiversity and water management systems. The case studies also showed the importance of social inclusion during the process; an open and participatory procedure where stakeholders are involved in the process. The involvement of the municipality is also important to guarantee that the area development considers regional and local requirements and ambitions. Industrial urban areas that are transformed into mixed-use neighborhoods allow for local, collective ecologies where shared forms of mobility, energy production and consumption, the exchange of (residual) flows and resources are possible. Due to the mixed nature of such a transformed area, the upgrade of public space with greenery and activities results often in valuable new districts that challenge the status quo.



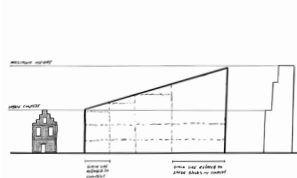
## Strategies



*Creating a stronger regional network by redeveloping strategic areas*

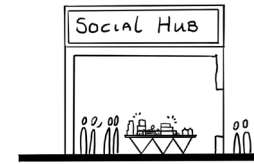


*Dividing the area in districts to allow for the co-existence of various functions*

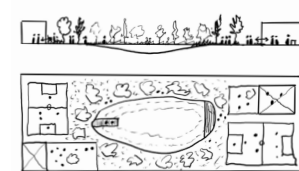


*For urban integration, building heights and sizes can be derived from the urban context*

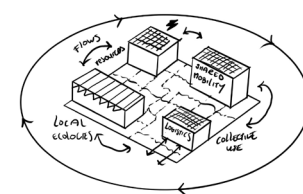
## Strategies



*A social hub provides space for participation and discussion with the neighborhood*



*Social green spaces that improve biodiversity and foster interactions and leisure*



*Collective use of water, energy, mobility, resources, residual flows, resulting in local ecologies*



# IV. RE-IMAGINE DWELLING

*“Can industrial buildings be transformed  
into mixed-use housing communities?”*

*“How to realize affordable housing types  
without losing essential living qualities”*

SYMBIOTIC SOLUTIONS: LIVING & FARMING  
IN INDUSTRIAL URBAN AREAS, CLOSE TO CITIES

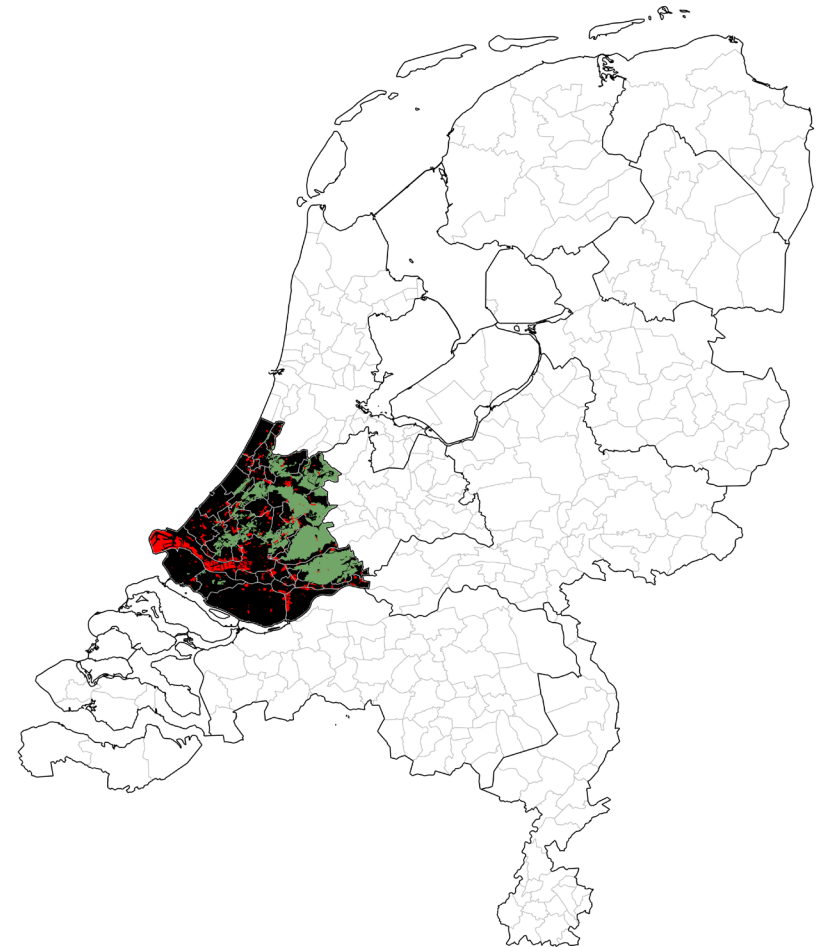


Figure 87. A representation of the industrial areas and peat soil landscapes in South-Holland, the Netherlands (2021).

## THE POST-WAR RECONSTRUCTION ERA

After the second world war, a significant housing shortage had developed in the Netherlands. Especially after 1945, when soldiers returned home and family life continued. The population growth required more homes and thus the reconstruction era began; the housing crisis got high priority and was declared “the public enemy of the nation”, a problem that had to be solved. A challenge and responsibility that the government would attend to in the following years (Pflug, 2015).

To grant citizens social security, a special motion was announced, a council would oversee all construction projects in the country, ensuring that all the available materials and resources would be used to develop appropriate housing to compensate for the shortage. All material stock in the country could be summoned and used by this special council to advance the construction of housing. If municipalities, developers, contractors or individuals wanted to construct a building, they first needed to request permission (figure 88-B). In the year 1945, a special emergency public housing decree was announced, allowing municipalities that lost more than twenty percent of their housing stock to the war, to construct temporary emergency shelters (Pflug, 2015). In some areas this resulted in the appearance of prefab dwellings, and for example in Groningen, discarded tram mobiles were transformed into housing units (figure x). Although the progression was slow in the beginning, capacity advanced gradually; between 1945 and 1962, in 17 years time, the government managed to build one million homes. Between 1962 and 1971, this time in only nine years time, one million homes were produced once again, with a record amount of 146.200 homes in the year 1974 (figure 88-C), which is more than double the amount of homes that were built in 2023 (CBS, 2023). Due to the pressing urgency for capacity and quantity, the decades of reconstruction have resulted in specific housing types, which can be found back throughout the country. The problem that arises with the focus on quantity, is that on other aspects there be compromises; such as the quality of buildings. The government had focused on an efficient and cost-effective strategy to mitigate the housing crisis at the time. Therefore, strict rules and regulations were set in place to ensure an efficient trajectory for the production of homes. Every house had to be exactly the same, regardless the geographic location; whether the house was built in Groningen or Maastricht, it had to be identical to allow for efficiency. This resulted in systematic and prefab building methods, where industrial elements would be mass-produced to construct large amounts of the exact same buildings throughout the country. The standardized building techniques gave birth to the Dutch row houses; simple pitched-roof dwellings, constructed as tunnel with a standard layout and a garden, usually configured as a continuous strip (figure 90). An urban variant which was more condensed, was the reconstruction flats, also built from concrete, constructed as tunnels with windows on both ends (figure 92). The automated and monotonous nature of production, and the loss of essential spatial qualities in housing, slowly led to a thirst for authenticity and innovation, which led to artistic reflections and visions about the future and the introduction of an experimental Dutch housing program in the late sixties (Hengeveld, 2008).

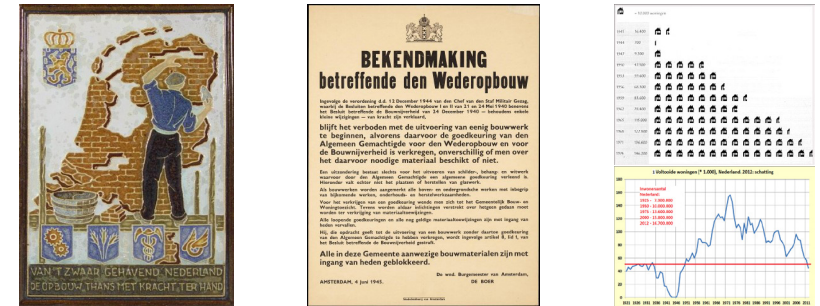


Figure 88. A) Reconstruction tile (1945). B) Special motion regarding construction and resources. C) Housing production 1945 - 2011.



Figure 89. Re-used trams, transformed as emergency housing (1949).



Figure 90. Typical mass-produced Dutch row houses (1954).



Figure 91. Modular building system, by Oost-Sidelinge (1949).



Figure 92. Typical mass-produced Dutch urban flats (1954).

# NEW BABYLON

*Visionary conception for housing in a technological era,  
in response to the monotony of post-war architecture*

**Timeframe:**

1956 - 1974

**Location:**

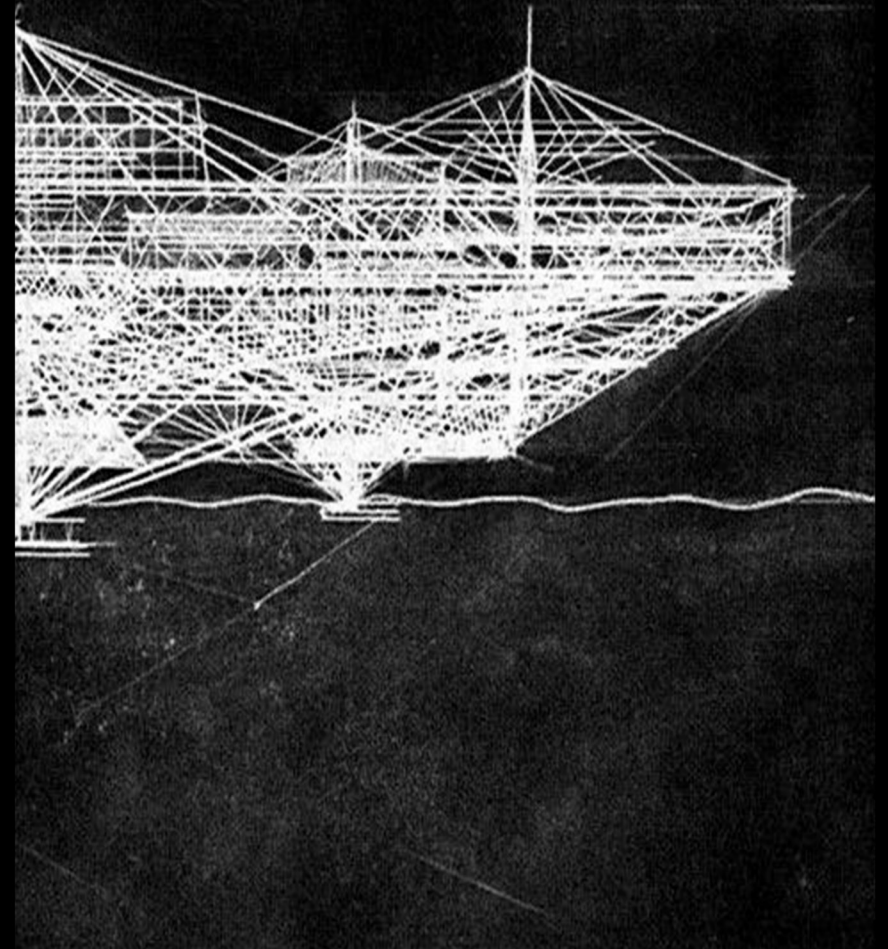
Amsterdam, The Netherlands

**Size:**

Large scale intervention

**Client:**

Autonomous project





## CONSTANT NIEUWENHUYNS - NEW BABYLON (1956-1974)

Constant Anton Nieuwenhuys was a Dutch multipotentialite, displaying his genius through various forms of art, writings and music. Born in 1920, Constant lived through the second world war and the age of reconstruction after the war. This period was propelled by automation and efficiency, the observations of the impact this had on society filled Constant with visions of the future (Kunstmuseum Den Haag, 2016). Between 1956 and 1974, Constant worked on a broad collection of artworks envisioning a future where an intriguing relationship between automation and leisure forms the bedrock of society. Inspired by the book 'homo ludens', by Johan Huizinga, he envisions how cities would operate in an age where automation has overtaken many of the operable 'human tasks', leaving an abundance of time for the 'playful man' to explore and express creativity (Stichting Constant, 2023).

Constant imagined an infinite city, New Babylon, hovering above the traces and remains of existing cities. With a minimal footprint; a few points of contact with the earth, massive sectors would be constructed above the ground. Constant made sketches defining the massive size of the structures of New Babylon (figure 93). This was a vision for a new construct, enabled by technological advancement which allows for expansive spatial planning for the ever-evolving human activities. Due to the technological developments, Constant envisioned that the common man would develop into 'homo ludens'. Liberated from repetitive work, an abundance of time would be available for creative pursuits. In a world where everything is optimized, automated and mass-produced, man would long for the expression of creativity. Playfulness and craftsmanship would be perused, in contrast to the rational processes technology would be in charge of. The architecture would need to accommodate for the constantly changing needs of civilization. Instead of prescribing a form, the visionary described a process with prerequisites.

*"Everything must remain possible, everything must be allowed to happen, the environment is created by the activities of life and not vice versa."* - Constant Nieuwenhuys (1974).

As a part of his intriguing oeuvre, Constant expressed the playfulness and ambiance of New Babylon in his painting 'Labyrinth of moving ladders I' (figure 95). Portraying a colorful world of activity and interaction among its residents. New forms of communication would enable residents to converse and socialize, which would in turn have an influence on the spatial tissue of the clusters. The technological tools and appliances would allow for continuous and ultimate adaptation. Spaces would be able to be reconfigured according to the users likings; configurations, atmosphere, smell, lighting, the thermal conditions, everything would be subject to instant alteration. (Gemeentemuseum Den Haag, 1974).

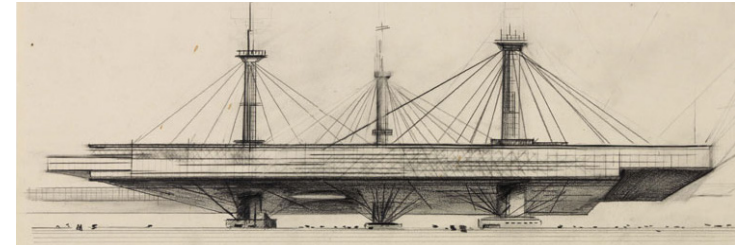


Figure 93. 'The hanging sector' - Sketch portraying the massive size of the New Babylon sectors (C. Nieuwenhuys, 1964).



Figure 94. 'The hanging sector' - Physical model displaying the structure and spatial infill of a sector (C. Nieuwenhuys, 1964).

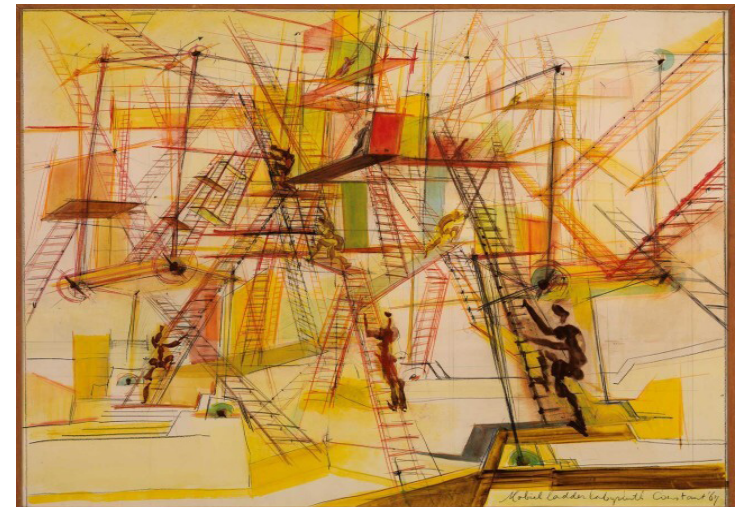


Figure 95. 'Labyrinth of Moving Ladders I' - a promising playful world, allowing for ultimate adaptation (C. Nieuwenhuys, 1967).



*Experimental housing that questions and re-imagines the status quo of post-war mass produced housing*

1968 - 1973

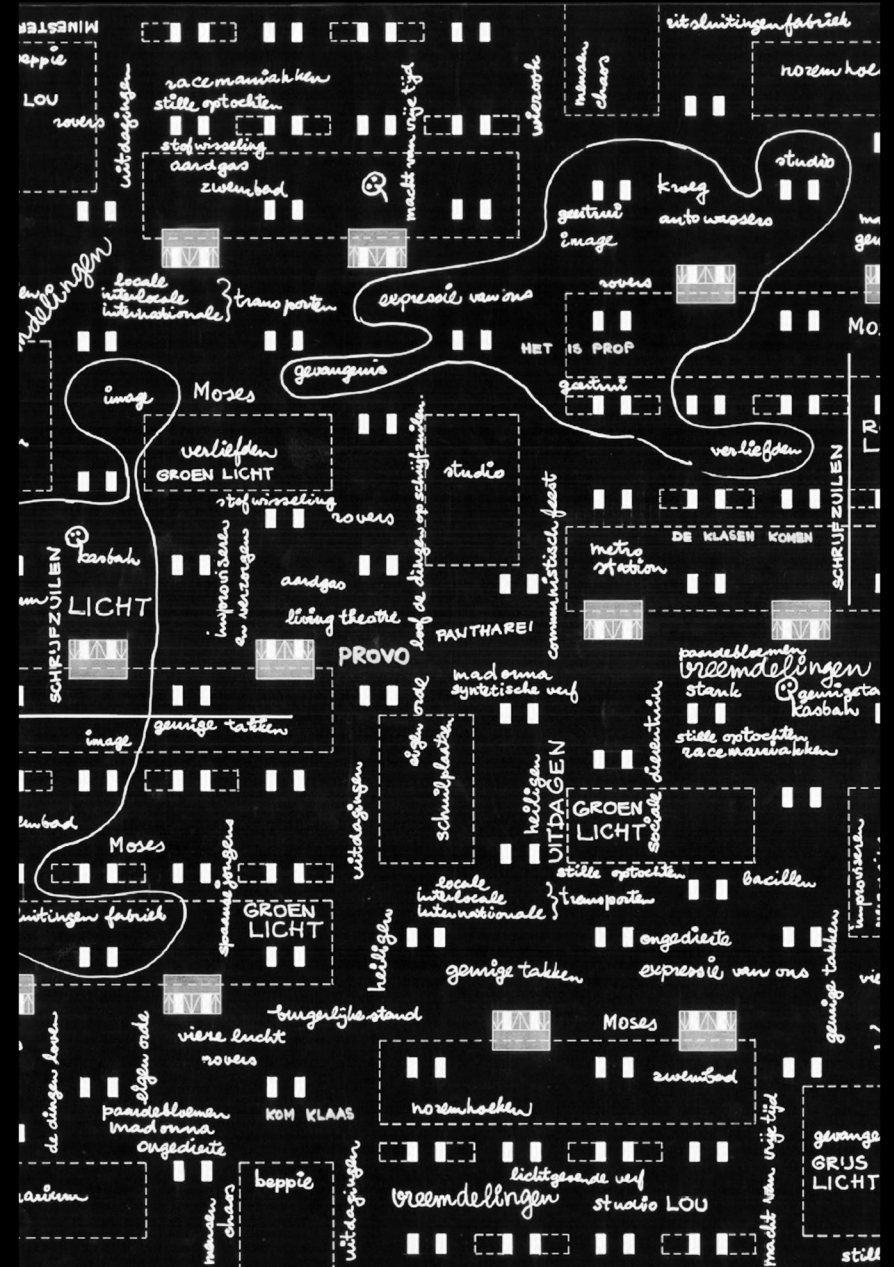
Rotterdam, The Netherlands

30.000 m2 (Including 184 dwellings)

Municipality of Hengelo

Municipality of Hengelo

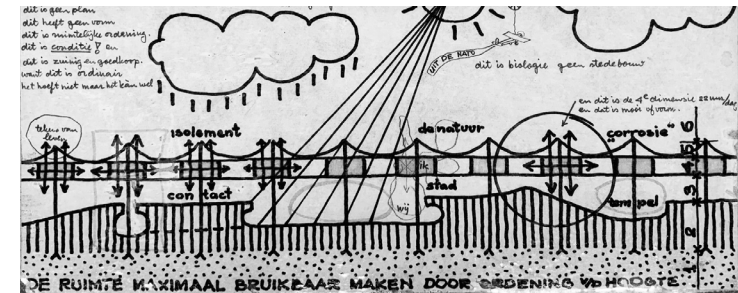
Piet Blom, Beltman Architecten



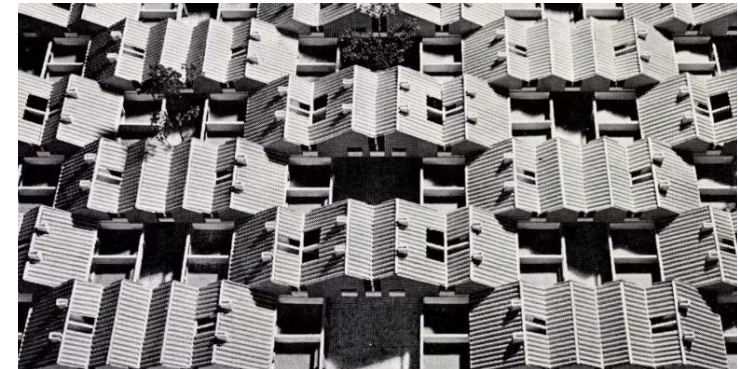
### PIETER BLOM - KASBAH (1973)

In 1968, the minister of Housing and Spatial Planning, ir. Wim Schut, was not satisfied with the government's housing 'volume policy' and he decided to set up a scheme to boost the experimental housing developments. The hope was that this would stimulate more variation in the creative and functional design for new dwellings. The ministry's attempt to break with the conventional post-war architecture in 1968, was a perfect breeding ground for Blom to realize his 'Urban roof housing' vision (Hengeveld, 2008). Blom captured his thoughts and ideas by making conceptual drawings, accompanied with expressive words and text. He envisioned a new way of living, where the conventional way of planning is challenged and re-considered. In the remarkable drawing from 1968, he illustrated a layered approach to spatial planning (figure 96). The text explains that this new strategy subdivides the spatial realm into 6 different zones. Instead of monotonous 2-dimensional structures, that were dominating the Netherlands during that time, he developed a system of 3-dimensional planning. His aim was to maximize available space by the vertical arrangement of space and functions, resulting in a scalable structure that is multi-functional. A new hybrid form, where functions are intertwined and the boundary between public and private space is blurred.

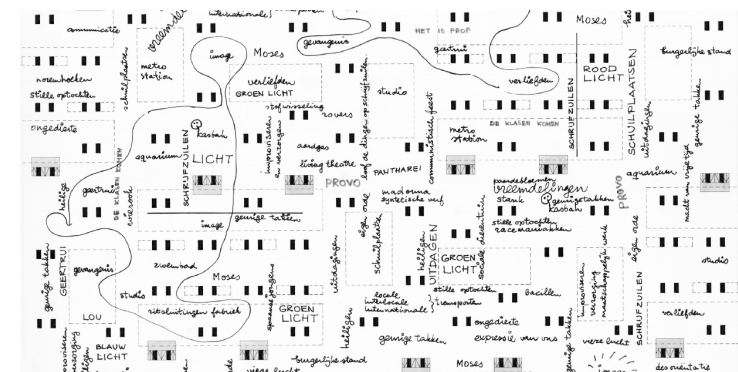
The first zone is the sandbar, far underneath the ground, carrying the fundamental piles which carry the structure above. Zone 2 is drawn as a layer that morphs into various shapes, Blom calls this the 'stirrable ground', a layer which can be dug out, manipulated in a way that is most suitable for the user, as long as the foundation is not affected. The third zone is labeled as the 'social space', which is the original reason why you would like to live somewhere, since this layer of space is an intermediary between people and the experience and interactions they have. This layer can be used continuously and for various purposes, ranging from business and employment to social gathering and initiatives. Zone 4 embodies the dwellings, which Blom calls the 'small cells of the city', which are a product of 'technocracy'. In other words, these dwellings come to existence on the basis of the results of various technical, economical and social analyses, which define the needed capacity and nature of the homes. Blom proposes dwellings that are positioned in such a way that they connect in 3 essential directions. Over time, the dwelling can adapt to the individual needs of the user and become a vehicle for social interactions. In the sketch (figure 96), this is accentuated by intersecting arrows that indicate the adaptability of the dwellings over time. With red and black circles, he stresses the interconnectivity between the upper layer (the dwellings) and the 'social' layer underneath. The fifth zone is considered the outdoor space that the dwellings have access to. He believes in the importance that inhabitants can engage in simple but yet important activities like planting flowers, gardening, enjoying the extended outdoor space of the living room, but also feeling the sun and the rain on your roof and being exposed to the night sky, and being able to gaze at the stars. Zone 6 is described as the pristine layer of nature, providing daily vitamins and nutrients.



**Figure 96.** *A new system of three-dimensional planning; a subdivision of the spatial realm in six levels (Blom, 1973).*



**Figure 97.** A physical model of the Kasbah, showing the open areas for sunlight access and outdoor space (Blom, 1973).



**Figure 98.** An illustration of the lively ground floor under the Kasbah, with many social functions (Blom, 1973).

# FENIX I

*The transformation of a monumental transshipment warehouse into a mixed-use icon for Rotterdam.*

**Timeframe:**

2013 - 2019

**Location:**

Rotterdam, The Netherlands

**Size:**

45.000 m2 (Including 212 dwellings)

**Client:**

Municipality of Rotterdam and  
Heijmans Vastgoed

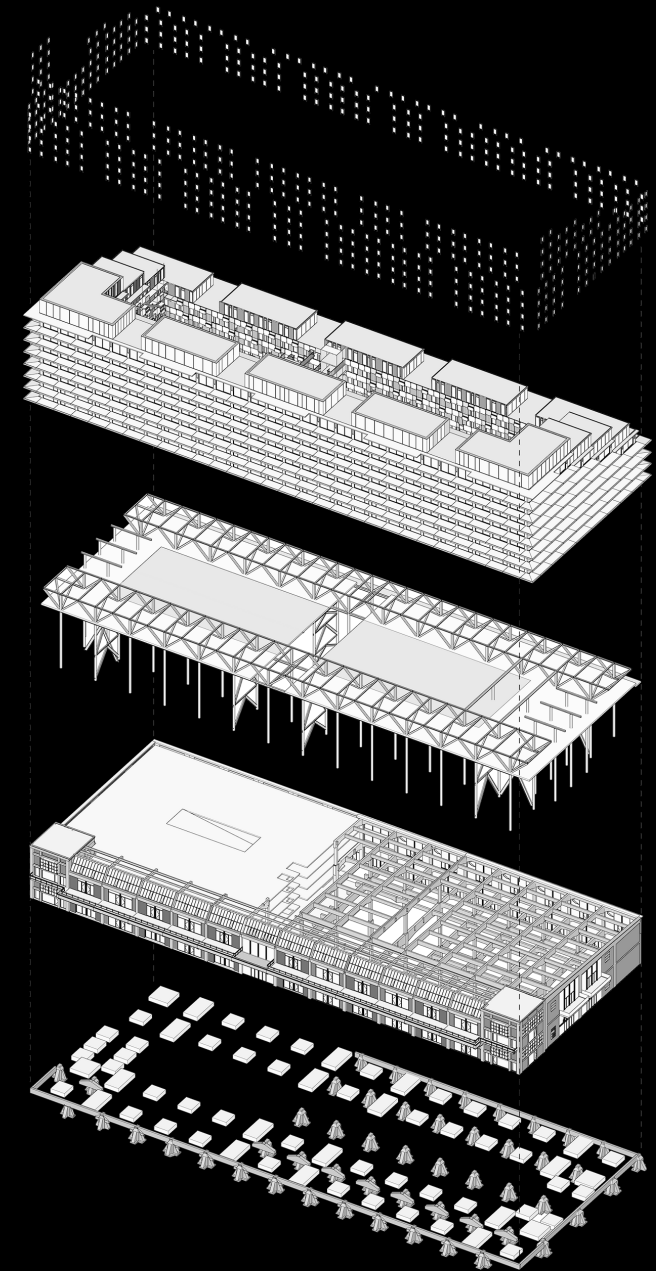
**Developers:**

Heijmans Woningbouw

**Architects and collaborators:**

Mei Architects and Planners, Heijmans Woningbouw, ABT, Techniplan adviseurs, LBP | Sight, Suzanne Fischer, Windsafe, EGM, CSM Steelstructures, PD Lightning, Studio Faber, Marc Goodwin, Peter Hooijmeijer, Aiste Rakauskaite, Bart van Hoek

*\* Interview about the transformation of Fenix I with Robert Platje, partner (and building technologist) at Mei Architects and Planners.*



## FENIX I - FROM INDUSTRY TO LIVING

At the *Schiecentrale* in Rotterdam inside a large, glazed building — a vertical volume, seemingly levitating above a historical power station from 1901 — I sat down with Robert Platje, at the office of Mei Architects and Planners. Robert is one of the three partners at Mei, and his expertise as a building technologist has been invaluable for the projects he has been involved in for the past twenty years at the firm. Mei is known for complex projects where existing heritage or historical buildings are often re-purposed and transformed into new (mixed) buildings. An exemplary project, where Robert was extensively involved in, is the transformation of the historical Fenix transshipment building into a mixed-use ensemble.

The urban context surrounding the Fenix I building underwent a significant change in the past centuries. Before the twentieth century, this area was a polder region. Harbor barons lived in large country-houses amidst the green fields of the polder, before the harbor was constructed by means of physical (human) labor; through the act of digging and shoveling large harbor basins were constructed. While the harbor expanded towards the city, large areas, such as the 'Maashaven' and the 'Rijnhaven', were constructed and the green, lush landscape evolved into an industrial harbor district. This resulted in the construction of various large industrial buildings during the beginning of the twentieth century. One of these buildings was the 'San Francisco shed', built in 1922 for the storage of goods for the 'Holland-America line', with a total of 360 meters in length it was the biggest transshipment building in the world at the time. A multistory building; with trains driving through the building on the ground floor, trucks being able to reach and drive on the first floor, and with eight massive cranes on the roof to hoist goods into the building via elevated loading decks. The products would arrive by boat on the water and find their way into the large building, which performed as an optimized logistics machine. During the second world war, the Nazi's bombed the harbor area, resulting in the destruction of the San Francisco complex. In 1946 the reconstruction of the San Francisco shed started, restoring the original continuous building. In 1950 a big fire outbreak caused the destruction of a big part of the building in the middle. The large building was restored in 1954, into two separate volumes with an extension towards the waterside. In between the two buildings, a new square came into existence with a small canteen building and two large volumes on each side. The two separate buildings were renamed into Fenix I and Fenix II, derived from the ancient Egyptian mythology of the 'Phoenix' bird, which after catching fire would rise from it's ashes. In 2012, the 'Rijhavenbrug' was opened, this small bridge connected the 'Deliplein' to the 'Kop van Zuid'. This made the area more accessible and more place-making started to occur; the presence of cultural institutions, using the vacant Fenix buildings had promoted more liveliness and activities in the area. In 2015, the transformation of Fenix I started, where 23.000 m<sup>2</sup> of housing would be added on top of the historical building. In 2019 the construction had finished, rejuvenating the larger area of Katendrecht, attracting many local residents and international tourists.

1930



Figure 99. The multistory, 360m long San Francisco Shed (1930).

1946



Figure 100. The remains of the San Francisco shed after WWII (1946).

2012



Figure 101. Fenix I to be redeveloped, situated at the Deliplein (2012).

2019



Figure 102. 45.000m<sup>2</sup> of housing above the Fenix I building (Mei, 2019).



## THE PROPOSAL

An important run-up to the development of Fenix I, was the activation of the urban context. Before the construction of the famous ‘Rijhavenbrug’, connecting the somewhat isolated area of ‘Katendrecht’ to the ‘Kop van Zuid’, the municipality of Rotterdam increased and promoted activities in the area of Katendrecht. Especially because the isolated area had a bad reputation in terms of crime and safety, an upgrade of the urban context was needed before it could be redeveloped. Cultural institutions, like ‘Walhalla’, and ‘Codarts’, could make use of various (vacant) buildings for low rents. The cultural activities, performances and theatre shows contributed to more shops and restaurants in and around the area. The social activation and accessibility of the area was important to give confidence and a positive outlook for the transformation of this area. This provided assurance for the investor that would be willing to develop these historical buildings. The investor that took on the development of Fenix I was Heijmans, and they would also be the contractor and builder of the project, in close collaboration with the Municipality of Rotterdam and Mei Architects and Planners. The Rijnhaven bridge, constructed in 2012, was a small intervention with a big impact. The municipality wanted to improve the area, and the new bridge would allow for an enclosed route around the ‘Rijnhaven’ bay, allowing for developments along the promenade overlooking the waterside. Fenix I was one of the first buildings that would become an icon for the area, and was developed as a part of a bigger master plan. During the tender for the redevelopment of the old Fenix building, the municipality had described that a new envelope above the building, consisting of a few layers, would be allowed to host the new function of housing. The client, Heijmans, had also performed a structural analysis with the engineering office ABT, to analyze what would be structurally feasible on top of the existing building. This resulted in a technical manual of the possibilities for the transformation of the building, which had been informative for for the tender prerequisites and the program of requirements for Fenix I. A range of architecture firms was selected to develop proposals for the tender and Mei was one of these firms. In response to the building envelope in the tender requirements, Mei proposed to break the envelope constraints by increasing the height of the envelope towards the water and the city center (the North side) and lower it towards the neighborhood (the South side). This strategy allowed for a better urban integration, an increase in apartments with double-sided views, and the addition of spatial qualities; sunlight would be able to reach into the courtyard and dwelling terraces would be oriented towards the south. A proposal that all the stakeholders were very enthusiastic about, and eventually Mei was selected as a winning party.

*“We are a very context-driven firm that does not want to create landed objects, but rather interventions that fit very well into the environment, while adding extra qualities to the plan. An important architectural intervention was the incision layer, which ensures that the warehouse and the new volume are separated from each other, so that the quality of both buildings is guaranteed.” - R. Platje (2024).*

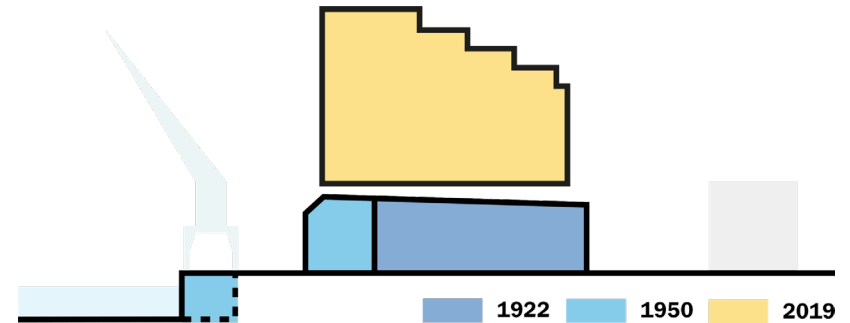


Figure 103. Concept diagram to illustrate the various historical layers of the Fenix I building, including the new addition (Mei, 2019).



Figure 104. Concept section which illustrates the urban integration and spatial qualities of the proposed envelope (Mei, 2019).

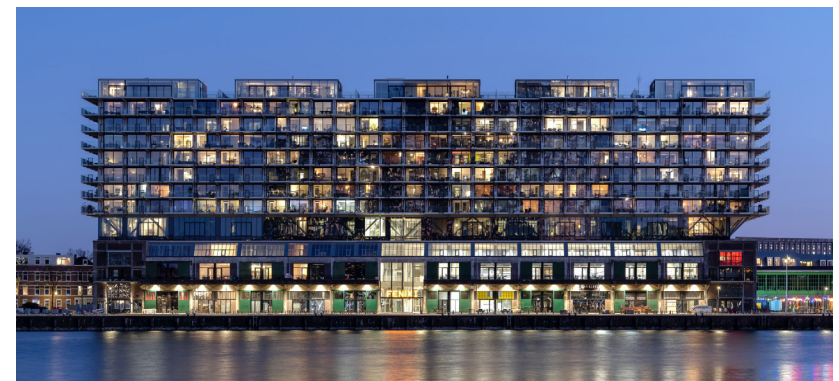


Figure 105. A photograph showing the building from the North, the transformed Fenix I building became a new icon for the city (Mei, 2019).



**Figure 106.** An illustration of the layered mixed program that characterizes the Fenix I building (Mei, 2019).



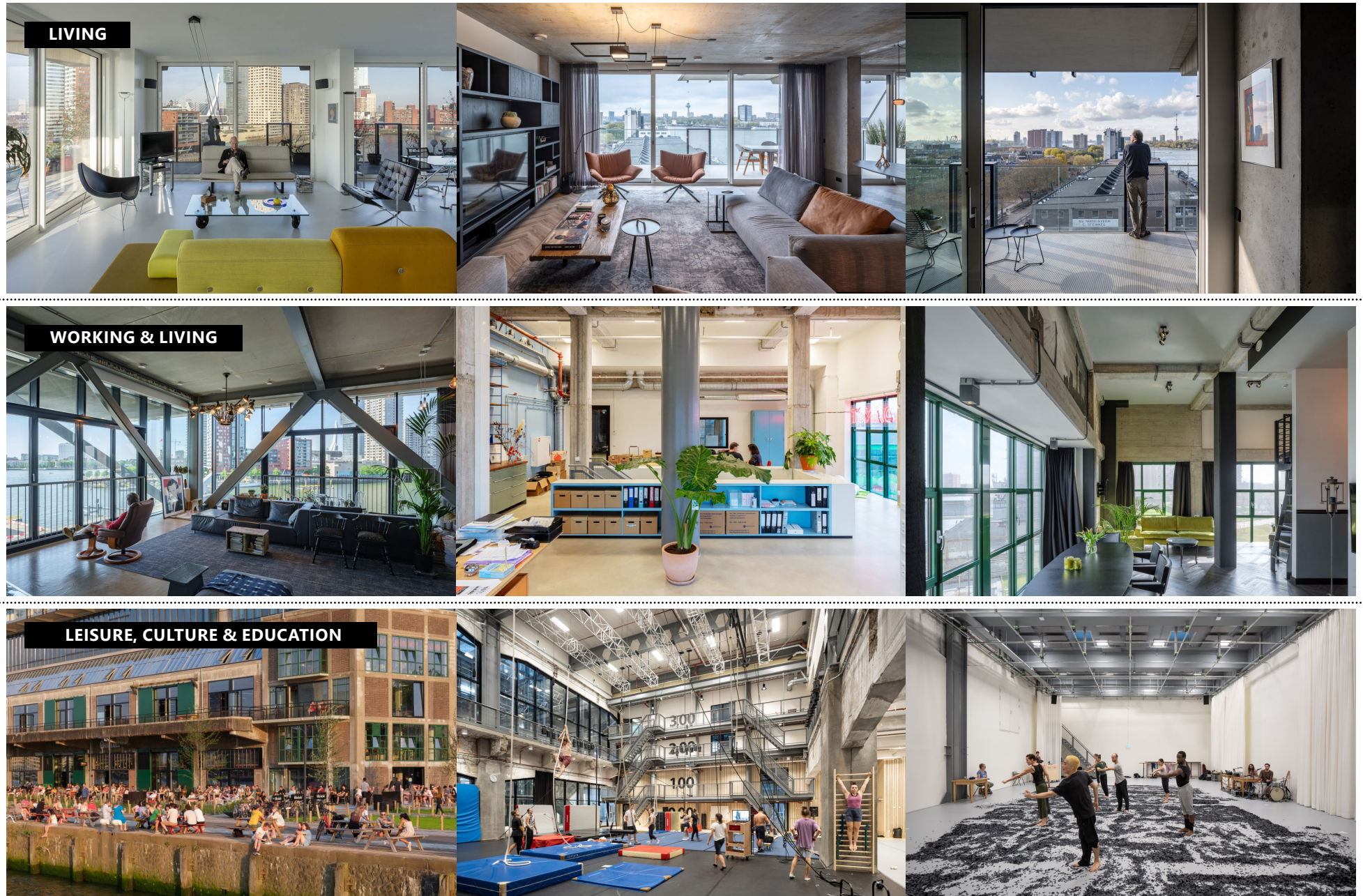


Figure 107. An overview of the layered mixed program that characterizes the Fenix I building (Mei, 2019).



## TECHNICAL CHALLENGES

Although the Fenix building was not a monument, it was treated like a monument because of the rich history it embodied for the local city of Rotterdam, and therefore provided a lot of extra value, especially when a suitable cultural program was found to occupy the large spaces in the Fenix building. With the tender requirements, the ambition was to increase the capacity of the building, while retaining as much of the existing qualities of the building. Although the heavy concrete structure would have allowed for an extension on top, this would only be a few layers — when built with very lightweight materials — which would not lead to maximizing the capacity of the envelope above the existing building. Because densification was the objective, especially considering the future development of master plan with high buildings, Mei Architects decided to engineer a separate structure from steel and concrete that would allow for a greater addition in volume.

This was quite an operation; an inventory was made of the existing foundation by removing the floor and exposing the foundation to determine the positions and to optimize structural preservation. In areas where no existing foundation was found, the new foundation was added, to make sure that the new addition could rely on its own load-bearing capacity. A ‘table construction’ was designed that perforates through the existing building, landing on the new foundation and providing the new volume with its own primary support structure.

*“We developed a transfer structure, which perforates through the existing building, this allows for the difference in grid size and minimizes impact while providing the new building with an independent primary support structure” - R. Platje (2024).*

The new volume on top of the existing building had to accommodate for dwellings, which have a smaller grid size than the large grid of the industrial hall. Due to the transfer from a larger grid to a smaller grid, a structural transfer layer was needed. This strategy minimized the perforation points through the existing building, the large perforating grid of more than eight meters also minimized the impact on the use of the space in the existing building. Careful financial considerations were constantly compared with structural and spatial efficiency, before coming to the final composition. To minimize the use of structural material, the large courtyard, an oasis of calmness amidst the dwellings, did not need many columns, as it could rely on the sturdy concrete structure of the existing building. The technical challenges of Fenix I are mainly represented in the structure. In total, one million kg of steel was used to realize the minimum-impact intervention. On top of the steel structure, the dwellings were realized using a concrete tunnel box construction in combination with walls which were designed as disc-columns to provide the dwellings with optimal flexibility. The combination of the steel structure which supports concrete dwellings, is a unique concept and has been exemplary for the transformation of existing buildings with historical value around the globe.

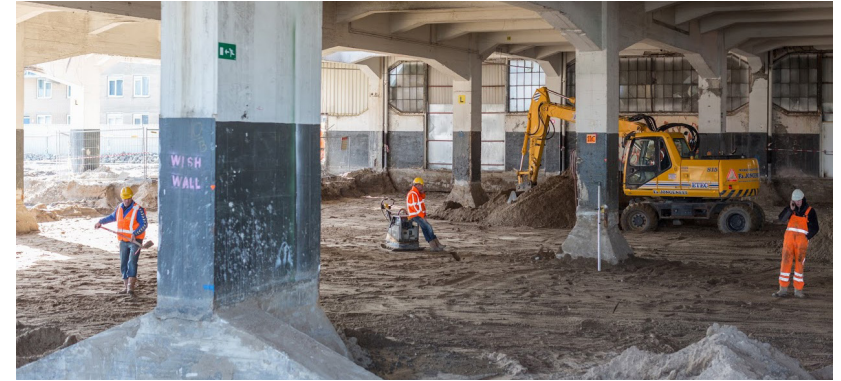


Figure 108. The soil was excavated to map out the foundation for repairs and to determine the new foundation positions (Mei, 2019).



Figure 109. A) Careful positioning of the new structural columns. B) the transferstructure allows for minimal perforations (Mei, 2019).



Figure 110. A) The dwellings have a smaller grid size than the hall below B) The transfer layer bridges the difference in grid sizes (Mei, 2019).

## FLEXIBLE DWELLING ARRANGEMENTS

The tender for Fenix I was in 2013, and during the aftermath of the financial crisis, many properties had decreased in value, and many people were not eager to buy or invest in a properties either, so there was a need for a different approach when it came to developing housing. There was a need for a new model, not just a fixed dwelling type, but a flexible model that could easily be adjusted to the demand of the time. If there would only be a need in the housing market for smaller dwellings, a flexible framework should be able to offer many small homes, if by the time the building would be finished there would be a demand for large lofts, the structure would need to be able to accommodate for that as well. This was one of the tender prerequisites that the municipality and the client (Heijmans) formulated. This was also a form of risk management, to minimize the financial risk for the development.

*“A very important part of the concept was the flexibility of the superstructure, which allowed the buyer to decide the size of their home before it was built, which led to a very mixed palette of dwelling types. The structure also provided optimal flexibility for the interior arrangement of the apartments” - R. Platje (2024).*

For Mei Architects and Planners, this was a fantastic opportunity to develop a spatial framework for a new way of living. They found the solution in making the structure of the building flexible. Instead of fixed structural walls, they proposed a grid of columns (4,30m x 8,60m) which would allow for a flexible arrangement of the space. Within the grid of the columns a dwelling could expand both horizontally, growing in square meters, and vertically. Instead of developing a fixed set of dwelling types, they decided to offer available square meters to the market, so people would be able to buy square meters instead of a fixed dwelling type. Robert told me that the square meter price in 2013 was much lower than it is now, which resulted in much more spacious apartments than we are used to with developments nowadays. With a ‘hit chart’ they approached the market to see how buyers would arrange their home and how many square meters they would be interested in purchasing. That’s a unique concept; the buyers can decide how big or small they want to live in a to-be-developed building, the team had introduced a product into the market that did not yet exist. This resulted in a very mixed palette of small apartments, bigger apartments and some duplex lofts. After the final configuration, flexibility still exists; the home owner can decide where to place temporary walls and how to arrange his own space. But on a larger scale, the flexible structure of the building could also be re-purposed for other functions if needed. The individual homes could be combined into larger homes and recently one of the home owners has split his large penthouse into two smaller homes. That’s proof of concept, where it shows that the dwellings can evolve over time according to the needs of the users, something that is missing in contemporary housing, even now, 10 years later, it seems that floor plans and housing becomes more standardized, small and inflexible. Therefore this ‘open building’ concept by Mei Architects and Planners is an innovative and flexible way to develop housing that can be flexible, and therefore resilient and durable.

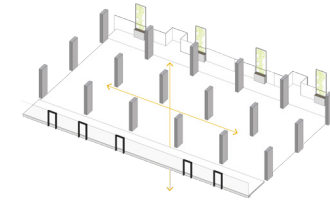


Figure 111. A grid of disk columns allow for optimal flexibility (Mei, 2019).

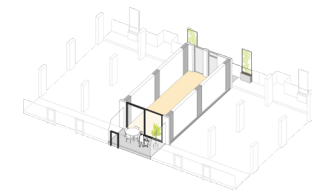


Figure 112. The grid allows for smaller dwelling configurations (Mei, 2019).



Figure 113. The grid allows for larger dwelling configurations (Mei, 2019).

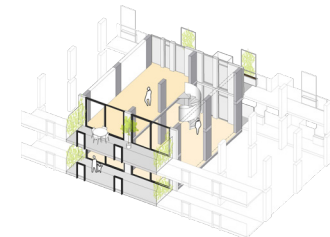


Figure 114. The grid allows for double-height dwelling configurations (Mei, 2019).

# KALKBREITE

*A housing cooperation that developed an inclusive and affordable housing community above an old tram depot.*

**Timeframe:**

2007 - 2014

**Location:**

Zurich, Switzerland

**Size:**

6.350 m2 (Including 82 dwellings of various types for 250 residents)

**Client:**

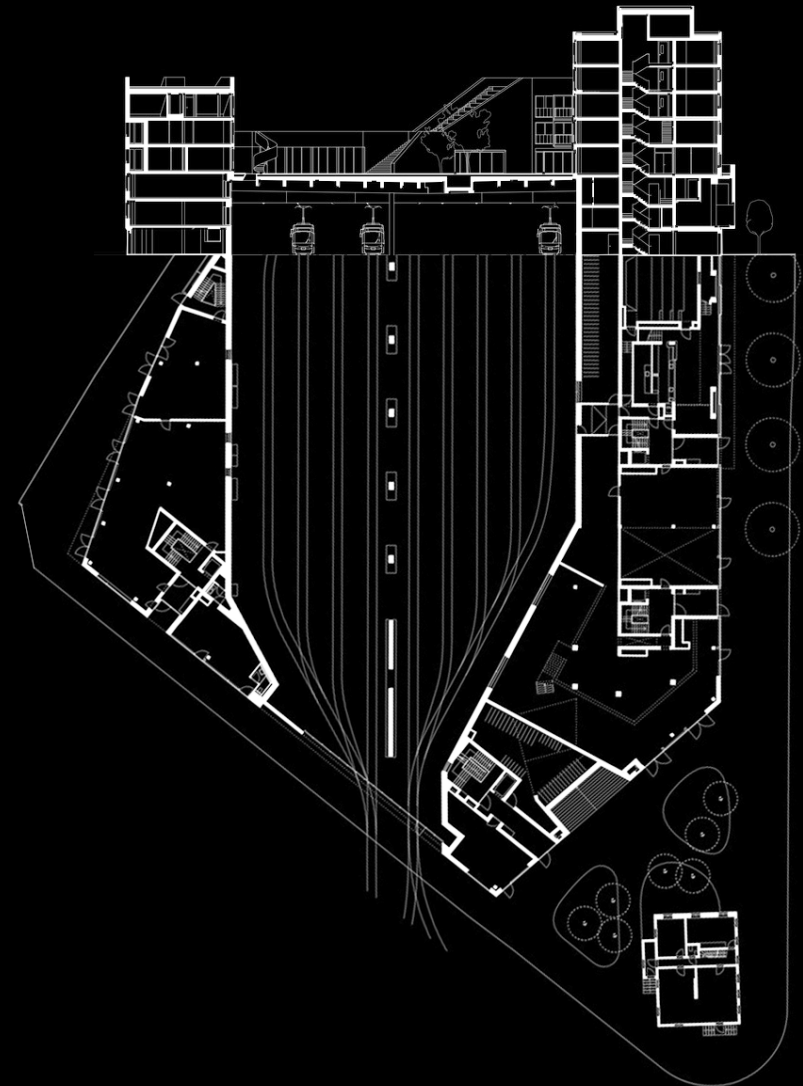
Housing cooperative Kalkbreite (live-work-complex)  
City of Zürich (tram depot)

**Developers:**

Housing cooperative Kalkbreite (live-work-complex)  
City of Zürich (tram depot)

**Architects and collaborators:**

Lead Architect: Müller Sigrist Architekten AG, Construction Management: B&P Baurealisation Building Physics: BWS Bauphysik AG, Winterthur Civil Engineer: Dr. Lüchinger + Meyer Bauingenieure AG  
Landscape Architecture: Freiraumarchitektur GmbH





## FROM TRAM DEPOT TO WOHNGENOSSENSCHAFT

Zurich has a special history with transportation - as one can imagine, moving through a cityscape with variances in altitude can be challenging - and this shows in the city planning. To aid mobility in Zurich, various forms of transport were powered by horses before the twentieth century; a special insight is that the tram mobiles in Zurich used to be run by horses as well. Although trams were modernized throughout the years, the tram network remained and commuting by tram is still a very efficient and frequently used mode of transport in the city of Zurich.

The location where the wohngenossenschaft was constructed ties back to the history of trams; Kalkbreite was originally a tram depot; offering shelter to trams and horses before the twentieth century (circa 1980). Around 1900, the horse tram depot was replaced by a larger depot to facilitate storage space for electric cars. Due to its poor condition, this station was demolished in 1979, and since then the area was used for open-air tram stabling. Over the years, various plans and proposals were reviewed to redevelop this tram depot - which is situated on a well-connected urban intersection - but none of the developments was carried out. Often the re-allocation of the tram depot was proposed to make room for a new development, but because this tram depot was located in close proximity to another tram depot on the other side of the road (Elisabethenstrasse), there was a strong preference to preserve this depot and continue stabling the trams in this location. (Proaktiva, 2009).

In 2002, the city council of Zurich allocated 8.3 million francs for the renewal of the Kalkbreite tram district. The area was considered a non-space, city councilor Elmar Ledergerber described the area as “necrosis”; dying tissue in the city’s body, and something had to be done to rejuvenate the area (Tages-Anzeiger, 2002). Since 1978, there had been suggestions from the district and proposals from the SP people’s initiative to redevelop the Kalkbreite district into an affordable, cooperative housing community. Suggestions to cover the tram depot and realize housing on top, were rejected because it was considered to be too expensive. However, in 2003, the municipal council had passed a motion from the SP and CVP, against the will of the city council, to agree on a residential development on the Kalkbreite site. A further study had shown that covering the tram depot was financially feasible and that the problem of traffic noise could be solved. Since the book value of the area was only 30,000 francs, the land could practically be used for development free of charge. Although there were still some disparities between political and municipal parties, the redevelopment of Kalkbreite was a fact. In further discussions, it was determined that the city had to make an investment in this redevelopment and finance the structural coverage of the tram depot, which would allow for a financially viable, non-profit residential development. The Kalkbreite Association developed a vision for the area where this “non-space” could be transformed into a “place of power”. The housing association consisted of many people with an expertise and they collaborated with external experts to develop a feasible vision and architectural proposal for Kalkbreite. Eventually, in 2007, the building rights were transferred to the Kalkbreite cooperation and the development could begin (Kalkbreite, 2022).

1869



Figure 115. Local machinists with a horse-powered tram, Zurich (1869).

1980



Figure 116. Tram depot, trams stabled in open-air, Kalkbreite (1980).

2006



Figure 117. Association formulates plan to redevelop Kalkbreite (2006).

2014



Figure 118. Mixed-use wohngenossenschaft Kalkbreite, Zurich (2014).

## THE HOUSING COOPERATION - KALKBREITE

In February 2006, a city labor workshop took place to gather ideas about the future of Kalkbreite, many residents from the area participated and the workshop led to a united group of citizens whom formed the foundation for the association Kalkbreite. In June 2007 the Kalkbreite Cooperative was founded, which was an important step in the process, because this allowed for the building rights of the Kalkbreite site to be granted to the cooperation by the City of Zurich in 2007. The decisive factor for the transfer of rights was the vision for the integration of the project into the urban context, both structurally and socially, which had great potential to transform the district into a vivid neighborhood center. In 2008, the cooperation invested time in establishing organizational structures, which allowed for interested members of the cooperative to be involved in the future planning process of Kalkbreite. The same year, the City of Zurich organized a tender and this led to an architectural competition. The ambition was the realization of a new building which could accommodate for 400 users, flexible and modular room concepts with different sizes were considered to be the bedrock of the proposal. It was important that the proposal would be a sustainable building, with attention for exterior spaces and financial feasibility. In the tender prerequisites, the importance of accessibility was underlined; with the need for street level access and public spaces, but also provide optimal internal access and accessibility, with elevators and riser systems to facilitate room for operating utilities. In the following year of 2009, the architectural firm Müller Sigrist AG won the competition, and negotiations on the building rights contract were conducted. Approval of the architectural layout by the City Council of Zurich took place in 2011 which provided the community with a legally binding building permit for Kalkbreite. Due to the participatory process during the development and construction phase, almost all commercial spaces were rented out before construction began. Many events and meetings were organized with the cooperation and all the stakeholders to ensure that the preferences and wishes would be heard and considered. An important factor that advanced the process was that all residents and cooperative members could voice their needs and opinions, but eventually a trusted expert group within the cooperative would make the final decisions to ensure appropriate communication with all stakeholders. During the official opening of the building, around 10,000 curious visitors attended and the district started to develop into a well-known and cherished area in Zurich. A long-standing tradition in Zurich of cooperative housing paved the way for the development of Kalkbreite, illustrating the importance of the promotion of alternative housing; future developments depend on it. Kalkbreite was built without a general contractor, it instead assembled its own planning team, which required a lot of knowledge and discipline on the side of the property developers, but it ensured a lot of freedom. Due to this construct, costs could be controlled in a more focused manner and savings and spending potential were discussed in a different manner. This cost-effective way of developing allowed for very affordable rents while still having a wide variety of programmatic functions, such as a cinema, sauna, restaurants, open-use areas and attractive outdoor spaces (Kalkbreite, 2022).



Figure 119. Through a collective approach, residents formed the Kalkbreite Cooperative and started planning for development (2022).



Figure 120. Various meetings and gatherings were organized to discuss the plans, the progress the challenges with the group (2022).



Figure 121. The interactive meetings allowed for a close and valuable bond between the members of the cooperative (2022).



Figure 122. A lot of families are part of the cooperative and the needs of the kids were also taken into consideration (2022).





Figure 123. There are various public commercial functions in the plinth of the building and its circulation invites for exploration (2022).



Figure 124. The building is developed as a unified superblock with shape alterations, situated on an important intersection (2022).

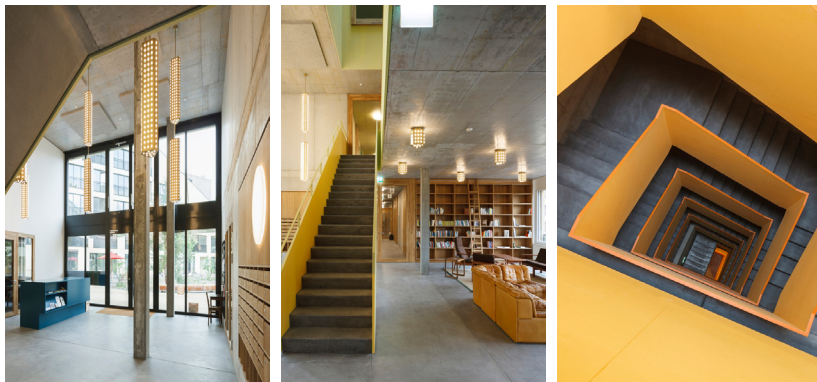


Figure 125. The interior of the superblock has various collective spaces, characteristic with colors and warm palettes (2022).



Figure 126. A large courtyard amidst the super block, providing a social habitat for households to interact and use the public amenities (2022).



Figure 127. The adjacent functions in the plinth provide liveliness to the elevated garden, it's a calm habitat for children to play (2022).



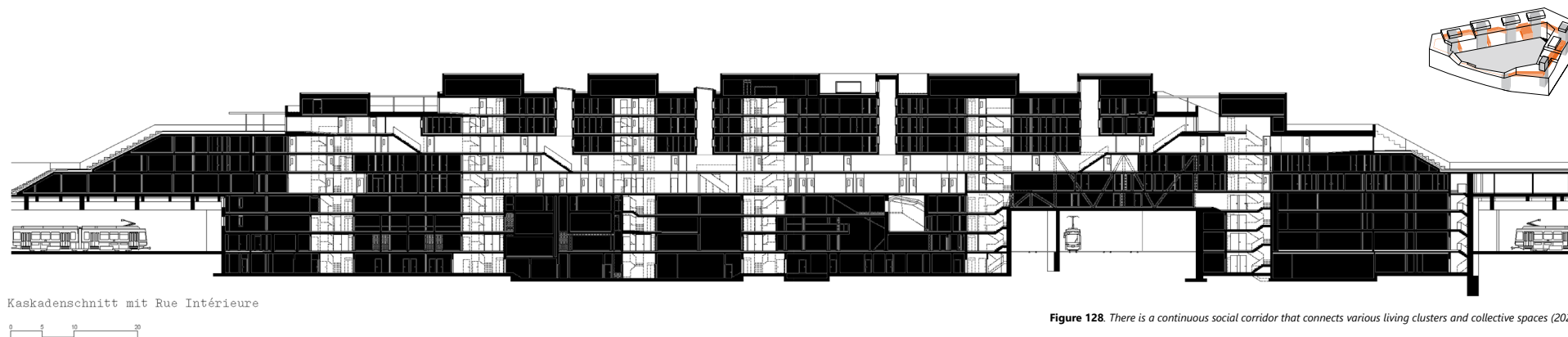


Figure 128. There is a continuous social corridor that connects various living clusters and collective spaces (2022).



Figure 129. The superblock has a large green public courtyard with many commercial functions (2022).

## THE DWELLING CLUSTERS - AN INCLUSIVE COLLECTION

Kalkbreite is characterized by a phenomenal layering of thresholds; ranging from public space, to collective space, to communal space, all the way to private spaces. This intricate system spatial configurations is present throughout the building. On the ground floor, in the plinth of the building, a broad range of commercial functions provide services and products to the public. These include a cinema, a library, shops, a doctor's practice, a daycare center, restaurants and cafe's. From the street level, several access points - impressive staircases - connect the main street level to a secondary street level; a large 2,500m<sup>2</sup> roof garden, which is accessible for the public. Functions such as a cafeteria, a launderette, the library and various workspaces overlook the courtyard. Some spaces on this level can be rented out to the public, such as a garden kitchen and the sauna. Kalkbreite promotes car-free mobility; there are only two parking spots which are reserved for disabled residents. A big bike storage space provides a space to store bicycles for the residents and the public can also rent a bike parking spot. From the level of the courtyard, the residential building is accessible; the entrance hall is located next to the cafeteria, and is equipped with an information desk and mailboxes. The residents can reach their home by a continuous central inner corridor, running along all the collective spaces of the dwelling clusters. This central hallway provides access to all floors via colorful staircases and elevators. The inner corridor continues outside, connecting both ends via an outdoor walkway, one level above the courtyard (Kalkbreite, 2022).

To ensure that the individual households would not be lost in anonymity - due to the size of the development - the cooperation made sure to provide a social, small scale framework for community building. Various "clusters" were developed, consisting of a number of residential units which could share communal facilities such as a big kitchen or living room. Each cluster was considered to be a household, and the formation of smaller communities within the large block would allow for better and more personal bonds and relationships between residents. Clusters would range in size, but an example of a cluster would be: 9 small residential units (between 29m<sup>2</sup>-50m<sup>2</sup>) connected by a social corridor, sharing a communal kitchen space (as big as a residential unit) and two extra "joker rooms" which could be used as a workspace or guestroom (Figure 131). Families, in need of more space, would live in the 'Grosshaushalt': a group of 20 homes, with a communal living and dining area and a professional kitchen with chefs, also accessible for other clusters. In addition, Kalkbreite provides a cluster for young residents (16-25 years old) and a boarding house with 10 rooms. The variety in dwelling clusters and dwelling types illustrates that this is a development which provides inclusiveness and community building, not just on a residential level but even on the level of the neighborhood. The broad range of residential units and clusters also allow residents to move to a smaller or larger cluster when that would be needed. This strengthens the community as it allows for the local circulation of households, so that residents can keep living in the area and community they feel connected to and are not forced to move elsewhere when their lifestyle or needs change; Kalkbreite provides inclusive flexibility (Kalkbreite, 2022).

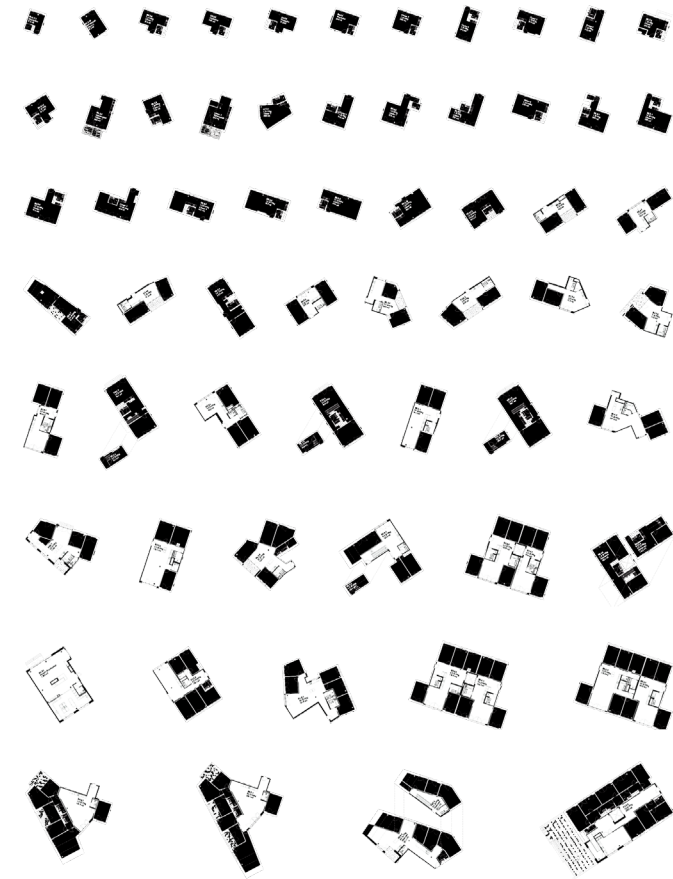


Figure 130. A variety of dwelling clusters and dwelling types to accommodate for a divergent group of households (2014).



Figure 131. Dwelling cluster with 9 residential units, large social corridor, communal kitchen, and two extra "joker rooms" (2014).

# MEHR

*A housing cooperation that developed an inclusive and affordable housing community on an old industrial site.*

**Timeframe:**

2009 - 2015

**Location:**

Zurich, Switzerland

**Size:**

41.000 m2 (Including 395 dwellings, 1200 residents and 150 jobs)

**Client:**

Housing cooperative Mehr als Wohnen

**Developers:**

Housing cooperative Mehr als Wohnen  
City of Zürich (Hunziker Aereal)

**Architects and collaborators:**

Duplex Architekten, Futurafrosch GmbH, Architekturbüro Sik AG, Müller  
Sigrist Architekten, pool Architekten, Müller Illien Landschaftsarchitekten





## THE HOUSING COOPERATION - MEHR ALS WOHNEN

In 2007, the City of Zurich and the Zurich housing cooperatives celebrated 100 years of urban housing policy. During various events, participants exchanged their ideas about new forms of living. As a result of the many discussions and events that were organized during this period, a new large housing cooperation was formed that would develop a vision under the slogan; “Mehr als Wohnen” (more than just living). This new cooperative is supported by 55 existing housing cooperations from Zurich, residents and other legal and private individuals. The union of the many stakeholders was driven by a common interest to voice pressing questions about the future of urban development and to generate knowledge for the entirety of the housing sector. In 2008 a new vision for the Hunziker area in Zurich had to be developed and the Office for Buildings of the City of Zurich in collaboration with Mehr als Wohnen, launched an international architectural competition. The aim was to explore ground-breaking architectural solutions for a future-oriented district, which needed to be climate adaptive, with affordable and socially inclusive housing. From the almost 100 submissions, 26 were selected to develop an urban concept for the Hunziker area. The parameters dictating the proposals were centered around new forms of living, such as generational living and co-living. Proposals needed to adhere to the 2000-watt society\* principles and special attention had to be paid to the optimization of the planning and production process and affordability. After the winners of the competition were announced, an extensive period followed that offered room for dialogue and participation. The winning teams would discuss with the jury and other participants how the area would be developed. The dialogue evolved around the topic of urban planning and living; “how can a neighborhood and not just a ‘settlement’ be created” (Mehr als Wohnen, 2017). Important topics of discussion were the relationship between inside and outside, the mix of functions, structures, building types and forms of living. By 2012, a comprehensive vision and design had been formulated for an ecological, economic and socially sustainable district development. During the planning phase, so called ‘echo chambers’ were run to allow a platform for dialogues between the developers, cooperative members and the wider public. Instead of car parking spaces, the community decided to build town squares to promote a car-free district while minimizing their carbon footprint. To ensure a common approach for the different buildings, a set of principles was developed; entrances always had to be situated on the smaller alleys, expression in facades had to face the central courtyards, and volumetric and facade principles were proposed (figure X). Although the result was a very divergent mix of architectural blocks, key principles were incorporated. To monitor the mix of residents, the cooperative used a professional Online renting tool which allowed them to understand which social mix was desired for better community formation. The cooperation developed a handbook to inform the members about the collective maintenance and procedures within the cooperation (figure 133). The 13 housing blocks, consisting of around 380 homes, facilitate an affordable and socially inclusive neighborhood for approximately 1400 residents (Mehr als Wohnen, 2017).

\* The 2000-watt society is a term that was introduced in 1998 by ETH Zurich, which aims at reducing primary energy use to no more than 2,000 watts without compromising the standard of living (United Nations University, 2009).

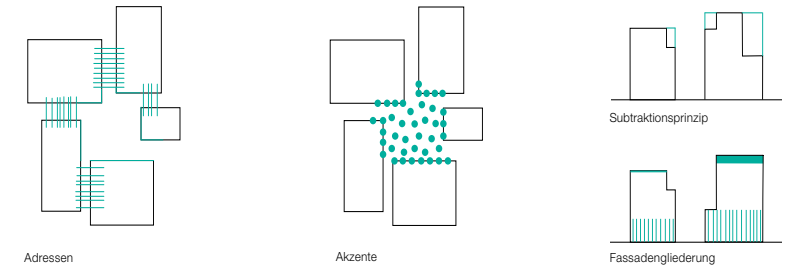


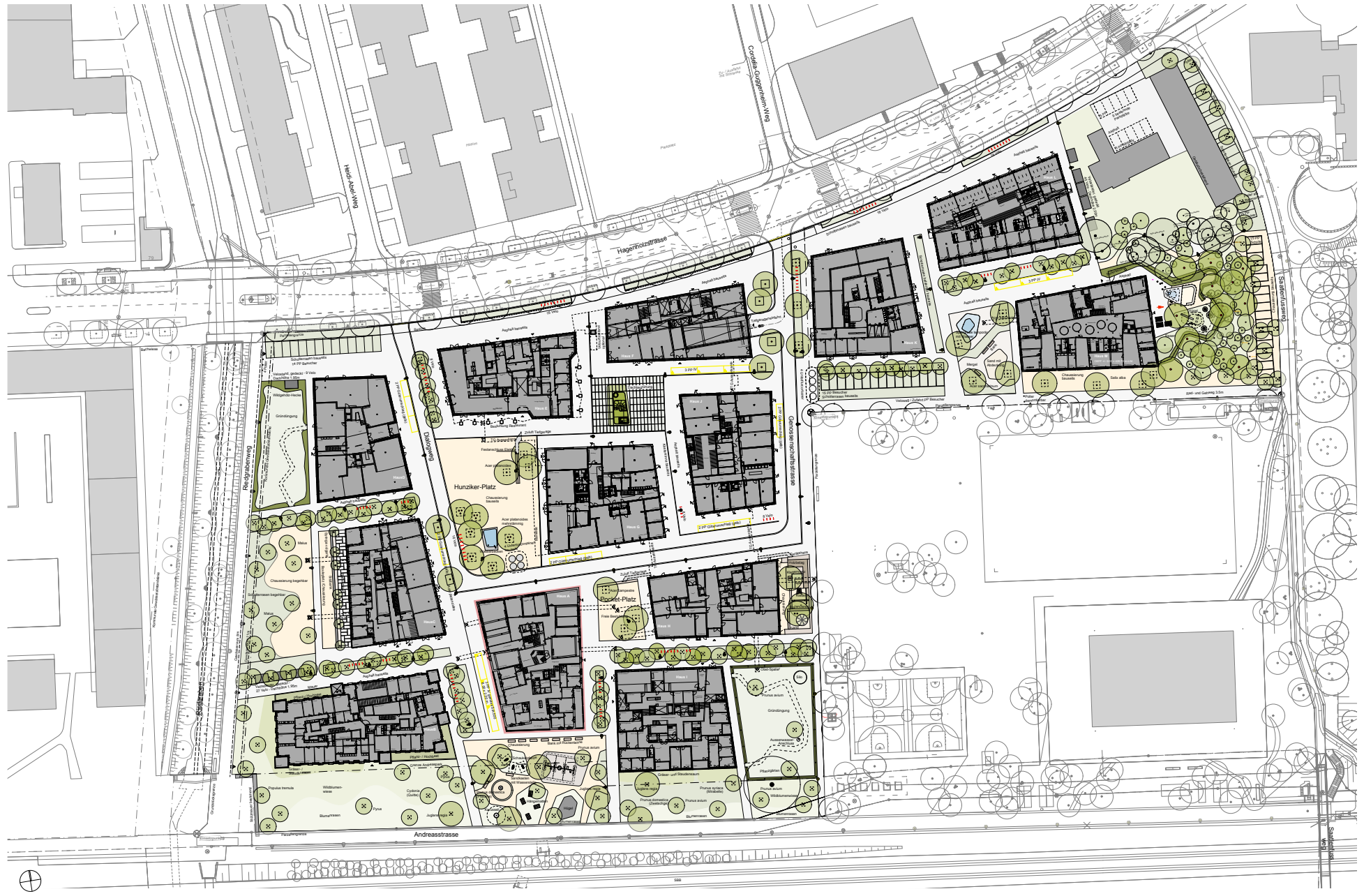
Figure 132. A set of general principles was developed to ensure a common approach for the architectural layout and design (Mehr, 2017).



Figure 133. A manual, outlining the general rules, obligations and processes for participation was developed by the cooperative (Mehr, 2017).



Figure 134. The car-free, town squares facilitate social meeting spaces for residents and the general public to meet and interact (Mehr, 2017).



3073 projekt 1 mehr als wohnen  
 Situation-Grundriss mit EG 1 : 500  
 25. September 2013

0 5 10 25m

Bauherrschaft: hausgenossenschaft mehr als wohnen  
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Architekt: FUTURAROSCH, DUPLEX architekten, Müller Sigrist Architekten  
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Figure 135. The urban masterplan; the landscape was designed first to ensure proper urban integration (Mehr, 2017).



## THE SPATIAL CONFIGURATION AND ESSENTIAL LIVING QUALITIES

The urban masterplan is characterized by large building blocks, consisting of around five to seven layers in height. The winners of the competition got one or more building blocks assigned that they could develop a design for. Aspects that needed to be considered were co-living principles and general architectural layout and facade principles to adhere to a larger urban cohesive framework.

Duplex Architekten was one of the winning parties during the competition, and they got to develop two building plots; Haus M and Haus A. The practice was inspired by the unique composition of the master plan, a palette of gradients in space and character. The scattered building blocks form a network of paths which alternate in scale and size, resulting in an interesting tension between different use-cases of the public space. In the urban fabric, there are small alleys which provide a sense of shelter, open spaces, and larger town squares for social gathering. The architects took the arrangement of the public space as an inspiration and a point of departure for their floor plan layout design of Haus A (figure 136). During the dialogue phase following the competition, the wishes of the co-living residents translated into floor plans that embodied a sense of community and togetherness at the center of the living experience, representing a new form of co-living (Duplex Architekten, 2015).

The large cluster apartments are characterized by their chamber system. Each resident has its own private studio with a kitchen and bathroom, providing a maximum level of privacy, while the residue space at the center of the chambers is formed. This is a communal space, used for shared living facilities with a big kitchen and living room. The configuration allows for essential living qualities; the need for privacy is guaranteed, while qualitative spacious communal spaces form the heart of the clusters. These communal spaces are composed as a sequence of paths and squares, offering more secluded areas that provide a sense of sheltering, and more open areas for social interactions and activities. In the center of the cluster, where least of the daylight reaches, a shared chamber facilitates storage space, a closet area and an extra bathroom, besides functioning as a central shaft for installation technique. The general size of the urban blocks is very big, allowing the architects to re-think and re-design conventional floor plan layouts. The large floor plates give room for unique configurations with various types of spaces. Due to the large footprint, daylight won't reach the center of the plan, therefore circulation is solved at the heart of the building. A big atrium at the center receives daylight from a skylight, lighting up the staircases that lead the residents to their dwellings. The circulation area in the middle is very bright and spacious, making this space a pleasant area to be and to encounter other neighbors. It's as if the public character of the square is continued into the building, connecting the ground floor back towards the sky. In Haus A, every cluster also has an outdoor terrace or balcony, providing the residents with thermal comfort and a chance to step outside of the building for some fresh air and soothing views (Duplex Architekten, 2015)..



Figure 136. Individual residential studio's allow for privacy, while large communal spaces provide essential spatial qualities (Mehr, Haus A 2017).





**Figure 137.** Spacious and bright staircase atriums offer a social circulation space for the residents of Haus M (Duplex Architekten, 2015).



**Figure 138.** The private chambers are equipped with a kitchen, but communal spaces invite for social interaction (Duplex Architekten, 2015).



**Figure 139.** A composition of private rooms and spacious communal spaces provide essential living qualities (Duplex Architekten, 2015).

# FINDINGS & STRATEGIES

*“Can industrial buildings be transformed into mixed-use housing communities?”*

*“How to realize affordable housing types without losing essential living qualities”*

- *By preserving historical qualities and proper urban integration.*
- *By accentuating both the old building and the newly added volume.*
- *By maximizing preservation through minimal structural perforation.*
- *By developing a new structure that is self-supporting and loadbearing.*
- *By structural efficiency that results in optimal flexibility for the users.*
- *By developing through non-speculative frameworks: e.g. a cooperation.*
- *By fostering a participatory planning process with clear prerequisites.*
- *By adding space for inclusion: public, collective, communal, and private.*
- *By circular and collective frameworks that allow for community building.*
- *By a broad range of living clusters for optimal inclusion and variety.*
- *By social collective spaces that connect the various community clusters.*
- *By spatial configurations providing privacy, spaciousness and interaction.*

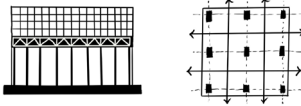
The chapter re-envision dwelling aims to learn from the past and the present to provide a window into the future. By looking at historical developments and how pioneers reacted to the challenges of the time, a deeper understanding of ambitions and consequences during periods of crisis is developed. In times of crisis, it is important to re-think and think ahead, especially when the decisions affect many generations to come. Therefore, a selection of case studies have been analyzed to understand how realized and proven examples can inspire new ways of dwelling in the decades to come, dealing with transformation, affordability, mixing functions, social inclusion, and spatial configurations for decent living qualities.

The first case study is the transformation of the historical Fenix I building. The interview with the partner that was involved in the development of this project provided various insights. This project shows that it is possible to transform industrial buildings into mixed-use housing communities, although this example provided the market with flexible dwelling arrangements, by selling square meters instead of fixed dwellings, this led to a diverse mix of dwelling sizes. Important strategies to consider are the urban integration, the preservation or accentuation of historical and cultural aspects, the addition of new spatial values, the co-existence of various functions, the structural approach when constructing a new volume above an existing building, and the value of optimal structural flexibility and how this can affect dwelling configurations. The second case study shows the power of cooperative development; above an old tramp depot, the cooperative Kalkbreite managed to create a space that was never there. This non-space was transformed into a mixed-use housing community. Because the land was available for redevelopment a lot of cost was saved, especially with the (financial) support that the City of Zurich provided. Unique strategies derived from the study are the layering and presence of various types of space: public space, collective space, communal space and private space. A complimentary palette that can provide exclusivity and social interactions. Within this building, a collection of communal living clusters were developed for many age groups allowing for inclusive living. It also enables residents to move to a smaller or bigger cluster within the community when needed, which strengthens the community as well since residents are not forced to move out when their lifestyle changes. This case study shows how a mixed-use housing community can be developed by redeveloping a non-functional site and building. The final case study is the development of the Hunziker area, where a special phenomenon took place; 55 cooperatives united and supported a new big housing cooperative: Mehr als Wohnen. They had the capacity to develop a master plan for a collection of 13 housing blocks, consisting of around 380 homes, which facilitate an affordable, sustainable, and socially inclusive neighborhood for approximately 1400 residents. One of the block designs is analyzed in more detail to establish a better understanding how spatial configurations can contribute to spacious and social living qualities. Both Kalkbreite and the development of the Hunziker area prove that it is possible to realize affordable housing types without losing essential living qualities; through cooperative development, social participation, and considerate social and spatial configurations.

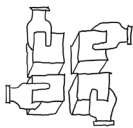
## Strategies



*Urban integration: preservation and accentuation of old and new, while adding new spatial qualities*



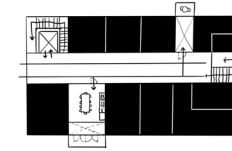
*Self-supporting, minimizing perforations and optimal structural flexibility*



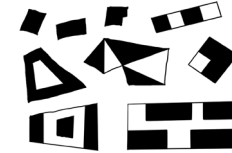
*Non-speculative developing with local support and participation*

GOVERNMENTAL  
AND MUNICIPAL  
SUPPORT  
• CLEAR AMBITIONS  
• PARTICIPATION  
• TENDER OR  
COOPERATION  
• PRE-EXISTING  
PLANNING  
EXPERIENCES

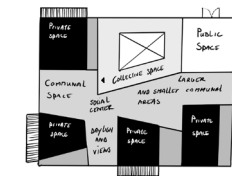
## Strategies



*Co-living clusters and collective spaces are connected by a central corridor*



*A large diversity of clusters allows for inclusion and circulation of households*



*A gradient of spaces provide essential living qualities for affordable prices*



# DISCUSSION

For this research report, a combination of methods was used to gather information and data, resulting in a comprehensive approach which developed a broad understanding of the research problems (the Dutch housing crisis and the agrarian crisis). By studying history, gathering data and investigating potential implications and solutions for both crisis, the research aim was developed; finding spatial solutions for these transitions. This led to the discovery of the presence of a large amount of industrial areas in the Netherlands, which could potentially offer spatial solutions for both problems. Considering the research problems, research aim and the broader societal framework, the following research question was developed:

***“Can industrial urban areas be redeveloped in response to the agricultural transition and mitigate the housing crisis with inclusive, affordable housing communities?”***

To find answers, various case studies have been analyzed, accompanied by in-person interviews with a range of stakeholders. The reason for choosing case studies as a method is because of the nature of these projects; these precedents are not theories, but have been realized under real, societal conditions. Analyzing and understanding the processes, challenges and strategies can be not only informative for research and design, but also proof of concept. Findings and strategies were distilled from the case studies which can be used for research and design. In order to allow for more depth and detail, the in-person interviews have provided information that could not be found other wise. By having the chance to ask specific questions, more direction was given to the data gathering process. Although several research methods were used, it is important to note that a the consultation of theoretical research was limited. Due to the nature of the research problems, an approach that looked into history, the present and future projections was more applicable. Nevertheless, more opposing views derived from literature studies could have challenged or strengthened the findings and strategies, which leaves room for further development. Because the scope of the research was very broad, it has not reached the depth and detail of topical research, it rather provides an overarching framework to understand and address the research problems. The retrieval of data was conducted through open-source systems, although known to be trustworthy platforms and sources, it can not always guarantee the full exposure of data and accuracy and actuality, therefore sometimes sources date from different years. An extreme example was the map of the ‘monetary value system of the agrocluster’, displaying the financial value of the landscape. This map was derived from a study in 2004, and is quite informative as it challenges the more recently developed ‘ecological value system’ map. More recent information about the monetary value of the landscape was incredibly difficult to find, and no useful sources were collected eventually, therefore this aspect could be elaborated on. Although the research aims at redeveloping urban areas, it does not exclude the possibility of building in the landscape - since this could also be done in a visionary and sustainable way - this research simply focuses on solutions and strategies for sustainable urban redevelopment.

# CONCLUSION

The research report covers many scales and uses various methods to acquire information to recognize patterns and come to insights and conclusions. In order to provide relevant solutions, a deeper understanding was needed of the underlying mechanisms that caused the various issues we are faced with. The research aims to approach the problems (the Dutch housing crisis and the agrarian crisis) in a holistic way. By doing historical research, a foundation is laid to recognize that the housing crisis is not a new phenomenon, but rather a recurring issue. The valuable thing about history is that it can provide lessons for the future. By studying the past, the causal relationships between ambitions, decisions and results are clearly displayed. The focus on quantity and mass-production during the reconstruction period has led to a large volume of housing that alleviated the crisis back then, but make the majority of the current housing stock problematic and monotonous. The majority of the current housing stock being family row homes or urban flats that were constructed during this era. With a population that grows more diverse in households and lifestyles, the mismatch in supply and demand starts to become an issue, causing scarcity in the real-estate market. The research also tries to provide a new contemporary perspective on the topic by discussing the political statements and decisions that are made recently in response to the current housing crisis. Recent news articles and publications by journalists and researchers are consulted to develop a broader perspective on the problems. A collection of different opinions and perspectives from authorities in the field is collected through literature research, aiming to reveal the full spectrum of the research problems. Many of the research suggests that the governance and policymaking by the government and political parties have led to many of the issues that are present in the real-estate market. While short-term solutions are possible - decisive political governance, more efficient use and transformation of the existing housing stock, and the construction of temporary housing - there is also a need for a more holistic, long-term vision. Open source data and statistics are studied and compared to provide a quantitative, objective layer of information to find patterns and draw conclusions from. The data shows that there is a significant mismatch in terms of housing supply and demand. The amount of smaller households (and elderly people) are increasing, while the amount of available smaller homes is underrepresented. The large group of smaller households (65% of the population) consists of starters, singles, couples and divorced households; a diverse group of people to accommodate for, with special needs and requirements for social interaction and spatial configurations. This requires a careful consideration and special approach when designing new dwellings for the future. While the government currently has planned to build all across the nation, this is not necessarily a sustainable planning approach. Research suggests that the densification of urban areas can result in a more positive impact for the environment. It is economically more feasible and requires less extra resources to construct infrastructure and facilities to make remote places more accessible. Redeveloping urban areas allows for a sustainable upgrade of the existing urban public spaces, buildings and a more efficient use of existing facilities. In order to conquer affordability new ways of developing and building need to be considered.

While the housing crisis is a problem that can be traced back in history, the agricultural crisis seems to be a new phenomenon, especially in the light of the sustainability targets that dictate a lot of the decision making regarding the agrarian crisis. Therefore, mostly contemporary resources such as news articles and interviews with researchers from recognized institutions (Such as WUR) are consulted to understand how the agrarian crisis became such a prevalent topic in the media and how it led to societal reactions such as protests by farmers. The analysis of the Dutch landscape, through consulting open source data bases and studying cartographic information, is mapped out and causal relationships are established. By analyzing the Dutch landscape through the lens of two frameworks; the monetary value system and the ecological value system, the character, strengths and weaknesses of the landscape are inventoried. The production of resources in the landscape provide the nation with monetary value, while the presence of ecological systems (such as nature reservoirs or the dune landscape) offers ecological value. The study and comparison of these two value systems, projected on the Dutch landscape, offered new insights in what areas would be logical to redevelop or re-envision. The areas that were found to add little monetary and ecological value, while emitting significant amounts of CO<sub>2</sub>, were related to the soil type of the areas. The peat soil landscape, close to large cities such as Rotterdam and Amsterdam, provide opportunities to be redeveloped into areas that could provide much more ecological and monetary value to the country. The envisioning of the redevelopment of the landscape and exploring more sustainable and efficient ways of producing resources while adding value, is what the agrarian transition entails. Due to the magnitude of these areas and the implications the transformations will have, a lot of time will be considered for the agrarian transition and therefore allows for a futuristic scenario where new ways of farming and living would be considered. While a lot of attention is currently projected on the emissions that farmers cause, according to experts there is only a small margin of reduction in emissions feasible. If the reduction of emissions is such an important ambition, there should be a more holistic approach; for example reducing the emissions in the industrial sector (the largest sector with 31 percent) or the reduction of car commute and the reduction of cargo transport (the second largest sector with 19%). Re-thinking and re-organizing the landscape and production of resources in such a way that local circular economies can be established could be a more reasonable way to approach the reduction problem. Having outdoor, regenerative farming and production of resources in close proximity to large cities, in combination with very efficient, and modernized urban farming technology (such as vertical farming and hydroponics) could boost the local production and distribution of resources. Perhaps, the increase in the local production of food and resources could also bring down the surging prices of food and materials, and we could reduce the amount of imported goods (reducing emissions) and export the superfluous amounts of resources we produce.

In search of spatial solutions for the transitions that both crisis require, the significant presence of industrial areas in the Netherlands was discovered. Through open-source databases, the presence of industrial estates could be quantified; this turned out to be around one thousand square kilometers. To put this into perspective, this land coverage was compared to the total amount of land coverage that major cities in the Netherlands amount to. When combining most of the largest cities in the Netherlands, this would be comparable to the immense amount of square meters that industrial areas cover. Although scattered all over the country, often very large industrial areas have been established close to major cities, due to historical developments and for trading purposes. The specific focus for the redevelopment of industrial areas is placed on areas that are situated in larger cities. More specifically, in Rotterdam since the percentage of industrial areas in this municipality contributes to a big portion of the land coverage. Because the harbor region would require a separate study and approach, the focus is placed on urban areas that are closed to the city center. To understand how these areas can be redeveloped in an appropriate way, two case studies have been analyzed. The first case study looks at a smaller area which was previously used for industrial purposes. The second case study looks at a larger area, which was previously used for the production and transit of goods. Both case studies are accompanied with primary information from an in-person interview with important stakeholders that were part of the developing process. The case studies and interviews have provided valuable insights on how to develop industrial urban areas and in what capacity this should occur. From these studies, various strategies are developed that can inform the design process. Some of the important conclusions are: the consideration of regional planning, the historical and cultural research and background of an industrial area, the consideration of preservation or transformation of existing buildings, the urban integration in terms of massing and size of newly added volumes, fostering the identity of the area by respecting existing functions and communities, social participation throughout the process of design and developing, and the development of the plan in phases to allow for logistic and financial feasibility. Other important spatial strategies to be considered when developing an area with a variety of functions that have the potential to allow for new ecologies are: the accessibility of the area through public transport and the facilitation of parking, collective shared and smart mobility, collective energy production and distribution, collective exchange of residual flows, collective water management, providing public spaces with different characters, and the upgrade of public space by the means of greenery and biodiversity which can help to reduce the urban heat island effect in industrial areas. An important intervention to allow for the mix of functions in an industrial urban area is the division in several districts, so that there is space for more heavy industry, lighter industry and also areas designated for a mix of functions such as living, working, leisure, and social activities to foster a vivid and diverse neighborhood.



In the chapter re-imagine dwelling, the search for answers on how to transform industrial buildings into mixed-use housing communities resulted in a case study where an existing industrial building was transformed into a mixed-use ensemble that offers flexible housing configurations alongside commercial and cultural functions. This case study was supplemented with an interview with one of the partners that was involved in the development of this project. There was added value of doing an interview in addition to the case study, because the partner's expertise was building technology and during the interview he could provide answers to very specific questions regarding the transformation of the building. The focus of the case study and interview revolved around the development of the shape of the building, the special treatments of the industrial building, the combination of various functions, the technical and structural process and challenges and the development of the flexible dwellings in the newly added volume. Key findings of the case study and interview are: the value of place-making in area development, the importance of historical and cultural value when it comes to transformation, the importance of preservation and accentuation of both building volumes, the combination of programs, the importance of planning and structural engineering, the importance of structural efficiency and feasibility, and how the structure of a building can allow for flexibility, which is translated to the floor plans of the dwellings. The findings are translated to design strategies which can be used to inform the design process. The second subquestion that was explored in this chapter is how affordable housing types could be developed without losing essential qualities. This led to exploring a new form of developing (non-speculative developing) where the financial aspect was very different from traditional developments. While traditional developments are driven by profit, the development through cooperations allow for a different financial approach. Decisions on where to save money and what to spend it on lies in the hands of the cooperation (the residents), therefore the involved stakeholders and future residents of the development can have a big influence on how they will live in the to-be-developed neighborhood or building. Decisions regarding the mix of functions and the configuration of space become more relevant for the residents as they can affect their way of living. The case studies that were analyzed to find answers are Kalkbreite and the Hunziker area in Zurich (by Mehr als Wohnen). Both projects have shown the importance of the larger development of the area and the involvement of the governing bodies. The city of Zurich has been very supportive in both developments, allowing for a unique way of planning, developing and building. By studying the development of Kalkbreite, important insights were gathered and principles that were derived from this study are: regarding the planning process of a property by a cooperation, the importance of social participation, the inclusion of a mix of functions, various types of space to foster inclusion, and the development of a wide array of dwelling clusters. This also allows for the internal circulation of households; when the needs or lifestyle changes, households could easily move to another cluster that would accommodate for their new needs. Both the research about Fenix I and Kalkbreite show that existing buildings (or sites) can be redeveloped into mixed-use housing communities.

The project by Mehr als Wohnen is of a very large scale, and shows the significant potential cooperations have when they unite and collaborate with the government. What was remarkable about the Hunziker area, is that the larger plan has been developed as a breeding ground for housing commons. An innovative area where architects were challenged to develop ground-breaking ideas for new forms of co-living and generational living. This resulted in an eclectic mix of building blocks, each offering a different way of living for 1400 residents in total. Throughout the development of the area, the ambition was set to adhere to the 2000-watt society, which entails that sustainability and energy efficiency are important parameters for the development of the area but also for the lifestyle and operational performance of the buildings. This resulted in the installation of sustainable, efficient energy appliances and an (almost) car-free development to promote sustainable mobility. While during a profit-driven development these factors might be considered less often, for residents these can be valuable and important principles they want to live by which also prescribe their lifestyle. The larger area functions as one big community with many public spaces, greenery and regular meetings and events. Because of the non-profit development (of both Kalkbreite and the Hunziker area) very affordable housing was realized. Although we often consider that affordable housing is only possible when sacrifices are made in terms of quality, both of these projects prove that affordable housing types can be realized without losing essential living qualities (such as qualitative use of materials, qualitative spatial configurations and a mix of nearby amenities). The analysis of the floor plan layout of Haus A (one of the blocks from the plan) by Duplex architekten, it was shown how considerate spatial configurations can be developed to allow for essential living qualities. Providing residents with private space and facilities while also having access to well-lit, spacious communal living rooms and kitchens that foster the social interaction between co-living residents.

Together, these four chapters have provided a wide range of answers and strategies which can inform the design process and can be helpful for other researchers and students to elaborate on. The main research question has also been answered;

***Industrial urban areas can be redeveloped in response to the agricultural transition and mitigate the housing crisis with inclusive, affordable housing communities.***

This potential has been proven by the analysis of all the key factors that would contribute to the success of such a development. Findings and strategies have been developed through a broad range of research methods such as; historical research, theoretical research, literature reviews, quantitative analysis, through obtaining primary source materials, and through the analysis of realized case studies that underline the success and feasibility of this endeavor.

# REFLECTION

## **1. What is the relation between your graduation project topic, your master track and your master programme?**

The master track of architecture encourages students to develop a creative and innovative approach to design buildings, where spatial, social and technical challenges ought to be important staples that contribute to the research and design approach. Students are expected to develop an independent and academic attitude towards the challenges they encounter in the built environment.

The advanced housing design graduation studio fits well within this broader framework as it explores how housing design can successfully address societal challenges such as social polarization, demographic change, global warming and environmental impact. The studio departs from the analysis of what 'inclusion', 'affordability', and 'housing needs' are. The provided context by the graduation studio is the vast (peat) landscape area between the cities Rotterdam and the Hague. The contextual framework has provided the students with a visionary plan for the redevelopment of this agrarian landscape into a national regenerative production park. The assignment includes the analysis of this landscape, and developing a vision on how the transformation of this landscape would affect the larger (surrounding) area and cities. A drastically changing landscape also requires a different approach when it comes to housing, therefore students were invited to develop ideas and visions on how the future of dwelling would look like during and after the transformation of this landscape; 'Midden-Delfland'. While some students developed small resilient dwellings for the new (swamp) landscape, other students developed larger settlements and in my case, I made a statement to not build in the (vulnerable) landscape but instead double down on the densification of the urban environment close by. More specifically, the densification and redevelopment of a large industrial urban area into a resilient mixed-use neighborhood that could offer spatial solutions for the agricultural transition (by developing a strong relationship with the new production landscape) and mitigate the housing crisis by designing affordable, and socially inclusive dwelling types. The topic of the graduation project is called 'productive neighborhoods', referring to the mixed-use redevelopment of the urban industrial area where new ecologies would be allowed to flourish through a collective and circular planning approach. The research behind the graduation project explores the history, cause and potential solutions for the Dutch housing crisis, and unravels the complex agrarian crisis through data, statistics and literature studies. In order to respond to the agrarian transition, a better understanding of the future of the countryside is developed. Various interviews and case studies have been conducted to develop a theoretical foundation and design strategies for the redevelopment of industrial urban areas into mixed-use neighborhoods, and how existing buildings can be transformed into housing communities, while social and spatial qualities are fostered through design. The graduation project, and research and design approach, addresses relevant topics such as societal challenges, spatial challenges, and technical challenges. The project displays an independent and academic attitude, where creative and innovative ideas are researched and developed as a case study into a well-designed and engineered proposal.

## 2. How did your research influence your design, and how did the design influence your research?

The research has been of fundamental importance for the design process. The research into the Dutch housing crisis and the agrarian transition, although only providing an introduction and background to the actual proposal, have been crucial in the formation of ideas and ambitions. Delving into the history of Dutch housing, looking at recent interviews, news articles and open source data, provided a deeper understanding of the underlying mechanisms that have contributed to the housing crisis in the Netherlands. By having a better understanding of the underlying cause, the symptoms were better understood and appropriate proposals could be formulated during the research and design process. The research about the housing crisis provided insights about the major influence policymaking and governance has on the built environment. It also exposed the alarming mis-match between the supply and demand of housing, which could be traced back to the reconstruction era and illustrates the mindset of developers in current times. When I understood the mismatch, I realized that we are in need of housing that provides for the largest demographic group in the Netherlands; smaller households, which also have special needs when it comes to accessibility, social aspects and spatial qualities. Understanding this, informed the research and design, and pointed me in the direction of new forms of development such as cooperative housing and co-living. Suitable case studies were analyzed to understand what it entails to design in a inclusive, affordable and sustainable way. While designing, and wanting to redevelop an industrial urban area to minimize additional infrastructural implications, I was in urgent need of good examples on how to do that. This led me to approach specialists (a developer and the municipality) whom had recently worked on a similar challenge. The interviews and case studies helped me to develop a considerate strategy for the redevelopment of the industrial urban area the 'Spaanse polder'. The ambition to transform an existing building into a mixed-use housing community, was quite a challenge; both programmatically and structurally. After developing several design options, I had to take a step back and find appropriate ways to do this. This led me to interview one of the Partners at Mei Architects and Planners, whom worked on the transformation of Fenix I. By conducting an interview, a lot of new insights were gathered that were developed into design principles. A careful and respectful approach was derived from the interviews, and this had an impact on the massing and architectural design of the (newly added part of the) building. In terms of the dwellings, studying the cooperative housing case studies, with a rich collection of co-living clusters, definitely inspired the design process. This came back in the form of circulation principles, public-collective-communal-and private spaces, and the spatial configuration of the floor plans of the dwellings. In terms of materials; the research about the production park Midden-Delfland, where local, bio-based materials could be produced, gave me the idea to design the new building from (local) bio-based materials, also to reduce emissions as much as possible. On the level of detail, the ambition was to make everything as de-mountable possible.

## 3. How do you assess the value of your way of working (your approach, your used methods, used methodology)?

The research consists of a problem statement that covers two issues; on the one hand the housing crisis and on the other hand the agrarian crisis. The aim of the research is to find spatial solutions for these transitions, and to develop an urban environment that is sustainable, socially inclusive, affordable to live in, and with local ecologies. The methods that were used to understand the problems, were a selection of different approaches. Not necessarily through doing theoretical research and comparing existing research papers, but rather by collecting as much information as possible about the past and present developments regarding the issues. This was supported by quantitative research methods; collecting open-source data and information on the past, present and future projections in order to understand causal relationships and recognize patterns that would explain the underlying mechanisms that contributed to the problems. A divergent expert panel was composed, where important but contrasting opinions about the problems by experts in the field were gathered. This allowed for a broader perspective on the research problems. Although the combination of these research methods did allow for the development of a broad perspective, I still feel that a theoretical support coming from existing research could have strengthened some of the findings and conclusions. While doing research and having to formulate insights and conclusions, I also had to learn to be careful not to be too subjective in the description of the findings, but rather display the information in a more objective and scientific way, as well as the conclusions. Besides the problem statement and the research aim, various interviews were conducted and existing case studies were analyzed. The interviews provided an opportunity to collect primary sources which could give unique insights for the research. The interviews were definitely very valuable for the research findings, as the interviewees shared information and details which usually wouldn't be able to be found any other way. The combination of the project descriptions of the case studies and the interviews gave a clear overview of appropriate ways to incorporate essential ambitions and allowed for the formulation of design principles which would inform the design process. The diverse collection of interviews (with the developer, the municipality and the architect of different exemplary projects) provided a broad range of insights when it comes to research, developing, urban planning and design. However, I do feel that there could have been more primary sources to inform the research, such as an expert on the housing market, a financial institution, an interview with a cooperation, and an interview with someone who lives in a communal dwelling cluster. This could have enriched the research and design process. Besides primary sources, I also think that more time dedicated to theoretical research could have challenged and also strengthened the final conclusions. One of the big challenges I faced, was that the research was very comprehensive, covering a lot of different topics, which was on the one hand informative but on the other hand restrictive. Having one simple, dedicated research topic would have allowed for a deeper and more theoretical research, however I do believe that the current research results do provide a unique value to the field of architecture and planning.



#### **4. How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?**

The topics that have been key to the research are the Dutch housing crisis, the agrarian crisis and transition, the redevelopment of industrial urban areas and buildings, and the development of affordable, socially inclusive housing communities. These topics cover some of the most crucial aspects that academia are faced with; sustainable transitions, the redevelopment and re-use of existing urban areas and buildings, and the re-consideration of existing forms of developing, planning, designing and living. Especially with a crisis regarding the housing of citizens, scholars should be hyper focused on detecting the underlying problems, finding potential solutions and sparking discussions regarding these topics that not only affect the built environment, but society at large. While often in-depth topical research is developed, the aim of this research report is to cover a wide range of overarching topics, which are entangled and crucial to consider side-by side, as they all influence each other and the way we plan and imagine the future. The scope of this research goes from the national level, to the urban level, it addresses the architectural level, the level of living and dwelling and even the level of details and materials. Therefor this research is not considered to be an in-depth report, but rather an overarching framework that can provide academia and society with valuable findings and strategies that can be discussed and further elaborated on. Ethical aspects of the report includes addressing governmental superstructures and revealing the major impact that governance has on society. The report also underlines the ethical responsibility to re-use and re-develop existing structures and buildings instead of continuously expanding cities into the countryside where architects and planners can freely design what they want. Instead, this report urges to operate in a restrictive domain; the urban context, and respecting history, the urban context, and utilize existing resources as much as possible. As architects and planners, we also have an ethical responsibility to re-imagine dwelling; we are responsible for how generations to come will live. Although we often work for clients that provide us with a job, it can be very refreshing to explore alternative models for developing and designing. The report gives various examples on proven case studies where the development and design of social communities took place and have proven to be a grand success. This could imply researchers, architects and planners to explore new ways of designing, where the user experience through collective use and spatial configurations could be central themes that drive design. This would be ethically responsible, as it would probably make the work of the designers more challenging while making the living environment for future generations more social and qualitative, and this would also serve a more diverse range of the populous.

#### **5. How do you assess the value of the transferability of your project results?**

The divergent research methods have resulted in a broad range of insights, conclusions and strategies. The Dutch housing crisis is a prevalent issue in our society, and will be a problem that many future architecture students and researchers will face. This research report provides readers with a deeper understanding of the underlying mechanisms that have contributed to the housing crisis. That can be an important starting point for further research. The collected data, diagrams and design principles can be used and elaborated on by other researchers and students. Because the agrarian transition is such a recent and complex phenomenon, unraveling the character of the Dutch countryside and quantifying it by the means of two opposing value systems, can also provide a better understanding of the Dutch landscape. More specifically, which areas have the potential to be re-imagined or redeveloped for a more climate adaptive and sustainable future. The various interviews with important experts also provide a lot of value and fertile breeding ground for further exploration and development. The case studies that display new ways of living, where the emphasis lies on social, qualitative spaces hopefully can be an inspiration for other students and researchers to consider during the development of their work. The research is overarching, covering many topics and highlighting various perspectives, open-source data and case studies, providing the field of architecture and research with a broad frame of references and insights. Because every chapter is concluded with findings, accompanied by design strategies, and in the discussion section various concerns and aspects for further development are discussed, I believe that the value and transferability of the research can be considered sufficient.

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**Figure 135.** The urban masterplan; the landscape was designed first to ensure proper urban integration (Mehr, 2017).

<https://www.mehralswohnen.ch/genossenschaft/mehr-als-wohnen/>

**Figure 136.** Individual residential studio's allow for privacy, while large communal spaces provide essential spatial qualities (Mehr, Haus A 2017).

<https://duplex-architekten.ch/perch/resources/publications/quartartikelduplex.pdf>

**Figure 137.** Spacious and bright staircase atriums offer a social circulation space for the residents of Haus M (Duplex Architekten, 2015).

<https://duplex-architekten.ch/perch/resources/publications/quartartikelduplex.pdf>

**Figure 138.** The private chambers are equipped with a kitchen, but communal spaces invite for social interaction (Duplex Architekten, 2015).

<https://duplex-architekten.ch/perch/resources/publications/quartartikelduplex.pdf>

**Figure 139.** A composition of private rooms and spacious communal spaces provide essential living qualities (Duplex Architekten, 2015).

<https://duplex-architekten.ch/perch/resources/publications/quartartikelduplex.pdf> (graphic alterations by the author (2024))

**Figure 140.** Concluding strategies for inclusive and affordable housing communities (Illustrations by the author, 2024).

*Illustrations by the Author (2024).*



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