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Greening without Borders

Monitoring & Evaluation Framework

TU Delft - Baseline Booklet 2025

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EUI Greening without Borders - Wijk in Bloei

WP3 Monitoring and evaluation framework

TU Delft - Baseline Report

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EUI Greening without Borders WP3 Monitoring & evaluation framework

TU Delft - Baseline Report

Garden in Oud Mathenesse, Rotterdam, the Netherlands.
Photographer: Arjan van Timmeren

Abbreviations

BOP	Bos op Poten
CELMOT	City at Eye Level MOnitoring Tool
EUR	Erasmus University
GC	Green coalition
GWB	Greening without Borders
MUA	Municipal Authority (Rotterdam Gemeente)
OM	Oud Mathenesse
TUD	TU Delft
WD	Witte Dorp
WIB	Wijk in Bloei

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View over Oud Mathenesse, Rotterdam, the Netherlands
Photographer: Nohemi Ramirez Aranda

Chapter 01

Summary

A quick introduction

1. Summary

Like many cities across Europe, Rotterdam is facing significant environmental challenges, air pollution, heat stress, drought, and biodiversity loss. As a port city situated 85% below sea level, it is increasingly vulnerable to land subsidence and rising water levels, which heighten flood risks. Public green spaces are also suffering severely from heat and drought. Rotterdam urgently needs more effective green space to address these challenges. Yet the City is limited in ability to achieve climate neutrality, as 60% of the potential land is privately owned.

Greening Without Borders (GWB) (locally known as "Wijk in Bloei", meaning Neighbourhood in Bloom) is an experimental public-private approach designed to expand and enhance green space by targeting private gardens in a collective-action green infrastructure project.

Piloted in Oud Mathenesse (OM), a deprived port neighbourhood, an innovative, integrated model will create social and economic opportunities through the greening of 4 large communal spaces and 90 individual gardens.

A community cooperative enterprise will provide green skills and employment opportunities to ninety-five residents and deliver shared-use projects to the wider community within the rehabilitated green spaces. The project will be supported and sustained by an innovative green fund designed to incentivize and maintain long-term greening efforts the neighbourhood. Benefitting from the expertise of a quadruple helix partnership, GWB aims to transform the way cities and individuals take action to increase both environmental and social resilience at a neighbourhood level.

1.1 Milestones

TU Delft's (TUD) team leading GWB WP3 'Monitoring and Evaluation' has made substantial progress across monitoring infrastructure, baseline data development, tool-building, stakeholder coordination, and early dissemination. TUD developed a mixed-methods approach that combines GIS-mapping (including PRIGSHARE+), sensors, observational mapping (both manually and through ESRI's Survey 1 2 3), surveys (incl. the Public Participatory GIS tool Maptionnaire), interviews and workshops culminating in the City at Eye Level MOnitoring Tool (CELMOT), as well as validation in two cases (one in the Netherlands and one in another EUI partner city).

To establish a robust environmental baseline,

1. Summary

TUD purchased seven weather stations. One station was installed on 1 July 2025 and has been collecting baseline measurements since then; it is also integrated into the Rotterdam Atmospheric Monitoring Network (RAMN). Preparations for deploying the remaining stations are advanced: four stations are planned for installation within OM in a private garden, a communal garden, and the Mobile Forest (public space), while the sixth and seventh station will be placed outside OM for validation purposes. Supporting infrastructure has been prepared through the purchase and near-site preparation (construction, filling, painting) of three additional base boxes. Deployment of these stations is foreseen from 2026, once final intervention locations are confirmed, after which they will also be integrated into RAMN.

In parallel, TUD has conducted a blended programme of on-site and desktop data collection. This has been supported by multiple coordination meetings with municipal representatives, residents, citizen organisations, and external parties to secure high-resolution, up-to-date datasets and to identify suitable locations for both interventions and sensing equipment. Within the discovery phase, TUD collected more than 100 geospatial data layers to support contextual analysis of OM; approximately half have been processed further, with more than 30 layers already used directly to pilot-test the CELMOT tool. Complementing formal datasets, TUD also implemented on-site participatory mapping using an additional digital PPGIS protocol Survey 123, combined with manual field capture. This resulted in over 200 mapped data points and the creation of a baseline map of informal and non-registered greening initiatives: an important foundation for understanding existing community-led greening dynamics and for targeting future interventions.

To support shared decision making, TUD produced a series of decision-support maps, meeting documents, and presentation materials for the Green Coalition (GC) and other GWB stakeholders, particularly residents and the municipality. These materials have directly informed discussions and decisions on the siting of the Mobile Forest (BOP, from its Dutch name Bos op Poten) and related interventions, with TU Delft presenting these outputs during GC meetings.

A core technical milestone has been the co-design and development of CELMOT (City at Eye Level MOnitoring Tool), which integrates quantitative datasets with qualitative, geo-tagged inputs to strengthen place-based decision support. Developed and coded by TUD in collaboration with Springco and STIPO, early test runs indicate promising performance in terms of accuracy and practical relevance, and the tool is already contributing to baseline assessment and informing partners in decision-making processes.

For 2026 data collection, TUD acquired a Maptionnaire licence and completed the onboarding process. Preparatory work is underway, including the development of survey questions and tagging structures. Importantly, this work is being aligned with other researchers and ongoing or past initiatives in the area through the OM Research Hub initiative, both to reduce duplication and to

mitigate resident survey fatigue. In addition, TUD has initiated a validation and replication protocol by establishing first contacts with a comparable district in the region (in another municipality), a second large Dutch city, and one of the EUI GWB partner cities. These relationships are intended to enable future testing, validation, and transferability of procedures and tools, particularly CELMOT, over the coming project years.

Educational coordination has also advanced through initial meetings between TUD, RDi, Rotterdam University of Applied Sciences (HRo), and other willing partners to align education-related activities connected to OM. As with the survey work, alignment is being pursued via the OM Research Hub initiative to reduce overlap and limit participation fatigue.

Regarding BOP, implementation preparations progressed significantly in 2025. In May 2025, TUD transported the first 15 full-grown trees from the nursery to a near-site location adjacent to OM. A watering task force supported summer maintenance, while root systems were prepared for repotting and sensor integration in August 2025. In October 2025, all 15 trees were planted into newly designed and manufactured planters featuring three different internal hydrology and insulation configurations; twelve planters were painted white. Throughout the period, TUD maintained the trees with watering frequencies adapted to seasonal conditions.

GWB visibility and engagement have been strengthened through community participation and communication outputs.

The project participated in OM's Spring Festival (Lente Feest) with an information stand focused on upcoming interventions, especially the BOP, and achieved strong resident engagement through interactive activities. TUD also contributed content and visuals for a joint EUI website publication on GWB (authored by Eddy Adams).

Progress has been regularly shared via social media, generating consistent engagement, and preparations are underway for a spatially focused website showcasing TUD's GWB work. Finally, early results and methodological developments have been disseminated through invited contributions at the International Conference on Socio-Ecological Urbanism (Sweden) and a PRIGSHARE+ development seminar (Germany), supporting external visibility and knowledge exchange.

1.2 Addendums to D3.2, D3.3 and D3.5

First, during the initial year of GWB, several issues led to delays and deviations from the original plan. Decision-making regarding the precise locations of the interventions (e.g., which communal gardens and which streets for the Mobile Forest), the indicators to prioritize in site selection, and the monitoring methods to use progressed more slowly than anticipated.

As a result, by the end of year one only one communal garden location had been firmly secured, and only two likely locations had been identified for the Mobile Forest.

Second, collaboration with the other monitoring partner in WP3 (EUR) was significantly compromised. Their monitoring focus was unilaterally shifted from socio-economic to socio-governance indicators, and a unilateral decision was taken to halt data sharing and communications for the transdisciplinary monitoring strategy that had been agreed in the project proposal. In addition, EUR showed reluctance to provide standard administrative documentation (such as adequate HREC approval), to share progress with TU Delft, and at times obstructed TU Delft's work on citizen consultations. These developments undermined scientific rigor and the intended joint quantitative–qualitative, transdisciplinary approach.

In response to the issues outlined under D3.2, TU Delft assumed additional qualitative monitoring responsibilities to safeguard the agreed deliverables, including further development and application of CELMOT. As collaboration problems escalated, the MUA asked the RDi Scientific Director to mediate after EUR unilaterally ceased communication in October 2025. This freeze was the last in a series of unilateral decisions that had been undermining TU Delft's ability to fulfill its tasks. Seeking support regarding these obstructive practices and EUR's non-compliance with administrative requirements, the TU Delft Principal Investigator consulted the university's legal department.

Mediation focused on finding a way forward and resulted in a partial solution; however, this did not address the root causes of the collaboration difficulties (i.e. EUR's gap in WP3), which were ultimately managed by TU Delft taking on additional workload.

Consequently, the formal partnership has been discontinued for the time being. A crucial – if not critical – role now lies with the MUA, which is expected to take up leadership and proactively assist the TU Delft team in managing the additional workload and addressing the consequences arising from the gap left by EUR in WP3.

Ideally, through active, impartial and constructive involvement from the MUA, solutions to these gaps can be developed and agreed collectively. If such resolutions cannot be reached, an alternative discussed with the mediator is to escalate the issue to an impartial party, such as the EUI Project Officer or a similar body.

These developments have substantially increased the workload and responsibility of the TU Delft team—without additional staff or funding—in order to safeguard the scientific quality and rigor of WP3 tasks and deliverables.

A key concern is the alienation of local stakeholders and associated researchers when TU Delft conducts on-site activities, as expectations and communication channels have been damaged by the partnership breakdown.

TU Delft must now compensate for the qualitative work originally assigned to EUR and repeatedly adapt and recalibrate quantitative components to accommodate changing conditions.

Despite multiple breaches of agreed tasks and the significant impact of EUR's unilateral decisions on the TU Delft team, no corrective measures have so far been taken against EUR, nor have any compensatory measures been provided to TU Delft.

Under the most recent mediated understanding, the only remaining joint activity currently foreseen is a validation phase through workshops in fall 2026, which still requires further discussion and confirmation.

1.3 Mapping potential transdisiplinary collaboration solutions

Three main solution pathways were explored to address the challenges in WP3 collaboration while staying as close as possible to project commitments:

Option A – Fully Separate Frameworks (Not compliant with EUI proposal)

- TUD and EUR operate independently; EUR does not contribute data to CELMOT.
- Joint workshops and shared monitoring would not occur.
- D3.5.1 could not be delivered as described and alternative funding or scope changes would be required.
- This would require clear delineation of citizen engagement with both engaging equally for project implementation, neutrality towards each other's methodological approach and a meeting to untangle interdependencies and set up an alternate working structure.

Option B – Conceptual Integration Only

- A Shared Monitoring Framework links insights conceptually.
- EUR's qualitative insights would not be coded into CELMOT, but joint workshops could potentially be organised to cross-compare lived, perceived, and measured experience. Would require communication with EUI and potential revision of D3.5.1.
- Preserves epistemic integrity but reduces technical integration and tool development.
- This would require a co-created monitoring and evaluation framework, citizen engagement planning and monthly meetings to support implementation.

Option C – Creative Integration

- A joint methodological process explores ways to integrate aggregated EUR insights (themes, categories, narratives) into CELMOT in a responsible manner.
- Ensures privacy, avoids flattening, and maintains methodological autonomy.
- Enables joint workshops combining lived, perceived, and measured experience.

1. Summary

- Aligns most closely with the original proposal while ensuring ethical use of qualitative data.
- This would require a co-created monitoring and evaluation framework, citizen engagement planning, sharing of intermediate results and monthly meetings to prepare for joint workshops.

In a meeting held in September 2025, EUR representatives agreed that the preferred path for further collaboration would follow option C. At present, this path remains unconfirmed due to a lack of willingness to collaborate from the appointed EUR researcher. The monitoring and evaluation work package, led by TUD, is structured such that several components (A3.2–A3.4) depend on primary data to be collected by EUR, creating a non-reciprocal dependency: TUD requires EUR's outputs to complete its deliverables, whereas EUR's deliverables do not structurally depend on TUD's contributions.

As of December 15, 2025, and after the unilateral communication freeze imposed by EUR on 17 October 2025, no agreement has been reached on how to address the gaps left by EUR in the deliverables for which TU Delft is responsible. These issues have been reported to the MUA.

Rotterdam seen from south. Rotterdam, the Netherlands.
Photographer: Werner Hilversum

Chapter 02

Introduction to Work Package 3 (WP3)

2. Monitoring and evaluation framework

Rotterdam, like many other EU cities, faces significant environmental challenges, including land subsidence, rising water levels, more frequent heavy rainfall, and increasing flood risk due to its position as a low-lying port city. The city is also experiencing a decline in native flora and fauna, deteriorating water and air quality, and increasing heat stress. To address these issues, Rotterdam needs more effective and better-connected green spaces. However, the City's ability to respond is constrained by the fact that approximately 60% of the land in Rotterdam is privately owned, limiting the impact of public green infrastructure alone.

Oud Mathenesse (OM) is a disadvantaged port neighbourhood facing multiple environmental, social, and economic pressures. The area is heavily paved (74%) (Figure 1), which contributes to high heat stress (up to 45°C in specific hotspots) and limited shade provision (around 6%). Rising water levels further exacerbate these vulnerabilities. In response, the City plans to upgrade the sewage system in OM between 2024 and 2031, increasing its capacity to handle heavy rainfall and restoring street levels. Affected public streets will receive some greening as part of these works. However, the planned measures are insufficient to deliver the amount and quality of green space required and may unintentionally cause water run-off into private gardens, turning them into de facto pools.

Figure 1 Examples of heavily paved surfaces in Oud Mathenesse. Source: Authors, 2025.

OM's socio-economic profile adds further complexity. Around 60% of residents belong to the lowest income group, many face barriers to the labour market (about 20% are EU migrant workers), and the neighbourhood offers limited economic opportunities, community networks, and public (green) spaces. High residential turnover, driven by precarious employment and housing conditions, contributes to a transient population. In this context, and as observed in collaboration with local stakeholders, climate adaptation and neighbourhood greening are rarely prioritized in residents' daily concerns. This "incentive dilemma" is a core starting point for the Greening Without Borders (GWB) model.

Recognizing the interdependence of environmental, social, and economic factors, GWB adopts a holistic approach. Building on the window of opportunity created by the planned public works, GWB, as an EUI implementation project, will pilot an experimental yet scalable public–private greening model. The aim is to reduce flood risk, improve heat resilience, and enhance biodiversity, while simultaneously generating social and economic benefits for residents.

The European Urban Initiative (EUI), successor to the Urban Innovative Actions Initiative implemented during the 2014–2020 programming period, is a key instrument supporting cities of all sizes in building capacity and knowledge, fostering innovation, and developing transferable and scalable solutions to urban challenges of EU-wide relevance. Its ultimate goal is to encourage the use of proven, innovative approaches in mainstream Cohesion Policy programs in urban areas,

particularly those supported by the European Regional Development Fund (ERDF). In line with Article 3 of Regulation (EU) 2021/1058 on the ERDF and Cohesion Fund, the EUI also seeks to strengthen the innovation capacity of cities as beneficiaries or intermediaries in managing these funds.

This report documents the baseline measurements for Work Package 3 (WP3), which focuses on monitoring and evaluation of the project interventions. WP3 comprises four predefined activities designed to strengthen project monitoring and evaluation. This baseline and subsequent follow-up measurements consider the following aspects and their associated deliverables:

- A.3.1 Monitoring of project performance (MUA): This activity focuses on tracking project progress and performance based on the monitoring plan consolidated during the Initiation Phase. It involves the systematic collection of information on project activities, verification that activities are on schedule, and documentation of deliverables and outputs. It starts on day one of project implementation and continues until the project's completion.
- A.3.2 Establishment of the evaluation framework of the innovative solution: This activity covers the preparatory work for evaluation during the first year of implementation, including scoping, piloting, and developing research instruments; defining the data required; and, where necessary, refining the project result indicators.
- A.3.3 Data collection on the implementation and performance of the innovative solution: This activity consists of collecting quantitative and qualitative data on the innovative solution/main project outputs. Data collection begins during the testing and implementation phase of the innovative solution and continues for a period sufficient to obtain a robust and representative dataset (ranging from about one month to six months or more, depending on the nature of the intervention).
- A.3.4 Final evaluation of the innovative solution and reporting on result indicators: This activity involves analysing and evaluating the collected data, assessing the innovative solution against project objectives and expected results, and preparing final evaluation factsheets, including lessons learned and strategies for continuing the "experiment" beyond the project end date. It also covers reporting on result indicators and engaging in knowledge exchange and meetings/events with EUI Experts. This activity is planned for the last six months of the implementation phase, once testing of the innovative solution and implementation of the thematic Work Packages have been completed.
- A.3.5 Development of CELMOT: City at Eye Level MOnitoring Tool.

In this report, we address Activities A.3.2, A.3.3 and A.3.5 (and their corresponding deliverables. Activities A.3.2 and A.3.3 are organized around three main components, summarized below and described in more detail in Section 5 of this document:

2. Monitoring and evaluation framework

- 1.Climate. Environmental and microclimatic changes will be monitored through a set of sensors distributed across OM in and around the interventions. These sensors will be integrated into the Rotterdam Atmospheric Monitoring Network (RAMN), enabling comparison with other locations in the city.
- 2.PRIGSHARE+. Preferred Reporting Items in Greenspace Health Research Plus (PRIGSHARE+) is a GIS-based framework adapted to the scope of the GWB project. It structures the collection, visualization, and reporting of data on green space, health, and related environmental indicators.
- 3.Surveys, interviews and workshops. Surveys, interviews and co-creative workshops will be used to validate the objective data. Subjective information on residents lived and perceived experiences in and around the intervention areas will be collected using the Public Participation GIS (PPGIS) platform Maptionnaire and a photovoice tool.

Action A.3.5 and its corresponding deliverable (D3.5.1) is CELMOT. CELMOT, the "City at Eye Level MOnitoring Tool," is a mixed-methods instrument that integrates qualitative and quantitative insights from Actions A.3.1 to A.3.3 (and, ultimately, A.3.4), providing an overall assessment of the performance and impacts of the interventions.

2.1 Operational challenges

Due to several delays in the project and unforeseen challenges within the WP3 collaboration, certain tasks had to be removed, adjusted, or postponed. Two key issues have had a cascading impact on WP3 and on the project as a whole: (1) delays in implementing the interventions caused by a lack of agreement on their locations, and (2) the need to restructure the monitoring strategy due to missing components in the transdisciplinary agreement.

The first challenge directly affects the monitoring strategy operationally. Without approved locations for the interventions, namely the 90 private gardens, four communal gardens, one mobile forest (BOP), and additional border solutions, the site-dependent components of the monitoring strategy, such as sensor placement and targeted consultation of nearby residents, are not feasible.

As this is fundamentally an implementation project, the absence of at least confirmed locations, let alone completed interventions, makes systematic monitoring and the establishment of a meaningful baseline impossible. Baseline measurements were originally planned to start in Month 6 (M6). At the time of writing this report (Month 13, M13), no interventions have yet been implemented in OM.

The second challenge undermines the transdisciplinary nature of the monitoring approach itself. The monitoring design is based on a mixed-methods framework that

combines quantitative analyses with qualitative assessments of socio-economic dimensions, which were to be provided by Erasmus University Rotterdam (EUR), as outlined in the submitted proposal (pp. 38–39):

[…] To accurately evaluate results, the project needs a blend of quantitative measurements, qualitative surveys in baseline and test periods, GIS-based mapping, and a "City at Eye Level" model (CELMOT). This model, developed by TU Delft in collaboration with Erasmus University and Erasmus Medical Center within the "Resilient Delta initiative" in Rotterdam, focuses on greening and its ecosystem services. […]

[…] TU Delft will lead the built environment part. Erasmus University Rotterdam (EUR) will lead the socioeconomic part. […]

EUR initially proposed a shift from a socio-economic perspective to a socio-governance perspective. This change implied a major restructuring of how CELMOT would operate within its transdisciplinary setting. To accommodate this shift, a section of the tool was intentionally left open to integrate the anticipated outputs from EUR. However, this arrangement was eventually cancelled due to stated concerns (cf 1.2) from EUR about mistrust in spatial modelling tools.

EUR reported they categorically refused for their output to be included in the transdisciplinary component of CELMOT.

As a result, the socio-economic/governance component carried out by EUR and originally intended to be integrated into CELMOT was effectively removed.

Similar difficulties arose when seeking clarification on EUR's methodologies, data collection strategies, and ethics approval (which, although provided, lacked sufficient detail).

Despite TUD consulting its data steward and faculty contract manager for support, the requested clarifications were ultimately never provided. After these efforts, EUR unilaterally enforced a five-week communication freeze.

In response, TUD, as WP3 leader, was forced to adjust the monitoring strategy to compensate for this lack of delivery. Significant effort and resources (at the expense of the team) were invested in attempts to find common ground and maintain the transdisciplinary setup with EUR.

These efforts ultimately had to be discontinued due to EUR's unwillingness to find common ground, in order to safeguard the timely delivery of WP3 outputs. Although stipulated in the EUI agreement as a shared effort, WP3 task's are at present being carried out solely by TU Delft's team.

View over Oud Mathenesse, Rotterdam, the Netherlands.
Photographer: Nohemi Ramirez Aranda

Chapter 03

Case study : Oud Mathenesse's context

3.Baseline mapping

OM is located in the province of South Holland, within the municipality of Rotterdam and the district of Delfshaven. It is Rotterdam's westernmost neighbourhood, bordering Schiedam and bisected by the relatively quiet shopping street Franselaan. Within OM, the world-famous Witte Dorp (White Village) is situated in the triangular southeastern area between Schiedamseweg and Tjalklaan (Figure 2).

Witte Dorp was built in 1922 as a temporary workers' settlement. Designed by architect J.J.P. Oud, the original houses were white with red, blue, and yellow accents (Figure 3). Although the original buildings have since been demolished, the 1980s reconstruction retained the street layout and reintroduced white housing, and the area remains known for its strong sense of community.

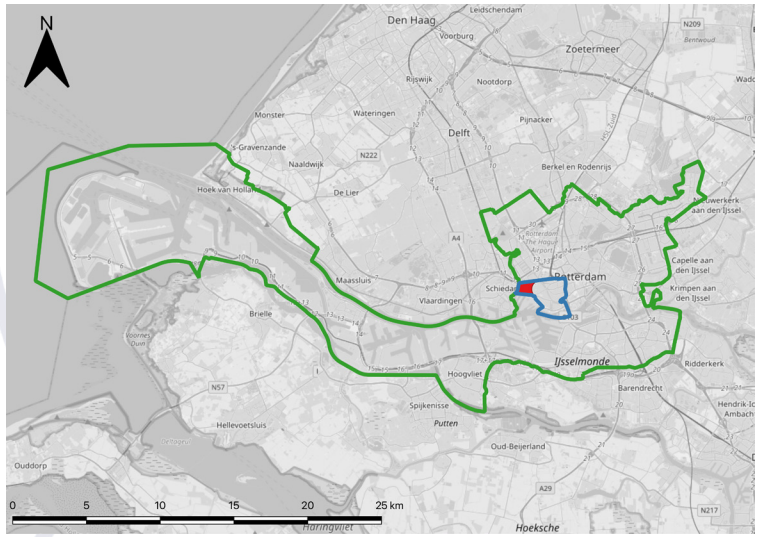

Figure 2 Location of OM (red) within Rotterdam municipality (green) and Delfshaven district (Blue). Source: Authors, 2025.

3. Baseline mapping

OM itself was developed in the 1930s on former meadows between Rotterdam and Schiedam. Located below the dike along Schiedamseweg, it was historically referred to as De Put. Its residents traditionally held a somewhat higher social status than unskilled labourers, and many teachers, craftsmen, and shipyard workers from Schiedam lived there.

Today, OM has nearly 7,200 residents, while Witte Dorp is a much smaller enclave with about 600 inhabitants. Franselaan is the heart of this neighbourhood and forms the dividing line between two areas: the Schepenbuurt (Ships District), which mainly consists of flats with communal entrances, and the Landenbuurt (Countries District), where pre-war flats and houses can also be found. The relatively inexpensive housing makes the neighbourhood popular among first-time buyers. Both Oud-Mathenesse and Witte Dorp have many social housing units, but in recent years vacant properties are also offered for sale.

Figure 3 Witte Dorp aerial photos: 1926 (left) and 2025 (right). Source: J.J.P. Oud (left), Authors (right).

As in many urban neighbourhoods, the formerly close-knit community is under pressure. Newcomers and temporary residents bring different lifestyles new patterns of use within the neighbourhood. However, residents are still working tirelessly for this area. One example is the Mathenesse aan de Maas (MadM) residents' association, where residents are committed to improving all aspects of the neighbourhood. MadM's mission and message are to put Oud-Mathenesse – Witte Dorp more on the map and connect this neighbourhood with the surrounding areas.

Local services and amenities are generally good. Franselaan functions as a commercial corridor, and the Vreelust complex provides a green sports axis that connects OM to the neighbouring district of Spangen. Nearby, the De Bokkesprong petting zoo is a local attraction (Figure 4).

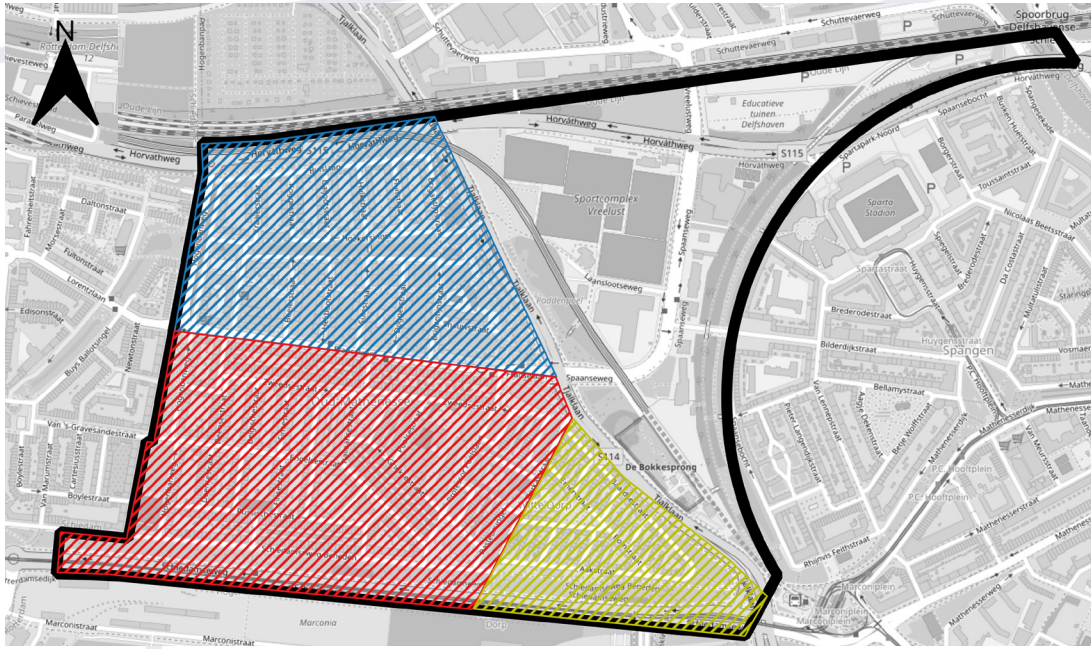

Figure 4 Subdivisions within OM. Schepenbuurt (blue), Landenbuurt (red), Witte Dorp (yellow). Source: Authors, 2025.

3.1 Demographic profile

OM has 7,200 residents. Of these, 54.1% are male and 45.9% are female. Most residents (40.1%) are young adults aged between 25 and 45 years old. The remaining age groups are 23.3% for “45 to 65 years”, 14.0% for “15 to 25 years”, 11.4% for “0 to 15 years” and 11.0% for “65 years or older”. Of the residents, 68.0% are unmarried, 19.1% are married, 10.6% are divorced and 2.3% are widowed. 1,870 residents come from the Netherlands, 1,965 come from Europe (excl. NL) and 3,245 come from countries outside Europe. This means that roughly three quarters of the neighbourhood’s population are from a migrant background.

There are 4,250 households in OM. 59.8% of these are single-person households, 20.4% are households without children and 19.9% are households with children. The average household size is 1.7 persons. Nationally, this is 2.1 persons. There are 5,800 income recipients in OM. The average income per income recipient is €29,100,

which is €8,300 (22%) lower than the national average of €37,400. The average income per inhabitant is €24,600, which is €6,200 (20%) lower than the national average of €30,800. Most residents of OM have secondary education. Specifically 43.0% have HAVO, VWO or MBO 2-4, 33.9% have VMBO or MBO 1 and 23.1% have HBO or WO. Of the 7,200 residents, approximately 62% are in paid employment. This is 3% lower than the national average of 65%. Most employees are in paid employment (85%), while 15% are self-employed. In OM, 19% of residents receive benefits. The largest group is those receiving AOW benefits. Approximately 670 people receive these benefits.

3.2 Housing

According to the Municipal Urban Authority (MUA), approximately 80% of the housing stock in OM was built before 1968. The dominant construction periods are 1925–1950, which account for 77% of the dwellings, and 1950–1970, which account for an additional 10% (Figure 5).

In total, OM contains 3,815 homes with an average WOZ value of €195,000. Around 95% of these homes are occupied and 5% are vacant. Many dwellings are rented: 65% are rental units and 35% are owner-occupied. Of all homes, 35% are privately owned, 19% are owned by housing associations, and 46% are owned by other types of landlords. According to the MUA, approximately 40% of all properties in the neighbourhood are in the hands of private landlords. Residential turnover is relatively high, with about 16% of residents moving away each year.

Figure 5 Examples of dominant 50s dwellings in Oud Mathenesse. Source: Authors, 2025.

3.3 Energy[1]

In OM, there are 3,874 addresses with a registered energy label. The most common labels are G (26%), E (21%) and D (18%). On average, an address in OM consumes 1,910 kWh of electricity per year (See Annex 3, Map 12). This is 28% lower than the national average of 2,640 kWh. With an annual consumption of 780 m³ per address, natural gas consumption is 20% below the national average of 980 m³.

[1] Much of the data in this report is drawn from a range of datasets containing regional figures from Statistics Netherlands (CBS) as well as Municipal reports. Many these datasets have been combined for this purpose. In addition, several other official data sources have been used, including the Land Registry, the Electoral Council, the Police, and the National Institute for Public Health and the Environment (RIVM).

3.4 Environment: Biodiversity status

While result indicator j: "Biodiversity increase", included in the initiation-phase Excel file, will be led by the MUA, we have compiled additional information on its spatial dimension in OM to provide a more comprehensive overview of the baseline situation.

In 2018, the MUA conducted an internal flora and fauna assessment to prepare for the revision of the zoning plan (Figure 6). For this analysis, the municipality used the Natuurwaarnemingen "flora/fauna" theme in the GISWEB2.2 database, which compiles recorded observations of plant and animal species within the municipality of Rotterdam from approximately 2012–2015.

The database was primarily developed to support the management of public green spaces and municipal spatial interventions. As a result, the dataset is not comprehensive: if no observations are recorded for a given area, this typically indicates that no ecological survey work has been carried out there, rather than the absence of flora and fauna.

Data collection for this municipal nature database continued through 2020, culminating in a publicly available report. Similar to the 2018 assessment, this report classifies OM as having a very low biodiversity class ("zeer zwak") and identifies only a limited number of protected species within the neighbourhood (Figure 7). In addition to species protected under the Nature Conservation Act, the database also includes records of Red List species, which are species that are not necessarily legally protected, but are considered threatened in the Netherlands and are indicative of higher ecological value. However, no Red List species have been recorded in OM in the available data.

Figure 6 Flora in Oud Mathenesse. Source: Authors, 2025.

Description per species group found in OM

Bats

The neighbourhood morphology is an attractive habitat for bats due to its varied housing stock, a relatively large number of green inner courtyards, and several small waterways. This type of urban fabric provides both roosting sites and foraging areas in close proximity.

According to the municipal nature database, only foraging bats have been recorded within the plan area (Figure 8), while roosting sites are known just outside it. Observations concern the common pipistrelle and whiskered bats.

Flight routes through the neighbourhood remain unknown and cannot be determined without additional ecological surveys. Breeding sites,

3. Baseline mapping

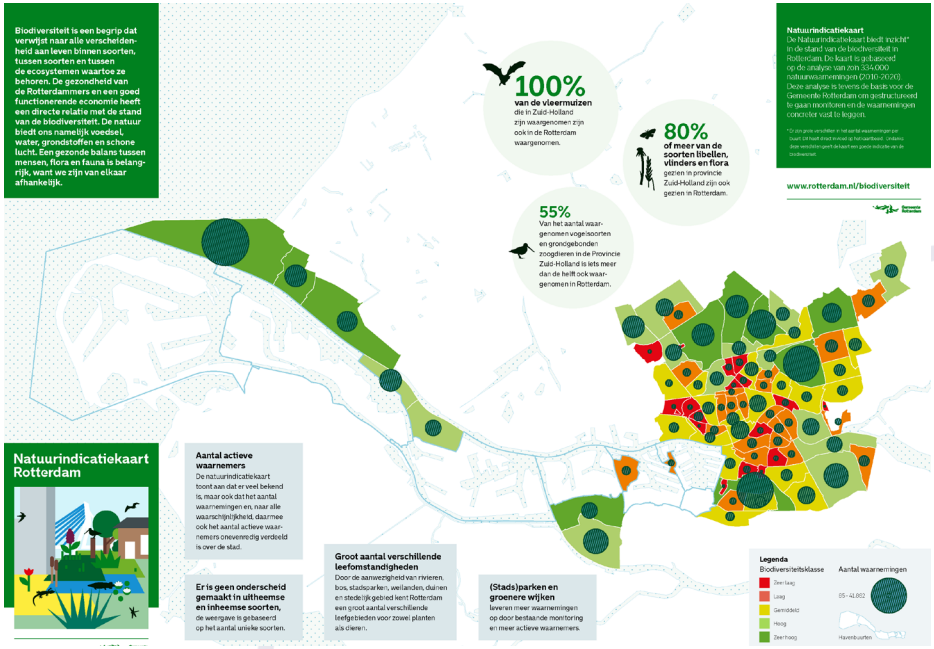

Figure 7 Nature indication map 2020. Source: Rotterdam Municipality.

Figure 8 Known bats sightings 2018. Source: Rotterdam Municipality.

permanent resting and roosting places, essential foraging areas, and key flight paths are strictly protected under the Nature Conservation Act.

Birds

OM has a diverse urban layout with several distinct types of environments, making it suitable for both typical urban species and songbirds. Among urban species, house sparrows and swifts are likely to occur, given the presence of tiled roofs that can provide suitable nesting places, as well as nearby foraging opportunities for house sparrows. However, due to the lack of recent survey data, no definitive statements can be made about the current presence, abundance, or distribution of these bird species.

Ground-dwelling mammals

Common species of ground-dwelling mammals are expected to be present in the neighbourhood. Strictly protected species are not anticipated, but their presence cannot be fully ruled out in the absence of up-to-date inventory data.

Fish

The area contains relatively little surface water, and water quality is likely to be poor in some locations due to occasional sewer overflows (Figure 9). As a result, the occurrence of sensitive Red List fish species or species protected under the Nature Conservation Act is considered highly unlikely.

Figure 9 Example of water surface in Oud Mathenesse. Source: Authors, 2025.

Reptiles and amphibians

Within the municipality of Rotterdam, only one reptile species occurs naturally: the sand lizard, whose distribution is limited to the Hoek van Holland area. The presence of this species in OM can therefore be excluded.

Nationally protected amphibian species, however, do occur within the broader zoning plan area and are subject to a provincial exemption in South Holland. Brown frogs, common toads, and smooth newts can thrive in heterogeneous urban environments like OM. The area is unsuitable for reptile and amphibian species listed under the EU Habitats Directive.

Vascular plants

The combination of varied building types, green courtyards, and limited surface water creates a potentially diverse set of micro-environments for plant growth. Major spatial interventions have been relatively limited over the past 20 years, which in principle supports the development of

species-rich vegetation. However, public space in the neighbourhood is heavily paved and often intensively used, which restricts opportunities for diverse plant communities.

In particular, the public space in the Witte Dorp subarea is designed in a way that offers almost no room for vegetation, except for a few highly resilient species adapted to very stony environments, such as common bent grass and horned sorrel. No observations of currently protected plant species have been recorded within the plan area.

3.5 Environment: Morphology and climate

The neighbourhood has a total area of 86 hectares, of which built surface accounts for 60 hectares, water 2.3 hectares and green surfaces 23 hectares (Figure 10).

With only 30% of its surface unbuilt and a density of 3668 persons per km2 the neighbourhood is relatively small, and the limited availability of open space makes it difficult to develop high-quality accessible green areas in both public and private realms. Existing green spaces provide some relief from the extensive hard surfaces, but their overall quality is low and their social and environmental functions are limited. In addition, not all of these spaces are publicly accessible; for example, the inner community gardens within the housing blocks in the Schepenbuurt area are semi-private.

While most of the vertical streets in Schepenbuurt have tree-lined avenues, this is not the case for the streets in Landenbuurt and Witte Dorp. This means that although a large percentage of the trees have reached an adult age depending on their health and species the canopy cover they provide is limited as is the (potential) heat stress relief they could provide (see further in Section 5.4.2) (Figure 11).

Another challenging aspect is that the tree population is experiencing decline in OM due to the ongoing sewage works scheduled from 2024 until 2031 (Figure 12). The ongoing sewage works (Figure 13A and 13B) imply that the adult trees currently present in several streets will have to be removed to carry out the works over a period of seven years.

There is already a municipal plan in place to make up for some of the trees that will be lost. However, it will take over 15 years before the new young trees can reach the size and canopy of the previous adult trees or achieve a comparable canopy to the ones proposed by BOP. While this challenge has been acknowledged, the municipality has yet to present a proposal on how and when these trees will be replaced. The building blocks immediately south of Franselaan are closed, which is slightly less favourable because it means that the inner courtyards are ecologically isolated. Most of the buildings date from shortly before the war.

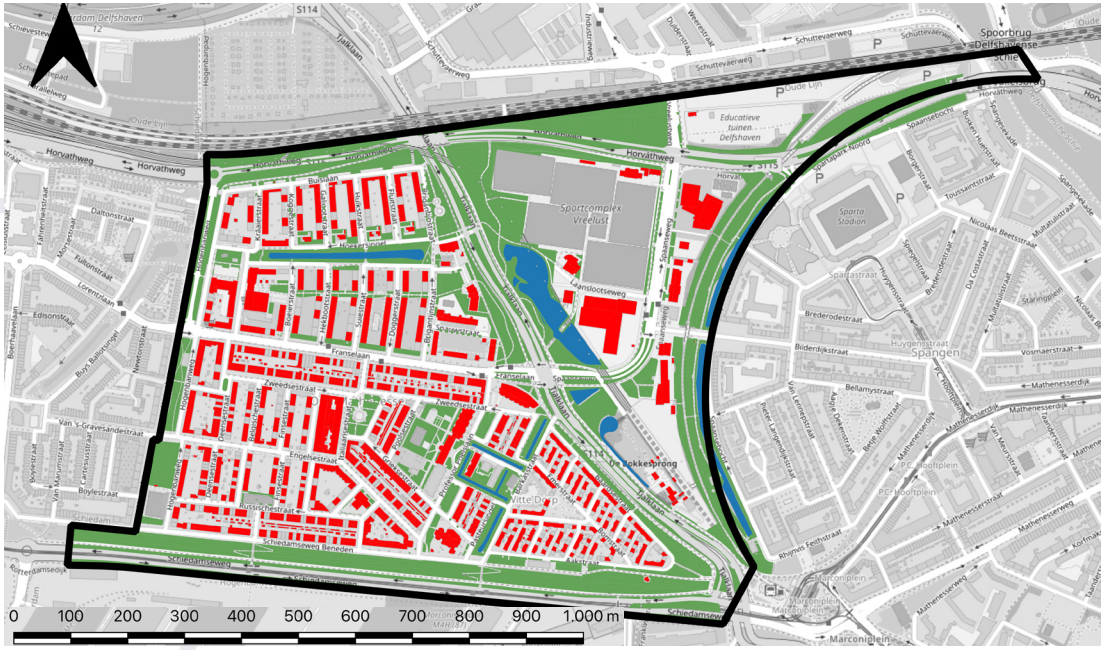

Figure 10 OM land typology scheme. Buildings (red), green areas (green), water surfaces (blue). Source: Authors, 2025.

Figure 11 Trees age. Source: Rotterdam municipality.

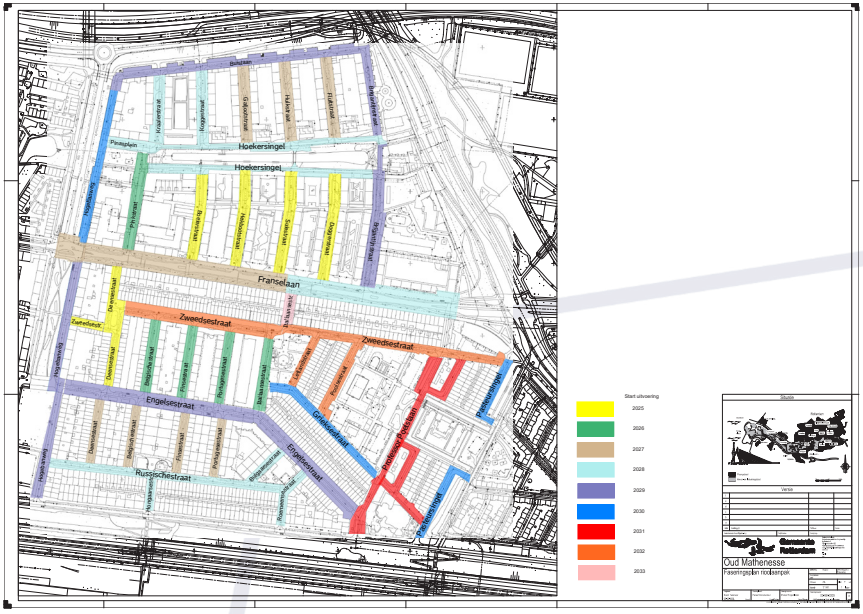

Figure 12 Upcoming sewage works. Source: Rotterdam municipality.

Figure 13A Ongoing sewage works in Oud Mathenesse. Source: Authors, 2025.

Figure 13B Ongoing sewage works in Oud Mathenesse. Source: Authors, 2025.

This type of building is often suitable for cohabitation by typical urban species such as pipistrelle bats, house sparrows, starlings, and swifts.

OM contains relatively little water (2.8 ha). The surface water that is present is also of poor quality. Sensitive species of dragonflies and plants are therefore less likely to be found here. However, the watercourses, together with the avenue planting and the open building blocks with green inner courtyards, ensure that the area is ecologically accessible internally.

The zoning plan area borders the former marshalling yard at Marconistraat, which until a few years ago was undergoing significant ecological development with varied flora and a rich variety of butterflies. The planning area is ecologically well connected via former and existing railway embankments and through its location near the Nieuwe Maas (part of the Dutch nature network).

3.6 Space and wellbeing

Perceptions of quality of life in OM are generally low. According to the Leefbaarometer 2025, residents rate the neighbourhood's overall liveability with a score of 2 on a 9-point scale, corresponding to "more than inadequate." The Liveability Barometer estimates the extent to which residents value key characteristics of the local living environment. It aggregates weighted environmental indicators into five dimensions: (1) housing stock, (2) physical environment, (3)

facilities (amenities), (4) social cohesion, and (5) nuisance and insecurity. These dimensions do not contribute equally to the overall score: “facilities” and “nuisance and insecurity” carry the highest weights, while the “physical environment” has the lowest. The contribution of each dimension to the total liveability score is derived from the underlying environmental indicators and their respective weightings.

As shown in Table 1 and Figure 14, Figure 16, and Figure 17, the low liveability scores for OM have been consistent at least since 2002. Similar low scores are reported for Witte Dorp and Feijenoord. Feijenoord has been included in the table as a reference case, as it is a widely cited Rotterdam neighbourhood with well-documented quality-of-life challenges and a range of social programs aimed at addressing them. Even though OM scores substantially lower than Feijenoord on the Leefbaarometer, the number of targeted social programs and interventions in OM remains relatively limited in comparison, suggesting a mismatch between the severity of the problems and the level of policy attention.

Table 1 Liveability barometer scorings for Oud Mathenesse through the years. Source: Leefbaarometer 2025.

Neighbourhood	2016	2018	2020	2022	2024
Oud Mathenesse	2	2	3	2	2
Witte Dorp	3	4	4	4	4
Feijenoord	4	4	4	4	4

	Quality of life
1	Completely inadequate
2	More than inadequate
3	Inadequate
4	Weak
5	Adequate
6	More than adequate
7	Good
8	Very good
9	Excellent

OM’s low scores are consistent with qualitative accounts from residents on online platforms such as buurtje.nl and neighbourhood forums. Respondents frequently describe the quality of greenery and cleanliness as poor (Figure 15), with ratings as low as 2.5 out of 5.

Several residents criticize the lack of aesthetic quality in streets, housing, and the wider environment, characterizing the neighbourhood as having “no soul” and calling for greater attention to the appearance of buildings and public space. Many contributions portray OM as a relatively poor area with aging housing stock, limited recreational and cultural amenities, and streets that are increasingly littered and used by loitering groups of youth. At the same time, residents also point to advantages, including good public transport connections to the city centre, short commuting times, and comparatively low rents.

Figure 14 Oud Mathenesse's liveability classifications. Source: Leefbaarometer, 2025.

Figure 15 Aesthetic and hygiene issues in Oud Mathenesse. Source: Authors, 2025.

3.6.1 Safety

According to the Leefbaarometer, nuisance and insecurity are also a major problem with "very significant negative contributions" to the quality of life in the neighbourhood (Figure 16). Perceptions of safety are notably gendered.

A substantial number of women report not feeling safe walking alone at night or in certain parts of the neighbourhood, even when they themselves have not been directly victimized (see residents accounts below). By contrast, some male residents indicate that they rarely feel unsafe, despite acknowledging that the area is disadvantaged and that serious incidents, such as explosions and violent offenses do occur (NL TIMES, 2025). Other respondents note social tensions, including conflicts within particular groups and the arrival of residents displaced from adjacent, gentrifying neighbourhoods.

Together, these accounts paint a picture of a neighbourhood with structural liveability challenges, but also with locational advantages that continue to attract and retain residents. Overall, commenters are sceptical that conditions will improve without substantial public investment comparable to that seen in other parts of Rotterdam, such as Zuid.

The following section summarizes user-generated comments from several Reddit communities discussing experiences of living in OM over the last ten years.

(circa 2023) User EgweneSedai said:

I've lived there for 12 years. Some areas are super ghetto and others are better. Most of it is relatively poor, the houses are not the best.

The positive is that you have a pretty good connection (tram, metro, bus, bike or even train if you live near Schiedam) to the city center. For fun there isn't much to do, but again, it's only a ~15 mins cycle to the center.

In 12 years, we've seen some messed up shit, but nothing ever happened to me. Although I will admit I didn't always feel the safest going out at night by myself as a woman.

We lived there for so long because of the short commute to work and public transport and how cheap the rent was. So it depends on priorities.

(circa September 2025) (idem) […] [OM] It's not going to improve unless they put some real money into the area like they did on Zuid.

(circa 2023) User LowRepresentative291 said:

I lived there for 2 years. It's definitely a poorer area of the city (when discounting Zuid, of which many parts are way shittier). A lot of immigrants, mostly eastern European (Bulgarian, Polish), but a lot of families. Besides a few supermarkets, immigrant shops and a handful of cafés for the local alcoholics, there is nothing to do here. That means that it's generally more quiet at night than

when you live closer to the center. As a man I never felt unsafe here on the streets and had a decent 3 room apartment for under €900, which is I think the biggest plus of this part of the city. Takes about 10-15 minutes to get to the center, depending on where exactly you live.

(circa 2023) anonymous user said:

[…] The negative: In my specific street there was lots of Polish families infighting amongst themselves but it wasn't aimed at anyone outside that group. Teens and young adults, loitering on street corners, the streets are also full of trash and getting worse by the year. When I left in 2021, there was a lot of scumbags moving to the area because they had been kicked out of their previous surrounding neighbourhoods, that had/were undergoing gentrification.

(circa 2023) user lucasvandongen said:

To me it appears that there are a lot of seasonal workers for example Polish, Romanian and Bulgarian people. Of course, the neighbourhood would be better off with people that feel a permanent connection to the place they live but generally you won't have any issues with them.

(Dec 2025) User Barbarossah said:

In Oud-Mathenesse, waste has been a major problem for years. It doesn't help that 60% of the residents are temporary migrant workers who have no connection to their surroundings.

3.6.2 Social cohesion

OM is characterized by relatively high residential turnover and poor social cohesion (Figure 17): approximately 16% of residents move away each year. This is exacerbated by a constant influx of seasonal workers, who often have a limited sense of belonging or long-term attachment to OM, and by the fact that roughly 75% of the population has a migration background (Rotterdam Municipality (MUA), 2025). Together, these factors constrain the share of residents who are both willing and eligible to participate in improvement initiatives or to vote in formal elections.

As a result, a large part of the neighbourhood is effectively invisible in electoral terms, which in turn reduces the political incentive for top-down investment. This aligns with the prevailing feelings of invisibility and despair reported by residents, both in online forums and in the conversations held during Green Coalition meetings in the area.

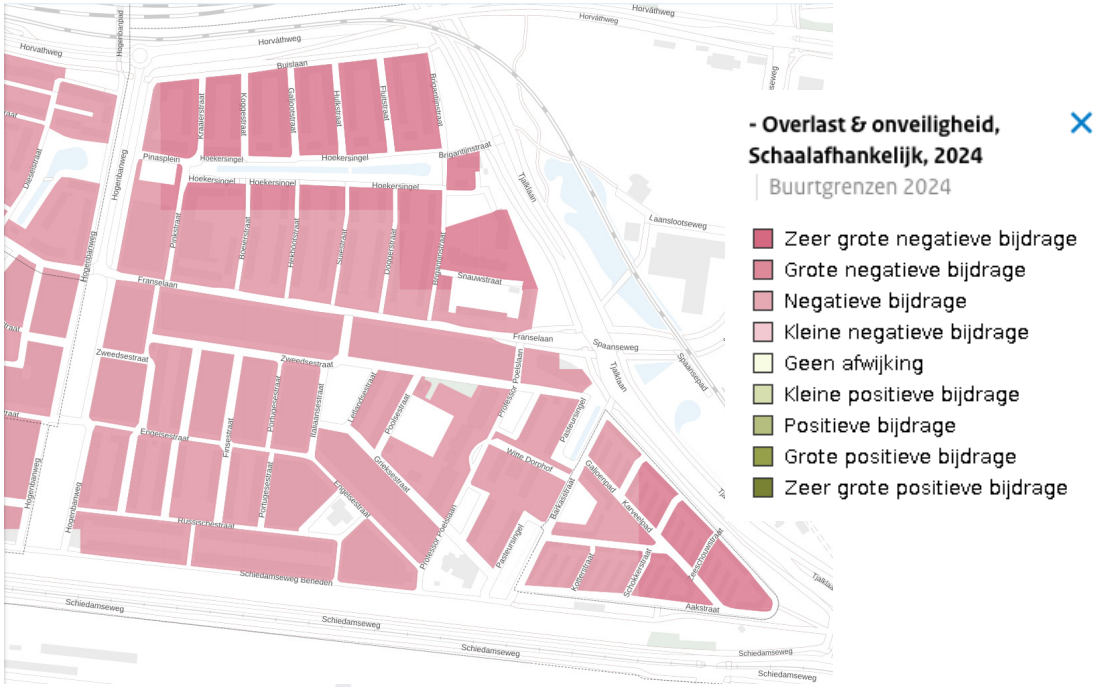

Figure 16 Nuisance and insecurity. Source: Leefbaarometer 2025.

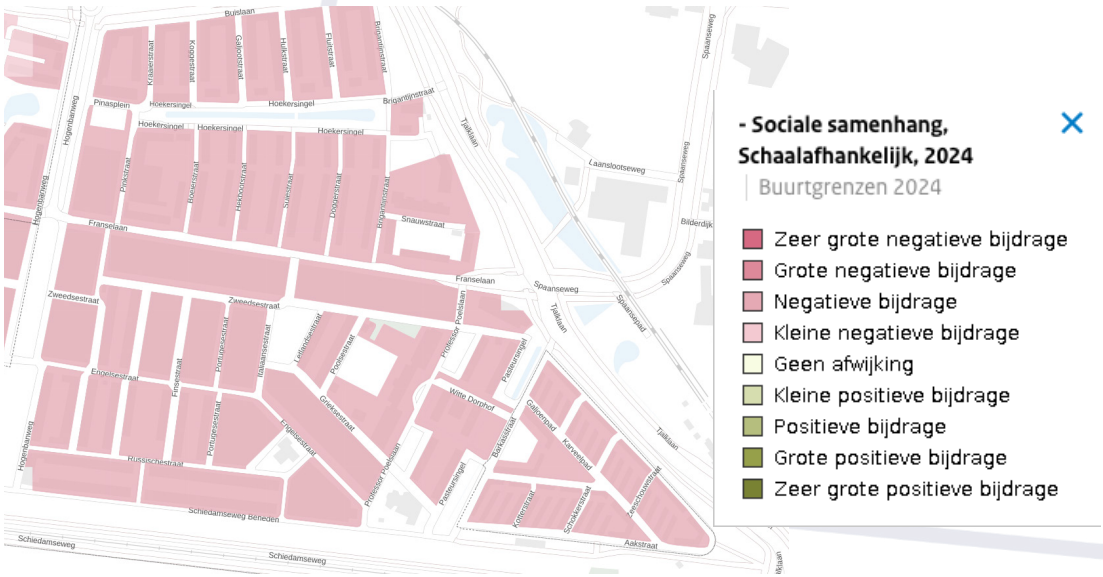

Figure 17 Social cohesion. Source: Leefbaarometer 2025.

3.6.3 Health and wellbeing

In sections 3.1 to 3.6, we have reported the contextual situation in which residents are simultaneously exposed to multiple spatial, environmental, and social factors in their daily living environment. Together, these factors shape overall quality of living, which in turn has a direct impact on health and well-being. Existing literature consistently demonstrates that poor environmental conditions are associated with adverse mental and physical health outcomes which is consistent with the observed situation in OM.

Data from the National Institute for Public Health and the Environment (RIVM) show that the health status of adults aged 18–65 in OM is consistently 8–9 percentage points lower than the national average, while the gap compared to the Rotterdam average is smaller, at about 2–3 percentage points (Figure 18).

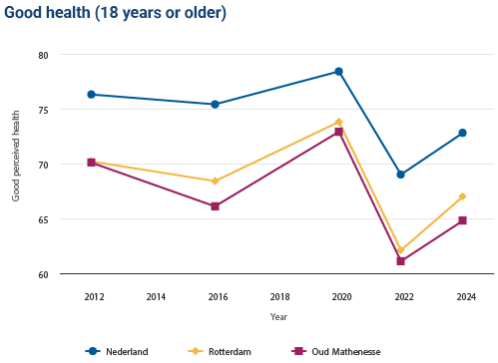

Figure 18 Percentage of residents 18 years old or older in good health. Source: National Institute for Public Health and the Environment (RIVM) 2025.

58% of adults in OM (ages 18–65) experience limitations in their daily lives due to physical health problems (Figure 19). In addition, 67% of residents in this age group have weight-related issues: 50% are classified as overweight and 17% as obese. Overweight is defined as having a body mass index (BMI) of 25.0 kg/m² or higher, while obesity refers to a BMI of 30.0 kg/m² or higher. Moreover, 32% of adults reported feeling "very much stressed" in the four weeks preceding the consultation (Figure 20). Regarding social capital and sense of belonging, 64% of residents between 18 and 65 years old reported feeling lonely.

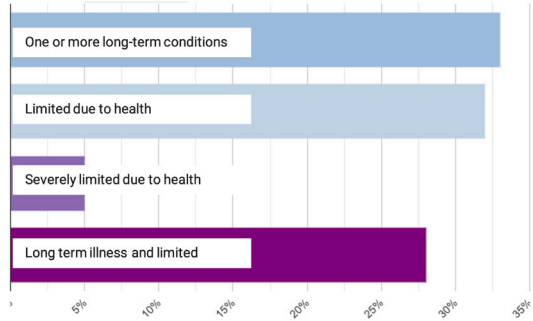

Figure 19 Percentage of residents 18-65 years old with limitations in their daily lives due to health problems. Source: RIVM, 2025.

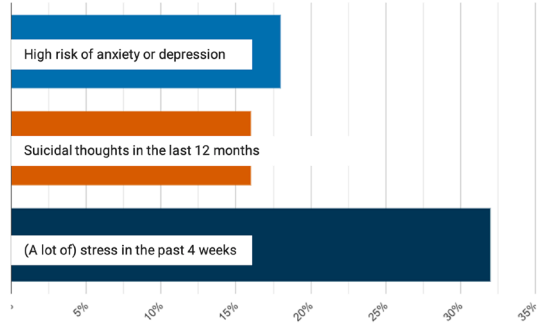

Figure 20 Mental health in Oud Mathenesse adults aged 18-65. Source: RIVM, 2025.

3. Baseline mapping

To obtain a more comprehensive picture of both physical and mental health conditions in the neighbourhood and to understand how this compares with the municipal and national scores discussed above, we examined the graph from the Neighbourhood Atlas in greater detail (Figure 21).

This graph shows standardized scores (Z-scores) for a series of health, lifestyle, environmental-nuisance, and satisfaction indicators, comparing Rotterdam as a whole (bars) with OM (dots). These scores are derived from combining the following five Dutch databases into one: National Compass Public Health, National Atlas of Public Health, Health Care Balance Sheet, Costs of Diseases, and Healthcare Data.

The horizontal axis expresses how much each area deviates from the Dutch average: values around 0 are similar to the national mean, negative values indicate worse outcomes, and positive values indicate better outcomes (or, for risk factors such as obesity or noise nuisance, a higher burden).

Overall, both Rotterdam and OM score worse than the Dutch average on most health-related indicators: self-reported good health, presence of long-term conditions, physical limitations, anxiety/depressive feelings, frail health, low resilience, loneliness, difficulty making ends meet, and several forms of serious noise nuisance. This double negative scoring for OM and Rotterdam is consistent with their general health status (Figure 18).

For many of these, the OM dot lies further to the negative side than the Rotterdam bar, suggesting that the neighbourhood is doing even worse than the already disadvantaged city average, particularly for chronic conditions, frail health, low perceived control, loneliness, and financial strain.

On lifestyle indicators, the picture is mixed. Rotterdam performs better than the national average on meeting alcohol guidelines and on walking/cycling for transport, while both Rotterdam and OM lag behind on meeting the physical-activity guideline and weekly sports. For smoking and some forms of noise nuisance, OM is closer to the national average (or slightly better) than Rotterdam. In terms of satisfaction with housing, neighbourhood, and greenery, Rotterdam as a whole scores clearly below the Dutch average; OM is sometimes slightly less negative than the Rotterdam mean, but still does not reach the national level.

When related back to the percentages here previously reported for OM in terms of physical and mental health, i.e. high shares of adults with health-related limitations, overweight/obesity, stress, and loneliness, the graph confirms that these are not only absolute problems, but also problems that are more pronounced than both the national situation and, for several indicators, the Rotterdam city average.

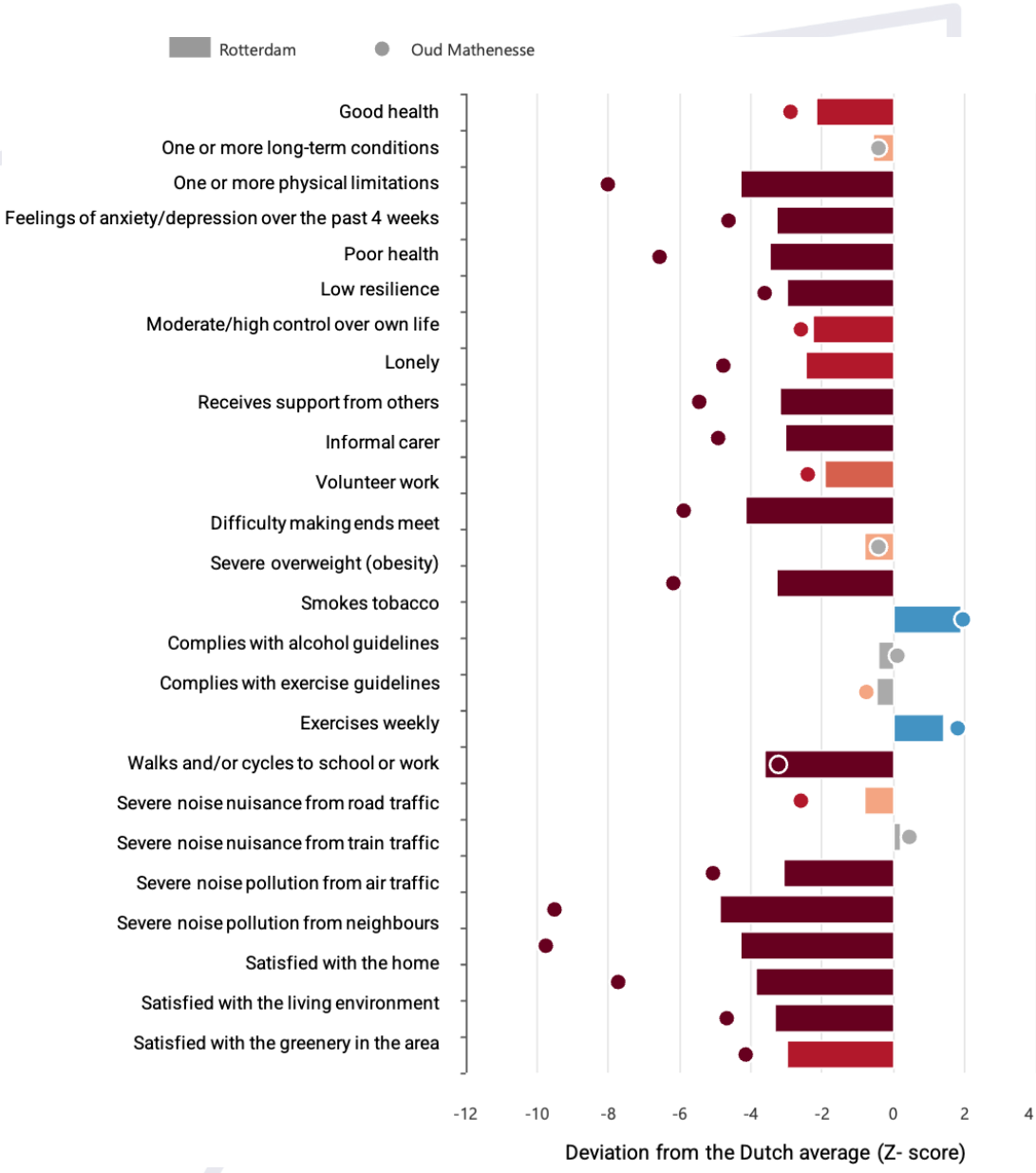

Figure 21 Good perceived health in Rotterdam and Oud Mathenesse. Source: Buurt Atlas 2025.

Mobile Forest (15) in Tjalklaan site, Rotterdam, the Netherlands.
Photographer: Nohemi Ramirez Aranda

Chapter 04

Greening wihtout Border's interventions

4. Typologies and sites

In Section 3, we presented the baseline assessment of OM's spatial, social, and ecological context, with particular attention to the aspects that need to be considered when the Greening Without Borders (GWB) interventions are introduced. The central experiment in the GWB project is greening individual and collective private gardens by creating off-the-shelf greening 'packages' to meet environmental needs. These interventions are designed to alleviate the pressures that existing conditions place on both residents and the environment. The goals of these interventions, both in the short and long term, are to adapt to and mitigate the effects of climate change within the neighbourhood, as well as for the human and non-human populations that inhabit it.

The following section provides a detailed description of each intervention planned for the neighbourhood over the next three years, along with an explanation of how each relates to the challenges faced by the neighbourhood. These interventions have been grouped into three clusters based on their spatial accessibility typologies: private, semi-private / public and temporal (Figure 22).

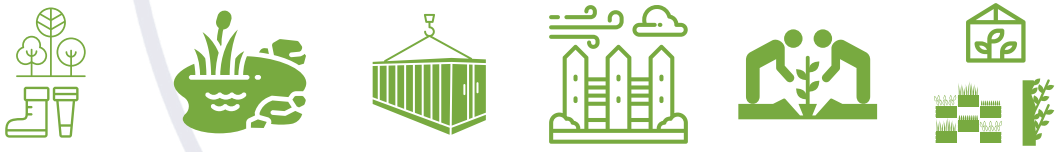

Figure 22 Typologies of interventions covered in Greening without Borders. Source: Authors, 2025.

4.1 Interventions in private and semi-private areas

The elements of the GWB greening model, greening packages for private gardens (cf 4.1.1), border space solutions (cf 4.1.2), and communal gardens (cf 4.1.3)– have been designed for OM and can be adapted to suit other contexts.

With 60% of the city's land in private hands, the initiative activates latent green resources and aims to contribute to Rotterdam's biodiversity and climate adaptability goals. In this context, it is important to note that from 2024 to 2031, OM streets will undergo improvements, including sewage system upgrades, raising sinking streets, and limited public land greening. The GWB model aims to capitalise on this work to deliver a street-by-street approach to raising and greening as much land as possible by targeting privately owned gardens (both individual and communal), as well as alleyways alongside the public streets. The land and the greening work are conceived as one – a responsibility and activity shared equally by the municipality, the community, and individual residents. Collaboration involves a design team comprising project staff, municipal sewage project teams, private garden owners, and educational institutions.

The interventions related to the greening of private gardens (cf 4.1.1), creation of façade gardens and backyard alleys (cf 4.1.2), and redesign and regreening of the communal gardens (cf 4.1.3) together establish the experimental approach to increase the amount of effective green space in a neighbourhood by greening (semi)private gardens in a public-private approach: through a suite of green-blue solution packages for (semi) private gardens.

4.1.1 Greening private gardens

The experimental character related to private gardens will be in exploring whether residents are willing to open their private gardens for community benefits. These gardens are often hardened and lack open soil that could help alleviate heat and water issues (Figure 23). To help with this transition, off-the-shelf greening 'packages' will be offered to support the greening of private gardens and address key environmental needs.

This includes:

1. Designing solutions for 'Sponge Gardens:' soil, water absorption, and biodiverse planting
2. Combining solutions into 'greening packages' for various spaces and budgets
3. Pricing the packages and explaining access to the Greening Fund for residents
4. Creating leaflets covering design, installation, pricing, maintenance, and support
5. Engaging residents to select and install packages, in collaboration with the co-op.

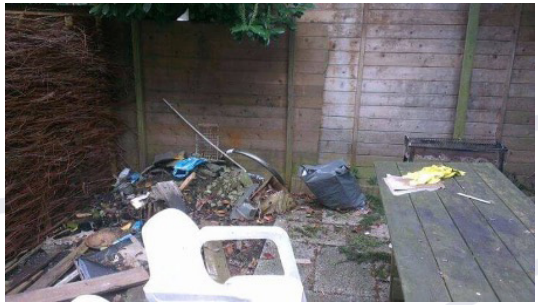

Figure 23 Example of a neglected and paved private garden. Source: Hopman, (2015).

GWB aims to climate-proof approximately 90 private gardens (around 35 m² each) by raising soil levels to match street level and integrating water retention and biodiversity-enhancing measures. These transformations will be be realized through a citizen activation program, potentially linked to a neighbourhood contest and/or a stamp-collection scheme within the "Wijk in Bloei" program, with participation open to all households in OM. Award criteria will be defined by the OM Community Green Working Group (Groene Coalitie) and are expected, as originally proposed, to prioritize: (1) areas with high heat stress as identified in Rotterdam's heat stress map; (2) locations with significant pluvial flooding risk; and (3) sites with strong potential for biodiversity enhancement. The type and scale of the interventions will be appropriate to the type of garden and the willingness of garden owners to facilitate collective benefit from their land (although this will be incentivized by the terms of the fund).

The private gardens implementation campaign is currently under preparation but has been delayed and is now planned to start in mid-2026. As a result, no specific garden locations have yet been selected, and no intervention-site-specific monitoring of locations, surroundings, or stakeholder dynamica has yet been initiated.

4.1.2 Border space solutions: Façade gardens & alleyways

Aside from the private gardens, 'solution packages' for so-called 'border spaces' will be provided. These border spaces are defined as transitional or mediating zones that facilitate or restrict movement and interaction, rather than simple fixed lines. They are often referred to as thresholds or buffer zones in design and urban theory. Border spaces between public and private realms are fluid and socially constructed, serving as areas of negotiation, exchange, and control.

- Physical and psychological elements: Borders can be concrete physical barriers like walls, fences, and gates, but also more subtle psychological or perceptual cues, such as a change in paving material, elevation, or landscaping.
- Transitional zones (thresholds): They are often "thick" or expansive spaces, not just a single line. They function as mediating spaces that allow a gradual shift in the degree of publicness or privateness, rather than an abrupt transition.
- Negotiation and hybridity: These spaces are where public and private interests, activities, and rules interact and are contested. Examples

in urban areas are hybrid spaces that might be privately owned but used by the public under specific access restrictions.

- Control and access: A primary function of these border spaces is to manage access and define who belongs in a particular area. They can be designed to foster social interaction (a welcoming front porch) or enforce exclusion (a high security gate, like for instance in the backyard alleys in some parts of the Landenbuurt in OM).

Examples of Border space solutions in the built environment are e.g., building façades with greening or pots/benches placed on sidewalks (Figure 24), front yard/porches, public accessible courtyards, buffer zones and backyard alleys (Figure 25).

In OM the GWB program focuses on two types of buffer zones, viz. façade gardens and greening solutions for backyard alleys. As to façade gardens (greening of façades, with green rooted in public sidewalks), local and National campaigns, referred to as 'Tegelwippen', or: 'tile-tilting' are well-known. The GWB approach adds an additional layer through the provision of off-the-shelf greening 'packages' to meet environmental needs. Complementing formal datasets, in the second half of 2025, the TUD team applied on-site observational mapping using a digital PPGIS approach combined with manual field capture (200+ mapped data points of informal/non-registered greening initiatives) (Figure 26).

4.1.3 Communal gardens

The GWB experimental pillar on "greening packages" addresses three complementary spatial typologies in Oud-Mathenesse: private gardens, border spaces, and communal gardens. Within the neighbourhood 's predominantly post-war housing fabric, characterized by apartment blocks and shared courtyards, communal gardens are a particularly relevant focus area because they offer a rare opportunity to deliver environmental benefits (cooling, drainage, biodiversity) while also strengthening social cohesion at the block scale.

A communal garden can be defined as a shared open space in an urban setting that is collectively used and maintained by residents for recreation, social interaction, and, in some cases, food production (Figure 27). In the Dutch context, the governance of such spaces is frequently intertwined with the Vereniging van Eigenaren (VvE), the legally required homeowners' association for multi-owner buildings. If a garden is part of the common property defined in the deed of division (splitsingsakte) and associated regulations (splitsingsreglement), decisions on its use and maintenance are made through the VvE's general meeting and are binding for members. This structure can be an asset, providing formal decision-making procedures, continuity, and a mechanism to finance maintenance through mandatory service fees, but it can also slow implementation and constrain experimentation where residents' ambitions or priorities diverge.

Figure 24 Sidewalk self-managed interventions: Source: Author, 2025 (down). Mattijs van ‘t Hoff, 2025 (up).

Figure 25 No-man's land. Back alleys in Oud Mathenesse. Source: Authors, 2025.

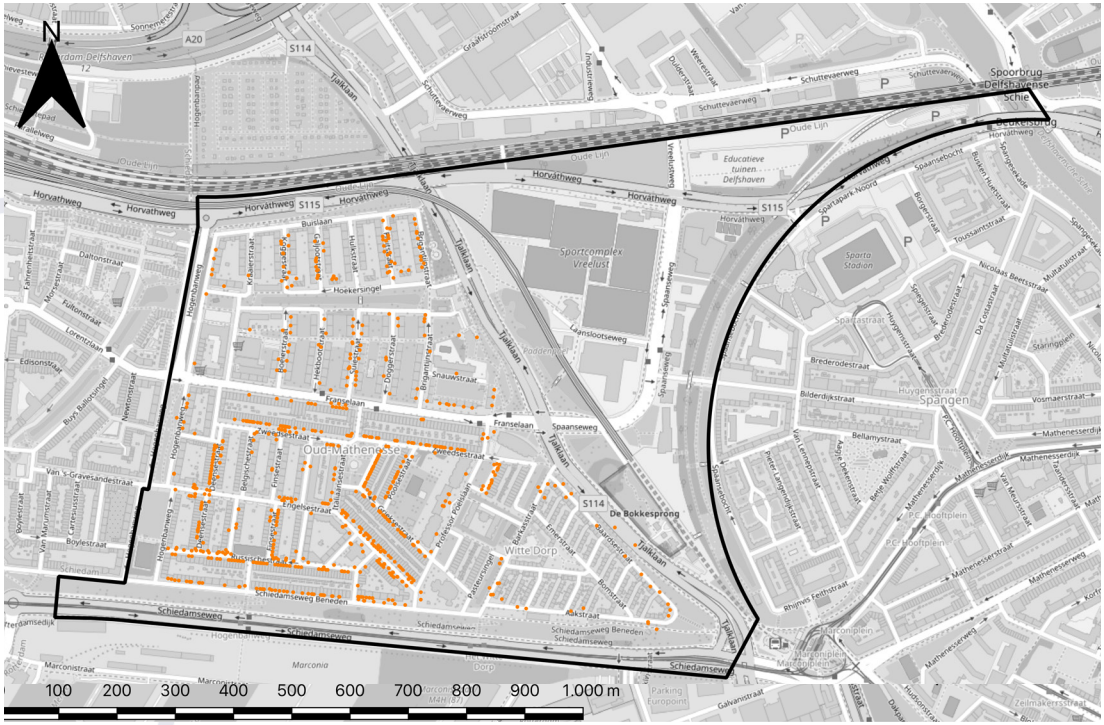

Figure 26 Self-managed green interventions in Oud Mathenesse. Source: Processed by Authors, with input from Authors, Anne Bruggen and Lea Hartmeyer, 2025.

Figure 27 Buurt tuin Oud Mathenesse. Source: Authors, 2025.

In practice, communal gardens vary widely in their access arrangements and management models. Some operate as fully enclosed courtyards reserved for residents, while others are semi-open or hybrid spaces where non-residents may enter informally but are expected to behave as "guests." Organizationally, gardens may be managed as a single collective plot, as multiple individual plots under shared rules, or through mixed approaches.

In Oud-Mathenesse, 13 communal gardens have been identified, representing a wide range of ownership and governance configurations (e.g., fully rental blocks versus mixed tenure; single-VvE governance versus multiple or fragmented VvEs per courtyard) (Figure 28).

In 2025, the Main Urban Authority (MUA) led the process to identify four candidate communal gardens for GWB interventions.

This selection proved challenging due to the heterogeneity of governance arrangements and, in several cases, a reluctance to participate linked to uncertainties about post-project responsibilities and long-term maintenance expectations (Figure 29).

By late 2025, one communal garden had been selected (Figure 30), and a first co-design workshop took place in mid-December 2025 involving the relevant VvE and the landscape design firm appointed through an open procedure. The design process aims to develop (and co-create) shared-use interventions that respond both to residents' needs and to the project's broader impact ambitions, specifically: (1) reducing heat stress in areas identified as high exposure in Rotterdam's heat stress mapping; (2) addressing locations with significant pluvial flooding risk; and (3) enhancing biodiversity where site conditions and connectivity suggest high potential.

From a monitoring perspective, the current plan is to install the weather station associated with the communal-garden intervention in January 2026. However, the delays in finalizing the remaining communal garden sites create a methodological and strategic concern: it remains uncertain whether the first selected garden is the most suitable "test case" for GWB's objectives.

The garden currently engaged appears relatively well organized and already comparatively green, which may reduce the observable marginal effect of interventions and limit learning on governance barriers that are more typical for OM's more complex or fragmented courtyards.

This raises a legitimate question about whether the selection best supports GWB's goal of generating transferable evidence and maximizing neighbourhood -wide impact, particularly if the other candidate gardens (still under discussion) might offer greater environmental need, clearer added value, or more representative governance conditions for the district.

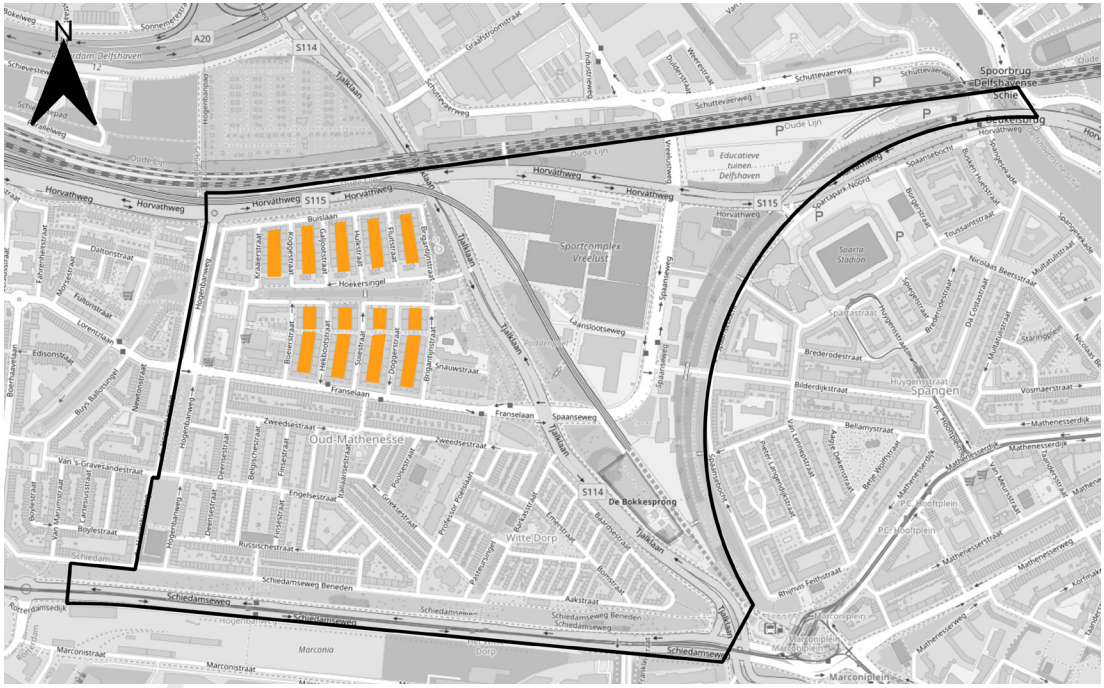
N
Horvathweg
Oud-Mathenesse
Spangen
Sportcomplex Vreelust
De Bokkesprong
Witte Dorp
Schiedamseweg
Marconiplein
Spoorbrug Delfshavense Schie
Bokkesbrug
Tjalklaan
Franselaan
Spaanseweg
Laanslootseweg
Hoekersingel
Bursiaan
Kraaierstraat
Kopperstraat
Chemiestraat
Hoogstraat
Fluitstraat
Heksenstraat
Boerestraat
Suezstraat
Doppenstraat
Brigantijnstraat
Snauwstraat
Zweedsestraat
Engelsestraat
Russischestraat
Schiedamseweg Beneden
Aakstraat
Marconistraat
Marconia
Sparta Stadion
Educatieve tuinen Delfshaven
Oude Lijn
Schuttevaerweg
Graafstroomstraat
Vreewijkstraat
Spaanseboch
Bilderdijkstraat
Breerodestraat
Mathenesserdijk
Mathenesserweg
Beiamystraat
Vosmaerstraat
Nicolaas Beetsstraat
Dirk Coolaertstraat
Starringlaan
Spangenstraat
Sparrenstraat
Hugo de Grootplein
Pieter Langendijkstraat
Van Meerlantstraat
Van Meursstraat
Rhijnvis Feithstraat
Boerhaavelaan
Edisonstraat
Lorentzlaan
Fahrenheitstraat
Daltonstraat
Fokkerstraat
Newtonstraat
Bury Mathonnetstraat
Van 's-Gravesandestraat
Boylestraat
Cartesiusstraat
Van Musschenbroekstraat
Dommerstraat
Beijerinckstraat
Fresnelstraat
Linnéstraat
Professor Pekelaan
Rotterdamsedijk
Hogenbanweg
Hogenkampweg
Oude Delfshaven
Sonneveldweg
Hogenbanpassage
Schiedamsedijk
Schiehaven
Schiekade
Schiewijkstraat
Schiekade
Schiedamsevest
Schiedamsevest
Schiedamsevest

Figure 30 Pre-selected communal garden. Source: Authors, 2025.

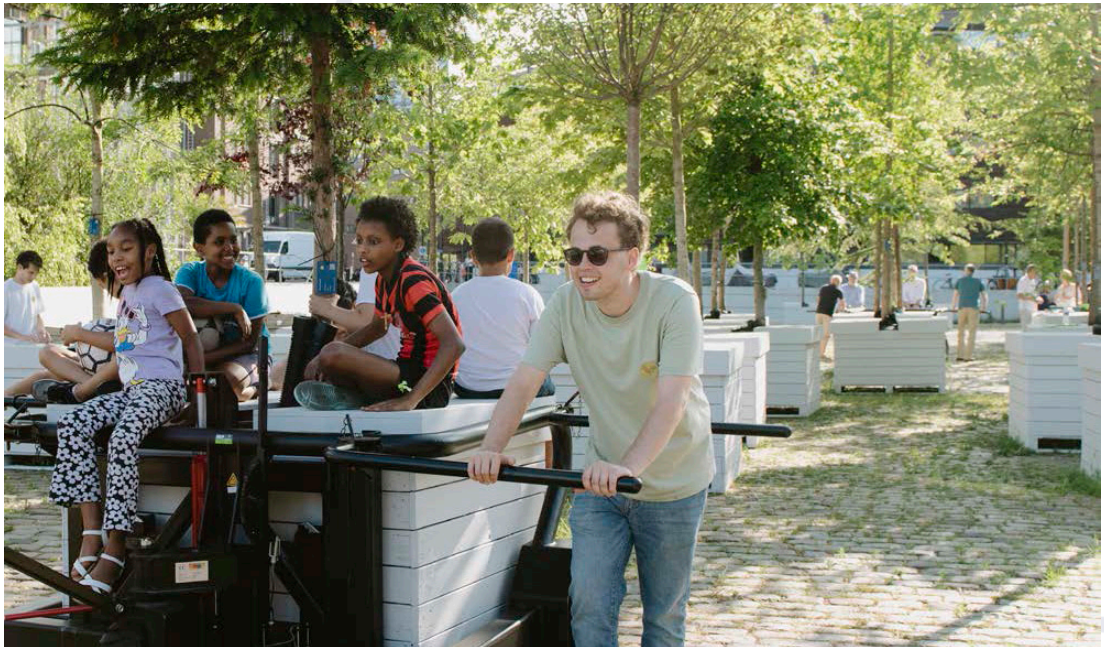

Figure 31 Custom made trolleys for moving BOP. Source: Komovo.

4.2 Interventions in public areas and temporal interventions

4.2.1 Mobile Forest ('Walking Forest' / Bos op poten)

The 'Mobile Forest' (Walking forest, or, in Dutch: 'Bos op Poten' - BOP) project consists of a collection of young trees in specially designed containers, which can be easily moved with a custom-made cart (Figure 31 and Figure 32). These innovations originate from the Urban Forestry research group at TU Delft, which has been working on research and innovation around "mobile forestry" in the city since 2019.

This concept offers a solution for locations where the subsoil is too congested, above-ground space must remain flexible, or where there is no plan or budget for greening. The research group's first project combined technical innovations for above-ground tree growth with research into the cooling performance of different tree species.

Between 2020 and 2023, climate arboreta were installed in various locations in the Netherlands, including the forecourt of the Faculty of Architecture and the Built Environment at TU Delft, a tiny house community in Dordrecht (later relocated to the Floriade in Almere), and an industrial area in Barendrecht. The research focuses not only on innovations in container design but also on improvements in potting substrate, stability, portability, and management. A double container was developed: inside, an airpot system for the root ball and the substrate, encased in a protective wooden shell with a lid. This protective box kept the inner container cool and tamper-proof, prevented dehydration, and simultaneously functioned as a seating element.

The "Bos op Poten" (BOP) was subsequently used in an initial project in Rotterdam, at the Handelsplein in the district 'Kop van Zuid-Entrepot' (2023-2025) financed by the Resilient Delta initiative (Figure 32 Figure 33). The main research areas for the BOP research group include (i) reducing heat stress in cities; (ii) greening for the sake of citizen health; (iii) exploring new greening options; (iv) citizen participation in green care; and (v) reciprocities between BOP and neighbourhood stewardship, as infrastructures of care.

In OM a small group of trees will be placed to continue all stated research activities, while putting in particular emphasis on research goals (i), (iv) and (v). A total of (at least) 16 trees will be placed in the neighbourhood. In 2025, implementation preparations by TUD progressed significantly. In May 2025, TUD transported the first 15 full-grown trees from the nursery to a near-site location adjacent to OM (Figures 34A and 34B). A watering task force supported summer maintenance, while root systems were prepared for repotting and sensor integration in August 2025. In October 2025, all 15 trees were planted into newly designed and manufactured planters featuring three different internal hydrology and insulation configurations; twelve planters were painted white. Throughout the period, TUD maintained the trees with watering frequencies adapted to seasonal conditions.

Figure 32 Custom made trolleys for moving BOP. Source: Authors, 2025.

Figure 33 Closing event BOP in Handelsplein location. Source: Authors, 2025.

Figure 34A BOP preparations in Tjalklaan. Source: Authors, 2025.

Figure 34B BOP preparations in Tjalklaan. Source: Authors, 2025.

However, the preparations on the side of MUA did not proceed according to the planned timeline. Priority was given to the process of the Communal gardens (through a complex process with the Owners' Association -VvE's, ao). As a result, it was only in mid-December 2025 that a tentative decision was made during a joint (Citizen/ MUA/TUD) walk through a dedicated area in the Landenbuurt of OM regarding the placement of the BOP trees. For the time being (i.e., without final confirmation from MUA) three clustered locations were identified[2], which serve as a starting point for the further preparations to place the trees in the first week of April 2026, and thus to finalize the related Baseline measurements for surrounding spaces and together with (nearby) citizens during the period of January to March 2026.

4.2.2 WADI

WADI stands for Water, Afvoer, Drainage en Infiltratie (Water, Discharge, Drainage, and Infiltration) and refers to a type of sustainable urban drainage system (SUDS) used to manage stormwater in cities. The term is derived from the Arabic wadi (وادي), meaning a dry riverbed, valley, or gully that temporarily fills with water during and after heavy rainfall. In urban settings, WADIs are typically shallow, vegetated depressions designed to collect, temporarily store, and infiltrate rainwater, thereby relieving pressure on sewer systems and reducing flood risk during peak rainfall events (Figure 35).

In the Dutch context, WADIs play an increasingly important role in climate adaptation strategies, as more frequent heavy downpours and longer dry spells require solutions that both buffer water and support groundwater recharge. Recent research and practice show that WADIs can also be planted with specially selected trees and understory vegetation without compromising their hydraulic performance. This has led to new design variants that combine stormwater management with enhanced biodiversity, urban cooling, and improved neighbourhood amenity.

In OM, at least one WADI will be realized. Its exact location will be determined through a series of participatory design workshops focused on the four communal gardens (ongoing in 2025–2026), as the intention is to integrate the WADI into these co-created green spaces. Consequently, no intervention-specific monitoring activities for the WADI have yet been carried out, although TUD has already mapped current flooding risks (see Annex 1), as well as projected flood risk for 2050 and 2100, for the entire OM neighbourhood.

4.2.3 P-LAB

The P-Lab is a temporary intervention in Oud-Mathenesse, planned to take place in connection with the Lente Feest (Neighbourhood Spring Festival) in 2026 or 2027, including activities before and after the event.

[2] For further detail on the iterations on BOP potential locations suggested by residents and the MUA from Spring 2025 until Winter 2025 refer to Annex 4, Map #20.

It consists of a mobile, containerized unit, approximately the size of a 20-foot high-cube shipping container, (Figure 36, Figure 37) developed by TU Delft (Environmental Technology & Design section). To date, the P-Lab has been deployed at three sites in Amsterdam and Delft and is currently being tested and further optimized at TU Delft's *The Green Village*.

In Oud-Mathenesse, the P-Lab will function as a real-world testbed to refine operational processes and, more importantly, as a visible "attractor" to stimulate residents' curiosity and engagement with neighbourhood greening and its practical requirements, particularly watering and nutrient provision.

This focus aligns with growing evidence that improved nutrient management, including recycling nutrients from waste streams back to greening initiatives (or urban agriculture), is essential for reducing ecosystem damage while safeguarding green (or: food) security and access to fertilizers. An increasing number of studies highlight cities as nutrient hotspots, where nutrients, especially nitrogen (N) and phosphorus (P), can be recovered and recirculated into greening concepts as part of a circular loop.

The TU Delft team participated in OM's Lente Feest (Spring Festival) in 2025 with an information stand introducing the forthcoming P-Lab intervention. To translate circular nutrient concepts into a tangible, conversation-starting activity (Figure 38), visitors were invited to take part in a short quiz asking how many carrots could be grown using the nutrients recoverable from the urine produced by an average resident. It led to many submissions including one award-winning entry.

At the upcoming Spring Festival, the P-Lab will further strengthen community outreach by combining hands-on engagement with structured data collection. On-site interactions will be directly linked to TU Delft's Maptionnaire surveys, broadening participation and connecting experiential learning to residents' perceptions, needs, and priorities regarding sustainable greening, including practical aspects such as watering and nutrient management.

Figure 35 Example of a Wadi in Oldenzaalsestraat-Enschede. Source: Visit Enschede, 2025.

Figure 36Closed P-LAB in the Green Village at TU Delft campus. Source: Authors, 2025.

Figure 37 P-LAB interior. Source: Authors, 2025.

Figure 38 Lentefeest 2025 in Oud Mathenesse. Source: Authors, 2025.

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Chapter 05

TU Delft's monitoring plan

5. A mixed methods strategy

As discussed in Section 4, the nature of the interventions is closely intertwined with the neighbourhood 's social, environmental, and spatial conditions. Monitoring and assessing the impact of such a diverse set of interventions requires a dynamic strategy. The TU Delft team has therefore developed a mixed-methods approach that combines quantitative and qualitative methodologies and indicators within a transdisciplinary framework. This framework is conceived as a decision-support tool that provides, at a glance, an integrated perspective on how the interventions affect both the local environment and the well-being of OM's residents.

Figure 39 TU Delft methodologies in WP3. Source: Authors, 2025.

The monitoring and evaluation framework consists of six components arranged along a continuum from fully quantitative, through mixed, to fully qualitative methods (Figure 39). The first five components generate thematic indicators that feed into a sixth, integrative component, which synthesizes the results into an overall assessment of intervention impacts.

5. A mixed methods strategy

Within the discovery phase, TUD collected more than 100 geospatial data layers to support contextual analysis of OM; approximately half have been processed further, with more than 30 layers already used to pilot-test the CELMOT tool. Complementing formal datasets, TUD also implemented on-site participatory mapping using a digital PPGIS protocol combined with manual field capture. This resulted in over 200 mapped data points and the creation of a baseline map of informal and non-registered greening initiatives (Figure 26): an important foundation for understanding existing community-led greening dynamics and for targeting future interventions.

To support shared decision making, TUD produced a series of decision-support maps, meeting documents, and presentation materials for the Groene Coalitie (GC) and other GWB stakeholders, particularly residents and the municipality. These materials have directly informed discussions and decisions regarding the siting of the Mobile Forest (Bos op Poten) and related interventions, with TUD presenting these outputs during GC meetings (Annex 4).

5.1 Sensors

The first component on the fully quantitative and climate end of the spectrum is the microclimate monitoring system. TU Delft acquired seven wireless Davis Vantage Pro2 Plus stations, which are research-grade professional outdoor weather stations known for their customizable features, high accuracy, and robust performance. These units include all standard Vantage Pro2 features plus UV and solar radiation sensors.

They provide real-time updates every 2.5 seconds and have an industry-leading transmission range of up to 300 m (1,000 ft) from the integrated sensor suite to the WeatherLink console. The TU Delft team has programmed the stations to upload measurements every 15 minutes to the WeatherLink cloud service. In addition to UV and solar radiation, each station measures:

1. Outdoor temperature and humidity (in a passive radiation shield)
2. Wind speed and direction
3. Wind chill and heat index
4. Barometric pressure
5. Dew point
6. Rainfall and rain rate
7. Historical graphing and forecasting data
8. Moon phase
9. Evapotranspiration (ET)
10. THSW index (temperature–humidity–sun–wind)

Each unit is approximately 2.00 m tall with a base diameter of about 1.00 m (Figure 40). Because these are state-of-the-art and relatively costly instruments, additional precautions have been taken to ensure stability and safety. Three of the stations will be mounted in robust tree planters,

Figure 40 Weather stations VantagePro2Plus. Source: Davis, 2025.

of the same type used for the mobile forest, that measure 1.00 × 1.20 × 1.00 m and are filled to the top with soil to secure the installations.

The sensors will be positioned adjacent to a sample of the interventions to measure microclimatic conditions before and after implementation. The seven stations will be deployed as follows: (a) communal garden, (b) private garden, (c) mobile forest (2), (d) control location within OM, and (e) external validation site outside the neighbourhood (2).

Although the sensors collect data continuously, there are several critical points in the project at which "cuts" in the time series are required for systematic comparison. We have defined three intermediate measurement points at Month 12 (M12), Month 18 (M18), and Month 24 (M24). These are in addition to an initial calibration and baseline period at Month 6 (M6), before any interventions are implemented, and a final measurement at the end of the project (M32).

These milestones were part of the original project planning and will need to be adjusted to account for the delays outlined in the summary section of this report. Such delays have significant implications for the measurement strategy, as seasonal comparability between time points must be maintained to ensure analytical rigor.

This is particularly critical for the mobile forest, where the phenological cycle of the trees (e.g., presence or absence of leaves across seasons) has a direct influence on local microclimate and the environmental effects observed in situ.

Due to delays in the decision-making process regarding the locations of the six interventions, only one sensor, the one assigned to the control location, has been installed and calibrated to date. As of December 15, 2025, two potential sites have been identified for hosting BOP, and one site has likewise been identified for one of the four communal gardens. Further refinement and confirmation of these locations are required before the remaining stations can be deployed.

In Annex 2 there is a compact summary of the baseline measurements from July to November 2025 captured by "Sally" with console code GWB_ODMS_100C (Figure 41). This Vantage Pro2 Plus weather station is currentlyw installed as a control point in Rotterdam West. A detailed version of this data pack has been uploaded into the RAMN and will be made available with a repository DOI.

Figure 41 Weather station control point "Sally". Source: Authors, 2025.

5.2 PRIGSHARE and PRIGSHARE+

Interest in the relationship between green space and human health and well-being is growing rapidly across both research and practice. At the same time, the evidence base remains fragmented due to the field's historically mono-disciplinary origins and the resulting diversity in terminology, indicators, and study designs. As greenspace–health research evolves toward genuinely interdisciplinary work, consistent definitions, transparent reporting, and shared quality standards have become increasingly important, particularly when studies aim to be comparable, replicable, and usable for synthesis (e.g., meta-analyses) and practice-oriented decision-making.

A key milestone in establishing a shared conceptual foundation was the identification of three mechanistic pathways through which green space can affect health and related outcomes (Markevych et al., 2017a):

- Mitigation: reducing environmental stressors such as heat, air pollution, and noise.
- Restoration: supporting attention restoration and stress reduction through contact with nature; and
- Instoration: providing affordances that promote physical activity and social interaction.

While these pathways (Figure 42) are widely accepted, methodological consistency remains a central challenge.

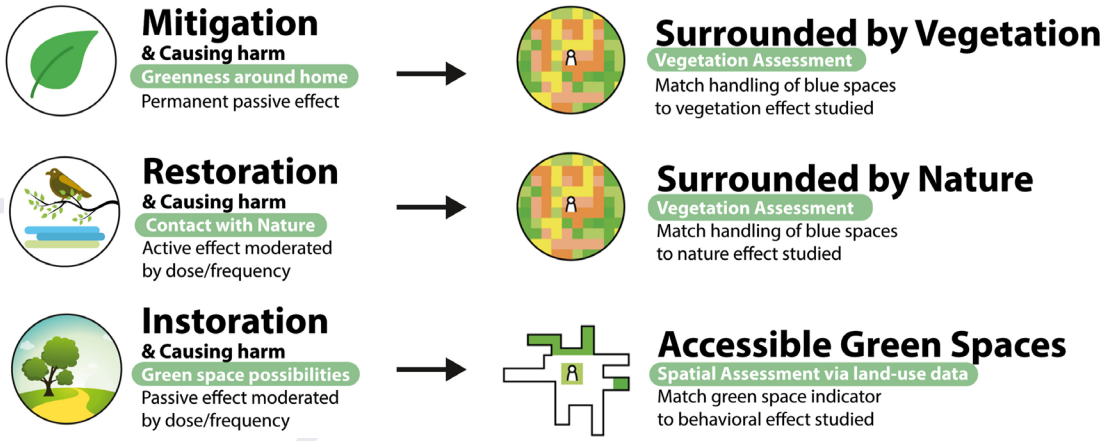

Figure 42 PRIGSHARE mechanisms between green space and health. Source: Cardinali et al., 2023.

This is partly because "green space" is not a single, uniform exposure: its type, structure, quality, features, accessibility, and perceived experience vary substantially across contexts (Taylor & Hochuli, 2017).

Recent work therefore calls for more precise and harmonized indicator definitions within and across pathways, as well as sensitivity analyses that test how different greenness metrics relate to outcomes and mechanisms e.g. (Davis et al., 2021; Labib et al., 2022).

Equally important is improving transparency through rigorous reporting of both indicators and contextual variables, since incomplete documentation can prevent replication and may obscure risks of bias (Browning et al., 2022; Collins et al., 2020; Markevych et al., 2017b).

5.2.1 From PRIGSHARE to PRIGSHARE+: a GWB-specific adaptation

To address these needs, TU Delft developed PRIGSHARE (Preferred Reporting Items in Greenspace Health Research) as a reporting guideline designed to make greenspace assessment decisions explicit and comparable (Cardinali et al., 2023). Building on this foundation, PRIGSHARE+ was developed as a QGIS-based operational framework tailored to the GWB project's monitoring and evaluation needs in Oud-Mathenesse.

The PRIGSHARE+ adaptation was prepared during a dedicated international working session in Detmold with German colleagues and TU Delft staff involved in the original PRIGSHARE development. For GWB, the adaptation centred on three main adjustments:

- Scale of application: shifting from broader city-scale applications to neighbourhood - and street-level, consistent with the spatial granularity of interventions in Oud-Mathenesse.
- Contextual dimensions: strengthening the representation of accessibility and water-related elements as part of the lived everyday environment, particularly relevant in a low-lying, climate-stressed urban district.
- Outcome focus: aligning assessment decisions more explicitly with well-being (alongside health), reflecting the project's broader socio-ecological objectives and community-facing evaluation logic.

PRIGSHARE+ is accompanied by an open-source script intended to support collaboration across disciplines by making the assessment workflow legible to both spatial and non-spatial researchers. In practice, the framework guides users through a transparent decision sequence from the study objective to pathway selection, to indicator choice and contextual covariates, so that green space exposure measures are aligned with the hypothesized mechanism rather than selected by convention.

The PRIGSHARE checklist comprises 22 reporting items that address common risks of bias and barriers to comparability. Items are grouped into five domains: objectives (3 items), scope (3 items), spatial assessment (8 items), vegetative assessment (4 items), and context assessment (4 items).

For each item, pathway-specific rationales and explanations clarify why a given parameter is required and how it supports interpretability across studies (Table 2).

In the GWB context, this structure supports consistent documentation of baseline conditions and post-intervention assessments, enabling robust pre–post comparison across intervention typologies and sites.

5.2.2 Making implicit choices explicit: the decision flow

A central contribution of PRIGSHARE+ is its emphasis on the explicit "decision flow" linking the outcome variable (here: well-being and related socio-environmental conditions), the theoretical pathway(s), and the resulting green space indicators. Historically, such dependencies have often been treated implicitly, a practice that makes studies difficult to reproduce and comparisons unreliable. PRIGSHARE+ operationalizes this logic as a guided decision tree (Figure 43) and reinforces an important methodological implication: no single green space indicator can adequately represent all pathways. Different mechanisms require different measurement choices (e.g., shade and thermal comfort for mitigation; perceived naturalness for restoration; walkable, usable green features for instoration).

5.2.3 Modular development and integration with CELMOT

PRIGSHARE was designed to be modular, allowing additional assessment strategies to be added over time, for example, 3D visual exposure using street-level imagery, LiDAR-based vegetation metrics, or GPS-based tracking of green space "dose" and frequency. This modularity is particularly relevant for GWB, where TU Delft is developing complementary methods beyond standard 2D GIS layers through the CELMOT tool. Specifically, CELMOT's approach (currently under development) applies AI-supported processing of 360° Google Street View imagery to capture aspects of the third dimension of street greenery in a (semi-)automated manner. In Oud-Mathenesse, this is complemented by systematic observational mapping of informal greening initiatives, including border-space solutions such as façade gardens, documented at 25-meter intervals along street segments (see Section 5.4. Together, these components strengthen PRIGSHARE+ by expanding exposure characterization from "mapped green" to "experienced green," while maintaining a transparent reporting structure that supports comparability and interdisciplinary interpretation.

In summary, PRIGSHARE+ provides GWB with a coherent, transparent, and scalable framework to define, assess, and report greenness and context variables at the neighbourhood scale in Oud-Mathenesse, supporting both scientific rigor and practice-oriented learning across interventions.

Table 2 PRIGSHARE checklist items. Source: Cardinali, 2023.

Checklist of items to include when reporting research on green space health effects		
#	Section/Topic	Checklist Item
	OBJECTIVE	
1	Health Outcome(s)	Specify the health outcome(s) being researched
2	Pathway(s)	Position the research within a theoretical pathway (Mitigation, Restoration, Instoration).
3	Green Space Focus	Provide a clear definition of green space features being researched, distinguishing between surrounding vegetation, contact with nature, and accessible green spaces.
	SCOPE	
4	Type of Distance	Specify the type of distance used with rationale (Euclidean Distance (ED), Network Distance (ND), Buffered Service Area (BSA), Administrative Units (AU)).
5	Walkability Network	If accessibility to green spaces is part of the study design, indicate if the walkability network used to generate isochrones or buffered service areas has been checked for bias and how.
6	Distance	Give a rationale for the chosen distance and indicate if different distances were tested (Sensitivity Analysis).
	SPATIAL ASSESSMENT	
7	Proxy for Exposure Variable	Define the spatial indicators used in research and indicate if different indicators were tested (Sensitivity Analysis).
8	Data Source	Indicate which database was used and if there has been an adjustment for potential bias (expert assessment).
9	Public Ownership Bias	Indicate if the dataset was controlled for the usability of green spaces from public-owned plots and how.
10	Residential Ownership Bias	Indicate how semi-public residential green spaces have been handled.
11	Classification Bias	Indicate how green spaces have been classified.
12	Accessibility Bias	Indicate if green spaces have been checked for fences and other types of barriers and how.
13	Usability Bias	Indicate if the usability of green spaces was checked and report inclusion/exclusion criteria.
14	Connectivity Bias	(Optional) Indicate if the database has been corrected for green space network connectivity and how.
	VEGETATIVE ASSESSMENT	
15	Proxy for Exposure Variable	Specify the indicator(s) used to assess surrounding vegetation or nature and indicate if the sensitivity was tested.
16	Data Source	Provide the data source of the satellite images and their resolution.
17	Handling of Blue Spaces	Indicate how blue spaces have been handled.
18	Handling of Seasons	Explain how variance in vegetation indices due to seasonality or changes in the built environment was handled.
	CONTEXT ASSESSMENT	
19	Personal Context	Give a rationale for the chosen personal context variables that have been tested or controlled for.
20	Local Context	Give a rationale for the chosen local context variables that have been tested or controlled for.
21	Urbanicity Context	Give a rationale for the chosen urbanicity context variables that have been tested or controlled for.
22	Global Context	Indicate in which climate, societal, and cultural setting the study was conducted. If several settings are part of the research explain how the results were controlled for potential confounding and tested for effect modification.

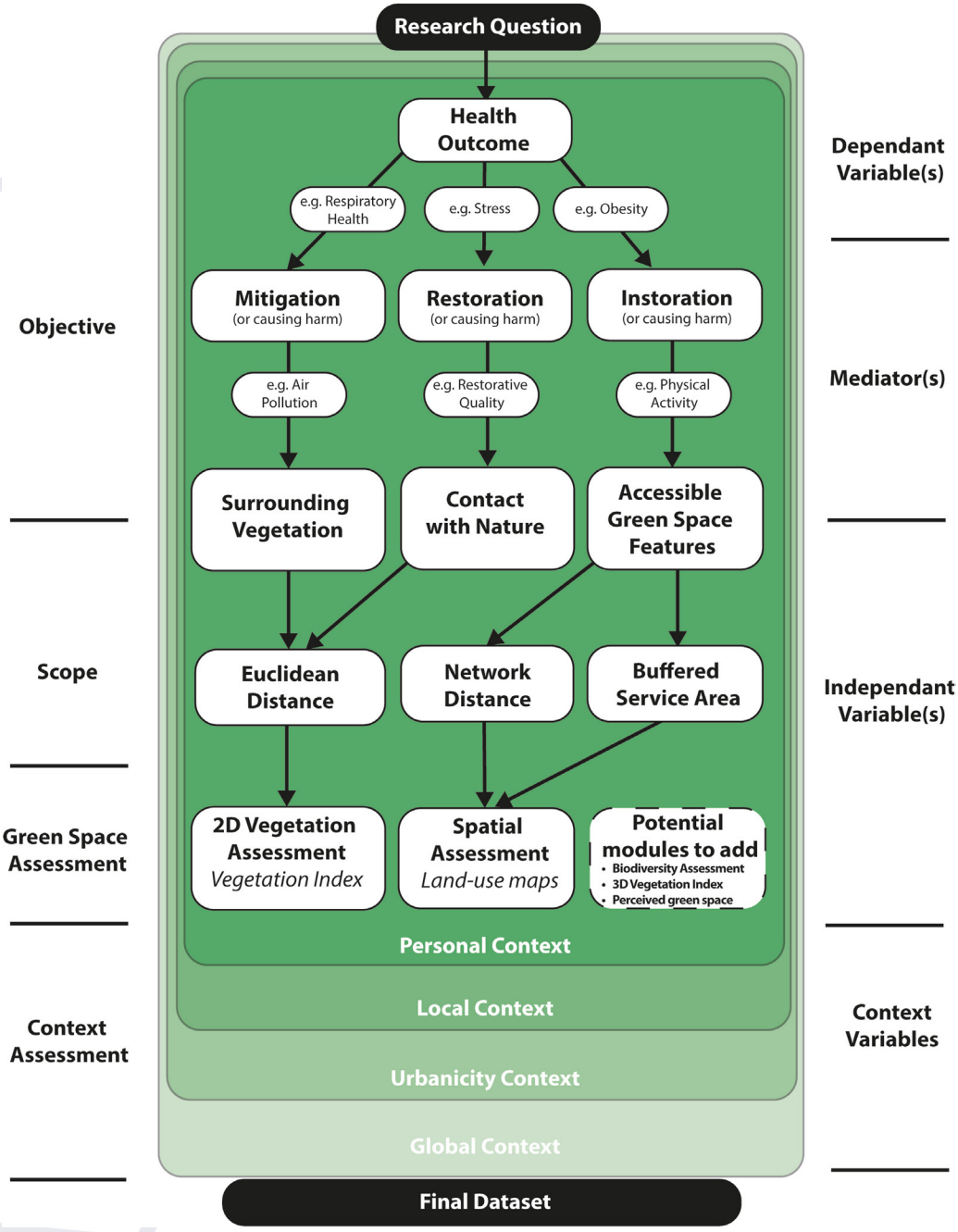

Figure 43 PRIGSHARE+ operationalization. Source: Adapted from Cardinali, 2023.

5.3 Surveys, Interviews and Workshops

5.3.1 Surveys

Moving toward the more qualitative end of the monitoring strategy, the key components are the geotagged surveys, targeted interviews, and co-creation workshops.

The surveys occupy a threshold between qualitative and quantitative methods, functioning as a bridging mechanism between the highly quantitative spatial and climate data generated by the sensors and PRIGSHARE, and the more qualitative insights derived from interviews and co-creation workshops. They play this "glue" role because they are implemented through Public Participatory Geographic Information Systems (PPGIS).

PPGIS tools, in both digital and analogue formats, have been shown to help challenge and soften power hierarchies in planning and decision-making processes (Guldi, 2017). When PPGIS is used, less privileged groups, particularly those with limited or no agency in formal decision-making, can be empowered through access to tools that were previously available mainly to government officials, practitioners, professionals, and policymakers (Kar et al., 2016). PPGIS is a context-specific application of GIS technology that seeks to harness local and indigenous knowledge through community engagement and social learning.

In relation to more traditional research methods in spatial studies, PPGIS "celebrates the multiplicity of geographical realities rather than the disembodied, objective and technical 'solutions' which have tended to characterize many conventional GIS applications" (Dunn, 2007, p. 616). In many participatory mapping studies, especially in contexts with low levels of digital literacy, community knowledge is collected through physical, low-tech data collection methods. In OM, we will adopt a hybrid approach in which both digital and analogue options for completing the survey are available during consultations (Figure 44).

Figure 44 Example of PPGIS hybrid pilot testing with least engaged communities in Gent. Source: Authors, 2019.

The digital PPGIS platform selected for this project is Maptionnaire. Maptionnaire is a platform developed by urban planning researchers and professionals based in Helsinki who identified a growing need for cities and urban planners to engage residents in a user-friendly way while still generating high-quality, spatially explicit data. The platform allows users to design their own map-based questionnaires without the steep learning curve of traditional GIS software and can

be scaled from a simple map-based survey tool to a broader community engagement platform.

The questionnaire to be deployed in OM for monitoring and evaluating the Greening without Borders interventions is place-based and therefore highly dependent on the final locations of the interventions. To obtain a sample that is representative of each intervention typology, required sample sizes (n) will be calculated based on spatial analysis of the locations: using a 25 m buffer for interventions in collective or public spaces, and, for individual interventions, based on the total number of interventions implemented on-site.

The questionnaire is structured into three thematic clusters covering, among others, the following topics:

1. Demographic information (e.g., age, gender, ethnic background).
2. Interventions in space (e.g., location and perceived attributes of the interventions and their spatial context).
3. Interventions and people (e.g., how the interventions make respondents feel and what impact, if any, they perceive on their well-being. This in relation with the PRIGSHARE protocol for mitigation, restoration and instoration).

Due to the current delays in confirming the locations of the interventions, no questionnaires have yet been administered. However, given the two tentative locations identified for the mobile forest and one site for one of the communal gardens, preliminary consultations could begin as early as January 2026.

5.3.2 Interviews

While the PPGIS surveys capture the breadth of potential impacts on the sites and residents, the interviews focus on their depth. Accordingly, the sample size (n) for interviews will be substantially smaller, approximately a dozen participants, targeting key stakeholders. These include, but are not limited to, residents, municipal representatives, private and civil society organizations, and academic partners.

The purpose of these interviews is to obtain a multi-stakeholder perspective on the impacts of the interventions in situ, and to understand how different actors relate to, experience, and interpret these changes from their respective positions.

5.3.3 Co-creation workshops

The co-creation workshops are designed to actively involve residents in the decision-making process regarding the adaptation of the interventions on-site. This is particularly important at the midpoint of the project, when the interventions have already been implemented and adjustments may be necessary before the final evaluation.

During these workshops, residents will be presented with preliminary results from

the monitoring and evaluation framework. The workshops also function as a validation mechanism, allowing participants to react to and reflect on the emerging findings. For example, if the interventions appear to have had a measurable climatic effect on specific sites, the objective quantitative data will be compared with the survey responses to assess the level of alignment or divergence between measured conditions and perceived impacts.

These combined results will serve as the starting point for workshop discussions and will guide the refinement of the interventions in the neighbourhood, so they better reflect residents' wishes, expectations, and lived experiences.

A key component of the workshops is the use of a digital photovoice tool, the Urban Belonging app. This app allows participants to record walking routes in the neighbourhood with high spatial accuracy and to take photographs of relevant elements in the built and natural environment. Each photo can be tagged by users with positive or negative attributes.

A set of predefined attributes, derived from the comparative analysis of survey results and quantitative data, will be preloaded into the app. However, participants will also be able to add their own tags to capture nuances that may not have been anticipated by the research team. After the neighbourhood walks, a collective reflection round will be organized in which participants review and discuss the photographs and tags generated by others. This step is crucial for deepening the understanding of how quantitative measurements relate to residents' subjective, place-based experiences.

According to the original project planning, adjustments informed by the midterm co-creation sessions will be implemented where feasible. At the end of the project, a final workshop will be held to assess the extent to which these adjustments have influenced both residents and the sites, thereby closing the feedback loop between measurement, co-creation, and intervention.

5.4 CELMOT

The City at Eye Level Monitoring Tool (CELMOT) is the central component of the monitoring and evaluation strategy, and a stand-alone deliverable, in which all five other components (sensor data, PRIGSHARE+, surveys, interviews, and workshops) directly or indirectly converge. It integrates quantitative spatial and climatic information from sensors, PRIGSHARE+, additional GIS analyses, AI-based processing, and spatial statistical modelling with qualitative, perception-based insights on the interventions and their impacts, thereby strengthening place-based decision support.

During this year, a key technical milestone was the co-design and development of CELMOT through a triple-helix collaboration between TU Delft, Springco, and STIPO. Preliminary results are promising in terms of both accuracy and practical relevance, and CELMOT outputs have been used in several partner decision-making

meetings. Of the 100+ geospatial data layers compiled to support the contextual analysis of OM, approximately half have been further processed, with more than 30 layers already used directly to pilot-test CELMOT.

In their book The City at Eye Level – Lessons for Street Plinths, STIPO provides guidance on how to improve streets and public spaces by focusing on what people experience at ground level. The authors argue that the quality of public space is the backbone of a sustainable, resilient city, and that "great streets" are places where people intuitively want to stay longer, feel safe, and experience a clear human scale.

The key unit of intervention in the interface between public and private space is the plinth: the ground floor of a building. It is the most crucial part of a building for the city at eye level, as it is what every pedestrian encounters whenever they move through the city using active modes of transport.

People experience their cities through the "public realm," which extends beyond public spaces in a narrow sense and includes building facades and everything visible at eye level. Plinths are therefore a critical component of this realm. A building may be architecturally poor, yet a vibrant plinth can still create a positive street-level experience. Conversely, even a beautiful building with a blank or closed ground floor will offer a poor experience at eye level.

Plinths are thus essential for the attractiveness and usability of urban space in both residential and commercial areas. Research shows that if a destination feels safe, clean, relaxed, legible, and meets or exceeds visitors' expectations, people stay up to three times longer and spend more money than in unfriendly or confusing environments (Figure 45). Good plinths benefit not only the urban economy but also social capital: inviting streets foster social interaction, which in turn strengthens social cohesion and sense of belonging.

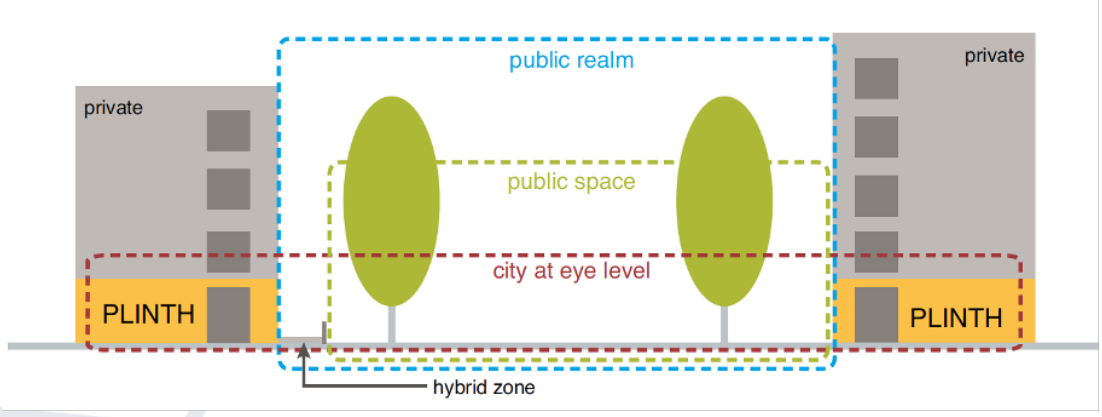

Figure 45 Dissection of a plinth. Source: STIPO, 2016.

5. A mixed methods strategy

In residential areas, an estimated 80% of interactions between neighbours occur in the space between the sidewalk and the plinth. While the ground floor may represent only about 10% of a building's volume, it accounts for roughly 90% of the building's contribution to the experience of the environment.

CELMOT takes STIPO's guidance as a starting point and adapts it to focus specifically on the green interventions within GWB while accounting for the climate challenges OM faces. Further geospatial layers related to this are found in Annex 3. To this end, we operationalized the relevant tenets of the city-at-eye-level approach and the key components of the green interventions planned for OM. The resulting indicator set includes the following items:

Urban morphology and green

- Individual Trees (3-30-300)
- Canopy Cover (3-30-300)
- Greenery Public Space (3-30-300)
- Greenery Private Space
- Hardness (percentage of hardened surface)
- Green connectivity
- Green buffer (25m)
- GSI
- Google street view (% of trees, grass, plants, bushes, shrubs, fields and potted plants)
- FSI
- Self-managed green*

Climate and environment

- Particulate matter
- Temperature
- Humidity
- Dew Point
- Solar Radiation
- Wind Speed (5-minute average and Gust)
- Rainfall
- Pressure

Wellbeing

- Labour-force participation
- Housing price per square metre
- Energy label
- Amenities accessibility
- General health *
- Cultural ecosystem services*
- Spatio-emotional relations*

*Items to be collected and added into the model.

To summarize these indicators into composite scores, we estimated a Structural Equation Model (SEM) in R. In this framework, the score is conceptualized as a latent construct inferred from observed indicators. SEM allows researchers to specify, in a single integrated measurement model, the relationships between the latent factors and their observed measures.

The resulting model produces a scoring system that quantifies the contribution of each indicator to

the overall construct. The spatial unit of analysis is the plinth, or "streetscape," which in CELMOT is segmented into 25-meter sections to increase spatial granularity (Figure 46). This segmentation is particularly important because preliminary analyses showed that green performance can vary considerably along the same street. The 25-meter interval was chosen to approximate the average distance between plinths and to capture these micro-scale variations.

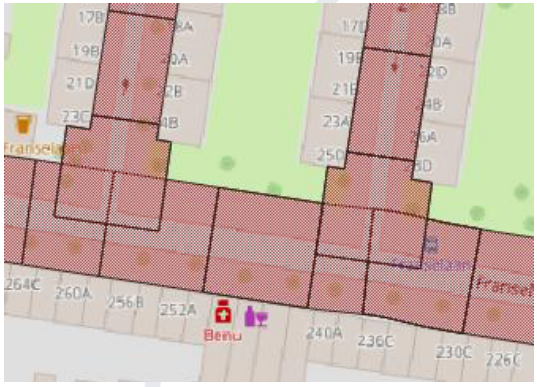

Figure 46 Granularity detail on streetscapes at 25m. Source: Authors, 2025.

The preliminary model was iteratively evaluated and refined using standard SEM diagnostics until an acceptable fit was achieved. The final measurement structure comprises two latent factors, Local Green and Contextual Green, with one overlapping indicator:

- Local Green = Individual trees + Canopy cover + Private green + Public green + Hardscape (inverse) + Street-view green
- Contextual Green = Green connectivity + Green buffer + GSI + Street-view green

Street-view green loads on both factors because it captures both immediate (local) and surrounding (contextual) greenery.

To capture the vertical "eye-level" dimension of green in OM beyond the two-dimensional perspective of geospatial layers, we applied an AI-based algorithm to Google Street View imagery taken every 25 meters in 360° (Figure 47, Figure 48). The algorithm estimates the percentage of vertical green visible in the plinths. While this adds crucial information on perceived greenery, it also introduces limitations, such as potential noise from occlusions (e.g., parked cars or other objects blocking low or small green elements).

To address these limitations, we complemented the AI-based assessment with manual mapping of resident-managed green elements using a digital PPGIS protocol. The resulting GIS layers are being incrementally integrated at successive project milestones to enrich and correct the street-imagery inputs in CELMOT (Figure 26).

An important asset within the CELMOT model is weighting of its components. For the preliminary baseline results, all components were assigned equal weights. This implies that trees and shrubs, for example, exert a similar influence on their modelled relationship with well-being indicators.

Figure 47 Google street view detail for 360° photos every 25m. Source: Authors, 2025.

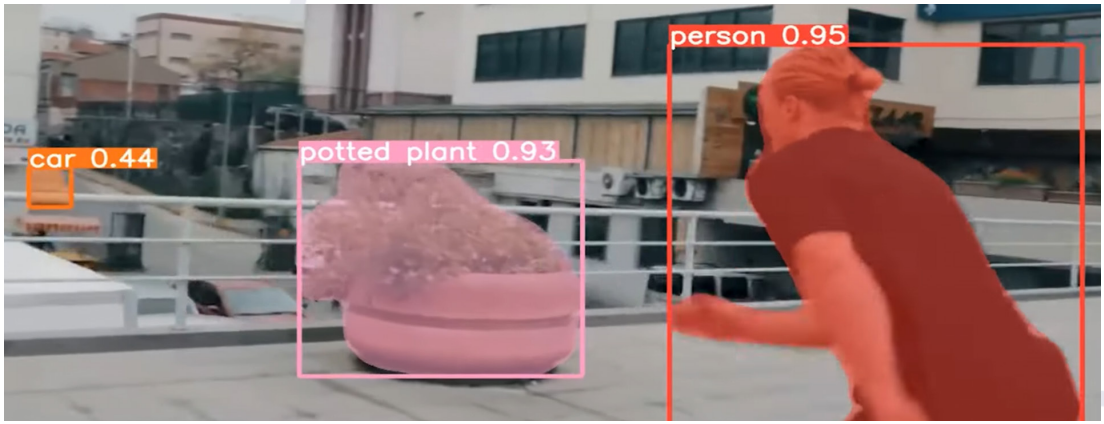

Figure 48 Example of AI object detection algorithm used in CELMOT. Source: Online, 2025.

One of the objectives of the upcoming co-creation workshops is to present these preliminary results and jointly adjust the weights so they better reflect residents' perceptions, priorities, and aspirations.

For instance, it may emerge that residents value shrubs more than trees in certain locations, making shrubs a more feasible and acceptable option for insertion into the neighbourhood. Incorporating such preferences will strengthen the model, enhance its contextual sensitivity, and ensure that CELMOT is better aligned with the specific needs and values of OM's residents.

CELMOT produces a set of maps using streetscapes as the main spatial unit of analysis, subdivided into 25-meter segments. For each segment, CELMOT generates composite scores based on a range of geospatial data layers, including morphological, green, climatic, environmental, and well-being indicators. The figure below illustrates preliminary results (Figure 49).

As outlined earlier, CELMOT supports two types of analysis: local and contextual. The local analysis focuses on conditions and relationships at the immediate streetscape level, while the contextual analysis captures broader, network-level effects. The map shown here represents the outcome of a contextual run.

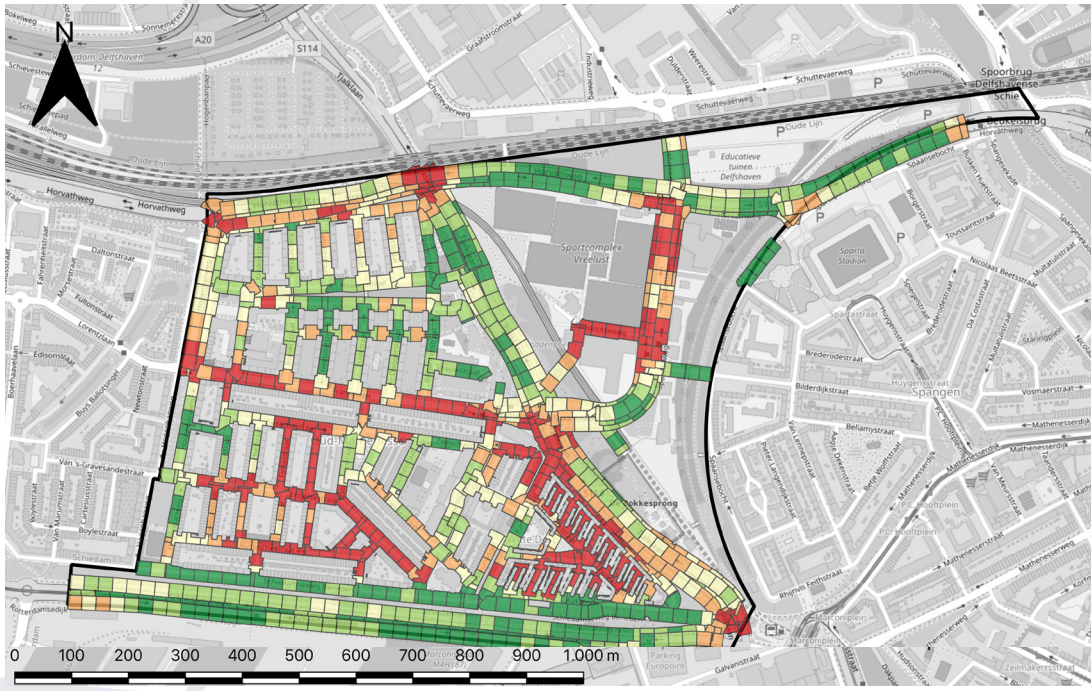

Figure 49 CELMOT preliminary contextual results. Source: Authors, 2025.

In this visualization, neighbourhood segments are displayed along a colour gradient from green to red. Intense red segments indicate that the (lack of) greenery is associated with a negative relationship to the well-being components in the model. Segments in yellow to green tones indicate that existing greenery is positively associated with well-being indicators. These results are consistent with the preliminary results of the 3 30 300 rule and the general geospatial analysis.

As a baseline assessment, these preliminary CELMOT results clearly highlight which areas of OM stand to benefit most from hosting GWB interventions.

5.4.1 Rule 3 30 300

Green elements such as urban trees and green spaces, central to the GWB interventions in OM, are widely recognized for their contributions to climate moderation and public health. However, municipalities and organizations often struggle to prioritize where to intervene, given limited resources and competing policy agendas. In this context, frameworks and guidelines that support targeted, small-scale interventions in neighbourhoods facing pronounced socio-economic, climate, and environmental challenges are especially valuable. The 3–30–300 rule offers such a framework.

Within GWB, the 3–30–300 rule has been incorporated into the monitoring framework and embedded in CELMOT to identify locations where green infrastructure, particularly urban trees, is underperforming. Urban forestry is a key component of GWB and will be advanced through the Mobile Forest and complementary greening actions. While the 3–30–300 rule does not fully capture climatic or detailed morphological characteristics, it does provide a robust overview of both local and network-level (contextual) performance of green infrastructure in a defined area.

Developed by Dutch researcher Cecil C. Konijnendijk, the 3–30–300 rule sets clear, easy-to-communicate thresholds to promote equitable access to trees and green spaces: (1) at least three well-established mature trees visible from every home (minimum canopy surface of 28m2 or a minimum crown radius of 6-8 meters), school, and workplace; (2) a minimum of 30% tree canopy cover in every neighbourhood ; and (3) a maximum distance of 300 meters from every residence to the nearest high quality public green space of at least 1 hectare (Figure 50). Having vegetation in view is associated with improved mental health and cognitive performance; local tree canopy contributes to urban cooling and broader climate adaptation; and nearby public green spaces support regular use, with positive effects on physical, mental, and social well-being.

Given the socio-economic vulnerabilities and climate-related pressures in OM, the 3–30–300 rule provides a simple yet comprehensive lens to identify which locations are likely to benefit most from hosting GWB interventions and to guide the strategic allocation of limited greening resources.

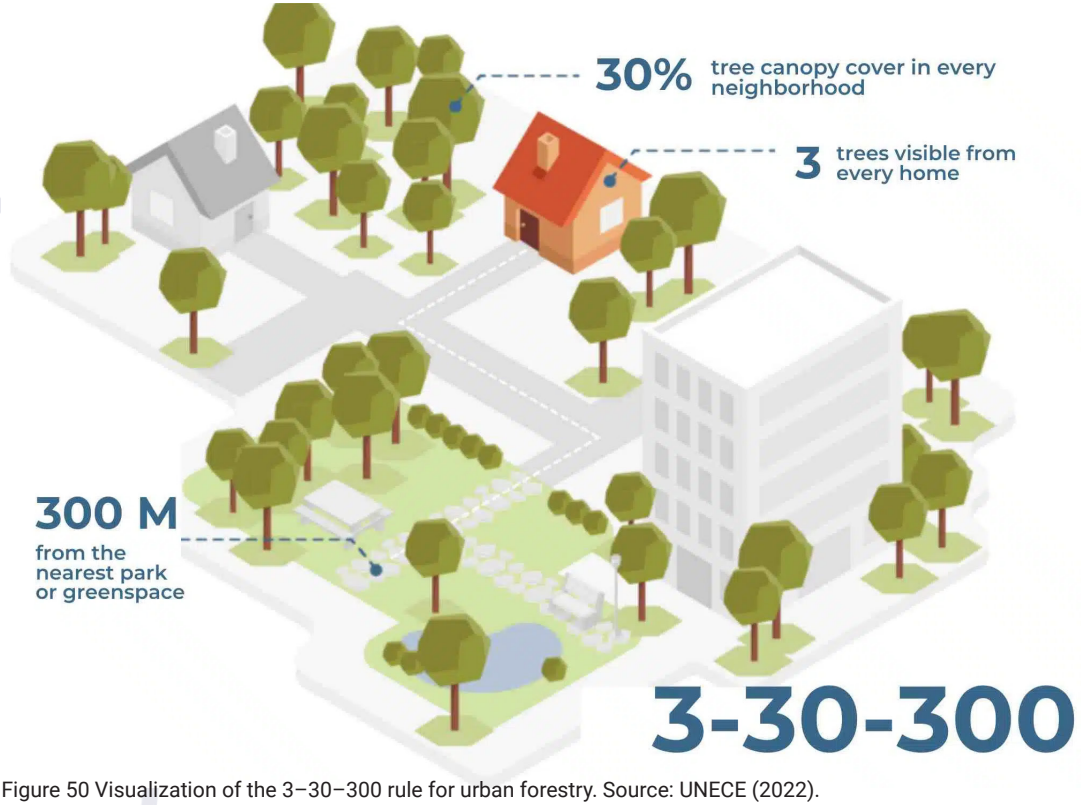

Figure 50 Visualization of the 3–30–300 rule for urban forestry. Source: UNECE (2022).

A preliminary analysis using the 3 30 300 protocols has been carried out in OM using a hexagonal grid of 50m per cell. This level of aggregation was selected instead of the preset blocks within the neighbourhood to avoid administrative biases. While the results are preliminary and will eventually require some recalculations, they already provide a clear idea of each area in OM are underperforming against the rule conditions.

5.4.2 OM 3.30.300 Preliminary results

At first glance, OM does not appear to be lacking vegetation. A quick scan on Google Maps suggests a relatively green neighbourhood (Figure 51). However, on the ground, the perception varies markedly between the three different sub areas. While Schepenbuurt benefits from several communal gardens and Schiedamseweg Beneden from the green dike slopes, the morphological configuration of Landenbuurt and Witte Dorp offers far fewer such advantages and provides substantially less green relief at eye level.

Figure 51 Hybrid satellite image of Oud Mathenesse and its subdivisions. Source: Authors, 2025.

According to the municipal tree database, OM contains 1,336 registered trees (Figure 52). This inventory still needs to be updated to reflect trees that have died or been removed due to recent sewage works. Even so, the raw number of trees reinforces the initial impression that the neighbourhood performs reasonably well in terms of tree presence. However, once the 3–30–300 rule is applied, a different picture emerges: of the 1,336 trees in the neighbourhood, only 458 meet the minimum crown-size requirements needed to deliver the full range of anticipated benefits (Figure 53). In other words, just 34% of the trees comply with the guideline. Figure 54 further illustrates where this is the case within the neighbourhood, using a hexagon grid to show the spatial distribution of compliant trees.

Regarding the 30% rule, tree canopy cover should reach at least 30% for key benefits, such as cooling and health effects, to materialize, and cities should strive for higher percentages where possible. Crucially, this 30% threshold should be achieved at the neighbourhood scale, not merely as a citywide average, to avoid “tree inequity,” where some areas are well served while others are deprived.

Empirical studies show that both proximity and local canopy cover are critical for delivering thermal comfort and health benefits. Even in locations where trees may struggle to grow (e.g.,

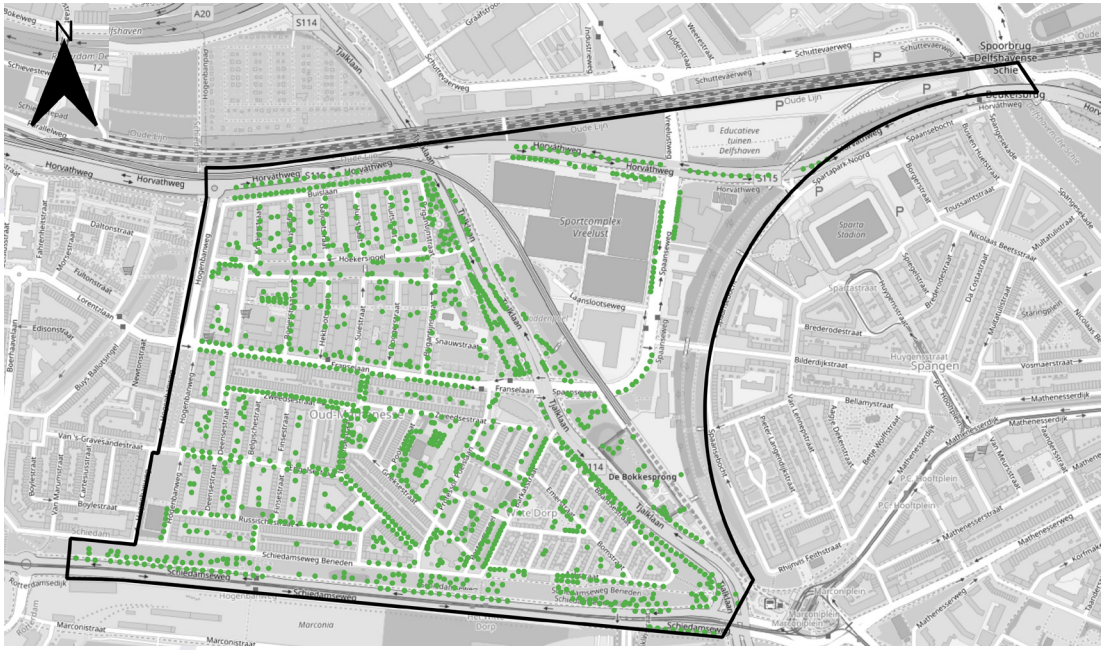

Figure 52 Current trees in Oud Mathenesse. Source: Authors, 2025.

Figure 53 Trees in Oud Mathenesse compliant with the 3.30.300 rule. Source: Authors, 2025.

Figure 54 Areas in Oud Mathenesse compliant with the 3 rule at a 25m range (green). Source: Authors, 2025.

very dense or arid environments), the target should remain 30% overall vegetation, with a strong tree component wherever feasible.

Preliminary results for OM indicate that only about one fifth of the neighbourhood 's total surface currently meets the 30% canopy-cover rule. Moreover, the compliant areas are concentrated on the far eastern edge of the neighbourhood, at a considerable distance from the main residential areas (Figure 55). This spatial mismatch is particularly problematic for the Landenbuurt subarea, which also performs poorly on the "3" component of the 3–30–300 assessment. Together, these findings underscore both a quantitative and an equity gap in access to effective urban tree canopy within OM.

With regards to the 300 rule, OM also performs poorly. According to the guidelines houses should be within 300m of a high-quality park with a minimum size of 1 hectare. The quality of such spaces should allow for a range of recreational activities, including functioning as social meeting places, and offering opportunities for children's play. There should also be sufficient trees and vegetation to provide shade.

As of this moment the largest green area in the neighbourhood is an open green surface of 0.8ha in the northeastern side of the neighbourhood, at the crossing between the highways S114 and S115 and far away from the residential area.

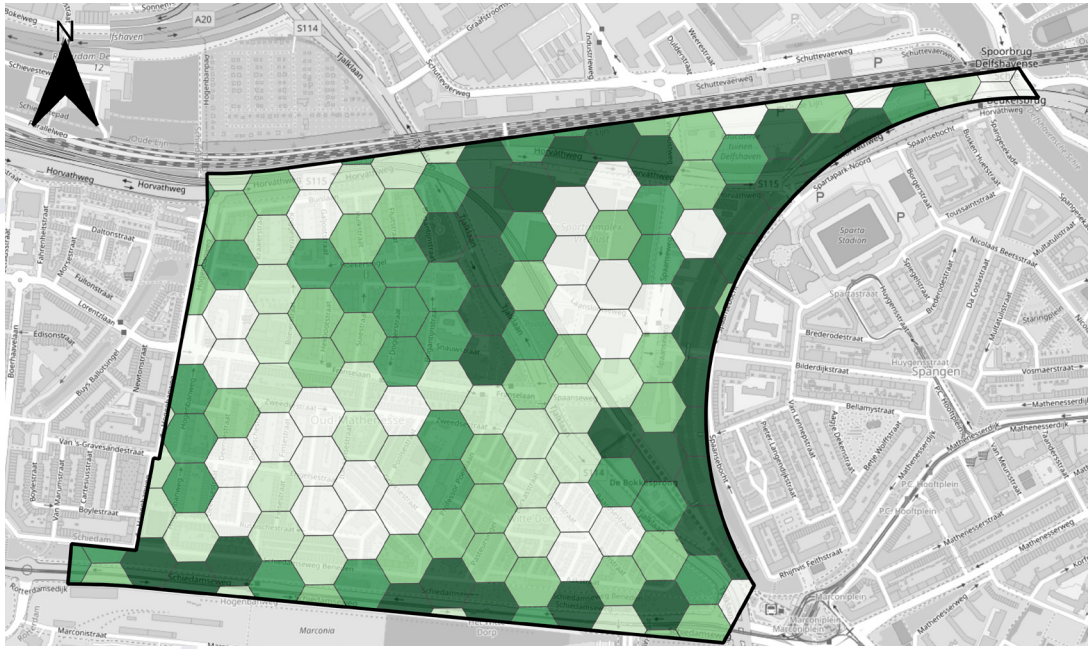

Figure 55 30% rule compliance results in Oud Mathenesse. Source: Authors, 2025.

This green area functions as a transitional green buffer next to the rail tracks and is currently not in use for any social activities. While there are some trees on the site, no public amenities such as benches or water fountains are installed. In addition to the noise produced by the rail track, this is far from a high-quality park.

Regarding the 300-meter rule, OM also performs poorly. According to the guideline, every dwelling should be located within 300 meters of a high-quality public green space of at least 1 hectare. Such a park should accommodate a range of recreational activities, function as a social meeting place, and provide opportunities for children's play. It should also contain sufficient trees and vegetation to offer shade and thermal comfort. Currently, there are two major green areas in the neighbourhood: (1) the Vreelust sports fields (5.3 ha) and (2) a triangular green space (0.8 ha) at the intersection of the S114 and S115 (Figure 56).

While Vreelust meets the minimum size requirement, it is owned by a local sports club and functions as a sports and recreation complex rather than a fully public park. In addition, its accessibility is constrained by the highway that separates it from much of the neighbourhood. The triangular green space is in the northeastern corner of OM, at the junction of the S114 and S115, at some distance from the main residential areas.

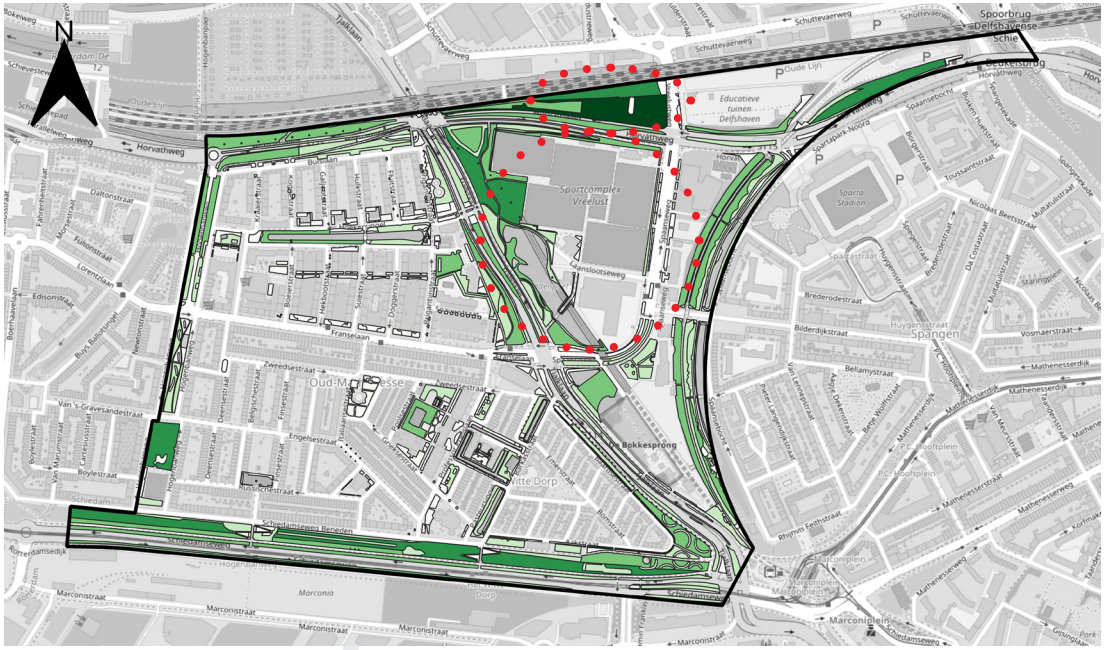

Figure 55 30% rule compliance results in Oud Mathenesse. Source: Authors, 2025.

This area functions primarily as a transitional green buffer adjacent to the railway tracks and is not currently used for social or recreational activities. Although there are some trees on site, there is no public furniture, such as benches, play equipment, or water fountains, and the constant noise from the rail line further reduces its amenity value. In its current form, this space falls short of the definition of a high-quality park and does not fulfil the 300-meter criterion of the 3–30–300 rule.

In brief, these preliminary results on OM's 3–30–300 assessment reveal that the neighbourhood apparent greenness masks significant quantitative and equity gaps in access to effective urban green. Although the neighbourhood counts 1,336 registered trees, only about one third meet the minimum crown-size requirements to deliver full cooling and health benefits, and only around one fifth of the area reaches the 30% canopy-cover threshold. The better-performing patches are concentrated on the eastern fringe, away from the main residential fabric, leaving subareas such as Landenbuurt and Witte Dorp particularly underserved.

OM also performs poorly on the 300-meter criterion. There is no high-quality public green space of at least 1 ha within 300 m of most dwellings. The largest public existing green area, a 0.8 ha buffer strip near the S114/S115 junction and adjacent to the railway, is distant from residential streets, lacks basic amenities, and is significantly affected by noise, falling far

short of a functional neighbourhood park.

Taken together, these findings underscore that strategic greening in OM cannot rely on overall tree counts or coarse visual impressions from above. Instead, targeted interventions are needed to increase canopy cover, improve the distribution and quality of green at eye level, and create or upgrade accessible, high-quality public green spaces within walking distance of residents, with particular attention to the most underperforming subareas.

Pinasplein,Oud Mathenesse, Rotterdam, the Netherlands.
Photographer: Arjan van Timmeren.

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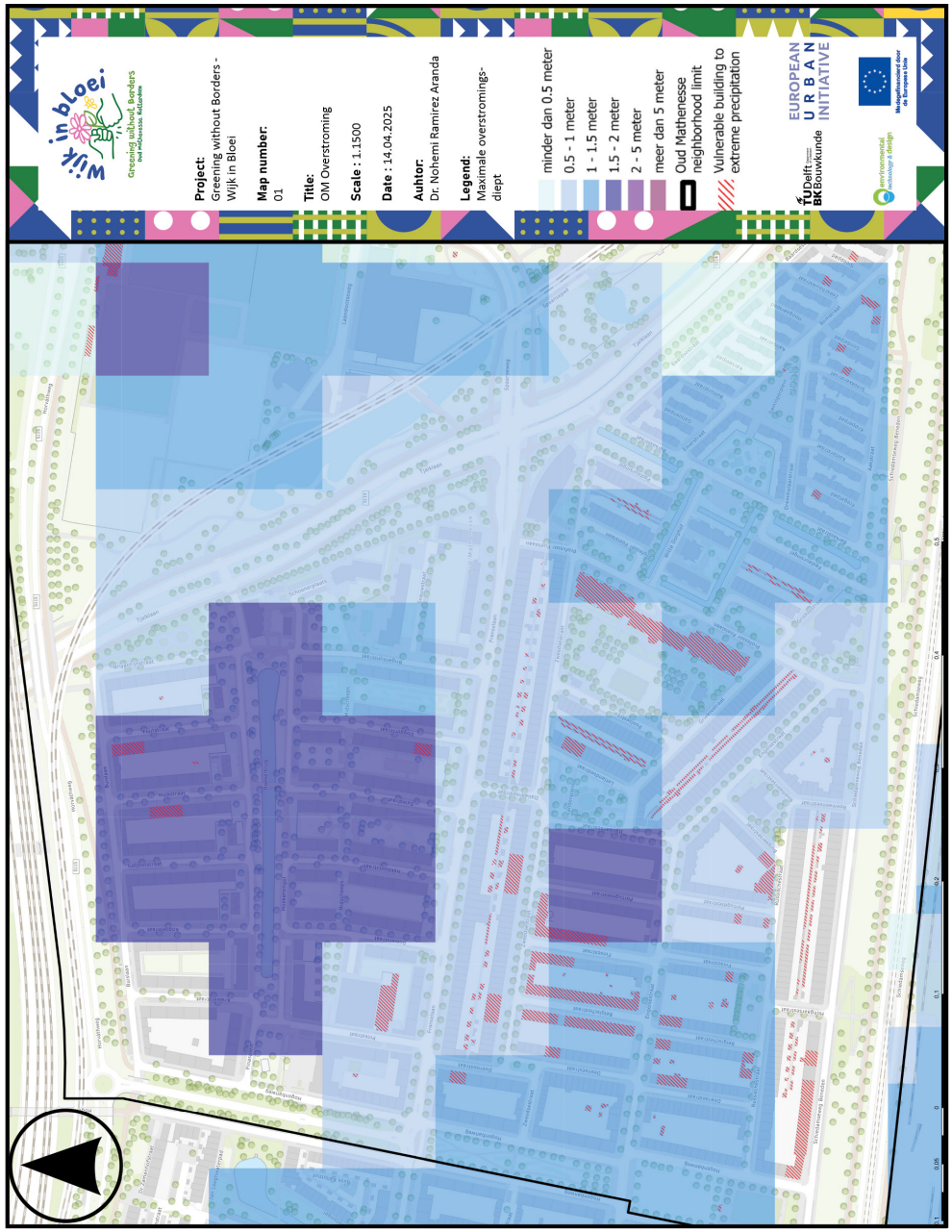
Annexes

Annex 1


Project:
Greening without Borders - Wijk in Bloei
Map number:
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Title:
OM Overstroming
Scale : 1:1500
Date : 14.04.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Maximale overstromings-diept
minder dan 0.5 meter
0.5 - 1 meter
1 - 1.5 meter
1.5 - 2 meter
2 - 5 meter
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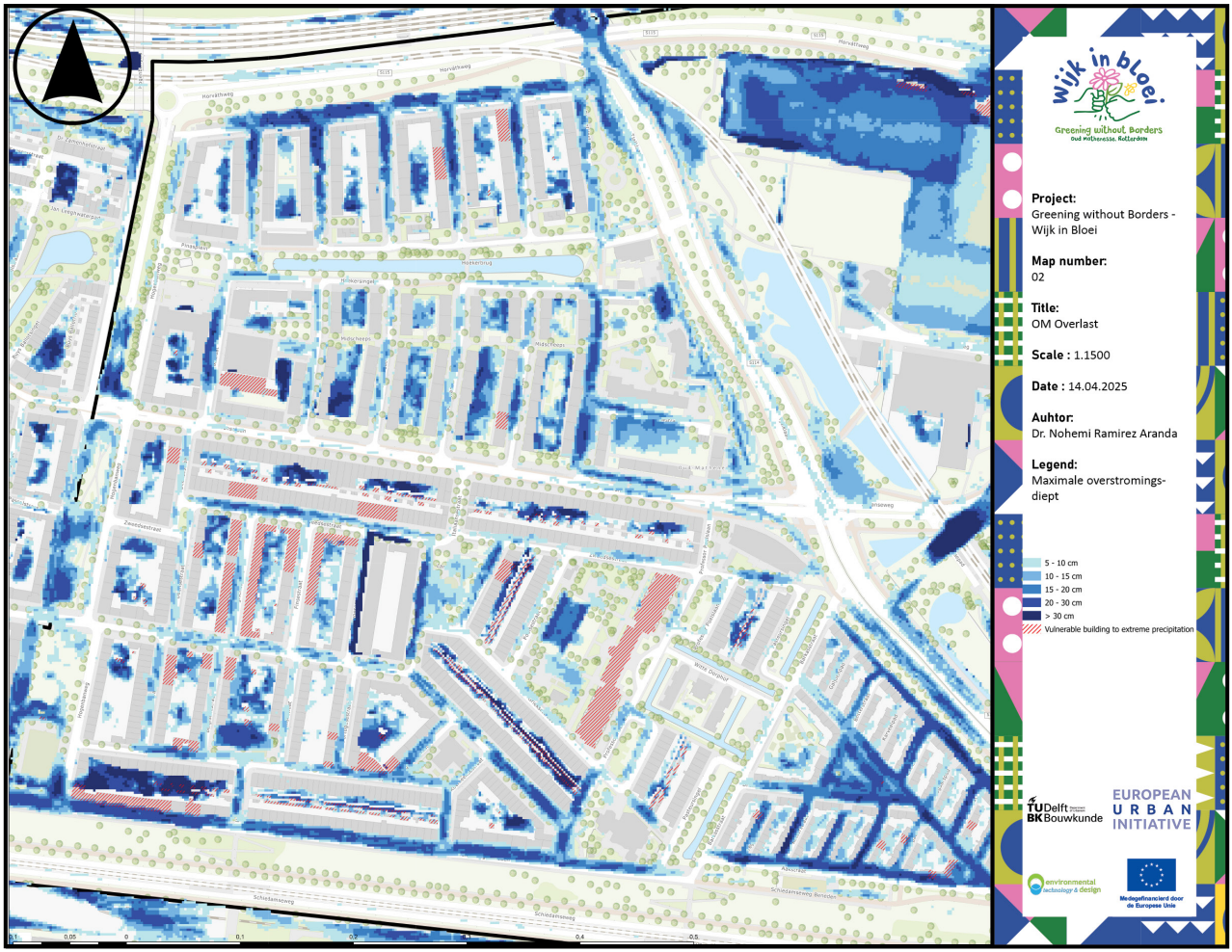
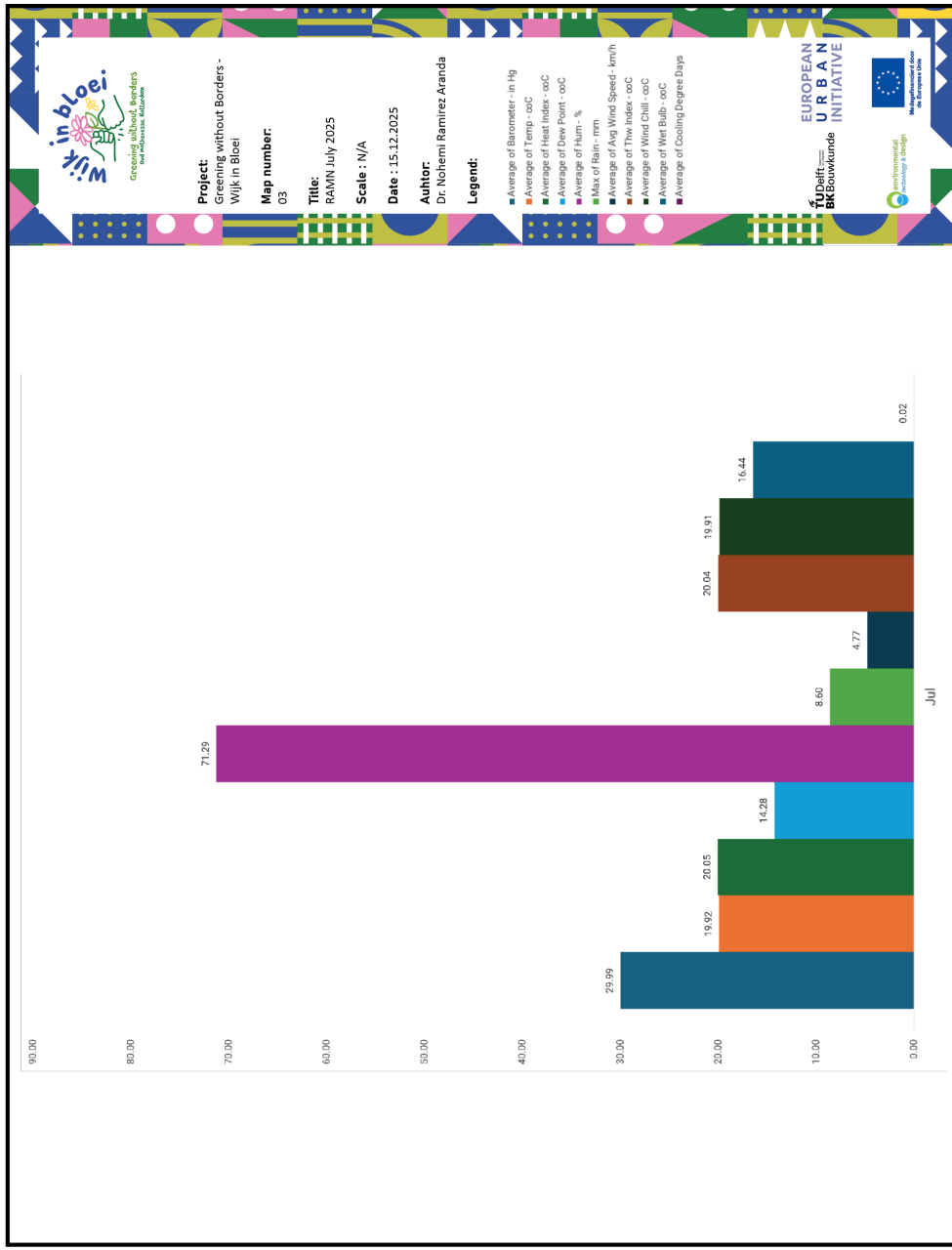
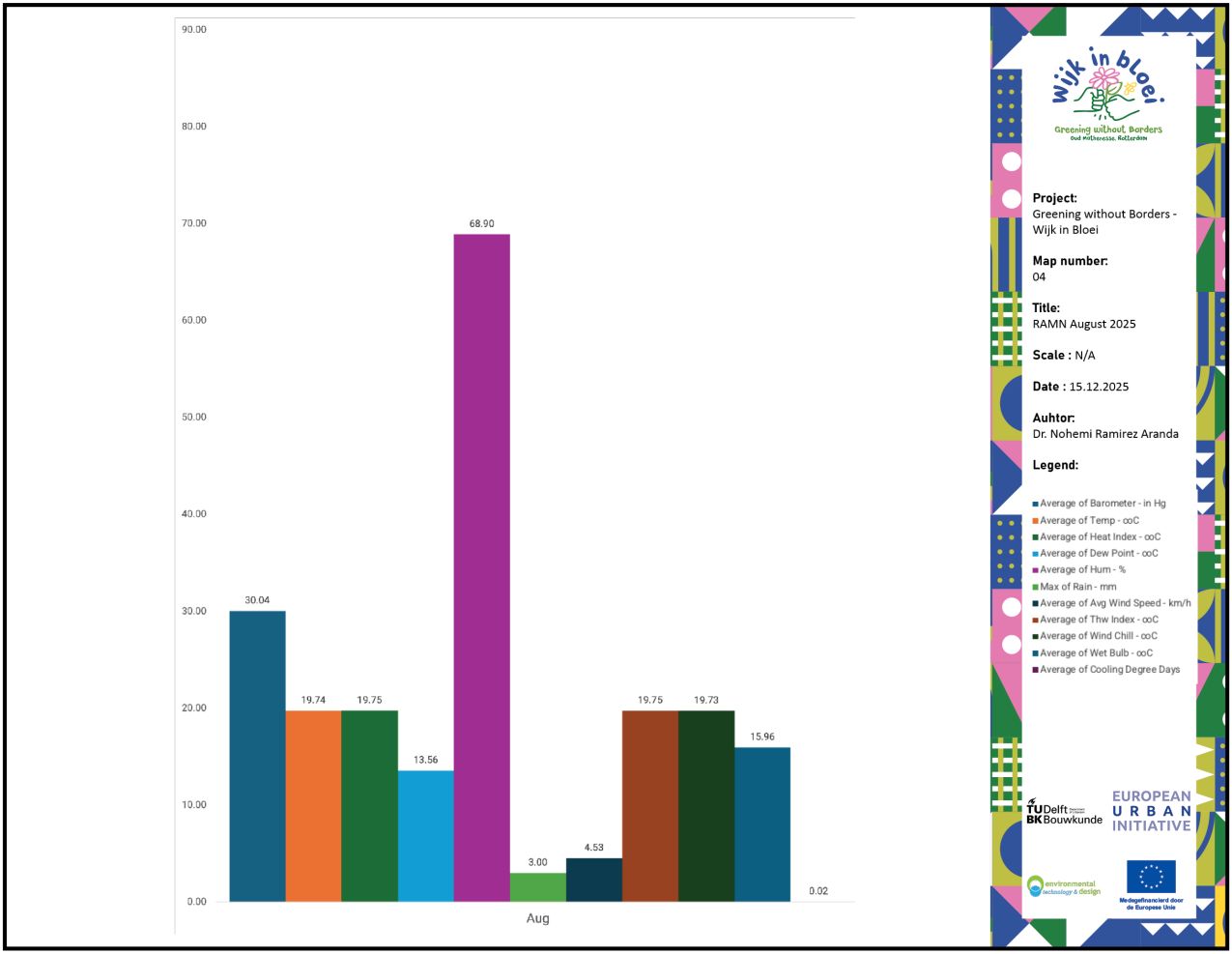
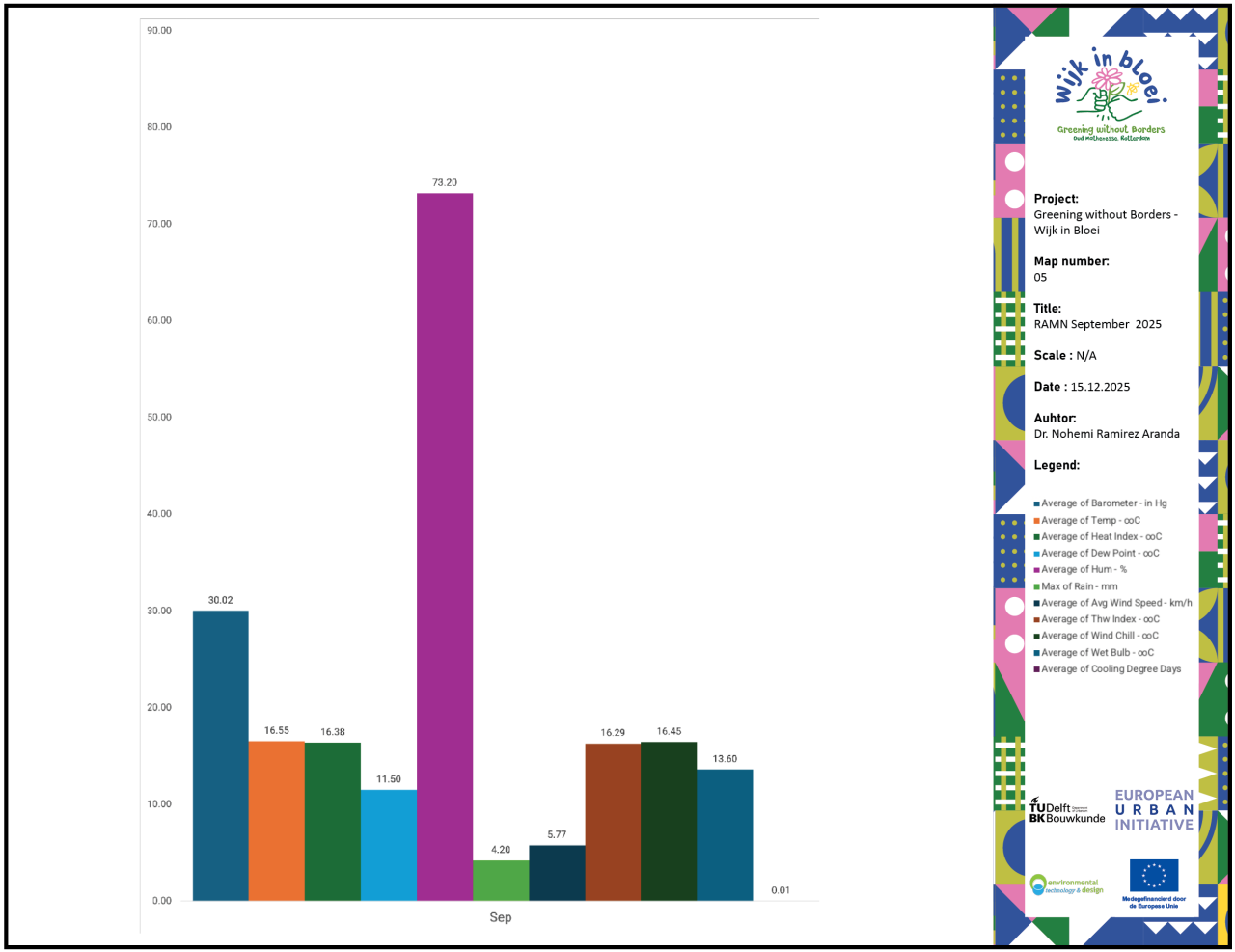
Oud Mathenesse neighborhood limit
Vulnerable building to extreme precipitation
EUROPEAN URBAN INITIATIVE
TUDelft BK Bouwkunde


Wijk in bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
02
Title:
OM Overlast
Scale : 1.1500
Date : 14.04.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Maximale overstromings-diept
5 - 10 cm
10 - 15 cm
15 - 20 cm
20 - 30 cm
> 30 cm
Vulnerable building to extreme precipitation
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
environmental technology & design
Mede gefinancierd door de Europese Unie


Project:
Greening without Borders - Wijk in Bloei
Map number:
03
Title:
RAMN July 2025
Scale : N/A
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Average of Barometer - in Hg
Average of Temp - ooC
Average of Heat Index - ooC
Average of Dew Point - ooC
Average of Hum - %
Max of Rain - mm
Average of Avg Wind Speed - km/h
Average of Thw Index - ooC
Average of Wind Chill - ooC
Average of Wet Bulb - ooC
Average of Cooling Degree Days
EUROPEAN URBAN INITIATIVE
TUDelft BKBouwkunde
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
29.99
19.92
20.05
14.28
71.29
8.60
4.77
20.04
19.91
16.44
0.02
Jul


90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.04
19.74
19.75
13.56
68.90
3.00
4.53
19.75
19.73
15.96
0.02
Aug
Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
04
Title:
RAMN August 2025
Scale : N/A
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Average of Barometer - in Hg
Average of Temp - ooC
Average of Heat Index - ooC
Average of Dew Point - ooC
Average of Hum - %
Max of Rain - mm
Average of Avg Wind Speed - km/h
Average of Thw Index - ooC
Average of Wind Chill - ooC
Average of Wet Bulb - ooC
Average of Cooling Degree Days
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
environmental technology & design
Mede gefinancierd door de Europese Unie


90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.02
16.55
16.38
11.50
73.20
4.20
5.77
16.29
16.45
13.60
0.01
Sep
Wijk in Bloei!
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
05
Title:
RAMN September 2025
Scale : N/A
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Average of Barometer - in Hg
Average of Temp - ooC
Average of Heat Index - ooC
Average of Dew Point - ooC
Average of Hum - %
Max of Rain - mm
Average of Avg Wind Speed - km/h
Average of Thw Index - ooC
Average of Wind Chill - ooC
Average of Wet Bulb - ooC
Average of Cooling Degree Days
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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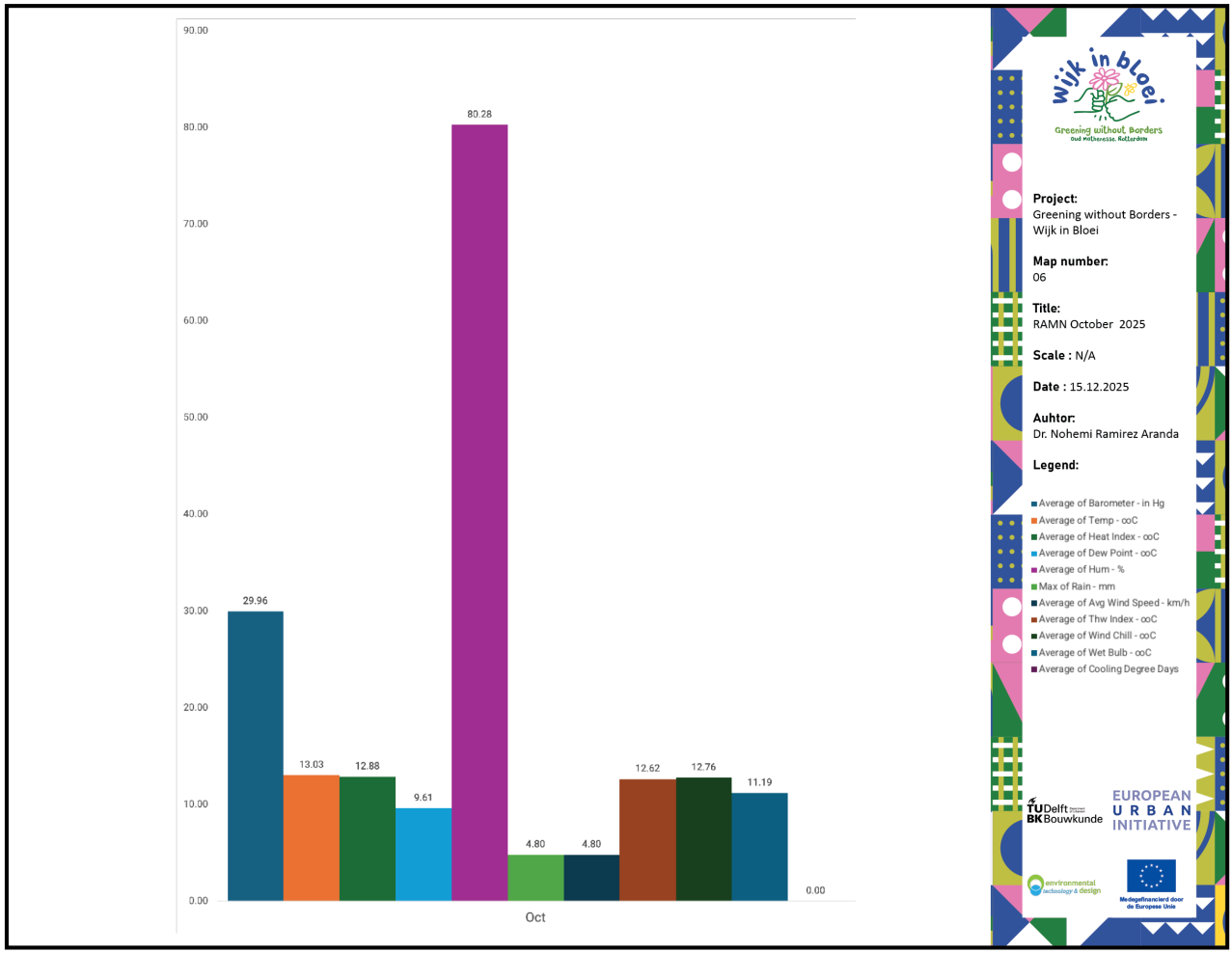
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
29.96
13.03
12.88
9.61
80.28
4.80
4.80
12.62
12.76
11.19
0.00
Oct
Wijk in bloei!
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
06
Title:
RAMN October 2025
Scale : N/A
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Average of Barometer - in Hg
Average of Temp - ooC
Average of Heat Index - ooC
Average of Dew Point - ooC
Average of Hum - %
Max of Rain - mm
Average of Avg Wind Speed - km/h
Average of Thw Index - ooC
Average of Wind Chill - ooC
Average of Wet Bulb - ooC
Average of Cooling Degree Days
TU Delft BK Bouwkunde
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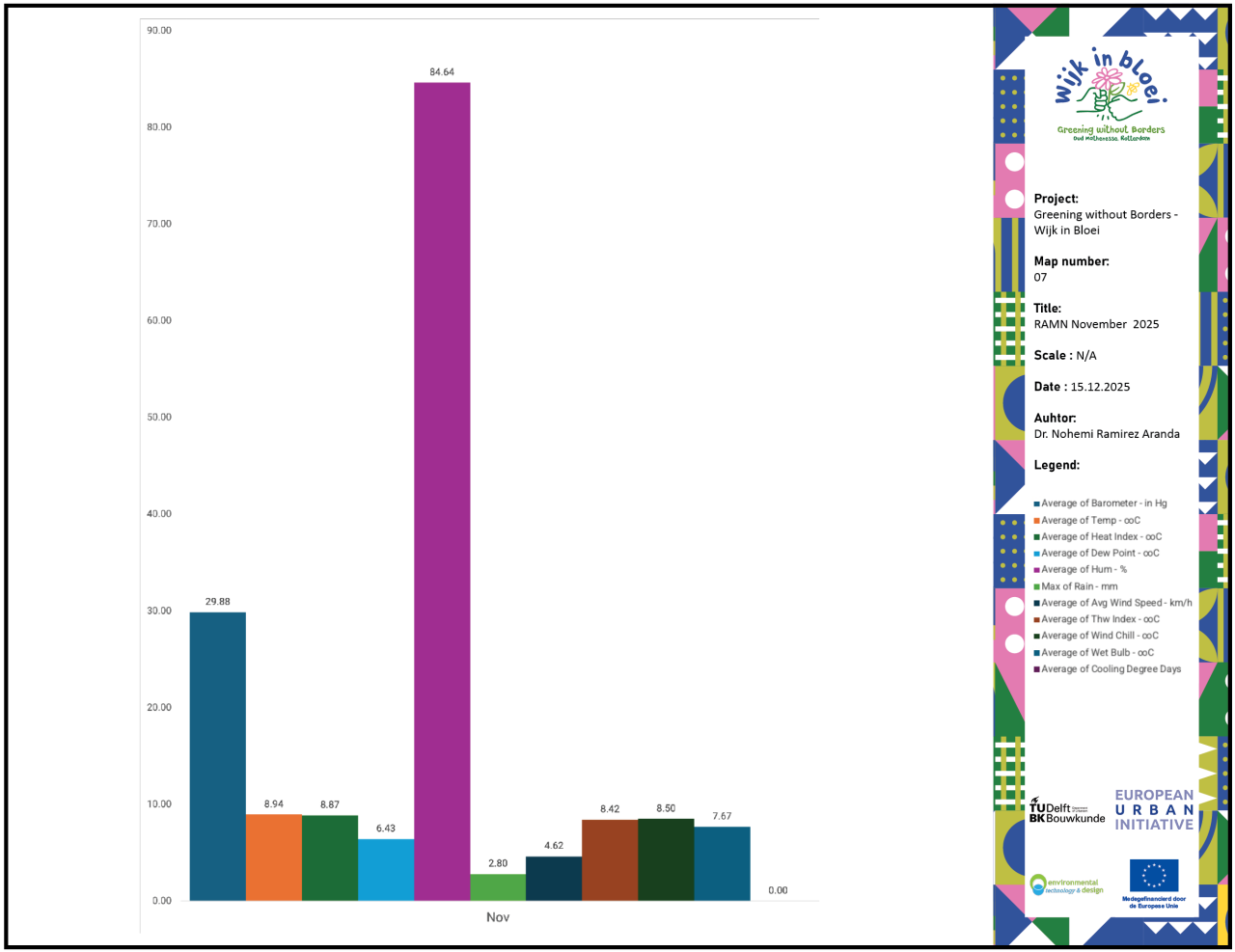
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
29.88
8.94
8.87
6.43
84.64
2.80
4.62
8.42
8.50
7.67
0.00
Nov
Wijk in Bloei!
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
07
Title:
RAMN November 2025
Scale : N/A
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Average of Barometer - in Hg
Average of Temp - ooC
Average of Heat Index - ooC
Average of Dew Point - ooC
Average of Hum - %
Max of Rain - mm
Average of Avg Wind Speed - km/h
Average of Thw Index - ooC
Average of Wind Chill - ooC
Average of Wet Bulb - ooC
Average of Cooling Degree Days
TU Delft BK Bouwkunde
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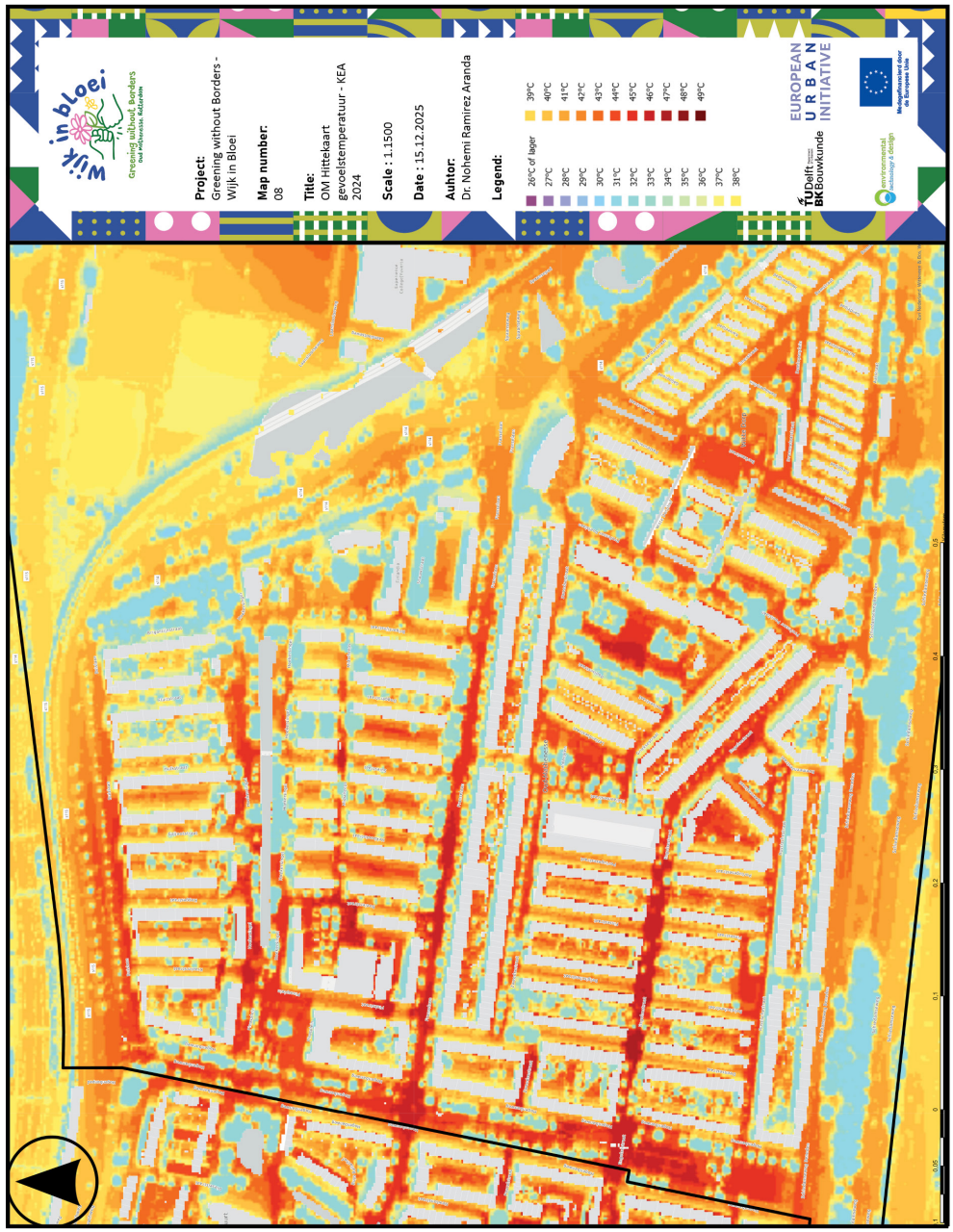
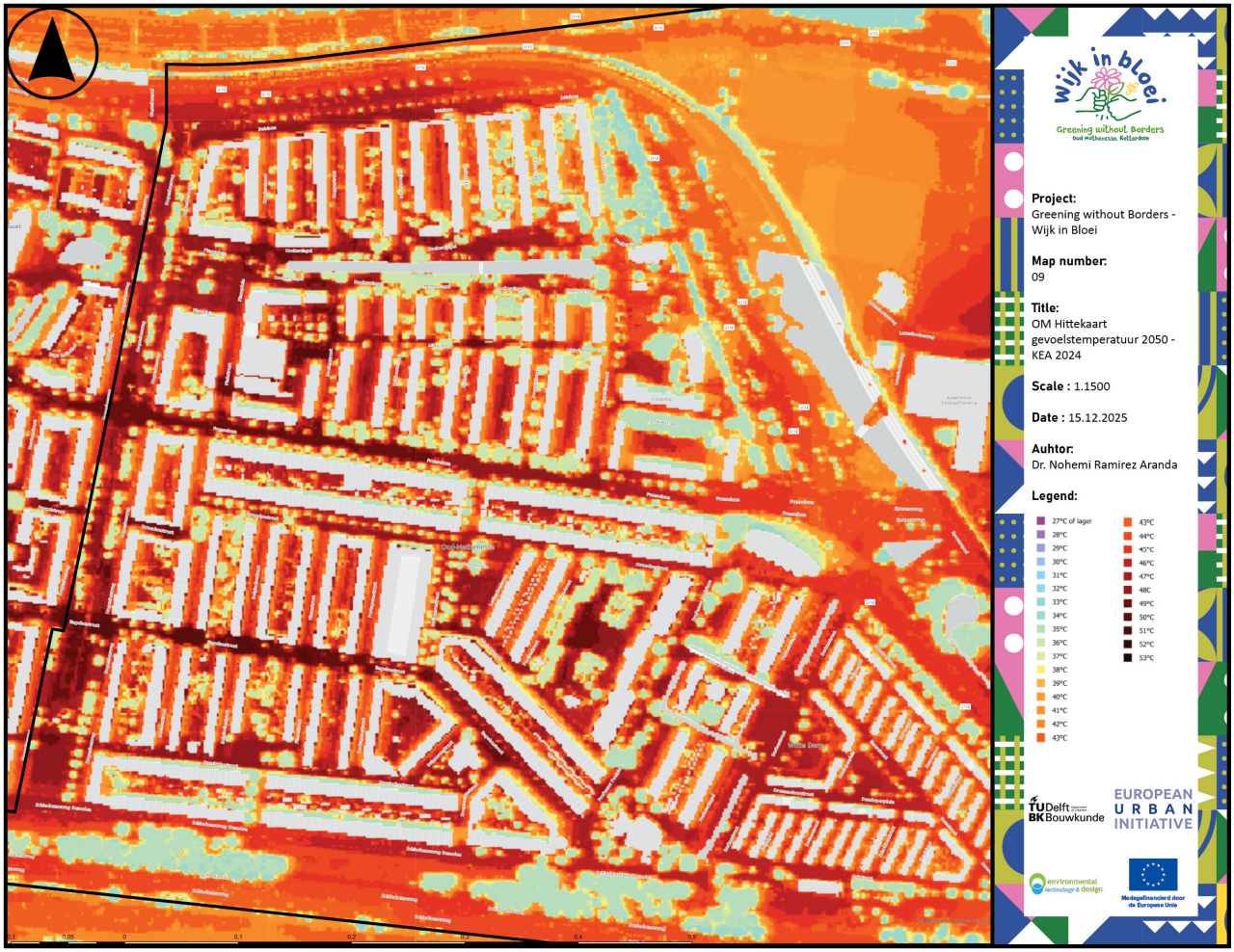
Annex 3


Project:
Greening without Borders - Wijk in Bloei
Map number:
08
Title:
OM Hittekaart gevoelstemperatuur - KEA 2024
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
26°C of lager
27°C
28°C
29°C
30°C
31°C
32°C
33°C
34°C
35°C
36°C
37°C
38°C
39°C
40°C
41°C
42°C
43°C
44°C
45°C
46°C
47°C
48°C
49°C
EUROPEAN URBAN INITIATIVE
TU Delft
BK Bouwkunde


Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
09
Title:
OM Hittekaart gevoelstemperatuur 2050 - KEA 2024
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
27°C of lager
28°C
29°C
30°C
31°C
32°C
33°C
34°C
35°C
36°C
37°C
38°C
39°C
40°C
41°C
42°C
43°C
44°C
45°C
46°C
47°C
48C
49°C
50°C
51°C
52°C
53°C
TU Delft BK Bouwkunde
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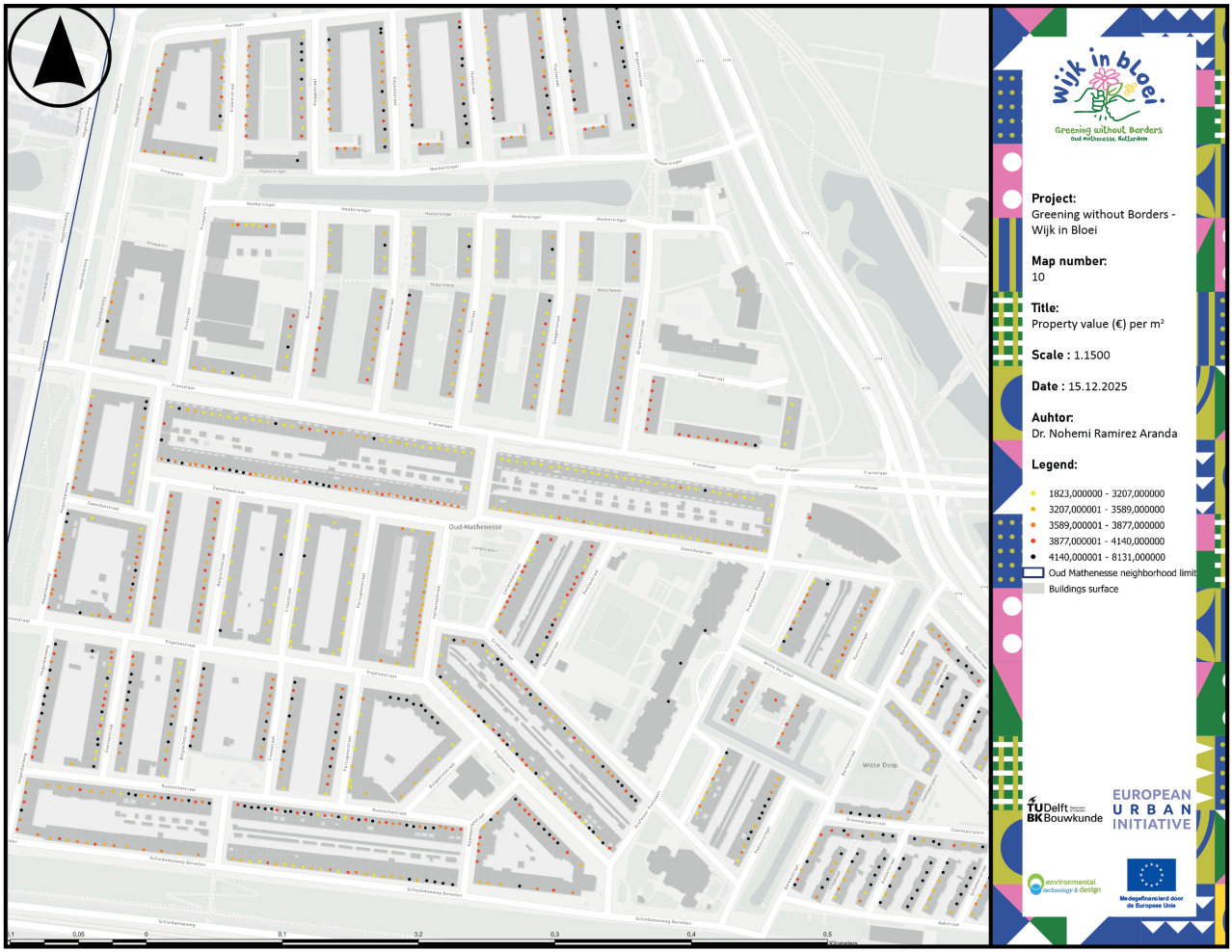
Wijk in bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
10
Title:
Property value (€) per m²
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
1823,000000 - 3207,000000
3207,000001 - 3589,000000
3589,000001 - 3877,000000
3877,000001 - 4140,000000
4140,000001 - 8131,000000
Oud Mathenesse neighborhood limit
Buildings surface
Oud-Mathenesse
Witte Dorp
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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0.1
0.05
0
0.1
0.2
0.3
0.4
0.5
Kilometers

Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
11
Title:
Underground cables
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Stedin_HS_Verbinding_2021
Stedin_MS_Verbinding_2021
Stedin_laagspanning_ 2021
stedin_gasvervangingsdata_2021
Gemeente Rotterdam Rioolbuizen
Oud Mathenesse neighborhood limit
Witte Dorp
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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0.1 0.05 0 0.1 0.2 0.3 0.4 0.5
Kilometers

Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
12
Title:
Dominant e nergie labels 2025
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
Energy labels 2025
A
A+
A++
B
C
D
E
F
G
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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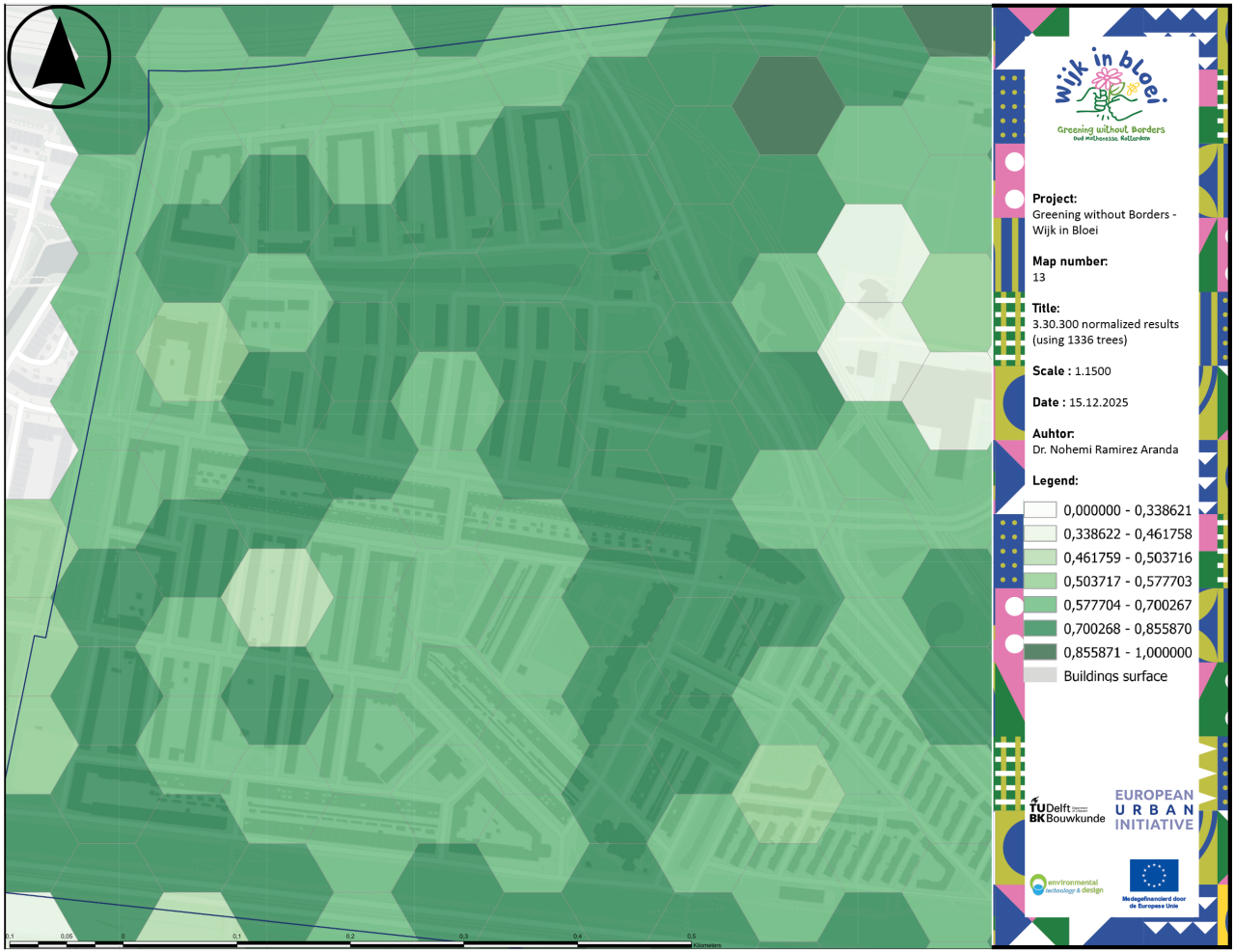
Medegefinancierd door de Europese Unie
Horvathweg
Schuttevaerweg
Oude Lijn
Tjalklaan
Sportcomplex Vreelust
Educatieve tuinen Delfshaven
Sparta Stadion
Spaanseweg
Franselaan
Zweedsestraat
Hoekersingel
Buislaan
Witte Dorp
De Bokkesprong
Schiedamseweg
Schiedamseweg Beneden
Marconistraat
Marconiplein
Rhijnvis Feithstraat
Bilderdijkstraat
Brederodestraat
Spartastraat
Vierhavenstraat
Galvanistraat
Parking Europoint
Marconia
S114
S115
0
300
400
500
600
700
800
900
1.000 m


Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
13
Title:
3.30.300 normalized results (using 1336 trees)
Scale : 1.1500
Date : 15.12.2025
Auhtor:
Dr. Nohemi Ramirez Aranda
Legend:
0,000000 - 0,338621
0,338622 - 0,461758
0,461759 - 0,503716
0,503717 - 0,577703
0,577704 - 0,700267
0,700268 - 0,855870
0,855871 - 1,000000
Buildings surface
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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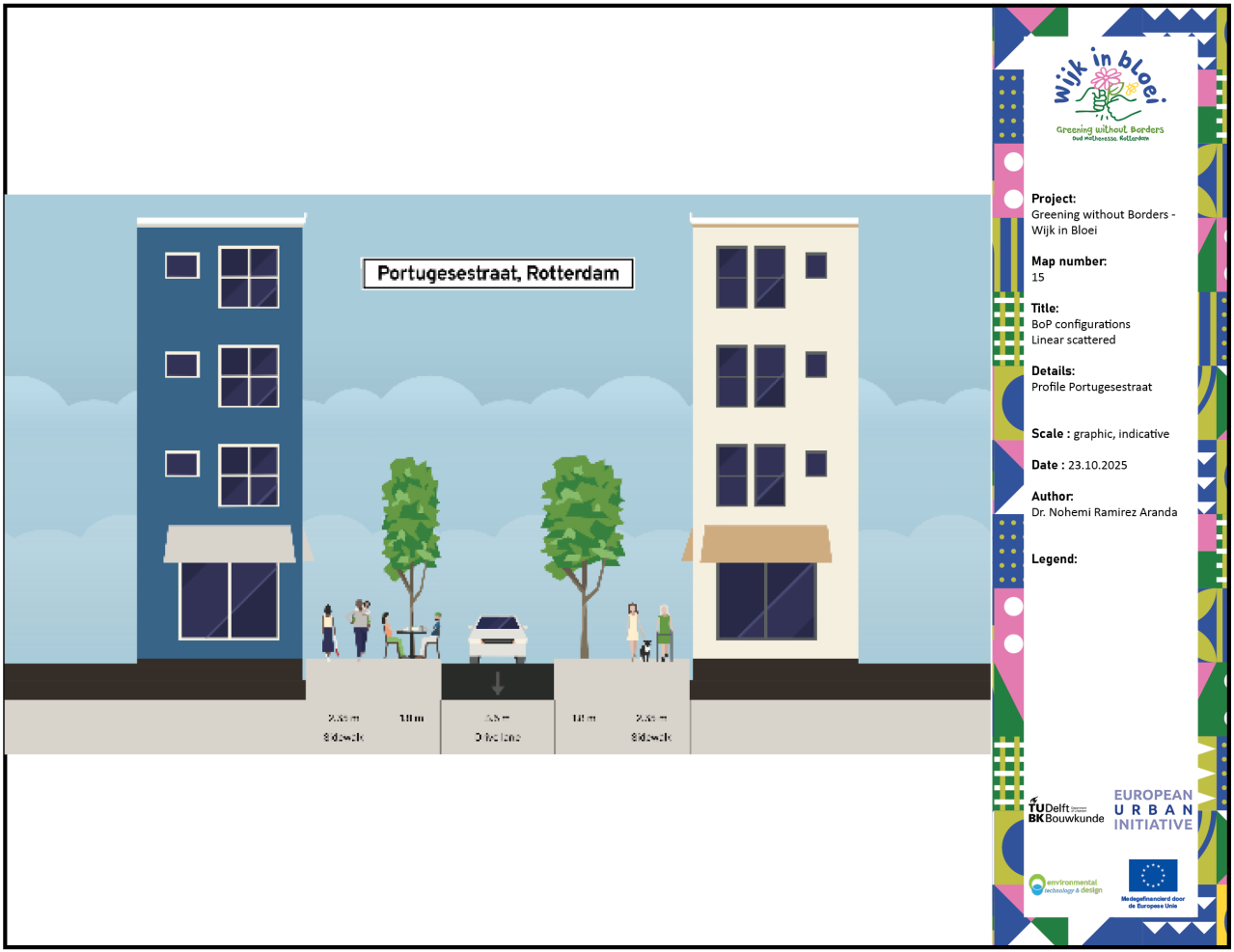
0.1 0.05 0 0.1 0.2 0.3 0.4 0.5
Kilometers

Annex 4

Wijk in Bloei
Greening without Borders
Project:
Greening without Borders - Wijk in Bloei
Map number:
14
Title:
BoP configurations
Linear scattered - ground view
Details:
Scale : graphic
Date : 26.06.2025
Author:
Dr. Nohemi Ramirez Aranda
Legend:
Existent trees
Box op Poten trees
Bench
EUROPEAN URBAN INITIATIVE
TU Delft
BK Bouwkunde
environmental psychology & design


Portugesestraat, Rotterdam
Wijk in Bloei!
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
15
Title:
BoP configurations
Linear scattered
Details:
Profile Portugesestraat
Scale : graphic, indicative
Date : 23.10.2025
Author:
Dr. Nohemi Ramirez Aranda
Legend:
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
environmental technology & design
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Wijk in bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
16
Title:
BoP configurations
Blocks centralized - ground view
Details:
Scale : graphic
Date : 26.06.2025
Author:
Dr. Nohemi Ramirez Aranda
Legend:
Existent trees
Bos op Poten trees
Bench
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
environmental technology & design
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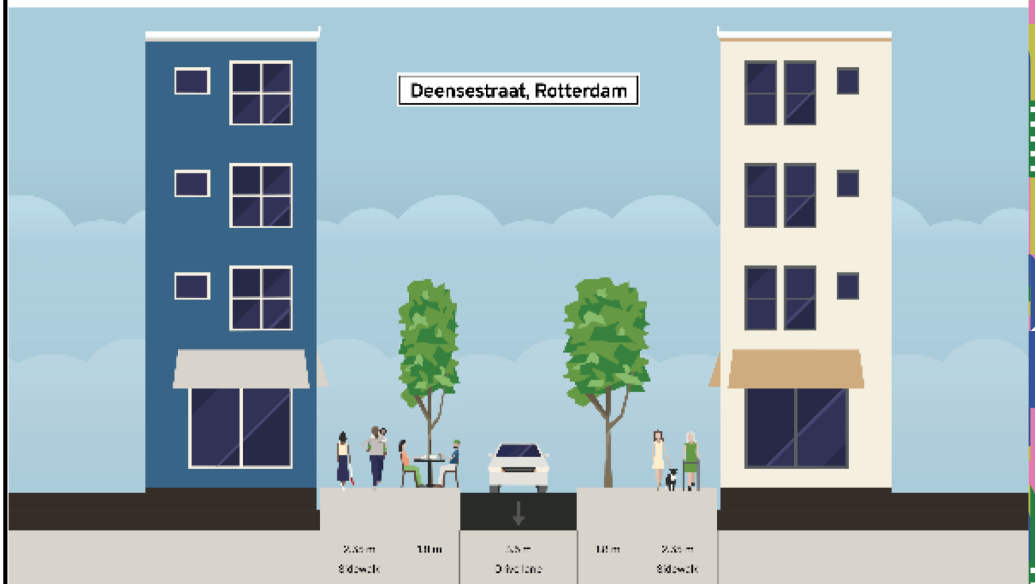

Wijk in Bloei
Greening without Borders
Oud Mathenesse, Rotterdam

Project:
Greening without Borders - Wijk in Bloei

Map number:
17

Title:
BoP configurations
Linear scattered

Details:
Profile Portugesestraat

Scale : graphic

Date : 23.10.2025

Author:
Dr. Nohemi Ramirez Aranda

Legend:

TU Delft BK Bouwkunde

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Wijk in bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
18
Title:
BoP configurations Crossings scattered - ground view
Details:
Scale : graphic
Date : 26.06.2025
Author:
Dr. Nohemi Ramirez Aranda
Legend:
Existent trees
Bos op Poten trees
Bench
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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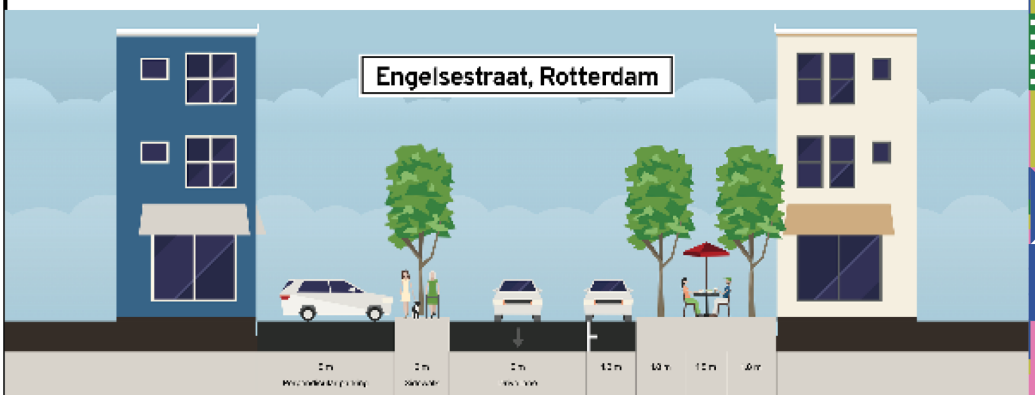

Wijk in Bloei!
Greening without Borders
Oud Mathenesse, Rotterdam

Project:
Greening without Borders - Wijk in Bloei

Map number:
19

Title:
Crossings scattered - Engelsestraat

Details:

Scale : N/A

Date : 26.06.2025

Author:
Dr. Nohemi Ramirez Aranda

Legend:

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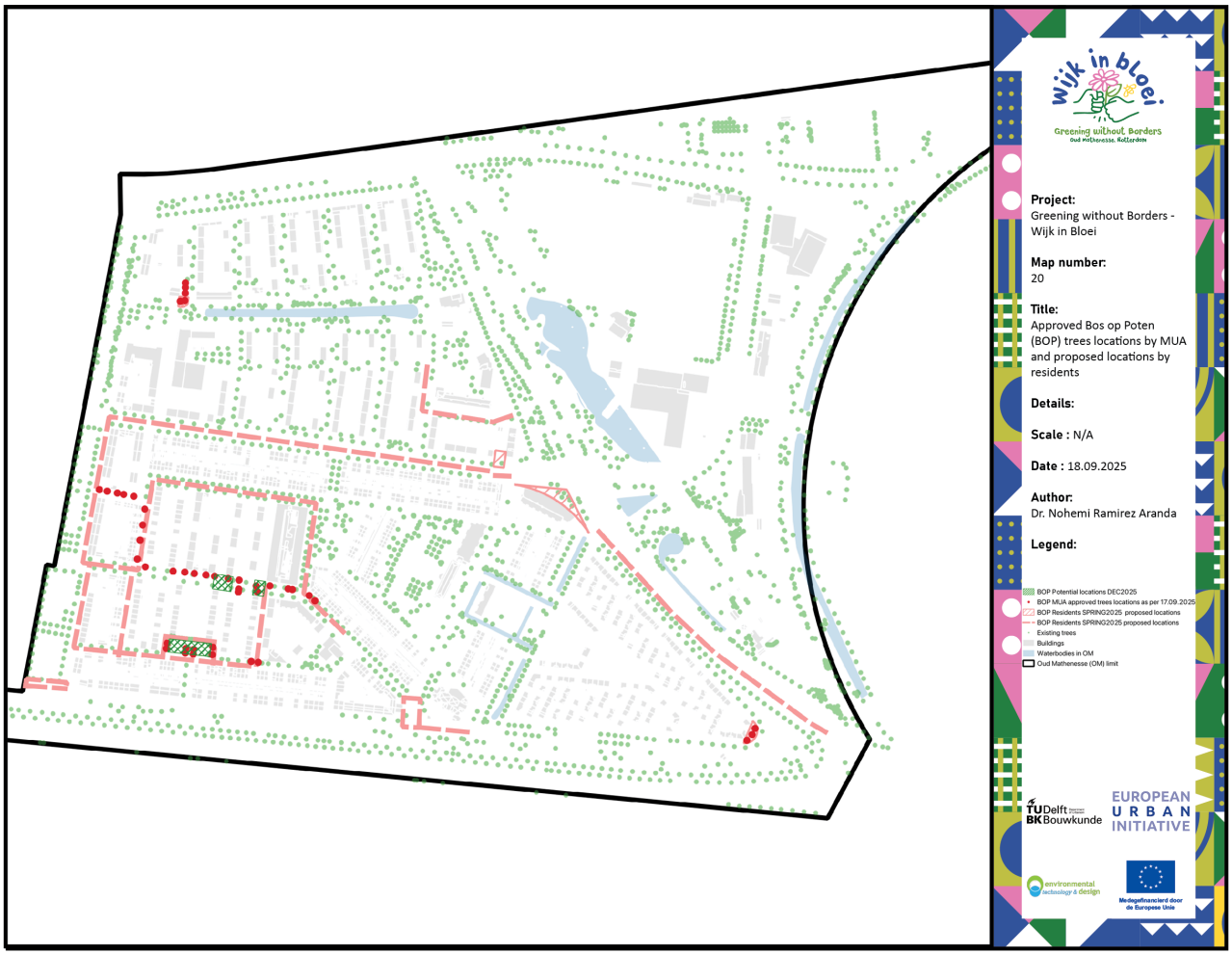
Wijk in bloei
Greening without Borders
Oud Mathenesse, Rotterdam
Project:
Greening without Borders - Wijk in Bloei
Map number:
20
Title:
Approved Bos op Poten (BOP) trees locations by MUA and proposed locations by residents
Details:
Scale : N/A
Date : 18.09.2025
Author:
Dr. Nohemi Ramirez Aranda
Legend:
BOP Potential locations DEC2025
BOP MUA approved trees locations as per 17.09.2025
BOP Residents SPRING2025 proposed locations
BOP Residents SPRING2025 proposed locations
Existing trees
Buildings
Waterbodies in OM
Oud Mathenesse (OM) limit
TU Delft BK Bouwkunde
EUROPEAN URBAN INITIATIVE
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Document information

EUI Greening without Borders - Wijk in Bloei

WP3 Monitoring and evaluation framework

TU Delft - Baseline Report

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PU-Public

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www.wijkinbloei.bk.tudelft.nl

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