SOLARIS
SOLIDARITY IN CLIMATE CHANGE

SOLIDARITY IN CLIMATE CHANGE ADAPTATION POLICIES: TOWARDS MORE SOCIO-SPATIAL JUSTICE IN THE FACE OF MULTIPLE RISKS

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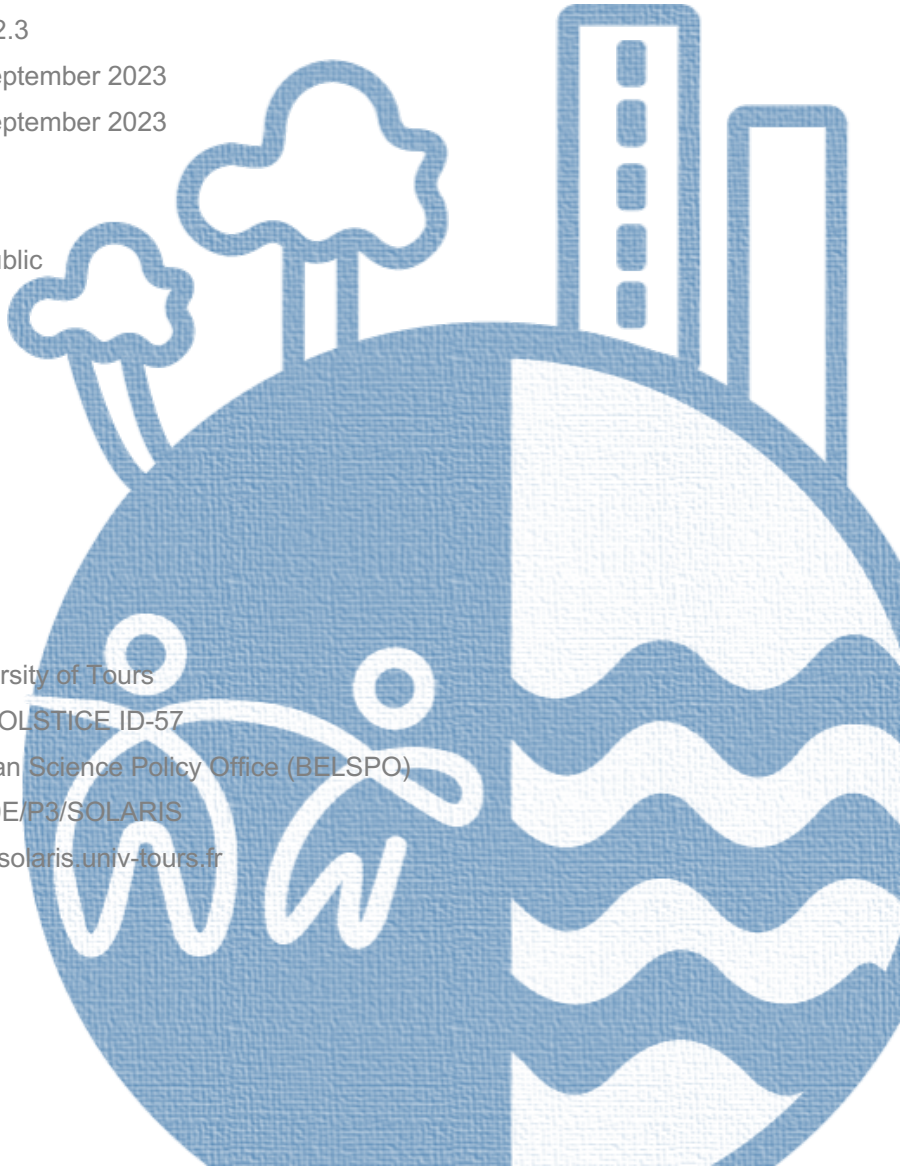

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Preface

What to find in this country report?

This report is part of the Work Package 2 (WP2) deliverable of the research project SOLARIS (SOLidarity in climate change Adaptation policies: towards more socio-spatial justice in the face of multiple RISks), funded by the participant countries to the SOLSTICE program of JPI Climate "Connecting Climate Knowledge for Europe". More information about the SOLARIS project, its purpose and outputs can be found here https://jpi-climate.eu/project/solaris/.

This document is part of the compilation of reports on the empirical investigations carried out at national level in the four SOLARIS countries (Belgium, England, Finland, and France) and eight case studies. WP2 is dedicated to case study analysis, based on common conceptual and methodological work conducted in in WP1, which enables cross-case analysis (WP3) and finally dissemination (WP4). The eight case studies cover climate change adaptation policies (CCAPs) and flood risk management (FRM) strategies implemented in the four countries. These strategies are implemented differently from one country to another, but they share similar questions when they launch projects and have similar concerns about the impacts of CCAPs. WP2 analyses the justice implications of these policies, the socio-spatial inequalities deriving from these strategies, and any initiatives that institutional stakeholders adopt to limit these inequalities.

An important aim of the project is to disseminate results of case studies analysis among practitioners and scientists via different media (practitioner's handbook, oral presentations, scientific articles, e-doc website etc.).

Context

Facing the unpredictability and unavoidability of climate change effects, public policies in Europe must (re)consider their CCAPs. In this field, adaptation to extreme hydraulic events such as flooding and erosion are more urgent than ever. As Tradsowki et al. considered when they examined floods in Western Europe in July 2021: "Models indicate that intensity and frequency of such events will further increase with future global warming" (Tradowsky et al., 2023).

In such a context, climate change impacts raise controversies on the distribution of negative consequences. At the same time, however, adaptation to climate change itself raises questions of fairness, justice, and equity (Adger, 2001; Byskov et al., 2021). Studies have highlighted the essential issue of justice in climate change exposure, especially in countries in the Global South (Bobo, 2006; Owen, 2020) as well as in Europe (Reckien et al., 2014), however further analysis of justice issues related to CCAPs in Europe is needed. The SOLARIS project focuses on flood risk issues and illustrates how justice can be considered in public policy.

FRM has long raised issues of justice (Walker & Burningham, 2011). Flood risk itself is often unevenly distributed, due to the diversity of causes of flooding, types of landscape, the location of the houses and assets on which people depend. The impacts of floods and their consequences on individuals and communities is determined by a range of factors other than the severity of the flood itself, such as socioeconomic

characteristics and capital, health conditions, age, and psychological characteristics (Thaler et al., 2018). Furthermore, access to the benefits of FRM is also said to be "inherently unfair" (Johnson et al., 2008; Johnson et al., 2005). The (un)fairness of FRM is principally a question of who benefits from the measures and who pays for them (Begg, 2018). But other considerations include the ability of stakeholders to influence the decisions made and the way in which vulnerable people are recognised and defined.

As such, justice in FRM can be categorised as ***distributional justice*** (winners and losers in FRM including who pays for measures and whose flood risk is reduced), ***procedural justice*** (mechanisms to support representative and fair decision making), and ***recognition justice*** (how vulnerable and/or disenfranchised people are identified so that injustices can be tackled).

These three forms of justice – as well as the way FRM is carried out – help to define some related terms, namely fairness, solidarity, equality, and equity. To analyse the socio-spatial injustices within CCAPs related to FRM, SOLARIS utilises three key research questions:

1. How and when are issues of equality and justice identified and addressed in FRM? How does it link up with other policies, like CCAPs?
2. How is participation in decision making for FRM facilitated?
3. What is the role of (and access to) knowledge in FRM? How does this support capacity building for addressing social inequalities?

Methods

SOLARIS is a qualitative social science research project aiming to explore justice in FRM across four countries: Belgium, England, Finland, and France. The three research questions have been answered for each participant country at both national and sub-national (case study) level.

This project takes a case study approach with a common protocol used during the investigation. The above research questions dominated the analysis, and the case study approach utilises four main empirical tools (mixed-method design): analysis of policy/guidance documents/grey literature, interviews with stakeholders, local discussion groups, and participant observation.

The first method of data collection is ***document analysis.*** Document analysis involves the analysis of legal and policy documents such as legislations, rules, and programs (Massey et al., 2014) to underline how FRM has considered the issues of justice. We aim to note the distance between the formal documents and the discourses of the different groups (through interviews and local discussion groups). In total, 187 documents (France, 86; Belgium, 24; Finland, 43, England, 34) have been formally analysed by the four countries, however others may have been consulted to direct the research. Where appropriate it has also been possible to draw on the analysis of documentation undertaken in previous research projects (see, e.g., Alexander et al., 2016).

The second method of data collection is ***semi-structured interviews*** carried out with public authorities, policy makers, and other experts and practitioners involved at the national and case study level, as well as local

NGOs. In some of the cases, interviews were also conducted with local at-risk inhabitants to supplement data. Specific attention was given to the implementation from national to local. Interviews typically lasted 60-90 minutes and began with a set of pre-prepared questions focussing on the role of justice and equality in FRM, both in policy and in practice, as well as participatory practices and the role of knowledge. Following on from these questions, the interviews would become less structured to expand and probe issues that participants had raised. All interviews were recorded with the participants' permission, transcribed, and thematically analysed through an iterative process. A total of 166 interviews were conducted in the four countries (France, 53; Belgium, 39; Finland, 49; England, 28).

The third data collection approach is the organisation of ***local discussion groups***. The aim was to contribute to the analysis through a discussion with a limited number of relevant experts (flood risk managers, i.e., engineers, spatial planners, etc.; policy makers; NGOs, local resident experts) invited to the local discussion group. The idea is twofold: first, to ask for feedback on preliminary results and to provide knowledge exchange concerning next steps, and then to invite experts to reflect on the (in)equality and (in)justice issues that are raised by current spatial planning policies for FRM. Each country organised a Local Discussion Group per case study level.

The final and fourth data collection approach is ***participation observation***. Participant observation implies the presence of the researcher in the social world of the respondents, in their usual activities (Beaud & Weber, 2003; Bryman, 2016). The objective is to understand their relationships and daily practices beyond the mere collection of their discourse (carried out in the context of an interview). This data collection strategy was implemented according to the case studies, the disciplinary context, and the willingness to experiment in each country. For instance, Finland realised an art experience called *SOLARIS-ART: Engaging with Solidarities in Flood Risk Management Through Community Art.* It is "a temporary public space for listening called the Outdoor Living Room (OLR). This is a unique method that was developed to set up a living space in public places to engage people, who would otherwise not feel comfortable attending more formal meetings" (Mazzotta, 2022).

Section 1: National-level analysis

Hydro-meteorological events

Type of flood risks

Flanders is the northern, low-lying part of Belgium. It consists of a coastal plain, that borders the North Sea in the northwest, and a central plain with a dense river network. Most of the rivers are tributaries of the Scheldt river, except for the Meuse river on the Belgian-Dutch border in the east and the Yser river in western Flanders (see Figure 1) (Kellens et al., 2013). Climate change increases fluvial, pluvial, and coastal flooding in Flanders. Climate change projections up to 2100 show an increase in average temperature between 0.7°C and 7.2 °C, an increase in winter precipitation up to +38%, and an increase in the frequency and intensity of extreme precipitation events in summer (VMM, 2015). These heavy rainfall events can result in floods by overflow of river embankments and surface runoff. Other flood risks are related to storm winds above the North Sea, which can result in storm surges and tidal waves rolling up the Scheldt river, such as during the storms of 1953 and 1976 (Kellens et al., 2013). The number of problematic floods in Flanders has increased, now also affecting areas that were not considered flood prone before (VMM, 2015). This can only partly be explained by climate change, as population growth, an increase in prosperity, and surface hardening also contribute to potential losses and damages from floods.

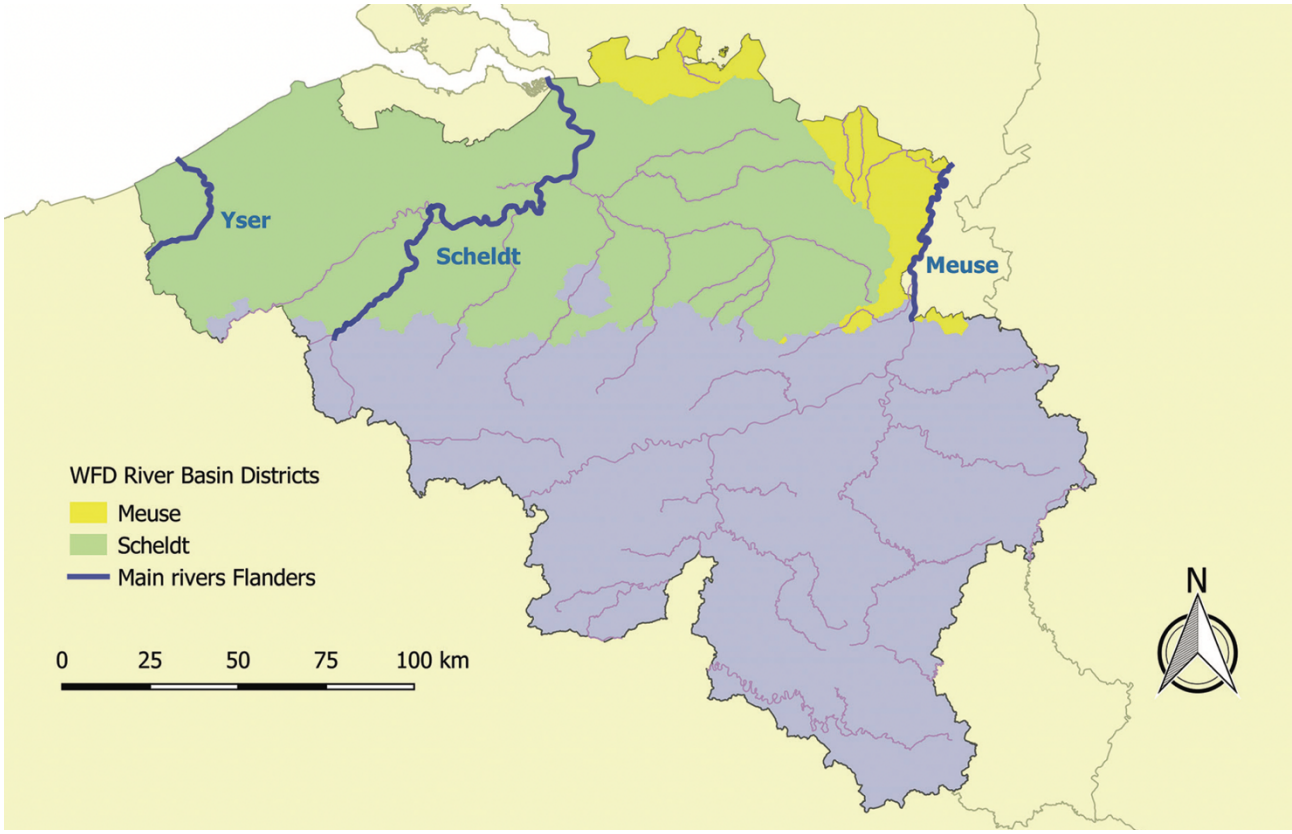

Figure 1. *Location of the region of Flanders in Belgium, its main rivers (Yser, Scheldt, and Meuse) and the subunits of the EU Water Framework Directive (2000/06/EC) river basin districts. Figure from Vannevel et al (2018).*

Climate change also alters the nature of the flooding system in Flanders. Floods during the 20th century often had a tidal cause (coastal inundation and tides contributing to fluvial flooding along the Scheldt river), but recent events are mostly caused by fluvial and pluvial flooding (Mees, Suykens, et al., 2016). There are various reasons for this shift. Firstly, many rivers in Flanders are rain fed: discharges depend on the amount of precipitation (Mees, Suykens, et al., 2016). Secondly, Flanders is a densely populated and industry-developed region (Kellens et al., 2008) with a high degree of surface hardening: 16% on average, with up to 44% of surface hardening in urban areas such as the city of Antwerp. This prevents infiltration (Mees, Suykens, et al., 2016) and contributes to surface runoff during precipitation events. Built-up areas are projected to increase in the future by 30-50% (Poelmans & Van Rompaey, 2009). This further increases the risk of fluvial and pluvial flooding in Flanders.

Increasing flood risks can significantly impact the lives and livelihoods of inhabitants. In Flanders, about 67.000 people live in areas in which flooding has a return period of 100 years, whereas 220.000 inhabitants could be affected by floods that have a return period of 1000 years (VMM, 2015). Floods have led to substantial damage in recent decades. Since 1988, ~5% of the Flemish territory has flooded. This has resulted in €50 million in damage per year (Kellens et al., 2008; VMM, 2015). Examples of sectors that are significantly impacted by floods include fisheries, transport, agriculture, energy, and tourism. The river basins most susceptible to flooding are the Dender and Senne, both part of the Scheldt basin (Mees, Suykens, et al., 2016).

Timeline of recent flood events

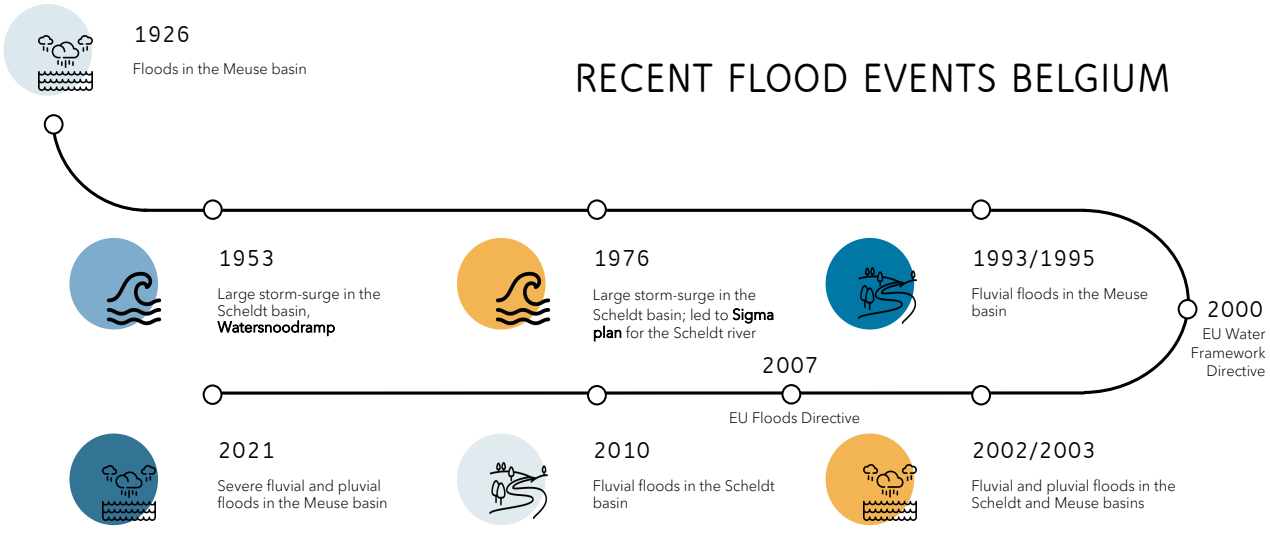

Figure 2. *Timeline showing harmful floods in Belgium in the 20th and 21st century. Different icons indicate the type of flooding (pluvial, fluvial, or coastal). Data obtained from Mees, Suykens, et al. (2016).*

Public policies

Climate change adaptation policies

Characteristics of CCAP in Flanders

Climate change adaptation policy (CCAP) in Belgium is fragmented. Belgium is a federal state and consists of three regions: Flanders, the Brussels-Capital region, and Wallonia. The regions all have their own executive and legislative bodies. As a result, there are both federal and regional adaptation plans, many policy domains are involved, and uncertainty remains around responsibility for the implementation of adaptation measures. There is no hierarchy between the federal and regional level. The governments are on equal footing, however targeting different policy domains. Generally, the regions are responsible for the domains related to their territory, i.e., agriculture, water, housing, energy, transport, environment, spatial planning, rural renovation, nature conservation, etc. Climate change adaptation is therefore mostly a regional responsibility. However, there are also federal climate change adaptation plans and strategies, specifically including measures that are relevant for the federal state (Nationaal Adaptatieplan, 2016), as well as to harmonise strategies of the federal government and the three regions. Various coordinating bodies have also been set up for that purpose (e.g., The Coordination Committee for International Environmental Policy and the National Climate Committee). There are also local-level and municipal adaptation plans. For example, the municipality of Beerse, in which the first case study covered in this report is situated, produced its own rainwater and drought plan. The plan includes a list of initiatives and measures to adapt to the impacts of climate change.

For a long time, the topic of climate change adaptation has been neglected in Flanders, resulting in a lack of institutional structures, rules, and (budgetary) means that guarantee commitment to the development and implementation of CCAP (Crabbé et al., 2011). The Department of Environment of the Flemish government is responsible for coordinating climate policy and adaptation. In 2022, the government spent €542 million on energy and climate (which adds up to 1% of total government expenditure) and climate policy is fully funded through the auctioning of emission rights (SERV, 2022). However, there is no specific government department responsible for CCAP and it does not have it's own dedicated financial resources. Instead, funding and implementation happens through various policy domains, including water management, spatial planning, mobility, agriculture, and nature. Climate change adaptation in Flanders is at most a network of stakeholders from these policy domains and is not as institutionalised as the domain of FRM. Actions often depend on the goodwill of these stakeholders. There are no formal requirements imposing policy domains to cooperate. For example, a steering committee for climate change adaptation exists, but its members are loosely connected, there are few rules and regulations, and there is no specific budget available that can be used across the different policy domains (Crabbé et al., 2011).

Overview of CCAPs

The first National Climate Plan (at the federal level) in Belgium was adopted in 2002 for the period 2002-2012 but was already replaced in 2008 by the second National Climate Plan. The plan sets out the overarching vision for climate change adaptation and aims to coordinate adaptation efforts. One of the main goals was to establish a national strategy specifically for climate change adaptation. This resulted in the National Adaptation

Strategy, which was established in 2010. The new strategy had three goals: 1) to improve the coherence between existing adaptation activities, 2) to improve the communication at national, European, and international level, and 3) to start the process of developing a national action plan on climate change adaptation. The National Adaptation Strategy proposes adaptation actions for different sectors, i.e., health, tourism, agriculture, forestry, biodiversity, ecosystems and water, coastal, marine, and tidal areas, and production systems and physical infrastructure (Nationale Klimaatcommissie, 2010). In 2016, the National Adaptation Plan was adopted, which was prepared by the National Climate Committee's working group on climate change adaptation. This document identifies and describes adaptation measures that should be taken at the national level. It also aims to strengthen the collaboration between governments involved in climate change adaptation in Belgium (Nationaal Adaptatieplan, 2016).

Adaptation policies at the regional level in Flanders are prepared by the Flemish Taskforce Adaptation. The Taskforce hosts representatives from various policy domains, including environment, water management, agriculture, infrastructure, economy, nature and forest management, and energy. The activities of the Taskforce are coordinated by the Department of Environment of the Flemish government. The Taskforce prepared the Flemish Adaptation Plan which was adopted in 2013. The plan describes how the Flemish government aims to act, respond, and adapt to climate change, including measures for all sectors that are impacted by climate change (water management, environment, nature, industry and services, energy, mobility, tourism, agriculture, fisheries, and health). For example, at present, about €500,000 has been invested in adapting to extreme weather events. A new plan has recently been released for the period 2021-2030.

Link between CCAP and FRM

CCAPs in Flanders emphasise that climate change reinforces existing environmental problems through, e.g., drought, heat stress, storms, and floods (National Adaptation Plan, 2016). Water is one of the many environmental factors that is being affected by climate change (interview, 21-10-2021) and floods have impacted more people in the 21st century than other natural disasters (de Goër de Herve, 2022). Climate change does not only result in rising temperatures, which contribute to sea-level rise through ice melt and thermal expansion. It can also lead to an increase in the frequency and intensity of precipitation patterns. Hence, climate change can significantly increase coastal and river flood risks. Flood risk management (FRM) in Flanders can therefore be understood as an important aspect of climate change adaptation. However, the recognition that climate change significantly changes flood risks in Belgium has been relatively recent. This becomes apparent when looking at the river basin management plans (RBMPs) – key tools for implementing the EU Water Framework Directive (2000/06/EC) – because only the recent plans, for 2015-2021 and 2022-2027, mention climate change. Before, the RBMPs did not actively recognise the links between climate change and floods but focussed mostly on managing the current water system.

Flood risk management policies

In federally organised Belgium, FRM and spatial planning are regional responsibilities (Davids et al., 2019). This means that in the three regions, FRM and spatial planning are subject to different legal frameworks and policies. The STAR-FLOOD project distinguished five different FRM strategies for Belgium: flood risk prevention, flood defence, flood risk mitigation, flood preparation, and flood recovery (Mees, Suykens, et al., 2016). Competences related to the first three strategies (prevention, defence, mitigation) are a regional responsibility and are therefore grouped together under the Water Systems Arrangement. Flood preparation focuses on emergency planning and crisis management, which is governed mainly at the federal level in the Flood Preparation Arrangement. Similarly, recovery after floods concerns insurance issues which is primarily governed at the federal level in the Flood Recovery Arrangement.

Water Systems Arrangement

Water management in Flanders is characterised by a pluralist, state-oriented process: the Flemish government is obliged to consult advisory boards that formally represent civil society groups in the decision-making process (Mees, Suykens, et al., 2016). The Flemish Water Systems Arrangement is also fragmented in terms of actors (Davids et al., 2019; Mees, 2017). The management of watercourses is split into four categories, each with a different responsible water manager. As a result, there are many governmental actors divided over regional, provincial, municipal, and sub-local level (see Table 1) (Mees, Suykens, et al., 2016).

Table 1. *Responsibilities of different governmental levels in Flemish water management, from Mees, Suykens, et al. (2016).*

Government level	Responsibilities
Regional	Legislative competence for water management and spatial planning Developing regional spatial plans Management of navigable watercourses by the Vlaamse Waterweg, De Scheepvaart and Department Maritime Access Management of first category non-navigable watercourses by the Flemish Environment Agency (VMM)
Provincial	Supervision of municipal spatial planning Developing spatial plans Management of second category non-navigable watercourses (small watercourses, basin <100 ha)
Municipal	Granting building permits, developing municipal spatial plans Management of third category non-navigable watercourses
Polders/wateringues	Management of second- and third category non-navigable watercourses

The most important legislation on FRM in Flanders is the Decree on Integrated Water Policy (DIWP), which was introduced in 2003 and reformed in 2013 (Mees et al., 2017). It integrates legal instruments for water management that were previously scattered. The DIWP also created a committee, the Coordination Committee on Integrated Water Policy (CIW), for the coordination of water policy at the Flemish level, as different organisations, departments, and levels of government are involved in water management and spatial planning. All water policies are deliberated in this forum and the CIW is a principal actor for water management in Flanders (Mees, Suykens, et al., 2016).

An important instrument for flood prevention included in the DIWP is the 'water assessment'. This obliges decision makers to seek advice from water managers (i.e., public authorities from flood defence) on the impact of permits, plans, and programs on the water system. Other important tools in the DIWP include the RBMPs for the Scheldt and Meuse rivers. The RBMPs initially focussed on improving water quality standards in rivers and streams, but also identify watercourses with significant flood risks (Mees, Suykens, et al., 2016). Spatial planning instruments are becoming more attentive to FRM. For example, the regulation on rainwater mandates that when (re)building, measures should be taken to ensure rainwater is not drained but used or infiltrated. Another example is the use of signal areas, which are areas that are currently undeveloped and have a high potential for water retention and infiltration. The aim is to prevent further development in these areas to account for increasing flood risks. However, the rate of surface hardening in Flanders is extremely high. The remaining open space is rapidly being developed. Opportunities for spatial planning to make a difference in FRM in Flanders are therefore limited.

The discourse in the Water System Arrangement focuses on the three-step approach (capture, storage, drainage) and since 2013, the concept of multi-layer water safety (MLWS) was adopted in accordance with the EU Floods Directive. According to MLWS, equal attention should be given to flood prevention, protection, and preparedness, with a shared responsibility between governmental and non-governmental actors. However, citizen participation in Flanders is rare. Most participation opportunities are limited to organised stakeholder groups. For example, the Flemish Council for Environment and Nature, the Social and Economic Council of Flanders, and the Strategic Advisory Council on Spatial planning are consulted in the development and preparation of decrees related to FRM – although their advice is non-binding. Interest in the involvement of citizens in FRM is increasing, for example, through property-level protection, but citizens do not yet widely contribute to FRM (Mees, Suykens, et al., 2016). This could partly be explained by belief that FRM is a government responsibility (Mees et al., 2016).

Flood Preparation Arrangement

Crisis management, emergency planning, and disaster relief are primarily a federal responsibility in Belgium. However, emergency plans are also developed at provincial and municipal levels providing general guidelines to manage different types of emergencies (Mees, 2017). Some risks require additional preparatory measures, for which provincial and municipal governments can draw up separate plans.[1] Crisis response in Belgium is divided into three phases or levels of action. The appropriate phase is proclaimed depending on the size and nature of the emergency, the need for coordination, etc. Crisis response generally starts at the municipal level and is lifted to a provincial or federal phase if necessary, for example, if a flood crosses multiple administrative borders (Mees, Suykens, et al., 2016).

The principal legislation in the Flood Preparation Arrangement is the Royal Decree on Emergency Planning of 16 February 2006, which aimed to harmonise emergency plans at different policy levels (Mees, 2017). The EU Floods Directive (2007/60/EC) is also important in the context of flood preparation, because it requires member

[1] https://crisiscentrum.be/nl/wat-doen-overheden/voorbereiding/noodplannen

states to develop flood risk maps showing the number of affected inhabitants, types of economic activity, installations that might cause pollution during floods, etc.

Involvement of citizens in crisis management in Belgium is currently underdeveloped. There is no strong tradition of community involvement. Although it is believed that crisis management should be a shared responsibility, it is argued the Belgian population lacks the culture to get involved due to a lack of flood experience and awareness (Mees, Suykens, et al., 2016). There has been encouragement from, for example, fire brigades, to stimulate citizens' self-reliance during flood events, to reduce pressure on fire fighters during flood emergencies (e.g., residents can purchase water pumps to pump water out of their cellars themselves, instead of relying on fire fighters to help them). However, there are few initiatives by the public to become more involved in crisis management.

Flood Recovery Arrangement

The Flood Recovery Arrangement is increasingly a shared competence between the federal government, private companies, and regional governments (Mees, Suykens, et al., 2016). The 1992 Insurance Act is an important framework for the Recovery Arrangement. In 2006, with the Act on the Insurance of Natural Disasters, flood damage was included in the general fire insurance policy. This significantly strengthened flood recovery (Mees, 2017). Thus, private parties play an important role in flood recovery in Flanders. Since the Act of 17 September 2005, insurance companies have replaced the role of the government as compensator (Mees, Suykens, et al., 2016). Individuals also play an important role in the Flood Recovery Arrangement, as they are the ones buying private insurance policies.

Flood damage that is not covered by private insurance can in some cases be compensated through the public disaster fund (Mees, 2017). Once a flood event is recognised as a natural disaster, a compensation procedure is started. In Flanders, the provincial governors receive applications for damage compensation and decide on these applications. The disaster fund grants a compensatory fee (Mees, Suykens, et al., 2016).

Answering SOLARIS research questions from a national level perspective

Attention attributed to justice/fairness/inequalities in policies (RQ1)

Justice, fairness, and equality in general public policy

We provide a brief overview of how issues of justice, fairness, and (in)equality are considered and understood in general public policies in Flanders, however a full analysis of all policy domains is unfortunately beyond the scope of the SOLARIS project.

The first forms of social policy associated with the welfare state in Belgium were initiated between the first and second World War (Buyst & Smeyers, 2016) and have been gradually expanded since. Belgium is classified as a conservative welfare state, meaning that solidarity generally remains low as the direct influence of the state is limited to the provision of income benefits related to employment (Esping-Andersen, 1990), i.e., social

rights are mainly derived from one's position in the labour market. However, Belgium's welfare system is considered relatively large and redistributive. In 2015, 30.3% of the country's GDP was allocated to public social expenditure (Marx & Van Cant, 2019). In recent decades, a major concern has been cost containment. Growing numbers of claimants in unemployment, early retirement, and sickness (due to sociodemographic changes and migration) are complicating the objective of providing people with adequate income protection, and public expenditure is expected to further increase due to the ageing of the population (Marx & Van Cant, 2019). Although the Belgian welfare system has low and relatively stable income inequality rates, the labour market is not considered as sufficiently inclusive because employment rates are low and welfare dependency is high (Marx & Van Cant, 2019). Some important sectors of the Belgian welfare system (e.g., education, training, job placement, and elderly and invalidity care, etc.) are governed at the regional level (Flanders, Brussels-Capital, Wallonia). Social security remains a federal competency.

At the regional level, the coalition agreement of the Flemish government (2019-2024) refers specifically to "living together in solidarity" multiple times throughout the document (Vlaams
, 2019-2024, p.19). This indicates that the Flemish government increasingly emphasises the importance of solidarity in different policy domains. Solidarity is understood as "an effort to offer everyone living in Flanders a decent existence" (Vlaams Regeerakkoord, 2019-2024, p.19). However, it is not further specified or explained what a "decent existence" means. Furthermore, it is said that solidarity does not exist without responsibility. Flemish citizens will be supported, but only if they take their responsibility to seize opportunities provided by the government. This is also emphasised in a policy containing the strategic choices of the Flemish government for the domain of equal opportunities and civic integration. Although the government "opts for an inclusive approach" (Beleidsnota Gelijke Kansen, Integratie en Inburgering, 2014-2024, p.6), policies and strategies are only tailored specifically to needs of vulnerable groups if absolutely necessary. This is supported by the argument that a target group-oriented approach, in which various groups are treated differently, may lead to polarisation.

Reducing poverty is said to be one of the central strategic goals of the Flemish government (Beleidsnota Welzijn, Volkgsgezondheid, Gezin en Armoedebestrijding, 2014-2024). In 2020, the Flemish Action Plan on Poverty Reduction was approved. This Action Plan aims to: 1) prevent people from living in poverty and needing social housing, 2) specify targeted actions against child poverty, 3) activate and increase people's self-reliance, 4) support citizens who experience sudden changes in their lives, reducing the risk of poverty, and 5) create a high-quality, liveable and healthy living environment for all societal groups.[2] Furthermore, by 2030, the Flemish government aims to reduce the number of families living in poverty and facing social exclusion, increase housing security and affordability, and reduce the number of people affected by economic impacts, damage to infrastructure, and disruption of basic services caused by weather- and climate-related disasters.[3] The government also aims to further reduce inequality by 2030 through stimulating the participation of disadvantaged groups in all aspects of social life in Flanders, reduce inequality in health and well-being by

[2] https://armoede.vlaanderen.be/vlaams-actieplan
[3] https://www.vlaanderen.be/uw-overheid/beleid/het-vlaamse-beleid-voor-duurzame-ontwikkeling/sdgs-in-vlaanderen/sdg-1-beeindig-armoede-overal-en-in-al-haar-vormen

decreasing differences in life expectancy and well-being by 25%, and by stimulating sufficient knowledge of the Dutch language for all long-term Flemish inhabitants.[4] Multiple indicators are provided by which progress on these goals is monitored. However, efforts to reduce poverty and inequality is not directly linked to climate change adaptation or FRM. In addition, research shows that in reality, poverty rates are not reducing and there is little prospect of eliminating inequality in Belgium (Coene et al., 2021). At present, 13% of the Flemish population still lives in poverty and social exclusion, while 4.4% lives in conditions of "severe material and social deprivation."[5]

Justice, fairness, and inequality in FRM policy

We conducted a thematic analysis of important climate change adaptation and FRM policies in Flanders. The following documents were analysed: the National Adaptation Plan, the Flemish Adaptation plan, the Scheldt RBMP, and the Waterbeleidsnota (at the regional level). The thematic analysis shows examples of the SOLARIS concepts in both CCAP and FRM policies. In general, CCAPs include more explicit references to the SOLARIS concepts[6], e.g., vulnerability, (in)equality, and fairness. Although FRM policies do include references to vulnerability, this is often understood in terms of exposure to flood risks. Social vulnerability is not mentioned or addressed. Furthermore, FRM policies are more technical and detailed, whereas the language used in CCAPs remains more general and high-level.

Attention to justice and equality in CCAPs

The National Adaptation Plan recognises that "as climate change accelerates, increasingly severe impacts on natural ecosystems are expected. In addition, future climate change is expected to slow economic growth, erode food security, and increase inequality worldwide" (Nationaal Adaptatieplan, 2016, p.14). This potentially refers to a recognition of differences in vulnerability of people and in their capacity to adapt to a changing climate, however it remains a general (global-level) statement. It does not address the impact of climate change on vulnerable groups in Belgium specifically, nor does it recognise their specific needs or interests. The plan includes multiple measures that will be taken at the federal level to adapt to a changing climate. One measure focuses on evaluating the socioeconomic impact of climate change in Belgium, "to identify the extent to which Belgium is prepared to tackle climate change, and to identify the sectors, companies, and worker groups that will be most affected and how" (Nationaal Adaptatieplan, 2016, p.28). Results from socio-economic impact analyses suggest that socially vulnerable groups will be disproportionately impacted by climate change, for example, those with poor health, lower incomes, or inadequate housing (Nationale Klimaatcommissie, 2020). This is potentially relevant to differences in vulnerability as well as distributive justice. The National Adaptation Plan also recognises that climate change impacts human health and well-being, and that these factors are strongly related to socioeconomic indicators (e.g., income, housing, employment, education, etc.). This may indicate a recognition that different groups are impacted in different ways by climate change, depending on their socioeconomic characteristics (Nationaal Adaptatieplan, 2016), however this is not

[4] https://www.vlaanderen.be/uw-overheid/beleid/het-vlaamse-beleid-voor-duurzame-ontwikkeling/sdgs-in-vlaanderen/sdg-10-dring-ongelijkheid-in-en-tussen-landen-terug).
[5] https://www.vlaanderen.be/statistiek-vlaanderen
[6] Access, capacity, (procedural and distributive) justice, equality, equity, fairness, opportunity, participation, recognition, socio-economic characteristics, solidarity, vulnerability.

explicitly said. At the regional level, in the Flemish Adaptation Plan, there is only one small section that seems to acknowledge that some groups experience increased vulnerability due to climate change, but this is not directly related to floods: “periods of extreme heat lead to heat stress, which increases the risk of death in weaker population groups […]. In the future, this effect may be even more problematic due to the aging of the population” (Vlaams Adaptatieplan, 2013, p.70). However, the language used in the excepts above is generic, as is often the case in high-level climate policies. Furthermore, the documents do not indicate how to address issues of fairness and justice at local levels, nor how local people are included in decision-making processes to reduce inequality.

Attention to justice and equality in FRM policy

The Waterbeleidsnota and the RBMPs are important documents in the context of FRM in Flanders. The Waterbeleidsnota sets out the general vision for water management. A participation process was organised for the development of the Waterbeleidsnota for the 2020-2025 period. Participants included members of advisory councils and local authorities, as well as other who are involved in water policy. This indicates that individual citizens, and, more specifically, vulnerable communities were not necessarily targeted in the participation processes. The primary objective of the participation process was substantive: including new ideas and working with (local) stakeholders to explore potential solutions to water management issues. This is important, as the Waterbeleidsnota is to be translated into RBMPs, which include more concrete measures to be implemented to improve groundwater and surface water quality, and for flood protection and drought. Although both documents describe water management issues that require action, none of these issues focus on tackling issues of inequality or justice in floods (CIW, 2011a). The RBMP does describe that flood risks are determined by also looking at social and economic impacts. However, social impacts are defined as the number of buildings in a potential flood area, and the economic impact is determined based on compensations paid by the disaster fund. Hence, no attention is attributed to potential differences in social vulnerability between different groups, nor the resulting inequality and justice issues.

Understanding of justice, fairness, and inequality by public authorities

We conducted interviews with relevant public authorities in Flemish FRM, at the federal, regional, provincial, and municipal levels, and from the various flood risk governance arrangements. In general, the respondents are aware of and interested in fairness and equality in FRM. However, the results also show a difference in attention to and understanding of social vulnerability to floods among water managers and spatial planners. Water managers, who are the main actors in the strategy of flood defence in Flanders, are characterised by a more technical approach, focussing on reducing the exposure of people and infrastructure to floods (without differentiating between those who may be more or less vulnerable to those floods). According to an interviewee, differences in social vulnerability are not a water management problem. It should be addressed in other policy domains, such as immigration and housing. Furthermore, water managers in Flanders believe that floods do not disproportionately impact vulnerable groups: “it does not matter if a working-class neighbourhood or an area with large villas is hit by floods” (interview, 26-08-2021). Measures implemented in the context of FRM should, according to water managers, equally benefit all groups. Spatial planners, who are the main actors in flood risk prevention, are more sensitive to differences in social vulnerability to floods.

According to spatial planners, FRM should consider the interests and needs of vulnerable groups. As an interviewee explains: “in the literature, you have the *Rawlsian* justice principle which states that justice means target-group specific policy, so specifically focussed on the most vulnerable groups. This is the principle I am most inclined to” (interview, 24-09-2021). Public authorities at local levels of government (e.g., municipalities) also seem to be more sensitive to issues of justice and (in)equality in floods and have more contextual knowledge of the differences in social vulnerability to floods of different groups in their territory.

However, among both water managers and spatial planners, uncertainty remains about who exactly is impacted and in what way, which groups are most vulnerable, or how to address inequality through FRM policy. In this context, public authorities underline the importance of procedural justice through e.g., citizen participation. This corresponds with our policy analysis: examples of public participation and partnerships were found frequently throughout the documents. However, public authorities interviewed all stress that participation procedures are not always necessarily a reflection of society, but that it is often the typical, engaged citizen who participates, while vulnerable groups may be excluded. Various reasons were provided by the interviewees that may explain this: 1) a lack of awareness or sense of urgency among the population, 2) a lack of flood experience among the population, 3) a lack of financial means to participate in FRM, 4) people who rent are less likely to participate (in case of property-level protection), 5) FRM is often perceived as a government responsibility, and 6) uncertainty about climate change and its impacts.

It has been argued that flood resilience can only be achieved if both public and private actors are involved in FRM (Driessen et al., 2018). To ensure vulnerable communities are also included in FRM, a recognition of inequalities and differences in the capacity to participate is required. This is currently not (sufficiently) the case in Flanders. The interview data show that there are various reasons for this, e.g.: 1) uncertainty about who is responsible to address inequalities in FRM, 2) efficiency concerns, meaning that considering differences between people takes more time, 3) inequalities are sometimes not perceived as a water management problem, but as a fundamental and underlying societal problem that should be solved in another policy domain (e.g., poverty or housing), 4) there is a lack of recognition of inequalities in FRM in the first place, but also 5) a lack of knowledge about the inequalities, or how to address them.

Role of participation (RQ2)

In 1990-1991, pilot river basin committees were installed for the five main river basins in Flanders to increase stakeholder involvement in water management in Belgium (Hegger et al., 2013). The committees had to facilitate multi-stakeholder dialogue and integrated policy making. In 2003, the river basin committees received a legal status (Hegger et al., 2013). Participation procedures are also becoming more important in Flanders, as is illustrated by the following excerpt from an interview with spatial planners involved in FRM:

> “An important trend in Flanders or Belgium is that participatory processes have increased enormously in the last 10 years. You could say: they work more towards procedural justice. But in

practice it is difficult for all groups to participate, so you can question this trend" (interview, 24-9-2021)

Stakeholder participation in FRM has also been increasingly stimulated at EU level. The European Water Framework Directive establishes a framework to protect and restore clean water across Europe and ensure its sustainable use. One of the tools for the implementation of the WFD are the RBMPs, in which citizens have an important role to play. People are expected to be informed about and involved in the preparation of the RBMPs. Stakeholder participation in FRM in Europe even became a legal requirement as a result of the European Floods Directive (Begg, 2018). The requirements as stated in the Floods Directive have been translated into the Decree on Integrated Water Policy in Flanders. The Decree is based on principles of participation, meaning that citizens should be given the opportunity to participate in the preparation, determination, implementation, monitoring, and evaluation of water policy.

At the Flemish level, in 2012/2013, a discourse emerged that increasingly questions the exclusive role of the government in FRM. With MLWS, there is a tendency to redistribute responsibilities for FRM between water managers, spatial planners, other governmental bodies, and private stakeholders, including citizens (Mees, 2017). One important rationale for increased citizen involvement in the delivery of FRM is efficiency: coproduction is seen as a means of cost sharing for FRM (Mees, Crabbé, et al., 2016). The involvement of additional actors is also believed to increase the effectiveness of future FRM (Mees, Tempels, et al., 2016). An example of a way in which citizens are actively involved in FRM in Flanders is through the 'duty to inform'. Both landlords and those selling their properties are obliged to inform potential tenants or buyers if the property is located in flood risk area.[7] Another example of increased citizen involvement in FRM is the use of property-level protection measures (Mees, Suykens, et al., 2016).

However, many water managers at regional and provincial levels recommend that citizens should be informed rather than actively included in the decision-making process (Mees, Crabbé, et al., 2016). We found a similar result from our exploratory interviews: public authorities recognise that participation procedures are often tokenistic, e.g., to reduce resistance and build support. "In practice, water managers start participation processes with a few possible measures in mind and attempt to get citizens to propose the same measures. People feel like they came up with the plans together and that they contributed, resulting in more support" (interview, 29-9-2021). This can be problematic, as an increase in citizen coproduction should be accompanied by increasing opportunities for citizens to also influence decision-making processes and co-determine the plans (Mees, Crabbé, et al., 2016). The interview data also shows that public authorities know that participation procedures are not always a good reflection of society, as vulnerable groups may be excluded:

> "Participation processes are an attempt to involve citizens in policy and the development of projects. But it is very difficult to involve everyone. […] As policy makers you try to inform everyone about the project and include as many people as possible. But we also notice the inequalities that

[7] https://www.vlaanderen.be/informatieplicht-over-de-overstromingsgevoeligheid-van-vastgoed

> arise in other policy domains. Citizens who participate are always those who are already involved in water policy or in nature associations for example […]. It is very difficult to reach socially vulnerable groups through projects" (interview, 27-09-2021).

This can further reinforce existing inequalities in FRM.

Knowledge and capacity-building on social inequalities (RQ3)

There is abundant environmental, hydrological, technical, etc. data available on flood risks. This knowledge is produced through a collaboration between flood risk managers at the regional governmental level, and includes flood maps based on scenarios of climate change, showing water depth and the potential consequences for humans (often properties affected), ecology, economy, and cultural heritage. These maps can be accessed through www.waterinfo.be. Knowledge is available on the potential impacts of floods on 'vulnerable institutions' like hospitals, schools, or prisons (CIW, 2011a). Furthermore, maps showing social vulnerability to floods also exist in Flanders. The maps are produced through a collaboration between the Vlaamse Waterweg, Flanders Hydraulics Research, and the Flemish Environment Agency. The social impact of a flood is calculated by multiplying the number of affected persons with the flood index and the social vulnerability index. The latter includes various socioeconomic and demographic indicators, e.g., the number of residents entitled to social welfare benefits, the number of disabled people, the number of people with a foreign background, the number of people aged >75 years, and the number of single-parent families.

However, the social vulnerability maps are not publicly available (on www.waterinfo.be) and they are not actively used in FRM decision making in Flanders. When deciding on the most suitable FRM strategies to be implemented, public authorities rely on cost-benefit analyses (CBAs). Decision making based on CBAs may be a too narrow approach in FRM, because it focuses on total costs versus houses protected, which obscures the need to consider social elements. As a result, there is a lack of knowledge on the needs and interests of vulnerable groups among water managers and other stakeholders involved in FRM in Flanders:

> "I have no idea what the complete diversity of social profiles in the flood plains is. If we host information meetings, is that a good reflection of the people who effectively live in flood zones? […] And for communication and different social profiles, I would not really know how to approach that. I would send a letter to everyone; and assume they understand that letter. But even when drafting letters, I notice that our communication department says that some people will not understand. Even though I think that is just basic Dutch. So yes, I think there is still a lot to be gained here" (interview, 27-08-2021).

The lack of knowledge about inequality in FRM may be explained by water managers' technical background and expertise. Traditional water management focuses on keeping the water out and preventing homes from being flooded. It does not matter whose home that is: everyone is treated equally. Differences in vulnerability are often overlooked. This issue is compounded by the fact that the provinces in Flanders (responsible for the

management of second category non-navigable watercourses) focus on spatial issues. The departments that focus on social policy domains have been removed from provincial levels and are now a municipal responsibility (interview, 4-10-2021).

Multiple respondents referred to the website www.provincies.incijfers.be, which provides figures and data on e.g., the number of inhabitants, age, family composition, ethnicity, births and deaths, economic sectors, employment, education, etc. Although his website provides data about socioeconomic and demographic characteristics of a province or municipality, it is not widely used in FRM. Respondents also indicated that municipalities may be better equipped to consider inequality and justice issues in FRM, as they have more contextual knowledge and a better understanding of local conditions and the needs of communities living there.

Research by Goosse, Boelens & Mees (n.d.) studied whether populations in flood-prone areas in Flanders show more social vulnerability characteristics and found that these relationships were either marginal or statistically non-significant at the Flemish and municipal levels of Denderleeuw, Geraardsbergen, and Ninove. This means that, in Flanders, socially vulnerable groups are not necessarily more exposed to floods or concentrated in flood risk areas, contrary to what has been found in for example the UK (Sayers et al., 2018; Walker & Burningham, 2011). However, this does not mean that socially vulnerable communities have sufficient capacity to prepare for, respond to, or recover after a flood event occurs.

Section 2: Beerse (Case Study 1)

Case description

Case study area

Introduction

This first case study is located in the municipality of Beerse, in the north of the Province of Antwerp, in Flanders, Belgium. The location of Beerse is shown in Figure 3 below. Beerse belongs to the bigger city region of Turnhout, together with the municipalities Oud-Turnhout and Vosselaar. Beerse is a small municipality with just over 18,000 inhabitants. It is a residential and industry-developed area, with 487 inhabitants per km^2, which is slightly lower than the average population density for Flanders as a whole (492 inhabitants per km^2) (Provincie in Cijfers, 2022a).

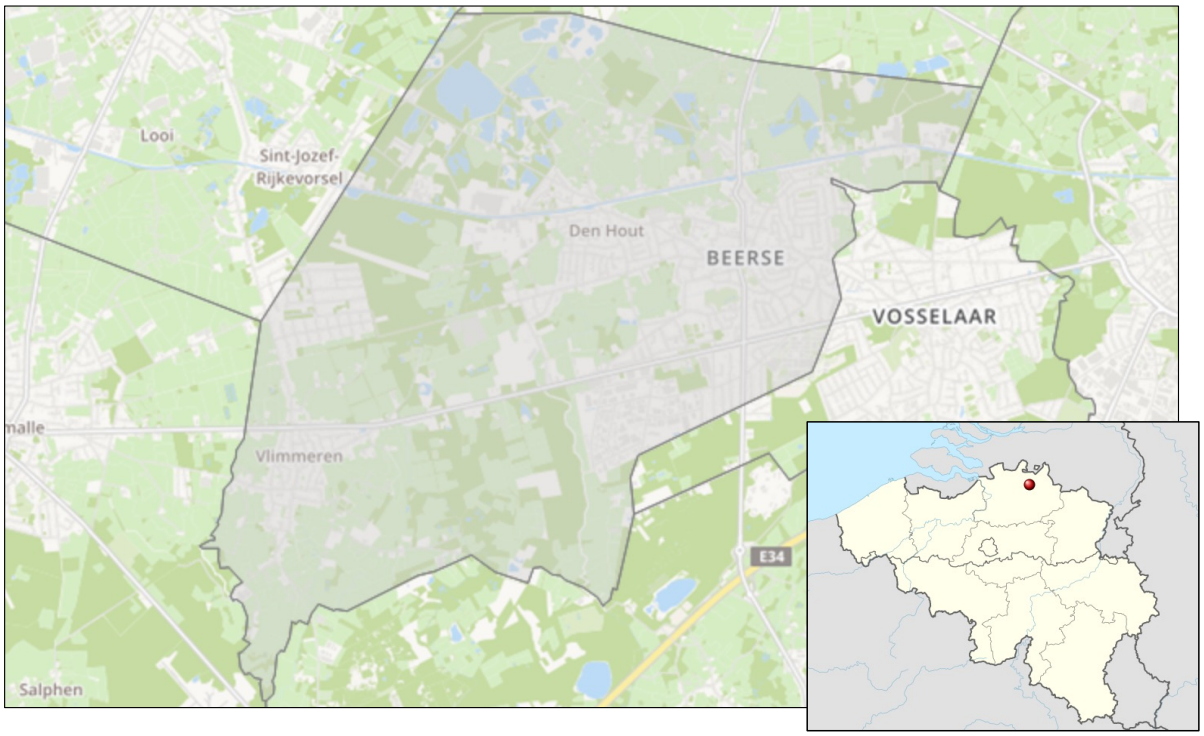

Figure 3. *Map showing the location of Beerse. Adapted from www.provincie.incijfers.be and Wikipedia.*

A small river, the Laakbeek, flows through the centre of Beerse. The Laakbeek is only 8.21 km in length and is part of Nete river catchment, which is 1,673 km^2 in size (for comparison, the Scheldt River catchment is 21,863 km^2). The Nete is a tributary of the Scheldt, a 350 km long river that runs through northern France, western Belgium, and flows into the North Sea in the southwest of the Netherlands. Beerse's topography is relatively flat, and the municipality is located at an altitude of approximately 22 metres. The topsoil is characterised as sandy, which normally results in high infiltration rates. However, a thick layer of clay can be found deeper in the soil which reduces infiltration capacities. Soil fertility is also relatively low. Over the last centuries, various strategies have been implemented to increase agricultural activities to accommodate for the area's population growth. However, this increase in agricultural activities has further reduced soil fertility as well as water infiltration capacity, creating vast heathlands (Gemeente Beerse, 2022).

Water management responsibilities in Flanders are split into four categories (see Table 1 on page 7). The Laakbeek in Beerse is a second category, non-navigable watercourse which falls under the responsibility of the provinces. The administrative entity in charge of managing flood risks along the Laakbeek is therefore the Province of Antwerp.

Socioeconomic and demographic characteristics

This section provides some socioeconomic and demographic statistics of the case study area, including population characteristics, nationality/ethnicity, economy and work, and poverty. First of all, Beerse's population has grown over the last decades, from 17,829 in 2016 to 18,261 in 2022 (a 2.4% increase). The population is projected to continue to increase in the future. 19.4% of the population in Beerse is younger than 18 years old (with 3.8% of the population between 0 and 3 years) and 18.3% of the population is older than

65. This is comparable to the average for Flanders: about 1 in 5 people are over the age of 65, although that number is projected to increase in the future (Statistiek Vlaanderen, 2022). The average age in 2021 was 42 years old. About 25% of Beerse's inhabitants live alone (Provincie in Cijfers, 2022a).

Beerse's population is made up of different nationalities. In 2022, 15.4% of the population had a non-Belgian origin (compared to 25.4% for Flanders), with 5.1% of the population having a non-EU origin. The number of inhabitants with a non-Belgian nationality has increased over the years, from 4.1% in 1990 to 15.4% in 2022 (Provincie in Cijfers, 2022b). In the FRM literature, ethnicity has been identified as an important factor that potentially increases vulnerability to floods. Ethnicity is related to other factors, including socioeconomic status and education. In Beerse, the proportion of people working in 2019 was 46.3%. This statistic is similar for those with a Belgian or non-Belgian, EU origin: 47.4% and 42.9% respectively. However, the proportion of people working with a non-Belgian, non-EU origin is lower: 31.7%. We observe a similar pattern for the proportion of people looking for a job. For those with a Belgian and non-Belgian, EU origin, this equals 1.6%. However, for those with a non-Belgian, non-EU origin, the proportion of people looking for a job is 2.9% (Provincie in Cijfers, 2022b).

The average net taxable income per resident in Beerse is €21,055, which is slightly above the average of the Province of Antwerp (€20,007). In 2019, the percentage of people with a net income lower than €10,000 was 19.1%, while only 2% of the population received social welfare benefits. In Beerse, the number of people living in social rent in 2022 is 307, which is 4.1% of the total population. Overall, the number of people living in social and material deprivation in Beerse is lower compared to the average for the Province of Antwerp (Provincie in Cijfers, 2022b). Table 2 on the next page provides an overview of some relevant socioeconomic and demographic statistics for FRM in Beerse.

***Table 2**. Overview of relevant socio-spatial indicators in Beerse. Retrieved from: www.gemeente-stadsmonitor.vlaanderen.be and www.provincie.incijfers.be*

Category	Indicator	Value	Measurement year
Demography	Percentage of people aged >65 years	18.3%	2021
	Percentage of people aged <18 years	19.4%	2020
	Percentage of children aged 0-3 years	3.8%	2021
	Population growth	0.4%	2020
Nationality	Percentage of inhabitants with non-Belgian, EU origin	9.7%	2021
	Percentage of inhabitants with non-Belgian, non-EU origin	5.1%	2021
Work	Proportion of people working	46.3%	2019
	Proportion of people working Belgian origin	47.4%	2019
	Proportion of people working with non-Belgian, EU origin	42.9%	2019
	Proportion of people working with non-Belgian, non-EU origin	31.7%	2019
	Proportion of people looking for a job with a Belgian origin	1.6%	2019
	Proportion of people looking for a job with a non-Belgian, EU origin	1.6%	2019

	Proportion of people looking for a job with non-Belgian, non-EU origin	2.9%	2019
Poverty	Average net income per inhabitant	€21,055	2019
	Inhabitants with a net income <10,000	19.1%	2019
	Inhabitants with social welfare benefits	2%	2021
	Percentage of children born in underprivileged families	10.7%	2021
Health	Percentage of inhabitants with chronic illnesses	11.5%	2020

The socioeconomic and demographic statistics presented show that Beerse's population does not seem to be extremely socially vulnerable to the impacts of floods. Although the population is expected to increase in the coming decades, with a larger proportion of people aged over 65, Beerse's population is relatively homogeneous with a small percentage of inhabitants with non-Belgian origins (especially considering the Flemish average, which is higher). Furthermore, the average income is relatively high, with a low percentage of inhabitants receiving social welfare benefits and living in deprivation. However, one should bear in mind that statistics often provide an incomplete picture as they do not include resident perspectives or the interests and needs of vulnerable communities. Furthermore, there may be other factors in addition to the socio-demographic statistics provided above that determine someone's vulnerability to floods, such as, for example, access to secure housing, social resources, and community-based organisations, or flood awareness and experience (Pelling, 1997).

FRM background

Flood risks in Beerse are mostly concentrated along the Laakbeek (CIW, 2011b), which is shown in Figure 4 below. The Laakbeek has multiple smaller tributaries and is characterised by a pluvial regime, meaning that it can experience large differences in its flow rate depending on the amount of precipitation at a given point in time. The valley of the Laakbeek is also characterised by a high degree of surface hardening. 31.4% of the total surface area of the municipality is built up.[8] This is almost twice as high as the average degree of surface hardening for Flanders (15%).[9] Surface hardening increases runoff and potential pluvial flood risks. Furthermore, the neighbourhoods along the Laakbeek suffer from fluvial flooding, often due to heavy rainfall events that cause the Laakbeek to overflow.

[8] https://gemeente-stadsmonitor.vlaanderen.be/
[9] https://www.vlaanderen.be/statistiek-vlaanderen/ruimtegebruik/verharding

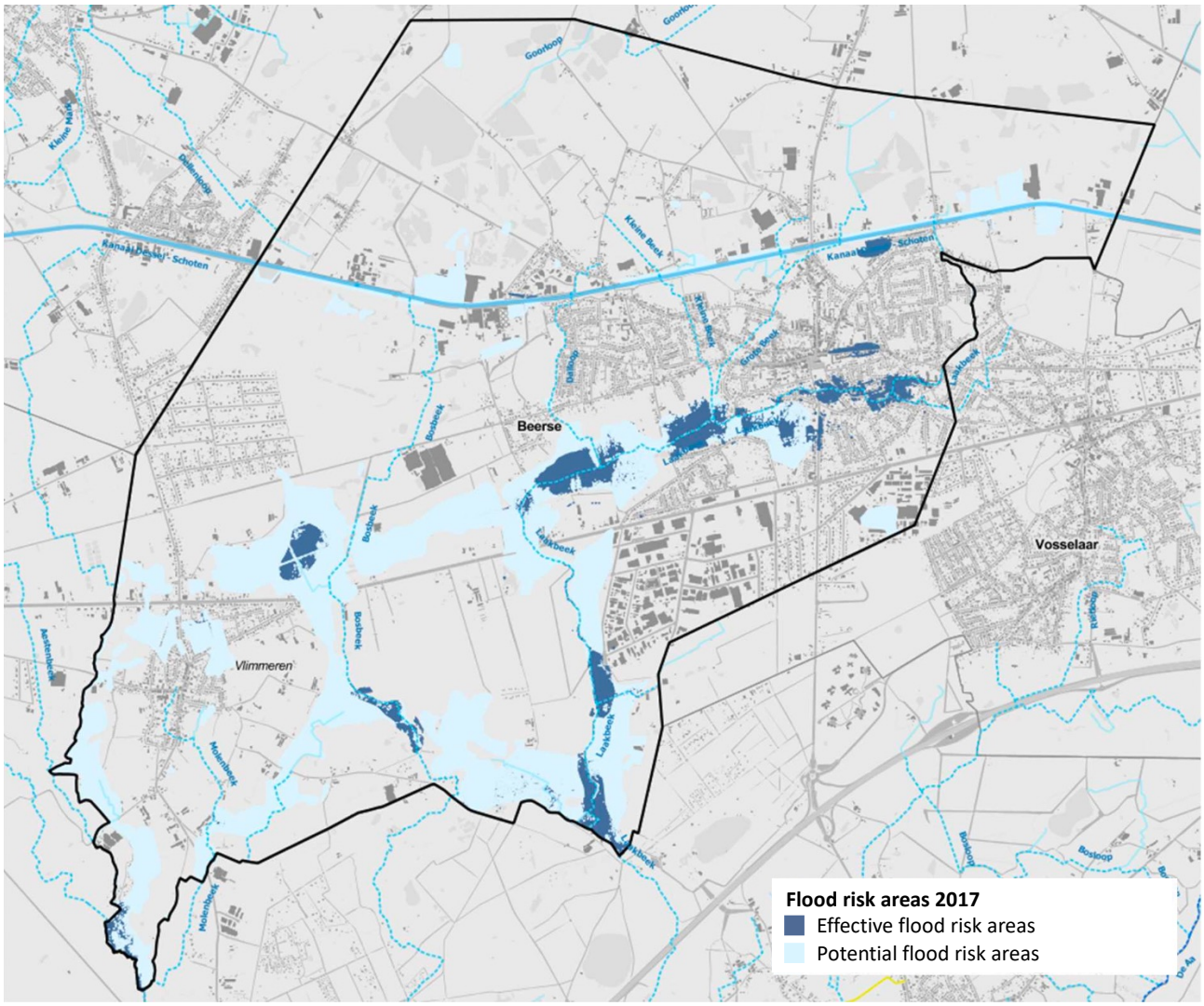

***Figure 4**. Flood risk areas in Beerse, showing both effective flood risk areas as well as potential flood risk areas Source: Gemeente Beerse (2022).*

These flood risks may further increase in the future due to climate change and the projected increase in the frequency in extreme precipitation events in Flanders (Helsen et al., 2020). A 38% increase in the amount of precipitation is expected during the winter months (see Figure 5). Summer storms are also expected to increase in intensity and frequency (Gemeente Beerse, 2022). Recent flood events in Beerse occurred in 1998, 2000, 2003 (CIW, 2011b).

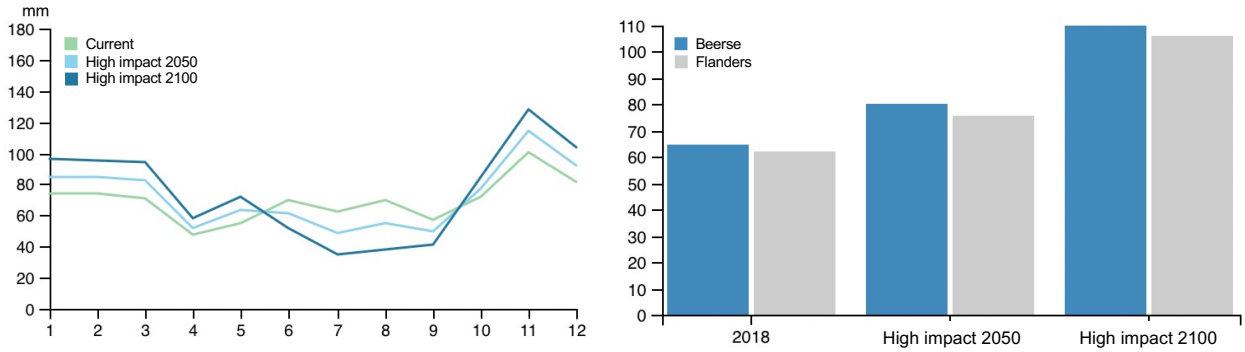

***Figure 5**. Projections of precipitation change per month for Beerse (on the left) and per year (on the right) for Beerse and Flanders, under different climate scenarios. Retrieved from www.klimaat.vmm.be.*

Project description

Plans to tackle flood risks in Beerse originated about 10 years ago. The idea was developed by water managers from the Department of Integrated Water Policy of the Province of Antwerp. The plan was to transform two at the time undeveloped plots of land (in total 1.57 ha in size, shown in Figure 6) in Beerse into a flood retention area.

***Figure 6**. Undeveloped plots in Beerse. Source: Province of Antwerp.*

The plots are located just east of the town centre of Beerse in a residential area. The location of the plots is shown in Figure 7. The plots had been labelled as a so-called 'signal area' by the CIW. Signal areas are undeveloped land areas with a hard planning destination (e.g., residential or industrial) located in flood risk zones. As they are still undeveloped, they play an important role in preserving the water storage capacity of

rivers and reducing flood risks through water retention and infiltration. Although the undeveloped plots in Beerse experienced some flooding in the past, significant flood risks exist further downstream where another small river, the Grote Beek, flows into the Laakbeek (see Figure 7 below) (CIW, 2011b). Model simulations conducted by the Province of Antwerp suggested that creating more space for water upstream would be an effective strategy to reduce flood risks, and that the undeveloped plots could play an important role in protecting residential areas further downstream from flooding. In addition, the undeveloped plots are located in a depression (CIW, 2011b), which is beneficial for water retention, and are some of the only empty plots left in Beerse (interview, 2-3-2022).

***Figure 7**. Location of the flood retention area in Beerse, indicated in red. Source: CIW (2011b).*

The flood retention area is designed as a nature-based solution (NBS) with multiple benefits in addition to water storage during high discharge events, such as carbon sequestration, urban cooling, increased biodiversity, and nature experience and recreation. Local residents were involved in the design of the flood retention area, which was funded by the Interreg 2 Seas CO-ADAPT project (2014-2020, 2S06-023). The participation opportunities were presented as 'co-creation processes' by the province and consisted of an online survey and two participation events.

The new flood retention area in Beerse can be categorised as a combination of flood risk prevention and flood risk mitigation. Limiting further development of land areas can be classified as prevention, whereas constructing flood retention areas inside flood risk zones to increase water retention is considered as flood risk mitigation (Hegger et al., 2016).

Socio-spatial inequality in the case study area

The case study area is not highly socially vulnerable. The neighbourhood surrounding the new flood retention area mostly consists of stand-alone houses, as can be seen in Figure 8. Furthermore, the households are characterised as middle-class with intermediate to high education levels. There is no social housing in the area, and there are strong social ties between residents (interview, 1-12-2022). However, age has been identified as a potential factor contributing to social vulnerability to floods, which may play a role in the case study area. A care home is located adjacent to the flood retention area, whose residents could be considered as vulnerable to floods. Furthermore, most residents living around the flood retention area are around or just over the age of retirement (interview, 22-3-2022).

***Figure 8**. Birds-eye view of the case study area. Source: Province of Antwerp.*

Hence, at a first glance, socio-spatial inequality does not seem to be a major issue in the case study area in Beerse. However, there are justice and equality issues raised that relate to the attention attributed to justice and equality in the development of the flood retention area, which will be further explained in the results section.

Methods

We take a qualitative, case study approach with a mixed-method design based on two methods of data collection: document analysis and interviews. The first method of data collection, document analysis, involves analysing legislation and policy relevant to FRM in the case study area. Interviews with public authorities, policy makers, and other experts and practitioners involved in the case study, as well as local residents, forms the second method of data collection. Before further explaining how the empirical data was gathered, we briefly explain the choice for Beerse as a case study.

Case selection

The flood retention area in Beerse was chosen as a case for SOLARIS due to its potential to further explore three issues related to justice and equality that are central to Flemish FRM: (1) how a technical approach in the implementation of FRM strategies can result in a lack of attention to social vulnerability, equality, and justice in floods, (2) how stakeholder participation in the design and implementation of FRM strategies does not necessarily reduce social vulnerability, nor promote justice in FRM, and (3) how landowners in Flanders have the power to stimulate or prevent land-use change needed to account for increasing flood risks.

We aim to exemplify these issues through an ex-nunc evaluation of the development of the flood retention area in Beerse. An ex-nunc evaluation is an assessment of the current situation, in contrast to evaluating a past event. At the time of collecting empirical data and writing this report, the construction of the flood retention area is still ongoing. Therefore, we evaluate the role of justice and equality in the project between the development phase and its implementation.

Data collection and analysis

As mentioned, the data for this case study report was collected through document analyses and interviews. A thematic analysis was conducted of important local and regional FRM and spatial planning policy documents and plans, that impacted the choice for a flood retention area in Beerse. The documents were analysed to explore how SOLARIS concepts, such as justice, equality, equity, fairness, and social vulnerability, are addressed. The following documents were analysed: the Waterbeleidsnota, Scheldt RBMP, (sub-)river catchment management plans for the Nete river, and Beerse's rainwater and drought plan.

We also conducted semi-structured interviews with public authorities and other stakeholders involved in the design and implementation of the flood retention area in Beerse. In total, seven respondents were interviewed from the provincial and municipal governments, as well as from a consultancy organisation involved in the design of the co-creation processes. Although some neighbourhood residents were interviewed, the results predominantly reflect professionals' perspectives. We took a qualitative approach to reflect on the justice and equality perceptions of the stakeholders involved in the project. Interview questions focussed on the characteristics of the project, the stakeholders involved, on social vulnerability to floods and the role of knowledge about vulnerability and inequality in the design of the project. Additional questions focussed on the design of the co-creation processes and on perceptions of justice in participation, and on the role of knowledge about differences in vulnerability in the design of the project. The interviews were transcribed and thematically analysed in NVivo by inductive coding through a systematic and iterative process.

Results

First, the main stakeholders involved in the development and implementation of the flood retention area in Beerse will be presented, as well as their level of involvement in the different phases of the project. The rest of the results are structured around the three main SOLARIS research questions. This section aims to answer (1) if and how issues of justice and equality were recognised and addressed in the development and implementation of the flood retention area in Beerse, (2) if the participation processes contributed have the

potential to contribute to a fairer outcome (distributive justice), and 3) which indicators, knowledge, and expertise on social vulnerability to floods were available to the project developers, or what knowledge is perceived to be needed by the stakeholders to actively consider social vulnerability in future projects.

Stakeholders involved

Various public and private stakeholders were involved in the development and implementation of the flood retention area in Beerse. Table 3 below provides an overview of each of the stakeholders, whether their involvement in the project was central or minor, their power base, and the specific tasks or roles in the project.

***Table 3**. Stakeholders involved in the development and implementation of the flood retention area in Beerse, including their power base and specific role.*

Stakeholder	Central/minor	Power base	Specific role(s)
Department of Integrated Water Policy, Province of Antwerp	Central	Division of water management responsibilities	• Initiated and developed the project • Hydraulic/hydrological modelling and technical expertise to determine flood risks in Beerse and the optimal location to tackle flood risks • Provided 75% of the funding for the project (from provincial taxation) • Hired three consultancy firms to 1) aid in setting up the participation processes and 2) help with technical aspects of designing NBS
Interreg 2 Seas CO-ADAPT (2014-2020, 2S06-023)	Central	Funding and support	• Provided funds for co-creation processes
Municipality of Beerse	Minor	Project implemented on their territory	• Provided 25% of the funding for the project (from local taxation)
Regionaal Landschap Kleine & Grote Nete	Minor	Expertise	• Neutral partner in negotiations with previous landowners (mediator) • Expertise around translating numerical modelling results to residents • Ensuring a good fit between the NBS and the historical background of the municipality and neighbourhood
Consultancy organisation 1	Central	Expertise	• Expertise around participation and stakeholder management • Developed and set up the co-creation processes • Responsible for communication strategy
Consultancy organisation 2	Minor	Expertise	• Specialised in online participation
Consultancy organisation 3	Minor	Expertise	• Specialised in technical aspects of designing NBS

Local residents	Minor	Affected by project	• Responsible for the technical drawings of the NBS in Beerse • Participation in two co-creation events

Project timeline

Phase 1 (2012): Initial plans based on modelling simulation

The plans to tackle flood risks in Beerse originated about 10 years ago, when the municipality already suffered from flooding along the Laakbeek. The Laakbeek is a second category, non-navigable watercourse. The responsibility for tackling flood risks in Beerse therefore lies with the Province of Antwerp. Hydrological modelling simulations conducted by water managers from the Province of Antwerp suggested that creating more space for water upstream would be an effective strategy to reduce flood risks in the centre of Beerse, and that a combination of measures would be most effective.

Phase 2 (2013-2018): Conflict of interest with previous landowners

However, to realise the flood retention area, a change in zoning was required, as the undeveloped plots were labelled as a residential expansion area. The Province of Antwerp needed to acquire the land first, as the plots were owned by a family in Beerse, who initially were not willing to sell their land. The plots are located relatively close to the town centre of Beerse, and the owners intended to build on their land. There was also a big difference between the asking price and the amount that the province was willing to pay, and the landowners felt they had to sacrifice their land to solve a problem (i.e., increasing flood risks) they did not cause on their own, whilst the solutions offered (flood retention area) were not necessarily benefiting them personally. This resulted in a legal battle that lasted multiple years, during which the project came to a complete standstill. The landscape organisation Regionaal Landschap Kleine & Grote Nete played an important role in the negotiation processes with the previous landowners, to ensure the new flood retention area would also meet their needs and interests.

Phase 3 (2018): Plans to involve residents

Eventually, the Province of Antwerp and the previous landowners reached an agreement, after which the province bought the land in 2018 with a 25% contribution from the Municipality of Beerse. This marks the official start of the project. Initially, there we no plans to organise co-creation processes and involve residents in the design of the flood retention area, because there was little experience among the project initiators on how to effectively involve the public in the design of the area. However, the Municipality of Beerse underlined the importance of involving the neighbourhood from the design stage of the project area, as “local residents know best what is needed in their neighbourhood, and what the problems are” (interview, 3-3-2022). Furthermore, the project initiators from the Province of Antwerp picked up on the Interreg CO-ADAPT project. The plans for the flood retention area in Beerse fit well with the overall objectives of CO-ADAPT, which focuses on climate change adaptation through nature-based and natural process solutions by involving the public in co-creation processes.

Phase 4 (2018-2019): Planning co-creation events

CO-ADAPT provided funds that allowed the province to hire external consultancy organisations specialised in participation and stakeholder management. An information flyer was distributed to around 1.000 families located in the area around the undeveloped plots, announcing an online survey, and inviting them to two participation events. The participation events were hosted by the Province of Antwerp in collaboration with the Municipality of Beerse and one of the consultancy organisations, and were framed as 'co-creation' processes. The participation events mainly happened at the end of 2019, before the COVID-19 pandemic hit. During the co-creation processes, residents could co-decide on the layout of the flood retention area. The stakeholder Regionaal Landschap Kleine & Grote Nete also played an important role during the participation events, as they had expertise around translating numerical modelling results from the province's water managers to the residents. As one interviewee explains:

> "The Regionaal Landschap was able to present our numerical results in a different way. With our models, we look far into the future. And sometimes that is difficult to translate to the public. Some of the residents in the area have never experienced flooding, so it is difficult for them to understand the urgency of the situation. Our models also focus on a bigger scale, while residents maybe focus on their own street, and at most two or three blocks away. The Regionaal Landschap played an important role in raising awareness and explaining how we all have to take our responsibility in reducing flood risks" (interview, 2-3-2022).

The participation evenings were divided into different parts. First, the Province of Antwerp provided an explanation about their plans and intentions for the undeveloped plots, as well as the boundary conditions that needed to be considered when designing the flood retention area (e.g., physical boundaries of the area, minimum water buffering capacity, maximum costs). After the initial briefing, residents were divided into small working groups in which they collaboratively decided on which elements they wanted to prioritise for the area, such as type of vegetation, type of pathways, benches, playground elements, etc. This is shown in Figure 9. In designing their plan for the area, the participants needed to consider the boundary conditions mentioned as well as the costs and benefits of the elements they wanted to include, for which they had received an information sheet during the participation events.

***Figure 9**. The process of designing the layout of the flood retention area in Beerse in small working groups. Source: Provincie Antwerpen.*

Phase 5 (2019-2022): Implementation of the flood retention area

After the two participation evenings, the drawings for the design of the flood retention area were made. The project initiators underlined that the final design of the area is strongly based on the ideas provided by the residents and has not been changed significantly after the participation events. “The idea is, we outline and design the flood retention area here, together, without significant changes or adjustment afterwards by policy makers” (interview, 2-3-2022), and residents interviewed also indicated they felt like the project initiators really based the final design of the flood retention area on their input. One of the consultancy organisations was involved in the technical design of the flood retention area, including its additional functions as an NBS. The construction works started in January 2022 and finished in November 2022.

An overview of the different phases in this project, including an estimation of the level of involvement of each of the stakeholders, is provided in Table 4 below.

***Table 4.** Stakeholders involved in the development and implementation of the flood retention area in Beerse, with columns indicating the level of involvement of the stakeholders in the different phases of the project.*

	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**
Province of Antwerp	High	High	High	High	High
CO-ADAPT	Low	Low	High	High	Low
Municipality of Beerse	Low	Low	Medium	High	Medium
Regionaal Landschap Kleine & Grote Nete	Low	Medium	Low	High	Low
Consultancy 1	Low	Low	Medium	High	Low
Consultancy 2	Low	Low	Low	High	Low

Consultancy 3	Low	Low	Low	Low	High
Local residents	Low	Low	Low	High	Low

Attention attributed to justice/fairness/inequalities (RQ1)

There are various regional and local-level FRM and spatial planning policies and plans that impact the implementation of the flood retention area in Beerse. Here we describe if and how issues of justice and equality are considered in these policies. The analysis starts with Flemish-level FRM policies, how the need for space for water through NBS (the measure chosen in Beerse) is framed and whether or not the social impacts of such strategies are recognised. We subsequently zoom in on more local-level FRM policies and adaptation plans. The overall conclusion is that lower-level FRM policy documents and plans are highly technical and little explicit attention is attributed to justice and equality.

FRM policy

The Waterbeleidsnota at the Flemish (regional) level sets out the overarching vision for integrated water policy in Flanders and provides the framework within which the river basin management plans (RBMPs) are implemented. The RBMPs describe actions to be taken at the Flemish level to improve the condition of watercourses and groundwater resources, and to provide protection against floods. The RBMPs also further specify actions to meet the requirements imposed by the EU Water Framework Directive and the Floods Directive. The RBMP for the Scheldt propose a set of basic and additional measures. The measures that specifically apply to the construction of the flood retention area in Beerse are presented in Table 5 below.

Table 5. *Measures proposed in the Scheldt RBMP that encourage the development of a flood retention area in Beerse.*

Measure	Description
Basic measure 6_003	Where possible, preserve water retention capacity through adapted land uses
Basic measure 6_004	Safeguard current and potential water storage areas and capacity
Basic measure 6_007	Increase water retention areas and optimising existing capacity
Additional measure 5B_008	Construction of additional water retention areas to improve the hydraulic regime of surface bodies
Additional measure 5B_009	Construction of additional water retention areas
Additional measure 5B_010	Adaptation to climate change
Additional measure 6_018	Optimise water retention areas through land-use conditions
Additional measure 6_020	Increase water retention capacity for second category, non-navigable watercourses

It becomes clear that none of the measures proposed in the Scheldt RBMP focus specifically on tackling justice and equality in flood risk. The RBMP does describe that flood risks are determined by studying the socioeconomic impacts; however, social impacts are defined as the number of buildings in a potential flood area and the economic impact is determined based on compensations paid by the disaster fund (CIW, 2011a).

No specific attention is attributed to potential differences in social vulnerability of the population, or how to account for those differences to prevent the creation of new or the reinforcement of existing inequalities.

Flanders is further divided into 11 sub-basins. The Laakbeek in Beerse is part of the Nete sub-basin, which has its own river catchment management plan (2008-2013). It outlines the vision for the Nete sub-basin, which aims to increase and optimise water retention capacity of its rivers and further prevent and reduce surface hardening in river valleys. The main objective of the river catchment management plan for the Nete sub-basin is the protection, restoration, and improvement of the natural functioning and structure of the water system. Although the plan recognises that various human interests play an important role in managing the Nete sub-basin, there are no references to justice, equality, or social vulnerability in the plan. It includes no measures or actions to be taken to tackle these issues. Principles relating to resource allocation are only discussed in the context of drought, relating to who gets priority access to water during droughts.

At an even lower level, the sub-river catchment management plan aims to reduce flood risks in the centre of the municipality of Beerse. It contains a specific action (db 10-06_15) that aims to tackle flood risks through reducing overflow from sewage systems as well as expand the water retention capacity of the Laakbeek. The construction of the flood retention area in Beerse is a direct translation of this action into practice.

Local CC adaptation and water management policy

The Municipality of Beerse produced a rainwater and drought plan in 2022. Tackling flood risks in Beerse is based on the principles of integrated water policy (i.e., avoiding surface runoff, stimulating water infiltration, buffering, and reuse of water if possible before draining). The plan underlines that especially low-lying areas along the Laakbeek are prone to flooding due to climate change, hence reserving areas for water retention is stimulated. It is also explicitly underlined in the plan that flood retention areas should fulfil additional functions, such as recreation, nature experience, or as a meeting place for local residents. The case study area is a specific example that translates this objective into practice as it is designed as an NBS that fulfils multiple objectives in addition to water retention, including carbon sequestration, urban cooling, increased biodiversity, nature experience, and recreation. However, in the academic literature, it has been shown that NBS do not necessarily provide benefits to both natural and social systems, as questions remain around the distribution of benefits and burdens of NBS, whether they equally benefit everyone, and NBS can reinforce dynamics of social exclusion through green gentrification (see, e.g., Kaufmann et al., 2021; Nesshöver et al., 2017; Sekulova et al., 2021). These justice implications are not considered in the plan.

Beerse's rainwater and drought plan contains a list of proposed measures that should contribute to building resilience for Beerse's residents through implementing natural water retention areas. Resilience seems to be understood as a property of the system: "to be able to withstand and accommodate new challenges and trends" and to be able to "deal flexibly with future changes" (Gemeente Beerse, 2022, p.74-75). It is not described as characteristic of (vulnerable) people to be strengthened. The plan distinguishes between four types of measures (technical measures, policy change, raising awareness, and conducting research). The flood retention area in Beerse can be considered as a technical measure with the specific aim of reducing flood risks

further downstream. It stands out that the rainwater and drought plan is highly technical. It describes opportunities to take local actions to reduce flood risks in Beerse. None of these actions focus on tackling justice issues in floods, or how attention to differences in vulnerability and equality may contribute to improving the resilience of Beerse's residents to climate change. The plan does not mention SOLARIS key concepts such as social vulnerability, (in)equality, justice, solidarity, or fairness. Furthermore, although the plan is a result of the collaboration between different stakeholders, these include mostly FRM experts and practitioners, whereas social policy domains or residents were not involved in drafting the plan.

Spatial planning policy

Spatial planning policy is also highly relevant for the Beerse case, as the construction of the flood retention area required a change in zoning from residential expansion area to open space. The municipal spatial plan for Beerse, which was approved by the Province of Antwerp on 6 December 2007, describes that the Laakbeek and Grote Beek are important nature areas that should be given sufficient space to flow more freely and should be protected from further development. The plan also describes the importance of the principles of integrated water policy. Two important instruments in Flemish spatial planning are the 'water assessment' and the 'signal areas'. The water assessment aims to discourage development in flood risk areas by obliging decision makers to seek advice from water managers on the impact of permits, plans, and programs on the water system. As described, signal areas are undeveloped land areas with a 'hard' planning designation (e.g., residential or industrial) in flood risk zones that play an important role in preserving the water storage capacity of rivers and reducing flood risks. These two instruments influenced the choice to discourage further development of the empty plots in Beerse, which fits the overall aim of the municipal spatial plan.

Originally, the undeveloped plots in Beerse were labelled as a residential expansion area in the so-called sub-regional plans (interview, 2-3-2022). Sub-regional plans are defining zoning plans in Belgium and determined the land-use for each square meter of land for the entire country (Coppens et al., 2021). To be able to use the plots for water retention, a change in zoning was required, from residential expansion to open space. However, the plots were not owned by the Province of Antwerp or the Municipality of Beerse, but by a family in Beerse that has been described as "relatively big and well-known" by an interviewee (interview, 3-3-2022; 22-3-2022). A change in zoning would result in a loss of development rights for the previous owners, and therefore they were not willing to sell their land. The plots are located near the town centre of Beerse and were therefore seen as an important investment opportunity for the owners (interview, 3-3-2022). The owners also felt disadvantaged because they had to sacrifice their property to contribute to reducing flood risks, even though, in their opinion, it was not their problem to solve (interview, 3-3-2022). Their interests were therefore actively considered in the design of the flood retention area, to increase their willingness to cooperate:

> "Someone from the Regionaal Landschap started a conversation with them [the previous landowners]. I think that really helped, that we considered their opinions and listened to their problems. Because sometimes, when they were really angry, they were not interested in the solutions we were trying to offer. While if we talked to them separately, one-on-one, we could […] find a compromise" (interview, 3-3-2022).

This shows how the stakeholders involved in the project in Beerse had different interests and power regarding the use of the land: while the previous landowners preferred to build on their land, water managers from the Province of Antwerp wanted to use the land for water retention. This conflict of interest resulted in a legal battle that lasted multiple years and significantly delayed the implementation of the flood retention area, even though flood risks further downstream still existed. Financial compensations are also required by law to compensate the owners for the loss of their land. In other words, the landowners had the power to delay, or even prevent, the construction of the flood retention area, and their interests and needs were protected by current policies, which potentially obscures the interests and needs of communities further downstream who are more vulnerable to flooding. It could therefore be argued that current spatial planning policy insufficiently recognises and addresses issues of equality while strongly protecting private property rights.

Once the Province of Antwerp bought the land in 2018, a provincial spatial implementation plan was then drafted to further specify the new zoning of the undeveloped plots in Beerse. The main use of the land will be for water management of the Laakbeek, however secondary functions include social and recreational use.

Attention to justice, fairness, and equality by stakeholders involved in the project

Justice and equality concerns were not actively considered in the development or implementation of the flood retention area in Beerse. The project initiators from the Province of Antwerp did not pay attention to potential differences in vulnerability of the population or the social characteristics of the neighbourhood in which the flood retention area is being constructed: “it is not something we actively considered. […] We did not pay any attention to it, and that is something we might still need to learn. Not only at the municipal level, but also at the level of the Flemish government” (interview, 2-3-2022).

An explanation for the lack of attention to justice and equality in the development and implementation of the flood retention area relates to the project initiators’ perceptions of justice and equality in FRM, and the relevance of these issues for the case of Beerse more specifically. The project was developed by water managers from the Province of Antwerp. Water managers are engineers and are characterised by a technical approach to climate change adaptation (O’Hare & White, 2018) with often a lack of attention to justice and equality in floods. Water managers’ main task relates to managing watercourses and they are generally further removed from social issues, such as social vulnerability and inequality in flood risks (interview, 27-9-2022). Water policy is considered as just when it serves and promotes the common interest. It is believed that:

> “Water makes no distinction between rich and poor. The houses that suffer from flooding in Flanders are usually single-family homes. Whether those are inhabited by two earners, or certain ethnicities… It is not just the impoverished neighbourhoods that experience flooding. We have never seen that. It is the average Fleming who is victimised by floods” (interview, 27-9-2021).

As a result, no specific attention was attributed to differences in social vulnerability to floods in the development of the flood retention area in Beerse. The project initiators also believed that attention to justice and equality

would not have significantly contributed to the effectiveness of this project, nor to the effectiveness of FRM policy more generally (interview, 27-9-2021; 2-3-2022).

Role of participation (RQ2)

Residents in Beerse were involved in the design of the flood retention area through co-creation processes. A big reason for initiating the participation processes was funding. The Province of Antwerp, like most governments in Flanders, are constantly looking for extra funding. They submitted the Beerse project to CO-ADAPT to receive European funding, but CO-ADAPT only included project where residents would be actively involved in the process through co-creation. Participation opportunities therefore needed to be provided in Beerse for the project to be eligible for the European funding. About 60 residents from the neighbourhoods surrounding the flood retention area in Beerse participated. However, these neighbourhoods are not characterised as highly socially vulnerable (interview, 14-3-2022), which may explain the project initiators' belief that justice and equality are not major concerns in the case study area.

Furthermore, residents located further downstream from the flood retention area were not involved in the co-creation processes, and their socioeconomic and demographic characteristics remain underexplored. The project initiators did not actively seek to identify or include vulnerable groups in the participation procedures (interview, 2-3-2022), and their voices may not have been heard. As one of the water managers involved in the development of the project explains:

> "We organised two participation evenings and provided an information flyer in the neighbourhoods surrounding the flood retention area. […] That is where it stopped for us. We did not ask questions such as: Who are we forgetting here? Who are we not reaching at all? We tried to account for the elderly as a target group, but we did not get much of a response to that" (interview, 2-3-2022).

Furthermore, the impact of residents on the outcome of the co-creation events remained limited. Although the processes did stimulate joint decision making between residents, and participants did feel like their ideas were heard and actively taken along in the design of the flood retention area, the primary objectives (i.e., increasing the water buffering capacity of the Laakbeek) had already been established beforehand by water managers from the Province of Antwerp. Residents were not included from the onset of the project and their influence remained limited to secondary aspects. They could provide input on, e.g., vegetation, type of pathways used, whether to include benches, picnic tables, streetlights, and playground elements, etc. in the flood retention area (interview, 2-3-2022). Furthermore, one of the main objectives of organising the participation events was to prevent resistance, as it was expected beforehand that residents would experience some disruptions due to the construction works (interview, 1-12-2022). Questions therefore remain around the inclusivity of the co-creation processes in Beerse as well as the impact of participants. It can be said that the processes remained largely tokenistic (as per Arnstein 1969) as residents were not included from the initial design stages of the project, and are unlikely to contribute to procedural or distributive justice.

Knowledge and capacity building on social inequalities (RQ3)

Water managers' understanding of justice and equality in Beerse relates to the availability of information and knowledge about vulnerable groups at higher levels of government in Flanders, and within the domain of water management in particular. As mentioned, water managers are often engineers using a technical approach to reduce flood risks. Actively considering differences in social vulnerability within the population is not their main area of expertise. This further is illustrated in the Beerse case by the organisation of the participation processes. Participation was initially not planned for the project, until the project initiators joined the Interreg CO-ADAPT project. CO-ADAPT provided the funds needed to hire two consultancy organisations specialised in stakeholder participation. The project initiator explains why this was necessary: "we have little experience with that [participation] in our department" and "this was the first project with such active citizen involvement" (interview, 2-3-2-2022). This highlights a lack of knowledge of and experience with differences in social vulnerability or how to engage different groups in society.

However, stakeholders involved in the project do acknowledge that knowledge about the neighbourhood in which projects are implemented is important to understand the needs of different groups and to effectively map and tackle inequalities (interview, 3-3-2022; 22-3-2022). According to interviewees from the Municipality of Beerse, such contextual knowledge is available at municipal level and within neighbourhood associations. The project initiators also underlined that they rely on local governments to provide them with information about where vulnerable groups are located and what their needs are, because local authorities work in much closer proximity to their residents (interview, 27-9-2021). However, information about the social vulnerability of the neighbourhoods surrounding the case study area in Beerse was not requested for this project.

Based on our interviews, we conclude that public authorities from the Municipality of Beerse seem to be more sensitive to justice and equality issues in floods compared to water managers from the Province of Antwerp. They are more aware of where vulnerable communities may be situated in Beerse and how to address their needs and concerns. However, it should be noted that local-level policy makers have additional incentives to consider the interests and needs of vulnerable communities, as it may impact their chances of being re-elected. Municipal authorities strongly underline the importance of interdisciplinarity in mapping and tackling issues of justice and equality in flood risks:

> "We need to include people from various policy domains such as urban planning, mobility, poverty, culture, and sustainability, as well as stakeholders from public social welfare centres in the municipality. […] If you bring those people together, you will get a much more realistic idea of the vulnerable communities and their needs" (interview, 3-3-2022).

Furthermore, authorities from the Municipality of Beerse underline that national or regional-level statistics are insufficient to understand the needs and interests of vulnerable communities. When asked how to make this contextual knowledge available to water managers, one respondent explained:

> "We just have to organise another meeting. Although a lot of numerical information can be found online, it is important to get a real feeling with the neighbourhood. I would personally take the water managers to the neighbourhood in question. […] We walk through it while I explain more about the background of the neighbourhood and the people living there. In this way, you get more of a feeling with the numbers that are presented on websites" (interview, 22-3-2022).

However, the Municipality of Beerse was not a full partner in the development and implementation of the flood retention area, as managing flood risks along the Laakbeek falls under the responsibility of the Province of Antwerp. Including public authorities from the municipality in the development of the project may have increased attention to justice and equality in the flood retention area in Beerse.

Conclusion

Here we briefly summarise the main results of our analysis of the first case study. The project in Beerse was initiated by water managers from the Province of Antwerp, who conducted modelling simulations to determine the optimal location for a flood retention area reduce risks further downstream. A change in zoning was required to realise this project, but the previous owners were initially not willing to sell their land. This resulted in a legal battle that significantly delayed the implementation of the project. The landowners' interests and needs were also actively taken into consideration, potentially obscuring the needs of those living further downstream. Overall, there was little attention to justice concerns in the development of the project. Residents were involved in the design of the flood retention area, but their impact on the outcome of the participation events remained limited to secondary design aspects. The 'co-creation events' may therefore remain partly tokenistic. The lack of attention to justice and equality may be explained by the fact that the project initiators are engineers, characterised by a technical approach with little attention to the social impacts of floods. Municipal authorities may be more aware of where vulnerable communities are situated, as well as their needs and interests. However, the Municipality of Beerse was not a full partner in this project.

Section 3: Geraardsbergen (Case Study 2)

Case description

Case study area

Introduction

This second case study is situated in the municipality of Geraardsbergen. Geraardsbergen is located close to the border with Wallonia in the south of the Province of East Flanders, in Flanders, Belgium, as is shown in Figure 10 below. Geraardsbergen is a medium-sized municipality with just over 34,000 inhabitants. Geraardsbergen's population density is 425 inhabitants per km^2 (compared to the average of 492 inhabitants per km^2 for Flanders) (Provincie in Cijfers, 2022a).

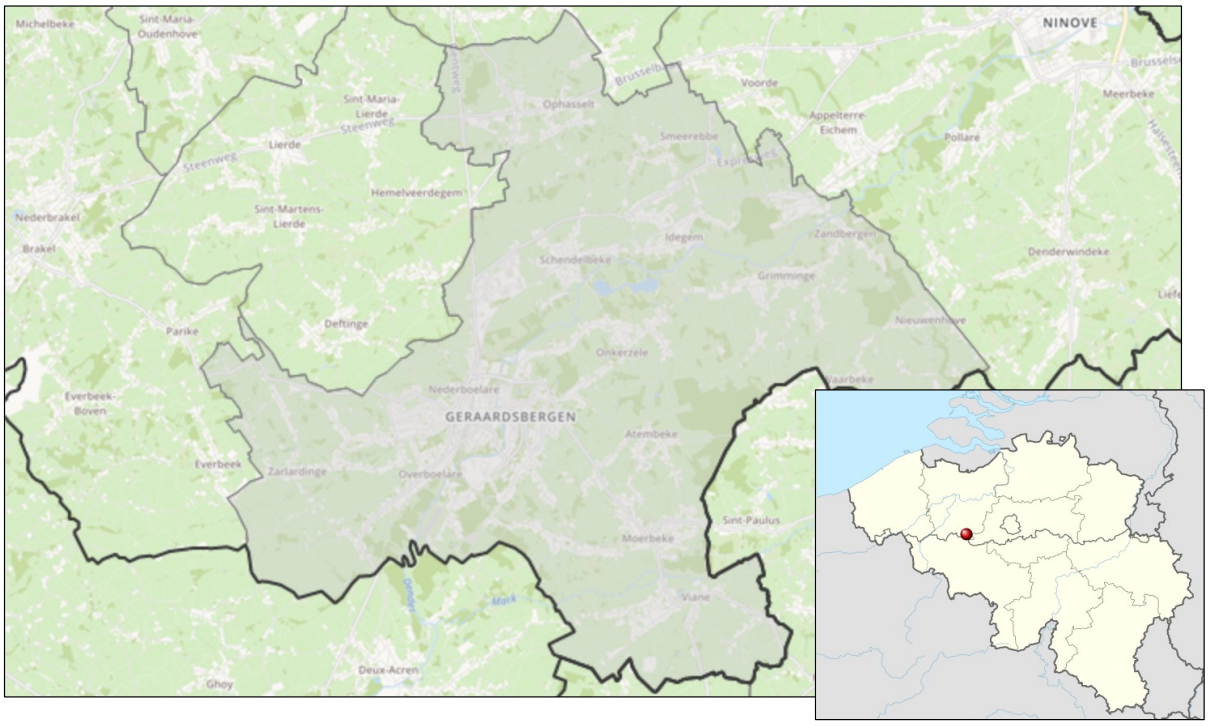

***Figure 10**. Map showing the location of Geraardsbergen. Adapted from www.provincie.incijfers.be and Wikipedia.*

The Dender River flows through the municipality of Geraardsbergen. The Dender is 69 km in length (of which 51 km are located in Flanders) and flows through the provinces of East Flanders and Flemish Brabant. Its catchment is 1,384 km^2 in size (for comparison, the Scheldt River catchment is 21,863 km^2). The Dender flows into the Scheldt river at the municipality of Dendermonde. The Scheldt is a 350 km long river that runs through northern France, western Belgium, and flows into the North Sea in the southwest of the Netherlands. The Dender is canalised, and in 1865 multiple sluices were built to facilitate navigation. However, at present, the sluices prevent effective drainage of the Dender's discharge to the Scheldt river (Mees, Suykens, et al., 2016), thereby contributing to flood risks.

Geraardsbergen is located in the hilly Dender valley at an average altitude of 42 metres. Although Geraardsbergen is located relatively close to big cities such as Brussels and Ghent, it is more rural which attracted people looking for affordable building plots in the countryside (Mees, Suykens, et al., 2016). The

combined effect of hills, soil characteristics, and land-use (70% of the area consists of arable land and meadows) in the Geraardsbergen area results in high soil erosion potential, especially on loamy soils along steep slopes (Gemeente Geraardsbergen, 2018). Precipitation intensity and duration largely determine erosion in the area, as well as vegetation cover.

The Dender is a navigable watercourse and its management falls under the responsibility of W&Z (Waterways & Sea Canal). However, many tributaries of the Dender in the Geraardsbergen area are non-navigable watercourses that fall under the responsibility of different water managers (Gemeente Geraardsbergen, 2018). The main actor in this case study is the Flemish Environment Agency (Vlaamse Milieumaatschappij, VMM), responsible for the management of first category, non-navigable watercourses (see Table 1 on page 7).

Socioeconomic and demographic characteristics

This section provides some socioeconomic and demographic statistics of the case study area, including population characteristics, nationality/ethnicity, economy and work, and poverty. Geraardsbergen is experiencing population growth, from 32,723 in 2012 to 34,366 in 2022 (an increase of 5%). This trend is likely to continue in the coming decades. 19.1% of the population in Geraardsbergen is younger than 18 years old (with 3.6% of the population between 0 and 3 years) and 20.8% of the population is older than 65. The average age in 2021 was 43 years old. Although the number of people aged over 65 years in Geraardsbergen is slightly higher compared to Beerse, it is still comparable to the Flemish average (where 1 in 5 people are 65 years or older). About 14% of Geraardsbergen's inhabitants live alone (Provincie in Cijfers, 2022c).

The population of Geraardsbergen is made up of different nationalities. According to statistics from 2021, 16.6% of the population has a non-Belgian origin. 10.9% of the population has a non-EU origin, which is almost twice as high as the proportion of inhabitants with a non-EU origin in Beerse. The number of inhabitants with non-Belgian nationalities in Geraardsbergen has increased significantly in the last three decades, from 453 (1.5%) to 5,253 (15.4%) in 2021 (Provincie in Cijfers, 2022d). Although ethnicity has been identified as an important determinant of vulnerability to floods, it is often related to other factors, such as socioeconomic status and education. In Geraardsbergen, the proportion of people working in 2019 was 44.2%. This number is similar for those with Belgian and non-Belgian, EU origins: 45.7% and 43.5% respectively. However, the proportion of people working with a non-Belgian, non-EU origin is much lower: 30.3% in 2019. A similar pattern can be observed for the proportion of inhabitants looking for a job. For inhabitants with a Belgian origin, this number equals to 1.3%. For those with a non-Belgian, EU origin it equals to 1.5%, and for those with a non-Belgian, non-EU origin it equals to 2.9% (Provincie in Cijfers, 2022d), similar to the numbers in Beerse.

In 2019, the average net taxable income per resident in Geraardsbergen was €19,848, which is lower than the average of the Province of East-Flanders (€20,804) (Provincie in Cijfers, 2022e). In the same year, the percentage of people with a net income lower than €10,000 was 17% and 3.9% of the population receives social welfare benefits. The number of people living in social rent is 373, which equals to about 1.1% of the total population. The number of children born into underprivileged families in Geraardsbergen is 19.2%, which

is high compared to that number for Beerse.[10] Table 6 provides an overview of some relevant socioeconomic and demographic statistics for FRM in Geraardsbergen.

Table 6. *Overview of relevant socio-spatial indicators in Geraardsbergen. Retrieved from: www.gemeente-stadsmonitor.vlaanderen.be and www.provincie.incijfers.be*

Category	Indicator	Value	Measurement year
Demography	Percentage of people aged >65 years	20.8%	2021
	Percentage of people aged <18 years	19.1%	2021
	Percentage of children aged 0-3 years	3.6%	2021
	Population growth	8.7%	2021
Nationality	Percentage of inhabitants with non-Belgian, EU origin	4.5%	2021
	Percentage of inhabitants with non-Belgian, non-EU origin	10.9%	2021
Work	Proportion of people working	44.2%	2019
	Proportion of people working Belgian origin	45.7%	2019
	Proportion of people working with non-Belgian, EU origin	43.5%	2019
	Proportion of people working with non-Belgian, non-EU origin	30.3%	2019
	Proportion of people looking for a job with a Belgian origin	1.3%	2019
	Proportion of people looking for a job with a non-Belgian, EU origin	1.5%	
	Proportion of people looking for a job with non-Belgian, non-EU origin	2.9%	2019
Poverty	Average net income per inhabitant	€19,848	2019
	Inhabitants with a net income <10,000	17%	2019
	Inhabitants with social welfare benefits	3.9%	2021
	Percentage of children born in underprivileged families	19.2%	2020
Health	Percentage of inhabitants with chronic illnesses	13.6%	2020

In general, the socioeconomic and demographic trends are fairly similar for Beerse and Geraardsbergen. The municipalities do not significantly differ in terms of population growth and the projected increase in the number of people aged over 65. The percentage of non-Belgian inhabitants in Geraardsbergen is higher than in Beerse, especially the percentage of non-EU inhabitants. This suggests that the population in Geraardsbergen is somewhat more diverse. The average income in Geraardsbergen is lower than the average for the Province of East-Flanders, and the percentages of social welfare recipients and of children born in underprivileged families is relatively high. This may suggest that Geraardsbergen's population is more socially vulnerable to the impacts of floods. However, again, these statistics do not include perspectives and needs of local residents and should therefore be interpreted with caution.

FRM background

Geraardsbergen is highly vulnerable to flooding causing a high risk of potential damage (Gemeente Geraardsbergen, 2018). Geraardsbergen experiences both fluvial and pluvial flood risks. Fluvial flood risks are

[10] www.gemeente-stadsmonitor.vlaanderen.be

caused by the Dender River. The Dender is a so-called 'spate' river. It is a fast-flowing river, and its discharge is strongly determined by the amount of rainfall. As a result, water levels can suddenly rise during periods of high or intense precipitation (Mees, Suykens, et al., 2016). Since the 1970s, continued spatial development in the Dender valley has increased flood risks by reducing the space for the Dender to flow and flood freely. This has increased the flood vulnerability of the river basin. Effective flood risk areas in Geraardsbergen are concentrated along the Dender river, which is shown in Figure 11 below.

In addition to fluvial floods from the Dender River, Geraardsbergen is also susceptible to pluvial floods. Its location in the hilly Dender valley increases the risk of erosion and runoff during extreme precipitation events. This compounded by the municipality's surroundings, with 70% consisting of arable land and meadows (Mees, Suykens, et al., 2016).

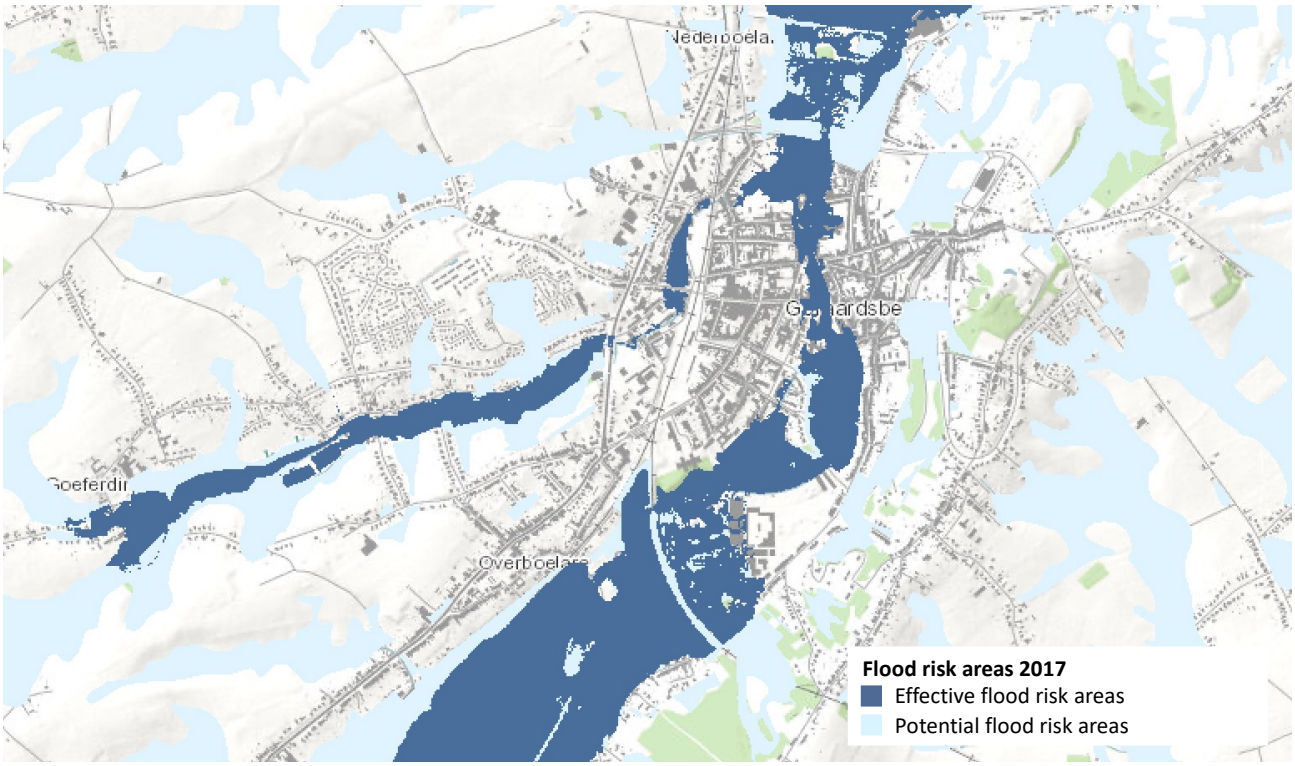

***Figure 11**. Flood risk areas in Geraardsbergen, showing both effective flood risk areas as well as potential flood risk areas Source: www.waterinfo.be.*

Flood risks in Geraardsbergen may further increase in the future due to climate change and the projected increase in the frequency and intensity of extreme precipitation events in Flanders (Helsen et al., 2020). Figure 12 below shows projections of precipitation change under different climate scenarios for Geraardsbergen. In all scenarios, precipitation in mm per event is expected to increase, which increases potential losses and damages. For example, the percentage of buildings impacted by floods in Geraardsbergen is expected to almost double by 2050 under a high impact climate scenario.[11]

[11] https://klimaat.vmm.be/kaarten-en-cijfers

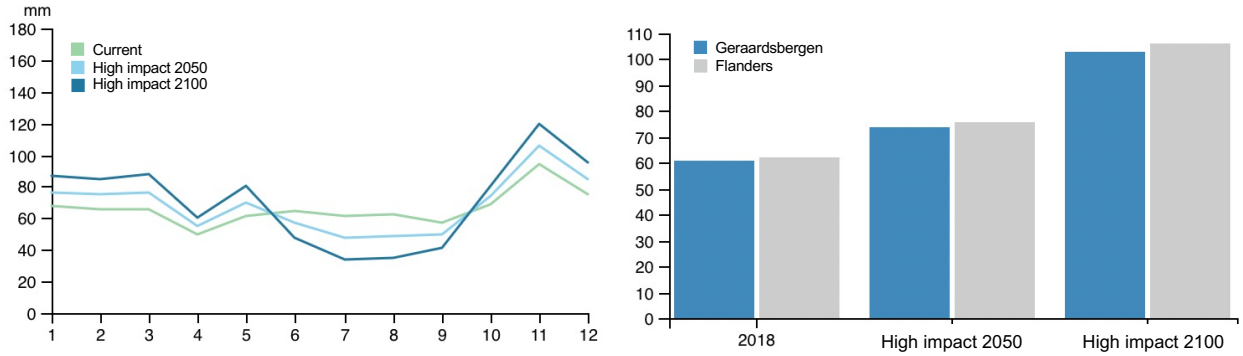

***Figure 12**. Projections of precipitation change per month for Geraardsbergen (on the left) and per year (on the right) for Geraardsbergen and Flanders, under different climate scenarios. Retrieved from www.klimaat.vmm.be.*

Over the last two decades, fluvial floods from the Dender river have caused flood damage on multiple occasions: in 1995, 1999/2000, 2002/03, and 2010. The most severe flood event occurred in November 2010, which resulted in the flooding of 389 households in Geraardsbergen and one casualty (Mees, Suykens, et al., 2016). In May 2016, exceptional rainfall caused local mudslides and put pressure on the sewage system in Geraardsbergen. Many streets and houses were flooded and suffered water damage (see Figure 13). The floods also caused agricultural damage from erosion on the newly tilled and sown fields.[12] This pluvial flood event led to the establishment of a municipal intervention plan in Geraardsbergen.

***Figure 13**. A street in Geraardsbergen flooded due to extreme precipitation in May 2016. Retrieved from: www.nieuwsblad.be.*

[12] https://www.integraalwaterbeleid.be/nl/bekkens/denderbekken/overstromingen/overstromingen-2016-in-kaart-gebracht

Project description

In the last decade, there has been a growing understanding in Flanders that collective flood protection measures alone will likely be insufficient to fully prevent floods. There are various reasons for this, including cost saving, building resilience at the level of individual properties, and a lack of public space (Mees, 2017). Instead of an exclusive focus on flood protection, the importance of flood prevention and preparedness are increasingly recognised. In other words, non-structural measures are needed in addition to dikes and embankments, such as changes in land-use policy, early warning systems, and measures at the level of individual properties to prevent water from entering buildings (Attems et al., 2020). The VMM therefore increasingly stimulates the implementation of property-level protection (PLP) measures to reduce flood risks. Examples include waterproof interior materials, non-return valves, and flood gates (see Figure 14).

Figure 14. *Flood gate fitted over a front door. Retrieved from: www.climatejust.org.*

To increase awareness and interest in PLP, the VMM started pilot projects in various municipalities in 2015 (Sint-Genesius-Rode and Beersel) and 2017 (Lebbeke, Sint-Pietersleeuw, and Geraardsbergen). For this report we focus on Geraardsbergen specifically. Geraardsbergen was chosen as a location for the VMM's pilot project for two main reasons: 1) Geraardsbergen experiences both fluvial and pluvial flood risks and have suffered multiple floodings in recent years, hence it was expected there would be a lot of interest in the project, and 2) all potential collective flood protection strategies, such as embankments and flood retention areas, had already been implemented along watercourses managed by the VMM, but remained insufficient to eliminate flood risks (interview, 29-7-2022).

The project in Geraardsbergen aimed to provide households advice on the PLP measures most suitable for their home. In 2018, an information meeting was organised by the VMM in collaboration with the municipality

to inform Geraardsbergen's residents about the need for PLP and how to sign up to receive advice. All residents of Geraardsbergen could sign up; the project did not specifically focus on an area or neighbourhood within Geraardsbergen that experiences high flood risks. About 80 households signed up. Technical experts hired by the VMM visited each of the households and provided tailor-made advice on the protection measures most suitable for their property. The advice was without obligation, i.e., the choice whether to implement the measures was left to residents. The Municipality of Geraardsbergen aimed to further stimulate the implementation of the PLP measures by providing a subsidy that covers part of the installation costs of PLP. However, the subsidy only covers 50% of the costs made, up to a maximum of €250.
Stimulating PLP in Geraardsbergen can be categorised as flood risk mitigation, as it includes measures inside the risk area to flood-proof properties (Hegger et al., 2016).

Socio-spatial inequality in the case study area

In contrast to the Beerse case discussed in the previous section of this report, Geraardsbergen and the surrounding area is characterised by a diverse set of social profiles. There are bigger differences in socioeconomic status between different social groups. This is especially true for Geraardsbergen's city centre, which, at the same time, is also very vulnerable to flooding. "About 1/5 people live in the city centre. […] But if we look, for example, at the number of people receiving social welfare benefits or people with increased social risk, then 70-80% of those people live in the city centre" (interview, 18-11-2021). As large parts of the city centre are susceptible to fluvial flooding from the Dender, these floods may be more likely to hit socially vulnerable groups.

These statements are supported by previous research showing that some neighbourhoods in Geraardsbergen are socially more vulnerable to flooding than others. Coninx and Bachus (2007)'s analysis is based on various socioeconomic and demographic indicators, including age, health status, income, family composition, nationality, and type of property. Figure 15 below shows which neighbourhoods in Geraardsbergen are considered as extremely socially vulnerable to flooding, indicated in red.

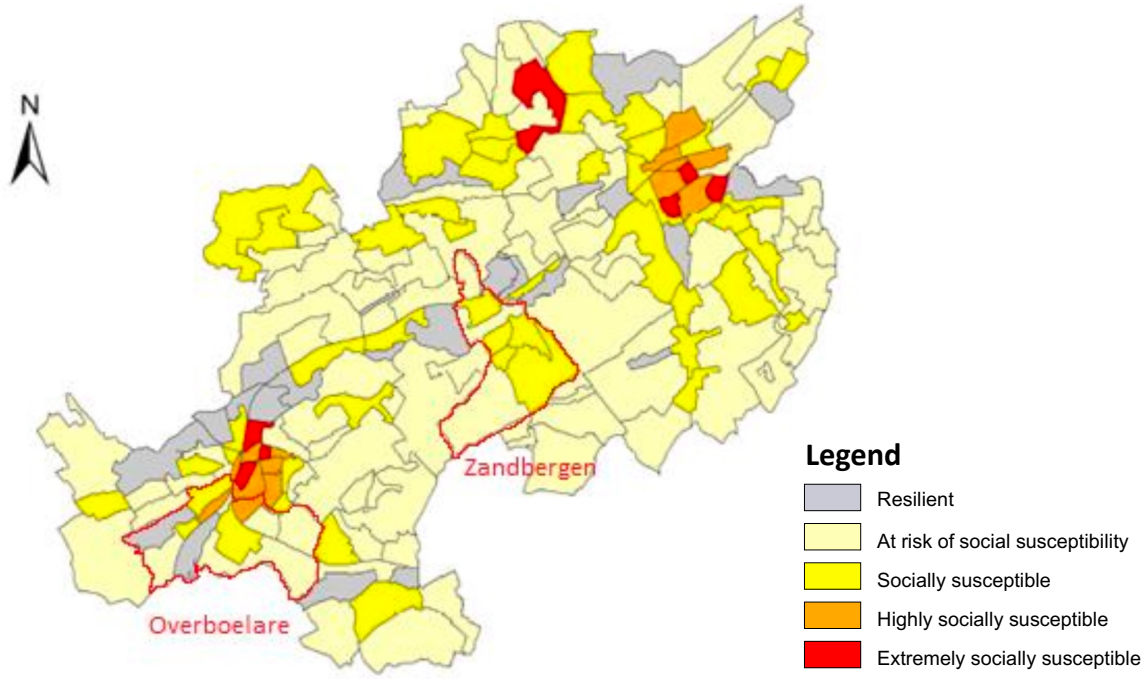

***Figure 15**. Map of Geraardsbergen showing which areas are socially vulnerable to flooding. Source: Coninx and Bachus (2007).*

Although social vulnerability to flooding varies significantly between different areas, as can be seen in Figure 15, Coninx and Bachus (2007) confirm that the most vulnerable areas are located near the city centre of Geraardsbergen along the Dender. Their study also shows that social vulnerability to flooding in Geraardsbergen is likely to increase in the future, due to "the increasing proportion of financially deprived people, the high percentage of single parents, and the ageing population" (Coninx & Bachus, 2007, p. 17). The same authors conducted another study in 2009 which further strengthened these results. Their geographical analysis showed that social vulnerability in the Dender basin is highest among the five basins studied (the other basins being the Yser, Demer, Meuse, and Nete basins; the Laakbeek in Beerse is part of the Nete basin). They identified the proportion of single parents and financially deprived people as main driving forces of social vulnerability. According Coninx and Bachus (2009), policy makers should direct measures towards socially vulnerable groups through extra financial support, risk communication, and spatial planning. It is important to acknowledge that the studies by Coninx and Bachus may be outdated – but there is not more recent data available.

The relatively large proportion of financially deprived people may result in difficulties to cope with loss and damage resulting from floods as well as difficulties to prepare for future flood events, due to, e.g., disruption of physical and financial health, lack of financial means, and difficulties in meeting basic needs or rebuilding their house (Coninx & Bachus, 2009). A focus on PLP in Geraardsbergen therefore raises some important questions, such as: Does the VMM's project consider differences in the capacity of citizens to contribute to FRM through implementing PLP? What are the consequences of a potential (mis)match between the need for PLP and the capacity of Geraardsbergen's residents to implement these measures, in terms of (increased) flood risks and (reduced) resilience?

Methods

To further explore these questions, we take a similar approach as we adopted in our Beerse case: a qualitative, case study approach using a mixed-method design based on document analyses and interviews. The first method of data collection, document analysis, involves analysing relevant legislation and policy documents to FRM in the case study area. Interviews with public authorities, policy makers, and other experts and practitioners involved in PLP in Geraardsbergen forms the second method of data collection. We briefly explain the choice for Geraardsbergen as a case study before elaborating on how the empirical data was gathered.

Case selection

The limits of collective, infrastructural flood protection are becoming more and more visible, so further flood protection at the level of individual properties is needed. However, issues of inequality and justice are often not actively considered or addressed through policies that aim to stimulate the uptake of PLP, which makes it a highly relevant topic to include in this SOLARIS report.

Geraardsbergen specifically was selected for this project because of its flooding history (flood events in 1995, 1999, 2001, 2003/03, 2010, 2016) and because of the diversity of social profiles in the municipality, which provides an opportunity to further explore how differences in social vulnerability to floods can influence the implementation of PLP measures by all groups in society. Additionally, previous research has shown that social vulnerability to flooding in Geraardsbergen will likely increase over time (Coninx & Bachus, 2007) which further underlines the relevance and urgency of studying the impact of differences in social vulnerability on PLP implementation. We evaluate and explore how (a lack of) attention to social vulnerability, equality, and justice in the development and implementation of the VMM's project influences the distribution of flood risks in Geraardsbergen, the potential consequences for the policy's effectiveness, as well as where governments can help to ensure equal opportunities to implement PLP and build resilience to floods.

Data collection and analysis

The data for this case study report was collected through document analyses and interviews. A thematic analysis was conducted of relevant local and regional FRM policy documents and plans, to better understand the local discourse on justice and equality in Geraardsbergen. The documents were analysed by studying how central SOLARIS concepts, such as capacity, (procedural and distributive) justice, equality, equity, fairness, opportunity, participation, recognition, socioeconomic characteristics, solidarity, and vulnerability, are considered and addressed. Furthermore, we analysed whether the documents specifically referred to shared responsibility and PLP. The following documents were analysed: the Waterbeleidsnota, the Scheldt RBMP, the river catchment plan for the Dender river specifically, and Geraardsbergen's rainwater plan.

We also conducted semi-structured interviews with public authorities and other stakeholders involved in the development and implementation of the VMM's pilot project on PLP in Geraardsbergen. At this stage, 3 respondents were interviewed, from the VMM, as well as from voluntary town councils and community members. More interviews will be added. During the interviews, we reflected on justice and equality

perceptions of the stakeholders involved in the project, as well as on their opinions on how differences in social vulnerability may impact the capacity of individuals to implement PLP. Interview questions focused on the characteristics of the project, the stakeholders involved, on social vulnerability to floods, and on the role of knowledge about vulnerability, justice, and equality in the design of the project. Additional questions focused on building resilience through PLP, how to actively consider the needs of vulnerable groups in implementing PLP, and the role of the government to fulfil those needs. The interviews were transcribed and thematically analysed in Nvivo. A systematic and iterative process was followed to inductively code the interview results.

Results

We first present the main stakeholders involved in the development and implementation of the project on PLP in Geraardsbergen, as well as the different phases in the project and the level of involvement of each stakeholder in those phases. The rest of the results are structured around the three main SOLARIS research questions. This section aims to answer (1) if and how issues of justice and equality were recognised and addressed in the development and implementation of the project in Geraardsbergen, (2) if the participation processes contributed have the potential to contribute to a fairer outcome (distributive justice), and 3) which indicators, knowledge, and expertise on social vulnerability to floods were available to and used by the project developers, or what knowledge is perceived to be needed by the stakeholders to actively consider social vulnerability to increase the uptake of PLP in the future.

Stakeholders involved

Various stakeholders were involved in the development and implementation of the VMM's PLP project in Geraardsbergen. Table 7 below provides an overview of each of the stakeholders, whether their involvement in the project was central or more decentral, their power base, and the specific tasks or roles in the project.

***Table 7**. Stakeholders involved in the development and implementation of the VMM's PLP project in Geraardsbergen, including their power base and specific role.*

Stakeholder	Central/minor	Power base	Specific role(s)
Flemish Environment Agency (VMM)	Central	Division of water management responsibilities	• Initiated and developed the project • Provided funding for the project, from the agency's general budget. Funding not from taxation • Organised and hosted an information meeting in Geraardsbergen for residents to learn about the project and sign up • Hired technical experts for house visits
Municipality of Geraardsbergen	Minor	Project implemented on their territory	• Played an important role in communicating the VMM's plans to the public and showing support • Provide a subsidy to cover part of PLP installation costs (max. up to €250)
Technical experts (external organisation)	Central	Expertise	• Visited each of the households • Provided tailor-made advice about the most suitable PLP measures

80 households in Geraardsbergen	Central	Flood measures to be implemented at the property level	• Two plans for each household: a 'low cost' and a 'full protection' scenario • Initiated and developed the project • Responsible for implementing the advised PLP measures • Responsible for covering the installation costs

Project timeline

Phase 1 (2012-2017): Preparatory analyses

The initial plans to stimulate PLP to protect homes from flooding in Flanders originated 10 years ago. Analyses conducted by water managers from the VMM in the context of MLWS further underlined the importance of flood risk prevention and preparedness in addition to collective flood protection measures. As described by the project initiator:

> "For decades, it was believed we could solve flood risk issues by building dikes and flood retention zones, and by straightening rivers where needed. Obviously, this did not work and only relocated the problems to areas further downstream, so we really have to focus on MLWS. Providing flood protection at the level of individual properties is an important aspect of that" (interview, 29-7-2022).

The focus on PLP is also partly triggered by contacts between the VMM and water managers in the UK, where protection of individual properties is further advanced compared to Flanders. The VMM initiated the first pilot projects on PLP in 2015 in two Flemish municipalities: Beersel and Sint-Genesius-Rode. According to the project initiator, the residents in these two municipalities were interested and enthusiastic about the project. Three new pilot projects were therefore started in 2017, in Lebbeke, Sint-Pieters-Leeuw, and Geraardsbergen. This marks the start of our case study project.

Phase 2 (2018): Informing Geraardsbergen's residents and raising awareness

On February 22, 2018, the VMM hosted an information meeting together with the Municipality of Geraardsbergen. The meeting was targeted at everyone living in Geraardsbergen – not just those living in a specific area at risk of flooding. Residents were informed about the meeting through media channels of the municipality. During the information meeting, residents were informed about the need for PLP in Geraardsbergen, the different types of measures that can be implemented, and about the project for which residents could sign up to get free advice on the PLP measures most suitable for their property.

Different stakeholders were invited to the information meeting. Not only local residents were invited, but also private stakeholders with expertise about the need for and the practical side of installing PLP. For example, representatives from companies who provide different types of PLP (e.g., flood gates) were present, as well as Aquafin, a Flemish company responsible for pre-financing, developing, and managing infrastructure for water treatment in Flanders. These stakeholders were invited to provide residents with answers on their questions about PLP.

Phase 3 (2018-2019): House visits by technical experts

About 80 households signed up for the project. Technical experts from an external organisation were hired by the VMM, who visited each of the households and provided them with free advice on the PLP most suitable for their property. The experts provided the households with two scenarios: a basic plan (lowest investment costs, basic flood protection) and an advanced plan (expensive, automated system, full flood protection). Residents could decide for themselves whether they wanted to implement the PLP measures, and if so, they were responsible for paying for the measures. Residents could apply for a subsidy from the municipality to cover part of the installation costs.

Phase 4 (2019): Feedback

In 2019, a study was conducted by researchers from the University of Ghent to explore which of the households who signed up for individual advice actually implemented the PLP measures. The results showed that only 7 households fully implemented the advised PLP measures, and 18 households partly implemented the measures. One of the main reasons mentioned by the residents to not implement the suggested PLP relates to the costs, it is considered as relatively expensive. An overview of the different phases in this project, including an estimation of the level of involvement of each of the stakeholders, is provided in Table 8 below.

***Table 8**. Stakeholders involved in the development and implementation of the VMM's PLP project in Geraardsbergen, with columns indicating the level of involvement of the stakeholders in the different phases of the project.*

	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Flemish Environment Agency (VMM)	High	High	High	Medium
Municipality of Geraardsbergen	Low	High	Low	Low
Technical experts	Low	Low	High	Low
Households	Low	Low	High	Medium

Attention attributed to justice/fairness/inequalities (RQ1)

Various regional and local-level CC adaptation and FRM policies impact the plans and strategies implemented at the local level in Geraardsbergen. The analysis starts with Flemish-level FRM policies, how these policies address the need for responsibility sharing in FRM (through property-level measures) and whether the potential justice implications are recognised. We subsequently zoom in on more local-level FRM policies and adaptation plans. Similarly to the policies and plans that apply to the Beerse case, the documents analysed here are technical and pay little attention to the SOLARIS concepts.

FRM policy

At the Flemish (regional) level, the Waterbeleidsnota sets out the overarching vision for integrated water policy in Flanders. The Waterbeleidsnota includes references to responsibility sharing in FRM. It underlines how

flooding causes a lot of damage in Flanders, and that previously, 'keeping the water out' has always been the main objective. However, that changed significantly after 1976, when major flooding occurred. It was then realised that "that space must be given to rivers, instead of embanking them. […] We became more aware that we cannot protect ourselves against every flood. Since then, we focused more on preventing damage from flooding through multi-layer water safety [MLWS], with measures in the domain of protection, prevention, and preparedness, and with shared responsibility for implementing these measures" (CIW, 2020, p.20). In other words, a shift in discourse occurred. Not only public authorities, but also other sectors and citizens are responsible for reducing damage from flooding.

The Waterbeleidsnota also underlines that many governmental organisations, sectors, and citizens are insufficiently aware of flood risks and how reducing flood risks is a shared responsibility. One of the objectives in the Waterbeleidsnota is therefore also to increase awareness around flood risks and how PLP measures taken at the individual level can reduce overall flood damage. However, in this vision for integrated water policy in Flanders, no attention is attributed to potential differences in social vulnerability between citizens that may determine whether they have the capacity to take up responsibility in FRM and implement PLP.

The Waterbeleidsnota provides the framework within which the river basin management plans (RBMPs) are implemented. The RBMP for the Scheldt does not refer to PLP specifically. However, in the same way the Waterbeleidsnota refers to responsibility sharing, the Scheldt RBMPs states that: "an optimal mix of measures from the 3 Ps [prevention, protection, preparedness] for FRM implies a choice for MLWS and shared responsibility. Water managers, spatial planners, crisis services, the insurance sector, and citizens must be aware of their responsibility and their role to fulfil for efficient FRM" (CIW, 2011a, p.255). It is explained how water managers still play an important role in flood protection, but that citizens can and should assume responsibility in prevention and preparedness as well. Generally, PLP measures are considered as a preventative measure in Flanders. However, again, there is no recognition of differences between citizens that may affect their capacity to protect their own properties from flooding. No attention is attributed to justice and equality in the Scheldt RBMP.

As we described in the Beerse case section, Flanders is further divided into 11 sub-basins. The Dender that flows through Geraardsbergen (see Figure 16) is one of these sub-basins has its own river catchment management plan (2022-2017). It contains general information about the Dender river, which governmental bodies are responsible for which watercourses in the Dender basin, which problems and challenges occur, and how these can be tackled by outlining a general vision and more specific actions. The Dender RCMP refers to PLP on two occasions. The document describes how flooding is a frequently recurring problem in the Dender basin. Combining prevention, protection, and preparedness, as well as responsibility sharing among various stakeholders, will lead to a reduced risk of flooding and damage. The importance of PLP specifically is underlined in relation to pluvial floods, as these measures can significantly reduce the number of people experiencing damage. However, the river catchment management plan for the Dender is a technical plan. It does not refer to justice and equality in FRM in general and does not recognise how stimulating PLP can be

problematic without recognising differences in the capacity of citizens to implement PLP measures, for example, due to their financial situation or because they rent the property from a landlord.

Figure 16. *Dender rivier in Geraardsbergen. Retrieved from: www.wikipedia.be.*

Local CC adaptation and water management policy

After the floods of May/June 2016, an action plan against flooding was drafted by the Municipality of Geraardsbergen. The plan underlines that maximum reductions in risks of loss and damage from flooding can only be achieved if the local government works together with its citizens in prevention, protection, and preparedness. The plan includes four main actions: 1) drafting a rainwater plan (introduced in the paragraph below), 2) a focus on PLP for flood-prone buildings, 3) raise awareness and stimulate citizen involvement in preparedness, and 4) improve crisis communication during floods.[13]

The rainwater plan is one of the main plans through which the Municipality of Geraardsbergen wants to reduce flood risks. The final report includes various measures that should help prevent and prepare for floods like the 2016 floods in Geraardsbergen. The rainwater plan includes multiple sections, including an analysis of the water system and how different parts of the Dender basin are interconnected, an analysis of current flood problems and challenges in Geraardsbergen, the visions and objectives, and specific measures to be implemented. However, Geraardsbergen's rainwater plan is technical and focuses mainly on the challenges that arise in the physical or hydrological system. It focuses on measures to reduce flood exposure, but it does

[13] https://www.geraardsbergen.be/product/862/wateroverlast

not recognise differences in social vulnerability of the population to floods. No attention is attributed to justice and equality concerns. Examples of measures to be implemented include minimising surface hardening, maximising infiltration, expanding green-blue networks throughout Geraardsbergen and NBS, preventing erosion, etc. Interestingly, none of these measures refer to shared responsibility or the importance citizen participation in FRM through the implementation of PLP.

Attention to justice, fairness, and equality by stakeholders involved in the project

In general, issues of justice and equality in flood risks are not actively considered in local level FRM in Geraardsbergen. The Mayor of Geraardsbergen explains how differences in social vulnerability of the residents could, at some point, be more actively considered. However, municipal authorities also underline that when a flood occurs, everyone should be offered the same help:

> "If we are standing in front of two houses. One house is occupied by a man, a woman, and two children, with a good income. And their neighbour is poor and does not have sufficient money to prepare for or recover after floods. I don't think we have ever thought to help the poorer family first […]. Everyone is the same at that moment" (interview, 18-11-2021).

However, it is recognised that differences in social vulnerability to floods will become more visible when residents are expected to take up responsibility in FRM and protect their own properties against floods through PLP, as it may result in a situation where those with a higher socioeconomic status and more financial means will be better protected against the impacts of floods compared to those who might not have sufficient funds to invest in PLP, or might be renting their house and therefore are not in a position to invest in structural renovations.

> "Now, especially with those energy prices skyrocketing, if people are expected to invest in protecting their homes from flooding, I don't think there will be many who can afford that. If they have to choose between buying food and paying rent or protecting their homes from potential future flooding, they will choose food" (interview, 2-9-2022).

The quote above underlines that socioeconomic status can determine someone's capacity to implement PLP. However, in stimulating PLP, the VMM does not distinguish between differences in social vulnerability. The project initiator explains that the initial goal is to provide everyone with the same level of flood protection. Socioeconomic status does not determine whether someone is entitled to higher or lower flood protection – even though, without considering someone's capacity to implement property-level measures, the measures are unlikely to provide the same protection for all. Furthermore, there are other factors that may determine the effectiveness of property-level measures, such as which measures each individual household chooses. An attempt was made to consider someone's financial capacity to implement PLP in the advice provided by the VMM. Each household was provided with two potential scenarios: a 'basic' plan, providing maximum flood protection against minimum costs, and a more 'advanced' plan, which is more expensive but includes automated flood protection systems that are more robust and do not need human intervention to be activated. In other words, households with insufficient financial means were given the

option to choose a cheaper, more basic level of flood protection. However, the level of protection between the 'basic' and the 'advanced' plans is not exactly the same:

> "The big difference [between the plans] is the time you have, which is certainly relevant in Geraardsbergen on the hills. Sometimes floods come really fast during a storm. Which means you either have to be at home, or you have to be notified to place the gates to prevent water from coming in. If you are at a barbecue with family, and you do not realise a heavy thunderstorm is coming, then you might be too late if your system is not automated" (interview, 27-7-2022).

This illustrates that even if socially vulnerable communities have sufficient money for the 'basic' scenario, there might still be a difference with those who can afford more advanced PLP measures, potentially creating or further reinforcing existing inequalities, which cannot be considered as fair. In addition to financial means, there are other determinants of social vulnerability potentially relevant here. For example, for those dependent on others, such as the elderly or physical and mentally impaired, the 'basic' scenario may be insufficient, as they may not be able to activate their PLP system on their own. Instead, a more expensive, automated system may be required, which again raises questions around the financial capacity of people.

According to the project initiators, it is important to provide equal opportunities for households to receive advice on the most suitable PLP measures for their house – even though we think it is important to stress that not only the technical feasibility is considered, but also household circumstances. According to the project initiators, the big question is how to consider differences in social vulnerability in the follow-up process, after the initial advice on the most suitable PLP measures has been provided:

> "Perhaps the rich people can pay for PLP themselves and that we have to provide funds for those who cannot afford it. I think this is where inequality really becomes visible. People who have sufficient financial resources will be able to put a few thousand euros aside and do something about flood risks. While other people, who barely make it through the month, simply don't have that option. […] But in terms of flood protection levels, I think we should strive for the highest possible level for everyone. Nobody wants to suffer damage from flooding" (interview, 27-7-2022).

In other words, one way in which differences in social vulnerability to floods could be more actively considered when stimulating PLP is through income-dependent subsidies, which to a certain extent would take individual capabilities into account. Although the Municipality of Geraardsbergen provides a €250 subsidy, this amount is relatively small and the same for everyone who applies. As underlined by the project initiator, this subsidy will not make a big difference. Instead, "it might be better to give €1,000 to people who do not have sufficient money to invest in PLP measures. The people who can already afford it, don't need the €250, do they?" (interview, 29-7-2022). Providing additional funds to support those who cannot afford PLP may be a way to stimulate responsibility sharing in FRM. Insurance companies could also play a role

here. Instead of covering damage costs, additional money could be provided so that residents can include PLP measures to prevent damage in the future, such as the Build Back Better initiative in the UK.

Role of participation (RQ2)

Stimulating the uptake of PLP is a means to responsibility sharing in FRM, and a way to involve citizens in the implementation of flood risk mitigation (i.e., co-delivery). It is recognised by the stakeholders involved in the project that it can be more difficult to reach vulnerable communities and to get them to participate in the implementation of FRM policy. Those with less financial means or those who rent their homes may have been less interested in the information meeting organised by the VMM and the Municipality of Geraardsbergen on PLP and might not have joined the meeting in the first place.

No efforts were made by the VMM or the municipality to ensure that socially vulnerable groups were present at the information meeting. Questions remain around the representativeness of the participation events. It remains unclear who attended the meeting, and more importantly, who did not. This is problematic, because if vulnerable groups do not even attend the information meeting, it becomes impossible to provide them with additional financial support in implementing PLP measures, which has been suggested by the project initiators as a solution to stimulate the uptake of PLP among socially vulnerable communities. In addition to difficulties around stimulating Geraardsbergen's residents to attend the information meeting, the actual uptake of PLP measures among those who did attend the meeting and signed up for the advice also remains limited. According to the public authorities involved in the project, it remains unclear what the main reasons are for residents to decide against implementing PLP measures. It is believed that implementation costs are not the main problem:

> "The subsidies provided in the province of Flemish Brabant [a different province in Flanders] are higher than in Geraardsbergen and are sufficient to fully protect a house. They provide up to €4,500. But I understand […] that they really have to push it to convince people. So, money is apparently not a big trigger. I think it's still part of the attitude of 'floods are not going to happen a second time' or 'the government should provide protection'. And we really have to break through that in the long term" (interview, 29-7-2022).

However, a phone survey was conducted by the University of Ghent among residents who received the tailor-made advice from the VMM. Questions asked focussed on whether or not the residents implemented the proposed PLP measures, and if not, what the main reasons were for deciding against implementation. Only 13% of those who participated implemented all the proposed PLP measures. Major factors for residents to decide against implementing the measures include the costs, a lack of flood risk awareness, and a lack of a sense of urgency (Davids, 2019). Furthermore, research shows the importance of communication skills of technical experts that provide advice on PLP measures in convincing homeowners of the importance of the measures (Davids et al., 2022).

Knowledge and capacity building on social inequalities (RQ3)

At present, differences in social vulnerability are not actively considered in PLP policy. One potential explanation for the lack of attention to justice and equality in PLP is a lack of collaboration between policy domains. The project in Geraardsbergen was initiated by public authorities from the VMM, who are characterised by their technical approach to tackle flood risks and insufficient knowledge on the social impacts of floods. This is explained by a member of a local town council:

> "I think the information meeting in 2018 was a very good initiative in itself. Only one important aspect was missing, and that is the link with other policy domains such as poverty. At the municipal level, we also have an official that deals with poverty. […] And I think these two policy domains should have been brought together. Now it is only the policy domain of water management, or technical matters, that focuses on the problem of flooding. […] But to my knowledge, the domains of water management, poverty, and maybe also integration, have not worked together on PLP and that is a major flaw" (interview, 9-8-2022).

Not only could an increased collaboration between different policy domains in FRM lead to more just and equal PLP policies, due to the integration of different types of knowledge, but respondents also indicated the importance of working together with local levels of government. The VMM works at the regional level of Flanders, and is further removed from local issues which sometimes leads to frustration among residents:

> "Local residents often feel overwhelmed by the technical information that is fired at them during these information meetings. […] Almost all had the feeling that the different authorities in FRM shifted responsibilities and claimed to not be authorised to help residents with particular problems. In the end, many residents reached the conclusion that apparently, no one could help them" (interview, 9-8-2022).

Municipal governments and town councils are likely to have more knowledge of local issues and the needs of residents, including the needs of vulnerable groups. This may make lower levels of government better equipped to consider differences in social vulnerability that determine whether or not people can actually implement PLP measures and protect themselves from future floods. In other words, knowledge and information about the social vulnerability of households is available, but currently not used in FRM decision making or implementation. Collaboration between different policy domains as well as different levels of government may be beneficial to address issues of justice and inequality in PLP.

Conclusion

In Geraardsbergen, the VMM stimulates the uptake of PLP. Although the project initiators recognise that differences in social vulnerability will become more visible when residents are expected to protect their own properties from flooding, as those with higher socioeconomic status and more financial means will be better prepared against future floods, such inequality concerns were not taken along in the development of the

project. The aim was to provide everyone with the opportunity to receive advice on the measures most suitable for their houses. Although PLP is a way to stimulate citizen participation in the co-delivery of FRM, residents were not included in decision-making processes around the need for and feasibility of PLP in the municipality. Furthermore, no efforts were made to include socially vulnerable groups. The lack of attention to justice in this project can be explained by a lack of collaboration between policy domains. The project was initiated by water managers, characterised by their technical approach. Collaboration with other domains, such as poverty, housing, and integration, as well as with municipal authorities, who are more aware of local problems and needs, may be beneficial to the broader uptake of PLP.

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Annex 1: Interviews

In total, we have conducted 39 interviews with FRM policy makers, experts and practitioners from relevant government levels and departments in Flanders, as well as residents in flood risk areas. The interview data has been collected between August 2021 and May 2023. The interviews were recorded and transcribed.

National-level analysis

Organisation	*Date*	*Interviewer*
Flemish Environment Agency (VMM)	26-08-2021	Mandy Paauw
Flemish Environment Agency (VMM)	27-08-2021	Mandy Paauw
Province of East-Flanders	24-09-2021	Mandy Paauw
Province of Antwerp	27-09-2021	Mandy Paauw
Province of Flemish-Brabant	29-09-2021	Mandy Paauw
Flemish Environment Agency (VMM)	01-10-2021	Mandy Paauw
Province of East-Flanders	04-10-2021	Mandy Paauw
Province of Antwerp	06-10-2021	Mandy Paauw
Province of Antwerp	12-10-2021	Mandy Paauw
University of Ghent	18-10-2021	Mandy Paauw
Province of Antwerp	19-10-2021	Mandy Paauw
Environment Department, Flemish Government	21-10-2021	Mandy Paauw
National Crisis Center	29-10-2021	Mandy Paauw
Province of Antwerp	05-11-2021	Mandy Paauw
Province of Limburg	09-11-2021	Mandy Paauw
Fire Brigade	10-11-2021	Mandy Paauw
Bond Beter Leefmilieu (BBL)	23-11-2021	Mandy Paauw
Province of East Flanders	03-02-2022	Mandy Paauw
Flemish Environment Agency (VMM) & Vlaamse Waterweg	30-09-2022	Mandy Paauw
Flemish Environment Agency (VMM)	03-03-2022	Mandy Paauw

Environment Department, Flemish Government	03-05-2023	Mandy Paauw
University of Antwerp	04-05-2023	Mandy Paauw
Province of East-Flanders	05-05-2023	Mandy Paauw
University of Antwerp	09-05-2023	Mandy Paauw
University of Wageningen	09-05-2023	Mandy Paauw
Flemish Environment Agency	17-05-2023	Mandy Paauw
University of Ghent	14-06-2023	Mandy Paauw

Case study 1: Beerse

Organisation	*Date*	*Interviewer*
Province of Antwerp	02-03-2022	Mandy Paauw
Municipality of Beerse	03-03-2022	Mandy Paauw
Stakeholder engagement consultancy	14-03-2022	Mandy Paauw
Municipality of Beerse	22-03-2022	Mandy Paauw
Resident	01-12-2022	Mandy Paauw
Resident	15-12-2022	Mandy Paauw
Resident	22-12-2022	Mandy Paauw

Case study 2: Geraardsbergen

Organisation	*Date*	*Interviewer*
Municipality of Geraardsbergen	18-11-2021	Mandy Paauw
Flemish Environment Agency	29-07-2022	Mandy Paauw
Resident	09-08-2022	Mandy Paauw
Resident	02-09-2022	Mandy Paauw
Municipality of Geraardsbergen	14-09-2022	Mandy Paauw