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Explore Lab graduation studio  
TU Delft, MSc Architecture

Graduation report  
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# 1. Introduction

In July 2021, heavy floods hit the Dutch province Limburg after days of rainfall in south-west Germany, the Ardennes and southern Limburg. In two days, precipitation amounts between 160 mm and 180 mm were measured, exceptionally high levels especially for the summer season. Rivers like the Geul, the Roer and the Maas couldn't discharge the large amounts of water. Many parts of these regions flooded, and approximately 50.000 people have been evacuated from their homes. (Task Force Fact Finding hoogwater 2021, 2021, pp. 8 - 10).

How safe residents feel in the river landscape is affected by the floods. The sense of safety people get from the landscape depends on how they perceive that landscape and how they perceive their safety in it. How landscape and safety are perceived relates to the relationship residents have with their landscape. Bobbink and Loen (2020) signal that local communities are increasingly cut-off from their water system, due to centralized supervision, and they are changing from active workers to passive users. Ultimately, their knowledge of the water systems is forgotten (p. 5).

Another aspect of perceiving a sense of safety is related to the Dutch water management strategies. Optimizing and directing water has dominated the Dutch attitude. Engineering strategies including dikes, storm surge barriers and regulated polders are dominant in the Dutch landscape (Metz & Van den Heuvel, 2012, p. 281). With these strategies, the Dutch have outsourced their water safety to engineers and water boards. As water safety is primarily the concern of professionals, people themselves are decreasingly aware of their dependence on these defence systems, and simply perceive dikes and other defence systems as objects in the landscape (Metz & Van den Heuvel, 2012, p. 79).

As a result of this strategy, the relationship between humans and river has become a rigid one. Humans dominate water by force, pushing it away hard as possible. However, because of the changing climate water is now pushing back, which resulted in the floods of 2021. Changing how we relate to rivers, and water in general, can help to establish a new spatial relationship that is not based on dominance but rather on equality. By looking at water as a condition changing over time, architecture can give shape and expression to such a new relation between humans and river.

In light of the recent floods in Limburg, this graduation project deals with the question of perceiving a sense of safety in river landscapes. Chapter 2 presents the leading research questions and explains the qualitative research methods that are applied. For this research, I made a four-day cycling trip along the Maas to conduct field work and interviews. Chapter 3 introduces the landscape of the river Maas, as well as the interviewees that I have spoken with. It describes what they see as characteristic for the Maas landscape, and how this perception indicates their relation to the river. Chapter 4 discusses how residents perceive their safety in the river landscape. The Dutch river management strategies are here related to the floods of July 2021. This is followed by chapter 5, which presents the notion of a power balance between humans and rivers. This notion

helps to understand how humans relate to rivers in terms of their sense of safety, and contributes to define a new relationship that is capable of dealing with future flood events.

Chapter 7 presents the chosen design assignment. From the research outcome, leads, inspirations and design ideas are gathered to formulate the assignment that will be the next phase of this graduation project. The vision of river literacy by Dacunha (2019) forms the inspiration to formulate a new way of looking at water, and a kind of architecture that expresses and establishes this new relation. The design project deals with a public building that provides a safe evacuation centre in times of high water, while in the everyday functioning it expresses its position in the water landscape and in turn provides a lens on the water conditions in this landscape. Chapter 8 elaborates on the resulting design project, in which a permanent platform provides the base for a temporary evacuation centre. Together with other design objects (a hiking trail, a bridge, water basins) the project addresses river dynamics and flood dangers in Valkenburg aan de Geul, in Limburg.

The closing chapter 9 relates the outcome of the design project to the design goals of chapter 7, and reflects on the differences between the Maas as a research site and the Geul as a design site. It describes how the dynamic lines in the design project on the Geul can be translated to the Maas landscape, to introduce a less rigid and more equal relation to humans and rivers.



Image 1 - My bicycle in the Overdiepse Polder, April 25 2022

# 2. Understanding the sense of safety in Dutch river landscapes

## 2.1 Research questions

The flood defence mechanisms are objects of engineering and design, with a clear functional relationship to, and position in, the landscape. In relation to the decreasing awareness and perception of river safety this leads to the main research question:

What is the role of architecture in perceiving a sense of safety in Dutch river landscapes?

This question requires inquiry into perception of the river landscape and into the sense of safety. With the floods of last summer fresh in memory, the Dutch Maas landscape makes an interesting case study. This is what the first sub-question addresses:

(1) How are the characteristics of the Maas river landscape perceived?

A resident strikingly states during flood evacuations in 1995: "I don't want to live here any longer. All that water makes me seasick." (Vandersmissen et al., 1995, p. 38). The residents' perception of the Limburg rivers and their sense of safety are affected by floods. Therefore the second sub-question is:

(2) How do people gain a sense of safety from the landscape?

Architecture plays a role in shaping the defence elements in the Dutch landscape. This means that the research questions are not only addressed by the aforementioned inquiries, but also by the design assignment following this research project. Therefore, preliminary design requirements are already enclosed in the research question: architecture is rooted in the Dutch river landscape and stimulates a sense of safety for its users. The final sub-question unites the first two in this design inquiry:

(3) What is the role of architecture in establishing a sense of safety?

The three sub-questions have a clear sequence of investigation, the third question can only be answered after answering the first and the second consecutively. On the other hand, the questions form a clear counter-sequence when dealing with the design assignment: starting with the role of architecture and ending with

the goal of creating a sense of safety in Limburg. This means that the design assignment is not only a spatial answer to the main research question, it also offers an architectural lens to investigate the landscape in relation to the sense of safety of its residents.

## 2.2 Research methods

The research follows a three-fold to find answers to the research questions. On the one hand, literature research into the Limburg river landscape and water management, sense of safety and power balance is the starting point. With field work on the other hand I explore the Maas and its landscape, and I interview residents about their experiences of river floods and their perception of safety. Lastly, visual documentation synthesizes the findings of the prior two strategies in drawings combined with annotations and descriptive writing (Havik, 2014). The latter two strategies are further explained below.

### *Fieldwork*

To grasp the full size of the Dutch Maas, I chose cycling as a mode of travelling to structure the field work, since cycling provides an efficient ratio of time spent and distance travelled. Also, it allowed me to stop at any moment to have a closer look at sites and locations. In four days (April 25th to April 28th 2022) I travelled from Delft to Maastricht along the river Maas. The interviews with residents (four in total) were held in their homes along the route. These interviews are informal: the goal is to gather their personal stories and interpretations of the floods and the landscape they live in. Therefore they are not structured to be statistically formatted, but rather they serve to provide insights to answer the research questions and inspirations for the following design assignment. Chapter 5 introduces the notion of a power balance between humans and river. To investigate this mutual relationship from both sides equally, I conducted immersive analyses at intermediate stops, selected in advance. This method serves to give an insight into the perspective of non-human actors in the (built) environment (De Wit, 2022). Through close observation and investigation through questions similar to interview questions, a profound account of the non-human perspective can be created. By placing the interviews with residents, and immersive analyses of non-human elements in the landscape side by side, they are regarded as equals in understanding the power balance.

### *Documentation: annotated drawing and descriptive writing*

The cycling trip itself is documented through a full timelapse made with a small action camera on the steer of the bicycle. Every 60 seconds a snapshot was taken, resulting in approximately 1000 photographs. The immersive analysis, of a total of three locations, are presented as introductions to the chapters 3, 4 and 5. A sketch illustrates each analysis with annotated comments of information found on site or discussed in the interviews, personal observations and background information. Based on this annotated sketch, a short piece of text provides descriptive characteristics (Havik, 2014): with comparisons, metaphors, and imagery the text creates an account of the analysed site that helps to imagine possible future scenarios and implicit qualities and stories of that site. For each

text, there are supporting drawings that visualise the metaphors. These sketches combined with text therefore combine a variety of sources in one result. This interaction of (literary) text and sketches allows for the combination of objective sources with personal observations and artistic sources in a structured way. The map on the next page provides in a similar way an overview of the cycled route, and presents observations, locations of interest and the conducted interviews along the way.

This research is characterized as qualitative research (Wang & Groat, 2002 p. 176-180). The field work investigates elements in their natural setting. Furthermore, the interviews are informal, respondents are asked for their personal interpretations of the landscape and their experience of the disastrous events. Lastly, the documentation techniques give room to subjective observations and interpretations of the research findings.

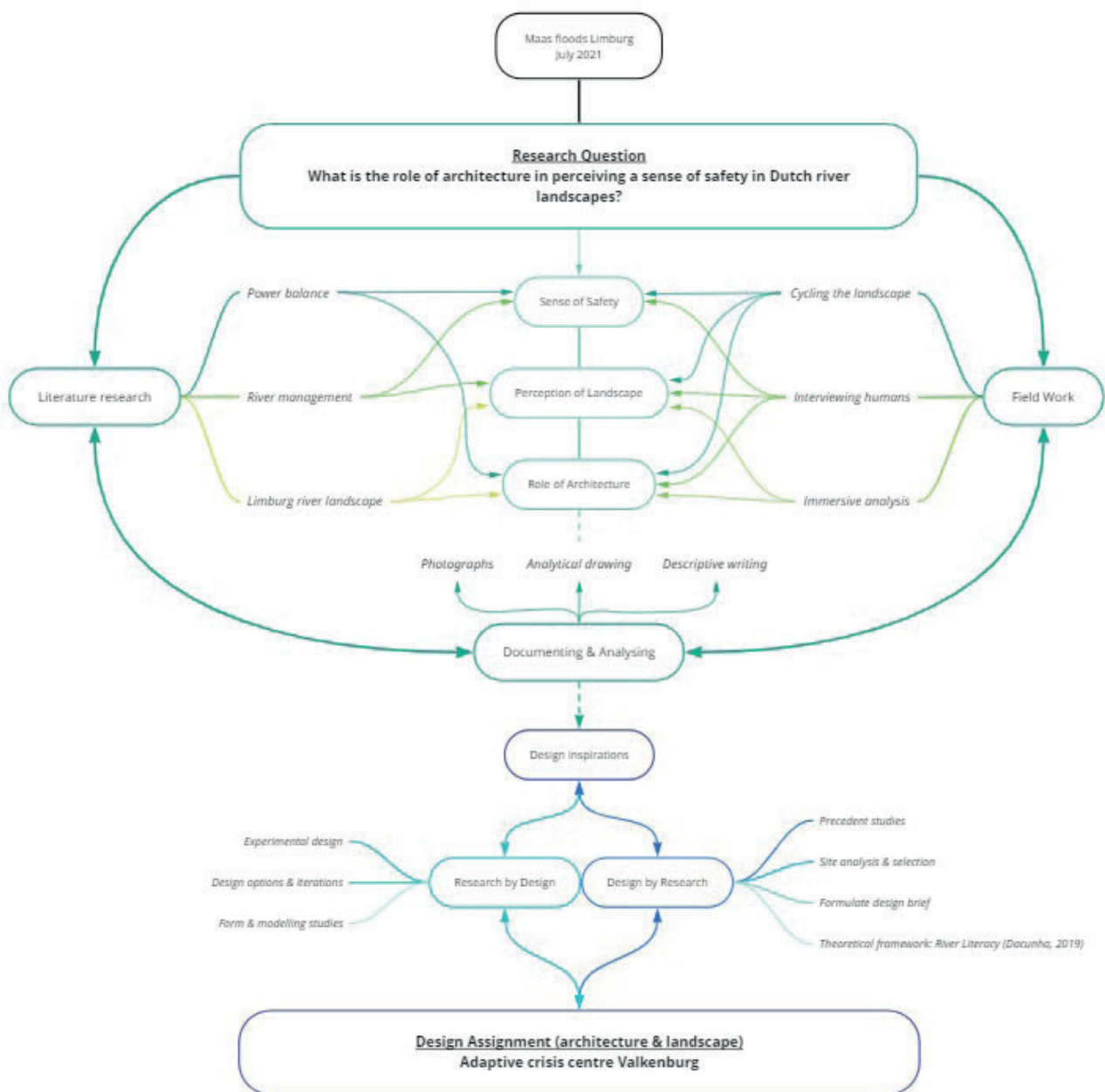


Image 2 - Scheme of research and design project

APRIL 25TH: START DAY 1

7:40 I DEPART FROM DELFT. DISAPPOINTING WEATHER. I WAS NERVOUS SO I PACKED 3 BAGS OF PASTA, 9 WAFFLES, 3 APPLES AND 6 BANANAS.

BECAUSE OF THE HARINGVLIETKERING, AGRICULTURE ALTERED: SALT WATER TURNED BRACKISH. THE "KIERBESLUIT" IS SUPPOSED TO ALTER THIS.

FIRST MILESTONE IS A LEFTOVER OF FLOOD (1421). NOW PRESERVE, HERE BETWEEN SWEET AND THE FOOT FERRY OF

DELFT

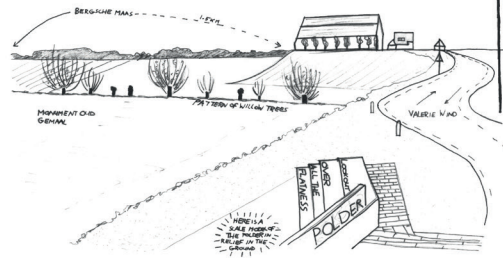
ROTTERDAM

ZWINDRECHT

DORDRECHT

SECOND MILESTONE ON THE ROUTE: "OVERDIEP" POLDER. I CAME HERE FOR THE "SUPERTERPEN" AND THEY ARE "SUPER". THE POLDER IS A PROJECT OF "RUINTE VOOR DE RIVIER" THE ELEVATED "TERPEN" PROTECT THE FARMS FROM FLOODING. THEIR RATIONAL SHAPE EXPRESSES THIS, QUITE TECHNOCRATIC.

I WAS VERY HAPPY TO ARRIVE HERE AFTER 96 KM. STILL 40 MORE TO GO. SOME SAY THIS IS THE END POINT OF MAAS. FROM HERE IT DIFFUSES THROUGH AMER, HOLLANDS DIEP, MERWEDE, NIEUWE MAAS, ONDE MAAS...

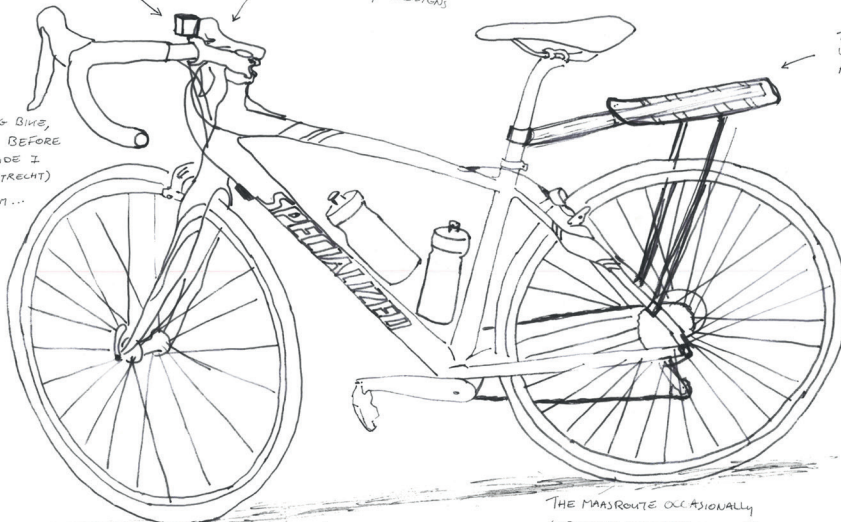


THIS ACTION CAM TAKES ONE PICTURE EVERY 60 SECONDS, RESULTING IN A TIME LAPSE OF 328 PICTURES, 305 MINUTES, 16 HOURS AND 35 MINUTES.

MOBILE PHONE CASE, IN CASE NAVIGATION GOES WRONG (IT DID OCCASIONALLY) I FOLLOW THE "MAASROUTE" (HOEK V. HOLLAND -> MAASTRICHT) INDICATED WITH (7km) ROAD SIGNS



TWO CARRIER BAGS WITH FOOD, CLOTHES AND BIKE TOOLS.



AVERAGE SPEED: 23 km/h

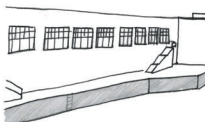
THE MAASROUTE OCCASIONALLY SURPRISES ME WITH UNPAVED GRAVEL ROADS THAT TERRORIZE THESE FRAGILE TIRES. MIRACULOUSLY, THE BIKE SUFFERS NOT A SINGLE BREAKDOWN THESE 4 DAYS

THE FIRST KILOMETRES I RODE WITH THIS BIKE WERE ON THE MAAS DIKES NEAR WIJCHEN, CUYK AND BATENBURG

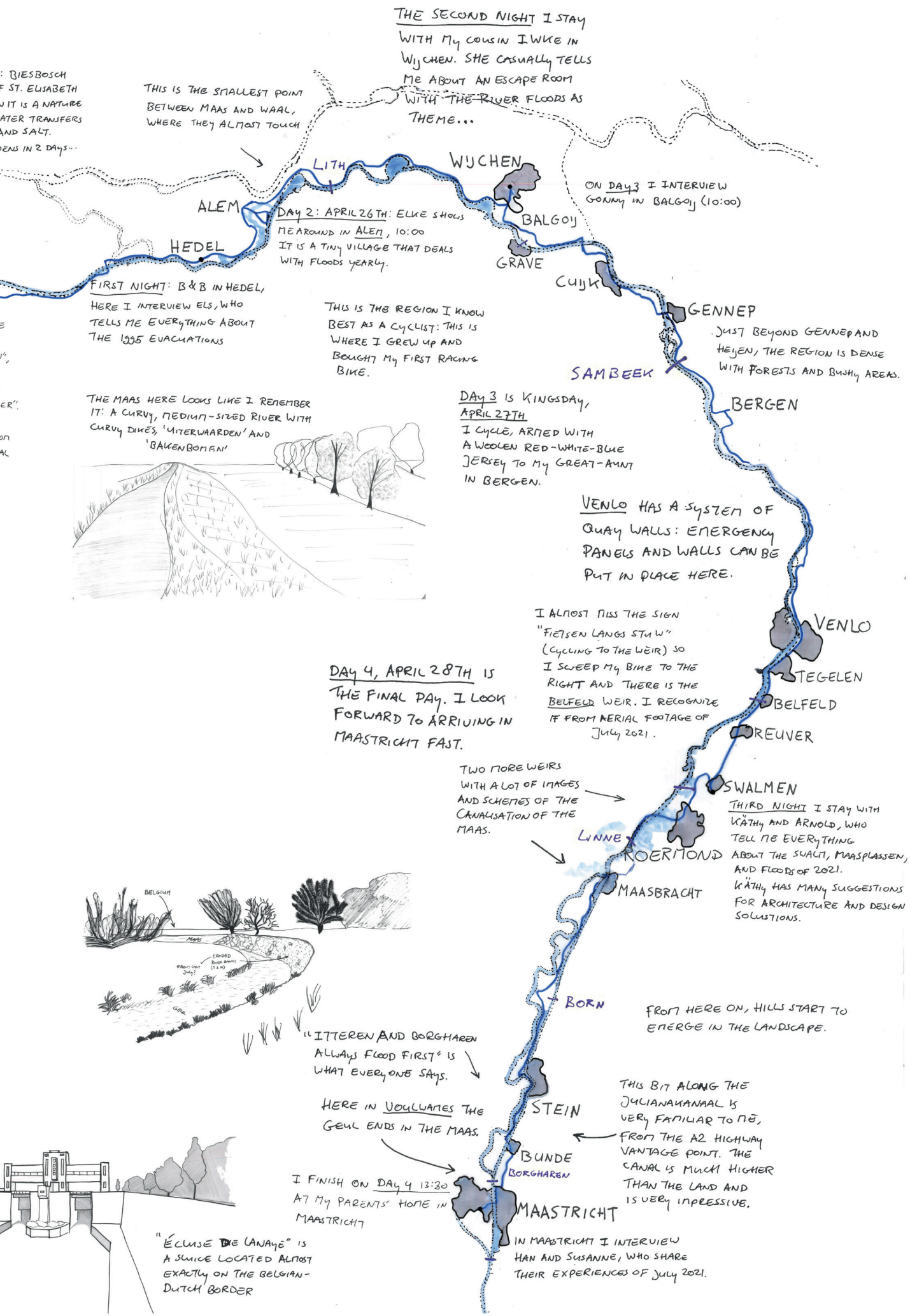
# DELFT → MAASTRICHT

APRIL 25 - APRIL 28 2022

THIS MAP IS DRAWN STRUCTURED ALONG THE MAAS AND THE ROUTE I FOLLOWED, BECAUSE THESE TWO GEOGRAPHICAL LINES STRUCTURE MY THOUGHTS AND OBSERVATIONS







*In the distance lies the Maas, calm and steady in this spring season. 'Mother Maas'<sup>1</sup>, is how they call her here, feeder of the soil and employing the clay industry. A fierce mother, streaming forever in the hilly landscape. This feminine side of the river is profound in literature. From an elegant, caring lady in prosperous years, to a grumpy old woman, a female 'hulk', when breaking from her borders. "The Maas is like a woman. If you don't keep an eye on her, she'll do whatever she wants. Stubborn bitch."<sup>2</sup> Both a heroine and a villain. But what about her smaller sisters? Roer, Swalm, Geul... Modest in size compared to the fierce mother, but just as vigorous last summer. Flowing from the Ardennes to Voulwames, cutting Limburg like an elegant knife, the Geul left the landscape wounded. Wijlre, Schin and Valkenburg were her main victims. On this sunny day in Voulwames, the Geul lies calm in its bed. How idyllic and steady it looks today, so grim it was ten months ago. How much misery, dragged from homes along the way, has passed this estuary in those days?*

*Lady Geul strides fast through the landscape, drawing strength from multiple springs. She is well-mannered, but her speed gives an explosive temper. With positive energy she supplies water mills and the felt production. The watery fabric of her dress seeping in the landscape, she is the lifeline of exceptional ecologies – a grateful servant of the land. How embarrassed she feels about the summer. "I couldn't help it, the water was just too much. I tried to distribute it, like I always do, but it just came and didn't stop. Normally there is not enough, and now it was way too much. I don't know what to do." With help of the beaver and plants, she tries to calm the water down, but if this water grows and grows, the landscape will suffer permanently.*



1. Odekerken, M. (z.d.). *Moeder Maas*. LeesGedichten.nl. Accessed on May 31 2022, from <https://www.leesgedichten.nl/natuur-gedicht/moeder-maas-13547/>
2. Vandersmissen, H., Bos, H., Burlage, A., Hoogers, M., Nijland, R., & Nationaal Rampenfonds. (1995). *Watersnood 1995*. bv Kunst drukkerij Mercurius-Wormerveer.

# 3. The Dutch Maas and perception of landscape

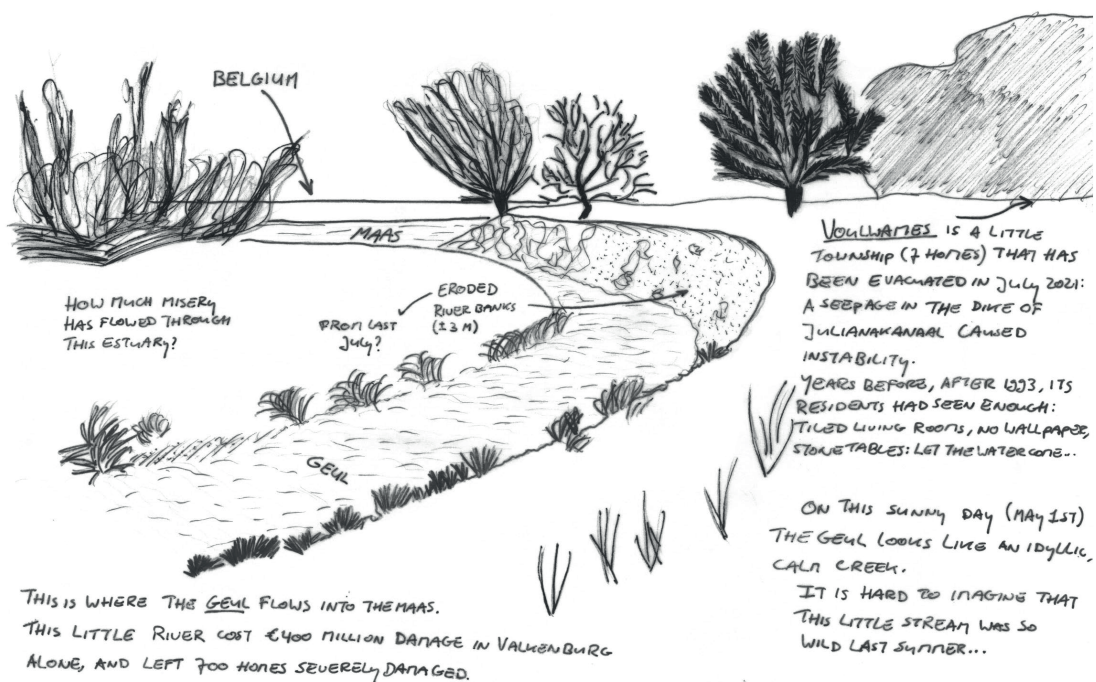


Image 4 - Voulwames, Annotated sketch

The floods of July 2021 struck the country by surprise. Not only the Maas, but also its smaller side streams caused a lot of damage. The Maas is known to flood in winter times, but not in summer. Because the Maas is a river fed by rain and melting snow, the difference between the minimum discharge in summer and the maximum discharge in winter is almost a factor 300 (Vandersmissen et al., 1995, p. 16).

To discover the characteristics that define this landscape for its residents, and that played a role in the floods, I made the decision to cycle along the Dutch part of the river Maas, starting in Delft and ending in Maastricht. Along the route this means starting in an area that was least affected by the high water, and ending in the epicentre of the floods. The benefit of cycling in this case, over walking or driving by car, is the efficient ratio between the distance travelled



Overdiepse Polder

and the time that it costs. In four days, I travelled approximately 370 kilometres. On foot, for instance, this distance would have meant 15 travel days. By car, this distance would be only a matter of hours. In addition, cycling gives a certain freedom to stop at any time to make observations, notes and photographs. In the Netherlands, the dikes are almost everywhere accessible for biking, which allows to constantly keep a close look at the river. This chapter follows the bike route and describes observations and interviews along the way.

**Hedel.** In the cities where I stay overnight, I hold a series of five interviews. The first stop, Hedel, is a village in Gelderland on the north side of the Maas. The river here forms the border with the southern province Noord Brabant. Here I speak with Els, who shares her experiences about the floods and evacuations in 1995. The years 1993 and 1995 confronted the Netherlands with exceptionally high water levels in the rivers. In Gelderland, many dikes were weak and threatened to break (Vandersmissen et al., 1995).

Els lives right behind the river, about 200 metres north of the dike. She tells me she grew up on a cargo ship that would travel the Maas from Rotterdam to Germany and Belgium. “So I have a thing fow water, it always attracts me.” (full interview transcripts can be found in Appendix A). For Els, what is most characteristic about the Maas and the landscape are the flood plains and the dikes along the river banks, as well as the routes you can cycle there and the ferries you can take to cross the rivers on foot or by bike. She runs the bed & breakfast where I stay that night. Many of her guests are cycling the Maas route. “Water is never the same,” she says “and a dike always swings. There’s always a view, and wind.” She tells me the Maas is safe for swimming, and there is a little beach on the river banks, that sometimes disappears under water when the water level is rising.



Image 5 - Home of Els in relation to the river Maas

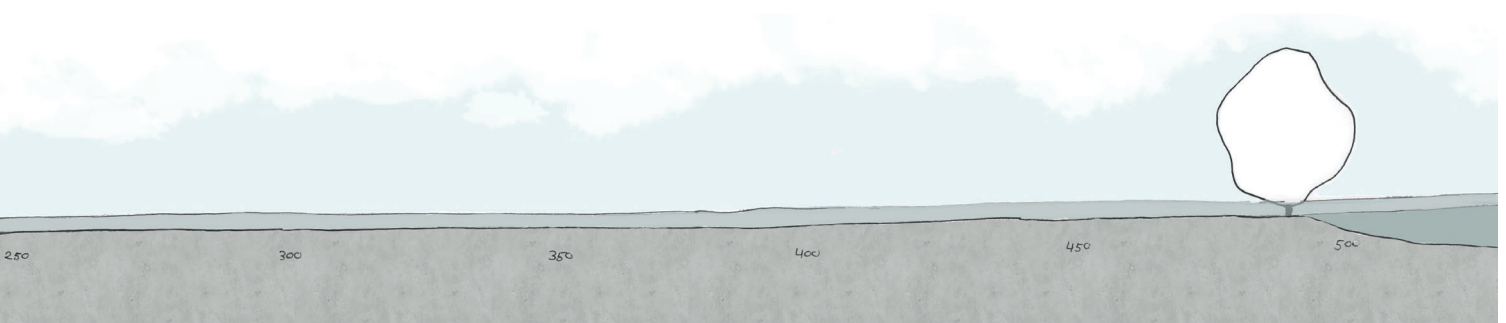


Residents near the Maas count on river floods in winter times. In that time of year, all camp sites are closed, caravans are gone and livestock is safe in sheds. High water is common in winter times, when upstream snow is melting or there are periods with a lot of rain. But in the middle of summer, the flood plains are full. Campsites are full and animals are grazing everywhere. This is why the floods of 2021 were unique came as a surprise, even in regions where high water levels are known.

Although Hedel lies on the banks of the Maas, the river Waal is only eight kilometres away. Near Heerewaarden, where I pass the second day, the two rivers almost touch. There is only one kilometre of land that separates them. The canal of Sint Andries connects the two rivers, and a set of sluices regulates the water levels and ships that pass between the rivers.



Image 6: The Waal (left) and the Maas (right) near Heerewaarden





Heusden

**Alem.** In Alem, next to the canal Sint Andries, I visit Elke, who grew up here. The village of only 600 residents lies in a river curve that is now called Dooie Maas, ‘dead Maas’. This curve was cut off by canalisations to improve shipment. Alem is enclosed by a dike, but in the flood plains, farmers have their corn fields to produce food for livestock. Because this is outer dike area, Elke tells me these fields occasionally flood. Because this usually happens in winter months, this is not a problem for the corn production. However, in July 2021 the fields were full of corn plants, that couldn’t be used for livestock food because of the pollution of the Maas water. The corn plants were damaged and the harvest destroyed. Elke points out that because the plants were unusable, they were left on the fields instead of harvested. Now these corn fields appear neglected: instead of neatly ploughed fields, new weeds start to appear in the damaged corn plants left behind after the floods (E. Mulders, personal communication, April 26 2022).

**Balgoij.** Near Wijchen, the second overnight stop, lies the small village Balgoij on the dikes of the Maas. Gonny has lived here for 20 years, the house is only one soccer field away from the dike. When Gonny thinks of the Maas, she tells me “the Maas always has the same type of trees. They are some kind of benchmarks. When you look at the river, everywhere on both sides you see these high trees” (full interview transcripts can be found in Appendix A). This row of trees are beautifully called bakenbomen, ‘beacon trees’. In the 1930s they were planted in rows along the river banks to mark the channel of the river at times of high water (De Maas & Waler, 2022). Also she mentions to me two natural flood



Image 7: Neglected corn fields after the 2021 floods



Batenburg

plains that have been created in the area, near Keent and near Batenburg.

From the dike of Balgoij the weir of Grave is visible. In the 19th and 20th century, a number of strategies was deployed to improve the Dutch river systems. These strategies were defined by regulation (ensuring a constant course by adjustments in the winter bed), normalisation (ensuring an adequate amount of depth for a regular flow in summer) and canalisation (regulating the water level through a system of weirs) (Vandersmissen et al., 1995, p. 16). Regulation is clearly visible in the landscape by shortcuts in the river, cutting off river curves, as is the case for Alem. The sluice of Grave is one in a series of ten weirs and sluices that is the result of the canalisation strategy.



Image 8 - 'Bakenbomen' along the Maas near Nederasselt

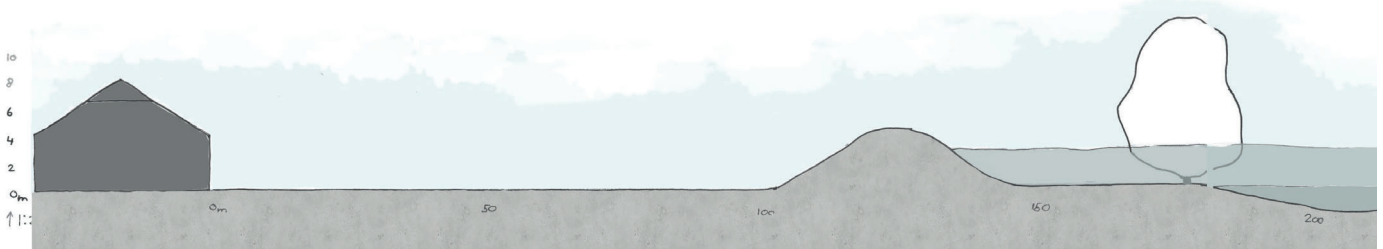


Image 9 - Home of Gonny in relation to the river Maas



Arcen



Image 10 – The beacon trees in high water levels in the Maas near 's Hertogenbosch. Image retrieved from Google Maps, May 4 2022

The bridge over the Maas between Oeffelt and Gennep marks the border between Noord Brabant and Limburg. Here the landscape becomes more bushy and I cycle through forests from time to time. Where the section of the Maas in Noord Brabant and Gelderland is lined with continuous dikes, in northern Limburg the river has meandered freely. Because this created somewhat higher river banks, dikes were not always necessary (Renes, 1999).

**Venlo**, where I pass on day 3, is the first big city since Rotterdam and Dordrecht that lies directly on the borders of the Maas. Here the dikes have been integrated in the cityscape. Whenever the bike path crosses the dike, impressive quay walls have openings with slots in them. These slots indicate that emergency walls can be put in place if there is a high water threat, to keep the defence line of the dike closed.

**Swalmen**. This city is named after the river Swalm, that starts in Germany and after 270 kilometres mounds in the Maas near Swalmen, north of Roermond. Like the Roer and the Geul, the Swalm is one of the little rivers that feed into the Maas in Limburg. Käthy and Arnold live here, their house lies about 5 metres elevated from the river Swalm. For their house to flood, first the nearby Maasplassen will flood to such a level so that the Swalm can't discharge it's water in the Maas. But this seems highly unlikely. Currently the Swalm is not fed from its original source. Because of lignite mining upstream in Germany, the groundwater table is lowered. The Swalm is now fed by the river Rhine. In the near future the groundwater table will be raised again, so that the Swalm is reconnected to its original source (based on the interview with Käthy and Arnold, full transcripts can be found in Appendix A).





Grensmaas near Roosteren



Image 11 - Quay walls in Venlo with slots for emergency walls

For Käthy, the Maasplassen are most characteristic in the area. These Maasplassen have emerged after gravel extraction from the Maas, but nowadays they serve as recreational areas. The pools are in direct connection with the Maas, so there are no dikes separating them from the river. Here, when the Swalm can't discharge its water in the Maas, lower laying areas will flood, such as where the villages Asselt and Wieler are. Around it are grounds naturally a little bit higher, so you can clearly see that the Maas has flown through a valley in this area.

We go to have a look at the Rozenkerkje in Asselt. Käthy points out that the old farmhouses here, and also the church, are built on naturally higher grounds. A restaurant in this street lays lowest in the village, and last year it was heavily struck by floods of the Maasplassen. These pools now lay calmly on the other side of the street.

**Roermond** is the next large city built on the banks of the Maas, where I pass on the fourth day of the cycling trip. From here it is more difficult to follow the dikes and bike paths, because of the many pools that surround the river. Here the river was very dynamic, resulting in big meandering curves. Large gravel



Image 12 - Home of Käthy and Arnold in relation to the river Swalm



Stein

deposits have formed, and later have been extracted by the gravel industry (Renes, 1999).

In Maasbracht, the next set of sluices have been built in the Maas. Here is the first time I encounter the Julianakanaal. This canal was created to form a new waterway, because this southern section of the Maas, from Maastricht to Maasbracht, was too curvy for canalisation with weirs and sluices (Vandersmissen et al., 1995, p. 18). It is striking how high the water level of the Julianakanaal is compared to the lower lying land. In some places the height difference of the canal dike and the lower land is almost 13 metres. As Metz and Van den Heuvel strikingly note: “it is an odd and very Dutch experience to see boats floating by above your head, on water you can’t see,” (2012, p. 282).

**Maastricht.** After following the trajectory Grensmaas, where the Maas forms the border between Belgium and the Netherlands, I arrive in Maastricht. Just north of Maastricht lies the little township Voulwames, where the river Geul mounds in the Maas. This little river was one of the rivers causing most damage in July 2021 (Task Force Fact Finding hoogwater 2021, 2021). Looking at this small idyllic river on a sunny day makes it hard to imagine how wild it must have been only ten months ago.

In Maastricht I speak with Han and Susanne, who live in the south of the city on the west banks of the Maas. Their house is separated from the river by a small road, the main road to Belgium and the Maas dike. A canal used to run from the sluice of Lanaye near the border all the way to the Basin in the city centre.



Image 13 - The 'Rozenkerkje' in Asselt



Image 14 - Gravel extraction site near Stein



Julianakanaal near Geulle



Image 15 - Julianakanaal near Ohé en Laak



Image 16 - Weir of Belfeld



Maas quay in Maastricht

Susanne tells me this part of the Maas is canalised, so it has not the typical river character it has in Belgium: here it is without flood plains. The house has not had any trouble during the floods, of 2021 but also not in 1993 and 1995. “When we bought the house we did ask the previous owners if they had any damage in ’93-’95, but they didn’t,” (full interview transcripts can be found in Appendix A). However, a bit further in the neighbourhood, cellars have flooded. On the other side of the river I see a campsite, full of caravans, which reminds me of Els who mentions them as well.

**Eijsden** lies about seven kilometres further south of Maastricht. Henk lives here on the banks of the Maas, only 20 metres separates his house from the river. The Eijsder Beemden is the natural reserve that lines the east side of the Maas. “The Eijsder Beemde is a natural area that runs all the way to Maastricht, owned by Natuurmonumenten (...) That makes it hard, if you want to solve the issues, broadening [the Maas] for example, you’ll walk directly into the property of the Beemden,” (full interview transcripts can be found in Appendix A). He talks about the many animals that can be seen here: Galloway cattle, Konik horses



Image 17 - Eijsder Beemden

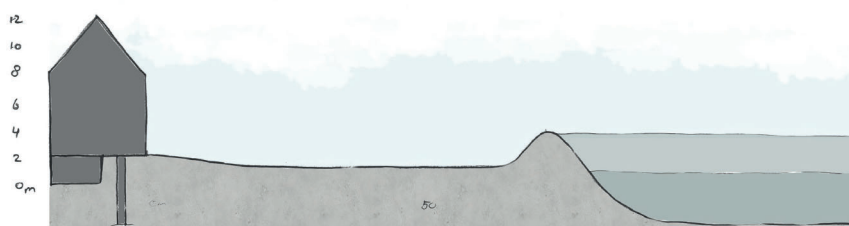


Image 18 - Home of Han and Susanne in relation to the river Maas

and blue herons. He even tells me that when he came to live here around 23 years ago, the level of the Maas was so low that occasionally boats could get stuck in the channel – how different is the situation now. In July 2021, the risk of flooding was so high that he had to evacuate from his home for one night. This has changed his view on the landscape critically and he says “So this is a beautiful area, and before last summer I have never worried or thought that it might be dangerous here.”

**Lanaye.** The last stop on the trip is the sluice of Lanaye, two kilometres beyond the border with Belgium. These sluices are the first in the series of works that I have encountered along the Maas. They mark the point where the Albert canal separates from the Maas and leads around Maastricht. These impressive water works for me mark the end of a 370 kilometre, four days long bike trip along the river and its meanderings, canalisations, weirs, sluices, dikes, flood plains, Maasplassen and its beacon trees.



Image 19 - Écluse de Lanaye

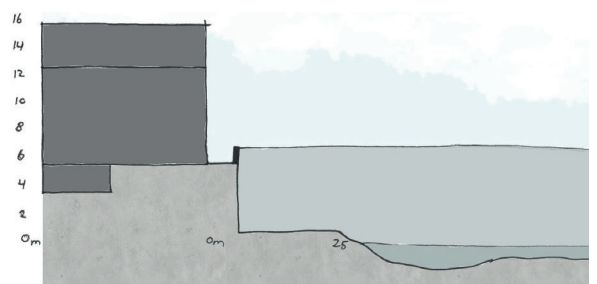
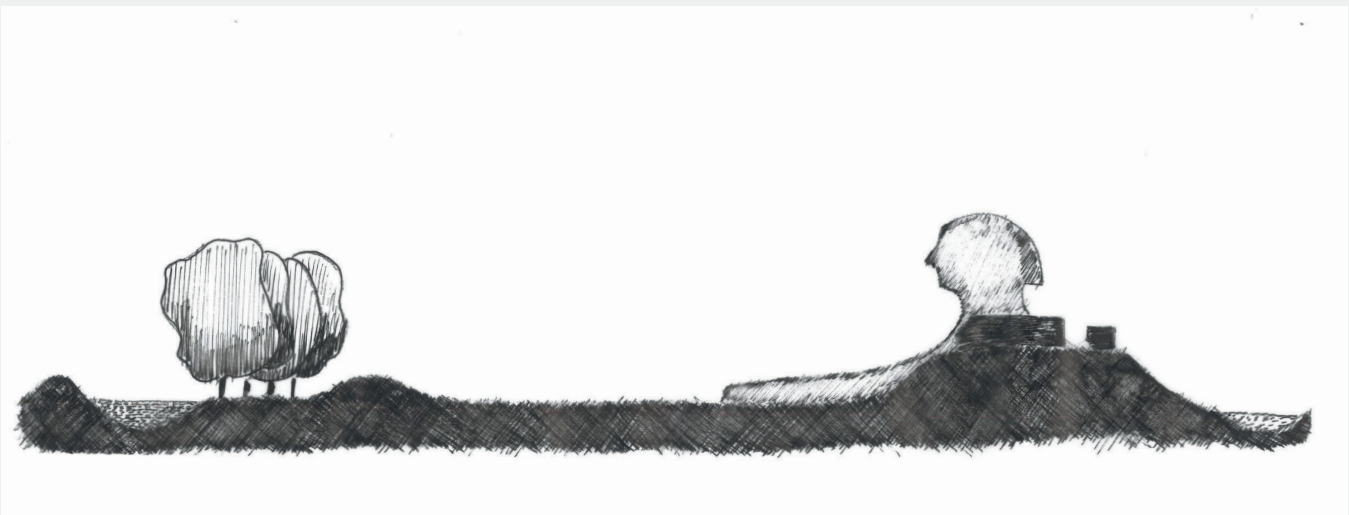


Image 20 - Home of Henk in relation to the river Maas

*The silence is overwhelming on this cloudy day. The Overdiepse Polder stretches ahead, to the left and to the right into the misty sky. On land defined by flatness and rationality, the slightest gestures of relief gain enormous dominance and expression. A formation of six sphinxes, connected by the dike, lies on the south border. Large bodies of earth carry the farmhouses on their backs. The landscape resembles the work of giants: long, smooth lines of water and land, organised colours and patterns of vegetation. In constant labour to direct the water, the polder is the result of many hands work through the centuries. Names like 'Bergsche Maas' and 'Oud Maasje' contain the stories of disastrous years: 1421, 1995, 1997. The sphinxes, calm, static and robust guards of this landscape, seem to bear witness to it all, but their age is not even a decade. Their emergence is yet another result of technological interference of man in water. Man and water, forever engaged in a battle of chess. First the dikes in the 12th century. Then the Elisabeth flood in 1421. The canalisation of the Bergsche Maas, in 1900. The Flood Disaster of 1953. The 'Terpenplan', in 2011. Threatening water in 2021... This constant battle for power, what will be the next move?*

*The old flood plain lies quiet next to the river bed, tired of all the manipulations. "I used to be part of the natural river course, now I am defined, controlled and cultivated. When will they ever stop?" Dominated by rationality and organisation, the landscape is the display of human interference. "At first the water was just free, flowing over me unobstructed. But then came the first negotiations. Dikes, peat excavations, ditches, that's where it all started. But I remember 1421, the water came and it was everywhere, all at once – that set back man's manipulations, fortunately." With grandeur and publicity, the terpenplan was introduced in 2011, transforming the Overdiepse polder back to the flood plain. "But I don't understand what the big deal is, I used to be a flood plain forever, until 1946. Only then did they take my water away from me permanently. Now they say I'm no longer a safe living environment, but why did they come to live here in the first place?" The plain now has the company of the eight terpen, "yeah, supposedly to protect the farms from the water. If you ask me they should stop changing the landscape to fit their economy, and change the economy to landscape. Imagine if they would accept water again, I could be so much more than rigid agriculture."*



# 4. Dutch river management and sense of safety

OVERDIEPSE POLDER IS TRANSFORMED FROM 2010-2015, PART OF "ROOM FOR THE RIVER" PROGRAMME. THE POLDER WAS TRANSFORMED TO INCREASE BUFFER CAPACITY. THE ESTIMATE IS THAT ONCE EVERY 25 YEARS THE POLDER WILL FLOOD. ALL FARMS (THE ONES THAT ARE LEFT) ARE CONSTRUCTED ON "TERPEN": MOUNDS ON WHICH THE FARMS ARE BUILT TO PREVENT THEM FROM FLOODING.

I ARRIVE HERE ON DAY 1 APRIL 25TH AT 15:30. THE SKY IS WET AND GREY.

THIS WAS AN INITIATIVE BY THE FARMERS AND IS CALLED "TERPENPLAN"

THIS SECTION WAS CANALISED IN 1887 TO LET WATER IN THE RIVER AFTER, MITIGATING FLOODS UPSTREAM.

HOWEVER, THIS "OUDE MAASJE" IS A TIDAL STREAM, A LEFTOVER OF THE ST. ELISABETH FLOOD

OFTEN THIS NAME REFERS TO THE "AFGEDANDE MAAS". THIS SECTION WAS DANCED IN 1273. IN 1421, THE ST. ELISABETH FLOOD DESTROYED THAT SECTION ALMOST ENTIRELY.

AN INFORMATION SIGN BY "BRABANTSE DELTA" EXPLAINS THE FUNCTIONING OF THE POLDER. "BRABANTSE DELTA" IS THE WATER BOARD SINCE 2004, WHEN THE 5 BOARDS OF BRABANT MERGED. IN 1340 THERE WERE OVER 200 BOARDS...

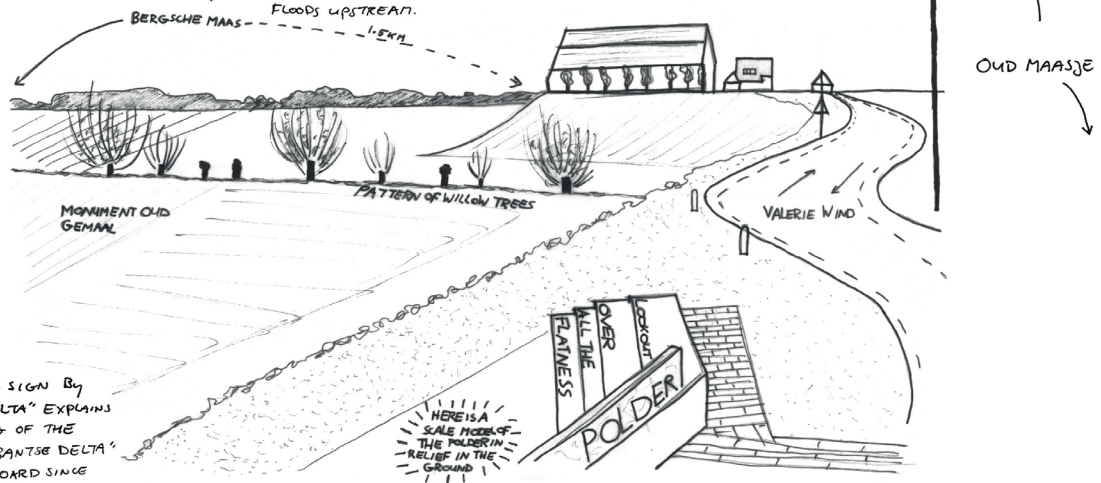


Image 21 - Overdiepse Polder, Annotated sketch

Where the Bergsche Maas diffuses into other flows such as the Amer, the Biesbosch, Hollands Diep, Merwede, Dordtsche Kil, Oude and Nieuwe Maas, lies the Overdiepse polder, an illustrative example of how the Dutch water management strategies gradually shape and organise land.

The first dikes have been built here in the 13th century in a marshy landscape. This stimulated peat excavation, leaving typical traces of straight ditches. After the disastrous St. Elizabeth's Flood of 1421, the tidal area that is now the Biesbosch was created. The soil was covered in a thick layer of clay, but gradually the cultivated structure was restored by man. In 1900, the canalisation of the Maas, now called Bergsche Maas, gives the polder its current contours. After the completion of the Delta works, the polder can completely be drained in the 1970s, and a series of farms has been built that use the polder for agriculture.

The floods of 1993 and 1995 lead to strategically depoldering the Overdiepse polder, to create capacity to buffer water. On initiative of the farmers, a series of terpen (mounds) have been built to raise the farms and to protect them from the water (Heemkundekring 'Op 't goede spoor' Waspik, 2011, p. 179-181).

This brief historical timeline shows how the water strategy focusses on optimizing the landscape by cultivating it for agriculture, for profit. From time to time, the rivers flood, and this is then answered by further adjustments and alterations in the landscape. This chapter relates the dominant water strategies to the floods of the '90s and of 2021 with personal experiences of the interviewees, and how they perceive their safety from river floods.

### *Profit and security*

The history of draining the marshland and reclaiming land from the sea has created the landscape of the Netherlands, especially in the last two centuries. Water has always been in the inferior position compared to the economy: polders are continuously drained for agriculture and rivers have been canalised for the shipping industry. In combination with the sandy soil, this resulted in the highly manipulated cultural landscape that is typical for this country (Metz & Van den Heuvel, 2012).

To prevent the country from floods either from the sea or from the rivers, the strategy has always been to push water away as much as possible. After the great North Sea Flood of 1953, the Delta Works were constructed over the course of the 20th century, reducing the coastline and keeping the sea water at bay (Metz & Van den Heuvel, 2012, p. 31). The rivers of the Netherlands have been subject to continuous optimizations, mainly for the benefit of shipping. This means that the aim is to have a constant flow in the river. A few examples of tactics to achieve this are canalisations, bypassing curves, the implementation of cribs and clearing the flood plains from obstacles (Vandersmissen et al., 1995, p. 16). The country now relies on an extremely complex and optimized system that serves the security and the economy of its land.

### *The floods of the '90s*

The 1990s mark a turning point in the Dutch water management strategies. In 1993 and 1995, the great rivers deal with high water levels. The Maas flooded large parts of Limburg in those years, and in 1995 also the Rhine, Waal and IJssel reached critical levels. This led to the evacuation of almost 250.000 residents of the river region.

After days of rain in France and the Ardennes, at the end of January 1995, the level of the Maas rises dangerously. With the floods of 1993 fresh in memory, some municipalities take precautions like building emergency dikes of sand bags. In the night of January 26, the first evacuations start to happen in Maastricht. "There is hardly any panic among the people of Limburg, who have to flee for the second time in a year from the deluge. Resigned and confused, they nail down windows and doors, get into army trucks and seek refuge higher up." (Vandersmissen et al., 1995, p. 33).

Because this is the second flood in two years, many residents act on experiences



of 1993. Before evacuating, living rooms are emptied and furniture is placed higher up, windows and doors are nailed shut, homes are protected with sand bags and water pumps are installed. The wisdom gained from 1993 is striking. Water itself is not so much the issue, it is the dirty sludge and mud that causes most trouble. To keep the mud out, families have tiled their living rooms and relocated electronics to higher places. Some even drown their ground floors themselves with tap water. In other places, houses and shops are soldered shut with bitumen to make them waterproof (Vandersmissen et al., 1995, pp. 33, 35).

Communication between governments and residents is key in running the evacuations smoothly. For example, the town hall of Haelen stays open through the night (Vandersmissen et al., 1995, p. 31). Solidarity is of utmost value in these times of crisis, and stimulates cooperation and aid in building emergency dikes and helping others (Vandersmissen et al., 1995).

In Gelderland, it was not so much the Maas but the Waal that caused great concern. “When we had to leave in ’95, the dikes near Tiel and Ochten were very weak. If they were to break, we find ourselves in a soup bowl,” is what Els tells me when she talks about her experience of the evacuations. Hedel lies on the dikes of the Maas, but the Waal is only a few kilometres away. Should the Waal dikes break, the water would be obstructed by the Maas dikes and the area in between would flood. Els went to her sister, only 11 kilometres away, but outside the ‘soup bowl’ between Maas and Waal. Before she left with her family, they packed valuable items like photo albums, and cleared out their ground floor. Els tells me that the idea of leaving their home was a bit scary, it could flood at any time. But at the same time she says “we are all alive and well, and we’ll see how it goes.” Communication was different at the time. The municipality sent out letters to notify of the evacuations, including traffic instructions and information about municipal support. I can only imagine how impressive it must be to receive a document like this. Because of a lack of mobile phones or the internet, it was unsure how friends and family were doing. For Els, who worked at the hospital in ‘s Hertogenbosch, this was a place where people came and shared their stories, how they are doing and where everyone is staying. When I ask her if this experience has changed her feeling of safety in the river landscape, she tells me “When there is high water, you would keep an eye out, but they have started directly with repairing everything. Everywhere there was dike maintenance going on, so that gave a safe feeling.”

### *Room for the River*

In the aftermath of 1993 and 1995, questions are raised about building and living in the river landscape. The realisation is growing that after pushing water away hard as possible, water is now pushing back. “We must ask ourselves, preferably in an international context, whether it is still responsible under these circumstances to build in the area that in fact belongs to the domain of Mother Maas. We cannot continue to take away pieces of land unpunished, without giving anything in return,” (Vandersmissen et al., 1995, p. 47). Since the floods of the ‘90s, polders like the Overdiepse Polder are being given back to the water by breaking away dikes. The famous programme *Ruimte voor de Rivier* (Room for the River) is being drafted. In many locations along the big rivers room is being created through dike relocations, depoldering and the creation of flood

areas (Metz & Van den Heuvel, 2012). This programme marks an important change, from a strategy of draining water as fast as possible to creating enough capacity to retain it.

### *The floods of 2021*

In 2021, it is again rain that raises the level of the Maas dramatically, only this time in summer. Henk lives on a street that is 5 metres higher than the river, lined with a small quay wall. The water rose fast, extremely fast, all the way to the edge of that wall. They decide to place all furniture higher on crates, although Henk thinks it's useless. "If the water rises so much that it comes inside, we'll have bigger problems than a damaged couch or a piano. So I didn't like it, but well, we did it anyways."

He decides to call an acquaintance who works at the flood crisis centre in Eijsden, and he said "Man, get out of there. It can get all the way up to the first floor." Henk tells me this was because of the sluice of Monsin. This sluice was under construction during the floods, which is why it was weak at the time. There was a chance of 60% that the sluices would break. If that happened, the whole area from Eijsden to Maastricht would have been flooded, and this is why Henk had to evacuate.

At some point, the water reached its peak. If the threat of the sluice wasn't there, they could have stayed home. But at some point the fire department did come to evacuate the residents. "The fire department comes to your door, with seals, and tells you there's have 40 minutes to leave." Only when the fire department breaks the seals you can go back into your house again. Henk tells me it was a restless night, "there's nothing you can do."

In the local cultural centre of Eijsden the crisis centre was set up. They would care for people who didn't have anywhere to go, and they were in contact with all the monitoring points in the Netherlands and Belgium. When I ask Henk



Image 22 - Floods in Asselt (K. Nijmens, personal communication, April 27 2022)



Image 23 - Rising water levels in Maastricht (S. de Poel, personal communication, May 1 2022)

about communication with the local authorities he tells me it was chaotic and unclear. At some point, experts came to the quays saying nothing would happen, almost mocking the concerns of local residents. “So yeah, I thought these guys are paid to do this job, they’ll know what’s going on. That’s why I was so calm, until I called the crisis centre who told me to leave as soon as possible. And indeed the fire department came to evacuate us half an hour later.”

Henk is convinced these floods will recur. “The idea that we can go back, that the danger is gone, that idea no longer exist. We can only make sure that the danger doesn’t increase exponentially. And that leads to the question should I sell my house?” He tells me it is not so much the fear of something happening to themselves, but rather the financial damage that will not be refunded is what concerns him. Fortunately, in the end the evacuation was merely a precaution: “We didn’t have any damage, the neighbours had a bit of water in the basement. Well, pump it away and that’s it. So in fact, nothing went wrong here.” Finally, he says about living with water: “It is threatening. At once, the idyllic becomes threatening.”

In Maastricht, residents of the neighbourhoods Heugem and Randwijck are requested to leave. On the other side of the Maas, Han and Susanne held a close look at the water level. Every one or two hours, Susanne went out on the dike to take a photo of the campsite on the opposite bank. “I had a benchmark, there are these trees and tables and chairs. So first all the tables and chairs disappeared and I thought those bushes will stay, but they were all gone at some point. And then you’d see caravans disappearing.” Susanne explains that on their side of the Maas, the land is a bit higher than on the other side. Also the dike here is slightly bigger, so they were not worried that their side of the street would flood. Neighbours however, Susanne tells me, were more nervous. They packed their valuable stuff, and parked the car higher up. “Their house doesn’t have a cellar, and we do. So when our house would flood it would have only been the cellar, and that is already 1.90 metres high.” They show me the water well that is visible through their kitchen floor. Deep below lies a black pool of ground water. They tell me that with a tape measure they kept track of the water table in 2021. When in the evening of July 15 the water level stagnates, they know there won’t be any floods near their house. North of Maastricht, near Smeermaas, more room has been created for the river and that gives some rest here, Together with the elevated position of their house and keeping track in the water well, this gives reassurance in times of high water. Susanne suggests that further upstream before Maastricht would be a logical location to create more room.

The water peak reaches Roermond a day later. In Swalmen, Käthy and Arnold

keep a close look on the weather through websites. The level of the Swalm is high but of no significant danger. Käthy tells about the little village Asselt, where there is a restaurant that has been struck by the floods. About one metre water has been inside. In this area, on the banks of the Maasplassen, the houses have been built on naturally higher grounds, but this restaurant lays a little bit lower and that caused a lot of trouble.

In Beesel, close by, evacuations were effected in the middle of the village, quite some distance from the river. Because this is the lowest point of the village, all water would flow here if the dikes should break.

Käthy mentions that at a campsite nearby Roermond, for two months a caravan has been stuck in the trees, and bushes and trees have been brown of the mud for the lower two metres. “Higher than yourself, I actually think that was very impressive.” Käthy and Arnold have seen a lot of neighbourhood initiatives, people who took in friends and family, or pets, people who needed help with livestock. “Everyone feels very connected in those times.” Also the waterboards set up communication lines, together with the municipality to keep track of what was needed where. Käthy and Arnold are not worried themselves of floods for their own house, but it still bothered them. “I do think it was scary,” Käthy says, “because you knew that there were people in your area that were struck by the floods.”

When the water peak reaches Balgoij, there is no further threat of flooding. Nevertheless the views on the river Maas are impressive. Gonny tells me that it is always a sensation to watch, “When there is high water, this region is completely flooded, a beautiful view.” It is because of the flood plains near Keent and Batenburg that Gonny felt safe: “the water here can go anywhere,” she tells me.

### *Sense of safety*

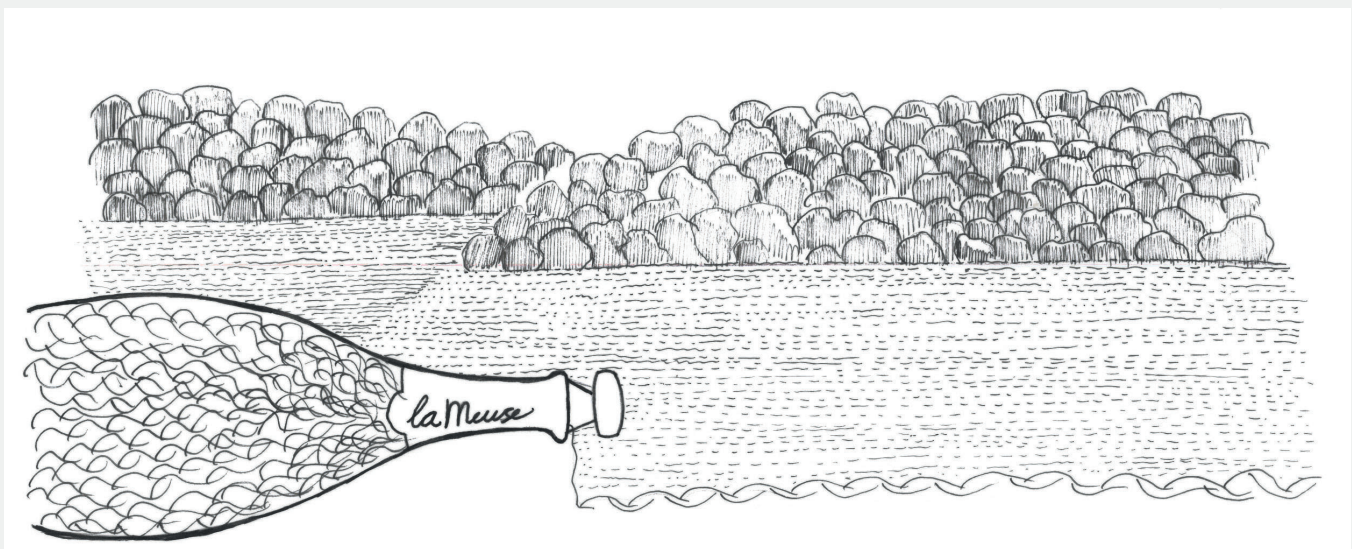
The floods of 2021 were larger in terms of water discharge than the floods of '93 and '95. Thanks to the improvements of Ruimte voor de Rivier, the river systems could process these vast amounts better (Task Force Fact Finding hoogwater 2021, 2021). The people I spoke to showed confidence in the Dutch defence structures and in the efforts by the water boards and governments to keep the country safe. Metz and Van den Heuvel (2012) underpin this sense of security, but explain that this greatly relies on the government. Safety is not very tangible for the average citizen. The defence systems are ultimately the domain of engineers and professionals, and people themselves are less aware of their dependence on them (p. 229). The reason for Henk to consider moving away is that as a resident you are depending on the government taking the right measures to keep the living environment safe. “You are dependent on the solutions that might be implemented.” But he also tells me this urgency to move is decreasing. “Quietly I hope that measures will be taken here. So yeah, you position yourself depending on the people responsible for taking the measures. (...) And I hate that.”

“In the past, people were a lot more dependent simply on what was there. There were less services, lower dikes, everyone grew up with the water. Sometimes it came, sometimes a couple of years it didn't, but then it would come in the end. So people counted on that and that was passed on from generation to generation,”

Käthy tells me. The Netherlands relied on a culture that revolved around water, until the twentieth century. Nowadays people rely heavily on the government controlling and maintaining the defence system (Metz & Van den Heuvel, 2012). Now that because of climate change the Dutch defence system is under pressure, it is interesting to see what can be gained when people themselves increase awareness and self-sufficiency in flood protection.

*In the border region between Belgium and the Netherlands, lie the sluices of Lanaye. These works bear various names in the two languages. Sluis (Dutch) refers to a work that enables ships to bridge differing water levels. Sluizen means to transfer something between intermediate stages. Écluse (French) has a similar meaning as sluis. But these sluices bear the nickname bouchon. Figuratively, it refers to a bottleneck: a narrowed section that impedes the flow of water, giving these sluices a critical position in the flow of the Maas. Literally, bouchon means cork (on a bottle), and another English word for sluice, lock, comes to mind. A lock secures something in place, protecting treasures from the outside, or securing dangers from breaking out. During the high waters of 2021, l'écluse de Monsin, just North of Liège, was on breaking point due to the high water pressure. Should it break, then Limburg downstream would be dealing with catastrophic floods - some spoke of a tsunami in Maastricht. However, accumulating water upstream endangered Liège from flooding. Liège or Maastricht, who will tell? Who has the power over this water danger? Who rules the locks on the Maas?*

*The doorman of Lanaye stands with both feet in the water. With its expressive posture it marks human's footprint on the landscape. "Man put me in this position to guard the border, but I just want to welcome everyone." Equipped with heavy doors, more often closed than open, the doorman only permits water when man says so. "They regard water in its isolated form, its power to destruct as a singular capacity." The doorman is a manifestation of efforts to suppress this singularity. "But what about waters' potential to facilitate life, nature? How it organises landscape and has all forms from vapour to ice. Imagine they would accept all that water, everywhere. I wouldn't limit water to linear movements. One day I could be swimming in the river, the other day I could float in clouds, the next I would store water, for some other day of drought. I would allow water to be anywhere, instead of restricting it between here and there."*



# 5. The power balance between human and river

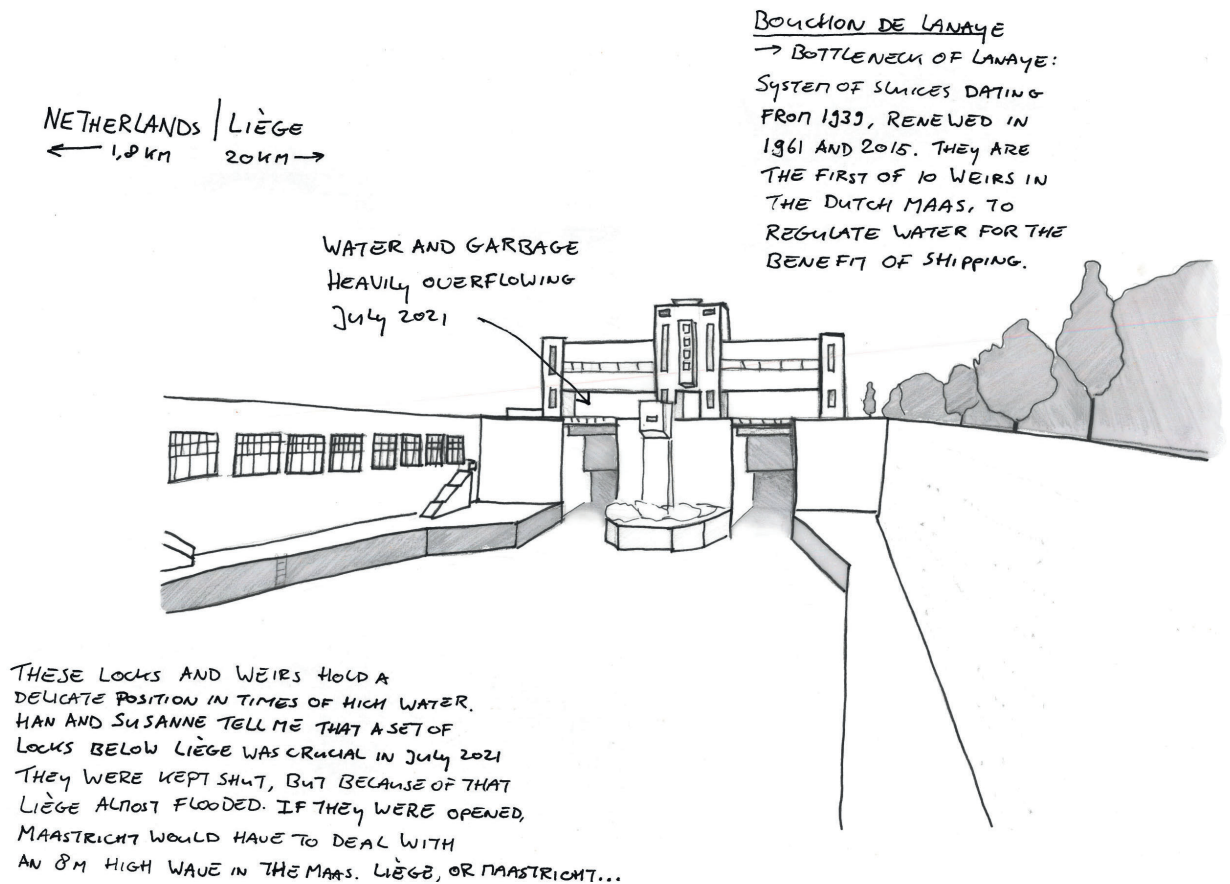


Image 24 - Écluse de Lanaye, Annotated sketch

Henk, and Han and Susanne tell me about a precarious situation that emerged between Liège and Maastricht. In Monsin, north of Liège, the sluices were under construction during the high water of 2021. Because of the water pressure and the maintenance works the sluice was on the verge of breaking. The Maas was here obstructed and more and more water accumulated in the city centre of Liège. Urgent requests came to open the sluice, to prevent Liège from flooding and to prevent the sluice from breaking. However, this would mean that the peak in the Maas would rapidly enter Maastricht, some even spoke of a tsunami of 8 metres in the city centre.

This anecdote explains an unpleasant situation between two countries having to choose between two evils. Who controls the sluices holds a powerful position in relation to the surrounding land. Controlling water is something intrinsically

Dutch, as is explained in chapter 4. This chapter explains the relationship between humans and rivers with the notion of a power balance. This power balance gives a perspective on the forces that humans and rivers have in relation to each other, and it gives insight in how that relation is spatially tangible. Altering this power balance leads to new visions on how to live with water in less destructive ways.

## *Dominance*

“River floods are as old as the river itself. Only when man came to live at the river did it become a problem” (Vandersmissen et al., 1995, p. 8). This quotation addresses the power balance at its core: it is a relation of dominance. Of the two powers involved, man and river, one dominates the other with its forces. The Dutch have enforced a dominant position on the Maas, by confining it with dikes, regulating it with sluices and weirs, and changing its course. The Dutch have engineered this defence system so well, that when the Maas supersedes these borders and floods, the Dutch are taken by surprise (Vandersmissen et al., 1995). In those moments, the Maas takes over the dominant position. Its steep course in the Ardennes, with a relatively impermeable soil, in combination with heavy precipitation upstream has led to historically notorious Maas floods (Vandersmissen et al., 1995, p. 16). The Maas gains its strength from the landscape and territorial conditions, whereas humans modify landscape and construct water works.

The dominance of a river should also be seen in light of the vulnerability of humans. River floods only became a problem when man came to live at the river: whenever there is something valuable built, there is something to lose. Gonny expresses this well: ““When you say safety you think about personal safety. But it is already a problem if there is 20cm of water in your house, that would be troubling already.” In the 18th century, when the Netherlands was a growing country, the first national Inspector-General of the rivers was appointed, who laid the foundations for Rijkswaterstaat, the federal department of Waterways and Public Works (Vandersmissen et al., 1995, p. 13). From that moment, the Dutch water management gradually developed into matters of the federal government and centralised management by professionals. The Dutch have become so successful at dominating water that it has become a national pride, with the Delta Works at its summit (Metz & Van den Heuvel, 2012; Vandersmissen et al., 1995). However, this also meant that over the last centuries, water was not a principle of spatial organisation; water was brought where it was needed and drained where it was undesired (Metz & Van den Heuvel, 2012, p.29). Because of the strong ability to control water, its dangers have left the public awareness and water safety is seen as the responsibility of the government (Metz & Van den Heuvel, 2012).

Now the power balance is shifting. Because of climate change, the forces of the river are growing and the position of man is becoming increasingly vulnerable: sea water levels are rising, polders are sinking, precipitation is increasing (Metz & Van den Heuvel, 2012; Vandersmissen et al., 1995). After a long period of absence, the floods of 1993, 1995 and 2021 bring back high water levels to the collective human memory (Vandersmissen et al., 1995, p. 24). This realisation of the Maas and its powers can be read in language that is used in the aftermath after the 1995 floods. Phrases like ‘the ever mighty nature’, the title of the report De



Maas Meester ('Mastering the Maas'), and 'taming the river' give expression to the determination to answer the forces of the Maas with power (Vandersmissen et al., 1995, pp. 21; p. 24). In particular, the Maas has a female personality in literary descriptions, which are used as metaphors to characterise the river when it floods: "Mother Maas hasn't shown her best side in recent years. The old woman seems to be getting more and more grumpy;" (Vandersmissen et al., 1995, p. 28-29).

### *Spatiality*

This battle for dominance is a spatial one, human and river make claims on the same territory. The fundamental law is that water flows to the lowest point, and this flowing of water stimulates natural processes like erosion, deposition and meandering that shape rivers and the landscape. Man-made defence mechanisms consist of spatial elements and constructed water works such as dikes, dams and barriers, and land reclamation methods alter the landscape and soil composition. Although the report that marks the start of the recovering plan after 1995 is called *De Maas Meester*, the realisation is growing that building even bigger dikes, resulting in a Maas being pushed into walls like "hideous straight jackets of security", is not a durable option. The report presents a number of strategies to strengthen the defences against the Maas, but the main message is that we should get used to more frequent floods and fluctuations of the Maas from time to time. Furthermore, it is concluded that canalising and construction in the river landscape has reduced the original river dynamics and efforts should be made to restore that dynamic (Vandersmissen et al., 1995, pp. 21, 24).

*Ruimte voor de Rivier* was the first nation-wide programme after the Delta Works to reverse the water management strategy: retaining water as long as possible, instead of draining it as fast as possible. Although *Ruimte voor de Rivier* allows the rivers to flow more freely, cynically speaking it still doesn't let go of the dominant position of humans over water. It still influences the river course and contains the water in places where we allow it, dikes are relocated but not fully removed (Metz & Van den Heuvel, 2012, p. 143). How can we then change our dominant position over water, in such a way that waters regain its natural dynamics and that humans can live with water safely?

Mathur and Dacunha (2014) advocate their understanding of river literacy to understand how the human view on rivers expresses their dominant position in the power balance. This understanding can help changing that view, so that a non-dominant relationship can emerge. The way humans see rivers and bodies of water is as entities that are defined by a clear line, the line that separates land from water. Mathur and Dacunha (2014) argue that these lines are the result of a human act, rather than a natural feature (p. 1). The demarcating lines have three tasks: separating water from land in space, calibrating time by defining a flow from an origin to an end, and holding water to a defined channel. These three tasks mean that spatial planning, development and engineering is based on envisioning and directing water along those lines, and enforcing them as borders. A flood is then seen as water trespassing those borders (Mathur et al., 2014, pp. 2, 4). The core of the argument for this river literacy is the question if those lines are necessary. A flood is considered a natural (but temporary) exceedance of the river border. After the flood, much is discussed about reinforcing those borders to prevent floods from happening again, or at least to

mitigate its damage. But there is little discussion about the necessity of such a border (Mathur et al., 2014, pp. 4-5). In this perspective, the Delta Works can be seen as the most extreme example of enforcing the border between sea and land, and Room for the River as a regression (but not deletion) of the borders between river and land. The alternative view Mathur and Dacunha advocate is that water in every form is everywhere, and in moments it is perhaps rain that pours on land, or water that flows over it. Water is then defined by its form in time, rather than by its location in space (Mathur et al., 2014). Water in its fluid form is preferred over water in ephemeral states (rain, vapor), because it can be simplified and fixed in time by drawing the demarcation line between land and river. This gives it a more permanent status than in its other forms, which means that those forms are seen as an inconvenience and secondary to water's fluid state. Furthermore, water's separation from land gives it an inferior position to it, which means that rivers are preferred to be seen as draining land, and not as inundating it (Da Cunha, 2019, p. 9). In this light, the canalisations and regulations of the Maas are efforts to fix this river to a constant flow of liquid water, serving agriculture and industry. When the Maas floods, as it does often as the result of precipitation, this is a violation of its preferred, fixed state.

The power balance between human and river is based on dominance. By removing or reducing the power of one, and decreasing the vulnerability of the other, the dominant relation can be altered. Since the power balance is manifested spatially, the notion of temporality is interesting in redefining a relationship with water. Envisioning water in time (rather than in space defined by lines), when it transforms from moments of clouds, to moments of rain, to moments of water also changes the vision on architecture. Lines that we draw around settlements and homes are lines we don't want water to cross. But if we remove those lines from our imagination, and think of water as it is already in those locations (one moment as vapour in low concentrations, and other moments as flowing water in high concentrations), our vision on where we are safe from floods (dependent on the rigid location of our house where we don't want water to be) shifts to when we are safe from floods: depending on the form, concentration and moment in which water is present. Creating architecture that is not an enforcement of lines, but an enablement of all forms of water, disarms the power balance and allows humans and water to be equals. The possibilities of such a kind of architecture can lead to a full research paper on its own, but chapter 7 describes a first exploration that leads to the design assignment.

# 6. Conclusion

In the Netherlands, it is difficult to escape from the condition of water, and this feeling safe is what led to the main research question: What is the role of architecture in perceiving a sense of safety in Dutch river landscapes? The conclusion below is structured along the three sub-questions that follow this research question.

## *(1) How are the characteristics of the Maas river landscape perceived?*

The Maas is a rain-fed river with water levels fluctuating from high levels in winter, when snow is melting, and low levels in summer when precipitation rates are low. Concluding from the interviews, literature research and personal observations included in this research, the spatial characteristics of the Maas can be categorized in three groups: morphology, use & activities and spatial interventions.

**Morphology.** The Dutch trajectory of the river is characterised by its curvy channel lined with flood plains and a dike on both sides. The trajectory along the border of Gelderland and North Brabant is lined with bakenbomen. In the north of Limburg, the landscape is more bushy, where in Brabant and Gelderland the landscape is dominated by (flat) farmland. Some characteristics of the Maas provide indications of high water levels, as happened in 2021, like mud and garbage hanging high in trees.

**Use & activities.** The dikes along the Maas provide wide views and popular cycling routes, like the Maasroute that I followed in April. Agriculture in the flood plains is common, although after the floods in summer, before the harvest, the farmland is looking damaged. The Maas is known to have high water levels in winter, but not in summer. Therefore in summer times, campsites in the flood plains are full, but in winter they are cleared out. Because of the gravel industry, the Maas is lined with Maasplassen that now serve recreational purposes.

**Spatial interventions.** The Maas is characterised by regulations of its course and channel. Along the Dutch trajectory there is a series of weirs that regulate the river for shipping. Other characteristics are canalisations and cut-off river curves. Between Maastricht and Maasbracht lies the Julianakanaal, a channel that was created between for shipping, because here the Maas was too curvy.

The characteristics that come to the fore from the interviews are all defined by passive observations. When asked what characterises the Maas for them, the interviewees describe the shape of the river, the dikes and the type of vegetation and fauna on the banks. Hardly any answers indicate active interactions with the landscape; only Els describes cycling routes and ferries, and her Bed & Breakfast occasionally hosts cyclists. Some of the interviewees describe cycling and hiking as recreational activities in the Maas landscape, but none name any active interactions that they participate in. In line with this are my personal observations of the cycling tour, where I was a passenger riding through, but not actively interacting with, the landscape. This research is limited to the five

interviews and personal observations, but I state that these passive observations indicate a passive, distanced relationship between residents and river. Further research would be essential to back this up.

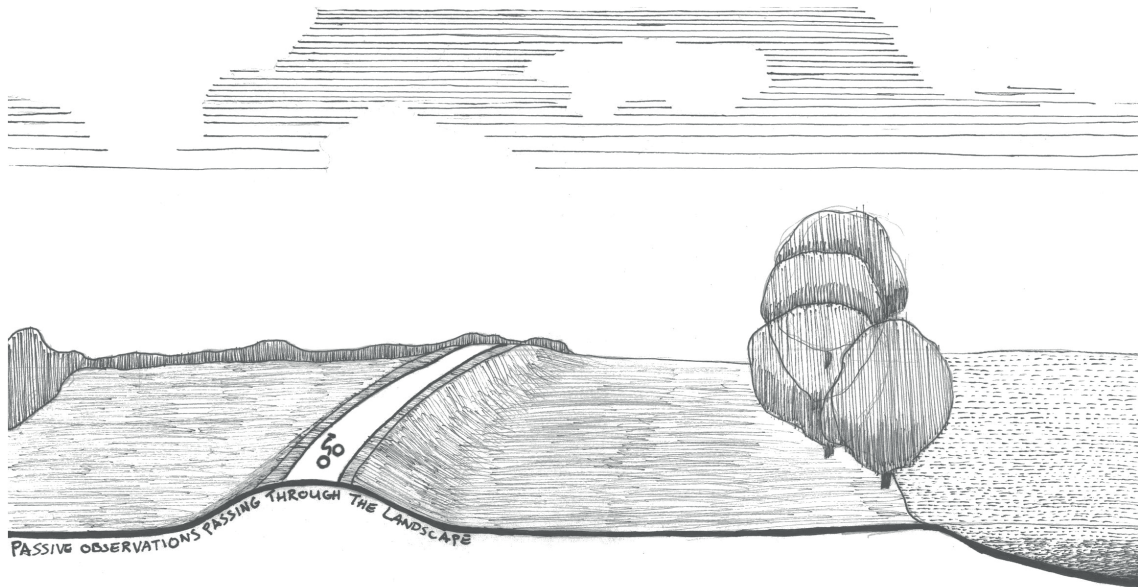


Image 25 - Conclusion: passive observations indicate a passive relationship with the landscape

## *(2) How do people gain a sense of safety from the landscape?*

Dutch river management is characterised by optimizing rivers for the economy and security of residents. This means draining the land and pushing water away as fast as possible. Because this strategy is so much optimized, water doesn't serve as an organising principle in the landscape. The Delta Works are the summit of this strategy. The sense of safety residents gain in the Dutch river landscape is defined by a number of elements. These elements below are defined based on this research, but this is not an exhaustive list.

**Communication with the government.** The government bears the responsibility to protect residents from flood dangers. By notifying residents of what to do and communicating where to find help, the government plays a key role in alerting residents of dangers and effecting evacuation orders. The story of Henk stresses that unclear and chaotic communication from local authorities can lead to incomprehension among residents.

**Community and solidarity.** In times of disaster, great feelings of solidarity arise in communities. Out of empathy, residents who are not in danger help victims protecting them from floods. Sometimes this happens by building emergency dikes together to prevent flood damage, sometimes this helps by offering places to evacuate. After floods, when material damage is the result, communities gather financial means to support local companies and residents to recover and reconstruct from the floods.

**Personal safety and material safety.** The biggest problem of flooding is the material damage that the water causes. Residents are not so much afraid something will happen to themselves, but the emotional and economical damage that the floods can cause is huge. This is why many residents protect their homes with last-minute safety measures, like sand bags, moving away furniture and

valuable possessions, and waterproofing facades.

**The role of the government and the role of self-sufficiency.** In the Netherlands, residents feel safe because they rely heavily on the government, and they have faith in maintenance of the defence mechanisms. However, centralised governance of these defence mechanisms has created a distance between residents and the water system, decreasing awareness of it. Interviewees don't mention feeling safe because of self-sufficiency when dealing with flood dangers. Their safety depends on the government taking the right measures and precautions to protect the landscape. Residents themselves have limited options to keep themselves and their possessions safe. The defence system is under pressure, and increasing self-sufficiency of residents seems promising in increasing a sense of safety.

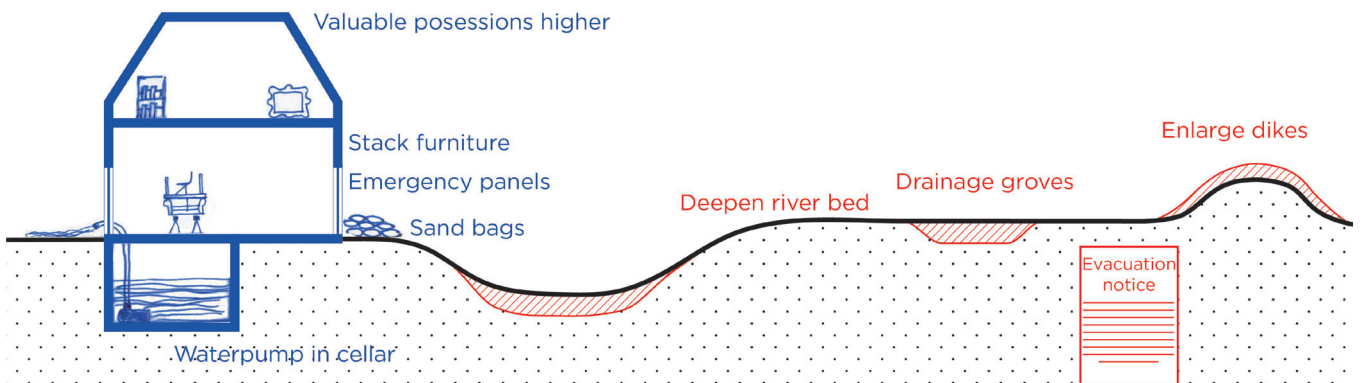


Image 26 - Conclusion: residents have limited means to protect themselves and their possessions from floods (blue). The government has the capacity to adjust the landscape to prevent floods from happening (red). Therefore residents rely heavily on the government to be and feel safe.

### *(3) What is the role of architecture in establishing a sense of safety?*

The relation between human and river can be seen as a power balance, based on dominance and spatial manifestations. By reducing power, this relation of dominance can be changed to a relation of equality. Envisioning water through its forms in time, rather than its position in space provides an interesting perspective on architecture. Creating architecture from the question of when we are safe from floods, depending on the state and concentration of water, instead of where we are safe from floods, depending on a geographical location and a fixed state of water, disarms the power balance and equals humans and water.

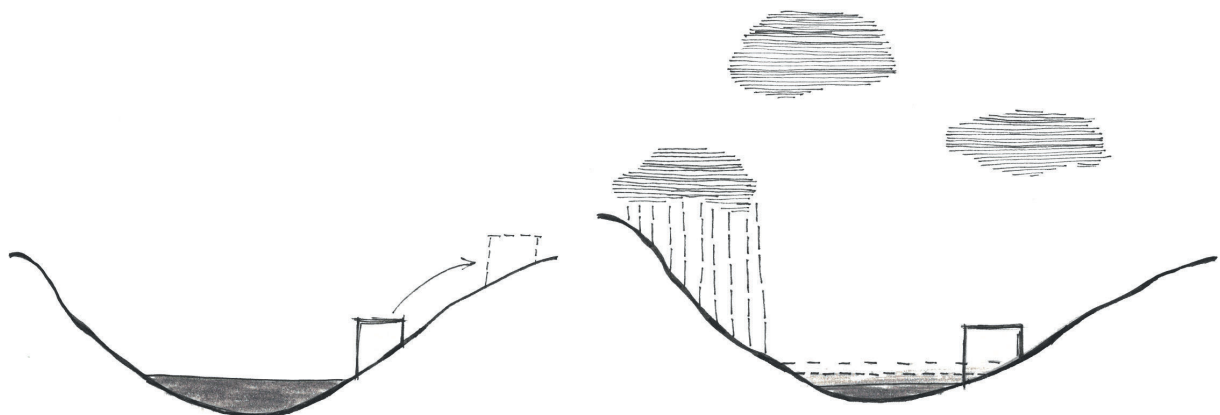
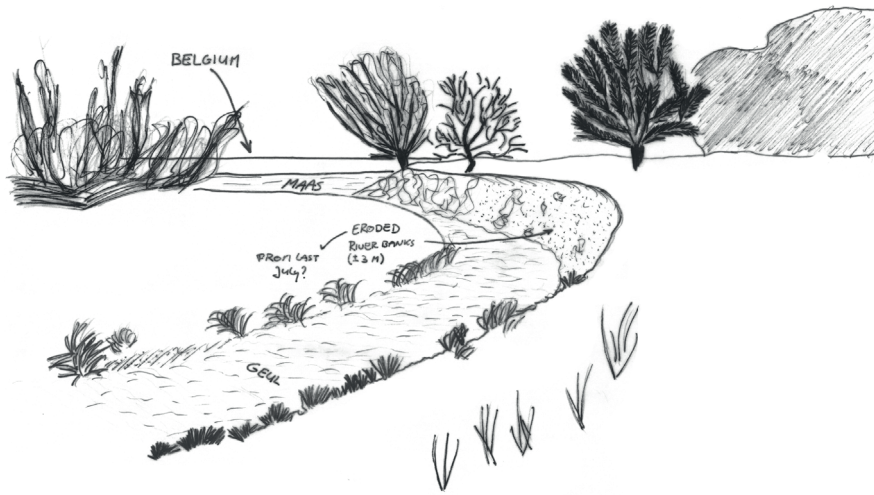
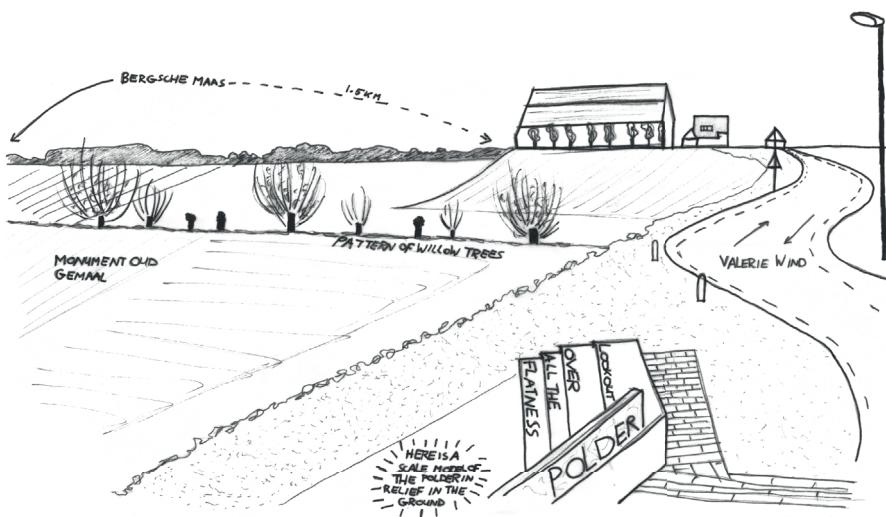


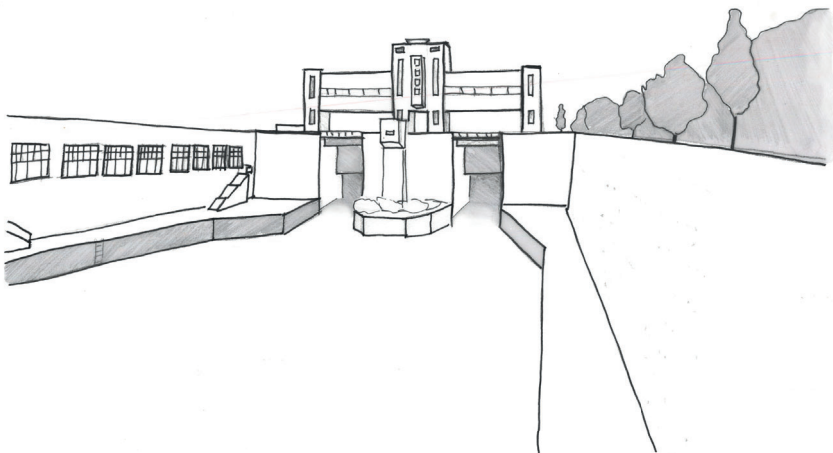
Image 27 - Conclusion: architecture can help shift the power balance, by changing our vision from where we are safe from floods (left) to when we are safe from floods (right).



Water



Landscape



Architecture

The three immersive analyses represent the three main themes of this research project.

# 7. Design assignment

The vision Mathur and Dacunha propose to look at rivers differently is inspirational for architectural design. What would this vision mean for our relation to rivers? How can we expand this vision to architecture, and what would that mean for how we design and use buildings? The design assignment is a method to study questions like these.

The conclusion that there is a distance between residents and the flood mechanisms that protect them from floods indicates that there is something to gain by increasing self-sufficiency. The current situation is that it is fully seen as the responsibility of the government to protect the country from floods. What can people do to gain self-sufficiency and how does architecture contribute to this? A variety of design leads and inspirations are extracted from the research. In the scheme below, these inspirations are organised by the three main themes of this research and design project: water, landscape and architecture.

**Use and activities.** Els tells me about swimming in the Maas and the little beach she always goes to. Gonny also goes for walks and tells me about the "bakenbomen" and overflow areas nearby. This active use of the landscape can be used to stimulate knowledge and awareness of it.

**Informal indicators.** All the interviewees remarked the large amounts of damage high up in trees after the floods, and mud that the Maaswater has left behind. In Voulwames I saw moist soil on the banks of the Geul, and Henk tells me he could smell moist in cellars as a result of high groundwater levels. The landscape can act with indicators, 'informal rulers' that represent water levels. In this way, it is not the government that sends you an evacuation letter, it is the landscape telling you when it is unsafe. Architecture itself can provide indicators and measures to increase knowledge about flood and decrease vulnerability, like the water well of Han and Susanne, cellars that provide buffer capacity.

**Action and improvisation.** Architectural and landscape indicators in that sense can also stimulate knowing when to act. Records of the floods in the '90s tell about people taking precautions, for example the bitumen roof coverings that are soldered against facades. Also Henk tells about the need to place furniture higher up (even though it might be useless). Architecture can facilitate these kind of adjustments and improvisations, and in turn send a message about flood situations.

**Community.** Communication with the government, help and solidarity are extremely important for people to cope with floods. The neighbourhood initiatives that Käthy and Arnold tell me about, the hospital that for Els was the place to hear stories and to stay updated on friends and family, the town hall of Haelen that stays open through the night: these functions of the community enable people to help each other and to keep themselves and their possessions safe. Els tells me that the evacuations were meaningful for her and her family; if a community is able to successfully cope with floods this stimulates a strong community feeling that is rooted in its landscape.

**Evacuation.** Understanding the landscape, feeling safe and the know-how in the

community how to remain safe are important but not absolute. Situations may occur where a house is no longer safe to stay and people need to evacuate. “No one in the municipality of Venlo had to sleep on camp beds,” is what the mayor proudly said, all evacuees could find a place to stay at friends and family (NOS, 2021). There is not one evacuation centre in the Netherlands. When residents are evacuated, temporary centres are set up in large buildings like sports halls, where people sleep in camp beds with little privacy and temporary facilities. Building an evacuation centre expresses that there is something to flee from and this raises awareness of flood threats.

From these design inspirations, four main design goals are formulated:

- Stimulate an active relationship between humans and the landscape.
- Indicate and expression of the water conditions.
- Decrease the distance between the government and residents, and increasing the role of the community.
- Provide safety from flood dangers.

Expanding the vision of Mathur and Dacunha to architecture requires the

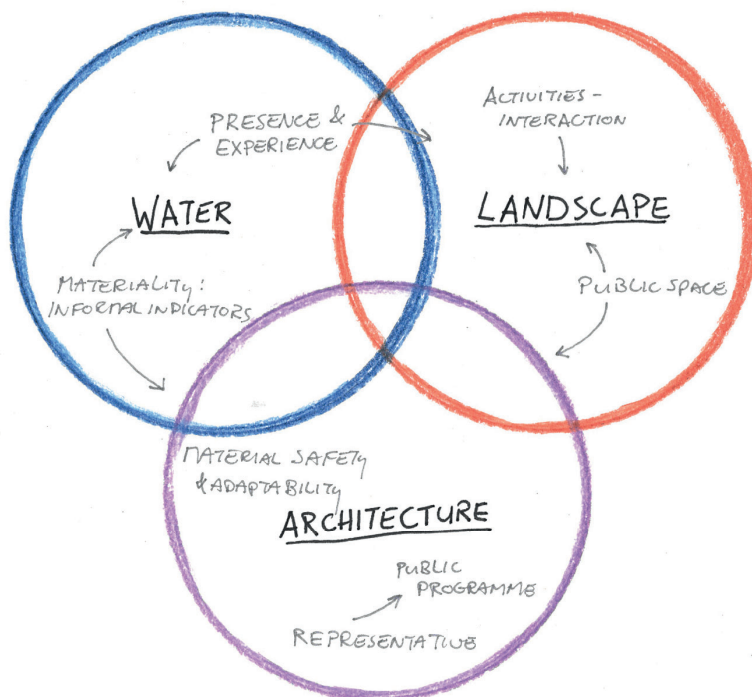


Image 28 - Venn diagramme of design inspirations

design not to limit itself to the building. If we need to think of rivers not as fixed water bodies with lines around them, we can also think of architecture, as a vulnerability in times of flood, without such borders: understanding when and in what form water can enter a building helps in reducing its vulnerability. In addition, this gives water an equal status as humans, altering the power balance. That combined with the strong role of community leads to the idea of designing a public building in areas that are heavily struck in 2021, like Valkenburg. Because of its idyllic historic centre, which is built tightly on the banks of the Geul and on which Valkenburg’s whole tourist economy relies, there is no space for water. The main focus of the Netherland’s river management and safety programmes are the big rivers, for Limburg that means the river Maas (Veiligheidsregio Limburg-Noord & Veiligheidsregio Zuid-Limburg, 2019, 2022). The floods of the Geul and their size struck the country by surprise. More attention needs to



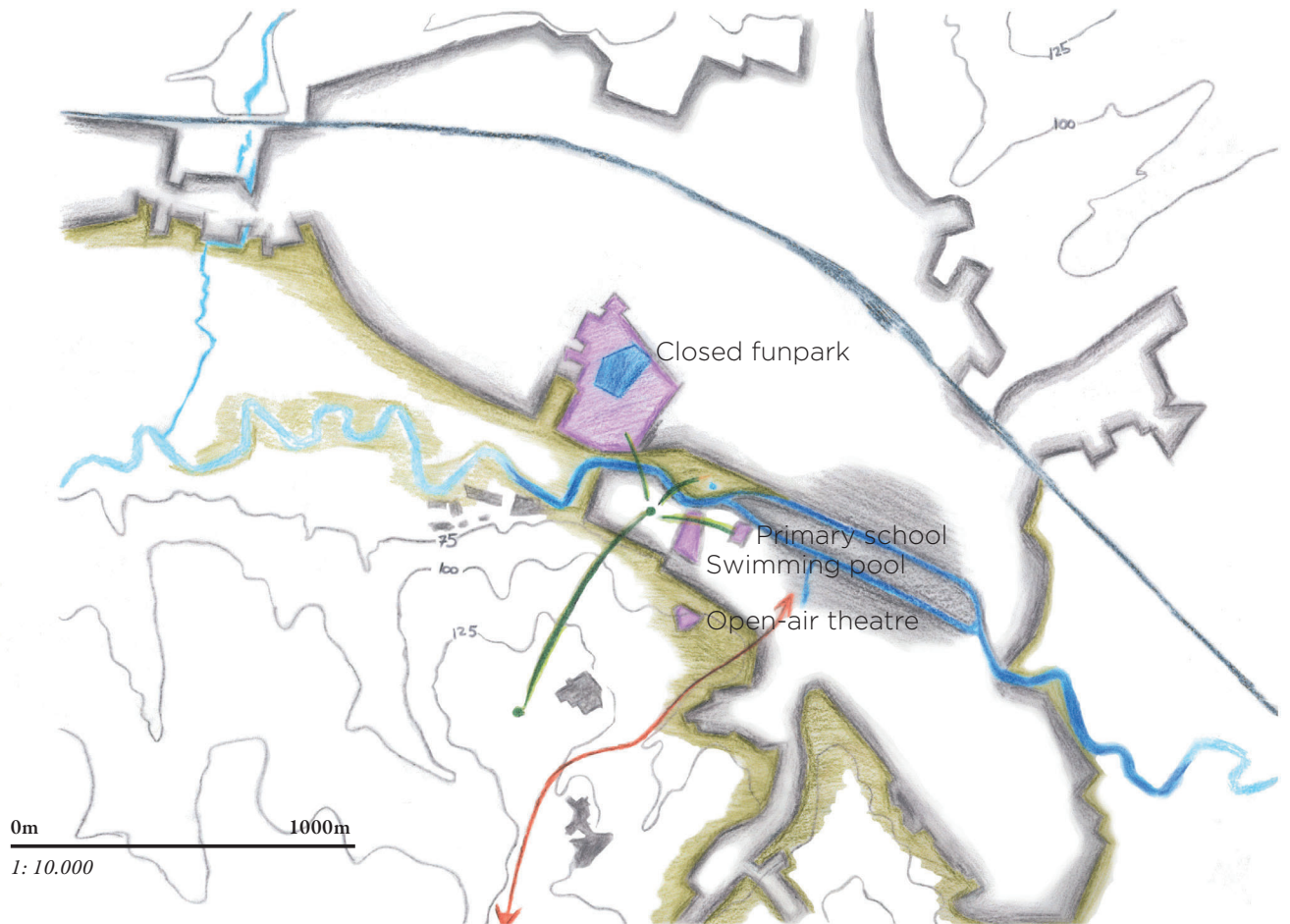


Image 29 - Figurative map of Valkenburg

go to the safety of smaller rivers like these.

Next to Valkenburg lies the Cauberg (130m +NAP), only 800 metres away from the Geul valley. This combination of the low lying river close by the Cauberg gives an interesting design site: a section leading from wet river conditions below, to high and dry conditions on top of the hill.

The design site Valkenburg then deviates from the Maas as research site. The river Geul is much smaller than the Maas (a length of 58 km compared to 950 km in total and a flow rate of 4 m<sup>3</sup>/s compared to 230 m<sup>3</sup>/s). Contrary to the Maas, the Geul has no dikes and in the Netherlands, the Geul basin shows much more relief than the Maas basin. The landscape of the Geul is to a lesser extent modified than the landscape of the Maas, although in Valkenburg the Geul is canalised in the city centre and small weirs modify and regulate its flow through

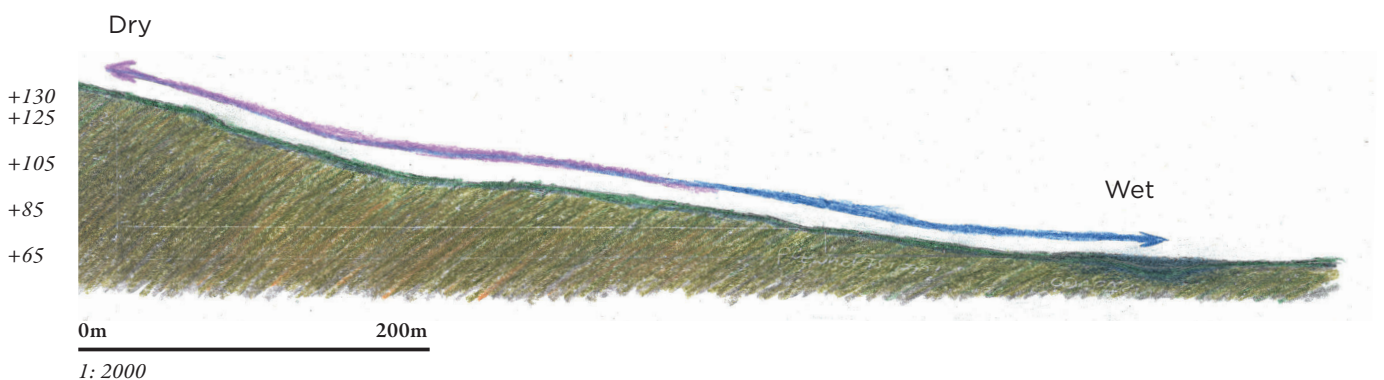


Image 30 - Section over Cauberg

the city. This means that the landscape of the Geul shows relatively little human involvement, in a way providing a 'clean sheet' for new approaches to river landscapes. The design project develops a new approach to river landscapes and a new relation between humans and rivers. Chapter 9 reflects on to what extent the principles of this new relation can be applied to the Maas landscape.

The responsibility to protect citizens remains with the government, and therefore it is interesting to design a crisis and evacuation centre for the city. There is no evacuation centre yet in the country, and it is a challenge to design a suitable and appropriate place where people are, and feel, safe, where they can find and support each other and have proper facilities that are not improvised and provided last-minute. The location on top of the Cauberg provides enough height and distance from the river to be a safe location. In this location, the building can serve as a beacon looking over the landscape. Because an evacuation centre is not a permanent function, the building will be constructed as two phases: a permanent base and a temporary construction. In safe times, the permanent base is publicly accessible, creating a place on top of the Cauberg, in its architectural expression displaying the relation between Valkenburg and the Geul. This permanent phase then adds to the touristic flows (such as hiking and cycling) on the Cauberg, and connects to the public functions below in the city. In times of high water, the temporary infill is put in place, creating a centre for evacuation and communication. Because of its vantage point on top of the hill, the absence or presence of the temporary infill will express the state of safety or state of flood risk. The crisis centre will be a safe place for people to find shelter, communication with local authorities and support with fellow citizens. The design assignment then functions as a design inquiry into a new relationship between human and river, with a special focus on the relation between citizens and government.

Designing a public building allows to design the public space around the building as well, linking architecture with the landscape. The crisis centre expresses through landscape and architectural objects the water conditions, stimulating a sense of safety, which decreases the gap between flood protection and the residents. Throughout the landscape, architectural and landscape indicators are situated in the landscape and public space to connect the crisis centre through routes and in functions with the city of Valkenburg. In this way, in the public space of Valkenburg people can read the water conditions, in relation to the safe beacon on top of the Cauberg, that plays a central role in expressing the states of flood danger and states of safety that might occur.

The design brief addresses a public building in a larger site of the public realm. The interviews that contributed to the research project mainly speak about the private home and private possessions, and how to protect those. However, the broader context of flood safety is a public matter, and a sense of safety is gained by understanding the defence mechanisms that are part of the public realm. By looking at these defence mechanisms and introducing new elements in the public space that address and express flood dangers, the public can understand the relation and possible vulnerability of their private homes with these dangers, and take adequate precautions for their possessions. In this way, the design project with its public design can serve as an example and inspiration for the public.

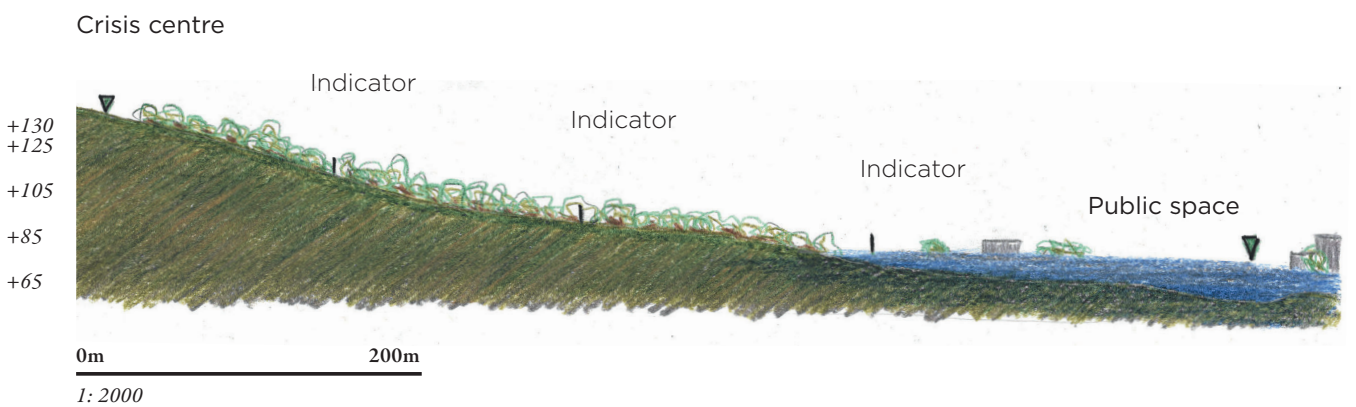
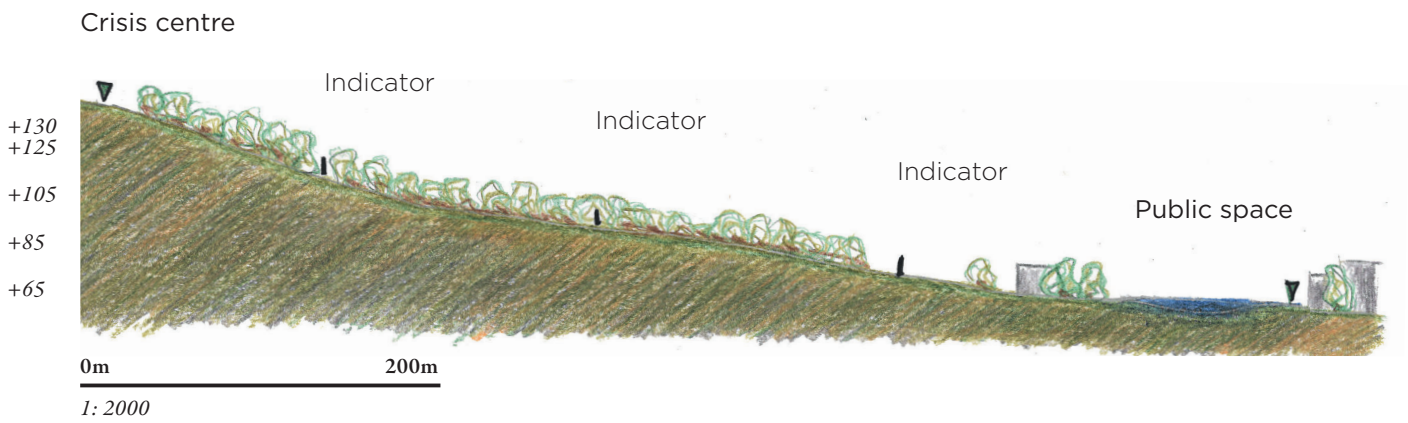
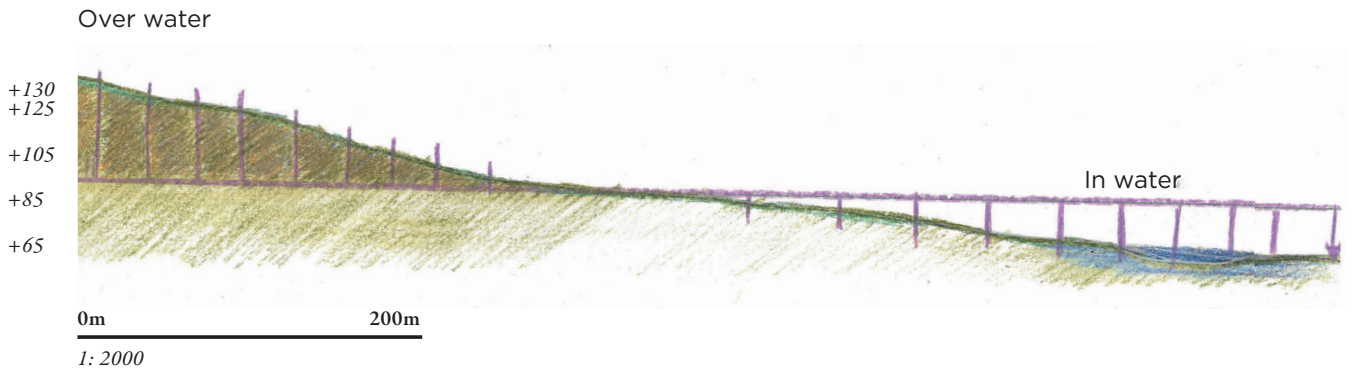


Image 31 - Series of sections over the Cauberg, indicating the sequence of the programme: from the public space situated in water at the bottom to the crisis centre situated over water at the top. The two are connected via a series of informal indicators as objects in the landscape. The lower section indicates the water level as it was in July 2021.

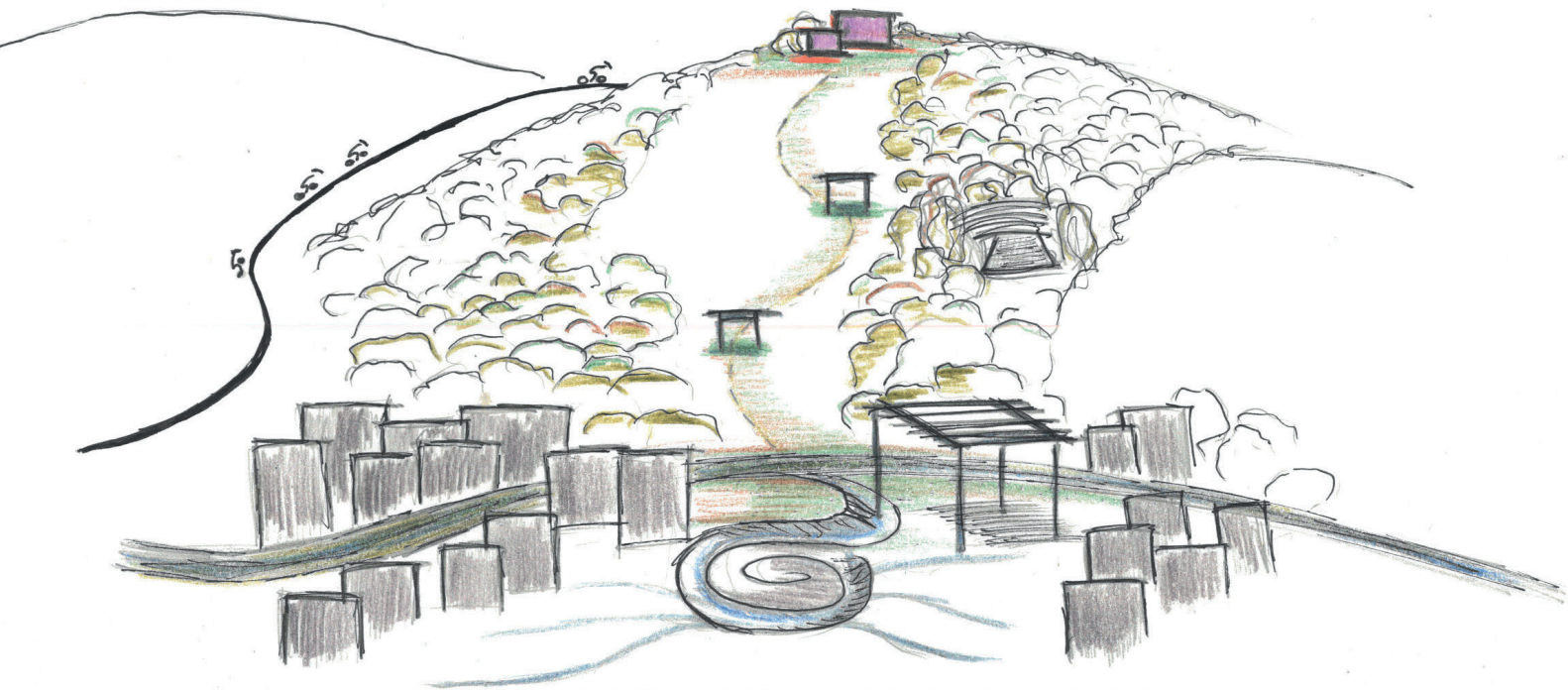


Image 32 - Figurative sketch of the proposed design assignment

# 8. A dynamic landscape of lines

## Landscape design

The design project covers the design of the public evacuation centre, and three public design objects: the hiking trail, the bridge and the water basin. The main focus of the design project is the public evacuation shelter. This building programme expresses a safe place from flood dangers for residents, and allows government and residents to come together. Its anchoring in the landscape addresses the water dynamics and river presence in the Geul landscape of Valkenburg. Together the four objects address the four design goals. The total design addresses different forms of water, and the site provides different conditions in relation to the river: from objects close-by the river in the Geul valley to high over water on the Cauberg. The design then reaches over a large area with multiple interventions.

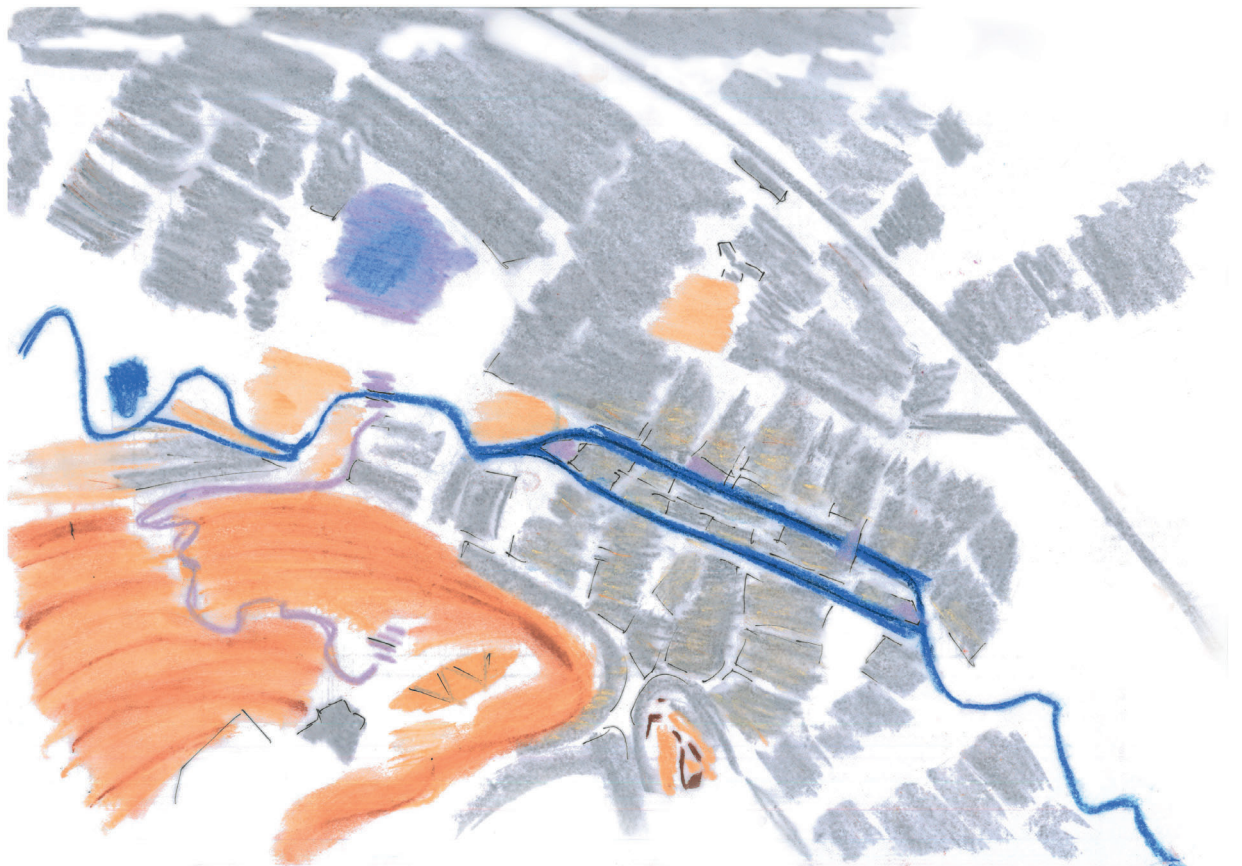


Image 33 - Figurative map of Valkenburg

Valkenburg is one of the cities most affected by the floods in 2021. It provides suitable topography that is both close to the river Geul and has height on the Cauberg. The strategy of the design on the landscape and urban scale draws qualities from several layers: proximity to river, height and topography, and (historical) landmarks in the urban tissue.

The site selection for the design objects is based on a number of urban studies.

These studies explored four landscape strategies. In his book “The Cultivated Wilderness, or What is Landscape?”, Paul Shephard (1997) identifies the relationship between landscape and architecture. Landscape represents the overview, a certain spatial strategy. Architecture represents the tactics in that landscape: putting strategic moves in position. On a smaller scale, machines, installations and materials represent operations: they carry out the tactics set in the larger strategy. In this understanding, “every architectural move is set in a landscape strategy.” (p. XII). Contemporary landscape strategies in the Netherlands are strategies of economical exploitation. In relation to water management this means directing water to where it is needed rather than where it is located (see chapters 4 and 5). The strategies explored in the urban studies are the concepts of view lines, spatial sequences, networks of landmarks and scenic routes. These studies are based on reference projects and two site visits.

The result of these studies is the landscape plan. In the landscape plan, the chosen design objects are a water basin, a bridge (connected to the basin), the evacuation shelter on top of the Cauberg, and a hiking trail connecting the four objects. Four other points of interest in the landscape plan are two water mills in the city centre and the points where the Geul separates and confluences. The two water mills motivated the city to split the Geul in two channels, so that the water level of the mill channel could be regulated. In turn this canalisation resulted in the historical development of Valkenburg where the buildings are built directly on the banks of the Geul channels, which means a high vulnerability at high water levels.

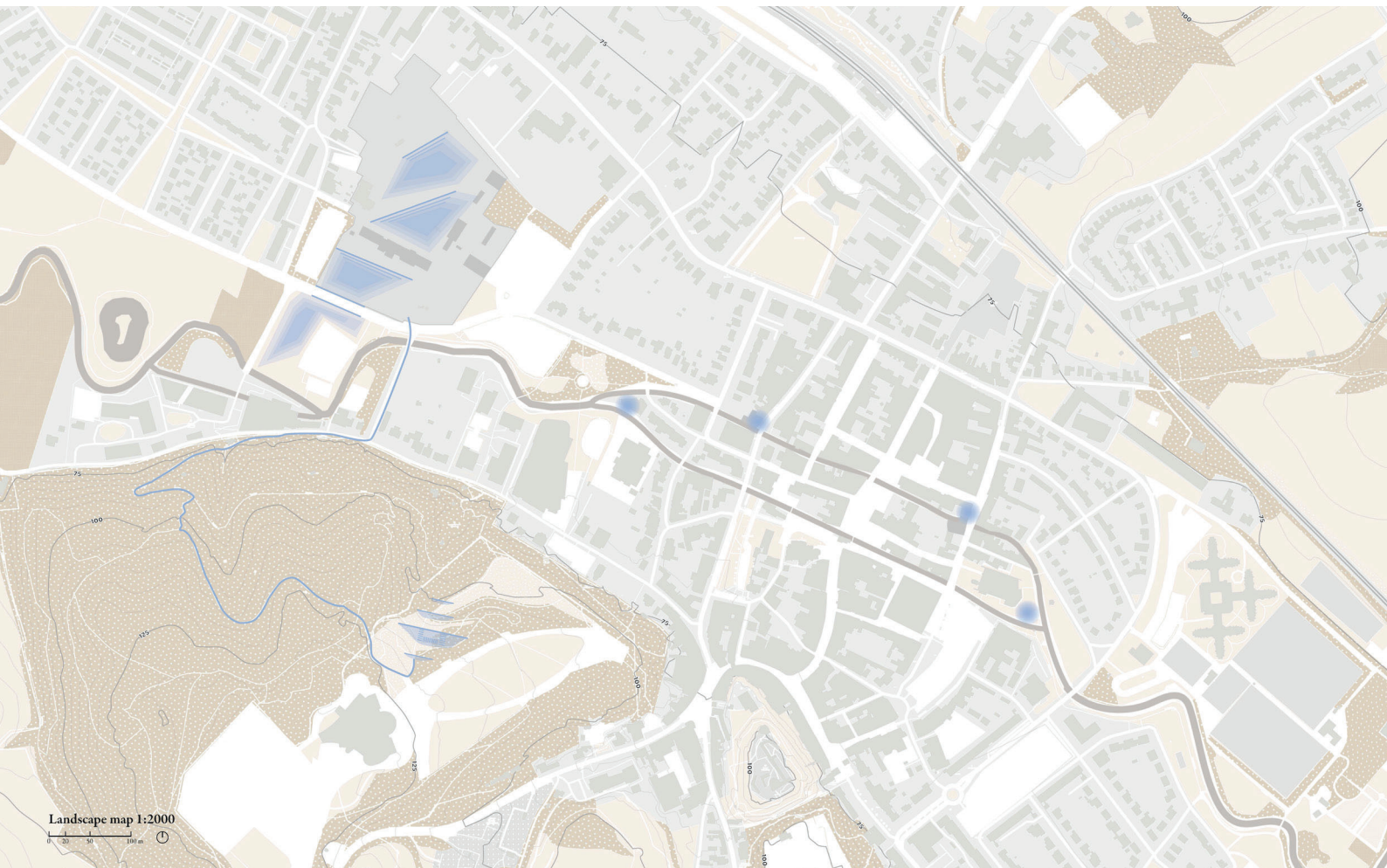
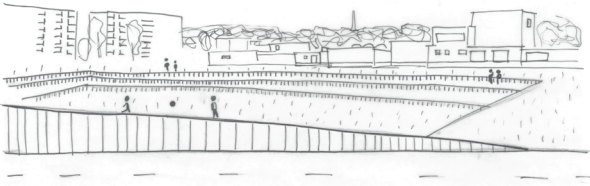
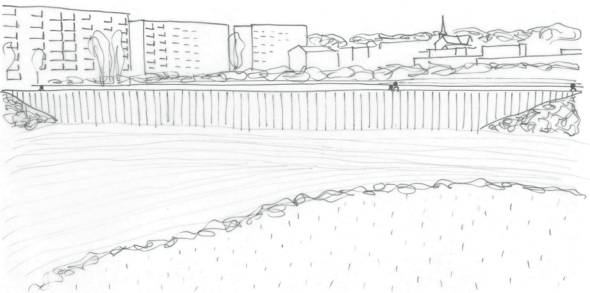


Image 34 - Landscape design 1:2000



The design objects show coherence, so that it is experienced by the visitor who is walking past all of them in series. First, near the Geul is the water basin: a composition of four connected basins with stepped banks. The steps are made of brick ridges to sit on. These basins provide water storage at high water levels. With low water levels, they can be used as a city park.



Secondly there is the bridge. This bridge allows the road to go unobstructed past the connection between the Geul and the basins. The design of the bridge leads the road downward to the level of the Geul, between two retaining walls that keep the road water proof from high water levels. In this way, the passenger comes at eye level with the retaining walls and experience the changing water levels from this low vantage point. The retaining walls are covered with vertical Azobé planks, that will return later in the design of the platform.



Thirdly there is the hiking trail, that leads from the Geul valley to the top of the Cauberg. Along the hiking trail there are brick benches to sit on.



Arriving on top of the Cauberg is the platform, designed as a brick paved surface with a facing of Azobé planks. The platform is a strong expression of the landscape contours. Its horizontal surface cuts in a straight line through the topography, presenting an abstract volume. In series with the platform are vegetated terraces in the landscape, lined with bushes and small Azobé thresholds. These are called 'escarpments', or 'graftern' in Dutch. The platform is part of this series of terraces.

Image 35 - Sketches of design objects

# The Fundament & the Shelter

The Azobé facing is retaining wall, relating to dam structures. The Azobé wood is recycled from dismantled retaining walls in the Netherlands. The surface of pavement indicates remnants of a building, the support for a flooring system is present in the form of brick beams and concrete foundation blocks. These support beams express the slight sloping of the platform in their variable heights.

Entering the platform we can see this slope, and the lining of rills directing the water from the pavement down into the landscape. The beams and paving of the platform draw the contours for a building in a U-shape, facing the valley.

This is the base for the evacuation centre, the temporary building that is constructed when the water of the Geul is rising and causing damage to the city.

Under the platform, there is a basement with a cargo lift in the middle that stores the building elements. The doors to the basement will open, the lift will carry the building elements up, starting with the floor boards (a system of wood sandwich panels) that fit on the brick beams.

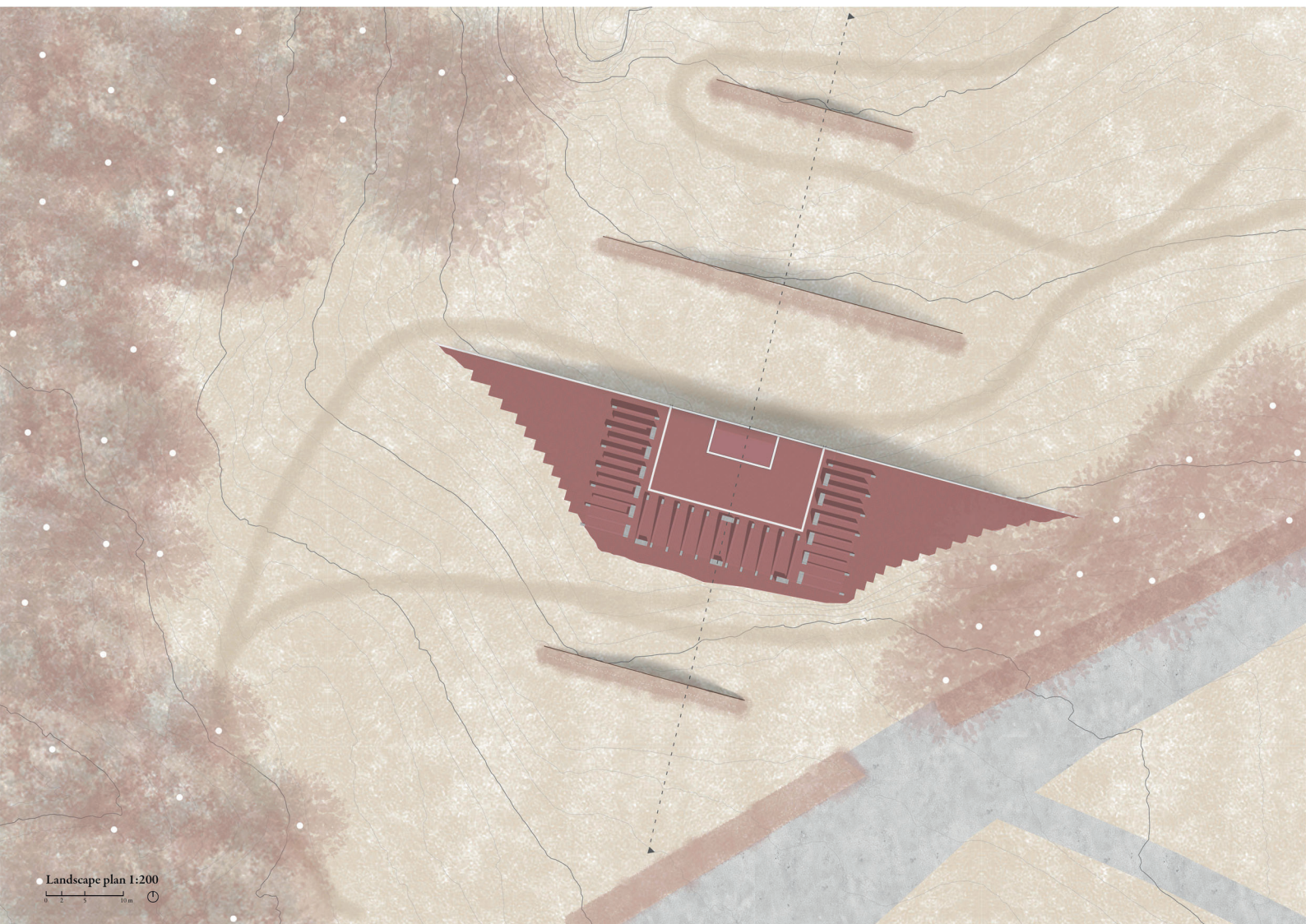


Image 36 - Landscape map 1:200



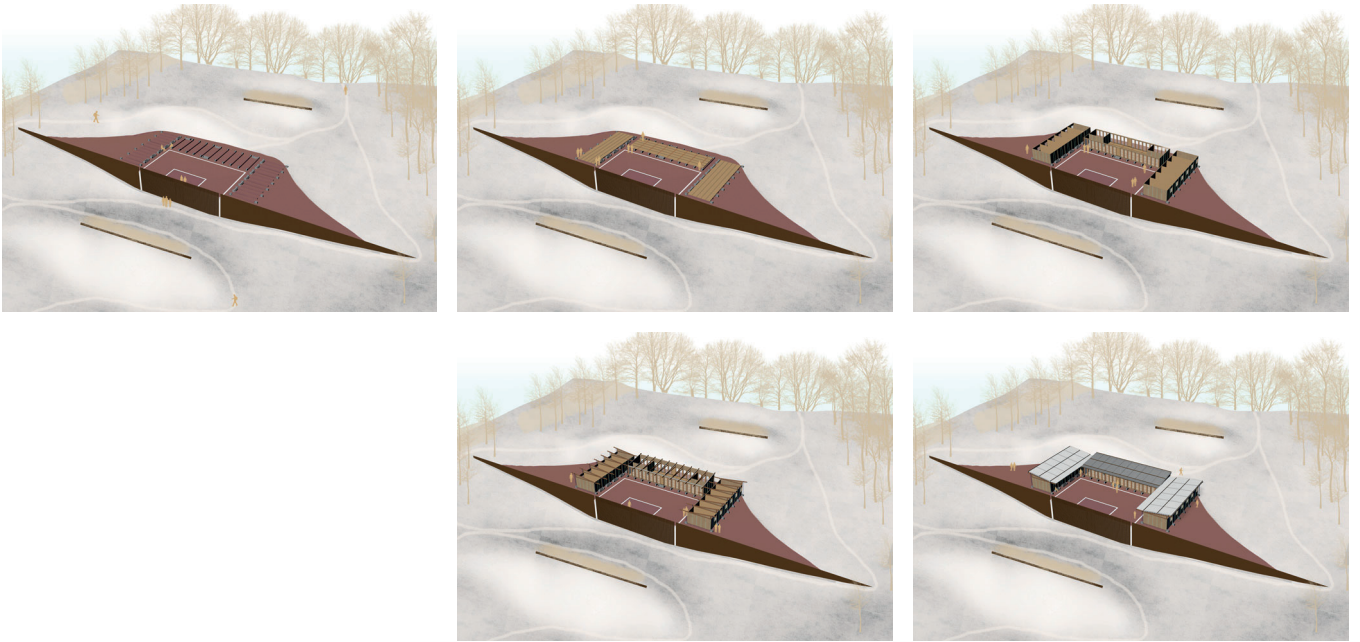


Image 37 - Five steps of the construction process: laying floor boards, placing wall panels, installing roof trusses, placing roof package.

The wall panels fit on the floor boards and provide building stability, integrated insulation, windows in combination with ventilation grills, and doors. The doors match the concrete stepping blocks on the platform.

Next, the wooden trusses are installed and fixed to the concrete blocks with lashing straps. The wooden trusses are covered with insulated panels and corrugated steel plates. Lastly, these are fixed to the trusses with pressure beams and tension cables. The continuous roof canopies to the inner courtyard of the building, connecting governments and residents under one roof and building.

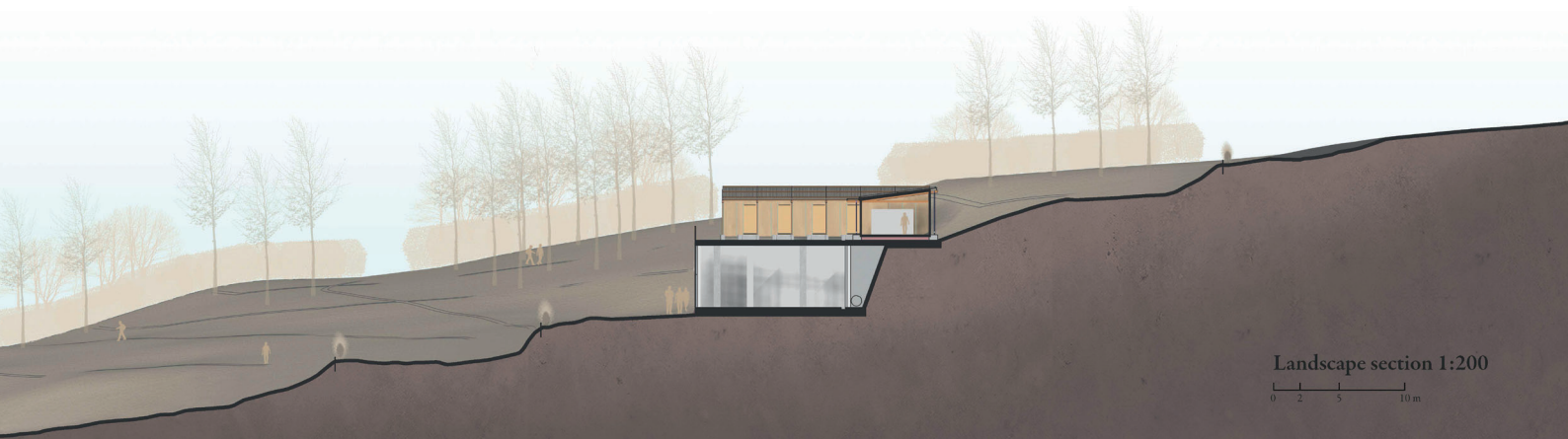


Image 38- Landscape map 1:200

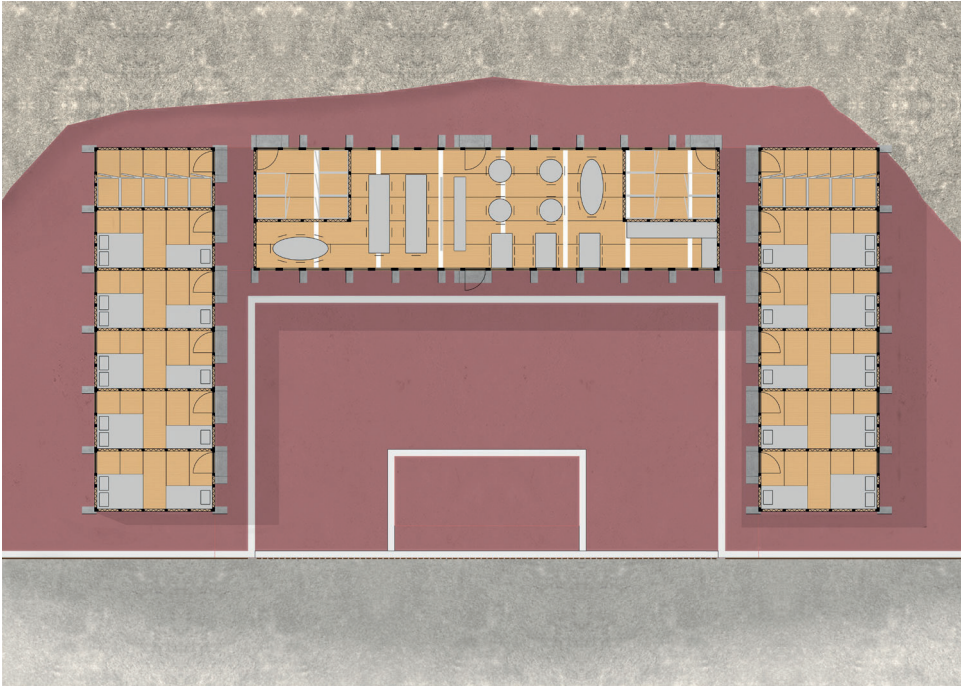


Image 39 - Floor plan 1:100

The central wing of the building provides collective services: a reception for arriving at the shelter, in open plan with the assembly room, open kitchen and communication offices. This means that in one space, government and residents can meet, and relaxing, gathering and socializing can take place.

In the wings, there are 10 four-person shelters, arranged with two one-person beds and bunk beds. The shelters accommodate 1 to 4 people, in various constellations (couples, families with children, singles, housemates). Each unit is private and has a dedicated private toilet and a private shower. The doors enter to the courtyard, the windows lookout to the natural forest.

The organisation of this building is inspired by the interviews. Several remarks from the interviewees have led to a design that allows for open communication between the authorities and evacuees. Also, the evacuees can come together and exchange stories or offer each other help. The shelters are private and closed from the collective services, providing a calm lookout outward to the forest. The U-shape of the building gathers everyone around a courtyard, that provides the best view on the landscape in this point.

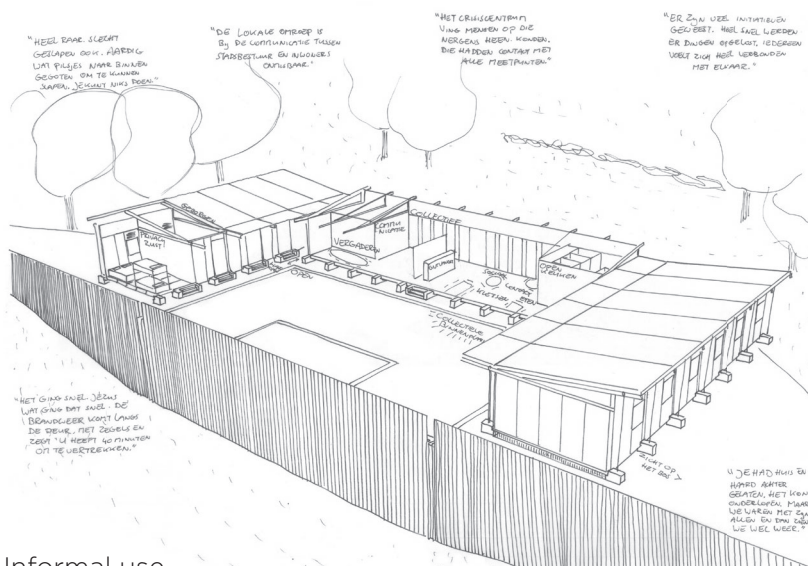


Image 40 - Informal use

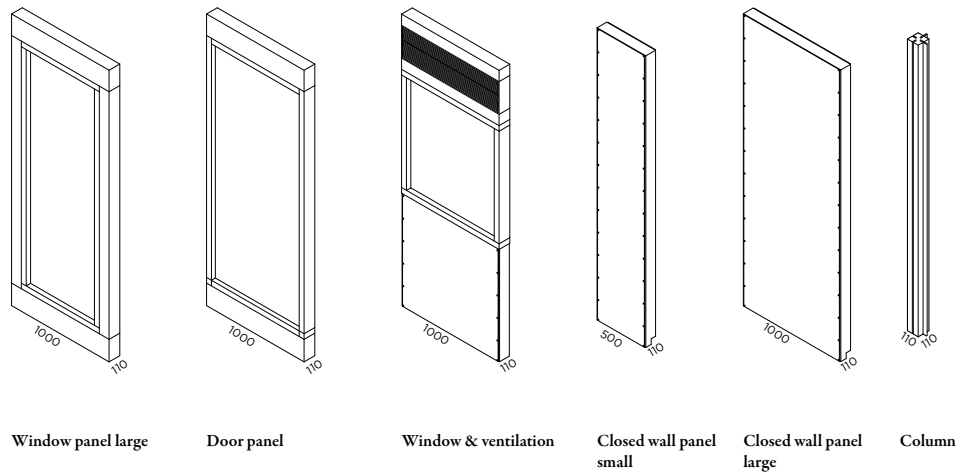


Image 41 - System of sandwich panels

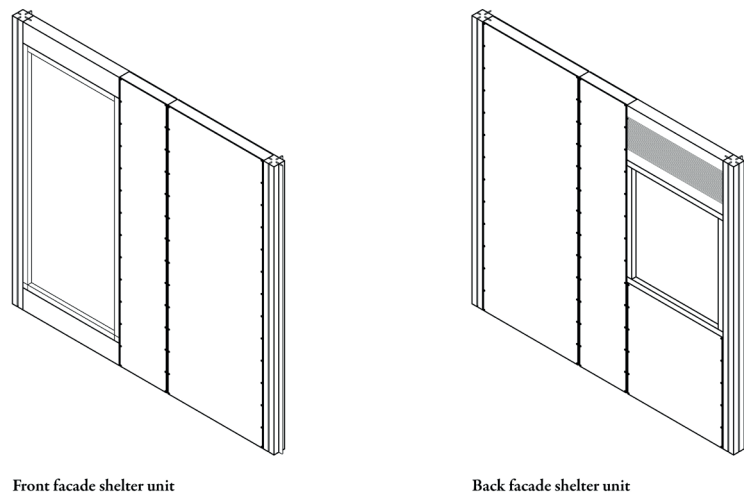


Image 42 - Facade fragments

The construction of this building is designed to be built within limited time (24h). This means that all elements need to be carried by four people and have a straightforward assembly. The main construction consists of sandwich panels: a wooden frame filled with insulation, and plating material on its faces. The floor panels fit in the brick/concrete beams of the pavement. The 6 types of wall modules fulfil their own function. There are two variations of closed panels, one window/ventilation panel for the shelters, door panels, and large window panels for collective building. Corner columns connect up to three panels. Fully performed in wood, they have different plates for interior finishing (particle board which is cheap and light-weight) and exterior finishing (plywood, lacquered to be weather-proof), indicating their application clearly. Floor boards are made of underlayment: cheaper than plywood, but stiff enough to carry the loads. The strength of this temporary building is that it can be built by the community itself, because of its straightforward assembly.

The architecture of the facades is one of repeating vertical lines defined by the window frames of the collective wing. The flutes on the closed panels add to this rhythm.

The closed panels are finished with painted flutes. The plates have a slight setback from the inner frame and are painted in a soft blue. The flutes are lined with black screws to emphasize the verticality. Different types of wood express the different functions in the construction.

The sandwich panels join in the corners with columns. These columns are made of laminated douglas wood. It is sources in the Ardennes close by, built cheap from rest pieces, and strong through lamination. The joints are hard-rubber strips that form in the flutes of the columns. Each element has these strips fixed on one side and an open flute on the other.

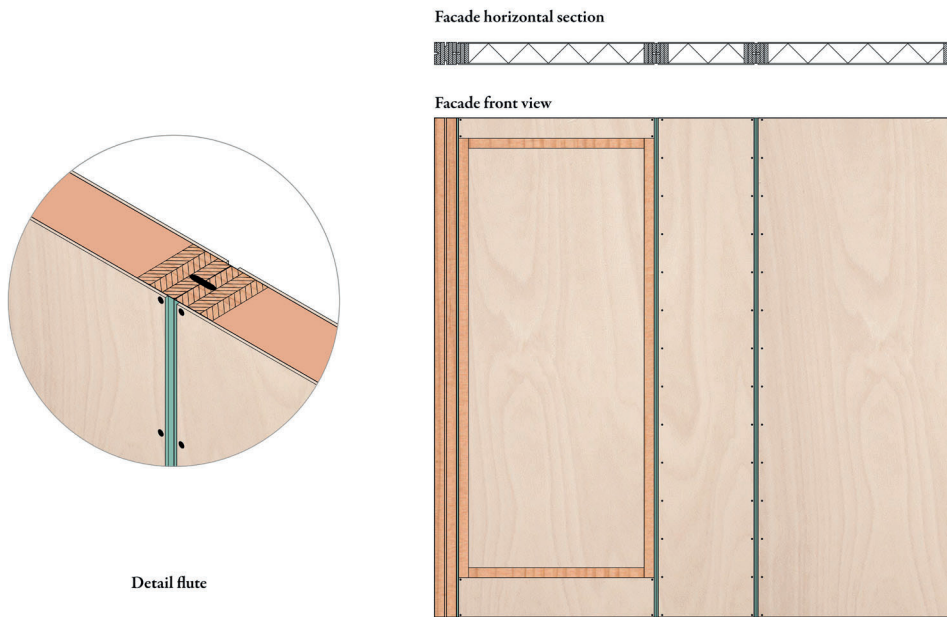


Image 43 - Joint between two panels, showing the emerging flute

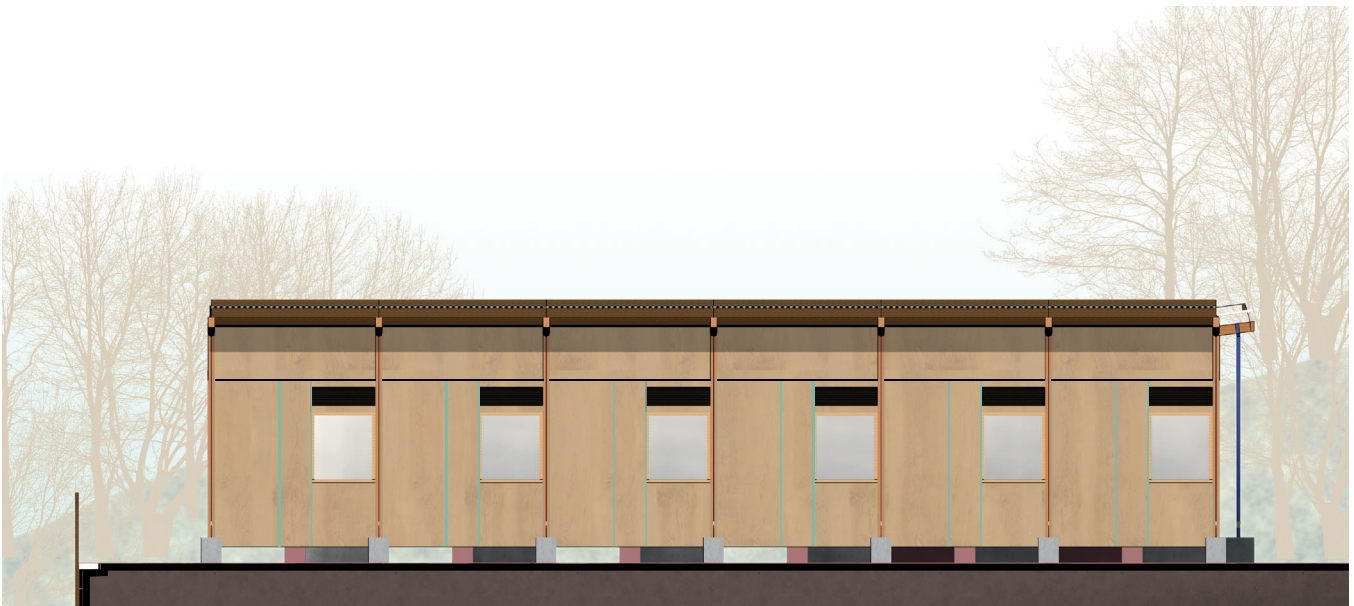


Image 44 - West facade

The detailed section of the shelters firstly shows the pavement: three different patterns express the different applications on the pavement. Over the basement the pavement is joined in a custom centralised pattern. Under the shelters there is an unjoined herringbone pattern with brick beams. On the sides of the platform there is an unjoined block pattern. The blue lashing straps connect the roof trusses, pulling the construction down in connection to the concrete foundation blocks that are connected with the brick beams. These blocks are entry steps into the shelters too.

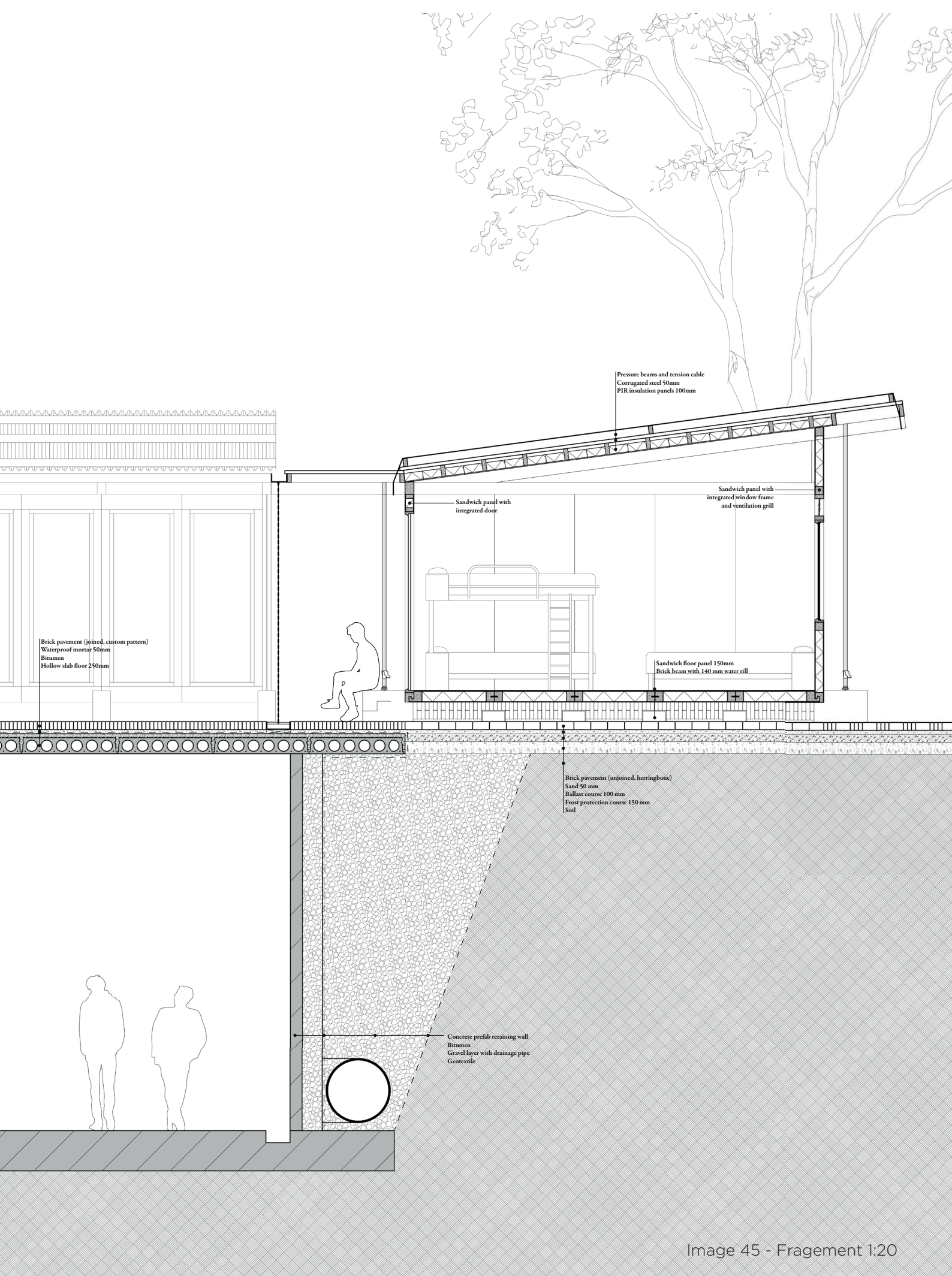


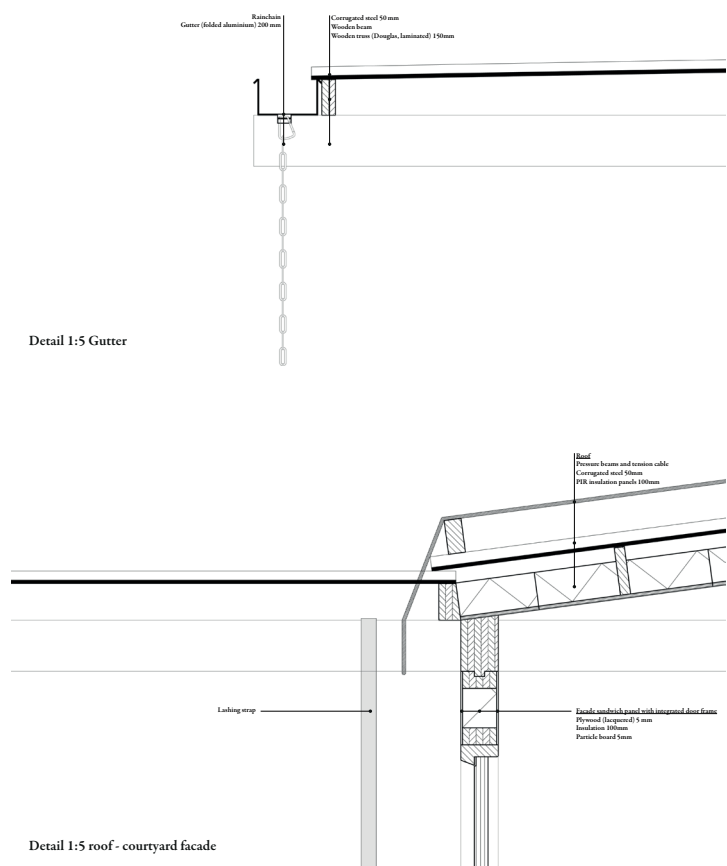
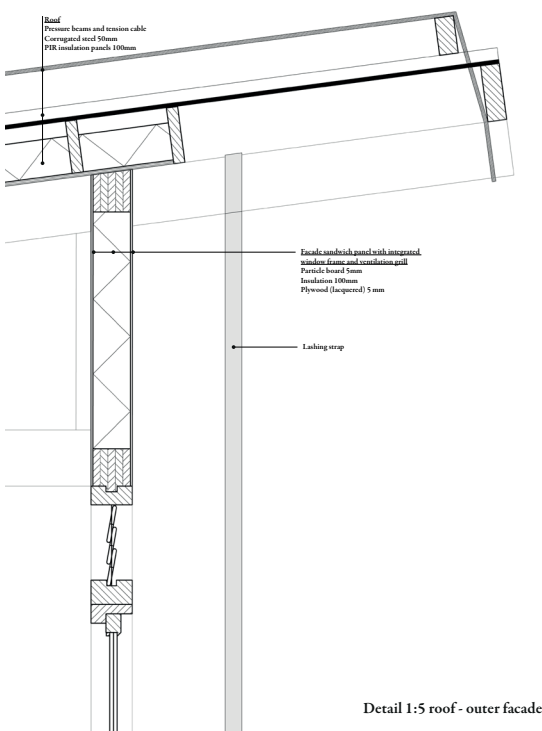
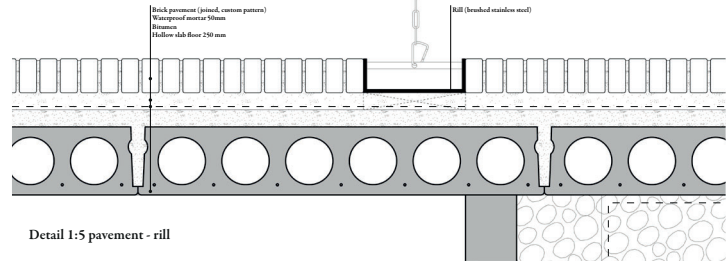
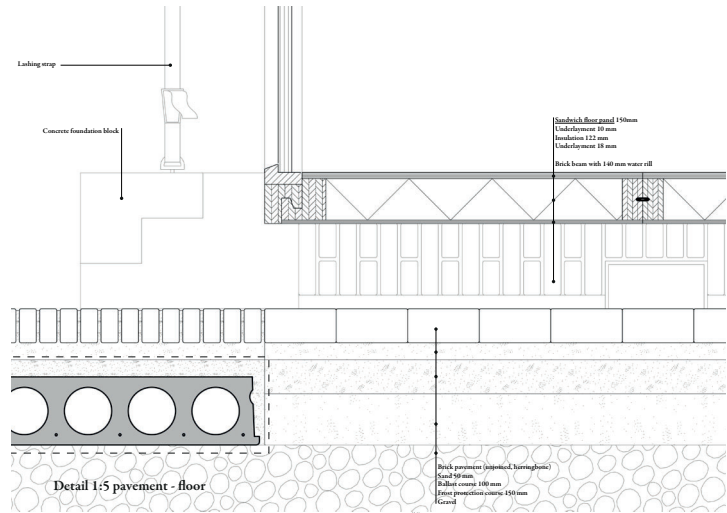
Image 45 - Fragment 1:20

The floor panels have varying thickness of plates, according to load capacity. The form lock joins the wall and floor panels.

Over the basement, the joined pavement is connected with waterproof mortar on the concrete slab. This concrete slab is lined with bitumen that diverts water to the sides, to the gravel drainage package. The rill is flush in the pavement, from brushed stainless steel: a bright highlight in the pavement.

The gutters of the roof rest on the canopy of wooden trusses, and are secured with rainchains to the rills in the pavement.

The roof rests on the wooden trusses. These trusses are secured with lashing straps. The roof is built of PIR panels, covered with corrugated steel plates carrying water to the gutters on the canopy. These corrugated steel plates are secured with pressure beams and tension cables that strap to the trusses.



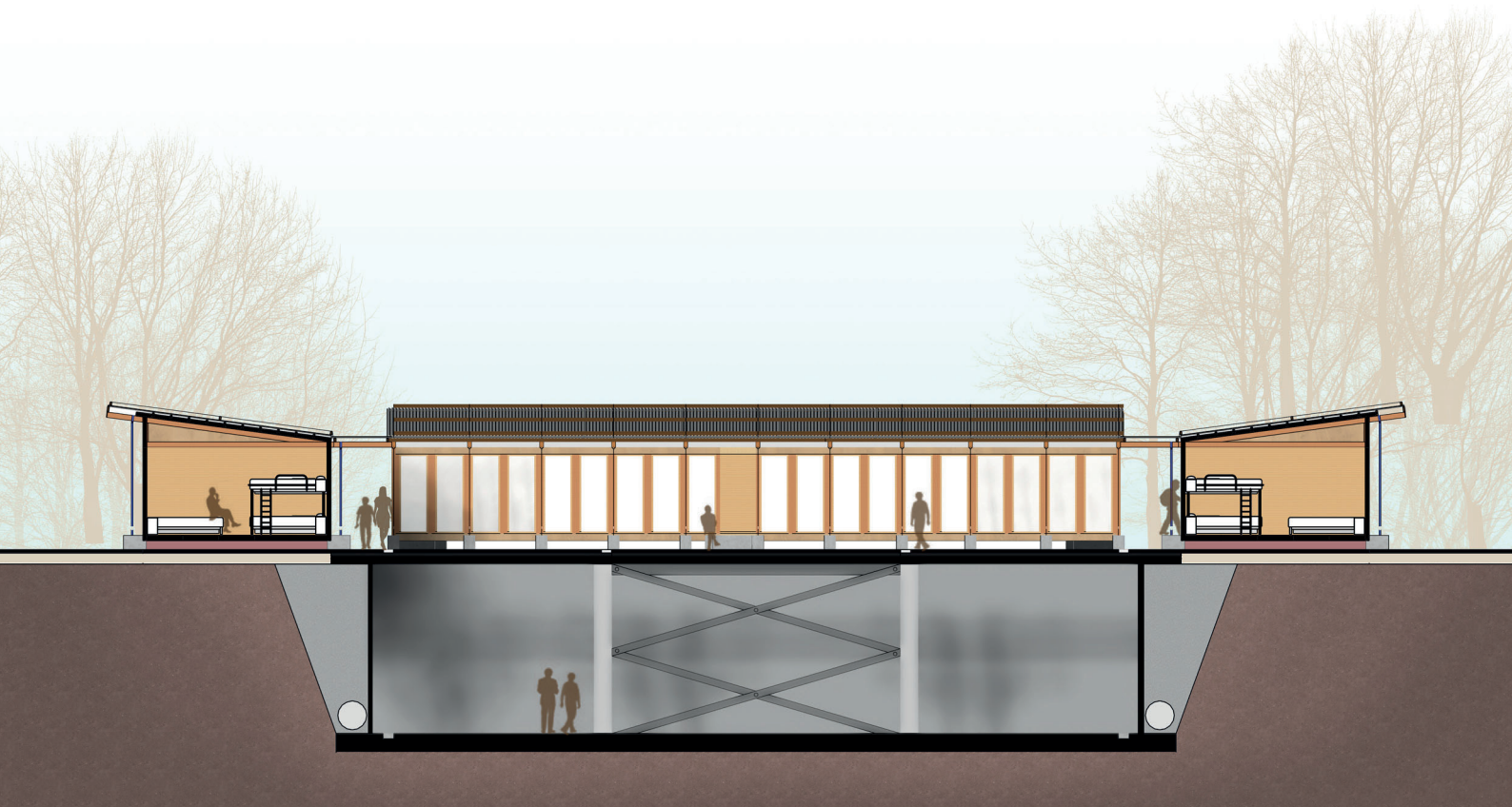


Image 46 - Long section 1:100

The construction of the basement is of concrete prefab retaining walls. These are not fully waterproof but let a bit of water seep through. This means that an architectural precaution is needed to process this water: the rill at the bottom provides this. The retaining walls are at an offset from the shelter, so that the construction can remain simple and lightweight.

The basement has the function of storage, but it is essential that it can also be experienced when it is not fully constructed. The basement is therefore accessible to the public, and the rill inside is visible. The gates in the Azobé facing open into the basement, a construction of butted prefab walls with the lift in the middle.

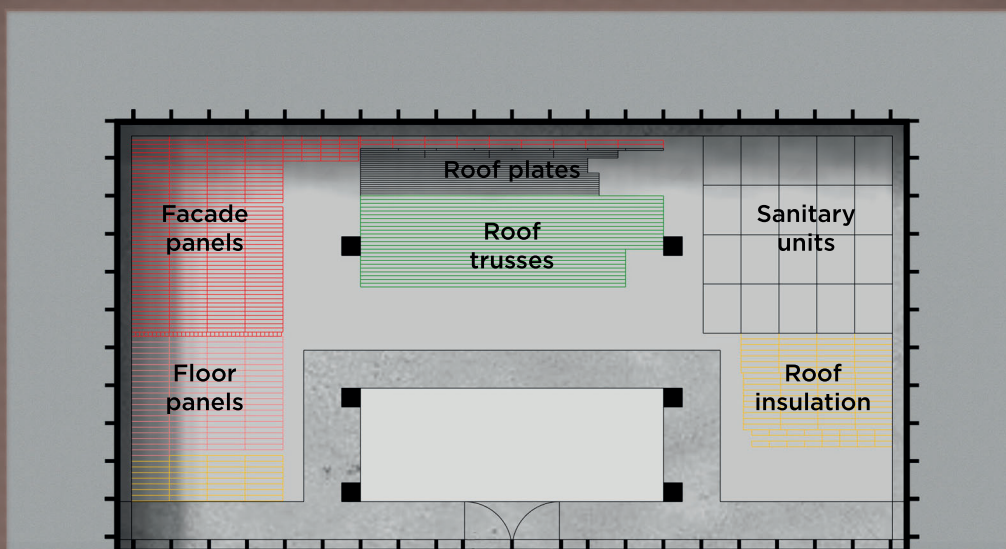
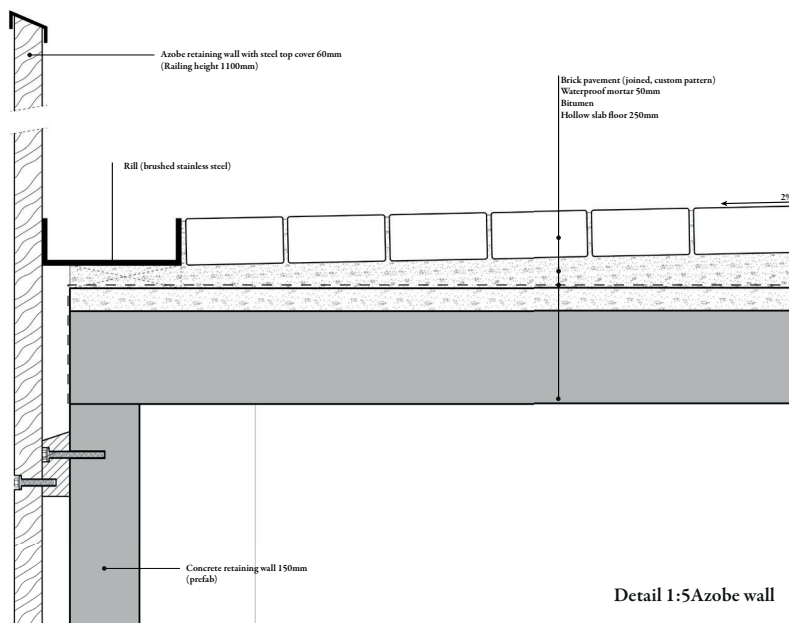
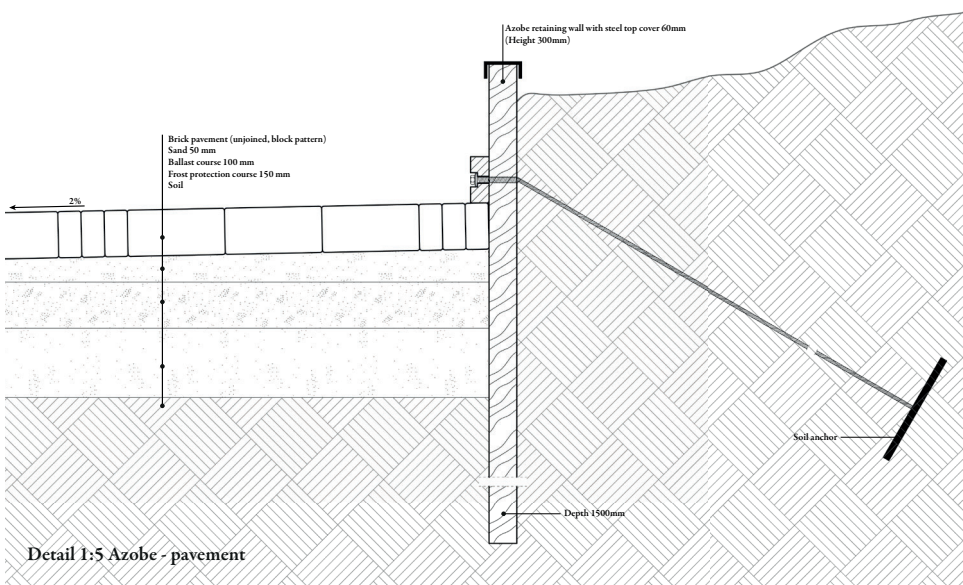


Image 47 - Floor plan basement 1:100

The programme of the building addresses the design goal of a safe place for flood dangers. The platform provides a place for perceiving and experiencing the landscape. The architecture and construction methods are of a kind that is permanent and fundamental, but made of prefab elements so that they can be removed in the future if this is desired.

## Water course

The edge of the pavement is lined with small Azobé thresholds. These thresholds are in line with the brick beams that support the building. By placing these thresholds, rainwater will deposit soil and hummus to the edge of the pavement, creating a smooth line. These thresholds therefore form dynamic lines that transform the outline of the platform from a stepped line to a smooth curve.





The water design connects the building to the pavement – literally. The roof channels rainwater to the gutters, that are fixed to the pavement with rainchains. Here the water is collected in rills that transport it to the edge of the platform where it is channelled down into the landscape. The pavement itself is tilted so it directs water downwards. The detail shows how the sloped pavement meets the rill through the Azobé wall.

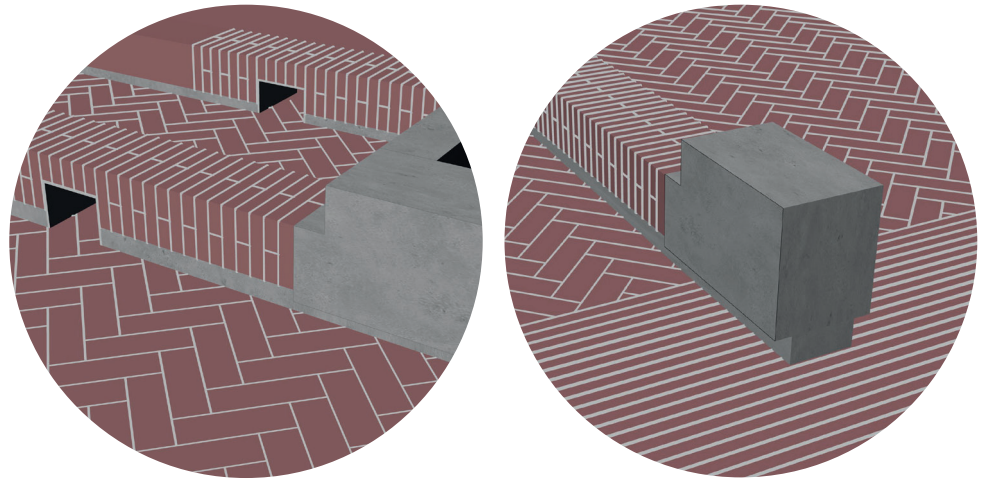


Image 48 - Rills in and along brick beams

The perpendicular orientation of these beams makes that the beams need to allow for water to flow through. Here the brick beams are perforated with a rill for water to pass to the edge of the platform. In the longitudinal beams, that follow the direction of the water, we see the sloped bottom of the beams following the platform.

This detail for water design is the connecting detail present in all objects. All objects are part of a coherent whole and they are designed and materialised to show similarity. The design principles for the hiking trail, the bridge and the water basin are derived from the design layers of the platform.

First of all, all design objects act as a straight line that intersects the topography, in a direction perpendicular to the water flow in the landscape, and parallel to the water flow of the Geul. The platform and the escarpments create terraces by constructed horizontal lines in the topography. The hiking trail is a linear path meandering downhill. The bridge emerges from the two retaining walls separating the road from the water basin. Lastly the basins are created by constructing the brick steps as a series of ascending lines in the ground.

Secondly, all objects support flows of people and water, in various directions. Thirdly, the water running over the surface and through the soil is retained, slowed down and diverted. Fourthly, the construction is always formed by the soil underneath, grounding it profoundly. And finally, the design incorporates the highlighting rills to stress water flows and water levels.

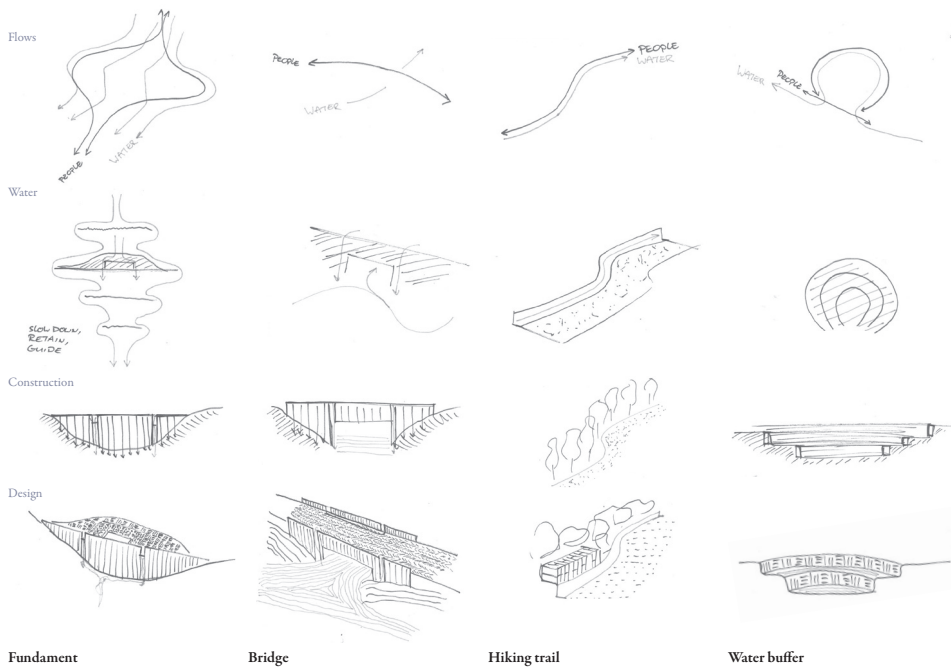


Image 49 - Design objects & design layers

Above the surface are the brick beams on the sloping platform, the water rills indicating the building contours and the lookout point at the Azobé wall. Below the surface is the basement. In safe times, the basement is storage for the building elements and accessible for visits. A gutter is integrated to allow for water to seep through and be channelled to the outdoor rills. Here the architecture expresses ground water and allows it in the construction.

If we follow the water into the landscape we come across a series of 'graften': landscape elements that create terraces on slopes. By planting bushes and scrubs, and reinforcing those with a small Azobé threshold, processes of erosion and deposition start to shape terraces on the hills. The 'graften' retain water, they slow it down and divert it sideways. The gradual transformation of the hill to a terraced terrain indicates the formative role of water in a territory.

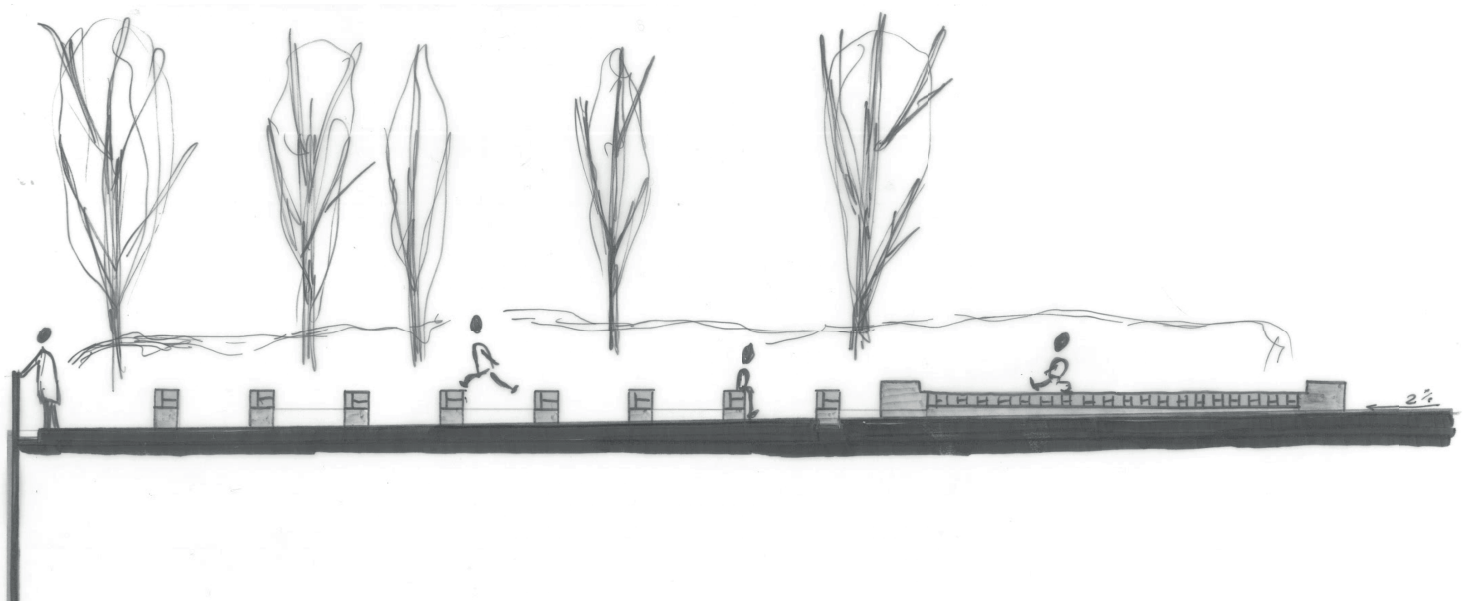


Image 50 - Sloping pavement

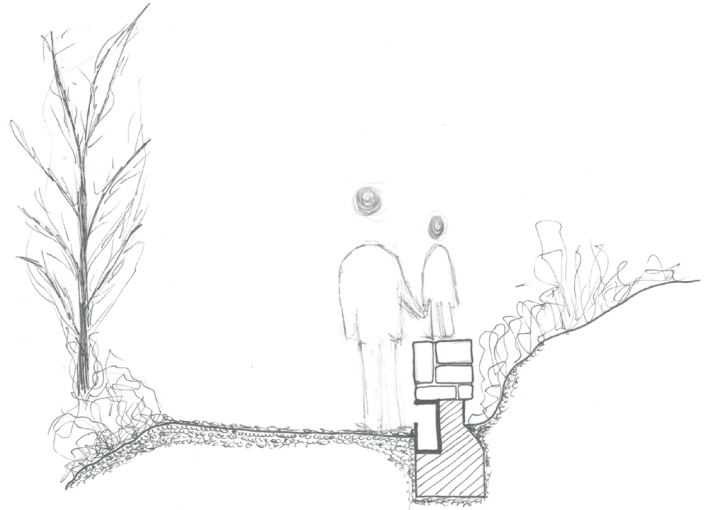
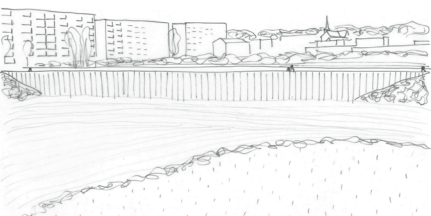
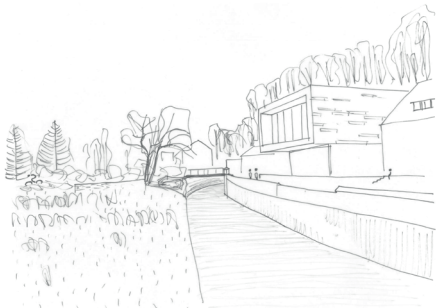
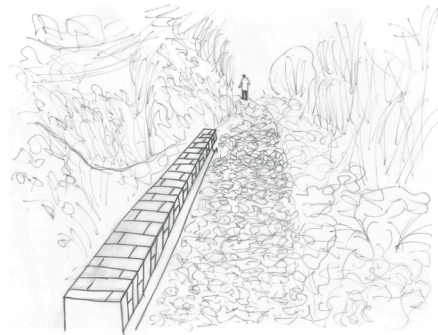


Image 51 - Section of hiking trail

The brick beams of the platform are translated into brick benches lined with a rill as a plinth. The path is sloped towards the rill so that as a whole it forms a gutter. The highlight rill is a steel profile in the ground that collects the water and channels it downhill. The path is located on the north side of the Cauberg, so here it feels relatively cold and damp on rainy days.

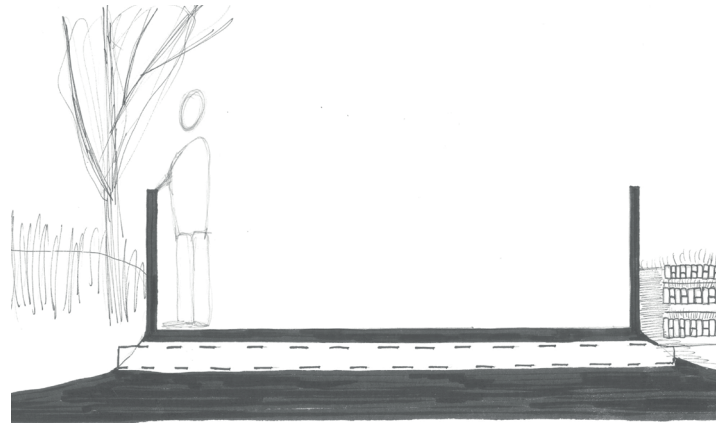


Image 52 - Section of the bridgel

The bridge resembles the construction of the platform. The two retaining walls are fully waterproof and clad with Azobé facings. The pavement dives into the landscape and climbs up again, providing an eye-level vantage point of the river for passengers. Below the water level are pipes connecting the river course to the water basins.

The bridge leads water to the basins. This terrain belonged to a funpark, that was foreclosed after flood damages in 2021. This large plot in the city is therefore suitable for water storage. The terrain has a Lay-out in three connected basins so that water fills in stages. At low water levels the basins can be used as a park. The brick bench from the hiking trail is here translated to stepped sides of the water basins. The rills are in the bottom corner of the steps, indicating water levels like a ruler.

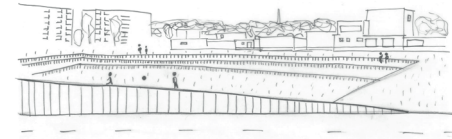
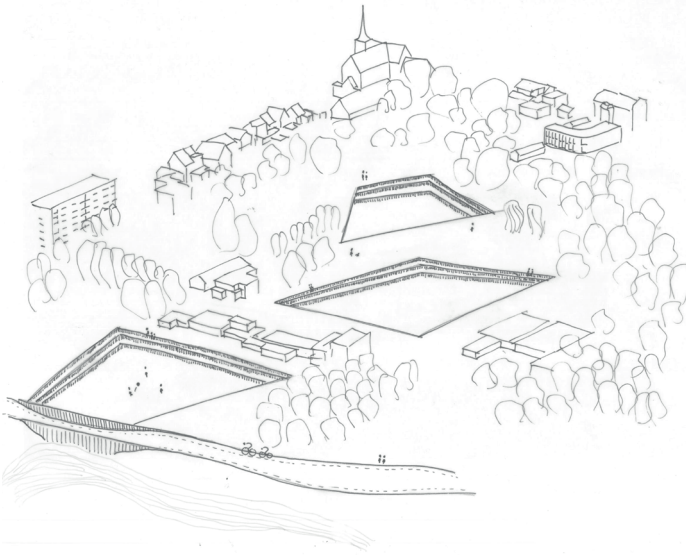
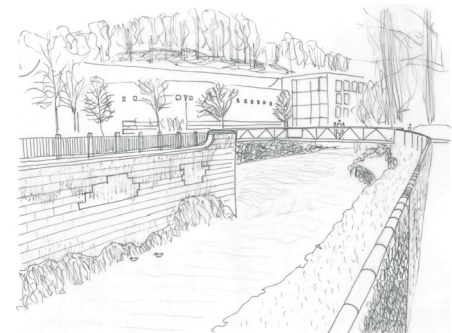


Image 53 - Aerial sketch of water basins

## Conclusion

The design project answers the four design goals. The active relationship with the landscape is realized with the functions of the objects: the hiking trail for hiking, the vantage point of the platform, the visiting of the basement, the vantage point on the bridge, the water basins as a city park, the visible transformation of the escarpments through erosion and deposition. The objects are an expression of the topography and the soil and water conditions.



The water levels and flows are indicated by the variations of the rill and the sloped pavement, that is a continuous theme throughout the four design objects. These details are recognizable but applied to the object and its function.

The distance between government and residents is decreased in the evacuation centre, where the roof connects both parties and all functions. The open plan allows for direct communication and transparency.



The safe shelter is on top of the Cauberg and can be realized within 24 hours. Furthermore, the landscaping (escarpments and basins) retain water and directly mitigate flood damage by storing it and slowing it down, instead of channelling it through the city.

So what is the role of architecture in perceiving a sense of safety? Architecture can express the water flows by directing it, by bringing it to the surface and by finding architectural applications that deal with the water situation as it is, rather than disguising or manipulating it.



This surface then is a material expression of the water conditions.

Architecture can also allow a community to build their own safe places, their own safe haven that they know and understand. Where the community can join forces and help each other out, under guidance of a caring government.

Lastly architecture can shape new approaches to landscape, forming in this way new relations between humans and rivers. This project shows how architecture can contribute to a landscape that retains and distributes water, that allows it to flow in all directions, instead of a rigid landscape of water channels and manipulations that direct water to flow away as fast as possible.

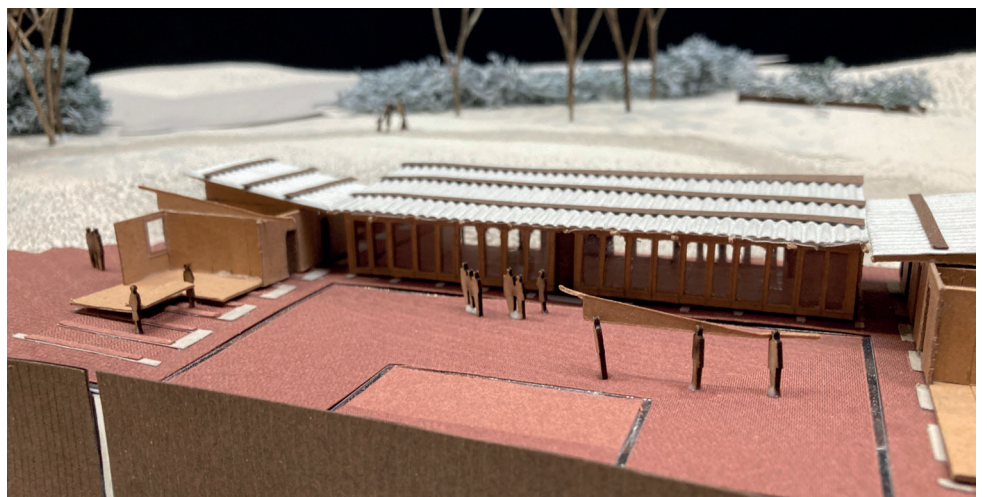


Image 54 - Photos of  
maquette

# 9. Reflection

## Design goals

The four design goals that followed from the research were the starting point of the design assignment. How does the design project meet those goals?

The first goal is to stimulate an active relationship between humans and the landscape. The design project does so on the large scale by introducing places to visit (such as the fundament and the water basins), and by enabling movement in the landscape (the bridge and the hiking trail). This enables residents of Valkenburg to spend time in the landscape and to (re)visit it several times. However, the presence of the residents remains of a passive kind: walking, moving and observing are the main activities, whereas forms of agriculture, craft or other types of work in the landscape might enable a more active understanding of the landscape, its materials and processes. Nevertheless, the gradual transformation of the landscape that is stimulated ('graftern') or accentuated (bridge, basin) by the landscape is made explicit and can be experienced during (frequent) visits. This further contributes to an active relationship.

The second goal, to indicate water presence and river dynamics, plays a role on all scales in the design objects. Depending on the location, different types of water are accentuated. The fundament and the graftern work with rain water, as it falls on the surface and flows through it, and ground water, as it flows through the soil. The hiking trail accentuates rainwater by collecting and directing it. The water basin collects river water, and the bridge expresses the water level in the basin. All design objects have the form of a straight line, parallel to the flow of the Geul, perpendicular to the flow of rain water. Each line activates a transformative process in which water is the main actor. The fundament and the graftern direct water so that processes of sedimentation shape the hill. The hiking trail cuts through the surface, making rain water explicit. The bridge and the buffer cut in and through the landscape, to create room for water and to express the water level. In this way, each element individually is an indicator of the relationship between water and landscape, and as a whole, they display a variety of waters and processes it can activate.

The third and fourth goal, decreasing the distance between government and residents, and providing safety from flood danger, are combined in the emergency centre, in a programmatic way. By providing these functions in one building, both goals strengthen each other. In addition, the water basins decrease flood dangers by creating water storage. This contributes directly to providing safety. However, the focus of the interviews in the research project is the perception of floods and safety of individual residents. This means that the research provides many insights on the private home, but the design project deals with interventions in the public space and public facilities for the city. This resulted from the conclusion that civilian actions to protect themselves and their properties are limited to the private home, whereas the government has the means to intervene in the landscape and to provide safety for the community. Community strength and support is what this programme aims to improve. The

reasoning is that if the community can find ways to support each other and find safety together, the individual understanding of safety and capacity to deal with flood dangers increases. This means to increase the self-sufficiency of the community as a whole, and in that way to increase self-sufficiency of individual residents.

## Continuities & deviations

Although the research project preceded the design project, providing the latter with insights, goals and inspirations, the two projects remained autonomous. They are intricately connected, but one can be understood without the other. In this way, the design project is a continuation of the research project, but at the same time it deviates on certain points.

The main deviation is the project site. The research project focusses on the Dutch Maas with its floods in the '90s and 2021, whereas the design project works with the Geul in Valkenburg, a much smaller river (although also flooded in 2021). It is a deliberate choice to opt for a different design location. If the Maas had been the design site, the design project might be too dependent on the research project. I preferred two projects that provide insights in coherence, but at the same time independently. In this way both projects can strengthen and add to each other.

The deviating site does not mean that the design project is not applicable to the research site. The site of Valkenburg is less manipulated than the Dutch Maas. This gives room to explore approaches to river safety that are not based on directing water or building rigid dikes and structures to limit the river course. The design interventions in Valkenburg are all based on a straight line parallel to the river course, that stimulate or activate landscape processes that contribute to water retention, that ultimately leads to slowing down water and decreasing flood dangers. The dikes along the Maas are also straight lines but of a rigid character: they do not interact with landscape processes but solely limit the water flow. If the lines of dikes would take on the activating character of the lines in Valkenburg, perhaps they can develop into safety measures that contribute more to the landscape than only rigid walls. The dikes on the Maas are static linear elements, where the lines in Valkenburg have a more dynamic character. Applying these dynamics to the Maas dikes helps residents to perceive and understand river dynamics. In this way their understanding of flood dangers increases, and stimulates them to increase their resilience and self-sufficiency.

Furthermore, the dynamic lines in the design for Valkenburg need the presence of water to start the processes that contribute to water dynamics, perception of landscape and flood safety. Without water, these applications would be meaningless. Regarding the power balance between humans and water, this means that these human interventions in the landscape need the force and movement of water to be functioning. This means that an equal, and collaborative relationship between the forces of humans and the forces of water, in all its forms, is necessary.

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