

Research for the Frames project in Alblasserwaard and Vijfherenlanden with the focus on Kinderdijk. This to gain information to prepare Kinderdijk for the future.

# Preparing Kinderdijk for the future

HZ University of Applied  
Sciences

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Remco Griffioen, Cornee Kramer, Koen  
Spijker, Alvin Traas, Sabine Voermans &  
Koen de Weert

## FOREWORD

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We are six second years Deltamanagement students at the HZ University of Applied Sciences. Our research group follows lectures from J.M Buijs in the course 'research assignment'. Our group decided to focus on a research in the Netherlands. After some discussions with our teacher, we decided to take the case about Alblasserwaard. FRAMES was looking for someone who want to do a research about Alblasserwaard, the province of South-Holland are participating and willing to collaborate in the assignment. This was a great opportunity for us, to work in a different province of the Netherlands. We are very excited and motivated to work on this research.

This research will show our plan of approach. It will integrate our plans of research around in the field and at the desk. Additional to that it shows an overview of our working timetable. This group works together with the stakeholders and every group that is interested and involved in this research, trying to compromise the interests of the stakeholders without losing sight of the main goal.

20 January 2017, Vlissingen

Remco Griffioen,

Cornee Kramer,

Koen Spijker,

Alvin Traas,

Sabine Voermans,

Koen de Weert

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## SUMMARY

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### THEORETICAL FRAMEWORK

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The Dutch government has introduced the concept of ‘Multi-Layer Safety’ (MLS) in the National Water Plan. In the concept the first layer is about preventing floods with strong dikes, dunes and ‘storm flood barriers’ (robust and future oriented). Prevention stays the primary pillar of the policy. The second layer is about achieving a sustainable land use planning (location and planning issues), this can reduce victims and limit the damage from possible flooding. Flood risks will therefore play a stronger role in spatial planning considerations. The third layer is about disaster management. Good preparation for disasters is essential to effectively (lower number of victims) deal with a flood disaster. Furthermore in the theoretical framework is a broader sight of the multi-layer safety approach in the Netherlands described.

Besides contradicting principles within each separate layer there are also contradicting principles between the layers as a whole. The new flood risk standards are the result of new insights and methods that have become available.

The theoretical framework is about the concepts in the project Alblasserwaard. The main focus area in this project will be Kinderdijken. This area is famous for its historic windmills. The dikes form together with the water network the accessing roads to the world heritage Kinderdijken. Kinderdijken attracts a lot of tourist each year, because of its high cultural heritage, Kinderdijk has a lot of mills that attracts these tourists.

### METHODOLOGY AND OPERATIONALIZATION

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The research group chose the Alblasserwaard because of its unique challenges, created by different phenomena that are threatening the region such as the land subsidence and the fact that the area does not meet the new norms.

The methods that are used in our research are desk research by searching for online sources and an interview with senior policy advisor of the area. The meeting took place in The Hague, province of Zuid-Holland, on the 21th of December 2016 with Jeroen Delmeire. Lucy Smeets from the department of Water and Green was also present during the meeting.

## RESULTS

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First the most important things about Kinderdijk are described, because in this research the focus is on Kinderdijk, this is the pilot area. Within the second paragraph the online data that is used is described and the whole interview in The Hague is described. Furthermore it includes a GIS map that shows interesting outcomes. The map makes clear that close to the dikes are buildings or industry located, this makes it more and more difficult to improve layer 1 from the multi-layer safety approach, because there is not enough space for dike strengthening. It is possible to improve the area by layer 2, spatial adaptation, for example to make houses more water proof and water robust.



FIGURE 1. TYPICALLY DUTCH POLDER IN ALBLASSERWAARD, THIS IS HOW MOSTLY THE WHOLE AREA LOOKS LIKE. SOURCE: WWW.DACHTOCHTENARANGEMENT.NL

## 1.0 INTRODUCTION

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This research focusses on the problems in the Alblasserwaard area related to the multi-layer safety concept. Alblasserwaard has problems with the Nieuwe Waterwet 2017, the dikes in the area must be strengthening.

### 1.1 REASON FOR RESEARCH

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In 2017 there are new norms for the water safety in the Netherlands. These new norms are set down in the new Deltawet that is included in the Deltaprogramme of 2017. At this moment, there are some projects about strengthening the dikes. Between 2030 and 2050 the dikes must be strengthened on different places, Merwede, Lek and Noord. This problem is related to the second and third layer of the multi-layer safety approach. (De gemeenten in Alblasserwaard/Vijfheerenlanden, 2016). The multi-layer safety approach is an approach that reduces the possible damage to areas and make sure that people can evacuate effective by a natural disaster, mostly flooding's. The first layer is about prevention, by using dikes and storm-surge barriers. In addition, the second layer is about spatial planning, making spatial plans to reduce the damage to the area. Finally, the third layer is about disaster management, it is about evacuating effectively. In Alblasserwaard is already a solution for the first layer. About the second layer, there are not spatial adaptation measures already implemented. About the third layer, there is a lack of evacuation possibilities. (Defacto stedenbouw, 2013). In this research proposal, the demarcation is set as the second and third layer. This research proposal gives a better view of the possibilities with the second and third layer.

This research proposal will show our plan of approach. It will integrate our plans of research around in the field and at the desk. Additional to that it shows an overview of our working timetable which the team has already worked on. However, the timetable is still flexible and can be adjusted during the project. You will be able to see how our group of experts will work together with stakeholders and every group of interests involved in the research, trying to compromise the interests of the stakeholders without losing sight of the main goal.

## 1.2 BACKGROUND INFORMATION

Alblasserwaard is an area between Rotterdam and Dordrecht. It is surrounded by six rivers; river the Lek, the Merwede, the Noord, the Oude Zederik, Merwedekanaal and the Linge. The area is surrounded by dikes. To improve the water drainage two crossings were implemented. One crossing is called the Grootef-Achterwaterschap. The other crossing is called the Nieuwe Waterschap. They both discharge in the river the Lek. In Alblasserwaard are a lot of farms located and some villages. Moreover, the cities in the area have historical and protected city centers. Alblasserwaard consist of eight municipalities called: Alblasserdam, Giessenlanden, Gorinchem, Hardinxveld-Giessendam, Molenwaard, Papendrecht, Sliedrecht en Zederik. In the area is a lot of cattle breeding, fruit farming, shipyards and dredging industry. Furthermore, the area has two provincial roads and two highways. In addition, a very busy junction called Knooppunt Gorinchem and one train track is located in Alblasserwaard.

(De gemeenten in Alblasserwaard/Vijfheerenlanden, 2016)

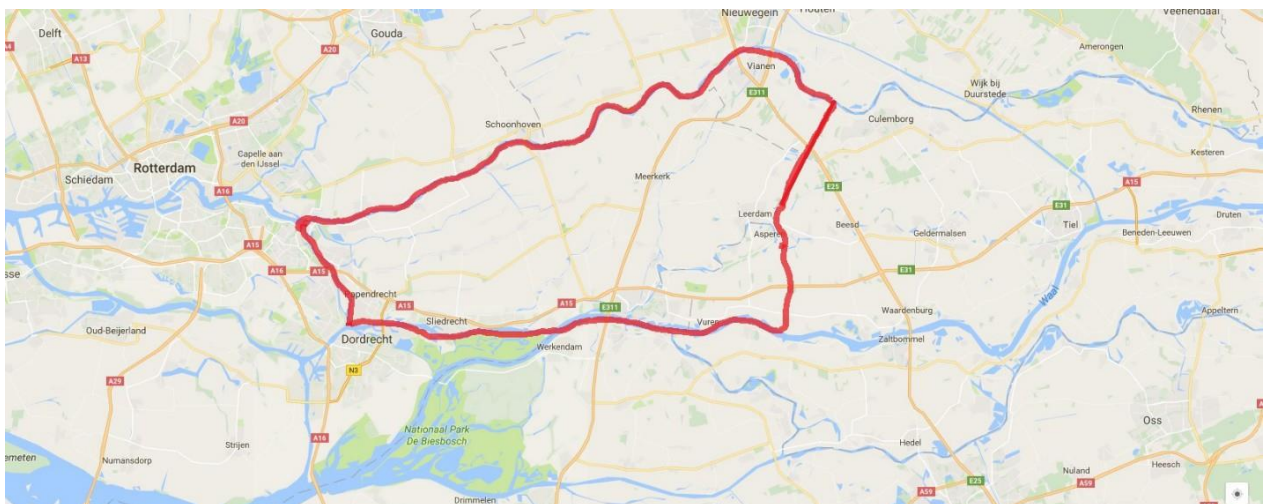


Figure 2. Project area, on the left side is Rotterdam and Dordrecht located. Source: Google maps.

### 1.3 PROBLEM DEFINITION

In 2017 there are new norms for the water safety in the Netherlands. These new norms are set down in the new Deltawet that is included in the Deltaprogramme of 2017. At this moment, there are some projects about strengthening the dikes. Between 2030 and 2050 the dikes must be strengthened on different places because these dikes do not meet the new norms, this is basically for the whole Alblasserwaard area. This problem is related to the second and third layer of the multi-layer safety approach. The multi-layer safety approach is an approach that reduces the possible damage to areas and make sure that people can evacuate effective by a natural disaster, mostly flooding's. In Alblasserwaard is already a solution for the first layer, but this solution is not enough, this solution distract the view of some people's home's for example so there have to become solutions in other layers to solve these problems. About the second layer, there are not spatial adaptation



Figure 3. Multi-layer safety approach. Layer 1, prevention by dikes and storm-surge barriers. Layer 2 spatial adaptation, adapting against the changes. Layer 3, disaster management, evacuate efficiently.

measures already implemented. For example, there are a lot of houses build next to dikes, the dikes cannot be strengthening further because it will damage the houses, by searching spatial adaptation measures, it is possible to find solutions for these problems. About the third layer, there is a lack of evacuation possibilities. Because there are not evacuation plans, this makes it difficult to evacuate if there is a real disaster. (De gemeenten in Alblasserwaard/Vijfheerenlanden, 2016). In this research proposal, the demarcation is set as the second and third layer. The problem is related to the whole area of Alblasserwaard, so the focus of this research will be on the whole area, in figure 2 is the whole area described and in figure 1 is the location of the area described. It is not possible to make a solution for one area within Alblasserwaard, because they all have the same problems and relate to each other.



### 1.3.1 CLIMATE CHANGE

Alblasserwaard must deal with the effects of climate change. First the higher river discharges, due to the increasing temperature, more ice is melting and this lead to higher river discharges, also in the Netherlands. So, in some periods the area should deal with high river levels this is the reason that the chance on flooding's is very high, as described in figure 4 below. Moreover, there is more intensive rainfall, the area must deal with this intensive rainfall and should find solutions to discharge the water out of the area. Furthermore, in some periods the river levels are lower, because of the longer dry periods, this causes problems with the freshwater supply. To summarize, Alblasserwaard should deal with higher and lower river discharges, which causes problems with a shortage or surplus of water and it must deal with temperature fluctuations. This drier periods causes problems for the soil, the soil will become to dry. (Ministerie van infrastructuur en milieu,

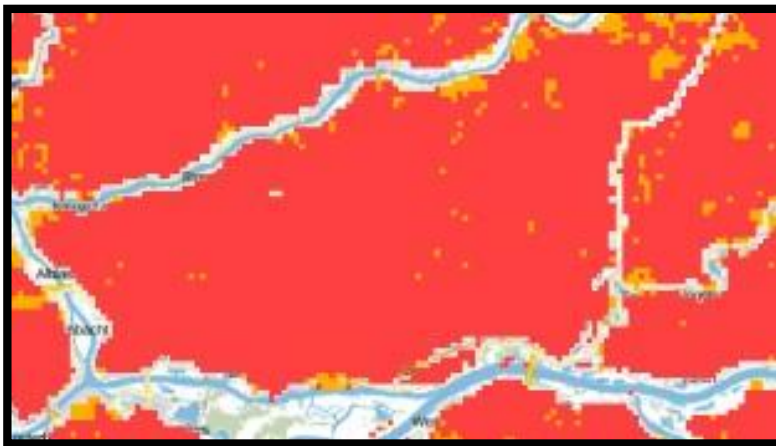


Figure 4. Change on flooding's in Alblasserwaard. How darker the color how higher the change on flooding's? So, the red color is the dangerous area.

Source:

[www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

At the klimaateffectatlas tool

2016)



Figure 5. Drought stress in Alblasserwaard. How darker the color, how more drought stress there is. So, in some areas in Alblasserwaard is big drought stress, mostly the areas that are located to the river. Source:

[www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

At the klimaateffectatlas tool

Besides all the effects of climate change Alblasserwaard have also to deal with land subsidence. This is a big problem, because if the land is becoming lower and there are higher river discharges, this causes water problems because the dikes must be strengthened more and more. This has effect on the houses located in Alblasserwaard, on some places there is not enough space to strengthened the dikes, because buildings are to close build next to the dikes so there is not enough space to build stronger dikes. (Ministerie van infrastructuur en milieu, 2016)

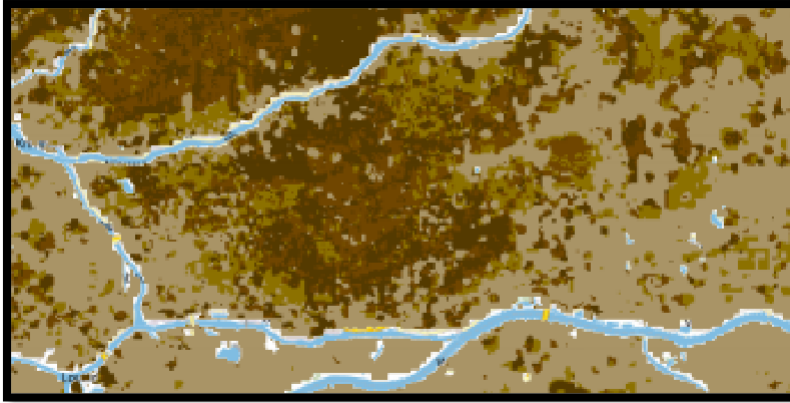


Figure 6. Land subsidence in Alblasserwaard. How darker the color, how more land subsidence till a maximum of 2 meters. So in Alblasserwaard is a lot of soil subsidence. Source: [www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

At the klimaateffectatlas tool

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### 1.3.2 6 'W'MODULE

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#### WHAT?

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First, what is the problem? In 2017 a new policy plan will start. This norm is from the new law the “Waterwet” and it means that all the primary water defense system will be tested and improved if needed. This must be accomplished before 2050. (Deltares, 2016) By doing these tests the governance in the area found a few problems. The area will not be safe in the future due to global warming and sea-level rise. The current defence system “dikes” do not meet the needs for the future. There need to be better water-safety in the area.

#### WHO?

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Secondly, who owns the problem? The problem is owned by the municipality of Alblasserwaard and Vijfherenlanden working together with the province Zuid-Holland, water board Rivierenland and the government of the Netherlands. All these bodies cooperate with the “Gebiedsraad” in English called the area board. The area board involves companies and organisations in the project. Special attention is payed to the companies who are positioned next to the dikes. The project also approaches different companies which can help in the project on different aspects. For example, on accessibility, living, environment and innovations. Furthermore, there is a big share at the people who live outside the area. In a report from ministry of infrastructure and milieu and economic businesses there is mention that the area of Alblasserwaard and Vijfherelanden especially vulnerable are in the outer dike area. (Ministerie van Infrastructuur en Milieu Ministerie van Economische Zaken, 2015)

#### WHEN?

Thirdly when did the problem arise? The problem arose on January 29 2009. This was when the “Waterwet” was introduced. By the announcement of the law all the governance in the Netherlands started question their protection and started research on their municipality. This was the same for Alblasserwaard and Vijfherenlanden. After 2009 all the stakeholders are very busy finding the weak point and point of improvements in Alblasserwaard.

#### WHY?

Mostly in the whole area are the dikes close located to the houses, so there is little room to strengthening the dikes. The houses should be removed or the dikes would be not strengthening. For these issues have to be found a solution. Moreover the new norms of the water safety in 2017, this new norms means that a lot of dikes have to be strengthening and meet the new norms.



Figure 7. Houses close located to the dikes, so it is difficult to strengthening the dikes, there have to be found smart solutions for this problems.  
Source: [www.hetkontakt.nl](http://www.hetkontakt.nl)

#### WHERE?

Sluis, Kinderdijk and Sliedrecht - Biesbos

#### HOW?

Via a research with the province, two waterboards and the municipalities, Alblasserwaard and Vijfherenlanden. Furthermore some organizations and companies, bring their stake in this research.

### 1.3.3 PROBLEM DEFINITION IN IMAGES

The picture below described the selected areas in Alblasserwaard where dike strengthening can be linked to chances and ambitions. Especially Kinderdijk, these area has a big cultural heritage because of it amount of mills combined with the grasslands and amount of water in the area, so in this area there is a change to combine the dike strengthening with some ambitions, for example to make it more attractive than it was.



Figure 8. Map of Alblasserwaard, the selected areas are areas where dike strengthening can be linked to chances and ambitions. Source: (A5H, 2017)

In the picture below are the problems described related to the houses in the area. Due to climate change there is rising sea level and there are higher river discharges, this causes more water in the rivers, what can cause more flooding's in outer dike areas. Because of the higher norms the dikes have to be strengthened but there is land subsidence that causes that the dike is sinking. So there is more instability in the dikes what can cause more change on flooding's. Because of the land subsidence the polder levels are getting lower and the water levels are getting higher because of the sea level rise and the higher river discharges, this causes problems to with the instability of the dikes.

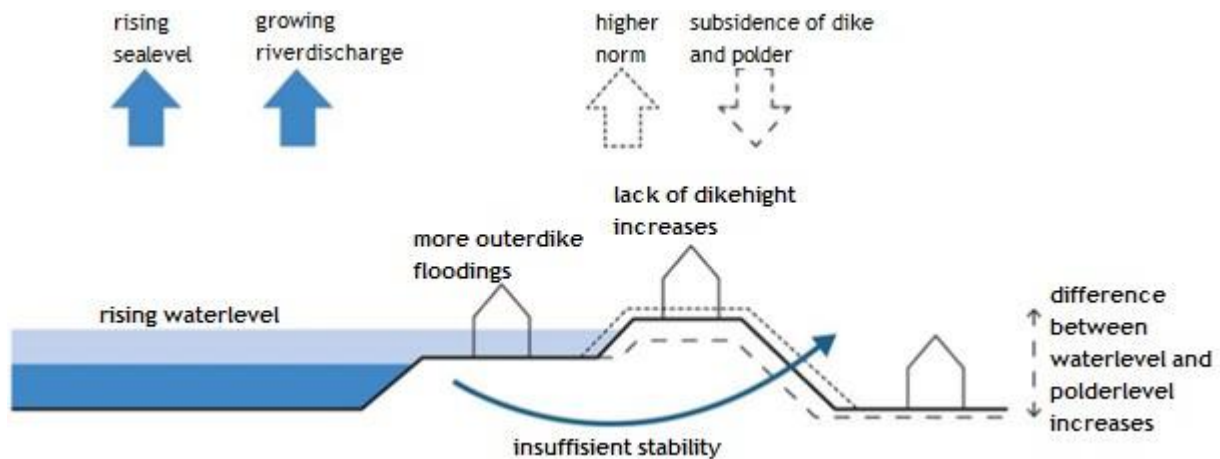


Figure 9. Main problems in Alblasserwaard, higher water level, flooding's in outer dike areas, increase between the water and polder level. Source: (A5H, 2017)

#### 1.4 PROBLEM DEMARCATION

In the problem demarcation is described how and why the issues related to the multi-layer safety in Kinderdijk will be solved. The things described below are only a few indicators about how and why the problem have to be solved, this is to get everything in a row to know more problems and to get some indication.

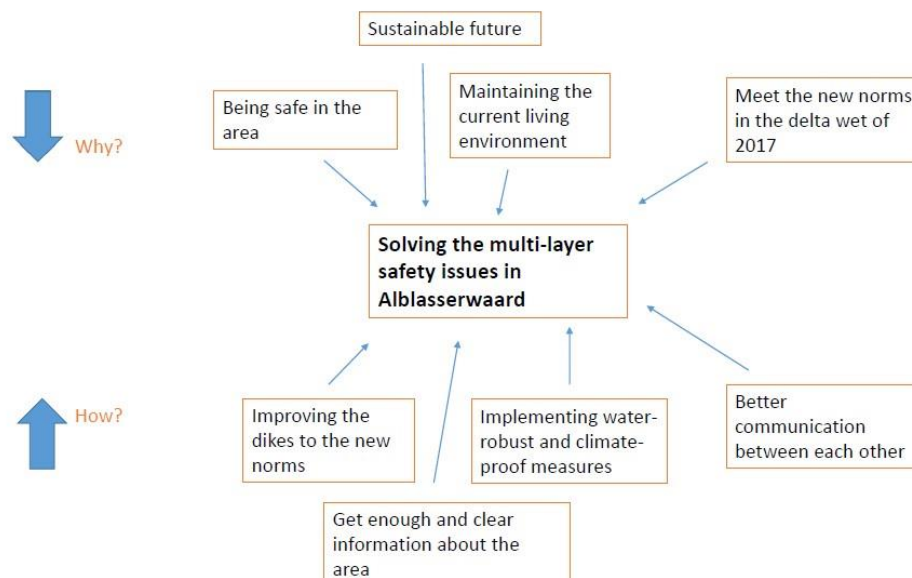


Figure 10. how's and why's to solve the problem.

## 1.5 RESEARCH QUESTIONS

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Below are the main and sub questions described of the research. By solving these questions there will be a broader sight about the issues in Alblasserwaard and some possible answers how this issues can be solved.

Main question:

How can the Kinderdijk area meet the new requirements of the waterwet 2017 combined with improving the multi-layer safety concept in Kinderdijk related to dikes?

Sub questions

: What is the waterwet 2017 norm and what are the consequences for the Kinderdijk area?

What is the multi-layer safety?

What can layer 2 & 3 contribute to meet the requirements of the waterwet 2017?

## 1.6 RESEARCH GOAL

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This research proposal aims at defining a model that can contribute in the multi-layer safety concept which can contribute to protect Kinderdijk against the water. Kinderdijk has problems with water, there are several solutions that are linked to layer 1 already, but there aren't yet solutions for layer 2 and 3. Our research goal is to give several opportunities and options to implement layer 2 and 3, moreover to point out the weak spots for Kinderdijk. This research will give a broader view of the area; it will consist information that is useful for the province of South-Holland. The goal is to give them information about unclear subjects in the area.

## 2.0 THEORETICAL FRAMEWORK

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After this point the focus of this research will be focused on Kinderdijk. All the important information about Multi-layer safety in the Netherlands will be mentioned in this part. Each individual layer will be taken a look at.

### 2.1 LITERATURE REVIEW ABOUT MULTI LAYER SAFETY IN THE NETHERLANDS

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The Dutch government has invented the Multi-layer safety approach (MLS). The introduced is in the National Waterplan in 2009. In the this plan all the measures that should be taken in 2009-2015 are mentioned. Also in the report for 2016-2021 these this mentioned in various ways. These measures have the goal to keep the Netherlands dry, increase spatial planning and guarantee a sufficient disaster management. Before the MLS approach the Netherlands only focused on the first layer. Which are only hard structures. However, with more knowledge about climate change other measurements need to be used. By creating the MLS and make it clear by adding the second and third layer it reduces flood risks and damage caused by the flooding. Thus, where the old policy was mainly about prevention the new MLS concept creates a different dimension to this due to prevention and a complex work environment.

#### 2.1.1 CONTRADICTING PRINCIPLES WITHIN EACH SEPARATE LAYER

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In this part, every layer will be mentioned in more detail.

##### Layer 1; flood prevention

Layer 1 is about flood prevention. The national governance want to change from hard water defense systems to more softer water defense systems in other word building with nature. This idea is already being executed by sand engineering. A good example is the “Sand engine”. Sand is supplied and spread along the coast to strengthen the coastal defense. However, on the other side hard structures are still being build. Other new structures do involve multi purposes for example the dike boulevard of Scheveningen. Which is used as dike but in the main time restaurants and kiosk are placed inside it for multi functionality.

This is also a perfect example what MLS now stands for. Can we include this in kind of solution in MLS or can't we because how about the environment and layer 3. This is a big problem with MLS a lot of people have different opinion about MLS. This is what also came through in the interview is that the province stays put with the MLS concept because not everyone is on one line about the rules and the implementation.

### Layer 2; living with water

The second layer is focus on improving the spatial aspects in a project. This will lead to less victims and damage during a flood and will decrease the change on such event. By looking at spatial planning and decisions on urban, rural and natural developments. By combining all these aspect, the damage of bad event can be reduced. Society will be able to not only live next to the water it will also be able to live with the water. This living with water is an interesting concept because over the past years a lot of interesting concept and ideas occurred. For example; floating houses or amphibious houses, city's which are covered in green roofs and capturing water and sustainably use it again. However, this is not so successful as you might think. Living with water is almost made impossible. Building outside water defense system is rarely aloud and if so the waterboard can't guarantee safety. This is mainly due to the old habit from the Dutch which is that water is a tread. Water in the Netherlands is still seen a tread and needs to be kept out. Hopefully new generation will change this together with new regulations. By looking at other cases the Netherlands can learn a lot from other countries.

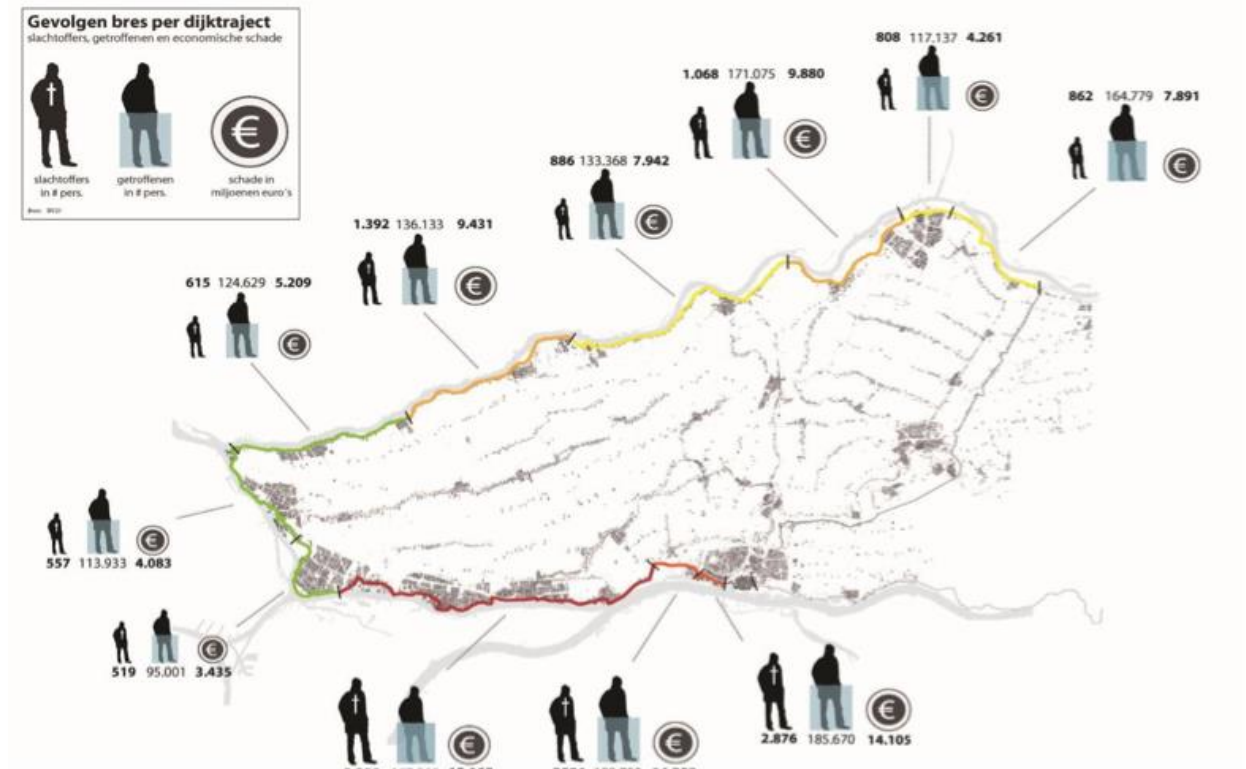
### Layer3; Evacuation

The third and final layer is based on disaster management. Meaning a good preparation for disasters leading to sufficient managing during a disaster. There are doubt on layer 3 because is layer 1&2 are executed properly then layer 3 is unnecessary. However, the Dutch won't take any risk at all if it comes to water so the third layer is implemented. The problem with layer 1&2 is that there are some flaws in the fabric. You need access point for water into the country and outlets. Furthermore, systems can fail or age. In such scenarios layer 3 is implemented.

Layer 3 is most important to make people aware of the risk. Most people don't now the risk and think they are safe. However as already mentioned a fail in the system can occur. When this happens, people need to know what to do so they can react fast and the life's taken by the water will be none. There are a lot of tools which one can look up to see how high the water will be at their house and what they need to do and how they can prepare. Based on the risk in an area. This risk is based on 2 factors first, the probability (how even such events occur). Secondly the consequences (potential damage will be at such flood). Multiplying these 2 and you get the risks.

Source for 2.1: (Wolf, Contradicting Principles within the concept of Multi layer safety , 30-06-2014)





Added above is an extra interesting picture we got from our contact person at the province of Zuid Holland. It is interesting for layer 3 focusing on the damage on the area of ablasserwaard. It shows the number of victims that will die because of a break in the dikes. Next to that the amount of person hit by the flood, the last information you can get out of this picture is the damage in millions of euro's.

## 2.2 DEFINITIONS OF MOST IMPORTANT CONCEPTS

This part is about the concepts in the project Alblasserwaard. The main focus area in this project will be Kinderdijken. This area is famous for its historic windmills. The dikes form together with the water network the accessing roads to the world heritage Kinderdijken. Kinderdijken attracts a lot of tourist each year.



Figure 11: the area of Kinderdijk. Source: [www.hetposthuijs.nl](http://www.hetposthuijs.nl)

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### 2.2.1 NEW WATER LAW 2017

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This area is threatened by the water, the dikes and other water defences that are located in this area aren't sufficient anymore. The Netherlands has been divided into dike rings. These dike rings are areas that need to be protected against high water levels. On a few places in the Netherlands the dike rings do not meet the required standards from the new water law 2017 to keep these areas safe.

Kinderdijken belongs to the region Rijnmond-Drechtsteden. This region has its own approach in the Delta program. The Delta program should protect the Netherlands from floods and has to make sure that there is enough fresh water.<sup>1</sup>

The area Kinderdijken has a cultural value. The character of the area has to be remained as well as possible. This is going to be difficult because the dikes in Kinderdijken do not meet the new standards of the new water law 2017. These dikes need to be reinforced. Reinforcing the dike in the traditional way the Netherlands has always reinforced dikes could compromise the character of the area. Other ways to reinforce the dike without compromising the cultural value and character of the area has to be found.

A solution for this problem could be building with nature. Let the force of the nature help with reinforcing the dikes in Kinderdijken. An example of building with nature are rich dikes, these are simple and cheap changes to hard structures like dikes, piers and dams can be used to retain water in higherlying parts of intertidal areas, resulting in an enormous boost for local biodiversity. This makes it possible to create pools at the foot of the dike without affecting flood prevention. Birds and other marine animals feed on the organisms in the pools, which also enhance the recreational and educational value of the area.<sup>2</sup>

Another realistic building with nature solution could be forebanks. River forebanks with vegetation break waves. Fields with willows in front of dikes mitigate wave impacts and so the dike does not need to be as high. Studies have shown that a strip of willows one hundred metres wide can reduce the height of one metre-high waves by 80%. Dikes protected in this way can be much lower and they can be covered in clay rather than rock. So introducing vegetation to forebanks can prevent expensive dike upgrades and also enhance the natural and recreational value of these areas.<sup>3</sup>

These possible solutions could make sure that the character of the area remains the same.

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<sup>1</sup> <http://a5h.nl/dijken/>

<sup>2</sup> <https://www.deltares.nl/app/uploads/2015/01/Dossier-Building-with-nature-Delta-Life-1.pdf>

<sup>3</sup> [deltares.nl/app/uploads/2015/01/Dossier-Building-with-nature-Delta-Life-1.pdf](https://www.deltares.nl/app/uploads/2015/01/Dossier-Building-with-nature-Delta-Life-1.pdf)

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### 2.2.2 DIKES AND BANKS

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Dikes and Banks have in a rural and regional way their own identity. They have their own logic, build and character. When dike reinforcement is necessary, thought should be given to the design of the dike. The dikes are an important identity keeper of the area, this means that the dike reinforcement needs to strengthen the already existing qualities of the dikes. This requires knowledge and awareness of the distinguishing qualities and the identity of the dikes and banks. In the vision of the dikes and banks the existing qualities and characters will be captured. This does not only mean the cultural historic elements but also the character shipyards next to the river, these are characteristic for the maritime character of the area.

In this vision there can be given thought to see which characteristics will be kept and which can be reinforced. There are a few dike visions on local scale. These will be completed and strengthened by an overarching vision for the area Alblasserwaard. The combination of the different characters is forming a string of beads that gives character to the area.<sup>4</sup>



Figure 12: the edge of a river bank. Source: [www.deltares.nl](http://www.deltares.nl)

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### 2.2.3 NATURE, RECREATION AND TOURISM

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Alblasserwaard has a huge recreation potential. The old Dutch water defence line and its associated forts can be found in this area besides of Kinderdijk. The area has also a cultural and historic value where special bird species live.

Stakeholders in the area are cooperating on the theme nature, recreation and tourism in the region agenda. The accessibility of the area for tourism is an important focus point. The accessibility capacity of the area Kinderdijk should be reviewed. As well as the availability of ports for recreational boating and the consistency of the bike, walking and canoe routes in the area.<sup>5</sup>

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<sup>4</sup> <http://a5h.nl/gebiedsbrede-themas/dijken-en-oevers/>

<sup>5</sup> <http://a5h.nl/gebiedsbrede-themas/natuur-recreatie-en-toerisme/>

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## 2.2.4 REGIONAL ACCESSIBILITY

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The main road structure forms the basis for the internal and external accessibility of the region. This structure is formed by the highways A2, A15 and the A27 and the province roads in the area. The main road structure for the regional agriculture and freight traffic is formed by the province roads.

The region would like to optimise the accessibility and the region tries to limit the negative effects of car traffic. The main focus lays on the flow on the main road networks and the connection between these networks.

The possibility to combine this with reinforcement of the dikes is been viewed. Another thing that is been viewed is the possibility to separate the car traffic form the bicycle roads on the dikes. Furthermore there can be opportunities in traffic on the water, for goods, inhabitants of the area and tourists. An example for this could be a water taxi.<sup>6</sup>



Figure 13: A regional road in the area. Source: [www.a5h.nl](http://www.a5h.nl)

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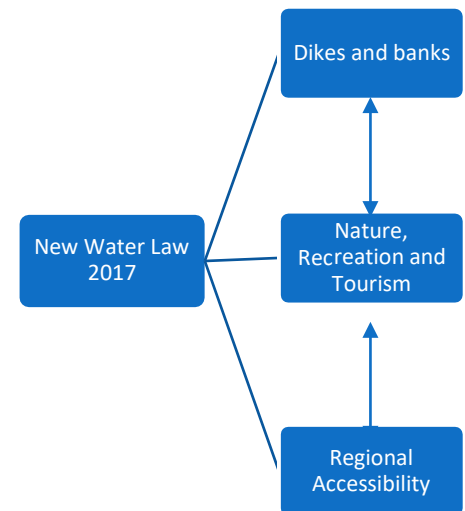
<sup>6</sup> <http://a5h.nl/gebiedsbrede-themas/regionale-bereikbaarheid/>

## 2.3 CONCEPTUAL MODEL

Here the relations between the different concepts will be mentioned. This to give a clear overview of the relevant information in the project.

First, the most obvious connection which can be seen on the right. It's the connection between the new water law 2017 and the other concepts. The New water law is the “main problem” in this project because everting needs to be improved because it doesn't meet the new standards. Because they don't meet the new standards problems occur on all these aspects.

However, the law is made to provide safety to the Netherlands also for Kinderdijk. Better said is that the law is the solution to the problems in the area. which occur now and must be solved to guarantee safety.



Secondly, the interaction between the 3 concepts in the multi-layer safety, each of them is related to each other. On policy level but also on civil and ecological level. Changes in one layer will influence the other in various ways. Furthermore, by connecting these layers in a smart way the perfect solution will come up. All those layers have an even level of importance.

The dikes and banks provide a lot of nature and recreation and tourism. With integrated purposes like roads and recreation area value will be increased. On the other hand, better roads will probably lead to more recreation. New dikes and especially new shallow slopes will support all different kind of organisms. Which tourist and local people can enjoy.

The dikes and banks can provide a lot of nature and recreation and tourism. With integrated purposes like roads and recreation area value will massively be increased. This will also work the other way around. Accessibility will increase tourism and can be combined with nature and flood protection. By doing this the circle will be closed. Creating a high value and sustainable region.

## 3.0 METHODOLOGY AND OPERATIONALIZATION

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### 3.1 RESEARCH DESIGN

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The research group chose Kinderdijk because of its unique challenges, created by different phenomena that are threatening the region such as the land subsidence and the fact that the area does not meet the new norms, the choice for a qualitative research is logical because there are a lot of different interests in this specific case such as the inhabitants and the municipal and national government and their regulations.

For the Alblasserwaard in particular there are no other examples because this programme is the pilot programme for the region, so no case studies that can be used to learn from. The collection of data will come in the form of online and offline sources that will be specified in the next subchapter.

To determine if the information that is collected is true or false it is needed to stay in contact with the sources of the information, a way to do this is to send the research document to them for a final checkup.

### 3.2 METHODOLOGY AND RESEARCH QUALITY

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To gather the information for the research, different methods are used by the group.

In this chapter, those methods are described. It is important that all the information that will be gathered is reliable and correct. The first research method that the group used is online sources. The second source used is a meeting with a senior policy advisor of the project region.

#### Online sources

The first source that the group used for the research is the availability of online sources.

On the internet, there are sources available that contain information about the project area. The sources are easily accessible. To be certain that the sources are reliable, the group did a quality control for the sources that are used.

Furthermore, official sources, such as the Delta program, are used as much as possible.

Another online source the group has used are maps from [www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl).

These maps show the impact that different kinds of climate change have on the area.

The impacts of for example land subsidence, heat stress and rising water levels are clearly visible on these maps.

### Meeting with senior policy advisor of the area

The group arranged a meeting with the senior policy advisor who moreover is the deputy head of the bureau for realization of Water and Green in the area. The meeting took place in The Hague, province of Zuid-Holland, on the 21th of December 2016. Lucy Smeets from the department of Water and Green was also present during the meeting. The group gathered information about the area which helps in the research assignment about the Kinderdijk region.

### 3.3 OPERATIONALIZATION OF THE MAIN CONCEPTS

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To gather the right information during the research, several methods, which are explained on page 21, are used. In this research, online sources and a meeting were the most important methods. This chapter will explain what kind of questions the group used during the meeting/interview in Den Haag and why they asked those questions. During the interview, the group asked a lot of questions about the multi-layer safety approach in the A5H region. An example of one of these questions is if there are any plans for developments in the second layer in the area. The group asked this question because the research was focusing on the 2nd and 3rd layer of the approach. The answer was that there are plans, but they are currently rough ideas. This answer can be used in the research. Other questions that are discussed during the interview are climate related. How does climate change affect the region? Is there any impact of climate change already? Is climate change taken into account when making plans for developments? These questions give the group a better view of how the plans are made and how resilient the area already is. The group asked questions about layer 3. Are there any evacuation plans in times of a crisis? An interesting conversation followed when answering the question. There are online maps available with the risks and the vulnerability of the area. These can be used in the research. Furthermore, the group asked about the area which the research focusses on: Kinderdijk. The area was discussed and the accessibility was subject of conversation. During the interview/meeting, the group gathered a lot of useful and reliable information which can be used in the research. The quality of the research will rise because of the interview.

## 4.0 RESULTS

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### 4.1 PILOT DESCRIPTION

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This area is threatened by the water, the dikes and other water defenses that are located in this area aren't sufficient anymore. The Netherlands has been divided into dike rings. These dike rings are areas that need to be protected against high water levels. On a few places in the Netherlands the dike rings do not meet the required standards from the new water law 2017 to keep these areas safe. Kinderdijk belongs to the region Rijnmond-Drechtsteden. This region has its own approach in the Delta program. The Delta program should protect the Netherlands from floods and has to make sure that there is enough fresh water. The area Kinderdijk has a cultural value. The character of the area has to be remained as well as possible. This is going to be difficult because the dikes in Kinderdijk do not meet the new standards of the new water law 2017. These dikes need to be reinforced. Reinforcing the dike in the traditional way the Netherlands has always reinforced dikes could compromise the character of the area. Other ways to reinforce the dike without compromising the cultural value and character of the area has to be found. Information about the area: Kinderdijk has 830 inhabitants living in 330 houses. The households are relatively large with an average of 2.44. The total surface of Kinderdijk is 96ha, of which 57ha is land and 39ha is water.

### 4.2 RELEVANT DATA TO ANSWER SUBQUESTIONS

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#### 4.2.1 ONLINE DATA

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(Wolf, Water policy, Governance and law, 14), this source is to answer the sub question about multi-layer safety. It describes how the Dutch government comes to the concept of multi-layer safety. It describes the contradicting principles within each separate layer, so there is a good overview from each layer. This overview can be linked with the multi-layer safety concept in Alblasserwaard.

(Rodenburg), this document describes information about the changes in the Nieuwe Waterwet of 2017. It describes all the changes that were made. Moreover this document includes a contact person, so we can contact if necessary.

(Rijksoverheid, 2012), this source is the Deltaprogramme of the area Rijnmond-Drechtsteden. A Deltaprogramme describes everything related to water and water safety, in combination with spatial adaptation. Alblasserwaard and Vijfheerlanden are located in Dijkkring 16, there is information about this Dijkkring included in the document.



(Defacto stedenbouw, 2013). This document describes information about the multi-layer safety concept in Alblasserwaard related to dike strengthening. This means dike strengthening related to layer 1. It shows examples of what the government can do with dikes by implementing layer 1. Moreover it shows innovative solutions for layer 2 and 3, what they can do to improve those layers. This is an important thing, because there is lack of layer 2 and 3 in the area. Furthermore the document shows information about the flood risk in the area and the change on damage and victims. In addition it shows dike strengthening in the outside dike areas.

(Rijkswaterstaat, 2014), this important document gives an area description that can be important to know. Because it is important to know what kind of soil there is in the area and what there could be done with that kind of soil. Moreover it describes the change on flooding's, in combination with the change of failing the dikes. It describes per Ringdeel what the problems would be and what the weak points are.

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#### 4.2.2 INTERVIEW

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The interview that is attached in Appendix 3 answers a lot of our questions, this interview was really good to do.

The main points of the interview are that in the area of Kinderdijk is to less attention for layer 2 & 3 in the multi-layer safety. The answers of the interview are attached in Appendix 3. The answers are really good to give a broad overview of the research questions it is really worthwhile to read these chapter. It describes exactly what the research is about and what the plans are in the future and what they do in case of flooding's or in case of change on flooding's. In some areas they combine layer 2 & 3. For example they want to make a dike and in the dike is a stairs, these stairs are for the inhabitants to enjoy the view. But those kind of plans are only proposals. They have a lot of ideas. Another combination of layer 2 & 3 is to raise up the streets, when the streets need maintenance, the government is thinking about combining with the maintenance raising up the streets.

## 4.3 GIS-MAP

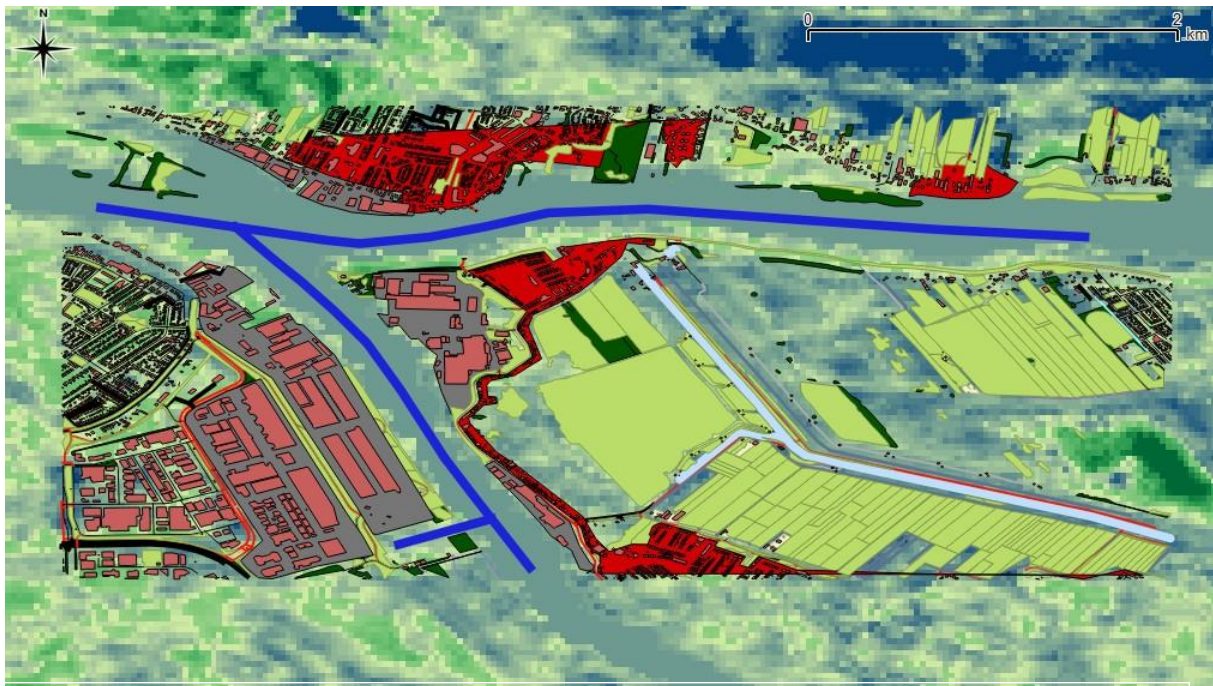
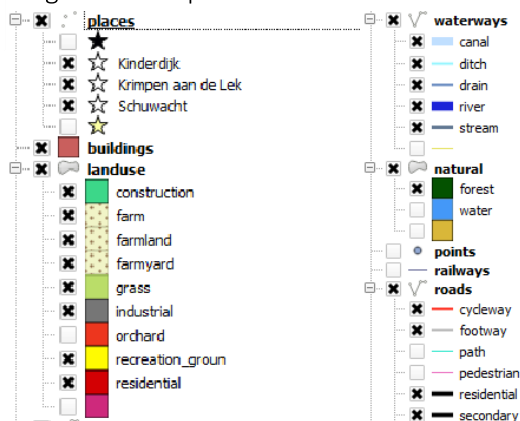


Figure 14. Map about the area of Alblasserwaard Vijfherenlanden with the focus on Kinderdijk.



In figure 14 is the area of Alblasserwaard Vijfherenlanden described with the focus on Kinderdijk. In the area is much farming, moreover there is industrial area and residential area. The background describes the NAP. So the conclusion is that mostly the whole area is lying below sea level. In addition on the areas close to the dikes. Those areas close to the dikes are lying low, this causes several problems. Moreover the map makes clear that close to the dikes are buildings or industry located, this makes it more and more difficult to improve layer 1 from the multi-layer safety approach, because there is not enough space for dike strengthening. It is possible to improve the area by layer 2, spatial adaptation, for example to make houses more water proof and water robust.

## 5.0 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

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### 5.1 DISCUSSION OF RESULTS

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This research is a pilot programme, therefore it is quite difficult to link this information with other researches because of the fact that they simply haven't take place yet. One thing that has been experienced as a discussion point is that there is no equal amount information about all the layers in the multilayer safety approach, this is because some layers are not in use at the moment the result of this is that it is not possible to draw a clear conclusion.

This project brought us new knowledge about information collection, because the online sources were not very broad our research group needed to find the information as close at the source as possible. The research group travelled to The Hague to gather the most correct information.

Because the sources that were used are the policymakers at the base of all the information, the information is pure and unrefined. This can also threaten the outcome because there is no objective view on the research information.

The recommendations for the next research is to begin earlier, if so it is possible to contact possible other companies/policy makers and stakeholders to broaden the vision of the research group.

### 5.2 CONCLUSION

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Within this research, the goal was to answer the research questions, the main question of these research is; How can we meet the new requirements of the waterwet 2017 combined with improving the multi-layer safety concept in Kinderdijk related to dikes and the shoreline? To answer this question the division is made with some sub-questions like; What is the waterwet 2017 norm? What is the multi-layer safety? What can layer 2 & 3 contribute to meet the requirements of the waterwet 2017?

This research proposal aims at defining a model to protect Kinderdijk against the water. Kinderdijk has problems with water, there are several solutions that are linked to layer 1 already, but there aren't yet solutions for layer 2 and 3. Our research goal is to give several opportunities and options to implement layer 2 and 3, moreover to point out the weak spots for Kinderdijk. This research proposal will give a broader view of the area, it will consist information that is useful for the province of South-Holland. The goal is to give them information about unclear subjects in the area.

In 2017 there are new norms for the water safety in the Netherlands. At this moment there are some projects about strengthening the dikes. Between 2030 and 2050 the dikes must be strengthened on different places because these dikes do not meet the new norms. This problem is related to the second and third layer of the multi-layer safety approach. In Kinderdijk is are some solutions for the first layer. About the second layer, there are not spatial adaptation measures already implemented. Moreover AKinderdijk has to deal with the effects of climate change.

Below is an outline of the research questions described, first an outline of the sub-questions, together these sub-questions forms an outline to the main question.

#### What is the waterwet 2017 norm?

The Netherlands has been divided into dike rings. These dike rings are areas that needs to be protected against high water levels. On a few places in the Netherlands the dike rings do not meet the required standards from the new water law 2017 to keep these areas safe. Kinderdijk belongs to the region Rijnmond-Drechtsteden. This region has its own approach in the Delta program. The Delta program should protect the Netherlands from floods and has to make sure that there is enough fresh water.

There are huge challenges in the area Kinderdijk because of the cohesion between water security, build on dikes, spatial and economic developments and the open landscape.

Most of the areas in Rijnmond-Drechtsteden are laying so low beneath the sea level that the area will fill up fast with deep water during a flood. Prevention of flooding's is very important. This can be done by choosing a combination of three prevention measures; storm surge barriers, dikes and room for the river. The focus in the area Kinderdijk is mainly on the dikes.

#### What is the multi-layer safety?

The Dutch government has introduced the concept of 'Multi-Layer Safety' (MLS) in the National Water Plan. The National Water Plan describes the measures that should be taken in the period 2009-2015 to keep the Netherlands liveable for future generations, and to exploit the opportunities of water. At first, the protection against floods was only focused on flood prevention, by improving dikes and investing measures like strengthening dikes and building dams. The new MLS concept contains 3 layers to reduce flood risks and potential damage. In the concept the first layer is about preventing floods with strong dikes, dunes and 'storm flood barriers' (robust and future oriented). Prevention stays the primary pillar of the policy. The second layer is about achieving a sustainable land use planning (location and planning issues), this can reduce victims and limit the damage from possible flooding. Flood risks will therefore play a stronger role in spatial planning considerations. The third layer is about disaster management. Good preparation for disasters is essential to effectively (lower number of victims) deal with a flood disaster. The first layer is traditionally the main pillar. Risk

approach of this pillar is primarily motivated to overrun a chance of flooding. The second and third layer both focus on reduction and management of consequences of floods. Thus, where the 'old' policy was based on prevention, the concept of multi-layer safety makes flood protection a more complex environment to work in.

### What can layer 2 & 3 contribute to meet the requirements of waterwet 2017?

Layer 2 can contribute to meet the requirements of the waterwet 2017. In the areas where the houses are close located to the dikes it is possible to make houses with steels. It is also possible to build dikes with special attention. For example adapt the dikes to the houses and be sure that the dikes are strong enough. But then it is possible that the dikes obstructs the view of the houses. It is possible to adapt dikes to the houses on such a way that it not obstructs the view. But then it costs more money to adapt the dikes to the surrounding area. But this has also an advantage, because there are changes for dikes by adapting it to the surrounding area. The dikes can be used for other purposes. In addition it is also possible to get less of water in the area and replace it in other areas. These areas can store the water. For example more room for the river, water storage places or water squares and more green in the city. By these solutions is it important to keep the water quality in mind. This solutions are possible in layer 2, the spatial adaptation layer.

Layer 3 is difficult to contribute to meet the requirements of waterwet 2017. Because layer 3 is about the evacuation possibilities. This do not contribute to the safety of layer 1, but it can contribute to the higher safety in the area, because the evacuation could be more efficient. If the evacuation plans could be made more effective and efficient, it is possible to do other thinks with the dikes, for example make them waterproof till a maximum level, and be sure that the evacuation is possible. For example make houses waterproof in the area and be sure that the people in the area can evacuate vertical, this means evacuate to the top of the houses.

The main question; How can we meet the new requirements of the waterwet 2017 combined with improving the multi-layer safety concept in Kinderdijk related to dikes and the shoreline?

This is possible by combining layer 2 & 3, if the right combination succeed, the problems with the dikes and shorelines will be solved. By layer 2 it is possible to build houses with steels. It is also possible to build dikes with special attention. For example adapt the dikes to the houses and be sure that the dikes are strong enough. But then it is possible that the dikes obstructs the view of the houses. It is possible to adapt dikes to the houses on such a way that it not obstructs the view. But then it costs more money to adapt the dikes to the surrounding area. This has also an advantage, because there are changes for dikes by adapting it to the surrounding area. The dikes can be used for other purposes. In addition it is also possible to get less of water in the area and replace it in other areas. These areas can store the water. For example more room for the river, water storage places or water squares and more green in the city. By these solutions is it important to keep the water quality in mind. Within layer 3 it is possible to do other thinks with the dikes, for example make them waterproof till a maximum level, and be sure that the evacuation is possible. For example make houses waterproof in the area and be sure that the people in the area can evacuate vertical, this means evacuate to the top of the houses. By combining all these layers it would be possible to get enough safety in the area. By implementing dikes that do not obstruct the view and implementing enough evacuation plans, is it possible that the area is safe enough.

How this research will explain the answers, is to use trustable sources and use the interview with meneer Delmeire, because he is also reliable, he helps us a lot in the research and he has been engaged in the FRAMES project. This information explain the answers by using the right information, above are a few options described, these options can be used to give a final answer on the questions.

## 5.3 RECOMMENDATIONS

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### 5.3.1 RECOMMENDATIONS FOR THE PILOT AREA

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For this area MLS, could mean a lot more. By looking at the knowledge about MLS in the Netherlands and the interview with the Province of Zuid-Holland (see appendix 7.1). By the research done on the MLS in the Netherlands found was that the opportunities and techniques are incredibly good. The Netherlands if the founder of MLS meaning the now all the ins and outs about the concept. However, by the interview with the province shown was that MLS is used way to less. The main conclusion is that layer 1 comes first and when this layer is complete other layers are looked at. The dikes must be fully build and meet the norms, when this is finished layer 2 is implemented by smart infrastructure and spatial planning. When this all is implemented layer 3 is finished. Layer 3 is by this approach bad. Recommended is using layer 2 and 3 in the very beginning when the problem still needs to be develop. By doing so smarter, sustainable and safer solution can be found.

### 5.3.2 RECOMMENDATIONS FOR THE MULTI-LAYER SAFETY IN GENERAL

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The Netherlands are the makers of the MLS concepts so a lot of recommendation is not there. most important is that every layer must have equal amount of attention payed to it. Furthermore, layer 2 and 3 could have a lot more attention to it then it is now. Layer 2 is mostly seen as expensive and not necessary. However, on longer term and short term this can lead to a reduction of climate change impacts. Besides this, it increases liveability and green spaces in dens populated cities. Layer 3 can lower the number of victims caused by a flood. If people now what to do and when the can evacuate vertical or out of the area. this will lead to a lower damage to the society and economy. By a good MLS the change on a flood and damage will be as low as possible, moreover the people whom live in flood treated areas can live safe without the fear of flooding.

## 6. REFERENCES

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- A5H. (2017). *A5h*. Opgehaald van [www.A5H.nl](http://www.A5H.nl)
- De gemeenten in Alblasserwaard/Vijfheerenlanden, P. Z.-H. (2016). *a5h.nl*.  
Opgehaald van Water en ruimte verbinden: [a5h.nl](http://a5h.nl)
- Defacto stedenbouw. (2013). *Proeftuin meerlaagsveiligheid Alblasserwaard Vijfheerlanden*. Opgehaald van Defacto stedenbouw.
- Deltares. (2016). *nieuwe normering goed beschermd blijven tegen overstromingen*.  
Opgeroepen op 10 10, 2016, van <https://www.deltares.nl>:  
<https://www.deltares.nl/nl/issues/nieuwe-normering-goed-beschermd-blijven-tegen-overstromingen/>
- Ministerie van infrastructuur en milieu. (2016). *Kennisportaal ruimtelijke adaptatie*. Opgehaald van Ruimtelijke adaptatie:  
[www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)
- Ministerie van Infrastructuur en Milieu Ministerie van Economische Zaken. (2015).  
*Deltaprogramma Rijnmond-Drechtsteden*. Layar.
- Rijksoverheid. (2012, 25 March). *Deltaprogramma Rijnmond-Drechtsteden*.  
Opgehaald van Concept gebiedsrapportage Alblasserwaard en Vijfheerlanden.
- Rijkswaterstaat. (2014). *Overstromingsrisico Dijkkring 16 Alblasserwaard en de Vijfheerenlanden*.
- Rodenburg, I. E. (sd). *Unie van Waterschappen*. Opgehaald van Normering Waterwet.
- Wolf, M. v. (14, July 30). *Water policy, Governance and law*.
- Wolf, M. v. (30-06-2014). *Contradicting Principles within the concept of Multi layer safety*.



## 7. APPENDICES

### 7.1 RESEARCH LOG OF THE WHOLE GROUP

#### Research log

Name: Koen de Weert

Course: CU04143 Research Assignment

School: HZ University of Applied Sciences

Date of search	Activity	Summary of the activity	Time in hours	Result and interpretation
13-09-16	Decide on project	We choose the project of Alblasserwaard in the Netherlands	1	Basic information about the Alblasserwaard
23-09-16	Add the best unique article. I add an article about MLS approach in Dordrecht	MLS, finances and these connection between stakeholders in Dordrecht	1	Desk research about MLS in Dordrecht, moreover it gives a view of how it works in the Netherlands.
27-09-16	Summarizing source.	Summarize the source, the source I summarized was the source about the MLS in Dordrecht Result: 1 Source summarized	2	How to find useful information from articles made to also entertain
03-10-16	Introduction of the research proposal, finding the problem definition and made the research questions. My role was to write the introduction, the problem definition and find research questions together with Koen Spijker	Writing the introduction, and think about the research questions.	2,5	Background information of the area, and problems of the area.
10-10-16	Feedback about the research proposal and improve the feedback. We had not that big amount of work to do, we had a good feedback and work on the feedback.	Together with Koen, we write an introduction about Alblasserwaard. Moreover we write the problem definition, we did it really good so, we have to improve some little things.	1	Improvement of the feedback.

13-10-16	Group meeting about what work have to be done.	Giving everyone different tasks to improve their work, Koen and I already did our work	1	
17-10-16	Doing the last things to finish the research proposal and deliver it.	Helping Sabine, Alvin and Remco, with the theoretical framework and the planning. They asked me for some help	1	Delivering of the research proposal
20-10-16	Start thinking about presentation, together with Koen and Alvin	Discussing about the presentation	1	Good view about what we want in the presentation
22-10-16	Start with making the presentation	Starting the presentation	1	Begin of the presentation is made.
31-10-16	Preparing the presentation	Preparing the presentation	1	
01-11-16	Giving the presentation	Presenting	1/4	
21-11-16	Discussing the research questions	Rewriting the research questions	1	New research questions
22-11-16	Contacting the contact person	Writing an email and discuss it with the teacher	1/2	
28-11-16	Groups meeting	Groups meeting together with the teacher, asking questions about the research questions and about the mail to our contact person. Also improving the questions and preparing a mail to the contact person.	1.5	New research questions
29-11-16	Sending a mail to the contact person	Sending a mail to the contact person	1	New mail to the contact person
1-12-16	Finding a relevant article on Research gate and starting with the document	Finding relevant articles, starting with the document	1.5	Receiving an article and the start of the document
5-12-16	Dividing the tasks for the draft end report	Tasks divided for the draft end report	1	Task divided
7-12-16	Making the GIS map	Making the GIS map	4	GIS map
8-12-16	Making a paragraph in results	Making a paragraph in results	2	Paragraph in results
18-12-16	Preparing the interview with Delmeire	Thinking about questions	1.5	Interview questions
21-12-16	Preparing the interview and doing the last things as preparation	Doing the last things	1	Interview
21-12-16	Interview with people from the province of South-	Doing the interview	2	A lot of information about

	Holland			the subjects related to our research
22-12-16	Working out the interview on paper for the report	Working out the interview	2	A worked-out interview
23-12-16	Doing the last things to finalize the draft report	Finalize the draft report	2	A final draft report
9-1-17	Reading the feedback that is received by mail	Reading the feedback	1	Know what we have to improve and what kind of questions I have for the next lesson
10-1-17	Getting feedback from the teacher	Receiving feedback	0.5	Know what we have to do and when we have to deliver the final report
10-1-17	Improving my part of the feedback	Improving feedback	3	Improved piece of the report
12-1-17	Discussing together with the group who has what to do and when we want to finalize the report	Discussion by group	1	Discussion to get the best out of the report.
13-1-17	Deadline that we set as group to finalize the report, this because now we have still some time to work on the presentation on 16-1-17	Put everything together and finalize the report	1	Finalization of the report
14-1-17	Doing the last things for the report	Finalizing the report	1	Finalization of the report

## Research log

Name: Sabine Voermans

Course: CU04143 Research Assignment

Teacher: Mister Buijs

School: HZ University of Applied Sciences, Vlissingen

Date	Activity	Time in hours	Result and interpretation
13-09-16	Decide on project	0.5	Basic information about the Alblasserwaard
23-09-16	Add the best unique article. I added an article about watersafety	1	Desk research about water safety in the netherlands
27-09-16	The assignment summarize the article	1	Learning how to select the most important information from an article
03-10-16	Introduction of the research proposal, finding the problem definition and made the research questions. My role was to write the theoretical framework together with Cornee Kramer.	2,5	Background information of the area, and problems of the area.
10-10-16	Feedback about the research proposal and improve the feedback. We had to adjust some things in the theoretical framework. It had to be more.	1	Improvement of the feedback.
13-10-16	Here we had a group meeting, discussing the work we already had done and what we still needed to do.	0.5	Here we learned time management
17-10-16	Finishing the theoretical framework.	1	Delivering of the research proposal
21-11-16	Group meeting with the main subject: the research questions	0.5	Delivering new research questions.
28-11-16	Group meeting with our teacher	0.5	
1-12-16	Research gate	1	
7-12-16	Researching for information for the theoretical frame work, final version.	1	Searching for reliable information
18-12-16	Group discussion to prepare the interview with mister Delmeire	0.5	Interview questions

21-12-16	Interview with the contact people at the province of South-Holland		2.5	I learned a lot from this meeting, we received a lot of information about the area.
23-12-16	Handing in the final version		1	
10-1-17	Receiving feedback from the teacher on our final version		0.5	Learning what we needed to adjust
12-1-17	Adjusting my part of the final version + I made a piece about kinderdijken and the new water law.		2	Learning that the focus in the final version needed to be clear
13-1-17	Handing in the final version		0.5	
13-1-17	I am going to present the final presentation with Remco Griffioen and Cornee Kramer. This weekend (13-1-17 until 15-1-17) we will make a presentation and prepare us.		2	

## Research log

Name: Koen Spijker

Course: CU04143 Research Assignment

School: HZ University of Applied Sciences

Date of search	Activity	Summary of the activity	Time in hours	Result and interpretation
09-16	Decide on project	We choose the project of Alblasserwaard in the Netherlands	1	Basic information about the Alblasserwaard
10-16	Meet with Koen de Weert to write the introduction of the research proposal, finding the problem definition and making the research questions.	Writing the introduction, and think about the research questions.	2,5	Background information of the area, and problems of the area.
10-16	Feedback about the research proposal and improve the feedback. We had not that big amount of work to do, we had a good feedback and work on the feedback.	Together with Koen, we wrote an introduction about Alblasserwaard. Moreover we write the problem definition, we did it really good so, we have to improve some little things.	1	Improvement of the feedback.
10-16	Group meeting about what work have to be done.	Giving everyone different tasks to improve their work, Koen and I already did our work	1	
10-16	Start thinking about presentation, together with Koen and Alvin	Discussing about the presentation	1	Good view about what we want in the presentation
10-16	Start with making the presentation	Starting the presentation	1	Begin of the presentation is made.
10-16	Preparing the presentation	Preparing the presentation	1	
11-16	Giving the presentation	Presenting	1	
11-16	Groups meeting	Groups meeting together with the teacher, asking questions about the research questions and about the mail to our contact person. Also	1.5	New research questions

		improving the questions and preparing a mail to the contact person.		
12-16	Interview with people from the province of South-Holland	Doing the interview	4	A lot of information about the subjects related to our research
12-16	Making and finalising my last part (pilot description)	Working on computer	1.5	Reasonably good pilot description
12-16	Doing the last things to finalize the draft report	Finalize the draft report	2	A final draft report
1-17	Reading the feedback that is received by mail	Reading the feedback	1	Know what we have to improve and what kind of questions I have for the next lesson
1-17	Getting feedback from the teacher	Receiving feedback	0.5	Know what we have to do and when we have to deliver the final report
1-17	Improving my part of the feedback	Improving feedback	3	Improved piece of the report
1-17	Group meeting about feedback	Discussion by group	1	Discussion to get the best out of the report.

Date	Activities
Week 38, 2016	Making groups and choose country
Week 39, 2016	Starting the research and determining a focusing area. In our case: the A5H region which is part of the FRAMES project. Start writing the proposal and dividing tasks.
Week 41, 2016	Further investigating the subject and gathering information about the subject. In the meantime, feedback is given by Mr. Buijs.
Week 43, 2016	Writing on the proposal. Group meeting and dividing tasks.
Week 44, 2016	The group has their assignments and every group member is busy on the writing of the proposal. The part of methodology was one of my main tasks.
Week 44-1, 2016-2017	In these weeks a lot is done in the proposal. During these weeks, several group meetings have taken place and some feedback sessions are done. The most important thing that happened during this week was the meeting in The Hague with people of the province. We discussed the issues in the A5H area and the issues in Kinderdijke.
Week 2, 2017	Finishing up the proposal. Making a presentation.
Week 3, 2017	This week the final presentation will be given. I will do the presentation together with Sabine Voermans and Cornee Kramer.

## RESEARCH LOG REMCO GRIFFIOEN



## Research Log

**Cornee Kramer**

Day	Hours	What
13-09-16	1	Choose the project area. We choose the Netherlands and then the frames project of alblasserwaard.
13-09-16	2	Collecting information of our project area alblasserwaard.
27-09-16	1.5	Make the 6W formula for our project area. Also make the research question. Collect more information.
03-10-16	2	Make the rest of the research proposal with the group members. I made a part of the 6w's and of the Theoretical framework.
10-10-16	1	Improve the feedback on the project proposal.
17-10-16	1	Further improvements
21-11-16	1	We found that the research question where to broad and needed to be changed.
28-11-16	1.5	rethink the research question with the teacher and come up with new ones.
08-12-16	1	write the draft report. Part of the introduction/ theoretical framework.
12-12-16	1	prepare the interview with the province
21-12-16	2	Interview with the province on Zuid Holland.
23-12-16	2	create and put the final draft report together. Also handing it in for the whole group
09-01-17	0.5	analyse the feedback
10-01-17	1	Discuss feedback with mr. Buijs
13-01-17	1.5	improve feedback. Make the final report and layout.

## RESEARCH LOG

Name: Alvin Traas

Course: CU04143 Research Assignment

School: HZ University of Applied Sciences

	Activity	Time in hours	Result and interpretation
13-09-16 Untill 10-10-16	Decide on project, creating a group	1	Deciding on which project we will work (Alblasserwaard) and with who
	Collect a good article related to our study	1	I found a good article about water safety
	Summarizing the article	2	Learn to separate information that you need from unnecessary information.
	Reading the feedback that we received and improve the research where needed.	2	Improving the feedback.
13-10-16 Untill 23-12-16	Group meeting about what work have to be done.	1	Dividing the tasks
	Doing the last things to finish the research proposal and deliver it.	1	Delivering of the research proposal
	Come up with a presentation, together with Koen and Koen	1	Bringing up our ideas and put them in
	Start with making the presentation	1	Begin of the presentation is made.
	Preparing the presentation and Giving the presentation	2	
	Discussing the research questions	1	New research questions
	Group meeting	1.5	New research questions
	Dividing the tasks for the draft end report	1	Task divided
	finalizing the draft report	2	A final draft report
	Reading the feedback that is received by mail	1	Know what we have to improve and what kind of questions I have for the next lesson

9-1-17 Untill 13-1-17	Asking feedback from Mr Buijs to do some last adjustments	0.5	Know what we have to do and when we have to deliver the final report
	Improving the part of the feedback for the part that Remco and I did.	3	Improved the part Methodology
	Making some last “deals” with the other group members to see if there is any room for improvement	1	Putting the puntjes on the I to get the best out of the report.
	Deadline that we set as group to finalize the report, this because now we have still some time to work on the presentation on 16-1-17	1	Finalization and delivering of the report and presentation.

Interview 21-12-2016

- Wat zijn volgens u zwakke plekken in het A5H gebied?

Dijkvakken, er zijn niet exacte locaties voor zwakke plekken, wel kwetsbare plekken. Neem een voorbeeld aan Kinderdijk, hier komt al het water samen en het is kwetsbaar als daar een dijk doorbreekt, dit komt ook omdat het een laag puntje is in Alblasserwaard en er veel toerisme naar toe komt. Verder zijn er op verschillende plekken versterking nodig, maar er zijn niet specifiek zwakke plekken.

- Wat voor impact heeft de klimaatverandering op de A5H?

Bij lagere water levels van de rivier door langere droge periodes en minder regenval kunnen de oevers en dijken beschadigen omdat het te droog wordt. De oevers kunnen ook beschadigd raken door verzilting, door de lagere water levels in de rivier komt de zee sneller landinwaarts, dit is vooral het probleem bij Kinderdijk. Kinderdijk krijgt als eerste te maken met de verzilting. Bij heftigere regenbuien hebben de dorpen en steden ook problemen zoals water op straat etc. Voor deze problemen zijn nog geen concrete oplossingen gevonden, maar dit is ook niet echt het vakgebied waar hun zich mee bezig houden, dit probleem is meer voor de gemeentes.

- Wij hebben Kinderdijk gekozen is dit een interessant gebied?

Kinderdijk is zeker in interessant gebied, dit mede omdat alles hier samenkomt en Kinderdijk per jaar zo'n 400000 bezoekers krijgt.

### **Waterwet 2017**

- Wat zijn de problemen met de nieuwe waterwet 2017 in Kinderdijk?

De problemen zijn dat de dijken op dit moment niet voldoen aan de eisen. We hebben tot 2050 om te voldoen aan de dijken, je kan een keuring van een dijk vergelijken met een APK voor een auto, de ene keer komen ze door een keuring heen, de andere keer niet en moet er wat aangepast worden, dat is op dit moment het verhaal binnen de A5H.

- Wat zijn de plannen om aan de nieuwe waterwet te voldoen in 2017 en daarna?

Er zijn geen concrete plannen enkel een aantal voorstellen om te kunnen voldoen aan deze normen. Er zijn echter een aantal voorstellen gedaan om de dijken te verbeteren deze voorstellen kunnen gelinkt worden aan laag 1, maar op sommige plekken zijn er ook voorstellen gedaan om van de dijk iets moois te maken zoals een trap op een dijk, dit is te linken met laag 2 spatial adaptatie. Op een plek in de A5H hebben ze zelfs een delta dijk, dit is een dijk die zo breed en groot is dat de kans dat die overstroomt nihil is.

## Meer laags veiligheid

- Wat zijn de plannen voor laag 1 in Kinderdijk?

Er zijn geen exacte plannen, enkel een aantal voorstellen. Deze voorstellen zijn belangrijk om naar een eindvisie toe te werken. Maar deze voorstellen zijn er heel veel om op te noemen, het gaat er vooral om dat er een goede combinatie gevonden wordt veiligheid en wat de burgers willen.

- Denkt u dat investeren in laag 1 een goed plan is?

Zeker is investeren in laag 1 een goed plan, dit is waar wij als Nederlanders namelijk ook goed in zijn. Er moet in laag 1 geïnvesteerd worden om aan de nieuwe waterwet te voldoen. Het is niet zo in Nederland dat wij de nadruk kunnen leggen op laag 2 & 3 en dan minder de nadruk op laag 1. Het is volgens de wet vastgelegd dat de dijken aan normen moeten voldoen, en dijken kunnen niet aan die normen voldoen als er alleen maar gekeken wordt naar laag 2 & 3, dus investeren in laag 1 is zeker nodig.

- Hoe wilt u omgaan met de gebouwen en mensen die dicht tegen de dijken aan wonen?

Daar zijn verschillende plannen voor, hier houden vooral de waterschappen zich mee bezig. Het is natuurlijk vervelend om bewoners te vertellen dat ze hun huis moeten verlaten. Er zijn wel oplossingen voor bewoners die nog dicht tegen de dijk willen wonen, bijvoorbeeld op sommige stukken wordt de grond onder de huizen verhoogt en worden de huizen een soort van hoger neergezet, dit kan ook weer gelinkt worden aan laag 2. In sommige gevallen is als het echt niet mogelijk is, moeten mensen inderdaad hun huis verlaten en zal het huis vernietigd worden. Gelukkig komt dit niet heel vaak voor.

- Wat zijn de plannen voor laag 2 in Kinderdijk?

Er zijn geen exacte plannen, enkel een aantal voorstellen. Deze voorstellen zijn belangrijk om naar een eindvisie toe te werken. Maar deze voorstellen zijn er heel veel om op te noemen, het gaat er vooral om dat er een goede combinatie gevonden wordt veiligheid en wat de burgers willen.

- Wordt er naar oplossingen gekeken binnen de steden zoals water plein en groen daken?

Er wordt nog niet naar zulke oplossingen gekeken, we zijn in Alblasterwaard 5 herenlanden nog niet bezig met laag 2 & 3. En dit is een heel landelijk gebied, dus er zijn geen grote steden in dit gebied. Waterpleinen zijn handiger in grote steden en ook groene daken hebben daar meer effect.

- Is ruimtelijke adaptatie mogelijk in het gebied (bijvoorbeeld waterproofhousing)

Ja, er wordt bijvoorbeeld gekeken naar de wegen, als die onderhoud nodig hebben of ze ook opgehoogd kunnen worden. Er wordt niet naar waterproofhousing gekeken, er wordt binnen het gebied eigenlijk te weinig gekeken naar laag 2.

- Wat zijn de plannen voor laag 3 in Kinderdijk?

Er zijn geen exacte plannen voor laag 3 in Kinderdijk, dit komt omdat we nog niet in die fase van het frame zitten. In Nederland worden over het algemeen laag 2 en 3 niet zo veel gebruikt en zijn er dus niet veel plannen voor. Er moet nog over nagedacht gaan worden of we echt concrete plannen voor laag 3 uit gaan voeren.

- Weten de inwoners van het gebied wat ze moeten doen tijdens een ramp?

Iedere inwoner van Nederland kan dit opzoeken op verschillende websites op internet. Wij zijn niet verantwoordelijk voor het per persoon inlichten voor eventuele evacuatie routes en wat ze moeten doen tijdens een overstroming. De verantwoordelijkheid ligt ergens anders.

- Zou verticale evacuatie mogelijk zijn tijdens nood?

Verticale evacuatie zou zeker mogelijk zijn tijdens nood, dit alleen niet perse in de zin van hoge gebouwen. Er zou een evacuatie hub aangewezen kunnen worden op een stuk buitendijks gebied, dit gebied ligt hoger dan Alblasserwaard en is dus veilig tijdens overstromingen. Natuurlijk is dit voor de inwoners onnatuurlijk omdat ze dan tijdens een ramp naar de rivier toevluchten in plaats er vandaan. Maar dit zou een mooie mogelijkheid kunnen zijn voor verticale evacuatie.

- Wat zijn de evacuatieplannen tijdens een ramp?

Wij zijn niet verantwoordelijk voor de evacuatieplannen, maar zoals vanzelfsprekend is zo veel mensen uit het gebied krijgen tijdens een overstroming.

- Hoe gaat ervoor gezorgd worden dat de toegankelijkheid voor toeristen verbeterd wordt in Kinderdijk?

We hebben al met verschillende design bureaus samengezeten om dit probleem aan te pakken. Wat ook een probleem is dat buitenlandse toeristen geen fietsers gewend zijn en de Nederlandse toeristen zitten voornamelijk op de fiets in kinderdijken. Dit probleem gaan we dus proberen aan te pakken door samen te werken met een design burea.

- Hoe worden belanghebbende zoals burgers betrokken bij beslissingen?

Het is wederom niet onze verantwoordelijkheid om burgers te betrekken bij eventuele beslissingen in dit gebied. Deze verantwoordelijkheid ligt bij het waterschap. In dit gebied is er vaak sprake van ophoging/verbreding of versterking van dijken. Hierdoor zijn de inwoners in dit gebied gewend dat er om de zoveel jaar iemand van het waterschap aan de deur komt om te vertellen dat er weer gewerkt gaat worden aan een dijk in de buurt. Waterschap stuurt alle inwoners van dit gebied ook regelmatig brieven met informatie over de dijken en eventuele aanpassingen.

- Hoe is de samenwerking met de gemeentes in het gebied?

Deze is goed alleen de gemeentes moeten beseffen dat over een tijd niet alleen de provincie en waterschap verantwoordelijk zijn voor het water tegen te houden, de gemeentes zullen uiteindelijk ook verantwoording krijgen voor laag 2 en 3.

# Preparing Kinderdijk for the future

HZ University of Applied Sciences

14 October 10, 2016

koenRemco Griffioen, Cornee Kramer,  
Koen Spijker, Alvin Traas, Sabine  
Voermans & Koen de Weert

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## 1. INTRODUCTION

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### 1.1 REASON FOR RESEARCH

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We are six second years Deltamanagement students at the HZ University Of Applied Sciences. Our research group follows lectures from J.M Buijs in the course ‘research assignment’. Our group decided to focus on a research in the Netherlands. After some discussions with our teacher, we decided to take the case about Alblasserwaard. The province of South-Holland was looking for someone who want to do a research about Alblasserwaard. This was a great opportunity for us, to work in a different province of the Netherlands. We are very excited and motivated to work on this research.

In 2017 there are new norms for the water safety in the Netherlands. This new norms are set down in the new Deltawet that is included in the Deltaprogramme of 2017. At this moment there are some projects about strengthening the dikes. Between 2030 and 2050 the dikes must be strengthened on different places, Merwede, Lek and Noord. This problem is related to the second and third layer of the multi-layer safety approach. The multi-layer safety approach is an approach that reduces the possible damage to areas and make sure that people can evacuate effective by a natural disaster, mostly flooding’s. The first layer is about prevention, by using dikes and storm-surge barriers. In addition the second layer is about spatial planning, making spatial plans to reduce the damage to the area. Finally the third layer is about disaster management, it is about evacuating effectively. In Alblasserwaard is already a solution for the first layer. About the second layer, there are not spatial adaptation measures already implemented. About the third layer, there is a lack of evacuation possibilities. In this research proposal the demarcation is set as the second and third layer. This research proposal gives a better view of the possibilities with the second and third layer.

This research proposal will show our plan of approach. It will integrate our plans of research around in the field and at the desk. Additional to that it shows an overview of our working timetable which the team has already worked on. However the timetable is still flexible and can be adjusted during the project. You will be able to see how our group of experts will work together with stakeholders and every group of interests involved in the research, trying to compromise the interests of the stakeholders without losing sight of the main goal.

### 1.2 BACKGROUND INFORMATION

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Alblasserwaard is an area between Rotterdam and Dordrecht. It is surrounded by six rivers; river the Lek, the Merwede, the Noord, the Oude Zederik, Merwedekanaal and the Linge. The area is surrounded by dikes. To improve the water drainage two crossings were implemented. One crossing is called the Groote- of Achterwaterschap. The other crossing is called the Nieuwe Waterschap. They both discharge in the river the Lek. In Alblasserwaard are a lot of farms located and some villages. Moreover the cities in the area have historical and protected city centers. Alblasserwaard consist of eight municipalities called: Alblasserdam, Giessenlanden, Gorinchem, Hardinxveld-Giessendam, Molenwaard, Papendrecht, Sliedrecht en Zederik. In the area is a lot of cattle breeding, fruit farming, shipyards and dredging industry. Furthermore the area has two provincial roads and two highways. In addition a very busy junction called Knooppunt Gorinchem and

one train track is located in Alblasserwaard. (De gemeenten in Alblasserwaard/Vijfheerenlanden, 2016)

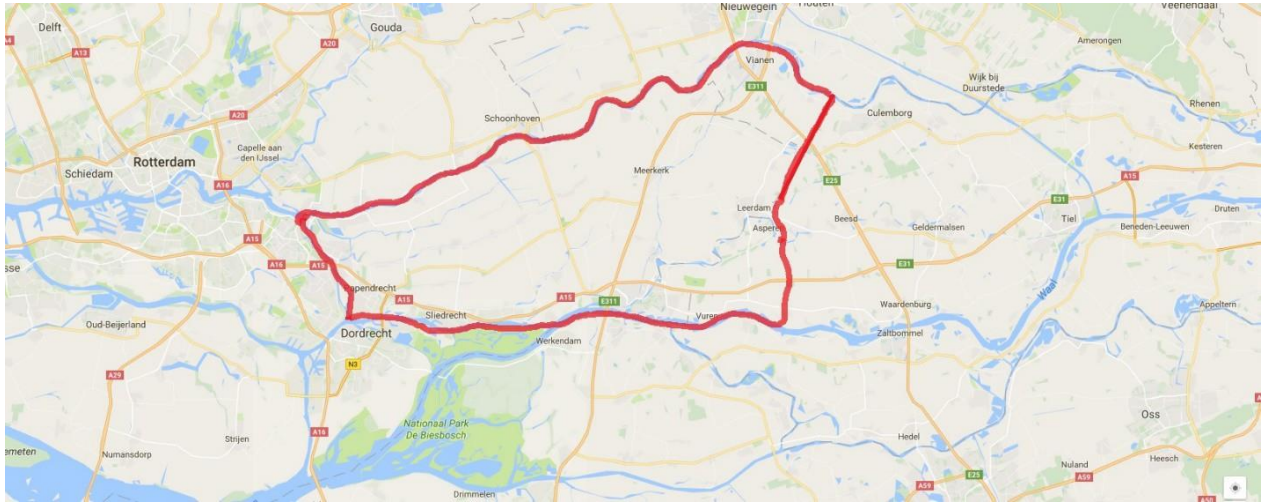


Figure 1. Project area, on the left side is Rotterdam and Dordrecht located. Source: Google maps.



Figure 2. Project area. Source: [www.a5h.nl](http://www.a5h.nl)

### 13 PROBLEM DEFINITION

In 2017 there are new norms for the water safety in the Netherlands. This new norms are set down in the new Deltawet that is included in the Deltaprogramme of 2017. At this moment there are some projects about strengthening the dikes. Between 2030 and 2050 the dikes must be strengthened on different places because these dikes do not meet the new norms, Merwede, Lek and Noord are those dikes. This problem is related to the second and third layer of the multi-layer safety approach. The multi-layer safety approach is an approach that reduces the possible damage to areas and make sure that people can evacuate effective by a natural disaster, mostly flooding's. The first layer is about prevention, by using dikes and storm-surge barriers. In addition the second layer is about spatial planning, making spatial plans to reduce the damage to the area. Finally the third layer is about disaster management, it is about evacuating effectively. In Alblasserwaard is already a solution for the first layer. About the second layer, there are not spatial adaptation measures already implemented. For example there are a lot of houses build next to dikes, the dikes can not be strengthening further because it will damage the houses, by searching spatial adaptation measures, it is possible to find solutions for this problems. About the third layer, there is a lack of evacuation possibilities. Because there are not evacuation plans, this makes it difficult to evacuate if there is a real disaster. In this research proposal the demarcation is set as the second and third layer.



Figure 3. Multi-layer safety approach. Layer 1, prevention by dikes and storm-surge barriers. Layer 2 spatial adaptation, adapting against the changes. Layer 3, disaster management, evacuate efficiently.

The problem is related to the whole area of Alblasserwaard, so the focus of this research will be on the whole area, in figure 2 is the whole area described and in figure 1 is the location of the area described. It is not possible to make a solution for one area within Alblasserwaard, because they all have the same problems and are connected with each other.

### 1.3.1 CLIMATE CHANGE

Alblasserwaard has to deal with the effects of climate change. First the higher river discharges, due to the increasing temperature, more ice is melting and this lead to higher river discharges, also in the Netherlands. So in some periods the area has to deal with high river levels this is the reason that the change on flooding's is very high, as described in figure 4 below. Moreover there is more intensive rainfall, the area has to deal with this intensive rainfall and has to find solutions to discharge the water out of the area. Furthermore, in some periods the river levels are lower, because of the longer dry periods, this causes problems with the freshwater supply. To summarize, Alblasserwaard has to deal with higher and lower river discharges, which causes problems with a shortage or surplus of water and it has to deal with temperature fluctuations. This more dry periods causes problems for the soil, the soil will become to dry. (Ministerie van infrastructuur en milieu, 2016)

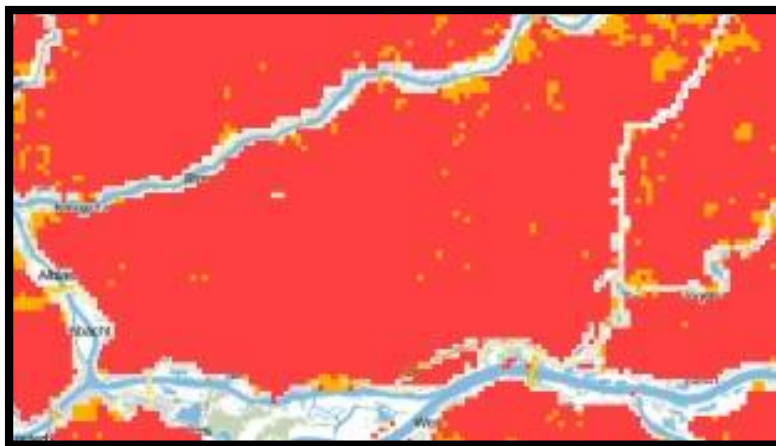


Figure 4. Change on flooding's in Alblasserwaard. How darker the color how higher the change on flooding's. So the red color is the dangerous area.

Source:

[www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

At the klimaateffectatlas tool



Figure 5. Drought stress in Alblasserwaard. How darker the color, how more drought stress there is. So in some areas in Alblasserwaard is big drought stress, mostly the areas that are located to the river. Source:

[www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

At the klimaateffectatlas tool

Besides all the effects of climate change Alblasserwaard have also to deal with land subsidence. This is a big problem, because if the land is becoming lower and there are higher river discharges, this causes water problems because the dikes have to be strengthening more and more. This has effect on the houses located in Alblasserwaard, on some places there is not enough space to strengthening the dikes, because buildings are to close build next to the dikes this gives problems. (Ministerie van infrastructuur en milieu, 2016)

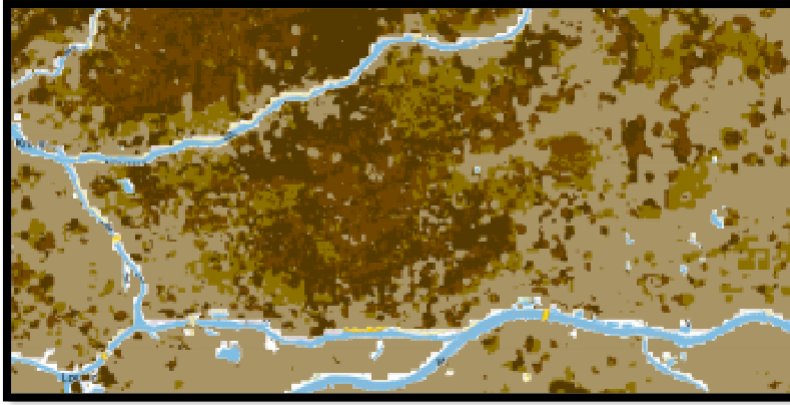


Figure 6. Land subsidence in Alblasserwaard. How darker the color, how more land subsidence till a maximum of 2 meters. So in Alblasserwaard is a lot of soil subsidence. Source: [www.ruimtelijkadaptatie.nl](http://www.ruimtelijkadaptatie.nl)

At the klimaateffectenatlas tool

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### 1.3.2 6 'W'MODULE

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#### WHAT?

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First of all, what is the problem? In 2017 a new policy plan will start. This norm is from the new law the “Waterwet” and it means that all the primary water defence system will be tested and improved if needed. This has to be accomplished before 2050. (Deltares, 2016) by doing these test the governance in the area found a few problems. The area will not be safe in the future due to global warming and sea-level rise. The current defence system “dikes” do not meet the needs for the future. There need to be better water-safety in the area.

#### WHO?

---

Secondly, who owns the problem? The problem is owned by the municipality of Alblasserwaard and Vijfherenlanden working together with the province Zuid-Holland, water board Rivierenland and the governance of the Netherlands. All these bodies cooperate with the “Gebiedsraad” translate area board. The area board involves companies and organisations in the project. Special attention is payed to the companies who are positioned next to the dikes. The project also approaches different companies which can help in the project on different aspects. For example, on accessibility, living milieu and innovations.

Furthermore, there is a big share at the people who live outside the area. In a report from ministry of infrastructure and milieu and economic businesses there is mention that the area of Alblasserwaard and Vijfherelanden especially vulnerable are in the outer dike area. (Ministerie van Infrastructuur en Milieu Ministerie van Economische Zaken, 2015)

#### WHEN?

---

Thirdly when did the problem arise? The problem arose on January 29 2009. This was when the “Waterwet” was introduced. By the announcement of the law all the governance in the Netherlands started question their protection and started research on their municipality. This was the same for Alblasserwaard and Vijfherenanden. After 2009 all the stakeholders are very busy finding the weak point and point of improvements in Alblasserwaard.

1.3.3 PROBLEM DEFINITION IN IMAGES



Figure 7. Map of Alblasterwaard, the selected areas are areas where dike strengthening can be linked to chances and ambitions. Source: [www.a5h.nl](http://www.a5h.nl)

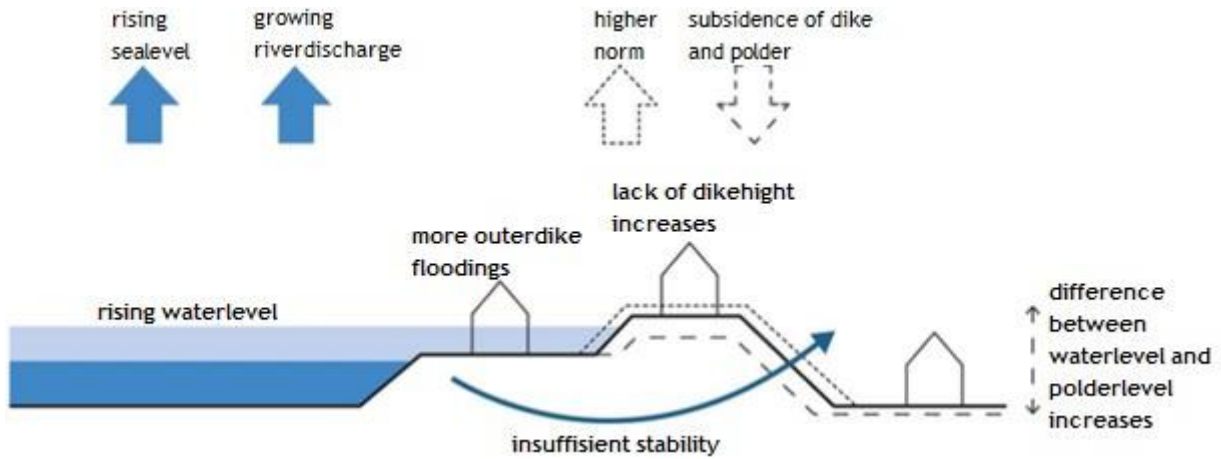


Figure 8. Main problems in Alblasterwaard, higher water level, flooding's in outer dike areas, increase between the water and polder level.

## 14 RESEARCH QUESTIONS

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### Main question

- How can we improve the use of layer 2 and 3 of the multi-layer safety concept in Alblasserwaard?

### Sub questions

- What are the problems with layer 1 in the area?
- What are the problems with layer 2 in the area?
- What do the stakeholders want to improve about water safety?
- Can we improve and adjust layer 2 and 3 without damaging the nature?

## 15 RESEARCH GOALS

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This research proposal aims at defining a model to protect Alblasserwaard against the water. As described in 1.3 Alblasserwaard has problems with water, there are several solutions that are linked to layer 1 already, but there are no solutions for layer 2 and 3. Our research goal is to give several opportunities and options to implement layer 2 and 3, moreover to point out the weak spots for Alblasserwaard.

## 2. THEORETICAL FRAMEWORK

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These resources are the resources that will be used to distract the best information for this research. With the information in these resources the sub questions and the main question can be answered with reliable information. The information has to be reliable to have a good research proposal.

These resources were found true google scholar. Google scholar is a reliable search machine with only scientific and governmental reports.

In this part four resources have been found and ordered.

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### RESOURCE 1:

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**Title:** "Bepaling van de intreeweerstand van de Lek en de verticale weerstanden van de uiterwaarden en polders nabij Langerak (Alblasserwaard)."

**Link:** <http://edepot.wur.nl/371144>

**Summary:** In the second fase of the environmental effect report 'grondwaterwinning Alblasserwaard en Vijfheerenlanden' a research on the effects of the floodplains water extraction Langerak (Alblasserwaard) is been carried out. This resource could be used to help answer the sub question: what are the problems with layer 1 in the area?

**Keywords:** ground water flow, ground water distraction, floodplain, drink water.

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### RESOURCE 2:

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**Title:** " Gebiedsrapportage Alblasserwaard en Vijfherenlanden"

**Link:** <http://repository.tudelft.nl/islandora/object/uuid:36f1dbdb-5383-4c44-8663-27576dac3730/?collection=research>

**Summary:** Overview of the potential measures in the Alblasserwaard and the Vijfherenlanden for the water security. This resource could help to answer the sub questions: what are the problems with layer 1 in the area?;What are the problems with layer 2 in the area?

**Keywords:** water security, climate change, Delta Program, strengthening dikes.

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### RESOURCE 3:

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**Title:** Afsluitbaar Open Rijnmond - een eerste integrale verkenning: Effecten op natuur en milieu

**Link:**

[http://www.aor.tudelft.nl/fileadmin/UD/MenC/Support/Internet/TU\\_Website/TU\\_Delft\\_portal/Onderzoek/Infrastructure/Engineering\\_challenges/open\\_en\\_afsluitbaar\\_Rijnmond/doc/AOR\\_Effecten\\_natuur\\_en\\_milieu\\_TdeNijs\\_JClaessens\\_TUD\\_RCP\\_KvK\\_.pdf](http://www.aor.tudelft.nl/fileadmin/UD/MenC/Support/Internet/TU_Website/TU_Delft_portal/Onderzoek/Infrastructure/Engineering_challenges/open_en_afsluitbaar_Rijnmond/doc/AOR_Effecten_natuur_en_milieu_TdeNijs_JClaessens_TUD_RCP_KvK_.pdf)



*Summary:*

Major part of the area outside the dikes in the Rhine estuary is likely to flood when water levels increase due to climate change. An explorative study by RIVM shows that flooding of these areas may give rise to environmental risks. Implementation of the plan Rhine estuary 'closeable but open', which tries to reduce the water levels, limits these risks only to a small extent. In the study RIVM has evaluated the effects on nature and environment of the plan Rhine estuary 'closeable but open'. The environmental risks arise from residential and industrial areas as well as a number of industrial activities outside the dikes which have to comply with the Seveso Directive concerning the handling and storage of hazardous substances. Moreover, the old centres of Rotterdam and Dordrecht contain a large number of potentially serious and urgent soil sanitation sites. RIVM advises to make a survey of the potential environmental risks outside the dikes due to increasing water levels. The plan Rhine estuary 'closeable but open' was presented in 2008 by the Dutch Delta commission as one of the alternatives to safeguard the residential and industrial areas outside the dikes in Rotterdam and Dordrecht. According to this the plan all major waterways in the Rhine estuary will be closed by adjustable dams when water levels become too high. In this plan the water of the river Lek, which normally flows into the sea through Rotterdam, is redirected via a new waterway towards Hollands Diep and Haringvliet. In this study RIVM analysed the future water levels in the Rhine estuary simulated by Delft Technical University and HKV consultants.

*Key words:* environment, nature, flooding

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RESOURCE 4:

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*Title:* Combineren met natuur, Economische, sociale en ecologische duurzaamheid van functiecombinaties

*Link:* <http://library.wur.nl/WebQuery/wurpubs/fulltext/299267>

*Summary:*

To combine nature and use functions there is an advanced system needed. Over more than 300 practical examples are used and combined in this report. 30 projects are used with economic, social and ecological sustainability. An analysis of social trends and spatial potential projects gave an insight on the spreading opportunities and function-combinations.

Governance can encourage function combinations and sustainability.

*Key words:* policy, sustainability, function-combinations physical opportunities, social opportunities, nature

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## 3. METHOD

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In this proposal, several methods will be used. All the questions that have to be answered need a different approach. The most important is that the method is effective. The method should give the writers as much information as possible, in order to write a proposal which is reliable and contains right information. Moreover, sources have to be taken into account. In this chapter, methods that the group can use for the proposal are described.

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### 3.1 VISITING THE RESEARCH AREA

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This is crucial for the research. See the research area with your own eyes and visualize it. It is important to take notes when visiting the area. It is also easy to take pictures of the area, which later on can be used in the proposal. When the writers have visited the research area, it becomes more clear and makes it more easy for the writers to actually get information on paper.

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### 3.2 ASKING QUESTIONS TO PROJECT DEVELOPERS

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Extracting information from professionals is another method that can be used. This can be done in combination with visiting the research area. The professionals that are already working in the area may give new insights that can be used in the research. For the group it is useful to know what they already have done. How they did it and especially why they did it.

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### 3.3 MAINTAIN IN CONTACT WITH THE PROJECT DEVELOPERS

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It is useful to maintain in contact with the professionals. They can give updates on the project for example once or twice a month. For the proposal, the group can take these developments into account.

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### 3.4 USING INTERNET SOURCES

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The internet contains a lot of information. In most of the cases, there is already information to be found on the internet. It is important to make sure that the sources that are used in the proposal are reliable. The information that will be extracted from internet sources should contain the right information.

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### 3.5 INVOLVING INHABITANTS / SURVEY

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The inhabitants of the area can provide information. Their opinions have to be taken into account and listened to. This can be done by means of a survey. When doing this, permission of the local government is needed.

### 3.6 CASE STUDIES

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A case study is a study that is done in the past. In this project it is possible to look into the past and learn from projects that are already done in the past. These projects have to be more or less equal to the project the group is working on at the moment. Evaluating the case studies can provide lessons. Some things can be used in your own project. Case studies provide insights in what went well and what went wrong.

Criteria for the case studies are:

The group has to know what kind of actions have been undertaken in comparable projects to be able to know if these actions are efficient or inefficient.

The group has to know what kind of governments were involved during comparable projects.

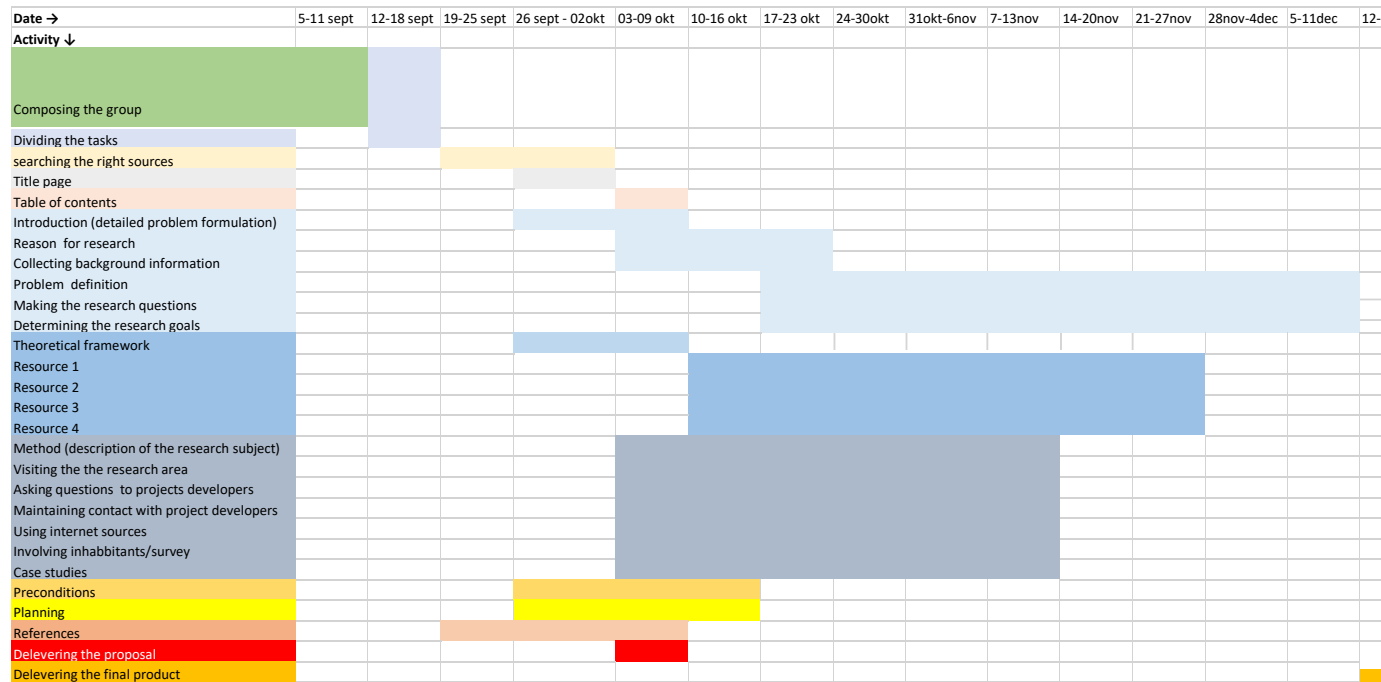
The group has to look at the way ecology and environment has been or has not been taken into account in comparable projects.

The group has to be aware of the outcomes of case studies.

## 4. PLANNING AND PRECONDITIONS

### 4.1 PLANNING

To come up with a good end product a good structured planning needs to be constructed, when the planning is kept in mind the authors of the research proposal can always fall back if the deliver week of a certain project part is forgotten. And if everyone agrees with the planning none of the members can come up with the excuse that he or she did not knew the deliver week.



## 4.2 PRECONDITIONS

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A first precondition is a good description of the research question. The answers on the sub research questions should be well described so there must be a clear outcome of the research. The outcomes of the sub research questions formed the outcome of the central question. This is the conclusion of the research proposal, this is really important, because the whole outcome of the research proposal is dependent on the conclusion. Another preconditions is that this research must be useful for the province of South-Holland. So companies get enough background information about the different situations in Alblasserwaard. So it is really important that the research proposal is useful. A third precondition is that this research proposal is useful for other areas that looks like the Alblasserwaard area. This research proposal must describe the advantages and disadvantages that also could happen in an area that looks the same as Alblasserwaard. So this research proposal must also be useful for other areas.

The limit of the research is that it is not described far in detail. It only gives the most important information about Alblasserwaard. It gives not detailed information because this is not necessary. Giving too much information is confusing for the readers. They do not know the most important outcomes of the research.

## 5. BIBLIOGRAPHY

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A5H. (2017). *A5h*. Opgehaald van [www.A5H.nl](http://www.A5H.nl)

De gemeenten in Alblasserwaard/Vijfheerenlanden, P. Z.-H. (2016). *a5h.nl*. Opgehaald van Water en ruimte verbinden: [a5h.nl](http://a5h.nl)

Defacto stedenbouw. (2013). *Proeftuin meerlaagsveiligheid Alblasserwaard Vijfheerenlanden*. Opgehaald van Defacto stedenbouw.

Deltares. (2016). *nieuwe normering goed beschermd blijven tegen overstromingen*. Opgeroepen op 10 10, 2016, van <https://www.deltares.nl>: <https://www.deltares.nl/nl/issues/nieuwe-normering-goed-beschermd-blijven-tegen-overstromingen/>

Ministerie van infrastructuur en milieu. (2016). *Kennisportaal ruimtelijke adaptatie*. Opgehaald van Ruimtelijke adaptatie: [www.ruimtelijkeadaptatie.nl](http://www.ruimtelijkeadaptatie.nl)

Ministerie van Infrastructuur en Milieu Ministerie van Economische Zaken. (2015). *Deltaprogramma Rijnmond-Drechtsteden*. Layar.

Rijksoverheid. (2012, 25 March). *Deltaprogramma Rijnmond-Drechtsteden*. Opgehaald van Concept gebiedsrapportage Alblasserwaard en Vijfheerenlanden.

Rijkswaterstaat. (2014). *Overstromingsrisico Dijkkring 16 Alblasserwaard en de Vijfheerenlanden*.

Rodenburg, I. E. (sd). *Unie van Waterschappen*. Opgehaald van Normering Waterwet.

Wolf, M. v. (14, July 30). *Water policy, Governance and law*.

Wolf, M. v. (30-06-2014). *Contradicting Principles within the concept of Multi layer safety*